BASICS TO BENEFITS

EUROPEAN CETACEAN SOCIETY
37th Annual Conference

22–24 April 2026
DUNDEE • SCOTLAND





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CONFERENCE SCHEDULE

MON	TUE	WED	THU	FRI
9:00 - 13:00 WORKSHOPS	9:00 - 13:00 WORKSHOPS	OPENING CEREMONY 09:00 - 09:30	PLENARY LORI SCHWACKE 09:00 - 09:45	PLENARY PAUL THOMPSON 09:00 - 09:45
		PLENARY EMER ROGAN 09:30 - 10:15		
		HUMAN INTERACTIONS & CLIMATE CHANGE 10:15 - 10:45	ANATOMY & PHYSIOLOGY 09:45 - 10:45	ABUNDANCE & DISTRIBUTION 09:45 - 10:45
		COFFEE BREAK	COFFEE BREAK	COFFEE BREAK
		HUMAN INTERACTIONS & CLIMATE CHANGE 11:30 - 13:00	CONSERVATION & MANAGEMENT 11:30 - 13:00	BEHAVIOUR 11:30 - 13:00
LUNCH	LUNCH	LUNCH SUSTAINABILITY DISCUSSION 13:30 - 14:30	LUNCH MENTORING DISCUSSION 13:20- 14:15	LUNCH
14:00 - 18:00 WORKSHOPS	14:00 - 18:00 WORKSHOPS	GENETICS 14:30 - 15:45	ABUNDANCE & DISTRIBUTION 14:30 - 15:45	ECOLOGY 14:30 - 15:30
		COFFEE BREAK	COFFEE BREAK	AGM 15:30 - 17:00
		BEHAVIOUR 16:30 - 17:30	HEALTH & WELFARE 16:30 - 17:30	CLOSING CEREMONY 17:00 - 17:30
		IN MEMORIUM 17:30 - 17:40		
		OCEANWINDS POSTER SESSION (ODD NUMBERS) 17:40 - 19:00	HARRIS GIN POSTER SESSION (EVEN NUMBERS) 17:40 - 19:00	
	ICE BREAKER 20:00 V&A DUNDEE		STUDENT AGM 19:00 - 20:00	BANQUET 19:30
		STUDENT PARTY 20:30 - LATE RIDDOCH'S	FILM NIGHT 20:00 - 22:00	DANCING 21:30

LIVEHOUSE,
DUNDEE, SCOTLAND

20TH - 24TH APRIL, 2026

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LOCAL ORGANISING COMMITTEE (LOC)

Mariel ten Doeschate - Scottish Marine Animal Stranding Scheme, School of Biodiversity, One Health and Veterinary Medicine, University of Glasgow, UK

Carol Sparling - Sea Mammal Research Unit, University of St Andrews, UK

Joanna Kershaw - Sea Mammal Research Unit, University of St Andrews, UK

Ailsa Hall - Sea Mammal Research Unit, University of St Andrews, UK

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Ellie MacLennan - Scottish Marine Animal Stranding Scheme, School of Biodiversity, One Health and Veterinary Medicine, University of Glasgow, UK

Alice Walters - WDC, Whale and Dolphin Conservation, UK

Jessica Montabaranom - Sea Mammal Research Unit, University of St Andrews, UK

Izzy Langley - Sea Mammal Research Unit, University of St Andrews, UK

Franca Eichenburger - Sea Mammal Research Unit, University of St Andrews, UK

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Holly Armstrong - Sea Mammal Research Unit, University of St Andrews, UK

Mia Hurst - Sea Mammal Research Unit, University of St Andrews, UK

Ellen Hayward - Sea Mammal Research Unit, University of St Andrews, UK

Nikki Taylor - Joint Nature Conservation Committee, UK

Karen Hall - NatureScot, UK

Denise Risch - Scottish Association for Marine Science, UK

Emily Hague - University of the Highlands and Islands, UK

Emma Neave-Webb – International Whaling Commission, UK

Alison Lomax - Hebridean Whale and Dolphin Trust, UK

Siobhan Moran - Hebridean Whale and Dolphin Trust, UK

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Tilen Genov – Morigenos, Slovenian Marine Mammal Society and University of Primorska, Slovenia

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Volunteer Coordinator: Marc Ruiz-Sagales

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Tuesday 21st April REGISTRATION at the Livehouse 12:00 – 19:00

SCIENTIFIC PROGRAMME

Day 1 – Wednesday 22nd April

08:00	09:00		Registration	
09:00	09:30		Opening Ceremony	
09:30	10:15		Keynote Talk – Emer Rogan	
Human Interactions & Climate Change: Chaired by Tilen Genov				
10:15	10:27	Oral	Habitat suitability forecasting suggests major distribution shifts of small cetaceans due to climate change in the North Atlantic Ocean	Guillaume Chandelier
10:27	10:39	Oral	Mapping whale-ship collision risk in the Eastern North-Atlantic, an integrated approach	Charlotte Lambert
10:40	10:44	Short	Predicting climate-driven shifts in long-term core habitat for sperm whales (*Physeter macrocephalus*) in the southwest Indian Ocean	Alexander Lomas
10:45	11:30		**Coffee Break**	
Human Interactions & Climate Change: Chaired by Emily Hague				
11:30	11:42	Oral	Time-series of essential amino acid isotopic values from a small cetacean indicate climate-driven variability in carbon cycling	Cinthia Velazquez-Matus
11:42	11:54	Oral	Seismic survey noise reduces fin whale vocalisations offshore northwestern Spain	Amy Feakes
11:54	12:06	Oral	Dine in, or take out: Sonar exposure influences foraging choices of beaked whales	Leigh Hickmott

12:06	12:18	Oral	Evaluating the risk of collision of seals swimming within metres of operating tidal turbines	Jessica Montabaranom
12:18	12:30	Oral	Mapping the vulnerability of cetaceans to offshore wind farms in French waters: A tool for spatial planning	Emeline Pettex
12:30	12:34	Short	Collaborating with Scotland's creel fishers to reduce entanglement of whales and other megafauna through simple gear modifications	Susannah Calderan
12:34	12:38	Short	Performance review of the Sea.AI Sentry thermal camera for whale detections under various environmental conditions	Emilie De Loose
12:38	12:42	Short	PearlNet in action: Evaluating harbor porpoise bycatch and gear performance under commercial conditions	Andrea Milanelli
12:42	12:46	Short	Assessing the combined effects of multiple stressors on a coastal bottlenose dolphin population to inform effective conservation efforts	Enrico Pirotta
12:46	12:50	Short	Marine mammals and navy sonar: Summarising 20+ years of research on behavioural response	Catriona Harris
12:50	12:54	Short	USBL and catch control systems cause wide displacement of harbour porpoises - geophysical surveys cannot be carried out simultaneously with baseline studies in offshore windfarms	Line Kyhn
12:54	13:00		Short Talks Questions & Answers	
13:00	14:30		**Lunch Break**	

Genetics & Evolution: Chaired by Andrew Kitchener

14:30	14:42	Oral	Epigenetics in marine mammal conservation	Ashley Barratclough
14:42	14:54	Oral	Monitoring Mediterranean ferry routes with LIFE-Conceptu Maris: eDNA insights into marine mammals and their prey	Alessia Rota
14:54	15:06	Oral	Large-scale genomic–isotopic analysis reveals cryptic population structure in *Tursiops truncatus* across the Mediterranean and Eastern Atlantic	Daniel Moore
15:06	15:18	Oral	How pinnipeds produce high fat milks – a grey seal lactation 'omics view	Jeni Sidwell

15:20	15:24	Short	Non-invasive drone-based sampling of bottlenose dolphin blow in the northern Adriatic Sea: Genetic identification and future application	Elia Fiore
15:24	15:28	Short	From Atlantic Ocean to the Mediterranean Sea: Uncovering connectivity and introgression in *Grampus griseus* large-scale dataset with RAD-seq analysis	Lucrezia Latini
15:28	15:32	Short	Evaluating tissue type, preservation method, and decomposition stage effects on DNA quality to support standardized genetic sampling in stranded small cetaceans	Miguel Grilo
15:32	15:36	Short	Immunogenome analyses of Mediterranean striped dolphin over 33 years, show evidence of selection in genes associated with *Morbillivirus* infection	Andre Moura
15:36	15:40	Short	Methods for analysing wildlife DNA methylation data	Theoni Photopoulou
15:40	15:45		Short Talks Questions & Answers	
15:45	16:30		**Coffee Break**	
			Behaviour: Chaired by Denise Risch	
16:30	16:42	Oral	Differences in acoustic presence and vocal behavior of Spitsbergen's bowhead whales under ice-covered and open-water conditions	Marlene Meister
16:42	16:54	Oral	Source parameter and spectral banding characterisation of the echolocation clicks of Risso's dolphins (*Grampus griseus*)	Thomas Webber
16:54	17:06	Oral	Rhythmic individuality is expressed in pattern not precision in humpback whale song	Alex South
17:06	17:18	Oral	Multilayer networks reveal behavioral asymmetries in sperm whale units	Yaly Mevorach
17:20	17:24	Short	What's the "diel" with all these unknown long-duration beaked whales (Cetacea; Ziphiidae) signals?	Kiersten Runte

17:24	17:28	Short	Using passive acoustic monitoring to gain insights on potential spinner dolphin habitat use, Peros Banhos atoll, Chagos Archipelago	Evie White
17:28	17:30		Short Talks Questions & Answers	

17:30	17:40	**In Memoriam**
17:40	19:00	**POSTERS** (odd numbers)
20:30		**Student Party**

Day 2 – Thursday 23rd April

09:00	09:45		Keynote Talk: Lori Schwacke	
			Anatomy & Physiology: Chaired by Andrew Brownlow	
09:45	09:57	Oral	Electrocardiogram recordings from a free-swimming fin whale reveal remarkable modulation of cardiac rhythm and conduction during diving and ascent for breathing	Angelo Torrente
09:57	10:09	Oral	Optimised gas management: How phocid seals override 'normal' autonomic vasomotor responses to CO2 accumulation during diving	Eva-Maria Bonnelycke
10:09	10:21	Oral	Swimming energetics assessment in cetaceans: An integrative theoretical and experimental approach	Vadim Pavlov
10:21	10:33	Oral	Whales and polar bears in a petri dish: Cell-based *in vitro* models for studying the impact of pollutant exposure on lipid metabolism	Maud Van Essche
10:33	10:37	Short	How stiff are cetacean arteries? New insights into aortic mechanics and structural adaptations for diving	Yara Bernaldo de Quirós
10:37	10:41	Short	Best practice guidelines for sampling and analyses in marine mammal neuroscience: Maximizing the value of studying the nervous system	Ksenia Orekhova
10:41	10:45		Short Talks Questions & Answers	
10:45	11:30		**Coffee Break**	
			Conservation & Management: Chaired by Karen Hall	
11:30	11:42	Oral	Robustness of the PBR control rule against population structure: A pilot study on common dolphins (*Delphinus delphis*) in the Bay of Biscay	Matthieu Authier
11:42	11:54	Oral	Beyond static thinking: Incorporating species dynamics and changing risks into spatial conservation	Tim Awbery

11:54	12:06	Oral	Dynamic movement patterns challenge our ability to monitor and manage protected populations	Barbara Cheney
12:06	12:18	Oral	Marked declines in Antarctic fur seals question their current listing of Least Concern	Jaume Forcada
12:18	12:30	Oral	New ecological insights and coordinated conservation action for Indian Ocean humpback dolphins in Kenya and Tanzania	Gill Braulik
12:30	12:42	Oral	From systemic failure to collaborative recovery: How Europe's small-scale fishers and cetacean scientists can work together to restore inshore ecosystems	Bally Philp
12:42	12:46	Short	Out of sight, out of mind: Scientific effort remaining focused on inshore habitats hinders effective conservation of marine mammal populations	Ana Mafalda Correia
12:46	12:50	Short	A global declaration for river dolphins: Learnings for cetacean conservation	Emily Cunningham
12:50	12:54	Short	Scientists, policy makers, and the fishing industry: Is dialogue being hindered to the detriment of those absent from decision-making processes?	Julien Viau
12:54	12:58	Short	Twenty-five years of coastal dolphin research in the Eastern Mediterranean: Integrating visual, acoustic, and stranding data for conservation	Aviad Scheinin
12:58	13:05		Short Talks Questions & Answers	
13:05	14:30		**Lunch Break**	

Abundance & Distribution: Chaired by Tim Awbery

14:30	14:42	Oral	How to study harbour porpoise activity in noisy German rivers	Marco Gauger
14:42	14:54	Oral	Deep diving cetaceans within the proposed deep sea mining area of the Nordic Sea	Kirsten Young
14:54	15:06	Oral	Tusâven? Spatio-temporal patterns in odontocete acoustic presence in the waters of the Torngat Mountains Area of Interest, Nunatsiavut	Eva Hidalgo Pla

15:06	15:18	Oral	Predicting changes in species distribution using an ecosystem end-to-end model: The case of harbour porpoises in the North Sea	Rémi Pigeault
15:20	15:24	Short	From binoculars to big data: 20 Years of WDC Shorewatch Citizen Science	Alice Walters
15:24	15:28	Short	An unexpected journey: Assessing sperm whale spatial movement through satellite tagging in the Strait of Gibraltar	David Silgado
15:28	15:32	Short	Tracking the invisible - localising harbour porpoises using multichannel fixed-bottom Soundtrap arrays	Tom Bär
15:32	15:36	Short	Mark-recapture survival and fecundity rates of harbour seals in areas of contrasting population trajectories in Scotland	Monica Arso Civil
15:36	15:40	Short	Seasonal-specific association of rough-toothed dolphins with an eastern North Atlantic island	Claire Raffaelli
15:40	15:45		Short Talks Questions & Answers	
15:45	16:30		**Coffee Break**	

Health & Welfare: Chaired by Rosie Williams

16:30	16:42	Oral	Surveillance of Cetacean *Morbillivirus* (CeMV) in the western Mediterranean coast: A new circulation event starting August 2025	Mariano Domingo
16:42	16:54	Oral	Multiple stressors in killer whales: Using the COVID-19 travel restrictions to explore the combined effect of whale watching, contaminants and nutritional status	Clare Andvik
16:54	17:06	Oral	Marine mammal strandings in a rapidly warming coastal ecosystem	Emma Christopher
17:06	17:10	Short	Application of ballistics euthanasia and cetacean behavioural responses during stranding	Rebecca Boys
17:10	17:14	Short	Felids and cetaceans, a shared history: *Toxoplasma gondii* from land to sea in the Adriatic basin	Federica Marcer

17:14	17:18	Short	Lessons from an integrated multidisciplinary investigation into the health, ecological, and environmental drivers of two large pilot whale mass stranding events in Scotland	Andrew Brownlow
17:18	17:22	Short	Natural vs. anthropogenic contamination: Organobromine compounds in distinct ecological populations of common dolphins (*Delphinus delphis*)	Raul Valente
17:22	17:26	Short	Viral community structure in Scottish marine mammals reflects interspecies interactions and host demography	Matt Arnold
17:26	17:35		Short Talks Questions & Answers	
17:35	19:00		**POSTERS** (even numbers)	
19:00	20:00		**Student AGM**	
20:00	22:00		**Film Night**	

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Day 3 – Friday 24th April

09:00	09:45		Keynote Talk: Paul Thompson	
Abundance & Distribution: Chaired by Nadya Ramirez Martinez				
09:45	09:57	Oral	Spatiotemporal data integration for marine megafauna SDMs in dynamic environments: A point process approach	Moritz Klaassen
09:57	10:09	Oral	Refining remotely sensed cetacean abundance estimates with sensitivity simulations	Jacob Linsky
10:09	10:21	Oral	Insights into the abundance, distribution, site fidelity and population structure of a killer whale community that interacts with the Northeast Atlantic mackerel fishery	Roisin Pinfield
10:21	10:33	Oral	Advancing species-level acoustic classification of delphinids for gulf-wide habitat modelling	Morgane Dackiw
10:33	10:37	Short	Environmental drivers of blue whale abundance off the United States west coast across three decades	Georgina Whittome
10:37	10:41	Short	Acoustic baseline of cetaceans in the NEOM region: First integrated visual–acoustic assessment in Northwestern Saudi Arabia	Juan Manuel Salazar Sierra
10:41	10:45	Short	Comparing glider-based and static passive acoustic monitoring of marine mammals in western Scottish waters	Denise Risch
10:45	10:50		Short Talks Questions & Answers	
10:50	11:30		**Coffee Break**	
Behaviour: Chaired by Gill Braulik				
11:30	11:42	Oral	Diel and seasonal patterns in the acoustic behavior of Commerson's dolphins (*Cephalorhynchus commersonii*) in the Kerguelen archipelago	Elise Fouin

11:42	11:54	Oral	Invisible conservation risk: Human driven resource fragmentation filters individual strategies and weakens social networks in coastal bottlenose dolphins	Bruno Díaz López
11:54	12:06	Oral	Fin whale movements from the Mediterranean Sea to the North Atlantic Ocean: New feeding opportunities?	Viola Panigada
12:06	12:18	Oral	Calf-initiated behaviors and their influence on group dynamics of common dolphins (*Delphinus delphis*) along the south coast of Portugal	Antony Pieters
12:18	12:22	Short	Into the unknown: Population structure, social dynamics, spatial-temporal distribution and vocal repertoire of sperm whales off the Eastern Mediterranean Sea of Türkiye	Aylin Akkaya
12:22	12:26	Short	AI-based approach to identify evidence of possible signature whistle occurrence in Mediterranean striped dolphin	Carla Cherubini
12:26	12:30	Short	Sperm whale slow click production on a breeding ground	Cláudia Oliveira
12:30	12:34	Short	Patterns of seasonality, circadian rhythms, and behaviour of the critically endangered Iberian harbour porpoise	Cláudia Oliveira-Rodrigues
12:34	12:38	Short	Understanding species-habitat associations of harbour seals and offshore wind farms	Nina Maurer
12:38	12:42	Short	Fin whales' residency and site fidelity patterns offshore Lisbon	Martim Quinta
12:42	12:46	Short	Using fiber-optic cables to reveal fin whale acoustic patterns in the Strait of Gibraltar	Miriam Romagosa Verges
12:46	12:50	Short	First use of a novel automated PhotoID web application on aerial drone videos of southern hemisphere fin whales to explore automated identification using a deep learning approach	Alexander Nicolas Rychwalski
12:50	12:54	Short	Interannual fidelity of grey and harbour seals to their seasonal home ranges	Cecile Vincent
12:54	13:05		Short Talks Questions & Answers	
13:05	14:30		**Lunch Break**	

Ecology: Chaired by Janneke Ransijn				
14:30	14:42	Oral	Seasonal and individual variability in habitat use of male sperm whales (*Physeter macrocephalus*) in high-latitude Northeast Atlantic.	Zoë Morange
14:42	14:54	Oral	Ontogenetic developing of foraging in short-finned pilot whales in the Canary Islands	Natacha Aguilar de Soto
14:54	15:06	Oral	Mercury trends in nine Arctic and subarctic toothed whale species investigated using total mercury and mercury stable isotopes	Marina Arregui
15:06	15:18	Oral	Killer whales of the Southwest Indian Ocean: 25 years of sightings and stable isotopes reveal increased presence, regional site-fidelity and generalist diet	Maeva Terrapon
15:20	15:24	Short	From wrasses and seabass to skates and conger eel: Long-term dietary shifts of grey seals in the Iroise Sea	Mallaury Chemin
15:24	15:28	Short	Do striped dolphins follow chlorophyll — or does chlorophyll follow them?	Arianna Azzellino
15:28	15:30		Short Talks Questions & Answers	
15:30	17:00		**AGM**	
17:00	17:30		**Closing Ceremony**	
19:30			**Banquet & Ceilidh**	

KEY NOTE SPEAKERS

Prof. Emer Rogan



Emer is a lecturer in Zoology at University College Cork. Her research focuses on marine mammal biology, abundance and distribution, trophic ecology, conservation and ecosystem health. Her work examines interactions between marine mammals, fisheries, and environmental variability, advocating for ecosystem- based fisheries management. With a background in plankton ecology, she has contributed to understanding marine ecosystem functioning and has long experience in small cetacean strandings and postmortem studies.

“Back to the future – why basic science is still important”

Over the past 30 years, marine mammal science has grown steadily, marked by increasing research output, broader collaboration and expanding interdisciplinary engagement. Curiosity-driven basic research has increased our understanding of how marine mammals develop and function within their environments, offering valuable insights into the health of our oceans. Continued investment in basic research is critical for scientific progress, especially when fundamental discoveries can inform effective conservation and management. In this talk, I will draw on examples from basic research to highlight the importance of long-term monitoring programmes to help understand changes in distribution and overall health, the “wicked” challenge of reducing marine mammal bycatch and the need for an integrated approach to management. I will also explore the often-significant time lag between identifying problems and the implementation of solutions in conservation policy. As we look “back to the future,” I will argue that curiosity-driven science remains vital. The next era of marine mammal research will depend on continued long-term monitoring programmes, bridging historical datasets with emerging technologies, such as drones, AI, remote sensing and environmental DNA, and integrating these tools within interdisciplinary management frameworks. By reflecting on three decades of scientific progress, we can better define, and hopefully shape, the future of marine mammal conservation.

Dr. Lori Schwacke



Lori is the Scientific Program Director for the U.S. Marine Mammal Commission, and has focused her research career on understanding how environmental changes influence marine mammal health and population status. With her strong foundation in statistics and epidemiology, her research specifically focuses on development of models to understand and quantify impacts of pollution and other anthropogenic stressors on marine mammal populations. She led the assessment of injuries to marine mammals following the catastrophic Deepwater Horizon oil spill, and her team's research delivered the first direct evidence of oil-associated health impacts on cetaceans, leading to long-term consequences for many populations.

“The Scientific Advantage: Strengthening Science to Understand Human Impacts and Drive Recovery”

Scientific advances in recent decades have helped us to understand the important stressors to which cetaceans are exposed and how those stressors affect individuals, populations, and species. These advances cover a range of breakthroughs from molecular discoveries, improved understanding of individual animal health and what drives it to change, and analytical frameworks to quantify how effects on individuals translate to population changes. While we’ve come far in understanding impacts of human activities on marine mammals, knowing what to do about them is often more difficult. Where we urgently need scientific progress is in the discoveries and understanding that can help to effectively restore or recover populations once such issues have been identified. I will draw from my experience in assessing exposure and effects of stressors, particularly chemical pollutants, on cetacean populations and discuss how such assessments would not have been possible without integration of multidisciplinary science. I will further discuss lessons that we’ve learned from these assessments and the difficulties in determining how to restore or recover populations once the degree of adverse impact is understood. This is my call to the next generation of scientists to consider how their skills and expertise can contribute to the development of knowledge and tools that are urgently needed for restoration and recovery of species or populations in decline, and for conservation of those at risk.

Prof. Paul Thompson



Paul is a Professor in Zoology at the University of Aberdeen's Lighthouse Field Station. Over the last four decades, his group has explored how environmental change influences the behaviour and dynamics of marine mammals and seabirds. This research has been underpinned by long-term individual based studies of harbour seals and bottlenose dolphins in the Moray Firth. Collaborating with academic, regulatory and industry partners, this research programme has been adapted to support a series of emerging conservation and management issues, with recent work focusing on interactions between marine mammals and offshore wind farm developments.

"Basics to benefits; does curiosity risk killing the cat?"

As this conference theme highlights, today's discoveries and tomorrow's applications to conservation and management are born from our drive to understand and protect. But these efforts must build upon, and are constrained by, our legacy of existing research and the evolving policy, funding and ethical frameworks that we work within. This plenary reflects on changes that have shaped our field in the three decades since the ECS last held their conference in the UK. Domestic policy and legislation protecting marine mammals has grown in response to new international agreements, underpinning increases in funding that have resulted in enormous growth in our field. New technology allows us to observe wild animals and describe their populations in ways that were unimaginable when we met in Inverness in 1993. At the same time, we still struggle to identify the key drivers of variation that we can now observe and describe so much more elegantly. Consequently, it often seems as challenging as ever to identify and prioritise effective conservation and management interventions. Drawing on the work of *conservationevidence.com* I explore how we might improve the way that evidence is used to optimise marine mammal conservation and management interventions. I highlight key outcomes of recent curiosity driven research, particularly those integrated research programmes that consider impacts at both individual and population levels. Looking ahead, I explore how we can ensure that our curiosity for increasingly fine-scale "nice to know" questions doesn't divert attention from urgent questions and actions required to address climate and biodiversity crises.

FILM NIGHT

LIVEHOUSE venue, 20:00 - 22:00 Thursday 23rd April

Strandings

1. **Hvalreki**

Introduced by Diego Llinás.

This film traces the history of cetacean strandings and explains their scientific importance, demonstrating how stranded animals have helped researchers understand whale and dolphin biology, causes of death, and threats to ocean health. It emphasises the value of coordinated stranding networks across Europe and highlights their key role in advancing research to support marine conservation.

2. **The whale of the Gulf: from stranding to public engagement in the Northern Adriatic**

Introduced by Luca Ceolotto, Department of Comparative Biomedicine and Food Science, University of Padova.

This film documents the discovery of a stranded juvenile fin whale in the northern Adriatic and the scientific process that followed. From offshore sinking and monitoring of its decomposition to skeletal recovery, analysis, and reconstruction, it showcases how an unusual event became a valuable research and public outreach opportunity to promote marine conservation.

Public engagement

3. **Helping conservation take flight: seal population surveys**

Introduced by Claire Stainfield, Scotland's Rural College (SRUC).

These two short films demonstrate how complex marine research can be communicated to different audiences. The first, created for an adult audience, explains interdisciplinary work on human–wildlife interactions and grey seal research, making science accessible beyond academia. The other, designed for children, simplifies the same concepts by introducing technology and AI in an engaging way. Together these films highlight the importance of breaking research down to its core ideas to connect with diverse audiences.

4. **The whale poo quadrille**

Introduced by Dr Jocelyn Elson-Riggins, Bournemouth University and Stichting Rugvin.

Inspired by a talk on the ecological importance of whale waste, this film brings a playful poem to life through animation to engage children with marine conservation. The project aims to spark curiosity about cetaceans and the environment, while serving as the first step toward a larger educational video combining song, animation, and real wildlife footage.

5. **Silurian youth surveys – breaking down barriers and inspiring future ocean advocates**

Introduced by Sadie Gorvett, Hebridean Whale and Dolphin Trust (HWDT).

This film highlights a youth outreach programme offering disadvantaged young people hands-on experience in marine conservation aboard HWDT's research vessel Silurian. Through cetacean surveys and practical skills training, participants build confidence, teamwork, and awareness, inspiring a diverse next generation of marine conservation advocates.

Rescues and entanglement

6. **Fisher disentanglement**

Introduced by Bally Philp, Scottish Creel Fishermen's Federation (SCFF).

This film documents the discovery and disentanglement of a juvenile humpback whale by fishermen off the Isle of Skye in 2025.

7. **The Creel Deal**

Introduced by Susannah Calderan, Scottish Entanglement Alliance (SEA).

This film documents a collaborative project between Scottish creel fishermen, scientists, and conservation groups to trial sinking rope as a method of reducing whale and shark entanglement in fishing gear. The trials showed that sinking rope can potentially reduce entanglement risk by up to 80% for some species while remaining practical and cost-effective for fishermen to use, and highlights how cooperation can deliver effective, real-world solutions that protect marine wildlife and support fishing livelihoods.

Other

8. **If they were us: the humpback whales of the Sargasso Sea**

Introduced by Andrew Stevenson, Whales Bermuda.

A heartfelt, feel-good story that goes beyond whales to explore human connection, purpose, and the power of dreams. Through Andrew and his daughters' journey, it shows how the ocean reconnects us with nature and each other, while highlighting the hopeful recovery of humpback whales as a symbol that change—and second chances—are possible at any stage of life.

9. **Nothing went as planned on this dolphin expedition**

Introduced by Aylin Akkaya, Be Brave to Act.

This film follows a research team as they embark on a challenging expedition to find Risso's dolphins. Overcoming numerous setbacks including storms, equipment failures and losing their boat, the team succeeds against all odds. The film delivers an emotional and motivational story that highlights perseverance and the importance of studying these elusive animals to better protect them.

10. **A special tourist in Venice**

Introduced by Guido Pietroluongo, Department of Comparative Biomedicine and Food Science.

In the summer of 2025, a solitary bottlenose dolphin named Mimmo unexpectedly took up residence in Venice's busy lagoon, where researchers monitored its health and behaviour. The film highlights this rare case of a dolphin thriving in a heavily urbanised environment, while exploring the real challenge of managing human interactions to ensure peaceful coexistence.

EXHIBITORS

Hebridean Whale & Dolphin Trust

KIMO

WHALE SEEKER

Fishing For Litter

SCOTTISH ENTANGLEMENT ALLIANCE

NAMMCO

Sea Mammal Research Unit Instrumentation

WILDLIFE COMPUTERS

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002	Historic Data Indicate Range Contraction in Baltic Sea Harbour Porpoises	Magie Aiken
003	Citizen science highlights changing seas in the Southwest UK	Rebecca Allen
004	The Mediterranean Monk Seal in Italy: Six Years of Sightings Provide Data for a “Data Deficient” Species	Sofia Angione
005	Using large-scale seismometer data to detect fin whale calls in the North Atlantic: implication for population density estimation	Gabrielle Arrieta
006	Sperm whale hotspots off western Ireland and the importance of dynamic variables as shown by a multiscale Bayesian Additive Regression Trees workflow	Cynthia Barile
007	First evidence for three dolphin species regularly inhabiting the Thermaikos Gulf, North-west Aegean Sea, Greece	João Bernardo Barreiros
008	Eleven years of passive acoustic monitoring of harbour porpoises and small delphinids off Calais port.	Julie Beesau
009	Who goes where? Detecting and localising cetaceans from hydrophone arrays on multiple gliders.	Gemma Bekki
010	A multi-level citizen science framework for long-term demographic monitoring of Bottlenose dolphins (*Tursiops truncatus*) in French Brittany	Juliette Biacchi
011	Preliminary results on the abundance and distribution of *Tursiops truncatus* (Montagu, 1821) in the southern Tuscan Archipelago using opportunistic platforms	Francesco Bonucci
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013	First photo-identification records of Delphinus delphis in the Gulf of Palermo: a contribution from Avvistiamo APS	Andrea Calascibetta
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015	A long-term monitoring reveals a stable presence of harbour porpoises in southern Iberia	Mara Company
016	Worldwide expert elicitation of noise regulation reveals under-regulated sound sources and missing binding thresholds for marine mammals	Michael Dähne
017	Mesoscale variables drive blue and fin whale distribution in the northeast atlantic	Théo Ducasse
018	Forty years of killer whale sightings in Iceland: a multi-source assessment of distribution, seasonality and regional patterns	Ayça Eleman
019	Spatial coverage is vital when monitoring a protected population during range expansion.	Grant Ellis
020	Recent observations and updated insights on the Mediterranean monk seal in Lebanese coastal waters	Samer Fatfat
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022	From rare to recurrent: The emerging presence of Bryde's Whales (*Balaenoptera edeni*) in the Azores through whale-watching records	Clàudia Fernández Oliveras
023	Presence, distribution and movements of the bottlenose dolphin (*Tursiops truncatus*) in the Western Mediterranean Sea	Gilberto Gatta
024	New records and spatial insights on the distribution of Gervais' beaked whale (*Mesoplodon europaeus*) in the Eastern North Atlantic	Anxo Gende Seoane
025	Expanding Cetacean Monitoring in the Alboran Sea: New Insights from the Málaga–Melilla Ferry Route	Joan Giménez
026	Abundance of deep-diving cetaceans in the western Mediterranean Sea derived from yearly aerial surveys	Oriol Giralt Paradell
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041	An assessment of grey seal pup-production using time-lapse cameras and remotely-piloted aerial systems in western Ireland.	Sarah Jana Manthorpe
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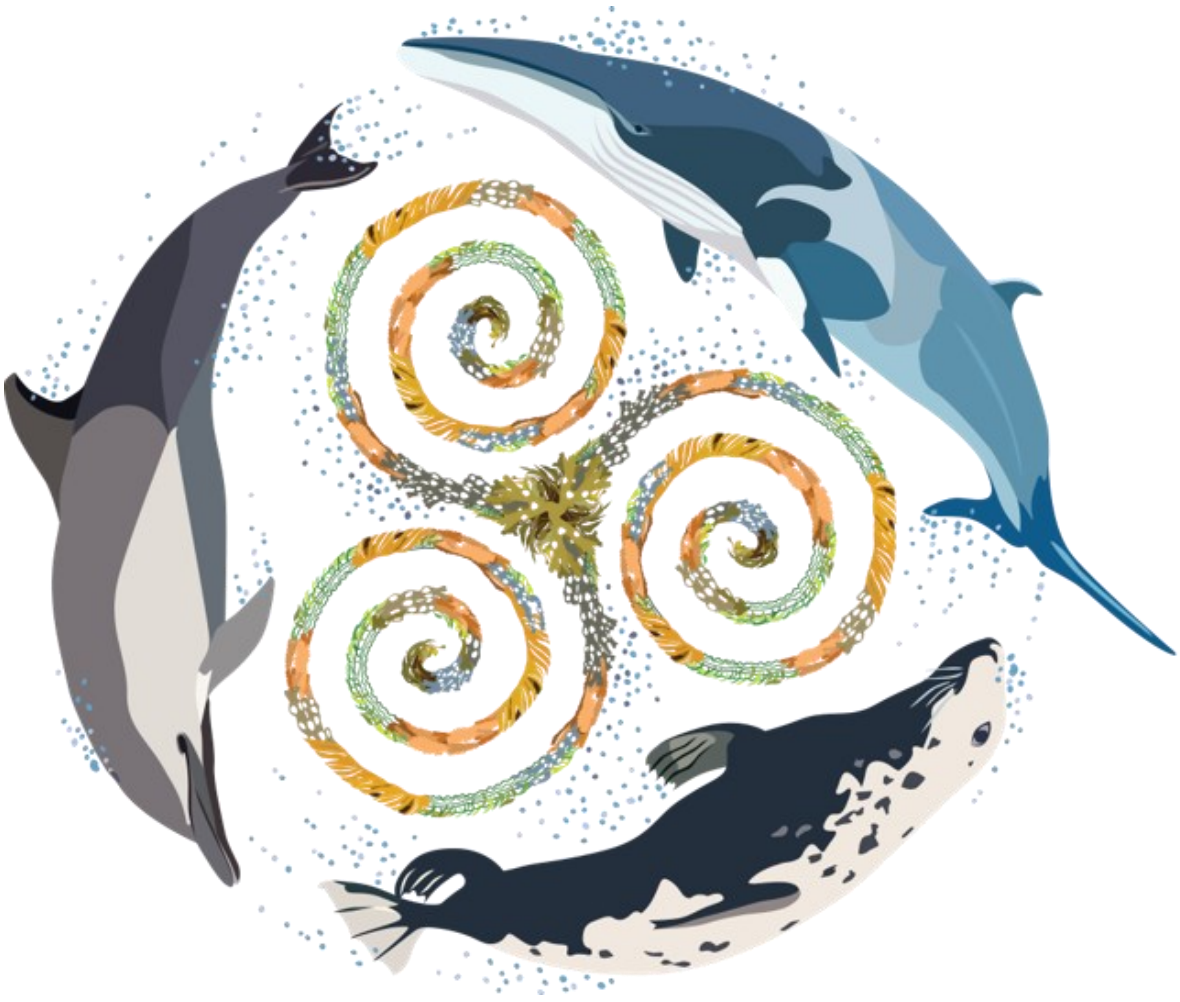
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ABSTRACTS

Abstracts are ordered by presentation type, and alphabetically by last name of first author.



ECS 2026
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ORAL PRESENTATIONS

Ontogenetic developing of foraging in short-finned pilot whales in the Canary Islands

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Short-finned pilot whales (PW) off Tenerife are known as “cheetahs of the deep” for their sprinting deep-foraging behaviour. However, because diving capabilities relate to body mass, it seems unlikely that young whales can perform such feats. This study examines how different age groups of PW manage their foraging strategies and whether they divide available niches based on body size. Using DTAGs and UAVs to record the diving behavior of 23 whales, body length (BL) was estimated via aerial morphometry. BL ranged from 2.1 to 5.1m, with whales classified into adult males (BL > 4 m, n=8), indeterminate (adult females/immature males) (BL 3–4 m, n=6), juveniles (BL 2.3–3 m, n=7), and calves (BL < 2.3 m, n=2). We aimed to tag one whale from each category per social group per tagging day. Four tag deployments lasted more than 20 hours and up to 40 hours. Maximum dive depths were similar for adult males and indeterminate whales, a 3.3 m whale got the depth record at 1130 m. This suggests that size in males might be more related to social than foraging purposes. Juveniles dived shallower (max depth ~600 m). The smallest calf (2.1 m) dived only to 25 m over 7 hours, while the larger calf (3.23 m) reached 375 m. Unlike adults, juveniles did not sprint but targeted shallower and more abundant prey, possibly related to the Deep Scattering Layer (DSL). Adults crossed the DSL searching for deeper prey but rarely exploited it. Ontogenetic niche differentiation is key for the social stability of PW in low-latitude, oligotrophic waters. The reliance of juveniles on the DSL makes them vulnerable to potential declines in prey availability that might happen if emerging fisheries targeting the DSL become widespread within the home ranges of short-finned pilot whales.

Multiple stressors in killer whales: Using the COVID-19 travel restrictions to explore the combined effect of whale watching, contaminants and nutritional status

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Marine mammals are exposed to multiple stressors, however risk assessments often address only single stressors and underestimate combined effects. Killer whales (*Orcinus orca*) from Norway have high concentrations of contaminants, are exposed to frequent boat traffic from winter whale watching, and experience fluctuations in prey availability due to climate change. This study aimed to assess the effect of multiple stressors on steroid hormone levels (including cortisol) and 28 health-related mRNA transcripts, to give an indicator of physiological and nutritional stress. Blubber and skin biopsy samples were obtained from 88 photo-identified individuals of varying age and sex from northern Norway. Samples were taken in periods of low boat traffic (spring/summer months and winter 2020, with reduced boat traffic due to COVID-19 travel restrictions) and high boat traffic (winters 2019, 2021 and 2022). Five individuals were sampled in both low and high boat traffic periods. Contaminants, fatty acids, stable isotopes, and mercury analysed from the same biopsy samples to provide information on pollution, nutritional status, and diet. We found no effect of boat traffic on cortisol levels across all whales, however, all re-sampled whales had significantly higher cortisol levels in the high boat traffic period. This highlights that population-level averages may hide individual responses, and photo identification is an essential tool to account for such variations. In males, we found a positive correlation between contaminants and cortisol, and a subtle but significant synergistic effect between contaminants, boat traffic and nutritional status. Transcriptomics data showed that females had a stronger toxicological response to contaminants than males, and a higher rate of lipid catabolism in winter seasons, possibly due to reproduction. This is the first investigation of

the interaction between contaminants, whale watching and nutritional stress on health in a marine mammal, and can aid the establishment of protective conservation and management strategies.

Mercury trends in nine Arctic and subarctic toothed whale species investigated using total mercury and mercury stable isotopes

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Mercury (Hg) exposure remains a concern for Arctic toothed whale populations and the local communities consuming these. This study evaluates variation in total Hg (THg) and Hg stable isotopes among tissues, species, and regions across nine toothed whale species to assess exposure, sources, pathways, environmental processes, and internal fractionation. THg and Hg isotopes were analysed in muscle and/or skin from 185 individuals collected between 1972 and 2025 across Greenland, Baffin Bay, Newfoundland, the Faroe Islands, and Norway. Skin and muscle showed significant positive linear correlations for THg, indicating that skin, and thus also biopsies, can serve as a proxy for internal body Hg exposure. Small but significant differences were observed in the Hg isotope signatures δ^{202}Hg and Δ^{199}Hg/Δ^{201}Hg between skin and muscle for some species/locations, reflecting differences in dietary Hg input over time, given the much faster Hg turnover in skin than in muscle. Both THg and Hg isotopes revealed significant species- and region-specific differences. Within-species comparisons showed that long-finned pilot whales and Atlantic white-sided dolphins from the Faroe Islands exhibited higher THg concentrations than conspecifics from other locations. THg and δ^{202}Hg increased with trophic level, with the highest values observed in killer whales, reflecting biomagnification, internal metabolic demethylation and excretion of inorganic Hg along the food web. The Δ^{199}Hg/Δ201Hg signatures, reflecting aqueous photochemical Hg reduction, varied among species. Narwhals showed significantly lower Δ^{199}Hg/Δ^{201}Hg, suggesting feeding at greater depths in the water column and Hg uptake from deeper or less-illuminated waters. The Δ^{199}Hg/Δ^{201}Hg and Δ200Hg signatures showed a latitudinal gradient with some exceptions (e.g., Pangnirtung in Baffin Bay), possibly associated with local glacial or terrestrial Hg inputs. These results

provide new insight into current Hg exposure, sources, and pathways, and establish the first baseline of Hg isotope signatures for Arctic and subarctic toothed whales.

Robustness of the PBR control rule against population structure: a pilot study on common dolphins (*Delphinus delphis*) in the Bay of Biscay

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Managing marine mammal populations in data-poor contexts requires several trade-offs to be pragmatic and enable timely actions. However, this does not mean to sacrifice biological realism or to ignore the best available evidence: the latter can be encoded in digital twins to leverage simulations in a management strategy evaluation framework. This framework allows to set robust limit reference points with control rules such as the Potential Biological Removal (Wade 1998). Building from the recent OSPAR assessment of cetacean by-catch, we illustrate two methodological developments to enhance the robustessness of the PBR control rule against (i) a knowledge gap and (ii) a monitoring gap. In the first case, inspired from the common dolphin (*Delphinus delphis*) in the Bay of Biscay, we developed a multi-population operating model to assess the effect of ignoring population sub-structure in management. Current genomic and genetic evidence demonstrate panmixia at the scale of the Northeast Atlantic but isotopic evidence points to different seasonal use of shelf waters and oceanic waters by dolphins within the Bay of Biscay. There is thus uncertainty in whether management should proceed with one or two stocks in the Bay of Biscay and we illustrate how to buffer against this uncertainty. In the second case, we investigate how irregular updates on marine mammal abundance can be buffered against with PBR by careful calibration of the recovery factor.

Beyond static thinking: Incorporating species dynamics and changing risks into spatial conservation

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Conservation and management frameworks often assume that species distributions are static, yet this overlooks the inherent mobility of many marine animals. Cetaceans respond dynamically to shifting oceanographic conditions and prey availability. Failing to account for this mobility risks misrepresenting their seasonal distribution and underestimating exposure to human pressures. In this study, Generalised Additive Models were applied to a 20-year dataset (2004-2024) collected by Hebridean Whale and Dolphin Trust to examine spatial and temporal variation in minke whale distribution on the west coast of Scotland. Predictions from these dynamic models were compared with those generated by a static framework. In addition, creel fishing effort from ScotMap and vessel traffic data from EMODnet were overlaid with the monthly dynamic predictions of minke whales for 2023–2024 to estimate exposure risk. Marked differences emerged between static and dynamic predictions outside June and July. From March to April, dynamic predictions were predominantly south-west of those produced by the static model, while from September to November they shifted north of the static predictions. The dynamic model further indicated that minke whale distribution lay largely outside designated marine protected areas during non-summer months. Analysis of exposure to creel fishing identified four priority risk areas, two of which overlapped with existing marine protected areas. Exposure to vessel traffic varied by both vessel category and season with cargo and tanker vessels posing the greatest risk earlier in the year (March-June) and exposure to fishing vessels peaking in September. Overall, these findings emphasise the importance of incorporating temporal dynamics when modelling mobile megafauna and anthropogenic pressures to produce realistic assessments of exposure risk. The study presented here provides a framework for how ecological and anthropogenic insights can be translated into informed, targeted conservation action.

Epigenetics in marine mammal conservation

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Age estimation in marine mammals is pivotal for understanding population demographics and survival probability, particularly in protected species. Our research objective was to enable age estimation of cetaceans through remote biopsy skin samples, assessing the epigenetics, specifically DNA methylation from the DNA extracted from skin. We focused on bottlenose dolphins (*Tursiops spp.*) due to access to known age individuals to calibrate an epigenetic clock to estimate age. With >1,000 skin samples from 12 different stocks / populations throughout the USA, we assessed 37,000 CpG (cytosine-phosphate-guanine) sites on the HorvathMammalianMethylChip40 to identify those closely associated with age. Our epigenetic clock was created through a combination of elastic net regression and random forest classifiers with results demonstrating a median absolute error of only 1.7 years across the full lifespan (0-60yrs). In addition to age, epigenetics can be used to infer health status with this research documenting age acceleration in dolphins exposed to the Deepwater Horizon oil spill and dolphins experiencing entanglement in fishing gear. Similarly, when comparing age acceleration with VESOP scores (Veterinary Expert Survival Outcome Prediction), individuals with highest positive age residuals (inferring age acceleration) had lowest health scores (indicative of poorest health) ($p=0.013$). Finally, we are expanding the dataset with samples from known pregnant dolphins to identify methylation shifts in CpG sites which can be used to determine pregnancy status. The ability to apply this tool remotely enables application to larger, less-tractable species than bottlenose dolphins and to smaller cetaceans that are unable to be safely handled for blood sampling or biopsy. DNA can also be extracted post-mortem from stranded cetaceans, expanding conservation applications. Our findings suggest that analysis of DNA methylation

patterns is a viable approach, not only for estimating age of dolphins, but also to assess individual and population health.

Optimised gas management: How phocid seals override ‘normal’ autonomic vasomotor responses to CO2 accumulation during diving

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Phocid seals have an exceptional hypoxemic and hypercapnic tolerance, in part, due to their accentuated dive response characterised by pronounced peripheral arterial vasoconstriction and compensatory bradycardia. Previous work in harbour seals demonstrated peripheral vasoconstriction in anticipation of diving. However, the extent to which circulating O2 and CO2 tensions influence the cognitive modulation of this vasomotor response remains unclear. In the current study, voluntarily diving grey seals (*Halichoerus grypus*) were equipped with non-invasive continuous-wave near-infrared spectroscopy (NIRS) to monitor changes in peripheral blood volume and oxygenation. Seals were exposed to ambient, hypercapnic (8% CO2), hyperoxic (50% O2), and hypoxic (11% O2) gas conditions to examine how this influenced the magnitude and timing of peripheral vasoconstriction and oxygenation during diving. NIRS measurements were collected for 15 diving trials, including 69 dives, across three seals. We demonstrate anticipatory peripheral vasoconstriction before the start of diving and peripheral vasodilation before the end of diving. Our findings also demonstrate a significant effect of hypercapnia on vasomotor control upon surfacing and diving in seals. Specifically, under hypercapnia seals showed a greater magnitude of peripheral vasoconstriction, and this response started earlier in advance of diving compared to the other gas conditions. This is fundamentally different to the expected vasodilatory response to hypercapnia seen in other mammals. The ability to overcome ‘normal’ autonomic physiological responses, and doing so in anticipation of diving, demonstrates that seals can cognitively control the magnitude and timing of vasomotor changes in response to CO2 accumulation. This ability is essential for optimised gas management in phocid seals; without it, their diving ability would be limited by the normal vasodilatory response to hypercapnia. These results change our understanding of cognitive control of physiology in seals and evidence that factors beyond dive duration are affecting how seals cognitively regulate their cardiovascular system.

New ecological insights and coordinated conservation action for Indian Ocean humpback dolphins in Kenya and Tanzania

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The Indian Ocean humpback dolphin (*Sousa plumbea*) is a threatened coastal cetacean confined to shallow nearshore waters of 23 countries along the Indian Ocean rim, from South Africa to India. Despite its Endangered status on the IUCN Red List and its occurrence in heavily impacted coastal habitats, major gaps persist in baseline ecological and population knowledge. Here, we present new insights drawn from extensive boat-based visual surveys conducted around Pemba Island, Tanzania (2014–2016), and across the southern Kenya–northern Tanzania coastline (2022–2023), a region where information has been particularly sparse. Across 129 survey days and nearly 4,900 km of effort, we recorded 48 humpback dolphin group encounters. Photo-identification of naturally marked individuals, combined with closed-population mark–recapture analyses, revealed very small population sizes: an estimated 43 individuals (95% CI: 32–110) around Pemba and 59 (95% CI: 29–117) in the mainland study area, with many dolphins exhibiting strong site fidelity. Species distribution models indicated clear niche separation from other sympatric cetaceans, with humpback dolphins restricted to extremely nearshore, shallow habitats characterised by low tidal energy and elevated chlorophyll concentrations. All identifiable individuals photographed in Kenya were also sighted in Tanzania, confirming a single cross-border population and highlighting the need for coordinated transboundary conservation. In response, researchers and conservation practitioners from across the species' range have established the Indian Ocean Humpback Dolphin Conservation Network (HuDoNet) to catalyse collaborative action. Five thematic working groups—Biology; Threats and Solutions; People; Policy; and Network Success—were formed to assess existing knowledge, identify gaps, and recommend priority actions. Their outputs were synthesised into a Network Action Plan that consolidates current understanding, identifies leverage points for impactful

conservation interventions, and outlines requirements for addressing critical information and management needs.

Habitat suitability forecasting suggests major distribution shifts of small cetaceans due to climate change in the North Atlantic Ocean

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The effects of climate change on biodiversity have increasingly been investigated, although limited studies have attempted to predict species distribution shifts due to warming ocean temperatures, including some of the most mobile but vulnerable species in marine ecosystems. Due to their high trophic positions and high metabolic rates, small cetaceans (dolphins and porpoises) have the potential to have disproportionate effects on community and ecosystem dynamics. However, there have been limited attempts to predict how climate change could affect their distribution. Here, we assess how future climate scenarios may affect the habitat suitability of small cetaceans across the fast-warming North Atlantic. We compiled the most comprehensive occurrence dataset to date using open-source databases and developed Species Distribution Models (SDMs) to project their distributions under three CMIP6 scenarios: ‘optimistic’ (SSP1-2.6), ‘intermediate’ (SSP2-4.5), and ‘pessimistic’ (SSP5-8.5). Our results revealed a consistent poleward shift in habitat suitability by 2100. Significant range losses are projected in tropical zones, while subtropical and temperate regions are expected to emerge as key climate refugia. Species-specific responses highlight that broadly distributed temperate species are projected to expand their range, whereas strictly tropical or subpolar species will experience range contraction. Response from primarily cold temperate species show contrasting results, but primarily range expansion to subpolar waters by 2100. These findings underscore the urgent need to integrate climate projections and small cetacean redistributions into species and ecosystem-based management strategies in the North Atlantic Ocean.

Dynamic movement patterns challenge our ability to monitor and manage protected populations

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Conservation and management measures are typically focussed around distinct protected areas or management units. However, for highly mobile species there is often uncertainty over whether these represent populations or whether there is contemporary exchange of individuals between these areas or units. Here we investigate the demographic consequences and conservation implications of a recent range shift of individuals from a protected bottlenose dolphin population. Long-term individual-based photo-identification studies have demonstrated that the bottlenose dolphin population using the Moray Firth Special Area of Conservation has expanded its range outside the SAC and the existing management unit into NE England. However, for the first time, with the help of citizen scientists, we have photographic evidence of previously unknown movement patterns. Since 2019, at least 24 individuals that occurred regularly in the Moray Firth SAC over multiple years were seen in five different management units around the UK and coastal Europe. To date six dolphins have returned to the SAC but 16 remain in these new areas, where two have died and three females successfully reproduced. In addition, 11 individuals are missing. This movement has impacted demographic trends in the SAC. Although estimates of abundance remain stable over the long-term, there has been a recent 5% annual decline in the number of dolphins using the SAC. Adding data after this range shift resulted in a significant decline in apparent annual survival of both all adults (0.95 to 0.88) and reproductive females (average 0.93 to 0.73). However, reproductive rates appear to be unaffected. As demographic trends are commonly used to monitor protected areas, these results highlight the impact of movements outside of a protected area on its conservation status. Potential connectivity between populations around the UK and Europe also challenges conservation policies based upon discrete fixed protected areas or management units.

Marine mammal strandings in a rapidly warming coastal ecosystem

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Marine heatwaves (MHWs) are prolonged periods of anomalously high ocean temperatures that are increasing in frequency, intensity, and duration globally. MHWs have profound physiological and ecological consequences in the marine environment, including shifts in species distributions, changes in prey availability, and increased disease susceptibility. Coastal ecosystems experiencing rapid warming, such as the Gulf of Maine (GoM), are particularly vulnerable, yet the extent to which MHWs impact marine mammals remains poorly understood. This study investigates the spatiotemporal relationships between MHWs and marine mammal strandings over six decades (1964 – 2024) in the GoM by integrating long-term stranding records from NOAA's Marine Mammal Stranding Program with sea surface temperature (SST) data from NOAA OISST. Results indicate latitudinal shifts in strandings locations of several species including harbor seals (*Phoca vitulina*), gray seals (*Halichoerus grypus*), and common dolphins (*Delphinus delphis*). Between 2000 and 2022, a total of 83 MHW events occurred in the GoM, with annual events ranging from 0-13. Several years had no MHW events (e.g., 2003, 2004, 2008; n = 0), but MHW are becoming increasingly common in recent years (e.g., 2012, n = 12; 2013, n = 10, 2016, n = 9, 2018, n = 5; and 2021, n = 7). Here we describe how MHW events link to marine mammal strandings and investigate this relationship with potential lagged effects using generalized linear models, accounting for seasonality, reporting effort, carcass detectability. By linking long-term stranding records with SST data from the GoM, this study provides insight into climate-driven impacts on marine mammals and highlights the value of strandings as indicators of ecosystem change.

Advancing species-level acoustic classification of delphinids for gulf-wide habitat modelling

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Studies of spatio-temporal dolphin distributions have been limited by the difficulty of distinguishing delphinid species acoustically relative to other odontocetes. This study addresses that challenge by further separating delphinid click types and modelling species-level habitat use in the Gulf of Mexico. Fourteen delphinid species occur in the Gulf, yet historically only one click type—Risso's dolphin—had been confidently linked to a species, limiting ecological inference. As the Gulf is an international basin, and previous studies focused mainly on U.S. waters, Gulf-wide species-level classification has remained limited. We expanded delphinid classification to twelve click types using spectral features, inter-click interval (ICI), waveform characteristics, and whistles, a challenging task given overlapping clicks, large pod sizes, multispecies encounters, as well as the large difference in species abundances. Six groups of species were reliably separated using a neural network classifier trained on data from 2018-2025, matching click types from stenellids, short-finned pilot whales, false killer whales, melon-headed whales, pygmy killer whales, and Risso's dolphins. These types exhibited differentiable characteristics including peak frequencies from ~20-40 kHz, troughs and notches across the spectra, and ICI ranges spanning 0.055-0.2 ms. Using these refined acoustic classes, we derived species/group densities and developed habitat models to assess how surface and depth-varying oceanographic conditions influence distributional patterns. This analysis draws on near-continuous recordings from 24 HARP sites (2020-2024) spanning ~270-3,800m across the Gulf, revealing that dolphin groups exhibit distinct spatial and temporal distributions. These results provide the first Gulf-wide, multi-species assessment of delphinid habitat use based entirely on passive acoustics and demonstrate that dynamic near-surface features, including the Loop Current and associated eddies, are key drivers of oceanic dolphin distributions.

Invisible conservation risk: human driven resource fragmentation filters individual strategies and weakens social networks in coastal bottlenose dolphins

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Coastal human activities fragment resource distributions and create predictable foraging hotspots for marine top predators, yet the conservation implications of the resulting changes in individual behaviour and social structure remain rarely quantified. Here, we integrate long-term datasets on wild bottlenose dolphins (*Tursiops truncatus*) from human impacted coastal systems in the Mediterranean Sea and the Atlantic Ocean to assess how human activities reshape habitat use, social structure, and individual strategies, and to inform a holistic approach to population monitoring and conservation. In these coastal areas, aquaculture installations, coastal fisheries and nutrient inputs from agricultural and urban sources generate dense and reliable prey patches that attract dolphins and drive fine scale habitat selection, resulting in local increases in density and encounter rates. Over time, however, these same areas display a contrasting pattern: despite higher local density and stronger site fidelity, social structure weakens. Frequent users of these patches exhibit weaker associations, lower network strength and more peripheral network positions, whereas dolphins that rely less on these hotspots remain socially central and strongly connected. Together, these results indicate that human driven resource fragmentation and enrichment do not erode behaviour per se, but instead amplify existing individual differences in risk-taking and foraging decisions. This process promotes the emergence of behaviourally distinct groups and a progressive weakening of social cohesion. This social degradation unfolds while local abundance and site fidelity around resource hotspots increase, creating an invisible conservation risk: populations may appear numerically stable or even enhanced, yet become less resilient due to impaired cooperation, reduced social learning and uneven exposure of behavioural phenotypes to anthropogenic threats. These findings highlight that abundance-based indicators may underestimate population vulnerability. Integrating social, behavioural and individual-level data into monitoring frameworks is therefore essential to design management actions that preserve both abundance and social network integrity critical for population resilience.

Surveillance of cetacean morbillivirus (CeMV) in the western Mediterranean coast: a new circulation event starting August 2025

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Since the first epizootic of Cetacean Morbillivirus (CeMV) in the Mediterranean Sea starting in 1990, the virus has caused further recognized episodes of mortality in the area. The aim of this study is to present the results of CeMV surveillance in stranded cetaceans in the western Mediterranean coast (Catalonia and Valencia regions), with detection of a new circulation event starting in August 2025. In the Catalonian coast, CeMV surveillance has been performed since 1990, first by histopathology and Immunohistochemistry (IHC) and from 2012 onward also by RT-PCR. In 2024 qRT-PCR was implemented. After 1990, outbreaks of CeMV systemic disease in the western Mediterranean Region were detected in 2006, 2013, and 2016. Localized forms of CNS disease associated to CeMV have been regularly detected immediately after waves of systemic disease. The last systemic CeMV case was detected in the Catalonian Coast in September 2017. From August 2025, 5 striped dolphins with systemic CeMV disease have been detected in Valencia and Catalonia regions. Usual histopathological lesions, like interstitial pneumonia, lymphoid depletion and encephalitis were found, but not in all dolphins. The complete sequence of this new CeMV strain was obtained by NGS in an Illumina MiSeq device from lung tissue from Id N-375/25. Genome of this strain clustered in a monophyletic branch together with a Danish and several Italian strains detected between 2016 and 2017, with nucleotide identities around 99%. The highest sequence similarity of this strain was with sequences of CeMV from the Italian coast detected in 2016-2017. Nevertheless, the 2025 strain shows divergence of the above-mentioned Italian isolates, with 65 unique mutations, 47 of them within coding segments, and only 2 nonsynonymous. CeMV detection in stranded cetaceans in the western Mediterranean coast fit to a non-endemic scenario, with reintroductions after periods between 15 and 8 years.

Seismic survey noise reduces fin whale vocalisations offshore northwestern Spain

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Anthropogenic ocean noise is increasing globally, yet fine-scale impacts on marine life remain poorly understood. Baleen whales are particularly vulnerable due to their reliance on low-frequency sound for communication, navigation, and foraging. Seismic surveys, which produce intense, repetitive airgun pulses, represent a widespread and potentially disruptive source of underwater noise. We assessed the impact of a 2013 seismic survey offshore north-western Spain on fin whale (*Balaenoptera physalus*) 20Hz pulse vocalisations. 63 days of continuous ocean-bottom recordings from three instruments were analysed across four alternating periods with and without airgun shooting. Vocalisations were detected with a convolutional neural network based on EfficientNetB0, trained on 50 hours of manually labelled data and validated with 85.6% accuracy (AUC = 0.93). Detection counts were analysed with a negative binomial GLMM, including instrument and day as random effects to account for recorder variation and temporal autocorrelation. To account for calls potentially masked by airgun pulses, a worst-case masking correction was applied. Across instruments, vocalisations declined 70.4% during active shooting and 52.0% after masking correction ($p < 0.0001$), with calling dropping within 1-2 days of survey onset, suggesting reduced vocalisation and temporary avoidance. The results suggest seismic surveys activity can induce immediate behavioural responses, likely reflecting a combination of decreased calling and temporary avoidance of noisy areas. Given the extensive spatial reach of airgun noise, the study highlights the importance of mitigation measures, such as temporal or spatial restrictions. More broadly, this study aims to highlight the importance of integrating acoustic monitoring into activities that produce anthropogenic noise, to better understand the impacts of permitted sound-generating operations on marine mammals and inform responsible management of such activities.

Marked declines in Antarctic fur seals question their current listing of Least Concern

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When abundant species are classified as Least Concern on the IUCN Red List due to insufficient data rather than true population stability, they are likely to receive limited conservation attention, especially compared to species with higher extinction risk. The Antarctic fur seal (*Arctocephalus gazella*), the world's most abundant otariid, remains listed as Least Concern despite evidence of rapid regional declines within its core range in the South Atlantic region of the Southern Ocean. We reassessed this status using long-term survey data from South Georgia, the South Orkney, and South Sandwich Islands, which together support ~97% of the global population. Over 47 years, consistent annual monitoring revealed rapid, synchronous declines at South Georgia and the South Orkney Islands, with a sustained population downturn since 2000 that exceeds short-term fluctuations. At South Georgia, population surveys showed a mean annual change of -3.93% [95% CI: -2.73; -5.13], reducing the estimated population to ~1.98 million seals in 2022, ~1.5 million fewer than in 2007. Over three generations (26 years), reduction was -0.57 [-0.65; -0.48], with a 0.92 probability of exceeding 50%, meeting IUCN A2 criteria for Endangered. Potential drivers include climate-induced shifts in prey availability, ecosystem changes, and cumulative anthropogenic pressures, although the ultimate causes remain unresolved and are very unlikely to reverse soon. Despite a positive increase at the South Sandwich Islands (3.12% [2.59; 3.66]), South Georgia alone (~96% of global abundance) dominates species-level trends, and is declining like the other major South Atlantic subpopulations, at the South Shetland Islands and Bouvetøya. Reassessing the species' global status is thus essential to ensure timely conservation management and safeguard the species role in Southern Ocean ecosystems.

Diel and seasonal patterns in the acoustic behavior of commerson's dolphins (*Cephalorhynchus commersonii*) in the Kerguelen archipelago.

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Commerson’s dolphins (*Cephalorhynchus commersonii*) comprise two distinct subspecies: one along the coasts of South America (*C. c. commersonnii*) and the other around the Kerguelen islands in the Indian Ocean (*C. c. kerguelensis*). Due to the relative difficulty of accessing the archipelago, ecological knowledge of the Kerguelen population remains limited, and studies are needed to comprehend the ecological specificities of the population. Commerson's dolphins emit high-frequency echolocation clicks (> 100 kHz), which can be used as a proxy of their presence and behavior. Passive acoustic monitoring (PAM) has widely been used in the last decades and has been proven to be an effective way of understanding cetacean occurrences and habitat use. In this study, acoustic data were collected using fully automated passive acoustic monitoring instruments equipped with click detectors (C-POD, Chelonia Limited). Acoustic monitoring was carried out over a period of 6 years at 4 sites in the Gulf of Morbihan in the archipelago. Detection-positive minutes per hour were used as a metric of the acoustic presence. In addition, each detection was classified to identify whether it contained feeding buzzes, allowing analysis of foraging behavior. To identify patterns in acoustic activity, generalized additive models (GAMs) were applied, examining the influence of diel and seasonal factors. The four sites were also compared to assess spatial variation in habitat use in the bay. The results revealed consistent acoustical activity of Commerson’s dolphins through years with an average of 90% of days positive to their detection. A strong diel pattern was observed, with increased acoustic activity at night and a seasonal occurrence of the species. This study highlights the occurrence and distribution of Commerson's dolphins in the Gulf of Morbihan and demonstrates the effectiveness of passive acoustic monitoring to improve knowledge of this poorly studied species in a remote area.

How to study harbour porpoise activity in noisy German rivers

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The harbour porpoise is the only cetacean species procreating in the German Bight. From there it ventures seasonally into the estuaries of German rivers. These estuaries provide suitable feeding habitats, but suffer under stress from noise and other anthropogenic activities. Accurate presence estimates of this top-predator are key to a better understanding of these aquatic systems. Harbour porpoise presence in the tidal stretches of these estuaries was determined using Cetacean Porpoise Detectors (C-PODs), a proven passive acoustic monitoring technique of Narrow Band High Frequency click-trains. We analysed C-POD data in the lower Elbe (river-km 642 to 643) and in the outer Ems (river-km 47 to 75) that we collected between 2018 and 2023. The precision of the KERNO classifier provided by the manufacturer is high in quiet environments but low in these noisy habitats (0.632), making manual validation necessary. With the objective to assist the validation workflow, we trained a machine learning (ML) model using parameters of 235,529 manually validated and marked click-trains from C-PODs (2023 – 2024). The obtained accuracy of testing data (0.985) and of the larger data set (2018 – 2023: 0.849) showed that the model generalized well beyond the training data. The validated data showed: (1) in the Ems and Elbe estuaries, spring was the most important time of the year for porpoise occurrence, (2) stations monitored for several years did not show marked interannual variation in the number of detections (exception: few detections in the lower Elbe estuary in spring 2019 and high detections in 2024), (3) current velocity in combination with sediment transport are likely the most important factors responsible for the occurrence of background noise, both hampering the detection of harbour porpoises with C-PODs, and (4) the ML tool can complement the process of manual validation, thus improving the validation workflow of C-POD data significantly.

Dine in, or take out: sonar exposure influences foraging choices of beaked whales

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Beaked whales (*Ziphiidae*), are vulnerable to very low levels of noise, in particular, military mid-frequency active sonar (MFAS, 3-8 kHz), resulting in lethal outcomes and non-lethal disturbance effects. To understand population level consequences of disturbance, energetics frameworks require knowledge of adult-female behavioural responses, including foraging disruption. Here we present foraging data collected using satellite-transmitting tags during observational studies of naval warfare exercises, using real sonars, over actual operational time frames. During a 10-year period (2006-2015), and as part of a multidecadal study of Blainville's beaked whales (*Mesoplodon densirostris*) at the Atlantic Undersea Test and Evaluation Center (AUTEC), The Bahamas; adult-female Blainville's beaked whales with known life-histories, were tagged prior to MFAS operations using SPLASH Mk-10 LIMPET tags (n = 7). Acoustic and movement evidence of foraging from DTAG deployments (n = 4), complemented the LIMPET tag data. Baseline foraging dives were typified by exceeding a depth of 500 m and duration of 35 minutes. Foraging dive depths were bimodally distributed, and diving patterns linked to diurnality. Mesopelagic and bathypelagic dives were recorded, with nighttime foraging typically being bathypelagic and associated with longer inter-deep-dive-intervals. During MFAS activity, foraging dives were shallower (χ^2 = 29.3, df = 4, p = 6.9e-06), shorter (χ^2 = 19.6, df = 4, p = 0.0006), and more pelagic than pre- and post-exposure dives. Intense sonar events caused the largest departure from baseline behaviours, but dives during smaller sonar activities also differed from baseline foraging. Interestingly, the responses of two resident adult-female whales showed distinct inter-individual variability, differing in their displacement and anomalous dive responses during exposure to MFAS. These sonar responses, evidence of extreme nocturnal diving, habituation and the timing of warfare training have important connotations for long-term monitoring, AUTEC operations and when evaluating population level effects of disturbance for management and conservation strategies.

Tusâven? Spatio-temporal patterns in odontocete acoustic presence in the waters of the Torngat Mountains Area of Interest, Nunatsiavut

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Baseline studies on the spatiotemporal presence of marine mammals are essential for understanding ecological responses to rapid environmental change, including the impacts of underwater noise, and for informing marine spatial planning initiatives. This study uses the first multi-year passive acoustic recordings from the Torngat Area of Interest (TAOI) in Nunatsiavut to characterize odontocete diversity and seasonal presence across the Labrador continental shelf. Passive acoustic data collected from 2021–2024 at two year-round hydrophone moorings in the central and southern TAOI were analyzed for the presence of echolocation clicks. A semi-automated detection and classification pipeline was used to identify signals and cluster them based on spectral shape, inter-click intervals, and duration. A trained deep neural network categorized detections based on dominant classes, with expert review confirming species identification. Across the multi-year monitoring period, analysis revealed the presence of at least five odontocete species, including harbour porpoises, white-beaked dolphins, sperm whales, and belugas. All odontocete species, with the exception of belugas, were primarily detected during the summer and fall months. In contrast, belugas were frequently encountered during the ice-covered season, underscoring the importance of the region as an overwintering habitat. These findings establish the first multi-year acoustic baseline of odontocete occurrence in the TAOI and offer new insights into habitat use, in a region where visual surveys are limited. Led by the Nunatsiavut Government, this research directly supports the Imappivut Marine Plan and ongoing feasibility studies toward designating the TAOI as an Inuit Protected Area.

Spatiotemporal data integration for marine megafauna SDMs in dynamic environments: A point process approach

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Species distribution models (SDMs) for marine megafauna such as cetaceans traditionally use occurrence data from scientific surveys. These surveys follow standardised protocols and provide spatially structured data, making them a reliable source of information on distributions. However, they are costly and temporally limited, offering only a snapshot of distributions in time. Because cetaceans track changing oceanographic features, models built on survey data alone often lack temporal transferability. In contrast, platforms of opportunity (such as whale-watching vessels) allow obtaining occurrence data with high temporal resolution and near-daily sampling. These data are restricted to small coastal areas and subject to spatial bias yet remain informative through time. Given the complementary nature of these sources and the absence of a general spatiotemporal framework for combining designed line-transect detections with opportunistic presence-only data, here we present an integrated modelling approach that leverages their strengths: broad spatial structure from surveys and high temporal resolution from whale watching. We combine these sources in a joint-likelihood log-Gaussian Cox process (LGCP), fitted in a Bayesian hierarchical framework using integrated nested Laplace approximations (INLA) via inlabru. The survey contributes a one-stage line-transect distance-sampling likelihood, and whale watching contributes an availability-restricted presence-only likelihood. Simulations show

that integration lets the model absorb the temporal signal from whale watching without losing spatial structure from the survey. We apply the approach to short-beaked common dolphins (*Delphinus delphis*) off mainland Portugal. The integrated model improves spatial fit and combines heterogeneous data within a coherent framework, though dynamic covariate effects were weak, limiting temporal variation in spatial predictions. The results demonstrate potential and limitations of spatiotemporal integration. They clarify data requirements when combining surveys with opportunistic data and provide a general, extensible framework for integrating marine datasets that might differ in design, extent, and temporal resolution.

Mapping whale-ship collision risk in the Eastern North-Atlantic, an integrated approach

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Maritime traffic is one of the most impactful anthropogenic activities to large whales globally, particularly through vessel collision and noise pollution, with sublethal to lethal consequences. Ship collisions are frequently fatal to whales when involving large vessels like tankers and cargoes. Since they form the majority of maritime traffic worldwide, the ever-increasing intensity of this shipping activity incurs great concerns for whale populations. Although this issue is well recognized and of utmost importance for guiding effective conservation strategies, large-scale mapping of collision risk remains limited at regional and global scales due to the elusive nature of whales and the remoteness of the offshore pelagic ocean. Thanks to the international synergy fuelled by the Atlantic Whale Deal project, we were able to build the first large-scale map of collision risk throughout the Eastern North Atlantic (ENA), explicitly considering species abundance. To do so, we (1) collated and formatted ship and plane based surveys to a dataset of unprecedented size and quality; (2) modelled and predicted the seasonal density and distribution of four whale species (fin, minke, sperm and Cuvier's beaked whales) in the ENA; (3) measured the maritime traffic from AIS data, contrasting vessel types, number and speed; (4) developed a method to derive integrated risk map from (2) and (3), accounting for uncertainty in species distribution and differences in strike lethality depending on vessel size and speed. To account for the

fact each species impact differently the ecosystem services provided by the ocean (e.g. killing a single blue whale would not have the same effect on carbon sequestration than killing a single minke whale), the method also integrates differences in species-specific population size, life-history strategy and species conservation status. Our results evidence areas of high collision risk, depending on vessel types, and provide invaluable information to refine mitigation measures.

Refining remotely sensed cetacean abundance estimates with sensitivity simulations

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Advances in satellite-based cetacean detection are accelerating conservation monitoring, but converting satellite counts into robust abundance estimates requires site- and species-specific parameterization of behavioral, environmental, and technological factors. The objective of this study was to identify which parameters most strongly influence abundance models derived from very-high-resolution satellite imagery, using the Maui Nui, Hawai‘i, humpback whale (*Megaptera novaeangliae*) breeding site as a case study. We used empirical behavioral data from 17 humpback whale multisensor suction cup tag deployments collected from 2019–2024 to fit hidden Markov models, then used fitted models to simulate whale populations under controlled sensitivity “experiments.” We systematically varied key inputs, including water column visibility, demographic composition (e.g., male versus female/calf ratios), bathymetry, and depth-related detection loss, to evaluate their relative influence on the proportion of whales detected. Preliminary results indicate that water column visibility and demographic ratios significantly affect detection (both $p < 0.01$), whereas depth-based detection degradation was adequately captured with a simple linear function in our simulations. This presentation will also highlight ongoing refinements to study design, including the effects of satellite image timing and spatial coverage, and how environmental covariates such as bathymetric, atmospheric, and surface conditions may influence whale detection. These findings identify the key empirical data inputs required for reliable satellite-based abundance estimates in this region and outline a transferable workflow for application to other regions and species. By quantifying the variables that contribute most to model uncertainty, this framework helps prioritize limited ground-truthing efforts toward the data streams most likely to enhance abundance model performance.

Differences in acoustic presence and vocal behavior of Spitsbergen's bowhead whales under ice-covered and open-water conditions

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Arctic-endemic bowhead whales (*Balaena mysticetus*) are affected by severe habitat alterations, driven by rapid sea-ice loss. This study compares the acoustic presence and vocal behavior of the endangered Spitsbergen bowhead whale population at two ecologically distinct sites: an ice-covered region northwest of Svalbard (81.5° N; acoustic data collected between 2022 and 2023) and the predominantly ice-free eastern Fram Strait (~79° N; acoustic data collected between 2012 and 2023). To detect bowhead vocalizations, we trained two convolutional neural networks, one for each recording site. At both sites, vocalizations were detected primarily from October/November to April, but acoustic presence was substantially higher and more continuous at the ice-covered site northwest of Svalbard. Here, we also frequently detected song, suggesting that this region serves as a winter breeding ground. Song diversity showed pronounced intra-seasonal variation and peaked in February, coinciding with a temporal sea-ice retreat in the wider region that brought the ice edge to the vicinity of the recorder. In contrast, detections in eastern Fram Strait consisted exclusively of simple calls or (parts of) calling sequences, indicating that this open-water region is not used for breeding. However, recurring seasonal detections across all recording years show consistent use of the region, likely as a movement corridor or feeding habitat. Our findings reveal clear differences in winter habitat use between an ice-covered and an open-water environment and highlight the importance of sea ice as a breeding habitat. This study provides new insight into intra-seasonal occurrence patterns and contributes to assessing how ongoing Arctic sea-ice decline may reshape future distribution and habitat suitability for the critically small Spitsbergen bowhead whale population.

Multilayer networks reveal behavioral asymmetries in sperm whale units

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Sperm whales live in complex, multi-level societies in which long-lived females and their offspring form stable social units that associate within vocal clans defined by shared coda repertoires. Such systems raise the possibility that some individuals occupy important positions and may play leadership or coordination roles expressed through movement and vocal behavior. Here, we use two decades of data from Dominica to link social structure with fine-scale behavioral and acoustic patterns using a multilayer network approach. First, we construct a social association network from photo-identification data, focusing on nine units observed frequently enough to estimate robust social metrics, and identifying individuals with high strength and betweenness within and between social units (calves were excluded). We then derived three additional directed networks from dive and acoustic data collected from clusters of multiple whales that dive together while being photographed and identified: a fluke-ordering network (who flukes first); a first-click ordering network (who initiates echolocation first); and a coda-ordering network (who initiates coda exchanges and overlaps). The last two were constructed based on IPI analysis of identified individuals recorded on-axis from the boat or from tag data. Together, these four networks represent complementary facets of social, movement, and communication structure. The parameters were then normalized so that each individual was given a standardized 0–1 score based on its social role and its tendency to initiate dives, echolocation, or coda exchanges. Several statistical analyses were conducted to compare the networks and scores, and determine whether high scores are randomly distributed or concentrated in certain individuals. The results showed that among the 53 individuals tested, 26 had significantly higher scores than expected, most of them older females. Combining vocal and social analysis revealed behavioral asymmetries among unit members, indicating a more complex pattern of relationships within units than previously believed.

Evaluating the risk of collision of seals swimming within metres of operating tidal turbines

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We used imaging sonar to continuously monitor wildlife at an operational tidal turbine in the Pentland Firth, Scotland, between May 2022 and June 2023. Of 704 detected seal tracks, 347 occurred during turbine operation and 122 of these were detected directly upstream of the rotating blades in the horizontal plane. Using a series of repeatable and objective questions in a, partly automated, partly manual, assessment we characterised factors that were associated with a higher likelihood of collision and assessed the associated risk of collision between each seal track and the rotating blades. Thirty five tracks (10% of tracks during operation) approached the rotor swept area within 10 metres and 16 of these passed through the rotor swept area in the horizontal plane. There is strong evidence to suggest that most of these high-risk tracks passed above, around, or possibly through, the turbine without collision. As well as providing useful data to assist in the prediction of collision risk, this approach provides a standardised method to evaluate similar data from other tidal energy sites or species. These outcomes can help de-risk the consenting process and support the sustainable development of the tidal energy industry.

Large-scale genomic–isotopic analysis reveals cryptic population structure in *Tursiops truncatus* across the Mediterranean and Eastern Atlantic

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Understanding how population structure forms in highly mobile marine predators remains a core scientific question in marine mammal science. The hypothesis that oceanographic variation and trophic specialisation are key drivers of population differentiation in the common bottlenose dolphin (*Tursiops truncatus*) is often presented, but rarely formally tested. Here, we address this research gap by assembling one of the most geographically extensive and collaboratively generated datasets for this species, integrating high-resolution genomic markers (Single Nucleotide Polymorphisms) from 157 dolphins (collected 1988–2017) with stable isotope analyses from 76 individuals from across the Mediterranean Sea and adjacent North Atlantic. Analyses of genomic data revealed previously unreported fine-scale structure. Notably, dolphins from Sicily, Valencia, and the Azores formed a distinct cluster, consistent with published acoustic and social data, suggesting the offshore ecotype penetrates deep into the Mediterranean basin. Additional genetic discontinuities matched major oceanographic features, including the Almería–Oran front, the Corsica–Sardinia divide, and the Bosporus, reinforcing the role of environmental boundaries in shaping connectivity. Stable isotope data showed pronounced trophic differentiation among regions, with Gulf of Cádiz dolphins feeding at higher trophic levels, while Azorean and Sicilian individuals exhibited values consistent with offshore foraging. Redundancy analyses confirmed that environmental variables and $\delta^{15}N$ significantly explained genomic variance, highlighting strong links between environmental gradients, prey choice, and population

genetic structure. Our findings show that, despite high mobility, T. truncatus populations exhibit structure driven primarily by ecological processes rather than physical isolation. This integrated genomic–isotopic approach offers insights into how environmental heterogeneity can shape cetacean population diversity. This study represents a major multi-institutional collaboration across eight countries, exemplifying the cooperative research effort the European Cetacean Society champions. These results have significant implications for conservation planning, emphasising the need to incorporate trophic ecology and oceanographic context into population assessments for this widely distributed marine predator.

Seasonal and individual variability in habitat use of male sperm whales (*Physeter macrocephalus*) in high-latitude Northeast Atlantic.

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In the Northeast Atlantic, male sperm whales (*Physeter macrocephalus*) occur year-round, primarily in deep waters off Northern Norway and Svalbard. However, most studies conducted at high latitudes in the Northeast Atlantic have focused on summer, limiting our understanding of potential seasonal patterns in habitat use. Using year-round photo-identification data collected between 2009 – 2025 from Andøya, Northern Norway, and satellite tracking data of whales tagged in the same area between 2020 – 2025, we focused on seasonal and individual patterns in habitat use of male sperm whales at high-latitude foraging grounds. Photo-identification highlighted year-round presence of sperm whales in the Andøya area with preferred periods in occurrence of individuals observed over multiple years. From October to April, their presence was influenced by sea surface temperatures (5-7°C) and strong northeast wind and current, which likely enhanced nutrient-rich coastal waters, attracting potential demersal prey. The number of both individuals observed for the first time and over multiple years during this period was higher. These individuals were often observed in groups with synchronized behavior. From May to September, individuals were more solitary. Their presence was influenced by an increased net primary production, potentially attracting pelagic prey over deep waters. Satellite tracking data further revealed seasonal and individual shifts in habitat use over the high latitudes of the Northeast Atlantic. Between January-April, Areas of Restricted Search (ARS) were recorded in fjords and underwater valleys (mean seafloor depth = 563m), with localized movements and diving to benthic layers (200-500m). Between June-November, ARS occurred over continental shelf edges and deep ocean basins (mean seafloor depth = 1393m), with directed movements and diving to pelagic layers (300-700m). Our results highlight how individual male sperm whales adapt their habitat use and foraging differently to seasonal changes in prey distribution and oceanographic conditions at high latitude foraging grounds.

Fin whale movements from the Mediterranean Sea to the North Atlantic Ocean: New feeding opportunities?

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Understanding large-scale movements and habitat use of marine megafauna is challenging due to wide-ranging behaviors and difficulties collecting at-sea data. Here, we combine satellite telemetry and environmental data to describe migratory routes and habitat use of fin whales (*Balaenoptera physalus*) leaving the Mediterranean Sea. Seven Argos LIMPET satellite transmitters (SPOT-365) were deployed off Dénia (western Ibiza Channel; n = 6), and in the Gulf of Lions (n = 1) in June-July 2022-2025. Tracks were regularized at 4-hour time steps using state-space models, and behavioral states were inferred using Hidden Markov Models to assess area-restricted search (ARS; putative foraging) and transit. Whales rapidly left the Mediterranean Sea to reach multiple foraging hotspots along the Atlantic Iberian coast, where they spent most of their time in ARS. Two individuals continued to the Bay of Biscay, foraging in the 'Abyssal Plain' and 'Shelf Edge and Slope' Important Marine Mammal Areas (IMMAs) until transmissions ended (10 and 42 days, respectively). Preliminary outputs from ongoing integrated step-selection analyses, modeling movement decisions as a function of bathymetry, slope, and a proxy for potential foraging habitat (derived from chlorophyll-a horizontal gradients in water depth areas >65m), show that fin whale movements are influenced by linked static and dynamic habitat features. Deeper waters and favorable potential foraging habitat emerged as significant predictors ($p < 0.005$, coefficients = 7.99×10^{-4} and 1.42×10^{-2}, respectively), helping explain the rapid transit through the shallow Dénia area during a period of decreasing habitat productivity and increasing temperatures. These patterns align with whales concentrating ARS activity in deep, productive habitats. These results provide a first mechanistic understanding of how fin whales select routes and feeding areas within and beyond the Mediterranean Sea, offering insights for spatial conservation planning, especially in regions where mitigating vessel-strike risk and noise disturbance is a priority.

Swimming energetics assessment in cetaceans: An integrative theoretical and experimental approach

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Quantifying the cost of locomotion (CoL) in cetaceans provides a foundational framework for interpreting species differences, assessing habitat use, and predicting responses to environmental change. Because direct measurements of physiology and locomotion are largely limited to captive animals, the allometric scaling of CoL with body mass has been a cornerstone for studies of free-ranging cetaceans. However, the use of mass-specific proxies for CoL in cetaceans may introduce biases due to the fundamental differences in physical forces that influence locomotor cost in terrestrial versus aquatic animals. Here, we present a study of the functional phenotyping of cetaceans that links body composition and drag as major determinants of the mechanistic CoL. The goal of our integrative approach was to test whether external morphology can serve as a proxy for swimming patterns and, ultimately, for CoL. To this end, we created realistic CAD models of adult females of the harbor porpoise, Risso's dolphin, and false killer whale based on standardized morphometric measurements obtained from stranding networks and published sources. Adult females were selected due to their significance in the Population Consequences of Disturbance framework, which links disturbance effects on individual behavior and physiology to population-level consequences. Swimming kinematic parameters optimal for the characteristic velocities of each species were calculated from the results of the wall-modeled large eddy simulations (WMLES) of the CAD models. Analysis of theoretical (WMLES) and experimental (tri-axial accelerometry of tagged individuals) data showed that body size and composition jointly influence swimming gait patterns and CoL. Our results suggest that, for most wild cetaceans where direct measurements are logistically infeasible, functional phenotyping may be the most practical approach for estimating drag characteristics, which are primary determinants of locomotor cost.

Mapping the vulnerability of cetaceans to offshore wind farms in French waters: a tool for spatial planning

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In face of European Union's ambitions to develop offshore wind capacity by 2050, rigorous planning is essential to reconcile energy production with biodiversity conservation. In that agenda, detailed spatial vulnerability assessments are crucial for identifying sites that minimise the impact on biodiversity, including cetacean populations. We developed seasonal maps of cetacean vulnerability to offshore wind energy in French Atlantic and Mediterranean waters. We performed habitat modelling using Generalised Additive Models, incorporating monthly averages of physiographic and biological covariates corresponding to the data collection period. This large-scale analysis is based on fifteen years of standardised aerial and boat-based surveys at sea, covering over 315,000 km in the Atlantic and 110,000 km in the Mediterranean. The study is based on 31 datasets comprising a total of 107,000 records from eight cetacean groups. The distribution maps were then combined with species-specific sensitivity indexes and conservation status to produce vulnerability maps for offshore wind farms (OWFs). Risk factors included underwater noise, entanglement and habitat displacement. Government agencies have used these maps to identify areas that are least at risk from offshore wind and prioritise them for future wind farm development. The study also highlighted the need to improve data collection, particularly through greater standardisation of practices for data acquisition and archiving. For example, several of the available datasets revealed gaps in observation efforts relating to environmental conditions and spatialisation which posed specific challenges to ensure their inclusion. This work represents the most up-to-date knowledge in France regarding the vulnerability of cetaceans to offshore wind turbines. However, it will be essential to update it regularly as our understanding of how species respond to offshore wind farms improves. Finally, we emphasise the importance of integrating ecological knowledge continuously into energy transition strategies to reduce conflicts over marine use and ensure the rational development of renewable energy

From systemic failure to collaborative recovery: how Europe's small-scale fishers and cetacean scientists can work together to restore inshore ecosystems

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Across Europe, small-scale low-impact fishers are calling for reform of inshore fisheries management, advocating ecosystem recovery, fair access, and low-impact fishing priority areas. These aims align closely with many conservation goals, and create major opportunities for collaboration between small-scale fishers and cetacean scientists. Long-standing management failures and declining forage fish populations have degraded coastal ecosystems, leaving both wildlife and fishers impacted by reduced productivity. Emerging fisher–scientist partnerships, including in Scotland, show how trust-based collaboration is advancing both mitigation and management reform. Efforts to reduce marine megafauna entanglement often falter, not due to shortcomings in the science, but because the starting point is rarely with the fishers themselves or the realities they face. Since fishers have no desire to entangle cetaceans, meaningful mitigation must begin with collaboration which takes account of viability and the operational constraints of life at sea. Aligned with the ECS theme 'Basics to Benefits', this talk uses case-study outcomes from projects around Europe to demonstrate that progress depends on engaging small-scale fishers as primary partners and aligning scientific expertise with local knowledge and practical realities. This is a space where collaboration is not only possible, but it is urgently needed, and ripe for success.

Calf-initiated behaviors and their influence on group dynamics of common dolphins (*Delphinus delphis*) along the south coast of Portugal

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Cetacean nursery groups play a critical role in the successful rearing of calves, offering social learning and integration into complex social networks. While these groups are well-documented in species with stable, matrilineal social structures, little is known about how calf social development is supported in species with more fluid social dynamics. To answer this question, we investigated common dolphin (*Delphinus delphis*) calf rearing groups along Portugal's southern coast, a known nursing and calving area for this species. Here, we present a novel calf-centered approach to examine how calf-initiated behavior (CIB) might influence the group's natural behavior. CIBs provide a clear, observable point in time from which to track potential subsequent responses to allow us to better understand the mechanisms underlying social responsiveness and group-level coordination. Systematic behavioral logging of aerial observations obtained using unmanned aerial vehicles was employed to analyze shifts within the group's dynamic in response to behavioral initiations by calves versus adults. In total, 290 thirty-second observation intervals from 21 focal follows were analyzed using Generalized Additive Mixed Models. Our models' results indicated that although calves were significantly less likely to initiate directional changes than adults, maternal responsiveness increased with these directional misalignments by their calf. Besides mothers, non-mother individuals within the group responded significantly more often to calf-initiated behaviors than to those initiated by adult dolphins, suggesting a form of alloparental alertness. Additionally, this responsiveness increased as the proportion of calves in the group increased, indicating threshold-based social response. Our findings provide insight into adaptive social strategies showing that calves are not just passive recipients of care but can actively influence group dynamics. This study also offers a foundation for future efforts to establish thresholds for defining nursery groups in common dolphins.

Predicting changes in species distribution using an ecosystem end-to-end model: the case of harbour porpoises in the North Sea

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Predicting changes in species distribution and identifying their drivers are crucial for informing conservation policies. In the North Sea, a higher density of harbour porpoises was observed in the southern region in summer 2005 compared to 1994. This pattern continued until 2016, but reversed between 2016 and 2022. Here, we aggregated summer cetacean line-transect survey data from 1994 to 2022 (196,396 km; 15,636 harbour porpoise groups) from national monitoring and large-scale surveys (e.g. SCANS) to better predict and explain such changes in distribution. We used 2002-2022 data to fit species distribution models (SDMs) with an ecosystem end-to-end model (ECOSMO E2E, 2 km resolution) via backward selection, reserving 1994 data for validation. ECOSMO E2E couples physical and biological processes to provide a consistent modelling framework from nutrients and phytoplankton to zooplankton, detritus, and fish. We predicted distributions for summers 2005, 2016, and 2022 and hindcasted the 1994 summer distribution. Selected covariates included sea surface temperature (SST), fish production potential, and oceanic fronts. SDM predictions replicated the increase in porpoise density in the south from 1994 to 2005 and the subsequent decline in this area between 2016 and 2022, albeit at a lower magnitude than observed. This indicates that the SDM fitted with the ecosystem end-to-end model can capture changes in distribution and hindcast porpoise distributions for other years, although not all drivers are yet captured. Our results identify temperature and fish production potential as key proxies for predicting these changes. Notably, SST has been linked to the North Sea regime shift (1996-2003), which affected species across trophic levels from phytoplankton to fish. These findings provide useful tools for conservation management, enabling model-

based evaluations of anthropogenic pressures and climate change impacts on a key top predator in the North Sea.

Insights into the abundance, distribution, site fidelity and population structure of a killer whale community that interacts with the Northeast Atlantic mackerel fishery

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Killer whales that interact with the Northeast Atlantic (NEA) mackerel fishery represent a poorly studied community, with little known about their abundance, distribution, site fidelity, and population structure. To address these knowledge gaps, we combined photo-ID and genetic analyses to investigate this community. Photo-ID images were collected from trawlers between 2016-2018, resulting in an identification catalogue of 199 individuals, 24 of whom were resighted between 1 and 3 times during the study period. Group sizes ranged from 4 to 70 individuals (mean = 14 ± 2.8 SE). An open-population mark–recapture model estimated a super-population size of 218 individuals (95% CI: 93–511; CV = 0.74). Comparison of this catalogue with photo-ID images gathered from various sources in the NEA between 2005 and 2023 yielded 18 matches. The geographical range of this community includes the NEA, North Sea, Norwegian Sea and possibly includes the Skagerrak strait. Evidence of strong fishery association was demonstrated with 13 individuals resighted (at least once) more than nine years after their initial identification. In addition, 21 epithelial samples collected from strandings around Scotland and Ireland (n = 14) and biopsies taken from mackerel trawlers in the North Sea (n = 7) were genotyped and screened for variation in allele frequencies at 16 polymorphic microsatellite DNA loci. The results suggest there are at least three populations frequenting Scottish and Irish waters: two

of which were significantly differentiated, while the third appeared to represent a mixture of individuals from poorly sampled populations. The results revealed that the mackerel fishery associating killer whales were assigned to a large population that also included individuals sampled in Shetland, Norway, and Iceland. These findings provide critical baseline information on the ecology and connectivity of this community and underscore the importance of incorporating such data into conservation and fisheries management strategies to mitigate potential anthropogenic impacts.

Monitoring Mediterranean ferry routes with LIFE-Conceptu Maris: eDNA insights into marine mammals and their prey

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The conservation of cetaceans in the Mediterranean Sea is inextricably linked to several stressors and threats, generating ecological changes in their habitats and potentially in the biological communities they host. The inaccessibility of the remote and vast open sea, where these species live and breed, poses constraints to the study of cetacean abundance and distribution, limiting data collection. Therefore, a consistent information gap persists about the hotspots of cetacean species presence, species relationships and habitat preferences. Presumably, cetaceans' distribution is driven by their prey, whose composition and availability are often overlooked and underexplored. This study applied environmental DNA (eDNA) metabarcoding to characterize marine biodiversity across the Mediterranean Sea, simultaneously screening three markers to detect the vertebrate and invertebrate communities. Using ferries as sampling vessels as part of the LIFE- Conceptu Maris project (LIFE20 NAT/IT/001371), a total of 447 seawater samples were collected across 2 years. Nine cetacean species were identified, together with hundreds of fish and invertebrate species that revealed distinct seasonal and spatial diversity patterns, with hotspots in the Alboran Sea, Spanish Cetacean Migratory Corridor and the Pelagos Sanctuary. The results allow us to underline gaps in coverage for key cetacean habitats, remarking the need for science-informed conservation networks to more effectively align with actual species distributions. Indicator species and co-occurrence network analyses highlighted ecological interactions, prey associations, and diel patterns, revealing nocturnal predation dynamics of cetaceans. The findings reported demonstrate the power of eDNA technique to map marine biodiversity and give insights into species interactions and marine mammals' distribution drivers. With one of the most extensive eDNA datasets of the Mediterranean Sea, this work aims to enhance our understanding of the ecology and conservation status of Mediterranean cetaceans, informing the establishment of open sea protected areas and contributing to the expansion of the Natura 2000 network.

How pinnipeds produce high fat milks – A grey seal lactation 'omics view

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Milk is a defining mammalian trait compromising thousands of distinct biologically active compounds, yet the evolutionary genomic basis of variation in milk properties across species remains poorly explored. Compared to other mammals, pinnipeds produce milks characterized by high fat and reduced sugar content. Phocid seals produce some of the highest-fat milk of all mammals (up to 60%), supporting short lactation periods ranging from a few days up to 5 weeks. Milk fat globules (MFGs) are the key lipid carrying structures in milk, but to date their properties have only been characterized in depth for humans and dairy species. Here, we investigate grey seal (*Halichoerus grypus*) lactation using transcriptomic and molecular evolution analyses, and physical characterization of milk fat globules, for milk samples collected from 10 lactating females on the Isle of May, Scotland in Autumn 2023. In RNAseq analysis of milk fat, we find high abundance relative to other mammals of transcripts associated with MFG membrane proteins (including MFGE8, CD36, BTN1A1) and lipid mobilization. Using in silico evaluation of functional properties and ancestral state reconstructions of milk fat globule membrane (MFGM) proteins across mammalian taxa, we find significant correlations between reduced negative charge and decreased polarity with increasing milk fat content. Changes in these properties could influence electrostatic and stearic repulsion among MFGs and hence milk emulsion behavior. Physical characterization of grey seal MFG size using dynamic light scattering and nanoparticle tracking, and measurement of net charge via zeta potential, indicate the MFGs have reduced size and zeta potential compared to available data for other mammals, consistent with predictions that emulsions with smaller particle size have higher stability. Together these results suggest MFG properties may play a key role in how pinnipeds achieve high fat milks and illuminate the evolutionary pathways that give rise to milk adaptations across mammals.

Rhythmic individuality is expressed in pattern not precision in humpback whale song

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Timing consistency (precision) in musical rhythms can be pleasing to the human listener, but the relationship between timing consistency and the role of rhythm in other animal displays is underexplored. In biology, within-individual timing consistency may correlate with singer quality, as for singing rates in great tits (*Parus major*), and individually distinctive rhythmic patterns may communicate identity, as in tambourine doves (*Turtur tympanistria*). In humpback whales (*Megaptera novaeangliae*), males within breeding populations converge on shared songs comprising stereotyped sequences of themes. In each theme, multi-unit phrase variants are repeated with small within-individual variation, leading to song with highly consistent phrase durations. However, when it comes to the rhythmic patterning of phrase variants, the within- and between-individual rhythmic variability of humpback singers is unknown. In our study, we measured inter-onset intervals between 15,908 song units produced by ten singers off Mo'orea, French Polynesia, September-November 2019. We quantified the rhythmic variability within and among individual singers to (1) measure within-individual levels of rhythmic consistency and (2) assess for individually distinctive rhythms. Using mixed-effects models, we were unable to distinguish individuals through the level of within-individual rhythmic consistency with which they sing specific phrases, making it unlikely that rhythmic consistency signals quality. However, Mantel correlation tests provided evidence consistent with the hypothesis that individuals sing shared song phrase variants with distinctive rhythms. This makes it possible that rhythms could be used for individual identification, although we did not test whether songs could be assigned to a particular singer. Finally, we defined a measure of 'rhythmic individuality' which quantified how different singers' rhythms were to population means: mixed-effects modelling allowed us to reject the hypothesis that rhythmic individuality varied randomly across phrase variants. This supports the interpretation that individuals who have markedly distinct rhythms in one phrase variant are also distinctive in others.

Killer whales of the Southwest Indian Ocean: 25 years of sightings and stable isotopes reveal increased presence, regional site-fidelity and generalist diet.

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Knowledge of killer whale ecology in the tropical Southwest Indian Ocean (SWIO) is sparse. To address this data gap, we combined visual sightings and stable isotope analyses to investigate killer whale distribution and diet. A 25-year dataset of opportunistic sightings from a range of data sources (general public, tourism, researchers, fishers) across the SWIO was qualitatively assessed. Killer whale encounters (n=108) occurred throughout the region, increased between 1996 and 2025, and took place across all seasons. Photographic recaptures of known individuals across years in the Mozambique Channel suggested long-term site-fidelity in this area. Predation events (n=30) were compiled across the region and documented a wide range of prey taxa (baleen whales, pelagic fish, odontocetes and elasmobranchs). Stable isotope composition (d13C and d15N) was measured in annual growth layers from teeth collected from 5 stranded killer whales in the SWIO. The diet of these individuals was predicted using mixing models with d13C and d15N isotope literature values for potential regional prey items. Results suggested SWIO killer whales were likely generalist feeders with a preference for either sharks and odontocetes in South Africa, or for a combination of pelagic fish, humpback whales and odontocetes in the Mozambique Channel and southern Madagascar. This work provides a baseline for increasing our understanding of tropical SWIO killer whale ecology. It highlights the importance of opportunistic data sources and combined approaches in regions with little or no dedicated

research effort to help fill knowledge gaps for species that range widely and spend most of their time offshore.

Electrocardiogram recordings from a free-swimming fin whale reveal remarkable modulation of cardiac rhythm and conduction during diving and ascent for breathing.

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Measuring heart rate (HR) in large whales provides rare insight into cardiac physiology at extreme body sizes. However, electrocardiograms (ECGs) from free-swimming whales are extremely difficult to obtain due to challenges in tag attachment, body motion, seawater interference, etc. Consequently, only a few ECGs exist for large cetaceans, most of them dated and from stranded or restrained animals. To study whale HR, we developed a suction-cup ECG tag that could be attached on the whale back, coupled with the CATS-CAM system, to correlate HR variation with whale trajectory and behavior. Using this device, we obtained the first ECG of a free-swimming fin whale, monitoring multiple dive cycles, up to 37.5 m of depth, during 5 hours. This whale was recorded in August 2025 in the Mediterranean Sea, was estimated at 16 m and ~25 tons, and likely had a ~150-kg heart (500 times the human heart). During dives, the whale showed pronounced bradycardia. HR varied between 6 and 8 bpm, correlating with depth, but was unrelated to dive duration or maximum depth after inhalation. During ascent, HR reached ~23 bpm just before surfacing. By analyzing ECG waveforms, we provided the first measurements of cardiac conduction in a free-swimming whale. The cardiac conduction intervals PR and QRS shortened with increasing HR, whereas the QT interval remained stable, likely reflecting reduction of vagal modulation during ascent. The average PR interval (~0.8 s) matched expectations for a ~150-kg heart and suggests that the relationship between atrioventricular conduction and heart size becomes exponential in larger body mammals. These results reveal remarkable modulation of cardiac rhythm and conduction in fin whales to meet the contrasting physiological demands of diving and surfacing. Moreover, we established HR as a valuable

new metric for studying whale behavior and health, with important potential for assessing responses to human-induced stressors.

Whales and polar bears in a petri dish: cell-based in vitro models for studying the impact of pollutant exposure on lipid metabolism

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Marine predators such as whales and polar bears are threatened by bioaccumulated and biomagnified contaminants such as persistent organic pollutants (POPs). Due to difficulties studying these species in the wild, we aimed to develop an alternative approach through in vitro cell-based models to characterize toxicological responses to POPs in marine mammals. We successfully isolated fibroblast cells from skin biopsies of five cetacean species – killer whale (*Orcinus orca*), fin whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), humpback whale (*Megaptera novaeangliae*), and pilot whale (*Globicephala melas*) – and from polar bears (*Ursus maritimus*). In addition, we isolated adipose-derived stem cells (ASCs) from the subcutaneous adipose tissue of these five whale species and polar bears. Further, we developed an in vitro differentiation model by directly converting primary cells into pre-adipocytes to further investigate the impact of POPs on cell function (i.e. lipid metabolism). We successfully differentiated both ASCs and fibroblasts from polar bears into adipocyte-like cells with optimized differentiation cocktails (with or without insulin). In contrast, neither differentiation cocktails induced adipogenic conversion in the whale-derived cells. The ASCs and fibroblasts from six polar bears were exposed during the differentiation process to an environmentally relevant POPs mixture (PCBs and organochlorine pesticides) at different time points (five exposure windows: early - day 3 to 7, mid-early - day 7 to 11, late - day 11 to 14, extended - day 3 to 14, and overall - day 0 to 14). Preliminary results suggest that POPs exposure affects adipogenic lipid accumulation (AdipoRed assay – lipid quantification) in a time-dependent manner: early and continuous exposure during the differentiation process reduced lipid accumulation, whereas late exposure increased it. These minimally invasive cell-based models provide new insights into the molecular mechanisms underlying pollutant toxicity in marine mammals and their impacts on lipid metabolism.

Time-series of essential amino acid isotopic values from a small cetacean indicate climate-driven variability in carbon cycling

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Interannual variability of $\delta^{13}C$ in essential amino acids (EAAs) of common dolphins (*Delphinus delphis*) incidentally caught in gillnet fisheries in the Southern California Bight, U. S., was evaluated between 1990 and 2008, in relation to seawater temperature, primary productivity (Chl-a as a proxy), dissolved inorganic carbon (DIC), and the coastal upwelling transport index (CUTI). A total of 178 skin samples (bulk tissue) were analyzed, with a subset of 30 used for EAAs analysis. Bulk $\delta^{13}C$ values showed no significant differences across years. In contrast, EAAs values revealed distinct temporal patterns: Lysine, methionine, and phenylalanine displayed the greatest fluctuations (6–10‰), trending toward lighter values, while leucine showed progressive enrichment. Valine, Isoleucine, and Threonine exhibited no consistent changes. On average, $\delta^{13}C$EAAs declined by 3.5‰ between 2000 and 2008, a magnitude far exceeding the Suess effect (~0.2‰ per decade), suggesting that oceanographic drivers beyond atmospheric forcing shaped the isotopic signal. Generalized additive models (GAMs) identified temperature, DIC, and Chl-a as the most important predictors, explaining up to 76% of isotopic variability. These results demonstrate that common dolphins are biological samplers of the ecosystem, integrating through their diet the isotopic signal of primary producers. The $\delta^{13}C$EAAs values thus reflect the marine carbon cycle. Unlike traditional approaches, such as $\delta^{13}C$ of particulate organic matter, which may be influenced by bacterial contributions, or $\delta^{15}N$ of zooplankton, which reflects trophic-level effects, the $\delta^{13}C$EAAs in top predators offer a novel and more precise tool to trace changes in carbon fixation by the primary producers that support the food web where the predators forage. This highlights the potential of isotopic analysis of essential amino acids in dolphin skin, sentinels of the ecosystem they inhabit, to understand the dynamics of the carbon cycle in response to high environmental variability

Source parameter and spectral banding characterisation of the echolocation clicks of Risso's dolphins (*Grampus griseus*)

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Risso's dolphins exhibit an atypical coastal distribution in the shallow waters around Scotland. There is a need for a robust monitoring programme to meet conservation objectives set out for Risso's dolphins in Scottish waters, particularly within the North-east Lewis MPA, established for Risso's dolphins. Passive acoustic monitoring provides an efficient method by which Risso's dolphin presence can be monitored year-round, but relies on accurate characterisation of their echolocation clicks in order to confidently identify the species from acoustic data alone. One of the key identifying characteristics known as spectral banding within the echolocation clicks of Risso's dolphins are still not fully understood. Using a vertical multi-channel hydrophone array, echolocation clicks of Risso's dolphins were recorded and the spectral banding and source parameters of on-axis clicks characterised. On-axis clicks were of high energy (mean source level 197 dBpp re 1 µPa at 1 m), broadband (mean 10dB bandwidth 44.5 kHz), and had a narrow beam width of 11.5° (directivity index 23.8 dB). Spectral banding was found to be a result of additional multipath pulses following the initial echolocation click, creating stable frequency peaks when integrated within the chosen time resolution of spectrogram bins or power spectra. The stable peaks in their frequency spectrum were similar to those of Risso's dolphin in other areas of the north-east Atlantic. These features may therefore be diagnostic for the species, and provide a means for single species monitoring of Risso's dolphins from passive acoustic data using advanced signal processing methods

Deep diving cetaceans within the proposed deep sea mining area of the Nordic Sea

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Deep-sea ecosystems of the Nordic Sea, particularly those associated with the Arctic Mid-Ocean Ridge, are subject to industrial interest following Norway's proposal to mine the 281,000 km² of seabed. This region provides habitat for a diversity of cetaceans. During the summers of 2024-25, two visual–acoustic surveys were conducted using the SY Witness. One prototype autonomous drifting hydrophone was also deployed during June 2025 for ~24 hrs near the subsea canyon southeast of Jan Mayen Island. Surveys covered 8,826 km of track, including 6,578 km of acoustic and 1,578 km of visual effort. Across both years, eight cetacean species were visually and/or acoustically detected, with sperm whales (*Physeter macrocephalus*) and northern bottlenose whales (*Hyperoodon ampullatus*) the most frequently detected taxa, primarily along deep ridge features (1000–3900 m deep). Spatial partitioning was evident between these two species: bottlenose whales were concentrated along the Jan Mayen Fracture Zone, whereas sperm whales were distributed more broadly. Our findings are consistent with other studies that suggest that the waters southeast of Jan Mayen are a hotspot for bottlenose whales, at least during May–June. This area is a spawning ground for boreoatlantic armhook squid (*Gonatus fabricii*), their preferred prey. Analyses of call types suggest that bottlenose whales were feeding in the proposed mining area. Differences in detection rates between surveys conducted in 2025 (9 – 19 June and 26 June – 5 July) indicate that the potential onset of migration for this species is mid-June, coinciding with the end of the squid spawning period. The occurrence of deep-diving odontocetes raises concerns regarding potential impacts from future mining. Increased shipping, chronic noise and sediment plumes could pose risks to cetacean behaviour, prey availability, and ecosystem function. Our results highlight the need for precautionary management, extended monitoring, and international coordination prior to any deep-sea mining operations.



SHORT TALKS

Into the unknown: Population structure, social dynamics, spatial-temporal distribution and vocal repertoire of sperm whales off the Eastern Mediterranean Sea of Türkiye

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Sperm whales (*Physeter macrocephalus*), the largest toothed whales and classified endangered within the Mediterranean Sea, are highly social marine predators whose complex group structures and vocal behaviors provide unique insights into population organization, communication, and cultural dynamics. While global research exists, our study aims to fill knowledge gaps in the Eastern Mediterranean by investigating sperm whale spatial-temporal distribution, social structure, demography, and acoustic behavior. Current results rely on the seasonal data collection between 2018 and 2025, with an overall survey effort of 229 days, covering the Eastern Mediterranean Sea of Türkiye. Sperm whales were predominantly observed between Rhodes Basin, Finike Canyon, and Antalya Canyon, exhibiting clear seasonal patterns: summer sightings were highest, while during the winter surveys they were only detected acoustically. Group sizes ranged from solitary individuals to social units of up to 17 whales, with a mean of three. Social units were most common, followed by bachelor groups and solitary males. Mean body length across individuals was 9.5 m (SD = 1.4 m), ranging from 7.7 to 12.7 m, with no large bulls recorded. Interspecies interactions were observed between solitary males and groups of bottlenose dolphins. Preliminary acoustic analysis revealed the presence of both 3+1 and 3++1 codas within the Eastern Mediterranean Sea of Türkiye. Further, the presence of chirrups were also noted. These findings provide the first information on sperm whales from the easternmost region of the Mediterranean and contribute to understanding their spatial-temporal distribution, social organization, demography, and acoustic behavior. The study demonstrates that dedicated regional monitoring, even at smaller scales, forms a crucial foundation for large-scale ecological knowledge across the basin.

Viral community structure in Scottish marine mammals reflects interspecies interactions and host demography

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Viral diseases pose a major threat to marine mammals, with the recent emergence of high-consequence pathogens like highly pathogenic avian influenza and rabies raising urgent ecological and conservation concerns. Yet, because samples from free living individuals (particularly cetaceans) are difficult to acquire, data on viral infection has largely been restricted to epidemiology of a few important viruses, leaving gaps in our understanding of the processes shaping pathogen emergence and spread in these animals. In this work, we aimed to understand how demography, ecology, and evolutionary relationships determine viral community structure in marine mammals. To characterise complete viral diversity, we applied total RNA sequencing to samples from 138 individuals stranded on the coast of Scotland between 2016 and 2019 representing 15 species, providing the first multispecies study of marine mammal viromes. We identified diverse viruses spanning different genome types and life-history strategies, establishing a strong proof of concept for repurposed necropsy samples from inaccessible wildlife populations for this kind of study. In this dataset, we found evidence of frequent viral sharing, including between seals and cetaceans, reflecting observed interspecies interactions in UK waters. These findings suggest that new viral introductions could spread between species and even orders in marine mammal communities, and highlight the possibility for pathogen spread from new interspecies interactions caused by changes to home ranges. We also showed that juveniles harbour richer viral communities than adults or neonates, highlighting how shifting population age structure may influence transmission. These insights provide a novel framework to understand how changes to populations and ecosystems could shape infectious disease in marine mammals and suggest how future outbreaks may spread in these threatened populations.

Mark-recapture survival and fecundity rates of harbour seals in areas of contrasting population trajectories in Scotland

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Understanding the demographic drivers behind observed changes in abundance is key to inferring intrinsic and extrinsic causes behind such changes in wild populations. In Scotland, harbour seal populations have undergone regional declines since the early 2000s. Here, we apply mark–recapture models to photo-identification data collected during June and July (breeding season) at haulout sites representative of three areas with contrasting population trajectories, to estimate sex-specific apparent adult survival and fecundity rates. Apparent adult survival rates were lower at the declining site of Burray (2016 to 2022 data); female survival = 0.844 (95%CI 0.803–0.878) and male survival = 0.826 (95%CI 0.751–0.883). This site, located within the North Coast and Orkney Seal Monitoring Unit (SMU), has declined by 85% since the mid-1990s. In contrast, at stable or increasing sites, estimated apparent adult survival rates were higher: at Dunvegan (West Coast SMU, generally increasing since monitoring started in the mid-1990s) female survival was 0.878 (95%CI 0.810–0.924) and male survival was 0.842 (95%CI 0.756–0.902) (2016 to 2022 data). At Loch Fleet (Moray Firth SMU, currently stable with no trend since 2003), estimates were also high: female survival was 0.941 (95%CI 0.922–0.956) and male survival was 0.919 (95%CI 0.888–0.942) (2006 to 2021 data). Mark–recapture fecundity rates were generally high at all sites (0.809 to 0.883), with the lowest estimate at the declining site of Burray. The results indicate that the causes of the decline are likely acting on adult survival, while evidence that a decrease in fecundity is behind the observed declines received less support. These results fill in a recognised data gap to understand the drivers of harbour seal population dynamics in Scotland, and provide key information for future parameterisation of population assessments to explore impact of human activities and inform management decisions.

Do striped dolphins follow chlorophyll — or does chlorophyll follow them?

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The influence of top predators like striped dolphins (*Stenella coeruleoalba*) on lower-trophic-level dynamics in the Western Mediterranean Sea is poorly understood. Although these dolphins are linked to surface chlorophyll as a sign of prey, it remains unclear whether they are drawn to areas of higher primary productivity or if they contribute to increased productivity themselves. As part of the BLUESCAPE project, we combined aerial survey data with satellite imagery to investigate whether striped dolphin distribution simply reflects local productivity or if their presence also boosts productivity by recycling nutrients. Using locally derived abundance estimates (1.85–2.9 ind. km^{-2}) and annual nutrient excretion rates (41 kg N and ~4 kg P per dolphin assuming Mediterranean N:P ≈ 22:1), we estimated that dolphin aggregations may supply 0.3–0.5% of the nitrogen and phosphorus required annually to sustain phytoplankton production—a modest but important input, especially when released in concentrated pulses within an oligotrophic, phosphorus-limited system not aligned with the Redfield ratio. We performed a correlation analysis to examine the relationship between concurrent dolphin density (n = 452) and daily satellite-derived chlorophyll concentrations, using control sites without dolphins (n = 254) for comparison. Additionally, a hierarchical classification based on seabed slope and depth was employed to identify four distinct geomorphological sectors within the Pelagos Sanctuary. For each of these sectors, chlorophyll levels were analyzed in comparison with controls and varying dolphin abundances. A Kruskal–Wallis test revealed significant differences in chlorophyll levels across dolphin abundance classes ($P < 0.01$), with higher dolphin densities consistently associated with higher daily chlorophyll concentrations. By comparing these estimates with data from trophic models like OGSTM–BFM, we present the first quantitative analysis of how dolphins both respond to and affect the carbon-fixing ability of the Pelagos Sanctuary ecosystem.

Tracking the invisible - localising harbour porpoises using multichannel fixed-bottom Soundtrap arrays

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Passive acoustic monitoring of small odontocetes is often based on single hydrophone devices; these can collect information on the presence and acoustic behaviour of vocalising animals but does not provide information on direction or position. Positional information can be very important to describe behaviour, especially when studying reaction to potential threats, such as fishing gear. To fill this gap, fixed multichannel recording arrays can be used; these can determine the direction of high frequency sounds, such as porpoise echolocation clicks. During the project PAL-CE (https://www.deutsches-meeresmuseum.de/wissenschaft/projekte/aktuell/pal-ce), four hydrophone arrays (soundtrap 4300-HF, Ocean Instruments, NZ) were placed around an artificial gillnet, with the aim to track harbour porpoises and get information about their behaviour (e.g. speed, moving direction) using additional drone observations during daytime. The acoustic localisations were tested with artificial playback sounds to check for accuracy of the positions. By combining a minimum of two arrays recording the same signal, the absolute position error compared to regular GPS position was around 10m, which is partly caused also by the high GPS positioning error. Inter positional changes on the other hand were highly accurate. The drone footage was analysed using CetTrack (cettrack.info), resulting in georeferenced positions of >50 tracks of harbour porpoises within the setup. For those tracks, the acoustic recordings, were inspected for porpoises detected on two or more arrays at the same time. We compared matching visual–acoustic pairs to demonstrate the accuracy and potential of acoustic tracking of harbour porpoises, especially for solving the problem of nocturnal entanglement, when they are not visible at the surface and rely heavily on echolocation.

How stiff are cetacean arteries? New insights into aortic mechanics and structural adaptations for diving

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Cetaceans experience rapid shifts in blood pressure and distribution during diving, suggesting their arteries must accommodate substantial volume changes. This implies greater arterial elasticity than in terrestrial mammals. Because cetaceans evolved from artiodactyl ancestors, goats provide a phylogenetically relevant terrestrial comparison. However, the material properties that define arterial stiffness in cetaceans are largely unknown. The elastic modulus, which measures resistance to stretching, reflects arterial stiffness: higher values indicate vessels that deform less. This study tested whether odontocete aortas are more flexible than those of goats and whether there are differences among the odontocete species examined. Aortic rings were collected from *Stenella coeruleoalba* (n=1, male, adult), Delphinus delphis (n=1, female, adult), *Globicephala macrorhynchus* (n=1, male, juvenile), and *Orcinus orca* (n=1, male, adult), recovered from stranded or euthanised animals following health assessment. Two adult goats (*Capra hircus*, n=2) acted as terrestrial controls. All samples came from the mid-descending thoracic aorta, were frozen and thawed identically, and tested in uniaxial tension until failure. The size and thickness of cetacean arteries required engineering-grade equipment, representing the first application of this approach to cetaceans. We calculated the maximum tangential elastic modulus from the final linear region of the stress–strain curve. Absolute stiffness values may be influenced by post-mortem processing, but interspecific differences were clear. All odontocetes showed lower terminal stiffness than goats, confirming our working hypotheses. The striped dolphin aorta was approximately 1.4 times more flexible than that of goats, with similar values for *Delphinus* (~1.6×), *Globicephala* (~1.4×), and *Orcinus* (~1.8×). Future work including more species, ages, and both sexes will clarify how biological factors modulate arterial mechanics and whether stiffness scales with body size or diving behaviour. Understanding arterial stiffening in cetaceans helps reveal structural strategies that support diving physiology and highlights the need for broader biomechanical datasets.

Application of ballistics euthanasia and cetacean behavioural responses during stranding

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Euthanasia may be necessary to end suffering of stranded cetaceans. To ensure a humane death, insensibility must be verified following application of the killing method. However, only limited information is reported on individual euthanasia events, including how insensibility and/or death is assessed. We describe current practices for euthanising stranded cetaceans in New Zealand by analysing video footage of fourteen ballistics events involving five delphinid species. Specifically, we detail the ballistics procedures applied and the elicited behavioural responses of animals involved. Additionally, we sought to understand how animal insensibility was evaluated following each event by surveying the personnel involved. Video recordings ranged in length from 25 to 480 s post initial shot and involved 14 cetaceans: one Cuvier's beaked whale, one pygmy sperm whale, one bottlenose dolphin, four pilot whales and seven false killer whales. Insensibility criteria were typically not observed being verified in the analysed videos, despite markspersons stating that death occurred in <1 minute for most animals. Key behaviours indicative of insensibility included a continuously slack lower jaw and epaxial muscle relaxation. Based on behavioural observations, 66.7% of animals for which an estimate could be made (n=12) were likely unconscious within 30 s of the initial shot; half of these were likely unconscious within 10 s. The remaining animals appeared conscious for 30 s after the initial shot, and half of these were likely still conscious after one minute. Ten animals (71.4%) displayed post-shot behaviours suggestive of voluntary control, including tail lifting, beyond the point of presumed death reported by markspersons. The lack of verification of insensibility in most animals (12/14) hinders our ability to understand how these behaviours may correlate with awareness, and thus welfare impacts of shooting. While the application of ballistics appeared to follow current national recommendations, the procedures mandated for verifying death were rarely observed.

Lessons from an integrated multidisciplinary investigation into the health, ecological, and environmental drivers of two large pilot whale mass stranding events in Scotland

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Cetacean mass stranding events (MSE) pose extreme operational challenges where animal welfare, public safety, and scientific investigation must be balanced under acute time pressure, substantial logistical constraint and heightened public and media scrutiny. Long-finned pilot whales (LFPW, *Globicephala melas*) exhibit among the highest global stranding frequencies and these events can generate both public concern and rare research opportunities on an otherwise elusive deep-water cetacean species. Two large MSE in Scotland in July 2023 and 2024 enabled a coordinated multidisciplinary investigation. Here we synthesise the principal findings and outline implications for future response, analysis and public engagement. Taken together, the LFPW mass strandings at the Isle of Lewis (2023) and Sanday, Orkney (2024) represent the most extensive MSE datasets for this species in the northeast Atlantic. Complete necropsies were performed on 59 individuals with tissue samples from an additional 73. The investigation sought to identify potential drivers of the events while also evaluating broader indicators of health, feeding ecology and habitat use. Integrated analyses incorporating pathology, microbiology, genetics, stable isotopes, fatty acids, proteomics were combined with long term sightings records on

distribution and abundance and environmental, bathymetric, and underwater-noise data. Most individuals were in good condition, with no evidence for significant disease, trauma, fisheries interactions, or biotoxin exposure, although a dystocia in one case may have been a proximal trigger for the 2023 event. Fatty acid and isotope data indicated no abrupt dietary or habitat shifts, and genetic analyses showed the aggregation comprised multiple unrelated pods and provided useful insights into population structure. Several animals exhibited unexpected heavy-metal burdens, highlighting MSE's as sensors of broader environmental pollution. These findings are synthesised into a framework for integrating multisource data to derive holistic ecological interpretations of cause of death and life history potentially of use in the investigation and interpretation of future events.

Collaborating with Scotland's creel fishers to reduce entanglement of whales and other megafauna through simple gear modifications

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The Scottish Entanglement Alliance (SEA) is a collaborative industry/research/NGO partnership working to better understand and reduce marine megafauna entanglement in Scottish fisheries. Entanglement in creel fishing gear (static pots/traps) is a welfare and conservation concern for minke whales (*Balaenoptera acutorostrata*), humpback whales (Megaptera novaeangliae), and other megafauna in Scottish waters. From interviews with over 150 creel fishers about their experiences of entanglement, SEA estimated that, where entanglement type was known, 83% of minke and 50% of humpback whales were caught in groundlines between creels, as floating polypropylene rope forms arches several metres high in the water column between pots. Suggestions from creel fishers for entanglement mitigation options included replacing floating rope with negatively buoyant groundline, which lies on the seabed. Since 2022, creel fishers from all around the Scottish mainland and islands (~100 vessels) have been collaborating in a project to assess the practicality of negatively buoyant groundline in their gear and suggest how it might be implemented. Most creel fishers have been positive about the feasibility of switching, provided that there is a flexible scheme which addresses issues such as cost, timescale and regional differences. Negatively buoyant rope has trialled particularly well in creel fisheries with the highest entanglement risk – those targeting langoustine (*Nephrops norvegicus*) and brown crab (*Cancer pagurus*) in water >30m. Some fishers prefer it to floating rope. This project has established that there is a relatively simple, low-cost option which can be applied in most creel fisheries to mitigate megafauna entanglement. It is a good example of a collaborative 'basics to benefits' scenario where initial interview data from fishers have been followed through towards a coherent, bottom-up mitigation strategy with potential to substantially reduce risk to megafauna. This can now be progressed towards national implementation.

From wrasses and seabass to skates and conger eel: long-term dietary shifts of grey seals in the Iroise sea

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Nowadays, the Iroise Sea (Brittany, France) is inhabited by more than 300 grey seals (*Halichoerus grypus*). The growing presence of this predator in the Marine Protected Area (MPA) raises questions about its interactions with prey populations as well as the extent to which their diet overlaps with fisheries' target species. However, no detailed data on grey seals' diet has been made available in this area since the early 2000s. We studied the diet of grey seals in the Iroise Sea by analyzing 249 scats collected between 2017 and 2024, using standard methods based on the identification of diagnostic hard parts (otoliths, fish bones, cephalopod beaks). Our results revealed a diet now dominated by conger eel (*Conger conger*, 34.2% of ingested mass), wrasses (17.6%, mainly *Labrus bergylta*), and skates (11.1%). Compared to the early 2000s diet, major changes include a strong increase in conger consumption (20.7% in 2000) and the recent appearance of skates, absent in the 2000s, followed by a marked decline in the importance of wrasses (divided by 3) and commercially important species such as seabass (*Dicentrarchus labrax*, 11.9% in 2000) and pollock (*Pollachius* spp., 3.7% in 2000). Such shifts likely reflect changes in local prey availability. Such ecosystem modifications may be linked to fishing pressure or climate changes and suggest an evolution in the food-web structure in the Iroise Sea, potentially altering seal–fishery interactions. Understanding these trophic relationships is fundamental to assessing the potential for direct and indirect competitions between seals and fisheries. It also provides a basis for developing appropriate conservation strategies to ensure the sustainability of wildlife populations and fishery resources in the Iroise Sea MPA.

AI-based approach to identify evidence of possible signature whistle occurrence in Mediterranean striped dolphin

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Signature whistles (SW) represent individually distinctive calls that play a central role in social cohesion, group coordination, and identity signalling in delphinid species. While extensive research exists for the common bottlenose dolphin, information for other species is very scant. Particularly, the acoustic behaviour of striped dolphin (*Stenella coeruleoalba*) remains poorly explored, and only suggestions on the occurrence of stereotyped whistles are reported in the Mediterranean Sea. This study is the first quantitative investigation of SW in striped dolphin clustering structural variability and socio-acoustic drivers based on a passive acoustic monitoring carried out in the Northern Ionian Sea (Central-Eastern Mediterranean Sea). Analysis integrates SIGID-based classification with advanced unsupervised learning methods. From 363 SW records, manually labelled according to SIGID method, 8 acoustic contour parameters (beginning, ending, minimum, maximum, range and gradient frequency, duration, number inflection) were extracted by PAMGuard with ROCCA module. These parameters, together with the group size, as an additional social predictor, were used in a pipeline that combines multiscale Uniform Manifold Approximation and Projection dimensionality reduction with a hierarchical density-based clustering technique. Twenty-one SW clusters were identified, showing a weighted purity of 86% relative to the SIGID-based labels, demonstrating strong agreement between expert-labelled whistles and those retrieved by the unsupervised pipeline. Remarkably, 10 SW were recorded on at least 2 years on different occasions. Results showed that striped dolphin emits stable stereotyped whistles ascribable to SW, despite notable within-event acoustic plasticity. These findings provide a new robust, reproducible, and promising computational framework for SW identification in data-poor or hard-to-study species. This approach supports future applications in individual recognition, abundance estimate, and the development of AI-based bioacoustics tools for ecological knowledge improvement and conservation purposes.

Out of sight, out of mind: scientific effort remaining focused on inshore habitats hinders effective conservation of marine mammal populations

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The logistical and financial capacity of research institutions has shaped the spatial coverage of marine research. Global initiatives, such as the High Seas Treaty or the “30x30” target, promote biodiversity conservation across jurisdictional boundaries, however, monitoring open oceanic waters remains a major challenge. Several marine mammal species spend a great amount of their lifetime in offshore habitats, and effective protection of their populations relies on data across their distributional range. To evaluate research trends and gaps and perform a comparative analysis between research effort in inshore and offshore environments, we conducted a systematic review on marine megafauna studies, including mammals (2000-2024). The search yielded 17,072 peer-reviewed publications from Scopus and WOS. The analysis highlighted that, despite an overall increase in the number of records throughout the 21st century, research continues highly biased towards inshore regions. With a total of 8,920 records focused on marine mammals (6,335 inshore versus 3,836 offshore, including 1,251 studies targeting both), the contribution of offshore studies varies from 33% in 2000 to 39% in 2024. Nonetheless, the Compound Annual Growth Rate (CAGR) for offshore records (CAGR = 8.2) is higher than that of inshore ones (CAGR = 7.1), and that of the overall marine mammal research (CAGR = 7.2). A spatial analysis showed that the marine mammal research in offshore waters is underrepresented (in comparison to inshore), being most balanced in Europe and most skewed in South America (23% and 65% difference between inshore and offshore contribution, respectively). An outstanding increasing trend in offshore research between 2003 and 2005 (with offshore studies surpassing inshore ones in 2005) could be related to scientific publications derived from financial incentives at the start of the century, thus confirming that dedicated funding and scientific cooperation can drive research beyond borders - an essential endeavour to meet high-seas conservation targets.

A Global declaration for river dolphins: Learnings for cetacean conservation

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Since the 1980s, the combined populations of river dolphin species have plummeted by 73%; with all 6 extant species of freshwater cetacean now classified as Endangered or Critically Endangered. Freshwater cetaceans are found in 14 countries in Asia and South America, but their decline is driven by the same universal threats of bycatch, habitat fragmentation from infrastructure (dams and barrages), pollution, direct hunting, and low public, political, and funder awareness. In response, a Global Declaration for River Dolphins was developed and, in October 2023, signed by 10 range states (Bangladesh, Brazil, Bolivia, Cambodia, Colombia, Ecuador, India, Nepal, Pakistan, and Venezuela). This landmark agreement - to our knowledge the first of its kind for cetaceans - seeks to replicate the conservation impact of species declarations for tigers and snow leopards. For the purposes of the Declaration and WWF's Global River Dolphin Rivers Initiative, we consider "river dolphins" to include the 6 extant species of freshwater cetacean: Amazon River Dolphin (*Inia geoffrensis*), Tucuxi (*Sotalia fluviatilis*), Indus River Dolphin (*Platanista minor*), Ganges River Dolphin (*Platanista gangetica*), Irrawaddy Dolphin (*Orcaella brevirostris*) and Yangtze Finless Porpoise (*Neophocaena asiaeorientalis*). The signing of the Global Declaration helped raise global awareness of river dolphins significantly, with communications activities recorded to have a reach of 1 billion people. Following the signing of the Declaration, work has focussed on: delivering the agreed pledges, securing the support of remaining range state governments, and closing the significant funding gap for river dolphin conservation worldwide. We share our lessons learned from supporting governments in this process, as well as innovative approaches to secure sustainable finance for this work over the next decade.

Performance review of the Sea.AI Sentry thermal camera for whale detections under various environmental conditions

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Ship strikes are one of the major threats to large whale populations globally. Therefore, utilising thermal cameras for early detection of whales and empowering mariners to avoid collision may be a crucial mitigation strategy, yet information on its feasibility under different environmental conditions is limited. To analyse the effectiveness of such technology, a Sea.AI Sentry thermal camera was mounted onboard research vessels spanning from the Faroe Islands to the Mediterranean Sea. Two marine mammal observers conducted single-platform line transects while the thermal camera filmed continuously along the transect line with 4 different cameras (2x thermal: 640×512 px, 2x lowlight: 2592×1944 px). The sightings records were utilized to calculate the detection rate, detection distance and changes in detection based on environmental conditions. Along 12 weeks, 674.5hours of visual surveys were recorded, logging 48 large whales. Of these,18 whales were seen on the thermal camera, producing 52 blows, which were analysed. Most (87%) missed sightings were due to the whale appearing outside the 30° wide camera angle, with other failures primarily attributable to excessive distance. Blows were detected by MMOs at 5000m with the furthest blow captured on the camera limited to approximately 1600m, both on the thermal camera and lowlight view. Cetaceans missed by MMOs were identified in the footage retroactively. Fog and mist reduced the thermal camera's ability to capture heat signals by creating a homogenous field. However, no major difference in detection rate was noted between various sea surface temperatures (8-18°C), air temperatures (7-22°C), temperature difference (1-6.6°C), wind speed (1-21knots) or Beaufort Sea States (1-5). Lower detection

rate and lower quality footage of the thermal camera were predominantly due to the lower spatial resolution of the thermal sensors. In conclusion, this preliminary analysis of the Sea.AI thermal camera shows great potential in early whale detection in various environmental conditions.

Non-invasive drone-based sampling of bottlenose dolphin blow in the northern Adriatic Sea: genetic identification and future application

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Non-invasive sampling methods are increasingly essential for assessing the health of free-ranging cetaceans, particularly small odontocetes, for which traditional approaches are often logistically challenging or potentially stressful. This study, carried out in the context of the Interreg Italy-Slovenia project SeaInsights, aimed to evaluate the feasibility and reproducibility of drone-based blow sampling of common bottlenose dolphins (*Tursiops truncatus*) off Piran, Slovenia, northern Adriatic Sea, in spring 2025, with the objective of characterizing genetic material present in exhaled respiratory droplets. Seven sampling bouts were conducted on single individuals or small groups, using a waterproof drone equipped with a sterile sampling tool designed to intercept the blow without disturbing the animals. The biological material collected in the field was processed to isolate DNA using the DNeasy Blood and Tissue kit (Qiagen) and to detect the presence of bottlenose dolphin mitochondrial DNA (mtDNA), in order to first determine individual identity or group clustering. Considering the low amount of extracted DNA, a semi-nested PCR approach was designed to amplify mitochondrial gene fragments characterized by high intra-species variability by using species-specific primers. A concatamer, a single long nucleotide sequence, was then constructed by merging the shorter mitochondrial loci sequences (6 loci in total) and used for phylogenetic analyses. Of the seven samples collected, six with high-quality genetic material allowed the successful amplification and sequencing of at least 4 mitochondrial loci, confirming the reliability of the drone-based collection protocol under field conditions. The successful acquisition of respiratory genetic material from free-ranging dolphins underscores the value of drone-based blow sampling as a non-invasive method applicable not only to large cetaceans—as commonly reported—but also to smaller coastal odontocetes. This technique holds promise for integrating health assessments, population genetics, and long-term monitoring, especially in well-studies populations such as the one considered here.

Evaluating tissue type, preservation method, and decomposition stage effects on DNA quality to support standardized genetic sampling in stranded small cetaceans

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Effective conservation management depends on reliable knowledge of population structure, which in turn requires access to high-quality genetic material. Stranded cetaceans represent a major source of biological samples, yet ensuring that these meet the standards required for genetic analyses remains difficult. Although tissues from stranded animals are routinely used in conservation genetics, no controlled study has systematically tested how DNA yield and quality vary across different tissues and preservation approaches. In this work, we compared DNA concentration, purity, and integrity obtained from skin, muscle, and blubber samples preserved either in 96% ethanol or frozen at −20 °C. All specimens originated from a tissue bank of stranded dolphins (n=25, samples were collected between December 2022 and November 2023 in Lisbon and Tagus Valley) and were assigned to one of five decomposition condition categories based on internationally accepted criteria. Standardized workflows were applied for DNA extraction, quantification, and quality assessment. Statistical analyses were then performed to determine the effects of tissue type, preservation method, and decomposition level on DNA quality metrics. Skin consistently yielded the highest DNA concentrations and maintained suitable purity values across most decomposition stages. As expected, DNA integrity decreased progressively with advancing decomposition in all tissues, with the exception of muscle, which showed comparatively better integrity even at later stages. Drawing on these results, we present two practical frameworks: one tailored for researchers selecting samples according to sequencing needs, and a simplified decision tool designed for rapid application by stranding network personnel. Together, these guidelines support more harmonized sampling procedures and enhance the robustness and comparability of genetic datasets generated from stranded small cetaceans.

Marine mammals and navy sonar: summarising 20+ years of research on behavioural response

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The behavioural response of marine mammals to navy sonar has been a research area funded by US and European Navies for around two decades. This has motivated the collection of vast quantities of baseline and exposure data across a diversity of marine mammal species in different exposure contexts, alongside analytical method and tool development. First, we present a synthesis of available data from behavioural response studies (BRS) relating to navy sonar across research programs, the questions that have been addressed through BRS research, and the analysis methods used. This synthesis sits within a wider effort to review the state of the science available to meet US Navy needs for environmental compliance, which we will briefly discuss. One element of the compliance workflow is the fitting of exposure-response functions to BRS data to be able to predict the probability that an individual will respond at a given received level of sound. We will present the statistical framework underpinning the exposure-response functions used by the US Navy and discuss priorities for adapting this framework to accommodate the ever-growing and increasingly diverse datasets resulting from BRS research. To inform management and conservation, there is a need to understand population-level effects as well as effects on individuals. Knowledge gaps in the parameterization of population consequences of disturbance models (PCoD) may be addressed by revisiting the rich array of BRS data. In particular, the duration of responses and the ability of individuals to compensate for disrupted foraging time may have profound consequences on the long-term effects of disturbance, and BRS datasets at multiple scales may now support these investigations. We will present an overview of efforts to integrate BRS data into PCoD models. Together, these inter-linked projects are helping inform priorities for future research on the behavioural responses of marine mammals to navy sonar.

USBL and catch control systems cause wide displacement of harbour porpoises - geophysical surveys cannot be carried out simultaneously with baseline studies in offshore windfarms

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In a Danish North Sea pre-investigation area for 10 GW offshore windfarms, geophysical surveys were conducted simultaneously as baseline harbour porpoise presence data. Within, there was an investigation on whether the use of USBL (Ultra-Short BaseLine) acoustic positioning systems during geophysical surveys had any impact on presence of porpoises in the survey area. USBL systems emit signals at 18-65 kHz with a source level of <208 dB re 1 mPa rms, which is known to cause deterrence of harbour porpoises. Porpoises were monitored with F-PODs and USBL signals with ST600HF SoundTraps. We hypothesized that number of porpoise positive minutes (PPM) decreases with increasing received levels of USBL signals, that there would be a delay before the first harbour porpoise detection following a USBL pulse (Waiting Time), and that Waiting Time length would increase with increasing received levels. These hypotheses were accepted with statistical significance. At a received SPLrms125msVHF =100 dB re 1 mPa, the predicted number PPM was halved in relation to periods without USBL signals. The study also showed that USBL signals had a potential effect range of 1 – 5.5 km for the same USBL system/vessel. Furthermore, the study showed that the predominant source of USBL like signals recorded were from trawlers in the area. Trawlers use catch control systems that functions similar to USBLs with a comparable frequency and source level. Each trawler has multiple transponders to monitor the position of the trawl in the water column, to measure fish entering the trawl, total catch etc., i.e. a hitherto undocumented and unregulated noise source omnipresent in the marine environment which is used on all types and sizes of trawlers, at least in Danish Waters. The impact of USBL signals is understudied, as well as other acoustic-based marine technologies, and are in high need of better documentation and regulation.



From Atlantic Ocean to the Mediterranean Sea: uncovering connectivity and introgression in *Grampus griseus* large-scale dataset with RAD-seq analysis

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Understanding the connectivity of widely distributed cetaceans is crucial in assessing population structure and evolutionary trajectory, and developing effective conservation strategies. Risso's dolphin (*Grampus griseus* Cuvier, 1812) is a highly mobile species, widely distributed, about which little is known regarding the population genetic structure in the Mediterranean Sea and the Atlantic Ocean. Previous studies based on mitochondrial DNA control region and microsatellites, together with a geographically limited sampling area, have provided only a partial view of large-scale connectivity of this species, hence the need for

wider spatial coverage and more polymorphic genetic markers to clarify its population patterns. A total of 152 skin or muscle samples of G. griseus were obtained through collaborative agreements with several research institutes in the study area. Samples come from three main regions: North Atlantic (Faroes, Scotland, and Ireland), Central Atlantic (Portugal, Spain, France, and the Azores), Western Mediterranean (Italian coast, Spain, France, and the Balearic Islands), and Eastern Mediterranean (Italian coast, Croatia, and Türkiye). The samples were used for DNA extraction, and a double-digest Restriction-site Associated DNA Sequencing (ddRAD-Seq) protocol was performed. Paired-end sequencing was carried out on an Illumina platform, generating ~2–5 million paired-end reads (150 bp) per individual. After demultiplexing, quality filtering, and alignment to the reference genome, loci were assembled in Stacks and further filtered in PLINK. The final dataset consisted of 27,106 high-quality SNPs (Single Nucleotide Polymorphisms) from 105 individuals. Population structure analyses revealed significant differentiation between North Atlantic, Central Atlantic and Mediterranean areas, with some level of admixture suggested among all regions. The improved spatial resolution and the use of highly polymorphic markers contribute to defining G. griseus population structure on a large-scale for the first time, and offer a robust framework for future ecological, evolutionary and conservation studies.

Predicting climate-driven shifts in long-term core habitat for sperm whales (*Physeter macrocephalus*) in the southwest Indian Ocean

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Climate change and cumulative anthropogenic pressures threaten marine communities and ecosystems yet predicting future habitat dynamics for vulnerable taxa remain challenging in data-poor ocean regions. We integrated seven datasets, comprising visual boat-based, acoustic, and aerial survey records collected between 2008 and 2023, to model contemporary and future habitat suitability for sperm whales (*Physeter macrocephalus*) across the tropical and data-poor southwest Indian Ocean (SWIO). Using Ensemble Ecological Niche Modelling (EENM), we combined static (depth, slope) and dynamic (sea surface temperature, chlorophyll-a, eddy kinetic energy) environmental variables to assess habitat suitability and forecast changes under three Shared Socioeconomic Pathway climate scenarios (SSP1-2.6, SSP2-4.5, SSP5-8.5) projected for 2040–2100. The contemporary ensemble model performed strongly (TSS = 0.81), identifying slope and depth as primary predictors, with highly suitable habitat concentrated along steep island-associated bathymetric features. All climate scenarios projected substantial declines in highly suitable habitat (20–48% loss), with the greatest reductions under SSP1-2.6 and the smallest under

SSP5-8.5, likely reflecting scenario-specific changes in current velocity and eddy activity. Despite overall range contraction in the region, all scenarios revealed persistent suitable habitats in discrete regions associated with major topographic structures—particularly the northern Mascarene Plateau, northwest Madagascar, Comoros archipelago, and waters west and south of Mauritius, including habitat for the region's only known resident sperm whale social unit. Our findings demonstrate the value of integrating diverse presence-only datasets for forecasting future distributions of vulnerable cetacean species in remote marine ecosystems and highlight priority areas for long-term monitoring and conservation planning. Our work also highlights the need to integrate climate projections and species redistributions into marine spatial planning.

Felids and cetaceans, a shared history: *Toxoplasma gondii* from land to sea in the Adriatic basin

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Toxoplasma gondii is a protozoan parasites able to infect a broad range of hosts, leading to infections in humans and other warm-blooded animals, including cetaceans. Presence of the parasite in the marine environment seems to be related to wastewater and runoffs, with oocysts being brought from felid feces to water and remaining viable in the environment or in carriers (invertebrates and fish). The Northern Adriatic Sea is a semi-enclosed basin characterized by shallow waters and significant river inflow, potentially facilitating coastal contamination. The aim of the study was to investigate *T. gondii* strains occurring in bottlenose dolphin (*Tursiops truncatus*) and in the population of European wildcat (*Felis silvestris silvestris*) inhabiting the Northern Adriatic Sea and the contiguous terrestrial area, respectively, to point out any epidemiological association. Samples of brain and heart were collected from 46 bottlenose dolphins stranded along the Northern Adriatic coasts (2006-2025) and from 47 roadkilled European wildcat collected in Friuli Venezia Giulia region (2022-2024); a PCR targeting the nss-rRNA gene was used for the detection of *T. gondii* DNA. The sequences from positive samples were compared with those in GeneBank using BLAST software. Four wildcats (8.5%) and three bottlenose dolphins (6.5%) tested positive for T. gondii; sequences from felids showed high homology (98.36-100%) with those previously isolated from cats worldwide; one of the feline isolates also showed 100% homology with a sequence from one examined bottlenose dolphin. Strains from cetaceans were also characterized through microsatellite analysis, highlighting occurrence of genotype II, predominant in the Mediterranean basin. The study highlights a low prevalence in both wildcats and coastal dolphins in this area, compared to other areas of the Mediterranean Sea. Genotyping of wildcat isolates is ongoing to obtain their fingerprint in order to confirm the correlation between marine and terrestrial strains of *T. gondii* in this peculiar area.

Understanding species-habitat associations of harbour seals and offshore wind farms

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The number of offshore wind farms (OWFs) is rapidly increasing in response to the critical need for renewable energy in the European Union. One of the most abundant top predators in the North Sea, harbour seals (*Phoca vitulina*), inhabit a wide range of coastal environments, ranging from rocky coastlines of the United Kingdom to the tidal mudflats of the Wadden Sea. They regularly initiate offshore foraging trips from their haulout sites, raising the question whether seals use OWFs as foraging habitats due to reef-building potential or avoid them due to anthropogenic disturbances, including vessel traffic and turbine noise. Despite the rapid expansion of OWFs, their ecological effects on marine predators remain poorly understood. To address this, we tracked 26 harbour seals from the German Wadden Sea using SMRU GPS Phone Tags deployed between 2015 and 2024. These devices recorded surfacing positions (Fastloc GPS), dive and haulout data. We applied step selection functions (SSFs) to quantify animal movement patterns and habitat associations, including environmental variables such as seafloor substrate, geomorphology, temperature, ship and OWF turbine presence. Our results show that most harbour seals spent less than 8% of their time at-sea in OWFs. Thus, despite their fishery closures and artificial-reef potential, they do not appear to constitute disproportionately attractive foraging habitats for harbour seals. Our preliminary SSF model further suggests that there is high inter-individual variability in space use and that associated factors with vessel activity exert a stronger influence on movement patterns than the presence of OWFs themselves. Ongoing analyses aim to evaluate the ecological implications of the pervasive and continuous vessel presence, which shapes the soundscape substantially and may potentially outweigh the positive effects of OWFs. This work highlights the importance of integrating behavioural ecology with conservation strategies to understand and mitigate impacts of OWF developments on marine predators.

PearlNet in action: evaluating harbor porpoise bycatch and gear performance under commercial conditions

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Odontocete bycatch, especially in bottom-set nets, represents a significant threat to these species worldwide. To mitigate this problem, a modified net design has been developed: the PearlNet (PN). The PN follows the same configuration as standard nets but includes small plastic spheres attached to the netting that act as acoustic reflectors to enhance detectability. Although the PN has been evaluated in the Baltic and Black Sea with respect to target-species catch efficiency and handling time, a key question remains: Does the PN reduce odontocete bycatch? To date, only one trial in Turkey has assessed bycatch effects and, although the results suggested a reduction in harbor porpoise (*Phocoena phocoena*) bycatch, it was not statistically significant. To address this question, we tested the PN in a commercial gillnet fishery in Iceland, a region with historically high harbor porpoise bycatch. Recognizing that fisheries differ in machinery, environmental conditions, and target species, we also evaluated PN performance in terms of cod (*Gadus morhua*) catch efficiency and handling time. The study was conducted over 13 days between April and May 2025 under commercial fishing operations. All gear deployed represented fishing effort that would have occurred regardless of the study, with PNs replacing standard nets. Each string was 10 m high, comprising 60 m panels. Six strings were standard nets (12 panels; 720 m per string), while two were PNs (8 panels; 480 m per string). In total, 32 harbor porpoises were bycaught, 29 in standard nets and 3 in PNs. Our results indicate that the PN reduces harbor porpoise bycatch while maintaining handling times comparable to standard nets. Additionally, the PN effect on cod catch efficiency is not significant. This study represents an important step toward implementing the PN in commercial fisheries, showing it may reduce odontocete bycatch without negatively affecting the fishery.

Immunogenome analyses of Mediterranean striped dolphin over 33 years, show evidence of selection in genes associated with *Morbillivirus* infection

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Pathogens are an important source of global cetacean mortality, with *Morbillivirus* being a notable causal agent responsible for epizootics across multiple species. Mediterranean striped dolphins are well-known for having experienced multiple such *Morbillivirus* epizootics since 1990. Genetic studies found increased striped dolphin inbreeding coefficient (FIS) during epizootic events, although the underlying biological mechanisms remains unclear. This cyclical increase in FIS could be a triggering factor for the repeated epizootics, or it could instead reflect a reduction in genetic variability due to differential mortality from the virus. In this study, we investigate the hypothesis that cyclical patterns in genetic variation result from selective pressures associated with *Morbillivirus* infection. A total of 1169 immune system genes were genotyped for 248 samples, covering every year between 1987 and 2020 from Mediterranean Spain, France, and Italy. We then identified candidate loci for selection through outlier analyses and GLM association tests between genetic diversity and epizootic events over the 33 years analysed. Genes including SNPs under selection were then tested for enrichment in KEGG pathway terms. Loci putatively under selection show strong fluctuations in FIS roughly coincident with epizootic events, while neutral loci show no noticeable variation throughout the study period. Furthermore, both loci putatively under selection and those associated with epizootics, are enriched for biochemical pathways involved with Morbillivirus infection and pathways associated with well-known opportunistic infections (e.g. toxoplasmosis). Other respiratory diseases, such as Covid19 and Influenza

A, are also enriched among putatively selected genes. These results suggest that Morbillivirus has been a main natural selective pressure affecting the survival of Mediterranean striped dolphin. It also helps clarify the timing and severity of Morbillivirus epizootic cycles. Enrichment for other respiratory diseases commonly associated with anthropogenic discharge, identify a potentially important source of emerging diseases in marine mammals that should be monitored regularly.

Sperm whale slow click production on a breeding ground

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Slow clicks are loud, metallic sound like clicks with a low repetition rate, low frequency emphasis and low directionality, known to be produced by mature or maturing male sperm whales (*Physeter macrocephalus*). In high-latitude foraging grounds, slow clicks are produced in bouts at the surface (52%) and while ascending from foraging dives, between 100 and 300 m depth (48%) and with mean inter-click intervals (ICIs) of 4 to 10 s, presumably for long-range communication with other males. Slow clicks at mid-latitude breeding grounds are thought to have a reproductive role, serving as acoustic display to attract females, mediate male interactions, or both. However, there is currently no information on the ICIs and behavioural and depth contexts of slow clicks produced at these latitudes that could provide insights into their function. Here, we analysed slow click characteristics and production from three mature male sperm whales instrumented with animal-borne tags in the Azores, in 2018, 2020 and 2022. As in high-latitude waters, slow clicks were produced in bouts, with similar mean ICIs (4-9 s). However, a lower percentage of slow clicks was produced at the surface (38%) and most of them was produced at 165-425 m depth (62%), during dive descents, ascents and, exceptionally, during shallow dive bottom phases. Slow clicks were produced in specific temporal patterns that were comparable with those at high latitudes and may be related to the encoding of additional information for conspecifics, however this still requires further investigation. Despite our small sample size, the existence of a well-defined depth range for slow click production, both in breeding and foraging grounds, suggests depth may play a key role in the production of this signal. As with other cetacean species, this could be related with sound propagation and/or with physiological constraints of male sperm whales.

Patterns of seasonality, circadian rhythms, and behaviour of the critically endangered Iberian harbour porpoise

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The harbour porpoise (*Phocoena phocoena*) is the smallest cetacean occurring in European waters. Within the Iberian Peninsula, a putative genetically distinct population – *P. phocoena meridionalis* – has been suggested. Classified as “Critically Endangered”, this population in mainland Portugal is expected to disappear in less than 20 years without effective conservation measures. Given their critical conservation status, a better understanding of their occurrence and behavioural patterns is urgently needed. Accordingly, this study aims to analyse the circadian and seasonal patterns of harbour porpoise occurrence and behaviour at the seafront of the Douro River, on the northern coast of mainland Portugal, using presence data collected with two Cetacean POrpoise Detectors (C-PODs). For each detected click train, detailed acoustic parameters were extracted, including duration, number of clicks, frequency, sound pressure level, and inter-click intervals. Both C-PODs operated for a total of 153 days, providing acoustic coverage during winter (December 2024–January 2025) and summer (June–October 2025). Harbour porpoises were detected on 70.5% of monitored days, with travelling identified as the predominant behaviour. To assess diel patterns, the number of clicks emitted per minute was quantified for periods of darkness, daylight, and crepuscular transitions. Descriptive statistics and Generalised Additive Models were applied to investigate temporal variation and to characterise seasonal and diel patterns of occurrence and behaviour. These findings confirm the regular presence of harbour porpoises in the study area, suggest that the area may serve as an important transitional

zone for connectivity and foraging, and highlight the value of long-term passive acoustic monitoring for guiding future conservation strategies for this endangered population.

ECS 2026
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Best practice guidelines for sampling and analyses in marine mammal neuroscience: Maximizing the value of studying the nervous system

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The marine mammal nervous system provides critical insight into systemic and cognitive health, evolutionary adaptations, and vulnerability to environmental stressors, pollutants, and infectious disease. Nevertheless, neuroscientific data on cetacean nervous systems remain scarce. Comprehensive post mortem analyses including virology, bacteriology, parasitology, neuroimaging, cytoarchitecture, histopathology, toxicology, and molecular biology require timely, systematic, representative sampling due to the brain's structural heterogeneity and susceptibility to lesions. Rapid decomposition makes a careful assessment of post mortem interval, environmental and geographic conditions, and brain-specific conservation status essential. Regional cell-type-specific and selective neuronal vulnerability to stressors is increasingly recognised in both human and animal brains, underscoring the need for targeted sampling strategies. Recent advances in marine neuroscience leverage state-of-the-art techniques including transcriptomic analyses, induced pluripotent stem cell cultures, and studies of neural, vascular, and glymphatic structures. These highlight the potential to acquire multifaceted information from single specimens. To support this progress, we propose a dual brain-sampling approach consisting of 1) a best-case scenario targeting specific analyses, and 2) a compromise strategy, maximising utility across multiple investigations. A decision-tree framework should ensure representative sampling of brain regions and nuclei while accommodating logistical constraints across specialties. Implementing these standardized guidelines will improve comparability across cetacean neuroscience. As a consequence, this will enhance understanding of neurobiology, pathology, and toxicology, ultimately advancing conservation, comparative neuroscience, and translational research.

Methods for analysing wildlife DNA methylation data

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The analysis of DNA methylation data for wildlife conservation is gaining momentum as the technology for quantifying the methylome becomes mainstream. The use of epigenetic information extracted from tissue samples can be used for estimating chronological age, individual traits, and phenotypic variation. Methylation data presents an exciting opportunity to study wildlife populations, with the potential to provide insights into age structure, vital rates and health. However, the statistical methodology for answering the emerging research questions has been developed and mostly applied in the human biomedical setting. We review the key methodologies commonly used in wildlife settings, and methods that have been used only in human studies so far that could improve our understanding of wildlife epigenomic changes. We show how the different methods relate to each other and how they link to research questions, illustrating each approach with data from a case study, a large dataset from wild bottlenose dolphins (*Tursiops* spp.) from the US southeast and Gulf coast. Estimating chronological age from models called epigenetic clocks, and understanding the relationship between epigenetic indicators of health and exposure to stressors, are both key goals in wildlife settings; however we show that a single model cannot do both accurately. This is a fundamental limitation of clock-type models and might explain why some age-related health conditions have been found to be related to epigenetic age and others not. Decoupling the analysis of age and health is challenging because the two are confounded but is especially important in wildlife settings where age prediction is often the main analytical objective.

Assessing the combined effects of multiple stressors on a coastal bottlenose dolphin population to inform effective conservation efforts

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With the expansion of human activities in the marine environment occurring in the context of a rapidly changing climate, assessments of the combined effects of multiple stressors on individuals and populations are critical for the effective conservation of cetacean species. Here, we report the results of a large project where the population consequences of multiple stressors (PCoMS) framework was applied to a coastal bottlenose dolphin population that suffered long-lasting health effects following the 2010 Deepwater Horizon oil spill. We conducted controlled vessel approaches to investigate whether compromised health status resulting from oil exposure affected dolphins' ability to respond to other stressors, specifically vessel traffic. Results highlighted some effects of health; for example, we found that lung disease was associated with a delayed dive response, which could affect the ability to avoid collisions by diving. This work demonstrated the value of formalising stressor interactions as multidimensional dose-response functions and explored the feasibility of experimental, multiple-stressor studies in wild systems. Next, we integrated results from health assessments, analysis of scarring from traumatic injury as a function of health, and epigenetic age analysis to inform a PCoMS model for this population. We used the model to

simulate management scenarios involving the reduction of other stressors beyond oil exposure. Results showed that chronic health effects continue more than 10 years post spill, and scar prevalence indicated that oiled animals are more likely to get struck by vessels. Moreover, chronic effects of entanglements were evidenced in individuals' epigenetic patterns. Simulated scenarios suggested that reduction of lethal vessel strikes could have accelerated population recovery if implemented promptly after the spill, but could still be beneficial if implemented later. Altogether, results from this project demonstrate that modelling the cumulative risk from multiple stressors helps predict benefits of stressor mitigation, supporting faster, evidence-based ecological restoration following anthropogenic disasters.

Fin whales' residency and site fidelity patterns offshore Lisbon

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Fin whales (*Balaenoptera physalus*) are a cosmopolitan species and known for their long migrations, including through offshore Lisbon waters, where an important whaling industry took place in the past. Nowadays, although visual surveys suggest this area is a hotspot for fin whales, there is still no information on their residency patterns and site fidelity, i.e. whether the animals use the area only as a passage or also as a specific habitat. Here, photo-identification data collected from dedicated surveys and opportunistic platforms (whale-watching vessels) during the species' peak season (June-October) in 2023-2024 were used to assess temporal and spatial movement patterns in an area of 530 km2. Based on 125 photo-identification captures from 74 different individuals, the best-fitting Lagged Identification Rate (LIR) model estimated that 13 whales (95% CI = 10 to 19) remained in the study area on average for 4.6 days (95% CI = 3.2 to 6.3) before leaving on average for 130 days (95% CI = 49 to 566) and possibly returning in the same season, with no mortality. The Standardised Site Fidelity Index (SSFI) showed a mean value of 0.021 (for both years; where 1 would indicate that the animals were always present and 0 if they were only captured once), supporting the previous results where some animals are recaptured in a short period, followed by a long absence. There was only one interannual recapture. In addition, behavioural data showed foraging activity was present in 51% of the sightings (from a total of 93). This study supports that the offshore Lisbon waters constitute an important migratory route for fin whales in the Northeast Atlantic and shows, for the first time, that the area is also a (short-term) seasonal opportunistic habitat, fostering the basis for future and relevant research in the region.

Seasonal-specific association of rough-toothed dolphins with an Eastern North Atlantic island

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The rough-toothed dolphin (*Steno bredanensis*) is widely distributed across warm and tropical waters worldwide, yet its spatial ecology remains poorly understood, with most studies limited to small areas of the Pacific and western Atlantic. This study presents the first assessment of site fidelity and residency patterns for the species in Madeira Island (Portugal), using year-round photo-identification data collected from 2016 to 2024. A total of 1092 photographic captures were obtained from 637 well-marked individuals, of which 398 (62.5%) were captured only once. Among the remaining 239 individuals (37.5%) 112 were recaptured intra-annually (mean = 2.8 captures, SD = 0.8, range = 2-7) and 127 were recaptured interannually (mean = 2.1 years, SD = 0.3, range = 2-4), with a maximum recapture interval of 8 years apart (i.e., between the first and last year of the study). The proportion of distinctively marked dorsal fins was 51.1% (SD = 6.4%). Lagged Identification Rates based on models incorporating emigration and reimmigration estimated around 28 individuals present during summer (July-August), with a mean stay of 6.4 days and absence of 626 days. These results indicate that rough-toothed dolphins primarily occur as transient or occasional visitors, typically during short seasonal periods, with some individuals repeatedly using the area across years. The Standardized Site Fidelity Index (mean = 0.0057, SD = 0.0065) further supported this low association with the area. Overall, the results suggest high individual mobility and limited temporal association with the Madeiran southern waters, mainly occurring during the summer months. Understanding these spatio-temporal patterns, especially those of a poorly-studied oceanic species, is crucial for guiding transboundary conservation strategies, particularly given the ecological importance of the Macaronesian waters for cetaceans.

Comparing glider-based and static passive acoustic monitoring of marine mammals in western Scottish waters

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Gliders can be used effectively for underwater soundscape monitoring using self-contained, recorders. Compared to static passive acoustic monitoring (PAM), these mobile platform have the advantage of collecting data across a wider spatial area. They also enable animal tracking to derive information about behaviour and may contribute to abundance estimation. The integration of these data with environmental parameters collected by the glider itself can provide knowledge on marine mammal habitat and threats such as underwater noise. The INTERREG VA COMPASS project implemented a static PAM array to investigate the seasonal distribution of marine mammals at ten sites between Scotland and the island of Ireland. Two one-month Seaglider missions were equipped with a Soundtrap 300 HF and run in proximity to the existing array, to compare glider-based detections with those obtained by stationary recorders. The glider tracks were carried out in spring and autumn and covered the Islay Front and Stanton Banks, an area known for its high species diversity and abundance. Many instances of porpoise and delphinid detections were found to be reliably detectable during both glider missions. In both the spring and autumn deployments, harbour porpoises were detected on every day of the deployment. Delphinids were also detected regularly during both deployments and most often when the glider was surveying close to Stanton Banks. These data demonstrate the feasibility of using glider-based acoustics to monitor difficult to access offshore marine regions and highlight their role in remote species monitoring and habitat assessments for identifying key marine regions of conservation priority.

Using fiber-optic cables to reveal fin whale acoustic patterns in the Strait of Gibraltar

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Fiber-optic submarine telecommunication cables represent an emerging, cost-effective technology for large-scale, real-time monitoring of whales, providing spatial resolution far beyond that of traditional passive acoustic systems. Although recent studies have demonstrated the feasibility of detecting and localising whales using distributed acoustic sensing (DAS), their long-term utility for ecological monitoring and management applications remains insufficiently evaluated. Here, we use a submarine cable in the Strait of Gibraltar, instrumented with DAS, to characterise the autumn–winter (September 2023–February 2024) acoustic presence and song properties of fin whales. DAS recordings were compared with concurrent data from ocean-bottom seismometers (OBS) deployed along the same cable route to benchmark detection capability. Fin whale songs, consisting of A-notes (20 Hz) and B-notes (backbeats), were automatically detected using a kurtosis-based algorithm (Kurtosis-Value-Picker, KVP) originally developed for earthquake monitoring and here adapted for fin whale vocalisations. For each song, the cable channel with the highest signal-to-noise ratio was selected for detailed analysis. Both DAS and OBS datasets showed increasing call rates from September through February, with the cable detecting consistently lower rates. This seasonal rise aligns with visual observations of migrating animals and suggests that fin whales may engage in reproductive vocal behaviour while transiting the strait. Song internote intervals (INIs) displayed substantial variability across methods, including bimodal AA INIs of 12 and 16 seconds, differing from earlier reports describing two distinct song INIs attributed to the Mediterranean and North Atlantic populations. These findings underscore a greater plasticity in fin whale song structure that need further investigation. The DAS-equipped submarine cable, though less sensitive than OBS sensors, still captured comparable fin whale acoustic information and offers unique spatial coverage, demonstrating its value as a management-relevant monitoring tool in high-traffic regions such as the Strait of Gibraltar, where fin whales face a high risk of collision.

What's the "diel" with all these unknown long-duration beaked whales (*Cetacea; Ziphiidae*) signals?

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Beaked whales (*Cetacea*: *Ziphiidae*) produce species-specific frequency-modulated (FM) echolocation signals, yet several species remain without confirmed FM signal types. A distinct, long-duration, nighttime-only FM signal has been reported in the North Pacific, western Gulf of Mexico, and Gulf of Guinea, but its global distribution has not been assessed. We conducted a basin-scale investigation using recordings from multiple passive acoustic monitoring projects to identify previously unreported regions where this signal type occurs. In total, 19 recording projects (total of 156 high-frequency passive acoustic datasets) that spanned between 72° N and 42° S were analyzed. An automated detector-classifier (per-file Precision = 1.00; Recall = 1.00) was applied to all datasets to locate potential detection events, followed by manual validation. We document the presence of this FM signal in five new regions: one glider track (512 kHz) near the Canary Islands; three bottom-mounted recorders (250–512 kHz) off Western Australia; and a single detection from Blake's Plateau in the southeastern USA. Across all sites, detections occurred exclusively during local nighttime hours and were absent at latitudes >29° N and >19° S. Although species identity remains unresolved, the signal's spectral and temporal structure was highly conserved across ocean basins. Our findings broaden the known geographic range of this unsolved FM signal and underscore how global acoustic collaborations can reveal previously unknown elements of beaked whale vocal repertoires and distribution.

First use of a novel automated PhotoID web application on aerial drone videos of Southern Hemisphere fin whales to explore automated identification using a deep learning approach

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Photo Identification (PhotoID) is an integral methodology in cetacean ecology for research into abundances, population connectivity and site fidelity. However, with steep increases in database sizes in recent years, the manual matching process has become increasingly inefficient and labor-intensive, requiring hundreds of hours of dedicated effort by trained individuals. The introduction of novel PhotoID methodologies, such as the use of aerial drone imagery, have only exacerbated this development and further highlighted the need for automated PhotoID tools to catalogue and match individuals. In this study, we apply our newly developed automated PhotoID web application to aerial drone data of Southern Hemisphere fin whales (SHFW) at their feeding grounds near the Western Antarctic Peninsula to identify, catalogue and match individuals based on dorsal pigmentation patterns. The drone footage used in this study was collected during research expedition MSM115 (austral summer of 2023) and captured vertical views of the unique dorsal pigmentation pattern, particularly the central chevron pattern and the blaze, which act as main identifying features for SHFW during aerial PhotoID. The automated PhotoID application was applied on a subset of the drone data and, among all identified individuals, found > 6 matches within the same dataset. The identified individuals represent the groundwork for the creation of the first aerial PhotoID catalogue of SHFWs. The successful identification and matches completed in this study demonstrate the feasibility of individual identification of fin whales using aerial drone video data, marking a big step towards automated data processing and vertical photoID. As a future prospect, the continued use of the web application and integration of another dataset available from the same feeding ground but from a different year (PS112 in 2018) is expected to produce matched identities between different years and to provide first insights into site fidelity at the Southern Ocean feeding grounds.

Acoustic baseline of cetaceans in the NEOM region: First integrated visual–acoustic assessment in northwestern Saudi Arabia

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The marine area of northeast Saudi Arabia remains one of the least studied regions of the Red Sea regarding cetacean distribution and acoustic behaviour. To address this gap, two surveys were conducted in winter and summer 2023 in the NEOM region, providing the first integrated visual and, especially, acoustic dataset for marine mammals in Saudi Arabian waters. A total of 199 acoustic stations were completed using a drop-down hydrophone (Aquarian AS-1 with ZOOM F3 recorder), and recordings were made both at the end of transects and during visual sightings, allowing a direct link between acoustic detections and visually confirmed species. A total of 64 visual observations and 34 acoustic detections were analysed. Only 34.6% of winter detections and 61.5% of summer detections could be analysed due to masking from natural and anthropogenic noise. Confirmed detections included 16 of *Tursiops truncatus*, 2 of *Tursiops aduncus*, 6 of *Stenella longirostris*, 4 of *Stenella attenuata*, and 2 summer detections of *Grampus griseus*. Furthermore, 2 mixed Stenella events, and 2 unidentified small delphinids were recorded, while no acoustic detections of *Sousa plumbea* or *Dugong dugon* were collected. Clicks, whistles, and burst-pulse patterns were analysed with more than 53,000 impulsive signals and 385 whistles characterized for local cetaceans. This study provides the first acoustic characterization of delphinids in the northwestern coast of Saudi Arabia and establishes an essential reference for describing species-specific vocal patterns, forming the baseline needed for future analyses, monitoring, and assessment of the underwater soundscape in the NEOM area.

Twenty-five years of coastal dolphin research in the eastern Mediterranean: Integrating visual, acoustic, and stranding data for conservation

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Long-term monitoring is essential for understanding population trends and informing conservation strategies for coastal dolphins in human-impacted ecosystems. Over the past 25 years, we have conducted an integrated research program along the Israeli Mediterranean coast, combining visual surveys, passive acoustic monitoring, and stranding network data to assess the status and threats facing bottlenose dolphins (*Tursiops truncatus*) and other cetaceans. Systematic boat-based line transect surveys, covering more than 60,000 km of effort, revealed two distinct populations: a small, stable population of bottlenose dolphins and a dramatically declining population of common dolphins (*Delphinus delphis*), now rarely sighted. These surveys documented spatial and temporal patterns in dolphin distribution, habitat preferences, and interactions with fisheries, including resource partitioning with bottom trawl fleets and interspecies interactions between bottlenose and common dolphins. Complementary passive acoustic monitoring provided continuous detection of dolphin presence and diel activity patterns, highlighting critical habitats and periods of increased vulnerability to noise and fishing gear. Acoustic data also revealed behavioral adaptations to coastal development and maritime traffic. Finally, analysis of 450 stranding cases over two decades offered insights into mortality causes, including bycatch, ingestion of fishing gear, and emerging health threats. Stable isotope and stomach content analyses further elucidated trophic ecology and overlap with fisheries. This multi-faceted approach underscores the cumulative impacts of fisheries, pollution, and habitat degradation on a small, isolated dolphin population. Our findings have informed national conservation policies, contributed to marine spatial planning, and supported the designation of marine protected areas. The integration of visual, acoustic, and stranding data provides a robust framework for adaptive management. It highlights the urgent need for regional cooperation to safeguard coastal dolphins in the Eastern Mediterranean.

An unexpected journey: Assessing sperm whale spatial movement through satellite tagging in the Strait of Gibraltar

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The Mediterranean sperm whale (*Physeter macrocephalus*) sub-population is classified as 'Endangered' and has long been considered genetically distinct and demographically isolated from the Atlantic, with no documented exchange between basins based on decades of photo-identification and genetic studies. Building on a long-term monitoring program initiated in 2010 in the Strait of Gibraltar, a critical high-density feeding ground, this study challenges the hypothesis of strict containment. Throughout 2025, we deployed 14 satellite tags (Wildlife Computers SPOT-365) on sperm whales to investigate fine-scale spatial use and dispersal. Telemetry data were processed using Bayesian State-Space Models (SSM) via the aniMotum R package to account for location error and reconstruct robust trajectories. Results revealed unprecedented divergent dispersal strategies that fundamentally revise our understanding of the population's spatial dynamics. Consistent with previous intra-basin records, several individuals utilized the designated Cetacean Migration Corridor to reach the Balearic Islands, exhibiting seasonal return movements that confirm functional connectivity across the Western Mediterranean. However, overturning the paradigm of strict isolation, one individual undertook a directed long-distance migration southwest into the Atlantic, reaching the Canary Islands archipelago. Additionally, residency analysis confirmed that a portion of the population maintains high site fidelity within the Strait's central waters. These findings redefine the Strait of Gibraltar not merely as a biogeographic boundary, but as a dynamic crossroads facilitating connectivity between the Atlantic Macaronesian and Mediterranean subpopulations. This evidence of multi-basin range use underscores the urgent need to update transboundary conservation strategies to mitigate high-risk threats, such as ship strikes and underwater noise, across the shipping lanes connecting these distinct marine ecosystems.

Natural vs. anthropogenic contamination: Organobromine compounds in distinct ecological populations of common dolphins (*Delphinus delphis*)

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In the Anthropocene era, understanding how marine ecosystems are affected by human activities is crucial. Among various pressures, marine pollution has significantly disrupted ocean environments and their biota, leading to biodiversity/habitat loss and alterations in food-web dynamics. Within the wide range of contaminants, organobromine compounds (OBCs) have often been overlooked. Natural OBCs can be synthesized by marine organisms such as algae and sponges, whereas anthropogenic OBCs are produced by industries related to plastics, electronic equipment, and foams. Marine mammals are considered sentinel species, providing early warning signals of potential impacts on the overall ecosystems and human health. In this study, we quantified the concentrations of naturally occurring and anthropogenically derived OBCs in the blubber of common dolphin (*Delphinus delphis*) biopsy samples from two ecological populations in the Northeast

Atlantic: Madeira Island, Portugal (Madeira; n = 23) and mainland Northwestern Portugal (NW PT; n = 14). The collection of samples involved the use of a biopsy darting system, handled by experienced researchers and authorized by legal permits. The bioaccumulation profile was dominated by naturally produced Methoxylated polybrominated diphenyl ethers (MeO-BDEs), mainly 2′-MeO-BDE 68 and 6-MeO-BDE 47, followed by anthropogenic polybrominated diphenyl ethers (PBDEs), primarily BDE 47. Median ΣMeO-BDE concentrations ranged from 700.9 to 1047.1 ng g^{-1} lipid weight (lw) across populations, while ΣPBDE concentrations ranged from 309.0 to 927.8 ng g^{-1} lw. Anthropogenic OBC concentrations (ΣPBDE) were higher in dolphins from the NW PT than in Madeira Island, implying a coast-to-ocean contamination gradient. Conversely, ΣMeO-BDE concentrations were similar between the two study areas, suggesting a comparable level of natural production between this oceanic island and the mainland coast. PBDE levels detected in the NW PT population are of particular concern, as they are comparable to concentrations known to trigger endocrine disruption in marine mammal species, thereby potentially posing a serious threat.

Scientists, policy makers, and the fishing industry: Is dialogue being hindered to the detriment of those absent from decision-making processes?

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This paper explores the difficulties in developing science-based compromises around the environmental, economic and social issues related to fishing activities. The methodology is based on Action Research approach conducted by a team of management scientists involved in the Delmoges project to reduce bycatch of small delphinids in the Bay of Biscay (Spring 2022 to September 2025). The longitudinal analysis of this research program is based on the Actor-Network Theory and the concept of Responsible Negotiation in order to highlight the networks of human and non-human actors. The data comes from a triangulated analysis of several sources, including: participant observation, semi-structured interviews (20), stakeholder surveys (248 replies), workshop discussions (5) and documents. Beyond a difference in perception regarding the effectiveness of measures to reduce bycatch among the fishing industry and NGOs, the survey shows that there is broad agreement on the negative social consequences of a one-month winter closure of the Bay of Biscay and on the fact that this measure preserves marine ecosystem. Furthermore, despite the difficulties of dialogue between scientists, the government and fishermen's representatives, the results of qualitative study highlight that the voices of marginalized or absent actors — such as fishermen, NGOs, small cetaceans and other non-human marine species — are both a major source of tension and a source of compromise for the development of shared solutions. Thus, although the winter closure is criticized by fishermen as a solution to reduce bycatch, it can be accepted to preserve fish stocks. These tensions raise questions about the role of scientists as technical experts, mediators, or whistleblowers. This case study highlights that the joint development of solutions based on scientific knowledge and empirical data could lead to the sustainable use of marine territories. Scientific mediation would therefore benefit from bringing together stakeholders committed to preserving values for future generations.

Interannual fidelity of grey and harbour seals to their seasonal home ranges

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Individual strategies of habitat and space use in predators depend on prey distribution, its predictability, and cost of transport. We assessed the interannual repeatability of at-sea distribution in two top predators by tracking them outside their moulting season. Harbour seals are usually considered relatively sedentary, whereas grey seals can travel long distances between key periods of their annual cycle or within foraging trips. We focused on individual seasonal home ranges, defined as the period during which seals repeatedly used one specific haulout area, and assessed interannual site fidelity in 3 grey seals and 5 harbour seals. We calculated individual autocorrelated Kernel Density Estimates (aKDE) and used Bhattacharyya Affinity (BA) to quantify inter- and intra-individual overlap (0=no overlap; 1=identical distributions) of pairs of individuals. In the Iroise Sea (IRO, grey seals), Seine Estuary (BSE, grey seals), and Baie des Veys (BDV, harbour seals), we tracked 19, 39 and 12 individuals, including 2, 5 and 1 tracked over two different years, respectively. Among different individuals, BA averaged 0.382±0.202 (IRO), 0.669±0.150 (BSE) and 0.643±0.169 (BDV). Among identical individuals, BA averaged 0.988±0.009 (IRO), 0.686 (BSE), and 0.931±0.067 (BDV). In IRO, grey seals displayed strong fidelity to their seasonal home ranges, contrasting with low interindividual overlap. In BDV, harbour seals showed moderate interindividual overlap and very strong individual fidelity. In BSE, a recently colonised site with lower seal numbers, both intra- and interindividual overlaps were moderate. Age did not appear to influence these patterns. More data are needed to evaluate the roles of density dependence, habitat type, or colony seniority in shaping the strength of site fidelity in grey and harbour seal seasonal home ranges. However, our results show that both species can maintain highly consistent home-range and foraging patterns across years, likely linked to their benthic diet.

From binoculars to big data: 20 Years of WDC Shorewatch citizen science

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For two decades (2005–2025), WDC Shorewatch has kept “eyes on the sea” from Scottish coastal sites, recording over 122,000 effort-standardised watches and sightings of 17 cetacean species. Long-term programme continuity transformed a “basic” citizen science survey methodology into a platform for diverse outputs: peer-reviewed science; designation (MPA/IMMA); monitoring of critical habitats; baseline evidence for planning; disturbance reporting; volunteer responses to consultations; stakeholder connectivity; and blue-health benefits. Shorewatch exemplifies an iterative partnership between research and community. Early work (Embling et al., 2015) quantified the effort needed to detect trends in bottlenose dolphin occurrence, supporting programme expansion around Scotland. Gutierrez-Muñoz et al. (2021) extended analyses to five regularly sighted species, also identifying the need to fill winter data gaps. Rodríguez-Mendoza et al. (2025) applied Generalised Additive (Mixed) Models across 14 core sites and six Scottish Marine Regions, exploring the potential integration of Shorewatch (2017-2023) into routine status monitoring. Analyses revealed seasonal peaks and significant occurrence trends for bottlenose (Moray Firth decline); harbour porpoise (decline in West Highlands, increases in eastern regions); minke whale (2017 peak then decline in the Outer Hebrides); common dolphin (upward trends in Forth & Tay and Outer Hebrides); and Risso’s (upward trend in the Outer Hebrides); plus emerging seasonal signals for humpback and white-beaked dolphins. Preliminary distribution models for harbour porpoise and bottlenose dolphins in Moray Firth coastal waters show strong discriminatory performance in distinguishing between presence and absence, with AUC values of 0.88 and 0.97, respectively. Model predictions aligned well with existing anecdotal knowledge, and the relatively low mean coefficient of variation within coastal waters (<3 km from shore; CV = 0.19) demonstrates the usefulness of this data beyond trend analysis. This 20-year journey demonstrates how sustained investment in simple, standardised citizen science can deliver high-value, policy-relevant ecological insights—powering rigorous analysis, effective management, collaborative partnerships, and wider social benefits.

Using passive acoustic monitoring to gain insights on potential spinner dolphin habitat use, Peros Banhos atoll, Chagos Archipelago

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Spinner dolphins (*Stenella longirostris*) are the most prevalent cetacean in the Chagos Archipelago MPA, where they provide important nutrients to coral reef atolls. This species exhibits distinct diurnal cycles, resting in lagoons by day and foraging offshore on the mesopelagic boundary at night, where their foraging is modulated by the diel vertical migration (DVM) of their prey. This study investigates how temporal variables influence patterns of dolphin whistle presence. Acoustic data were collected in Peros Banhos lagoon from February to August 2024. An automated whistle detector was used to detail seasonal, diurnal, and lunar patterns in whistle occurrence. Dolphins were detected on 100% of days, primarily in the daytime, with a higher probability of detections during the north-west monsoon season. Lunar parameters influenced nocturnal patterns, with reduced presence during the second part of the night on brighter nights. This research reinforces that Peros Banhos Atoll is a crucial site for dolphins, most likely spinner dolphins based on their acoustic characteristics, as it confirms their high presence and fidelity. These patterns align with environmental drivers in the region; the north-west monsoon months bring calmer conditions to Peros Banhos and may enhance prey availability through processes associated with the Seychelles–Chagos Thermocline Ridge, suggesting that seasonal variability could influence both foraging-site accessibility and rest-site suitability. The observed lunar effects further support the idea that dolphins track offshore prey movements governed by illumination and DVM. Understanding the movement patterns and population dynamics for Peros Banhos' spinner dolphins is crucial, given the area's status as a relatively untouched model-site for Indian Ocean research and the dolphins' key role in nutrient dynamics. This study highlights how acoustic data is a valuable tool for monitoring cetaceans in a remote and under-researched location.

Environmental drivers of blue whale abundance off the United States west coast across three decades

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Understanding the drivers of variation in population distributions over time is essential for monitoring the impacts of climate change on ecological systems. Estimates of eastern North Pacific (ENP) blue whale (*Balaenoptera musculus*) abundance off the United States west coast (USWC) show interannual fluctuations that are not expected for a long-lived species, suggesting that environmental processes are influencing distribution throughout its range. Spatial capture–recapture (SCR) provides a spatially explicit framework for estimating population size based on individual recognition data. We apply SCR methods to photo-identification data collected off the USWC since the late 1980s, incorporating environmental covariates to evaluate the drivers of temporal variation in blue whale numbers using the USWC. Blue whales are sensitive to environmental fluctuations because they specialize in feeding on krill and require dense aggregations to sustain their large body size. The USWC is characterised by wind-driven coastal upwelling, which strongly influences krill biomass and aggregation. We therefore selected covariates representing three processes that shape upwelling dynamics: (1) fixed environmental features, (2) short-term indicators of upwelling, and (3) long-term oceanographic cycles. For each category, we evaluated multiple covariates with varying time lags and used AIC to identify those that best explained variation in abundance. The top-performing covariates were distance from the continental shelf, vorticity (a measure of current velocity used as a proxy for upwelling) during peak months of blue whale presence, and the El Niño–Southern Oscillation index from the previous year. Combining these hypothesis driven covariates in a single spatially explicit model allows us to capture biologically meaningful spatiotemporal variation in blue whale abundance for the first time. Identifying the environmental drivers of blue whale distribution is a crucial step toward detecting climate impacts and improving our ability to forecast future distribution and abundance patterns.

POSTERS

Cetacean mitogenomes in NCBI's nucleotide database: Coverage, gaps, and insights from global to European waters

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Emerging molecular ecology tools, such as environmental DNA (eDNA), offer complementary information to traditional monitoring surveys. However, eDNA methods largely depend on the completeness and quality of public genomic data repositories to ensure effective method design and produce accurate results. Therefore, it is essential to assess the status of the available information, its coverage, and the gaps that need to be addressed. We conducted the first global assessment of cetacean mitogenome sequences, examining taxonomic and geographic coverage, metadata completeness, and the representation of five mitogenome markers (12S rRNA, 16S rRNA, D-loop, Cytochrome oxidase I, and Cytochrome b), which are often targeted in eDNA studies. A total of 17,569 accessions for cetacean species were retrieved from the NCBI Nucleotide database. The Delphinidae and Balaenopteridae families dominated the dataset, making up almost 68% of all existing records, while Ziphiidae showed clear underrepresentation with only 23.5 unique accessions per species. All cetacean species are represented, but NCBI Taxonomy shows discrepancies with the current accepted classification (e.g. outdated genera, non-accepted species, and collapsed higher-level taxa). The D-loop emerged as the most abundant marker, supported by 12,437 standalone sequences, underscoring its relevance for primer design in both eDNA and population-level analyses. Metadata gaps are evident, with only 38% of accessions including geographical information. Only 578 Europe-associated sequences were identified (around 9% of all geo-referenced records), mostly distributed among the Northeast Atlantic Ocean (263), Mediterranean Sea (140), European Arctic

Ocean (74), and Black Sea (15). In Europe, records are led by Delphinidae (455) and Phocoenidae (113), with other families, particularly Balaenopteridae (19), notably underrepresented. Our findings reveal substantial taxonomic imbalances, marker biases, and major metadata gaps, underscoring the need for improved data standards, expanded sequencing efforts, and more open data sharing to reinforce genomic reference databases and facilitate robust and globally effective eDNA-based cetacean monitoring.

Prey preferences of cetaceans as a plausible driver of their susceptibility to fisheries exploitation in Ghanaian waters

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Cetaceans continue to be exploited in Ghana despite existing regulations prohibiting their exploitation. Their exposure to threats stems from weak enforcement and interaction with fishing gear on fishing grounds, leading to targeted and incidental captures. This study documented cetacean landings and analysed how their feeding behaviour and habitat preferences contribute to their susceptibility to incidental capture in artisanal fisheries. Data on landings (by-catch and direct take) and, for the first time, stomach contents were collected between April and October 2022. Results from a total of 56 animals examined showed that drift gillnets (DGN) accounted for the highest proportion (95%) of catches. Peak months occurred between August and September, while purse seine nets (APW, Ali-Poli-Watsa) had the least captures. Most cetaceans were landed at Dixcove fishing village, with the pantropical spotted dolphin being the most frequently caught species. Shannon-Wiener species diversity was relatively high (2.7), with species almost evenly distributed along the coast of Ghana (Pielou's evenness = 0.91; Margalef's richness = 2.5). Examined stomach (n = 29) contents comprised cephalopods (60%), with orangeback flying squid being the main prey item. Small pelagic fishes, predominantly Atlantic flying fish, were also identified. The occurrence of cephalopods in artisanal fish catch remains undocumented; however, their importance to the sector cannot be overlooked, highlighting a likely connection between the prey preferences of cetaceans and the target species of fishers. Reducing this overlap through targeted bycatch reduction strategies and strengthening fishers' awareness of regulations is essential to enhancing cetacean conservation efforts in Ghana.

Assessing Mediterranean monk seal occurrences along the Gargano Peninsula and the Tremiti Islands (north-east Apulia, Italy).

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The presence of the Mediterranean monk seal (*Monachus monachus*) along the Italian coasts of Gargano and the Tremiti Islands (San Domino, San Nicola, Capraia, Pianosa, and the islet of Cretaccio), parts of the Gargano National Park, North-East Apulia, has long been acknowledged. However, no comprehensive biogeographical studies have ever been performed for this region. The aim of this work is to compile historical and contemporary evidence of monk seal occurrences across the Gargano–Tremiti area. To this end, we reviewed published literature, archival and grey sources, and gathered information on monk seal presence and encounters also interviewing residents, fishers and long-term maritime operating in the area. Only a single toponym directly referencing the species - Grotta del Bue Marino, a marine cave in San Domino - was identified. No detailed historical data on marine caves occupancy, individuals' number, or reproductive activity were retrieved. Documented accounts mainly concern sporadic sightings around the Tremiti Islands between '50s and '80s, generally involving single individuals and mostly reported in autumn near Pianosa. Nonetheless, archaeological evidence indicates the species' presence in Apulia (Salento) since the Paleolithic, documented by the remains found in Grotta Romanelli. The interviews were carried out using a specific sightings protocol, allowing the record of six sightings occurred between 2022 and 2025. More frequent occurrences have been documented in nearby Adriatic and Ionian regions (Salento, Albania, Montenegro, Croatia, northern Ionian-Greece) and a well-monitored and reproducing population thrives in the central Ionian Sea, Greece. These findings highlight the need to include the Gargano-Tremiti area within regional conservation planning and strategies, particularly under the "Low Density Areas" category of the Monk Seal Action Plan of Specially Protected Areas Regional Activity Centre (under the United Nations Environment Programme – Mediterranean Action Plan, within the framework of the Barcelona Convention), as part of an integrated, basin-wide management approach.

Historic Data Indicate Range Contraction in Baltic Sea Harbour Porpoises

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The Baltic Proper harbour porpoise (*Phocoena phocoena*) has undergone severe population declines over the past centuries, leading to its current classification as critically endangered. Despite extensive multinational conservation efforts, population estimates are limited, with the only basin-wide abundance data originating from the SAMBAH project (2011–2013). Archaeological and historical sources suggest that the population once had a broader distribution in the Baltic Sea. However, its past abundance and range remain poorly understood, particularly before the mid-20th century. This study analyses over 1,400 archival Swedish newspaper records from the late 1700s to early 1900s to evaluate historical presence, distribution, and human–porpoise interactions. The findings indicate that harbour porpoises historically appeared regularly along the entire Swedish coast, including the northernmost parts of the Gulf of Bothnia, where the species is nearly absent today, showing a significant range contraction. The records imply a larger population and more frequent sightings in the past than currently. Peaks in occurrence during spring and summer suggest the Gulf of Bothnia was once an important habitat for foraging and possibly reproduction. The historical data also reveal the long-standing impact of human activity on this population. Repeated records of bycatch reflect the historic intensity of fishing in the region, while additional descriptions of direct hunting highlight pressures likely contributing to the species' decline over time. By combining historical records with modern conservation knowledge, this study offers essential insights into the long-term effects of human activities on the Baltic Proper harbour porpoise and emphasizes the importance of understanding historical ranges and populations to develop more effective conservation strategies.

Results of the first ever visual marine mammal monitoring research in Pagasitikos Gulf (Greece); emerging evidence of key nursery and feeding habitat use by marine mammals.

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Systematic visual monitoring is a key approach for assessing essential data on marine mammal presence, abundance, distribution, health status, habitat use and anthropogenic pressures spatio-temporally. Identifying species-specific site fidelity and associated behavioral patterns in marine mammals, is critical for advancing population ecology, especially within small or spatially constrained marine habitats. Pagasitikos Gulf, a semi-enclosed shallow basin of high ecological value in central Greece, has historically lacked scientific data on its marine mammal community. The Marine Mammal Monitoring Unit of the University of Thessaly conducted the first dedicated visual monitoring programme in the gulf between the period 2021-2024 collecting photo ID data. Boat-based surveys employing distance sampling methodology collected photo-identification data across five distinct ecological sub-regions. Multinomial Logistic Regression was applied to investigate possible behavioural-spatial relationships, and Model Fit Measures were used to assess reliability. These surveys confirmed/documented the presence of *Tursiops truncatus*, *Stenella coeruleoalba*, *Delphinus delphis*, *Grampus griseus* and *Monachus monachus*, establishing the marine mammal fauna of the gulf. T. truncatus was the dominant species (n=207 encounters), with calves representing 31% of the sightings. The presence of numerous productive and potentially productive females, as indicated by seasonal patterns, a high proportion of calves, and frequent observations of maternal care and social learning, suggests that Pagasitikos Gulf likely serves as an important 'nursery habitat' for bottlenose dolphins. Foraging was the most frequently observed behaviour across species, suggesting that the gulf is also a key feeding ground supported by high prey availability and favorable geomorphological-oceanographic conditions. These results, combined with the previous recordings of *Ziphius cavirostris* and *Balaenoptera physalus* as well as, the dead stranding of *Phocoena phocoena* in the area, highlight the ecological significance of Pagasitikos Gulf

for “Vulnerable” and “Endangered” species and underscore the need for continued monitoring to support its consideration within the National and European marine conservation frameworks.

Citizen science highlights changing seas in the Southwest UK

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Cornwall Wildlife Trust (CWT) has two long running citizen science projects which record data on marine mammals (and other marine megafauna) around the Cornish Coast. Our Seaquest Southwest project has been running for 14 years and collects effort-based survey data from coastal locations to record the presence and abundance of marine megafauna. The Marine Strandings Network (MSN) which has been running for thirty years, trains volunteers to document dead marine wildlife washed up around the coast. For both projects volunteers undergo training in marine species ID and recording methodology and data is verified and confirmed by experienced coordinators. For both the community receives regular feedback in the form of meetings, talks and reports. Both projects are indicating a shift in predominant species in the coastal waters of this most Southwestern county of the UK over the last decade. The presence of some species is decreasing (harbour porpoise and bottlenose dolphins) whilst others increase (common dolphin, Risso's dolphin, and possibly fin and humpback whales). In addition the strandings data shows a concerning increase in the strandings rate for common dolphins perhaps highlighting a growing interaction with local inshore fisheries. Both projects highlight the importance of citizen science data in enabling relatively low cost but high quality, long-term datasets which can be used to document ecosystem changes and evolving threats to marine species.

Lower song complexity in older singers reveals insight into humpback whale song ontogeny

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Insight into vocal learning ontogeny is critical to understanding the ecological role that cultural communication systems play. Studies of birdsong development place species into two categories: closed-ended learners with an early-life learning stage, and open-ended learners that learn throughout life. Humpback whales are likely to be open-ended learners; males sing an elaborate culturally transmitted song that changes each year but shows population-wide conformity providing a rare opportunity to examine open-ended song ontogeny in a mammalian species. Previous work on South Pacific humpback song dynamics has shown that over time populations demonstrate an oscillating pattern in song complexity, a feature linked to female mate preference in songbirds. We investigated the relationship between age and song complexity using 22 years of data (1998-2020) from the South Pacific humpback population of New Caledonia. Complexity was quantified for 666 complete song cycles, providing a baseline of population-wide song complexity each year. From this, population-normalized complexity scores were calculated for the songs of 49 identified singers for whom epigenetic age was calculated from tissue samples. Complexity showed a negative relationship with age, with older males singing a less complex version of the song compared to the population as a whole. We hypothesize that this is due to 1) improved learning ability of older males to more accurately match the population song pattern compared to higher variability in less accurate younger males and/or 2) a decreased emphasis on complexity due to the population-wide conformity, which may instead select for features such as consistency or accuracy.

Spatial and temporal dynamics of seal harvests by Inuit communities in Greenland under rapid Arctic change

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Pinniped harvest is critical in the cultural identity and food security in Inuit communities in Greenland, yet they are increasingly affected by rapid environmental and socio-economic change. Climate-driven shifts—particularly declining sea ice and rising sea surface temperatures—are reshaping Arctic marine ecosystems and altering the distribution and accessibility of key hunted species. In this study, we analyzed spatial and temporal trends of seal harvests in Greenland from 1994 to 2024 using records from the Greenland Institute of Natural Resources and the North Atlantic Marine Mammal Commission (NAMMCO). Total catches peaked at approximately 190,000 seals in 1999 before declining and stabilizing at around 50,000 seals in recent years (2020–2024). Species composition also changed markedly: ringed seals (*Pusa hispida*) dominated the catch prior to 2010, after which harp seals (*Pagophilus groenlandicus*) became the most frequently harvested species. Captures of hooded seals (Cystophora cristata) showed a substantial decline throughout the study period. Spatial variation in harvest levels was largely shaped by the distribution of hunters, with larger annual catches corresponding to areas supporting larger hunting communities. Catch trends suggest that the decline in pack ice is significantly affecting seal species composition and availability. Integrating environmental datasets with indicators of human activity and governance over time will help explain spatial and temporal patterns in species-specific harvests along the Greenlandic coast. These findings will improve understanding of how ongoing ecological shifts may affect future seal availability and support the development of resilient, community-grounded strategies for sustainable hunting in a rapidly changing Arctic.

Automatic image-based detection of bottlenose dolphins in trawl net monitoring cameras.

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The interaction between dolphins and fishing trawls has been widely documented worldwide, particularly involving the bottlenose dolphin (*Tursiops truncatus*), with reports increasing since the 1990s. In northern Catalonia, 87.5% of all dolphin sightings in 2022 involved interactions with trawlers, while underwater behaviour remains poorly understood. The objective of this study was to automatically detect bottlenose dolphins and analyse their underwater behaviour in relation to trawl fishing gear using artificial intelligence, based on computer vision techniques. To achieve this, in 2022, five underwater cameras were attached to fishing nets during 19 trawling trips in northern Catalonia, generating 310 hours and 8 minutes of footage across 1,647 video recordings. Object detection and tracking were performed using YOLO (You Only Look Once), a deep learning algorithm based on convolutional neural networks that enables real-time object detection by predicting object location and class in a single processing step. Models were trained to automatically identify bottlenose dolphins. The best model reached an mAP50–95 of 0.693, indicating high precision across different Intersection over Union (IoU) thresholds, with room for further improvement. To optimise computational efficiency, the input resolution was reduced to 320 × 320 pixels and only one of every ten frames was processed, significantly reducing inference time without compromising key object detection. As a result, a processing speed of 0.66× relative to real time was achieved. These results demonstrate the potential of artificial intelligence to monitor dolphin–trawl interactions under real fishing conditions in an efficient and non-invasive manner. Future research will focus on improving image labelling and implementing unsupervised learning to identify behavioural patterns related to feeding, foraging, and others. This approach provides a powerful tool for advancing the understanding of dolphin fishery interactions and supports more effective management and conservation of bottlenose dolphin populations.

Detection and avoidance systems in ship strike mitigation: a review with key case studies

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Cetaceans are fundamental in the functioning of marine ecosystems, playing crucial ecological roles as top predators and ecosystem engineers. However, ship strikes remain a major anthropogenic threat, causing significant injury and mortality in regions where marine traffic and cetacean presence overlap. Recently, a growing number of technology-based mitigation systems have been developed to help reduce this threat. To better understand current progress, we conducted a review focusing on systems already implemented or in the implementation phase. Four case studies across the Atlantic, Pacific, and Mediterranean were identified, covering high ship strike risk areas. The target species include the North Atlantic right whale (*Eubalaena glacialis*) in the Gulf of St. Lawrence, the fin whale (*Balaenoptera physalus*) in the Ligurian Sea, the sperm whale (*Physeter macrocephalus*) along the Hellenic Trench and the blue whale (*Balaenoptera musculus*) in San Francisco Bay. Across these areas, ship-strike mitigation measures rely on the combined use of real-time or near-real-time whale detection, AIS-based vessel monitoring, dynamic risk modelling, interactive alert tools, and traffic management measures. Acoustic monitoring is the most consistently applied whale detection technology, whether through fixed passive acoustic monitoring (PAM) stations or mobile platforms, such as gliders. However, most cases apply a multi-platform detection system, combining acoustic (e.g., PAM triangulation) and visual (e.g., aerial surveys, vessel-mounted thermal cameras) detection technologies. The case studies show that the technologies used vary considerably based on species ecology, shipping activity, meteorological and geographical conditions, and local government policies, while proposed mitigation measures mainly rely on speed restrictions or re-routing options. These cases demonstrate that a combination of real-time detection technologies, risk assessment and adaptive traffic management is a key factor of effective ship-strike mitigation. The adoption and implementation of successful mitigation systems in high-risk areas will help further reduce ship-strike mortality and support cetacean conservation under increasing anthropogenic pressure.

A puzzling calf: First record of an association between a presumed *Grampus griseus* calf and an adult *Tursiops truncatus* in the Mediterranean Sea

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Risso's dolphins (*Grampus griseus*) and common bottlenose dolphins (*Tursiops truncatus*) are generally considered species with distinct habitat preferences in the Mediterranean Sea. Common bottlenose dolphins typically occupy coastal waters and frequently interact with fishing activities, whereas Risso's dolphins are more commonly found in deeper offshore environments. Consequently, encounters between the two species are considered rare, and no mixed groups or hybrid individuals have been confirmed to date in the Mediterranean basin. During a survey conducted in June 2025 along the Catalan coast (north-eastern Iberian Peninsula), an unusual sighting was recorded on the continental shelf: a calf displaying the external characteristics of *G. griseus* was observed swimming in an echelon position beside an adult *T. truncatus* within a group of 11 bottlenose dolphins following a trawling vessel. The association was documented through three photographs and one video, all of which clearly show the consistent proximity of the calf to the same adult. Given the rarity of the sighting, we consider two possible explanations for this observation: alloparental care or hybridisation. Thus, the calf may represent the first documented hybrid between these species in the Mediterranean, or the sighting may constitute the first instance of alloparental care by a bottlenose dolphin toward a Risso's dolphin. Regardless of the nature of the association, the sighting indicates that an interspecific interaction occurred, reflecting a rare spatial overlap between the species. Potential factors contributing to spatial overlap between the species in this region are discussed. This observation provides novel evidence of unexpected interspecific interactions in the Mediterranean and highlights the need for further research into potential shifts in the distribution patterns of delphinids and the factors that could drive these changes.

Movement patterns of Risso's dolphins in the Catalan–Balearic region (northwestern Mediterranean Sea)

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Understanding the distribution and movement patterns of cetaceans is essential for evidence-driven conservation in the Mediterranean Sea. However, information on these patterns is scarce for Risso's dolphins (*Grampus griseus*). This study provides the first integrated assessment of movement patterns of this species in the Catalan-Balearic region (western Mediterranean Sea) using photo-identification data collected by eight organisations between 2010 and 2024. A consolidated dataset of 1,389 photographs from 133 sightings yielded 852 individual identifications. Cross-catalogue comparisons revealed that these records corresponded to 712 unique individuals, including 93 recaptures (five individuals were sighted by three organisations, and 88 by two). Short- and medium-range movements were documented along the Catalan coast and the Balearic Islands, with no matches detected between regions. Most movements were local (mean distance ~40 km, generally <200 km), although some individuals undertook longer-range movements. Social network analysis identified three main clusters, located along Catalan waters, the Balearic Islands, and the Valencia Channel, indicating spatial segregation. These results establish the first regional-scale baseline for movement dynamics of Risso's dolphins in the western Mediterranean Sea and highlight the value of coordinated, multi-organisation datasets for advancing ecological understanding of this species and informing conservation planning.

The Mediterranean monk seal in Italy: six years of sightings provide data for a “data deficient” species

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In Italy, the Mediterranean monk seal (*Monachus monachus*) is currently listed as “Data Deficient” (DD) by the IUCN, reflecting insufficient information to assess its conservation status and implement targeted protection measures. This study contributes to addressing this gap, by documenting species’ opportunistic sightings along Italian coastlines over the past six years (from January 2020 to December 2025) and assessing their relevance for revising the national classification. Sightings were collected by "Gruppo Foca Monaca APS" (GFM), an Italian organization active since 1976 that promotes species protection through citizen engagement and systematic data validation. Sightings were gathered via social media and interviews, then verified through a standardized procedure to ensure reliability. A total of 97 validated sightings out of 113 collected were recorded across 12 of Italy’s 15 marine regions: Campania (25), Sicily (23), Apulia (23), Tuscany (9), Calabria (6), Basilicata (3), Friuli Venezia Giulia (2), Sardinia (2), Abruzzo (1), Molise (1), Veneto (1) and Emilia-Romagna (1). Annual frequencies varied, with peaks in 2025 (n=34) and 2022 (n=22), followed by 2023 (12), 2024 (10), 2020 (10), and 2021 (9). Notably, 2 pups were documented - one in Apulia (2020) and one in Calabria (2023) - and adult individuals were identified, including an adult male recorded in Campania (2025). Overall, the collected sightings data, whose recent rise may reflect increased citizen engagement, provide evidence of *Monachus monachus* presence in Italian waters, corroborated by environmental DNA (eDNA) results. The documentation of pups and adults also suggests possible reproductive activity. Together, these findings provide a baseline for reassessing the species’ current national classification and guiding future conservation efforts.

Same scat, different prey: Novel insights into seal diet through DNA metabarcoding using a multi-marker approach

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Diet studies are critical to understanding ecological interactions that drive population trends. UK seal diet has been estimated through hard-parts analysis of remains in scats. However, increasingly diet studies utilise molecular methods. There are inherent limitations in both approaches. In this study, we estimate diet composition (in May 2024) for sympatric harbour (n = 67) and grey seals (n = 66) in Southeast England, a region of recent harbour seal decline, using DNA metabarcoding. Additionally, we had samples for which seal species (n = 2) and diet (n = 20) were known. We explored the impact of scat sampling method, time-to-freezing, and for a subset of samples compared with hard-part methods (n = 48). A multi-marker approach was used, targeting 12S (MiFish-U, MiMammal-U) and 16S rRNA mitochondrial genes (Boyi-Fish) to identify seal species and fish taxa. Diet composition was estimated using frequency of occurrence and relative read abundance. MiMammal-U and Boyi-Fish correctly identified predator species in known samples. Fourteen new UK seal prey species were identified including starry smooth hound and thornback ray. Boyi-Fish consistently identified sandeels and gobies to species-level, whereas MiFish-U was more successful in identifying dragonets. Using Boyi-Fish, harbour seal diet was estimated to comprise primarily dover sole and garfish where grey seal diet in the same place primarily comprised dover sole. Our results indicate that DNA metabarcoding and hard-parts analysis are complimentary. More broadly, our results indicated that while estimates varied by marker, they were relatively insensitive to variations in considered protocols tested. Indeed, there was no significant impact on DNA detections or sequence read numbers of scat sampling method (subsample vs homogenisation in solution) and delayed sample freezing (up to 16 weeks tested). This multi-marker approach is an important development in the study of marine top predator diets, with implications for conservation management (e.g. skates), fisheries competition, and seal populations.

Using large-scale seismometer data to detect fin whale calls in the north Atlantic: Implication for population density estimation

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Estimating the number of individuals in a population is a fundamental challenge in ecology as it underpins informed decisions about species conservation. Traditionally, visual survey methods are used for marine mammals, but are limited by weather, funding, daylight and accessibility. For vocalizing species, such as fin whales (*Balaenoptera physalus*), acoustic data have become an increasingly important alternative. Ocean bottom seismometers (OBSs), typically deployed worldwide to monitor earthquakes, provide an opportunity to study baleen whale vocalizations across large spatial and temporal scales. This project aims to use OBS data to investigate spatial and temporal patterns of fin whale calling, with the ultimate goal of estimating fin whale density. The UPFLOW array, which consisted of 49 instruments, was deployed across the Azores–Madeira–Canary Islands region from June 2021 to September 2022, covering approximately 1,000 × 2,000 km (https://upflow-eu.github.io/). A spatially and temporally balanced random subsample of the acoustic data was manually annotated, resulting in 7,980 fin whale calls across 19 sites. Peaks in manual detection occurred from November 2021 to March 2022 across all sites with the number of detections varying per site. The subsampled detections were used to evaluate the performance of a spectrogram cross-correlation detector using receiver operating characteristic (ROC) and precision-recall curves. As automatic detection enables efficient analysis of the full UPFLOW dataset, the manual subsample is key to understanding how detector performance could impact the accuracy of eventual density estimates. Performance varied by site due to variation in background noise, non-target signals, and call characteristics. To assess how these factors propagate into density estimates, we examined each step of the detection process and analyzed sources of false and missed detections. Understanding how detection performance can lead to over- or underestimates in density is critical for interpreting the resulting density estimates from the full dataset.

Evolution without spit: how gene loss shaped salivary glands in cetaceans

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Cetaceans underwent a dramatic evolutionary shift from terrestrial to fully aquatic lifestyle, a transition that involved extensive morphological, physiological, and behavioral modifications. Among the molecular changes associated with this shift, the loss of genes has emerged as an important driver of phenotypic diversification in these marine mammals. Salivary glands play a key role in the mammalian digestive system by producing saliva essential for swallowing, digestion, and taste perception. However, whether cetaceans retain functional salivary glands remains unclear, as previous studies have reported conflicting observations. In this study, we aim to investigate both the functional integrity of salivary gland structures and the protein composition of the buccal cavity in cetaceans. Using a well-established analytical pipeline, we evaluated the coding status of genes that - based on the Human Protein Atlas and other published sources - are known to be highly and specifically expressed in human salivary glands. We also conducted minimally invasive shotgun proteomic analyses (LC–MS) on buccal swab samples collected from bottlenose dolphins (*Tursiops truncatus*), the common hippopotamus (Hippopotamus amphibius), and humans (Homo sapiens). Our results indicate that several genes associated with salivary gland function, including BPIFB2, BPIFB6, and BPIFA2, are lost across both Odontocetes (toothed whales) and Mysticetes (baleen whales). Proteomic profiles should further highlight cetacean-specific patterns when compared to that of their terrestrial relatives. Thus, our findings underscore the power of molecular approaches in identifying lineage-specific adaptations and in deepening our understanding of the genomic foundations underlying phenotypic diversity.

Closing cetacean evidence gaps: Innovative pilot exploring scaling up of cetacean monitoring in UK waters

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Monitoring whales, dolphins, and porpoises is notoriously challenging, leaving critical gaps in the evidence base that underpin marine management. To help address this, the Joint Nature Conservation Committee (JNCC) and ORCA have launched a pilot programme that leverages existing seaborne platforms - such as ferries, cruise ships, and freight routes - to deploy highly trained and experienced citizen scientist surveyors where data are most needed. By aligning effort with priority species, seasonality, and areas, this initiative aims to improve data availability on abundance and distribution of species to strengthen assessments of marine mammal status, support spatial management, and improve industry advice. All data collected will be openly shared through the Joint Cetacean Data Programme (JCDP), enabling government, regulators, researchers, and NGOs to apply it widely. This offers a cost-effective long-term method for enhanced data collection highlighting how strategic collaboration and open data can deliver immediate and sustained capacity for high-quality cetacean science.

Whales at the gateway: foraging ecology of humpback whales in Chatham Sound's expanding port corridor

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Coastal regions of British Columbia (BC) have been identified as important winter foraging grounds for populations of North Pacific humpback whales (*Megaptera novaeangliae*). Post-whaling recovery of these populations is resulting in an increase in prevalence and residency times of humpback whales within northern BC waters. To support continued population recovery, understanding seasonal shifts in humpback whale presence, the prey they target, and the variability of their foraging behaviours is essential for implementing effective protective measures. The aim of this study was to assess habitat use by humpback whales in Chatham Sound near Prince Rupert, BC over a 10-year period and to examine the drivers of humpback whale foraging in the last three years. Historic sighting records reported to the Ocean Wise Sightings Network from 2015 to 2025, combined with seasonal variation in sea surface temperature and chlorophyll-a as a proxy for productivity, were used to assess how habitat use varies across spatial and temporal scales. To examine foraging trends, prey species presence was determined through bi-monthly environmental DNA (eDNA) sampling across 10 defined stations between 2023 and 2025. Opportunistic humpback whale visual surveys were conducted in tandem to facilitate collection of eDNA from surface waters following 34 observed foraging events. By integrating eDNA analysis with sighting records and fine-scale behavioural data, this work aimed to identify key spatial and temporal prey assemblages in the region and better understand local drivers of foraging flexibility. Given that Chatham Sound forms the approach to one of North America's fastest-growing ports and the most efficient trans-Pacific shipping route, understanding the use of this area by humpback whales is essential for informing conservation planning and implementing dynamic protective measures in a region of high ecological and industrial importance.

From advice to action: How statutory conservation advice shapes fisheries management for harbour porpoise SACs

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Effective management of threats to harbour porpoise (*Phocoena phocoena*) is crucial to ensuring that the UK's network of Special Areas of Conservation (SACs) for this species meet their conservation objectives and contribute to achieving or maintaining Favourable Conservation Status. The Marine Management Organisation (MMO) - a marine regulator with powers to manage fishing in English waters offshore of 6nm - are assessing the impacts of fishing on harbour porpoise SACs under the Conservation of Habitats and Species Regulations 2017, and where appropriate, proposing potential management. Their draft assessments focus on the Southern North Sea SAC and Bristol Channel Approaches SAC, two UK MPAs designated for harbour porpoise. UK Statutory Nature Conservation Bodies (SNCBs) - Joint Nature Conservation Committee, Natural England, and Natural Resources Wales - are providing advice, evidence, and expert guidance to support the MMO in the delivery of their assessments and options for management. In applying SNCB conservation advice on matters including use of sites, bycatch across the wider populations, prey availability and supporting habitats; the MMO's draft assessments indicate that porpoise bycatch from gillnets is over sustainable levels in the North Sea and Celtic and Irish Seas. The MMO are now exploring potential options for managing porpoise bycatch with stakeholders, including spatial closures, acoustic deterrents, voluntary options and monitoring. Since harbour porpoise are highly mobile and do not have MPA-based populations, these options are being considered in the two MPAs and across wider seas within MMO's remit. This poster highlights how the SNCBs have delivered conservation advice for the MMO at key stages so far, and how SNCB advice will be used to inform proposed formal management measures as they are refined. This evidence-led, collaborative approach strengthens the scientific basis for MMO's decisions, supporting the delivery of proportionate measures consistent with UK and international obligations.

Chasing the chill: climate-change driven range shifts of common dolphins in mid-Atlantic waters

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Climate change is occurring at a rapid pace, often causing many species to relocate from their historical habitats in an effort to find more suitable environments. In the Azores, common dolphins (*Delphinus delphis*) are the most sighted year-round, making them one of whale-watching's target species. With preferences for cold to temperate waters, in a climate change scenario where Azorean water temperatures are predicted to increase 2.7 ºC by the end of the century, common dolphins could face habitat shifts. The main objective of this study is to assess the current habitat suitability for common dolphins in the Azores archipelago and to infer potential future climate-change driven range shifts under the Shared Socioeconomic Pathways (SSPs) "Middle of the Road" (SSP2) and "Fossil-fuelled development" (SSP5). Data on the occurrence of common dolphins was collected between 2010-2023 from whale-watching vessels, mainly on the south coast of São Miguel. The corresponding environmental variables (slope, distance to coast, depth, SST and mass concentration of chlorophyll-a) were extracted. Generalised Additive Models (GAMs) showed the species' preference for cold to temperate waters, shallow depths, and near seamounts. Groups with calves preferred temperate to warm waters, warmer than groups without calves. Habitat suitability maps for the present showed a maximum suitability of 0.82 out of 1 for the archipelago for the general population, and a lower suitability for groups with calves, of 0.66. Future predictions revealed an overall gradual northward shift, with the most pronounced change forecasted under the SSP5 scenario for 2070-2080 (maximum habitat suitability of 0.59). In the same scenario, calves increased their habitat suitability in the central islands. However, although seasonal differences exist presently, future environmental data to account for them are not yet available. The results emphasise that different approaches to mitigation policies directly impact the species distribution and its vulnerability to climate change.

From blubber to seawater: The rise of eDNA in cetacean research

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Tissue biopsies have long underpinned cetacean science, enabling assessments of contaminants, genetic structure, hormonal profiles, and health biomarkers. However, their invasive nature poses ethical, regulatory, and logistical challenges. In recent years, environmental DNA (eDNA) has been increasingly promoted as a non-invasive alternative, yet its actual capacity to complement or replace biopsies remains poorly quantified in cetacean research. To address this gap, we systematically reviewed empirical studies published between 2015 and 2025. A Scopus query combining “environmental DNA” OR/AND “biopsy” with cetacean-related terms returned 213 records. After excluding non-articles, 197 primary studies were retained. Following full-text screening, 180 studies were analysed and coded by sampling method, research objective, and target taxa. eDNA-based studies increased significantly over time ($\rho = 0.62$, $p = 0.032$), from an average of two per year (2015–2023) to 12 in 2024 and 19 in 2025, surpassing biopsy-based studies for the first time. In contrast, biopsy use remained stable, with no significant trend ($\rho = -0.29$, $p = 0.356$). A significant association was found between sampling method and targeted taxa ($\chi^2 = 58.2$, $df = 14$, $p < 0.001$), suggesting that species or family selection is not random but method-dependent. Biopsy studies were strongly skewed towards Delphinidae (87.5%) and Balaenopteridae (75.8%), while eDNA was more frequently applied to multi-species assemblages and cryptic or elusive taxa such as Phocoenidae, Kogiidae, and Monodontidae. Biopsy-based studies mainly addressed contaminants (28.1%), population genetics (18.8%), and health (18.0%). In contrast, eDNA studies focused on species detection (40.0%), method development (22.0%), and prey composition (14.0%), with emerging applications in population genetics (12.0%), microbiome profiling, sexing, and age estimation. Overall, eDNA is rapidly emerging as a complementary and increasingly versatile tool in cetacean research, broadening the field’s methodological and ethical horizons.

Understanding the spatio-temporal drivers of common dolphin distribution in relation to fishing activity

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The common dolphin (*Delphinus delphis*) is the most observed cetacean along the northern Portuguese coast. This region is influenced by a strong coastal upwelling, which enhances primary productivity and supports large aggregations of small pelagic fish. These conditions attract common dolphins and extensive fishing activity in the area, increasing the likelihood of interactions such as bycatch. This study aimed to identify the main predictors driving the spatial and temporal occurrence of common dolphins in relation to fishing activity. For this purpose, a Generalised Additive Model (GAM) was used to evaluate environmental, temporal, spatial, and fisheries-related effects on dolphin occurrence. Visual surveys sighting data from the ATLANTIDA project (2021-2024) were analysed together with environmental datasets derived from remote sensing and fisheries information from Automatic Identification System (AIS) records, covering the area between Espinho and Caminha, from 2 to 12 nautical miles away from shore. The best-fitting GAM indicated an increase in dolphin presence in 2023. Spatially, the probability of occurrence was higher at lower longitudes, corresponding to oceanic waters. Dolphin presence was also associated with high monthly chlorophyll-a concentrations and daily sea surface salinity. Regarding fisheries-related variables, the presence of gillnets, purse seines, and trawlers was associated with dolphin presence, showing statistically significant positive effects ($p = 6.82x10^{-5}$, $2.80x10^{-5}$, and $1.34x10^{-4}$, respectively). In contrast, although models suggest marginal effects of the fishing effort on the species occurrence, those were not statistically significant ($p = 0.084$). This indicates that dolphin-fishery co-occurrence is mainly caused by common environmental factors rather than direct attraction to fishing effort. These findings highlight the need to

consider broader ecological drivers when evaluating cetacean-fisheries interactions and to develop mitigation measures that anticipate areas of potential overlap.

Sperm whale hotspots off western Ireland and the importance of dynamic variables as shown by a multiscale Bayesian additive regression trees workflow

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Species distribution models are increasingly used to understand species' environmental preferences and habitat use to inform management decisions. To forecast changes in habitat suitability under future climate scenarios, identify important areas, or mitigate anthropogenic impacts, emphasis should be placed on computing accurate and representative models from which reliable predictions can be derived. This study used Bayesian Additive Regression Trees, an innovative alternative to traditional classification tree methods that inherently handles uncertainty by including a Bayesian component. We applied this framework to data collected over six seasonal passive acoustic surveys (2015–2016) along the Irish continental shelf break to assess sperm whale habitat use. While sperm whales are known to travel through Irish Atlantic offshore waters along migration routes, recent studies confirm the area does not act as a simple migration corridor but also provides important habitats, explaining the species' significant presence. Sperm whale movements throughout the area likely result from interactions between migrations and access to patchy prey resources. The scale-dependent nature of these processes adds complexities to quantifying relationships between environmental variables and species distribution. For this reason, we used a multiscale framework to investigate the influence of topographic features and oceanographic processes acting as proxies for prey availability on sperm whale occurrence. Animals were associated with depth, slope gradient and orientation, distance to fronts, frontal strength, relative sea surface temperature, chlorophyll-a concentration, and sea level anomaly. These variables were retained at different scales, confirming the importance of multiscale approaches. The complex relationships between these variables and sperm whale occurrence suggest that the underlying mechanisms and environmental processes remain unclear. This study highlights the complex interactions between sperm whales and their habitat and demonstrates the potential of Bayesian frameworks for modelling cetacean habitat use.

Pathological findings in grey seals (*Halichoerus grypus*) in Southwest England (2020-2025)

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Data collected from stranded marine mammals can make important contributions to our knowledge on their health and diseases, and anthropogenic activities affecting populations. In southwest England, the most common marine mammal found stranded is the grey seal, despite pup production being only ~0.5% of the overall grey seal pup production in the United Kingdom. Until recently, few investigations had been carried out into the pathology of grey seals in southwest England, but a review of primary pathological findings in 107 grey seals necropsied between 2013 and 2020 was published in 2021. Between March 2020 and February 2025, a further 153 grey seals (88 males, 65 females) were necropsied. The vast majority of animals presented for necropsy (n=151) were found on the coasts of Cornwall and the Isles of Scilly, representing 12% of the total number of grey seal strandings recorded for that period in the region (n=1227). As in the earlier published review, pups in their first year of life made up the majority (n=128; 84%) of necropsied seals and most seals (n=116; 76%) were originally found alive. In contrast to the previous review, infectious disease (n=70; 46%) was the most common primary pathological finding, followed by trauma (n= 58; 38%). In 12 seals (8%), the primary pathological finding was starvation. Infectious diseases included those of the respiratory (n=37), gastrointestinal (n=10) and central nervous (n=6)

systems. Traumatic cases were predominantly chronic in nature, involving secondary infections following initial trauma (n=40); there were also 10 cases of acute trauma and 8 cases of fisheries-related trauma. In autumn 2022, five cases of avian influenza (H5N1 or H5Nx) were detected in necropsied seals and, in autumn 2024, a novel *Mycoplasma* species. *M. phocimorsus* was detected in three seals.

First evidence for three dolphin species regularly inhabiting the Thermaikos Gulf, north-west Aegean Sea, Greece

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The Aegean Sea, with its productive waters and complex oceanographic features, constitutes a key Mediterranean biodiversity hotspot, and is home to several cetacean species. In its North-west side, the Thermaikos Gulf, recognized for its ecological value, includes a National Park and multiple smaller protected areas. Nevertheless, the Gulf faces significant anthropogenic pressures, primarily from vessel traffic, coastal development, and fisheries. However, despite knowledge of species occurrence in the area, there is a gap in the dynamics of cetacean populations and potential risks associated with human presence, hence the launch the Thermaikos Biodiversity Project in 2021, by iSea, aiming to conduct regular year-round boat-based monitoring, including photoidentification and collection of behavioural data, as well as designing and promoting ecosystem-based marine conservation action. With experimental surveys between 2021 and 2023 and regular efforts in 2024 and 2025, 85 sea surveys were conducted, covering a survey area of roughly 1000 km2 under favourable conditions, which yielded 60 dolphin sightings and 59 hours of direct behavioural data collection and photo-identification: 47 sightings of bottlenose dolphins *Tursiops truncatus* (125 photo identified individuals); 11 common dolphins *Delphinus delphis* sightings (47 IDs), and 2 striped dolphins *Stenella coeruleoalba* (26 IDs) . Sightings of bottlenose and common dolphins were more frequent nearshore, while stripped dolphins were found only over deeper waters. All species exhibited a broad spectrum of behaviours with 66 bottlenose dolphins being re-sighted (including 13 individuals sighted 5 or more times). Our results provide the first evidence on the importance of the Thermaikos Gulf for, at least, three dolphin species. Continued research efforts will be crucial to provide reliable dolphin population estimates and key information on population dynamics, social structure and identify conservation threats, thereby supporting well-informed management strategies.

Eleven years of passive acoustic monitoring of harbour porpoises and small delphinids off Calais port.

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In the context of increasing maritime traffic between Calais and Dover, the Port of Calais undertook a major expansion project (“Calais Port 2015”). The Strait of Dover, in the English Channel has been identified as a prime location for harbour porpoises. A passive acoustic monitoring (PAM) was designed to assess harbour porpoises acoustic activity near the port before, during and after the expansion project. A total of eleven years of passive acoustic data were collected using Cetacean Porpoise Detectors (C-PODs; Chelonia Ltd. UK) distributed across two authorised monitoring sites (Walde and CA4). First of all, Detection Positive Minute (DPM) was the metric used to analyze the distribution, seasonality and diel pattern of click trains from harbor porpoises and also dolphins. Then Feeding Buzzes Ratio (FBR), the proportion of feeding buzzes among all detected clicks was used to identify foraging activity around the two sites for both species. The analyses revealed: (1) a strong seasonality in harbour porpoise detections, (2) a decline in harbour porpoises acoustic detections during the last four years, although foraging activity appears unaffected and (3) an increase in delphinids detections since 2021. The expansion of the Port of Calais has profoundly altered the sedimentary relief in the study area, likely leading to changes in the habitat of marine mammals. The decline in habour porpoise detections should be interpreted in the context of the increase in the regional grey seal population since 2021 (predation), the more recent rise in dolphin presence in the area (predation and/or food competition) and the decline in porpoise strandings observed over the past several years. Together, these results provide new insights into the local and regional responses of small cetaceans to large-scale coastal development.

Who goes where? Detecting and localising cetaceans from hydrophone arrays on multiple gliders.

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Sperm whales (*Physeter macrocephalus*) can be found in every ocean, primarily along continental shelf edges and canyon systems. Visual surveys have been used to estimate the species' geographical distribution but is not well suited for underwater surveys, whilst tagging can provide detailed information relating to an individual but is difficult to scale to population levels. Acoustic monitoring has the potential to bridge the gap between these methods, providing species-level insights into the distribution of whales underwater by detecting their vocalisations. We present results regarding the detection and localisation of Sperm whales using data from underwater gliders, which can survey more extensive geographical and depth ranges than static moorings or towed hydrophone arrays. Four SeaExplorer (Alseamar) gliders fitted with a compact six-hydrophone array were simultaneously deployed in the PELAGOS protected sanctuary in the Mediterranean. Sperm whales were first detected using a novel echolocation click detector to better understand their winter distribution. Then, the positions of individual vocalising whales were determined by combining the bearing estimates of several localisation techniques, including 3D beamforming, across each glider. By collating information from each glider and multiple techniques, a more robust estimate of the cetacean's position can be calculated. These results will help gain better insight into Sperm whale abundance and behaviour near several major canyon systems. This is the first time moving platforms have been simultaneously deployed for the challenge of species identification and localisation, which could enable further insight into sperm whale abundance and behaviour in major canyon systems using incidental or planned glider missions.

New insights into the ecology of humpback whales in French Polynesia: the Odyssey for Life Program

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Humpback whales (*Megaptera novaeangliae*) population in the South Pacific reproduces annually in French Polynesia, where anthropogenic activities, such as whale-watching and ferry traffic, have been increasing since 2010. Yet, there is little quantitative biological data on the whales' key processes occurring in this area and the degree of human encroachment on them. Preliminary behavioural data collected during the first field season of the Odyssey for Life provide new insights into the ecology of humpback whales breeding in French Polynesia. The high proportion of mother–newborn pairs (53% of sightings) and the predominance of resting behaviour (78% of total observed time) are consistent with the role of these islands as critical nursery habitats during the winter breeding season. Resting mother–calf pairs depend on predictable access to sheltered areas with minimal disturbance, which underscores the ecological sensitivity of these habitats. The behavioural budget observed—dominated by resting, with additional time allocated to nursing, travelling, and occasional mating—aligns with patterns reported for other South Pacific breeding grounds. However, the intense overlap with human activities is cause for concern. Whales were exposed to whale-watching vessels and other maritime traffic during 73% of daylight hours in Tahiti, 91% in Moorea, and 78% in Bora Bora. Such sustained exposure may alter the behaviour and energy expenditure of mothers and calves, potentially reducing calf growth rates and compromising the success of the breeding season. These results highlight the urgent need to quantify the behavioural and energetic implications of vessel interactions throughout the remainder of the programme. The first photo-identification match between an individual observed in French Polynesia (2024 winter season) and Antarctica (2025 summer season) provides valuable confirmation of migratory connectivity between these regions. This recapture supports the integration of multi-year, multi-platform datasets to better characterize population structure, fidelity to breeding sites, and long-distance movements across the South Pacific.

Mapping exposure to bycatch risk for marine mammals in the North Atlantic

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Bycatch is globally one of the biggest threats to marine mammals today. While being a tangible, immediate threat, accurate quantification of the removal rate of bycaught individuals from a population is often challenging. In the scientific community, it is widely accepted that bycatch reports made by fishers are often unreliable and may be orders of magnitude below the actual rate. On-board monitoring of bycatch is resource intensive and, therefore, often unevenly distributed, which currently prevents accurate estimation of bycatch rates for many species across different fishing métiers in some areas. To facilitate better informed monitoring efforts, the North Atlantic Marine Mammal Commission Working Group on Bycatch (BYCWG) is applying a three-step approach to evaluate the exposure of different marine mammal species to bycatch occurring in marine fishing areas in the North Atlantic, from Greenland to Norway: (1) mapping relative fishing effort intensity over a grid, for individual métiers and seasons, using the average number of hauls between 2021 and2023; (2) mapping relative species densities per season across the same grid, for ten marine mammal species; if density data cannot be calculated, proxies such as presence/absence or range data can be used; (3) combining these two metrics and standardising the result to map each species' bycatch risk by gear type. The primary goal of this project is to identify areas with high or low threat of bycatch from different fishing gears for various marine mammal species, providing actionable advice to managers for the allocation of monitoring resources. This approach has not been applied before in this area and will ultimately enable the calculation of accurate bycatch rates for marine mammals, leading to improved population assessments. The project includes case studies for both data rich and data poor species, showcasing how this approach can be applied in other areas of the world.

Variation in predator responses to disturbance at offshore windfarms

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Given rapid expansion in the offshore wind energy sector, a better understanding of potential ecological effects of offshore windfarms on protected marine species is required to optimise future sustainable developments. As part of the PrePARED project, this study aims to investigate whether vessel traffic and prey availability would mediate levels of harbour porpoise responses to disturbance during offshore windfarm construction and operation, in the Northern North Sea, NE Scotland. Between 2017 and 2023, large arrays of echolocation click detectors (CPODs) were deployed within and around three offshore windfarms in development, to monitor harbour porpoise acoustic occurrence and behaviour during pile-driving, operation and maintenance activities. Levels of windfarm related vessel traffic and construction activities were characterised using AIS-vessel tracking data and engineering records. Additionally, the probability of sandeel occurrence and porpoise buzzing activity (a proxy for foraging) was summarised at each monitoring site, to infer prey availability. Echolocation click detections were extracted to investigate the probability of response to piling activities and to estimate times to first harbour porpoise acoustic detection (or buzz) following close approaches by service vessels at an operational windfarm. Overall, despite being regularly detected at offshore windfarm sites throughout the study period, harbour porpoises were temporarily displaced from disturbed areas. However, during both the windfarm construction and operational phases, harbour porpoise levels of response to piling activities and service vessel traffic decreased in areas with higher probability of sandeel occurrence and/or porpoise foraging activity. These findings may suggest that porpoise levels of response to disturbance may be mediated by prey availability and predictability. This study highlights the value of combining data on predator behaviour, prey availability and vessel traffic to minimize potential impacts of anthropogenic noise and better understand the long-term cumulative effects of offshore windfarm developments.

Wind farms, lost fishing gear and marine mammals: Considering potential entanglement risk

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Accidental entanglement of marine mammals and other megafauna in both actively fishing and abandoned/lost/discarded fishing gear (ALDFG) is an ongoing global conservation and welfare concern. As offshore wind farms (OWF) and other renewable energy installations proliferate, seeking to address climate change, concerns have been raised about potential interactions between ALDFG and this novel offshore infrastructure, which could create opportunities for 'secondary' entanglement of animals in fishing gears attached to the OWF (rather than 'primary entanglement' in anchor chains or power cables). In 2025, a series of pilot projects was initiated to explore the likelihood of such entanglement events occurring in floating offshore wind (FOW) installations. The overall project, delivered on behalf of the Scottish Government, focused on ALDFG in Scottish waters and sought to address the following questions:

- How, and how often might ALDFG be generated?

- How might buoyancy of floating ALDFG change over time?

- How much floating ALDFG is detectable using standard digital aerial survey methods?

- Can ALDFG, attached to subsea FOW infrastructure, be observed by Remotely Operated Vehicles [ROVs]?

Findings indicate that 1) Gear loss rates across different Scottish fishing sectors are highly variable, with the main cause being 'weather'; 2) buoyancy of common fishing gear components can change drastically over time, mainly driven by increasing rates of biofouling; 3) ALDFG and other marine debris can be observed through digital aerial surveys, and observed amounts were lower than expected; 4) ALDFG was observed on ROV footage of FOW infrastructure, albeit in small amounts. These results, together with current fisheries data, will form the basis of focused spatiotemporal modelling studies to populate a secondary entanglement risk

framework in relation to FOW installations. As wind farms expand further offshore and potential interactions with ALDFG are increasing, this framework will underpin informed future decision-making around this complex topic.



Understanding physiological responses to stress in marine mammals: challenges and opportunities of using ex vivo experimental approaches

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The ability to predict population consequences of stress exposure in marine mammals requires an understanding of the impact of those stressors on individuals. Multiple and chronic stressors are difficult to tease apart from observational data. Experimental data allows causal mechanisms to be established but is extremely challenging to obtain at whole animal level for marine mammals. However, ex vivo approaches can circumvent some of these challenges by culturing live tissue pieces obtained from biopsies and exposing them to chemical or physiological stressors to explore impacts on cellular or molecular responses. Here we present an overview of what we have learnt from using ex vivo blubber explants from grey seals (*Halichoerus grypus*) to probe basic tissue properties and responses to stress (and other) hormones, persistent organic pollutants (POPs), phthalates and hypoxia. The blubber biopsies were taken between 2015 and 2017 from grey seal pups on the Isle of May Scotland during the breeding season each year (n = 27-36 per year) or juvenile grey seals in 2018 from East coast Scotland populations before, during or after their annual moult (n = 17). We discuss the range of alterations to metabolic properties and to expression of both stress-induced and metabolic function genes, showing how tissue responses could be predictive of whole animal consequences of POP exposure. Precision-cut adipose tissue slices (PCATS) are a refinement of the explant method. We compare gene expression findings between seal explants and PCATS from humpback whales (*Megaptera novaeangliae*) from Norway in 2024 (n = 12). We outline some of the challenges encountered in using ex vivo methods, including logistical constraints and induction of stress pathways from tissue disruption and hypoxia. Nevertheless, we show that ex vivo techniques

offer opportunities for enhanced understanding of stress responses in marine mammals that can be useful for conservation and management.

A multi-level citizen science framework for long-term demographic monitoring of Bottlenose dolphins (*Tursiops truncatus*) in French Brittany

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The French Brittany coast (English Channel) hosts a resident population of Bottlenose dolphins (*Tursiops truncatus*), a high conservation interest species. A multi-level citizen science pipeline was implemented to initiate an estimation of key demographic parameters on a subpopulation of the Normand-Breton gulf using 2023 datasets. The first level consisted of spatially opportunistic boat surveys conducted from March to November, whose primary objective is public engagement while participants assist in marine mammal sightings on a collaborative citizen science platform. The second level, EMM'Raude, is a long-term monitoring through structured year-round boat surveys, supported by trained volunteers involved throughout the survey process. It was designed using a stratified and spatially balanced sampling plan. This approach provides representative spatial coverage, enables detection of seasonal and annual trends, and integrates a multidimensional analysis of environmental and anthropogenic factors influencing dolphin presence and behavior. The third level, Trisk'Aile, consisted of a citizen science program supporting the initial processing of photographs for photo-identification. Trained volunteers, supervised by marine scientists, sorted 12746 images, graded 404 dorsal fins, and identified 144 individuals from 77 capture occasions, following a standardized protocol. This study aimed to assess whether combining data from three complementary citizen science programs could provide demographic parameters for bottlenose dolphin population. A capture history matrix (n= 144 individuals) was built to explore potential seasonal patterns. Jolly Seber models were applied to derive preliminary demographic parameters. Time-dependent formulations revealed strong heterogeneity in detection linked to uneven sampling effort, while constant model produced identifiable estimates ($\Phi \approx 0.97$, $p \approx 0.30$, $\hat{N} \approx 157$). These results provide a demographic baseline but highlight the need for multi-year monitoring to estimate dynamics reliably. The complementarity between opportunistic and structured surveys proved essential for building year-round capture histories, underscoring the value of a coordinated citizen-science framework for long-term population assessment.

Fundamentally modified chemosensory control of ventilation in the grey seal (*Halichoerus grypus*)

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Understanding how breathing is controlled in mammals is vital, as respiration sustains life by enabling gas exchange and maintaining homeostasis, underpinning behavioural responses to environmental stimuli. In mammals, breathing is tightly regulated by the autonomic chemoreflex, which responds to fluctuations in oxygen (O2), carbon dioxide (CO2), blood pH and cerebrospinal fluid pH. Among these, CO2 is the primary driver, with increases in CO2 eliciting marked increases in ventilation rate. However, for phocid seals which regularly experience low O2 and high CO2 whilst diving, it is unclear if the “normal” mammalian chemoreflex pathways are maintained given an increase in ventilatory drive could limit dive times. Here, the autonomic roles of CO2 and O2 in phocid ventilatory responses were experimentally investigated. Six juvenile, wild-caught grey seals (*Halichoerus grypus*) in managed care made voluntary dives from an open-flow respirometry chamber , where exposure to O2 and CO2 was manipulated to affect alveolar and arterial gas exchange. We demonstrate that the typical mammalian ventilatory response to O2 and CO2, is not present in grey seals. Inter-dive ventilation rate (n=405) did not change in response to hypoxia (11% O2), hypercapnia (8% CO2) or hyperoxia (50% O2), suggesting modified or attenuated chemosensory control of ventilation. Exhalation amplitude, used here as a proxy for lung tidal volume, increased in response to hypercapnia and hypoxia. This uncoupling of tidal volume and ventilation rate may be an important modification to the chemo-reflexive pathway in seals. These findings ultimately suggest ventilation rate is not under reflexive control by respiratory gases, allowing seals to control breathing in a way optimised for efficient gas management during diving and recovery. Beyond advancing our understanding of respiratory physiology in seals, this study provides key insights into how the evolutionary pressures of apnoea have fundamentally altered autonomic chemo-receptive responses in diving animals.

Bottlenose dolphin as a sentinel species: In vitro assessment of PFOS and PFOA toxicity in a fibroblast cell line

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Bottlenose dolphins (*Tursiops truncatus*) are widely recognized as sentinel species of marine ecosystem health due to their long lifespan, high trophic level, and close interaction with coastal human activities. These traits make them particularly vulnerable to the bioaccumulation of persistent contaminants such as perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). Understanding how these pollutants affect dolphin cells is therefore essential to anticipate potential impacts not only on individual health and population resilience but also on the broader marine environment. In this context, we employed a fibroblast cell line from bottlenose dolphin to explore the cellular responses induced by PFOA and PFOS. Cytotoxicity was first assessed through luminescent viability assays to determine IC_{50} values after 24, 48, and 72 hours of exposure. Further analyses evaluated early apoptosis and necrosis (Annexin V Apoptosis and Necrosis Assay), late apoptosis (Caspase 3/7 Assay), and oxidative stress (Glutathione Assay) at sub-cytotoxic concentrations (≤ IC25). Results revealed that PFOS exhibited consistently higher cytotoxicity than PFOA, with IC_{50} values around 230 µM at all time points, while PFOA showed IC_{50} values of 934, 837.5, and 695.2 µM at 24, 48, and 72 hours, respectively. Although necrotic effects were absent, both compounds triggered early apoptosis and oxidative stress at concentrations well below cytotoxic thresholds, specifically 100 µM for PFOS and 300 µM for PFOA. Despite the relatively high IC_{50} values—comparable to those reported in human cell lines—the data indicate that these PFAS can induce subtle but biologically relevant alterations preceding overt cytotoxicity. These findings highlight how cetacean in-vitro models constitute powerful and ethical tools for investigating the mechanistic effects of contaminants of environmental concern. By providing early-warning insights into pollutant toxicity in a key marine sentinel species, such approaches contribute to a deeper understanding of environmental risks and support conservation and ecosystem health monitoring efforts.

Public perception of the Mediterranean monk seal in Italy: a tool for more effective management

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Public awareness and perception assessment play pivotal roles in wildlife conservation. As coastal populations grow, encounters with threatened marine species are increasing. Among those, the Mediterranean monk seal (*Monachus monachus*) is reemerging in Italian waters, with an increasing number of sightings and reports from citizens, highlighting its gradual return in Italian seas. This study assessed Italian public knowledge of the species—awareness, emotional responses, and preferred management strategies using a standardized online questionnaire. Our study, carried out on 1879 surveys, revealed a comprehensive awareness of the presence of the Mediterranean monk seal in Italy (66.3 %). This perception aligns with a moderate to high ability to correctly identify the Mediterranean monk seal when compared to potentially confusable species, such as sea lions (80.8%). However, more than half of the respondents reported feeling poorly informed about the species (54.9%), or having never heard about it (18.0%). Moreover, the majority (98.1%) of the surveyed population expressed positive feelings about the presence of the Mediterranean monk seal, along with support for its conservation, compared to negative emotions (1.1%), such as competition with fishers and potential danger to humans. In addition, investigating their willingness to pay (WTP), 68.6% of respondents were disposed to pay for monk seal conservation, although over half could contribute only ≤€10 per year due to limited financial capacity. This study shows that the Mediterranean monk seal's return to Italian waters is met with strong public support and positive emotional responses. However, low self-reported knowledge and limited financial capacity show that awareness alone cannot sustain conservation. The willingness to support monk seal protection, highlights the need for coordinated political, institutional, and private-sector action to translate support into effective, long-term conservation.

Preliminary results on the abundance and distribution of Tursiops truncatus (Montagu, 1821) in the southern Tuscan Archipelago using opportunistic platforms

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The Mediterranean Sea is one of the most impacted marine regions globally, yet monitoring of marine mammals remains uneven, particularly in the southern Pelagos Sanctuary. To address this gap, systematic surveys of bottlenose dolphins (*Tursiops truncatus*) were initiated in Tuscany in July 2024 along the Piombino - Portoferraio and Porto Santo Stefano - Giglio Porto ferry routes, using the Fixed Line Transect methodology on Moby Lines and Toremar ferries. *Tursiops truncatus* is listed under Annex II of Habitat Directive and was chosen as a focal species because it is a key indicator of coastal ecosystem health and is highly sensitive to human pressures, providing valuable insight into the conservation status of the area. Surveys were conducted under favorable sea conditions (Beaufort scale ≤ 3). Encounter rate (ER) and relative abundance index (RAI), used as indicators of relative density, were ER = 0.0049 and RAI = 0.0210 for Porto Santo Stefano–Giglio Porto, and ER = 0.0059 and RAI = 0.0131 for Piombino–Portoferraio. Seasonal ER and RAI values were calculated by pooling data from both areas, with winter showing the highest values (ER = 0.0119; RAI = 0.0311), followed by spring (ER = 0.0089; RAI = 0.0267), autumn (ER = 0.0075; RAI = 0.0145), and summer (ER = 0.0037; RAI = 0.0124). Calves were observed throughout the year, with the highest proportion in winter (38%). These preliminary results fill a knowledge gap in a poorly monitored area of the Pelagos Sanctuary and provide baseline data for future assessments. They are essential for evaluating potential marine protected areas under the Habitat Directive and for developing targeted conservation strategies. Ferry-based surveys offer a cost-effective and repeatable method that generates long-term data, supporting the understanding of seasonal trends, anthropogenic pressures, and effective management of Mediterranean marine mammals.

Trophic ecology of common and striped dolphins in the western Mediterranean Sea and northeastern Atlantic Ocean using stomach content and stable isotope analysis

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Understanding trophic relationships and niche partitioning mechanisms is fundamental for assessing coexistence dynamics among sympatric cetaceans. This study provides a comparative analysis of the diet and trophic overlap between common (*Delphinus delphis*) and striped dolphins (*Stenella coeruleoalba*) across the northeastern Atlantic (Atlantic Morocco, Azores, Bay of Biscay, Canary Islands, English channel, Galicia, Gulf of Cádiz, Ireland inshore, Ireland offshore, Madeira, North of Portugal, Scotland) and western Mediterranean Sea (Alboran Sea, North-western and Western Mediterranean Sea), combining stomach content analysis (SCA) and stable isotope analysis (SIA). Data from 1,405 stomachs and 1,135 skin samples, collected between 1991 and 2023, revealed marked spatial differences in feeding strategies. Trophic overlap ranged from low in northern Atlantic regions (Scotland, Ireland, and Bay of Biscay) to very high in Atlantic regions at lower latitudes, such as Galicia (Pianka's index: 0.98) and the Gulf of Cádiz (Pianka's index: 0.79), where Gadidae and Alosidae dominated the diet, respectively. In general, common dolphins displayed broader dietary niches and consumed more fish species, while striped dolphins relied more on mesopelagic fish and cephalopods. By contrast, in the Mediterranean, particularly in the Alboran Sea, both species depended heavily on Myctophidae (Pianka's index: 0.63) and exhibited the highest isotopic similarity (SEAB overlap: 48%). However, the second most important group of prey differed, as common dolphins consumed more coastal and commercially important Alosidae and Sparidae species, while striped dolphins exploited more oceanic cephalopods, such as brachioteuthids. These findings suggest that overlap does not necessarily imply competition in prey-rich Atlantic waters, whereas in the Mediterranean, where coastal resources are heavily exploited, common dolphins may be more vulnerable than striped dolphins. The combined use of SCA and SIA proved to be a very useful tool for assessing resource use and potential interspecific interactions, particularly when investigating niche partitioning among ecologically similar cetaceans.

From observation to action: Building cetacean-friendly beach seine practices in Portugal

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The traditional beach-seine fishery (arte-xávega) operates along the north-central Portuguese coast. During summer –early fall, when fishing effort peaks, this fishery has a documented history of cetacean bycatch, posing risks to the critically endangered harbour porpoise (*Phocoena phocoena*). To help achieve European bycatch-reduction objectives, a monitoring and mitigation program was initiated in 2025 under the EU Horizon Marine Guardian project, combining observer data, and pilot deployment of acoustic deterrent devices (pingers). Fishers were interviewed prior to fieldwork across multiple beaches to identify areas of greatest concern, enabling targeted mitigation testing and strengthening collaboration between the fishing community and scientific team. From June to October of 2025, 45 hauls were monitored. Overall sighting, bycatch and mortality rates were 1.29, 0.58 and 0.13 animals per haul, respectively. All interactions involved only common dolphins (*Delphinus delphis*). During pinger trials (August to October of 2025), 16 hauls were controls and 13 carried pingers (either Fishtek or Future Oceans; 60-120 kHz). Common dolphins were sighted during net deployment in 5 hauls (1 control; 4 pinger), corresponding to sighting rates of 1.13 sightings/haul (controls) and 2.69 sightings/haul (pingers), indicating that pingers did not consistently exclude animals from the fishing area. In total, 11 dolphins were captured: 10 in controls versus 1 with pingers. This resulted in a bycatch rate of 0.63 captures/haul in controls compared with 0.08 captures/haul using pingers — a 87 % reduction. Mortality also decreased substantially, from 3 fatalities in controls (0.19 mortalities/haul) to 1 with pingers (0.08 mortalities/haul). However, the post-release fate of animals surviving bycatch remains unknown. These early results provide a significant coordinated baseline for cetacean interactions in the Portuguese beach-seine fishery and highlight the value of co-developed solutions with fishers to refine mitigation strategies, support communities as new regulations emerge, and guide towards genuinely cetacean-friendly beach-seine practices in mainland Portugal.

Entangled whale response in the Canadian Maritimes and Quebec provinces: adapting response to shifting whale distributions and training to build network capacity

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Entangled whale response networks have been established in various areas worldwide based on local need. In the Canadian Maritimes, the Campobello Whale Rescue Team (CWRT) was formed in 2002 by volunteer fish harvesters and equipped with government surplus boats and specialized disentanglement tools. Response training was provided by the Center for Coastal Studies (Provincetown MA). Over the next dozen years, the volunteer team responded to entangled whales (right, humpback, minke and fin whales) primarily in the Bay of Fundy and adjacent waters. There were few reports from the southern Gulf of St. Lawrence (sGSL) until 2015. A well-documented shift in right whale habitat due to oceanographic changes affecting their prey resulted in an overlap with fisheries in the sGSL. Two right whale entanglements in sGSL crab fishing gear in 2016 and an unusual mortality event with multiple mortalities attributed to entanglement in 2017 quickly emphasized the heightened entanglement risk and the need to expand response capacity in this new habitat area. In 2018-2019, CWRT was funded and equipped as a mobile rescue team to expand entanglement response on demand in the sGSL and Quebec waters. Given the size of the response area, CWRT trained volunteer crab fishers and biologists to expand capacity. Crab fishers formed an apprentice team in 2021 named Équipe de Désempêtrement du Golfe and volunteered with CWRT to gain experience on entangled whale responses in the sGSL. Biologists with the Réseau Québécois d'Urgences Mammifères Marins were trained and have responded as reports of entangled whales increased in the St. Lawrence Estuary, Quebec. To further build first response capacity and support for disentanglement operations, CWRT provides bilingual training to Federal fishery officers stationed in Quebec and Atlantic Canada. This approach has resulted in positive response outcomes and is well adapted to whale distribution changes.

Site Matters: The relationship between bottlenose dolphins and Atlantic salmon varies between two locations within the inner Moray Firth SAC.

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Bottlenose dolphins are frequently observed predating on Atlantic salmon at two sites (Sutors, Cromarty and Chanonry Point, Rosemarkie) within the Moray Firth Special Area of Conservation. Previous studies have identified these areas as key feeding sites and have indicated that salmon abundance can influence social behaviour, however, the direct influence of yearly salmon abundances on the site use of this population has not been examined. In this study, freely available salmon catch data from the rivers associated with each feeding site was used in conjunction with long term passive acoustic monitoring data to determine the influence that salmon abundance has on levels of dolphin occurrence and their foraging behaviour. Data was analysed on both a monthly and yearly scale using generalized additive models (GAMs) and linear models. Contrary to prior assumptions, salmon abundances did not appear to influence dolphin activity on a monthly scale, with the dolphins instead conforming to seasonal patterns. On the yearly scale, there was a significant interaction between salmon and site which indicated that in years of low salmon abundance, foraging levels increased at Chanonry and decreased at the Sutors. The findings suggest that the foraging capacities of dolphins are likely being maintained by other, less obvious food sources and that Chanonry Point is likely to be a more successful and efficient foraging site to predate on reduced numbers of salmon.

What is the impact of marine vessels on the behaviour of common bottlenose dolphins (Tursiops truncatus) in Montenegro?

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Marine vessel presence is a major anthropogenic pressure in coastal waters globally, with potential impacts on cetacean behaviour through acoustic disturbance, physical presence and habitat displacement. In the coastal waters of Montenegro, the resident population of common bottlenose dolphin (*Tursiops truncatus*) is subject to increasing vessel activity from commercial, recreational and tourist vessels. Using a review of available literature and survey data collected by Montenegro Dolphin Research (15th September 2016 - 7th February 2025), this study examines the impact marine vessels have on the behaviour of common bottlenose dolphins along the Montenegrin coastline. Focal group scan sampling was used to determine the predominant behaviour of common bottlenose dolphins. Transition probability matrices were created using first-order Markov chains for behavioural states in both control chains (absence of marine vessels within a 400m radius of the focal group) and impact chains (presence of marine vessels within a 400m radius of the focal group). Markov chains were used to assess the behavioural budget of common bottlenose dolphins. Results showed that the behavioural budget of common bottlenose dolphins in Montenegro is significantly affected by the presence of marine vessels. Surface feeding and travelling behaviours significantly decreased in the impact budgets whilst diving and resting/socialising behaviours increased in the presence of marine vessels. There were no significant changes in stalling/milling behaviour between control and impact budgets. These findings suggest that there may be ecological consequences to the increasing presence of marine vessels in Montenegrin waters. The results of this study highlight the importance of conservation measures and the need for protected zones in order to prevent long term harm on the fitness of cetaceans.

Current monitoring and conservation perspectives on the Mediterranean monk seals in the Adriatic Basin

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The Mediterranean monk seal (*Monachus monachus*), one of the world's most endangered marine mammals, has experienced dramatic declines in both range and population size over past centuries. Nevertheless, recent signs of recovery have been documented within the species' main reproductive strongholds in the eastern Mediterranean (Greece, Turkey, and Cyprus). This recovery may be encouraging individuals to expand their movements beyond these core areas, potentially leading to the recolonization of former habitats. Such hypothesis is supported by increasing evidence of monk seal presence, particularly along the Adriatic coasts. Building on previous research efforts in the Adriatic region, the Adriatic Monk Seal Project (AMSP) was launched in 2024. The project adopts a cross-border, collaborative approach to monitoring and conservation across the Adriatic basin, bringing

together four key countries: Albania, Montenegro, Croatia, and Italy (Apulia). Within the framework of the project, 14 previously identified marine caves have been systematically monitored with camera traps. To date, two caves in Albania have been confirmed as occasionally used by at least two individual monk seals. Thus far, AMSP has documented 49 confirmed sightings supported by photographic or video evidence, along with additional 10 undocumented encounters. Albania accounts for the majority of encounters collected and verified within the project. Additionally, historical records of monk seal presence, as well as both past and recent data (up to 2024), have been reviewed across the study area. These findings, together with the close presence of a well-studied, reproducing subpopulation of approximately 50 individuals in the Ionian Sea (Greece), underscore the region's importance as a potential recovery hotspot for the species. Collectively, they highlight the urgent need for long-term, basin-wide monitoring and targeted conservation measures to support the permanent return of the Mediterranean monk seal to the Adriatic.

An acoustic analysis: the impact of calf presence on communication of Tursiops truncatus populations along the Montenegrin coastline

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This study aimed to investigate a research gap concerning the acoustic characteristics of *Tursiops truncatus* populations where calves are present versus absent in the Eastern Adriatic Sea. Populations where calves are present are expected to show a difference in communication across six main parameters (delta frequency, peak frequency, delta time, harmonics, inflection points and whistle type) compared to populations where calves are absent. The acoustic recordings of *T. truncatus* used in this project were taken during boat surveys in the Boka Kotorska Bay from March to October 2025 via a passive dropdown hydrophone. Recordings were analysed using Raven Pro 1.6.5, and parameters were measured for each individual whistle. R version 4.3.1 was used to produce linear mixed effects models and ANOVA tests. Results indicated that delta frequency and peak frequency were significantly higher when calves were absent ($p=0.003$, $p<0.001$), whereas for delta time, whistles were significantly longer when calves were present ($p<0.001$). The number of harmonics, number of inflection points and type of whistle showed no significant difference whether calves were present or not. The Eastern Adriatic and calf presence are both understudied in terms of *T. truncatus* behaviour and distribution. However, the available literature shows diminishing *T. truncatus* populations correlated with increasing levels of anthropogenic noise due to vessel presence, seismic activity and military operations. This is critical as *T. truncatus* relies on acoustic communication for the rearing of calves and their signature whistle development. Understanding the nature of this communication is essential for successful conservation efforts, as the existence of future populations relies on calves being present in the area.

Size and structure of humpback whale trophic footprint in a changing North Pacific

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The movement of energy, nitrogen, and carbon around the earth are fundamental drivers of primary productivity and ecosystem functioning. Mobile animal taxa contribute to these movements by removing biomass in the form of plants and other animals and redistributing it via movement, excretion and ultimately death and consumption by predators and scavengers. For example, large carnivores exert top-down influence on overall biomass distribution via removing and changing the behaviour of their herbivore and/or mesopredator prey. Conversely such predators require stable prey availability, as their long generation times constrain their ability to recover from perturbations to prey resources at the population level. Humpback whales (*Megaptera novaeangliae*) exemplify these processes at their extremes. Their large bodies, energy requirements and engulfment capacities, combined with a life-history strategy involving long migrations between spatially separated feeding and breeding grounds, are expected to make them disproportionately influential on ecosystem processes relative to their population sizes. Here, we synthesise and extend recent empirical advances to estimate the total biomass required to maintain humpback whale populations at their current size and to enable full recovery to pre-exploitation abundance. Our approach uses age-structured monte-carlo simulations to estimate the energetic requirements of individual whales as a function of age and life history state and scale them to population prey biomass requirements. Sensitivity analysis was performed with respect to individual modelling parameters (e.g. prey species ratio), structural uncertainty (i.e. alternative functional forms representing alternative mechanistic hypotheses) and alternative methodological approaches (e.g. respiration-, thrust- and volume- based methods of proxying field metabolic rate). Thus, as well as providing substantive estimates of prey biomass requirements, our analysis directs future empirical work by identifying data gaps to which such estimates are sensitive, and is an important step towards forecasting how prey limitation may shape humpback whale population status in changing oceans.

Association between persistent organic pollutants and steroid hormone levels in Baltic grey seal (Halichoerus grypus) pups

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The Baltic Sea is heavily polluted with persistent organic pollutants (POPs) that bioaccumulate in marine mammal blubber and transfer to offspring during gestation and lactation, increasing early-life exposure. This study examined POP concentrations in relation to endocrine parameters and morphometrics in freeranging (Innarahu, Estonia, 2024) grey seal pups (n = 20; 10 females, 10 males). Grey seal pups of defined size and sex were captured using a specially designed pup bag and sedated with 1.5–2.0 mL midazolam (5 mg/mL; Accord). Local anesthesia for blubber sampling was provided with lidocaine (16 mg/mL; Lidobel, Bela-pharm GmbH & Co. KG) (2 mL per site). Mean handling time from capture to release was 17 minutes. All procedures were conducted under permit No. 1-3/25/44 issued by the Estonian Environmental Agency. Blubber POP concentrations were quantified using gas chromatography–tandem mass spectrometry. Detected groups included: polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs), polybrominated diphenyl ethers, polycyclic aromatic hydrocarbons (PAHs), triphenyl phosphate (TPP), benzophenone (BPN), benzyl benzoate, diphenyl sulfone, homosalate, and bis(4-chlorophenyl)sulfone. Comparison of 1998 and current data shows reduced pollutant levels in grey seal pups, with ΣPCBs down 83% and ΣOCPs down 68%. Liquid chromatography-tandem mass spectrometry was used to quantify steroid hormones: cortisol, cortisone, corticosterone, androstenedione, 11-deoxycortisol, 11-deoxycorticosterone, progesterone, pregnenolone, 17-OH-pregnenolone, 17-OH-progesterone, dihydroprogesterone. A generalized linear mixed model was used to assess associations between POP concentrations and morphometric parameters. POP accumulation was sex-dependent, with males showing higher ΣPCBs and DPS levels. HOM and TPP were positively associated with pup body mass and axillary girth.

First photo-identification records of *Delphinus delphis* in the Gulf of Palermo: a contribution from Avvistiamo APS

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Photo-identification (photo-ID) is a widely applied non-invasive method to study cetacean populations, allowing individual recognition, long-term monitoring, and assessment of demographic structure. Despite its extensive use in several Mediterranean regions, structured photo-ID studies of the common dolphin (*Delphinus delphis*) remain absent from the Gulf of Palermo, where data on local occurrence and group composition are still limited. Here, we document the presence of *D. delphis* through the creation of the first individual photo-ID catalogue for this area. Visual surveys and opportunistic data collection were conducted by Avvistiamo APS between Capo Zafferano (east) and the Capo Gallo–Isola delle Femmine Marine Protected Area (west), with the support of citizen-science initiatives and local boat-tour operators. Between May and November 2025, 25 visual and acoustic surveys were carried out, totalling 112 hours of effort. *D. delphis* was observed once near Capo Mongerbino at a bathymetric depth of 124 m. During this encounter, standardised photo-ID procedures were applied to document natural and persistent markings (fin contours, notches, scars, and pigmentation), while drone-based photogrammetry provided additional accuracy in group size estimation and age-class assignment. Approximately 600 high-quality photographs were selected and processed, leading to the identification of 26 distinct individuals, coded Dd01–Dd26. Preliminary demographic assessment based on body proportions and fin morphology suggests that 6 individuals were adults, 16 subadults, 3 juveniles, and 1 newborn, indicating a socially structured group potentially including breeding components. This represents the first structured photographic documentation of common dolphins in the Gulf of Palermo. The catalogue provides a baseline for future re-sighting analyses, long-term monitoring, and Mediterranean-scale comparisons. Overall, the study improves understanding of *D. delphis* in a coastal area exposed to strong anthropogenic pressure and supports conservation planning at local and regional scales for effective future management actions.

Acoustic environment and bottlenose dolphin behaviour around Marine Protected Areas

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Understanding how coastal soundscapes influence bottlenose dolphin acoustic behavior is essential for assessing anthropogenic impacts in Marine Protected Areas. As part of CLAPS project (CLimate Adaptation Pelagos Sanctuary) - a network of hydrophones deployed across several Italian MPAs - we analyzed continuous underwater recordings collected off the Bergeggi Island (Ligurian Sea). Since February 2024, the system has been operating autonomously, acquiring 15 minutes of broadband acoustic data every hour in a continuous, long-term monitoring framework. 1270 hours of recordings between February and December 2024 have been analyzed. This study examines temporal patterns of dolphin biosonar activity and their potential relationships with vessel presence and coastal anthropogenic noise. A custom-developed software estimated mean noise and automatically detected files containing boat passages based on characteristic spectral and temporal features.
Preliminary results show that average noise levels remain relatively stable between day and night, likely due to harbor activity, while vessel detections are higher during daylight. Dolphin clicks are predominantly nocturnal, suggesting that reduced daytime activity may reflect species-specific behavioral patterns and possible avoidance of anthropogenic activities. These findings raise two key questions: (1) whether reduced daytime acoustic activity indicates actual absence or behavioral silence, and (2) whether vessel traffic reinforces this daily pattern. More daytime visual surveys from land and boat are needed to determine if dolphins consistently produce sounds when present. If sounds are reliably emitted during sightings, lack of daytime detections would more likely indicate absence rather than silence. Furthermore, comparative analyses in other CLAPS areas with lower-traffic rate will assess whether nocturnal click dominance is exclusively intrinsic to local ecology or partially shaped by human activity. This study provides a baseline of acoustic patterns for the Bergeggi MPA and contributes to understanding how human activities influence cetacean ecology in coastal Mediterranean environments, offering insights for conservation and management strategies

Who returns to Sagres? Photo identification study of pilot whales

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The objective of this study was to establish the first pilot whale photo-identification catalog for the Sagres region by determining the number of individuals present, clarifying their species classification, and assessing re-sighting patterns to evaluate site fidelity across years. Archived photographs from 14 sightings (2014–2018) were analyzed using a standardized protocol for image preparation, tagging, and cataloging. About 1,800 clear images were assessed based on dorsal fin morphology. Individuals were identified from left and right dorsal fin profiles to create a structured catalog. A total of 127 unique individuals were identified, including 61 with both profiles, 31 right-side only, and 35 left-side only. Among them were adults, juveniles, and eight documented mother–calf pairs. Fourteen individuals were re-sighted in different years between 2014–2018. All individuals originally labeled only at the genus level (GLO) were later matched to confirmed short-finned pilot whale (*Globicephala macrorhynchus*) sightings, demonstrating that the entire dataset represents this species. The final catalog included approximately 200 high-quality photographs selected to represent distinctive morphological traits for each individual. Pilot whales were sighted from June to October, with a peak in September (N = 10). This study is valuable because, while the species classification of pilot whales observed in the study area had previously been uncertain, the photo-identification analysis demonstrated that all identified individuals belong to the short-finned pilot whales. The results provide valuable insight into the species' seasonal presence, and resightings suggest that Sagres is part of their home range or may function as a recurrent visiting area along their migratory route. Moreover, this study established the first standardized photo-ID protocol and catalog for pilot whales at Mar Ilimitado and in the Algarve region, enabling long-term monitoring. Given the limited research on pilot whales in Portugal, this work can serve as a baseline for future population assessments and conservation studies.

Multiple climate scenarios have contrasting effects on the range of non-migrating baleen whales in the tropical Indian Ocean

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Ocean warming is expected to intensify without major climate mitigation. In tropical oceans, increasing temperatures may push marine organisms to their thermal limits, leading to species redistributions and major community shifts. Bryde's whales (*Balaenoptera edeni*) are one of three known species of non-migrating baleen whales and that primarily occur in tropical waters and might be increasingly vulnerable to climate change effects. Here, we investigated the environmental drivers Bryde's whale occurrence in the western tropical Indian Ocean using vessel-based sighting survey data conducted in November 2020 and 2021. We used the Maximum Entropy (MaxEnt) to model the effect of several key environmental predictors, including sea surface temperature, primary productivity, and physiography (depth and slope) on the distribution of Bryde's whales and predict habitat suitability under climate scenarios, specifically Shared Socioeconomic Pathways (SSP). In total, we recorded 100 Bryde's whale sightings over 30 days of cumulative effort and 6,490km surveyed. Primary productivity, temperature, and depth were the most important predictors of suitable habitat for Bryde's whales, respectively. In 2050 and 2100, suitable habitat of Bryde's whales (>60% suitability) will expand south (1.7-2.3°) and west (1.5-2.1°) under the best-case scenario (SSP 1.5) and current climate trajectory (SSP 4.5), with suitable habitat expanding by 30-35%. However, for the most pessimistic scenario (SSP 8.5), suitable habitat would decline dramatically by 75%. These results show major contrasts in predictions depending on climate scenarios but highlight that climate change impact on vulnerable cetaceans and associated communities and ecosystems need to be further examined. There is also urgency to incorporate these projections into management strategies, including adaptative area-based conservation.

Using citizen science to inform local marine management in the southern Bay of Biscay

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Ananta is an interdisciplinary socio-ecological project that aims to bring together marine science with humanities and social sciences in order to better understand (1) the dynamics of marine mammals populations in the Bay of Biscay, France and (2) the use of the area by local stakeholders as well as their perception of sharing territory and living together with marine mammals. To do so, an eponymous mobile application is provided to local stakeholders (fishermen, scuba divers, surfers, boat captains) to allow them to collect opportunistic data on marine mammals at sea, and a registration questionnaire provides data for the upcoming humanities and social study. Launched in 2019, the citizen science project is completed with One ocean's team year-round fieldwork, both at-sea and on-land, providing an “on effort” database. Since 2023, the Ananta app has provided 85 observations thanks to 250 observers. Eight cetacean species have been observed off the Gironde coast, with at least 80% of confidence: *Delphinus delphis*, *Tursiops truncatus*, *Stenella coeruleoalba*, *Globicephala melas*, *Phocoena phocoena*, *Physeter macrocephalus*, *Balaenoptera physalus* and *Balaenoptera acutorostrata*. Also, 6 opportunistic observations of: mahi mahi (3), white marlin (2) and blue shark (1) have been made. Furthermore, One ocean “on effort” database counts 53 observations of 6 marine mammals species: *Delphinus delphis, Tursiops truncatus, Stenella coeruleoalba, Phocoena phocoena, Grampus griseus* and *Halichoerus grypus*. There is a general lack of data on coastal cetaceans dynamic in the Bay of Biscay. Using participative science could allow us to better understand these dynamics, on both ecological and social sciences and help fill knowledge gaps in an aim to better inform local marine environment management. Additionally, citizen science values non-scientific knowledge, raises public awareness, and actively involves people in conservation efforts.

Cumulative impacts on the Baltic Proper harbour porpoise

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The Baltic Proper harbour porpoise is critically endangered and subject to a number of different threats that not only act on their own but also interact with each other to cause cumulative impacts on the population. Realising that cumulative effects are rarely sufficiently presented in EIAs, here we aim to present an overview of cumulative impacts on the Baltic Proper harbour porpoise, how some of the common conceptual models can be applied to the Baltic Proper harbour population, and how cumulative effects should be approached for this population going forward. It becomes clear that many of the pressures cause similar physiological, endocrine disrupting effects, making it very likely that many of the threats have additive or even synergistic effects. There is an urgent need to take cumulative impacts into greater account in the Baltic Proper today, employing the precautionary principle and to develop some kind of quantitative model for the population in order to help prioritize conservation efforts.

PAMCéClass: Building a national acoustic database of delphinids of the French coasts through passive acoustic monitoring for the development of an open-source species classifier

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Passive acoustic monitoring of cetaceans is mandatory as part of impact studies and monitoring of offshore wind farms along the French coasts. However, there is currently no open-access available tool that can acoustically differentiate between the species of delphinids present along France's three maritime coastlines (*Tursiops truncatus, Delphinus dephis, Globicephala melas, Grampus griseus, Stenella coeruleoalba*), due to the lack of specific data for these regions and the similarity in the characteristics of their vocalizations, which complicates classification. It is therefore necessary to create an accessible and standardized tool, as these species have different conservation issues. To this end, the French Office for Biodiversity has funded the PAMCéClass project, which aims to create a database of acoustic signals from delphinids along the French coasts with the goal of developing a classification tool. To do this, we are initially working with seven local partners (marine natural parks and NGO) that we have trained to collect acoustic recordings, each of which is associated with the species visually identified according to a standardized protocol. This database, collected along the French coasts (English Channel, Atlantic Ocean, and Mediterranean Sea), will enable us to implement our classifier using PAMGuard classifier modules (free software developed for the detection and classification of marine mammals). All data from this project will also be manually annotated (with extraction of acoustic parameters) in order to create a national library of delphinids sounds from the French coasts, which will then enable us to compare acoustic characteristics with data recorded in other regions of the world.

Linking colony density to weaning body condition in a capital breeder, the Baltic grey seal

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Grey seals (*Halichoerus grypus*) are capital breeders, meaning females rely entirely on stored energy during their two-to three-week lactation period to both maintain themselves and to feed their pup. This system provides a natural experiment to study how environmental variation shapes maternal investment. Within dense breeding colonies, conflict between individuals is likely to disrupt lactation and hence negatively impact the efficiency of energy transfer from mother to pup. This is one potential mechanism of density dependence that may limit the growth of pinniped species. The isolated Baltic grey seal population has recovered steadily from historic overexploitation over the past three decades. Births on land breeding sites have increased exponentially as a result. In this study, we aim to quantify the effect of colony density on pup body condition at weaning. Using drones and computer vision, we have developed a method for the automated quantification of pup numbers, pup mass, and the identification of moulting pups (coinciding with weaning). Over two years, we collect cross-sectional data from land breeding sites. We found a decline in weaning mass towards the end of the breeding season, coinciding with increased pre-weaning colony density. While work remains to explore other demographic and environmental drivers of these patterns, study outcomes indicate a quantifiable relationship between colony density and pup quality. These findings have the potential to improve the mechanistic integration of density dependence into population models and support sustainable management.

Presence of cetaceans in the newly marine protected area in the Algarve, Portugal

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Marine Protected Areas (MPAs) have expanded globally in response to the growing challenge of safeguarding ocean biodiversity. Portugal is committed to the 30 by 30 agenda, a global initiative that targets the protection of 30% of its marine territory by 2030. As so, in 2024 a new Marine Protected Area was created in the south of Portugal, the Marine Natural Park of the Algarve Reef – Pedra do Valado. These protected areas help preserve the integrity of marine ecosystems while offering important conservation benefits for highly mobile species such as cetaceans. The present study provides information on cetacean presence in the Pedra do Valado MPA, using data collected from both research surveys and platforms of opportunity over a period of 15 years (2010 – 2024). A total of 818 sightings of cetaceans, corresponding to 7 different species were observed within the MPA. Bottlenose dolphins (*Tursiops truncatus*) were the most sighted species (58%), followed by common dolphins (*Delphinus delphis*) (33%). Other species such as harbour porpoises (*Phocoena phocoena*), Risso's dolphins (*Grampus griseus*), and baleen whales (minke – *Balaenoptera acutorostrata*, sei – *B. borealis*, and fin whales – *B. physalus*) were also occasionally sighted. These results highlight the ecological value and cetacean richness of the region, reinforcing the evidence that supported the designation of the Pedra do Valado MPA. Moving forward, it is essential to understand how these species use the MPA and to assess the potential benefits that the MPA may provide, enabling a comparative "before and after" evaluation of its effectiveness. To ensure this, a continuous and dedicated monitoring programme is implemented. This includes ongoing transect surveys for distance sampling, and its extension utilising unmanned aerial vehicles is planned for future years. This will aid gaining long-term insights into occurrence of species, habitat use, and the evolving role of the MPA in supporting cetacean populations.

Monitoring cetacean strandings in the northern Adriatic Sea during 2023–2025: implementing transboundary collaboration

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Cetacean strandings offer a unique opportunity to assess population health, identify emerging threats, and inform conservation actions. This study, carried out in the context of the Interreg Italy-Slovenia project SeaInsights, aimed to monitor the health status of cetacean subpopulations in the northern Adriatic Sea through systematic necropsies conducted between 2023 and 2025 along the coasts of Italy (Veneto and Friuli Venezia-Giulia) and Slovenia. All stranded animals were recorded, measured, and post-mortem examined according to standardized protocols, with biological samples collected, when feasible, for virology, parasitology, bacteriology, and dietary analysis. During the study period, 32 dead strandings were documented, mostly involving *Tursiops truncatus* (n = 31) and one *Balaenoptera physalus*, with individuals ranging widely in size and sampling completeness due to variable decomposition condition codes. Several cases revealed pathological findings, including herpesviral infections (n = 2) and parasitic burdens (e.g., Pseudaliidae (n = 1), *Pholeter gastrophilus* (n = 1), while others contributed valuable ecological information, such as gastric content composition. Two atypical, both alive and dead, stranding events provided additional insights into regional cetacean health and response procedures. The first involved a live-stranded *Stenella coeruleoalba* in Friuli Venezia Giulia, an uncommon species in this area, which underwent health assessment and biomonitoring procedures, including blow sampling, before being released, apparently successfully. The second concerned an unusual stranding of a dead *Balaenoptera physalus* in the Port of Trieste (Marina Porto San Rocco, Muggia, Trieste, Italy), where sampling was conducted at sea under constrained conditions, preventing a complete necropsy, but still yielding important biological material. These findings highlight the value of coordinated regional monitoring in detecting pathological trends, improving response strategies, and enhancing knowledge of cetacean ecology in a semi-enclosed and heavily impacted basin such as the northern Adriatic Sea. Continued investment in standardized stranding networks is essential for understanding long-term population health and supporting conservation planning.

Dental traits as potential indicators of hybridisation among wild phocids in Baltic and Skagerrak waters

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Hybridisation among phocids has been documented under human care, including grey seals (*Halichoerus grypus*; GS) with spotted seals (*Phoca largha*), harbour seals (*Phoca vitulina*; HS), and ringed seals (*Pusa hispida*; RS). In the wild, GS×HS interactions occur, sometimes fatally. Recent observations of RS further south in the Baltic and increasing reports of GS along the Swedish west coast may create new zones for GS×RS and GS×HS interactions. Additionally, reduced heterozygosity in the Kalmarsund HS population may influence mate choice and likelihood of interspecies mating. These ecological shifts raise the possibility of phocid hybridisation occurring naturally in Swedish waters. The objective of this pilot study was to evaluate post-canine (PC2-5) morphology in potential hybrids collected by the Swedish Museum of Natural History and compare them to confirmed hybrids and true GS and RS. Due to limited time, HS were not included in this study. Cusp numbers, angles and overall dental traits were quantified in 27 GS individuals suspected of hybrid ancestry, collected from Swedish waters during 2017-2024. Fifteen overlapped geographically with the Kalmarsund HS population, one originated from the west coast (Skagerrak/Kattegatt HS overlap), and eleven came from the northern Baltic (RS overlap). Dental traits were visually compared to CT models of a GS×RS hybrid and images of a GS×HS hybrid under human care. Cusp data were compared to published true GS (N=65) and RS (N=65) teeth. Future studies will include larger sample sizes and HS teeth. Hybrid candidate teeth had significantly different cusp numbers and angles compared to true GS and RS, especially intermediary values in PC2-3 ($p < 0.001$). Interestingly, several also exhibited supernumerary molar roots (N=18). When validated genetically, dental morphology could serve as a non-destructive tool for detecting hybridisation. This approach may improve the understanding of shifting species interactions and inform management strategies in a rapidly changing ecosystem.

Cetacean bycatch in the United Kingdom: a 30-year review of postmortem examination data (1991-2020)

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Bycatch – the accidental capture of non-target species in active fishing gear – remains a significant threat to marine biodiversity and the long-term viability of many predator populations. Cetaceans are particularly vulnerable due to slow life histories and low reproductive rates, and bycatch events pose not only population-level risks but also welfare impacts for individuals that experience acute trauma. This study provides the first national-scale long-term assessment of cetacean bycatch in UK waters using post-mortem examination (PME) data collected through the UK Cetacean Strandings Investigation Programme between 1991 and 2020. Harbour porpoises (*Phocoena phocoena*) and short-beaked common dolphins (*Delphinus delphis*) dominated both PME cases and bycatch diagnoses across the three-decade dataset, with persistent hotspots identified in South and South West England. Bycatch counts declined significantly for harbour porpoises but not for common dolphins, and while proportions fell for both species, the combined evidence supports a real reduction in bycatch mortality only for harbour porpoises. These contrasting patterns highlight the dynamic nature of cetacean-fishery interactions and the need for species- and region-specific mitigation. Seasonality strongly influenced bycatch with the highest proportions occurring in winter and early spring, particularly for common dolphins in South West England. This 30-year, UK-wide analysis demonstrates that cetacean bycatch remains a persistent conservation and welfare issue. The findings provide evidence to support targeted mitigation in high-risk fisheries, especially along the South and South West

coasts of England and Wales. Enhanced monitoring of small-vessel activity, improved integration of strandings and fisheries observer data, and the application of carcass drift modelling are recommended to better identify the source of bycatch, refine risk assessments and inform effective management strategies to reduce cetacean mortality.

Long-term decline in the body condition of stranded common dolphins relates to environmental change and prey shifts in Galician waters

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In recent decades, common dolphins inhabiting the Galician coast (NW Spain) have undergone shifts in their trophic ecology, likely driven by changes in prey composition and availability. The implications of these ecological changes for dolphin health remain poorly understood. To address this, we used body condition as proxy for health status and derived two complementary body condition indices (BCI) from morphometric measurements of 521 individuals stranded between 1998-2019. BCIs were first calculated as residuals from Generalized Additive Models (GAMs) relating body length to girth and blubber thickness, thereby accounting for body-length effects. These indices were then used in GAMs to (1) assess temporal trends in body condition, (2) evaluate the influence of potential confounding factors (reproductive status, cause of death (COD), decomposition state, season, area), and (3) identify potential trophic and environmental drivers, including proxies for prey quality (calories consumed), prey availability (Spawning Stock Biomass (SSB) and Chlorophyll-a (CHL)), and environmental variables (sea surface temperature (SST), upwelling intensity (UI), North Atlantic Oscillation (NAO)). Both BCIs indicated an increase in male body condition from 1998 to 2009–2010, followed by a steady decline through 2019, with no changes in females. The indices differed in their relationships with covariates: the girth-BCI was mainly affected by COD, while the blubber-BCI was influenced by season, reproductive status, and COD. Trophic and environmental drivers also differed between indices: girth-based variation was best explained by prey quality, prey availability (SSB and CHL), SST, and NAO, while blubber-based variation was linked to prey availability (SSB), SST, and UI. Overall, results indicate that body condition in common dolphins fluctuates with season and reproductive status, while also being sensitive to prey dynamics and both local and large-scale oceanographic conditions. Nevertheless, additional, unmeasured factors, such as disease or physiological stress, may also contribute to the recent decline in body condition.

Hidden folk among giants

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One of the consequences of the ongoing biodiversity crisis may be the extinction of half or more of the existing species on the planet, including many that have not yet been discovered and described. One of the most overlooked groups remains the parasite organisms. Indeed, parasite communities are often neglected in biodiversity studies due to the difficulties in obtaining samples, and the challenges associated with species identification, including the lack of experts. These knowledge gaps limit our understanding of the ecological role of the parasite in the ecosystem. Studying parasites is even more challenging with elusive hosts such as marine mammals. Indeed, the larger the host, the rarer the opportunity to observe and describe endoparasites. Here, we present the first occurrence of the notocotylid trematode *Ogmogaster antarctica* Johnston, 1931, recovered from the intestine of a stranded male fin whale (*Balaenoptera physalus* Linnaeus) on the edge of the Arctic Ocean in November 2021. This record in a new geographical ocean basin, extends the distribution of *O. antarctica* and provides an updated set of morphogenetic characters. Furthermore, it emphasizes the crucial need to investigate the understudied parasite communities of cetaceans when opportunities arise. Such research is essential across the world's oceans, as these communities represent an integrative part of biodiversity, which may prove crucial to consider at a time of environmental change and shifting marine ecosystems.

Beyond the pile, beneath the waves: A regional assessment of cetacean acoustic presence during offshore wind construction using a variety of foundation installation methods

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Underwater noise generated during offshore wind farm construction can impact marine mammals, particularly during impact pile driving. This study investigated whether alternative foundation installation techniques, drilling and suction bucket caissons, alongside limited impact piling affected porpoise and dolphin presence in the Forth and Tay region, Scotland. Construction activities using these alternative methods were expected to generate lower noise levels compared to impact piling, therefore we hypothesised that they would have minimal detectable effects on cetacean presence compared to natural environmental variation. Passive acoustic monitoring data were collected from a regional array of 21 stations over 6 years from March 2019 to December 2024, encompassing pre-, during-, and post-construction phases at Neart na Gaoithe and Seagreen Offshore Wind Farms. Broadband recorders and echolocation click loggers recorded cetacean acoustic presence and ambient noise levels. Covariate data including spatial, temporal, oceanographic, vessel traffic, and construction variables were compiled. Generalised Additive Models and Generalised Additive Mixed Models were fitted separately for dolphins and porpoises to evaluate drivers of acoustic presence. Both species groups were detected across all monitoring sites, with porpoises exhibiting cyclical temporal patterns. Underwater noise during drilling and suction caisson installation showed 3–5 dB increases in the 0.1–1 kHz band compared to non-construction periods, whereas piling produced 18 dB increases. However, anthropogenic covariates explained the lowest proportions of model deviance for both species, indicating that natural and environmental variation primarily drove detection patterns. Construction activities had no discernible impact on dolphin or porpoise detections. This study provides a rare long-term, spatially extensive assessment of offshore wind construction effects on cetaceans, uniquely comparing under-studied installation methods across concurrent developments. The findings demonstrate that regional-scale monitoring over extended periods is essential for contextualising localised, short-term disturbance within broader ecological patterns, offering valuable evidence for environmental impact assessments of future offshore wind developments.

A long-term monitoring reveals a stable presence of harbour porpoises in southern Iberia

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This study evaluates the temporal presence and habitat preferences of the harbour porpoise (*Phocoena phocoena*) in the Gulf of Cádiz, representing its southernmost ecological limit in the Northeast Atlantic. The aim is to determine persistence and identify critical habitats by integrating dedicated sighting data with historical strandings. Data were collected during dedicated research surveys across three monitoring periods: 2001–2004, 2009–2013, and 2023–2025. Across this time series, we recorded 27 confirmed sightings, demonstrating persistent annual occurrence rather than episodic presence. The first period yielded five sightings; the second increased to 13 (peaking in 2012); and following a monitoring gap, surveys in 2023–2025 recorded nine sightings. Notably, 2025 surveys reconfirmed the species with eight sightings, including mother–calf pairs. To explore habitat preferences, we developed a Generalized Additive Model (GAM) using presence–effort data across all monitoring periods. The model shows a strong association with shallow waters, highlighting a narrow and well-defined ecological niche along the Huelva coastal shelf. This consistent, multi-decadal presence, combined with a clear habitat preference and evidence of reproduction (recent calves and historical neonate strandings), identifies the Gulf of Cádiz as a critical habitat for harbour porpoises at their southern range limit. Given its biological relevance and the vulnerability of this edge population, we propose that this area should be considered for designation as a Site of Community Importance (SCI/LIG, Habitats Directive Annex II) to ensure long-term protection and appropriate management.

SoundNet – A long-term passive acoustic monitoring dataset of cetaceans around UK gillnets

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Incidental capture and entanglement in static nets is the largest cause of direct anthropogenic mortality for many small cetacean species, particularly the harbour porpoise, across UK waters and globally. Despite their sophisticated narrow-band high-frequency (NBHF) biosonar for sensing their environment, porpoises continue to interact with fishing gear, occasionally becoming entangled. This raises critical conservation and welfare concerns and poses important questions relating to fine-scale acoustic behaviour near nets. Our long-term Passive Acoustic Monitoring (PAM) project aims to fill this knowledge gap by generating detailed data on porpoise presence and acoustic activity near operational static nets. Since 2016, high-frequency acoustic recorders (SoundTraps) have been attached directly to actively fishing nets, monitoring porpoise acoustic presence and encounter rates, which serve as a reliable proxy for animal density. We present initial results derived from almost 200 deployments, describing porpoise acoustic encounter rates in comparison with environmental and operational factors. The results also inform our understanding of porpoise behaviour in response to Acoustic Deterrent Devices (pingers), which are theorised to cause temporary displacement of porpoises from areas of bycatch risk. This long-term monitoring approach generates invaluable data which may allow the refinement of bycatch estimation and mitigation strategies.

Assessing mitigation options to reduce grey seal bycatch and depredation at static-net fisheries.

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Seal-fishery interactions are a major source of conflict in European waters. In Ireland, grey seal bycatch in static-net fisheries can exceed 10% of hauls, while depredation rates, the full or part removal of fish from nets by seals, can be as high as 40%. Developing effective mitigation to minimise these conflicts is challenging due to the often-erratic occurrence of bycatch and depredation events, the practical/technological limitations of deploying mitigation devices at sea, the adaptability of seals to mitigation (e.g. habituation), and the potential of mitigation methods to disturb/impact fisher catch and non-target species (e.g. elasmobranchs/cetaceans). Here, we present results from two pilot trials to assess the effectiveness of: (1) Targeted Acoustic Startle Technology (TAST; GenusWave) in decreasing seal depredation at gill-net fisheries targeting pollock, and (2) flashing lights (FishTek Marine) at reducing seal bycatch in a tangle-net fishery targeting spiny lobster. Areas subject to high bycatch and depredation, and thus suitable for targeted study, were identified through observer programmes. Initial trial results suggest an overall decrease in depredation at TAST nets compared to control nets, although overall low catches and a small sample size limit conclusive inference. Small cetacean detections did not significantly differ between TAST and control nets, suggesting TAST has no adverse impact on the fine-scale presence of these animals. The first season trialling lights on fishing nets saw bycatch of four seals on nets with lights (hauls = 60) versus seven seals on nets without lights (hauls = 63). Spiny lobster catch was similar between nets with/without lights as was bycatch of elasmobranchs. Results from these two pilot trials highlight potential in these mitigation options to reduce bycatch and depredation in highly impacted regions, supporting the continuation of trials in 2026 to better quantify the effectiveness of these measures and provide pertinent information for the management of seal-fishery conflicts.

Environmental and operational drivers of catch performance and dolphin interactions in small-scale fisheries: Insights from the Depredation-3 project (Western Ionian Sea)

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The Depredation-3 project, conducted by Marecamp association in 2024–2025, in partnership with ACCOBAMS and funded by FAO-GFCM, investigated the environmental and operational drivers shaping fishing performance and cetacean interactions in small-scale fisheries of the Western Ionian Sea. The study focused on increasing depredation pressure from bottlenose dolphin (*Tursiops truncatus*) and striped dolphin (*Stenella coeruleoalba*), whose recurrent presence around gillnets and trammel nets generated notable economic losses (10,000 euros per year, depending on effort and gear damage). Through a multi-model analytical framework, including Generalized Linear Models (GLMs) and non-linear models, we examined predictors of fish catch weight, and variables associated with dolphin presence during net deployments. A GLM on log-transformed catch weight showed that sun elevation, mean water temperature, and soak duration were significant positive predictors. Daytime retrievals were associated with higher catch weights, while soak duration displayed a non-linear effect: moderate increases improved catches, whereas extended deployments produced diminishing returns. Catch performance varied across ports, with mean predicted catches of ~5.5 kg in Acitrezza, 4.7 kg in Augusta, 5.0 kg in Riposto, and 3.5 kg in Siracusa. Gear type, depth, dolphin detection proportion, and the time between first detection and retrieval showed no significant effects. A second GLM analysing dolphin detections in 30-min intervals identified sun elevation, deployment phase, depth, and port as significant predictors. Dolphin presence peaked at mid-solar altitudes (~0.014; $p < 0.001$), increased strongly with depth (from ~0.002 at 20 m to >0.10 at 180 m; $p < 0.001$), and was highest during the soaking phase (~0.012; $p < 0.009$). Spatial patterns showed elevated detection rates in Riposto and Acitrezza, with Siracusa yielding the lowest. Gear type had no measurable effect. These patterns provide a robust quantitative basis for early depredation-risk assessment and are supporting the development of adaptive, evidence-based mitigation measures tailored to the needs of small-scale fisheries in the region.



Worldwide expert elicitation of noise regulation reveals under-regulated sound sources and missing binding thresholds for marine mammals

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Regulation for minimizing underwater noise impacts on marine mammals has developed over time and focusses on various species depending on their occurrence and sensitivity to specific noise producing activities. To get a clearer picture of the existing guidance and needs, and to define a status of worldwide efforts to protect species from underwater noise impacts, we conducted an expert elicitation survey by targeting 147 experts based on workshops during the ECS and SMM conferences 2024, OSPAR and HELCOM expert groups for underwater noise and by contacting MARMAM and BIOACOUSTICS-L lists in 2025. Of the contacted experts, 55 answered the first survey which had questions on threats and general regulation related to underwater noise. 31 experts answered the second part focussed on offshore wind farm construction and in-depth regulation covering all continents, but mainly in Europe. Experts represented public universities, regulatory bodies, policy advisors, NGOs and consultancies. Results show that wind farms are (in some countries) well-regulated, while seismic surveys, military activities and carbon capture and storage are currently under-regulated despite being of high concern. With 5 out of 7 activities projected to increase over the next decade, growing pressure from noise is expected. The exceptions are oil and gas platforms (decreasing) and detonations (rated as stable to increasing). Regulations are well established in some countries, while others lack thresholds, mitigation measures, and monitoring of acute impacts. It is worrisome that most experts indicated that no binding thresholds for impulsive or continuous noise existed in their country. Experts judge that industrial needs are often favoured over nature conservation. Results also indicate that existing measures, with the exception of some activities in specific areas, are currently not sufficient to protect marine mammals from adverse impacts, raising concern when considering the projected trend of an intensified use of the seas around the globe.

The metabolic clock; harnessing metabolic enzyme activity in stranded cetaceans to estimate time since death

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Cetacean strandings provide rare opportunities to investigate marine mammal physiology and mortality, while also providing critical material for forensic assessment and conservation efforts. However, estimating post-mortem interval (PMI) remains a major limitation in forensic and conservation contexts. Visual decomposition scoring, the current standard, is subjective and often unreliable. This novel study approach evaluates metabolic enzyme activity decay as a quantitative proxy for PMI in cetaceans, focusing on lactate dehydrogenase (LDH) and citrate synthase (CS) in long-finned pilot whales (*Globicephala melas*) that died in the UK's largest mass stranding event in nearly a century. Muscle samples from 54 pilot whales that stranded concurrently were sampled at different post-mortem times and stored at –20 °C or –80 °C. To complement this field dataset, we conducted controlled laboratory degradation trials using fresh muscle collected immediately after death of 7 individuals. Enzyme activity was measured spectrophotometrically, and temporal decay was assessed using length-corrected trends (proxy for age) using generalised additive models. Both LDH and CS remained detectable up to 350 hours post-mortem, confirming that stranded cetacean muscle retains enzyme activity for extended periods. LDH exhibited a consistent decline over the sampling period which suggests it could be a suitable candidate for more accurate PMI estimation (± 55-hour range), while CS showed greater variability but could act as a complementary indicator. These results demonstrate that metabolic enzyme activity can support quantitative PMI estimation in stranded cetaceans, offering a more objective alternative to visual scoring. This can aid interpretation of pathological findings at necropsy and provides crucial information for refining drift models aiming to indicate locations of mortality and generate spatially explicit threat-specific risk estimates. By providing a quantifiable tool, this research offers new value to marine mammal health assessment and conservation management, while also highlighting the potential of already archived stranding samples for physiological studies.

First confirmed fisheries bycatch case in a resident bottlenose dolphin (*Tursiops truncatus*) population, west coast of Ireland

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Fisheries bycatch is a recognised pressure on coastal dolphins worldwide. Confirmed bycatch cases of coastal bottlenose dolphins (*Tursiops truncatus*) in the north-east Atlantic remain limited, especially in small, site-fidelic populations with low stranding rates. Here, we present the case history of an adult female bottlenose dolphin from a small, genetically discrete, resident population on the west coast of Ireland. A post-mortem examination determined the cause of death to be peracute underwater entrapment due to fisheries interaction. This represents the first documented bycatch case for this population. The dolphin was matched to the Shannon Dolphin Catalogue, a long-term photo-ID dataset used to monitor this unique population, for which stranding records are rare. The individual was a known reproductive female in the population that gave birth to her first documented calf in 2023, providing important life-history context and highlighting the demographic significance of this mortality event. External examination revealed traumatic lesions consistent with fishing gear interaction, including a complete amputation of the tailstock and encircling linear net impressions on a pectoral fin. No evidence of vessel strike or predation was observed. Internal findings included recently ingested prey remains within the cardiac stomach, supporting sudden death during active foraging, gas bubbles within mesenteric blood vessels, reported in association with asphyxia due to forced submergence in cetaceans, and marked pulmonary and hepatic congestion, non-specific changes reported in many cases of bycatch. The loss of reproductive females to anthropogenic activity can disproportionately affect a small, resident populations. This case highlights the importance of comprehensive necropsy investigations, even in populations with low stranding frequency, and demonstrates the value of integrating stranding data with long-term individual-based monitoring to document rare, and significant, bycatch events in coastal bottlenose dolphin populations.

Effects of pile driving on harbour porpoises: Behavioural responses to low-frequency, long-term exposure to transients sounds

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Harbour porpoises (*Phocoena phocoena*) react to anthropogenic sound sources, such as pile driving, at impressive distances. So far, most studies have involved individual animals exposed to sounds for shorter durations. Here, we had the opportunity to observe how three harbour porpoises housed in a net pen at Fjord&Bælt, Denmark, reacted to a pulsed-sound exposure over the course of two weeks, in autumn 2025. The sounds were produced during massive pile driving happening on land, in a construction site 50 m from the animal enclosure. The generated underwater sound pulses had a frequency emphasis of around 500 Hz and a received level of up to 135 dB re 1 µPa rms. Porpoise behaviour was monitored by filming the animals from above. The porpoises' breathing rates and position in the pool were annotated during 10 min intervals throughout the day, and a comparison was made between days with and without pile driving. We observed mild but consistent responses during long-term exposure to pile driving, with the porpoises showing more signs of weariness later in the day. Our data suggest that long-term underwater noise exposure may be of concern to harbour porpoises, even though no reactions are detectable in the first few hours. This finding is particularly relevant in regard to offshore windfarm construction, which often involves intensive pile driving. [Work supported by WOZEP, Netherlands].

Evidence of killer whale predation on deep-diving cetaceans in Madeiran waters

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Killer whale (*Orcinus orca*) predation on marine mammals is well documented in some regions but remains poorly described in the central Northeast Atlantic, particularly around oceanic islands such as Madeira where both predator occurrence and behavioural records are scarce. Here, we report two confirmed records of killer whale predation on deep-diving cetaceans in Madeiran waters, based on independent observations recorded in June 2023 and June 2025. Observations were conducted from licensed whale-watching vessels operating in compliance with regional regulations. Events were documented using the ILogWhales app recording GPS tracks and sighting information, as well as synchronized photo-identification, surface and underwater video recordings. These data were used to identify individual killer whales, confirm prey species, and reconstruct event timelines and spatial movements. In June 2023, a group of four killer whales was observed feeding on the carcass of an adult Cuvier's beaked whale (*Ziphius cavirostris*), with the behavioural context and carcass condition suggesting active predation rather than scavenging. In June 2025, a coordinated attack by another group of three killer whales on a live pygmy sperm whale (*Kogia breviceps*) was documented over approximately 28 minutes. It involved ramming, aerial displacement, prey handling, and apparent intra-group coordination. The sequence closely resembled prey-handling behaviours described in mammal-eating killer whale populations elsewhere. During the interaction, the pygmy sperm whale repeatedly expulsed large quantities of reddish-brown 'ink', consistent with previously described attempts at escape mechanism when threatened. These two observations constitute the first verified cases of killer whale predation on marine mammals off Madeira and provide rare empirical evidence of predator–prey interactions involving deep-diving cetaceans in the central Northeast Atlantic. The study underscores the critical role of sustained at-sea effort, efficient recording tools, and partnerships between whale-watching operators and research institutions in recording rare species occurrence and documenting infrequent but ecologically significant behaviours.

The whistle repertoire of Scottish west coast common dolphins (*Delphinus delphis*)

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Vocal repertoires are catalogues of the sound types a species produces, and their diversity can be an indicator of communication complexity. Delphinids use whistles for communication, but comprehensive whistle repertoires are unavailable for many species. Existing research has focused on describing means and ranges of acoustic variables, or broad categorisations of contour shapes, rather than an analysis of individual whistle types. However, we know from bottlenose dolphins that the frequency modulation pattern carries significant information. This project describes the whistle type repertoire of the short-beaked common dolphin from the west coast of Scotland, using data collected by the Hebridean Whale and Dolphin Trust between 2003 and 2020. Whistles were measured and traced using PAMGuard's Real-time Odontocete Call Classification Algorithm (ROCCA) module and the resulting contours were analysed using ARTwarp. A total of 1271 whistles were extracted and categorised from 29 independent encounters, resulting in 79 whistle types. The cumulative whistle type discovery curve levelled off at these 79 types when 600 whistles were analysed, and therefore, we are confident that the full repertoire has been described. We also used this whistle repertoire to assess the use of biodiversity indices to predict repertoire size from smaller whistle samples. We found that the most accurate prediction is achieved by using the species richness measure with a hill number of 0. By describing and comparing whistle types and whistle repertoires, we can obtain a more complete picture of delphinid communication, with acoustic repertoire comparisons provide a further avenue for investigating population structures in addition to genetics. This avenue of study allows us to start to understand the factors that impact communication variation between and within species as well as improve our ability to identify species in passive acoustic monitoring.

Tourism pressure on reproductive success in Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) of the northern Red Sea

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Coastal marine mammals are increasingly exposed to human activities, with tourism representing one of the most pervasive pressures. We hypothesize that reduced tourism coincides with increased reproductive success in Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in the northern Red Sea. We analysed a long-term dataset collected by Dolphin Watch Alliance between 2009 and 2025, comprising ~500 photo-identified individuals, including ~200 reliably assigned calves. Birth months were determined using multiple morphological, maternal pregnancy records, and behavioural indicators. Tourism figures were obtained from the official quarterly dataset “Egypt – Tourist Arrivals” published by CEIC Data, based on registrations from the Egyptian Ministry of Tourism and Antiquities. Preliminary analyses reveal strong seasonal clustering of births, with spring and early summer emerging as the predominant calving period. Beyond this biological rhythm, periods of reduced tourism activity, such as during the Arab Spring (2011–2013) and the global COVID-19 pandemic, were followed by noticeable increases in calf births. Analyses accounting for the ~12 month gestation period revealed a consistent negative association between tourism arrivals and dolphin calf births. Busy and quieter periods were defined relative to the median quarterly tourism arrivals and showed a significant correlation with birth counts. Although causality cannot be firmly established in a small population with long gestation, extended maternal care, and typically one calf every 3–5 years, the temporal alignment between declines in tourism and subsequent peaks in births highlights human presence as a potential driver of reproductive success. This work underscores the value of long-term photo-ID monitoring and informs discussions on sustainable marine tourism and conservation in the Red Sea. The widespread and often uncontrolled practices of dolphin watching and swim-with-dolphin activities call for stricter adherence to codes of conduct to minimize disturbance and safeguard reproductive success, reinforcing the case for responsible marine tourism.

Acoustic repertoire of sperm whale (*Physeter macrocephalus*) social units recorded in the Pelagos Sanctuary area (north-western Mediterranean Sea)

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Sperm whales present a complex matrilineal social structure based on social units (SUs). Their relationships are mediated primarily by culturally-transmitted rhythmic vocalisations called Codas (CO). Other rapid-click sequences, such as Chirrups (CH) and Coda-Creaks (CC), are also part of SU acoustic repertoires and may function in transmitting information between group members. This study aims to characterize, by discriminating social vocalizations, the acoustic repertoire of six SUs encountered in the Pelagos Sanctuary, where groups of females and immatures were rarely encountered in the past. 2,438 vocalizations were manually extracted using Raven-Pro 1.6, from 35 hours of recordings collected between 2021 and 2023. The frequency of occurrence, duration (s), emission-rate (n/min), and Inter-Click-Intervals (ICI) (s) were calculated. First-Order Markov chain model (FOMM) was used to investigate the transition of CO, CH, and CC in vocalization sequences. To assess possible clusters within the SUs, a hierarchical cluster analysis (HCA) was conducted on CO ICI and on the vocalization sequences. While most of the vocalization were CH (n=1,301; 53,3%), CC were the less frequent (n=224; 9,1%). CO represented 37% (n=913) of social vocalization, with an emission rate of 0,58 (±0,73) CO/min, a predominance of the 3+1 CO type (n=561; 62%), an average duration of 0,62 s, ICI1 and ICI2 0,15 s and ICI3 0,29 s. Duration and ICI showed significant differences between SUs (Kruskal–Wallis H, df=5, $p<0.05$). The HCA identified two main clusters, with one SU exhibiting faster CO patterns than the others. FOMM revealed a non-stochastic emission syntax with higher probability (~70%) of auto-transition among vocalizations. HCA on transition matrices isolated one SU, suggesting possible dissimilar communication strategies within different SUs. This study provides new insights into the complexity of SUs acoustic repertoire and contributes to understanding whether the area is a convergence zone for SUs from different parts of the Mediterranean.

Comparative analysis of adaptive behavioral strategies of cetaceans in the Black Sea based on surveys in the Bulgarian Exclusive Economic Zone

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The three cetaceans species that occur in the Black Sea are Black Sea Common Dolphin (*Delphinus delphis* ssp. ponticus), Black Sea Bottlenose Dolphin (*Tursiops truncatus* ssp. ponticus) and Black Sea Harbor Porpoise (*Phocoena phocoena* ssp. relicta). The data for the current study were collected in the period 2010-2024, and included two aircraft surveys and one vessel survey of the Bulgarian Exclusive Economic Zone, a ship survey of the Natura 2000 protected areas at sea, a survey of the shelf by vessel and observations from the shore using the vantage point method. Also, monitoring of stranded dead cetaceans on shore were carried out. The populations of the three species have similar distribution areas, but are of different number of individuals. The common dolphin is the most numerous, followed by the harbor porpoise. The bottlenose dolphin is the least numerous. Although the harbor porpoise and bottlenose dolphin are traditionally considered coastal species, inhabiting mainly the shelf zone, they have changed their behavior significantly, adapting to the open sea, where they compete with the common dolphin, feeding on pelagic fish. They do not completely copy the strategies of the common dolphin, as they are also found in coastal waters. Here, however, their habitats are severely degraded due to anthropogenic pressure. The complex pressure on coastal and bottom fish populations forces these cetaceans to move to the open sea, where they pursue more abundant but also more difficult to access prey. The common dolphin rarely appears in coastal waters. A specific strategy of the common and bottlenose dolphins is to form ensembles together with seabirds by following fishing vessels. In the present study, comparative analyses of the behavior of the three species in relation to people, vessels, port infrastructure and fishing gears were made.

Impacts of whale-watching on the behaviour of gray whales (*Eschrichtius robustus*) in Bahía Magdalena Lagoon Complex, Mexico

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Whale-watching has increased in recent decades in Mexico, raising concerns about potential disturbances to whales. To minimize negative impacts, the Mexican regulation NOM-131-SEMARNAT-2010 was established. However, in non-protected marine areas, compliance with this regulation remains uncertain. This study aimed to evaluate regulation compliance by whale-watching operators and assess short-term behavioural responses of gray whales (*Eschrichtius robustus*) to vessel presence. Observations were conducted using instantaneous sampling during the 2022 whale-watching season across three sites within the Bahía Magdalena Lagoon Complex: Puerto Adolfo López Mateos (PALM), Bahía Magdalena (BM), and Bahía Almejas (BA). Our results indicate that most operators did not comply with the established regulations (72.4% of sightings in PALM, 73.2% in BM, and 65.3% in BA). The most frequent infractions involved vessels approaching closer than the allowed minimum distance and improper vessel positioning during encounters. In PALM, we found that a higher number of infractions occurred during sightings of mother-calf pairs. In BA, we detected an inverse relationship between whale abundance and the number of infractions committed by vessels. Regarding behaviour, in BM, the probability of avoidance increased significantly when vessels did not comply with local whale-watching guidelines, particularly when boats used inadequate approach trajectories, or failed to maintain the required distance from whales. In PALM, no correlation was found between avoidance responses and non-compliance. In BA, no avoidance behaviours were observed. As the first systematic assessment of whale-watching practices and their potential impacts, the results should be taken as preliminary. Broader, long-term studies are needed to obtain more robust insights into compliance patterns and whale behavioural responses. We recommend strengthening monitoring efforts, adapting management strategies, and continue promoting education for operators and tourists about responsible whale-watching. These actions can help increase compliance and support a more sustainable industry that balances economic benefits with whale welfare and conservation ethics.

An individual-based model to assess whale-ship collision risk

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Large whales frequently suffer serious injury or mortality from collisions with ships in many high-traffic areas worldwide. Although mitigation measures are increasing, the fine-scale dynamics of interactions between cetaceans and shipping traffic remain poorly understood, limiting accurate risk assessment and the effectiveness of management strategies. Individual-based modeling (IBM) is particularly well suited to explore, at fine spatial and temporal scales, how cetacean behavior and vessel characteristics interact to generate collision situations. We developed an individual-based model to predict fine-scale collision risk between fin whales (*Balaenoptera physalus*) and large commercial vessels (cargo ships and tankers) in the Bay of Biscay, where essential foraging habitats spatially overlap with dense shipping corridors. The resulting IBM simulates fin whale movement, diving cycles, and ship-avoidance behavior, as well as the routes and speeds of cargo and tanker vessels, within a virtual seascape representing the bathymetry of the Bay of Biscay. Whale agents follow empirically derived behavioral rules, while ship agents follow AIS-based routes and realistic speed distributions. Potential collision events are computed from spatio-temporal co-occurrence combined with whale depth relative to vessel draft, and whale mortality is determined from ship length and speed. The model was calibrated to reproduce realistic swimming direction, turning-angle distributions, and dive patterns of fin whales, as well as realistic vessel passage dynamics. It allows us to identify major whale-ship co-occurrence areas and estimate encounter risk. Ongoing simulations examine how vessel speed and whale behavioral state influence predicted encounter risk and evaluate mitigation scenarios. This model improves our understanding of the behavioral and spatial drivers underlying ship strikes and provides a transferable tool to support targeted management actions such as dynamic speed reductions or routing adjustments to reduce ship-strike risk for fin whales in the Bay of Biscay.

Age class partitioning in the foraging ecology of minke whales in northeast Scotland using bulk skin stable isotopes.

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Northeast Scottish waters are highly productive, offering rich seasonal foraging opportunities for migratory cetaceans. Among these, the minke whale (*Balaenoptera acutorostrata*) is the most abundant baleen whale, yet its feeding ecology in this region remains poorly resolved. This study provides the first integrated isotopic assessment of minke whale diet and trophic niche dynamics in Northeast Scotland by analysing stable carbon and nitrogen isotope ratios in adult and juvenile whale skin and in the muscle tissue of putative prey species. Bayesian stable isotope mixing models (BSIMMs) indicated that sand eels (Ammodytidae sp.) were a major component in the diet of both age classes, whilst clupeids and krill also showed relative importance in adults and juveniles, respectively. However, posterior distributions were diffuse, reflecting uncertainty in prey contributions. The isotopic niche metrics: total area, standard ellipse area (SEA), corrected SEA and Bayesian SEA were also quantified to evaluate differences between adults and juveniles across spring and summer. Juveniles consistently displayed larger isotopic niches than adults, with the greatest niche overlap occurring in spring (51%) before complete niche partitioning in summer. Seasonal shifts were pronounced in both age classes, with adults showing a marked niche contraction from spring to summer, while juveniles exhibited a slight expansion. Minimal niche overlap across seasons (adults: 2%; juveniles: 10%) indicates flexible and dynamic foraging strategies. These findings emphasise the need for improved trophic discrimination factors, larger sample sizes from both live animals and strandings, and complementary movement data to

better constrain foraging ranges and prey composition. Together, these results provide essential baseline information on minke whale resource use in a region where prey populations face pressure from fisheries and climate-driven change. This work supports adaptive management of Scottish fisheries and Marine Protected Areas, including the recently designated Southern Trench MPA, a recognised foraging hotspot for this species.

Integrated ‘omics reveal systemic effects of pathological changes in the lung of harbour porpoises from the North and Baltic Seas

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Omics approaches provide a powerful, emerging technique to gain integrative insights into the adaptations and responses of marine mammals to environmental and pathological stressors. In the North and Baltic Seas, intensifying human activities coincide with observations of worsening pulmonary health in harbour porpoises. While helminth infestations and associated lung lesions are commonly observed during routine necropsies of harbour porpoises, consequences for diving behaviour and potentially compensatory adaptations are poorly understood. In this project, we aimed to investigate whether pathological lung lesions induce compensatory molecular responses in the lung and, in a more systemic approach, whether these changes are detectable in the distant locomotor muscles, as proxy for whole-body effects. We applied untargeted transcriptomics, proteomics and metabolomics for which we collected tissue samples during necropsies of 20 harbour porpoises from the North and Baltic Seas (2016-2022). Porpoises were classified as non-healthy or healthy depending on lung health status. Non-healthy harbour porpoises displayed a sustained immune response in both lung and muscle. This is consistent with a chronic inflammation comparable to the pathogenesis of human lung diseases. In the lung, multi-omics results indicate elevated oxidative stress, including HIF1 signalling activation and upregulation of antioxidative pathways. Moreover, we found dysregulation of processes in the lung suggesting impaired tissue repair and permanent tissue loss. Likewise, a systemic immune activation appears to contribute to an energetic imbalance. Both tissues exhibited shifts to altered, less efficient metabolic pathways, in addition to accelerated muscle metabolisation to meet increased energy demand. Thus, the pathological lung lesions substantially affect the locomotor muscles, with possible consequences on competitiveness and fitness. Our study demonstrates that pulmonary pathologies in cetaceans can result in a detectable impact on the general health status, hence emphasises the need to understand the interaction of stressors and systemic adaptations in these animals to inform future conservation efforts.

Mesoscale variables drive blue and fin whale distribution in the northeast Atlantic

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Bottlenose Dolphin Research Institute BDRI

Understanding the spatial distribution of a species is essential for management and conservation efforts. This study looks at how both static and dynamic oceanographic variables, including mesoscale variables, shape the distribution of blue whales (*Balaenoptera musculus*) and fin whales (*Balaenoptera physalus*) along the Iberian Peninsula. Using presence-absence data collected from 2017 to 2022 along the NW Iberian Peninsula, we used Generalized Additive Models (GAMs), Random Forests (RFs), and Boosted Regression Trees (BRTs) to identify key environmental drivers of baleen whale presence and evaluate predictive performance. Our results show that dynamic variables have a dominant influence on whale occurrence, with sea surface temperature and chlorophyll-a concentration lagged by 45 days being major predictors. The mesoscale indicators we used, eddy kinetic energy (EKE) and sea level anomaly (SLA), also ranked among the strongest predictors, highlighting the central role of mesoscale circulation in driving prey aggregation and influencing habitat preferences. Depth was also significant, with both species preferring waters deeper than 200 m. Seasonal prediction maps indicate that suitability peaks in autumn, which is consistent with migratory patterns. While RF and BRT models outperformed GAMs, the inclusion of mesoscale features improved all model accuracy. These findings emphasize the need to incorporate dynamic, mesoscale-driven oceanographic processes and temporal lags into predictive habitat models for large marine predators. Our study underscores the importance of adopting flexible, seasonally adaptive conservation strategies in the Iberian upwelling system, particularly as climate-driven changes increasingly alter mesoscale dynamics and the habitats they create.

Novel gammaherpesviruses identified in multicentric B-cell lymphoma in free-ranging California sea lions (*Zalophus californianus*).

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Lymphoma is the most common hematopoietic neoplasm in vertebrates and has been diagnosed in several pinniped with both solitary (T- and B-cell) and multicentric (B-cell) forms. Two stranded CSLs (a juvenile male and an adult female) were rescued by The Marine Mammal Center. The juvenile male was lethargic, had a distended abdomen and a prolapsed penis. He was euthanized on suspicion of urogenital carcinoma. At necropsy, he had preputial plaques consistent with this diagnosis and there were multiple, firm, white nodules in various organs (presumed carcinoma metastases). The adult female stranded during a leptospirosis epidemic with emaciation, azotemia, hypoglycemia, and leukopenia. She was also euthanized on poor prognosis. At necropsy, both adrenal glands and ovaries were markedly enlarged and the architecture effaced by white, homogenous masses. Cytology of the adrenal mass revealed a monomorphic, atypical round cell population and on histopathology, for both animals, multiple organs were infiltrated by similar uniform, intermediate to large, neoplastic lymphocytes strongly immunoreactive for CD79a, but not for CD3, confirming a B-cell origin. Viral discovery by PCR followed by Oxford Nanopore sequencing using frozen adrenal, ovary and lymph node from the female detected three putatively novel gammaherpesviruses that shared between 85.5-89.9% nucleotide and 85.5-90.9% amino acid homology with each other. NCBI BLAST comparisons showed that they were most similar to a gammaherpesvirus from an Antarctic fur seal (88.5-94.6% nucleotide and 90.9-94.6% amino acid homology), followed by Otarine herpesvirus 2 (87.2-92.7 % nucleotide and 89.1-92.7% amino acid homology) from a CSL. Virus isolation from the male CSL was unsuccessful as no neoplastic tissue was archived. This study reports multicentric lymphoma in two free-ranging CSLs with an atypical tissue distribution. Furthemore, multiple putatively novel gammaherpesviruses were identified in naturally occurring neoplasia of marine mammals, and further study of potential roles of these viruses in neoplasia is merited.

APLOSE: A web-based platform to facilitate the collaborative annotation of Passive Acoustic Monitoring data

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Improving the performance of automated Passive Acoustic Monitoring (PAM) data-processing algorithms requires access to robust, standardised reference libraries of underwater sounds. However, constructing such libraries remains challenging due to the volume, diversity, and variable quality of underwater recordings. APLOSE (Annotation PLatform for Ocean Sound Explorers) is a community-oriented solution to overcome this bottleneck by enabling large-scale, standardised, and collaborative annotation of PAM data. APLOSE is an open-source, web-based application designed to host multi-user annotation campaigns on long-term acoustic recordings. Since 2021, it has supported projects spanning European shelf waters, tropical ocean basins, and high-latitude environments, involving more than 100 annotators and 25 000 hours of audio data. Users can visualise long-duration spectrograms, annotate signals of interest (e.g., odontocete clicks and whistles, baleen whale calls, anthropogenic, geophysical sounds and so on.) and export harmonised datasets for algorithm development. Features include a standardized ontology, user-specific labelling interfaces, nested quality-control workflows, and integrated metrics to investigate inter-annotator agreement. Across recent applications, APLOSE enabled (1) to quantify inter-annotator variability across multiple marine mammal taxa, (2) to generate curated training and validation datasets for click and whistle detectors, and (3) to explore efficiently low-SNR or noisy recordings that are typically under-utilised in PAM studies. Preliminary results demonstrate that collaborative annotation significantly reduces individual bias and increases consistency, leading to higher-quality ground-truth datasets for machine learning. APLOSE provides a scalable and transparent framework for the marine bioacoustics community to co-produce open, standardised reference datasets. As the field moves toward reproducible, data-driven PAM workflows, the platform offers a practical path to accelerate algorithm development, improve comparability across studies, and strengthen large-scale monitoring of marine mammal populations.

Tangled Paths: Gear types driving dolphin–fishery interactions in the Croatian part of the Adriatic Sea (1990–2025)

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Dolphins interact with fishing gear either actively during depredation or passively with abandoned gear while swimming in the water column. We reviewed post-mortem reports of 576 stranded cetaceans from the archives of the Faculty of Veterinary Medicine, University of Zagreb, Croatia, in order to determine the types of gear involved in dolphin–fishery interactions. From October 1990 to December 2025, a total of 105 cetaceans in the Croatian part of the Adriatic Sea were identified as having been involved in dolphin–fishery interactions. In most cases (N = 101; 96.2%), the bottlenose dolphin (*Tursiops truncatus*), the region's most abundant species, was involved (52 males, 46 females, 3 of unknown sex) of which 15 calves, 37 juveniles, and 49 adults. In 70 cases (69.3%), post-mortem findings indicated dolphin–fishery interactions; however, the specific fishing gear involved remained unknown or the available descriptions were insufficient. Among the cases with identified fishing gear, cotton and/or nylon gillnets were most common (N = 24; 23.8%), followed by hooks (N = 4; 3.8%) and mixed gear—including nets, lines, and hooks—found on the body or in the digestive system of the specimen (N = 3; 2.9%). Our results indicate that gillnets represent the most frequent type of known fishing gear involved in dolphin–fishery interactions in the Croatian Adriatic. Bottlenose dolphins of both sexes are affected, with juveniles and adults more frequently involved than calves. This study provides strong evidence supporting the need for further behavioral and conservation research to mitigate this threat.

Snagging issues: is secondary entanglement on offshore renewables infrastructure a realistic impact to marine megafauna?

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The expansion of offshore renewable energy introduces novel anthropogenic structures into marine ecosystems, raising questions about potential entanglement risks for marine megafauna. One hypothesised pathway is secondary entanglement, whereby abandoned, lost, or discarded fishing gear (ALDFG) becomes snagged on mooring lines/cables associated with offshore devices, subsequently posing hazards to marine megafauna including mammals, fish and turtles. For secondary entanglement to occur, a series of sequential steps must take place for a marine animal to be at risk. Each step has an associated probability of occurrence, and the likelihood of harm is ultimately a product of these dependent probabilities. This study evaluates the likelihood and significance of secondary entanglement at offshore renewables developments through the use of a probabilistic framework to assess the overall significance of that risk. While the consequences of entanglement can be severe, including injury or mortality, the probability of the full sequence of events required for entanglement is extremely low. Factors such as the prevalence of fishing activity in/near a development, or the likelihood that ALDFG will drift and snag on infrastructure, must be considered. Mitigation measures such as underwater inspections further reduce snagging potential. Furthermore, the burden posed by this pathway to impact is placed on the renewables industries, rather than the source of the debris causing the entanglement. ALDFG can snag on any subsurface structure, including other human (e.g. shipwrecks), geological (e.g. boulders) or biogenic (e.g. reef) features. The renewables industries are, to our knowledge, the only industries required to assess, mitigate and monitor this risk. These findings suggest that secondary entanglement on offshore renewables infrastructure may not be a realistic impact pathway. The results of any ongoing monitoring of subsea infrastructure should be reported and shared as offshore renewables expand globally, to permit further evaluation of the risks posed by ALDFG around renewables developments.

Migratory fidelity across four decades shapes genetic structure of humpback whales on feeding grounds of the eastern North Pacific

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Migratory fidelity influences the structure and connectivity of many baleen whale populations within and across oceans. Here, we reconciled an extensive catalogue of DNA profiles (a 'DNA register'), including sex, mitochondrial (mt) DNA haplotype, and 10 nuclear microsatellite loci, from 1,572 individual humpback whales (*Megaptera novaeangliae*). With this DNA register, we describe the spatial and temporal genetic structure of whales from feeding grounds in the eastern North Pacific (32.53 – 59.20°N) over nearly four decades (1987 – 2023). Haplotype frequencies differed markedly among nine subregions ranging from southern California to Southeast Alaska (overall FST = 0.218, FST = 0.352, $p < 0.001$) and remained stable across the study period. In comparison, microsatellite allele frequencies showed only weak differentiation among subregions (overall FST = 0.006, F'ST = 0.021, $p < 0.001$). However, distance between subregions was strongly correlated with levels of genetic differentiation for both mtDNA and microsatellites, demonstrating a latitudinal cline of isolation by distance. Assessing mtDNA diversity on a continuous scale using generalized additive models affirmed latitudinal position as a significant predictor of the probability of

sampling specific haplotypes across the feeding grounds, with varying explanatory power depending on haplotype (deviance explained: 8% – 36%). Overall, our results demonstrate the strong and persistent maternal fidelity of humpback whales to their feeding grounds, despite a recent recovery in abundance and the impact of changing environmental conditions. These findings support the continued development of effective conservation and management strategies to protect humpback whales, their genetic diversity, migratory culture, and foraging habitat in the eastern North Pacific.

Passive acoustic monitoring of harbour porpoises (*Phocoena phocoena*) in the Kiel Bight using fisher-collected data

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As top predators, harbour porpoises (*Phocoena phocoena*) play an important stabilizing role in the Baltic Sea ecosystem. However, they face significant threats including incidental bycatch in fishing nets and the drivers of harbour porpoise-fisheries interactions remain unclear. By linking passive acoustic monitoring of harbour porpoises to regular bottom-set gillnet fisheries, this research aims to assess the main drivers of spatiotemporal harbour porpoise distribution, habitat utilization, and interactions with gillnets in the Kiel Bight. It seeks to support local harbour porpoise conservation efforts and strengthen fisheries–science collaboration. Data has been collected from April 2024 until October 2025 by four local fishers who undertook 104 fishing trips (4 – 72 hours gillnet soaking times) within the Kiel bight. A FPOD (full waveform capture porpoise detector) was deployed on each gillnet for harbour porpoise detection. To link harbour porpoise detections to the fishing data, fish species, body length and weight, and spawning status of the catch of approximately 200 meters of each net were documented by the fishers. Additionally, gear specifications such as net type, gear length, mesh width and depth of the net were considered. There was no record of harbour porpoise bycatch. Moreover, for each time and location of the fishing trip, oxygen, salinity, temperature, and current speed were obtained from loggers attached to the gillnets and the German Federal Maritime and Hydrographic Agency. Initial results indicate that porpoises have reduced interaction rates with the gillnets during daytime, possibly due to diel activity rhythms. No clear relationship between overall detection rate and catch-per-unit-effort was observed, suggesting that other factors aside from overall catch rate drive interactions near the nets in the Kiel Bight. Finally, the partnership with local fishers has been a successful model for the opportunistic monitoring of porpoise activity in the region, generating valuable scientific data in situ.

Rude to intrude: Utilising citizen science to support efforts to reduce wildlife disturbance in Scotland

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Human disturbance is an escalating threat to coastal cetaceans, particularly where wildlife and vessel activity overlap. Scotland is important for lots of cetacean species including resident bottlenose dolphins. These inshore waters overlap with numerous harbours and marinas bringing cetaceans into contact with boat traffic. While most vessel operators behave responsibly, small recreational and tour craft can cause disturbance through close approaches, erratic movements, chasing or splitting groups, resulting in disruption to feeding, social behaviour and energy budgets. In the UK and Scotland, disturbing cetaceans intentionally or recklessly is a criminal offence. However, disturbance is often difficult to prove, as most cetacean behaviour occurs underwater and demonstrating any impact can be challenging. Reliable evidence requires proof of behavioural changes, vessel identification and detailed reporting. WDC's citizen science programme, Shorewatch, trains land-based volunteers to recognise and report potential disturbance incidents. These observations provide robust, systematic data on vessel interactions and cetacean responses, supporting police enquiries and targeted education campaigns. Shorewatch volunteers have documented multiple disturbance incidents, including bottlenose dolphins and pilot whales being pursued in Aberdeen waters and orcas being disturbed in the Moray Firth and reported them to Police Scotland. To reduce disturbance and improve compliance, WDC works with NatureScot, Police Scotland and the UK National Wildlife Crime Unit, raising awareness of legislation and promoting responsible wildlife watching through the Rude to Intrude campaign. National marine wildlife codes of conduct provide practical guidance for appropriate vessel behaviour. We highlight the critical role of empowered citizen scientists in documenting and identifying disturbance, the need for improved monitoring and enforcement, and the ongoing importance of public outreach to reduce risk. Ensuring respectful, low-impact interactions is essential for cetacean welfare, and to continue opportunities for people to experience Scotland's dolphins and other marine wildlife wild and free.

Forty years of killer whale sightings in Iceland: a multi-source assessment of distribution, seasonality and regional patterns

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Long-term datasets provide essential baselines for understanding spatial and temporal patterns in marine mammal occurrence, particularly where dedicated monitoring is limited. We used a 40-year compilation of killer whale (*Orcinus orca*) sightings (1982–2025) to assess distribution, seasonality, group size and regional patterns within Iceland's Exclusive Economic Zone. Sightings came from multiple sources but were consolidated into three categories: dedicated surveys, citizen science and whale-watching platforms. Each record was assigned to one of six regions (Northeast, East, South, Southwest, West, Northwest) based on bearing from central Iceland. Monthly, seasonal and decadal patterns were summarised, and variation across source types and distance to coast quantified as descriptive analyses. Annual sighting totals increased significantly over the study period. Sightings occurred year-round but peaked in July (151), March (101) and June (87). Seasonal "hotspots" varied by region, with the South dominating summer and winter, the West spring and the East autumn. Killer whales were broadly distributed, with most sightings in the South (21.5%), Northeast (19.2%) and West (18.9%). Group-size analyses used 482 records (66.1%) and indicated typical groups of 4–7 whales, with the largest mean sizes in the Northeast. Mean distance to coast was 37 km (median 12 km), with dedicated surveys sampling farther offshore than citizen science and whale watching. The contribution of data sources changed over time: dedicated surveys dominated early decades, citizen science increased steadily and became the primary contributor in the 2020s, and whale-watching data were only present from 2010 onward. Only dedicated surveys included effort information; the remaining sightings were opportunistic and reflect where observers searched for whales. Spatial and temporal patterns should therefore be interpreted cautiously, as they may partly reflect observer behaviour rather than ecological change.

These results demonstrate the value of integrating heterogeneous long-term data sources to characterise killer whale distribution and seasonality in Icelandic waters.

Spatial coverage is vital when monitoring a protected population during range expansion.

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Distributional range shifts present a challenge in accurately assessing the population dynamics of highly mobile marine species The East Coast of Scotland bottlenose dolphin population experienced an initial range expansion in the mid-1990s, leading to an extension of the boat-based photo ID studies used to monitor the population from the original Moray Firth SAC (NE Scotland) to a second study site, Tayside (SE Scotland) in the 2000's. Following evidence of a further southern range expansion to northeast (NE) England in the last decade, we established a new study site there in 2024 to assess its importance. For the first time, we estimated the abundance of bottlenose dolphins in NE England using closed-population mark recapture models fitted to capture histories of marked individuals in 2024 using CAPTURE. With data from across this population's range (Scotland and NE England) we also estimated total population abundance. Once scaled up by the mark rate, we estimated 110 (95% CI 95-128) animals using the waters in NE England in 2024, and a total population size of 336 (95% CI 305-370) animals across the entire range. Our findings show that almost a third of the total population is using habitat in NE England outside the Management Unit boundary which currently does not extend beyond Scotland. This has direct implications for statutory assessments in the English North Sea. The estimated total population size for 2024 is approx. 37% larger than previously estimated in the most recent Moray Firth SAC Site Condition Monitoring Report using only data from Scotland. This highlights the importance of including range-wide data to maintain robust assessments of conservation status for this protected population in the future, and exemplifies some of the challenges of monitoring and spatial planning for mobile marine species.

Using citizen science to spotlight the sudden presence of humpback whale(s) (*Megaptera novaeangliae*) in the Eastern English Channel, UK (December 2024 - February 2025)

Elms, Hannah (1)

1. *The Sussex Dolphin Project*

Using sightings and evidence collated by the Sussex Dolphin Project (SDP), this research spotlights the sudden rare presence of humpback whale(s) (*Megaptera novaeangliae*) within the Eastern English Channel, UK during the winter months of December 2024 - February 2025, with the key aim to provide a reference baseline for future work. Sightings and photographs submitted by members of the public, alongside effort-based watches of trained citizen scientists and researchers of SDP were analysed to identify spatial and temporal patterns observed during the rare presence of this species within Sussex coastal waters. Data showed that sightings were predominantly restricted to the Eastern area of Sussex with no records of the species observed beyond Seaford, East Sussex. Temporally, species sightings occurred between 1200hours and 1600hours. Limitations in quality of submitted images prevented a firm conclusion on whether the presence of this species was a sole individual or if different animals were observed. One fluke photograph was successfully compared to existing catalogues to ascertain if this individual was previously identified. No matches were found to catalogued or non-catalogued individuals, resulting in a new individual added to databases. Despite year-round observation in Sussex, the discrete seasonality of the sightings could suggest that the Sussex area of the Eastern English Channel may represent a previously unrecorded migratory stopover as observed in other UK areas (O'Neil et al., 2019). Additionally, the value of citizen science and community engagement is further supported as a vital tool in monitoring cetaceans by this rare event in Sussex. Future work requires continued effort-based surveys from land and from sea, during winter months to determine if this was a singular, sudden event. If annual trends of humpback presence in Sussex persist, wider conservation and management may be required to protect the species from anthropogenic pressures within this area of the channel.

Species-specific baleen whale responses to environmental fluctuations in the North Atlantic: insights from the Azores

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Baleen whale migration is shaped by climatic and ecological drivers acting across multiple spatial and temporal scales. Previous research from the Azores found that the occurrence of some baleen whale species is more strongly predicted by productivity-related conditions at distant lags and migratory sites rather than by contemporary local conditions. Here, we studied the occurrence of four Balaenoptera species by analysing 17 years (2009–2025) of whale-watching data from São Miguel Island to investigate potential drivers of interannual fluctuations in a highly dynamic environment. We computed standardised daily presence ratios at different temporal resolutions, and fit Generalised Linear Models (GLMs) using monthly anomalies of temperature and productivity-related parameters from local to broader scale North Atlantic regions. Environmental predictors were incorporated at multiple temporal lags and cumulative periods and ranked based on overall model performance. We found a clear decline in occurrence for fin whales, an increase for Bryde's and sei whales—with an expanding seasonal trend for the latter—and a stable blue whale occurrence throughout the study period. Overall spring occurrence of blue and fin whales was best explained by local productivity of previous years; for blue whales, this relationship strengthened when coinciding with reduced large-scale productivity at lower latitudes. In contrast, fin whale occurrence during summer was more strongly linked to contemporary local productivity, particularly in relation to broad-scale conditions. Modelling for fin whales also indicated a strong preference for cooler conditions, whereas Bryde's whales favoured warm anomalies at a larger scale. For sei whales, results hinted at a mixed season-dependent response of both temperature and productivity, suggesting a strong influence of broader scale conditions on local occurrence. These species-specific responses may reflect distinct and flexible migratory strategies among baleen whales, highlighting the importance of continued monitoring to anticipate future distributional shifts under accelerating climate change.

Acoustic behaviour of short-beaked common dolphins in the Lisbon region: Influences of group size and composition, predominant activities, and boat presence

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The short-beaked common dolphin (*Delphinus delphis*) is frequently observed along the Tagus estuary and the Lisbon Coast of Portugal, yet its acoustic repertoire in this region remains poorly known. This study analyses the acoustic behaviour of common dolphins in the Tagus estuary and nearby coastal waters during different activities. Data were collected from 2023 to 2025 during 18 dedicated boat surveys in which only short-beaked common dolphins were sighted. Acoustic behaviour was recorded in various predominant surface activities with and without boats nearby. During 43 hours of field effort, 2,393 good-quality whistles were documented in 70 recordings (180 minutes of acoustic data). Whistle emissions, click trains, and pulsed sounds were also registered relative to group size and composition (Groups with calves vs. Groups with no calves). Whistle emission rates were lowest during traveling (0.4 whistles/min/dolphin, representing 49% of acoustic recording time) and higher during foraging (1.7 whistles/min/dolphin, accounting for 51% of acoustic recording time). Dolphins tended to produce more whistles as group size increased while foraging. Although whistle rates did not differ significantly between group types (Mann–Whitney U, $p = 0.72$), pulsed sounds and click trains were more frequent in Calves-absent groups, suggesting higher social activity and greater behavioural variety than in Groups with calves. Boat presence was associated with reduced dolphin vocalizations across all sound types, with the most significant effect observed during foraging. Under no-boat conditions, dolphins produced the highest levels of whistles, click trains, and pulsed sound. Our results suggest that behavioural state and anthropogenic disturbance appear to shape the dolphins' vocal behaviour more strongly than group composition and size.

Establishing reference intervals and a minimally invasive skin-based biomarker profile to assess the health and welfare of free-ranging bottlenose dolphins (*Tursiops truncatus*)

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Understanding the health and welfare of free-ranging bottlenose dolphins is critical for their conservation. This study aimed to establish an analytical profile of biochemical markers in skin samples to assess the health status of populations of this species, and the marine environment, given their role as apex predators. ELISA techniques optimized for minimal sample mass (10–30 mg) were developed, analyzing nine hypothalamic-pituitary-adrenal (HPA) axis hormones: Adrenocorticotropic hormone (ACTH), Growth hormone (GH), Catecholamines (Adrenaline, Noradrenaline and Dopamine), Cortisol, Corticosterone, Dehydroepiandrosterone sulfate (DHEA-S) and Aldosterone; three immunological markers: Fibrinogen, Lactate dehydrogenase (LDH) and Serum amyloid A (SAA) protein; and four metabolic markers: Albumin, Creatinine, Urea and Ferritin. Reference intervals (RI) were established from clinically healthy adult bottlenose dolphins under human care (n=38). Furthermore, skin biopsies from free-ranging bottlenose dolphins in Madeira (n=12) and the Canary Islands (n=10), as well as from necropsied animals in the Canaries (n=21), were analyzed to evaluate the proposed analytical profile. All analyses were carried out between 2024 and 2025 using samples collected in collaboration with marine mammal facilities in the Canary Islands, Mallorca and the Algarve, and through stranding monitoring and response

programmes, following best practices and under appropriate permits and licences. Hormone measurements showed high individual variability. However, the cortisol/DHEA-S ratio (RI: 0.008–0.167 ng/g) proved to be a robust and reliable indicator of chronic stress. Moreover, GH (RI: 1.36–5.36 µg/g) provided complementary information on metabolic status. Additionally, SAA (RI: 9.36–505.52 ng/g) and ferritin (RI: 0.334–7.972 µg/g) also showed stable distributions and differentiated healthy, free-ranging and diseased individuals. Together, these four parameters (cortisol/DHEA-S ratio, GH, SAA and ferritin) form a coherent analytical profile that offers a minimally invasive tool for monitoring the health and welfare of bottlenose dolphin populations and, by extension, marine ecosystem status.

The impact of rapid Antarctic climate change and post-industrial whaling on the distribution of humpback whales in the Southern Ocean

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Industrial whaling depleted baleen whale populations to near extinction before the 1986 International Whaling Commission (IWC) moratorium. The Antarctic was particularly impacted, due to the large abundance and diversity of whales that migrate to seasonal feeding grounds, inciting cascading effects in a heavily top-down controlled ecosystem. These effects are still seen today as their slow recovery is now hindered by human-driven climate change. The Antarctic climate is changing more rapidly than other regions, threatening the stable environmental conditions that vulnerable phytoplankton and krill rely on to form the base of the food web. The slow life history of humpback whales, including slow growth and reproductive rates, and tight synchrony between life history and water temperature, suggests baleen whales are highly sensitive to the impacts of climate change. The variance in these mechanisms across regions will impact the recovery rates of different populations and therefore inform future marine resource management. The ideal distribution theory predicts that a species will first inhabit the most favourable habitat, then spread to minimise competition and maximise its fitness. Baleen whale population recovery is highly variable due to changing environmental conditions, as well as migratory destination knowledge being lost with extinct populations. Changing migratory pathways and destinations has implications on fitness, calf survival, and energy expenditure. Understanding the changes in environmental conditions using historical climate models, can inform understanding of differences in recovery rates of different humpback whale breeding stocks across the Antarctic. This project aims to analyse humpback whales' past, present, and future distribution in the Southern Ocean, integrating the impacts of historic whaling and future changing environmental factors.

Exploring the distribution and habitat suitability of two Mesoplodon species in the Azores using 18 years of whale-watching data

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Beaked whales are among the least studied cetaceans due to their pelagic habits and elusive behaviour. In the Azores, four Mesoplodon species have been recorded, however, knowledge of their regional distribution and ecology remains scarce. We compiled 18 years (2008–2025) of whale-watching sightings from different areas of the archipelago for the two most frequently encountered species—the Sowerby's beaked whale (*Mesoplodon bidens*) and the Blainville's beaked whale (*Mesoplodon densirostris*)—with the aim of investigating and comparing their distribution patterns. M. bidens appeared more widespread across the study area, including the Central Island Group, whereas most *M. densirostris* sightings were restricted to the south coast of São Miguel Island, particularly off Ponta Garça, where the greatest spatial overlap between both species was observed. To explore habitat suitability, we fitted Generalized Additive Models (GAMs) using a set of dynamic and bathymetric predictors analysed both for São Miguel Island and for the whole study area, with non-target species sightings serving as pseudo-absence background. Best-performing models suggested a preference of *M. bidens* for warmer sea surface temperatures (SST) and bathymetry deeper than 700 m, while *M. densirostris* favoured depths between 800 and 1,300 m. Temporal GAMs revealed a more clustered seasonal occurrence for *M. bidens*, with a preference for the central months of the year. We further assessed niche segregation using additional GAMs and Principal Component Analysis (PCA) directly comparing presences of the two species. Results indicated that *M. bidens* showed a greater preference for warmer conditions and appears to use a broader bathymetric range. In contrast, *M. densirostris* showed wider thermal suitability. Overall, our models suggest strong habitat suitability overlap between both species, while hinting at niche segregation that may reflect distinct foraging habits. These findings reinforce the importance of opportunistic data collection platforms for monitoring rarely encountered species.

Recent observations and updated insights on the Mediterranean monk seal in Lebanese coastal waters

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Mediterranean monk seals were historically recorded along the Lebanese coast until the 1960s-70s, particularly near Beirut, Jbeil (Amchit), and Tripoli (Palm Islands). Records of their use of coastal habitats for resting and pupping are limited, with confirmed references only from Rawsheh Cave, Beirut. No data are available from the period of the Lebanese Civil War (1975–1990). The first post-war sighting occurred on May 17, 1997, near the Palm Islands Nature Reserve, followed by approximately 41 sightings between 2000 and April 2020. This study provides updated data on monk seal encounters since 2020, focusing on their presence along the Lebanese coast, habitat use, and feeding behavior to improve understanding of the species' status in the Levantine region. The research relied on photographic and video evidence collected from social media reports and contributions from local fishers and divers. A total of 43 sightings were recorded, 34 of which allowed photo-identification, confirming at least three distinct individuals. Among them, one adult female using marine caves in Amchit and Rawsheh. Video recordings of feeding behavior documented prey such as grey mullet and octopus -both targeted by local fisheries- indicating potential fisheries-wildlife conflicts. Additional sightings were recently reported, on 29 September and 2 November 2025, north and south of Beirut, respectively and a last one on 3 December 2025 near Tripoli. Only two were supported by video evidence, though it did not allow for photo-identification. These findings highlight the need for systematic, long-term monitoring, including the deployment of infrared camera, to identify suitable habitats and more accurately assess seal presence. A coordinated, region-wide effort is also recommended to better understand monk seal movements within the Levantine Basin and support broader conservation initiatives for this endangered species

Quality matters? Comparing manual and automated Inter-Pulse-Interval (IPI) measurements in Mediterranean sperm whales (*Physeter macrocephalus*)

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Sperm whales produce usual clicks (UCs), broadband impulsive sounds with a multi-pulse structure. Measuring the time-lag between consecutive pulses within a click (Inter-Pulse-Interval, IPI) allows estimating the size of the emitting whale. However, recorded clicks are often of suboptimal quality, reducing the effectiveness of automatic systems such as CABLE (Cachalot Automatic Body Length Estimator) in providing length estimation. The objective of the study is to compare IPI measurements derived from clicks of different qualities and to evaluate their consistency with estimates produced by the automatic system CABLE. Clicks' waveforms were manually extracted and classified from 13 recordings of four different sperm whales, recorded during nine sightings between 2008 and 2024 in the Pelagos Sanctuary, north-western Mediterranean. From 574 selected clicks, 26% were classified as high quality (on-axis UCs, with more than two detectable pulses; no overlapping with other clicks; no distortion or clipping of the signal) and 74% as medium quality (on-axis UCs with two detectable pulses or off-axis with more than two detectable pulses; no overlapping). The same dataset was used in CABLE, setting the "Minimum goodness probability" parameter at 0.7. No significant difference (Wilcoxon Signed-Rank Test, n=112, p-values>0.05) was found between IPIs manually estimated from high- and medium-quality clicks within the same recording, yielding IPI estimation for all four whales between 3.63 and 5.00 ms. CABLE returned IPI values for only two individuals, showing differences ranging from 0.06 to 0.66 ms, when compared with manually obtained values. Although preliminary, these results indicate that clicks classified in this study as medium quality may also be included in length estimation analyses, expanding the pool of usable data. The results of this manual analysis can be used in the future to provide useful ground-truth for training and validating new machine learning methods for IPI estimation.

Fin whale winter acoustic presence in the Alboran Sea

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The Alborán Sea is recognized as a key migratory corridor for fin whales (*Balaenoptera physalus*) during their seasonal movements into and out of the Mediterranean Sea. The Alborán Sea has also been identified as a potential feeding area for this species. Passive acoustic monitoring (PAM) offers a non-invasive and efficient approach for identifying the long-term occurrence and acoustic behavior of cetacean species. Male fin whales are known to produce stereotyped songs composed of regular sequences of low-frequency 20 Hz notes, sometimes accompanied by high-frequency notes around 130 Hz. These vocalizations have been linked to both feeding and reproductive behaviors. In this work, we conducted a PAM study in the Alborán Sea during the winter season (December 2023 to March 2024). A total of 724 hours of recordings were analyzed to detect and classify notes at 20 Hz and 130 Hz. Weekly detection rates were calculated, revealing a maximum detection rate of 0.5 (mean = 0.2, sd ±0.2; n = 15 weeks). The acoustic presence of fin whales was detected in 58% of the total days with recordings. Additionally, Inter-Note Intervals (INI) were measured for both note types. The mean INI for 20 Hz notes with a regular pattern was 16.2 seconds (sd ±0.4; n = 2302 INIs), while 130 Hz patterned notes showed a comparable mean INI of 16.4 seconds (sd ±0.4; n = 1171 INIs). These results show different findings regarding INIs published in previous studies on the acoustic behavior of fin whales in the Alborán Sea, providing new insights into their presence and song patterns in this area during winter. The movements of fin whales between the Mediterranean Sea and the North Atlantic Ocean remain poorly understood, especially regarding their winter distribution and feeding areas in the Mediterranean Sea. This study aims to begin explaining these aspects.

From rare to recurrent: The emerging presence of Bryde's Whales (*Balaenoptera edeni*) in the Azores through whale-watching records

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In line with predicted climate-driven shifts, some tropical and warm-temperate cetaceans are being recorded more frequently in the Azores. This study analyses the long-term occurrence pattern of Bryde's whales (*Balaenoptera edeni*) around São Miguel Island from 2009 to 2025, using data from a whale-watching company. A total of 104 sightings were documented. Records increased notably after 2017, with 2025 representing the highest annual peak (49 sightings). Preliminary photo-identification analyses reveal repeated sightings of the same individuals within the season, suggesting an increasing frequency of records and prolonged individual presence in the archipelago. These results indicate a strengthening occurrence pattern for this typically tropical species in the Northeast Atlantic, likely facilitated by ocean warming and the poleward expansion of suitable habitats. This work highlights the value of whale-watching data for monitoring climate change impacts. It also emphasizes a key methodological challenge: the difficulty of at-sea differentiation between Bryde's and sei whales (*Balaenoptera borealis*), emphasizing the need for standardized on board identification and photo-ID protocols to ensure robust data. Overall, our findings provide new evidence that Bryde's whale occurrence in the Azores is intensifying, supporting observations of tropical cetaceans responding to changes in their habitat, possibly due to the rising sea surface temperatures.

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Aerial video analysis reveals extended use of infant position in juvenile long-finned pilot whales

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Offspring care is important in cetacean development, playing a crucial role in facilitating nursing, protection, and culture transmission. In this study, we investigated the spatial configuration of calves in relation to associated adults within a population of long-finned pilot whales (*Globicephala melas*) that summer off the northwestern coast of Cape Breton Island, Nova Scotia, Canada. Using aerial videos, we quantified the percentage of time spent in different spatial positions (n=57) in relation to their mother or carer (e.g., infant, echelon), as well as whether calves spent more time on the left or right side of the accompanying adult. Zero–one inflated beta regression found a statistically significant difference between newborns and young juveniles ($p<0.05$), with newborns primarily observed in echelon position and young juveniles predominantly observed ininfant position. No significant side preference was identified for any age class ($p>0.05$). While young pilot whales showed significantly more variation in their spatial positioning compared to other odontocetes, this study confirmed the importance of echelon and infant positions as seen in other cetacean species. The frequent use of infant position by young juveniles (which have likely reached weaning age), suggests that the infant position may supply additional benefits beyond facilitating nursing. This study provides a baseline understanding of carer-calf swimming behaviour in long-finned pilot whales, which may serve as a basis for evaluating how these spatial relationships may change under specific disturbances (e.g., whale-watching pressure).

Fine-scale meta-population structure of narwhals in East Greenland

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Marine ecosystems in Southeast Greenland are currently experiencing rapid bio-physical changes that are cascading across trophic layers. Narwhals are disappearing in Southeast Greenland due to a combination of climate change and local harvesting. Inferring population structure of narwhals in this region is crucial for improving species management. We investigated genetic structure, kinship, sex, and diversity levels of narwhals sampled along the East Greenland coast (and to the north/northeast). We generated whole genomes from 80 individuals collected at seven localities between Isortoq and Ittoqqortoormiit, and in Northeast Greenland and Svalbard. We find a complex meta-population structure with three genetic clusters comprising narwhals (mainly) from: i) Northeast Greenland, Svalbard and the mouth of Scoresby Sound in the spring, ii) Scoresby Sound in summer and locations further south and iii) Sermilik/Kuummiut and south of Sermilik. We find elevated relatedness among individuals sampled in Scoresby Sound during summer, consistent with the small size of this population. The distribution of relatives along the East Greenland coast provides insight into patterns of dispersal among localities in Southeast Greenland. Importantly, narwhals harvested in the summer within Scoresby Sound are genetically distinct from narwhals harvested in the spring at the entrance of Scoresby Sound, confirming observations from local hunters that they are morphologically distinct.

Cetaceans, humans and climate change: A deep connection revealed by the Grotta dell'Uzzo bone assemblage

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Ongoing climate change strongly affects the marine environment with inevitable consequences for biodiversity. Some marine species have been proposed as indicators of ocean health, and among them cetaceans are considered "ecosystem sentinels", because their abundance, distribution and behaviour are influenced by changes in environmental conditions. Earth's climate has changed continually over the millennia, with the alternation of warming and cooling periods often punctuated by rapid climatic reversals. Studies on ancient cetacean remains have shown that their correct taxonomic identification can reveal range shifts and changes in migratory routes linked to specific climatic events. The largest prehistoric cetacean assemblage in the Mediterranean region was recovered at the archaeological site of Grotta dell'Uzzo (north-west Sicily, Italy) and dates to the closing stages of the Mesolithic, specifically to the time around the 8.2 ka BP cooling event. Ancient DNA analyses were performed on 20 cetacean remains to verify previous morphological identifications and to investigate which species were present in the Mediterranean during this climatic event. Taphonomic and isotope analyses on human and other faunal remains were carried out to investigate whether cetaceans played a role in the diet of humans, who lived at Grotta dell'Uzzo in this period. Our results show the presence of both Mysticetes and Odontocetes in the assemblage, suggesting that, while some remains originate from isolated strandings, specimens of *Globicephala melas* may reflect past mass strandings linked to climatic instability. Furthermore, cut marks and the isotopic composition of analysed remains suggest that cetaceans were opportunistically exploited by the inhabitants of Grotta dell'Uzzo. This study illustrates how integrated analyses of cetacean remains from archaeological sites can provide valuable insights into species distribution, ecology, and

human practices, and help predict the responses of cetaceans to past, present and future climate changes.

What's for dinner? The impact of prey availability on harbour porpoise diet.

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The diet of harbour porpoise (*Phocoena phocoena*) is known to be essentially composed of capelin (Mallotus villosus), but the observed changes in environmental conditions (increasing waters temperature and salinity, acidification) have modified the biology, timing of migration and distribution of the Iceland-East Greenland-Jan Mayen capelin stock. The aim of this study was to investigate the impact of these changes on harbour porpoise diet. The stomach contents of seven harbour porpoises bycaught in 2022 and of six harbour porpoises bycaught in 2025 were examined. All the stomachs of the porpoises bycaught west of Iceland (six) contained capelin remains, both in 2022 and 2025. In the stomach contents of the porpoises bycaught north of Iceland (seven), capelin was the predominant prey in 2022 (four) too whereas 2025 bycaught porpoises (three) had close to no capelin in their stomachs. These stomachs were either empty or contained Atlantic herring (*Clupea harengus*). Furthermore, the calculated capelin size, based on the size of the otoliths collected from the stomachs, appears to be smaller than the prey observed in similar stomachs, 30 years ago. Whereas capelin remains the predominant prey of harbour porpoise in west Iceland, there appears to be considerable variation in diet according to location and fluctuating size of fish stocks.

Navigating Safely: Mapping global risk zones for sailors to minimise cetacean collisions

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Maritime traffic poses a major threat to cetaceans, with both regional and global challenges. Its impacts range from direct mortality to behavioral changes, adding pressure to species already affected by human activities. Although sailing is generally considered more environmentally friendly than other vessel transport types, data compiled by the Marine Strike Log(MSL)* has demonstrated that the sailing sector can also negatively affect cetacean populations, especially where high-speed vessels and offshore routes overlap with migratory corridors, breeding areas, and foraging habitats of threatened species. Therefore, we summarize here the Global Risk Assessment, which has led to location-specific applicable conservation steps for sailors and the boating sector. To date, risk assessments have been conducted for two major international sailing races covering routes from the Baltic to the Central Mediterranean, and across the Atlantic to Ascension Island and the Caribbean. Additional assessments have been completed for training routes in the Bay of Biscay and the Northeastern Atlantic. These risk assessments integrate data from the MSL, online databases, delineated IMMA sites, and other protection measures to identify critical habitats for baleen whales, deep-diving and logging species, and threatened toothed whales. High, medium, and low-risk zones are mapped on predefined grids, providing sailors with spatially and temporally explicit guidance and recommended mitigation measures. By bridging sailing event and route planning with cetacean research, this work sets a model for best practices in reducing vessel strikes. The global risk assessment offers a credible, accessible resource for the sailing and boating sector, informing route planning, decision-making, and event management, and fostering safer navigation for both sailors and marine wildlife. * MSL, (Presented ECS2025), A Global database of encounters between sailing vessels and marine megafauna.

Social structure and community dynamics of bottlenose dolphins in the Sado Estuary: insights from associations and network analysis

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The Sado estuary and adjacent coastal regions (Portugal) are home to a small, resident population of common bottlenose dolphins (*Tursiops truncatus*), whose social structure is of special interest due to the population's limited size and aging demographics. This study examined association patterns within the population and investigated potential subdivisions using photo-identification data. A total of 3,060 images, collected during 17 survey days from October 2024 to October 2025, were analysed to determine group composition. Half-weight indices of association, adjusted for unequal sighting effort, were calculated, and Louvain community detection was applied to both daily and overall association networks. The analysis identified four stable subgroups, notably a frequent social unit of juvenile dolphins, and clarified relationships among all 23 recognized individuals. Occasional associations between resident and non-resident dolphins near the river mouth were also observed. These interactions may allow gene flow or immigration into the population, both of which would be quite relevant. Considering the serious conservation concerns for this community, continued monitoring of social dynamics and cross-population interactions is essential.

Comparative analysis of social structure and behavior of Bottlenose Dolphins (*Tursiops truncatus*) in Boka Kotorska Bay with implications of the influence of marine vessel presence

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Bottlenose dolphins (*Tursiops truncatus*) in Boka Kotorska Bay (Montenegro) face frequent exposure to motor-vessel traffic, yet quantitative long-term assessments of how this affects their behaviour are lacking. This study evaluates whether vessel presence alters dolphins' activity budgets and behavioral state transitions using a unique multi-year dataset (2016–2025). Behavioural scans at 5-minute intervals recorded states including travelling, diving, surface feeding, resting/socialising, and stalling/milling, alongside vessel presence and proximity. First-order Markov chain models compared transition matrices between control conditions (no vessel within 400 m) and impact conditions (vessel present within 400 m). Results indicate pronounced shifts under disturbance: surface-feeding decreased from ~16% (control) to ~5% (impact), diving increased from ~13% to ~31%, while travelling and resting/socialising remained dominant but slightly reduced (travelling: ~51% → ~47%; resting/social: ~10% → ~8%). Stalling/milling stayed low (~11% → ~9%). Transition probabilities show reduced persistence in feeding and a higher likelihood of switching into travelling under vessel presence (e.g., RESOC→TRA rose 0.22 → 0.27), suggesting disturbance-driven behavioural reorganisation. These findings demonstrate short-term behavioral disruption associated with vessel presence and highlight potential consequences for energetic intake, habitat use, and social cohesion. This study provides the first fine-scale, multi-year assessment of vessel impacts on bottlenose dolphins in Boka Kotorska Bay and emphasises the need for evidence-based management measures to reduce disturbance and support the conservation of Montenegro's resident dolphin population.

Underwater noise impact assessment in the Pelagos Sanctuary: a focus on four species

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The Pelagos Sanctuary, a cetacean Marine Protected Area in the north-western Mediterranean Sea, represents a key region for studying species distribution and evaluating the pressures acting on their habitat. Although numerous studies have examined noise, few have applied the Marine Strategy Framework Directive's methodology or verified its thresholds for continuous underwater noise, which stipulates that no more than 20% of the target species' habitat should exceed the Level of Onset of Biologically Adverse Effects (LOBE) in any month of the assessment year. This study used established habitat-preference models to assess whether these criteria are verified within the Pelagos Sanctuary. By integrating habitat suitability predictions with 2019 shipping noise maps generated by SHOM for the QuietSEAS project, the proportion of the suitable habitat exposed to noise levels potentially relevant to LOBE has been estimated. The analysis identified Bottlenose dolphins, Striped dolphins, Sperm whales and Cuvier's beaked whales as the Pelagos Sanctuary species most at risk from shipping noise due to their distribution. Models predict that over 80% of suitable habitat for some species could experience noise above identified LOBE, indicating a substantial loss of usable area. Seasonal analyses further allowed the evaluation of how noise-related impacts vary throughout the year, highlighting periods when a larger proportion of optimal habitat is exposed to higher acoustic pressure. The study enhances our understanding of how noise affects cetaceans and offers valuable guidance on considering habitat vulnerability to shipping noise when defining conservation and management objectives. These findings are crucial for creating strategies that reduce noise pollution and protect cetacean populations within the Pelagos Sanctuary.

Is Madeira archipelago a preferential summer destination for some Bryde's whales?

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Bryde's whales (*Balaenoptera edeni*) have been recorded in Madeira inshore waters since 2001. Over the years, some animals have been identified and resighted around the archipelago, raising the question: do some animals have a higher preference for Madeira waters than others? This question was studied using a photo-identification catalogue of Madeira archipelago, covering 2001-2021 and integrating dorsal fin images collected in scientific surveys, local whale-watching operations and opportunistic encounters. Analyses explored uncertainty in species identification, distinctiveness and matching certainty using four datasets combining these factors. Analyses focused on 1870 sightings of 55-106 individuals, depending on the dataset, from the period 2005-2021. Individual use patterns of Madeira waters were investigated, testing several site fidelity indices based on the indicator's occurrence, permanence and periodicity. The number of site fidelity classes was chosen using k-means clustering analysis. The site fidelity structure was very similar across datasets and, apart from transients, three site fidelity classes were identified: regular, occasional and rare visitors, with 26-33%, 53-66% and 8-15% of individuals, respectively, depending on the dataset. Despite the increase in the overall number of animals using the area over the study period, the percentage of regular and occasional visitors decreased (71% to 56%) between 2005-2012 and 2014-2021 (largest dataset), while the percentage of rare visitors and transients increased (29% to 44%), suggesting that Madeira may have reached its capacity to sustain animals regularly using the area. At least in the first period, most of the regular and occasional visitors using these waters were females. It is unclear why females would prefer Madeira over males, but one can speculate that it would be energetically beneficial for reproductive females to preferentially select more reliable food

sources in space and time (e.g. islands), while males can energetically afford to explore less reliable sources in open ocean, thus minimizing competition.



Beneath the surface: Approaches to represent biological processes and responses to disturbance in marine mammal models

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Process-based models are powerful tools for predicting species responses to global change and anthropogenic disturbance by explicitly representing organism–environment interactions. Yet, because researchers often tailor models to specific ecological questions or management objectives, a wide range of approaches have been developed to represent the same underlying biological processes. Although many such models exist, there has been little synthesis of how modelling approaches differ according to their objectives, limiting our ability to generalize across taxa and systems. Marine mammals, being highly protected and widely studied, provide a valuable case for such a synthesis. Here, we reviewed 209 peer-reviewed and grey literature sources covering 93 marine mammal species, categorizing model characteristics to identify patterns, biases, and gaps. We found a consistent emphasis on energetics, reproduction, and mortality (modelled in 111, 100, and 104 studies, respectively), while immigration/emigration and evolutionary processes were rarely included (9 and 14 studies). Disturbance modelling focused primarily on vessel traffic and noise (50 studies) and direct takes and collisions (49 studies), whereas infectious disease was largely overlooked (6 studies). We also found a strong bias toward a few relatively abundant species, with the top five considered in 42.1% of studies, and a tendency to model short-term physiological and demographic responses rather than long-term or eco-evolutionary dynamics. This review lays the groundwork for more standardized, transferable, and comprehensive modelling frameworks that can enhance predictive capacity and better inform conservation strategies across taxa and ecosystems.

Bayesian State-Space Modelling of Movement and Behavioural States in Sperm Whales (*Physeter macrocephalus*) Tagged in the Strait of Gibraltar

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The investigation focuses on the analysis of satellite telemetry data from sperm whales (*Physeter macrocephalus*) tagged in the Strait of Gibraltar, employing Bayesian State-Space Models (SSMs). The primary objective was to infer fine-scale movement patterns and objectively classify the behavioural states exhibited by individuals across the Strait and into the adjacent Gulf of Cádiz. To this end, and utilizing the same tracking dataset previously employed in post-tagging behavioural assessment studies, a switching SSM was fitted. This model was specifically designed to distinguish between two primary behavioural modes: transiting behaviour and area-restricted search (ARS). The results derived from the SSM consistently demonstrated that sperm whale behaviour is profoundly structured by bathymetry and seafloor slope. Specifically, it was determined that ARS behaviour (associated with foraging) occurred predominantly along deep bathymetric features and in areas with steep slope gradients. This distribution is highly coherent with the location of predictable foraging zones intrinsically linked to complex bottom topography. Conversely, transiting behaviour clearly dominated in shallower areas with gentler slopes, and was the principal mode of movement during the East-West crossings of the Strait. It is relevant to note that these behavioural patterns were highly consistent among the different studied individuals, indicating the existence of strong, shared spatial constraints in their habitat use. Our findings demonstrate that, even when using a limited set of environmental predictors, the application of Bayesian SSMs provides a robust and effective analytical framework for identifying key behavioural modes and for determining the physical characteristics that act as the main drivers of sperm whale movements in this critical region. This innovative methodological approach produces the first spatially explicit behavioural maps for tagged sperm whales in the study area and firmly underscores the central role played by bottom topography in shaping their movement ecology.

Common dolphins have distinct activity budgets in the northern and southern Bay of Biscay

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Activity budgets are essential elements of cetacean ecology, particularly in a conservation context. From 2020 to 2025, we studied common dolphins (*Delphinus delphis*) in the Bay of Biscay (BoB), using a dedicated sailboat with a crew of 3 to 5 persons, and PADOC application to document behaviors. Visual and passive acoustic techniques were employed to determine the activity of dolphins schools during summer, both in the southern (2020-2024) and northern BoB (2025). Sampled habitats were different in the northern region (neritic habitat with water depth < 100m) and in the southern BoB (mixed habitat, with a predominance of water deeper than 200m). After selecting suitable wind and sea conditions (< Beaufort 3), daylight hours(9h-21h), sighting duration (> 2 min) and distance (< 800 meters), 159 sightings remained for analyses, out of which 120 had their activity determined, primarily from visual criteria. Activity budgets were significantly different in the southern and northern BoB, with 39.7% of dolphins groups of the former region observed in foraging, against 60% in the north (Chi-2 test, $p < 0.04$). While frequencies of traveling and resting schools were broadly similar, dolphins were not observed socializing in the north. In the southern region, common dolphins were acoustically monitored by night, showing intense echolocation activity, when in the northern BoB three different day-time foraging modes were observed: two epipelagic modes (either chasing seemingly scattered fishes, or statically feeding on shoaling fishes with a slow pace) and one mesopelagic. Northern region common dolphins are intensively feeding in an area where coastal fisheries are extremely active, which may contribute to explain why by-catches locally peak during summer. Further research effort should include night time acoustic sampling in the northern region.
Acknowledgements: this project receives funding from France-Televisions, and is carried out in partnership with France-Nature-Environnement.

Not so excited to see us? Significant boat-shyness observed in Biscayan striped dolphins (*Stenella coeruleoalba*)

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1. *Groupe de Recherche sur les Cétacés*

Wild cetaceans display various reactions to humans and boats, potentially depending on the type and behaviour of involved boats but also on their species, their local habits, their ongoing activity, their physiological status, etc. Their reactions may then mitigate or aggravate any boat-induced disturbance. They can also scientifically be an interesting clue about the cetacean population well-being in its local environment. We studied Striped dolphins (*Stenella coeruleoalba*) in the Southern Bay of Biscay using a 12m sailboat; field protocol was aimed at behavioural data collection, with an emphasis on non-invasiveness to minimize any potential disturbance (respectful evolutions, no voluntary approach closer than 100m). Among other variables, dedicated parameters were collected using PADOC behavioural app in order to evaluate the reaction of dolphins to our research sailboat, the two main ones being the global school reaction to our boat (including avoidance, indifference, approach) and the occurrence of bowriding. In order to compare the behaviour of these Biscayan Striped dolphins (n=38 suitable sightings), GREC database was adequately filtered and two control groups (similar study protocol and exact same sailboat) were used: Mediterranean Striped dolphins (n=1571) and Biscayan Common dolphins (*Delphinus delphis*, n=209). When considering sightings with minimal distance Dmini>300m, indifference was widespread (11/11 for ScBoB, 384/466 for ScMed, 28/33 for DdBoB, no significant difference between ScBoB and controls). Considering only sightings with Dmini less than 300m, ScBoB were significantly more indifferent (20 cases) and less approaching (3) than ScMed (641 and 502 cases; Chi-squared $p<0.01$) and DdBoB (70 and 98, $p<0.001$). Among those last sightings, bowriding was significantly rarer for ScBoB (6/27) than for ScMed (593/1380, Chi-squared $p\approx0.001$) and DdBoB (115/187, $p<0.0001$). Reasons for this particularly indifferent behaviour are unknown but could be related to local bad experience with boats, behavioural inhibitions linked to co-occurring delphinids, or local differences in surface activity.

Diving patterns and vertical dynamics of the sperm whale (*Physeter macrocephalus*) in the Western Mediterranean

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The present study rigorously characterizes the diving patterns and vertical dynamics of six sperm whales (*Physeter macrocephalus*) equipped with MK10 satellite tags in 2025, focusing on their movements during transit between the Strait of Gibraltar and the Balearic Islands, a vital trophic corridor in the Western Mediterranean. The methodology integrated two telemetry sources: the behaviour files and continuous depth series recorded at a 2-minute frequency to reconstruct the temporal and spatial structure of the dive cycle, overcoming the limitations of low sampling resolution. Essential metrics, such as surface time, bottom phase duration, relative proportion of each stage, maximum depth, and approximate vertical velocities, were calculated, applying smoothing filters and segmentation to ensure the robustness of the reconstructed trajectories. The results demonstrate a highly specialized foraging strategy, showing that approximately 90% of effective dive time is spent in the bottom phase, with typical depths consistently ranging between 400 and 1,200 meters, underscoring an intensive and persistent use of deep mesopelagic layers. Although temporal resolution precludes the calculation of instantaneous velocities, aggregated estimates reveal that descent rates are systematically faster than ascent rates, a pattern consistent with the species' reported physiological dynamics. Furthermore, during transits towards the Balearics, a distinctive pattern was observed: a significant reduction in the frequency of deep dives, compensated by a relative increase in intermediate-depth dives (200–400 m), suggesting an optimized travel strategy that balances horizontal progress with occasional prey exploration. In conclusion, this dataset constitutes the first detailed regional analysis using MK10 loggers on Iberian sperm whales and establishes a fundamental baseline for assessing their exposure to maritime traffic and underwater noise in these ecologically sensitive corridors.

Multi-niche culturomics characterisation of fungal species in wild and captive cetaceans within a One Health framework

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Background: Fungal diseases are increasing globally under climate and environmental change, and marine ecosystems are emerging hotspots for the evolution and spread of pathogenic fungi. Cetaceans are key sentinels for ocean and One Health surveillance, yet data on their fungal colonisation remain limited. We conducted a multicentre culturomics study to characterise the cetacean mycobiome across wild and captive contexts. *Methods*: From 2023 onwards, we conducted systematic sampling through stranding networks, vessel-based blow sampling, and from animals under human care in Spain and the UK. A broad culturomics workflow using selective and non-selective media was combined with MALDI-TOF, PCR, and sequencing. Isolates were classified according to the WHO Fungal Priority Pathogen List, and logistic regression assessed whether captivity increased the likelihood of isolating WHO-priority fungi. *Results*: We sampled 61 animals from 9 species, mainly *Delphinus delphis* and *Stenella coeruleoalba* (13/61), *Tursiops truncatus* (12/61) and *Globicephala melas* (10/61). In total, 250 isolates representing 43 fungal species were recovered from up to 12 anatomical niches, many not previously reported in cetaceans. Of all isolates, 57.2% were from wild stranded, 36.8% from captivity, and 6.0% from free-ranging animals. Molds comprised 54% of isolates and yeasts 46%. The most frequent taxa were *Aspergillus fumigatus* (12.0%), *A. niger* (11.2%), *Rhodotorula mucilaginosa* (8.0%), *Candida parapsilosis* (8.0%), and *Nakaseomyces glabratus* (5.2%). WHO-priority fungi represented 34.8% of all isolates, including 17.6% Critical and 16.8% High-priority species,

but their prevalence did not significantly differ between captive and wild cetaceans ($p = 0.20$). *Conclusions*: Cetaceans harbour a diverse and clinically relevant mycobiome, with a surprisingly high proportion of WHO-priority fungal pathogens circulating across species, habitats, and anatomical niches. This study provides the first large-scale baseline of fungal colonisation in cetaceans and highlights the urgent need to incorporate fungal pathogens into marine wildlife surveillance and broader One Health preparedness strategies.

Population demographic parameter estimates from endocrine profiles of endangered sei whales (*Balaenoptera borealis*) in the Falkland Islands

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Industrial whaling severely depleted the populations of numerous whale species in the South Atlantic, some of which are showing signs of recovery. For example, sei whales (*Balaenoptera borealis*) are globally endangered, but the Falkland Islands are now one of the few places where they are predictably sighted. The Falkland Islands are therefore increasingly being recognised as an important foraging ground for sei whales, and monitoring population demographics in this area is imperative to gain an understanding of potential population recovery post-whaling. Sex ratios, sexual maturity, and pregnancy rates are important demographic parameters fundamental for evaluating population health and predicting population trends. Using sex and endocrine data, we investigated the population demographics of sei whales using this foraging ground. From 2019 to 2022, skin and blubber samples were taken from either free ranging sei whales via remote biopsy (n = 22), or from stranded, deceased animals (n = 8). Genetic sexing of skin samples revealed a sex ratio of males to females of 1:1.73, suggesting greater importance of the area to females. Sex steroid hormones, progesterone and testosterone, were quantified in blubber. Testosterone is useful for estimating reproductive activity, growth and sexual maturity in males. Concentrations averaged 1.067 ng/g ± 0.642 ng/g, and ranged from 0.354 – 2.191 ng/g (n = 11). These concentrations are comparable to those measured in other mature male baleen whales on their feeding grounds. Across four feeding seasons, pregnancy rates - estimated from progesterone concentrations – were high, and averaged 84% (n = 19). This is the first non-lethal study to describe sex ratios, maturity status and pregnancy rates in poorly studied sei whales, providing insights into the life history and population health of this endangered species in a globally significant foraging ground.

Presence, distribution and movements of the bottlenose dolphin (*Tursiops truncatus*) in the Western Mediterranean Sea

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Understanding the spatial ecology and connectivity of common bottlenose dolphins (*Tursiops truncatus*) is essential for the conservation of coastal cetacean populations within the Pelagos Sanctuary and the wider Western Mediterranean Sea. This study investigates the presence, distribution, and movement patterns of *T. truncatus* and analyses the connectivity between Liguria (Italy) and the Camargue Regional Park (France). Photo-identification analyses were conducted on two independent catalogues: the Delfini del Ponente dataset (2018–2024) and the Camargue catalogue (2020–2024). Photo-ID matching was performed using the open-source software finFindR, followed by manual validation to ensure accuracy. A total of 226 individuals were catalogued in Liguria and 213 in the Camargue. Three positive matches were confirmed, documenting long-range movements (mean 414 km) across the Western Mediterranean Sea, with temporal intervals ranging from 15 to 469 days, and highlighting ecological connectivity between the two areas. Dolphins were observed year-round in both regions (249 sightings in Liguria; 89 in the Camargue), but habitat use differed markedly. Ligurian sightings occurred closer to shore and in deeper waters (mean depth 85.0 m; distance 2.3 km), whereas Camargue dolphins occurred farther offshore and in shallower areas (mean depth 30.6 m; distance 7.6 km). Group sizes were comparable between regions, with a mean of 11.11 individuals (SD = 11.11) in Liguria and 12.45 individuals (SD = 8.63) in the Camargue, consistent with the species' flexible fission–fusion social structure. These findings contribute to a broader understanding of habitat use, movement ecology, and cross-border population structure in the Western Mediterranean. The confirmation of inter-regional matches underscores the importance of multinational monitoring networks and shared Photo-ID databases for effective management. The results emphasise that conservation strategies should account for dolphins' mobility across national jurisdictions and for the ecological characteristics of coastal habitats that support resident and transient individuals.

New records and spatial insights on the distribution of Gervais' beaked whale (*Mesoplodon europaeus*) in the Eastern North Atlantic

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Gervais' beaked whale (*Mesoplodon europaeus*) occurs throughout warm and temperate deep waters of the Atlantic Ocean in both hemispheres, ranging from Massachusetts (USA) to southern Brazil in the west and from Ireland to Namibia in the east, where most records come from strandings rather than at-sea observations. The species has been recorded throughout all Macaronesian archipelagos (Azores, Madeira, the Canary Islands, and Cabo Verde), with occasional strandings along the coasts of Portugal, France, and Spain. Despite this broad distribution, confirmed live sightings in offshore international waters, especially between Macaronesia and the European mainland, remain scarce. At sea, *M. europaeus* may be challenging to identify due to its low-profile surfacing behaviour and the subtle diagnostic traits that distinguish it from other Mesoplodon species, particularly True's beaked whale (*Mesoplodon mirus*). Between 2012 and 2025, dedicated visual monitoring conducted from cargo ships and oceanographic vessels operating between continental Portugal and the Macaronesian archipelagos documented 15 sightings of M. europaeus. Group sizes ranged from 1 to 4 individuals (mean=2.2±0.83; median=2) in depths ranging from 1519 to 5325 m (mean=4070; median=4380 m). The record closest to the mainland coast was at 38.50 nautical miles from Peniche, at the Nazaré Canyon. Notably, ten of the sightings (66.67%) occurred within a restricted area spanning approximately 36.4-39.7ºN and 16.7-10.1ºW, which comprises the Tagus Basin. These observations suggest the presence of a potential hotspot, and additionally provide live, photo-validated records from an area where the species' occurrence had previously been inferred only from strandings, enabling precise documentation of *M. europaeus* external morphology. This study enhances the live record database for *M. europaeus* and reinforces that sustained, systematic survey effort using established offshore transit routes as research platforms with trained observers onboard is essential for advancing knowledge of beaked whales' distribution and habitat use.

Reading the skin: photographic evidence of lesion dynamics in *Steno bredanensis* from the Canary Islands

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The rough-toothed dolphin, *Steno bredanensis*, is an oceanic delphinid whose health and external morphology are not fully documented. Skin lesions are valuable non-invasive indicators of individual condition, social interactions, and potential anthropogenic pressures in the cetaceans, yet systematic descriptions of their occurrence and temporal evolution in this species are limited. In the Canary Islands, long-term photo-identification has generated a substantial dataset of this year-round species, providing an opportunity to investigate lesion dynamics and assess the type, distribution, and progression of external injuries. More than 40,000 photographs collected between 2004 and 2012 were analysed, resulting in the identification of 800 individuals from left-side dorsal-fin images and 730 from right-side images. Skin lesion assessments were subsequently conducted on a subset of 307 individuals. Lesions were classified by type and body region, and their temporal progression was assessed in individuals that were sighted on more than one occasion. Re-sighting intervals ranged from a few days to multiple years. Tooth rakes and linear wounds were the most frequently lesion types. These lesions showed progressive fading and diminished contrast across the time. Superficial dorsal-fin indentations evolved into notches over the time, a progression indicative of cumulative scarring processes. Black marks and dark rings were less frequently recorded. Overall, these results highlight the value of long-term photographic datasets for documenting lesion dynamics and evaluating external health indicators in dolphins from the Canary Islands.

Depths of Behaviour: Cetacean Habitat Use in the Algarve, Portugal

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Cetacean behaviour responds to environmental gradients, and understanding these responses is key to interpreting species distribution and habitat use. This study aimed to characterise spatial, seasonal and behavioural patterns of cetaceans off South Portugal over a four-year period, integrating descriptive analysis and multivariate exploration of environmental variables. The Faro region is defined by a narrow continental shelf followed by a steep slope, creating a marked bathymetric gradient that shapes habitat availability. Data was collected year-round through opportunistic surveys conducted aboard dolphin-watching vessels during the study period. A total of n = 3229 sightings were analysed for five species: *Delphinus delphis*, *Tursiops truncatus*, *Stenella coeruleoalba*, *Balaenoptera physalus* and *Balaenoptera edeni*. *Delphinus delphis* was the most frequently recorded species followed by *Tursiops truncatus*. *Delphinus delphis* behaviour was predominantly feeding and travelling - with feeding occurring mainly at intermediate depths along the continental shelf – while *Tursiops truncatus* feeding was observed mostly in coastal waters. *Tursiops truncatus* displayed a consistent spatial and temporal presence aligned with a resident-type use of the region. *Stenella coeruleoalba* occurred less regularly and showed clear affinity for deeper waters associated with the slope. Baleen whales exhibited a pronounced seasonal pattern. *Balaenoptera physalus* were sighted primarily in spring, with feeding concentrated along the shelf–slope transition and aligned with elevated chlorophyll-a conditions. *Balaenoptera edeni* represented a special case: sightings occurred almost exclusively in 2025 during the spring–summer period. This unusual occurrence coincided with elevated temperatures, suggesting that inter-annual thermal variability may shape the species' presence in the region. Altogether, the results reveal distinct habitat-use strategies across species, reflecting differences in behavioural ecology, bathymetric preference and seasonal occurrence. The shelf–slope interface emerges as a key functional area supporting movement and foraging across species with contrasting ecological roles, underscoring the ecological value of this region and the importance of long-term monitoring for effective conservation planning.

Expanding Cetacean Monitoring in the Alboran Sea: New Insights from the Málaga–Melilla Ferry Route

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The Alboran Sea hosts one of the highest diversities and abundances of cetaceans in the Mediterranean Sea, functioning as a transition zone between Atlantic and Mediterranean waters and supporting key populations of resident and seasonally occurring species. Despite its ecological relevance, monitoring efforts have historically been concentrated in the northern portion of the basin and mostly limited to the summer period, resulting in substantial spatial and temporal knowledge gaps, particularly in Moroccan waters. The Fixed Line Transect Mediterranean Monitoring Network (FLT Med Net), operating since 2007, conducts systematic and year-round surveys from ferries used as platforms of opportunity across the Mediterranean. However, until recently, only one of its routes intersected the Alboran Sea. To improve coverage and temporal resolution in this region, a new survey effort was launched in April 2025 along the Málaga–Melilla ferry route, which crosses the basin along a northwest–southeast axis. Across fourteen surveys (two per month), we recorded 298 sightings of seven cetacean species. Encounter rates were 4.94 sightings/100km for common dolphin (*Delphinus delphis*), 1.91 for striped dolphin (*Stenella coeruleoalba*), 0.73 for bottlenose dolphin (*Tursiops truncatus*), 0.19 for goose-beaked whale (*Ziphius cavirostris*), 0.15 for long-finned pilot whale (*Globicephala melas*), 0.11 for Risso's dolphin (*Grampus griseus*), and 0.04 for fin whale (*Balaenoptera physalus*). This new monitoring route provides previously unavailable information for the central and southern Alboran Sea, improving our capacity to detect seasonal patterns and potential distribution shifts. By enhancing data coverage in Moroccan waters, this initiative contributes directly to basin-wide assessments and supports more effective conservation planning for cetaceans in the Alboran Sea.

Abundance of deep-diving cetaceans in the western Mediterranean Sea derived from yearly aerial surveys

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Describing the abundance of marine top predators such as cetaceans is a key first step towards understanding their conservation status and needs. However, surveys have traditionally been carried out in areas close to the shore, leaving data gaps in offshore areas. Aerial surveys allow for the monitoring of extensive areas, far from the shore, in a limited amount of time and have proved to be useful to gather information on data-poor cetacean species. A series of yearly aerial surveys organised by the International Commission for the Conservation of Atlantic Tunas (ICCAT) were conducted around the Balearic Islands in the western Mediterranean Sea between 2015 and 2022. In total, 32,710 km were flown on effort during which 38 sightings of Risso's dolphin (*Grampus griseus*), 39 of sperm whale (*Physeter macrocephalus*), and 9 of goose-beaked whale (*Ziphius cavirostris*) were collected and analysed using standard line-transect distance sampling methodology. Yearly abundances not corrected for availability bias (g(0)) were calculated for all species. Risso's dolphin abundance varied between a minimum of 91 (95% CI: 27 – 308, CV = 0.68) individuals in 2022 and a maximum of 1,205 (95% CI: 176 – 8,246, CV = 1.23) in 2018. Sperm whale abundance varied between 13 (95% CI: 3 – 68, CV = 1.01) individuals in 2015 and 360 (95% CI: 82 – 1,576, CV = 0.87) in 2022. Finally, goose-beaked whale abundance varied between 12 (95% CI: 2 – 70, CV = 1.09) individuals in 2022 and 116 (95% CI: 27 – 496, CV = 0.84) individuals in 2018. This study provides yearly abundance estimates for three deep-diving cetacean species and highlights interannual abundance variability in the area, that needs further research. This information can be used to fill knowledge gaps for these three species in the western Mediterranean and used as reference in management and improvement of monitoring schemes.

Detecting whales from space in meter-class satellite imagery to enable scalable monitoring and ship-strike mitigation

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Maritime traffic is increasing worldwide, exacerbating the risk of ship strikes for many cetacean populations. Focusing on two high-risk regions, the Azores and the Canary Islands, our objective was to assess the feasibility of using meter-scale high-resolution satellite imagery to detect large whales under operational conditions and support ship-strike risk-mitigation efforts. While centimeter-scale imagery offers higher detail, meter-scale resolutions can greatly increase the availability of images from new providers and upcoming satellite constellations. As a baseline, we relied on a deep learning model, based on a Vision Transformer (ViT) architecture, trained on manually labelled whales (~200 individuals) and negative examples (clouds, whitecaps, ships, water) using centimer-scale imagery; on the test set, whale targets were detected with >90% precision and >95% recall. Subsequently, the model was evaluated in meter-scale realistic contexts leveraging in-situ data (visual surveys from whale-watching vessels and other field observations) and expert review. To this end, we used high-resolution satellite scenes (native 1 m resolution) acquired between 2016 and 2024 over known whale key habitats and main marine traffic routes in Azores and Canaries. An end-to-end AI-based detection pipeline segmented the images and identified candidate whale-like objects. The candidate detections were supervised by experts to derive correct predictions. Under calm seas and cloud-free conditions, up to 80 % correct positive predictions rates, high specificity (~99%) and balanced accuracy ~90% were achieved, demonstrating potential for detections. Under whitecaps and clouds edges correct prediction rates however drastically decreased. We delineated environmental conditions under which detection is feasible and configurations where performance degrades. The results define realistic expectations for ship-strike risk mapping using meter-scale satellite imagery and inform requirements for operational monitoring that can take advantage of new sources of

imagery from an evolving Earth-observation landscape, characterized by broader access to meter-scale data, such as the forthcoming Atlantic Satellite Constellation.

Energetic requirements and prey consumption of five different-sized cetaceans in Icelandic waters

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Acquiring sufficient energy to support body maintenance, movement, and energy deposition is fundamental to survival. Cetaceans must meet these demands in a marine environment where prey availability is highly variable, with some species feeding year-round and others relying on shorter seasonal foraging periods. Because metabolic rate scales with body size, the quantity of prey required differs across different-sized species. Here, we estimated energetic requirements and prey consumption for five sympatric cetaceans inhabiting the productive, sub-arctic Icelandic waters: harbour porpoises (*Phocoena phocoena*; mean length±s.d=1.30±0.16m), white-beaked dolphins (*Lagenorhynchus albirostris*; 2.18±0.45m), minke whales (*Balaenoptera acutorostrata*; 7.06±1.14), humpback whales (*Megaptera novaeangliae*; 9.40±1.15m), and blue whales (*Balaenoptera musculus*; 21.59±2.13m). We combined unoccupied aerial vehicle (UAV) photogrammetry with published data, to estimate body size, condition, and field metabolic rates (FMR). For baleen whales, energy deposition was quantified from daily changes in body condition and converted to blubber mass gain. FMR was predicted from published allometric relationships with body mass. Mean energetic requirements were estimated using 10,000-iteration simulations incorporating uncertainty in model parameters, and were scaled to the population level using species-specific abundance distributions. These energetic requirements were then converted into prey biomass, using published data on species-specific diet composition and prey energy density. Absolute energetic requirements and prey intake increased, whereas mass-specific requirements decreased, with increasing body size. Smaller odontocetes consumed the equivalent of ~5-6% of their body mass per day, or 15-20 times annually, whereas baleen whales consumed ~2-3% of their body mass per day, or 3-7 times annually. Nevertheless, because of their considerably larger size, baleen whales required the greatest absolute energy intake; therefore, despite their lower abundance, large whales accounted for most of the total prey consumption in Icelandic waters. Importantly, the combined annual consumption of commercially exploited fish species by cetaceans was less than half of the catch removed by fisheries.

Development of a semi-automatic predictive modelling system integrated into the Intercet platform

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Predictive modelling analyses are a useful tool for studying the suitability of species-specific habitats on spatial and temporal scales, and predicting the effect of anthropogenic pressures, including climate change. This study, conducted as part of the PROMED project (https://promedproject.org/), is a pilot implementation aimed at developing a semi-automatic modelling system, integrated with the Intercet web-based GIS platform (https://www.intercet.it/), to predict habitat suitability for cetaceans in the Pelagos Sanctuary (north-western Mediterranean). A Random Forest algorithm was used to predict habitat suitability for the common bottlenose dolphin (*Tursiops truncatus*), using data uploaded to the Intercet platform by Acquario di Genova. Effort data (km travelled per sampling cell) and corresponding sighting data (sightings per sampling cell) were used, eliminating cells with insufficient sampling effort from the analysis after identifying the cut-off threshold. Static predictive variables (latitude, longitude, depth, slope, distance from coast, distance form main bathymetric isobath) were derived from EMODnet (https://emodnet.ec.europa.eu/en), while the dynamic variables (chlorophyll-a concentration, primary production, sea surface temperature) were derived from Copernicus (https://www.copernicus.eu/en). The model was trained and validated using a cross-validation framework to assess predictive performance. The prototype allows users to define a time interval, an investigation area and the species of interest, using a dedicated and intuitive user interface integrated into the Intercet platform. Based on the data entered, the system extracts information from the common Intercet dataset and performs the modelling workflow, returning a habitat suitability map, displayed as a continuous probability gradient over the map of the Mediterranean Sea. In this specific case, used as a test for the analysis process, the model identifies the habitat suitable for bottlenose dolphins in the waters of the continental shelf, with a clear limit at the 200 m depth isobath, in accordance with the results of previous studies in the same geographical context.

Migratory routes of fin whales (*Balaenoptera physalus*) between the western Mediterranean and the northeastern Atlantic: insights from satellite tagging (2010–2025)

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This study presents the movement patterns of 15 fin whales (*Balaenoptera physalus*) tagged with satellite transmitters between 2010 and 2025 in the western Mediterranean Sea, with the aim of characterizing their contemporary migratory routes and assessing their potential continuity with historical whaling areas documented during the 20th century. Data obtained through Argos satellite telemetry, after spatial and temporal filtering, revealed long-distance movements both toward the Atlantic and within the Mediterranean basin. The most recent campaign, carried out in June 2025 off the coast of Dénia (southeastern Iberian Peninsula), resulted in the tagging of nine individuals. The results revealed a diversity of migratory behaviors, including coastal movements southwestward toward the Strait of Gibraltar, exits into the Atlantic, and prolonged residency within the Mediterranean. Whales that left the Mediterranean displayed linear trajectories spanning several hundred kilometers and scattered areas of residency, suggesting a flexible migratory strategy likely influenced by interannual variations in pelagic prey availability. In contrast, the Mediterranean trajectories were characterized by slower travel speeds and greater spatial concentration, consistent with localized foraging behavior. The observed tracks overlapped with historical industrial whaling areas, where over 7,000 fin whales were captured in the past century, indicating a possible ecological continuity of migratory corridors. The prolonged residency of some individuals within the Mediterranean during the tracking period supports the still-debated hypothesis of a partially resident subpopulation, as suggested by previous genetic studies. These results represent the most extensive tagging dataset obtained to date for this species in the Iberian region and provide a solid foundation for the identification of migratory corridors and the development of transboundary conservation strategies.

Living longer than we thought? Long-term monitoring reveals extended longevity in Mediterranean common dolphins

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Long-term research and monitoring are essential to understand and protect highly mobile and long-lived cetaceans. Studies on life-history and demographic parameters for common dolphins (*Delphinus delphis*), conducted primarily in the eastern North Atlantic, suggest a maximum lifespan of about 30 years. Recently, it was revealed that common dolphins in the area live significantly shorter lives, with female longevity dropping dramatically from 24 to 17 years, offering critical early warning, calling for proactive conservation management. In these studies, age estimation from growth-layer groups in teeth of stranded animals was the standard method for assessing longevity. Long-term demographic data (e.g., age structure, survival, lifespan, reproduction rates) for Mediterranean common dolphins remain scarce, mostly due to a low population density, reduced encounter rates and strandings, limiting data collection. Here we report lifespan values from the longest-running study on common dolphins in the Mediterranean, led by Tethys Research Institute in the Eastern Ionian Sea, Greece. Boat surveys were conducted between 1992 and 2025. During 1,587 survey days, covering 72,772 km of survey effort, 549 common dolphin sightings were recorded, resulting in 258 photo-identified individuals. The maximum observed time span between a common dolphin's first and last sighting in this 30+ years dataset was 34 years, including 10 individuals observed for more than 30 years. Yet the ages for some of these dolphins are likely to be underestimated; seven of them may be close to 40 years of age, since they were first identified as adults. Demographic data, including lifespan, are fundamental to understand the population processes that are assessed for evaluating the status of dolphin population units and development of effective conservation measures and management plans. This is even more relevant in the case of the Inner Mediterranean Population of common dolphins, listed as Endangered in the IUCN Red List of Threatened Species.

Whale Track: Learnings from 20 years of community-based data collection on the west coast of Scotland

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Monitoring cetacean distribution and seasonal occurrence is essential for effective conservation management. Achieving sufficient spatial or temporal coverage is challenging for dedicated surveys alone. Citizen science initiatives offer a complementary approach enabling large-scale, year-round monitoring, and contribute observations of rarer species that are otherwise difficult to detect. To address this, the Hebridean Whale and Dolphin Trust (HWDT) has collated community sightings data off the west coast of Scotland for over 20 years (2004-2025). From 2004 to 2017, sighting reports were collected on paper and web-based forms. In July 2017, the Whale Track smartphone application and website launched allowing anyone to record effort-based surveys, casual sightings and photographs. Community outreach and training was provided and data verified to maintain data quality. From 2004 to 2017, almost 10,000 sightings were reported with an average 236 contributors per year. Following the launch of Whale Track and continued expansion of the project, participation and survey effort increased substantially. The average number of active reporters nearly trebled (184%), and the total number of sightings increased by 555% generating 63,216 sighting reports. Of these, almost half (41%) were from effort-based surveys (n=6,842) and 4% included photographs (n=2755). Whale Track enables communities to monitor rarer species and track known individuals. These data show a predictable late summer-early autumn occurrence of northern bottlenose whale sightings in Scottish inshore waters and provided 60% of photographs in HWDT's minke whale photo-ID catalogue for the west coast of Scotland, contributing to Europe's longest sighting history for an individual minke whale. These findings demonstrate that Whale Track provides important insights into species occurrence and behaviour, strengthening long-term, large-scale monitoring of cetaceans and playing a crucial role in conservation and management strategies. Combining technological advances with consistent outreach and training is essential to engage local stakeholders strengthening long-term community-based monitoring of Scottish cetaceans.

Towards predicting cetacean distribution: remote sensing insights from the Calabrian Ionian Sea (Gulf of Squillace)

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The Gulf of Squillace (Calabrian Ionian Sea) represents a complex and vulnerable environmental setting within the Central Mediterranean basin. Its ecological relevance as a biodiversity hotspot for cetaceans underscores the importance of collecting robust data on distributional patterns to better understand how odontocetes interact with dynamic marine environments. Flagship species such as the bottlenose dolphin (*Tursiops truncatus*) are particularly exposed to anthropogenic pressures, including fishing activities, underwater noise, and chemical pollution, which may compromise their long-term survival. This study investigates the relationship between cetacean distribution and environmental variables, based on sighting data of three odontocete species (*Tursiops truncatus*, *Grampus griseus*, *Stenella coeruleoalba*) collected between 2019 and 2025 during vessel surveys. Environmental descriptors were extracted from the Copernicus Marine Service and EMODnet bathymetric datasets. Satellite data were integrated to provide insights into behavioral patterns and habitat selection. Preliminary analyses highlight significant variations in key environmental parameters -salinity, sea surface temperature (SST), bathymetry, and chlorophyll concentration - that appear to influence cetacean distribution across the study area. These variations suggest that cetaceans respond to a combination of physical and biogeochemical drivers, with potential implications for their spatial ecology and resource use. By linking environmental variability to species occurrence, this research provides valuable knowledge to support conservation planning and adaptive management. Such evidence-based approaches are crucial for the designation of Marine Protected Areas (MPAs), the implementation of the Natura 2000 Network, and the identification of Important Marine Mammal Areas (IMMAs).

Is deep diving cheaper than shallow diving? Estimating energetic expenditure of near-shore and offshore bottlenose dolphins

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Understanding how disturbance affects marine mammals requires accurate estimates of baseline energetic expenditure, a core component of Population Consequences of Disturbance (PCoD) models. Current estimates are often coarse, limiting our ability to assess how metabolic costs vary with behaviour or dive strategy. A previous study indicated that deep diving incurs lower energetic costs than shallow diving. Typically, field measurements informing energetic expenditure estimates are taken when the animal is active at or near the surface. If near-surface activity is more energetically demanding than deep diving, these measurements may overestimate the energetic expenditure used in PCoD models. Here, we reconstructed high resolution energy expenditure estimates across different dive strategies in two bottlenose dolphin ecotypes, offshore and near-shore, to further investigate this potential overestimation. We used DTAG records from three near-shore (Sarasota Bay, shallow-water) and three offshore (Bermuda, deep-water) bottlenose dolphins (*Tursiops* spp.). Locomotion costs were derived using a gas dynamics model that converts activity metrics into energetic expenditure in wild dolphins. All measurements were allometrically scaled and reported as mean energy expenditure ($kJ \cdot kg^{-1} \cdot min^{-1}$) during dives and post-dive surface intervals. As in the previous study, despite using revised dive-threshold criteria, offshore Bermuda dolphins exhibited ~27 percent lower locomotion costs than Sarasota dolphins during both dives and post-dive surface intervals. However, individual-level analyses showed that the ecotype difference was driven primarily by one Sarasota dolphin with markedly elevated locomotion costs during both dive and rest phases, compared to the other Sarasota individuals. These findings highlight the need for continued data collection to improve our understanding and estimation of individual-level and population-level differences in locomotion costs. The outputs from this project strengthen the knowledge base for estimating energetic expenditure, the key denominator in assessing energetic balance, and will support more accurate and robust PCoD evaluations of disturbance impacts.

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Preliminary Assessment of the IPI–Body Length Relationship in Mediterranean Sperm Whales

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Existing empirical relationships between sperm whale body length and the Inter-Pulse Interval (IPI) of usual clicks have been widely applied across ocean basins, allowing estimation of sperm whale size even when the animal is not visually observable, provided that recordings from hydrophones are available. However, when these models are applied to Mediterranean sperm whales, their accuracy decreases markedly, producing systematic deviations that suggest population-specific morphological or allometric differences. One possible explanation is a distinct proportionality between the spermaceti organ and total body length (TBL) in this geographically semi-enclosed and genetically distinct population. To find a population-specific equation for Mediterranean sperm whales, we collected data from 17 individuals encountered during dedicated surveys between 2022 and 2025 research seasons within the Pelagos Sanctuary. TBL was measured using aerial drone photogrammetry, based on images processed with Whale morphometrics R package. Acoustic recordings were collected concurrently with drone measurements and analyzed through a cepstrum-based workflow using custom-developed software to extract robust IPI values from sequences of usual clicks. We modelled the relationship between IPI and measured TBL using linear regression. The resulting equation shows promising predictive performance and will be compared with previous findings for Mediterranean populations. Furthermore, this study includes some individuals smaller than 9.5 m, a size class not previously considered, which improves the range of the IPI–length relationship. Because the current dataset is limited to 17 individuals, this should be considered a preliminary estimate; including a more uniform representation of different body lengths would likely improve the accuracy and robustness of the IPI–length correlation. To date, this population-specific relationship improves the reliability of acoustically derived length estimates and underscores the importance of regional adjustments when using IPI as a morphological proxy for assessments of sperm whale body length.

Global atlas of ways citizen scientists and communities contribute to marine mammal science

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Citizen and community scientists play an increasingly significant role in advancing marine mammal research, yet the breadth and diversity of their contributions have never been captured in a single, accessible resource. This talk presents a new interactive global atlas that collates over 400 examples of community- and citizen-science initiatives focused on marine mammals. The atlas provides an open, user-friendly map that allows researchers, practitioners, communities, policymakers and citizen scientists themselves to explore how people around the world are contributing to marine mammal science across species, regions, and research themes. To build this resource, we combined evidence from three complementary approaches: (1) a systematic mapping of the peer-reviewed and grey literature; (2) contributions gathered during a dedicated workshop held at the 2025 European Cetacean Society conference; and (3) responses to an international public call for submissions. Examples span a wide range of activities, including long-term monitoring, strandings response, acoustic data collection, photo-ID catalogues and behavioural observations. The resulting dataset forms the basis of both a research paper and the interactive atlas. Together, these outputs highlight global patterns, identify gaps and opportunities, and showcase the many pathways through which communities contribute to marine mammal science. Beyond serving as a reference tool, the atlas aims to inspire new collaborations, support project development, and strengthen networks between researchers and the communities they work with. This talk will introduce the atlas, outline the methods used to develop it, and demonstrate its features, including filtering, project summaries, and links to further information. By making these efforts visible, we hope to promote more inclusive, cost-effective participatory approaches in marine mammal research and to celebrate the vital contributions of citizen and community scientists worldwide. The work was conducted under the BLUE CONNECT project, funded by the European Union under the Horizon Ocean Mission (HORIZON-MISS-2023OCEAN-01).

New and rare species in Icelandic waters as derived from stranding records

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Since the late twentieth century, the Marine and Freshwater Research Institute (MFRI) has kept records of all reported whale strandings along the Icelandic coast and created a database with over 1200 animals. Long-term stranding databases have gained increased attention because they offer critical insight into ecosystem status at a time when global warming is reshaping the marine environment affecting many cetacean species and evaluates patterns linked to changes in ocean temperature. The database includes some first-time records of species never reported before in Icelandic waters. Cetacean strandings and the presence of temperate water species around the country have drawn increased interest and this study highlights the value of consistent stranding records and sampling. The records provide the only information on biology and ecology for many cetacean species and long-term view of population health and distribution. Iceland sits at the northern edge of the mid latitudes and the gateway to the Arctic. These data support ongoing and future monitoring efforts to better understand the temporal and spatial patterns of cetaceans in fragile high latitude waters.

First examination of trends in the occurrence and distribution of humpback whales in UK and Irish waters using sightings and Local Ecological Knowledge

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In this study, we collated available sightings data and compared this to surveys designed to capture Local Ecological Knowledge (LEK) from experienced sea users. Available sightings data were collated from Instagram, Facebook, X (formerly Twitter), Google searches, and curated databases such as Happy Whale, with all records standardised, manually reviewed, and cross-referenced to remove duplicate reports. A survey was then distributed to marine stakeholder networks, identified through systematic online searches, to gather information on perceived temporal and spatial patterns in humpback whale occurrence and behaviour. Sightings data and LEK showed strong alignment, demonstrating the reliability of LEK as a complement for traditional cetacean monitoring. Our data show that humpback whale presence in UK and Irish waters has increased significantly over the past 25 years, though with non-linear fluctuations, regional variation and with some regions (Southwest Ireland) showing recent declines. The waters surrounding the UK and Ireland support diverse cetacean populations, including the humpback whale (*Megaptera novaeangliae*). Although once rare, humpback whales are now reported with increasing frequency in UK and Irish waters, primarily through NGO-maintained sighting databases. These records, while valuable, remain opportunistic and fragmented, and no comprehensive nationwide analysis has previously addressed occurrence trends. This study provides the first comprehensive examination of humpback whale occurrence trends in UK waters, and in doing so, provides essential information for conservation planning. Furthermore, our data contributes to international efforts to monitor recovering humpback whale populations following historical exploitation and provides a methodological framework to integrate LEK with sightings data that can be applied in other regions and for other marine species.

Assessing vessel traffic exposure in relation to the home range of short-finned pilot whales around Madeira Island

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Growing global vessel activity is increasingly recognised as a major disturbance source for cetaceans, yet the (real, not estimated) frequency and spatial extent of human and whale overlap remain poorly studied in most regions. To address this issue, we combined i) satellite tracking data from 12 short-finned pilot whales (*Globicephala macrorhynchus*) (tagged between 2018 and 2024) exhibiting resident behaviour, and ii) AIS vessel data from 2019 to 2022 covering the same area resident area, to quantify the spatial co-occurrence between maritime traffic and whale home ranges along the south coast of Madeira Island. The population home range, estimated using hierarchical autocorrelated kernel density methods, revealed a constrained 95% utilisation area of 1,450 km² and a core area (50% UD) of 190 km² located roughly 10 km offshore. The AIS data were prepared in accordance with standard procedures, and vessel density was mapped using a 500 × 500 m grid. Speeds, distances, and time spent in the home range area were estimated for each vessel category. The average overall speed in the area was 3.85 knots (SD = 5.21), ranging from 2 knots (fishing vessel) to 58 knots (speedboat). The main type of vessel using the area was sailing boats, followed by cargo and tankers. Across the study area and four years of AIS data, the vessels accumulated more than 69,500 hours of presence and travelled over 453,000 km. This period partially coincided with COVID-19-related restrictions, which likely reduced vessel activity and consequently underestimated the actual vessel intensity. Despite potential biases, this work emphasizes the importance of integrating AIS tracking data with animal movement data to examine fine-scale anthropogenic pressures on marine wildlife. These findings provide a reproducible framework for identifying risk zones and can directly inform mitigation measures such as speed reductions or temporal routing adjustments.

Harbour porpoise click detection probability depends on behaviour and detection-classification method

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The visually-elusive harbour porpoise (*Phocoena phocoena*) continuously produces stereotypical narrow-band high-frequency echolocation clicks for foraging, navigation, and communication, which can be detected using passive acoustic monitoring (PAM) detectors. To estimate animal density, it is essential to know the probability of detecting clicks, which is affected by behaviour, environment and detection-classification methods. Detecting porpoises with automated click detectors involves algorithms to identify sequences of consecutive clicks ('click trains'). These detections are often summarised into different units for analysis and inference, e.g., individual click counts or time units containing at least one click (e.g. click positive minutes'). Although these methods are commonly used in decision-making contexts by regulators, potential biases in this workflow are poorly understood. We explored how porpoise behaviour, click train classifiers and downstream detection units affect detectability using 201 hours of fine-scale acoustic and movement data from tag deployments on 9 harbour porpoises in Danish waters. We simulated a grid of PAM sensors and the received clicks that would have been detected on each sensor for each tagged porpoise track, accounting for porpoise position, orientation, sound propagation and beam pattern. Simulated detections were processed through click train classifiers and converted into different detection units to establish how detection-classification affects differences in detectability of different behaviours. Foraging behavioural states were two to three times more detectable than non-feeding states when using summary detection units such as click positive minutes, due to higher click rates and movement activity. This was exacerbated by click-train classification in positive minutes. Behavioural bias may cause significant over- or under-estimation of animal presence and disturbance in PAM studies using these detection-classification methods. This could lead to false conclusions being drawn, with significant

conservation consequences. We demonstrate critical gaps in detection-classification robustness and behavioural inference from PAM data and suggest how to address these challenges.

Bottlenose dolphins show clear geographic variation in whistles when controlling for repeated, stereotypical signals

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Geographic variation in animal signalling has been described in many taxa, including insects, anurans, birds and mammals. Delphinids exhibit large acoustic repertoires, but the presence and extent of their geographic variation remain largely unknown. We analysed geographic variation in whistles of the bottlenose dolphin *Tursiops truncatus*, utilising 46 time-frequency measurements from 980 whistles across 5 sites within the Atlantic and Pacific Oceans. Bottlenose dolphins are known to produce individually specific signature whistles which are highly stereotyped. Here, we propose a novel methodology for the study of vocal variation in bottlenose dolphins; controlling for the presence of signature whistles by excluding whistle type repetitions to avoid potential bias towards inter-individual, as opposed to inter-site, differences. We employed Random Forest classification modelling to establish a) whether whistles are reliably classifiable to site of origin; b) whether inter-site variation exceeds intra-site variation; and c) whether this variation is present between two adjacent populations with some overlap in ranges. This inter vs. intra-site comparison is a vital requirement to delineate geographic, from individual, variation. Whistles were accurately classified to site of origin (74.7% ± 0.05 [1 SD], k = 0.68). Our intra-site model performed poorly (28.0% ± 3.68, k = 0.16), indicating that inter-site differences outweighed intra-site differences. Our final model accurately classified whistles to the adjacent Eastern and Western Scottish coasts (81.3% ± 6.52, k = 0.63). These results inform ongoing development of odontocete species classifiers, and vocal differences observed between adjacent populations in this study may indicate social delineations or Evolutionarily Significant Units (ESUs) that would require specialised consideration during the designation of management units and Special Areas of Conservation (SACs).

Harmonising offshore wind and marine conservation: Lessons from indicator species and international noise regulations.

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This abstract discusses the challenges faced in emerging offshore wind markets with transient marine mammal species and variable developments of noise regulations and our recommended steps to overcome these challenges. The rapid expansion of offshore wind farms (OWFs) has raised concerns about cumulative impacts on marine mammals, particularly from piling, vessel traffic, and operational noise. While many countries adopt similar guidelines, variations in mitigation measures create regulatory inconsistencies. Moreover, species in new OWF areas remain understudied regarding their responses to underwater noise. This research explores whether indicator species can help standardise impact assessments across jurisdictions, addressing challenges posed by transboundary populations and the need for harmonised conservation policies. Using a comparative approach, the study examines key species such as harbour porpoises (*Phocoena phocoena*) and minke whales (*Balaenoptera acutorostrata*) as potential indicators of noise impacts. Case studies, including a piling project in South Korea, highlight cross-species comparisons and regulatory differences. Noise mitigation strategies, such as Germany's strict piling noise limits, are reviewed to evaluate best practices for international policy alignment. Preliminary findings suggest species with similar hearing sensitivities show comparable responses to underwater noise, supporting the use of indicator species in data-limited regions. Examples include comparisons between finless and harbour porpoises, as well as Indo-Pacific and common bottlenose dolphins. Transboundary populations, such as the North Sea harbour porpoise management unit, further emphasise the need for coordinated international conservation measures. Overall, standardised data collection, indicator species, and best-practice mitigation strategies are essential to balance renewable energy growth with marine mammal protection, particularly in emerging OWF markets with overlapping populations and diverse regulatory frameworks.

Applying fine-scale quantitative analysis to bowhead whale (*Balaena mysticetus*) song.

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Since being first recognised almost 150 years ago, bowhead whale (*Balaena mysticetus*) song has been documented as a remarkably diverse form of communication. Whilst songs in other taxa play fundamental roles in sexual selection and social organisation, the function of bowhead whale song remains poorly understood, in part due to a lack of studies that quantifiably explore variation in the behaviour. To address this, we applied a quantitative framework to identify possible fine-scale changes in bowhead whale song. We used passive acoustic data collected in the southern Chukchi Sea across three years (2011, 2014, and 2020) to firstly explore acoustic variation in 7342 individual song units through principal component analysis, before applying similarity metrics (Levenshtein distance and Dice's similarity) to identify temporal variation in the unit sequences of 250 song cycles. Our analyses revealed that songs clustered by year to form distinct song types, each of which contained a unique repertoire of units. While all song types underwent modification – whether through the addition and removal of unit types or changes in unit sequences – the rate and extent of change differed between years. Notably, songs from 2011 and 2014 showed more structural variation over several hours than 2020 songs did over several weeks. These changes were unevenly distributed across song components, with some unit types persisting for several weeks whilst others were only recorded on one day. Overall, these findings reveal that bowhead whales use a combination of persistent and variable features in songs, suggesting that multiple, possibly interacting, selective pressures may shape song structure. Furthermore, this study introduces a reproducible approach to the analysis of this variable behaviour – one of which is essential for understanding the function and evolution of bowhead whale songs.

The minke whales that keep coming back: Europe's longest sightings histories demonstrate the importance of Scottish waters

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Scottish waters provide important seasonal feeding habitat for minke whales (*Balaenoptera acutorostrata*). On the west coast of Scotland, the Sea of the Hebrides Marine Protected Area (MPA) for minke whales was designated in 2020; however, management measures are still to be developed, despite the species facing multiple threats including entanglement, underwater noise from offshore developments and changing prey distributions. This study examines site fidelity and spatial use within the MPA and adjacent waters to assess whether long-term use of specific areas warrants targeted protection. The Hebridean Whale and Dolphin Trust (HWDT) maintains photo-identification catalogues for cetaceans on the west coast of Scotland dating back to 1990. Observations come from HWDT's dedicated research surveys and long-standing community sightings network, Whale Track. Between 1990 and 2020, 308 minke whales were identified during 645 encounters. A quarter of individuals (25%, n=76) were resighted, and 42 demonstrated long-term site fidelity with sightings spanning five or more years. Across all individuals demonstrating long-term site fidelity, 72.5% of sightings occurred within the Sea of the Hebrides MPA boundary. One individual, FM02 ('Snowy'), was recorded over a 27-year period (1994-2020), representing the longest documented sighting history for a minke whale in Europe. Another individual, FD27 ('Knobble'), was recorded 62 times in 16 different years (2002-2020). All confirmed sightings of Knobble were within a core area approximately 300 km² inside the MPA. Sightings occurred between May and October, with 84% recorded between June and August. These long-term, repeated visits demonstrate the importance of specific areas on Scotland's west coast for minke whales and highlight persistent and significant habitat for some individuals both within and outwith the MPA. These findings will help inform the development of effective, targeted management measures for minke whales in Scotland.

ECS 2026
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Characterisation of cooperative feeding dynamics and a novel acoustic indicator of prey capture in herring-eating killer whales

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Group hunting is a widespread phenomenon, fundamentally shaping predator social dynamics and trophic interactions with their prey. The foraging behaviour of killer whale (*Orcinus orca*) groups feeding upon herring has been described as cooperative. However, details of feeding rates and the nature of their cooperative interactions have not been evaluated. Our study examined concurrent animal-borne audio and video data to characterise the behaviour of herring-eating killer whales (n = 8) within the Vestmannaeyjar archipelago (Southern Iceland) during summers 2022-2024. From video observations, whales within a foraging group appeared to stop herding herring schools following a tail-slap, feeding close to one another on spatially concentrated stunned herring. To overcome the video logger's limited field-of-view, an acoustic indicator of prey consumption, "slurping" — found to be emitted during 26 % of video-confirmed consumption events — was used. Single "slurps" were video-confirmed to correspond to single herring consumption events. Tallying all slurp sounds following a tail-slap, and applying the 26 % proportion, yielded a mean (±s.d.) estimate of 29.7 ± 25.3 herring consumed per tail-slap by the foraging group. By-product mutualism was identified, as whales consumed herring regardless of whether or not they conducted the tail-slap. Role specialization was indicated, with three tagged whales repeatedly occupying the "tail-slapping" role more than expected by chance ($p < 0.05$), and 5 tagged whales not producing any tail-slaps, over the duration of video recording periods. Only 8 % of visually-observed prey consumption events occurred in the absence of tail-slaps, indicating that tail-slap feeding drives most feeding. Our study confirms the highly social and cooperative nature of tail-slap feeding by killer whale groups, and provides a novel method to estimate group-level feeding rates. Fieldwork activities were carried out under an Icelandic Marine and Freshwater Institute permit and approved by the University of St Andrews' Animal Welfare Ethics Committee.

From colony growth to regional significance: Long-term daily monitoring (2016–2025) of grey seals on the Helgoland Dune, German North Sea

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Long-term, high-resolution monitoring is fundamental for understanding population dynamics and informing conservation of recovering marine mammals. Following severe declines from hunting and habitat loss, grey seals (*Halichoerus grypus*) have recolonised the southeastern North Sea since gaining legal protection in the late 20th century. While established regional surveys provide essential seasonal point estimates of breeding and moulting numbers, they lack the temporal and demographic resolution needed to capture fine-scale peak dynamics and year-round haul-out patterns of this recovering pinniped population. To address these gaps, nearly a decade of daily land-based counts (2016–2025) from the Helgoland Dune, Germany's largest of two grey seal colonies, were analysed to quantify trends in colony size, demographic composition, and seasonal phenology. Analyses focused on age- and sex-specific abundance during the reproductive (November–January) and moulting (February–May) seasons, as well as haul-out activity outside these periods (June–October). Seasonal maxima were additionally compared with annual Wadden Sea surveys for regional context. Results revealed pronounced seasonal haul-out patterns. During the reproductive season, maximum colony counts increased by roughly 13% per year, driven by rising births and increasing female numbers, while male counts remained comparatively stable. The timing of pupping and haul-out peaks showed no directional shifts, indicating stable phenology despite substantial growth. During the moulting season, both female and male maxima increased by around 10–11% annually, reflecting a broad expansion of the seasonal haul-out assemblage. Outside these key biological periods, numbers declined, suggesting increasing seasonal concentration of site use. The Helgoland Dune's contribution to Wadden Sea pup production rose from roughly 23% to 32%, underscoring its growing importance within the regional metapopulation. These findings demonstrate the value of sustained fine-scale monitoring for detecting demographic change and highlight Helgoland's pivotal role in the ongoing recovery of grey seals in the southeastern North Sea.

Skeletal ossification scoring in pectoral flipper radiographs refines age determination of harbour porpoises (*Phocoena phocoena*)

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Harbour porpoises (*Phocoena phocoena*) exhibit limited external signs of ageing, though accurate age estimation is essential for understanding life history aspects and assessing population viability. Different ageing methods exist, such as measuring standard total body length (TL) and counting growth layer groups (GLGs) in teeth. However, they vary in reliability, and precision declines with age as teeth wear, pulp cavities retract, and individuals reach asymptotic length. Here, we aim to refine age determination using non-invasive radiographic assessment of pectoral flippers to assess bone maturation to improve the accuracy of age estimation. Our current data set (n=148) includes radiographs of harbour porpoises under human care (n=37), and post-mortem samples of wild individuals (n=111). Radiographs of porpoises with known minimal chronological ages (n=12/148), either under human care or through long-term photo-identification, were used for validation. This study builds upon previous efforts showing that bone maturation in harbour porpoises occurs along the proximodistal axis and can be used for age classification. Following a recent ageing

study for bottlenose dolphins (*Tursiops truncatus*), skeletal ossification scores from -1 to 8 were assigned to different pectoral flipper bones. We found no difference in scoring flippers between left and right or ventral-dorsal (VD) and dorsal-ventral (DV) and defined left DV as the standard projection because of its usability in live animals. Five carpal bones were present in most animals, though ulnar and capitatum carpals, together with metacarpal I, were not yet ossified in the youngest individuals. Preliminary results showed a strong correlation (Spearman correlation test, $r=0.81$, $p<0.05$) between the skeletal ossification score and animals with known age. Future steps will use the sum of ossification scores to develop a formula to estimate age and will explore multi-proxy modelling, incorporating TL, GLG counts, skeletal ossification scores, girth behind the dorsal fin, and methylation levels.

From land to sky: Switching field methods to adapt to a shift in harbour seal haul-out behaviour

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Loch Fleet, Scotland, is the location of an individual-based study of harbour seals (*Phoca vitulina*) which completed 20 years of data collection in 2025. Individual recognition has been based upon photo-identification of pelage. For the first 16 years of the study, images were collected using non-invasive land-based techniques, enabling us to follow the survival and reproduction of this long-lived marine mammal. However, a growing population, together with changes in haul-out distribution within Loch Fleet, meant that re-capture rates were decreasing as fewer seals could be routinely photographed from land. To overcome this limitation, new approaches were therefore explored from the sky. By exploiting the rapid development of Unoccupied Aerial Vehicle (UAV) technology and imagery, we were able to successfully link earlier land-based images of facial pelage with UAV images of whole-body pelage patterns. Since 2022, multiple UAV flights have been conducted during each breeding season, providing accurate counts and the collection of high-quality photo-ID imagery. This has allowed us to continue following ~230 individuals, some of which have been sighted annually since the project began in 2006. This shift in perspective, from land to aerial imaging, highlights the adaptability required in long-term ecological studies. Despite challenges that came with switching perspective of seal observations, we have shown that using UAVs is an efficient and valuable tool to continue monitoring population abundance and vital rates when supporting management and conservation efforts. Image acquisition of seals from above has also opened avenues for answering further research questions, concerning variability in pregnancy rates, population size structure, body condition and pup growth.

A citizen science approach to studying the demographics and injury patterns of spinner dolphins in the Egyptian Red Sea

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The objective of this study was to assess the demographics and injury patterns of spinner dolphins (*Stenella longirostris*) in the Egyptian Red Sea using a citizen science approach that incorporates publicly contributed video footage. Data was collected using assorted GoPro cameras in Satayah, Egypt between May - September 2021. Dolphins were often filmed when passing by observers, resulting in a total of 476 videos. Data collection occurred over 6 days in May, 4 in June, 4 in July, 6 in August, and 7 in September. All footage was reviewed to identify sex and age class of dolphins, and visible injuries. Demographic analysis indicated that adult sex fluctuated, with more males present during the non-birthing season and more females observed during the birthing season suggesting sexual segregation. The natality rate was 12%. Social interactions were responsible for most injuries. 23% of males had marks from intraspecific interactions and 74% of females had breeding marks. The relatively high rates of shark predation injuries, 10%, suggests that dolphins are an important shark prey item in the Red Sea. Fishing and boat strike injury rates were relatively rare, likely due to dolphins occurring at offshore sites. Our results suggests that this spinner dolphin population has low population growth potential likely due to the Red Sea being an oligotrophic environment and therefore cannot sustain high levels of human related mortality. This study demonstrates that citizen science can provide valuable data and increase awareness of spinner dolphin populations. These findings highlight how citizen science can be used to monitor populations where traditional surveys are limited.

Growing tastes: ontogenetic shifts in prey composition of common dolphins (*Delphinus delphis*)

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Diet composition of common dolphins (*Delphinus delphis*) is known to vary geographically and temporally. However, variations between maturity stages are generally oversimplified, by relying on non-sex-specific total body length (TBL) as proxy for maturity. To assess diet changes between sex and maturity, stomach content from 43 male and 28 female (N = 71) common dolphins, stranded along the southern and southwestern coast of the Iberian Peninsula between 2021 - 2025. These were analysed using the hard-part identification method. For maturity status, considering their physiological differences, females were divided into either immature (TBL < 177.6cm) and mature (TBL ≥ 177.6cm). Males were divided into immature (TBL < 184.0cm), pubescent (185.0cm ≤ TBL < 205.0cm), and mature (TBL ≥ 205.0cm). To examine whether diet differed among sex and maturity classes, we converted stomach contents into proportional datasets based on prey counts and biomass. We calculated Bray–Curtis dissimilarities and used PERMANOVA to test for differences in overall diet composition. Finally, we used SIMPER to identify which prey species contributed most to the differences among maturity stages. Diet composition was not influenced by sex and showed some degree of differentiation among maturity stages. Chub mackerel (*Scomber colias*) consistently increased in mature individuals in both count and biomass ($p < 0.05$), driving most of the observed separation. The sardine (*Sardina pilchardus*) contributed strongly to dissimilarities and showed slight tendencies to decrease as animals matured. Horse mackerel (*Trachurus* sp.) biomass consumption increased in mature female individuals ($p < 0.05$). Overall, diets became more diverse as animals matured, with greater contributions from demersal fish species. This pattern is consistent with ontogenetic dietary expansion. Sampling and analysis will continue, and further investigation within female maturity stages (e.g. pregnancy) will be performed. This work contributes to more accurate trophic assessments supporting ecosystem-based management of this key marine predator.

Education, outreach and citizen science in marine mammal conservation: engaging coastal communities for long-term marine awareness

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Marine ecosystems in the German North Sea are increasingly affected by multiple anthropogenic pressures, while successful conservation of the harbour porpoise (*Phocoena phocoena*), the harbor seal (*Phoca vitulina*) and the grey seal (*Halichoerus grypus*) depends on effective governance as well as societal understanding of marine ecological change. This study examines how citizen-science-based education can complement existing conservation efforts in and around the Wadden Sea National Park Schleswig-Holstein surrounding the island of Sylt, adjacent to the Whale Sanctuary, where particularly shifting distributions of harbour porpoises have raised concern for long-term population trends. The project combines community-based cetacean observations, public knowledge transfer activities to participants of harbour seal watching vessel trips and school outreach activities designed to improve marine ecological literacy and encourage awareness raising of the importance of protected areas. Volunteer participants record coastal cetacean sightings and engage in guided learning about marine mammals, anthropogenic stressors and regulatory frameworks. Changes in both the volunteer's and the participants' knowledge, attitudes and self-reported behavioural intentions are assessed through qualitative feedback. Preliminary findings indicate sustained community participation, increased understanding of marine mammal ecology, and strong enthusiasm for supporting conservation measures within the Wadden Sea National Park and in adjacent marine protected areas. Participants reported heightened awareness of human impacts and indicated intentions to adopt more environmentally responsible behaviour. These results suggest that citizen science and targeted educational outreach can play a transformative role in strengthening the societal foundations of marine conservation. By linking experiential learning with local monitoring, this study highlights how public engagement can complement formal management processes and contribute to long-term behaviour change and enhanced marine environmental awareness, in line with the broader shift towards participatory and adaptive conservation governance.

Using acoustic data to identify seasonal and diel trends of harbour porpoise (*Phocoena phocoena*) in West Sussex, UK

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Using data obtained from Chelonia's Full-Waveform Capture Porpoise Detector (FPOD) devices, the aim of this study was to identify seasonal and diel trends in harbour porpoise (*Phocoena phocoena*) activity, while considering lunar cycle effects on the species presence along West Sussex, UK. Acoustic data covering the period of 2022 was analysed from three devices deployed across West Sussex. Over 269 days of recording, 32 days of detection positive minutes (DPM) confirmed harbour porpoise presence. The results attribute no significance to month, season or the lunar cycle on determining harbour porpoise presence. However, during winter, data was only recorded for a total of thirty-seven days and no DPMs for the species were observed during this time. It was observed that there were more DPMs recorded during the night phase then during the morning, day and evening phases. Acoustic devices deployed within the study area have identified harbour porpoise presence previously unrecorded through visual monitoring. Prior to this, visual records only attributed harbour porpoise presence to East Sussex. This study therefore supports the need for both acoustic and visual monitoring methods to fill significant gaps in evidence for harbour porpoise activity in Sussex.

Monitoring harbour porpoises: Comparing C- and F-PODs over a two year period in the Danish North Sea

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The harbour porpoise (*Phocoena Phocoena* L., 1758) is the most common cetacean in the continental shelf waters of north-western Europe. To monitor harbour porpoise distribution and abundance, Passive Acoustic Monitoring (PAM) based on CPODs has become an integral part of monitoring programs for more than a decade. However, the phasing out of CPODs following the development of the FPOD represents an important methodological change in data collection. Therefore, this study compares the detection rates of harbour porpoises using both CPODs and FPODs over a period of two years. Being equipped with a pair of a CPOD and an FPOD, nine stations were deployed in the Danish North Sea over two years between April 2023 and April 2025. Data from both devices are highly correlated and F-PODs generally recorded higher detection rates than C-PODs when analysing the same quality classes (“high” and “mod”). However, when looking at the details, differences between the two instruments could be identified, which should be taken into account, especially for long-term data series. The differences in detection rates were assumed to depend on (1) the temporal scale of data analysis (differences increase and become significant as the temporal scale of analyses increases), (2) the sample size (some of the differences between the two devices were less obvious after only one year of data collection, highlighting the need for a large sample size and thus further data collection) and (3) the study area (including habitat use of porpoises in the area and background noise levels). As a transition from CPODs to FPODs is imminent in the future, it is important to understand the differences in the detection rates und to proof theoretical assumption by comparing field data.

The first large-scale pre-construction baseline for cetacean presence and activity in a Dutch offshore wind farm development area

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In the southern North Sea, the rapid expansion of offshore wind development underscores the need to understand potential impacts on small cetaceans, particularly the harbour porpoise (*Phocoena phocoena*), the region's most abundant cetacean species. Although knowledge of harbour porpoises has increased in recent years, it remains largely derived from aerial surveys and strandings. In the Netherlands, continuous passive acoustic data have been collected within several offshore projects and wind farms, but such data have not previously been gathered prior to wind farm construction. As measurements only commenced during construction phases, key knowledge gaps remain regarding the effects of offshore wind farms on cetacean occurrence. Therefore, this study presents the first large-scale, pre-construction passive acoustic baseline for small cetaceans (harbour porpoises and dolphins) in a Dutch offshore wind development area. As part of the Ecowende wind farm ecological monitoring programme, a large-scale seabed sensor network was deployed in August 2024 to establish comprehensive baseline conditions one year prior to construction. Fourteen monitoring platforms, positioned inside and outside the future wind farm area, are equipped with F-POD echolocation click detectors continuously recording cetacean presence for 7 years in total. Here, we present the first year of baseline acoustic data (August 2024–August 2025), providing detailed insights into spatial and temporal patterns of cetacean occurrence. Detection-positive minutes (DPM), diel patterns, and seasonal trends are analysed to characterise habitat use in the area. At selected sites, the acoustic network is co-located with broadband hydrophones, echosounders, fish telemetry receivers, and oceanographic sensors, allowing for integrated ecological and environmental analyses. These baseline data provide an essential reference for future impact assessments and for evaluating the effectiveness of mitigation measures during wind farm construction and operation.

A geomorphon-based approach to automated polynya detection with applications for marine mammal ecology

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Polynyas, persistent areas of open water within sea ice, are vital for polar marine ecosystems, enabling heat exchange, nutrient cycling, and biological productivity. They also provide essential breathing and foraging habitats for marine mammals such as seals and whales, particularly during periods of extensive ice cover. Yet, current remote detection methods based on sea ice concentration thresholds often fail to capture the complex and variable morphology of these features, especially smaller coastal polynyas that may be ecologically significant. This study applies a geomorphon pattern recognition algorithm, originally developed for landform classification, to automate polynya detection from sea ice concentration data. Focusing on the Weddell and Amundsen Seas, the method was tested across over 200 parameter combinations and compared with traditional threshold-based approaches. By identifying morphological patterns analogous to depressions and valleys in the ice, the geomorphon method effectively maps both large-scale open water and fine-scale coastal polynyas. Its automated, scalable design enables rapid time-series analysis, up to two orders of magnitude faster than conventional techniques, providing new opportunities to link environmental variability with animal tracking data. This framework provides a powerful new tool for exploring how marine mammals use and respond to dynamic polynya habitats, supporting future studies of habitat availability, foraging behaviour, and ecosystem change in polar regions.

Baby on board: looking for differences in temperature and timing between baleen whale calves and adults in the Azores.

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Multiple baleen whale species yearly migrate through the Azores archipelago, which serves as a stopover and transit area between breeding and feeding grounds. Out of the seven mysticeti species registered in the Azores, six have been sighted with calves in the region. Despite increased understanding of their migratory patterns, mother-calf pairs and their strategies outside breeding grounds have been largely overlooked, especially in offshore areas. This study aims to compare the difference in timing and Sea Surface Temperature (SST) between sightings with and without calves of blue (*Balaenoptera musculus* - Bm), sei (*Balaenoptera borealis* - Bb), and fin (*Balaenoptera physalus* - Bp) whales in the Azores archipelago, using whale-watching data collected from 2008 to 2025. The percentage of sightings with calves registered per species was 4.3%, 8.3%, and 4% respectively. A Generalized Linear Mixed Model (GLMM) tested whether SST or Day of Year (DOY) influenced the presence of groups with calves compared to only adults, accounting for inter-annual variability. The models revealed significant differences in SST and DOY for sightings with calves in Bm, whereas Bb and Bp did not exhibit differences in either parameter. Estimated Marginal Means (EMMs) for blue whales with calves highlighted a stronger preference for warmer SST, increasing the level of response from 2.9% at 16.3ºC to 6.7% at 18.8ºC ($p < 0.01$); and a later DOY from 3.1% at 96 DOY to 6.2% at 154 DOY ($p < 0.05$). This study highlights the annual presence of threatened baleen whale calves in the Azores, providing the first insights into their life stage preferences. Endangered blue whale calves may become more vulnerable than adults to environmental variables like SST, and may not adapt as easily to drastic environmental changes. Within this context, studying calves through whale-watching becomes a highly valuable tool for long-term cetacean monitoring.

Pathological evidence of *Morbillivirus* infection with fatal coinfections in a striped dolphin stranded in southern Spain: implications for emerging or recrudescent CeMV lineages.

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Strandings of cetaceans in Andalusia are routinely investigated through systematic pathological examination within a long-standing collaboration under the frame of SESACET project, where Seashore Environmental Association performs necropsies and the Institute for Animal Health and Food Safety (IUSA), a WOAH Collaborating Centre for Marine Mammal Health, conducts histopathology. On 21 July 2024, an adult female striped dolphin (*Stenella coeruleoalba*) stranded alive on the coast of Estepona (Málaga, Spain) and died shortly afterwards. Necropsy revealed a multisystemic parasitic burden, including hepatic trematodes, gastric granulomas consistent with *Pholeter* spp., and pulmonary nematodes, while the predominant gross finding consisted of multifocal cerebral necrosis and haemorrhages. Microscopically, a severe pyogranulomatous meningoencephalitis with fibrinoid vascular necrosis and extensive hemorrhages was observed, associated with fungal hyphae, coccoid bacteria, and syncytial cells. Profound centrofollicular necrosis, widespread lymphoid depletion, and abundant syncytia indicated marked immunosuppression, a condition that may be caused or exacerbated by acute morbillivirus infection and that predisposes to secondary infections. Broncho-interstitial pneumonia with syncytial formation and multifocal epithelial hyperplasia and necrosis affecting diverse epithelial tissues further supported an etiological diagnosis of acute systemic morbillivirus infection. Additional lesions included poxvirus-compatible changes in the skin and muscular degenerative–necrotic alterations consistent with active stranding stress. Although histopathology strongly suggests morbilliviral involvement, molecular and immunohistochemical analyses, essential for identifying the etiologic agents and determining the CeMV strain involved, are currently underway. Establishing whether this case represents the emergence of a novel strain or the recrudescence of a lineage circulating in the Mediterranean for decades, potentially facilitated by declining herd immunity, is critical for understanding regional disease dynamics. The exceptional severity and multiplicity of co-infections, rarely documented in striped dolphins since the first Mediterranean epizootic in the early 1990s, underscore the

need to complement morphological diagnostics with targeted virological and microbiological approaches to elucidate multifactorial disease processes in stranded cetaceans.

Deep divers in a shallow sea: Rising beaked whale strandings in the southern North Sea

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Beaked whales (Ziphiidae) typically inhabit deep waters in temperate to tropical regions, and only a few species extend into higher latitudes. The shallow, sandy-bottom dominated southern North Sea is unsuitable for these deep-diving specialists, yet sightings in the Netherlands have increased. Since 1990, 27 individuals have been recorded (1990-1999 n=5; 2000-2009 n=3; 2010-2019 n=7; 2020-2025 n=12); 85% from June-October. These were *Mesoplodon bidens* (n=20; ten females, five males, five unknown; 13 juveniles, 4 adults, 3 unknown), *Hyperoodon ampullatus* (n=5; four females, one unknown; all adults), one *M. densirostris* (adult female), and one unidentified Mesoplodon. Six were refloated after (near)stranding, eleven were found dead, and ten live stranded and died. In the last decade, twelve *M. bidens* and two *H. ampullatus* were investigated post-mortem, including analyses for diet and debris (n=9), and inner ears (for cases accessed <18 hours, n=9). Most *M. bidens* died due to live stranding (8/12), common findings include myofiber degeneration, pulmonary oedema and haemorrhage, and sand in oesophagus and lungs. Starvation was probably related to strandings; 11/12 had largely empty gastrointestinal tracts; only one contained a larger amount of worn otoliths (mainly Gadiformes; reconstructed mass 1.6 kg). Additional pathologies included dermatitis (n=5), (meningo)encephalitis (n=3), parasitic gastritis (n=2), vertebral osteolytic lesions (n=1) and gas bubble disease (n=1). Inner ear analyses of the latter, and four other cases, revealed no evidence of hearing loss (results for two 2025 cases pending). Marine debris was detected in one, unrelated to death. Two H. ampullatus spent weeks in tidal bays before dying from ship strikes. Their stomachs contained squid beaks (Gonatus) and debris (ropes), unrelated to mortality. Once beaked whales enter the southern North Sea, they appear highly vulnerable to starvation and ship collisions. The reasons for their presence remain unclear, emphasizing the need for wide-scale assessments of stranding patterns and threats.

From Arctic waters to coastal towns: negotiating trade-offs between industry and wellbeing in 19th-century UK whaling

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The whaling industry shaped UK coastal communities in profound ways, yet its socio-cultural impacts remain largely overlooked. This study addresses that gap by examining how onshore infrastructures associated with whale processing affected everyday life in Hull, Dundee, and Orkney, drawing on archival sources to analyse the trade-offs between industrial prosperity and community wellbeing. Focusing on findings from the first phase of the TRANSECTS project, which explores three marine energy transitions (whaling, oil and gas, and renewables), we present a qualitative, multi-site case study based on historical document analysis spanning c. 1810–1910. Our corpus of archival sources, drawn from local archives and key national collections, includes court records, medical reports, personal correspondence, parliamentary papers, and newspapers, reflecting a balance between institutional records and personal perspectives. Thematic analysis reveals how whale blubber boiling brought an industry largely conducted offshore in the Arctic waters into everyday community life in the UK. This process produced both benefits for local industries and significant challenges, such as sensory nuisances, public health concerns, community conflict, and governance responses that persisted for decades. Archival accounts describe how the pervasive smell affected everyday mobility, prompting residents to petition local authorities for relief. These governance responses, ranging from local ordinances to national debates, illustrate how communities sought to balance industrial prosperity with public health. By comparing three case study sites, our analysis highlights commonalities and local specificities in how communities negotiated these trade-offs, offering insights into the diversity of experiences across UK coastal communities. The historical lens presented here resonates with contemporary discussions of marine energy transitions, in which communities continue to weigh industrial benefits against socio-cultural and environmental costs. These insights offer new perspectives on the lived experience of UK whaling and deepen understanding of how societies manage the benefits and disbenefits of marine resource extraction over time.

Diurnal patterns in occurrence and co-occurrence of delphinid whistles and echolocation clicks at Rame Head, Cornwall

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Sound production and reception are important tools for delphinids across a range of behaviours. Cornwall, UK, is well-known for its delphinid population, hence its designation as part of the Western Channel Important Marine Mammal Areas (IMMA). Despite this, it is threatened by intense human activity in the surrounding English Channel; one of the busiest stretches of ocean in the world. Knowledge of delphinids in this region is extremely limited, and there is little information about baseline vocalisation patterns. Whistle recordings and click detections from hydrophones deployed at Rame Head, South Cornwall, were used to discern patterns in the occurrence (and co-occurrence) of whistles and clicks. This study showed that dolphins vocalised more, and there was greater vocalisation co-occurrence, overnight. At night, whistles were significantly longer and at lower frequencies than during the day. The most common call type was downsweeps; with other whistle parameter characteristics, this suggests the recorded species was the common dolphin (*Delphinus delphis*). Hour of day was significantly related to whistle occurrence, click occurrence, and co-occurrence of both vocalisation types. 13% of days surveyed had clicks detections without whistles, mostly between 22:59 and 04:59. This study provides an insight into diurnal vocalisation patterns of dolphins in the English Channel, and identifies times when dolphin foraging and intense human activity potentially overlap, recognising opportunities for management in the IMMA.

ECS 2026
BASICS TO BENEFITS
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A synthetic review and dose-detection framework for individual-based, mechanistic understanding of wildlife disturbance

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Understanding the drivers and consequences of responses of individuals to anthropogenic activities is important for preventing population-level impacts of human disturbance on wildlife. However, considerable uncertainty remains in models attempting to predict behavioural and physiological responses and their fitness consequences. We address this by incorporating mechanistic knowledge of response drivers into individual-level effects models. We synthesize multi-disciplinary literature to identify both proximate (e.g., ecological, behavioural) and ultimate (evolutionary) drivers of response to derive a new modelling framework. The “Functional dose-detection-response” (FDDR) framework consists of three key components: probability of detection, probability of response given detection, and potential effects. These components are mediated by the environment and individual status (including behavioural, cognitive, physiological) and incorporate both exogenous and endogenous drivers of sensory processing. We apply the framework to marine mammal responses to underwater noise as case studies, for which the first stage of the model, noise exposure and probability of detection, is relatively well-understood and quantifiable. Through mechanistic simulations, we show how assumptions about response drivers lead to differences in the probability, type, and fitness consequences of response. We also investigate the effect of gaining information about different response outcomes for individuals in different habitats. The results were sensitive to input parameters that drive detection and foraging need, highlighting data gaps for future research. We also identify knowledge gaps for improved understanding of physiological responses, individual health, and life history outcomes. The FDDR framework provides a suite of mediating factors and driving mechanisms that can be incorporated in the next generation of statistical models to capture variability in individual response in different contexts. We conclude by discussing how the FDDR framework can inform studies of the population consequences of disturbance and wider implications for conservation behaviour and conservation physiology.

Environmental features influence acoustic activity of harbour porpoise in the north-western part of the Black Sea

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The Black Sea harbour porpoise (*Phocoena phocoena* relicta) is an endemic subspecies distributed only in the Black Sea and adjacent waters. It is listed as Endangered by the IUCN and is threatened by noise, pollution, and high bycatch. Russia's war against Ukraine has made the Black Sea unsafe. The Ukrainian waters of the north-western part of the Black Sea (NWBS) are currently unavailable for monitoring and research, whilst naval activities pose threats against cetaceans. While the impact of the war is difficult to assess, our knowledge of the influence of environmental factors on the porpoise is poor due to its cryptic behaviour and lack of long-term seasonal observations. Passive acoustic monitoring was used to explore the effects of a range of environmental covariates on harbour porpoise acoustic activity in the NWBS. The data (1,448 logdays) were collected from five F-POD stations along the Ukrainian coast of the NWBS within the international BlackCeTrends project during all the seasons of 2020-2022 and analysed using the General Additive Models (GAM). The main covariates influencing harbour porpoise acoustic activity in the NWBS during 2020-2022 were month and temperature which explained >23% of its variation. Also, several other covariates: dolphin presence, hour, seabed type, phase of the moon, and distance to the 20 m depth contour were found to improve model performance. Temperature and seabed substrate type could be connected with preferences of the key prey species in porpoise diet. Therefore, our work supported the heterogeneity in porpoise responses to the environment with prey being the key driver for that. An especially important area for the porpoises was found near the Dzharylhach Island and Kinburn Spit. Thus, understanding the habitat use of harbour porpoises in the Black Sea provides insights for conservation measures for this endangered population.

Evaluating acoustic deterrents devices in fixed gillnets, trammel nets and drifting gillnets in NW Spain.

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The objective of this study was to evaluate the effectiveness of acoustic deterrent devices (pingers) in reducing interactions between cetaceans and small-scale fixed-net fisheries (fixed gillnets, trammel nets, and sardine drifting gillnets) operating in Galician and Cantabrian waters (NW Spain). The study aimed to assess whether the use of pingers could reduce cetacean presence around the gear and minimise depredation or potential bycatch events. Between 2023 and 2025, experimental trials were conducted as part of the MERMACIFRA and Life CIBBRiNA projects, covering representative fishing ports across ICES divisions 8c and 9a. A total of 9 vessels participated, completing 150 fishing days and 485 fishing sets, including 222 experimental sets with pingers and 267 control sets. Four pinger models were tested: Banana (Fishtek Marine), NetGuard (Future Oceans), Pinger v2.2 (Marexi), and DDD03H (STM Products). Trials included operational gillnetters, trammel net vessels, and one artisanal sardine drifting gillnet vessel. No cetacean bycatch was recorded during monitored fishing operations. However, cetacean presence was common, with more than 50 confirmed sightings, including common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*), harbour porpoises (*Phocoena phocoena*), and pilot whales (*Globicephala melas*). A total of 27 dolphin–gear interaction events were documented, all involving bottlenose dolphins near sardine drifting gillnets, causing net damage and depredation. No consistent reduction in dolphin presence or interaction frequency was observed between pinger-equipped and control sets across the trials. These findings suggest that the tested pingers did not produce a reliable deterrent effect in these small-scale gillnet fisheries, particularly in areas with resident bottlenose dolphin populations. Continued research should integrate acoustic validation, behavioural monitoring, and gear-specific adaptations to improve mitigation tools. Strengthening evidence-based measures is essential to reduce conflict between artisanal gillnet fisheries and coastal cetacean populations.

Sensory adaptation and acoustic plasticity in the Ganges river dolphin

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River dolphins such as *Platanista gangetica* (Ganges River dolphin) represent an ancient and highly specialized lineage of freshwater odontocetes that diverged from marine ancestors during the Miocene epoch. Their transition into shallow, turbid, and acoustically complex river environments drove major morphological and sensory adaptations, most notably a near-complete reliance on echolocation resulting from severely regressed vision. Fossil and anatomical evidence suggests that early odontocetes had already evolved advanced high-frequency biosonar systems, cranial asymmetry, and enlarged melons—traits that enable precise, directional sound production essential for navigation and prey detection in freshwater habitats. Although marine odontocetes have been widely studied, the biosonar ecology of freshwater cetaceans remains comparatively understudied. Understanding how river dolphins adjust their acoustic behaviour in response to environmental variation is especially critical as anthropogenic pressures intensify, with the potential to disrupt their primary sensory modality and affect long-term survival. Findings from this study demonstrate that Ganges River dolphins display pronounced acoustic plasticity. Dolphins produced higher-frequency, higher-amplitude clicks with shorter inter-click intervals (ICIs) in hydrodynamically complex regions such as confluences and braided channels, whereas lower frequencies and longer ICIs were characteristic of wider, open river stretches. This habitat-dependent modulation mirrors patterns observed in echolocating bats navigating cluttered vegetation, illustrating a compelling example of sensory convergence between aquatic and terrestrial biosonar specialist's echolocation. Overall, these results emphasize the importance of detailed acoustic research for informing conservation strategies. Understanding how behavioural, morphological, and environmental factors interact to shape biosonar use is vital for protecting river dolphins that persist in rapidly changing freshwater ecosystems.

From data collection to conservation: The strengths of large-scale collaborative passive acoustic monitoring

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Recent decades have seen a substantial increase in the collection of passive acoustic monitoring (PAM) data, driven by rapid technological advancements in recording systems, storage capabilities, and automatic detection and classification of signals. The expansion in PAM enables researchers to address biological questions on a larger scale than ever before, such as determining spatiotemporal patterns of abundance, movement patterns over entire habitats, and changes in acoustic behavior linked to environmental drivers. This potential breadth is especially important for species with ranges that exceed the scale of a single research project, such as most mammal marine species. Large-scale PAM studies rely on the compilation of PAM data across research teams, thereby increasing effort, coverage, and statistical power, allowing for the quantifying of uncertainties and robust inference. For example, decades of collaborative PAM research have come together to allow near-real-time monitoring of North Atlantic right whales (*Eubalaena glacialis*) in the United States, providing a much-needed conservation tool for the critically endangered species. Here, we advocate for more large-scale, collaborative PAM research to more effectively monitor marine mammal species over biologically relevant scales. As part of the EU Horizon project, Digital Twin Ocean, we present a use case in which PAM data from diverse contributors allows us to model harbor porpoise (*Phocoena phocoena*) movement, behavior, and potential disturbance from future offshore development across European waters.

Evaluating safeguards for cetaceans in the UK's marine protected areas

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In the UK, 11 MPAs have been designated with cetaceans as the primary qualifying feature (harbour porpoise, bottlenose dolphin, Risso's dolphin and minke whale). These MPAs aim to protect habitats that are critical for cetaceans' survival and to restore their populations; however, MPAs will only achieve their conservation aims if they are managed effectively. WDC assessed the effectiveness of the management across these 11 UK MPAs using the Marine Mammals Management Toolkit developed by Ocean Governance. The assessment reviewed how well key pressures and activities, including fishing, anthropogenic noise, public outreach, research, and monitoring, are being addressed. This process generated scores reflecting the overall 'management effectiveness' of these MPAs. The findings show that the UK's cetacean MPA network is not currently managed at a level that would enable it to meet essential population and ecosystem recovery targets for designated species. Anthropogenic noise emerged as the most poorly managed threat across all sites, with bycatch the second most poorly managed threat. This assessment highlights that the UK's cetacean MPA network is not being effectively managed, impacting its ability to meet crucial population and ecosystem recovery targets for cetaceans. This work has been key in engagement with decision makers to lobby for clear, actionable steps to strengthen the management of harmful activities within cetacean MPAs towards supporting the intended conservation outcomes. Given the mobility of cetaceans, effective conservation requires large, well-connected areas of critical habitat. Aligning UK MPA management with evidence from IMMAs would strengthen network coherence and support ecosystem-scale recovery.

Case study review: management of solitary sociable bottlenose dolphins in UK waters

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Solitary sociable dolphins are especially vulnerable to anthropogenic pressures as they become increasingly habituated to human presence. Their tendency to seek interaction can lead to injury or fatality and creates dynamic challenges for those responsible for their monitoring and protection. This presentation outlines management techniques and tools applied during several recent cases in the UK. Since 2017, four solitary sociable bottlenose dolphins (*Tursiops truncatus*) in south-west England have required active management and intervention. “Danny” (2017–2020) was monitored using a detailed sightings log compiled from direct reports and social media. These data supported tracking of movements, habitat use, behavioural progression, and incidents of disturbance or inappropriate human behaviour. The recorded information was integral to management planning, visible policing, targeted messaging, and broader public-awareness efforts. “Nick” was present in August 2021, during which his level of habituation escalated rapidly. His final sighting required the evacuation of numerous children from a harbour due to increasingly erratic and potentially dangerous behaviour. “John,” active from March to August 2022, showed gradual behavioural habituation before abruptly disappearing in midsummer. In all three cases, the management strategy centred on systematic sightings recording, outreach to key authorities, and coordinated public messaging. “Reggie,” active since early 2025 within a relatively small home range, quickly became well-known to the local community. Management for this animal was led by a statutory agency; although no formal data-recording scheme was implemented, engagement with NGOs and collaborative planning supported the development and dissemination of clear public messaging. Managing solitary sociable dolphins presents a wide array of scenarios, some requiring urgent and adaptive responses. However, proactive, well-coordinated communication - supported by cooperation between agencies, NGOs, and community stakeholders - can yield substantial benefits. Strategised public messaging plays a vital role in reducing harmful human interactions and helping protect these unique animals.

Potential role of nematode larvae for vectorial transmission of brucellosis

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Since their discovery in 1994, marine *Brucella* spp. have been isolated from various marine mammals, *B. ceti* infecting cetaceans. The transmission pathways of marine *Brucella* spp. remain unclear, but there is evidence that marine mammals can contract brucellosis by vertical and horizontal transmission. Vectorial transmission via lungworm carrying the bacteria is suspected. This study aims to confirm the presence of *Brucella ceti* and the potential transmission by lungworm larvae. First-stage larvae were isolated and by sequencing, *B. ceti* was identified in larvae from airways of a common dolphin. These results support the hypothesis of a potential vectorial transmission of *Brucella* spp. by lungworms larvae in marine mammals.

Context-dependent vocalisations in bottlenose dolphins (*Tursiops truncatus*) as a non-invasive measure of welfare and affective states

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We hypothesised that a vocal learning mammal (bottlenose dolphin,*(Tursiops truncatus*) produces affect-dependent vocal signatures that could serve as non-invasive indicators of welfare. We utilised a hydrophone array to localise vocalisations from seven dolphins in human care at Oltremare Marine Park (Italy) across 100 discrete behavioural events categorised into positive (socio-affiliative, toy, and food related), neutral (1-2 independently swimming dolphins in a pool), and agonistic (socio-aggressive) contexts between March and October 2022. 508 whistles were categorised into 47 types using ARTwarp and 50 time-frequency measurements were extracted from them using PAMGUARD's ROCCA module. 1811 burst pulses were visually categorised into seven types. Differences in call type usage and acoustic parameters were compared across affective states using generalised linear mixed models. Calls per individual per minute (C/I/M) were significantly lower in neutral (0.27 C/I/M) compared to positive (2.9 C/I/M) and agonistic (2.2 C/I/M) contexts. In positive contexts there was an overall even proportion of whistles and burst pulses despite variation between positive contexts as affiliative events were dominated by whistles (96%) and play by burst pulses (72%). In agnostic contexts burst pulses (1.2 C/I/M) were produced more than whistles (0.9 C/I/M). Whistle type differed significantly between contexts with the number of steps, slope mean, and sweeps transitioning to or from a flat portion increasing significantly in positive contexts. Burst pulse type usage was significantly different between contexts where those with increasing and modulated click rates were produced significantly more in positive contexts and their duration significantly longer. All significant results exceeded Tukey's adjusted p-value thresholds. These findings provide the first quantitative demonstrations that dolphin call type and acoustic structure reflect affect. We highlight the potential to utilise such knowledge to advance cetacean welfare assessment and strengthen the interpretation of vocal behaviour in human care and wild populations.

Beyond aggregated models: tidal-phase habitat analyses highlight dynamic space use in harbour porpoises

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Traditional habitat models typically rely on aggregated datasets to produce generalised species distribution outputs, yet this approach may obscure ecologically relevant patterns in dynamic marine systems. We hypothesised that temporally disaggregated data, particularly across discrete phases of the tidal cycle, would generate markedly different distribution outputs for harbour porpoises *Phocoena Phocoena* and provide a more accurate reflection of their fine-scale habitat use. Mount's Bay (Cornwall, UK)is a recognised hotspot with high year-round porpoise occurrence and a pronounced late-summer peak. Using long-term effort-based sightings data (2011-2018) and environmentally relevant predictors including depth, substrate, proximity to bathymetric slopes, and tidal and thermal front features, we modelled the relative likelihood of porpoise presence both as a single aggregated dataset and as temporally disaggregated subsets corresponding to individual stages of the tidal cycle. The distribution patterns generated from aggregated data differed substantially from those produced from disaggregated data, with the latter identifying shifting high-use areas directly linked to tidal processes. These results indicate that conventional aggregated models may underestimate the ecological importance of tidal driven habitat dynamics, while temporally explicit approaches offer clearer insights into how porpoises respond to fine-scale environmental variability. This improved ecological resolution has important implications for conservation management, particularly for identifying high-risk zones for by-catch in fishing gear and designing spatially and temporally responsive mitigation strategies.

Optimizing beaked whale photo-ID: AI matching and detectability across UAV and vessel platforms

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Beaked whales are difficult to study due to their cryptic behaviour, deep-diving ecology and the scarcity of photographs suitable for individual identification. Around El Hierro (Canary Islands), populations of *Mesoplodon densirostris* and *Ziphius cavirostris* have been monitored since 2003 using digital photo-identification, providing a long-term opportunity to study island-associated cetaceans in the Northeast Atlantic. Field-based impressions over recent years suggest that local occurrence might have declined, raising concerns about population status. This study therefore aims to update a multi-year catalogue for both species and to evaluate the hypothesis that apparent use of the area and encounter rates have decreased in recent years compared to the earlier monitoring period. Digital photographs obtained from 2003 to 2017, previously validated, are integrated with additional images collected between 2018 and 2024 from surveys around the island, resulting in a continuous two-decade dataset. Several thousand images from hundreds of encounters are processed using Flukebook, combining manual matching with machine-learning-assisted candidate suggestions to improve efficiency and consistency in recognition. All images are screened under consistent quality criteria to ensure reliable identification across the time series. Each sighting is georeferenced and accompanied by basic group and environmental information, allowing patterns of individual occurrence, site fidelity and habitat use to be examined at scales relevant to local management. A focused comparison of image platforms shows that drones provided higher detectability of markings in the anterior region (60% over 46%), while both platforms performed similarly in the mid-body (73% and 86%). Mark visibility in the posterior region was low across both methods, consistent with the naturally limited markings in that area. The integrated dataset offers a robust framework to quantify long-term trends in apparent abundance and area use and to assess local population indicators, strengthening the baseline needed for future conservation and management measures.

Identifying common bottlenose dolphin (*Tursiops truncatus*) prey using photographs collected during focal follows

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Capturing surface feeding events of small cetaceans such as the common bottlenose dolphin (*Tursiops truncatus*) during photo-identification is relatively rare. However, these rare events provide a unique opportunity to study their diet and their feeding behaviour in finer detail. Here, we attempted to evaluate what can be learned about the diet of a population of common bottlenose dolphins inhabiting the Gulf of Trieste from such photographs. We analysed photographs collected between 2008 and 2021, resulting in 72 images of dolphins interacting with prey. Each photograph was graded as Good, Moderate or Poor quality, based on the visibility of prey identifying features and the possibility of identification to genus level. Prey were identified to the lowest possible taxonomic level by two independent researchers. Over half of the photographs were of Poor quality, with Good quality photographs only representing 2.8%. Half of all prey items were classified as unidentified fish, followed by mullet (family Mugilidae, 40.9%). The species *Conger conger*, *Belone belone*, *Spicara* sp. and an undetermined species of squid were each documented once. In addition, photographs were linked to GPS coordinates showing that despite broad coverage of the Gulf of Trieste, most of the photographs with prey were concentrated around the Piran peninsula. Despite several limitations, such as rarity of surface-feeding photographs, potential bias towards prey hunted near or carried to the surface, the possibility of identifying some species from poorer quality photographs than others, this approach provides one avenue to identify dolphin prey, especially when information collected via other means (e.g. biopsy samples or stranded animals) may not be readily available. When its constraints are taken into account, this approach can provide useful insights, especially in a well-studied population, but is not sufficient as a stand-alone method to describe the overall diet.

Elusive cetaceans of Montenegro: Historical records and rare sightings along the coastline

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2. *DMAD-Marine Mammals Research Association*

Common bottlenose dolphins (*Tursiops truncatus*) are regularly observed in Montenegrin coastal waters. However, unusual sightings of other cetaceans recorded in the Bay of Kotor in 2025 have prompted renewed interest in assessing the occurrence of similarly uncommon events in previous years. In the adjacent Southern Adriatic Sea, while common bottlenose dolphins are resident, species such as striped dolphins, sperm whales, fin whales, short-beaked common dolphins, Risso's dolphins, and Cuvier's beaked whales are less known and reported within the coastal waters of the Adriatic. Historical data further indicate that short-beaked common dolphins (*Delphinus delphis*) were once frequently observed along the eastern Adriatic coastline in the early 20th century, the species was thought regionally extinct until recently a common dolphin was tracked near the island of Krk, Croatia. Despite being a relatively common species, striped dolphins (*Stenella coeruleoalba*) are rarely seen in coastal waters. September 2023, a calf of striped dolphin was recorded alone in the coast of Budva for three consecutive days. Later on the 19th of June, 2025, a pair of striped dolphins were recorded for the first time to our knowledge in the Bay of Kotor. Furthermore, a particularly exceptional sighting was documented on 26 June 2025, when a fin whale (*Balaenoptera physalus*) entered the Bay of Kotor. This sighting constitutes the second confirmed record of the species within the bay, succeeding a juvenile reported in 2011. Limited knowledge on the ecology and status of cetaceans in Montenegro, make studies of any occurrence of cetaceans essential. The unusual sightings recorded in 2025 raise important questions about the factors driving these rare events. It also highlights the importance of systematic monitoring, targeted research, and long-term data collection to fill in gaps in our understanding of cetacean dynamics in the region and to inform effective conservation strategies.

Delphinid acoustic species classification on Faroese survey vessel during North Atlantic Sightings Surveys (NASS)

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The North Atlantic Sightings Surveys (NASS) were conducted in July 2024 with the primary objective of obtaining quantitative data on the distribution and abundance of cetacean species across the north Atlantic. The dedicated survey portion by Faroe Islands was conducted on 19 days aboard the vessel Ran in two survey strata which extend 1200 km south of Iceland. Sightings and acoustic data were collected simultaneously during independent observer line transects, in passing mode. Sound recordings were made at 500kHz and 192kHz with a total of 193.6 hours (3,714 km) during on effort line transect visual survey at 8-12 knots. Delphinid click train and whistle events were identified automatically and annotated manually using the PAMGuard click detector, click train detector, and whistle and moan detector modules. Distances to detections were determined using target motion analysis and used to derive an effective survey strip half width for delphinids combined. Coincident sightings and acoustic detections of common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*), white-beaked dolphin (*Lagenorhynchus albirostris*), long-finned pilot whale (*Globicephala melas*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*) and killer whale (*Orcinus orca*) were identified. The Risso's dolphin (*Grampus griseus*) were not sighted but identified in the acoustic data. The performance of species classifiers was compared using recently published Northeast Atlantic click and whistle classifier models for the whistle classifier, Rocca, and deep learning PAMGuard modules. With the hydrophone array towed 165m behind the vessel, elevated background noise levels influenced delphinid detection, highlighting the importance of the quality of detections for the accuracy of species classification scores.

Waves of solitude: The occurrence of solitary dolphins in relation to abundance estimates of bottlenose dolphins (*Tursiops truncatus*) in Montenegrin waters

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2. *DMAD-Marine Mammals Research Association*

Bottlenose dolphins (*Tursiops truncatus*) exhibit high social complexity and fluid fission-fusion social structure across their varied spatio-temporal distribution, particularly across the Adriatic Sea. With lower abundance and group size estimations recorded within the Southern Adriatic, a region with drastic seasonal fluctuations in anthropogenic presence, the growing occurrence of solitary Bottlenose dolphin sightings in Montenegrin coastal waters may reflect behavioural plasticity. This study aims to investigate whether this rise in solitary individual sightings is linked to variations in seasonal abundance, exploring solitude as a potential behavioural adaptation to fluctuation in ecological or anthropogenic pressures. From January 2017 to December 2024, spatial and behavioral data was collected during land-based surveys, and photo identification data from boat-based surveys, across Montenegro's territorial waters. The results of the mark-recapture analysis showed an overall population size of 338 individuals (±57 SE; 95% CI: 226-448), with a CV of 17%, within the study region. Findings revealed that 131 (28.42%) out of 461 land-survey sightings of Bottlenose dolphins during the survey period consisted of solitary individuals with an additional 51 (27.72%) of 184 encounters from boat-based surveys. Furthermore, solitary dolphins were the most frequently recorded group type; where in one case, the same individual was observed in solitude across a 4 month period and in others, solitary individuals were later observed in groups. With a historical record of solitary dolphins within the Boka Kotoska Bay, Montenegro, further study into the occurrence of solitary behaviour will provide insight into the behavioural plasticity and adaptation of bottlenose dolphins and aid in establishing future conservation measures in this region.

The history of the cetacean collections at National Museums Scotland and recent developments.

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National Museums Scotland has a long history of collecting cetacean specimens which date from the late 17th century. Collecting during the 19h century was opportunistic and influenced by discoveries of subfossils during land reclamation, specimens brought back from whalers from Greenland and the Southern Oceans, and sporadic local strandings. The national stranding reporting scheme by the Natural History Museum, London since 1913 led to more systematic collection of cetaceans from throughout Scotland, but the two national strandings schemes that began in the early 1990s led to a rapid increase in collection size, including the addition of several warm-water species never recorded before in Scotland or Britain . As the collections have developed, they have become an increasing focus for researchers for genetic, morphological and ecological studies.

Social networking; bottlenose dolphin *Tursiops truncatus* and white-beaked dolphin *Lagenorhynchus albirostris* population size and structure in NE England, 2010-2023

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3. *North East Cetacean Project*

In North East England, white-beaked dolphin *Lagenorhynchus albirostris* is a seasonal visitor to inshore/nearshore waters, whereas bottlenose dolphin *Tursiops truncatus* is present year-round. The designation of any marine protected areas or impact mitigation schemes to conserve these species requires evidence based determination of population size. This study aimed to generate population estimates, and create photo-ID catalogues, for both species. 7120 images of *L. albirostris* off the coast of Northumberland and County Durham, were obtained in 107 encounters between 2010-2023, almost exclusively from small boats. 3690 images of *T. truncatus* were accumulated from 38 small boat trip encounters, and photographs taken by members of the North East Cetacean Project Facebook group from land between the Scottish Border and the river Humber, between 2011-2023. Sociograms for both species were created using SocProg. 193 individuals of *L. albirostris* and 74 individuals of *T. truncatus* were catalogued, with 88% of the animals in the *T. truncatus* catalogue also present in the Aberdeen University East Coast of Scotland catalogue. The Chapman modification of the Lincoln-Peterson method of estimating population size suggests that 668 ± 269 *L. albirostris* individuals utilise the study area, with a crude estimate correcting for group size, marking rate and recapture rate suggesting a population of 582 individuals. The Chapman modification gave a population estimate of 78 ± 5 *T. truncatus* individuals, with a simple scaling method estimating abundance as 124 individuals. The sociogram for *L. albirostris* showed a population of 23 distinct subunits, although one of these was a connected network of more than 20 subunits, and that for *T. truncatus* showed a large, well-connected, social unit. As well as being the first long-term study of *L. albirostris* population size in North East England, this study also confirmed the ongoing southward shift of the East Coast Scotland T. truncatus population.

DEB or not to DEB? Comparing two approaches to modelling population consequences of disturbance – expert opinion or energy budgets

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Methods for assessing the consequences of various types of stressors on marine mammal populations have advanced considerably over the past decade. The Population Consequences of Disturbance (PCoD) framework describes the pathways linking exposure to a stressor to population-level consequences through behavioural and/or physiological changes, effects on health, and altered vital rates. Interim PCoD (iPCoD) is one of many quantitative approaches to operationalise this conceptual framework. It was developed in 2013 for UK regulatory assessments of offshore renewable energy developments. It uses Leslie matrix population models combined with expert-elicited transfer functions that link days of disturbance to effects on vital rates (iPCoD – EE). Due to variable expert opinions, these functions result in large variability in model output between simulations. Advances in understanding how disturbance affects vital rates led to the development of a new version (iPCoD – DEB) where the transfer functions are replaced by a mechanistic bioenergetic model. This assumes each disturbance day results in decreased energy intake, thereby linking disturbance to vital rates through energy allocation. These two approaches differ in their underlying assumptions. iPCoD – EE does not assume that disturbance acts via an energetic pathway only, as iPCoD – DEB does. However, it does not allow for seasonal variations linked to individual state, whereas iPCoD – DEB does. Moreover, iPCoD – DEB allows for compensation of lost foraging time, whereas iPCoD – EE does not. This talk will present both approaches, compare their strengths and limitations, and provide practical guidance for method selection, depending on the question asked and data availability.

Estimating reproductive traits of female bottlenose dolphins (*Tursiops truncatus*) in an ultra-oligotrophic marine environment

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This study aimed to estimate the reproductive life history traits of female common bottlenose dolphins *Tursiops truncatus* inhabiting the Israeli Mediterranean coast. Data were collected between January 2005 and December 2023 through 1192 boat-based surveys. During 244 sightings, 301 individual dolphins were recorded, excluding calves, based on analysis of 13,585 high-quality dorsal fin photographs. Calving rate, fecundity, birth seasonality, interbirth intervals, and weaning age were calculated using photo-identification, and Cormack-Jolly-Seber models estimated survival rates. During the study period, 517 identifications of 61 reproductive females and 114 dependent calves were made. Females with calves exhibited stronger site fidelity and were observed year-round. Of reproductive females, 61% (n = 37) were sighted with one calf, 16% (n = 10) with two, and 23% (n = 14) with three or more, with a maximum of seven calves produced by any known female. Results indicate a diffuse birth seasonality, with most births occurring during late spring and summer, associated with increasing water temperature. The calving rate was 0.2 (95% binominal CL 0.02–0.42) and fecundity was 0.11 ± 0.1. The mean interbirth interval was 2.97 ± 0.96 years, falling within the lower range of values reported for similar dolphin populations. The weaning age was 2.61 ± 0.48 years, suggesting that dolphins in the study area tend to wean their current calf at about mid-pregnancy. Cormack-Jolly-Seber models were used to estimate survival rates. Survival rates for both adults (0.80, n = 301) and calves (all calves: 0.52, n = 114; first-year calf survival: 0.73, n = 14) were lower than those reported in other studies, indicating that reproductive success may have a greater impact on population viability than survival rates in this population. These findings underscore the importance of understanding life history traits to forecast population trends and responses to environmental stressors in the Mediterranean population, which faces significant anthropogenic pressures as a coastal species.

Lost in translation: Comparing C-POD and F-POD detections of harbour porpoises (*Phocoena phocoena*)

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The transition from Cetacean Porpoise Detectors (C-PODs) to Full waveform capture PODs (F-PODs) raises challenges for maintaining consistency in long-term harbour porpoise (*Phocoena phocoena*) monitoring. C-PODs and F-PODs were simultaneously deployed at three sites (Scotman's Bay, Mid Burford, and North Burford) in Dublin Bay within the Rockabill to Dalkey Island Special Area of Conservation (SAC) from July 2022 to August 2023. This study (1) compared spatiotemporal occurrence patterns at daily and hourly scales using Generalised Additive Mixed Models (GAMMs), and (2) evaluated whether Random Forests (RFs) and Hierarchical Generalised Additive Models (HGAMs) could translate detections between devices and account for inconsistent detection differences, rather than applying a simple correction factor. F-PODs recorded higher detection rates than C-PODs, with total Detection Positive Minutes (DPMs) being 2.7, 1.4, and 2.3 times higher at Scotman's Bay, Mid Burford, and North Burford, respectively. Both devices captured similar seasonal and spatial patterns at the daily scale. At the hourly scale, F-POD models consistently predicted higher harbour porpoise presence probability and did not retain location as an explanatory variable. RFs performed marginally better than HGAMs as translation models when tested on unseen data. These models highlighted that variability was driven by unit-specific differences at the daily scale and by the impact of noise on C-POD detections at the hourly scale. The study informs long-term comparability of acoustic datasets for management and conservation and proposes a new approach for unifying datasets during device transitions.

Influence of mitigated UXO removal and deterrence choreography on harbour porpoise detections

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Within the German EEZ, there are more than 1.6 million tons of unexploded ordnance (UXO) present. Due to the expansion of Offshore Wind Farms (OWF), several controlled UXO clearances are carried out every year. Recently, mitigation strategies as well as deterrence choreographies have been developed within the regulatory framework in Germany, to avoid harming marine mammals. These comprise mitigation systems and several deterrence vessels operating seal scarers to ensure that the risk area where harbour porpoises could be affected by a permanent threshold shift (PTS) during controlled detonations is minimized. Additionally, harbour porpoise presence is monitored before, during and after deterrence and detonation using Passive Acoustic Monitoring (PAM). Since the actual amount of explosive can be estimated before the detonation, a noise prognosis to determine the impact area is modelled beforehand. After removal, the prognosis is evaluated based on the measurement results. In this study, harbour porpoise presence was monitored during a total of 13 UXO clearances in the German North Sea and Baltic Sea between 2022 and 2025 using CPODs located 1,500 m up to 30 km away from the detonation site. Results show that harbour porpoises return fairly quickly to the vicinity of the detonation site, depending on the amount of explosive charge detonated. Sound emissions of all UXO removals were mitigated with a double big bubble curtain. The results highlight the importance of an effective deterrence procedure as well as an effective mitigation concept to minimize impacts on harbour porpoises. The evaluation of the prognosis showed that depending on the model, a good match between prognosis and sound measurements can be achieved and that continuous adjustments are necessary to improve the prediction.

Local Ecological Knowledge feeds evidence-based conservation of an endangered harbour porpoise (*Phocoena phocoena*) population

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The harbour porpoise (*Phocoena phocoena*) is classified as Critically Endangered in mainland Portugal. Due to its elusive behaviour, knowledge of occurrence and behaviour remains limited. Consequently, engaging stakeholders, like small-scale fishers, and incorporating Local Ecological Knowledge can enhance monitoring efforts by increasing temporal coverage and detecting rare events. In this study, we analysed harbour porpoise occurrence at the mouth of the Douro River (Porto, Portugal), through land-based monitoring data (2017–2025). Records collected by Marine Mammal Observers (MMOs) during 116 survey days were combined with opportunistic reports from fishers, obtained in situ by MMOs during 39 of those survey days, to assess temporal and circadian patterns of occurrence. The combined dataset comprised 329 records of porpoise occurrence: 230 from MMOs and 99 from fishers. MMO data enabled the assessment of circadian patterns at seasonal and diel resolution, although limited by meteorological conditions, MMO availability (poor winter coverage), and daylight hours. Conversely, although lacking precise timestamps, fishers reported occurrences throughout the year and across the full diel cycle. Combining MMO and fisher datasets (only occurrences with daytime information: N MMO = 230; N fishers = 46) yielded 17 night-time records (21:00–7:00), 151 morning (7:00–14:00), and 107 afternoon (14:00–21:00), indicating continuous day-and-night use of the area by harbour porpoises. All but two night-time records were reported by fishers. Monthly analysis revealed that fishers contributed nearly 50% of sightings in several months. In February, all detections were opportunistic, whereas in November and December only MMO observations were recorded. Fishers also provided information on behaviour (e.g. foraging), group

composition (e.g., presence of calves), and occurrence of other cetacean species (e.g. *Grampus griseus*). These findings highlight the importance of involving local communities, whose observations expand temporal coverage, improve rare-event detection, and support conservation of threatened species.

Using a volunteer-supported research vessel as a platform for baseline cetacean monitoring via standardised transect surveys across Ireland's Areas of Interest

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1. *The Irish Whale and Dolphin Group*

The Irish Whale and Dolphin Group operates the 17m sailing vessel Celtic Mist as a member-supported platform for cetacean monitoring in Irish waters. A standardised visual survey methodology is used to collect baseline marine mammal data across the 16 Areas of Interest (AOIs) proposed by the Fair Seas campaign as candidate Marine Protected Areas (MPAs), which together cover ~36% of Ireland's maritime area. These AOIs were identified as biodiversity hotspots, yet many remain sparsely covered by dedicated transect surveys, leaving critical data gaps for MPA design and long-term monitoring. Between 2023 and 2025, Celtic Mist conducted visual surveys across all coastal AOIs using line-transect methods. Trained observers, drawn from IWDG members, were rotated hourly on paired deck-level positions, with continuous effort logging, environmental covariates, and sightings recorded in IFAW Logger. Sightings were georeferenced, assigned to species with confidence grades, and classified as on- or off-effort. Surveys were complemented by opportunistic photo-identification, behavioural notes, and recording of static-gear buoys and floating litter, enabling multimodal data capture without increasing disturbance risk. Across years, Celtic Mist logged >10,120km of tracklines and ≥1,193 sightings, documenting >5,601 individuals of at least 13 species, with common dolphins dominating sightings. Multi-species richness hotspots were consistently detected in southwest AOIs. Survey data are processed to derive species-specific encounter rates (sightings km^{-1}), species richness in $100km^2$ grid cells, and density layers for key taxa. Observations of cetaceans species across all AOIs confirm that this platform is effective for documenting species presence and relative encounter rates at a national scale. A vessel of this class, operating with structured training and a clear protocol, provides consistent, comparable datasets while maintaining low ecological footprint and high public engagement value. This approach supports Ireland's emerging MPA network by supplying targeted baseline data for AOIs and a scalable framework for future status-and-trend monitoring.

Into the depths: examining skin amino acid and blubber fatty acid isotope profiles with tissue-depth in killer whales (*Orcinus orca*)

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Bulk stable isotopes (SI) and fatty acid (FA) composition are widely used as dietary tracers for free-ranging cetaceans. However, interpretations of feeding patterns using these approaches can be challenging due to baseline isotopic variations across regions and overlapping prey FA patterns, respectively, as seen in previous studies on Eastern Canadian Arctic (ECA) killer whales. Compound-specific isotope analysis (CSIA) of amino acids (AA-δ15N and AA-δ13C) and FAs (FA-δ13C) represent promising complementary approaches that may reduce uncertainties and bias based on information from just one or two tracers. Nevertheless, further information is required before CSIA can be successfully applied to the study of cetacean diets; for instance, it is not clear if or how CSIA values may vary with depth within commonly analysed tissues, i.e., skin and blubber. Variation is likely given known within-tissue differences in bulk skin SI and blubber FA composition. In this study, we assessed within-tissue variation in AA-δ15N and AA-δ13C of skin and FA-δ13C of blubber in killer whale (*Orcinus orca*). We compared bulk and AAs isotope values among three skin sections (inner, middle, outer) and FA composition and FA-δ13C among ten blubber sections (outer to inner blubber) of seven killer whales from the North Atlantic (ECA, Greenland, Norway and North West Atlantic). Most AA-δ15N and AA-δ13C did not vary among skin sections; the notable exception was significant, yet small (~1‰), variation in Pro-δ15N values. Unlike FA composition (proportions), FA-δ13C values did not differ through the blubber layers for most dietary FAs. These results suggest that AA and FA isotope values do not vary to an extent that confound interpretations of dietary patterns. Analysis of FA-δ13C was then performed on outer blubber biopsies from ECA killer whale biopsies (n = 40) and

these results will be presented to further evaluate the utility of this tracer for free-ranging cetaceans.

Intraguild predation in sympatric seals and the effect on a declining population

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Evidence of intraguild predation (IGP) is found across taxonomic groups but varies in its prevalence within predator populations. The effects of IGP can be similar to traditional predation, but when exploited by few, specialist predators the impact on intraguild prey populations is less clear. Sympatric grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) share similar diets of a broad range of fish and cephalopod species. However, in recent years, adult male grey seals have been observed predating both grey seals and harbour seals. Combining 11 years of strandings data and direct observations of predation from citizen-science across Scotland, we examined the prevalence, spatial extent and temporal trends of IGP by grey seals. These results informed realistic predation scenarios and the effect of IGP on a small, protected population of harbour seals was explored. IGP was geographically widespread, involving multiple, seemingly specialist adult males across distinct subpopulations. The prevalence of IGP, as revealed by strandings data, appeared to increase through the study. Predation was most pronounced on adult harbour seals during the breeding season, amplifying the population level impact of each predation event through the loss of future reproductive potential. Indeed, in a depleted population in southeast Scotland, the estimated peak predation level was projected to cause declines of 7–11%, well within the rate of the current harbour seal decline. This study demonstrated the utility of integrating disparate datasets to address conservation challenges and highlights how IGP, while seemingly rare, can hold sympatric species in a predator pit preventing recovery and in small populations may even contribute to declines.

B cell lymphoma and streptococcal septicaemia in a common dolphin (Delphis delphis).

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Neoplasia is a relatively uncommon finding in cetaceans, and of the neoplasms described in the literature, lymphoma is infrequent. An adult female common dolphin in poor body condition that stranded on the Cornish coast (UK) was examined post mortem. There was evidence of previous trauma to the head, thorax, abdomen and tail stock, and widespread abscessation within soft tissues was considered likely secondary to this trauma. *Streptococcus phocae* was isolated from several tissues and abscesses, indicating septicaemia. Histological examination revealed neoplastic large lymphocytes which effaced the splenic architecture and were also present in the sinusoids of the liver. Immunohistology was utilised to characterise the neoplastic cells as of B cell origin (negative for CD3, positive for CD20, IgG). B cell lymphomas in cetaceans have been reported in bottlenose dolphins (*Tursiops truncatus*), Atlantic and pantropical spotted dolphins (*Stenella frontails* and *S. attenuata*). In these cases, the organ primarily affected has been the spleen, with hepatic and lymph node involvement also reported. Hepatosplenic B cell immunoblastic lymphoma has not previously been reported in the common dolphin; in this species only cases of T cell lymphoma affecting the central nervous system are present in the literature. Other cases of lymphoma in dolphin species have been associated with immunosuppression, either due to high pollutant burdens, or secondary to viral infection. In this case the dolphin had septicaemic infection with *Streptococcus phocae*; whether this was secondary to debilitation caused by the lymphoma, or symptomatic of another underlying cause of immunodeficiency, is not clear.

Mosquitoes as potential vectors for infectious disease in seals

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Mosquitoes are important vectors of pathogens in terrestrial vertebrates, but their presence and role in offshore environments remains poorly understood. Surveillance of mosquitoes in marine contexts is becoming increasingly relevant, as vector-borne pathogens like West Nile virus have been detected in marine mammals. It is still unclear whether mosquitoes feed on seals or transmit pathogens to them. This study investigated whether mosquitoes occur on Heligoland, an offshore North Sea Island located 50 km from mainland Germany, habitat for hundreds of grey and harbour seals and breeding site for numerous seabird species. Mosquito trapping was conducted at three sites in August 2024 near seal haul-outs using CO_2-baited BG sentinel traps. Further mosquitoes were trapped on mainland in July 2025 at Seal Station Friedrichskoog close to harbour seal pups in rehabilitation. Mosquito species determination was performed using morphological and molecular methods, including PCR and qPCR for subtyping of biotypes. 1480 mosquitoes were caught on Heligoland including the species *Culex pipiens* biotype pipiens, *Culiseta annulata*, *Aedes caspius* and *Aedes detritus*. DNA was isolated from blood meals to determine if engorged mosquitoes had fed on seal blood. One COI and three Cyt b primers producing 220bp, 305bp, 148bp and 402bp products were employed on blood meals of seven *Aedes* sp. mosquitoes caught in Friedrichskoog. Good quality sequences showed 100% similarity with harbour seal sequences and revealed that these mosquitoes had fed on seal blood. This is the first record of mosquitoes feeding on harbour seals and opens new perspectives for the transmission of infectious agents like filarial seal heartworm *A. spirocauda* via flying arthropod vectors. The presence of mosquito species on Heligoland underscores the importance of monitoring vector populations in marine ecosystems to assess disease risks for wildlife and inform future surveillance on the role of mosquitos as vectors in marine animals.

Blue whale songs at a mid-Atlantic migratory habitat, the Azores

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Blue whale (*Balaenoptera musculus*) songs consist of long, patterned sequences of low-frequency sounds believed to act as reproductive displays. Songs typically include downsweep calls (A and A+B). A lower frequency call, the 9 Hz call has been described in songs detected in the North-West Atlantic occasionally accompanying A and A+B calls. Although blue whale songs are known to differ between regions and populations, recent finer-scale studies report variability in song patterns detected within regions and populations, raising questions on how reliable song patterns can be as acoustic markers at a population level. Additionally, a number of studies have shown a worldwide declining trend in mean frequencies of calls. While there is still no broadly accepted explanation for this phenomenon, more recent observations can contribute to understand the drivers of this trend. Here, we measured the proportion of call types (A, A+B and 9Hz) and mean frequencies in selected songs (6 songs and 1825 calls) detected over five months (from August 2022 to January 2023) of recordings from continuous Ocean Bottom Seismometers deployed in the Azores. Our results revealed variability within and between songs: two songs with just A calls, one with A and A+B calls, one with A and 9 Hz call and two included the three call types. Even though A calls alone were dominant in all songs, the proportions of call types between songs showed variation. Average mean frequency measured in the Azores (16.4 Hz, SD=0.152) fit well with the long-term (over 6 decades) declining trend reported from multiple regions across the North Atlantic and supports its consistency over time. These results report for the first time detection of 9Hz call in the mid-Atlantic region and not only support previous findings of song complexity but also further illustrate the high variability in blue whale songs.



Seasonal patterns and long-term decline in harbour porpoise nutritional condition using standardised body condition indices

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Assessing body condition (BC) is a key method for evaluating nutritional stress in marine mammals and is increasingly prioritised in wildlife health monitoring and conservation policy. Harbour porpoises (*Phocoena phocoena*) are particularly vulnerable to stressors due to their high energetic demands and sensitivity to disturbance. Despite numerous studies into body condition, a standardised approach to developing body condition indices (BCI) in porpoises has not been established. In this study, we compared three commonly collected morphometric measures (weight, girth, blubber thickness) in 1183 stranded harbour porpoises from 1992 to 2024 in Scotland to generate standardised BCIs. We assessed how each metric reflects different physiological processes (e.g., dynamics of blubber loss) and examined seasonal, annual, and regional trends in BC across Scotland. Our findings showed that girth and blubber thickness BCIs captured rapid fluctuations in blubber reserves, while weight BCIs reflected more chronic changes associated with longer term catabolic processes and structural tissue loss. These results emphasise the importance of selecting BCIs specific to biological questions and highlight girth-derived measures as robust indicators for identifying cyclical periods of vulnerability. Seasonal patterns showed a 5-fold decline in BC during spring, indicating a critical period of nutritional stress in this population. The long-term decline in juvenile body condition suggests heightened vulnerability in this age class, with a 60% decrease in mean BC across the study period. Regional differences were also evident, with porpoises stranded on Scotland's Atlantic coast being in consistently better condition than those that stranded on the North Sea coast, potentially reflecting greater exposure to stressors in the North Sea. This study provides new insights into harbour porpoise health in Scottish waters and offers a framework for standardised BC assessment to better assess energy reserves and resilience to stressors in order to help inform conservation strategies and meet legislative health monitoring objectives.

Identifying signature whistles in free-ranging male bottlenose dolphins (*Tursiops truncatus*)

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Reliable individual identification is fundamental in population monitoring. In bottlenose dolphins (*Tursiops truncatus*), signature whistles offer a non-invasive cue for recognizing individuals, yet distinguishing them in natural social contexts remains challenging. This study compares three approaches for identifying signature whistles in free-ranging male dolphins using high-resolution DTAG3 recordings, where vocal source attribution is known. We analysed 1,021 focal whistles from six adult males across ten DTAG deployments in Sarasota Bay, Florida. Whistles were classified using two approaches: manual visual classification and unsupervised clustering with ARTWARP. Repetition-based detection was then assessed both globally and within bouts defined by inter-whistle intervals (IWIs), testing different IWI limits, proportions within range, and minimum whistle counts. Precision–recall metrics were calculated using each dolphin's established signature whistle as the reference, with recall indicating how many of the real signature whistle occurrences were detected. Visual classification showed the strongest overall performance, reaching precision = 0.76 and recall = 0.40 under its best settings. Bout-level evaluation also performed well, with an optimal configuration reaching precision = 0.76 and recall = 0.27. ARTWARP returned more fragmented categories and lower recall in this dataset, which may relate to contour variability in the male whistles analysed. Nonetheless, ARTWARP has shown strong performance in broader population-monitoring studies, so the reduced recall observed here likely reflects context-specific factors. While visual classification provided the most accurate results, it is time-intensive. Bout-level grouping offers a more efficient alternative, capturing useful temporal structure with far less effort. This makes it well suited for larger passive acoustic monitoring datasets where scalable methods are needed. Taken together, these comparisons provide insight into how different approaches perform in natural recordings of male dolphins. The findings support ongoing efforts to develop scalable and more objective tools for passive acoustic monitoring, with relevance for dolphin conservation and behavioural ecology.

First confirmed record of a narwhal (*Monodon monoceros*) in Ireland

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On 14 November 2025, a stranded whale was discovered on Sweet Nellie's Beach in Greencastle Cove, Co. Donegal and reported to the Irish Whale and Dolphin Group Stranding Scheme. The animal was initially reported as a pilot whale, though no images were available at the time. A further report submitted the following day included a single photograph that did not show the head. A request was subsequently made to the Volunteer Stranding Network to collect additional detailed images of the whale. These images confirmed that the animal was, in fact, a young narwhal (*Monodon monoceros*), representing the first confirmed record of this species in Ireland, alive or dead. The carcass was recovered for post mortem examination, which revealed that it was a young, sexually immature female measuring 2.42 m in length. Gross examination found the animal to be in poor nutritional condition, with a heavy parasite burden of *Anisakis* sp. in the fundic stomach. No other gross pathology was identified that would explain the cause of stranding, or the animal being out of habitat. Bacteriology and histopathology are currently pending. Narwhals occur exclusively in Arctic waters of the North Atlantic, typically north of 60°, and are rarely recorded outside this range. Only nine previous strandings have been documented in western Europe since the late 19th century. Sightings are similarly scarce, with only a handful reported from Scotland in the late 19th and 20th centuries. This Irish stranding event represents the tenth narwhal stranding in western Europe, and only the fourth female recorded. This event not only highlights the importance of national stranding schemes in documenting rare and unusual occurrences, but also demonstrates the essential role that volunteer networks play in confirming species identification and supporting rapid response efforts.

Creeling for sound: evaluating fisher-led deployment of static passive acoustic monitoring devices in Scotland

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Knowledge of the year-round distribution of cetaceans in Scottish waters is limited, yet this information is critical for informing effective conservation and management efforts. Long-term Passive Acoustic Monitoring (PAM) provides a consistent way of monitoring cetacean species. PAM data can also be used to assess how offshore human activities are changing marine soundscapes. This information is essential to assess impacts of underwater noise on the distribution and behaviour of cetaceans. However, the deployment of state of the art PAM arrays is expensive, which limits the range over which these devices can typically be deployed. The Creeling for Sound project, led by the Hebridean Whale and Dolphin Trust, aims to address this challenge by collaborating with creel fishers deploying crab and lobster pots (creels) around the Isle of Mull, Scotland to test the feasibility of deploying PAM devices on static fishing gear. Three fishermen participated in the initial testing phase, trialling deployment methods that integrate with real fishing operations. This phase provided valuable insights into suitable recorder positioning, attachment methods, and deployment and recovery protocols. A full deployment trial is now underway and will continue until Spring 2026 to explore alternative deployment configurations, device settings, and approaches that improve recorder security, and operational efficiency under real fishing conditions. Interest from other potential partners in the fishing community highlights the potential to expand this collaborative, fisher-led monitoring model over a larger spatial scale. A collaborative framework like this, could expand current monitoring efforts and generate valuable year-round data on protected species such as harbour porpoises and minke whales within and outside of the Marine Protected Areas designated for them, while also strengthening relationships between scientists and fishing communities. We will present preliminary findings from the pilot project and recommendations for future fisher-led PAM deployment in Scotland.

Direct science communication from cetacean research

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This research hypothesizes that researcher-led audiovisual summaries increase the public reach of scientific findings. The study and conservation of cetaceans must compete directly in the public and private spheres for the allocation of resources. Communicating the results of scientific research to society is critical in this competition; however, the specific communication efforts of researchers rarely go beyond specialized journals, leaving this responsibility to informal mechanisms of scientific dissemination. All analyses agree that the largest share of scientific information reaches the public through audiovisual media (web and television). It is also well documented that creating and adapting scientific content into audiovisual formats is costly, presents difficulties, and entails serious risks of trivialization—factors that tend to inhibit researchers from producing such material. In the case of cetaceans, there is a large amount of audiovisual content: conservation documentaries explaining their lives and the importance of their protection, and promotional materials for whale watching focused on sustainability. However, these do not reflect the research and scientific effort being carried out. The Institute for Animal Health and Food Safety (IUSA) at the University of Las Palmas de Gran Canaria (ULPGC) has initiated a specific audiovisual outreach line, enabling the accessible presentation of content from scientific articles published in high-impact journals, with the direct collaboration of their authors, following the emerging trend promoted by leading scientific publishers. Here we present the first videos based on articles that show direct results from pathology research in cetaceans, along with the analysis of the first year of direct downloads from the journal Frontiers in Veterinary Science and the number of simultaneous views of the same article on the IUSA-YouTube channel. This has made it possible to demonstrate that, while maintaining the original authors' scientific rigor, it is feasible to facilitate general understanding and double the impact of the article.

Evaluating pinger effectiveness through passive acoustic monitoring of odontocetes interactions with gillnets

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Understanding how odontocetes interact with fishing activities is essential for assessing potential risks and evaluating the effectiveness of mitigation measures such as acoustic deterrent devices (pingers). The objective of this study is to assess the presence of odontocetes near the fishing gear and differentiate detections by type of signal (whistles vs. echolocation clicks), incorporating the effective time the net remains in the water, and evaluating the influence of pinger type on occurrence patterns. These analyses will help refine our understanding of odontocete–fishery interactions and improve the assessment of pinger effectiveness. We analysed odontocete presence and absence using passive acoustic recordings collected with HydroMoth recorders during fishing operations involving three traditional gears used in Galicia (NW Spain): Fixed gillnet (‘Betas’), trammel net (‘Miños’), and sardine drifting gillnet (‘Xeito’). Recordings were obtained from eighty commercial fishing sets, which were equipped alternately with and without pingers, allowing direct comparison of detection patterns. Recordings were inspected through spectrogram visualization to identify whistles and echolocation clicks. For each set, we assessed: (1) the percentage of sets with odontocete presence, (2) the percentage of set time containing detections, and (3) the evolution of presence/absence throughout each fishing trip, particularly relevant for ‘Xeito’, where hauls are short and consecutive. Detections varied across gears and vessels, ranging from 20–30% of sets with pingers and 0–50% without pingers for ‘Betas’ and ‘Miños’, generally representing less than 5% of fishing set duration. For ‘Xeito’, odontocetes were detected in 63 and 60% of hauls with pingers and without pingers, respectively. Once odontocetes appeared within a ‘Xeito’ trip, the presence persisted for two or more consecutive hauls in 66% of the trips with presence, suggesting a consistent short-term spatial association during fishing activity. During the trip, the onboard observer recorded interactions of bottlenose dolphins that damaged fishing nets.

Trophic guilds and niche segregation among cetaceans in the Canary Islands

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The Canary Islands represent a biodiversity hotspot for cetaceans due to their unique oceanographic, geological, and biological characteristics. The convergence of tropical and temperate waters, complex currents, upwelling zones, and steep bathymetry reaching up to 2,000 m creates a highly productive and heterogeneous environment, promoting the coexistence of numerous species within a relatively small area. In this context, niche partitioning emerges as a central mechanism reducing competition among sympatric species and maintaining the high diversity of the community. In this study, a total of 17 cetacean species occurring in the Canary Islands from 2008 to 2024 were analyzed using stable isotope analysis of carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$). The results revealed clear interspecific differences in isotopic values, indicating segregation in prey choice and habitat use, and suggesting complementary strategies that facilitate coexistence. Cluster analysis of 14 species with sufficient samples size was perform and three trophic guilds were identified: a low-trophic guild including Bryde's whale (*Balaenoptera edeni*), the common dolphin (*Delphinus delphis*), the striped dolphin (*Stenella coeruleoalba*), and the Atlantic spotted dolphin (*Stenella frontalis*); a high trophic guild composed of short-finned pilot whales (*Globicephala macrorhynchus*), the goose-beaked whale (*Ziphius cavirostris*), and Blainville's beaked whale (*Mesoplodon densirostris*); and an intermediate trophic guild, composed of two subguilds; one represented by the sperm whale (*Physeter macrocephalus*), the rough-toothed dolphin (*Steno bredanensis*), and the Fraser's dolphin (*Lagenodelphis hosei*); and another composed by the pygmy sperm whale (*Kogia breviceps*), Risso's dolphin (*Grampus griseus*), Gervais's beaked whale (*Mesoplodon europaeus*) and bottlenose dolphin (*Tursiops truncatus*). These findings provide a baseline for cetacean trophic ecology in the Canary Islands and emphasize the need to preserve this unique ecosystem, as habitat loss or increased human impacts could compromise

biodiversity and disrupt the trophic interactions that allow multiple species to coexist in the archipelago.

Nocturnal haul-out behavior of rehabilitated gray seal juveniles (*Halichoerus grypus*) in the Baltic Sea

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Haul-out behavior is a key component of the behavioral ecology of pinnipeds and serves essential resting functions among others. Various intrinsic and extrinsic factors have been shown to determine the occurrence of haul-out events. However, in the Baltic Sea, a non-tidal, semi-enclosed shelf sea, the drivers of haul-out behavior in seals are not well characterized, especially in juveniles. In this study, 14 rehabilitated juvenile gray seals (*Halichoerus grypus*) were equipped with Argos satellite transmitters to enable post-release monitoring and to investigate the spatial and temporal aspects of haul-out behavior. The animals dispersed widely in the Baltic Sea and hauled out along coastal areas that largely overlapped with sites used by wild conspecifics. Seals tended to haul out during evening and night hours, with peak activity occurring after sunset. Both the probability and duration of haul-out events showed a tendency to increase with longer nights. No seasonal patterns or effects of sex or release year were identified. The association between haul-out behavior and night-time suggests a possible link to prey activity patterns, while also leaving room for additional influences such as physiological rhythms or inherited behavioral tendencies shaped by historical hunting pressure. Our findings indicate that such patterns may emerge early in life, independent of prior experience.

Assessing the importance of Ísafjarðardjúp, Iceland for foraging humpback whales

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Identifying areas of critical foraging habitat is essential for the effective conservation and management of migratory marine species such as baleen whales. While Iceland is recognized as an important feeding ground generally for North Atlantic humpback whales (*Megaptera novaeangliae*), the individual importance of small-scale coastal sites within these waters is not well known. Ísafjarðardjúp is a large fjord system in the northwest of Iceland, where humpback whale presence is seasonally high and reportedly increasing. To examine habitat use in this area, a combination of whale-watching trips and land-based drone surveys were used for the collection of photo-ID data. In total, 91 individual humpback whales were identified in Ísafjarðardjúp during June 13-October 9, 2024. Minimum residence time ranged from 1-107 days with a mean of 41.2 days using sighting intervals while lagged identification rates (LIR) estimated a mean residence time of 89.7 days within the fjord system. Interannual resighting rates were also examined and ranged from 0% to 60.3% with a mean of 31.1%. The results were compared to Skjálfandi Bay in northern Iceland, a coastal site already established as being locally important to humpback whales and other cetaceans. Average residence time was found to be much shorter in Skjálfandi Bay compared to Ísafjarðardjúp, ranging from 11.8 days using sighting intervals to 9.14 days using LIR. This study is the first to identify Ísafjarðardjúp as an important small-scale coastal foraging site for humpback whales within Icelandic waters which has management implications given intensifying anthropogenic activity within the fjord system. This study also highlights the necessity of ongoing research to better understand humpback whales' habitat use over time in Ísafjarðardjúp, and as such this project has continued into 2025.

Visual and acoustic surveys of Harbour Propoise in the Kenmare River SAC

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In 2025 funding was obtained from the National Parks and Wildlife Service (NPWS) to conduct three visual and acoustic surveys of the Kenmare River Special Area of Conservation (SAC) part of the EU Natura 2000 network of protected biodiversity sites. The SAC includes both harbour seals (*Phoca vitulina*) and harbour porpoise (*Phocoena phocoena*) designated as qualifying interests, with harbour porpoise recently added in 2024 and not yet included in conservation objectives. This recent addition reflects a national update to harbour porpoise management, where this species is now a qualifying interest in 16 SACs across Irish waters, at a critical time when emerging evidence suggests widespread declines. Three surveys were conducted with a single platform of two observers and a 100m towed array to collect opportunistic acoustic recordings , and drifting buoys with CPODs (2) and Audiomoths with hydrophones (2) deployed temporarily during the survey days. Due to licensing requirements for static acoustic moorings, longer-term deployments were not possible within the available project timeframe. Here we describe survey findings, the challenges associated with the short-term acoustic deployments, and the value of acoustic data for SAC monitoring surveys. We also highlight the urgent need for future studies to better understand the rapid decline in harbour porpoise both within and outside Natura 2000 sites in Ireland. Sustained long term monitoring, particularly including acoustic deployments, is needed to establish baseline occurrence, quantify spatio-temporal variability and support appropriate management of harbour porpoise.

Cetacean strandings on the Scottish coast: coastal accessibility and reporting bias

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Cetacean strandings along the Scottish coast provide valuable insight into mortality patterns, but records of these events may be subject to reporting bias. As strandings are recorded when reported by members of the public, coastal accessibility could affect the likelihood that a stranding event is documented. This study investigated whether such reporting bias is associated with road networks, human population density, and coastal slope. Stranding records were filtered to 3,495 verified events from 2001–2021 across mainland Scotland and surrounding islands. These were initially examined using GIS software in relation to factors such as species population density and oceanic variables, in order to understand the base level of expected strandings. Accessibility and topography variables were then mapped onto a 10 km hexagonal grid. Patterns in stranding density were first explored visually using GIS software, allowing identification of spatial trends and potential reporting biases. These relationships were then quantified using geographically weighted regression to account for spatial heterogeneity. Modelling revealed that regions with higher road-network density generally exhibit higher reported stranding density. This suggests that limited coastal accessibility may contribute to underreporting in more remote areas. By contrast, the relationship between human population and reported strandings was not statistically significant in the models. However, visual analysis indicated a more complex pattern: some highly populated regions coincide with high stranding numbers (e.g., urban coasts), while some low-population areas also show high strandings (e.g., remote islands). No significant effect of coastal slope was detected. These findings indicate that road access influences reporting of strandings, and that the relationship with human population may be spatially complex. Accounting for these biases is essential for accurate assessments of cetacean mortality, distribution, and for informing monitoring and conservation strategies along the Scottish coast.

Understanding the pathology of cetacean entanglement wounds to assess welfare impact.

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There is increasing public, scientific and policy recognition that assessing the welfare consequences of human activities on cetaceans is as important as evaluating traditional metrics such as health, cause of death and population trends. Within this context, a workshop was held at the 35th ECS conference to explore how pathological evidence can inform welfare impact assessments of bycatch and entanglement cases. A pilot Delphi assessment was conducted using a chronic entanglement case, where participants evaluated each entanglement-associated lesion according to four welfare-relevant criteria - pain, functional impairment, sensory disruption and systemic effects – and scored these on a scale of mild, moderate or severe. Entanglement duration was also assessed using standard pathological definitions of acute, subacute and chronic change based on macroscopic findings. Findings from this workshop have since been built on through a PhD to develop a standardised, pathology-informed welfare scoring tool for assessing and categorising the welfare consequences of entanglement. This tool is called the Cetacean Bycatch Injury Impact Scoring (CBIIS) system. It integrates quantifiable pathological attributes observed at necropsy with structured expert elicitation from more than 100 researchers across relevant interdisciplinary fields. In addition, entanglement cases examined by the Scottish Marine Animal Stranding Scheme (SMASS) have been reviewed, incorporating detailed histological interpretation of injury chronicity and its implications for individual welfare. Outcomes from these processes have informed the development of CBIIS as a robust and repeatable welfare scoring framework. This research aligns strongly with the ECS 2026 theme of ‘Basics to Benefits’, combining quantitative and qualitative research methods to produce an innovative tool for evaluating welfare impacts of entanglement at necropsy. The resulting framework has the potential to inform conservation strategies, enhance welfare-centred assessments, and support evidence-based policy development addressing anthropogenic threats to cetaceans.



Frontline: Sensor integration and platform autonomy to investigate the impacts of floating offshore wind via the Celtic Sea Front on cetaceans

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The UK's renewable energy aims include an ambitious target of 4.5GW of floating offshore wind (FLOW) in the Celtic Sea by 2035 and a further 12GW by 2045. To meet these targets, there needs to be planning, consenting and construction at pace and scale. FLOW, like other marine infrastructure projects, will result in a range of impacts on marine ecosystems. In the Celtic Sea, the potential direct and indirect effects on marine predators through changes in the seasonally stratified Celtic Sea front are poorly understood. Frontline, one of two EcoFLOW funded projects, will leverage cutting-edge technology and sensors to support a mechanistic understanding of the front and bottom-up and top-down processes. The front will be surveyed from satellite, digital aerial surveys (DAS) and a multi-sensor equipped autonomous platform. Data on cetaceans will be collected from the DAS but also, for the first time, we will deploy a hydrophone from NERC's Long-range Autosub to trial the method as a novel platform for cetacean data collection. Cetacean data will be collected at multiple spatial scales, over the front and within areas for FLOW development, with concurrent data collection on dynamic ocean physics, biogeochemistry, phyto- and zooplankton biodiversity and forage fish distributions. The use of the Autosub, will also enable an investigation of detection rates spatially, but also with depth and continuously day and night. Further detail of the cetacean sampling plan will be provided. We provide a review of cetacean acoustic monitoring from autonomous platforms to date, to inform development of the execution plan for the Frontline deployments in Autumn 2026. The benefits of dual deployments and data fusion are discussed in the context of addressing future impact assessments in a more holistic manner, rather than through individual receptor (e.g. marine mammals) focussed approaches.

Abundance and distribution of bottlenose dolphins (*Tursiops truncatus*) in the south of Portugal and Gulf of Cadiz

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The southern coast of the Iberian Peninsula, encompassing the Algarve region and the Gulf of Cadiz, is characterized by strong mixing of water masses that create a highly productive environment ideal for the occurrence of bottlenose dolphins (*Tursiops truncatus*), a species that exhibits a widespread distribution, occupying tropical and temperate waters. From 2001 to 2025, an extensive study was conducted, collecting more than 300,000 photographs to create a comprehensive photo-ID catalogue comprising a total of 1,109 individual dolphins, including 509 individuals identified in the south of Portugal and 690 in the Gulf of Cadiz. A preliminary comparison between catalogues shows 68 individuals present in both regions, indicating regular movements and connectivity between the two areas. Regarding spatial distribution, preliminary GAM models showed that depth, slope and sea surface temperature (SST) significantly influenced the occurrence of bottlenose dolphins. The best-performing GAM model (lowest AIC= 2622), which combined spatial smooths (longitude/latitude) with the interaction depth x SST, explained 13% of the deviance. These findings offer valuable insights into the connectivity and habitat use of T. truncatus in these interconnected regions, as well as long-term patterns of abundance and survival. This research also highlights the importance of sustained monitoring and cross-regional collaboration for effective conservation strategies.

Predicting future changes to the distribution of short-beaked common dolphin (*Delphinus delphis*) in the Northeast Atlantic under climate change: consideration towards conservation

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Climate change is reshaping the distribution of marine species, demanding predictive tools to inform adaptive conservation strategies. The present study assesses the current and future habitat suitability of the short-beaked common dolphin (*Delphinus delphis*) in the Northeast Atlantic under contrasting climate emission scenarios. For this purpose, MaxEnt models were developed to estimate habitat suitability over two baseline periods (2000-2010 and 2010-2020), using a set of relevant environmental predictors obtained from Bio-ORACLE and occurrence data from GBIF. Future projections were made for the middle (2040-50) and late-century (2080-2090) for a low- (SSP1-2.6) and intermediate-emission (SSP2-6.0) scenarios. Sea surface temperature, phytoplankton biomass, salinity, dissolved oxygen, and bathymetry were identified as the most influential contributors to model predictions. Projections for mid-century and late-century underSSP1-2.6 and SSP2-6.0 revealed an overall expansion in suitable habitat, particularly in the north of the Azores and offshore the Iberian coast, around the United Kingdom and Ireland, and the emergence of new suitable areas along the Moroccan coast. These spatial changes were more pronounced in late-century projections. Core suitable habitats remained broadly consistent across scenarios, namely around the Azores, the Bay of Biscay, the English Channel and the Iberian slope and shelf region. An overlay analysis with existing Marine Protected Areas (MPA) revealed both overlaps and mismatches, with substantial portions of future suitable areas extending beyond existing MPAs, particularly in open ocean sectors. However, the expansion of suitable areas and their overlap with MPAs will only benefit the conservation of *D. delphis* if species-specific management and conservation measures are implemented. Moreover, the increase in suitable habitat may intensify interactions with human activities, such as marine traffic and fisheries, creating additional conservation challenges in the Northeast Atlantic. This will likely require the development of adaptive strategies to ensure effective protection of *D. delphis* within the study area.

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Advancing management of impulsive noise within harbour porpoise protected areas: reviewing evidence underlying Effective Deterrence Ranges (EDRs)

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Harbour porpoises are readily disturbed by underwater noise from industrial activities, resulting in displacement and disruption of essential behaviours such as foraging and communication. To simplify the assessment and subsequent management of disturbance from impulsive noise sources in harbour porpoise Special Areas of Conservation (SACs), in parts of the UK, agencies recommend the application of default Effective Deterrence Ranges (EDRs) for specific categories of activity (e.g., piling, seismic survey, unexploded ordnance clearance). These EDRs represent the average habitat lost by an individual porpoise and are based on empirical studies of animals' responses or conservative assumptions where such studies are lacking. To inform an update to these default EDRs, we reviewed existing and emerging evidence, prioritising empirical studies that reported direct changes in porpoise vocalisations or distribution linked to noise exposure. We also drew upon both measured and modelled noise data and fixed noise thresholds to estimate distances between noise sources and the predicted onset of behavioural reactions. Our review found that empirical studies on harbour porpoise responses suitable for estimating EDRs remain limited for most noise sources, except for piling. While we were able to refine EDRs for piling, there were challenges associated with inconsistency in the analytical approach between empirical studies. This review enabled refinement of EDRs for several other impulsive noise categories, including some newly considered sources, but these often relied on noise measurement and modelling data, which carried greater uncertainty due to the limited direct evidence of animal responses. Overall, this review highlights the paucity of empirical evidence for a range of noise sources and identifies knowledge gaps that should guide future research priorities. Expanding empirical studies beyond piling will provide a more holistic understanding of the impacts of industrial activities on harbour porpoises.

An assessment of grey seal pup-production using time-lapse cameras and remotely-piloted aerial systems in western Ireland.

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Grey seals, *Halichoerus grypus*, are protected under the EU Habitats Directive and require regular assessments of population status. Pup production estimates are the most reliable method for assessing breeding populations, but in Ireland are less frequent than haulout surveys, with the last estimates now over 10 years old. This represents a significant knowledge gap in assessing the drivers of observed stabilising population counts. Pup production estimates require 5-6 repeat visits to count pups and model overall production. However, autumn/winter breeding on inaccessible offshore islands makes accessing sites challenging. We present the first results of a fixed time-lapse camera network to obtain pup production estimates from only a single visit to pupping sites. Twenty remote transmission cameras were installed on pupping beaches around the first Irish marine national park, Páirc Náisiúnta na Mara, Ciarraí, taking daily images from August 2025 to January 2026, totalling 3060 images. A subset of images were annotated by two observers to account for observer bias and a pup production model run on the daily counts of pups. Preliminary results from 2 cameras within the network gave an estimated 25 unique pups (CI: 95% [24.59-26.08]). Two remotely-piloted aerial system (RPAS) flights over pupping beaches found that a number of pups were not picked up by the fixed cameras due to occurring outside the camera view or being obstructed by rocks. Therefore total pup production is likely to be underestimated. Nevertheless, the fixed camera network still produces robust estimates and identifies peak pupping. This provides improved estimates of the grey seal breeding population, particularly where inclement weather may prevent regular surveys. Results highlight the need to account for fixed-camera error but provide a reliable method for estimating the breeding population across a wider geographic area, with important implications for the conservation and management of the species.

A worldwide spatial and temporal distribution of bacterial communities across captive and wild marine mammals as a proxy of health and welfare

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Understanding the temporal and spatial dynamics of microbial communities in marine mammals is essential for assessing health, welfare, and susceptibility to infectious disease in both free-ranging and captive populations. In this study, we investigated gut microbiome variations across five different marine mammal species sampled in two geographically distinct regions of Mediterranean Sea and West Pacific Ocean, including both free-ranging (Fin whale, n=11; long finned pilot whale, n=5; sperm whale, n=18; Cuvier's Beaked whale, n=1 and Indo Pacific Bottlenose, n=10) and captive individuals (Indo Pacific Bottlenose, n=4). Using 16S rRNA gene sequencing and QIIME2-based microbiome profiling, we characterized spatial patterns of bacterial diversity and examined species- and captivity-associated differences in microbial community structure. Significant distinctions in gut microbiome richness and community composition were detected between geographic regions (PERMANOVA,$p = 5 \times 10^{-6}$) and between captive and free-ranging marine mammals ($p < 0.005$). Species-specific differences were also prominent, with sperm whale and Indo Pacific bottlenose exhibiting markedly divergent microbial profiles ($p = 6 \times 10^{-6}$). Indo Pacific bottlenose, particularly, displayed the lowest bacterial taxonomic richness among all species analyzed. Taxonomic patterns further reflected strong environmental and management influences: in the free-ranging dolphins from West Pacific Ocean, Fusobacteria dominated, whereas captive individuals showed Firmicutes as the most abundant phylum. In contrast, in the free-ranging cetaceans from Mediterranean Sea exhibited more diverse community structures, dominated by Firmicutes, Proteobacteria, Cyanobacteria, and Actinobacteria. These results highlight a clear geographical, ecological, and species-specific signatures in marine mammal microbiomes, underscoring the importance of integrating microbial assessments into ongoing health and welfare monitoring. By establishing baseline spatial and captivity-associated microbiome patterns, this work contributes to improved standard operating procedures for health assessments and informs welfare-oriented management of both wild and captive marine mammals.

Royal fish, sea monsters, and the great Leviathan: The relationship between humans and whales in seventeenth century England

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The relationship between humans and whales has been transforming for centuries. The early modern English had varying and sometimes conflicting views of whales, considering them “royal fish,” useful commodities, and preternatural beings. Using qualitative analysis of accessible historical records including logbooks, pamphlets, journals, and legal documents, this study uncovers the multi-faceted way in which whales were perceived in seventeenth-century England – a time in which England was among the first nations to capitalize on the development of a commercial whaling industry. This work analyzes the role whales played both in the distant Arctic seas and along English shores. It investigates mariners’ shifting attitudes toward whales during the development of early English whaling, analyzes their role in legal disputes – particularly in the Crown’s claim to the foreshore – and explores the varied responses to whales stranded ashore. What is revealed is that the tie between humans and whales has always been far more complex and dynamic than a simple predator-prey interaction. Furthermore, this research seeks to not only reinsert whales into our understanding of early modern England, but also to provide a lens through which we can reevaluate our past and current relationship with these “wonderous” marine mammals. Though this work may not study extant whale populations, its historical perspective holds contemporary value. Examining how earlier societies interpreted, used, and responded to whales helps us understand some of the historical foundations of today’s human-whale relationship. Historical research can be an important tool for conservation, allowing us to identify long-term patterns in human behavior, question inherited assumptions, and better understand the sociohistorical factors that shape modern conservation efforts to protect these remarkable animals.

Preliminary assessment of the risk of small-vessel traffic approaching fin whales in a Special Area of Conservation in the Strait of Gibraltar (Spain)

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The Eastern Strait Special Area of Conservation (SAC; ES6120032) is an essential coastal migration corridor for fin whales (*Balaenoptera physalus*), used during their departure to the Atlantic Ocean in late spring and summer. No large ships or ferries transit this area, but there is intense recreational and fishing boat activity, which creates a critical overlap between cetaceans and small vessel traffic. All observations were made from a fixed point on the coast (36.160396, –5.338104) using binoculars with a rangefinder, recording every vessel that approached within 60 m — a distance strictly regulated by Royal Decree 1727/2007, which establishes measures for the protection of cetaceans in Spain— in a study conducted between May and August for two consecutive years (2024 and 2025). There were 94 sightings of fin whales, totalling 197 individuals; in 47 of these sightings, at least one vessel was recorded within 60 metres. Of 120 boats that approached within < 60 m, 27.5% overran the fin whale (direct spatial overlap without inferring physical collision). The risk varied significantly depending on the type of vessel: jet skis (90.9%), recreational motorboats (27.6%), motor sailboats (30%) and official vessels (50%). Speed was the most decisive predictor: 4% below 4 knots, 40% above 4 knots and 81.8% above 8 knots. Frontal, perpendicular, circular or rear approaches generated between 47–100% of events. Voluntary approaches showed a risk of 52.4% compared to 14.1% for involuntary approaches. These results show that, even within a SAC, fin whales are highly exposed to critical overlaps with light vessels. The patterns observed support the urgent implementation of speed limits (<4 knots) and reinforce the need to implement active surveillance programmes and effective regulatory compliance mechanisms.

Scoping a UK marine mammal forum to facilitate strategic coordination of efforts across marine mammal research in the UK

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The UK is fortunate to have an active and diverse community of marine mammal researchers, conservation practitioners, and volunteer observers who collectively generate a rich evidence base. This breadth of activity presents significant opportunities for collaboration and innovation however, opportunities for extended communication across regions and organisations are often limited. Thus, a UK-wide mechanism to connect these efforts more closely has the potential to enhance data accessibility, encourage methodological alignment, and support more efficient and impactful science and policy. To address this, JNCC delivered two projects under Year 3 of the marine Nature Capital and Ecosystem Assessment (mNCEA) programme mapping out the range of marine mammal data collectors in the UK, and scoping appetite and feasibility of a UK-wide forum for marine mammal science. JNCC worked with Mindfully Wired to convene an online scoping workshop which engaged key stakeholders and co-designed the purpose and structure of a potential Marine Mammal Forum. Participants identified essential ('Bronze') and enhanced ('Silver'/'Gold') forum functions, with a strong consensus for a central coordinated network that would "provide a central, coordinated network of marine mammal experts, which maximises its impact and reach by transmitting information, knowledge, expertise, and advice to those able to enact change." Four high-level objectives were agreed focussing on harmonising existing work, addressing priority knowledge gaps, and better utilising existing information in marine mammal policy. Building on the outcomes of the workshop, Mindfully Wired is now working with partners to provide greater clarity on membership, governance, and core functions, and begin to demonstrate how a UK-wide network could add value in practice. To enable the forum to progress from concept to implementation, sustained funding, resourcing and clear ownership with government partners needs to be secured.

Will they disappear? Population viability analysis of a small resident population of common bottlenose dolphins in mainland Portugal

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The Sado Estuary, Portugal, is home to a small resident population of common bottlenose dolphins (*Tursiops truncatus*). Over the past four decades, photo ID surveys have shown that the population is declining (from 42 animals in 1989 to 22 currently). Understanding the severity of this decline is paramount for effective conservation efforts to manage this population. Here, we did a population viability analysis based on 43 years of photo identification data (1981-2024). To inform it, we estimated mean fecundity rates (expected number of births per female per year) and age-based mortality (using a Kaplan-Meier estimator and a Siller Model) for the population. Additionally, for comparison, we used mortality parameters estimated for the Barataria Bay population. From those estimated parameters, we performed 1000 individual-based simulations of the population over the next 200 years, accounting for all known individuals currently alive, simulating deaths and births (in the case of females) for each individual. Birthed individuals were added as new entries in the population and their life was simulated the same way as for the real population. All simulations showed a decreasing trend in population size over time, with a proportion of extinction in the 200 simulated years varying from 95.9%, using a Kaplan-Meier age-based mortality estimator, to 99.9%, using the Barataria Bay estimated parameters. Our results show how vulnerable this population is, highlighting the importance of individual based approaches in cases where the population sizes are low, simulating trends accounting for each individual. Our results point to an alarming population trend. This, coupled with these animals inhabiting an estuary characterized by multiple sources of contamination and increasing human pressures, adds to the urgency of conservation measures to prevent their extinction. Whether or not we will still be able to avoid their extinction by improving survival and/or fecundity remains uncertain.

Harbour porpoise responses to unabated impact pile driving at an offshore wind farm on Dogger Bank, North Sea

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Harbour porpoises (*Phocoena phocoena*) are disturbed by underwater noise from impact piling during construction of offshore wind farms, with multiple studies reporting displacement of porpoise up to 10-20 km from piling. However, data from UK waters of the southern North Sea and from large monopiles installed without noise abatement measures is currently limited. A robust understanding of displacement effects is essential to assessing and managing cumulative effects of wind farm construction and informing marine noise policy development. Here, we build on existing studies to assess porpoise responses to unabated piling of monopile foundations at the Dogger Bank C offshore windfarm, adjacent to the Southern North Sea Special Area of Conservation (SAC) for harbour porpoise. An array of 27 passive acoustic monitoring moorings was deployed across an area up to 60 km from piling locations. All moorings were equipped with an echolocation click logger (CPOD), with eight moorings also having a broadband acoustic recorder for sampling raw acoustic data, including piling noise. The monitoring period was 5.5 months long and overlapped with foundation installation activities at three adjacent offshore windfarms. The probability of porpoises responding to impact piling was modelled as a function of distance from the piling location, vessel presence and other covariates. Responses to piling were assessed by calculating the proportional changes in porpoise acoustic presence during a 12-hour response period and a temporally-matched baseline period 48 hours before piling. The broadband acoustic data were used to extract pile driving noise and apply a porpoise auditory weighted filter to identify a truncation distance beyond which pile driving pulses are unlikely to be distinguishable from ambient noise. This study provides key data specific to large, unabated monopiles and the UK-portion of the southern North Sea to inform noise management within harbour porpoise SACs, including the estimation of effective deterrence ranges.

Drivers of mixed species groups off the coast of the Algarve: A common dolphin's (*Delphinus delphis*) point of view

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A Mixed Species Group (MSGs) occurs when two or more species join, forming almost one group temporarily, and it is a common event in many species of animals, including cetaceans. The possible drivers of the formation of MSGs are protection from predators, higher foraging success or social advantages. The common dolphin is one of the most sighted cetacean species along the coast of the Algarve, but there is still a lack of information about its ecology and behaviour. In this study, we aim to evaluate the importance of MSGs formation on the ecology of common dolphins (*Delphinus delphis*), off the coast of Faro, investigating if there are certain behaviours that are connected to these interactions. We analysed 2046 observations, recorded during dedicated surveys following random transects, and platforms of opportunity – whale watching vessels – between 2019 and 2025. There were 242 sightings of MSGs, mostly formed with *Balaenoptera edeni*, *Stenella coeruleoalba* and *Balaenoptera physalus*. We focused our analysis on the general behaviour of the species encountered, to evaluate if there is a relation between behaviours and the occurrence of MSGs. Feeding represented 56% of behaviours during MSG events, compared to 41.2% outside MSG. Traveling behaviour was more frequent in non-MSG sightings (29.8%), while socializing and other behaviours appeared almost exclusively outside MSG contexts. These preliminary results suggest that MSG formations are primarily associated with feeding, supporting the hypothesis that common dolphins form MSGs to increase foraging success. Additionally, this study highlights the importance of the study area for foraging activities of, not only common dolphin, but also other cetaceans.

Modelling cetacean distribution in the Cabo Verde archipelago – Predictions for conservation and management

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Despite being crucial marine top predators, cetacean distribution and habitat preferences remain poorly understood in many understudied oceanic regions. Although the Cabo Verde archipelago has seen limited cetacean surveys, they have shown it to be an important hotspot in the Atlantic Ocean. These surveys, however, have been insufficient to understand the distribution and niche preferences of local species, which hampers conservation efforts. This study collated 1,550 validated sighting records of 23 cetacean species, over a 25-year period (2000 to 2024), representing the largest cetacean sighting dataset ever compiled for Cabo Verdean waters. It is also the first study to model cetacean distribution in this region using species distribution models. Humpback whale, rough-toothed dolphin, short-finned pilot whale, pantropical spotted dolphin, and common bottlenose dolphin were selected to develop ensemble models capable of predicting their potential and current distribution. Coastal waters near the eastern islands were identified as critical habitats for humpback whales and rough-toothed dolphins, while pilot whales preferred shelf edges and seamounts. Spotted and bottlenose dolphins showed strong affinities for coastal waters throughout the archipelago. The models offer novel insights into cetacean ecology in this region. These results can inform marine spatial planning and guide future ecological research to improve cetacean conservation in Cabo Verde and West Africa.

Chemical contamination and conservation implications for harbour porpoises (*Phocoena phocoena*) from two management units in the north-east Atlantic

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The harbour porpoise (*Phocoena phocoena*) is one of the most abundant and coastal cetacean species in the north-east Atlantic, with different management units defined. Together with bycatch, chemical contamination is one of the species' major threats in this area. This study investigates the spatial and temporal patterns of chemical contamination in trace elements and persistent organic pollutants in male harbour porpoises belonging to two management units (MUs) off the French Atlantic coast: the North Sea (NS) and the Celtic and Irish Seas (CIS). A total of 143 porpoises that stranded between 2000 and 2022 were analysed for this purpose. Significant regional variations were observed, with porpoises from the NS exhibiting higher concentrations for most of the contaminants considered (e.g. Hg, Se, Zn, PCBs, PBDEs). Analysis of POP profiles revealed region-specific contamination signatures, with porpoises from the NS dominated by highly chlorinated PCB congeners. Toxicity thresholds were mainly exceeded for PCBs, especially in NS porpoises, for which total TEQ values were also significantly higher than in the CIS unit. Conversely, detoxification markers (Se:Hg ratio) indicated a physiological capacity for metal regulation in both MUs. Although dynamic linear models revealed no significant temporal trends, probabilistic outputs suggested increasing concentrations of several contaminants (e.g. ΣFurans in CIS, and ΣPCBs and ΣHCHs) in NS porpoises, and decreasing trends of ΣPBDEs in CIS individuals. Our results highlight contrasting vulnerabilities between porpoises from the two MUs. While NS porpoises appear to be particularly sensitive to chemical contamination, it is the CIS population that was described to have declined by around 40% between 2005 and 2016. Thus, our results support the hypothesis that the latter population is probably more threatened by the risk of bycatch, for instance, than by contamination effects. Results also emphasize the need to adapt conservation strategies to the specific threats facing each MU.

Seven years of sightings: long-term monitoring research of bottlenose dolphins in the Calabrian Ionian Sea, Central Eastern Mediterranean (2019-2025)

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Knowledge regarding the distribution and ecology of cetaceans in the Central Mediterranean is still fragmented, particularly in the southern sector of the Italian Ionian Sea. Bottlenose dolphins (*Tursiops truncatus*) are a key coastal species, and their presence is an indicator of coastal marine habitat health. This study presents the analysis of a seven-year, long-term monitoring effort aimed at filling the knowledge gap concerning the frequency and presence dynamics of this species along the Calabrian Ionian coast between Brancaleone (RC) and Botricello (CZ). Monitoring campaigns were conducted through dedicated vessel research surveys (effort-based surveying), which began in 2019 and continued through 2025. Effort-based surveying and Photo-Identification (Photo-ID) were utilized to estimate the Encounter Rate (ER) and characterize presence dynamics. Data concerning presence and the specific behaviours recorded were geo-referenced and correlated with bathymetric variables, given the proximity of the continental shelf to the shore in this study area. The data collected over seven years confirm that the Calabrian Ionian Sea represents a critical habitat for the bottlenose dolphin's population. The Encounter Rate (ER) and the high recurrence of sightings emphasize the urgent need to implement specific management and conservation measures for the area, possibly through the establishment of a Special Area of Conservation (SAC) in the area with the highest encounter rate, in line with Natura 2000 network objectives.

Humpback whale song and El Niño-Southern Oscillation (ENSO) forcing drive an austral breeding-ground soundscape

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Soundscapes play a crucial role in shaping animal behaviour and survival strategies, varying dynamically across spatial and temporal scales. Every austral winter (July to September), the New Caledonian humpback whale population migrates from Antarctic feeding grounds to the South Lagoon, a key breeding and calving site, where males sing elaborate acoustic displays. Previous studies in other locations have shown that humpback whale vocal behaviour responds to environmental drivers, including weather. For example, vocalisation source levels increase with rising wind-dependent noise, and song units shorten, increasing overall song "tempo." However, little is known about how rapid climate-driven changes in the South Lagoon may affect male vocal behaviour during this critical period of song learning and breeding time. Here, we quantified temporal variation in the soundscape, identified major sound sources, and explored their potential influence on humpback whale singing behaviour using austral-winter acoustic recordings from the South Lagoon collected over eight years (2018-2025). We found that humpback whale song is a major contributor to the winter soundscape, with a seasonal peak in August. The El Niño-Southern Oscillation (ENSO) index also emerged as a key driver of soundscape variability, modulating the contributions of wind, rain, and humpback whales. During years with positive ENSO index (La Niña), the absolute contributions of humpback whales were lower, whereas the absolute contributions from wind were higher. Rain also reduced humpback whale acoustic contributions. La Niña episodes are known to shift cyclone genesis zones closer to New Caledonia, increasing water temperature, rainfall, and consequently river runoff in the region. We therefore hypothesise that humpback whales may avoid the South Lagoon in response to these conditions. In a relatively remote subtropical lagoon with limited anthropogenic noise, our findings provide new evidence that climate-driven environmental variability shapes both short- and long-term patterns in humpback whale behaviour and habitat use.

Reproductive state influences female social network structure in wild bottlenose dolphins

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Social relationships play a fundamental role in the fitness and reproductive strategies of long-lived mammals, yet the extent to which social behaviour varies across the female reproductive cycle remains poorly understood. Female bottlenose dolphins (*Tursiops truncatus*) experience marked changes in energetic demands and socio-ecological trade-offs when transitioning between receptive, pregnant, and lactating states, which may in turn shape their patterns of sociality. In this study, we examined how reproductive status influences individual social network position in a free-ranging population monitored continuously over a 12-year period through boat-based surveys and photo-identification. Annual association networks were reconstructed using group co-occurrences, and we quantified multiple network measures, including association strength, affinity, eigenvector centrality, and local clustering. Bayesian generalised linear mixed models were used to assess the effects of reproductive status on each network metric while accounting for repeated measures and ecological covariates. Our findings indicate that reproductive state influences multiple dimensions of female sociability, suggesting that females adapt their social strategies in response to changing energetic demands, calf-care requirements, or mating opportunities. These results highlight the importance of considering reproductive physiology when studying social structure and provide new insights into the behavioural flexibility of female bottlenose dolphins. More broadly, this work contributes to our understanding of how life-history cycles shape social network dynamics in long-lived marine mammals.

Integrating the migratory ecology of the Southern right whale with the expansion of offshore wind energy

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This preliminary study gathers knowledge about the migratory ecology of the Southern Right Whale (*Eubalaena australis*) and its relationship with environmental management, serving as an initial scientific basis for the satellite telemetry project to be carried out between July 2026 and June 2027. Its general objective is to anticipate the potential conflict between the species' migratory routes and the planned expansion of offshore wind energy in the Western South Atlantic, in a context of new regulations for wind energy licensing in Brazil, which demands greater integration between science, planning, and decision-making. Specific objectives include: (i) identifying, through literature, the spatial and temporal consistency of migratory routes and connectivity corridors; (ii) recognizing stopover areas, intensive use areas, and critical seasonal windows that may coincide with wind farm planning zones; (iii) preliminarily mapping the overlap between the species' preferred habitats and regions designated for wind energy development. The central hypothesis is that the high predictability of migratory routes intensifies the species' vulnerability to acoustic and physical The importance of knowing the route of the southern right whale disturbances associated with offshore wind projects, especially where these corridors exhibit high interannual consistency and overlap with priority regions for wind farm installation. The literature review conducted to date reveals recurring migratory routes, stopover areas coinciding with energy planning zones, and defined temporal patterns of approach to breeding areas, indicating critical windows of sensitivity. These findings provide a technical basis for guiding mitigation measures, improving public policies, and enhancing environmental licensing. Furthermore, they structure the use of an innovative application of existing technology, combining satellite telemetry, connectivity analyses, and spatial scenarios of wind expansion, preparing for the execution of the complete project in 2026 and contributing to the goals of the Decade of Ocean Science.

Automatic real-time GPS tracking of tagged cetaceans to conduct controlled exposure experimental protocols at sea

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In addition to recording whale behaviour, animal-attached tags enable real-time tracking of a focal experimental subject – required for positioning a sound source to achieve a desired exposure design in behavioural response study (BRS). Tracking has typically been accomplished with visual observers spotting the tagged whale and recording its range and bearing. Here we describe an automatic system for near real-time GPS tracking of multiple tagged whales, accomplished by intercepting satellite transmissions from a Lotek F6G 149 series GPS-Argos unit attached to a whale within a suction-cup multisensor tag. Testing and refinement demonstrated tracking of killer whales (*Orcinus orca*) and humpback whales (*Megaptera novaeangliae*) to the horizon, and confirmed the benefit of specific tag placement flat on the body between the blowhole and dorsal fin. With receiving antennas placed 23m above sea level, positions were reliably received <10 min after they were recorded on the whale out to distances up to 17km - the distance to the horizon, and at a somewhat slower rate at even greater distances. A Matlab program ”CEE Tool” was developed to plot automatic GPS positions and plan vessel movements in the 3S4 sonar experiments. Using this system, we were able to carry out a challenging experimental protocol which required two approaches to within 1km of each tagged whale subject over an 8hr period, while maintaining a distance of ~10km between approaches. A publicly-available PAMGuard module to plot GPS locations is also available to support smaller scale experimental efforts. Automatic GPS tracking represents a fundamental advance that enables at-sea experiments with marine mammals to be conducted without continuous visual tracking, substantially lowering cost and expanding contexts in which playback or controlled exposure experiments (CEEs) can be conducted.

Turn down ocean noise: Recommendations for reducing anthropogenic underwater noise and its impacts to cetaceans

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Noise pollution poses one of the most widespread and poorly managed threats to cetaceans and is a major factor undermining the effectiveness of cetacean Marine Protected Areas (MPAs) for conservation. Offshore industrial activity has rapidly expanded globally, increasing the amount and intensity of underwater noise, and introducing new noise sources of which the impacts are not yet fully understood. While considerable scientific progress has been made, knowledge gaps remain, particularly regarding the long-term and cumulative impacts of noise on individual cetaceans and populations. How can we change this? A 2025 report by WDC in collaboration with SAMS Enterprise highlighted a series of recommendations for stakeholders to help reduce anthropogenic noise impacts for cetaceans and fill evidence gaps. This report provides an updated review of scientific literature on the impacts of both established and emerging noise sources. It draws examples from global research and regulatory practices, providing particular focus on UK regulations and policy, but the recommendations are also relevant to international efforts to better manage underwater noise pollution. The report provides clear, actionable recommendations to improve the protection of cetaceans from underwater noise. These include to 1) Implement effective, biologically relevant noise limits for noise-producing activities; 2) Integrate restrictions on noisy, high-impact activities into management plans for MPAs; 3) Invest in innovation and alternative techniques to reduce noise from offshore construction; 4) Commit to long-term, large-scale cetacean and noise monitoring at all development stages to assess cumulative impacts. By implementing the recommendations in this report, policymakers, industry, researchers and NGOs can work towards reducing the impacts of noise, ensuring that the effective protection of species is prioritised alongside economic growth, energy security and climate goals. It is important that we take decisive action now to safeguard cetacean populations and contribute to the long-term health and resilience of the ocean.



Regional and international collaboration enables a range-wide distribution and status update for the critically endangered Atlantic humpback dolphin

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The last range-wide description of the status and distribution of the Atlantic humpback dolphin (*Sousa teuszii*) was conducted in 2015, leading to the species' uplisting on the International Union for the Conservation of Nature's (IUCN) Red List from Vulnerable to Critically Endangered in 2017. The Red List assessment, alongside recommendations for action from the IUCN, the International Whaling Commission and the Convention on Migratory Species, catalysed international and regional collaboration at multiple scales. Increased awareness and funding have supported systematic boat-based research in four countries, standardized interview surveys in eight countries, and the formation of multiple local, national and regional marine mammal and fisheries reporting networks. Here we present new information on Atlantic humpback dolphin relative abundance, distribution, and threats, compiled throughout the species' range in the last decade, providing valuable new information on the conservation status of the species. Knowledge gaps that have been addressed include the first confirmed record of the species in Sierra Leone, as well as citizen-science-based sighting, stranding and bycatch records in countries where dedicated systematic cetacean research is still limited or non-existent. These records help to address the basic question of species presence and inspire and inform further research efforts. In a few countries, like Senegal, Guinea, Gabon and Congo, multiple years of interview-, boat-, and beach-based research using photo-identification, water parameter measurements, and passive acoustic monitoring are beginning to yield insights into relative and absolute abundance, fine-scale distribution and habitat use. These studies also provide insight into threats from fisheries and habitat degradation from coastal development, mining and port construction. Mark-recapture analyses, habitat modelling, the development of acoustic species classifiers, and bycatch risk assessments are ongoing, and directly inform conservation management strategies – thus creating multiple benefits for range-country scientists, NGOs, managers, and the dolphins themselves.

First steps towards an acoustic catalogue of Mysticete sounds from the Canary Islands.

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The Canary Islands are a key migratory corridor and seasonal habitat for baleen whales in the Northeast Atlantic, with at least seven species visually recorded. Despite their ecological importance, knowledge of mysticete acoustic presence and behaviour in the archipelago remains scarce. As part of the agreement between Promotur and the University of La Laguna along with the Spanish Oceanographic Institute to promote sustainable blue tourism and long-term marine conservation, we present the first steps towards building an acoustic catalogue of baleen whale vocalizations in the region. This initial phase identifies and compiles mid- to low-frequency calls (<3 kHz) recorded using a passive acoustic monitoring (PAM) system moored on the submarine volcano Tagoro (127 m depth), south of El Hierro. Results come from 47 days of recordings (96 kHz sampling rate; 1124 hours total) during three deployments carried out in October–November 2016, December 2023–January 2024, and November–December 2024. Species-specific call types were manually identified through spectrogram visual inspection. To date, the catalogue confirms the presence of at least six baleen whale species around El Hierro: blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), sei whale (*B. borealis*), Bryde's whale (*B. edeni*), humpback whale (*Megaptera novaeangliae*), and potentially North Atlantic right whale (*Eubalaena glacialis*). Key vocalizations include blue whale A–B calls, fin whale 20-Hz and double-pulse calls, sei whale downsweeps, Bryde's whale Be3 calls, and humpback whale calls. The ongoing project will expand this framework by deploying a network of acoustic sampling stations across nine marine reserves of the Natura 2000 Network, enabling continuous PAM coverage across the archipelago for the first time. These results will provide the baseline for applying PAM of mysticetes in the area in a synergy with blue tourism operators to promote a more sustainable tourism and conservational efforts in the area.

The value of citizen science in assessing dolphin distribution: A case study on bottlenose dolphins (*Tursiops truncatus*) in Thyborøn, Denmark

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Observational data on a small group of bottlenose dolphins (*Tursiops truncatus*) collected by dolphin safari guides from Jyllandsakvariet in Thyborøn, Denmark, provide a valuable opportunity to evaluate the spatial and temporal distribution of this local dolphin group. This study compares the citizen science records (n = 157 dolphin tours) with systematic researcher observations (n = 56 observation hours) to assess the reliability of citizen science for identifying distribution patterns and its potential as a complementary and cost-effective monitoring tool for coastal dolphins. We hypothesised that both datasets would reveal consistent habitat-use patterns, with dolphins showing preferences for specific areas. Minor discrepancies were anticipated due to differences in survey effort and observation conditions. Dolphin sightings were recorded across eleven predefined habitat zones during August and September 2025, with guides reporting the zones in which dolphins were encountered during each tour. The research vessel collected GPS-tracked behavioural data at two points per minute, which were downsampled to one point per zone per hour to avoid autocorrelation. Thus, if dolphins were observed in the same zone across consecutive hours, each hour contributed a separate point. Overall, both datasets revealed broadly similar spatial and temporal distribution patterns, despite some variation between zones and datasets. This ongoing project will continue through 2027 to refine data collection methods and strengthen collaboration between researchers and citizen observers. Our findings demonstrate that structured citizen science initiatives can yield reliable and cost-effective data for monitoring the distribution of coastal dolphins, underscoring their potential as a valuable complement to traditional research approaches.

Seeing scars: UAV-based identification of Risso's dolphins

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Photo-identification is a non-invasive technique that has been used to monitor cetacean populations since the 1970s. For Risso's dolphins (*Grampus griseus*), photo-ID has more recently been employed to investigate site fidelity in the Azores, Mediterranean and UK. Individuals can be recognised by their distinctive scarring, variable dorsal fin shapes and nicks, making Risso's dolphins well suited to this method. Robust photo-ID datasets can provide important insights into population structure and habitat use, but traditional boat-based surveys risk causing disturbance and are often limited for this species by animal avoidance. Drones, or unmanned aerial vehicles (UAVs), have been increasingly used in marine mammal research since 2010. However, the use of drone imagery for individual identification remains largely limited to large whale species. This study explores the suitability of aerial imagery for identifying individual Risso's dolphins using a DJI Mavic Pro 3 deployed during land-based surveys around Bardsey Island, off the Llŷn Peninsula in northwest Wales. Imagery was collected during encounters with groups close to shore, and video stills were assessed for identification suitability based on clarity, angle, and visibility of dorsal fin morphology and scarring. Between June and September in 2024 and 2025, 68 confirmed Risso's dolphin sightings were recorded, with UAV imagery obtained for 22 encounters. Aerial images allowed reliable identification of 72 individuals, 12 of which were resighted at least once within the same year and two of which were imaged in both years. Behavioural monitoring indicated no disturbance associated with drone presence. These findings demonstrate that consumer UAVs offer an effective and less invasive method for obtaining photo-ID imagery of Risso's dolphins, though the approach is not without limitations. Lower image quality compared to DSLR cameras, limited battery life, and reliance on close coastal encounters all constrained data collection.

Past, present and future of cetacean rehabilitation: Assessing the viability of cetacean rehabilitation in the UK based on global professional opinion

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Cetacean stranding events are projected to increase, raising questions about the ethical and scientific viability of rehabilitation as a management strategy in the UK. This study explored practitioner perspectives through qualitative interviews with experts involved in stranding response and cetacean care, analysed thematically against the historical and current literature. Four key themes emerged: diagnostic uncertainty, gaps in governmental responsibility, ethical tensions surrounding rehabilitation, and the need for future frameworks. Respondents consistently prioritised individual welfare, emphasising health, stress reduction, and likelihood of survival, over conservation status or public perception. However, the absence of diagnostic tools, limited post-release monitoring, and reliance on under-resourced NGOs undermine decision-making and outcomes. Rehabilitation was generally regarded as ethically contentious: participants supported short-term holding under specific conditions (e.g., stabilisation or unsafe refloat scenarios) but rejected long-term captivity, particularly for dependent calves where survival prospects remain poor. The findings indicate that while short-term rehabilitation may have targeted welfare value, current UK policy lacks the leadership, infrastructure, and evidence base required to justify widespread adoption. A viable framework would require restrictive admission criteria, robust outcome monitoring, and minimum standards for funding, staffing, and facilities to avoid repeating the ethically problematic practices of past captivity models. Until such safeguards and evidence exist, reliance on refloat-euthanise protocols remains dominant. Nevertheless, the potential for welfare improvements through carefully designed short-term rehabilitation warrants further empirical investigation, alongside clearer policy to ensure stranding responses are both scientifically defensible and ethically robust.

National health and disease surveillance of marine mammals in Sweden

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In 2020, an expanded health and disease surveillance program for marine mammals was launched, jointly delivered by Swedish Veterinary Agency (SVA) and the Swedish Museum of Natural History (NRM), funded by the Swedish Agency for Marine and water Management (SwAM). This program is a part of Sweden's environmental monitoring and provides knowledge on health status, diseases, cause of death and other threats to seals and porpoises to inform management and protection of these populations. These marine mammals serve as sentinels for the health of their populations and marine environments. Here we provide a brief overview of this program and results from animals examined at SVA between 2020-2025. Stranded seals with unknown cause of death are examined by SVA. Stranded and bycaught porpoises are examined together with NRM at SVA. Carcasses are transported from the field for necropsies. Data and organ samples are collected, archived and available for research. Targeted surveillance for Influenza A virus, morbilliviruses, and bacterial culture of lung is performed. Since 2020, 339 marine mammals have been examined at SVA: Harbour porpoises (*Phocoena phocoena*) (n=203), grey seals (*Halichoerus grypus*) (n=65), harbour seals (*Phoca vitulina*), (n=66), and five ringed seals (*Pusa hispida*). The most common cause of death for porpoises was bycatch (n=107), the majority were calves or juveniles. Regarding adults only, infectious diseases caused by parasites and/or bacteria were the most common (n=24). Additionally, eight cases of birth complications were diagnosed. Half of the seals died from infectious diseases (n=35) and various types of traumas (n=33). Young seals often were emaciated (n=31). Fourteen young seals had severe infestation of trematodes, causing death in eight individuals. Six mature grey seals died due to intestinal volvulus. This expanded surveillance program operates continuously to identify trends in marine mammal health and ecosystem status and monitor presence of zoonoses.

Gone with the tide: In situ decomposition and tracking of mass stranded long-finned pilot whales (*Globicephala melas*) in remote coastal locations

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The management of mass stranding events (MSEs) in remote, resource-limited locations presents significant logistical and financial challenges. On 10th August 2025, 23 long-finned pilot whale carcasses were discovered at The Riv, Sanday, Orkney, 13 months after a larger MSE at Tresness, Sanday (11th July 2024, 77 individuals) where carcasses were buried on farmland following consultation with strandings experts, Orkney Islands Council, county archaeologist, SEPA, NatureScot and local landowners. The 2025 MSE location on Sanday's north-east coast was inaccessible to both plant machinery and boats, rendering traditional disposal methods (mechanical removal, burial, or transportation) physically impossible. Combined with the site's remoteness and minimal public health risk due to low human activity, carcasses were left in situ for natural decomposition providing an opportunistic research framework to record decomposition rates in temperate coastal conditions and track carcass movement dynamics. Regular monitoring through the remainder of 2025 documented carcase fate using photographic records and GPS positioning. Results showed that the majority of carcasses were naturally removed by tidal action and returned to sea, while remaining specimens exhibited significant positional changes around the island and beyond. Carcase tracking revealed valuable insights into local current patterns and coastal sediment transport processes. Natural decomposition proved ecologically beneficial, providing substantial nutrient input to the coastal ecosystem and serving as an important food resource for scavenging species. This case study demonstrates that in situ decomposition represents a cost-effective, logistically practical, and environmentally sound disposal method for mass strandings in remote locations. We recommend this approach be considered as a viable management option where site conditions, access limitations, and low public interaction permit, with concurrent scientific monitoring to maximise conservation and oceanographic insights from these events.

Blue and fin whale habitat suitability and niche overlap in the Northeast Atlantic Ocean

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identification of suitable areas for threatened species is imperative for their conservation and to anticipate future impacts. The present study focused on the habitat suitability of blue (*Balaenoptera musculus*) and fin (*Balaenoptera physalus*) whales in the Northeast Atlantic waters. To this end, we used species occurrence data collected by five distinct sources (from 2014 to 2020) and environmental predictors to fit ecological niche models (MaxEnt) across seasons and ascertain whether their niches spatially overlap seasonally. The most important variables were depth, sea surface temperature, and mixed layer thickness, which exhibited seasonal variability and were likely associated with variations in prey availability. The habitat suitability of blue and fin whales overlapped during all seasons, a phenomenon concomitant with the documented use of the study area by these species as a feeding ground and a migratory corridor during their annual movements towards higher and lower latitudes. The overlap patterns suggest the potential for coexistence or competition for resources between the two species. Furthermore, there is a possibility that they may ultimately use the same areas for reproduction during the late fall and winter seasons. This study provides significant insights into the habitat suitability of two threatened species in a wide area used during migrations, thereby supporting conservation and management efforts.

Site fidelity and local abundance of harbour seals in the Firth of Forth, Scotland

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Harbour seals (*Phoca vitulina*) are an important species in the marine ecosystems around the UK, particularly in Scotland. East coast harbour seals have seen some dramatic declines in abundance but have become well established in the Firth of Forth although numbers are unknown. This study assessed site fidelity patterns and abundance using photo-identification and mark-recapture analysis at East Wemyss, West Wemyss and Seafield Tower in the Firth of Forth, used by harbour seals for hauling out and breeding. Data were collected from June to October 2023, with 24 land-based surveys conducted to count and photograph all seals present at each site. Eighty adult seals were identified using their distinct pelage patterns, and local abundance across all three sites was estimated at 82 (95% CI 80-89) individuals using closed population mark-recapture models. Individual resighting rates were high, with 82% of individuals being sighted more than once, and the average number of sightings was 5.6 (SD = 4.4). Only 2 new individuals were identified after survey 17 of 24. Site fidelity was high, as 52 individuals were seen at only one of the three sites, 20 were seen at 2, and 8 at all three sites. Pups were mostly observed at East Wemyss, with highest counts of 11 at East Wemyss, 3 at West Wemyss and 2 at Seafield Tower. This small group of harbour seals therefore depends on these sites but is in an area which is particularly susceptible to disturbance from nearby villages and footpaths, so these sites must be managed effectively to protect this group of seals, particularly during the breeding season.

Drivers of humpback whale distribution in the Scotia Sea: a temporal shift?

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Humpback whale populations in the Scotia Sea were decimated by historic whaling. This disruption likely changed the environmental drivers of their distributions. We investigate how these drivers have changed in the Scotia Sea over two decades of humpback whale population recovery. We use data from two large scale, multi-national surveys to estimate Antarctic krill biomass: the CCAMLR 2000 and 2019 synoptic surveys. These surveys, 19 years apart, covered a vast area in the South Atlantic, from the Western Antarctic Peninsula to the waters north of South Georgia. Cetacean observations from these surveys were used for abundance estimates. However, the relationship between whale distribution and various environmental variables has not been explicitly investigated. Notably, nor has any comparison been made between drivers of whale distribution across the two surveys- despite their spanning a critical time in whale population recovery. We use distance sampling methods on over 1000 sightings to build detection functions for humpback whales. Using corrected along-track density estimates, we then build generalised additive models (GAMs) to investigate the role of environmental variables like distance to shore and shelf break, sea surface temperature, and proxies for prey availability. Several hypotheses for the change in environmental drivers of humpback whales across time are explored, including recovery from whaling, and the impact of an unmodelled variable related to climate change. A better understanding of the drivers of humpback distribution, and how these have changed over time, is essential to improve our predictions of baleen whale distributions in unsurveyed years. These predictions will be relevant to the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), who manage the krill fishery and marine ecosystem in the Southern Ocean. Our work will also inform predictions of range shift and the impact of climate change on these species.

VALKYRIE: A Europe-wide initiative to harmonize passive acoustic monitoring data of harbor porpoises

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The harbour porpoise (*Phocoena phocoena*) is a key indicator species for temperate coastal and shelf waters yet large-scale assessments remain constrained by fragmented passive acoustic monitoring (PAM) efforts. While advancements in autonomous long-duration recording devices such as the C-POD and F-POD (Chelonia, Ltd) have expanded monitoring capacity, the lack of standardised data formats and metadata continues to limit analyses across projects. To address this challenge, we introduce VALKYRIE, a new tool developed under the EU Digital Twin Ocean initiative to aggregate and harmonise porpoise detection data across Europe. VALKYRIE provides a user-friendly interface for uploading porpoise detection files and deployment metadata, automatically validating, extracting and standardising information for integration into the European Tracking Network database hosted at VLIZ. By compiling large-scale porpoise detection data across research institutions, projects and organisations, VALKYRIE aims to unlock new opportunities for studying and understanding porpoise distribution, movement and habitat use over time, inform conservation strategies, and support evidence-based management of European marine ecosystems.

From rescue to rapid return: A novel rebonding strategy for an orphaned Mediterranean monk seal pup

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Maternal separation or loss in Mediterranean monk seal (*Monachus monachus*) pups is a well-documented phenomenon for this endangered species, most often associated with severe sea and weather conditions; however, anthropogenic factors may also contribute. Wildlife rehabilitation is a demanding process in terms of expertise, logistics, time, and financial resources. While limited in situ interventions have occasionally enabled reunion with the mother, the prevailing response has generally consisted of prolonged rehabilitation followed by beach release, during which the natural mother–pup or conspecific bond is lost. The objective of this study was to evaluate whether rapid return to the natal habitat after short-term basic care could serve as a realistic alternative to long-term monk seal rehabilitation. We present a novel intervention method, termed the “ReBonding Approach,” which combines rescue, short-term basic care, and rapid, direct return of the pup to its natal habitat, with the aim of re-establishing the mother–pup bond or enabling bonding with a foster female. On 24 December 2024, a molted monk seal pup was found stranded on the coast of Mersin, Türkiye. The pup showed signs of severe dehydration. Emergency response procedures were immediately initiated. Based on long-term research in the area, two possible natal habitats were considered. As the stranding site lay between these areas, prevailing wind, wave, and surface current conditions were evaluated to infer the most likely coastal transport pathway and assess the feasibility of rapid return. On the ninth day, once health and weather conditions were suitable, the pup was returned directly to its most probable natal cave. Post-release monitoring over one month confirmed the presence of the individual in the habitat, and no adverse outcome has been recorded to date. This case indicates that, in suitable cases, the ReBonding Approach may offer a low-impact and conservation-oriented alternative to prolonged full rehabilitation.

Towards an assessment of Risso's dolphins in the northeast Atlantic: first estimates of demographic parameters from a long-term photo-mark recapture study

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Risso's dolphins (*Grampus griseus*) in the Northeast Atlantic have recently shown a distributional shift, changes in habitat use and spatial segregation. However, quantitative demographic information remains critically limited, particularly in the English Channel. Survival had never been estimated for Risso's dolphins, leaving the species without a demographic baseline to compare regions, assess temporal trends or identify emerging pressures. This study provides the first demographic parameters for Risso's dolphins using the North-East French Brittany (NEFB) sector of the English Channel. Using a 17-year photo-identification dataset (2007-2023), we fitted a Jolly-Seber model with data augmentation in a Bayesian framework to estimate survival, detection, recruitment, annual abundance and infer superpopulation size (total number of individuals that used NEFB at least once over the study period). Detection modelling tested the effects of trap-dependence, fieldwork photographic effort, age and fin distinctiveness while survival modelling incorporated age effects (adult versus juvenile). Results indicated a high adult survival (mean = 0.92; 95% confidence interval [0.86-0.96]) and lower juvenile survival (mean = 0.42; 95% CI [0.20-0.63]). Detection probability was strongly influenced by trap-dependence and age with weakly contribution of fin distinctiveness. Annual abundance ranged from 7 (2012) to 67 (2014) showing heterogeneous local use of the area and variation in detectability and monitoring effort. The superpopulation size was estimated at 323 (315-334) individuals. These results demonstrate the seasonal habitat use of Risso's dolphins in the English Channel, potentially structured by age-class, and suggest connectivity with subpopulations in the eastern English Channel. By providing the first empirical age-structure estimation of survival for *Grampus griseus*, this study delivers essential evidence to inform regional conservation framework, including EU Habitats Directives, Marine Strategy Framework Directive and upcoming IUCN assessments. It also underscores the need for continued, long-term and collaborative monitoring through European network such as 'EDRIM' and 'Keep On Gramping' workshops.

Blubber remodelling in lactating female adult grey seals: histological and molecular changes during fat loss

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Reproductive success and survival during the first year are positively associated with fat reserves in grey seals (*Halichoerus grypus*). These capital breeders experience massive seasonal changes in fatness due to spatial and temporal separation of feeding, breeding, and moulting. It remains unclear how seals manage extreme and rapid changes in fatness without the typical negative health impacts observed in humans under these conditions. We examined blubber remodelling in wild adult female grey seals (n = 6) during the pronounced weight loss that occurs during their lactation fast in the Isle of May (Scotland). We hypothesised that reduction in fatness is associated with tissue morphological changes, underpinned by molecular adaptations. We measured adipocyte dimensions, extracellular matrix area and vascularity, and analysed concomitant shifts in molecular markers of tissue remodelling and hypoxia. Over 10 days, seals lost 23% of their body mass, which corresponded to an 11% reduction in adipocyte area, while blubber vascularity remained unchanged. Adipocyte diameter approached the theoretical maximum oxygen diffusion distance, suggesting that larger cells could be susceptible to hypoxia. However, no significant changes in hypoxia-inducible factor (HIF-1α) expression at either gene or protein level were observed. Collagen area was positively associated with adipocyte area. Transcript abundance for markers of mature adipocytes (PPARγ), cell proliferation (Pcna) and collagen (Col-3 and Col-6) showed no association with fatness or histological parameters. In this small sample, adipocyte diameter was not a good proxy for fatness. Notably, blubber collagen showed a unique distribution pattern of evenly spaced bundles approximately parallel with the skin, which we also observed in pups. We propose the observed collagen distribution might minimise constraints on cell size and allow blubber to expand and contract evenly and flexibly. This could help to maintain body shape and streamlining and prevent ectopic fat accumulation, a key trigger for comorbidities in humans.

Atlas: an Iberian *orca* bearing the weight of vessel interactions

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A young male *orca*, known as Atlas or Gladis Tarik, born in 2021 into the critically endangered Iberian orca population, was documented with severe wounds from a boat strike of unknown origin. As this orca population frequently interacts with vessels, and one of the commonly suggested deterrent measures is to reverse the vessel's engine, it cannot be excluded that such a manoeuvre contributed to these injuries. The wounds were first photographed in April 2025, and healing progression was documented over a period of four months using a sequence of high-resolution images. Atlas sustained multiple deep lacerations along his right lateral side, extending from the posterior margin of the head to the caudal peduncle. One laceration transected part of the dorsal fin, while another appeared to penetrate deeply into the tissues posterior to the eye patch. A separate wound on the right lateral flank was notably wider than the others, likely due to the continuous flexion of the caudal peduncle, which may have influenced the healing process. In the initial weeks following the incident, Atlas was difficult to photograph, but as the wounds healed he became very active and would frequently approach boats and occasionally rub against the hull. He was documented repeatedly breaching onto the same side as the wounds, likely facilitating debridement or representing a response to potential pruritus associated with wound healing. By the end of the monitoring period, most injuries had healed or shown substantial improvement, demonstrating the high resilience of this individual. Despite this recovery, the case highlights the substantial risk posed by vessel interactions to a population already facing critical conservation pressures. Based on these observations, we recommend that reversing engines in close proximity to any orca should not be used as a deterrent, as it may have a major impact on this iconic population.

Characterisation of the distribution and seasonal abundance of marine megafauna in the eastern English channel

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In a context of increasing human impact on natural ecosystems, seasonal and interannual monitoring programs for marine megafauna are becoming crucial to identify preferential habitats. In this context, the MAMO seasonal aerial survey was conducted over the Picardy Estuaries and Opale Sea Marine Natural Park (French marine protected area) and adjacent waters, from spring 2023 to winter 2025 (7 seasonal surveys). Covering nearly 9,000 km² for each survey, this campaign aims to enhance knowledge of the species diversity, as spatial and seasonal distribution of marine mammals of this MPA, complementing previous large-scale monitoring efforts. A digital camera system (STORMM) was deployed on board the aircraft to support visual observations during the last four sessions. This system made it possible to refine taxonomic resolution (specially for grey seals, *Halichoerus grypus*) and correct some identification errors. In total, more than 12,300 km of survey effort were carried out and 18,300 observations were made, including 941 marine mammals. Harbour porpoises (*Phocoena phocoena*) and seals (harbour seals, *Phoca vitulina* and grey seals) were the most encountered species. Common dolphins (*Delphinus delphis*) and bottlenose dolphins (*Tursiops truncatus*) were also encountered in summer and winter respectively. The use of Multiple Covariate Distance Sampling (MCDS) and Density Surface Modelling (DSM) approaches highlighted for harbour porpoises, a constant presence throughout the year, but with a peak abundance in winter (1,085 individuals, cv = 35%) and seasonal spatial variability, particularly between spring and the rest of the year. Conversely, these analyses revealed that the seals (both species pooled) have a relatively homogeneous spatial distribution throughout the year, with slight variation in their abundance. These findings contribute essential baseline data for management of the MPA. These results offer a valuable foundation for future assessment of anthropogenic pressures, and establishment of monitoring-indicators oriented to conservation in the Channel/North Sea region.

Ovarian structure, function, and asymmetry in sexually immature small cetaceans: Evaluating follicle counts as a potential marker for reproductive toxicity assessment

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Small cetaceans serve as sentinel species for monitoring marine ecosystem health due to their vulnerability to bioaccumulative contaminants that can disrupt reproductive development. Despite this, there is a lack of validated reproductive toxicity markers, particularly for sexually immature individuals. This study assessed ovarian follicle quantification in sexually immature female harbour porpoises (*Phocoena phocoena*) and common dolphins (*Delphinus delphis*) as a potential histological toxicity endpoint. Ovarian tissues from 29 stranded individuals were processed, and only those with adequately preserved bilateral ovarian sections (n = 18) were included in follicle-count and morphometric analyses. Non-growing follicles (NGFs)—including naked ova, primordial, and primary follicles—were identified, counted, and measured. Harbour porpoises exhibited significant left–right ovarian asymmetry, with the left ovary containing more NGFs in both calves and juveniles, consistent with previously reported left-sided reproductive morphology and lateralised mating behaviour in the species. In contrast, immature common dolphins showed no evidence of ovarian asymmetry. In both species, NGF counts declined markedly with increasing body length, while follicle diameter increased with somatic growth, indicating coordinated patterns of early-life follicular depletion and enlargement. Naked ova were consistently observed across all body-length classes in harbour porpoises but were absent from common dolphin ovaries, suggesting species-specific differences in early follicular development. These findings highlight species-specific patterns in ovarian development and asymmetry while supporting the use of NGF quantification as a reproducible and informative histological tool for characterising folliculogenesis in small cetaceans collected post-mortem, provided tissue is adequately fixed and stored. This approach offers potential for improving the assessment of early-life exposure to environmental and anthropogenic pollutants in stranded marine mammals, addressing a critical need for sensitive reproductive toxicity indicators in conservation and ecosystem health monitoring.

Chat for food: Fin whales' 40 Hz calls occurrence in a changing Arctic

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Climate change is affecting habitat and trophic conditions in the high Arctic. Although considered a migratory species in the North Atlantic, the fin whale has been recorded year-round in Svalbard waters. The species emits vocalizations at 20 and 130 Hz, as well as downsweeps, commonly referred to as “40 Hz calls”, which have been associated with feeding and social behavior. To provide insights into the species' behavior, acoustic data were collected from January 2021 to September 2025, in Kongsfjorden, Western Spitsbergen, and the occurrence of downsweep signals was investigated in relation to temporal (year and month) and trophic variables (such as chlorophyll concentration, fluorescence, and zooplankton biomass). Furthermore, the presence of downsweeps was examined in relation to 20 and 130 Hz calls to determine whether these sounds are used simultaneously and if they may serve a similar purpose. 21974 recordings were analyzed, totaling 5935 hours and 40 minutes. The encounter rate of downsweeps, calculated on a weekly basis, averaged 0.00051 (± 0.00083 SD). Results showed that these signals were recorded throughout the year, especially between June and December. Between January and May, they were more sporadic, apart for March, when downsweeps were always recorded. A weak positive correlation was observed with other vocalizations, indicating that they generally increased with increasing 20 and 130 Hz calls. Relations with trophic variables suggested they could be emitted during foraging activity, with annual changes possibly related to local food availability or environmental conditions. These outcomes add crucial insights about how fin whales are adapting to changes in the Arctic environment, but studies are still needed to understand their feeding behavior and prey.

POSEIDON: the new tool informing offshore wind planning in the UK.

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The United Kingdom (UK) has set ambitious targets for renewable energy and consequently, offshore wind is a rapidly growing industry. Effective spatial planning requires evidence to minimise ecological impacts. POSEIDON, a project led by Natural England with other partners, hosted by the Crown Estate, aims to inform marine renewable planning by identifying important areas for 5 marine mammal species including minke whale, bottlenose dolphin, common dolphins, white-beaked dolphins and harbour porpoises,: 20 seabird species, and benthic habitats. This project utilised data previously collated through the MERP project, and new data collected for POSEIDON to fill date deficient areas, to inform new innovative predictive spatial models within the UK EEZ and some adjoining regions. Cetacean and seabird densities were estimated from 1,949,405 km2 of vessel and aerial surveys (visual and digital) covering 25 years of data from 2000 to 2024 from 43 sources. Observed densities were corrected for imperfect detection, and where relevant, availability at the surface. Unique spatial general additive models were fitted to the adjusted densities for each species. Data were grouped into 4-year blocks and predicted density surface models were generated for each species and each month, for the years 2004, 2008, 2012, 2016, 2020 and 2024. Subsequent aggregation stages assessed each species distribution against relevant sensitivities and pressure risks and these have been integrated across years and species, to find areas minimising impacts across all species. We describe our approaches to data collation, collection, modelling, sensitivity scoring and integrated risk mapping across time and space; as well as introduce the new online interactive POSEIDON tool where results will be accessible. We present the marine mammal results and share new insights into the seasonal movements of species that the models have revealed. The expected applications of the outputs in future assessment work are highlighted.

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Development of microsatellite and sex markers for common bottlenose dolphins (*Tursiops truncatus*) and their application to biopsy, drone-based, and eDNA samples

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Genetic monitoring of free-ranging cetaceans increasingly relies on markers capable of producing reliable genotypes from low-quantity or degraded DNA. In the context of the Interreg project SeaInsights, we developed a novel suite of microsatellite (short-tandem repeats, STR) markers optimised for high-throughput sequencing (HTS) genotyping of the common bottlenose dolphin (*Tursiops truncatus*). Using the T. truncatus reference genome, we scanned for tetranucleotide STRs, designed primers following established HTS criteria, and screened 134 candidate loci through three testing phases using tissue-derived DNA from five well-known individuals with long-term resighting histories from the Gulf of Trieste, representing both females and males, as well as different social groups. In addition, we developed one marker for sex identification and have tested two previously published markers. After initial multiplex PCR and Illumina sequencing, 49 STR loci and all sex-identification markers were retained based on amplification performance, allele balance, and read depth. Subsequent optimisation in a unified multiplex and further sequencing allowed us to refine this set to 36 STR and one sex marker that consistently amplified across individuals and exhibited clear polymorphism. To assess broader applicability, the final panel was tested on biopsy tissue samples, non-invasive blow samples obtained using drones, and eDNA samples collected from fluke prints of T. truncatus from the northern Adriatic Sea. Preliminary screening demonstrates that the panel's design—short amplicon size, high sequencing sensitivity, and balanced multiplex performance—is well suited for challenging sample types such as exhaled air and trace biological material. This expands the potential for minimally invasive and non-invasive, high-resolution genetic monitoring of this species.

Three decades of whale watching and resident cetaceans in the Strait of Gibraltar: trends, population monitoring and sustainability recommendations

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Systematic monitoring of whale watching activity in the Strait of Gibraltar began in 1996, coinciding with the emergence of the first local operators, who started with a single vessel and just 15 passengers per day. Over nearly three decades, the sector has experienced sustained growth, now reaching a total of 10 vessels and an estimated annual flow of of approximately 20,000 passengers, establishing itself as a mature activity within the international whale watching landscape. The sector's evolution has followed a pattern observed in other well-established whale watching destinations, with early phases of rapid expansion followed by stabilization, linked to increasing professionalization and administrative regulation. In parallel, long-term population monitoring programs for long-finned pilot whales (*Globicephala melas*) and bottlenose dolphins (*Tursiops truncatus*), conducted continuously since 1999, show that both populations have remained stable over time, with average estimates around 300 and 250 individuals respectively. Year-to-year fluctuations appear to be driven primarily by natural dynamics, including occasional epidemiological events, with no evidence of decline attributable to whale watching activity. This poster presents an integrated synthesis of the historical evolution of the sector, long-term population trends, and the relationship between the two. Based on this evidence, we propose management recommendations aimed at ensuring the sustainability of whale watching, strengthening scientific monitoring, and supporting a form of economic development that is compatible with the conservation of resident cetacean populations.

A decade of live cetacean strandings in Catalonia 2016–2025: patterns and stranding outcomes

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Live cetacean strandings provide critical information on local populations, emerging threats, and overall health status. This study presents a retrospective analysis of live cetacean strandings recorded along the Catalan coast (NW Mediterranean) between 2016 and 2025. Data were compiled from the regional stranding network and included species, biometric information, location, geographic conditions, seasonality, initial clinical assessment, outcome, and post mortem findings when available. During the study period, approximately 50 live strandings were documented, involving five species, predominantly *Stenella coeruleoalba* and *Grampus griseus*. Most individuals presented signs consistent with infectious disease. Necropsies were conducted in nearly all animals that died, allowing determination of the cause of death in approximately 80% of examined cases. A smaller number of deaths were attributed to anthropogenic factors or non-infectious conditions. This decade-long dataset provides an integrated overview of live cetacean strandings in Catalonia and highlights the value of coordinated stranding response and pathology programmes for understanding health trends in Mediterranean cetaceans. The findings further underline the need for enhanced mitigation of anthropogenic pressures, strengthened rehabilitation capacity, and improved long-term monitoring strategies across the region.

Diverging distributional responses to changing environmental conditions of two North Sea cetacean species

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Understanding the environmental factors that influence distribution is increasingly important in the changing environment. Climate change driven distributional changes have been observed in a wide range of species, including cetaceans, which can lead to increased competition and exposure to new threats. This study assessed the influence of environmental features on the summer distributions of two cetacean species in the North Sea, the minke whale (*Balaenoptera acutorostrata*) and white-beaked dolphin (*Lagenorhynchus albirostris*), combining long-term line transect survey data from the 1994, 2005, 2016, and 2022 SCANS surveys. The combined data included 244 minke whale groups and 253 white-beaked dolphin groups within the study area and a total effort of 72,557 km. Generalized Additive Models were used to analyse the relationship between environmental variables and species densities to predict distributions and compare spatial changes in distribution. The two species showed contrasting distributional changes over the study period. Minke whales showed a southward summer range expansion with distribution influenced by depth and salinity, with sea surface temperature variations in later surveys (model deviance explained 30.1%). In contrast, white-beaked dolphins exhibited a northward summer distributional change with higher densities associated with distance to 100m isobath, sea surface temperature, and chlorophyll-a concentrations (model deviance explained 52.7%). These contrasting responses likely reflect differing ecological strategies. Minke whales, as generalist migratory feeders, showed greater adaptability through range expansion, likely following changes in prey availability. White-beaked dolphins, as cold-water specialists with a more localized range, demonstrated temperature-related responses potentially linked to direct thermal preferences and shifting prey species. These findings highlight species-specific responses to environmental changes and demonstrate how ecological characteristics influence adaptive capacity. Results provide important information for dynamic conservation planning and environmental impact assessments in the changing North Sea ecosystem, emphasizing the need for adaptive management strategies for marine top predators.

Cetacean isotopes reveal temporal shifts in nitrogen cycling and trophic structure in a coastal upwelling ecosystem

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The Galician coast (NW Spain), at the northern limit of the Western Iberian Upwelling System, showed marked oscillations in the upwelling intensity in recent decades. How this environmental variability alters biochemical cycles and food-web structure remains unclear. Using the common dolphin as a bioindicator species of coastal regions, we assessed long-term variability in trophic structure and function in Galician waters over the past two decades and identify the main environmental drivers of that variability. We analyzed bulk carbon and nitrogen stable isotopes, and amino acid nitrogen stable isotopes (CSIA-AA) in skin samples from 109 individuals stranded in Galicia (2004-2021) to estimate trophic position, isotopic niche width and overlap, and habitat use. We used Generalized Additive Models to examine sex-specific patterns and assess relationships between isotopic signals and environmental variables: sea surface temperature (SST), dissolved inorganic carbon (DIC), chlorophyll-a (CHL), upwelling intensity (UI), and the North Atlantic Oscillation (NAO). Isotopic niche overlap increased over time and niche width expanded in both sexes, more markedly in males, suggesting a shift toward more generalist foraging in both prey and/or habitat use, likely driven by changes in prey availability. Female bulk δ13C exhibited a near-significant nonlinear temporal pattern. Bulk δ15N suggest a sustained increase in female trophic position across the period. However, source AAs δ15N increased for both sexes over time, indicating ongoing shifts in the N biochemical cycle, while trophic AA δ15N indicated an increase in males only in recent years. Examining the functional responses of isotopes to environmental conditions showed that bulk δ13C declined with increasing SST; male trophic δ15N decreased with higher NAO and UI, while female source δ15N increased with rising SST and decreased with CHL. Together, these findings suggest substantial changes in N cycling, primary productivity, and trophic structure associated to both local and large-scale climatic shifts in Galicia.

A review of marine mammal bycatch in the central Eastern Atlantic

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Fishery bycatch is a significant threat to marine mammals worldwide. Here we review evidence of bycatch mortality in fisheries along the Atlantic coast of southern Europe and Africa, including Atlantic islands, from Spain to Angola. Excluding vagrant species, at least 37 cetacean species, two seal species and one sirenian species have been recorded in this area. We reviewed information on bycatch available in the scientific literature, including previous reviews and sources therein and records for the Iberian Peninsula and Macaronesia from the International Council for the Exploration of the Sea's Working Group of Bycatch. We also included information collected to date for the REDUCE project, based on observers and electronic monitoring systems onboard European longliners fishing in African waters. Bycatch mortality in the study area has been documented for at least 23 of the cetacean species as well as for both seal species and the manatee. Bycatch records derive from at least 11 countries and involve a range of fisheries including gillnets, drift nets, purse seine, pelagic trawls, longlines and artisanal gears. We are presently developing a simple bycatch risk index for these species, based on the frequency of bycatch reports, population trends where known and the IUCN Red List status of affected populations. While many bycatch records refer to abundant species classified as of Least Concern, species and populations of particular concern include the Atlantic humpback dolphin and Iberian porpoise (due to their low abundance and poor conservation status), and common dolphin (due to high numbers bycaught in the north of the study area).

Unusual mixed-species sighting in the Northern area of Pelagos Sanctuary

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Within the Specially Protected Area of Mediterranean Importance (SPAMI) Pelagos Sanctuary, there are eight cetacean species defined as regular but limited data are available regarding multispecies sightings. Mixed-species associations are temporary associations interpreted as a strategy to reduce predation risk, enhance foraging success and/or provide a social advantage. At the Mediterranean scale mainly striped and common dolphins are commonly involved in this association type. Common dolphin Mediterranean population status is currently Endangered and single-species groups of common dolphins have rarely been encountered in several areas of the Mediterranean. In contrast, mixed groups of common and striped dolphins are sighted regularly. In the late Spring of the 2025 research season, the Menkab association team reported an unusual sighting, previously unrecorded in this area, characterized by the co-occurence of three different species: *Stenella coeruleoalba*, *Delphinus delphis*, and *Grampus griseus*. Cetaceans were spotted near 500 m deep in front of the Marine Protected Area of Bergeggi Island. Five different ages Risso's dolphins were approached by a mixed group of common and striped dolphins and then two resting marbled-white Risso's dolphins were specifically surrounded and repeatedly harassed, a few meters below the surface. This behaviour could be interpreted as potentially aggressive. At the time of the sighting, none of the three species were feeding or accompanied by juvenile/calf; the interaction lasted for more than half an hour and was recorded acoustically by hydrophone. To the best of our knowledge, these three species have been observed together twice in the wild and only once in the Eastern of Mediterranean basin until now. This rare sighting represents the first record within the Pelagos Sanctuary and highlights the complexity of cetacean interactions in addition to underscores the importance of monitoring multispecies associations, which can reveal significant insights into the behavior and coexistence of different species.

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One database to rule them all: Building a multi-source survey dataset and a reproducible pipeline to enable robust cetacean density modelling.

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Marine mammals are under significant and varied anthropogenic pressure due to the expansion of human activities at sea, such as fishing, renewable energy production, and maritime traffic. Their conservation status is deteriorating on a global scale. The latest assessment of the OSPAR convention concluded that the state of marine mammals in the North-East Atlantic is poor. To prevent further degradation and assist in marine spatial planning, the MODELCET ATL project aims to compile all available datasets from the Atlantic and English Channel (ie marine waters adjacent to mainland France), and to develop robust statistical methods to produce reliable density surface models for different cetacean species in the North-East Atlantic. This work will feed into policy decisions on marine renewable energy projects among others. Our workflow compiles over 62 survey datasets and around 39,000 cetacean sightings from aerial and boat-based line-transect surveys including digital techniques. All datasets underwent standardised metadata documentation and harmonisation of taxonomic and observational fields first. The effort data were then linearised and segmented, and the sighting data were associated with them. To standardise this process, an R package (Pelascope) and a Shiny application were developed. Preliminary results show that the integrated database markedly expands the spatial and temporal coverage compared to any single survey, even if there is considerable heterogeneity in protocols and observation conditions. The cleaned and harmonised dataset now supports the simulation framework used to evaluate data integration strategies and determine the modelling strategy for the most robust density estimation possible. MODELCET ATL produced a large and comprehensive database of cetacean sightings in the Northeast Atlantic that is documented and policy ready. It aims to establish the methodological foundation necessary for producing bias-corrected density maps and abundance estimates at management-relevant scales, ultimately strengthening the basis for evidence-informed marine spatial planning.

Beyond Sanctuary Borders: identifying a new candidate IMMA for *Ziphius cavirostris*

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The Goose-beaked whale (*Ziphius cavirostris*) is a vulnerable and notoriously elusive deep-diving cetacean in the Mediterranean Sea, making its conservation particularly challenging. Through Vele del Panda (VdP) Project, an initiative integrating long-term research and citizen science, we documented an unexpectedly high number of *Z. cavirostris* sightings in the area south of Giglio Island. This zone remains outside the boundaries of the Pelagos Sanctuary and lacks any SPAMI designation, representing a clear protection gap for deep-diving species. From 2020 to 2025, VdP recorded 55 sightings of *Z. cavirostris* across the broader study region, with 25 concentrated specifically south of Giglio. This represents an unusually rich dataset for such a cryptic whale and provides valuable insight into its occurrence patterns in an under-studied habitat. Preliminary habitat-suitability analyses suggest that this region exhibits environmental features commonly associated with Important Marine Mammal Areas (IMMAs), including steep bathymetric gradients, submarine canyons, and predictable oceanographic dynamics. To further investigate environmental drivers of presence, we developed a MaxEnt Species Distribution Model using presence-only data. The model incorporated monthly-averaged variables (primary productivity, sea surface temperature, salinity) together with bathymetry and slope. Qualitative field observations were used to refine the ecological interpretation of model outputs and supported the identification of local suitability hotspots. Together, these findings indicate that the waters south of Giglio may serve as an important habitat for *Z. cavirostris* and therefore merit consideration as a potential candidate IMMA. This work provides the first integrated scientific basis for evaluating the conservation relevance of this currently unprotected area and highlights the need for further assessment to ensure adequate protection for this vulnerable species.

Diet of Black Sea harbour porpoises and bottlenose dolphins bycaught in Bulgarian waters

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The Black Sea, characterized by unique physicochemical features such as low salinity and an extensive anoxic zone, represents a highly vulnerable marine ecosystem. It supports three endemic cetacean subspecies—the harbour porpoise, the common dolphin, and the bottlenose dolphin—all listed in the International Union for Conservation of Nature's Red List. Over the past five decades, the Black Sea ecosystem has undergone substantial anthropogenic modification, leading to pronounced environmental alterations. During a bycatch monitoring program conducted between 2019 and 2021, stomachs were collected from 31 Black Sea harbour porpoises (*Phocoena phocoena* relicta) and 2 bottlenose dolphins (*Tursiops truncatus* ponticus). All of the bycaught cetaceans were entangled in bottom-set gillnets targeting turbot, except one porpoise found in a pound net. The study encompassed two seasons: spring and summer. Both bottlenose dolphins were females and were bycaught in spring, alongside nine harbour porpoises—two males and seven females. The remaining 22 porpoises, recorded in summer, were dominated by females - 16. A total of 277 prey items from the stomachs of 30 individuals were identified based on otolith analysis. Three of the female porpoises' stomachs were empty – one in spring and two lactating in summer. Identified porpoise preys belonged to five species (*Sprattus sprattus, Merlangius merlangus, Alosa pontica, Engraulis encrasicolus, Trachurus mediterraneus*) and one family – Gobiidae. M. merlangius had the highest share in both seasons: 84% and 77% respectively in spring and summer. *A. pontica, E. encrasicolus*, and *T. mediterraneus* were detected once each only in summer. Bottlenose dolphin prey consisted of Gobiidae and *M. merlangius*. Comparison of our findings with a similar study conducted in Türkiye during 2002–2003 suggests either a shift in preferred prey from *S. sprattus* to *M. merlangius* or a regional difference between the southern and northern sectors of the western Black Sea.

First description of pathological findings in stranded cetaceans in Galician's coast - NW Spain [2015-2024]

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In Galician waters, the long-term stranding monitoring network conducted by CEMMA since 1990 has recorded an average of 227 cetacean strandings per year. In recent years, however, this number has nearly tripled, with 618 strandings in 2023 and 614 in 2024. For over a decade (2015 – 2024), histopathological diagnosis of a representative sample of stranded cetaceans has been carried out by the Institute of Animal Health and Food Safety (IUSA-ULPGC). During this period, 417 cases belonging to 14 species were analysed. This study represents the first comprehensive compilation of histopathological results from the last ten years in Galicia. The majority of cases were common dolphins (*Delphinus delphis*, 231; 55.4%), whose main lesions were consistent with acute stress derived from fishery interactions (166; 71.9%). Other pathologies included those related to active stranding events, verminous bronchopneumonia, lethal traumatic lesions associated with interspecific interactions with Atlantic bottlenose dolphins (*Tursiops truncatus*), changes associated with senile conditions, and multisystemic parasitic infestations. Atlantic bottlenose dolphins (72; 17.3%) showed similar findings; however, advanced decomposition often hindered anatomopathological diagnosis. Infectious diseases such as Erysipelas and Brucellosis were also identified. Striped dolphins (*Stenella coeruleoalba*, 46; 11%) typically presented lesions associated with active stranding events, sepsis, and multisystemic parasitosis. Harbour porpoises (*Phocoena phocoena*, 31; 7.4%), an endangered species, were usually adults in good body condition with lesions linked to fishery interactions (21; 67.7%), or calves without evident pathologies. Together, these results highlight the significant impact of fisheries on common dolphins, Atlantic bottlenose dolphins and harbour porpoises stranded in Galicia. The persistence of high stranding rates, combined with the prevalence of lesions associated with fishery interactions, underscores the urgent need for mitigation measures. Long-term stranding and pathological data remain essential tools to assess anthropogenic pressures and to guide effective conservation strategies for vulnerable cetacean species.

Exploring hidden biodiversity: Multidimensional eDNA monitoring in Italy's submerged MPA

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The "Secche di Tor Paterno" is Italy's only fully submerged Marine Protected Area (MPA). Established in 2000 by the Italian Ministry of the Environment and managed by RomaNatura, it is located 4 to 7 nautical miles off the Roman coast in the Tyrrhenian Sea. It is an isolated marine shoal, with depths extending between 18 and 50–60 meters depth and characterized by rocky formations surrounded by sandy seabed and *Posidonia oceanica* meadows, close to the Tiber River delta. This study presents the first multidirectional environmental DNA (eDNA)-based biodiversity assessment conducted within the MPA. Its peculiarity consists in the simultaneous sampling conducted both vertically (the same site sampled at different depths) and horizontally (sampling across different benthic microhabitats). During each of five sampling days, spanning from November 2024 to July 2025, up to seven water samples were collected: five within the MPA and up to two outside as controls. Of these, three were surface samples (the two controls and one within the MPA), three were collected near the seabed, and one was taken from the mid-water column. The resulting 30 samples (22 MPA samples and 8 controls) consisted each of 12 litres of seawater. All samples were metabarcoded using MarVer1 (12S), MarVer3 (16S), and COI primer sets to characterize both vertebrate and invertebrate communities. Additionally, species-specific real-time qPCR assays were performed to investigate the potential presence of the Mediterranean monk seal (*Monachus monachus*), the only pinniped present in the Mediterranean basin. The results provide a first insight on the organisms inhabiting the water column at different depths and the possible relation between them. At the same time, this project highlights the importance of conservation efforts on such unique biodiversity hotspots.

Friendly transboundary collaboration enhances understanding of bottlenose dolphin movement ecology in the northern Adriatic Sea

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Research on highly mobile cetaceans is sometimes limited to the study areas of individual research groups, with limited communication among researchers operating in adjacent areas. Collaborative efforts, however, are important to enhance the interpretation and express the full potential of the collected data. In the context of the Interreg Italy-Slovenia project SeaInsights, two research groups joined efforts to examine the movements and connectivity of common bottlenose dolphins *Tursiops truncatus* across the northern Adriatic waters off Slovenia and Friuli Venezia-Giulia ('Gulf of Trieste'; 1200 km2) and Veneto, Italy (3000 km2). Photo-identification catalogues were merged, matched and validated, resulting in a catalogue of 4546 dorsal fin photographs, portraying a total of 946 individuals. Of these, 75 (8.7%) were found to move across the Gulf of Trieste and Veneto. In the Gulf of Trieste, shared individuals were encountered more often than the non-shared ones ($p<0.001$); in Veneto, less often ($p<0.001$). The 'Extent of Occurrence', i.e. the area included in the minimum convex polygon that circumscribes all points where an animal was photographed, varied greatly among shared individuals, ranging between 12 and 3628 km2, with no differences between females and males ($p=0.44$). Transboundary collaboration and data sharing led to a degree of joint analyses of the available information unprecedented in the region, providing meaningful new knowledge, strengthening bonds and collaborative spirit, and fostering trust among colleagues.

Assessing abnormal rigid surfacing in common dolphins (*Delphinus delphis*) off southern Portugal

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Detailed observations of free-swimming cetaceans with apparent physical abnormalities are crucial to understand individual and population health. We present a long-term case study of common dolphins (*Delphinus delphis*) off southern Portugal which consistently surface in a rigid, laboured manner, seemingly unable to arch their backs. Between 2010 and 2025 dedicated and opportunistic boat-based surveys were conducted to record behaviour, social structure, and whenever possible take pictures for photo-identification. Additionally, we sporadically documented the presence of individuals with abnormal rigid surfacing. Through detailed description of these cases, we were able to identify common characteristics of these animals. These included prolonged exhaling before breaking the surface (“blowing bubbles”), prominent, “inflated” rib cages, surfacing without arching their backs, and sometimes signs of emaciation. We recorded 103 cases, the first one in 2013 and observed an increasing trend of occurrence in subsequent years. In 19 cases (18.4%) there were multiple affected animals (up to four) within the same group and 8 dolphins (7.8%) were encountered alone. We identified 62 animals, out of which six were juveniles (9.7%), and six were mothers with dependent calves (9.7%), two of which (3.2 %) were also affected. The longest time between re-sightings of an individual was six years. While some of these individuals were observed lagging behind the group, most animals were integrated into behaviours like travelling at different speed, socialising, feeding, milling, and resting. Our results indicate that there may be different degrees of severity to this condition (integrated into the group, surviving numerous years vs. alone, emaciated, leaping for every breath). However, we cannot identify the underlying cause(s) of this condition, which could range from spinal, to abdominal, to pulmonary issues, and may be genetic and/or contagious. Yet, this study may contribute to characterising a pattern of recurring health implications in common dolphins off southern Portugal.

WinterSCANS - First time winter survey in the North Sea, elucidating seasonality of cetaceans

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Seasonal data on cetacean occurrence remain insufficient, yet evidence suggests seasonality in the distributions of key species in the North Sea, such as harbour porpoise, white-beaked dolphin and minke whale. Therefore, as an extension to SCANS-IV 2022, and to assess the feasibility of conducting surveys during winter, aerial surveys were conducted in the southern and central North Sea in January-March 2024, designated as winterSCANS. Concurrently, the French MAMO survey, following the same protocol was undertaken in the eastern Channel for the Marine Natural Park. Aggregated line transect data comprised 9,006km of effort and >550 sightings of cetacean groups. The combined estimated abundance for winterSCANS/MAMO was 136,825 (CV=0.19) for harbour porpoise and 5,666 (CV=0.36) for white-beaked dolphin, lower than in summer 2022 for both species in this area. However, abundance was higher in winter than summer for harbour porpoise in the southeastern North Sea and the northeastern English Channel, and for white-beaked dolphin across the southern North Sea. With only three minke whale sightings, abundance could not be estimated. Although the region surveyed by winterSCANS and MAMO represents only a portion of the known distribution range for the three observed species, the results offer new insight into seasonality in their distributions. The collection of such data also supports the management of Marine Protected Areas, the designation of Important Marine Mammal Areas, improves species status assessments and reporting, and facilitates the identification of seasonal trends. Understanding seasonality is essential to inform management of anthropogenic activities, particularly bycatch mitigation and offshore wind farm development and to understand the impacts of climate change, such as range shifts.

A decade of opposing trends in two deep-diving species raises tropicalisation signals in São Miguel (Azores)

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Global warming is forcing marine species to adapt their distribution in order to meet their ecological needs. A decline in the occurrence of Risso's dolphins (*Grampus griseus*) was reported a few years ago in a critical area for the species in the Azores, while, in parallel, short-finned pilot whales (*Globicephala macrorhynchus*) were progressively increasing. Here, we provide updated insight into recent occurrence fluctuations of these two species in another area of the archipelago, based on 11 years (2015–2025) of whale-watching data from São Miguel Island. Daily Presence Ratios (DPR) were computed for each month, and annual DPRs were estimated using beta-regression Generalised Linear Models (GLMs) to correct for seasonal heterogeneity in effort. Additionally, we fitted Generalised Additive Models (GAMs) using temporal predictors to assess interannual trends and species seasonality. Modelling revealed a significant decreasing trend for Risso's dolphins and an even clearer increasing trend for pilot whales, which became more pronounced in recent years. Predicted annual DPR for Risso's dolphins oscillated around 0.08 between 2015 and 2018 and around 0.05 between 2022 and 2025. Alternatively, annual pilot whale DPR ranged between 0.01 and 0.03 until 2021 and above 0.03 in the following years, with a maximum of 0.07 reached in 2025. Both species exhibited similar seasonality, with higher DPR around the summer months; however, Risso's dolphin occurrence in autumn and winter was significantly higher during the first years of the study period. Pilot whales showed the opposite pattern, with an increasing off-season presence. These local trends may reflect distribution shifts at a larger scale, driven by progressively warmer North Atlantic conditions. Therefore, under a scenario of local tropicalisation, these trends may continue to intensify, placing further pressure on local species and potentially leading to cascading effects on the pelagic marine environment.

Maldives Dolphin Project “Koba Koamas”: assessing potential anthropogenic impacts on spinner dolphins (*Stenella longirostris*) in Southern Maldives islands through photo-ID

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Spinner dolphins (*Stenella longirostris*) in the Maldives inhabit areas increasingly affected by human activities, yet research on anthropogenic impacts remains limited. This study, a branch of the Maldives Dolphin Project “Koba Koamas”, represents one of the first photo-identification efforts in the southern Maldives (Huvadhoo Atoll), conducted through both dedicated and opportunistic trips through Kooddoo Island’s resort, Mercure Maldives Kooddoo. Over a nine-month period, a catalog of 407 individual dolphins was compiled. An analysis of the photographs revealed that, among other causes (intraspecific marks and predation scars), approximately 20 dolphins, nearly 5% of the cataloged individuals, bore scars consistent with fisheries and nautical interactions. The relatively short survey period suggests that the actual population is likely larger, and little is known about its migration patterns, indicating that these findings may underestimate the extent of human impact. Despite the Maldives’ reputation for marine conservation, current laws and enforcement mechanisms for dolphin protection are limited. The study highlights the urgent need for stronger management measures, improved fisheries practices, and specific national guidelines for dolphin-watching and marine mammal welfare. By establishing photo-identification catalogs and documenting evidence of human impact, this research seeks to provide crucial insights into population size and health, and to inform science-based conservation strategies for spinner dolphins in the Maldives.

Evaluation of spatial patterns of cetacean habitat use through boat and land-based studies in the ría of Vigo

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Due to the enormous ecological richness and productivity of the Ría de Vigo, cetaceans use its waters as a habitat. This study aimed to describe spatial patterns of habitat use by cetaceans and assess the relative contribution of vessel-based surveys (VBS) and land-based surveys (LBS) to long-term monitoring efforts. From 2003 to 2019, a total of 905 surveys were conducted, with data collected from VBS through systematic surveys (along both defined routes and routes without a previously marked transect) and opportunistic sightings, as well as from LBS observations. Of these, 90 were VBS surveys, during which 132 *Tursiops truncatus* (Montagu, 1821), 31 *Delphinus delphis* (Linnaeus, 1758), and 4 *Phocoena phocoena* (Linnaeus, 1758) sightings were recorded. During the 815 LBS observation days at eight designated points, each lasting 20 to 60 minutes, 50 *D. delphis*, 36 *T. truncatus*, 19 *P. phocoena*, 5 *Grampus griseus* (G. Cuvier, 1812), and 1 *Globicephala melas* (Traill, 1809) were sighted. The higher proportional detection of species in LBS is linked to points near the ría limits—effectively open-sea areas—where species such as *G. griseus* and *G. melas* occur. These species do not have a uniform distribution along the Galician shelf and rarely approach the coast or enter the rías. In contrast, maritime surveys were mainly conducted within the ría, which could influence results. The study proposes that ría use varies by area and species, with bottlenose dolphin breeding groups constituting the resident population. Outer waters and surroundings are inhabited or at least frequented by non-resident groups of common dolphins and the other species mentioned. A slight association between *P. Phocoena* and the Cíes Islands was detected; although specific studies are required to confirm this, the finding could support the establishment of marine reserves, given its current endangered status.

Can the FaunaGuard ADD be used as a mitigation tool for minke whales?

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FaunaGuard has been successfully used as a mitigation tool for harbour porpoises in connection with construction of off-shore windfarms. Here we tested if FaunaGuard could also be effective for other species like minke whales. During construction of offshore wind mills no marine mammals can be close. Currently two main types of Acoustic Deterrent Device (ADD) are used: those which emit signals with few frequencies at high source levels (such as “seal scarers”) or those with more complex acoustic signals at lower source levels. We tested the behavioural reactions of minke whales when using the FaunaGuard system with complex acoustic signals and low amplitude signals. The experiment was designed as a 30-min focal follow of minke whales using Logger Software and a laser range finder to determine the distance, then a 10-min playback phase using FaunaGuard playing sounds in the frequency range of 100 Hz – 1500 Hz and finally, a 30-min post-trial observation. In addition, all minke whales were photographed for photo-identification and drone imagery was also collected for identification purposes. A total of 16 trials (11 experiment trials and five controls) were conducted, and of these, nine experiment trials and four controls could be used for further analysis. Trials were excluded when many minke whales were present at the same time (3 -5 whales) and it was not possible to reliably follow the focal individual. We lost the focal minke whale during the 10-min playback in seven out of nine experiment trials, while on the other hand we did not lose any during our control trials, indicating that the device elicited an avoidance response. In conclusion, our findings suggest that FaunaGuard has potential as a mitigation tool for minke whales, though further trials are required to be more conclusive about the behavioral responses of minke whales.

Status of the Iberian harbour porpoise

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The Iberian harbour porpoise, *Phocoena phocoena*, is a genetically distinct population of around 3000-4000 individuals and is classified as 'in danger of extinction'. The north-west Iberian Peninsula (NWIP; Galicia, north-west Spain and northern Portugal) is one of the world's main fishing areas and bycatch mortality of the Iberian porpoise is considered to 'critically exceed the agreed threshold' of zero. Following standard methods, age, maturity and pregnancy data were used to construct life tables and estimate overall mortality and reproductive rates for stranded and by-caught porpoises from the NWIP between 1990-2022. Very few animals over 10 years old were recorded. Iberian porpoises reach sexual maturity around 5 years old and appear to have a lower longevity than other studied populations. Life table results suggest a 15% annual mortality in the population. No sex-related differences in mortality rates were observed although by-caught porpoises appear on average to die younger than other porpoises. Assuming the data are representative of the living population, approximately 7.5% of the population dies annually due to fisheries interactions, potentially threatening the viability of the population. Data from 1990-2010 demonstrated that Iberian porpoises are larger than other studied populations, although when combining data from 1990-2022, all the larger porpoises are from the earlier years. Preliminary analysis suggests that there is no evidence of changes over time in age at sexual maturity and pregnancy rates, which could be responses to high mortality. However, analysis of testes and observations of newborns in strandings in recent years, suggests that Iberian porpoises are breeding later in the year than we recorded in our previous study between 1990-2010. The present study emphasises the importance of long-term data sets for monitoring trends in life history parameters and by-catch rates of small, distinct populations, and ultimately their conservation.

Gas bubbles in cetacean brain: novel criteria for distinguishing lesions from putrefaction. A pilot study.

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Gas bubble formation in cetaceans has been described in association with diverse pathological conditions as well as with perimortem and postmortem processes involving off-gassing from supersaturated tissues. Putrefactive bacterial proliferation also contributes significantly to gas accumulation in stranded cetaceans, both grossly and microscopically. However, distinguishing between true intravascular or intratisular gas bubble lesions formed *in vivo* and those arising postmortem remains particularly challenging within the central nervous system. In this study, ten stranded odontocetes of different species and conservation codes exhibiting cerebral gas bubbles on histological examination were evaluated to determine whether these structures reflected antemortem lesions or postmortem artefacts. In well-preserved brains (n=6), bubbles were consistently associated with hemodynamic alterations, including hemorrhage, congestion, edema, and compression of the neuropil, indicating an antemortem origin. Histochemical analyses with Oil Red O and Luxol Fast Blue, combined with chromic acid pretreatment to enhance lipid and myelin retention, revealed concentric laminated ring-like structures within the bubbles, compatible with intramyelinic separation previously described ultrastructurally in experimental decompression sickness (DCS). These bubbles tended to be small to medium in size with uniform borders. In contrast, bubbles attributed to putrefaction (n = 4) displayed highly heterogeneous morphology, substantial size variability, irregular contours and frequent localization within the white matter. Their vascular association was inconsistent, and some contained bacterial colonies, with intra-bubble material appearing amorphous and degenerative. Overall, findings in well-preserved specimens suggest that gas may compromise myelin integrity and potentially act as a nucleation surface for bubble formation in nitrogen-saturated nervous tissues. The combined presence of hemodynamic changes and demonstrable myelin separation may provide valuable histological criteria for identifying antemortem gas bubble formation in cetaceans.

Automatic discrimination of vocalisations between dolphin species and between killer whale ecotypes

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Passive Acoustic Monitoring (PAM) is a valuable technique to assess marine mammals' ecology. This method can overcome the constraints encountered with visual monitoring, allowing for long-term monitoring. However, PAM generates large volumes of data, requiring the development of automatic methods to detect and classify species. In this context, we describe two approaches to discriminate Delphinidae vocalisations: one based on signal metrics (using for instance a Linear Discriminant Analysis or a Gradient Boosting Classifier), and the other based on the entire signal shape (using ResNet-50, a convolutional neural network). These models were applied to two case studies. The first aimed to discriminate whistles produced by two dolphin species recorded in the English Channel: bottlenose dolphins (*Tursiops truncatus*) and short-beaked common dolphins (*Delphinus delphis*). The second aimed to distinguish calls produced by two killer whale (*Orcinus orca*) ecotypes encountered around the Crozet Islands: the Crozet Type and Type D. For both case studies, we estimated standard performance metrics based on the ratio of true positives at the vocalisation scale. Models for both studies achieved an average classification accuracy of around 80%. To approximate more realistic conditions in bioacoustics studies, we then investigated performance at the acoustic-event scale, as the proportion of well classified vocalisations per event (not used to train models). This approach allows for a certain degree of uncertainty at the vocalisation level while still enabling species or ecotype discrimination by considering the entire context. Application of the models to dolphin species revealed high precision when tested on an independent dataset from the Bay of Biscay. This approach also yielded a reliably high probability of assigning a killer whale acoustic encounter at Kerguelen to Type D. Overall, these studies demonstrate promising approaches for assessing the presence of marine mammals in environmental studies, with a good level of taxa's description.

Cross-border ecology of the Mediterranean monk seal (*Monachus monachus*): conservation lessons from a female moving Türkiye–Israel

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On May 12th, 2023, an exhausted Mediterranean monk seal (*Monachus monachus*) came ashore on Jaffa beach, along the central Israeli coastline. Human disturbance forced the animal back into the water, prompting immediate intervention by the local municipality, the Israeli Nature and Parks Authority (INPA), and Delphis NGO volunteers, who established a controlled exclusion zone with 24/7 surveillance. Photographs were sent to the IUCN Mediterranean Monk Seal conservation group for identification. A distinctive dorsal scar enabled confirmation that the individual was an already-identified adult female monitored since 2007 in southern Türkiye, over 530 km from the Israeli haul-out site. The seal remained ashore for 56 hours, responding only to waves or nearby animals. An international veterinary and research team was assembled to evaluate possible intervention. However , the animal's characteristics provided by Turkish researchers tipped the scales in favor of monitoring only, without intervention. Upon the animal's first return to the sea, two fresh scars were observed on the wet fur, most likely inflicted by a shortfin mako shark (*Isurus*

oxyrinchus). Over subsequent days, haul-out periods gradually decreased, while time spent at sea increased. On the fifth day, the seal left the beach of Jaffa, after which its movements were documented and monitored thanks to public help: reports and documentation of real-time sightings reached Delphis and INPA. The individual remained in Israeli waters for 17 days, with the last confirmed sighting documented in the Gaza Strip on June 2nd, 2023. This is the fourth Monk seal documented along the Israeli coast since 2010. Notably, two of the four individuals—both females—were also identified in neighboring countries. This case highlights the critical need of regionally coordinated conservation efforts for *Monachus monachus*, demonstrating how ecological requirements of this endangered species transcend national jurisdictions and require integrated, transboundary management.

Recent expansion of *Balaenoptera edeni* occurrence along southern Portugal: evidence from an anomalously warm year (2025)

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Bryde's whales (*Balaenoptera edeni*) are rarely documented in the northeastern Atlantic Ocean, and their presence in mainland Portuguese waters has been considered sparse. Since 2021, however, opportunistic monitoring during whale-watching operations in the Algarve has revealed a marked increase in sightings, culminating in an unprecedented peak in 2025, a year characterised by anomalously high sea surface temperatures. This study aims to describe the recent expansion of Bryde's whales occurrence along the southern coast of Portugal and examines environmental, behavioural, and demographic patterns associated with this rise. Between 2021 and 2025, data were collected during opportunistic surveys, including GPS tracks, environmental parameters (depth, SST, Beaufort wind scale), group composition, behaviour, vessel interactions, detection clues, and vessel density. Photo-identification was conducted when image quality allowed, and drones provided morphometric data from 45 flights. Across the study period, 218 sightings were recorded, of which 183 in Faro (Eastern Algarve) and 35 in Portimão (Western Algarve). A total of 21 different individuals were identified including 10 re-sighted across days or months. Notably, two mother–calf pairs were documented, one of which was re-sighted approximately two months later, suggesting short-term use of the area. Feeding was the predominant behaviour observed in both areas. Furthermore, Bryde's whales were sometimes encountered in mixed-species foraging aggregations with common dolphins (*Delphinus delphis*), striped dolphins (*Stenella coeruleoalba*), and Atlantic spotted dolphins (*Stenella frontalis*). Sightings tended to coincide with warmer-than-average sea surface waters, supporting a potential link between the 2025 heat anomaly and increased regional presence. These findings provide the first consistent evidence of Bryde's whale habitat use in southern Portugal and highlight the value of opportunistic platforms for detecting rapid ecological change. Continued monitoring is essential to determine whether these observations reflect a transient anomaly or indicate the onset of a longer-term northward range expansion.

Environmental DNA reveals sex, mitochondrial haplotypes, and nuclear allele frequencies from sperm whales in the Azores

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Sperm whales (*Physeter macrocephalus*) play a key ecological role in the North-East Atlantic, yet their deep-diving behavior, complex social structure, and low genetic diversity challenge efforts to assess population status. Environmental DNA (eDNA) analysis offers a minimally invasive complement to traditional genetic methods, with growing potential to support population-level monitoring. This study evaluated how eDNA-derived data can inform genetic assessments of sperm whales using molecular sexing, mitogenome sequencing, and microsatellite analysis. During summer 2023, 59 tissue biopsies and 62 paired 30 L eDNA samples were collected from sperm whales off the Azores. All tissue samples and 42 eDNA samples testing positive for vertebrate DNA were selected for downstream analyses. First, they were processed using a species-specific molecular sexing workflow with newly designed SRY and ZFX assays. Sex was assigned for 50% of eDNA samples, matching results from associated tissue biopsies (8 males, 14 females). Next, long-range PCR of five mitochondrial fragments produced >3 kb amplicons for 25 eDNA and 46 biopsy samples, which were sequenced with an Oxford Nanopore Technologies MinION to recover haplotype information. After strict bioinformatic filtering and quality checks, 10 eDNA samples yielded high-confidence mitochondrial reads identical to biopsy-derived sequences from the same encounter. Polymorphisms and haplotype structure were consistent with previously reported low but informative mitogenomic diversity expected in a strongly matrilineal species. The remaining eDNA samples did not meet coverage or variant-support thresholds. Finally, nuclear genetic information obtained from a 14-locus microsatellite panel enabled the first comparisons of allele frequencies between sperm whale tissues and eDNA samples. Collectively, these results demonstrate that population-genetic signals can be recovered from eDNA and integrated into non-invasive monitoring of sperm whale population structure and diversity.

Modelling sperm whale–vessel collision risk in the Canary Islands

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Collisions between vessels and sperm whales (*Physeter macrocephalus*) are a major conservation concern, particularly in the Canary Islands—an area recognized as a global hotspot for ship strikes. This study aimed to analyse the spatial risk of collisions between sperm whales and vessels in the Canary Islands by understanding the species' distribution through ecological modelling and its overlap with maritime traffic. This study results from a collaborative effort among researchers and institutions across the archipelago to compile data on this deep-diving species. A total of 478 validated whale records collected between 1913 and 2024 from systematic surveys, land-based monitoring, and opportunistic observations were pooled together. The use of opportunistic data allowed us to enhance spatial coverage and ecological inference in these data-limited contexts. Using GAMs within a presence–background framework, sperm whale habitat suitability was modelled as a function of bathymetry, chlorophyll concentration, and sea surface height, among other dynamic and static environmental predictors. The seven best-performing models were combined into an ensemble to generate archipelago-wide predictions. Collision risk was then estimated as the pixel-wise product of predicted habitat suitability and AIS-derived vessel density, weighted by a lethality probability based on vessel length and speed and computed

separately for each vessel type. Results indicate that high collision risk extends across the entire archipelago, with particularly elevated values in inter-island channels and corresponding major shipping routes, reflecting both the overlap between whale habitat and maritime traffic and the species' generalist habitat use. Results also demonstrate a more elevated risk of lethal collision involving fast ferries, cargoes and tankers. Although modelling studies inherently involve uncertainty, the results provide useful insights to inform management measures such as adaptive speed regulation, routing adjustments, and the development of early detection systems.

Seasonal shifts in fin whale (*Balaenoptera physalus*) distribution off the western Antarctic peninsula: implications for the management of important feeding grounds

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Recent estimates of Southern Hemisphere fin whale (*Balaenoptera physalus*) abundance indicate that the population is on track to reach pre-exploitation levels and is reclaiming historical feeding grounds off the Western Antarctic Peninsula (WAP). Fin whales migrate southwards during the austral summer to feed on Antarctic krill but today face pressures from the expanding krill fishery and increased vessel traffic at the WAP. The aim of this study was to better understand fin whale distribution and habitat use off the WAP and assess the spatiotemporal overlap with areas under international management. Systematic surveys using distance sampling methods were carried out via platforms of opportunity provided by IAATO tourist vessels over ten expeditions to the WAP in March 2014-19 and January 2023-25. Density surface models (DSM) were fitted to the January and March sightings (n = 106) separately using a set of environmental variables to best explain fin whale distribution. Findings highlighted that fin whales are predominantly an offshore species but found differing areas of importance to fin whales during mid and late summer. In January (mid-summer) high fin whale density was predicted to concentrate along the shelf edge where their preferred prey aggregates (large adult krill). In March (late-summer), high fin whale density shifted towards the middle of the shelf, driven by the migration of krill inshore. Overall, fin whale distribution was best explained by static, bathymetric features that influenced the aggregation of krill. High spatial overlap (≥50%) was found between areas of high fin whale density (≥4 whales per 10km2) and the krill fishing zone, but low spatial overlap (<50%) occurred with the general protection and speed restriction zones. These findings suggest a need to revise management criteria off the WAP to expand current conservation efforts offshore and provide adequate protection of important feeding grounds from human activity.

Identifying critical vessel speed and noise periods during whale watching sperm whale (*Physeter macrocephalus*) sightings

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Anthropogenic underwater noise is increasing globally, posing a threat to highly vocal species such as cetaceans. In the Azores, whale-watching (WW) is a major maritime-touristic activity, with animals, including sperm whales, one of the main WW targets, frequently exposed to vessel presence. However, vessel behaviour and underwater noise during sightings remain poorly assessed. This study characterises vessel activity and noise in the vicinity of sperm whales, identifying potential critical periods. GPS from a catamaran and acoustic data were collected during regular commercial trips around São Miguel Island between June 2024 and November 2025. Four vessel behaviour periods were defined during the sightings: “arriving/departing”, “waiting” for the animals to surface, “moving” between sightings and “sighting”. Sound Pressure Levels (SPLs) were quantified using 1/3-octave bands centred at 125, 1000, 2000, and 10000 Hz, metrics frequently used for small-vessel noise. GPS data (72 sightings, 51 hours) showed that vessels spent, on average, 34 ± 14 minutes within sperm whale areas, with only 43% of this time corresponding to direct animal observation. The remainder time consisted of “waiting” at low speed (42%, 3 ± 2.4 knots), interspersed with short, faster periods “moving” (14 ± 4.2 knots). During the acoustic recordings (12 h), WW vessels were detected 59% of the time. SPLs ranged from 78.42 to 122.25 dB re 1µPa at 500 Hz. Overall SPLs were similar with and without vessels, likely reflecting the extended low-speed periods. The higher-speed periods significantly increased SPL mean values by 7,5 dB re 1µPa. These results identified the “arriving/departing” and “moving” as the most critical vessel noise and speed periods. In the future, the overlap of GPS-acoustic data will provide a better understanding of the relationship between vessel behaviour and noise levels, which may improve monitoring strategies directly supporting vessel management and best WW practices.

PFAS concentrations in marine mammals from Greenland and Swedish waters 2010-2019

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In this study we compare concentrations of per- and polyfluoroalkyl substances (PFAS, so called “forever chemicals”) in marine mammals from Greenland and Sweden in relation to suggested threshold levels suitable for human consumption. Altogether liver samples from 90 mammals from Greenland were analysed: 23 from West Greenland: narwhales (*Monodon monoceros*), harbour porpoises (*Phocoena phocoena*), humpback whales (*Megaptera novaeangliae*), harp seals (*Pagophilus groenlandica*) and white beaked dolphins (*Lagenorhynchus albirostris*) and 17 mammals from East Greenland (harp seals, white beaked dolphins, long finned pilot whales (*Globicephala melas*) and a killer whale (*Orcinus orca*). Furthermore, 23 harbour porpoises, 20 grey seals (*Halichoerus grypus*) and seven pooled samples of ringed seals (*Pusa hispida*) from Swedish waters were included. All specimens were collected between 2005-2019, from domestic hunt in Greenland and Sweden, and bycaught or stranded animals (Sweden) and all appropriate permits were obtained for use and transport of materials. Generally, the porpoises from Swedish waters showed the largest range of PFOS (4-812 ng/g wet weight) and PFOSA (2.3-46 ng/g) whereas PFNA had higher concentrations in grey seals (15.4-97 ng/g) and ringed seals (30-75 ng/g). The one sample from a killer whale was not among the highest concentrations, not even within Greenland (apart for FOSA). White-beaked dolphins from West Greenland showed the highest range of PFUnDA (12-121 ng/g), PFTrDA (4.6-244 ng/g), PFTeDA (0.7-12 ng/g) and PFDoDA (2.4-20 ng/g). Only very few specimens had concentrations below threshold values for human consumption, set by the European Union, based on liver from domestic animals (2 ng/g for PFOS and 0.1 ng/g for PFOA, PFNA and PFHxS). In conclusion, despite geographical location almost all specimen had concentrations higher than suggested values for human consumption, even in the far north. And generally, and as expected, the concentrations were higher in specimens from Sweden compared to Greenland.

Validation of early detection systems to reduce cetacean collisions in the Canary Islands

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Increasing marine traffic poses a ship-strike threat to cetacean populations worldwide. This is exacerbated in areas where dense traffic overlaps with rich communities of cetaceans, such as the Canary Islands, with 32 cited species of cetaceans. The archipelago has been identified as a ship-strike hotspot by the International Whaling Commission and the International Maritime Organization. While the rise in international shipping is worrying, of particular concern is the occurrence of more than 20,000 yearly inter-island crossings of high-speed vessels travelling at up to 38 knots. On-going mitigation efforts include the development of technology for early detection of cetaceans facilitating the application of a strike avoidance protocol. On-board thermal cameras are widely used with this aim, but their applicability from fast ferries is still untested. As part of the Interreg Atlantic Whale Deal project, this study evaluates the effectiveness of two artificial intelligence software systems for early detection of cetaceans from fast-ferries: CVAT and SEA.AI. Both systems use multimodal and multifocal deep-learning methods for real-time detection and tracking using a combination of thermal and RGB images. Validation was performed using videos collected from fast-ferries and trained Marine Mammal Observers recording cetacean sightings. The dataset is representative of real-world scenarios, covering a variety of weather conditions and sea states. The results provide an assessment of each software's performance in early cetacean detection, highlighting both capabilities and limitations of both systems and the parameters affecting the occurrence of false positives and negatives. While thermal detection is clearly a worthy avenue for ship-strikes mitigation, our findings underscore the need for further testing for these systems to be reliably applicable from fast ferries. This highlights the importance of integrating technology in a broader ship-strike mitigation

strategy in order to prevent further strike mortality of cetaceans in the short-term in the Canary Islands.

A case study focusing on harbour porpoise (*Phocoena phocoena*) to trial automatic identification systems to aid in marine mammal impact assessment

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There has been considerable development of offshore windfarms off Scotland's east coast, with many projects still in the planning phase. A key factor in Environmental Impact Assessments for marine mammals is the effect of noise and disturbance from vessel traffic. Noise levels from vessels increase with vessel size and speed, making vessel type as important as vessel density. This is a case study using harbour porpoise (*Phocoena phocoena*) distribution data to investigate how AIS can best be used to aid impact assessment. Since 2020, HiDef Aerial Surveying has routinely collected Automatic Identification System (AIS) data during Digital Aerial Surveys (DAS), conducting over 130 surveys around the Firth of Forth and Tay region and surrounding areas. Using a combination of AIS and EMODnet vessel data, spatial and temporal patterns have been explored, demonstrating that the coastal 20km region from shore experiences the highest mean vessel density compared to all other regions ranging from 13.27 hours/km²/month in 2021 to 14.57 hours/km²/month in 2023. For all regions combined, the annual mean vessel density increased each year (except 2019), from 6.95 hours/km²/month in 2017 to 8.86 hours/km²/month in 2023. With this increase also came a change in vessel composition, 'support and supply vessels' made up a larger proportion of recorded vessels in 2024 compared to 2020. To use harbour porpoise as a case study, EMODnet data was overlayed with a species distribution model for harbour porpoise based on data collected via DAS. AIS was then used to investigate the type and speed of vessels present in the areas that had the greatest overlap with harbour porpoise. Radiated noise from different types of vessels was included in modelling to investigate how distance to vessel, and vessel type, may impact porpoise distribution.

Long-term trophic ecology and distribution of fin whales from bone stable isotopes

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Understanding behavioural responses of marine organisms to environmental and anthropogenic-driven change is essential for assessing ecosystem condition and anticipating its future dynamics. We aimed to investigate long-term shifts in the trophic ecology and foraging distribution of fin whales (*Balaenoptera physalus*) feeding off southwest Iceland during summer by using stable isotope ratios of nitrogen (δ15N), carbon (δ13C), and oxygen (δ18O) measured in the tympanic bulla of individuals harvested in 1984–1986 (n = 47) and 2015–2023 (n = 7). Inner and outer layers of this bone, representing the in-utero and last-formed tissues respectively, were analysed to evaluate (i) isotopic differences between layers and their potential to infer maternal behaviour, and (ii) isotopic multidecadal trends indicative of environmental or behavioural change. δ15N and δ18O values were significantly higher in its outer than in its inner layer, whereas δ13C values showed no difference, suggesting that the tympanic bulla could record both maternal and individual behaviour. By looking at the most recently deposited bone layer of each fin whale, we observed that δ15N and δ18O values declined, while δ13C increased slightly across decades, potentially indicating ecosystem-driven shifts in diet and habitat use. Alternatively, the calibration of seawater 18O-isoscape with bone δ18O values with fin whales from NW Spain and SW Iceland revealed distinct spatial patterns between samples of both regions and indicated a limited poleward shift in individuals from SW Iceland. These findings highlight the potential of cetacean bone, particularly the tympanic bulla, as a long-term ecological archival tissue to trace foraging distribution and habitat use in homeothermic marine predators.

Mycoplasma in stranded cetaceans from North Atlantic waters: new records for *Grampus griseus* and *Ziphius cavirostris*

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Mycoplasma spp. have been reported in several cetacean species, but information from European Atlantic waters remains scarce. This study investigated the presence of these bacteria in cetaceans stranded along the Galician coast (NW Spain) between 2023 and 2025. Spleen samples from 54 individuals representing the families Phocoenidae (n=5), Delphinidae (n=46), Kogiidae (n=2) and Ziphiidae (n=1) were collected and analyzed using molecular methods. DNA was extracted using a commercial kit, and a PCR protocol targeting the 16S rDNA partial gene of Mycoplasma spp. was performed. Positive amplicons were sequenced and compared against the GenBank database. Five samples tested positive – three *Delphinus delphis*, one *Grampus griseus* and one *Ziphius cavirostris* – corresponding to an overall prevalence of 9.3%. The obtained sequences showed a percentage of identity higher than 97% with various hemotropic *Mycoplasma* spp. previously detected in other cetacean species from Brazil and Mexico. To the best of our knowledge, previous screenings of *G. griseus* and *Z. cavirostris* have been negative. Our findings therefore represent the first worldwide documentation of Mycoplasma in these two species and provide new data on the occurrence of this pathogen in northeastern Atlantic cetaceans.

Comparative body morphometrics of free-ranging short-finned pilot whales in the North Atlantic and Central Pacific from aerial photogrammetry

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Populations experiencing geographical isolation often develop genetic divergence accompanied by observable morphological differentiation. This study compares the morphometrics of two morphotypes of short-finned pilot whales (*Globicephala macrorhynchus*), hereafter SFPW, both classified as the Naisa type but occupying distinct ocean basins: the North Atlantic and the Central Pacific. Morphological divergence between these populations is expected due to limited gene flow across the thermal front of the Benguela Current. Unmanned aerial vehicles (UAVs) were used to obtain zenithal photographs of free-swimming individuals in the Canary Islands and Hawai'i. Body length (BL), width, and dorso-ventral height were extracted from aerial photographs and used to estimate body volume (BV). Standard Major Axis (SMA) regression was used to examine BL–BV allometric relationships across regions. A total of 365 SFPW were measured between 2020 and 2024. BL showed no significant regional differences, whereas BV was significantly larger in whales in the Canaries compared to Hawai'i (adults 7%), juveniles (15%) and calves (70%). A strong linear relationship between log-transformed BL and BV was observed across all populations ($R^2 > 0.94$, $p < 0.001$). SMA regression found no significant difference in slope (LR = 2.284, df = 2, p = 0.319), but a significant difference in elevation (vertical offset under a common slope; Wald = 71.24, df = 2, $p < 0.001$) indicated variation in relative BV at a given BL, consistent with differences in body condition rather than allometric scaling. Overall, the observed morphometric variation likely reflects region-specific ecological pressures and may also be influenced by underlying population structure.

Updating records of *Ziphius cavirostris* and *Balaenoptera physalus* in the Northern Ionian Sea

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The Northern Ionian Sea (NIS) (Central-Eastern Mediterranean Sea) area is known to regularly host eight cetacean species. Up to date, it is described as a critical habitat for *Stenella coeruleoalba*, *Tursiops truncatus* and *Grampus griseus*, whereas it seems also serving as an occurrence area for *Delphinus delphis*, *Ziphius cavirostris*, *Physeter macrocephalus* and *Balaenoptera physalus*. Particularly, *Z. cavirostris* and *B. physalus* are considered rare in this region with historical records mostly documented through sporadic strandings and occasional sightings. This study aims to update the occurrence of both species in the NIS and to suggest a wider ecological relevance of the area. Sightings were collected during standardised vessel-based surveys conducted as part of a long-term cetacean monitoring programme started in 2009. The first sightings of *Z. cavirostris* were reported in 2023 and 2024, occurring within a depth range between 500 and 1110 m and involving groups of 2–3 individuals. Although the brief visual contact prevented detailed behavioural assessment, their presence aligns with the species' preference for steep slope habitats and suggests that the NIS may represent an overlooked portion of its Mediterranean range. In February 2025, an individual of *B. physalus* was observed feeding at approximately 600 m depth, providing the first recent evidence of active foraging by this species in the area. Occasional *B. physalus* literature records from 1994 to 2009 had already suggested the potential ecological relevance of the NIS. Now, this further observation reinforces the key role of this basin within broader movement and habitat-use patterns of the species in Mediterranean. These results highlight the value of continuous monitoring because capable of documenting rare events in this portion of the Mediterranean.

Critical seconds: modelling time to potential collision in vessel-whale encounters

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Vessel-whale collisions are a growing global concern and remain extremely challenging to accurately quantify. The use of proxies, such as Close Encounters (CEs), has been proposed and widely employed to assess collision risk. Using Time to Potential Collision (TPC) to define Ces, instead of a fixed distance, provides a novel, dynamic and speed-sensitive approach. A reduced TPC at the time of whale's detection prevents precautionary measures potentially needed to avoid a collision. This study aimed to identify the variables influencing TPC, and consequently collision risk, at the time of a whale's detection, using 13 years of cetacean occurrence data from the Eastern North Atlantic. Visual monitoring was conducted by dedicated Marine Mammal Observers (MMOs) onboard cargo ships and oceanographic vessels, used as research platforms. Ces were categorised into Surprise Encounters (Ses), Near-Miss Events (NMEs), and Likely Collision Events (LCEs), with thresholds defined based on TPC. A Generalised Additive Model was fitted to evaluate the influence of detectability-related variables on TPC, such as family, group size, sea and wind states (according to the Douglas and Beaufort scales, respectively), presence of rain, visibility conditions, vessels' characteristics, and MMOs experience (evaluated using qualitative criteria, based on the literature). The TPC of 873 on-effort sightings were included in the model, of which 441 were Ces, with a TPC lower than 116.63 seconds (including 417 Ses, 24 NMEs, and 7 LCEs). Lower TPC values were associated with beaked whales, cargo ships (relative to oceanographic vessels), the presence of rain, lower visibility conditions, and lower MMOs' experience. These variables had a significant impact on TPC, as they can substantially influence whale detectability. These findings contribute to a better

understanding of vessel-whale interactions in this region and highlight the importance of imposed mitigation measures, such as decreased speeds and having experienced MMOs onboard, to reduce collision risk.

Methods for estimating the active drag coefficient (λ) in free-ranging cetaceans using multi-sensor suction-cup tag data

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Carangiform fishes, lamnid sharks, and marine mammals have independently evolved oscillatory fin and fluke movements as an efficient mechanism for thrust generation. Quantifying swimming efficiency requires estimates of thrust and the active drag coefficient. However, existing methods, typically applied to small captive animals, are not transferable to large free-ranging cetaceans, creating a major gap in our understanding of their diving energetics. We investigate multiple methods for estimating the active-to-passive drag ratio, λ, using depth, accelerometer, and magnetometer data collected from suction-cup tags. Using the magnetometer method, we separate specific acceleration from body rotations to obtain key kinematic signals such as stroke frequency and relative stroke amplitude. Gliding periods provide independent measurements of buoyancy and passive drag coefficients. As an initial reference, we applied unsteady lifting-surface theory, a published but unverified framework for modelling thrust production in large cetaceans, to obtain predictions for λ. We developed several alternative approaches for estimating λ, including: (1) identifying the λ value that produces the best model fit between observed kinematics and theoretical acceleration; (2) estimating thrust directly from surge-axis specific acceleration; and (3) using shallow-depth buoyancy changes to independently infer thrust and active drag. Preliminary results with these alternative approaches indicate that λ is substantially lower than estimates derived from unsteady lifting-surface theory, which typically predict up to a ten-fold rise in active drag. Instead, our observations suggest moderate increases during stroking, suggesting that the energetic cost of swimming in large cetaceans may be considerably lower than estimates based upon unsteady lifting surface theory.

Sperm whale disentanglement in Scotland: a case study off the Isle of Skye

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We review our attempt to disentangle an adult male sperm whale (*Physeter macrocephalus*) approximately 14 m in length in the Sound of Raasay, Scotland, in early 2025. Our objective is to identify challenges specific to this large whale disentanglement and to document the operational and welfare considerations associated with this case. Over multiple days, a seven-person rescue team worked with support from local tour boats and land-based observers. Initial assessment from a support vessel, supplemented by drone footage, enabled the team to examine the extent of the entanglement and plan a safe cutting sequence. The assessment indicated extensive rope wraps around the head. Three team members approached the whale in an inflatable vessel, moving slowly closer each time to accustomise the whale to the boat. Operations were curtailed on the second day due to deteriorating weather and resumed on the third under calm conditions. Using knives on poles, the team removed approximately 5 m of rope across multiple cuts, after which the whale demonstrated improved manoeuvrability and longer, more forceful dives. The whale's emaciated body condition, exhaustion, and restricted feeding capacity indicated a poor prognosis despite partial gear removal. The animal stranded alive on the Isle of Raasay shortly after the response concluded and died soon after. Post-mortem examination revealed over 100 m of additional rope which was not accessible during the operation. This case highlights significant challenges in assessing entanglement severity in sperm whales, the value of drones for assessment and support, and the importance of dynamic risk assessment for both welfare and responder safety. Findings contribute to improving future large whale disentanglement practice.

Shedding light on Mediterranean monk seal (*Monachus monachus*) cave use along the southern coastline of Türkiye (2019–2023)

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The Mediterranean monk seal (*Monachus monachus*) exists as a Vulnerable species worldwide according to the 2023 IUCN Red List assessment but remains Endangered in the Eastern Mediterranean region. The research investigates how coastal caves function as seal retreats for pupping, nursing and resting under human activities that continue to expand. The research team conducted boat-based skin-dive surveys to identify 12 caves between Gökova Bay and Kaş while using camera traps for monitoring during 2019-2023. The research team verified nine caves as monk seal habitats. The monitoring data showed that seals spent 3,152 hours in caves during 327 haul-outs. The population ranges of Gökova Bay included 19-22 seals while Datça-Bozburun had 2 seals and Fethiye-Göcek had 6 seals and Kaş had 9-10 seals. The number of adult female seals visiting the caves increased during periods when their pups were present. Three caves recorded mother-pup interactions and social bonding of pups and vocalizations which served as individual recognition signals. The installation of a solar-powered remote monitoring system in 2019 marked the first such system in Türkiye which delivered better video quality for seal identification and protected data from loss and minimized human-seal encounters. The artificial ledge installed in a cave since 2020 proved that habitat enhancement programs especially in remote locations create successful solutions to decrease human interference in seal habitats. The extended monitoring program delivers vital knowledge about the natural habits, social patterns and population dynamics of this endangered marine species. The research delivers immediate data to government agencies and stakeholders which enhances their ability to create better conservation plans and execute more successful protection efforts in essential habitats. This study was supported by Fauna & Flora and was funded by the Endangered Landscapes Programme, the Prince Bernhard Nature Fund, the ZSL – EDGE of Existence Programme.

Concentration patterns of intentionally and unintentionally produced PCBs in harbour porpoises (*Phocoena phocoena*) stranded along the British coast

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Polychlorinated biphenyls (PCBs) are toxic synthetic chemicals extensively used throughout the 20th century until their ban in the 1980s. Although production ceased decades ago, PCBs persist in marine ecosystems and biomagnify up the food chain, contributing to immunotoxicity in marine mammals. While their persistence alone is a cause for concern, recent studies have revealed an overlooked threat in the form of unintentionally produced PCBs released as byproducts in other processes. Emerging literature suggests that unintentional PCBs could be responsible for up to half of PCBs found in marine mammal tissues, yet their trends remain poorly understood. To address this knowledge gap, we investigated spatiotemporal patterns of PCB concentrations in the blubber of harbour porpoises (*Phocoena phocoena*) stranded along the coast of Great Britain between 1992 and 2021. We focused on two congeners: CB128, linked to historical intentional production, and CB138, arising from both intentional and unintentional sources. Using Generalised Additive Mixed Models, we found that CB128 and CB138 concentrations were 43.3% and 47.05% lower, respectively, in porpoises stranded in Scotland compared to England. As anticipated following the ban, CB128 significantly declined through time, however, the rate of decline was steepest for animals stranded in Scotland and limited for individuals stranded in England. In contrast, CB138 that is known to be unintentionally produced showed no change in blubber concentrations through the time series for animals stranded in England,

suggesting long term persistence and also new production. This raises important questions about sources and impacts of the ongoing release of PCBs into marine habitats, particularly around England, which is characterised by a larger human population size and increased industrialisation. In particular, the results highlight the need for monitoring concentrations of unintentionally produced PCBs in marine mammals to inform wildlife management and new pollution control policies to reduce their continued ecological impacts.

Reproductive parameters and nutritional condition of stranded female harbour porpoises from the southern North Sea

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The harbour porpoise (*Phocoena phocoena*) population in the North Sea is under increasing anthropogenic pressures, for example from noise pollution, fisheries, contaminants and climate change. To understand population consequences of anthropogenic disturbances on the population, knowledge of reproductive parameters is needed for informed management and conservation decisions. This study uses stranded female harbour porpoises to describe the reproductive cycle and assess potential links between nutritional condition and reproductive status. We assessed 345 necropsied female harbour porpoises stranded in the Netherlands from 2009 to 2025, determining their reproductive status and nutritional condition based on post-mortem investigations. The nutritional condition was established using a combination of blubber thickness, visceral fat and muscle mass, subdivided into three categories (good, moderate and poor). Among adult female harbour porpoises, 13% were pregnant, 25% were lactating, and 16% were both pregnant and lactating. The remaining 46% were neither pregnant nor lactating (category ‘resting’). The pregnancy rate, the proportion of pregnant animals in total sample of mature animals, was 0.34. The pregnancy rate for harbour porpoises that had a good nutritional condition (0.57) was higher than the harbour porpoises in the moderate (0.23) and poor categories (0.26). A significant association was found between the reproductive status and the nutritional condition of harbour porpoises, with pregnant and both pregnant and lactating female harbour porpoises being found significantly more often in the good nutritional category, compared to harbour porpoises in the resting category. These results suggest that reproduction in female harbour porpoises is intricately linked with sufficient energy storage. Maintaining such storage can be challenging in an environment under pressure, which could ultimately impact harbour porpoise population dynamics. With this study, we provide region specific data on reproduction allowing for region specific management, improving the conservation of harbour porpoises.

Fine-scale variability in harbour porpoise acoustic detections in the north-western Baltic Sea

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Passive acoustic monitoring (PAM) data from 30 C-POD stations in the Kattegat and Kriegers Flak areas (Baltic Sea) were analysed over two consecutive years to evaluate spatial patterns of detection dynamics with a focus on interannual variability in phenology. Daily detection rates, temporal distribution of acoustic activity, and phenological markers, including onset, peak, and end of seasonal occurrence, were quantified. The results revealed substantial heterogeneity across the monitoring network, while the general detection pattern across stations suggested that stations clustered in specific subareas broadly followed a common phenological pattern. Several stations showed a pronounced interannual variability, with large differences in detection rate magnitude and shifts in onset, peak, and end of seasonal occurrence, indicating strong sensitivity to year-specific environmental conditions or local habitat dynamics. In contrast, a subset of stations showed remarkably consistent patterns between the two years. Detection rates were nearly identical, and seasonal curves showed a high correlation. These stations indicate consistent and predictable seasonal habitat parameters. Overall, the two-year comparison highlights station-specific dynamics, which are most likely either based on year-specific environmental conditions or specific seasonal habitat conditions. This finding underscores the importance of multi-year, multi-site PAM networks and further analysis of ecological factors to better understand the seasonal habitat use of porpoises. The results can help us develop and optimise conservation strategies.

Skye fisheries end of life rope recycling coalition

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1. *KIMO International*

Abandoned, lost and discarded fishing gear, including end-of-life rope from wild fisheries, is a major contributor to microplastic presence as well as marine entanglement risk in Scottish waters, particularly for cetaceans and basking sharks. While Scotland has begun transitioning towards safer fishing practices—such as the use of sinking groundlines to lower entanglement risk—there is no clear national framework for what happens when gear reaches the end of its operational life. As a result, communities with limited waste infrastructure face high costs and logistical barriers that push gear into landfill, skip hire or informal stockpiles. Fishing for Litter has operated in the UK since 2005 and now spans more than 70 harbours, with over 480 fishing vessels registered and more than 2,650 tonnes of marine litter recovered. FFL is recognised as the leading mechanism enabling fishermen to remove litter from UK seas. Despite this success, end-of-life gear recycling remains fragmented, inaccessible and cost-prohibitive, particularly for island communities. Most recycling options are designed for clean, single-material plastics, whereas fishing gear is mixed polymer, heavily contaminated and difficult to transport economically. These constraints discourage retrieval of ghost gear and undermine Scotland's efforts to protect marine wildlife. To address this gap, FFL is project managing the Skye Fisheries Recycling Coalition. A project we understand to be the first in Scotland to coordinated rope recycling from creel fishermen, aquaculture companies, harbour authorities and ghost gear disposed of in Fishing for Litter harbourside bins into a shared end-of-life disposal system. Rope has been consolidated and transported in bulk to Waterhaul, a specialist marine polymer recycler. This removed the cost/logistics burden from individual users, who previously had no viable recycling outlet. This presentation will identify where recycling capacity exists, where it fails, and what infrastructure/investment the UK requires to responsibly process its end of life gear.

Abundance of the short-finned pilot whale in southwestern Tenerife

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In the southwest of Tenerife, Canary Islands, the short-finned pilot whale, *Globicephala macrorhynchus*, is the main target species of a prospering whale-watching industry and is consequently the species most affected by anthropogenic activity in this area. As part of the national monitoring strategy, a photo-identification capture-recapture program was conducted in the Special Area of Conservation (SAC7020017) Punta Teno-Rasca between January 2023 and April 2025 to assess abundance, population structure and temporal dynamics. A total of 45 dedicated surveys covering 3,014.86 km recorded 441 cetacean sightings, 307 of them pilot whales, confirming the area as a core habitat for the species. More than 78,000 photographs were collected and 949 individuals catalogued, of which 540 well-marked animals were included in demographic modelling. Closed- and open-population mark-recapture frameworks were applied. Robust Design models revealed a pronounced seasonal pattern in local abundance, ranging from 369 individuals (95% CI: 287–476) in winter–spring to 717 individuals (95% CI: 628–819) in summer. POPAN superpopulation estimates indicated that 1,065 individuals (95% CI: 940–1,206) used the study area across the full monitoring period, reflecting an open population composed of residents, seasonal visitors, and transients. Heterogeneity in recapture and temporary emigration parameters indicated dynamic movement and availability patterns within the archipelago. These findings confirm that the SAC Punta Teno–Rasca constitutes a biologically essential area for short-finned pilot whales and provide a robust scientific baseline for conservation measures and management of human activities in this protected zone.

UAV-based determination of lateralization in mother–offspring pairs of bottlenose dolphins (*Tursiops truncatus*) in the Zonguldak waters of the southwestern Black Sea

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Bottlenose dolphin (*Tursiops truncatus*) mother-calf pairs exhibit various types of interactions including socially coordinated behaviors. One of the important aspects of such interactions is the lateralization that allows the offspring to benefit from the mother's vigilance, protection and social coordination. This study investigated the spatial lateralization of the offspring in relation to their mothers by analysing data collected along the Zonguldak coastline of the southwestern Black Sea. Since January 2025, boat-based surveys have been conducted and 35 bottlenose dolphin groups have been sighted. From these, nine mother–offspring pairs were successfully recorded using unmanned aerial vehicles (UAVs) and included in the analysis. Specifically, we examined the offspring's side preference (left or right) while swimming alongside their mother and quantified the proportion of time spent in each position. Our preliminary results revealed an age-related shift in spatial lateralization and positioning relative to the mother. Calves (n = 3) demonstrated a preference for the mother's left side (two of three individuals showed statistically significant preference, $p < 0.05$) and were predominantly observed in the echelon position. Juveniles (n = 5) exhibited variable lateralized behavior, with a majority favoring the right side (n = 3). While the observed side preference highlighted high individual variability, juveniles were significantly observed in the infant position. Newborn (n=1) was exclusively observed on the mother's right side. As the first lateralization study conducted in the Black Sea using UAVs, this work introduces a novel methodological approach and provides valuable aerial insights into the dynamics of mother–calf interactions in their natural habitat. Understanding positional preferences in mother–calf pairs provides a basis for developing behavior-based conservation strategies for the Black Sea bottlenose dolphin population.

Variation in harbour porpoise (*Phocoena phocoena*) diet in the coastal waters of Great Britain

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The harbour porpoise (*Phocoena phocoena*) is the most abundant cetacean in European shelf waters, yet its population ecology, including diet, remains under-described. Improving knowledge of harbour porpoise diet is important to advance understanding of their ecology and how they may respond to changes in prey availability caused by human activities. We analysed fish otoliths and squid beaks recovered from 362 stranded and bycaught porpoise stomachs collected from the UK coast and surrounding waters from 1995-2022 to describe regional (Celtic and Irish Seas (CIS) and southern North Sea (SNS)), seasonal, and inter-annual patterns in diet diversity and composition, and to assess the impact of potential bias associated with sample source (stranded vs. bycaught). Diet was described as dietary niche breadth (Simpson's Diversity), frequency of occurrence, and digestion-corrected prey biomass composition. Overall, harbour porpoise diet comprised approximately 10 frequently consumed prey types, with whiting, herring, and sandeel identified as key species. Although niche breadth did not significantly differ between regions, estimated biomass composition did: in addition to key species, dragonet were consumed in high proportions in the CIS, whereas gobies contributed markedly to porpoise diet in the SNS. Temporal trends showed a decline in the estimated proportion of whiting consumed from 2000–2009 in both regions, which coincided with significant increases in diet diversity and declines in whiting stocks. Seasonal shifts in prey availability were also reflected in estimated biomass composition. Sample source influenced estimated diet; bycaught porpoises consumed more sandy-benthic prey (e.g. gobies), whereas stranded porpoises consumed more benthopelagic species (e.g. whiting). Our results indicate harbour porpoises in English and Welsh waters share a broad dietary niche, with feeding patterns likely reflecting differences in prey availability influenced by habitat, prey life history, and fishing pressure. More broadly, our findings emphasize the importance of acknowledging potential sample-source biases in dietary analyses.

CIBBRiNA: Working with fishers to minimise bycatch in European fisheries: best practices for interdisciplinary collaboration and innovation

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6. *Scottish Pelagic Fishermen's Association*
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8. *Mindfully Wired - United Kingdom*

EU-LIFE CIBBRiNA aims to minimise bycatch of marine mammals and other Endangered, Threatened and Protected species across the North-East Atlantic, Baltic, and Mediterranean regions. The project unites fishers, authorities, scientists, and stakeholders from 13 European countries to establish effective mitigation, monitoring, and assessment programmes. We conduct eight case studies across diverse small- and large-scale fisheries. Our goal is to develop measures that are both feasible for fishers and effective in reducing and where possible eliminating bycatch. Through collaborative research and openness to innovative solutions, we produce new knowledge on mitigation and monitoring resulting in a practical toolbox for integration into European fisheries policy and fisheries best-practices. Bycatch is a sensitive issue. This makes meaningful engagement challenging. CIBBRiNA's distinctive approach recognises that technical solutions alone are insufficient. We actively integrate fisher perspectives, ensuring their voices are heard and valued as they need to work with the technology and believe in it to ensure it’s being used in practice. Success requires building mutual trust. Therefore, we proactively foster a “Safe Working Environment” characterised by trust, dialogue, and co-creation. Here, tools can be tested and optimised by combining fisher expertise with scientific knowledge. Successful cooperation requires continuous effort and dedication. We provide guidance on best practices, including a video series, to inspire and support ongoing engagement with fishers and other stakeholders for any project that aims to minimise bycatch. Our science partners attend masterclasses on industry collaboration and communication skills. For fishers, we host peer-to-peer meetings that facilitate exchange and dialogue. First results demonstrate that reducing bycatch demands more than technology. It requires recognising fishers as

essential partners in conservation who can make the change happen. By creating spaces for genuine collaboration and integrating diverse expertise, solutions can be developed that protect cetaceans and other marine species while remaining practical for fishing operations.

Surveillance of highly pathogenic avian influenza (HPAI) in stranded cetaceans from the Canary Islands (2024–2025)

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The unprecedented global spread of highly pathogenic avian influenza (HPAI) H5Nx viruses has revealed an increasing capacity for cross-species transmission, including spillover into marine mammals. Recent detections of HPAI H5N1 in cetaceans and pinnipeds across the North Atlantic and the Southern Hemisphere underscore the need to strengthen surveillance efforts in oceanic ecosystems. Conducted by the Institute for Animal Health and Food Safety (IUSA), a WOAH Collaborating Centre for Marine Mammal Health, this study aimed to assess the presence of HPAI infection in cetaceans stranded in the Canary Islands during 2024–2025. A total of 48 stranded cetaceans representing nine species were examined. Brain and lung tissues, recognized as primary target organs for influenza A infection, were collected during necropsy and analyzed using RT-qPCR targeting the influenza A matrix gene, following the validated Spackman et al. (2002) protocol. Nucleic acid extraction was performed using three validated methodologies (QuickGene Mini 80, MagBinder® Fit24 and EVOware® automated systems), under rigorous molecular quality-control procedures. All samples tested negative for influenza A virus, indicating no detectable HPAI infection in the stranded cetaceans examined in the archipelago during the study period. These findings contribute valuable baseline data for One Health-oriented epidemiological surveillance in the northeastern Atlantic and highlight the importance of sustained monitoring efforts led by WOAH collaborating centres in regions with high cetacean diversity and year-round stranding activity. Given the dynamic circulation of HPAI in wild birds and the increasing number of spillover events reported globally, continued and standardized surveillance of stranded cetaceans remains essential to detect early signals of viral adaptation to marine mammals and to support informed decision-making in marine wildlife conservation and public health preparedness.

Integrating thermal and visual methods for mitigation of vessel-whale collisions in the Eastern North Atlantic

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Marine traffic is recognised as a significant threat to whale conservation, as vessel collisions are a major source of mortality, especially for large, slow-moving, surface-dwelling species. Visual monitoring by Marine Mammal Observers (MMOs) remains the standard mitigation tool, but its effectiveness is constrained by daylight dependence, weather conditions, and the logistical impossibility of covering entire fleets. Therefore, alternative or complementary methods, such as the employment of thermal cameras, are being tested. This study assesses the detection of vessel-whale interactions associated with medium to large cetacean sightings (Balaenopteridae, Kogiidae, Physeteridae, Ziphiidae), recorded aboard a cargo vessel crossing the Northeast Atlantic between July and October 2025. The aim is to evaluate collision risk and to explore the added value of integrating thermal imaging with visual observations by MMOs. Through 6,016 km of actively monitored areas, MMOs documented 178 sightings, of which 63 involved medium to large cetaceans. Of these, 41.27% were classified as Surprise Encounters, indicating detections at short distances or

with limited reaction time, while 3.17% were categorised as Likely Collision Events based on their estimated Time to Potential Collision. During the surveys, footages were obtained for 38 of the MMO's sightings with the thermal camera system. Of these, 18 were detected on camera, including Surprise Encounters of both a Ziphiidae and a *Balaenoptera borealis*. Although the thermal camera demonstrated potential for detecting animals, it did not consistently capture all sightings and events of collision-risk, highlighting both its promise and current limitations. These results emphasise that combining traditional visual methods with emerging technologies has the potential to reduce observation gaps, improve early detection of cetaceans, and support proactive mitigation measures. Continued development and integration of these tools will be essential for mitigating vessel-whale collisions on-site, enhancing monitoring capacity, and informing management strategies aimed at reducing human impacts on vulnerable cetacean populations.

Making the links – climate change, cetacean welfare and conservation in the NE Atlantic

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The global ocean, once considered too vast to be significantly affected by human action, is now pulsing with signs of our interference and changing to the fast beat of continued greenhouse gas emissions. While the scientific literature regarding the impacts of climate change on populations of cetaceans is growing, few studies have addressed the welfare issues arising from our changing seascapes. In our analysis of the available information, we have identified likely impacts beyond the population-level consequences of the warming, rising, more acidic and more extreme event-exposed waters of the Northeast Atlantic. These impacts on cetacean welfare arise from climate-induced changes to their prey and habitat, as well as their ecophysiology and ecology, and encompass possible adverse effects in all the domains of the widely used welfare assessment scheme, the Five Domains Model (i.e. nutrition, environment, health, behavioural interactions, and mental state). Observed and predicted impacts of global warming include, for example, a loss of familiar habitat, habitat deterioration, altered prey availability, distribution and quality, altered phenology and migrations, higher exposure to pollution, pathogens, algal blooms, and extreme events, novel species interactions, and higher interspecific competition. Subsequent welfare concerns may include deteriorated health, increased susceptibility to disease, impaired immune, endocrine and reproductive systems, weakness, exhaustion, and suffering related to illness, hunger, malnutrition, stress, challenges to coping mechanisms, and/or displacement. Climate change is likely already impacting individual cetaceans' welfare as well as penetrating deeply into the social and cultural networks of these keystone species. This tightly links welfare and conservation science and highlights the importance of including climate change considerations in future, climate-smart/future-proof and holistic approaches to ocean stewardship – uniting classical conservation and emerging welfare considerations to meet the fast-evolving and progressively worsening challenges that cetaceans face in the Northeast Atlantic.

From satellites to eDNA: Integrating new technologies with local knowledge to monitor the GOOS EOV ‘marine mammal abundance and distribution’ and inform ocean health.

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Sustained ocean observations are essential for monitoring marine ecosystems and biodiversity, as well as for assessing the impacts of human activities (including climate change) on these systems. As top predators, marine mammals are powerful indicators of ecosystem health and productivity, effectively acting as environmental sentinels. Their broad geographic range and long lifespan allow them to interact with and influence the population dynamics, abundance, and distribution of numerous other species, thereby playing a key role in maintaining biodiversity, ecosystem functioning, and global nutrient cycles. Monitoring the distribution and abundance of marine mammals is therefore recognized as an Essential Ocean Variable (EOV) within the Global Ocean Observing System (GOOS), critical for advancing our understanding and management of a healthy ocean. However, establishing a truly global and sustained observing system for marine mammals requires balancing the adoption of emerging technologies with the integration of local and traditional ecological knowledge, ensuring that observations are both fit for purpose and applicable across ecological and governance scales. To this aim, we explore how innovative tools such as very high-resolution satellite imagery, drones, and environmental DNA (eDNA) can be used to monitor this EOV and complement local knowledge, paving the way for a fully integrated global observing system for the ocean.

Collaboration is key: designing a monitoring programme for cetaceans that supports the delivery of healthy marine ecosystems in Scotland

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Cetaceans are facing a range of threats and pressures that require careful and evidence-led management for successful conservation and protection. In Scotland, there is a huge wealth of data, knowledge, and expertise shared among the marine mammal science community that is enabling us to monitor, detect changes, and take targeted action. The foundation of this is the diversity of long-term monitoring and research programmes in Scotland collecting data on species seasonal occurrence, distribution, abundance, health, behaviours, and the prevalence of pressures. Of which, citizen science and collaborative interdisciplinary research across stakeholder groups is core. Improving the availability of current, fine-scale regional and temporal information is essential for enabling a targeted and adaptive management approach, understanding and improving species resilience, and for assessing whether our designated Marine Protected Areas (MPAs) for cetaceans are meeting their Conservation Objectives. NatureScot is working closely with individuals and organisations to coordinate and design a scientifically robust monitoring programme of work for marine megafauna, which aims to help provide the evidence base needed to support delivery of the Scottish MPA Monitoring Strategy, the Scottish Biodiversity Strategy, the newly published UK Cetacean Conservation Strategy, and several other national and international reporting and assessment needs. A 2-day workshop led by NatureScot, focusing holistically on cetacean monitoring needs and evidence gaps, bought together key organisations from the government, academic, and NGO sectors to discuss and collectively prioritise the work required in the short-medium term (~6years). Discussions considered the importance of including monitoring metrics to better understand and assess both the cetacean populations (state) and their prey and supporting habitat quality (pressures): where, when, and why a species or individuals are using areas; the species spatio-temporal distribution-pressure risk overlap; and developing analytical approaches for improved use of complementary data sources, collected using different methods and at various scales and resolutions.

Six years of live-cetacean strandings in Italy: patterns, outcomes and the challenge of conservation

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Live-stranding events are critical emergencies for cetacean welfare and conservation, requiring rapid and standardized responses. Despite numerous reports, systematic multi-year analyses of live-stranding dynamics, intervention outcomes, and spatiotemporal trends are limited in the Mediterranean Sea. This study analyzes all live-stranding response events recorded by the LIFE DELFI Stranding Response Network in Italy (2020–2025). Objectives were to (1) describe seasonal, spatial, and taxonomic patterns and (2) assess variation in intervention outcomes across species, regions, and operational contexts. Reports were received from the Coast Guard or the public. Standardized protocols documented morphometrics, life stage, health status, and spatiotemporal information. When animals died, post-mortem investigations were performed to assess their health status and anthropogenic interaction. Outcomes included: monitoring, first aid, rescue, euthanasia, or death. A total of 73 events involving 79 individuals were documented (annual mean: 13). Single-animal strandings accounted for 92%. *Stenella coeruleoalba* was the most frequent species (42%), followed by *Tursiops truncatus* (37%); all six resident Mediterranean species and one occasional (*Eschrichtius robustus*) were represented. Events occurred mainly in summer (56%) and southern Italy (66%). Most animals stranded on beaches or in shallow waters (63%), while 25% were out-of-habitat and 12% entangled. First aid was performed on 41 individuals, achieving 49% successful rescues. Monitoring occurred in 38 events. Euthanasia was performed in 5 cases. Among 27 deceased animals, 74% were necropsied, identifying infectious disease (n = 9), maternal separation (n = 5), and poor nutritional status (n = 2) as leading causes of death. For the first time, this multi-year, multi-species assessment of live-stranding responses in Italian waters highlights species- and region-

specific variability: adult *T. truncatus* showed higher rescue success, while other species more often exhibited underlying pathologies. Findings support prognosis-based triage and welfare-oriented decisions, including euthanasia when survival is unlikely, improving national networks and Mediterranean cetacean conservation.

Mortality probability for gray whales (*Eschrichtius robustus*) in San Francisco Bay is influenced by population subgroup

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Terrestrial and marine species alike are exhibiting distributional shifts due to changing climate and resource availability. As food webs are impacted, some species have moved into areas of increased human activity, encountering new hazards. As a coastal marine species that undertakes a long migration to forage for prey in the Arctic, the Eastern North Pacific (ENP) population of gray whales (*Eschrichtius robustus*) are especially susceptible to changes. Subgroups of ENP gray whales have adapted to exploit alternative feeding grounds as prey availability declines in the Arctic, including the Pacific Coast Feeding Group and the Sounders. Since 2018, gray whales have been observed seasonally in San Francisco Bay (SF Bay), California, United States. In this study, we evaluated subgroup identity and mortality of gray whales in SF Bay from 2018 - 2025 utilizing photo-identification. Data were collected through vessel-based surveys, opportunistic effort, and community science submissions. We identified 114 individual whales, of which eight were matched to a subgroup, indicating gray whales utilizing SF Bay are not merely the result of range extensions by foraging subgroups. Only four identified gray whales were resighted within SF Bay between years. Strikingly, 21 individuals were matched to necropsied carcasses, resulting in a minimum mortality rate of 18.3%; however, the estimated maximum mortality rate was 41.74%. Trauma consistent with vessel strike was found in nine of 11 matched carcasses where cause of death was determined, in 30 of 70 carcasses in this study, and additional individuals acquired injuries during their tenancy. Subgroup identity improved survival probability, but minimum length of stay did not. Our results reveal that gray whales entering SF Bay are at high risk for vessel strike mortality. Resource managers and the maritime industry should consider adaptive management strategies as individuals likely will continue to seek new inshore foraging habitats along their migration corridor.

Assessing the impact of offshore wind construction: Harbour porpoises behaviorally react to playbacks of vibropiling noise

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Offshore windfarm construction usually demands impact pile driving, generating intense sound pulses that can affect harbour porpoises (*Phocoena phocoena*) at distances of tens of kilometers. Other methods to install the turbine foundations in the seabed may reduce the noise levels and therefore the impact on wildlife. One such method is vibropiling, where the pile is vibrated into the sediment. However, the effects of vibropiling on porpoise behavior have not been explored. Here, we exposed 3 trained harbour porpoises to playbacks of vibropiling sound to observe their behavioral responses and establish behavioral response thresholds. We played back three 10-min long recordings of vibropiling to trained individuals at Fjord&Bælt, Denmark across five different sound source levels, which resulted in unweighted received levels within the porpoise enclosure ranging from 110 to 130 dB re: 1 µPa rms. The porpoises were filmed from above during playback, and their distance to the sound source and breathing rates were compared 10 min before, during, and 10 min after the vibropiling playbacks. In most cases, there were no behavioral responses to played back signals, but some responses were observed at higher sound pressure levels with large individual differences. The young female was most affected, the young male was least affected, and the old female showed few but mainly aversive responses to the highest played back levels. Even though vibropiling is a technique that avoids the loud sound pulses produced by impact driving, there may still be effects on harbour porpoises in the vicinity of the construction sites that need to be accounted for. This work was funded by Wozep, The Netherlands.

Deep priorities: identifying potential MPAs for beaked whale conservation in irish waters using species distribution modelling

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Beaked whales (Ziphiidae) are deep-diving, acoustically sensitive cetaceans vulnerable to a range of anthropogenic pressures. Their elusive behaviour and offshore distribution complicate our understanding of these species and the implementation of conservation measures. Ireland's Exclusive Economic Zone (EEZ) is known to be grounds of ecological significance for these species, yet current area-based protections provide limited coverage. This study applies systematic conservation planning to identify biological hotspots for beaked whales in Irish waters, integrating density surface models (DSMs) from two aerial surveys, ObSERVE1 (2015–2017) and ObSERVE2 (2021–2022) with spatially explicit anthropogenic marine use layers. We used the prioritizR package to identify priority areas for beaked whale under three scenarios: Ecological prioritization, stakeholder-centred conservation, and high-quality habitat protection. The DSM consistently identified high-density areas along the Rockall Trough and Porcupine Bank during ObSERVE1, while during ObSERVE2 the DSM showed a broader, more diffuse distribution across the shelf edge. Key planning units were repeatedly selected across scenarios, highlighting the areas of the Rockall Trough and the lower Porcupine Bank-Lower Porcupine Seabight canyon region as priority areas for offshore MPA designation. However, scenarios that incorporate human activity often fragment solutions, excluding ecologically important but high-conflict zones, like the Upper Porcupine Seabight, and instead prioritize more remote, offshore regions of the continental shelf. This shift illustrates the trade-offs between representing biodiversity and ensuring implementation feasibility. Despite data and modelling limitations, the framework provides a transparent and adaptable tool for offshore spatial planning, as well as highlights future steps for a more robust MPA designation strategy. This study underscores the value and challenges of integrating ecological, socio-political, and economic considerations into spatial planning. Given beaked whales' noise sensitivity and wide-ranging but probable philopatric behaviour, interconnected MPAs informed by systematic prioritization and supported by Ireland's forthcoming legislation will be essential to achieving conservation targets.

Fat under the microscope – histological characterization and lipids profiling in blubber of baleen and toothed whales

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In cetaceans, blubber is a specialized form of adipose tissue, playing essential roles in thermoregulation and hydrodynamics. Blubber constitutes the major storage of metabolic fuel during periods of energy need and its lipid composition reflects both diet and de novo lipogenesis. Blubber is also an endocrine and complex organ involved in a multitude of physiological and metabolic processes including immune response and lipid metabolism. Despite its critical functions, detailed knowledge of blubber structural variability and lipid composition across species remains limited, constraining our ability to interpret ecological strategies and physiological adaptations. We investigated blubber structure and lipid composition in 4 large whale species sampled in northern Norway in 2023/2024 including Killer whale (*Orcinus orca*), long-finned pilot whale (*Globicephala melas*), sperm whale (*Physeter macrocephalus*) and humpback whale (*Megaptera novaeangliae*). Biopsy samples were collected using a darting system with a 60 mm hollow stainless-steel tip in free-living animals. Histological sections (5 µm thick) from inner, middle, and outer blubber sections[PB1] were stained with hematoxylin-eosin or Masson's trichrome. For all species, the outer section consisted mainly of collagen-rich fibrous connective tissue with few adipocytes and sporadic muscle fibers. Adipocytes abundance increased with depth in pilot and humpback whales, whereas important fibrous tissue remained present along the biopsy core in killer whales. Interestingly, sperm whales exhibited a relatively uniform histological structure throughout the blubber depth with almost exclusively fibrous tissue and sporadic muscle fibers. In-depth investigation of structural variations is currently in progress using adipocyte area and index. In parallel, we are completing lipid profiling and quantification analyses of several lipid class and associated fatty acids including wax esters, triglycerides, free fatty acids, and phospholipids. Results will be discussed considering key ecological traits for each species (e.g., capital vs income strategy). Understanding blubber structure and biochemical composition provides key insights into its functional roles.

Helping conservation take flight: RootPainter an open-access tool applied for automating drone image processing of a grey seal population

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Monitoring protected marine mammal species is essential for understanding their ecology and achieving conservation objectives, yet funding constraints demand affordable approaches to fulfil this aim accurately and effectively. Drone surveys enable fine-scale assessment of seal colonies, but their practical implementation is reliant on software that streamlines data processing. Conservation funding limitations prompt increasing demands for open science, which highlights a need for accurate, efficient, and affordable tools. RootPainter—an open-access convolutional deep neural network originally developed for plant root tracking—was trained on Red-Green-Blue (RGB) drone imagery of a grey seal (*Halichoerus grypus*) haul-out. We evaluated Rootpainter, for three objectives: presence–absence monitoring, abundance estimation, and age–sex classification of seals resting on land. For presence–absence monitoring, RootPainter achieved a segmentation output precision of 94% and balanced accuracy of 90%. Abundance estimates derived from 29 orthomosaic images were within the range of -9.30 to 8.01% of manually processed counts from these same images and outperformed land-based surveys, which showed consistent underestimation in counts of abundance. RootPainter demonstrated potential for age–sex categorization, with a significant difference between mean pixel areas of high-quality segmentations identified as juveniles (1–2 years), subadults (3+ years), adult females, and adult males. These promising findings highlight how machine-learning, open-access software can be successfully trained on other taxa to process the large complex data produced by drone surveying. This highlights RootPainter as a practical open-science tool for grey seal monitoring, demonstrating efficiencies for both cost and resources.

Cetacean community composition across seasons along an offshore wind transect

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Cetaceans serve as top predators and ecological indicators, yet information on their spatial and temporal distribution remains incomplete, particularly in relation to the expansion of offshore renewable energy (ORE) developments to meet climate and energy targets. Understanding how cetacean communities use areas planned for development is essential for effective environmental assessment and mitigation. While Passive Acoustic Monitoring (PAM) provides year-round, weather-independent data on species presence, multi-species applications are relatively underutilised. The species exchange rate (SER), a probabilistic biodiversity metric quantifying temporal turnover in species composition, widely used in terrestrial ecology, offers a useful tool for assessing cetacean community dynamics in relation to environmental change. We applied SER to acoustic detections of cetaceans at four sites in the Irish Sea, selected for their relevance to existing and planned ORE development. Over the course of a year, PAM moorings equipped with combinations of Soundtrap hydrophones, C-POD click detectors, and low-cost HydroMoth acoustic recorders, collected data spanning high-frequency odontocete clicks, mid-frequency dolphin whistles, and low-frequency baleen whale calls. Across seasons, a range of odontocete and baleen whale vocalisations were detected and acoustically described, indicating multi-species usage, and highlighting variation in species composition between sites. New call types for the region were documented, and acoustic niches were visualised using Spectrographic Box Display. This study provides insights on cetacean community dynamics in an area of interest for ORE, and is the first to do so integrating SER with multi-species PAM. These findings will support future assessments of how ORE development may influence cetacean communities and contribute to more informed, ecosystem-aware decision-making.

Long-term monitoring reveals spatial patterns and group structure of harbour porpoises off the west coast of Scotland

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The west coast of Scotland is an important habitat for harbour porpoise (*Phocoena phocoena*), supporting persistently high densities of this species. In 2016, the Inner Hebrides and the Minches Special Area of Conservation (SAC) was designated due to its importance in providing critical habitat. Long-term, standardised monitoring is essential to understand how porpoises use these waters and to provide evidence to support monitoring and effective management. The Hebridean Whale and Dolphin Trust (HWDT) has conducted visual and acoustic line transects surveys across the west coast of Scotland using their dedicated research vessel, Silurian. Over 20 years (2003-2023), >127,000 km of visual survey effort was conducted, with a mean annual survey effort of 6,070 km (range: 27 - 8,157 km). Harbour porpoise was the most frequently recorded species, accounting for 36% of all sightings. Calves were recorded most regularly between July and September and accounted for 9% of all animals sighted. Group sizes were generally small, 97% of sightings had between 1 and 4 animals, however aggregations (≥5 animals) were also recorded. Mean group size was highest in October (2.47) and September (2.2). Spatial analysis identified several areas within the SAC where aggregations were recorded, including north of the Isles of Rum and Eigg (13 aggregations), within the Inner Sound, particularly around the Crowlin Islands (36 aggregations) and around the Isle of Mull (41 aggregations). These long-term data provide important evidence to inform future monitoring and management of the SAC and the wider region. They indicate a high calf-to-adult ratio, seasonal peaks in calf occurrence, and suggest that there are seasonal and spatial influences on the formation of aggregations. Given the mobility of the species and the range of pressures operating beyond site boundaries, such information is critical for developing effective and coordinated conservation measures both within and beyond the SAC boundary.



Modelling densities using a Relative Environmental Suitability index to cover data gaps: the benefits and challenges of this approach

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Marine mammal densities provide essential baseline data on the number of animals expected to be within an area. This has applications for environmental impact assessments, take estimates and conservation management. Densities derived from spatial models provide the most desirable estimates. However, obtaining density estimates for marine mammals using this method can be challenging: data is limited by factors including location, weather conditions, technology availability and cost. Therefore, for areas where density estimates are unavailable, an alternative solution is required to provide an estimate. One alternative approach is to model densities using known estimates from other areas and a Relative Environmental Suitability (RES) index: a value between 0 and 1 indicating how well suited an environment is to a species. We used the AquaMaps RES surfaces (https://www.aquamaps.org) to update RES-based predicted density models. Using this method, we processed over 130 sources and will present the lessons learned from this effort. The benefits of using RES-based modelling are that it is a relatively simple and cost-effective way to extrapolate density estimates for species in areas with no direct survey effort. However, this approach is dependent upon survey data being processed and either directly providing a density estimate or providing sufficient information to calculate one (i.e., abundance estimate and survey area size). The data also needs to provide an associated uncertainty measure (e.g., CV) and include a clearly defined survey boundary which can be spatially referenced. Raw survey and sightings data are not useable which means that sightings data on portals such as OBIS-SEAMAPs and GBIF are discounted, unless there is an associated publication where these data are analysed. This work highlights inconsistencies between survey data presentation and how small additions to the publication of results from those studies would maximize the value of the survey effort and data collected.

Birthing scars on female humpback whales (*Megaptera novaeangliae*) in the North Atlantic

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Humpback whales (*Megaptera novaeangliae*) exhibit a diverse array of scarring patterns resulting from both anthropogenic disturbances (e.g., entanglement, propeller strikes, vessel collisions, etc.) and natural encounters, primarily predation by orcas (*Orcinus orca*), or interactions with cookie cutter sharks (*Isistius brasiliensis*). Additionally, male humpbacks frequently sustain injuries during intraspecific combat over reproductive access, typically manifesting as diffuse superficial abrasions. Recent observations of female humpback whales in the North Atlantic reveal a compelling association between the presence of distinctive skin and the challenges encountered during parturition. These skin lesions have a concave contour and appear to be indentation scars on their dorsal region (referred to as pockmarks). These scars, located anterior to the dorsal fin, exhibit a range of severity, from slight indentations to pronounced abrasions. Humpback whale calves are born tail-first, a physiological adaptation that may predispose them to birthing complications. We hypothesize that females may seek refuge at coral reefs characterized by overhanging ledges, features prevalent in the Silver Bank birthing grounds situated north of the Dominican Republic and east of the Turks and Caicos Islands. These coral ledges potentially serve as a crucial aid enabling mothers to navigate the difficulties of delivering obstructed calves. The morphology of the observed pockmarks aligns with the uneven surface characteristics of these coral formations, suggesting a potential correlation between the scarring and the maternal behavior aimed specifically at facilitating calf delivery. Photographic surveys have documented 30 of 33 females with three of unknown sex exhibiting these distinctive scars on the Turks Bank, and a further 20 observations gathered through aerial and underwater footage in Bermuda. This initial study underscores the importance of understanding maternal strategies and environmental interactions during the critical reproductive phases of humpback whales and an insight into the ecological pressures influencing humpback whale reproduction.

Using mark-recapture models to understand goose-beaked whale (*Ziphius cavirostris*) residency on a US Navy training range in Southern California

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Goose-beaked whales (*Ziphius cavirostris*) are of global conservation interest given behavioural responses and occasional strandings in response to anthropogenic noise. A resident population exists in Southern California with core use areas heavily overlapping with a US Navy training range. Mark-recapture models for this population previously hypothesized that transient individuals from a broader Pacific metapopulation may be biasing estimates of resident abundance and population dynamics. Therefore, we developed a Bayesian continuous-time open-population mark-recapture model that accounts for a mixture of residents and transients within the study population and uses a marginalized likelihood to estimate parameters efficiently. The model assumes transients are available for detection for a relatively short time before leaving the study area. Results confirm that a subset of goose-beaked whales in Southern California exhibit lower apparent survival, thus allowing for differentiation between residency groups. Estimates of resident abundance were lower than previously estimated when not accounting for differential residency. Despite promising advancements in understanding goose-beaked whale population dynamics, precise estimation of transient dynamics was hindered by low detection probabilities and the short periods when transients are predicted to be available for capture relative to the field work sampling regime. Evidence was also found, with the aid of tag data, for emigration and re-immigration, thus potentially biasing detection probabilities. Improved understanding of goose-beaked whale residency patterns will help explain variation in observed sonar responses, which in turn will inform models of long-term aggregate exposure levels. The analysis of changes in the resident population over time will give insights into whether Southern California has a healthy or diminishing resident population, or perhaps acts as a population sink. Ultimately, an improved understanding of population structure will enhance models of population consequences of disturbance that can forecast effects of changing sonar regimes on population dynamics.

Photo-identification of Risso's Dolphin in South-West England

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Understanding the movements of a species is the first step in conserving them. Cetaceans are highly mobile, yet we don't understand the specifics of how they use different areas of the UK. In the following I will discuss the population of Risso's dolphin (*Grampus griseus*) that inhabit the area surrounding south-west Great Britain and discuss site fidelity among individuals from 2011-2025. Using photographs taken by members of the public and eco-tour companies. Individual dolphins were tracked using the non-invasive method of photo identification, between multiple sites and years, documenting change of "scarification" over time. The results indicate site fidelity among individuals, with individuals being re-sighted together multiple times, implying core social alliances. Large time gaps between re-sightings persist, with little information on where individuals have been during those periods. Resighting data shows sightings peak in midsummer, with known individuals being sighted in the same year in early autumn off the coasts of Wales and the Isle of Man. This suggests that a distinct population of Risso's dolphins exists, travelling often between south-west England and up as far north to the Irish sea off the Isle of Man with no current matches to Scotland, Ireland or France. We put forward that the southwest plays a vital role in supporting this sub-group of Risso's dolphins.

Where are the toothed whales? Predicting odontocete distribution in the Southern Indian Ocean to support conservation planning

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Cetacean distribution in the southern Indian Ocean has not been extensively studied, largely due to the difficulty of collecting data in this remote and harsh region. Fundamental information about ecologically important species is still lacking in the region. In the case of toothed whales, most of the few existing studies focus on killer whales and sperm whales, leaving most of the species understudied and potentially in need of conservation interventions. A clear example (with some species represented in this poster) is Ziphiidae: an ecologically important but poorly known family. Using occurrence data and eight environmental (e.g., sea surface temperature) and one anthropogenic (distance from the harbours) predictors, we modelled the distribution of killer whales, Commerson's dolphins, southern short-finned pilot whales, Hourglass dolphins, southern bottlenose whales, Arnoux's, Layard's and Cuvier's beaked whales for the region extending longitudinally from South Africa to Australia, extending from 20°W to 160°E, and latitudinally from 30°S to the Antarctic coast. Using the Maxent algorithm, we predicted occurrence values (0-1) and ranked variable importance for each species. From single-species distribution maps, we identified areas with predictions higher than 0.5 (medium-high probability) merging these into a species richness map, highlighting community-level important areas and biodiversity hotspots. This pilot study provides a basis for marine spatial planning in the area.

Near-isometric humeral scaling defines fully aquatic cetaceans and distinguishes early transitional taxa

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The evolutionary transition of cetaceans from terrestrial artiodactyls to fully aquatic forms involved profound restructuring of the postcranial skeleton to optimize biomechanical performance in water. Within the forelimb, the humerus remains a key proximal element transmitting forces between the pectoral girdle and the hydrofoil-like flipper, yet its scaling properties are still poorly quantified. We assembled humeral measurements for 40 extant cetacean species (odontocetes and mysticetes) from the literature and from 3D-scanned museum specimens, and for 14 extinct species ranging from the Eocene to more recent forms using 3D surface models. For each taxon we extracted body length (GSL) and humeral length (HL), and analysed log–log scaling relationships to estimate allometric exponents and compare residual patterns between fully aquatic and early semi-aquatic forms. Across modern cetaceans, HL scales almost isometrically with body length (slope ≈ 0.95), with tight fit and little curvature in log-log space. When extinct taxa are plotted against this relationship, most fall close to the same trend, but early semi-aquatic groups, particularly Protocetidae, consistently plot above the modern line, which indicates proportionally longer humeri for a given body length. This suggests that once cetaceans became fully aquatic, humeral proportions entered a highly constrained, near-isometric regime, whereas earlier lineages retained more elongate, functionally versatile forelimbs. Isometric scaling of skeletal elements is generally uncommon, especially across broad size ranges and phylogenetic diversity. The humerus of fully aquatic cetaceans appears to be an exception: its near-isometric scaling is recovered across different metrics and analytical approaches, making humeral length a reliable proxy for estimating body size in both living and fossil taxa.

Cause of death and pathologic findings of cetaceans stranded along the Ligurian coast within the Pelagos Sanctuary (2015-2023)

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Cetaceans, as long-lived top predators and the only mammals fully adapted to the marine environment, represent key sentinels for assessing the health of marine ecosystems from a One Health perspective. Data derived from stranding events provide fundamental insights into population health, allowing not only the determination of a cause of death (COD) but also an overview of the threats to which these species are exposed. This study presents a comprehensive analysis of post-mortem examinations performed on cetaceans stranded along the Ligurian coast (Italy), within the Pelagos Sanctuary, from 2015 to 2023. A total of 75/92 stranded animals were examined through complete post-mortem examination and standardized diagnostic protocols that included biomolecular, bacteriological, parasitological, histological and immunohistochemical investigations; when possible, organochlorine (OCs) levels in blubber were evaluated to assess whether potential hazard levels for these species have been exceeded. Moreover, statistical analyses were performed to explore possible variations in temporal and spatial patterns. Among the examined individuals, most of them were striped dolphins (*Stenella coeruleoalba*, n = 52/75), followed by common bottlenose dolphins (*Tursiops truncatus*, n = 20/75), Cuvier's beaked whales (*Ziphius cavirostris*, n = 2/75), and long-finned pilot whale (*Globicephala melas*, n=1/75). Concerning the COD, this was related to natural causes in 42/75 cases, the majority of which of infectious origin (n = 34/42); to anthropogenic factors in 4/75 cases and remain undetermined in 29/75 cases. Toxicological analyses were performed in 54/75 cases; among them 37/54 cases exceed the polychlorinated biphenyls (PCBs) threshold (17 mg/kg l.w.) known to cause adverse health effects and immunosuppression in marine mammals. In conclusion, these results provide an essential baseline for understanding the main threats currently affecting cetacean populations living in a Marine Protected Area (MPA) as the Pelagos Sanctuary and should

be incorporated by conservation policy as crucial contribution in monitoring the health status of these species.

Assessing habitat-use and impacts of disturbance on marine mammals in Irish waters

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The expansion of offshore renewable energy and marine developments in Irish waters will increase pressure on marine mammals through noise, vessel traffic, and habitat alteration. Under the EU Habitats Directive, these impacts must be evaluated through Appropriate Assessment (AA), a process that determines whether developments may adversely affect protected species and/or habitats. Robust ecological evidence is therefore essential, yet the current knowledge base lacks species-specific spatio-temporal data on distribution, habitats, foraging range, and responses to disturbance. To address this, we are conducting a systematic literature review and gap analysis of Annex II marine mammals in Irish waters including harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), grey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals to (1) evaluate distributions, habitat-use, and responses to anthropogenic marine activities, and (2) identify pertinent data/knowledge gaps. Screening and data extraction are being carried out in Rayyan, following PRISMA guidelines. Findings will be integrated with spatial datasets including at-sea distribution maps for grey and harbour seals, cetacean density and abundance maps, and seasonal frontal maps, to highlight potentially important habitats/foraging areas, and overlap with marine activities. Preliminary screening shows disturbance research is mainly focused on vessel interactions and piling, with limited evidence for borehole drilling or geophysical surveys. Reported responses such as avoidance, changes in foraging and diving behaviour vary across species and are mostly international studies, limiting direct relevance for management. By consolidating the available evidence, this work will strengthen the knowledge base for species considered in AA evaluations, identify areas where ecologically important habitat may coincide with increases in development pressures, and support more consistent, grounded decision-making. Ultimately, the study contributes to the conservation and management of protected marine mammals in Irish waters at a time of accelerating offshore development and provides a case study for how such evaluations may be completed elsewhere.

Deep-divers in conflict: first evidence of beaked whale mobbing behaviour directed towards sperm whales

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In the Azores archipelago, agonistic interspecific interactions have been regularly documented, mostly based on opportunistic observations collected during whale-watching activities. The majority of reported cases involve mobbing-like behaviours directed by bottlenose dolphins (*Tursiops truncatus*) towards sperm whales (*Physeter macrocephalus*), with additional records of similar interactions initiated by pilot whales (*Globicephala* spp.), Risso's dolphins (*Grampus griseus*), and false killer whales (*Pseudorca crassidens*), also targeting sperm whales. Such events are often interpreted as competitive behaviour or even kleptoparasitism. Despite indirect evidence of intraspecific aggression in several beaked whale species, there have been no confirmed reports of agonistic behaviours directed by beaked whales towards other cetaceans, either in the Azores or elsewhere. Here, we present the first documented records of mobbing-like behaviour by Sowerby's beaked whales (*Mesoplodon bidens*) directed towards sperm whales. These observations were collected during whale-watching trips from three different years, all occurring during summer, off the north coast of São Miguel Island, an area considered as a local hotspot for deep-diving species. In all cases, the interactions appeared to be initiated by the beaked whales and involved chasing or close-approaching behaviour. During one sighting, the sperm whales exhibited defensive responses, including lobtailing and rolling, and in all sightings, they subsequently undertook mid-water dives. These agonistic interactions between two deep-diving species that potentially share similar foraging habits may reflect competitive or territorial dynamics. They also highlight the value of whale-watching platforms as an important source of data for documenting rare behavioural events that would otherwise remain unreported.

Preliminary eDNA analysis of Mediterranean monk seal faeces for diet

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Environmental DNA (eDNA) sampling is a non-invasive research method that may be used to discover additional information about wild animals, such as if they are afflicted with a certain illness or dietary preferences. A fecal specimen of Mediterranean monk seal *Monachus monachus* was collected from a cave at Gökçeada Island, Türkiye, in the Northern Aegean Sea, during a camera-trap surveillance study in 2021. The metagenomics analyses of the *M. monachus* faeces was made by amplifying the CO1 gene for the total DNA extracted from the sample. The sequencing was made in the Illumina Miseq platform, using 300 bp pair-end reads. The results confirmed that the faeces indeed belonged to a monk seal and also provided the information on its preys, such as *Sparus aurata* (Gilthead seabream), *Phycis phycis* (Forkbeard), *Sciaena umbra* (Brown meagre), *Mullus surmuletus* (Striped red mullet), *Conger conger* (European conger), and *Serranus scriba* (Painted comber). These fish species are well-known in the Mediterranean monk seal diet. As conclusion, eDNA studies have a great potential to complement other monitoring efforts, such as those on abundance, distribution, diet and health status of such endangered populations. This study is the first one using eDNA in faeces to collect information about the diet of the Mediterranean monk seal in the Aegean Sea.

Digital aerial surveys in offshore wind development: Advancing marine mammal baseline knowledge

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Although marine mammals are extensively studied globally, a significant knowledge gap persists regarding their distribution and habitat use. With the development of offshore windfarms there is a necessity to collect robust baseline data to determine and mitigate potential impacts. Data collected during pre-construction environmental impact assessments (EIAs) presents a unique opportunity to increase scientific understanding of species occurrence in these underexplored environments. APEM conducted a programme of digital aerial surveys (DAS) for a windfarm off the Gippsland coast in Australia, over a 24-month period. Data collection was undertaken using high-resolution, ultra-high still cameras and LiDAR mounted in aircraft to capture detailed images of marine mammals. LiDAR and imagery collected were rigorously analysed to determine abundance, distribution and behaviour of marine mammals. A total of 694 marine mammals were sighted during the surveys, comprising of fur seals, common dolphin, bottlenose dolphin, humpback whale and unidentified dolphin species. In addition, there were sightings of loggerhead turtles, ocean sunfish and basking sharks. This demonstrates the value of developer-collected data in increasing the knowledge of species distribution which can contribute to significantly enhance regional marine spatial planning and conservation efforts, ensuring more effective protection of marine mammal populations in the face of increasing anthropogenic pressures.

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Impact of postmortem delay and storage condition on the blubber proteome and metabolome: a grey seal case study

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‘Omics applications are powerful tools in studying animal physiology and for measuring the impacts of anthropogenic and environmental stressors. Applying these techniques in marine mammal research is limited in part due to the challenges of collecting sufficient numbers of high quality biological and technical replicates. Sampling from strandings can overcome some of these challenges by allowing for collection of multiple samples from each individual, from animals of various physiological states, providing useful datasets for analysis. However, there is currently lack of information on the suitability of samples from dead marine mammals in ‘omics studies, as postmortem tissue and biomolecule degradation is expected to occur, impacting results. To address this knowledge gap, we assessed the impact of postmortem delay on the blubber proteome and metabolome, in a time series study, where blubber samples were collected over a 4-day period from a freshly dead juvenile grey seal (*Halichoerus grypus*) stored outside (ambient temperature 3.3-7.7°C). Additionally, three tissue sample storage conditions were assessed: flash freezing using liquid nitrogen and storage at -80°C, direct storage at -80°C, and direct storage at -20°C, to identify suitable preservation conditions. Total protein and metabolites were extracted using standard protocols. Liquid chromatography tandem mass spectrometry approaches were used for protein (n=2420) and metabolite (n=999) identification and relative quantification. Results showed limited proteome and metabolome changes up to an estimated 10 hours postmortem, and moderate changes up to 28 hours, with most changes observed after 52 hours postmortem. Samples stored at -20°C showed altered proteomic and metabolomic profiles compared to storage at -80°C. These changes were more extensive on the metabolome compared to the proteome. There were no differences between samples directly stored at -80°C and flash frozen ones. These results provide valuable information for sample collection and storage of blubber from dead animals for proteomic and metabolomic analyses.

Aggressive behaviour in grey seals (*Halichoerus grypus*) at Angel Bay, North Wales

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Grey seals (*Halichoerus grypus*) exhibit complex social and reproductive behaviours during the breeding season, when dense aggregations at haul-out sites increase the likelihood of aggressive encounters among individuals. Such aggression plays an important role in mating success, maternal defence, and social dynamics, yet variation in aggression across season and in relation to human disturbance remains poorly quantified in small, publicly accessible colonies. This study aims to quantify the frequency, type, and drivers of aggressive behaviour in the grey seal colony at Angel Bay, North Wales, during the 2025-2026 breeding and post-breeding season. Observations are being conducted from October to February using scan sampling at one-minute intervals and noting down all aggressive interactions within a 21-minute observation block. For each event, behavioural type, sex (where identifiable), sequence of escalation, and outcome are recorded. To evaluate potential effects of disturbance, environmental conditions, colony size, and human presence (people and dogs visible form the haul-out) are documented throughout each session. All observations are conducted from a fixed, elevated vantage point using non-invasive methods to ensure no disturbance. Preliminary results indicate that aggressive behaviour is common throughout the breeding season. Aggressive interactions typically concluded in one of three distinct ways: one individual retreating/fleeing, both individuals halting the interaction abruptly, or one seal rolling onto its back most likely sowing submission. Human presence generally appears to have minimal direct effect on aggression levels, however, sudden loud vocalisations from visitors (including shouting and dog barking) have been associated with temporary increases in vigilance in the colony. These findings contribute to understanding the behavioural ecology of grey seals in a semi-urban haul-out site and highlight the need for management practices that minimise disturbance during sensitive reproductive periods. This study provides insight relevant to conservation, welfare considerations, and visitor-management strategies at accessible seal colonies in the UK.

Marine megafauna conservation action plans: Systematic review and recommendations in preparation for a Global Cetacean Action Plan

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The IUCN Red List provides an overview of extinction risk and status of the 94 recognised cetacean species. Over a quarter, 26%, of cetacean species are classed as threatened with extinction. Threats facing cetaceans are location- and species-specific, and include fisheries bycatch, habitat degradation and ship strikes. Urgent conservation interventions are needed to address these threats and halt species and population declines. Evidence shows that strategically produced conservation action plans can support the implementation of conservation interventions, resulting in successful conservation outcomes. The last IUCN global action plan to guide cetacean conservation was drafted in 2002. In the face of mounting pressures on cetaceans globally, there is both opportunity and need to develop a new plan. To aid the creation of an updated Global Cetacean Action Plan (GCAP), a systematic review of the newest versions of multi-species, multi-country marine megafauna action plans produced up to 28 February 2025 was conducted. Searching and screening were conducted following the RepOrting standards for Systematic Evidence Syntheses (ROSES) steps for systematic review. A narrative synthesis and critical evaluation of action plans (n=23) was undertaken. Best practices from these plans were combined with other available conservation planning guidelines to distil the best action plan production approaches and make recommendations for a future GCAP. Recommendations include a 14-step action plan design process (encompassing securing funding, engaging stakeholders, setting a vision, creating SMART actions, dissemination and monitoring). Suggested threat and conservation intervention prioritisation metrics (e.g. level of public support, number of affected species) and monitoring metrics (e.g. number of bycatch events, population size changes) are also presented. The produced recommendations provide a comprehensive approach to developing a cetacean conservation action plan. Given the similarities between marine megafauna species' threats and management, findings will also be useful for those creating action plans for other marine megafauna taxa.

From depth to surface: A two-scale assessment of vessel noise effects on dolphin whistles in the Mediterranean Sea

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Anthropogenic underwater noise has doubled in the past decade, mainly due to increased maritime traffic. Commercial vessels generally tend to produce low-frequency noise (10–1000 Hz), while smaller boats often contribute higher-frequency noise (up to 50 kHz). The Mediterranean Sea is one of the world most heavily trafficked regions, yet remains a key biodiversity hotspot, especially for cetaceans that use sound for communication, navigation, and prey. The overlap with naval noise is evident in dolphin whistles (1 to 24 kHz).To assess how vessel noise affects dolphin acoustic behaviour, we analyzed a year of recordings from cabled ITINERIS hydrophones deployed in the Western Ionian Sea (100 km off Capo Passero, 3500 m depth), selecting 24 h/week on a randomly chosen day. We trained a YOLOv11 classifier to detect the presence of whistles in spectrograms. From 48 days a total of 63,308 spectrograms were analyzed. Whistles showed seasonal and hourly patterns, with significantly higher occurrence in spring and summer and peaks at sunrise and sunset. In addition, the Sound Pressure Level (SPL) of each 1/3-octave band recommended by the Marine Strategy Framework Directive for noise was evaluated. A glmmTMB model revealed a decrease in whistles correlated with increased SPL in the bands of 5 kHz and 20 kHz. Negative Spearman correlations were also obtained when comparing whistle presence with SPL at 63 Hz, 125 Hz, and 1 kHz bands. Finally, possible changes in whistle structure due to the SPL were investigated through analysis of 778 high-quality whistles recorded during 15 sightings (July 2024–September 2025) of striped dolphins in the Gulf of Catania aboard the Marecamp research vessel. A significant upward shift in frequency maximum and minimum, range, and begin, along with an increase in steps and a reduction in inflection points and minima, was observed as a consequence of engine ship noise.

Acoustic occurrence of cetaceans in northern Sicily: first passive monitoring insights from the Gulf of Palermo and Ustica Island.

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Passive acoustic monitoring (PAM) is a key non-invasive tool for detecting vocal marine mammals and assessing their occurrence and spatial distribution. Despite its increasing application across the Mediterranean, species-specific acoustic data remain scarce along the northern coast of Sicily. To address this gap, Avvistiamo APS implemented the first PAM programme in the Gulf of Palermo and around Ustica Island (67 km northwest of Palermo), integrating acoustic data with simultaneous visual observations. Monitoring was conducted using a static Aquarian H2D hydrophone connected to a Zoom F3 recorder along linear transects, enabling direct comparison between acoustic detections and visual confirmations. Sampling occurred between 10 May and 20 November 2025, covering late spring to early winter. A total of 221 recordings were collected (12 h 45 min of acoustic effort; mean duration 03:27 min). Species identification was performed through visual inspection of spectrograms using Raven Lite 2.0. Of 72 positive detections (5 h 41 min), 34 were attributed to striped dolphins (*Stenella coeruleoalba*), 2 to common dolphins (*Delphinus delphis*), and 28 to bottlenose dolphins (*Tursiops truncatus*). Six recordings contained simultaneous vocalisations of *Ziphius cavirostris* and *T. truncatus*, indicating multispecies acoustic presence. Mean seafloor depth at detection locations was approximately 572 m for *S. coeruleoalba*, 332 m for *T. truncatus*, 774 m for *Z. cavirostris*, and 190 m for *D. delphis*. These values provide spatial context but must be interpreted considering the variable detection range of the Aquarian H2D, influenced by source levels, environmental conditions, and ambient noise. Nearly all detections were visually confirmed, except for *Z. cavirostris*, acoustically recorded for the first time in the study area. These results provide the first

acoustic baseline for the region and demonstrate the value of combining PAM and visual surveys for cetacean monitoring and conservation.

When dolphins relocate – communication and behaviour in a non-native coastal group of common bottlenose dolphins

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Non-native bottlenose dolphins have recently established residency in the coastal waters of Denmark, presenting a rare opportunity to investigate if and how migrants adapt their acoustic and behavioural patterns to a new environment. This study aims to quantify the behavioural repertoire and acoustic activity of three female common bottlenose dolphins (*Tursiops truncatus*) - Chewbacca, Leia, and Tall Fin - that migrated from the Moray Firth (Scotland) to the Thyborøn area of Denmark around 2020, and to assess whether their patterns differ from those documented for their source population and other bottlenose dolphin groups. We hypothesise that behavioural and acoustic activity will show conserved species-typical traits and might also show modifications linked to the animals' novel habitat and anthropogenic context. Behavioural and acoustic data of the three dolphins was collected during August–September 2025 via boat-based surveys. Behavioural point sampling, photo-identification, and passive acoustic devices including Soundtraps and supplementary hydrophone arrays were used to collect data. Behaviour was recorded when individuals were in sight, and acoustic parameters - whistles, burst-pulse sounds, and echolocation clicks - were analysed in relation to behavioural state, spatial use, and proximity to tourist vessels. We report correlations between the occurrence of specific sound categories with particular behavioural contexts, as well as a seemingly unusually frequent usage of tail-slapping behaviour. These findings can provide the first detailed description of acoustic - behavioural coupling in this group of non-native dolphins. Understanding how migrant cetaceans adjust their communication and behaviour is essential for predicting ecological integration and assessing potential conservation needs. This study will contribute new insights into the behavioural ecology of bottlenose dolphins at the northern edge of their range and inform management of a small, socially cohesive group inhabiting an ecosystem in which the species has historically been rare.

Cases of neonatal and maternal strandings of harbour porpoise (*Phocoena phocoena*) in the south-western Black Sea (Zonguldak, Türkiye) in 2018-2025

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This study investigates neonatal and maternal mortality in the Black Sea harbour porpoise (*Phocoena phocoena* relicta), an endemic and threatened subspecies. The study material consisted of 40 harbour porpoises stranded on the south-western coast of the Black Sea (Zonguldak region) between 2018 and 2025. This dataset included critical demographic groups, specifically five pregnant or lactating females and eight neonates or calves. Calf body lengths ranged from 62 to 90 cm, which corresponds to an age of less than one year. The maximum body length of reproductively active females (pregnant or lactating) was 131 cm; the minimum body length was 123 cm, which is relatively small compared to other adult individuals found stranded during the study period. Strandings were most frequent in spring and summer; females in maternal condition were recorded in spring and early summer (n = 5), while calves were found predominantly in summer (n = 4). Peaks in mortality of pregnant and lactating females, as well as the subsequent death of newborns or very young calves, which are unable to survive without maternal care, may be associated with increased fishing activity in the region during the warm seasons. The loss of reproductively active females and their dependent offspring exacerbates demographic decline, further hindering the natural recovery of this vulnerable population. The obtained results complement the existing knowledge and emphasize the need for seasonally adapted management and bycatch-mitigation strategies in the region.

Evaluating an interactive 3D web-based learning tool to improve the understanding of ovarian transformations in long-finned pilot whales among marine and veterinary professionals

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Understanding ovarian anatomy and transitions between reproductive states is essential for interpreting female life history in cetaceans. Yet, research is constrained by limited specimen access and reliance on conventional methods such as histology and static images, which reduce three-dimensional complexity to two-dimensions representations. This study presents and evaluates an interactive WebGL-based 3D learning platform which allows visualizing ovarian structural transformations in long-finned pilot whales (LFPW) (*Globicephala melas*), with the goal of improving anatomical understanding among professionals and exploring MRI as a more comprehensive imaging technique for assessing female reproductive tissues and status. Ovarian structures from five stranded female LFPW specimens provided by the Scottish Marine Animal Stranding Scheme (SMASS) were digitally reconstructed from MRI data, using volumetric and 3D modelling software, and imported into a bespoke online interactive platform. The platform enables visualizing ovarian anatomy across two reproductive stages: sexually active adult and postpartum. Evaluations involved veterinary professionals, marine mammal researchers, and related specialists internationally (n = 22), using five metrics: knowledge gain (pre/post-test), cognitive load, face and content validity, usability (SUS), and user motivation (RIMMS). Knowledge assessments showed significant improvement ($Z = -2.652$, $p < 0.05$) with reduced score variability, indicating greater consistency in understanding. Cognitive load analysis revealed correlations between extraneous and germane load linked to interface design challenges. Face and content validity indicated favorable perceptions of anatomical accuracy and educational content, though variability highlighted areas for refinement. Usability scored above average (SUS = 75.57 vs. standard 68), and motivation was moderate to high, with confidence and satisfaction rated highest. This research establishes a replicable framework for transforming archived specimens into accessible educational and diagnostic resources, addressing gaps in diagnostic capacity for larger cetacean reproductive tissues. By removing geographical

barriers, the web-based platform advances digital visualization techniques, supporting marine mammal science and conservation education globally.

The identity and patterns in occurrence of depredating sperm whales on a Greenland halibut fishery off Vesterålen, Northern Norway

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Depredation by sperm whales (*Physeter macrocephalus*) is a global phenomenon, especially among adult males targeting long-line fisheries in high latitude feeding grounds. Since 2014, depredation on Greenland halibut (*Reinhardtius hippoglossoides*), a known prey species for male sperm whales in the North East Atlantic, has been documented on a small fishing ground, Langenesegga, off the coast of Vesterålen, Northern Norway. The traditional long-line fishery is open for two short periods, one in early June and another in early August. In 2024, the Greenland halibut fishing season was shortened to just one brief period in early June, and no depredating sperm whales were observed in the area. Further fishery management changes took place in 2025, when the fishery was open for the majority of the summer (June-August). Sperm whales were documented again depredating on long-line boats, as well as being observed in the vicinity of gill net boats. A long-term data set starting in 2014 including photo identification, surface observations and interviews with local fishermen give a unique insight into the behaviour. Majority of the observed whales were new identifications, with few individuals observed over multiple years. Observations also highlighted a change in behaviour after changes in fishing periods. As depredation has direct socio-economic, ecological and conservational impacts, understanding the behaviour and its patterns is crucial for sustainable fishery management.

Proliferative dermatitis in harbour porpoises (*Phocoena phocoena*) associated with alphaherpesvirus infection

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Herpesviruses can infect a wide range of vertebrates, including cetacea, where infections have been reported to may cause disease of variable severity. Three types of herpesviruses have been reported to infect harbour porpoises (*Phocoena phocoena*) in the North Sea: one gammaherpesvirus (*Phocoena phocoena* herpesvirus type 1, PPHV-1) and two alphaherpesviruses (PPHV-2 and PPHV-3), of which the latter (PPHV-3) has not previously been associated with disease. Here we report PPHV-3 infection in ten immature harbour porpoises with mild to very extensive skin ulceration and proliferation, that stranded in the Netherlands between 2012-2024. Grossly, the skin showed multifocal, ulcerative and proliferative, well-demarcated lesions, most often on the ventral abdomen, near the genital slit. Histopathology showed severe epidermal hyperplasia, ulceration, numerous intranuclear inclusions in keratinocytes and mild to moderate inflammatory response in the underlying dermis. All cases were neonates or juveniles. In four cases, the severity and extent of the lesions were considered sufficient to have contributed significantly to stranding and/or death. A retrospective review of pathology reports from 2012–2024 on the terms proliferative and ulcerative skin lesions and/or dermatitis in fresh (DCC 1 and 2) stranded harbour porpoises (n=365) identified a temporal increase in cases: only one PPHV-3-associated lesion was found between 2012–2020 (prevalence in stranded animals= 0.45%; 1/222), whereas nine cases occurred between 2021–2024 (prevalence in stranded animals= 6.29%; 9/143). Besides the reported increase in PPHV-3 infections associated with significant disease in stranded harbour porpoises from the southern North Sea, we provide the first evidence suggesting an association with morbidity and mortality. Infection rate was highest in neonates and juveniles, which may reflect limited immune competence.

North Atlantic minke whale seasonal presence in the northern North Sea revealed by 10 years of passive acoustic monitoring

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North Atlantic minke whales (*Balaenoptera acutorostrata*) are a species of conservation significance in Scottish waters. Since 2020, the species has been included as a priority feature in two Scottish Marine Protected Areas (MPAs), including the Southern Trench MPA off eastern Scotland. Concerns have been raised over potential injury or disturbance to minke whales using the Southern Trench MPA in relation to development of both fixed and floating offshore wind. However, assessments of impacts from the marine renewable industry on minke whales are hampered by a lack of information about their baseline seasonal occurrence in most of their distributional range. This study used a 10-year dataset (2015-2025) to investigate the presence of minke whale vocalisations in broadband recordings collected at nine monitoring sites in the Southern Trench and adjacent waters. Acoustic data were analysed using a recently developed machine learning detector for the automated detection of minke whale song (i.e. low-frequency pulse trains). While data collection continues for another 1.5 years, daily results to date (covering 3,695 monitoring days) indicate seasonality in the presence of minke whales, with song typically detected between May/June and November. Except for one detection in December, minke whale detections were absent from December to April at all sites and in all years investigated. Despite daily detection rates being highest from June to August, a bimodal peak in detections was observed across sites, revealing a secondary peak in August-October. This study focused on broader scale variation (seasonal and interannual) in minke whale occurrence and found stable patterns across years. The results will support assessments of underwater noise impacts from the construction and operational phases of planned offshore wind developments in the region. These data are also vital to develop monitoring and management plans for the Southern Trench MPA.

It’s complicated: Harbour porpoise response to operational offshore wind turbines

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The current offshore windfarm capacity in the North Sea, nearly 30 GW, is expected to increase significantly in the coming years to support the EU goal of 300 GW by 2050. Therefore, it is crucial to determine how these operational wind farms affect the marine environment. The harbour porpoise is the most common cetacean in these waters and relies on narrowband high-frequency echolocation clicks for navigation, foraging, and communication. This makes the species particularly sensitive to noise pollution, underscoring the need to understand how anthropogenic noise, especially from the expanding offshore wind energy industry, affects their distribution. To determine small scale distribution patterns, tripod-mounted F-PODs were deployed during a one-year period in Belgian waters, along a gradient of increasing distance from the nearest operational offshore wind turbine, at four intervals ranging from 150 m to 800 m. Using generalized additive models, Detection Positive Minutes (DPM) and Hours (DPH) metrics (per hour and per day) are examined to study patterns in harbour porpoise presence in relation to distance from operational offshore turbines, which serves as a proxy for turbine noise. Preliminary results show that DPM/day gradually increases from autumn onwards, with peak in late winter and early spring: a clear seasonal pattern in harbour porpoise presence that is consistent with the dynamics previously described outside windfarms. During these months a distinct diel pattern is observed consistent across distances. Exploratory analyses revealed differences in harbour porpoise detections across distances, being consistently lower at 800 m, non-significant or lower at 400 m and non-significant or higher at 600 m compared to 150 m, across both hourly and daily measures (DPM/DPH). This research will provide insight in how operational windfarms influence the fine-scale distribution of harbour porpoises, providing insights to improve cetacean management and conservation in the intensively used North Sea.

Anatomical mapping of collision trauma in stranded sperm whales from the Canary Islands (2000-2024)

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Ship strikes on cetaceans have increased over the last decades due to rising maritime traffic and vessel speeds. Sperm whales (*Physeter macrocephalus*), an IUCN Vulnerable species depleted by commercial whaling, now face ship strikes as a primary threat in high-risk areas, such as the Canary Islands. Accurate characterization of sperm whale ship strikes lesions improves collision diagnostics, can reveal impact dynamics, and supports mitigation strategy development in hotspots. We hypothesize that anatomical mapping of cut locations is crucial to understanding collision dynamics and identifying potentially predisposed body regions in this species. This work aimed to quantify the presence, number, and anatomical distribution of incisive lesions in sperm whales diagnosed with vessel collisions. A systematic 25-year stranded dead cetacean dataset (2000-2024) from the Atlantic Cetacean Research Centre was analyzed, obtaining 97 cases categorized as possible, probable, or confirmed collisions depending on information availability, carcass condition, and necropsy feasibility, with sperm whales comprising 57 cases (58.8%). Of these, 25 specimens from probable or confirmed collision categories were studied as they provide stronger evidence of collision. Lesions were macroscopically categorized by cut numbers and distribution across anterior, middle, and posterior body thirds. Results revealed predominantly single extensive cuts (84%) causing sectioning of the body in more than one third of cases, while the remaining cases involved multiple cuts (16%). These lesions were primarily confined to one body third (84%) with anterior and posterior thirds equally affected (32% each) followed by the middle third (20%). Multi-third affectation was infrequent (16%). Macroscopic incisional lesion mapping, combined with histopathological diagnosis of these animals, can facilitate the study of collision dynamics in sperm whales and the development of mitigation strategies in high-risk areas. This study, supported by the Atlantic Whale Deal project (INTERREG-Atlantic Area), advances ship strike risk management in the Northeast Atlantic.

Estimating cetacean density from small vessels: integrating passive acoustic monitoring with visual mark–recapture distance sampling

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Small vessel surveys are widely used to estimate density and abundance of coastal marine mammals and in environmental impact assessments of anthropogenic developments. Mark–Recapture Distance Sampling (MRDS) is critical for unbiased estimates when the assumption of detection of all animals on the track line is violated. However, small vessels often lack capacity for independent observers; limiting such surveys to conventional distance sampling, which may under- or overestimate true density and abundance. We evaluated an acoustic–visual MRDS approach for estimating harbour porpoise (*Phocoena phocoena*) density and compared it with standard double-platform visual MRDS. Vessel-based line transect surveys were conducted monthly for two years (Jan 2015-Dec 2016) off Northwest Wales in the coastal Irish Sea. Primary and independent visual sightings were combined with towed acoustic detections and analysed under two MRDS configurations: primary–independent ("visual") and acoustic–primary ("acoustic"). Field, analytical, and modelling approaches for both configurations will be described. Track-line detection probabilities were similar for visual (g(0) = 0.508, CV = 0.136) and acoustic methods (0.438, CV = 0.173), yielding overlapping densities from 0.807 (CI: 0.501–1.3; CV = 0.247; visual) to 1.031 (CI: 0.626–1.699; CV = 0.259; acoustic) individuals km^{-2}. The acoustic–visual configuration produced comparable absolute density estimates to visual MRDS, offering a practical alternative for surveying vocalising marine mammals from small vessels unsuitable for independent observers. This may be particularly useful for low-budget coastal projects that rely on small coastal vessels for surveying and for environmental impact assessment surveys of coastal developments.

Group decision-making behaviour and social interactions of killer whales in Hardangerfjord, Norway

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Investigating how leadership and social coordination operate in cetaceans provides insight into their complex social structures and ecological strategies. Using drone-based observations, this study examines leadership in group deep dives and social interactions (synchronised surfacing and physical contact) in killer whales (*Orcinus orca*) in Hardangerfjord, Norway. A total of 45 deep group dives and 274 social interactions were registered during winter and spring 2025. Overall, 82.2% of group deep dives were initiated by adult females, significantly more than males and juveniles, supporting the presence of unshared decision-making and suggesting that leadership is linked to age-sex class. Dive initiators were predominantly positioned in peripheral positions, but not necessarily at the front. Dive lag data showed a right-skewed distribution, indicating that most group members responded quickly to a single initiator. Group size and behaviour (travelling or resting) did not significantly influence mean dive lags or interindividual dive intervals, suggesting stable group cohesions. Social interactions, in the form of synchronised surfacing and physical contact, were most common in adult female-calf dyads. These interactions were context-dependent, with minimal interactions observed during foraging. Despite the limited number of groups covered, this study demonstrates the value of drone-based observations for uncovering fine-scale social behaviour and highlights the leadership role of adult females in shaping coordinated collective behaviour and maintaining social bonds in killer whales.

Testing and demonstration of cetacean exclusion devices in trawling fisheries in Spain

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Fishing fleets in Europe face the challenge of minimizing and eliminating impacts on protected species, namely marine mammals. The problems identified between fishing activities and cetaceans include a variety of issues that can be categorized as bycatch with mortality, predation of fish and damage to fishing nets. In this study we have carried out testing and demonstration of mitigation measures by carrying out pilot fishing trips to find out alternatives to the use of acoustic deterrents including net modifications (marine mammal excluder devices), deterrent acoustic devices (pingers) and other potential gear alternatives (LED lights). Since 2022, it has been developing a research program to mitigate bycatch in fisheries off the northern Iberian Peninsula. Five research projects have been carried out, involving the experimentation, validation, and monitoring of the performance of pingers and dolphin exclusion devices in Spanish gillnet, purse seine, and trawl fisheries. Data have been obtained on the effectiveness of different measures and their ability to minimize bycatch in 23 trials and 1118 fishing sets. In the trawl fishery, 8 trials (103 fishing hauls) with four prototype exclusion devices have been carried out. Underwater cameras placed on fishing gear were used to validate the operation and function of the devices inserted into the fishing net. These devices require minor modifications to the trawl nets and have an affordable economic cost, allowing larger species of larger size to escape through a higher exit. At the same time, they do not reduce the catch of the fish species targeted by the fishery. This represents a passive measure with significant potential, which, compared to pingers would not contribute to acoustic pollution in the marine environment.

Cetaceans exhibit region-specific habitat preferences across tropical waters

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To implement effective and appropriate conservation measures, especially in less studied tropical areas, a better understanding of cetacean distribution and habitat preferences is needed. Our aim was to predict the distribution of cetaceans in five tropical marine subregions and to compare their habitat preferences in subregions located in three different oceans. Using data collected during the large-scale REMMOA aerial surveys, we created species distribution models based on sighting data and environmental variables integrated over the water column and transformed using principal component analysis for eight cetacean species groups. We summarised the distribution maps using hierarchical clustering on principal components to highlight distribution patterns common to species groups in the different subregions. Overall, no species group exhibited similar relationships with environmental conditions across all subregions, though certain species groups did show comparable relationships with specific variables in certain subregions. This suggests that cetaceans exhibit region-specific habitat preferences across tropical waters, with certain distribution drivers operating similarly for some populations in some subregions. In particular, most species groups favoured oceanographic structures such as continental slopes, while others, mainly continental shelves, were only preferred by a few species groups. Finally, we found that the distribution patterns of species groups were congruent within oceanographic subregions. These results will inform marine spatial planning for conservation and maritime development purposes, and can also be used to relocate maritime activities to areas where they will have a lesser impact, i.e. away from areas with high cetacean densities that support vital activities such as feeding and reproduction.

Evaluating aerial survey sensitivity for trend detection in harbour porpoises

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Long-term monitoring programmes are crucial for understanding how species respond to natural- or human-induced changes. Since conservation decisions often rely on identifying reliable abundance trends, effective conservation of harbour porpoises requires monitoring efforts capable of detecting changes with sufficient accuracy and within timeframes relevant to both the species and management agencies. Using power analysis to quantify the survey effort needed to detect population trends, this study aims to assess how a series of small-scale aerial surveys can detect abundance changes in harbour porpoise (*Phocoena phocoena*) in the eastern English Channel, including a Marine Protected Area. To calibrate a simulation framework that closely replicates in-situ sampling conditions, empirical parameters were derived from a two-year aerial survey campaign conducted seasonally (Spring 2023 – Winter 2025) within the Estuaires Picards et Mer d'Opale Marine Natural Park (EPMO MNP, France) and adjacent English waters. The framework integrates estimates of seasonal abundance, inter- and intra-annual variability, group sizes, effective strip half-widths, encounter rates, and density surface model outputs (estimated distribution maps). Across 1,000 simulations, harbour porpoise groups were generated and spatially distributed within the study area, transect coverage was applied, aerial detections were simulated, group sizes were assigned using probability distributions calibrated from empirical observations, and total abundance was estimated following standard distance sampling procedures. To evaluate the ability to detect 'true' changes in abundance, population trajectories were simulated under declining scenarios ranging from 0% to 50% in 5% increments, each paired with corresponding levels of variability. The resulting statistical power curves allow to interpret abundance trends and to determine the minimum survey effort needed to detect meaningful trends. Ultimately, findings will support the design of a robust and standardised aerial monitoring strategy applicable to harbour porpoises, and other taxa (e.g., seabirds), within the EPMO MNP and beyond.

Isotopic time series, foraging niche, and contaminant burden of a killer whale from the west coast of Scotland

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Top marine predators, including seals, and odontocetes, have key ecological roles and exhibit complex environmental and social interactions. They are considered sentinel species for ecosystem and human health due to their position in the food web and their life-history traits but also face a wide range of anthropogenic pressures. On the west coast of Scotland, the killer whale (*Orcinus orca*) group known as the “West Coast Community” has been sighted regularly since monitoring began in 1992. It once consisted of ten individuals, and no calves have ever been recorded in this group. In 2016, W06 or “Lulu”, believed to be the last remaining female in this population, was found dead stranded on the Isle of Tiree following entanglement in a creel line. Killer whale strandings are rare and postmortem examinations on recently stranded individuals are uncommon. A prior investigation of chemical contaminants in UK marine mammals revealed significantly high concentrations of persistent organic pollutants in this individual. We analysed tooth growth layer groups (GLGs), creating a timeseries of stable isotopes ($\delta^{13}C$, $\delta^{15}N$), radiocarbon (^{14}C) and mercury concentrations. Stable isotopes indicate a long-term diet consistent with a resident apex predator foraging on marine mammals. The ^{14}C profile reveals a distinct civil-nuclear signal consistent with long-term foraging fidelity to western Scottish waters. Mercury concentrations were exceptionally high across tissues (liver: 176 mg/kg, kidney: 25 mg/kg, and muscle: 11 mg/kg wet weight) consistent with bioaccumulation at a high trophic level. Mercury measured across tooth GLGs and in different tissues allowed us to examine accumulation over various time scales, as well as the burden in certain organs. To our knowledge, this is the first study of this kind

on this species, highlighting that this resident apex predator experienced multiple human-derived stressors within the marine environment in her lifetime.

From feasibility to fieldwork: harbour porpoise tagging pilot in Dutch waters

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The pilot project to tag harbour porpoises (*Phocoena phocoena*) in Dutch waters aims to explore and gain experience with methods for catching and tagging individuals, while obtaining initial insights into their movements. The outcomes could support future tagging research on (i.a.i.e.) human impacts, such as offshore wind development. This presentation will outline the process leading up to the pilot, preliminary results, and lessons learned. The project has a long history. A feasibility study in 2016 led to a recommendation in the updated Dutch Harbour Porpoise Conservation Plan (2020) to explore harbour porpoise tagging options. A series of stakeholder and expert workshops followed, addressing capture and tagging techniques, animal welfare, and ethical considerations. Experiences from tagging studies in Denmark and Greenland have been particularly valuable in shaping the Dutch approach. Catching, handling and tagging protocols have been carefully developed and are refined as needed. The pilot started in 2023. Preliminary results are promising, and per December 2025, four harbour porpoises have been tagged in Dutch waters. One animal showed large-scale movement behaviour across the North Sea after remaining in the Wadden Sea area for ~1.5 months, whereas another animal stayed within the Wadden Sea area throughout the data transmission period (~3 months). Further tagging could indicate whether these patterns are general, or individual/time based. However, setbacks occurred, including harbour porpoise mortality. One porpoise swam into the net unnoticed and drowned. Another porpoise died two weeks after tagging; no causal link with tagging could be found (nor fully ruled out). Both cases were thoroughly evaluated, including consultation with independent international experts. It was decided to continue the project with adjustments to the protocols, involving starting with shorter nets (which can be better monitored and removed from the water more quickly) and a dedicated coordinator overseeing all activities during the tagging operations.

Decoding the fecal microbiome of harbour porpoises (*Phocoena phocoena*) from the German Baltic Sea using 16S rRNA-Sequencing

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The biodiversity in the Baltic Sea is increasingly impacted by climate change, eutrophication, and other human activities, and therefore maintains a critical ecological status. Amidst this environmental decline, the Baltic harbour porpoise (*Phocoena phocoena*), the most frequently stranded cetacean along the German Baltic coast, continues to decline in numbers. As top predators, harbour porpoises are sensitive indicators of ecosystem health, making assessments of their physiological condition especially important. Although the fecal microbiome plays a crucial role in an animal's health, it remains largely understudied in this species. Fecal microbiomes from around 100 dead, stranded harbour porpoises along Mecklenburg-Western Pomerania's coast (Germany) were characterised to establish a baseline. Presented are preliminary results of the first ten samples of a pilot study, from the years 2022-2024, analysed through 16S rRNA-Sequencing. The pilot dataset included a balanced representation of sex, age classes, and causes of death, a strategy that will proceed throughout the study. Across the processed samples, approximately 150 genera were identified, highlighting a diverse microbial community. Moreover, the samples revealed a microbiome strongly dominated by Firmicutes, which accounted for 50-95 % of the bacterial community per individual. The most abundant genera were *Clostridium* sensu stricto (Clostridiaceae), *Paraclostridium*, and *Paeniclostridium* (both Peptostreptococcaceae). Frequently detected non-Firmicutes taxa, contributing up to 15 % per sample, included *Actinobacillus* and *Pasteurella* (Pasteurellaceae) as well as *Mycobacterium* (Mycobacteriaceae). These initial findings suggest that the fecal microbiome of harbour porpoises shares characteristics with those of related taxa, like hippopotamuses, where Firmicutes and Proteobacteria typically dominate the fecal microbiome. The findings may also reflect diet-related patterns observed in pinnipeds, such as harbour seals. Establishing this baseline will support future assessments of health deviations linked to

disease, environmental stressors, or pollution and contribute to the conservation of this endangered population while helping evaluate ecological conditions of the Baltic Sea.

Future heatwave intensification may degrade cetacean habitat quality

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With global climate change intensifying, extreme heatwave events have become increasingly frequent and intense, posing potential threats to marine ecosystems, yet their impacts on cetacean habitats remain incompletely understood. This study aimed to assess the impacts of current extreme heatwaves on global cetacean habitat components (phytoplankton dynamics, communication range, and prey availability) and test the hypothesis that future heatwave intensification would alter habitat quality. Using long-term environmental, acoustic, and prey survey data (2012–2025) covering global cetacean habitats. Results showed that extreme heatwaves did not affect cetacean prey availability but triggered region-specific phytoplankton blooming and reduced cetacean communication range by approximately 30%; future projections indicated a substantial increase in global heatwave intensity and frequency. This work is the first to systematically link heatwave-driven communication disruption to potential cetacean habitat degradation, filling critical gaps in understanding climate change impacts on marine mammal habitats. The findings provide a scientific basis for developing targeted conservation strategies to mitigate climate-driven habitat quality loss for cetaceans, emphasizing the need to prioritize communication-related ecological resilience in marine conservation planning.

Establishing accurate baselines for marine mammal assessments: Challenges and opportunities

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Accurate marine mammal baselines are fundamental to effective environmental impact assessments (EIAs), yet current approaches to establishing baselines often fail to capture the complexity of marine mammal ecosystems and ecology. Marine mammal baselines frequently rely on historic reports, broad-scale datasets, or citizen science projects, which, while valuable, often lack spatial and temporal resolution, are often outdated, or fail to present issues with consistency and reliability. In particular, the existing soundscape and concentration of vessel traffic is often limited to a basic qualitative overview. Data deficiency combined with an undefined and inconsistent process for establishing marine mammal and environmental baselines mean that species-specific behaviours are often overlooked. Transient and migratory species also may not be represented accurately by seasonal surveys. Lack of knowledge of species distribution or behaviour reduces the ecological relevance of the baseline, potentially leading to an underestimation of risk. Likewise, lack of understanding concerning the natural and anthropogenic baseline environment and soundscape leads to challenges in predicting disturbance and masking effects. This work explores opportunities to improve baseline accuracy through development of a standardised, reference-driven framework that incorporates multiple data sources, behavioural ecology, and soundscape characterisation. It focusses on developing a more robust approach to estimating baseline vessel traffic and noise levels, particularly where noise monitoring within the area of interest is impractical or outside of project scopes. By improving baseline accuracy and consistency, we aim to advance best practice and ensure marine mammal assessments reflect the true complexity of modern marine environments.

Faeces of harbour porpoises (*Phocoena phocoena*) can stimulate phytoplankton growth

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Cetaceans act as ecosystem engineers by facilitating nutrient cycling and stimulating primary production. Their faeces supply essential (micro)nutrients, including Fe, N and P, to phytoplankton, enhancing primary productivity and oceanic uptake of atmospheric CO2. While faecal fertilisation has been studied in larger baleen whales, little is known about whether small cetaceans provide similar effects, or how these effects vary between oligotrophic and eutrophic waters. To address these knowledge gaps, the Rugvin Foundation conducted four laboratory pilot studies to study the fertilising potential of harbour porpoise (*Phocoena phocoena*) faeces. Experiments were performed using seawater from the North Sea (2022 & 2025), Eastern Scheldt (2023), and Mediterranean Sea (2025). In 2024, a methodology was developed to measure phytoplanktonic CO2/O2 exchange, and in 2025, the methodology for the in-vitro faecal fertilisation experiments was refined. Faecal material was obtained from stranded porpoises necropsied by the Utrecht University veterinary faculty (n=17, 6, 7, and 21 individuals respectively). Water was supplemented with faecal matter in four different concentrations, and one of several algal species (Cha*etoceros calcitrans, Nannochloropsis oceanica, Phaeodactylum tricornutum, Phaeocystis globosa*, or *Skeletonema costatum*). Cell densities were monitored for two weeks or until growth plateaued. Preliminary results show that harbour porpoise faeces enhanced algal growth in nearly all trials across both oligotrophic and eutrophic conditions. Positive dose-dependent responses were observed for *P. Tricornutum* (Eastern Scheldt), *P. globosa* (North Sea), and *C. calcitrans* exhibited higher growth in oligotrophic water compared to eutrophic water at several faecal doses. The gas-exchange method developed in 2024, which is awaiting improvement, provides a promising protocol for quantifying phytoplanktonic primary production in vitro. Results demonstrate that harbour porpoise faeces can stimulate phytoplankton growth in vitro. Combining small-scale physical-chemical and large-scale ecological models will further clarify the porpoise's role in nutrient cycling and primary production in both eutrophic and oligotrophic marine systems.

Response of the Moray Firth and North Sea harbour porpoise population to windfarm-related noise disturbance, changes in prey availability, and levels of bycatch mortality

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The harbour porpoise (*Phocoena phocoena*) is known to be affected by noise generated during the construction of offshore windfarms, and is also subject to mortality from fisheries bycatch. Estimates of the medium- and long-term effects on populations of such pressures on different spatial scales and their interactions are crucial for the establishment of suitable mitigation and protection measures. We used the DEPONS agent-based model to simulate the response of the North Sea harbour porpoise population to the noise from piling operations and service ship traffic at the Moray Firth offshore windfarm. DEPONS simulates the individual movements and survival of thousands of virtual porpoises in a dynamic landscape and implements the responses of porpoises to noise from piling and ship sources. We forecast porpoise population trajectories over a period of 50 years in scenarios representing different levels of bycatch mortality and changes to prey biomass in the vicinity of turbine piles, and assessed the impact of localized noise disturbance from windfarm construction within broader pressure regimes of variable severity.

Whale Alert - Reducing ship strike risk for all vessels through collaborative sharing of sightings and detections along with approach guidelines and management zones

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The Whale Alert mobile app was first released in 2014 to disseminate seasonal and dynamic management zone information for North Atlantic right whales. Subsequent releases added support for citizen science sighting reporting for all large cetaceans with a focus on North America. In 2025, Whale Alerts geographic focus was expanded to cover European waters including the Mediterranean. This expansion also included outreach to Europe based commercial shipping companies, ferries, and the sailboat racing communities to drive adoption. In early 2026, an improved desktop based Whale Alert will launch to target large ship bridge use where mobile devices are not allowed. Whale Alert aggregates sightings and automated detections from its own users and a growing network of 3rd parties including protected species observers, volunteer naturalists, government observing programs, robots for whales. Work is underway to integrate new, automated detection systems based on cameras and other sensors to Whale Alert. We will present lessons learned and current work in expanding Whale Alert's network of sighting & detection sources and increasing uptake of the aggregated information by 3rd party information systems used in vessel operations and planning.

Temporal increases in mercury concentrations are associated with increased risk of death by infectious disease in harbour porpoises (*Phocoena phocoena*)

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Trace elements, particularly heavy metals like mercury, pose significant risks to marine ecosystems due to their toxic and bioaccumulative properties. Concentrations in some marine species show concerning temporal increases, yet spatiotemporal trends in UK marine mammals have not been comprehensively assessed for nearly two decades. Marine mammals serve as sentinel species for ocean health due to their long lifespan and high trophic level, making them vulnerable to bioaccumulative pollutants. Monitoring trace elements, in highly exposed populations, is critical for assessing trends and indices of health, like infectious disease. Using liver tissue samples of 738 UK-stranded harbor porpoises (*Phocoena phocoena*) collected between 1990 and 2021, we found mercury and selenium concentrations have increased, in contrast to declines in cadmium and lead. Spatial analyses revealed that mercury concentrations are highest at lower latitudes, while cadmium increases northward. Levels of zinc, mercury, selenium, and cadmium are significantly associated with infectious disease mortality risk. Our findings highlight the importance of monitoring trace elements in sentinel species to inform conservation efforts and evaluate the effectiveness of pollution mitigation policies such as the Minamata Convention. Increasing mercury levels, despite emission reductions, underscores the urgent need for improved measures to protect marine biodiversity and ecosystem health.

Effective monitoring of small cetaceans – comparing C-POD, F-POD and SoundTrap data

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Offshore wind farm activities generate significant underwater noise during their life cycle, particularly from pile-driving during construction, and thus have potential to affect marine life. Due to their sensitive hearing abilities and common occurrence in European waters, harbour porpoise (*Phocoena phocoena*) and Delphinidae are appropriate indicators for investigating the impacts of noise on marine life. Therefore, monitoring of harbour porpoise, and other Delphinidae species prior to, during and after offshore windfarm installation is often undertaken (required in Germany) to assess distribution and potential impacts of construction, operation and decommissioning. Several devices have been developed to detect and monitor harbour porpoise acoustically; however, each device has pros and cons in terms of data storage capacity, battery duration, duty cycle, ease of data analysis, and transparency of built-in processing algorithms. Self-contained echolocation-click detectors (C-PODs & F-PODs; Chelonia Ltd.) store summarised information for each click and offer simple data analysis with continuous operation, while the SoundTrap ST600 HF (Ocean Instruments Ltd.) offers broadband recording at the expense of data analysis complexity and potentially duty cycle. We will report results of simultaneous comparisons of all these devices across multiple locations with different environmental parameters and ambient noise levels which may impact their detection capabilities and efficacy.

Grey seal foraging behaviour in relation with the tidal, diel and seasonal cycle

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Movement and foraging of marine organisms are largely determined by environmental conditions. Particularly seasonal, diel and tidal cycles can affect the distribution of many species, for instance through variation in nutrient availability via currents and primary productivity. Consequentially, a shift in planktivorous prey distribution can affect higher trophic levels like marine mammals, implying an indirect link between these cyclic processes and animals. Grey seals (*Halichoerus grypus*), as a large predator in the North Sea, can play an important role in trophodynamics, yet few studies have evaluated how their offshore foraging behaviour changes along the diurnal, seasonal and tidal cycle. Hence, we studied tracking data from 97 grey seals, recording locations and diving behaviour, to evaluate their foraging activities in relation to the day-night cycle, seasons and tidal currents. We used data gathered between 2006-2019, focussing on an area north of the Dutch Wadden Islands, with high known sandeel presence, the main food source of grey seals. Foraging activity was assumed with optimised time spent at the sea floor, due to benthic foraging being their main strategy. As such, variables like descent speed and dive duration were used as proxies for foraging. Data were analysed using generalized additive models. Our results reveal increased foraging around dusk and dawn in summer, aligning with sandeels leaving their burrows. Despite an observed decrease in descent speed at flood tide, the combination of foraging proxies showed an unclear pattern of seal foraging in relation to tidal currents. This could be attributed to this study's focus on small-scale foraging behaviour, while excluding spatiotemporal preferences. Nonetheless, our findings demonstrate foraging patterns analogous to diel and seasonal variation observed in prey behaviour. Additionally, this study provides insightful clues about marine mammal foraging in relation to environmental variation, and offers critical insights for future behavioural and impact studies.

A full-term abdominal extrauterine pregnancy in a common dolphin (*Delphinus delphis*): first documented case

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This study describes, to our knowledge, the first documented case of a full-term peritoneal extrauterine pregnancy in a common dolphin (*Delphinus delphis*), found stranded alive and later deceased. An adult pregnant female (114 kg, 205 cm) was discovered on 1 February 2023 during a mass stranding in the Bay of Loix (Île de Ré, France). Stranding records, necropsy reports, photographs, and partial histological data were analyzed and compared to published cases of extrauterine gestation in other species. The necropsy revealed a term male fetus (91.5 cm, 10 kg) freely located in the peritoneal cavity, in a moderately advanced state of decomposition, with remnants of hemorrhagic placental tissue attached to the fetal head and tail. The uterine horns were intact and non-gravid, but a perforation with a small serosal nodule on the uterine body was present, which could be consistent with fetal escape into the abdomen. Numerous abdominal adhesions, diffuse peritonitis, and intestinal putrefaction indicated a pregnancy in the abdomen. Maternal lesions suggested live stranding, chronic dermal poxvirus-compatible lesions, severe gastric parasitism, and mesenteric lymphadenitis. Histology confirmed multifocal acute myocardial necrosis, chronic peri-hepatitis, lymphadenitis, chronic interstitial pneumonia, and moderate placentitis. This case demonstrates that, despite the non-invasive, epitheliochorial placentation of cetaceans, an extrauterine pregnancy can progress to full term in this species, although fetal delivery becomes impossible and peritonitis fatal. The findings fill a significant gap in cetacean reproductive pathology and highlight that abdominal pregnancy—rare in animals but common in humans—should be considered as a differential diagnosis in gravid female cetaceans found in poor condition, especially when internal examination is not possible. This case highlights the remarkable reproductive plasticity in cetaceans, demonstrating their ability to adapt to atypical pregnancy locations, which broadens our understanding of reproductive strategies in these species.

Should I stay or should I flee: behavioural responses of harbour seals (*Phoca vitulina*) to shipping noise

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The English Channel stands out as one of the densest marine traffic areas in the world. Ships have become one of the main sources of anthropogenic noise in the ocean, impacting many marine species. Among these, harbour seals are particularly at risk due to their use of coastal habitats, highly impacted by marine traffic. The goal of this study was to evaluate behavioural responses of seals towards shipping noise. We used data from biologging tags (DTAGs) that record both noise and behavioural parameters. Vessel passes were identified using a high level noise detector and classified as "vessel" by three evaluators. For each vessel pass, a 15min window around the event was extracted, including a spectrogram, 3-axis accelerometer data, jerk (sharp acceleration) and swimming effort, depth, prey capture attempt positions, and a 2D movement track. Behavioural responses were classified into six categories by three evaluators. In this study, the category "unclassifiable" was excluded and the remaining categories were simplified into a binomial response variable ("change" ; "no-change"). Overall, seals showed behavioural changes in 30% of the 418 events. Their behavioural responses depended significantly on the characteristics of the noise and their initial behaviour. Seals were more likely to change behaviour when noise peaks were higher (pvalue ≤ 0.01). Additionnally, seals showed a higher probability of response when sleeping and a lower probability when foraging (pvalue ≤ 0.01). During foraging, an increase in the number of prey capture attempts was associated with a lower probability of response (pvalue ≤ 0.01), suggesting that they may tolerate noise in areas with high prey availability. In conclusion, harbour seals may weigh the costs and benefits of responding to a disturbance depending on their initial behaviour.

Health risks on human consumption of Eastearn Pacific common dolphins (*Delphinus delphis* bairdii) with high mercury levels in the coast of Peru.

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Human interactions have been previously documented in small cetaceans in the coast of Peru, however there is a poorly known practice associated to human consumption of dolphin meat in fishermen villages known as “harvesting”. The aim of this work is to present the evidence and risks of human consumption in the coast of Peru specifically towards the Eastern Pacific common dolphin (*Delphinus delphis* bairdii). Specimens were collected from the north and central coast within the range of the species in a retrospective, field based, comparative, observational, descriptive clinical and forensic analysis using the stranding data, medical findings and sightings. Sightings in the area confirmed the species coastal distribution from Punta Mero, Tumbes (3º53’18.32”S – 80º51’03.43”W), to Wakama Ecobeach, Ica (13º17’03.93”S - 76º16’31.91”W). Samples from terminal specimens where collected for hematology and methyl-mercury levels in plasma. Necropsies characterized lesions from human interaction for meat consumption including straight clean lateral, transversal and longitudinal cuts, removal of epaxial, hypaxial and abdominal muscles, flukes cut-out, melon or organ removal. Findings revealed 61% (N=80) presented evidence of “harvesting”. Methyl-mercury levels in blood samples (n=15) were over 200ug/dL, 20 times higher than human standard toxic value for exposed persons. The evidence revealed that dolphins found with signs of “harvesting” were target of intentional catch for the meat consumption exposing the fishermen communities to high levels of methyl-mercury, a serious public health risk to pancreas, liver, heart diseases. However, after twenty years, the trend of dolphin meat consumption is declining supported by the recent Animal Welfare and Protection Law and the enforcement at fishing docks to prevent commercialization. The understanding of the health risks of cetacean consumption in Peru is not being addressed and prevention is important to be supported with long-term educational programs to fishermen communities to secure the future of dolphins along the Peruvian coast.

Examination of the stomach contents of a sperm whale (*Physeter macrocephalus*) stranded on Windermere Island, Eleuthera, Bahamas

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Following a stranding of a sub-adult/adult sperm whale (*Physeter macrocephalus*) on Windermere Island (Eleuthera, Bahamas), the stomach contents were analyzed and identified using the beak guide in Clarke (1986). Recovered prey items consisted of 649 intact cephalopod upper beaks and 456 intact cephalopod lower beaks, as well as 35 cephalopod eye lenses and 2 fish vertebrae. The most numerous cephalopod identified was a squid belonging to the genus *Histioteuthis* (N=315), followed by *Chiroteuthis* sp. (N=98), *Mastigoteuthis* sp. (N=10), *Megalocranchia* sp. (N=8), *Lepidoteuthis* sp. (N=2), *Ancistrocheirus lesueri* (N=1), *Ommastrephes bartramii* (N=1), *Discoteuthis laciniosa* (N=1), and *Taonius* sp. (N=1). Additionally, octopus and vampire squid beaks were identified as *Haliphron atlanticus* (N=18) and *Vampyroteuthis infernalis* (N=1), respectively. Dorsal mantle length and wet weight of the cephalopods, at the time of ingestion, were reconstructed using equations provided by Clarke (1986) and Xavier-Cherel (2009); using these regression equations, the total wet weight of cephalopods that this sperm whale amassed prior to its stranding totaled 88,766.21 grams. With its diet spanning shallow to deepwater cephalopods, this sperm whale demonstrated remarkable diving behavior and a vast foraging ecology, especially considering that these prey remains were most likely from its final dives. Here we address a gap in the understanding of feeding habits of sperm whales from the surrounding waters of the Bahamas, an important breeding ground; the tropics as a whole are vital for sperm whales as females remain there year-round and form close-knit matrilineal social units while caring for their calves. Diet studies of deep diving top marine predators, such as sperm whales, are ever important as they demonstrate their impressive vertical movements into deep waters to forage for food, highlighting a knowledge gap in their role as mediators of carbon transport by ways of the biological pump.

Rough-toothed (Steno bredanensis) dolphins forage on prey associated to loggerhead turtles (Caretta caretta)

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Here we describe five cases of interspecific interactions between free-ranging rough-toothed dolphins (*Steno bredanensis*) and loggerhead turtles (*Caretta caretta*) off El Hierro and Tenerife (Canary Islands, Spain). Interactions were documented with aerial and underwater photographs and video. All underwater footage was collected from stopped boats using an immersed pole to hold the camera. Although both species are locally encountered year-round, all interactions were observed in July and August: one off El Hierro (August 15, 2015) and four off Tenerife (August 12, 2022; July 10, July 31, August 31, 2024). In all cases the events involved 3-5 dolphins with a single juvenile turtle. During these events, the dolphins gathered around the turtle, circling it or swimming fast, and even touching and tossing the animal. Dolphins were also observed vocalizing and emitting bubbles. The reptile showed apparent discomfort, with pectoral flapping and unsuccessful attempts to escape. While play behaviour was initially considered, observations of the dolphins with open mouths, visible teeth, and fish biting suggested foraging activity. Turtles were associated with potential dolphin prey items: pilot fish (*Naucrates ductor*) and juvenile Imperial blackfish (*Schedophilus ovalis*). Fishes were sheltered under on by the turtle, and even stranded on the turtle's shell (probably avoiding the dolphins). Underwater footage confirmed predation by the dolphins, targeting and capturing pilot fish near the turtle. The involvement of juvenile and adult dolphins highlights the importance of social learning for detecting and obtaining prey in the pelagic environment, by associating floating objects/turtles with prey presence. This is the first filmed report suggesting that *S. bredanensis*, a poorly known delphinid, utilizes sea turtles to detect prey. The evidence provides valuable insight into the complex interspecific interactions and feeding ecology of these highly-mobile top predators in the pelagic environment, and highlights the value of turtles as oceanic aggregators of prey.

The journey of a fin whale to Asinara Island: from stranding to skeleton valorisation

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In November 2017, a fin whale (*Balaenoptera physalus*) measuring approximately 17 meters long stranded on Platamona beach (Sorso, North Sardinia, Italy). The body was in advanced state of decomposition. A few weeks later, operations began to remove the viscera and most of the soft tissue from the beach using knives. The isolated skeletal elements were transported to a laboratory in the Department of Veterinary Medicine of the University of Sassari, specially equipped for cleaning and preparing the bones. The bones were boiled in order to try to eliminate as much fat as possible from the spongy bone tissue, instead the head was not boiled but rather exposed to open air for over a year. At the end of the cleanup work, a total of approximately 200 bones, including 59 vertebrae, 20 ribs, skull bones and right fin bones were cataloged and preserved for possible reconstruction. This work aims to highlight the importance of cooperation between different institutions in environmental conservation activities. Indeed in 2023, an agreement between University of Sassari, Asinara National Park, CRAMA Association (Asinara Marine Animal Rescue Centre), Sardinia Region and Municipality of Sorso made it possible to implement an environmental education project aimed at the valorisation of the skeleton. The skeleton was reconstructed in Asinara Island by placing it on a dune made of sand and dry leaves of Posidonia oceanica, reproducing a natural position of beaching. To complete the exhibition an educational path dedicated to biology, conservation and the role of Pelagos Sanctuary in Mediterranean Sea. Touring exhibitions were also organised throughout the local area. The skeleton is currently located in a building in the centre of the Island and welcomes thousands of students and visitors every year, representing an important reference point for environmental education and awareness activities of the Asinara National Park.

Sei whales & Bryde's whales - summer feeding in the Azores

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The Azorean waters are well known for the passage of migrating baleen whales in spring, mainly from April to June. In recent years, however, an increasing number of baleen whales—predominantly sei whales (*Balaenoptera borealis*) and, to a lesser extent, Bryde's whales (*Balaenoptera edeni*)—have also been recorded in summer and autumn, displaying behavioural patterns that differ markedly from those observed during the migratory season. Data were systematically collected from a whale-watching vessel operating around São Miguel Island. Whereas approximately 80% of sightings in spring involved travelling behaviour, between 60% and 80% of records from July to October corresponded to foraging activity, and during both behavioural states whales frequently associated with small delphinids, particularly Atlantic spotted dolphins (*Stenella frontalis*). Sei whales were documented feeding on boarfish (*Capros aper*), a prey species that appears to be largely disregarded by the accompanying dolphins. The summers of 2023 and 2025 and autumn of 2025 were characterized by high occurrences of sei whales and recurrent presence of Bryde's whales. In 2023, 120 successful photo-ID encounters resulted in the identification of 70 individuals, 35% of which remained in the area for two to 14 days (mean residence time: 5 days). In 2025, 116 successful encounters yielded the same number of identified individuals, 30% of which stayed for at least two days, exhibiting a markedly longer mean residence time of 33 days and a maximum stay of 104 days. In both years, sighting rates were lowest in spring, whereas July and August consistently showed the highest concentrations of sei whale sightings, Bryde's being more present in August 2023 and autumn in 2025. These patterns suggest potential shifts in habitat use and trophic dynamics, potentially linked to climate-driven environmental changes and feeding and distribution plasticity.

LC-MARE. Building your own underwater sound recorder.

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Passive acoustic monitoring (PAM) devices play a crucial role in studying and monitoring marine environments. Unfortunately, the high price tags on most commercially available autonomous underwater recording systems can make them out of reach—especially for educators and community science projects that operate on low budget. This financial barrier not only restricts broad application of PAM systems but also biases research opportunities toward institutions with greater funding. To address accessibility and cost barriers in underwater acoustic monitoring, the Low Cost Marine Acoustic Recorder (LC-MARE) was developed as an open-source project supporting the low-cost hydrophone initiative by the Partnership for Observation of the Global Ocean (POGO) and the International Quiet Ocean Experiment (IQOE). Its objectives are to provide reliable data for cetacean research, enable straightforward home assembly without specialised tools, utilise readily available components for customisation, ensure hardware and software are accessible to a broad scientific community, and maintain a significantly lower cost than commercial alternatives. This presentation covers the LC-MARE concept by explaining key aspects of its design, such as hydrophone selection, preamplifier development, electronics, software, pressure housing, and power supply. It also examines the operational limitations involved and highlights potential areas where the system can be applied.

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First photo-identification records of Delphinus delphis in the Gulf of Palermo: a contribution from Avvistiamo APS

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Association Between Persistent Organic Pollutants and Steroid Hormone Levels in Baltic Grey Seal (*Halichoerus grypus*) Pups

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Trophic ecology of common and striped dolphins in the western Mediterranean Sea and northeastern Atlantic Ocean using stomach content and stable isotope analysis

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Detecting whales from space in meter-class satellite imagery to enable scalable monitoring and ship-strike mitigation.

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Seasonal shifts in fin whale (Balaenoptera physalus) distribution off the Western Antarctic Peninsula and South Shetland Islands: Implications for the management of important feeding grounds

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Acoustic occurrence of cetaceans in northern Sicily: first passive monitoring insights from the Gulf of Palermo and Ustica Island.

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Whale Alert - Reducing ship strike risk for all vessels through collaborative sharing of sightings and detections along with approach guidelines and management zones

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An Unexpected Journey: Assessing sperm whale spatial movement through satellite tagging in the Strait of Gibraltar.

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Species-specific baleen whale responses to environmental fluctuations in the North Atlantic: insights from the Azores

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Digital Aerial Surveys in Offshore Wind Development: Advancing Marine Mammal Baseline Knowledge

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Mapping the vulnerability of cetaceans to offshore wind farms in French waters: a tool for spatial planning

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Multiple climate scenarios have contrasting effects on the range of non-migrating baleen whales in the tropical Indian Ocean

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