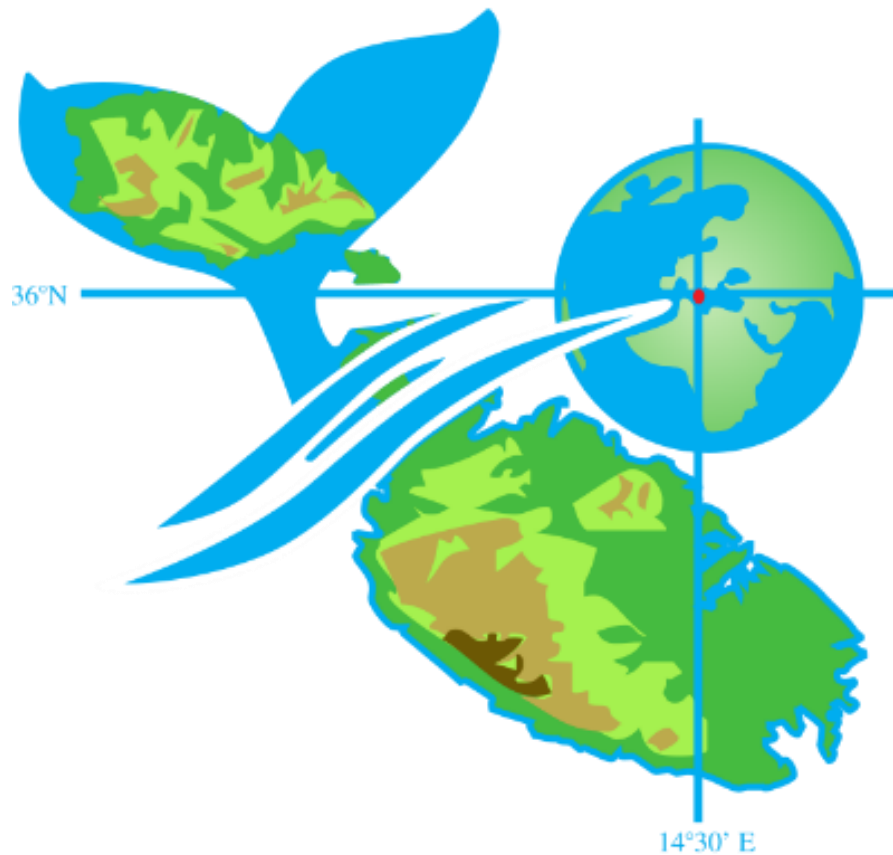


# MARINE MAMMAL CONSERVATION FROM LOCAL TO GLOBAL



## 29<sup>TH</sup> CONFERENCE OF THE EUROPEAN CETACEAN SOCIETY

23<sup>rd</sup> to 25<sup>th</sup> March, 2015

Intercontinental Hotel, St Julian's Bay, MALTA



UNIVERSITY OF MALTA  
L-Università ta' Malta

## USEFUL INFORMATION

### VENUE – INTERCONTINENTAL MALTA HOTEL, ST JULIANS



- 📍 Conference Hall, Cettina De Cesare (CDC), is in hotel.
- 📍 Paranga Beach Club is on the water edge in St George's Bay.



## USEFUL INFORMATION

### CONTACT NUMBERS

Direct Dialling Code for Malta: +356

International Code (to make an overseas call): 00

Emergency number: 112

Police: 21 22 40 01 ... 21 22 40 07

Mater-Dei Hospital (Malta): 25 45 00 00

Malta International Airport (General Inquiries): 21 24 96 00

Malta International Airport (Flight Information): 52 30 20 00 (each call: € 1.00)

Passport Office: 21 22 22 86

### WEBSITES

Malta International Airport (note one 'a' between Malta and Airport!)

Malta's weather                      [www.maltairport.com/weather](http://www.maltairport.com/weather)

Arrivals                                      [www.maltairport.com/arrivals](http://www.maltairport.com/arrivals)

Departures                                  [www.maltairport.com/departures](http://www.maltairport.com/departures)

Activities in Malta                      [www.visitmalta.com](http://www.visitmalta.com)



## ACKNOWLEDGEMENTS

### HOSTED BY

#### **The Biological Conservation Research Foundation (BICREF)**

The NGO BICREF was set-up in 1998 to promote conservation research and awareness in Malta. For this purpose it welcomes Internships in Malta; the next call starts immediately after the ECS conference 2015 and to last till the end of summer 2015. Options for taking up courses or training in marine conservation biology, cetacean and fisheries research are also possible.

Dr. Adriana Vella, Ph.D (Cantab.), founder of BICREF, is a conservation biologist with experience in mammal and marine conservation research at local and regional level. She is a senior lecturer at the University of Malta where she covers topics and research in conservation biology at graduate and post-graduate levels in both field ecology and molecular genetics. She has founded the NGO BICREF to promote conservation needs of biodiversity, focusing on long-term research when dealing with long-lived species such as cetaceans, elasmobranchs, and turtles. She leads the Conservation Biology Research Group at the University of Malta and the scientific and awareness efforts of BICREF. Through such research and awareness efforts it was possible to promote cetacean conservation requirements in Maltese waters and beyond since 1997.



# ACKNOWLEDGEMENTS

## PRINCIPAL SPONSORS



## ADDITIONAL SPONSORS AND SUPPORTERS



## ACKNOWLEDGEMENTS

### ORGANISING COMMITTEE

Chair of Organising Committee: Adriana Vella

Andrew Wright, Ayaka Öztürk, Clare Mifsud, Conor Ryan, Cristina Brito, Inger van den Bosch, Joanne O'Brien, Joseph Vella, Mark Camenzuli, Noel Vella, Roland Lick, Shirley Mifsud.

### SCIENTIFIC COMMITTEE

Chair of Scientific Committee: Adriana Vella

Amelia Viricel, Ana Rita Amaral, Andrew Wright, Antonio Raga, Barbara Mussi, Barbara Taylor, Cristina Brito, Daniela Silvia Pace, Gianni Pavan, Graham Pierce, Giuseppe Notarbartolo di Sciarra, Iwona Pawliczka, Joanne O'Brien, Joseph Vella, Karen Stockin, Mark Simmonds, Maurizio Würtz, Michela Podesta, Paddy Pomeroy, Peter Evans, Philip Hammond, Randall Reeves, Renaud de Stephanis, Simone Panigada, Thierry Jauniaux, Tilen Genov, Ursula Siebert, Vincent Ridoux.

### STUDENT VOLUNTEERS

Ana Mafalda Tomas Correia, Ana Filipa Sampaio Duarte, Andrea Pareira, Andrea Ripol, Begum Uzun, Ben Singleton, Catarina Fogaca, Cátia Sofia Formas Chanfana, Claudia Auladell Quintana, Dora Szekely, Dunja Jusufovski, Giulia Roncon, Gülce Saydam, Joanna Sarnocińska, Lese Costa, Lorenzo Ragazzi, Macit Ege Ercan, Maria Borg, Neus Figueras, Nina Bircher, Nina Santostasi, Rebecca Boys, Steffen de Vreese, Tara van Belleghem, Vera Jordão, Zofia Halicka

### ABSTRACT REVIEWERS

Ana Cañadas, Andrew Brownlow, Anita Gilles, Aviad Scheinin, Ayaka Amaha Ozturk, Barry McGovern, Begoña Santos Vazquez, Boris Culik, Carl Kinze, Christina Lockyer, Clare Mifsud, Cristina Milani, David Lusseau, Eduard Degollada, Evgeny Goldin, Fiona Read, Flore Samaran, Gema Hernandez-Milian, Giovanni Bearzi, Inês Carvalho, Jan Haelters, Jennifer Learmonth, Jeremy Kiszka, Jessica Alessi, Julia Carlström, Kelly Macleod, Kristina Lehnert, Léa David, Luis Freitas, Luke Rendell, Manuel Castellote, Maria Grazia Pennino, Maria Iversen, Mario Acquarone, Massimiliano Rosso, Mehdi Aissi, Michael Fontaine, Michel Andre, Mick Baines, Mónica Silva, Nick Davsion, Nick Tregenza, Nicole Vollmer, Noel Vella, Olivier Lambert, Pavel Goldin, Pia Anderwald, Robin Law, Rocio Ruiz-Cooley, Rus Hoelzel, Ruth Esteban, Sami Hassani, Sandro Mazzariol, Silvia Monteiro, Simon Berrow.



## ACKNOWLEDGEMENTS

### MTI MINISTER - CONFERENCE CONTRIBUTOR

**Joe Mizzi** continued his education with a course in Telecommunications at the Technical Institute of Paola Malta, and subsequently a course in Electronics and Telecommunications. In 1971 he started his working career as a computer room technician on board seismic survey ships, following which he was engaged as a radio officer on merchant ships, and later he entered the field of Telecommunications. In 1983 he was responsible of setting up RTV Ltd, and for a number of years he was its Technical Director.



Joe Mizzi commenced his political activities in the youth section of the Malta Labour Party and later started contesting the General Elections. He was elected as a Member of Parliament in 1992, 1996, 1998, 2003, 2008 and 2013. During the period 1996 – 1998 he was Minister at the Office of the Prime Minister, with responsibilities for Police, Home Affairs, Telecommunications and Oil Exploration. From 1998 onwards he has served as Shadow Minister for Environmental Planning, Oil Exploration, and Infrastructural Services. In 2013 he was appointed Minister for Transport and Infrastructure (MTI).

Mr Mizzi is married to Joyce *nee* Vassallo, and they have two children, Matthew and Charmaine.

Hon. Minister Mizzi is contributing an opening speech.

### EU COMMISSIONER - CONFERENCE CONTRIBUTOR

**Karmenu Vella** is the EU commissioner for the Environment, Maritime Affairs and Fisheries.

In 1976 Karmenu Vella was elected to parliament. He continued to be elected in the nine consecutive elections that followed. In 1981 he was appointed as minister for public works, and in 1984 he was appointed as minister for industry. He served as minister for tourism in 1996–98, and was again appointed as minister for tourism in March 2013.



He graduated with a degree in architecture and civil engineering from the University of Malta and later obtained his master of science in tourism management from Sheffield Hallam University.

EU commissioner is contributing a short presentation.



**Barbara Taylor** has researched marine mammals for over 30 years. She leads the marine mammal genetics group at the Southwest Fisheries Science Center in La Jolla, California. The group identifies units to conserve and has promoted developing guidelines and standards to facilitate naming new taxa of cetaceans using primarily genetic data. She specializes in estimating risk of extinction and has worked with some of the most endangered species. She is member of several endangered species recovery teams, and has served on many status reviews of species petitioned for listing, chairs the Conservation Committee of the Society for Marine Mammalogy, and serves as the Listing Authority for the Cetacean Specialist Group of the International Union for the Conservation of Nature (IUCN). In 2006 she participated in the survey that failed to find any baiji, the Chinese river dolphin, portending the first human-caused extinction of a cetacean. Consequently, she is working with scientists on the International Recovery Team and serves on Mexico's Presidential Commission to prevent the extinction of what now becomes the most critically endangered cetacean: the vaquita, or Gulf of California porpoise. Although vaquita face the single threat of death in gillnets, they exemplify the complex interplay between biological, social, economic and enforcement factors that make each conservation strategy unique.





**Gianni Pavan**, Italy. Formerly Professor of Ecology at the IUAV University of Venice (1994-2005), now teaches “Bioacoustics” at the University of Pavia and runs the “Centro Interdisciplinare di Bioacustica e Ricerche Ambientali” (CIBRA). He contributed to the creation and development in 1989 of advanced bioacoustic research based on digital techniques. He started to work on computational bioacoustics in 1980; he developed and maintains the SeaPro and SeaWave packages for real-time sound analysis and spectral display; he also designed the underwater equipment (various types of towed arrays and analysis instruments) used for marine mammals surveys on either small boats or oceanographic ships. He cooperates with INGV and INFN to develop multidisciplinary underwater acoustic sensing systems since 2003. His main research interests are on marine mammals acoustics, the impact of underwater noise on marine mammals, and marine and terrestrial soundscapes. He also cooperates with ACCOBAMS, ONR, NURC, WHOI, IT Navy and other institutions to study and protect marine mammals. He maintains the Italian Strandings Online Database. He is member of the International BioAcoustic Council (IBAC) and member of the Scientific Council of the International Ecoacoustics Society (ISE).



**Giuseppe Notarbartolo di Sciara** is a marine ecologist concerned with the conservation of the marine environment and its biodiversity. He obtained a PhD at the Scripps Institution of Oceanography (California) in 1985 with a thesis on the taxonomy and ecology of manta rays, of which he described a new species. In 1986 he founded the Tethys Research Institute, which he directed until 1997 and now again since 2010. In 1991 he proposed the creation of the Pelagos Sanctuary for Mediterranean Marine Mammals, established in 1999 by a treaty amongst Italy, France and Monaco. He has served as the Italian Commissioner at the International Whaling Commission (1999-2004), and as Chair of the Scientific Committee of ACCOBAMS (2002-2010). Currently he is the Appointed Councillor for aquatic mammals at the Convention on Migratory Species; co-chair of the IUCN Task Force on marine mammal protected areas; deputy chair of the IUCN Cetacean Specialist Group; Regional coordinator for the Mediterranean and Black Seas of IUCN WCPA – Marine; and Advisor, Pew Fellows in Marine Conservation. He teaches science and policy of the conservation of marine biodiversity at the University Statale of Milan (more details on [www.disciara.org](http://www.disciara.org)).



**Philip Hammond** moved from the NERC Sea Mammal Research Unit in Cambridge to the University of St Andrews in 1996, becoming Professor in 2005. Prior to that, after obtaining his PhD in population dynamics at the University of York in 1979, he worked at the Inter-American Tropical Tuna Commission in La Jolla, California for 5 years, culminating as Head of the Tuna-Dolphin Program. His research focuses primarily on population dynamics and ecology, in particular the applied aspects of how seals and cetaceans interact with mankind. He is particularly interested in (a) studies of the habitat use, foraging ecology and diet of marine mammals; (b) the estimation of abundance, survival and reproductive rates, and the modelling of marine mammal populations; and (c) studies of the management of whaling, cetacean bycatch in fisheries, seal-fishery interactions, and the conservation of vulnerable species. He has supervised more than 30 PhD students and published more than 100 papers in peer-reviewed journals. He is an associate editor for *Marine Mammal Science* and the *Journal of Cetacean Conservation and Management*. He teaches courses on quantitative methods in biology, ecology, biology of marine organisms, conservation research methods, marine mammal biology and marine mammal conservation. Over the last few years, he has taught practical workshops to students, early career researchers and professional practitioners on estimating abundance and population parameters, and on spatial modelling of habitat use and abundance, in Spain, Australia, Hong Kong, Thailand and South Africa. He has considerable experience working at the interface of science and policy. He was a member of the IWC Scientific Committee for more than 30 years, is a member of the ICES Working Group on Marine Mammal Ecology (and earlier WGs) (more than 10 years), is a member of the IUCN Cetacean Specialist Group (since 1998) and Red List Authority (since 2006), and is an invited expert to the UK Inter-Agency Marine Mammal Working Group (since 1996).



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WORKSHOPS

**New mitigation methods and evolving acoustic exposure guidelines**

FULL DAY

Andrew Wright & Patrick Lyne

**Communicating marine mammal science to students and the general public**

FULL DAY

Volker Smit

**ECS 2015 student workshop: Careers beyond academics**

FULL DAY

Inger van den Bosch

**Strengthening the cooperation for a better cetacean conservation in the ACCOBAMS area:**

**Working Together with Common Tools**

FULL DAY

Maylis Salivas

**ECS Rescue Workshop**

PM HALF DAY

Mark Simmonds



## CONFERENCE PROGRAMME

SUNDAY 22<sup>ND</sup> MARCH 2015

### WORKSHOPS

**Marine mammals pathology: update of the necropsy protocol on dissection techniques and tissue sampling**

FULL DAY

Thierry Jauniaux & Lonneke Ijsseldijk

**Developing professional ethics guidelines for European cetacean researchers**

AM HALF DAY

ECM Parsons

**Current developments in North Atlantic humpback whale research**

AM HALF DAY

Frederick Wenzel

**Procedures for the analysis of European marine mammal datasets from standardised transect surveys aboard dedicated research platforms**

PM HALF DAY

Rachel Davies

**SAMBAH - Private Meeting**

FULL DAY

Julia Carlström

Conference programme - Sunday 22<sup>nd</sup> March 2015

14:45 – 17:45 **EARLY REGISTRATION** at CBC Foyer

18:00 – 20:00 **ICEBREAKER** at the Paranga Beach Club, InterContinental Hotel, St George's Bay



08:00 – 09:00 REGISTRATION

09:00 – 09:30 **OPENING CEREMONY (CDC)**

### **UNDERWATER NOISE, A THREAT TO MARINE LIFE**

Keynote and Chairperson: **Gianni Pavan**

09:30 – 10:15 KEYNOTE

10:15 – 10:30 **Fin whale (*Balaenoptera physalus*) acoustic activity and shipping noise: a year-round study in Western Ionian Sea**  
Virginia Sciacca

10:30 – 10:45 **MALTA-Microphone array localization tool for animals**  
Jens Koblitz

10:45 – 11:00 **Evidence of acoustic trauma in long-finned pilot whale (September 2012 mass stranding, Scotland)**  
Maria Morell

11:00 – 11:30 COFFEE BREAK

### **ECOLOGY & ECO-TOXICOLOGY**

Chairperson: **Sandro Mazzariol**

11:30 – 11:45 **Application of stable isotopes to assess the feeding ecology of long-finned pilot whale (*Globicephala melas*) in the Northeast Atlantic Ocean**  
Silvia Monteiro

11:45 – 12:00 **Are seals and inshore fisheries targeting the same food source?**  
Martha Gosch

12:00 – 12:15 **Long-term trends in diet and mortality in harbour porpoises in Scottish waters**  
Graham Pierce

12:15 – 12:30 **Eco-toxicological analysis of free-ranging cetaceans from the North-western Mediterranean Sea**  
Marianna Pinzone

12:30 – 12:45 **Global pollution (PCB) hotspots and European dolphin declines**  
Paul Jepson



**12:45 – 13:00**      **Fin whales (*Balaenoptera physalus*) as wide-scale sentinel of exposure to microplastics in marine environment: the case study of Mediterranean Sea and Sea of Cortez**  
Maria Cristina Fossi

**13:00 – 14:30**      **LUNCH BREAK**

**14:30 – 15:30**      **SHORT TALKS: ACOUSTICS AND STRANDINGS**

Chairperson: **Joanne O'Brien**

**Vocalizations and social structure in the Cape Breton population of long-finned pilot whales (*Globicephala melas*)**  
Elizabeth Zwamborn

**From noise to disturbance: PAM and noise recorded in different distances to piling locations**  
Vladislav Kosarev

**Local effect of noise on porpoises around oil and gas platforms: suggestions for global effect of noise from oil and gas industry**  
Karin Tubbert Clausen

**Different and yet equal: results from digital aerial surveys and passive acoustic monitoring of harbour porpoises**  
Caroline Hoeschle

**Cetacean Distribution in Southern Black Sea: An Acoustic Approach Using a Methodology Combining Active and Passive Acoustics**  
Gülce Saydam

**Dead useful? Improving the ecological value of the strandings record as a monitoring tool**  
Andrew Brownlow

**Dolphin Morbillivirus in Mediterranean Fin Whales (*Balaenoptera physalus*): An epidemic cluster, or an endemic condition?**  
Sandro Mazzariol

**The Brain of the Sperm whale: A recent account after the 2014 mass stranding in Southern Italy**  
Mattia Panin

**Irish cetacean strandings; exploring patterns in a decade of data**  
Barry McGovern



- 15:30 – 15:45      **The Italian diagnostic network on stranded cetaceans: a “from local to global” approach**  
Federica Giorda
- 15:45 – 16:00      **100 not out - a century of strandings monitoring in the UK**  
Robert Deaville
- 16:00 – 16:15      **Long-term changes in the diet of striped dolphins (*Stenella coeruleoalba*) in the western Mediterranean: a comparison of stomach contents vs. stable isotopes**  
Francisco Javier Aznar

16:15 –16:45      **COFFEE BREAK**

### **SURVIVAL NEEDS AND PATHOLOGY**

Chairperson: **Thierry Jauniaux**

- 16:45 – 17:00      **Energy Demands of Juvenile Pacific Walruses (*Odobenus rosmarus divergens*) During the Nursing Interval: Modelling the Costs of Lactation**  
Shawn R Noren
- 17:00 – 17:15      **Reproductive failure in UK harbour porpoises (*Phocoena phocoena*): legacy of pollutant exposure?**  
Sinead Murphy
- 17:15 – 17:30      **Capture myopathy in 16 cetaceans stranded along the Italian coastline between 2008 and 2014**  
Cinzia Centelleghé
- 17:30 – 17:45      **Bacterial microbiota in harbour seals (*Phoca vitulina*) from the North and Baltic Seas of Schleswig-Holstein, Germany around devastating morbillivirus and influenza die-offs**  
Kristina Lehnert
- 17.45 – 18:00      **Temporal trend of biliary trematode infection in Baltic grey seals (*Halichoerus grypus*)**  
Charlotta Moraeus
- 18:00 – 19:30      **POSTER SESSION 1– Held at conference venue foyer:  
ALL EVEN NUMBERED POSTERS**
- 20:00 – 22:00      **VIDEO NIGHT – Held at conference venue (CDC)**





**CONSERVATION GENETICS:  
DISTINGUISHING POPULATIONS AND INDIVIDUALS**

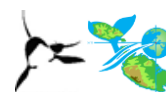
Keynote and Chairperson: **Barbara Taylor**

- 09:00 – 09:45**      **KEYNOTE**
- 09:45 – 10:00**      **Social structure of long-finned pilot whales (*Globicephala melas*) off Cape Breton, NS, Canada: what do we know about social units?**  
Joana Augusto
- 10:00 – 10:15**      **Does the pressure of achieving reproductive success prevent male grey seals from responding to human disturbance?**  
Amanda Bishop
- 10:15 – 10:30**      **Spatio-temporal distribution of harbour porpoises in the Baltic Sea provide further evidence for a separate breeding unit**  
Ida Carlen
- 10:30 – 10:45**      **Postglacial rise of three ecotypes of harbour porpoises (*Phocoena phocoena*) in western Palearctic waters**  
Michael Fontaine
- 10:45 – 11:00**      **Genetic population structure of the grey seal (*Halichoerus grypus*) in the Iroise sea: what can be learned from of a multi-locus analysis of the Mt genome**  
Carole Decker
- 11:00 – 11:30**      **COFFEE BREAK**

**FORAGING & FISHERIES**

Chairperson: **Daniela Silvia Pace**

- 11:30 – 11:45**      **Foraging strategies of an offshore predator: the striped dolphin (*Stenella coeruleoalba*)**  
Gema Hernandez-Milian
- 11:45 – 12:00**      **“Always at your side”: baleen whales stay within foraging distance to small pelagic prey**  
Mareike Volkenandt
- 12:00 – 12:15**      **Where is the risk? A spatial assessment for cetacean by-catch hotspots in fisheries**  
Patricia Breen
- 12:15 – 12:30**      **Maltese fisheries and conservation of large predators, including sharks and dolphins**  
Noel Vella



- 12:30 – 12:45 **Fisheries interactions of *Delphinus delphis* in the North-East Atlantic with an emphasis on Galicia, north-west Spain**  
Fiona Read
- 12:45 – 13:00 **Baleen Stable Isotope Records: Re-Evaluating Feeding and Migration Patterns of Southern Hemisphere Humpback Whales**  
Pascale Eisenmann
- 13:00 – 14:30 **LUNCH BREAK,  
ECS STUDENT AGM & ECS NCP MEETING**
- 14:30 – 15:30 **SHORT TALKS: CONSERVATION, MIGRATIONS & MARINE PROTECTED AREAS**

Chairperson: **Iwona Pawliczka**

**Heard but not seen: sea-scale acoustic survey shows that the Baltic Sea harbour porpoise is not extinct**

Julia Carlström

**Do baleen plates mirror seasonal migrations in fin whales? Results of trace elements analysis**

Morgana Vighi

**From the pool to the sea: applicable isotope turnover rates and diet to skin discrimination factors of bottlenose dolphins (*Tursiops truncatus*)**

Joan Giménez

**Cetacean strandings and diet analyses in the North Aegean Sea (Greece)**

Cristina Milani

**Combining occurrence and abundance models to evaluate the suitability of an existing Marine Protected Area for dolphins in Kenya**

Sergi Pérez Jorge

**Using habitat modelling to identify potential hotspots for cetaceans off Sao Tome Island (Sao Tome and Principe) - Implications for conservation**

Andreia Pereira

**Crossing borders: How can we protect migratory species across the borders of Marine Protected Area in the North Sea?**

Inger van den Bosch

**Development of a bioeconomic model of grey seal impacts on West of Scotland fisheries**

Vanessa Trijoulet

**Fisheries-cetacean competition: Lessons learned and its implications for conservation and ecosystem management in the Mediterranean**

Dunja Jusufovski



**Female Mate Choice by Dusky Dolphins (*Lagenorhynchus obscurus*) During Mating Chases**

Dara Orbach

**15:30 – 16:15**      **KEYNOTE: THE CMS AND THE ECS: WORKING TOGETHER TO BRIDGE POLICY WITH SCIENCE IN SUPPORT OF CETACEAN CONSER-VATION**

*Case Study – Conserving the Mediterranean open sea ecosystems: lessons from the Pelagos Sanctuary*

**Giuseppe Notarbartolo di Sciara**

**16:15 – 16:45**      **COFFEE BREAK**

**MONITORING MARINE MAMMALS**

Chairperson: **Vincent Ridoux**

**16:45 – 17:00**      **Utilising land watch data to determine long-term trends in abundance**  
Peter Evans

**17:00 – 17:15**      **Long-term trend analysis of deep diving cetacean species occurring in the Pelagos Sanctuary (Northwestern Mediterranean Sea)**  
Caterina Lanfredi

**17:15 – 17:30**      **Dolphins have individually distinct faces: photo-identification based on facial features as a tool to enhance studies of delphinids**  
Tilen Genov

**17:30 – 17:45**      **Abundance and distribution of the Common dolphin (*Delphinus delphis*) in the north of the Iberian Peninsula**  
Camilo Saavedra

**17:45 – 18:00**      **Moving of Bearded seals (*Erignathus barbatus*) from Sakhalin Bay (Okhotsk sea) in according satellite tagging in 2013-2014**  
Maria Solovyeva

**18:00 – 19:30**      **POSTER SESSION 2– Held at conference venue:**  
ALL ODD NUMBERED POSTERS

**19:30 – 21:00**      **PUBLIC AWARENESS NIGHT**  
**BICREF LOCAL AWARENESS SESSION (IN MALTESE)**



**THE MARINE STRATEGY FRAMEWORK DIRECTIVE: IMPLICATIONS FOR CETACEAN RESEARCH IN EUROPE**

Keynote and Chairperson: **Philip Hammond**

**09:00 – 09:45**      **KEYNOTE**

**09:45 – 10:00**      **Investigating the influence of construction activity and vessel presence on marine mammals: the importance of long-term monitoring programmes**  
Ross Culloch

**10:00 – 10:15**      **Aerial surveys to study cetaceans: implications for integrated conservation management and sustainable maritime development**  
Adriana Vella

**10:15 – 10:30**      **From surveyed to unsurveyed areas: extrapolating cetacean densities in the offshore North Atlantic**  
Laura Mannocci

**10:30 – 10:45**      **Too many cooks? The lack of a coherent marine mammal management and conservation framework in the EU.**  
Emer Rogan

**10:45 – 11:15**      **COFFEE BREAK**

**MONITORING CETACEANS AND HUMAN IMPACTS:  
DEVELOPING MITIGATION GUIDELINES**

Chairperson: **Giuseppe Notarbartolo di Sciara**

**11:15 – 11:30**      **Local human effects on the harbour porpoise**  
Frank Zanderink

**11:30 – 12:30**      **SHORT TALKS:**

**Photo-identification study of bottlenose dolphins off south west England 2007-2014**  
Rachel Davies

**Small cetacean monitoring from surface and underwater autonomous vehicles**  
Douglas Gillespie

**Localization of cetaceans and anthropogenic sources: a didactic pattern recognition framework using neural networks**  
Ludwig Houegnigan

**Towards underwater noise mitigation in Spanish waters: Developing MMO/PAM procedures and mitigation guidelines for marine mammals.**  
Carla A. Chicote



**Fish farm specialists: bottlenose dolphins in the Southern Evoikos Gulf, Greece**

Silvia Bonizzoni

**Return rates of harbour porpoise after pile driving for the offshore wind farm DanTysk**

Armin Rose

**The short-term responses of sperm whales (*Physeter macrocephalus*) to the attachment of suction-cup tags**

Victoria Warren

**Killer whale killers: a review of US court cases on captive orcas**

ECM Parsons

**Introducing the World Cetacean Alliance: conservation action from local to global**

Clare Mifsud

**Short talk by EU Commissioner:**

**FROM KNOWLEDGE TO EFFECTIVE CONSERVATION MEASURES**

Karmenu Vella

**12:30 – 14:00 LUNCH BREAK**

**14:00 – 14:45 WORKSHOP PRESENTATIONS**

**14:45 – 16:30 ECS – AGM (held in CDC).**

**16:30 – 17:00 COFFEE BREAK**

**17:00 – 18:00 AWARDS & CLOSING (HELD AT VENUE):**

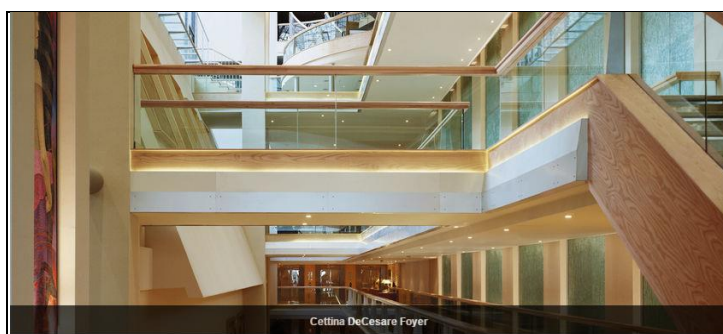
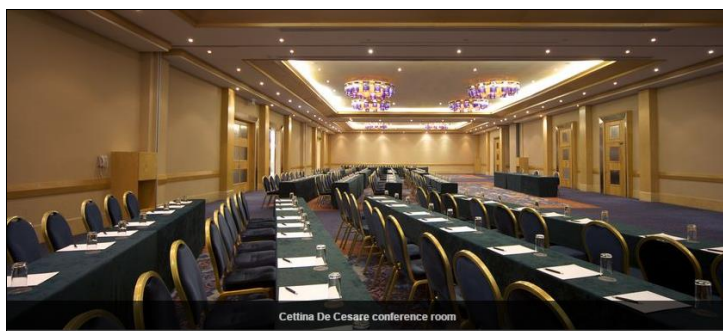
**STUDENTS AWARDS,**

**MANDY MCMATH CONSERVATION AWARD &**

**BALEINE LIBRE VIDEO AWARD**



Conference, Video Night and Poster Venues are at the **Cettina De Cesare (CDC) Conference Room** just inside of the InterContinental Malta Hotel lobby.



Conference Icebreaker is at the Paranga Beach Club (InterContinental Malta Hotel) on the water edge of St George's Bay (250 meters down the road from venue).



# KEYNOTE ABSTRACTS

## Underwater noise, a threat to marine life

Gianni Pavan, Claudio Fossati

*CIBRA (Centro Interdisciplinare di Bioacustica e Ricerche Ambientali), University of Pavia, Via Taramelli 24, 27100 Pavia, Italy;*

Although we know that anthropogenic sound in the ocean is a serious threat to marine life, we do not have sufficient information to understand the full extent of the problem. One of the biggest challenges faced in regulating the effects of noise is our ignorance of the characteristics and levels of sound exposure that may pose risks to marine animals in the long term. Given the current state of our knowledge we must therefore take a precautionary approach to the regulation of noise. We must also expand our efforts to protect and preserve marine life by instituting and using effective mitigation measures — such as geographic noise-exclusion zones — to keep marine animals at a distance from noise sources that have the potential to harm or kill them. The awareness that manmade noise can affect marine life, marine mammals in particular, has grown in recent years, mainly in the context of naval sonars and seismic surveys.

While most interest in the effects of anthropogenic noise has focused on marine mammals (mainly cetaceans and pinnipeds) and a few other vertebrates, there is increasing evidence for the impact of such noise on fish and marine invertebrates. This issue will need further research, which should also take into consideration the ecological direct and indirect effects on the whole food web and on fisheries. In particular, research is needed to better understand the acoustic mediated effects of noise on the behaviour and biology of all marine creatures. Acoustic impacts on the marine environment need to be addressed through a comprehensive and transparent research, management and regulatory system that includes all sources of noise, whether continuous and ubiquitous (such as shipping) or localized in space and time (sonars, seismic surveys, offshore and coastal construction works, scientific experiments, etc.). This system should address chronic and acute anthropogenic noise, long-term and short-term effects, cumulative and synergistic effects, and impacts on individuals and populations.





## Conservation genetics: applications from global to local

**Barbara Taylor**

*Southwest Fisheries Science Center, NMFS, National Oceanic and Atmospheric Administration (NOAA), USA*

Conservation takes place at scales requiring knowledge about how individuals relate to one another from the level of species down to the level of populations. Effective management actions require understanding when and where to control human behaviour. Uncertainty in key management decision points, like what is the unit to conserve and whether such units can sustain human-caused impacts, can lead to inaction. Genetic tools can contribute to reducing uncertainty, but scientists should acknowledge the limitations of interpreting the data and work to integrate genetic data more effectively into management decisions. Because population structure is hierarchical, I examine the use of genetics in conservation from the species level down to the demographically independent population level.

Cetacean conservation is handicapped by under-estimated biodiversity particularly at the level of subspecies. For example, groups of dolphins found in island waters and subject to unsustainable by-catch would be more likely to receive needed management as a named subspecies than if they are described only as part of a large globally distributed species. Until genetic methods became available, cetacean taxonomy proceeded slowly because morphological data are difficult to obtain for many species, especially on a global level. Interpreting genetic data is not straightforward and contributes its own uncertainties. I describe a group effort to review recent genetic publications and develop genetic standards to facilitate efficient progress in cetacean taxonomy.

Much conservation is needed below the species level to conserve evolutionary potential (Evolutionarily Significant Units or ESUs) or at the ecosystem functionality levels (Demographically Independent Unit or DIPs). Each level is a successive reduction in both time and spatial scales and therefore is best studied using different genetic markers and different analytical methods. Both the markers and analytical methods available will change through time but the need to resolve the definitions of the units to conserve will not. I use examples to illustrate the integral links between conservation laws, definitions of units to conserve and use of genetic data.



### **The Convention on Migratory Species and the European Cetacean Society: working together to bridge policy with science in support of cetacean conservation**

**Giuseppe Notarbartolo di Sciara**

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The Convention on Migratory Species (CMS) was adopted in 1983 to address the many threats faced by animal species which regularly cross borders between states, recognising that international cooperation is essential to the implementation of effective conservation measures for such species. Within CMS cetaceans occupy an important place, with 16 species listed as endangered in Appendix I, and 44 as requiring special agreements or cooperation for their conservation, listed in Appendix II. Of these species, many occur in European waters and will benefit from a cooperative effort between CMS and the ECS.

CMS also has promoted the creation of several Agreements and MoUs among Range States to conserve cetaceans in specific regions; of these, ACCOBAMS and ASCOBANS are particularly well known within the ECS circle and have directly involved ECS members in many of their activities. Throughout CMS' history, policy was always based on a solid scientific foundation: science has served the role of flagging issues needing urgent political attention, and of alerting to new issues, such as the danger posed by microplastics and the conservation relevance of dealing with animal culture. In turn, CMS has often served as a connective tissue creating functional links within the wider Multilateral Environmental Agreements (MEA) world, in order to achieve greater conservation effectiveness.

One example among many is the 2014 Resolution on “advancing ecological networks to address the needs of migratory species”, containing an explicit encouragement to Parties to engage in the current Convention on Biological Diversity (CBD) effort on Ecologically or Biologically Significant Marine Areas (EBSAs), as well as in the application of the criteria for identifying Important Marine Mammal Areas (IMMAs) developed by the IUCN Marine Mammal Protected Areas Task Force.



## The MSFD: implications for cetacean research in Europe

**Philip Steven Hammond**

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The MSFD specifies a regional approach to assessment of the achievement of GES based on geographical and environmental criteria, with particular reference to the role of the Regional Seas Conventions. Monitoring and reporting within the MSFD therefore needs to be coordinated among countries within the same marine region/sub-region of the relevant Regional Seas Convention to ensure consistency, coherence and comparability. Such a regional approach is particularly relevant for mobile, wide-ranging species such as cetaceans.

This presentation considers a number of issues raised by the MSFD relating to cetacean research, monitoring and mitigation, using examples from the European North Atlantic, for which OSPAR is the relevant Regional Seas Convention. Indicators of GES for cetaceans currently proposed by OSPAR relate to distribution/abundance and bycatch in relation to population size. Targets are to maintain/restore populations within natural variability and reduce bycatch to a rate that will allow conservation objectives to be met. How should we consider modifying or refocusing what we do to facilitate assessing and achieving GES under the MSFD?

Issues include:

The relevance of another high-level top-down directive. Can the MSFD really make a difference to improving the health of marine ecosystems, including cetacean populations? Should we engage in it?

Questions of scale. The MSFD is a regional, long term approach to conservation but the majority of research is undertaken at a local scale and is time limited. How important is it that these mismatches in scale be reconciled?

Co-ordination, collaboration and consistency. Achieving conservation objectives regionally in the long term will require that information collected at smaller scales can be appropriately combined at large scales. How important are co-ordination of research efforts, collaboration among research groups, and consistency of information?

The role of different stakeholders. Conservation involves a number of key participants including managers, scientists, resource users, NGOs and the general public; never more so than where cetaceans are concerned. How can these diverse groups best function to ensure that GES is achieved?



# ORAL ABSTRACTS

### **O-01: Fin whale (*Balaenoptera physalus*) acoustic activity and shipping noise: a year-round study in western Ionian Sea**

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Exposure to noise can produce a wide range of effects on baleen whales, such as interfering with long range communication, needed to facilitate mating and social interaction. Furthermore, ship-generated noise highly affects the main fin whale (*Balaenoptera physalus*) communication frequency band (15 – 30 Hz). The correlation between noise levels and biological sounds represents a fundamental tool in understanding the impact of noise on the species' conservation. In 2012, the SN1-NEMO cabled multidisciplinary seafloor platform was deployed in the Gulf of Catania at a depth of 2100 m. By using the low frequency seismic hydrophone (1-1000 Hz) installed aboard the platform we monitored for the first time fin whales acoustic activity in the area. From June 2012 to May 2013, acoustic data were continuously acquired and stored in 10 minute long files. About 7,000 hours of acoustic recordings have been investigated through spectrogram analysis. Background noise has been measured within the fin whale communication band. For each file, noise amplitude was calculated as integrated noise in the frequency band included between 17.8-22.4 Hz. A statistical analysis was then conducted by calculating for each recording median, minimum and maximum percentiles of integrated noise. Average background noise was compared in files with detections of fin whale vocalizations and in the rest of the time. Results indicate that the highest percentage of detections occurred in recordings with the lowest noise level. This could mean that noise limits our detection possibilities or they call less in presence of masking noise. In both cases noise affects our ability to detect them acoustically and to correctly estimate their presence. This study represents the first effort in evaluating noise impact on fin whale detection offshore eastern Sicily, Ionian Sea.

## O-02: MALTA – Microphone Array Localization Tool for Animals

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Large multi-receiver arrays have been used to record harbour porpoises in Danish waters and narwhals and belugas in Baffin Bay from pack ice. The MALTA recording system allows for synchronous recordings of 16 channels with a sampling rate of 500 kHz per channel. Recordings can be triggered manually based on a real-time visual output or continuous recordings for multiple hours can be performed. Various tools allow for quick screening of multi-channel data and subsequent in-depth offline analysis. Localization of the animals based on time of arrival differences and integrating GPS and motion sensors in PAMGUARD allow us to derive geo-referenced dive tracks. Dive tracks from multiple animals can be separated based on the spatial-temporal pattern of localized clicks. Integrating the position of the animal relative to the array, the frequency response of the receivers and hydrographic parameters allow for single click beam width and source level measurements. In addition, investigating the spectral composition of the click at various angles relative to the acoustic axis allows comparisons of off-axis distortion in various species. This detailed echolocation parameter description could aid species separation based on single receiver passive monitoring devices.

**O-03: Evidence of acoustic trauma in long-finned pilot whale (September 2012 mass stranding, Scotland)**

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Twenty-one long-finned pilot whales (*Globicephala melas*) stranded on the 2nd of September 2012 between Anstruther and Pittenweem, east Scotland. A full diagnostic necropsy was undertaken on site over the following 24 - 48 hours. No consistent infectious, metabolic or traumatic cause was identified in the visceral pathology which would explain the mass stranding. During the necropsies, twenty-nine ears were collected and fixed between 4 and 22 hours post-mortem with 10% neutral buffered formalin. Six of the best preserved cochleas were analysed by scanning electron microscopy for evidence of potential acoustic impact. Five ears were too autolysed for meaningful diagnosis, but one ear, removed within 4 hours of death, exhibited clear lesions at the apex of the cochlear spiral, consistent with underwater noise overexposure. Specifically, focal scarring had replaced the outer hair cells responsible for enhancing auditory sensitivity and frequency selectivity. The scarring was located in the first 380 µm from the apex of the cochlea that corresponds with the section of the ear responsible for transducing the lowest frequencies of the pilot whale hearing spectrum. It was not possible to establish the chronicity of the lesion or, given the small sample size, interpret this pathology as being causal to the mass stranding. Nonetheless, this first pathological legacy of noise overexposure in a cetacean stranding event clearly emphasises the need for the implementation of a specific protocol to document the presence of acoustic trauma in stranded cetaceans.

**O-04: Application of stable isotopes to assess the feeding ecology of long-finned pilot whale (*Globicephala melas*) in the northeast Atlantic Ocean**

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In order to improve our knowledge on the feeding ecology of pilot whales in the northeast Atlantic waters, stable isotopes analyses were used and compared with traditional methods, such as stomach contents analysis. Skin samples of 68 long-finned pilot whales (*Globicephala melas*) stranded in northwest Iberian Peninsula (NWIP, n=22) and Scotland (n=46) were analysed using stable isotopes of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$ . Isotopic mixing models were applied to obtain a quantitative estimate of the proportion of the main prey species in the diet of pilot whales. The results were compared with previously published stomach contents data, in order to detect differences between diets in both locations, at different time-scales. Stable isotope analysis revealed that 57.8 - 73.8% of the diet in NWIP consisted in curled octopus (*Eledone cirrhosa*), followed by European flying squid (*Todarodes sagittatus*), while in Scotland the predominant prey species was either *Histioteuthis* sp. or *Todarodes sagittatus*, depending of the trophic enrichment factor applied. These results are somewhat consistent with previous stomach content studies, however the isotopic analysis may provide new information regarding key prey species and habitat use that could be missed or underestimated if only stomach contents analysis were used. Additionally, considering that the Atlantic Coast of Iberia was responsible for 95% of the landings of the main prey consumed by pilot whales in this area, between 2000 and 2010, these data provide trophic baseline information to be taken into account in fishery impact assessment studies and management decisions.



## O-05: Are seals and inshore fisheries targeting the same food source?

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The grey seal is a top predator in Irish waters and protected under the EC Habitats Directive. Each year, Irish inshore fisheries experience substantial catch losses to seals, and large numbers of seals are by-caught in set-net gear along the south and west coasts of Ireland. This study aims to evaluate whether by-caught seals are actively targeting fish in the nets or simply foraging in the same location as fisheries, by comparing fish assemblages in the digestive tract of by-caught seals and the corresponding fishery catch composition. Digestive tracts from by-caught seals were recovered from trammel nets targeting monkfish and rays off the south coast (n=22), and tangle nets targeting pollock and crawfish off the west coast (n=22). Results reveal very little overlap between seal prey species and fishery net contents (PERMANOVA,  $P < 0.001$ ). In the trammel net fishery, none of the target species were detected in the digestive tracts and cod was the most abundant commercial species found in the seal stomachs. Similarly, in the tangle net fishery, no crawfish and low numbers of pollock were detected, with whiting being the numerically dominant commercial (but non-target) prey species in stomachs. While seals have been reported actively depredating fish from static gear, and seal depredation is indeed a serious issue in certain set-net fisheries in Irish inshore waters, there was little evidence of overlap between fish catches and prey species consumed by the by-caught seals in this study, suggesting that by-caught seals are not necessarily targeting fish caught in the nets. Given the high proportion of seal bycatch and catch losses, management mitigation measures are discussed within an ecosystem approach to fisheries management.

## O-06: Long-term trends in diet and mortality in harbour porpoises in Scottish waters

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Data on diet and age of harbour porpoise, *Phocoena phocoena*, have been assembled over 23 years based on the Scottish cetacean strandings monitoring programme, part of the UK CSIP. Here we integrate previously unpublished data from the mid-2000s onwards. While the same prey species continue to predominate in the diet, the contribution of sandeels (Ammodytidae) has declined over the last decade while Gadidae are more dominant. The way in which sandeel abundance has been assessed by ICES has changed since 2009, making it hard to directly compare porpoise diet selection and fish abundance trends; however diet composition has likely followed trends in prey availability. Age data were used to construct life tables and to estimate mortality rate; observed changes in mortality are mainly driven by the varying proportion of young animals, among which starvation/loss of condition is an important component of mortality, suggesting a link to food availability. Focusing on the period 1994-2005, we examine the changes which coincided with the apparent southwards shift in distribution recorded by the SCANS surveys. The importance of sandeels in the diet generally declined, and sandeel abundance in the North Sea declined after 1998. The importance of whiting in the diet fell during the first part of the 2000s, corresponding to low levels of stock abundance in the North Sea, and there was an apparent increase in porpoise mortality at the end of the 1990s. Finally we test the sensitivity of the provisional conclusions to likely biases in the data, including under-representation of age zero animals and changes in data collection protocols.

**O-07: Eco-toxicological analysis of free-ranging cetaceans from the north-western Mediterranean Sea**

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The numerous anthropogenic activities occurring nowadays in the north-western Mediterranean Sea strongly affect top predators such as marine mammals, especially through the bioaccumulation of lipophilic contaminants. In order to assess the eco-toxicological status of local living cetaceans, blubber biopsies were collected between 2006 and 2013. Selected persistent organic pollutants POPs (31 PCBs, 15 organochlorine compounds, 9 PBDEs and 17 PCDD/Fs) were analyzed in 49 long-finned pilot whales, *Globicephala melas*, 61 sperm whales, *Physeter macrocephalus*, and 70 fin whales, *Balaenoptera physalus*.  $\delta^{13}\text{C}$ ,  $\delta^{15}\text{N}$  values and POPs levels were assessed through IR-MS and GC-MS respectively. To assess the toxic potency of the dioxin-like compounds, the TEQ approach was applied.  $\delta^{15}\text{N}$  values were  $12.2\pm 1.3\text{‰}$  for sperm whales,  $10.5\pm 0.7\text{‰}$  for pilot whales and  $7.7\pm 0.8\text{‰}$  in fin whales, positioning sperm whales at higher trophic levels.  $\delta^{13}\text{C}$  instead was similar and amounted to  $-17.3\pm 0.4\text{‰}$ ,  $-17.8\pm 0.3\text{‰}$  and  $-18.7\pm 0.4\text{‰}$  respectively. Pilot whales presented higher concentrations than sperm whales for  $\Sigma\text{PCBs}$  ( $38666\pm 25731 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  and  $22849\pm 15566 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  respectively),  $\Sigma\text{PBDEs}$  ( $712\pm 412 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  and  $347\pm 173 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  respectively) and  $\Sigma\text{DDTs}$  ( $46081\pm 37506 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  and  $37647\pm 38518 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  respectively). Fin whales presented the lowest values, in accordance with its trophic position ( $\Sigma\text{PCBs}$ :  $5721\pm 5180 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$ ,  $\Sigma\text{PBDEs}$ :  $177\pm 208 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  and  $\Sigma\text{DDTs}$ :  $6643\pm 5549 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$ ). The PCA analysis confirmed how p,p' DDT and p,p' DDE were influential in differentiating the species, as a consequence of their migratory behavior and distribution. Pollutant concentrations were significantly higher than both their Southern Hemisphere and North Atlantic counterparts, possibly due to the particular Mediterranean geomorphology, which influences pollutants distribution and recycle. Dioxin-like PCBs accounted for over 80% of the total TEQ. This study demonstrated (1) an important exposure to pollutants of Mediterranean toothed-whales, often surpassing the estimated threshold toxicity value of  $17000 \text{ ng}\cdot\text{g}^{-1} \text{ lw}$  for blubber in marine mammals; and (2) how their geographical distribution can influence the pollutants profile and concentrations.

**O-08: Global pollution (PCB) hotspots and European dolphin declines**

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The severe impact on top predators of the bioaccumulation of DDT and other organochlorine (OC) pesticides in food webs was first identified in the early 1960s. Most OC pollutants were banned in developed countries in 1970s-1980s and many terrestrial wildlife populations recovered. However, the full impact of historic and current exposures to OC pesticides and the more persistent polychlorinated biphenyls (PCBs) on European marine top predators is unknown. In this study we show that several European cetacean species currently have markedly elevated mean PCB levels, likely to cause population declines and suppress population recovery. In a large pan-European meta-analysis of stranded or biopsied cetaceans (n=1,081), three out of four species (striped dolphins, bottlenose dolphins and killer whales) had mean PCB levels that markedly exceeded all known marine mammal PCB toxicity thresholds. Some locations (e.g. western Mediterranean Sea and off the south-west Iberian Peninsula) were global PCB “hotspots” for marine mammals. Cetacean PCB concentrations



initially declined following a mid-1980s EU ban, but have since stabilised (reaching a “steady state”) in UK harbour porpoises and striped dolphins in the western Mediterranean Sea. High PCB concentrations in many adult females were consistent with pregnancy failure or poor survival of calves and were often concurrent with population declines. Despite regulations and mitigation measures to reduce PCB pollution, their biomagnification in marine food webs is still causing severe impacts among cetacean top predators in European seas.

**O-09: Fin whales (*Balaenoptera physalus*) as wide-scale sentinel of exposure to microplastics in marine environment: the case study of Mediterranean Sea and Sea of Cortez**

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The impact of microplastics on baleen whales by filtrating feeding activity is largely unknown. Here we present the case study of fin whale (*Balaenoptera physalus*), exploring the toxicological effects of microplastics on mysticetes comparing two populations living in areas with different human pressure: the MPA of Pelagos Sanctuary (IT-FR-MC) and the Sea of Cortez (MX).

High presence of microplastics have been detected in superficial neustonic/planktonic samples collected in the Pelagos Sanctuary (0.62 items/m<sup>3</sup>) with high concentration of phthalates (DEHP and MEHP), used as tracers of plastic derivatives.

Relevant concentrations of MEHP, PBTs and higher biomarker responses were detected comparing the Mediterranean to the Sea of Cortez fin whales. A clear overlap between areas of high density of microplastics and whales feeding grounds in the Mediterranean Sea was pointed out, confirming their exposure to microplastics during the permanence in the summer feeding grounds.

In conclusion, we suggest the fin whale as a critical wide-scale indicator of the presence and impact of microplastics (and related sorbed PBTs and plastic additives) in semi-closed basins.

## O-10: The Italian diagnostic network on stranded cetaceans: “from local to global” approach

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Liguria Region is an important commercial and touristic area located in the north west of Italy on the Ligurian Sea, in the middle of the Pelagos Sanctuary. The ‘*Istituto Zooprofilattico Sperimentale (IZS) del Piemonte, Liguria e Valle d'Aosta*’, a Public Health Research Institute, in Imperia District, has been involved in the health and epidemiologic surveillance of cetaceans stranded in this area since 1985, with more than 130 animals submitted to diagnostic investigations. Since 2009, thanks to a project promoted by the Italian Ministry of Health, its’ diagnostic approach has been expanded to Tuscany and Lazio regions and progressively adopted by all other IZS. Such diagnostic network has been integrated in the national marine mammal strandings’ network, which uses a multidisciplinary approach involving several institutions and experts.

By doing so, standardization of diagnostic post mortem protocols, traceability of reports, sampling and sharing of the results were obtained. Thanks to these achievements, it was also possible to manage with efficiency and coordination an unusual mortality event (UME), which occurred along the Tyrrhenian coast of Italy between January and March 2013, which should be regarded as the fourth dolphin morbillivirus outbreak in the western Mediterranean basin (Casalone *et al.*, 2014), along with a mass stranding of 7 sperm whales (*Physeter macrocephalus*), whose investigations are still ongoing, which occurred in September 2014 along the Adriatic Sea coast.

The Italian experience permitted to realize how a joint activity leads to an optimization of the efforts. A similar approach, standardized across all the European countries of the Mediterranean basin, would allow improvement of the health and epidemiologic surveillance on stranded cetaceans, with the result of monitoring the aquatic environment, as well as the animal and public health, in the long-term and on a larger geographic scale.



## O-11: 100 not out: A century of strandings monitoring in the UK

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Between 1913 and 2012, 15054 cetaceans were reported stranded in the UK, comprising Phocoenidae (n=6563), Delphinidae (n=5364), Balaenopteridae (n=556), Ziphiidae (n=309), Physeteridae (n=189), Kogiidae (n=10), Monodontidae (n=3) and cetaceans of indeterminate identity (n=2060). Routine recording of stranded cetaceans in the UK began in 1913 under the aegis of the Natural History Museum. Routine and systematic necropsies of stranded cetaceans were initiated in the UK in 1990, under the aegis of the collaborative Cetacean Strandings Investigation Programme (CSIP). A significant increase in strandings reporting effort occurred after the inception of the CSIP, with 74% of the total strandings in this 100 year dataset recorded after 1990. The long-term nature of this dataset demonstrates changes in spatial and temporal distribution of strandings around the UK coast. For example, several mass stranding events (MSE's) of false killer whales (*Pseudorca crassidens*) were recorded in the UK during the 1920's and 1930's, but no strandings of this species have been recorded since 1935. In addition, strandings of apex predator species such as killer whales (*Orcinus orca*) and bottlenose dolphins (*Tursiops truncatus*) used to be recorded in UK regions where they are no longer found. This suggests that a contraction in range in coastal populations of bottlenose dolphins and killer whales has occurred in the UK over the last century, illustrating the potential impact of anthropogenic threats, such as exposure to marine pollutants like polychlorinated biphenyls (PCBs). In contrast, reported strandings of humpback whales (*Megaptera novaeangliae*, n=17) have only been recorded in the UK since 1982. This is consistent with the ongoing recovery of populations of some cetacean species, following the cessation of large scale commercial whaling. This unique 100 year time series acts as a valuable resource, illustrating changes in presence and distribution of cetacean species in UK waters.



**O-12: Long-term changes in the diet of striped dolphins, *Stenella coeruleoalba*, in the western Mediterranean: a comparison of stomach contents vs. stable isotopes**

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Long-term analyses on the trophic ecology of cetaceans are fundamental to assess the impact of natural and anthropogenic factors on their populations. A recent study based on stable isotopes investigated dietary changes of striped dolphins, *Stenella coeruleoalba*, from the western Mediterranean, killed by the dolphin morbillivirus (DMV) in 1990 and 2007-08. Results suggested a change from a sardine-dominated diet to a juvenile hake-dominated one, with an increase of prey species of low trophic levels, such as lantern fish, or with high turnover rates, such as cephalopods. Apparently, stock depletion of sardine, anglerfish and adult hake by fishing would have resulted in a trophic cascade provoking changes in prey availability. We re-examined this hypothesis based on stomach content analysis. Two sets of samples were analyzed, i.e., dolphins killed by the DMV in 1990 and 2007-08 (n=44), and dolphins stranded in the period 1991-2012 (n=75) on the central Mediterranean coast of Spain. Consistent dietary changes were observed in both sample sets. There was a significant increase in the consumption of the juvenile hake and the neritic squid, *Illex coindetii*, which dominated the diet of striped dolphins in the second decade; the size of consumed hake, however, significantly decreased throughout the years. Increased consumption of lantern fish, and of fish and cephalopods typical from the lower shelf, was also noted, with a parallel, sharp decrease of consumption of oceanic cephalopods. Sardine was detected only in 6 stomachs. These patterns suggest that striped dolphins might have relied more on oceanic prey in the 1990's, shifting to more neritic prey afterwards. Our study therefore partially confirms evidence obtained by stable isotope analysis, but suggests that depletion of sardine stocks may have had, if at all, an indirect effect on prey availability.

### **O-13: Energy demands of juvenile Pacific walruses (*Odobenus rosmarus divergens*) during the nursing interval: Modelling the costs of lactation**

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Pacific walruses are responding to climate induced reductions in sea ice by altering habitat use and activity patterns. This could impact their ability to consume sufficient prey, which could affect demographic rates, particularly if females are unable to support the energetic requirements of lactation. We used Bayesian models to analyze caloric intake and growth of male (n=6) and female (n=5) 0-2 year-old walruses housed in aquaria to assess the cost of lactation. Males and females had similar growth patterns; mean mass increased from 64 kg at birth to 289 kg by 2 years. Metabolic costs were higher for males than equally sized females, ranging from 600 to 1800 kcal day<sup>-1</sup> higher for males 0 to 2 years postpartum. Females had a 2000 kcal kg<sup>-1</sup> higher mass storage cost than males. The lower growth efficiency for females may be associated with higher proportions of body fat, which is more energy dense than lean tissue. Model-based estimates of total daily energy requirements, which include counteracting metabolic and storage components as well as random variation among individual walruses, were similar across sexes, and summed to approximately 170,000 kcal over the first month postpartum. Based on a previously determined value of 8,103 kcal kg<sup>-1</sup> of mass loss in adult female walruses, and not accounting for maternal caloric demands associated with mobilizing blubber and producing milk, nursing juveniles could deplete 21 kg of their mother's body mass within the first month post-parturition if she was unable to meet any of her energetic demands of lactation from ingested prey. This represents 11% of mass gained during pregnancy that was not associated with the placenta or foetus. Quantifying the energetic requirements of calves as a proxy for maternal lactation costs provides insight into the effects of changing sea ice conditions on population demographics.

**O-14: Reproductive failure in UK harbour porpoises *Phocoena phocoena*: legacy of pollutant exposure?**

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Reproductive failure in mammals due to exposure to polychlorinated biphenyls (PCBs) can occur either through endocrine disrupting effects or via immunosuppression and increased disease risk. Linking toxicological endpoints of reproductive dysfunction to PCB exposure in free-living marine mammal populations is difficult. To investigate further, full necropsies and determination of summed 25 chlorobiphenyl congeners ( $\Sigma 25\text{PCBs}$  lipid weight) were undertaken on 329 UK-stranded female harbour porpoises (1990-2012). In sexually mature females, 19.7% showed direct evidence of reproductive failure (foetal death, aborting and dystocia or stillbirth). A further 16.5% had infections of the reproductive tract and/or tumours of reproductive tract tissues that could contribute to reproductive failure. Resting mature females (non-lactating or pregnant) had significantly higher mean  $\Sigma 25\text{PCBs}$  (18.5 mg/kg) than both lactating (7.5 mg/kg) and pregnant females (6 mg/kg), though not significantly different to sexually immature females (14 mg/kg). Using multinomial logistic regression models  $\Sigma 25\text{PCBs}$  was found to be a significant predictor of mature female reproductive status, adjusting for the effects of confounding variables. Resting females were more likely to have a higher PCB burden. Health status (proxied by cause of death) was also a significant predictor, with lactating females more likely to be in good health status compared to other individuals. Based on contaminant profiles ( $>11$  mg/kg lipid), at least 48% of resting females had not offloaded their pollutant burden via gestation and primarily lactation. Where data were available, these non-offloading females were previously gravid, which suggests foetal or newborn mortality. Furthermore, a lower pregnancy rate of 50% was estimated for females that died of non-disease related (i.e. traumatic) causes of death, compared to other populations. Whether or not PCBs are part of an underlying mechanism, we used individual PCB burdens to show further evidence of reproductive failure in the north-east Atlantic harbour porpoise population, results that should inform conservation management.

### **O-15: Capture myopathy in 16 cetaceans stranded along the Italian coastline between 2008 and 2014**

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Capture myopathy (CM) is a non-infectious, metabolic muscular disease of wild mammals and birds associated with the stress of capture, restraint and transportation. Characteristic lesions are acute to subacute muscle degeneration affecting both skeletal and cardiac muscle and tubular nephrosis, often associated with tubular myoglobin. In cetaceans, pathological findings associated with severe skeletal muscle damage compared to CM of wildlife animals have been reported during live-stranding and transport. This damage is a direct consequence of stranding and reflects stress, exertion, trauma and crush injury. In order to define when these pathological changes are irreversible in alive stranded cetaceans and when euthanasia is the only option, microscopic and immunohistochemical (IHC) changes related to CM in the skeletal muscle, heart and kidneys occurred in 16 stranded cetaceans along the Italian coastline are herein described. Selected animals belong to six different species (4 *Physeter macrocephalus*, 3 *Tursiops truncatus*, 3 *Balaenoptera physalus*, 3 *Stenella coeruleoalba*, 2 *Grampus griseus* and 1 *Globicephala melas*) and time between stranding and death was known. IHC analyses were performed using anti-human desmin, actin, myoglobin, fibrinogen and myosin slow antibodies. In all muscular tissues (16/16) morphological microscopic changes suggesting CM were noticed, associated with myoglobin cytoplasmic depletion and a concomitant fibrinogen accumulation. Furthermore, myoglobin was detected in renal sections in the majority of animals (12/14). Microscopic and IHC findings were more severe in those animals which died after 12 hours from stranding, while in heavier animals (more than 6 m long), severe injuries were noticed within 6 hours. These findings confirmed that body length and mass and time from stranding could be used as critical points in the medical triage used on alive stranded cetaceans, being 12 hours the maximum time of recumbency on the beach. After this time, euthanasia is strongly suggested.

**O-16: Bacterial microbiota in harbour seals (*Phoca vitulina*) from the North and Baltic Seas of Schleswig-Holstein, Germany around devastating morbillivirus and influenza die-offs**

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Harbour seals are the most common pinniped species in German waters. In 1988/1989 and 2002 the North and Baltic Sea harbour seal populations were struck by two epizootic infections with phocine distemper virus (PDV) and in 2014 by an influenza H10N7 outbreak. As part of their health monitoring dead harbour seals are collected and necropsies are conducted. Microbiological findings in harbour seals from the North and Baltic Seas of Schleswig-Holstein, Germany between year 1996 and 2014 are presented. The results were interpreted with regard to potential changes caused by two devastating phocine distemper (PDV) and the recent influenza die-off.

Microbiological investigations were conducted on tissue samples from lung, liver, kidney, spleen, intestine, and mesenteric lymph nodes from 510 dead harbour seals.

A large variety of bacteria including potentially pathogenic bacteria like *Bordetella bronchiseptica*, *Brucella* spp., *Clostridium perfringens*, *Escherichia coli*, *Erysipelothrix rhusiopathiae*,  $\beta$ -haemolytic streptococci and *Staphylococcus aureus* were isolated. Those bacteria were associated with bronchopneumonia, gastroenteritis, hepatitis, arthritis, polyarthritis, nephritis, myositis, myocarditis and septicemia. *Bordetella bronchiseptica* and *Streptococcus equi* subsp. *zooepidemicus* were exclusively isolated during the seal die-offs as a secondary pathogen. *Brucella* spp. is also found in e.g. lung nematodes from the respiratory tract.

Bacterial infections severely influence the health status of harbour seals in German waters. Besides parasitic infections during the first months of life and the PDV and influenza outbreaks, bacterial infections seem to play a major role for mortality in harbour seal populations. Further investigations are needed to understand microbiota changes in relation to increasing seal populations, reintroduction of rehabilitated seals to the wild and increasing pressure from anthropogenic activities.



**O-17: Temporal trend of biliary trematode infection in Baltic grey seals (*Halichoerus grypus*)**

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Pinniped health has been monitored by the Swedish Museum of Natural History since 1977. Up until 2001, sporadic cases of trematode liver infection were described in the Baltic grey seals (*Halichoerus grypus*). Here we examine the presence of trematodes in livers of 1,555 grey seals from the Baltic Sea from 2002-2013. A total of 183 seals had evidence of parasitic infection. Grossly, small trematodes (1-2 mm long) were observed in the biliary system and gallbladder. The bile ducts commonly had thickened walls (chronic inflammation and fibrosis) when trematodes were present. An enlarged portal lymph node typically signalled trematode occurrence. The parasitic infection ranged from mild and localized to one liver lobe, to widespread and severe, resulting in debilitation and death from severe, chronic cholangiohepatitis. The annual prevalence of grey seals with biliary trematode infections increased significantly in 2008 to 26% from  $\leq 10\%$  in 2002-2007 ( $P < 0.001$ ). Yearlings and 1-year old seals had the lowest load of parasites. The proportion of infected seals increased significantly with increasing age. Trematode infections were significantly higher in males than in females during the whole time period. Trematodes from 10 seals collected from 2003-2010 were identified as *Pseudamphistomum truncatum* using molecular techniques. *P. truncatum* has been found in several predators foraging on fish and intermediate stages of this parasite have been described in roach (*Rutilus rutilus*). One explanation for increased prevalence of *P. truncatum* infection in grey seals could be an increase of cyprinid fish in the diet. Investigation of digestive-tract contents from 692 hunted grey seals, collected 2002-2013, showed a significantly greater occurrence of cyprinid hard parts during 2008-2013, compared with 2002-2007 ( $P < 0.001$ ). Further investigation of biliary trematode infection in grey seals, including identification of intermediate hosts, determination of reasons for increased prevalence and confirmation of monospecific trematode infection are needed.

**O-18: Social structure of long-finned pilot whales (*Globicephala melas*) off Cape Breton, NS, Canada: what do we know about social units?**

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The long-finned pilot whales that summer off Cape Breton have been studied from whale-watching vessels since 1998, during July and August each year. Photographic data was collected for each group encounter, allowing us to identify individuals. Units are comprised of key individuals and their close companions (CCs). Key individuals are identified as those sighted in at least four days, with these sightings separated by at least 30 days. CCs of key individuals are individuals seen on the same day as the key individual for at least four days, with these sightings also separated by at least 30 days. Biopsy sampling of individuals was also performed between 2010 and 2012, off a semi-rigid inflatable boat using a crossbow and biopsy bolts. Individuals were sexed using a multiplex PCR of two primer pairs that amplify portions of the ZFX/ZFY and the SRY genes; and tested for variability in 20 microsatellite loci. Using data from 1998-2011 we identified 27 units, containing from 2 to 23 well marked individuals. When scaled for the mark rate 0.336 and 0.352 plus 1 for the individual, these increase to 6 and 66 to 69 individuals. Smaller units were more common, with 30% of units comprising only 6 individuals. Individuals in eleven different units were sexed, but in only three cases were there more than one sexed individual per unit. In these three units we encountered both females and males. Loci variability is currently being tested, which will allow us to assess whether individuals within units are more related than between units. Ultimately, this will allow us to understand whether bisexual natal philopatry is general in this population, and aid in our understanding of their social structure.

### **O-19: Does the pressure of achieving reproductive success prevent male grey seals from responding to human disturbance?**

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Human-wildlife interactions can be incidental, or direct through activities such as wildlife-tourism. In the presence of anthropogenic activities, some animals exhibit behavioural alterations such as increased vigilance or spatial displacement. Thus, chronic exposure could be adverse to individual fitness through loss of energy or time. Pinnipeds are exposed to human activities in the aquatic environment and on land, but the degree of exposure varies across a species' geographic distribution. For example, breeding colonies of grey seals (*Halichoerus grypus*) along the mainland coast of England are exposed to anthropogenic disturbance in the forms of tourism and military activities; however, many offshore colonies are relatively undisturbed. Due to the recent rapid expansion of these mainland colonies, the impacts of human presence during the breeding season are of urgent interest for managers; however, many studies are limited to small spatial or temporal scales when investigating effects of disturbances on behaviour. Therefore, the aim of this study was to test for any behavioural adjustments associated with anthropogenic presence by comparing the activity budgets of individual male grey seals at a mainland colony, with activity budgets from two isolated colonies at other locations across the geographic range for the species. We found no evidence of differences in the male activity budgets for time spent in Non-Active behaviours across colonies, and no evidence that the amount of time spent Alert was greater at disturbed colonies. These results highlight that, as capital breeders, natural selection for conservation of energy is potentially overriding short-term costs of local stressors, and/or that males at the mainland colony have habituated to the human presence. This study further provides discussion of the utility and limitations of purely behavioural indices of disturbance and emphasizes the importance of considering broad ecological and evolutionary drivers of species' behavioural responses to human activities.



**O-20: Spatio-temporal distribution of harbour porpoises in the Baltic Sea provide further evidence for a separate breeding unit**

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The Baltic Sea harbour porpoise is considered critically endangered (IUCN), but the density and distribution of porpoises in the Baltic Sea has been previously largely unknown. The SAMBAH project aimed to estimate density and distribution of Baltic Sea harbour porpoises, with the ultimate goal to secure their survival. The main data collection was an acoustic survey, deploying porpoise click detectors (C-PODs) at approximately 300 stations in a randomly placed systematic grid from May 2011 to April 2013. The study area encompassed waters between 5-80 m depth from the Darss and Limhamn ridges in the southwest to the Archipelago Sea in the northeast of the Baltic Sea. The rate of click positive seconds collected by the C-PODs were used together with auxiliary data on detection probability to calculate absolute densities per station. Harbour porpoise densities were then modelled using general additive models, resulting in predicted monthly maps describing the density distribution in the study area. These maps give detailed information on the temporal and spatial distribution of animals, and reveal two main areas with higher concentrations of animals during May – December; one in the south-western Baltic Sea, and one around the offshore banks south of Gotland in the Baltic Proper. Compared to its surroundings, the Baltic Proper area has high densities in April-October, and is clearly separated from other high-density areas in May-September. Previous studies showing that mating in the Baltic Sea peaks in August, leads us to interpret our results as further evidence for the existence of a separate Baltic Sea breeding population of porpoises. The results of this study support treating the Baltic Sea harbour porpoise as a separate management unit, and are expected to have significant positive impact on the management of the Baltic Sea harbour porpoise through facilitating relevant conservation action where it matters.

**O-21: Postglacial rise of three ecotypes of harbour porpoises, *Phocoena phocoena*, in western Palearctic waters**

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Despite no obvious barriers to gene flow in the marine realm, environmental variation and ecological specializations can lead to genetic differentiation in highly mobile predators. Here, we investigated the genetic structure of the harbour porpoise over the entire species distribution range in western Palearctic waters. Combined analyses of 10 microsatellite loci and a 5085 base-pair portion of the mitochondrial genome revealed the existence of three ecotypes, equally divergent at the mitochondrial genome, distributed in the Black Sea (BS), the European continental shelf waters, and a previously overlooked ecotype in the upwelling zones of Iberia and Mauritania. Historical demographic inferences using approximate



Bayesian computation (ABC) suggest that these ecotypes diverged during the last glacial maximum (ca 23–19 kilo-years ago, kyrBP). ABC supports the hypothesis that the BS and upwelling ecotypes share a more recent common ancestor (ca 14 kyrBP) than either does with the European continental shelf ecotype (ca 28 kyrBP), suggesting they probably descended from the extinct populations that once inhabited the Mediterranean during the glacial and post-glacial period. We showed that the two Atlantic ecotypes established a narrow admixture zone in the Bay of Biscay during the last millennium, with highly asymmetric gene flow. This study highlights the impacts that climate change may have on the distribution and speciation process in pelagic predators and shows that allopatric divergence can occur in these highly mobile species and be a source of genetic diversity.

### **O-22: Genetic population structure of the grey seal *Halichoerus grypus* in the Iroise Sea: what can be learned from of a multi-locus analysis of the mitochondrial genome**

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The Iroise Sea, located at the northwest part of France, is the southern limit of the grey seal *Halichoerus grypus* distribution range. Previous studies based on satellite tracking and mark-recapture, have shown grey seal dispersions between the French Brittany coasts and the British Islands ones, suggesting the existence of a meta-population. However, demonstrated diet specificity and the absence of previous genetic study of the Iroise sea settlement prompted us to undertake a genetic characterization of the species in this area. As the use of different mitochondrial markers can produce incongruent results, we first analyzed the polymorphisms of three mitochondrial markers (the control region (MCR), the cytochrome b (cytb) and the cytochrome oxidase 1 (cox1) genes). Thirty blood samples taken from stranded animals nursed at the care center of Oceanopolis were used. As weighted, analysis of the MCR showed the highest genetic diversity and a complex haplotype network with no major haplotype. Nevertheless, four haplogroups were highlighted but no clear correlation was evidenced with biological, chronological or geographical parameters (e.g., the stranding date, place or gender). The cytb and cox1 markers revealed more or less similar haplotype networks with a major haplotype and respectively 4 or 5 minor ones. For the cox1 gene, the star like haplotype network could reflect the recent population expansion ( $F_s F_u = -2.82$ ,  $p < 0.05$ ). The concatenation of the three mitochondrial markers gave results similar to MCR alone, but the comparative analysis of the 3 markers is most likely meaningful in terms of ancestral origin of the haplogroups. We are presently performing an analysis on a larger sample and comparing mitochondrial and nuclear polymorphisms. The understanding of the population structure and genetic diversity of grey seals along the Brittany coasts is a necessary step for the establishment of an appropriate conservation strategy.

**O-23: Foraging strategies of an offshore predator: the striped dolphin (*Stenella coeruleoalba*)**

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The striped dolphin is relatively abundant in both neritic and oceanic habitats, close to the outer limits of its range, west of Ireland/Scotland. Both of these habitats differ in prey species composition and in prey availability. Little is known about the diet of striped dolphins in European Atlantic waters, and in particular of the diet in oceanic waters. In this study, the diet of striped dolphins by-caught in a drift net fishery in the oceanic waters south and west of Ireland (n = 75) is compared with the diet of animals from the neritic area. The investigations were carried out using traditional dietary analysis. We found differences between groups, where the stranded dolphins consumed shelf-prey species (such as whiting and *Trisopterus* spp.), while by-caught dolphins preferred mesopelagic and pelagic offshore prey (such as *Notoscopelus* spp. and *Histioteuthis* spp.). Overall, fish length ranged from 20 to 468 mm and most fish consumed were small schooling fish. Of the fish detected, only small proportions (9% N, 11% W) are commercial fish species. Cephalopods represented 18% N (59% W) of the diet in both the oceanic and neritic habitats. Annual food consumption was calculated based on the diet results and abundance estimation for this geographical area was estimated to be  $136.5 \times 10^3$  tonnes. The complexity of the foraging strategy detected shows that this species may carry out offshore-inshore trips regularly. This study shows that trophic role of this predator species in European waters maybe more complex than previously known and has to be considered in a wider context to integrate it within the ecosystem approach to fisheries management and the Marine Strategy Framework Directive.

**O-24: “Always at your side” – baleen whales stay within foraging distance to small pelagic prey**

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To profit from productive and rich waters in the Northern Hemisphere, baleen whales undergo large migrations of several 1000 km to feed on small pelagic fish and zooplankton. After arriving at the northern feeding grounds, baleen whales chose certain prey hot spots on the scale of several 100 km. The waters along the Irish south coast form such a prey hot spot due to the high abundance of forage fish. Cetacean surveys were carried out on acoustic surveys of fish distribution and abundance for Atlantic herring (*C. harengus*), European sprat (*S. sprattus*) and Atlantic mackerel (*S. scombrus*) from 2007 to 2013. We analysed the distribution of humpback (*M. novaeangliae*), fin (*B. physalus*) and minke whales (*B. acutorostrata*) in relation to these fish distributions. Our null hypothesis was that any spatial overlap of whales and small pelagic fish occurred by chance. The distance from baleen whales to the prey source was calculated and compared to a simulated random whale distribution. Statistically more often than by chance, baleen whales were within 8 km distance to herring and sprat, suggesting a prey preference for those species. Any spatial overlap with mackerel was not different to the random simulation. This distance is in agreement with the optimal foraging strategy of being close without alarming the prey. No foraging biomass threshold or prey size selectivity was found within an 8 km radius to the whale. This work helps the understanding of whale distribution along the Irish south coast and their relationship with some of their preferred prey. Further it increases the knowledge of trophic interactions, foraging decisions and behaviour of baleen whales, which can feed into bioenergetics models and can find implementation into a sustainable and ecosystem based small pelagic fisheries management.

### **O-25: ‘Where is the risk? A spatial assessment for cetacean bycatch hotspots in fisheries’**

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The EU Habitats Directive, annex II, lists harbour porpoise and bottlenose dolphin as species of community concern, requiring member states to implement Special Areas of Conservation (SACs) for these species. Member states must report on the status of populations on a 6 yearly basis. With the increasing move towards ecosystem-based marine management, there is a need for these conservation objectives to be considered alongside fisheries objectives. Appropriate methods of assessment and management of cetacean bycatch in fisheries are not currently well defined and so cetacean bycatch in some fisheries is still a major concern. Using a hierarchical approach, suitable even for data poor situations, we have developed a spatially and temporally explicit risk assessment methodology which evaluates fishing activity and species distribution to indicate hotspot areas for targeted conservation and management. Quarterly species distributions (modelled from sightings data) and VMS data of fishing activity within the Irish EEZ are used to demonstrate the methodology. Discussion focuses on the risk to these annex II species and the implications for the conservation of harbour porpoise and bottlenose dolphin within Ireland. Broadly, we highlight how this risk assessment methodology can be used within ecosystem-based marine management to ensure the successful integration of conservation and fisheries objectives.

### **O-26: Maltese fisheries and conservation of large predators, including sharks and dolphins**

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Upon accession to the EU, Malta's 25 nm Exclusive Economic Zone became a Fisheries Conservation and Management Zone which demands scientific research and monitoring of the marine ecosystem, habitats and species present in this area. Research which would integrate the various scientific methods to assess the status of fisheries stocks and wildlife have been developed locally by the Conservation Biology Research Group, UoM, focusing on marine predators including groupers, bluefin tuna, sharks, dolphins and whales. Understanding the distributions and connectivity of these species' populations from local to regional to global, where applicable, determines the extent of their vulnerability to exploitation and human impacts.

Conservation genetics, field surveys, fish market and fisheries related surveys are all integrated to provide a holistic view of the conservation status of the species' population at various levels to identify early warning signals for relevant conservation measures where required. Spatial-temporal relationships between fisheries' activities and predators, such as dolphins, have been investigated in a long-term field research effort that has been undertaken since 1997 and is still ongoing in this central Mediterranean region. Research data shows that the increasing competition for marine resources between fishermen and predators needs integrated management action from local to regional level and depends on accurate holistic knowledge of the problems and requirements these predators face.



**O-27: Fisheries interactions of *Delphinus delphis* in the north-east Atlantic with an emphasis on Galicia, north-west Spain**

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Bycatch from interactions with fisheries remains the biggest global threat to marine mammals. Galicia, north-west Spain, is one of the world's main fishing regions and a high level of cetacean-fisheries interactions has been reported from on-board observers, interviews with fisheries stakeholders and analysis of stranded and by-caught carcasses. *Delphinus delphis* is the most abundant cetacean in the area and since 1990 necropsies of over 1800 stranded and by-caught *Delphinus* have been conducted. Life history data (age, maturity, and pregnancy rate data) from stranded and by-caught cetaceans can be used to construct life tables and to estimate overall mortality and fisheries mortality rates. Age and maturity were determined from stranded and by-caught *Delphinus* between 1990 and 2009. Males and females reach sexual maturity at 8.5 and 7.5 years of age, respectively, and no temporal difference in age at sexual maturity was observed. Results indicate 13% annual mortality in the *Delphinus delphis* north-east Atlantic population and necropsy data suggests that 60% of mortality (i.e. 7.2% annual mortality) is attributable to fisheries interactions, predominantly from pair trawls and gillnets. By-caught *Delphinus* were found to die significantly younger than non-by-caught animals ( $p < 0.001$ ) although no sex-related difference in bycatch rate was observed ( $p = 0.051$ ). The estimated annual mortality due to fisheries interactions greatly exceeds the 2% limit set by ASCOBANS and the IWC and high bycatch rates are also reported for other countries e.g. the UK, France and Portugal. Although *Delphinus delphis* in the north-east Atlantic is one continuous population, the high level of bycatch occurring in parts of the range is most likely unsustainable and will be discussed. There is a need to carry out on-board monitoring, notably in the north-west Iberian Peninsula (Galicia and Portugal), to incorporate cetacean bycatch into fisheries advice and, above all, to start introducing mitigation measures.



## O-28: Baleen stable isotope records: Re-evaluating feeding and migration patterns of Southern Hemisphere humpback whales

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Southern Hemisphere (SH) humpbacks whales (*Megaptera novaeanglia*) undertake some of the longest migrations on the planet, travelling between their Antarctic summer feeding grounds and their tropical winter breeding grounds. The classical understanding of SH humpback whale ecology is that they are obligatory krill feeders relying on blubber stores accumulated in the productive Antarctic waters to sustain the annual migration event. Animals have been shown to lose between 30 and 50% of their accumulated blubber during the migratory fast.

A recent documented spike in humpback whale stranding events along the Australian coastline has renewed attention on the diet and nutritional status of SH humpback whales. The majority of stranded animals were calves and neonates in poor nutritional condition. A similar occurrence was simultaneously observed in South American breeding stocks. This increase in mortality in multiple breeding stocks raises the possibility that the Antarctic sea-ice ecosystem is at carrying capacity, either due to a rapid post-whaling rise in whale numbers, a krill biomass decline or a combination of both and/or other factors. This scenario is supported by an increase in the number of reports of SH humpback whales feeding along specific migration routes across the Southern Hemisphere.

Baleen plates are produced continuously throughout the life of filter-feeding whales, laying down permanent records of feeding events. Stable isotopes analysis of these temporal records have shown clear patterns in the isotopic records indicative of seasonal migration and feeding/fasting cycles.

In this study, our team analysed the stable carbon and nitrogen profiles of baleen plates from adult animals belonging to the east and west Australian breeding stocks. Findings present evidence of significant heterogeneity in individual feeding strategies, and hence a departure from the classical model.



### **O-29: Conserving the Mediterranean open sea ecosystems: lessons from the Pelagos Sanctuary**

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In 2006, in response to the *Johannesburg Plan of Implementation* call to establish protected areas globally, the Convention on Biological Diversity (CBD) started to develop and apply criteria to describe and designate *Ecologically or Biologically Significant Areas* (EBSAs) in the world's oceans, which will, *inter alia*, support the nations' commitment to achieve the Aichi Biodiversity Targets by 2020. The CBD also encouraged governments and international organizations to identify and adopt measures for conservation and sustainable use in relation to EBSAs, including establishing representative networks of marine protected areas. As part of this effort, the Parties to CBD declared 15 Mediterranean EBSAs in 2014. These EBSAs could portend designation of an ecologically representative network of Mediterranean open sea marine protected areas, which would facilitate the attainment of Aichi Target 11 by the Mediterranean nations. One of the most important EBSAs identified is in the wider northwestern Mediterranean – an area covered in part by the *Pelagos Sanctuary for Mediterranean Marine Mammals*. Established in 1999 by a treaty amongst France, Italy and Monaco and inscribed in 2001 in the Barcelona Convention's *List of Specially Protected Areas of Mediterranean Importance*, the Pelagos Sanctuary has done much to raise awareness about the value of the area for marine mammals and biodiversity, but the current management mechanism is insufficient. Nonetheless, Pelagos is the ideal laboratory for the experimental application of a regional open seas management mechanism, to help achieve a Mediterranean MPA network by 2020. We suggest that establishing a Biosphere Reserve in the *North West Mediterranean Pelagic Ecosystem* EBSA, which encompasses the Pelagos Sanctuary as well as currently unprotected cetacean critical habitat to the west and the south, could offer demonstration of such a management mechanism in order to pave the way to effective region-wide conservation of the Mediterranean open seas.

**O-30: Utilising land watch data to determine long-term trends in abundance**

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Every six years, under the Habitats Directive, EU coastal states are obliged to assess the conservation status of cetaceans. However, resources are rarely sufficient to achieve this using conventional methods such as systematic aerial and vessel surveys. For those species spending significant amounts of time in coastal waters, a cost-effective alternative is to undertake dedicated land-based watches. This study analyses over 75,000 hours of watches and c. 50,000 associated sightings of bottlenose dolphin and harbour porpoise, from 678 sites around the UK coast during 1965-2014, investigating spatial and temporal trends and comparing these to results from offshore data. The data are also used to identify areas of persistent high occurrence and relative abundance for possible establishment of Natura 2000 protected areas. Presence-absence and average sightings and count rates per unit effort were summarised by site and by day (thus eliminating within-day autocorrelation), filtering out records associated with high sea state and short observation duration. Generalised Additive Models were run for three time periods (1965-1993, 1994-2003, 2004-2014), along with mixed models (GAMMs) to quantify the effect of autocorrelation between consecutive days of observation. The results showed clear spatial patterns of distribution for both species, which broadly mirrored the results of offshore surveys, but the significantly larger quantity of effort revealed several additional spatio-temporal trends. Bottlenose dolphins were concentrated around W Wales and E Scotland, with very few in the southern North Sea or eastern Channel. Porpoises were more evenly distributed but eight, mostly persistent, hotspot areas were identified. Strikingly, the distributions of the two species showed little overlap, possibly due to the fact that bottlenose dolphins are known to attack porpoises where the two co-occur. Porpoises have declined in importance in NE Scotland but increased on the east and south coasts of England. Bottlenose dolphins showed no significant temporal trend.

### **O-31: Long-term trend analysis of deep diving cetacean species occurring in the Pelagos Sanctuary (northwestern Mediterranean Sea)**

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Several threats are known to affect cetacean species and their habitats in the Mediterranean Sea, most of them being related to human activities. To enforce effective mitigation actions, extensive knowledge of cetacean ecology is required. In this study a 23-year sighting series (1990-2012) of sperm whale (*Physeter macrocephalus*), Risso's dolphin (*Grampus griseus*) and Cuvier's beaked whale (*Ziphius cavirostris*) was analysed to assess temporal patterns or trends in their presence in the Pelagos Sanctuary area. Sighting data were collected by Tethys Research Institute (n= 434) and CIMA Research Foundation (n= 142) during shipboard surveys conducted between 1990-2012 and 2004-2012, respectively. This effort yielded a total of 576 sightings: 289 sperm whales, 164 Risso's dolphins and 123 Cuvier's beaked whales. For the purpose of the analysis a grid of 6.8 x 9.3 km cell units was created and used for the spatial analysis. The species' encounter rate variability in time was analysed through a General Linear Model approach, which revealed the existence of a significant increasing trend ( $P < 0.05$ ) for sperm whales and Cuvier's beaked whales presence in the area. Contrarily, no trend was found for Risso's dolphin. This study provides evidence that the animal distribution in the Pelagos Sanctuary is affected by some drivers of change. Changes may be due to a wide range of causes (i.e. prey availabilities, climate change, noise). The correlation of the results obtained with this long-term trend analysis with the available time series environmental variables (i.e. sea surface temperature from remote sensing) and anthropogenic pressure affecting the area (i.e. maritime traffic, fishing activities) will provide essential information to evaluate the implications of the different factors of variability and their possible interactions in order to support appropriate management and conservation strategies.

**O-32: Dolphins have individually distinct faces: Photo-identification based on facial features as a tool to enhance studies of delphinids**

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Application of photo-identification techniques to cetaceans and other animals has dramatically increased our understanding of their biology and ecology. In cetaceans, a range of long-term natural markings are used to identify individuals. Digital technology has further facilitated the use of photographs in wildlife research. In this study we investigated the viability of facial recognition as a tool to enhance the study of bottlenose dolphins. From a 12-year time series, we extracted 2,318 images from photographs containing dolphin heads and matched them to known individuals using dorsal fins. We looked at whether we could accurately and reliably identify individuals based only on faces. We then also looked whether we could successfully match individuals across left and right sides. Next, for those individuals for which we had sufficiently long time series of photographs, we evaluated whether the facial features were temporally stable and could be identified over long term. Finally, for mother-dependent calves for which we had photographs over a longer period of time we attempted to establish whether facial features changed drastically during the calf's development. We ran simple matching trials to determine whether other people could also distinguish dolphins this way. The results suggest that a) bottlenose dolphins can reliably be distinguished and identified by facial features; b) these features are consistent across the left and right sides; c) such features are temporally stable and could be used over long-term; and d) calves could be re-identified after weaning using this method. This has a number of implications for the study of these animals, but also broader applicability to other delphinids. We do not suggest that face recognition could or should replace standard dorsal fin identification, but argue that it may complement it and provide additional benefits and useful information.

**O-33: Abundance and distribution of the common dolphin (*Delphinus delphis*) in the north of the Iberian Peninsula**

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Common dolphins (*Delphinus delphis*) are one of the most abundant species of small cetacean in northeast Atlantic Ocean and the most abundant in Atlantic shelf waters of the Iberian Peninsula. However, the abundance, distribution and population trends in the recent years of this species are poorly known, but such information is needed to develop population dynamic models. Thus far, the only absolute abundance estimate in the shelf Atlantic waters of the Iberian Peninsula was obtained in 2005 during the SCANS-II survey. Along the north and northwest coasts of the Iberian Peninsula, the Spanish Institute of Oceanography has carried out annual acoustic surveys to estimate pelagic fish biomass for the last two decades. Since 2007, an observer program for top predators has been integrated into these surveys, collecting sightings on cetaceans, seabirds and other species using line-transect methodology. Common dolphin sightings from 2007 to 2014 were analyzed with Distance software to estimate relative population size. Because attraction to the vessel could inflate population estimates, common dolphin abundance was estimated using a detection function only from sightings where no attraction were recorded and also using Bayesian methods to combine previous data on attraction collected during SCANS-II with data collected from the acoustic fish surveys. Dolphin density estimated with both methods was  $< 0.3$  dolphins/km<sup>2</sup>, which is similar to the density estimated by SCANS-II. The Bayesian framework allows us to work with the scarcity and uncertainty of the data, particularly when obtaining annual estimates. Because cetacean sightings were collected during fish acoustic surveys, pelagic fish abundance (e.g. sardine and blue whiting), obtained concurrently to the sightings, can be used, along with other environmental variables, to model dolphin habitat and to predict dolphin abundance and distribution.

**O-34: Moving of bearded seals (*Erignathus barbatus*) from Sakhalin Bay (Okhotsk Sea) in according satellite tagging in 2013-2014**

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In our study we used data from satellite tags on bearded seals of Okhotsk Sea. Animals were tagged in September and October 2013 at Sakhalin Bay. Tags were placed on a flipper or head of the seal. A total amount of 10 seals of different sex and age were tagged. Working time of each transmitter was different, and seals were tracked for 41-224 days. During all time of investigation, 8 bearded seals were tracked (two by Pulsar, five by MK-10 and two by SPOT-5 transmitters). Tracking analysis showed that before ice appearance, seals kept closer to the shore in shallow waters (not deeper than 10 m). Only fast ice, formed from the shore, force them to go to regions with deep water and use ice for haul-out immediately after it forms. Even in winter, during the reproduction and molting period, they didn't move away from shore further than 50 km. Not a single seal had moved beyond 200 m of isobath.

Connection between summer feeding areas and winter breeding areas was revealed. We obtained data about most breeding haul-outs for the well-known breeding areas. During winter, seals from Sakhalin Bay chose only the nearest breeding area - shelf at the north and north-west coastline of Sakhalin Island - and didn't use other breeding areas in Okhotsk and Japan seas. None of the seals showed any preference for a specific breeding region. Migrations towards breeding areas occur mostly through oil-platforms alongside north-west coastline of Sakhalin Island.

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### **O-35: Investigating the influence of construction activity and vessel presence on marine mammals: the importance of long-term monitoring programmes**

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Prior to the commencement of construction on an underwater gas pipeline, a marine mammal monitoring programme was initiated in Broadhaven Bay, County Mayo, Ireland. From 2009 to date, the monitoring programme has conducted year-round land-based marine mammal surveys of Broadhaven Bay, where the pipeline makes landfall. There are five marine mammal species regularly recorded within the Bay: common dolphin, bottlenose dolphin, minke whale, harbour porpoise and grey seal. Generalized Additive Models and Generalized Estimating Equations were used to investigate if construction activity (e.g. dredging, rock placement) and/or number of vessels influenced the occurrence of these five marine mammal species within the Bay over a five-year period. Other covariates known to influence occurrence or detectability of marine mammals were included in the models. Construction activity negatively influenced minke whale ( $P < 0.005$ ) and harbour porpoise ( $P < 0.05$ ) occurrence and an increase in vessel traffic negatively influenced common dolphin occurrence ( $P < 0.001$ ). With the exception of bottlenose dolphins, all species showed significant annual and seasonal variations in occurrence. As expected, there was a significant negative influence of sea state on the detectability of all five species. Our results indicate that these findings are likely to be indicative of short-term displacement; however, continued monitoring post-construction will be vital for ascertaining whether or not this is the case.

The importance of appropriately assessing the impacts of anthropogenic disturbance on marine mammals is gaining much attention, particularly given the continued increase in offshore marine exploration and development, including marine renewable energy devices. The present study highlights the importance of undertaking monitoring pre-, during- and post-construction in order to better understand the short- and long-term impacts of marine developments whilst contributing more locally to management, conservation and mitigation practices within Ireland.

### **O-36: Aerial surveys to study cetaceans: implications for integrated conservation management and sustainable maritime development**

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Both long and short term marine conservation strategies are best implemented as part of effectively integrated maritime management. These strategies and management benefit from research and monitoring of mobile and vulnerable marine species, like cetaceans. A research area of 120,000 km<sup>2</sup> around the Maltese Islands has been and still is the subject of year-round marine research since 1997 (Vella 1998, 2000, 2001, 2002, 2005, 2006, 2008, 2009, 2010, Vella & Vella 2011, Vella & Vella 2012). All cetacean species in the area have been studied and are monitored annually using aerial strip-transect survey techniques (side-by-side with marine surveys) allowing for various aspects of cetacean species spatial-temporal associations to be analysed. This unique long-term aerial research effort and scientific data analyses for the Central Mediterranean, has developed a cost-effective monitoring system useful for assessment and modelling requirements. Abundance measures for *Tursiops truncatus*, *Delphinus delphis*, *Stenella coeruleoalba*, *Grampus griseus* and other cetacean species obtained using distance software too, show how year-round aerial surveys form an essential tool for building the knowledge required for these species which show different degrees of local site-fidelity and migration at different times of the year, life-history stages and anthropogenic activities. Abundance patterns and trends that would not be easily understood without year-round long-term research efforts. For example, the spatial-temporal climate change effects on cetacean abundance, distributions and survival would need to be monitored closely to measure shifts in behaviours and distributions. Aerial research efficiently provides for a local to regional wide-encompassing investigative set-up that caters for urgent considerations of new environmental changes causing deleterious synergistic effects on these marine mammals. Such sustained but concomitantly adaptable research method should be accessible to researchers around the Mediterranean to allow for effective and timely national to international conservation actions of cetaceans found both close to shore and offshore.

### **O-37: From surveyed to unsurveyed areas: extrapolating cetacean densities in the offshore North Atlantic**

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Extrapolating beyond the range of environmental variables is very risky; however, geographical extrapolation is acceptable when parsimonious habitat models are built from meaningful environmental predictors and survey datasets. We were contracted by the U.S. Navy to estimate the densities of 29 cetacean species in the Atlantic fleet testing and training (AFTT) area, extending from the shoreline of North America to 45°W and from 21 to 65°N. Most of this area has only been surveyed with line-transect protocols within 200 miles from shore. Our objective was to provide reliable extrapolations of cetacean densities in the AFTT area based on available cetacean line-transect surveys and environmental predictors. We built generalized additive models from over 1.2 million km of line-transect surveys in the U.S. waters and a variety of environmental predictors, favouring those for which a broad range of values was covered in the surveyed area. Since the U.S. surveys mostly covered nearshore waters, we incorporated European surveys which extended farther offshore but in the other side of the North Atlantic basin. The results illustrate the difficulty of providing robust density estimates in offshore waters from surveys mainly conducted in nearshore waters. In addition, our study suggests that, for some species, different environmental variables may drive cetacean distributions on each side of the North Atlantic. For example, when we added European surveys to our fin whale model, different predictors were selected and the abundance estimate for the AFTT area doubled. In contrast, for harbor porpoise, the same predictors were selected and the estimated abundance decreased by a more modest 30%. In both cases, much of the change in abundance occurred beyond the shelf. In conclusion, our study stresses the urgent need of conducting line-transect surveys in the offshore North Atlantic in order to provide the most accurate estimations of cetacean densities.

### **O-38: Too many cooks? The lack of a coherent marine mammal management and conservation framework in the EU**

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Marine mammals throughout their range are subject to a number of anthropogenic threats, including incidental capture in fishing gear. In Europe, cetaceans and pinnipeds are afforded protection from hunting and habitat destruction under the EU Habitats Directive and mentioned extensively in the new Marine Strategy Framework Directive (DG Environment), which seeks to “protect more effectively the marine environment”. Marine mammals are also included in a number of Regulations from DG Mare (Maritime Affairs and Fisheries), and under the many iterations of the Common Fisheries Policy, a number of specific Regulations and Directives have been implemented to reduce or monitor bycatch. In addition, scientists from a number of organisations and intergovernmental bodies, including ICES, the IWC and regional agreements such as ASCOBANS and ACCOBAMS examine conservation and management issues. However, within the EU, there are no species-specific management objectives, there is no mechanism to examine whether bycatch levels are an issue or not and no mechanism to evaluate the effectiveness of bycatch mitigation. In this paper, we examine the complicated legislative frameworks that exist within the EU, and taking as an example, the harbour porpoise, *Phocoena phocoena*, highlight the issues surrounding bycatch and the lack of conservation and management objectives. We identify a number of issues including the “too many cooks” syndrome which has led to the lack of a coherent conservation framework and to the ineffectual management of this and other marine mammal species and suggest a bycatch management framework as a way forward.

## O-39: Local human effects on the harbour porpoise

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In the 1980's a huge storm surge barrier was built between the Eastern Scheldt (ES) and the North Sea in the southwest of the Netherlands. In these days most cetaceans disappeared from the Dutch North Sea, due to overfishing and pollution. Probably, in the late 1990's the first porpoises managed to swim through the barrier and started to inhabit the ES, nowadays a National Park (200,000 ha). In 2009 the Rugvin foundation started their first research in the ES by scanning the whole area and counting the number of porpoises. It's then we started to get grip on the population dynamics and whereabouts of this species. Successively C-PODs were used to determine if and how frequent the porpoises migrated through the barrier, to and from. In 2011 more than 60 porpoises were counted but one month later the animals started to face a still ongoing process of high mortality. Tens of dead porpoises washed upon the shore with starvation as the main reason. Further investigation showed that most prey fish such as poor and Atlantic cod, sand goby, herring and whiting dropped dramatically in number. Nowadays it becomes more and more clear that in the 1970 the introduced Japanese oyster might be one if not the main reason for the decline of most fish species, and thus the NP. The numbers of tons of rapidly growing molluscs are filtering more and more of the NP's nutrients. Having the porpoises as a flagship species of the National Park the news about the declining number of porpoises and investigated role of the Japanese oyster led to political questions within the provincial government of Zeeland and to a growing knowledge of local indirect human effects on cetaceans in general.

# SHORT ORAL ABSTRACTS

### **S-01: Vocalizations and social structure in the Cape Breton population of long-finned pilot whales (*Globicephala melas*)**

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Long-finned pilot whales (*Globicephala melas*) are abundant in the North Atlantic and Southern Oceans, yet little is known about their life history, distribution, vocal repertoire, and other areas important for conservation. Consequently, they are considered “Data Deficient” by the IUCN. While this species’ vocalizations have been described, there has been very little research that takes into consideration what we know of pilot whale social structure when studying their calls. Recordings of a population found off Cape Breton Island, Nova Scotia, Canada have been collected since 1998, and include repeat encounters of known long-term social units that are spread out over the years. Studies were conducted off whale-watching vessels and used omnidirectional hydrophones to record the whales during all behavioural states and at a range of group sizes. Photo-identification using dorsal markings enabled the matching of individuals to recordings. On preliminary analysis, the over 95 hours of recordings show a high frequency of repeated pulsed calls, similar to those observed in *Globicephala macrorhynchus*. It is expected that individual social units may have unique call characteristics that allow for identification and/or group cohesion. If so, these socio-acoustic features may delineate the population in a fashion comparable to killer whales (*Orcinus orca*), for which such features have been incorporated into conservation initiatives. This study will reveal more about the intricate vocal structure of the pilot whale in relation to social context and help establish a baseline understanding that can be built upon in the future.

### **S-02: From noise to disturbance: PAM and noise recorded in different distances to piling locations**

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During piling of the foundations of offshore structures such as offshore wind turbines, pulsed noise is emitted into the water which has the potential to cause temporary or permanent threshold shifts in the auditory system of marine mammals. For this reason, in German waters, noise mitigation systems such as Big Bubble Curtains (BBC) are mandatory during all pile driving activities. For each piling of 240 piles of the offshore wind farm “Global Tech 1” a big bubble curtain was applied around each of the 80 tripod foundations at a water depth of 40 meters, which was never tested before. Harbour porpoise (*Phocoena phocoena*) acoustic activity and broad band noise were monitored simultaneously at up to 16 stations equipped with click detectors (C-PODs) and hydrophones during the construction phase 2012 – 2014. Data were collected in distances from 0.6 km to 28 km from each construction site, and S-weighted noise levels were calculated to assess the permeability of the bubble curtain for those frequencies critical to harbour porpoises. To analyse disturbance effects on harbour porpoises induced by construction-related underwater noise, models will be presented including environmental parameters such as season, temperature, currents, day length, and the measured noise levels as explanatory variables for harbour porpoise detection rates. First results show, that even though the BBC worked well, harbour porpoises clearly reacted aversively to the construction noise in distances up to several kilometres.



### **S-03: Local effect of noise on porpoises around oil and gas platforms: suggestions for global effect of noise from oil and gas industry**

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Noise in the marine environment is generally increasing worldwide and for harbour porpoises this may have a negative impact on their habitat selection. Porpoises may react to industrial sounds by avoiding an area or changing their behaviour. In this study, 19 static acoustic data loggers (CPODs) and 7 Noise loggers (Wildlife Acoustics) monitored the acoustic presence and background noise around five oil and gas platforms of various sizes before, during and after a shutdown period of 12 days in June 2014. The rare occasion of a full shutdown of all offshore production activities in the Southern Danish North Sea enabled us to make a BACI test of the following hypotheses: Are porpoises occurrence affected by noise from oil and gas platforms – that is are fewer porpoises detected close to the platforms during normal activity compared to the shutdown period? The sound exposure level (m-weighted) at 200 m from the noisiest platform was between 116-143 dB re 1 $\mu$ Pa rms during normal production activity while the natural background level in the area was between 102-119 dB re 1 $\mu$ Pa rms. The density of harbour porpoises increased around all platforms during the shutdown period and continued to increase after the shutdown period for all but the intermediate sized platform. There was a higher increase of porpoise detections close to the larger platforms during the shutdown period and a lower increase after the shutdown period compared to the reference platform (inactive subsea wellhead). This shows that porpoises generally show attraction to the platforms and are affected little by the noise from production activities. This study generates results critically needed to understand the interplay between the offshore oil and gas production industry and harbour porpoise abundance in both local and global scale, which is essential for appropriate noise regulations both in protected and industrialized areas.

### **S-04: Different and yet equal: results from digital aerial surveys and passive acoustic monitoring of harbour porpoises**

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Offshore installation of wind farms in German waters are accompanied before, during and after the construction phase by a substantial standard monitoring program. Harbour porpoises (*Phocoena phocoena*) are monitored by two different methods, digital aerial surveys and passive acoustic monitoring by means of C-PODs. During the construction of the wind farm Butendiek, located approximately 30 km west of Sylt, we compared the newly introduced digital aerial survey method with data collected by C-PODs at different locations within the study area. The study area is known for high density of porpoises during spring and summer. Between March and July seven digital surveys were conducted of which four surveys occurred during or shortly after pile driving. Results yielded a spatial gradient with increasing porpoise densities at greater distances. While aerial surveys have a high spatial resolution, they only represent the distribution of animals at the given survey time. Therefore any temporal shifts, e.g. of this gradient cannot be demonstrated. However, data from C-PODs collected at two positions outside and four positions at close vicinity of the wind farm area showed similar patterns for the time window when the aerial survey was conducted. Additionally, the enhanced temporal resolution of C-POD data compared to aerial survey data revealed that porpoises returned to the vicinity a few hours after pile driving had stopped. On a monthly scale, mean values of porpoise detections of both methods were investigated and discussed for seasonal patterns. It is concluded that both survey methods complete each other due to their differences in spatial and temporal resolution.

### **S-05: Cetacean distribution in southern Black Sea: An acoustic approach using a methodology combining active and passive acoustics**

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Large numbers of small cetaceans had been hunted in the Black Sea until hunting cetaceans was banned in Turkey starting in 1983. Even though hunting cetaceans had been ceased by Turkish fleets, there are still ongoing threats such as seismic surveys, overfishing and pressure from fishermen for the repeal of the hunting ban. One of the most striking reasons why any action cannot be taken to overcome these threats is the insufficient data about these populations.

This study aims to evaluate the distribution of the Black Sea cetaceans. To fulfil this role, active and passive acoustics methods were performed over transects during the monthly cruises held in July and October 2014, covering up to 120 miles off the Black Sea coast of Turkey. For the active acoustics, three scientific echo sounders were operated continuously over the cruise transects. For the passive acoustics, C-POD (Chelonia Ltd., Cetacean Monitoring Systems) was deployed on the 57 stations. Dolphin presence in echograms was validated with cetacean observation data following the normalization and generalization of dolphin sounds. C-POD data was used both for validation of cetacean species and characterization of cetacean vocalizations.

With the combination of these methods, distribution of especially one vulnerable (IUCN) Black Sea cetacean, short-beaked common dolphin (*Delphinus delphis* ssp. *ponticus*, Barabash-Nikiforov, 1935) was assessed. Initial results suggest that dolphins are concentrated mainly in Eastern part of the Black Sea. In addition, other two cetaceans inhabiting Black sea, namely bottlenose dolphin and harbour porpoise, were scarcely observed in the study area. The methodology developed proofed that the acoustical data collected for fisheries purpose can be used in cetacean research.

### **S-06: Dead useful? Improving the ecological value of the strandings record as a monitoring tool**

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The ecological value of the stranding record is often challenged due to the complexity in quantifying the bias associated with multiple components of the stranding process. There are biological, physical and social aspects that complicate the interpretation of stranding data at a population level. Here we show how examination of baseline spatial and temporal variability in the historic stranding record can reveal vital clues about the processes that generated those data. Seasonal variability was examined using harbour porpoise strandings between 1991 and 2013 on the east coast of Scotland. GAM modelling revealed a strong seasonal pattern, with numbers increasing from February towards a peak in April. Profiling seasonality in this way facilitated the detection of unusual elevations in stranding frequencies, as demonstrated by a marked increase in magnitude observed in spring 2013. We show how improved understanding of baseline variation assists interpretation of wider ecological metrics such as species composition, age, sex and body condition, cause of death, disease burden and pathology. Finally we show whether the observed seasonality in strandings reflects temporal differences in presence of live porpoises through analysis of data derived from C-PODs, thus aiming to examine the bias associated with the biological component.

There is a perennial need to monitor and detect changes to marine populations, often with increasingly sparse resources and funding. Strandings monitoring offers a relatively low cost option which can yield substantial information about the health and life history of the individual and, by careful inference, the population. We show that improvements in the methodological approach, refinements to sampling strategies and integration of multiple data sources provides methods to quantify and further reduce biases associated with strandings data. This is likely to improve the qualitative and quantitative applicability and ecological significance of stranding data for future monitoring.

### **S-07: Dolphin morbillivirus in Mediterranean fin whales (*Balaenoptera physalus*): An epidemic cluster, or an endemic condition?**

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Main threats for the Mediterranean fin whales' (*Balaenoptera physalus*) population include ship strikes and pollution but, in the last 3 years, dolphin morbillivirus (DMV) has been reported during ongoing epidemics. In September 2013, a 5.4 m long male newborn stranded alive in a port of Isola d'Elba (Tuscany) and died after short time. The animal turned out to be molecularly positive to DMV in several tissues (lungs, lymph nodes and thymus) and immunohistochemistry with an anti-rinderpest virus polyclonal antibody confirmed the diagnosis. Furthermore, necropsy revealed a poor body condition and *Crassicauda* spp. larvae both in intestinal lumen and in pulmonary nodules. These results gave us the opportunity to confirm transplacental DMV transmission also in this species, while detection of the virus in the thymus suggests the likely occurrence of immunotolerance in this whale. In previous years (2011-2013), DMV infection was also reported in three additional young fin whales within the Pelagos Sanctuary, with evidence of disease having been observed in at least one of them. These findings suggest the existence of an epidemic cluster of DMV infection in this fin whales' population, with the likely "adaptation" of the virus to CD150 fin whale's receptor and this should be considered among the main threats for this species within the Mediterranean Sea.



### **S-08: The brain of the sperm whale: A recent account after the 2014 mass stranding in southern Italy**

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The sperm whale has one of the largest brains among odontocetes, both in absolute and relative terms. There are few descriptions available in the literature, with some data on its weight and gross anatomy. The brains of big sized cetaceans like the sperm whale are not easy to obtain, due to the low frequency of strandings of fresh carcasses, and also due to the huge size of the animals that requires a big effort to detach the head and gain access to the occipital bone. Extracting the brain of a sperm whale is difficult also due to the complex shape of the skull that underwent an extreme transformation for the accommodation of the spermaceti organ. We describe here an extraction approach during the necropsy in the field, as well as some data on the gross anatomical features of the brain of this species. We recently had the opportunity to extract the brain from the carcasses of two stranded adult female sperm whales that were in good conditions.

### S-09: Irish cetacean strandings; exploring patterns in a decade of data

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Records of cetaceans stranded on the Irish coast between 2002 and 2013 were analysed to identify any seasonal and annual trends. The data were also used to identify concentrations of strandings that could be considered as strandings hotspots.

Temporal trends of the five most frequently reported species were analysed using two statistical methods; Chi-squared tests were used to quantify significant differences in annual and seasonal stranding events and Generalised Additive Models (GAMs) to identify patterns in the strandings for each of the five species, as a proportion of the total number of strandings. Kernel density maps were used to identify areas of high stranding densities including, live and mass stranding events (MSE).

There was a significant inter-annual pattern in strandings of harbour porpoises, common dolphins, bottlenose dolphins and pilot whales between years, while common dolphins and harbour porpoises also showed significant seasonal differences in strandings events. GAMs identified strong seasonal patterns in the proportion of strandings for common, striped and bottlenose dolphins and pilot whales, the pattern for harbour porpoises, whilst evident, was not as strong. The annual patterns were not strong, although a slight increase in the proportion of stranding records of common dolphins was detected as well as a slight decrease for harbour porpoises and pilot whales.

Areas of high stranding densities were identified for all five species, for live strandings and for MSE’s. Two areas (Mullet Peninsula, Co. Mayo and Dingle Peninsula, Co. Kerry) were elevated for a number of species and can be considered stranding “hotspots”, particularly for live mass strandings of pelagic delphinid species. These temporal and spatial patterns can contribute to management and the development of conservation policies within Ireland and can assist in assessing how to distribute limited resources.

### **S-10: Heard but not seen: sea-scale acoustic survey shows that the Baltic Sea harbour porpoise is not extinct**

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The abundance and spatial distribution of the Baltic harbour porpoise has been estimated by the project SAMBAH (Static Acoustic Monitoring of the Baltic Sea Harbour Porpoise). The main data collection was an acoustic survey where porpoise detectors (C-PODs) were deployed at approximately 300 locations in all EU countries bordering the Baltic Sea during May 2011 – April 2013. The C-PODs were distributed in a randomly positioned systematic grid in waters of 5 – 80 m depth from the Darss and Limhamn underwater ridges in the southeast to the Archipelago Sea in the northeast. Porpoise click trains were identified automatically using an algorithm developed specifically for Baltic conditions. The spatial and temporal distribution of the click trains revealed two main areas during May-December, that is the period that covers calving, mating and most of the lactation period. The areas were roughly separated by a line drawn in NW-SE direction east of Bornholm and may indicate the separation between the Baltic Proper and the Western Baltic-Belt Sea-Kattegat populations. Absolute abundance was estimated by computing the following three variables: (1) the rate of click-positive seconds in the C-POD data, (2) the C-POD detection function, and (3) the proportion of time wild animals carrying acoustic tags echolocate. The C-POD detection function was determined by acoustic tracking of free-ranging porpoises in an area with moored C-PODs, and by playing porpoise-like signals at different distances and during various hydrological conditions to the SAMBAH C-PODs. The SAMBAH results are expected to contribute to improved conservation status of the Baltic harbour porpoise, as estimated seasonal abundances in combination with known spatial distribution opens for dedicated actions in areas where conservation measures will matter. Being the largest ever passive acoustic monitoring study of any animal, the developed methodologies offer new possibilities for assessing population densities using passive acoustics.



### **S-11: Do baleen plates mirror seasonal migrations in fin whales? Results of trace elements analysis**

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Fin whales, like other mysticetes, are highly migratory organisms that undergo annual migrations between high latitude summer feeding grounds and low latitude winter breeding grounds. In the North Atlantic, after decades of heavy exploitation, the fin whale population was divided for management purposes into 7 stocks occupying separate feeding grounds. However, migration patterns, location of the breeding grounds and level of mixing between organisms belonging to these stocks still remain controversial. Baleen plates grow continuously, and being composed of metabolically inert tissue, appear to keep a permanent record of the variations of elements present in the environment that accumulate during the individuals' growth. In this study we investigated the potential for trace elements deposited in baleen plates to track the migration of fin whales feeding off West Iceland in summer. Zn, Cd, Cu, Hg, Pb, Sr and Ti concentrations were analyzed in 30 samples taken along the growth axis of 5 baleen plates sampled from five individuals. Cd concentrations resulted to be below analytical detection limits; Pb (ranging 16-97 ppb) and Ti (1492-1901 ppb) concentrations did not show any pattern with time. Hg concentrations were relatively low (731-1942 ppb), but 3 individuals showed some fluctuation with time. Analogous results were found in Cu and Zn, but at much higher concentrations (10-18 ppm and 303-427 ppm). Finally, Sr concentrations (5-30 ppm) appeared to decrease from distal to proximal layers of the plate. These results highlight a complex behavior of trace elements in baleen plates. Some elements are possibly reflecting the exposure to changing environments during migration while other may not be good tracers of migrations. Besides this, fin whales individual variability was very large probably due to individual-specific biological traits or migratory patterns.

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### **S-12: From the pool to the sea: applicable isotope turnover rates and diet to skin discrimination factors of bottlenose dolphins (*Tursiops truncatus*)**

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One of the most common applications in isotopic ecology is to study animal's assimilated diet through mass-balance mixing models. However, its applicability relies on the use of accurate diet-tissue discrimination factors and turnover rates, which are known to vary as a function of several factors including individual, taxon or tissue type. To date, few studies have assessed isotopic discrimination factors and turnover rates in cetacean species under controlled conditions. Previous experimental studies focused on blood, a difficult tissue to sample in the wild, or on a more appropriate tissue, the skin, but assessed in short experimental trials without arriving to the equilibrium. Here we present the results of the longest controlled feeding experiment available (350 days) in four bottlenose dolphins (one male and three females) to assess discrimination factors and turnover rates in skin. Animals' isotopic composition was first stabilized by maintaining individuals under an isotopically constant diet (90% sprat and 10% herring) during 172 days. Afterwards, diet was shifted to 10% sprat and 90% capelin during 178 days to calculate isotopic discrimination and turnover rates. Isotope turnover rates were quantified by fitting the data using a non-linear procedure NLS in R, whereas isotopic discrimination was expressed as ‰ differences between diet and dolphin skin. Half-life turnover rate was estimated to be  $24.16 \pm 8.19$  days (mean  $\pm$  SD) for  $\delta^{13}\text{C}$  and  $47.63 \pm 19$  days for  $\delta^{15}\text{N}$  while we obtained an isotopic discrimination factor of  $1.01 \pm 0.37$ ‰ for  $\delta^{13}\text{C}$  and  $1.57 \pm 0.52$ ‰ for  $\delta^{15}\text{N}$ . This is the first time that applicable values are available to assess the diet of free ranging small cetaceans through stable isotope mixing model analysis.



### S-13: Cetacean strandings and diet analyses in the north Aegean Sea (Greece)

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Data on cetacean strandings have been collected and stomach content analyses were performed on 26 specimens, which constituted 57% of the specimens stranded and collected during this period in the study area. Results from stomach content analyses of stranded specimens showed that: *Delphinus delphis* fed mainly on species from the Clupeidae and Myctophidae families which composed 45% of stomach content and a few cephalopods, *Tursiops truncatus* fed primarily on *Ophidion barbatum* (snake blenny), *Boops boops* (bogue), Clupeidae and cephalopods, such as squids of the genus *Loligo*. *Stenella coeruleoalba* fed on small pelagic fish, such as *Boops boops* (bogue) and especially on Myctophidae, such as *Ceratoscopelus maderensis* (Madeira lantern fish) and in a smaller proportion on cephalopods. *Phocoena phocoena* fed on fish, with a high preference for species of the Gobidae family followed by Clupeidae. This present work also contributes first data on *P. phocoena* diet in the Mediterranean Sea. *Grampus griseus* fed exclusively of cephalopods, prevalently from the Theutidae family, and the genus *Histiotheutis*. In none of the cetacean stomachs investigated, was there a relevant presence of important commercial species, which reached that value of 7.2% on the total prey. Trophic overlap between the five cetacean species stranded along the North Aegean coast and five types of fisheries in use in the Thracian Sea (trawling, purse seine, static nets, long lines and traps) was investigated and found to be low. Only with *T. truncatus* the overlap reached a value of 35%.

### **S-14: Combining occurrence and abundance models to evaluate the suitability of an existing MPA for dolphins in Kenya**

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Along the East African coastal region, dolphins are particularly vulnerable to anthropogenic threats due to their coastal distribution, small population sizes and limited home range. Identifying the habitat features that determine dolphins' distribution and abundance is a crucial step to evaluate the suitability of the existing Marine Protected Area (MPA) for dolphins, originally designated for the protection of coral reefs. Within this framework, we developed species distribution models (SDM) on the IUCN data deficient Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) in southern Kenya. Based on vessel-based surveys (2006-2009), we predicted the occurrence (using presence/absence data) and abundance (combining number of sightings and group size data) to assess the efficiency of the existing MPA. Through the combination of these prediction maps, we define recurrent, occasional and unfavourable habitats for the species. Firstly, our results showed the influence of dynamic and static predictors on the dolphins' distribution patterns. The predictive models suggest that dolphins may select shallow areas (5-30 m), close to the reefs (< 500 m), oceanic fronts (< 10 km) and the 100 m isobaths (< 5 km). Secondly, we predicted a higher occurrence and abundance of dolphins within the MPA, which covered a large percentage of recurrent areas (44%). However, the existing MPA did not encompass alternatively abundant areas as indicated by occasionally important areas. Within this context, we propose to extend the MPA protection to incorporate all occasional and recurrent areas, critical habitats for the species. The results from this study provide two key conservation and management tools: (i) an integrative habitat modelling approach to predict key marine habitats, and (ii) the first study evaluating the effectiveness for marine mammals of an existing MPA in the Western Indian Ocean.

### **S-15: Using habitat modelling to identify potential hotspots for cetaceans off São Tomé Island (São Tomé and Príncipe): Implications for conservation**

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São Tomé and Príncipe is a small African equatorial archipelago where few marine conservation efforts have been accomplished so far. By-catch, the use of certain fishing methods such as explosives, direct hunting and recent hydrocarbon exploration constitute major threats for cetaceans in this country. Since 2002, a total of 10 species of cetaceans have been recorded off São Tomé Island from 264 boat based surveys. Our aim was to identify ‘hotspots’ for cetacean occurrence in relation to physiographical and oceanographic variables using Maximum Entropy and relate them with anthropogenic pressure. We developed four models using sightings of 10 species that were collected between 2002-2006 and 2012-2014: 1) all species grouped (n = 193); 2) Odontoceti (n = 116); and the most sighted 3) small (*Tursiops truncatus*) (n= 59) and 4) large (*Megaptera novaeangliae*) (n = 77) cetacean species. Hotspots found in common with all four models occurred around Rolas Islet (south of São Tomé) and in the east coast of São Tomé. A hotspot for Odontoceti species was also found in the north coast of São Tomé. Based on the models for species groups, suitable habitats were associated with distance to river mouths, northing seabed aspect and chlorophyll-a concentration. However, at a species level suitable habitat conditions and areas were substantially different. Hotspots identified in the south and the east coast of the island were further supported by the strandings data. There was also an overlap with intense fishing areas where negative interactions seem to occur, given the description of some stranded animals and by-catch records. These negative interactions between humans and cetaceans should be deeper evaluated since it could represent a serious conservation issue. The results presented here show that habitat modelling provides valuable insights for the design and decision making of marine protected areas in the country.

### **S-16: Crossing borders – How can we protect migratory species across the borders of Marine Protected Areas in the North Sea?**

**Inger van den Bosch**, Joost Backx, Aylin Erkman

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The North Sea is one of the busiest seas in the world. Here, many potentially hazardous anthropogenic activities, such as fisheries, shipping, oil and gas platforms and wind farms are either adjacent to or overlapping with marine protected areas. These marine protected areas play an important role in the conservation of many species of benthic organisms, fish, birds and marine mammals.

The upcoming years, conservation measures will be proposed under various regional and EU environmental legislations and agreements (Habitat and Birds Directive and Marine Strategy Framework Directive, OSPAR, Convention on Biological Diversity) for the Dutch marine protected areas, the Dogger Bank, the Cleaver Bank and the Frisian Front. Additionally, for the Central Oyster Grounds and the Brown Bank benthos will be protected under the Marine Strategy Framework Directive. In the entire Dutch Exclusive Economic Zone, species specific protection status is regulated under a national law, the Flora and Fauna Act. This act implements the protective regulations from the Habitat and Birds Directive. Some years ago, a conservation plan for the harbour porpoise (*Phocoena phocoena*) in the Netherlands was composed.

In this presentation the theoretical framework of an ecologically coherent marine protected area network will be introduced and evaluated based on a case study involving the harbour porpoise (*Phocoena phocoena*). In this case study the life cycle of the harbour porpoise will be evaluated against the effectiveness of legislation for the protection of this species and the proposed measures from the conservation plan. The ecological requirements from a harbour porpoise perspective will be evaluated against the current marine protected area coverage and the species protective regulations from the Flora and Fauna Act.

Based on these results, recommendations on national and international marine protected area coherence will be proposed.

### **S-17: Development of a bioeconomic model of grey seal impacts on West of Scotland fisheries**

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Around UK, the 20th century has been marked by a change in fish stocks resulting in the depletion of high value commercial fish such as the Atlantic cod. Meanwhile, scientists have noticed an increase in grey seal population. This situation has created a controversy between fishermen and conservationists as regards to the role that grey seals may have played in the stock depletion. Currently, opinions are still divided, and further studies need to be done to mitigate these conflicts.

We developed a bioeconomic model able to quantify the economic impact of grey seal predation on West of Scotland fisheries for cod, haddock and whiting. The biological model accounts for seal predation and fishermen catches and is linked to an economic model accounting for fisheries revenues and costs. The model includes a multifleet component which enables us to be as close as possible to the current organization of the West of Scotland fisheries.

Three bioeconomic models are tested. The baseline model assesses seal predation impacts on fishermen's revenues. Two dynamic models are also considered to determine the impact on fleet revenues and behaviour: the closed fishery model with a constraint on fleet capacity, and an open-access model where fishermen can enter and exit the fishery freely.

The baseline model shows that drastic changes in seal population can induce huge changes in fleet revenues. However, the model also highlights the lack of seal predation impacts for realistic change in seal population. The whitefish fleets are the most impacted by seal predation. The dynamic models predict the collapse of cod in the long term regardless of the number of seals present. Furthermore, reducing the initial fishing effort does not prevent cod collapse in the long term. In conclusion, the bioeconomic models show little evidence of seal impacts on the West of Scotland fisheries.

### **S-18: Fisheries-cetacean competition: Lessons learned and its implications for conservation and ecosystem management in the Mediterranean**

**Dunja Jusufovski, Anna Kuparinen**

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The competition between fisheries and top predators, such as cetaceans, is intensifying with the decreasing fish stock abundances. This controversial topic has been fiercely debated among various stakeholders and presents a complex challenge worldwide. Ensuring maximum sustainable yields in fisheries and conservation of ecosystem biodiversity and functionality are already challenging enough. Nevertheless, the management of marine ecosystems is additionally burdened by insufficient or unreliable data, inapplicable and/or unfeasible models, lack of law enforcement and opposing stakeholders' interests. Therefore, to address this complexity, we explore the effects of fisheries-cetacean interactions on the objectives and practices in fisheries management and how do conservation measures, with a separate focus on marine mammals and fish stocks, reflect on the predator and the prey. For that purpose, we highlight the state of European hake (*Merluccius merluccius*) fisheries and common bottlenose dolphins (*Tursiops truncatus*) in the Mediterranean Sea, as species of great conservation concern. We synthesize the knowledge in terms of: 1) the resource overlap and uptake of hake by fisheries and by the bottlenose dolphins, respectively, 2) the involvement and interest of various stakeholders in this case of fisheries-cetacean competition and 3) current conservation measures encompassing this study system. Through our synthesis, we comment on the current knowledge of the study system with regards to other similar study systems. Conclusively, we discuss the implications of fisheries-cetacean interaction for current and future conservation priorities and its feasibility as well as sustainability for harvesting of hake in the Mediterranean.



### **S-19: Female mate choice by dusky dolphins (*Lagenorhynchus obscurus*) during mating chases**

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Female tactics for controlling paternity have received little attention compared to male tactics. A female's role in mate choice largely depends on associated costs. When females can be monopolized and males direct aggression towards evasive females, females are predicted to develop passive roles in mate choice. In the context of exploitative scramble competition, where females cannot be monopolized and males compete for a proximate position near a female during her ovulation, we predict that females have the potential to exercise active mate choice. Among dusky dolphin (*Lagenorhynchus obscurus*) mating subgroups off Kaikoura, New Zealand, four adult males typically chase one sexually mature female in exploitative scramble competition. We used first-order Markov chain analyses to test if females exhibit discriminatory behaviours among pursuing males. Boat-based focal group follows were conducted off Kaikoura during the peak breeding season (October 2013 - January 2014). The behaviours of dolphin mating subgroups near the surface were video-recorded and transcribed. The two most recurrent male behaviours [Inverted Swim ( $n = 139$ ), and Push-Female-to-Surface ( $n = 393$ )] and four most recurrent female behaviours [Body Roll ( $n = 93$ ), Tail Slap ( $n = 300$ ), Re-orientation Leap ( $n = 32$ ), and Direction Change ( $n = 107$ )] were included in the analysis. Female behavioural responses immediately following male behaviours were tallied. Females responded to male behaviours differently than expected by chance ( $G^2 = 242.09$ ,  $df = 3$ ,  $n = 532$ ,  $p = 0.001$ ). Body Rolls ( $z = 8.19$ ) and Re-orientation leaps ( $z = 9.51$ ) were more likely following Inverted Swims. Tail Slaps were more likely ( $z = 8.46$ ) following Push-Female-to-Surface. Females demonstrated behavioural manoeuvres that could be indicators of mate choice or ovulatory state. The low monopolization potential of females and resulting evasive behavioural manoeuvres may be due to large aggregations of dolphins in the Kaikoura region and spatio-temporal separation of behavioural states.

### **S-20: Photo-identification study of bottlenose dolphins off south-west England 2007-2014**

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In England the bottlenose dolphin is identified as a priority species for conservation action under the NERC Act. In order to assess progress in conserving bottlenose dolphins, there is a need for up-to-date information on distribution and abundance. In coastal English waters of the western English Channel a small and declining population of bottlenose dolphins is considered to be resident, but up-to-date information on status is lacking. Supported by Natural England, a partnership project was formulated in 2013, to produce a single photo-identification catalogue for the inshore and offshore waters off south west England. This brings together available photo-identification images and data on bottlenose dolphins collected since the mid-2000s by MARINELife, Marine Discovery and AK Wildlife Cruises.

A catalogue comprising 485 photographic sightings of 113 individual animals and accompanying data was compiled to describe distribution, population structure and abundance. In total, ~85 animals were estimated to have occurred within Cornish, Devon and Dorset (inshore/coastal) waters of the western English Channel between 2007 and 2013, including ~58 in 2013, indicating regional and possibly national importance in conservation terms. This report also suggests there are three sub-populations in the western English Channel demarcated by bathymetry and distance to land: (1) inshore Cornwall to Devon, (2) offshore English/French waters and (3) inshore France from Brittany to Normandy. Given this separation, the inshore English waters should be considered as a separate management unit requiring targeted conservation effort.

There is now a need to continue to build evidence on the distinctions between the populations, the restricted distribution, to more accurately estimate population size of inshore south-west England waters and to monitor changing status.

### **S-21: Small cetacean monitoring from surface and underwater autonomous vehicles**

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We present results of passive acoustic surveys conducted from three types of autonomous marine vehicles; two submarine gliders and a surface wave powered vehicle. Submarine vehicles have the advantage of operating at depth, which has the potential to increase detection rate for some species. However, surface vehicles equipped with solar panels have the capacity to carry a greater payload and currently allow for more on-board processing, which is of particular importance for odontocete species that produce high frequency sounds. Surface vehicles are also more suited to operation in shallow or coastal waters. We describe the hardware and software packages developed for each vehicle type and give examples of the types of data retrieved, both through real time telemetry and post deployment processing. High frequency echolocation clicks and whistles have been successfully detected from all vehicles. Noise levels varied considerably between vehicle types, though all were subject to a degree of mechanical noise from the vehicle itself.

### **S-22: Localization of cetaceans and anthropogenic sources: a didactic pattern recognition framework using neural networks**

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Methods for the localization of cetaceans are many and vary in complexity, efficiency, and accuracy or computation time. A computationally efficient way to solve the localization of cetaceans is to view it as a pattern recognition problem.

This is one of the directions that have been explored at the Laboratory of Applied Bioacoustics (LAB) over the past few years. Such an approach unifies in a clear way methods based on TDOAs and supposedly more complex space-time methods (e.g. beamforming) that have been developed along the years. The pattern recognition approach furthermore has a number of advantages: 1) it connects more tightly the tasks and tools for detection, classification and localization, 2) it applies the latest developments in machine learning and artificial intelligence to the field of cetacean localization, 3) it reaches a competitive accuracy, simplifies online computation and reduces drastically the computation time for real-time passive monitoring.

This presentation will show in a didactic way (e.g. a memory card game) and with concrete maps how the pattern recognition approach works and how it applies to the localization and tracking of various species (sperm whales, fin whales, blue whales) from deep sea observatories around the globe included in the LIDO\* framework.

\* Listening to the Deep Ocean Environment: <http://www.listentothedeep.com>

### **S-23: Towards underwater noise mitigation in Spanish waters: Developing MMO/PAM procedures and mitigation guidelines for marine mammals**

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The impact of noise on marine mammals is widely proven around the world. Underwater noise is considered a major contaminant by national, EU and international legislation. The Spanish Ministry of Agriculture, Food and the Environment (MAGRAMA) has the mandate to regulate and control activities that have the potential to harm the marine environment in EEZ waters. An important cause of underwater noise is oil and gas exploration and exploitation. This industry has considerably increased their activity in the last 5 years in Spanish EEZ. At present day (October 2014) there are 9 current concessions for exploitation, 20 offshore geophysical survey permits granted and 14 requested. Moreover, both national and foreign scientific geophysical surveys are occurring on a regular basis. At least 27 cetacean species are listed in Spanish EEZ, all included in the National Catalogue of Threatened Species. The Spanish marine Natura 2000 network counts with 26 Special Areas of Conservation (SACs). Under this scenario, MAGRAMA was in need of specific guidelines and procedural definitions to minimize the impact of underwater noise on marine fauna. In February 2010 MAGRAMA formed a national expert panel on underwater noise, which in 2012 published a national reference document on the "Impacts and mitigation of underwater noise". Within this framework, our team proposed the guidelines for minimizing acoustic impact to marine mammals during offshore geophysical surveys. Further on, our team assisted in organizing the first Marine Mammal Observer and Passive Acoustic Monitoring national course in 2014. As a result, Spain has leaped forward on the regulation of underwater noise mitigation, becoming one of the leading EU countries and one of the first Mediterranean countries to propose specific guidelines on underwater noise mitigation. This presentation aims to summarize the development of these guidelines and procedures and describe currently proposed mitigation protocols in the Spanish EEZ.

### S-24: Fish farm specialists: bottlenose dolphins in the Southern Evoikos Gulf, Greece

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Finfish farms (FF) are known to aggregate wild fish, primarily because of large quantities of uneaten food lost from the cages. Complex substrate, increased nutrient levels and provision of fish-feed produce trophic enrichment and can attract dolphin prey. Common bottlenose dolphins *Tursiops truncatus* were observed foraging in the proximity of FF in several Mediterranean areas, including in the coastal waters of Greece. For instance, FF were the main factor influencing dolphin distribution in the Northern Evoikos Gulf. In October 2014 we conducted boat surveys totalling 771 km throughout the semi-enclosed Southern Evoikos Gulf (surface area 465 km<sup>2</sup>). Additionally, we interviewed 52 fishers operating trammel and gill nets. Photo-identification suggests that a small number of bottlenose dolphins inhabited the Gulf. Of 14 individuals identified based on 1031 digital photographs, 13 were consistently found near FF cages. We tracked dolphin movements for 13 h 50 min. Dolphins spent 7 h 09 min (52% of total time) within 500 m of any of the 15 FF present in the Gulf, and 8 h 44 min (63%) within 1 km. In one case, 8 dolphins circled around a single FF cage for 1 h 48 min. While there is no evidence that dolphins depredate or damage FF, depredation of trammel and gill nets was reported by 85% of fishers interviewed during this study. Some fishers spontaneously stated that dolphins are "always" found near FF or lamented that FF "attract" dolphins (23% of respondents). This preliminary study contributes further evidence that bottlenose dolphins in the coastal waters of Greece routinely forage in the proximity of FF, wild fish attracted by FF possibly having become the dolphins' primary prey source. Depredation of trammel and gill nets, a different foraging type, may be increased due to dolphins being attracted to the general area by FF.

### **S-25: Return rates of harbour porpoise after pile driving for the offshore wind farm DanTysk**

**Armin Rose** (1), Jakob Tougaard (2), Jacob Nabe-Nielsen (2), Ansgar Diederichs (1), Vladislav Kosarev (1), Thilo Liesenjohann (1), Georg Nehls (1)

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The study presents short-term return rates of harbour porpoise (*Phocoena phocoena*) after pile driving for foundations of the offshore wind farm DanTysk. This wind farm was built in 2013 about 70 km offshore in the German North Sea west of the SCI ‘Sylt Outer Reef’ at water depths of around 30 m. Monopile foundations for 80 turbines were driven into the sea floor with hydraulic hammers. Porpoise activity was recorded by acoustic porpoise detectors (C-PODs) at 14 monitoring stations positioned between 1.4 km and 37.5 km distance to turbine foundations for a period of at least one year, and by mobile C-PODs placed relative to pile driving locations (750 m, 1500 m) over periods of a few days. The dataset was most consistent when including pilings solely under noise mitigation by a single Big Bubble Curtain. At short distances of up to 5 km from pile driving, harbour porpoise detection rates (*DPM h-1*) were significantly increased from 4-12 hours until at least 24 hours after piling, when compared to a control period of 4-10 hours before pile driving uninfluenced by previous piling events for at least 24 hours. This pattern was not found at distances above 5 km. Increased food availability – ground-living fish might be driven out of the sediment by piling – or other factors might have played a role here.

### **S-26: The short-term responses of sperm whales (*Physeter macrocephalus*) to the attachment of suction-cup tags**

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Animal-mounted data logging devices are commonly used to study the behaviour, physiology and ecology of free-ranging marine mammals, in addition to their fine-scale responses to controlled stimuli. However, it is important to consider whether the data collected are representative of natural behaviour, or biased by a reaction to the instrumentation attachment. Data from 31 suction-cup DTAG deployments on sperm whales (*Physeter macrocephalus*) were analysed to consider whether any tagging effect was evident within dive parameters. Statistical models were created for each of five response parameters. Covariates for dive index were added to assess whether model fit improved when the order of dives was taken into account. The models indicated that, subsequent to tagging, the first and second dives of a sperm whale were significantly shorter than average by 111 seconds and 26 seconds, respectively. Geometric models provided the best fit for parameters regarding maximum dive depth and the number of buzzes per minute suggesting that the effect of tagging decayed over time. Descent speed and the depth difference between the first regular click and first buzz (the initial prey search time) were not significantly affected by tagging. Shortened dive durations and reduced buzz rate indicate a potential energetic cost to tagging due to lost foraging opportunities. The DTAG has a frontal cross-sectional area < 3% of that of a sperm whale, so is unlikely to add much to the transport cost of an animal. The decaying nature of the effect suggests that animals may have been responding to the cumulative research exposure associated with tag attachment rather than carrying the tag per se. The method developed here could be readily applied to other deep-diving marine mammals to better understand the impacts of tagging.



### S-27: Killer whale killers – a review of US court cases on captive orcas

**ECM Parsons**

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In February 2010, a SeaWorld trainer was killed by a killer whale (*Orcinus orca*). The orca in question (Tilikum) had been involved in three of the four human deaths caused by captive killer whales. A second trainer had been killed two months earlier at the Loro Parque oceanarium (Canary Islands) by a SeaWorld orca on loan to the facility. As a result of the former incident, the US Occupational Safety and Health Administration (OSHA) cited SeaWorld in August 2010 for a wilful violation of the US Occupational Safety and Health Act, which SeaWorld tried appeal, albeit unsuccessfully. In addition to trainer deaths, approximately 100 incidents of aggressive behaviour (including those that led to injuries) by killer whales directed toward trainers were reported in court. In addition, the controversy over holding killer whales in captivity led the US Congress Subcommittee on Insular Affairs, Oceans and Wildlife to hold a Marine Mammal Protection Act oversight hearing in 2010, to address the educational value (or lack thereof) of holding killer whales in captivity. The controversy has led to a popular non-fiction book, *Death at SeaWorld*, and a documentary, *Blackfish*, both of which greatly increased public attention towards captive orca welfare and trainer safety. *Blackfish* in particular spawned a substantial social media response. Because of the controversy, the 20th Biennial Conference on the Biology of Marine Mammals hosted a panel discussion on the welfare of captive killer whales in 2013. In 2014, Bill AB 2140 was introduced in California. This Bill would have phased out captive killer whales in the State. A study on the impacts of the Bill was commissioned and it will be revisited mid-2015. Clearly public concern regarding this issue has increased in the past five years and policy-makers may need to reconsider the status quo in light of it.

### S-28: Introducing the World Cetacean Alliance

**Clare Mifsud** (1), Joana Castro (2), Dylan Walker (3), Adriana Vella (1), Joseph Vella (1)

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The World Cetacean Alliance (WCA) is a new global Partnership of scientists, non-profit organisations, whale watching tour operators and the general public, all working together to protect whales, dolphins and porpoises (cetaceans). This short presentation will highlight ways in which science is already playing a key role in the work of the WCA and will describe our need for further collaboration with current research projects in order to achieve practical conservation action where it is most needed. The World Cetacean Alliance connects its Partners both nationally and internationally. This local-to-global approach enables the Partnership to deliver coordinated and practical strategies on the ground whilst representing the views of its Partners on the international stage. Through cooperation, the Partners of the World Cetacean Alliance aim to conserve and protect cetaceans and their habitats in the world's oceans, seas and rivers, to ensure their continued health and survival. The WCA believes that local communities hold the key to protecting cetaceans and their habitats, supported by grass-roots organisations, knowledgeable individuals, and ecotourism experts (our Partners).

# POSTER ABSTRACTS

### **ABU-01: Abundance and distribution of cetaceans in waters of northern Sardinia (Italy)**

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The waters of northern Sardinia are located in the Pelagos Sanctuary for Mediterranean Marine Mammals, a special marine protected area extending about 90,000 km<sup>2</sup> in the north-western Mediterranean Sea between Italy, France and the Principate of Monaco. The greater part of the coastal area bordering northern Sardinia is heavily populated and disseminated with large and medium-sized coastal cities, ports of major fishery importance and industrial areas. Furthermore, the entire Sardinian coastal zone contains important tourist destinations, thereby subject to considerable added human pressure during the summer months. As a consequence, a range of diverse human activities exerts several actual and potential threats to cetacean populations in the Sanctuary. In addition, marine mammals are recognized by the EU Marine Strategy Framework Directive as an essential component of sustainable ecosystems and their ecological importance must be kept in mind. In spite of that, the cetacean available information regarding their ecology in these waters is quite scarce, and hence the proposed study can help to fill this gap. Indeed, here we modelled density and habitat use of the three most abundant species, striped dolphin (*Stenella coeruleoalba*), bottlenose dolphin (*Tursiops truncatus*) and fin whales (*Balaenoptera physalus*) using sighting data collected from 2012 to 2014 with seasonal surveys. Bayesian hierarchical spatial models were used to model the distribution of these species in relation to oceanographic (sea surface temperature, salinity, chlorophyll-a concentration) and topographic (depth, slope, type of seabed) variables. Predicted habitat maps were created for each species using Bayesian Kriging. Cetaceans responded to the heterogeneity in habitat quality, with higher densities predicted in more productive areas. However, Delphinidae appeared to be more dependent on habitat quality than fin whales. These results provide valuable biological information useful to develop conservation plans and establish baseline for future population trend studies.

### **ABU-02: Estimating the abundance of bottlenose dolphins (*Tursiops truncatus*) on the west coast of Ireland using Bayesian inference in multi-site mark recapture**

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Past research effort on bottlenose dolphins in Ireland has largely concentrated on a resident population occupying the Shannon Estuary, but less is known about another coastal population using multiple sites throughout the Irish west coast. In this study, mark-recapture methods were applied to Bayesian inference and hierarchical log-linear likelihood to derive a multi-site abundance estimate of coastal bottlenose dolphins for the wider Connemara-Mayo-Donegal area in 2013. The Bayesian multi-site method was chosen over a traditional frequentist maximum likelihood due to its ability to address problems caused by wide-ranging and heterogeneous movement patterns of the animals. Well-marked individuals ( $n = 87$ ) photographed during dedicated boat-based surveys at different sites were identified from high-quality photographs taken between May and August 2013 and included in the analysis. A contingency table was created of the well-marked dolphins based on their presence/absence in each of these discrete study sites. The final model incorporated the proportion of well-marked individuals as a binomial sample of the total number of animals seen (well-marked plus unmarked) to predict the total number of individuals in the combined study area. The model-averaged median estimate for the abundance of well-marked and unmarked dolphins in the whole study area in 2013 was 192 (95% CI = 145-294). The fact that the discovery curve did not reach an asymptote indicates that further survey effort is likely required to improve our sampling of this population. Given that the recent candidate SAC designation for bottlenose dolphins covers a substantial area of the west coast of Ireland, this approach and methodology is appropriate and robust for monitoring purposes. It is well-suited for sparse recapture data collected opportunistically at multiple sites when systematic line-transect surveys are often unfeasible due to changeable weather conditions and unpredictable occurrence of the animals.

### **ABU-03: A three year study of humpback whale (*Megaptera novaeangliae*) occurrence in Faial-Pico islands of the Azores and its relation to satellite-derived surface biophysical products**

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Several international studies have been linking the distribution of cetaceans to basic environmental and remote sensing data, yet, in the Azores region these are still very scarce or even non-existent for some species. In this study, data on the distribution of humpback whales (*Megaptera novaeangliae*) in the waters around Faial and Pico islands (Azores archipelago) were collected during three years (2012 to 2014) for the months of March to October. During this period of time, we recorded 60 encounters with this species, being six in 2012, two in 2013 and 52 in 2014. Recordings were made during whale watching trips from two whale watching companies in those islands. In an attempt to understand better the different yearly occurrences, we used MODIS/AQUA-derived Sea Surface Temperature (SST) and Ocean Colour (chlorophyll a) to calculate monthly and yearly anomalies for the region of study and for the same period of time. Results suggest that temperature is not the main factor affecting humpback whale occurrences in the region but near-surface chlorophyll a (as a proxy for phytoplankton biomass) may be. In fact spring bloom in 2012 occurred in February, while in the next year it occurred in March and the following year in April. Monthly average concentrations in chlorophyll a increased almost three-fold from the spring bloom of 2012 to 2014. Although temperature anomalies for the three years of study did not change significantly nevertheless during winter/spring 2012 waters were on average 1 °C more than in spring 2014. These results suggest the importance of relating spatial and temporal cetacean variability and distribution patterns with underlying physical/biological forcing mechanisms for a better identification of important areas of cetacean concentration and to ensure better management strategies of these habitats.

### **ABU-04: Population dynamics of sperm whales (*Physeter macrocephalus*) in Guadeloupe (eastern Caribbean): A mark recapture study from 2001 to 2013**

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The eastern Caribbean population of sperm whales seems to have little connection to other studied populations around the Caribbean, such as those of the Sargasso Sea and Gulf of Mexico. Therefore, robust ecological and demographic information is needed to understand the dynamics of the eastern Caribbean sperm whale population, to assess its conservation status and to assist implementing conservation plans if necessary.

Volcanic islands of the eastern Caribbean have narrow submarine shelves, and sperm whales can be encountered quite close to land in family groups of mature females including juveniles and newborns. Photo-identification data were collected since 1998 in the west coast of Guadeloupe and neighboring islands, with the aim of monitoring the sperm whale population. Data highlights a long-term degree of association between individuals and fidelity, with resightings of groups of individuals within and between years. Animals observed in the study area crossed national boundaries, with resightings in the lee of the islands of Dominica and Martinique, demonstrating temporary emigration from our study area.

Using a dataset of 1,563 photo-identifications, we estimated apparent adult annual survival and population size with a robust design capture-mark-recapture model. This model allowed taking into account imperfect detectability of individuals and temporary emigration from the study area. Model selection suggested a constant capture probability ( $0.101 \pm 0.114$ ) and a time varying recapture probability, which on average was  $0.173 \pm 0.025$ . The annual probability for an individual to emigrate temporarily from the study area was  $0.107 \pm 0.043$  and the annual probability to stay away from the study area was  $0.839 \pm 0.148$ . The proportion of transients was high (mean  $0.444 \pm 0.122$ ) and the survival of resident individuals was  $0.968 \pm 0.039$ . The population was stable during the period 2001-2013 ( $\lambda = 0.996 \pm 0.018$ ) at about  $59 \pm 18$  individuals.

### **ABU-05: Monitoring changes in cetacean communities in western Scotland: analysis of twelve years of low cost volunteer-based vessel surveys**

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Long-term monitoring of cetaceans remains a conservation priority towards developing more informed management measures for their protection. Using its dedicated research vessel *Silurian*, The Hebridean Whale and Dolphin Trust has been monitoring cetaceans using visual and acoustic line-transect surveys off the west coast of Scotland since 2003. Mean annual survey effort in Beaufort Sea state < 4 was 6113 km (range 3104 – 8187 km) between 2003 and 2014. Apparent trends in the relative encounter rate (sightings per km of survey effort) of the seven most commonly recorded species (harbour porpoise, minke whale, common dolphin, white-beaked dolphin, bottlenose dolphin, Risso's dolphin and killer whale respectively) are presented over a 12 year period. Harbour porpoise was the most frequently encountered species (n = 3319 sightings) followed by minke whale (n = 451) and common dolphin (n = 238). When pooled over the entire study area (The Hebridean Islands and contiguous waters), the relative encounter rate of common dolphins showed a marked increase ( $R^2 = 0.68$ ,  $P < 0.01$ ), while mean group size ( $22 \pm 47$  SD) remained constant. Most species showed substantial annual variation, but porpoise encounter rates were consistently high, highlighting the importance of the area for this conservation priority species.



### **ABU-06: Optimizing abundance estimates of striped dolphins in the Gulf of Corinth, Greece**

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The monitoring of cetacean abundance is often challenged by insufficient funding and/or effort. Large sample sizes are required to obtain reliable estimates via Capture Mark Recapture (CMR) models. Dataset simulations and power analysis can be used to assess 1) minimum sample size to achieve reliable estimates within one sampling season, and 2) the number of repeated estimates required to detect abundance trends. We used photo-identification data from June-September 2012 (11,167 photos) to estimate abundance of striped dolphins, *Stenella coeruleoalba*, in the Gulf of Corinth, Greece, using CMR models. To evaluate minimum sample size needed within one sampling season, we used dataset simulations in program MARK and compared accuracy and precision obtained with increasing sample sizes. We then used Gerrodette's inequality model to perform a power analysis and compare the smallest annual percent declines detectable by monitoring plans based on 1) one estimate per year, 2) one estimate every two years, and 3) one estimate every five years. The effect of different levels of precision of the estimates (CV = 0.01-0.04) was also investigated. Population abundance was estimated at 1,309 (SE = 62.45; CV = 0.05, 95% CI 1,192–1,437) for open models and at 1,293 (SE = 53.66; CV = 0.04, 95% CI 1,192–1,403) for closed models. These estimates are substantially larger than those obtained in 2009, and need validation. To obtain reasonably accurate estimates within one sampling season, simulations indicated a minimum sample size of 8 capture occasions, with minimum capture probabilities of 0.5 for closed models and 0.7 for open models. Furthermore, a power analysis indicated that annual declines between 5% and 12.5% could be detected by monitoring plans providing one estimate every two years. High levels of precision are required (CV = 0.01 to detect a 5% annual decline). This information is being used to set monitoring goals to optimize project design and available resources.

### **ABU-08: iTAG – An open source software facilitating the analysis of count data from still images**

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Using aerial still images is a common method when assessing animal abundances over large areas. Such surveys opportunistically take images at various angles and different altitudes and, contrary to orthorectified imagery, are hard to analyse using identification algorithms. The extraction of information is usually a tedious process that involves browsing all images, taking manual notes of the number of animals/objects counted within each picture and then processing the dataset. In order to streamline this workflow into an easy to use application, we have developed the open source software ‘iTag’.

Within iTag, users are able to load a series of images into a session and add tags on objects on these images within the previously defined categories and modifiers. For this purpose, up to 9 different categories can be defined and 4 modifiers are available to further increase the options during a tagging session. Option files can be stored to accommodate for various survey setups. Upon ending the session, the results are stored in spreadsheet files, including metadata as provided by the EXIF data for each picture. In addition, all images that were tagged are stored and all output is written into a folder named after the user created below the image directory.

A considerable number of researchers are already using iTag in scenarios that are far beyond the original scope of the software (e.g. monitoring of debris along beach sections). iTag is also on the list of recommended software compiled by the ‘Centre of Biodiversity and sustainable Land Use’, University of Göttingen ([http://www.tropical-studies.uni-goettingen.de/wiki/index.php/Main\\_Page](http://www.tropical-studies.uni-goettingen.de/wiki/index.php/Main_Page)).

We thus present a total package for all scientists that have to deal with manual object identification from still images that features archiving and quality assurance tools and increases the efficiency of the data processing step.

iTag is available for free at: <http://sourceforge.net/projects/itagbiology/>



### **ABU-09: First census in the channel between Canary Islands and Morocco: evidence of a new important cetacean habitat**

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The Canary Islands are a privileged location for the study, observation and conservation of cetaceans at a European and international level, particularly the eastern islands of Lanzarote and Fuerteventura which are characterized by a great abundance and diversity of cetaceans. Here, it can be found cold-temperate species typical of deep waters, co-existing with coastal species typical of both temperate and warm water, for a total of 28 species recorded.

In October 2014, a 10-day research survey has conducted the first census of cetaceans, turtles and birds, in the channel between Canary Islands and Morocco, covering an area of 262,832 hectares around the three priority points agreed for oil exploration. The surveys were designed and performed using distance sampling methodology, with a total of 550 Nm and 75 h conducted on searching effort in the study area. A total of 44 cetacean sightings were recorded. Nine different species of cetaceans were recorded including 3 species of Couvier's, Blainville and Gervais's beaked whales, short-finned pilot whales, striped dolphins, spotted dolphins and bottlenose dolphins, Bryde's whales and sperm whales. Photo-identification analysis showed the recapture of 11 pilot whales previously sighted in 2011 in the coastal waters of Lanzarote.

This area, together with the neighbouring islands of Lanzarote and Fuerteventura can be considered a cetacean hotspot of undoubted biological and ecological interest for the conservation of cetacean species, representing a unique habitat for their geographical location, proximity to neighbouring African coast, depth and special oceanographic conditions that increase primary productivity.



### **ACO-02: Preliminary results on the detection and tracking of fin whales using data from seismic exploration in the Gulf of California**

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The endangered fin whale (*Balaenoptera physalus*) commonly produces low-frequency and high-intensity sounds that extend across 20 Hz, named “20 Hz pulses”. The calls emitted by this species can occur in a variety of patterns that change in different seasons and geographic areas. The frequency bandwidth associated with seismic exploration (using airgun instruments) overlaps with these biological communication signals. The data analyzed in this work came from a geophysics project conducted in the Gulf of California in October 2002. In several locations across the Gulf, a series of Ocean Bottom Seismometers (OBS) were deployed on the seafloor. This study focused on 60 OBS deployed in Guaymas Basin. The instruments used had two data channels, a hydrophone and a vertical geophone, recording at 125 samples per second. This array continuously recorded data over a period of ~11 days, during which airgun surveys were conducted over 6 days during daylight hours only. A substantial acoustic dataset was produced and abundant vocalizations of numerous fin whales were recorded. The OBS were spaced ~12 km apart from each other, allowing the individual localization and tracking of whales. Specific algorithms were developed to automatically detect whale calls and to use these calls to track the whales’ direction of movement. For each whale, the Inter Call Interval (ICI) was highly stable and this facilitated the identification of specific individuals. Individual whale calls were identifiable on multiple instruments, enabling tracking by means of arrival time differences. In this preliminary study, some whales were tracked during the first day of the survey, before and after airgun shooting. Applying this analysis to more of the data could provide insights into the responses of fin whales to seismic exploration.

### ACO-03: Acoustic discrimination between clicks train of *Tursiops truncatus* and *Delphinus delphis* in the Mediterranean Sea

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The discrimination between wild dolphins through acoustic emissions is a critical issue for passive acoustic monitoring. The aim of present work is the comparison of clicks emitted in train by two Mediterranean species of Delphinidae: *Tursiops truncatus* and *Delphinus delphis*. Acoustic data were recorded in the area comprised from Capo Feto (Lat. 37°39.57' N, Long. 85 12°31.06' E) to Capo San Marco (Lat. 37°29.25 N, Long. 13°0.9' E) (Sicily, Italy) during 7 sightings (respectively 5 of bottlenose dolphins and 2 of common dolphins) during the summer 2012. The acoustic data were acquired at 300 kHz sampling rate using a calibrated hydrophone (B&K 8104) and a digital acquisition card (Avisoft Bioacoustics USGH416HB). In total, we analyzed 1,019 clicks from 262 minutes of recording. Using a MATLAB code we measured the following acoustic parameters for each click: duration (s), 1°, 2° and 3° peak of frequency (kHz), centroid frequency (kHz), 3 dB bandwidth (kHz), 10°, 25°, 75° and 90° percentile of power spectrum density (kHz). The Mann-Whitney U Test was carried out to compare the two species for each parameters. The discriminant function analysis (DFA) was performed in order to evaluate if the two species are distinguishable and which of parameters are more important for their discrimination. All measured parameters are significantly different ( $p < 0.01$ ) between the species excepted for the 3° peak of frequency. In particular, *Delphinus delphis* produce clicks with longer duration and lower frequency values than *Tursiops truncatus*. The DFA ( $\lambda = 0.882$ ,  $p < 0.01$ ) correctly attributed 64% of cross-validated cases (65.6% for bottlenose dolphin and 62.9% for common dolphin) using 90° percentile of power spectrum density and centroid frequency parameters. The results of this study show that these species emit clicks characterized by distinctive features that can be used for species classification during passive acoustic monitoring.

### **ACO-04: Passive acoustic monitoring of cetaceans: a critical approach for collecting and analysing data**

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The interest in passive acoustic monitoring (PAM) techniques has increased dramatically in cetacean research during last decade. Nowadays potential applications do not include only ecology projects (abundance, seasonality, foraging ecology) but also the risk assessment of human activities (wind farm construction, seismic survey). Therefore, the current knowledge of fixed and mobile PAM loggers is reviewed to assess pros and cons in applications of cetacean research. Noticeably, the choice of data logger and analysis depends not only on the species in question and its habitat, but also on the relevant research question. Such information is crucial when choosing a PAM technique for certain study. A review of algorithms currently used to detect vocalizations is synthesised from published literature. Improving the knowledge of PAM techniques can lead to the collection of higher quality data on the biology and conservation of cetaceans.

### ACO-05: Sperm whale (*Physeter macrocephalus*) social units and vocal clans in Mauritius

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The sperm whale (*Physeter macrocephalus*) as a species has a global distribution, but only the adult males venture out to high latitudes. Adult females and juveniles remain in tropical to temperate waters, where they live in small, long-term social units. Multiple social units can temporarily form larger groups. Whales within social units communicate by means of codas; short, stereotyped click sequences. Each social unit has its own specific coda repertoire and units with similar repertoires are said to belong to the same vocal clan. Different vocal clans can occur sympatrically and span vast ocean areas. The aims of the present study were (A) to identify different social units among the sperm whales of Mauritius in the western Indian Ocean, and (B) to describe and compare their coda repertoires to investigate the presence of different vocal clans. Six boat-based surveys using a towed hydrophone were conducted off the Mauritian coast in the period 2008-2013. During each sperm whale encounter, fluke pictures were taken to establish a photo-ID catalogue and coda vocalizations were recorded. Of the ~100 different whales identified, a group of ~20 whales is residential to the west of Mauritius and thought to consist of at least two social units. Possible sub-structuring of other encountered sperm whale groups could not be analyzed due to a lack of sighting data. Among the ~5300 codas that were extracted from the sound recordings, 62 discrete coda types were recognized based on number and temporal pattern of clicks. Seven group-specific coda repertoires were compared, revealing the existence of at least two sympatric vocal clans. To further elucidate the social structure of Mauritian sperm whale groups and evaluate the existence of different vocal clans in the western Indian Ocean, future surveys should aim at obtaining more sighting data and cover a more extensive area.

### **ACO-06: Whistle variations within the bottlenose dolphin (*Tursiops truncatus*) population of Cardigan Bay, Wales**

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Bottlenose dolphins live in fission-fusion societies and constantly use vocal cues to stay in contact with one another. Of all the sound types emitted by this species, whistles are the most studied and recorded vocalisation due to their ease of analysis and classification. In this study, whistles emitted from bottlenose dolphins in Cardigan Bay, Wales were analysed to test the hypothesis that variations occur between groups and that particular environmental and biological factors affect the structure of the whistles.

Recordings were taken during the summer months of 2012-2014 using a C55\_RS hydrophone during a combination of *ad libitum* and line-transect surveys. Whistles were separated into seven different parameters, and multivariate analysis was used to assess if differences did occur between groups of dolphins and the effects of different environmental and biological factors.

Whistles produced were similar between groups. However, non-parametric testing revealed that each whistle parameter was significantly different from one another between groups. Whistle characteristics such as beginning frequency (Post-hoc LSD tests,  $p = 0.011 - 0.017$ ) and minimum frequency (Post-hoc LSD test,  $p = 0.035$ ) both increased at greater depths, while minimum frequency decreased (Post-hoc LSD test,  $p = 0.02$ ), and duration increased (Post-hoc LSD test,  $p = 0.015$ ) in larger groups. These differences were thought to be due to dolphins adjusting whistle characteristics to account for the changing seabed within Cardigan Bay, with temperature and pressure changes at different depths affecting how sound travels. The presence of calves also affected whistle characteristics, with whistle contours being more complex for isolated mother-calf pairs. Although whistle variations were observed in the Cardigan Bay population, future studies are needed to get a better understanding of what is causing these variations and how other factors such as geographic location and season could influence whistle characteristics.



### **ACO-07: Individuating signature whistle in a free-ranging bottlenose dolphin population in the Sicily Channel (Italy)**

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Since 2004, a bottlenose dolphins' population was studied in the Sicily Channel from Capo Feto to Capo S. Marco (Italy), revealing a residency pattern of about 30% (Boldrocchi *et al.*, 2013) of 135 individuals estimated. The aim of this work was to verify, for the first time in the Mediterranean Sea, the possibility of using whistles presenting stereotypy and stability of the frequency modulation pattern as a mark-recapture technique for the resident individuals. Also, we described here the acoustic parameters and temporal pattern of signature whistle occurrence. For this study, we used data collected from June 2011 to October 2014. We recorded for about 13 hours using a calibrated hydrophone (model 8104, Bruel and Kjer, Nærum, Denmark) connected to a digital acquisition card by dedicated Avisoft Recorder USGH software. The signals were acquired at 300 kilosamples/s at 16 bits. We used SIGID method (Janik *et al.*, 2012) to identify signature whistles from free-ranging dolphins. Two observers independently confirmed the similarity of whistles. Signals were collected during 20 sightings. 630 whistles were analyzed in the free-ranging population. Approximately 60 whistle types were identified and 70% (i.e. 42) of them were found repeated in the specific 1-10 s window of each other or emitted in bouts. In order to validate results obtained, a subsample of about 30% of whistles that fulfil SIGID methodology was cross-validated through photo-ID technique. For 10 (83%) of these types, only one animal univocally matched the contour whistle in two or more sightings. Despite the stereotypy observed, more analyses are needed to confirm the methodology as an effective monitoring tool for this area.

### **ACO-08: Harbour porpoise (*Phocoena phocoena*) occurrence in the Gulf of Gdańsk and its relation to the underwater noise**

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The Baltic harbour porpoise (*Phocoena phocoena*) population is listed as a critically endangered in the IUCN red list of threatened species. Once numerous, the species went through a sharp decline and the actual number of animals is expected to be very low. Data on the occurrence of harbour porpoises in the Polish Baltic is scarce and future research on significance of this area to porpoises is needed. A region of special interest is the Gulf of Gdańsk, as it is relatively small and an enclosed site with high anthropogenic pressure caused by fisheries and shipping activities, which all might impact harbour porpoises. Up-to-date, one passive acoustic monitoring campaign was conducted in the gulf, which revealed that porpoises do occur in this area. In order to confirm these results and obtain more data on porpoises presence in the Gulf of Gdańsk, since July 2014 we have undertaken a passive acoustic monitoring campaign which is ongoing now. Data obtained in our study will be compared to available literature data on porpoises occurrence in other parts of the Baltic. Along with the research on porpoises, monitoring of the acoustic background is being carried out in the gulf, which will provide the first available data on continuous underwater noise pressure in the area and its possible impact on porpoises.

### **ACO-09: Characteristics and variability of whistles emitted by striped dolphin (*Stenella coeruleoalba*) in the eastern Mediterranean Sea**

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This study provides the first insight into the evaluation of the acoustic properties of whistles of the striped dolphin inhabiting the Gulf of Corinth (Greece). In order to investigate striped dolphins' vocal behaviour, both qualitative and quantitative analyses were carried out and the whistles pattern of emission was considered in relation to daytime and group size. Furthermore, the characteristics of the whistles were compared with the ones of conspecifics inhabiting different areas of the Mediterranean basin. Ten parameters were measured from each whistle and signals were classified into seven categories: Upsweep, Downsweep, Convex, Concave, Constant, Sine and Other. Striped dolphins' whistles showed a mean minimum frequency of 8.32 kHz and a maximum of 17.27 kHz. Convex whistles represented the 34.2% of the whole dataset, Upsweep whistles 18.1%, Sine 16.9%, Concave 10.5%, Constant 9.7%, Downsweep 7.2%. The 3.5% of whistles were finally classified as Other. The emission rates of Convex and Constant whistles differed during daylight hours, both categories showed higher emission rates in the evening. Upsweep, Downsweep and Convex whistles showed significant variation in relation to group-size. These three categories of whistles presented the highest emission rate with group size from 1 to 10 individuals, and the lowest for group size from 10 to 20. Whistles recorded in the Gulf of Corinth were more similar to the signals collected in the inshore waters of the Ionian Sea, compared to the ones collected in the rest of the basin. Due to that, some movements and exchange among the striped dolphin of the Gulf of Corinth and the ones of the Ionian Sea can be hypothesized.

### ACO-10: Developing acoustic parameters for dolphin detections and species differentiation using C-PODs

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The C-POD, a passive acoustic monitoring (PAM) device, has been used globally to study porpoise occurrence, with some studies verifying detections using acoustic characteristic parameters. Similar parameters do not exist for dolphin detections, with studies relying on the use of C-POD automated software resulting in undetermined accuracy. This study developed acoustic characteristic parameters for dolphins with the aim of quantifying the occurrence of false-positive and false-negative detections extracted by the C-POD software. The software is not able to distinguish between species; therefore devised parameters verify detections of dolphin species collectively. Click trains were deemed to be produced by dolphins if a minimum of 9 clicks between 30–150 kHz, with undulating patterns of inter-click intervals and sound pressure levels, often with higher frequencies produced at louder levels. 90% of clicks in a train were shorter than 18 cycles in length. These parameters functioned across all quality filters and classifiers within the software. Comparison of visually verified detections to automatic detections highlighted incorrect detections between 9 – 90% depending on the quality filters and classifiers used. After omitting false-positive detections, 6,457 verified hours from two listening stations showed similar temporal trends to data obtained via land-based observations across a two year period. Species identification tests based on coincident dolphin acoustic and sightings data (bottlenose,  $n = 30$ ; common,  $n = 20$ ; Risso's,  $n = 100$ ) confirmed that differentiation is not possible due to shared acoustic characteristics inter-specifically, with high variation in characteristics intra-specifically. In conclusion, caution should be exercised when using data extracted automatically from the software: a subset of these data should ideally be visually verified using the parameters outlined herein. However, as species differentiation is not possible, other PAM devices that can facilitate species identification would be necessary to differentiate between species in areas where multiple dolphin species occur.

### **ACO-11: Using an SM2M to acoustically monitor bottlenose dolphins in the Shannon Estuary SAC, Co. Clare, Ireland**

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The Shannon Estuary is only one of two designated SACs for bottlenose dolphins in Ireland and Ireland's only resident group are found here. The Shannon Estuary has been the focus of many different acoustic monitoring techniques over the years including; C-PODS, hydrophones and most recently an SM2M from Wildlife Acoustics. The Song Meter SM2M Marine is an autonomous passive acoustic recorder that allows collection of audio data including ambient, anthropogenic and animal sounds. The SM2M was deployed twice for continuous recording to collect acoustic data at Moneypoint PowerStation, Kilrush, and County Clare for 5 consecutive days in both July and August 2013. Acoustic detections, clicks and whistles were categorised in coherence with day and night and tidal cycles. Each sample was played through digital audio editing software (Cool Edit Pro 2.0), which displayed a spectrograph of each vocalization. Whistles were classified into upsweeps, downsweeps, sine, wave and u-shapes. In total 451 whistles were detected over a ten day period during spring and neap tides. The most common whistle type encountered was an up-sweep during the slack high tide amidst a spring tide. During the diel phases, 61% of whistles were heard during the day with 39% heard at night. The SM2M dataset was compared with C-POD data which was simultaneously recorded at the site with the SM2M recording a significantly higher amount of echolocation clicks over 5 days in August. This new device offers a more complete overview of dolphin occurrence at the site as both echolocation clicks and whistles can be recorded. Future research should be focused to determine the detection range of the device for the species in order to determine how many units should be deployed as part of long-term monitoring programmes which could contribute towards monitoring requirements under international legislation.

### **ACO-12: Echo-location landmark sequences: a new source of information on click source levels, hearing thresholds and swimming speeds in porpoises**

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It is not generally possible to determine acoustically how far a vocalising cetacean is from a single hydrophone, but landmark sequences do make this possible. These sequences occur in the click trains made by porpoises, and show a linear reduction over time in the interval between the clicks as the animal swims towards a target of interest to it, and the time for the animal to receive the echo becomes shorter. The target of interest to the porpoise may be the mooring of an echo-location monitor, such as a C-POD.

A recently developed algorithm allows these sequences to be found automatically in large data sets, and over 1,000 have been found in the porpoise data gathered during the SAMBAH project in the Baltic Sea.

We describe the detection process, and the sequences found, and show that they can be used to assess the swimming speed of the porpoise, and to estimate limits for both the acoustic source levels and hearing thresholds of the animals that produced them. These estimates are subject to various sources of uncertainty, but do fit within current knowledge.

### **ACO-14: The vocal behavior and distribution of the Atlantic white-sided dolphins (*Lagenorhynchus acutus*) in northern Norway**

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The Atlantic white-sided dolphins (*Lagenorhynchus acutus*) are migratory dolphins and their vocal behavior and distribution are understudied in Norway. Vessel based surveys were conducted in order to determine the vocal behavior and occurrence in the Vestfjorden in northern Norway. Hydrophone recordings were used to describe the vocal behavior of clicks, whistles, calls, buzzes and to determine the presence or absence of stereotyped whistles. Clicks (98-99%) were the most abundant sound produced and whistles (65.4%-76.0% excluding clicks) were equally abundant second to clicks. Stereotyped whistles were also observed (e.g. 11-20 kHz, length 853 msec). The relationship of vocal behavior and activity resulted in a dependence on activity: foraging, socializing, milling, and traveling. Sound production increased during socializing and calls were observed most commonly during traveling (32.4%) and least common during foraging (18.8%). Buzzes varied (0-14.0%) and were absent during milling. Photo-ID and sightings were used for tracking and a total of 72 yearly sightings were observed including 55 photo-ID individuals of which 29 individuals were re-sighted again. Two of the 15 re-sighted individuals were observed on 6 occasions with gaps no greater than two years. Many sightings of Atlantic white-sided dolphins including the re-sightings of photo-ID individuals indicate a stronger presence of Atlantic white-sided dolphins than previously reported in the Vestfjorden in northern Norway.

### ACO-15: Underwater vocalizations of Baltic grey seals, *Halichoerus grypus*

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Vocalizations play an important role for all pinnipeds. Sounds are used for mother–offspring recognition, alarm calls during the male-male competition in the breeding season, as well for males to attract females.

The aim of this study was to characterize the underwater sounds of Baltic grey seals, which has previously not been described.

Data were collected in June, 2014, in around Christiansø in the Baltic Sea, during an encounter with around 30 grey seals. 67 minutes of underwater acoustics recordings were made from a sailing yacht. A total number of more than 100 vocalizations could be analyzed and grouped into categories. The frequency content of the vocalizations was within 0.1-1 kHz, and the received level around 120 dB re 1  $\mu$ Pa. The results show that Baltic grey seals are highly vocal and that a lot remains to be known about the acoustic behavior of this species.



### **ACO-16: Diurnal and lunar effects on acoustic detections of harbour porpoises (*Phocoena phocoena*) around Kullaberg, Sweden**

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The harbour porpoise (*Phocoena phocoena*) is the only cetacean species regularly found in Swedish waters. Little is known about its movements and behaviour. Around the peninsula of Kullaberg, harbour porpoises are regularly found in relatively large numbers and they are considered to use the area both as a feeding area and as a reproductive area. Along the northern coast of Kullaberg we deployed six acoustic porpoise data loggers (Cetacean-Porpoise Detectors: CPODs, Chelonia, Ltd.), from April to August, 2014, to investigate the acoustic activity of harbour porpoises in these waters. We found a gradient of decreasing activity along the coast, ranging from extremely high activity at the tip of the peninsula to very few detections 8 km further east. During several periods of data collection, there was a very pronounced diurnal pattern in the acoustic activity closer to the tip of the peninsula, with detections peaking around midnight. There were also large effects on the activity caused by the lunar cycle. This data provides detailed insights into the acoustic activities of harbour porpoises in an area that may be of great importance for the protection of this threatened species in Swedish waters.

### **ACO-17: Combining acoustic and visual survey data to study the distribution of dolphins in Maltese waters**

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The LIFE-MIGRATE project aims to identify cetacean and turtle hot-spots in Maltese waters. In 2013 and 2014 we performed cetacean line-transect surveys (5,796 km) with visual observers and a 200 m towed hydrophone array sampling at 96 kHz. Simultaneous visual and acoustic surveys were conducted during 2,860 km of transect lines, with 5,331 surveyed visually and 3,311 km surveyed with acoustics methods. Here we use these data to study dolphin distribution. Integrating acoustic and visual data from an uneven coverage is challenging due to the different probability of detection of both survey methods. To account for this source of bias we obtained a correction factor (CF) for the survey effort, based on the number of acoustic/visual detections not captured by the other survey method, when both methods were at work. Acoustic detections were defined as records of dolphin clicks/whistles separated by at least one hour of silence between consecutive detections. During the simultaneous visual/acoustic survey, acoustic detections were captured visually in 20% of the cases, while 90% of the sightings were recorded acoustically also. Thus, we applied a  $CF=0.2$  to the effort of “visual-only” transect lines and multiplied by a  $CF=0.9$  the number of km covered in “acoustic only” transects. The corrected survey effort and the number of dolphin detections (visual or acoustic) per cell of a grid of 10x10 km were fed to a Kernel density estimator using ArcMap. The results show a high use area for dolphins to the W-NW of Malta. This result was enabled by obtaining a common outcome for both visual and acoustic survey techniques, increasing the sample size of dolphin detections. This study emphasizes the need to develop methods such as that used here to solve the analytical challenges posed by using mixed techniques in cetacean surveys.

### **ACO-18: Pulsed signal properties of free-ranging bottlenose dolphins (*Tursiops truncatus*) in the central Mediterranean Sea**

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This study describes pulsed signals from bottlenose dolphins of the central Mediterranean Sea. Data were collected during 2011 and 2012 in 27 surveys in the Sicilian Channel, during which 163 animals were sighted. Based mainly on the pulse repetition rate, the signals were classified as Low-Frequency Click (LF; single clicks without a regular pulse rate), Train Click (TC; with an interclick-interval of  $80 \pm 2$  ms), Burst (with an interclick-interval of  $3.4 \pm 0.2$  ms) or Packed Click (with a lower number of clicks per train and median interclick-interval of  $3.2 \pm 0.0$  ms). The measured parameters were SPL<sub>pk</sub>; signal duration; the 1°, 2°, and 3° peak of frequency; number of peaks frequency; bandwidth; centroid frequency; and the 10%, 25%, 75%, and 90% percentiles of the power spectrum distribution. Most of the parameters were significantly different among the different pulse rate groups, reflecting the different functions of these signals. LF clicks showed a lower peak frequency and percentiles and a longer duration and could be used to explore a wide area without a specific target focalization and with less resolution. The TC showed a higher SPL<sub>pk</sub>, higher peak frequency, lower duration, and lower number of secondary peaks frequencies, showing a better resolution to investigate a specific target.

### **ACO-19: New Mediterranean fin whale sounds found. How important is it to include them when monitoring during acoustic surveys?**

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A passive acoustic recording system was deployed in the Columbretes Islands Marine Reserve (Spain) during 2011-2012 to further contribute to the knowledge regarding fin whale (*Balaenoptera physalus*) seasonality patterns along the western Mediterranean Sea. The analysis of the 2011 acoustics data (April-July and September-December; a total of 186 sampling days; fin whale detections 129 days; 69.9%;) revealed typical long, patterned sequences of “classic 20-Hz” pulses but also found a new pulse type, fully described here. These new VFP (Variable Frequency Pulses) were recorded in a high variable bandwidth from 21Hz (min. freq.) to 120Hz (max. freq.). Although both vocalizations were detected in co-occurrence (37/186 days; April, May, June, November and December), a first acoustic analysis to discriminate the "pulse-type" was performed, showing a seasonal difference. VFP were found in a high rate during April-July sampling period (58/93 days) being almost the exclusive vocalization sound found during May (22/31 days). This study aims to demonstrate and emphasize the importance of including these VFP to acoustic studies dedicated to the presence and seasonality of the fin whale in the Mediterranean Sea (generally conducted with 20Hz pulse detections), as this sound increased significantly the fin whale presence rate for 2011 (17.7%; 33/186 days) in this area. The distribution and evolution of VFP during the April-July study period, suggests ecological or socialization importance of this new sound.

### **ACO-20: Whistles characteristic of two sympatric bottlenose dolphin communities: temporal and frequency differences**

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With their wide geographical distribution in the open oceans, coastal waters and estuaries, the common bottlenose dolphin (*Tursiops truncatus*) presents several poorly understood behavioural issues, such as the existence of intraspecific variation in the acoustic repertoires of different populations.

Groups of bottlenose dolphins are frequently observed in the region of the Sado estuary and the Arrábida coast, on the continental Portuguese coast. A resident population inhabits the Sado estuary and adjacent coastal waters, with apparently little social exchanges with other bottlenose dolphin groups. Transient groups present overlapping distributions with the resident population in coastal areas but do not enter the Sado estuary, where only the resident dolphins feed and socialize, year-round, on a daily basis.

To investigate the presence of dissimilarities in the acoustic repertoire of these two sympatric populations, acoustic recordings were made both in Sado estuary and Arrábida coast. Positive identification of resident individuals in groups sampled enabled the labelling of the emissions as resident or transient.

Preliminary results have shown significant differences in the frequency range ( $t(817) = 2.037$ ,  $p = 0.042$ ) and duration of whistles ( $U = 54.118$ ,  $p < 0.001$ ), as whistles from the resident population tend to have a lower frequency amplitude and to be longer. Furthermore, specific stereotyped whistles were recorded in the two different communities.

The observed variations in temporal and frequency characteristics of social acoustic signals could be a hint of ecological adaptation or cultural differentiation, and may contribute to segregation between the resident and non-resident groups.

### **ANA-01: A conjoined bottlenose dolphin (*Tursiops truncatus*) calf stranded on the Aegean Sea coast of Turkey**

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On 4 August 2014, a male conjoined dicephalic bottlenose dolphin (*Tursiops truncatus*) calf was found dead on the beach of Dikili/İzmir, the Aegean coast of Turkey. It was considered that it had completed the fetal development based on its body length (BL: 94cm). Since the specimen was at the advanced stage of decomposition, it was immediately preserved in 10% formalin solution. It was later examined by necropsy and x-ray. In radiology, y-shaped vertebral column with two pairs of ribs was observed. Necropsy revealed that the conjoined dolphin has two pairs of lungs and two hearts, two stomachs, two spleens, but single liver, anus, penis and one pair of kidneys. Heart and lungs on the right side were markedly larger than those on the left side. There were two completely separate heads, a pair of pectoral fins, two dorsal fins (the right one was dwarfed) and one normal shaped caudal fin. The vertebral column was bifurcated at L3. As a result, the present case was classified as dithoracic paraphagus with further specification as dibrachialis conjoined twin. Conjoined twinning is a complex congenital defect resulting from incomplete twinning. It has been reported more frequently in human and domestic animals and rarely reported in marine mammals. This is the first case reported in Turkey and the second in the Mediterranean Sea.



### ANA-02: The external ear canal of cetaceans: vestigial or not?

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Cetaceans descend from land mammals. Consequently, their hearing apparatus basically consists of the same anatomical components. Whales, as land mammals, feature an outer, middle and inner ear. However, these structures show strong evolutionary adaptations to underwater hearing. In addition, other morphological elements, such as the mandibles and the associated acoustic fat, have acquired an acoustical function in the propagation of sound waves to the middle ear. The original function of other structures such as the external auditory canal is therefore questioned. How cetaceans hear is not yet fully understood. However, it is essential to clarify this in order to assess the impact of anthropogenic underwater sound, since high-energy underwater sound can lead to physical trauma and hearing loss, physiological stress and behavioural changes. In this study the external ear canal of a white-beaked dolphin (*Lagenorhynchus albirostris*) and a common minke whale (*Balaenoptera acutorostrata*) are described and compared based on histological cross sections. These external ear canals seemed rudimentary, with a small to absent lumen. However, the blood supply, well-developed muscles, active glands and numerous nerve fibres could indicate some functionality. Moreover, the presence of numerous structures with a morphological similarity to lamellar corpuscles also could advert to a functional structure. Although the function of these potential mechanoreceptors is not known, they could play a part in pressure perception in these diving mammals.

**ANA-03: Anomalously white Atlantic spotted dolphins, *Stenella frontalis* (Cuvier, 1892) in the south coast of Pico Island, Azores**

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This work reports two anomalously white juvenile *Stenella frontalis* in the Azores region. Both were observed south of Pico Island, one presumably albino on September 17th, 2009, and a second individual completely white on July 13th, 2011, possibly suffering from leucism or piebaldism. These are the second and third record for the species in the Azores but the first record with photographic evidence.



### **ANA-04: Distribution of CGRP immunoreactivity in caudal spinal cord and corresponding spinal ganglia of the bottlenose dolphin (*Tursiops truncatus*)**

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The presence of calcitonin gene-related peptide (CGRP), a neuropeptide involved in the transmission of nociceptive information, was investigated in the caudal spinal cord and corresponding spinal ganglia of the bottlenose dolphin (*Tursiops truncatus*). The specimens from three animals, provided by the Mediterranean Marine Mammal Tissue Bank of the University of Padova, were processed with histological and immunohistochemical techniques. Mean perikaryal area and density of neurons were measured in cresyl violet- and immunoperoxidase-stained sections of the ganglia and spinal cord. In the spinal cord, CGRP immunoreactivity was detected diffusely in fibers and neurons of laminae I and II, in some fibers of lamina X, in interneurons of lamina VIII and in motoneurons of lamina IX. In the spinal ganglia, CGRP-immunoreactive neurons were small or medium-sized cells and displayed specific granular immunostaining. Interestingly, a mild CGRP-immunoreactivity was observed in satellite glial cells located around large-sized neurons, as previously described for cholecystokinin and other peptides. The distribution of the CGRP immunoreactivity in the dolphin spinal cord and corresponding spinal ganglia is very similar to that seen in other mammals. This study represents the first description of CGRP distribution in the spinal cord and spinal ganglia of a cetacean species and thus contributes to the current knowledge on the neurochemical profile and afferent transmission of nociceptive information in marine mammals.

### **ANA-05: Detecting dodgy dolphins: Physical anomalies in small cetaceans off La Gomera (Canary Islands, Spain)**

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During regular whale watching trips of the Canary Island of La Gomera, small cetacean sightings were documented photographically from 1996 through 2014. When taking images of individual animals from a variety of species, anomalies of different types were detected and analysed. Such anomalies were categorized as follows: a) skin lesions (e.g. large scratches) and injuries (fresh or healed); b) skin anomalies, e.g. distinct blotches, patchy scars, dents or bumps and c) skinny animals showing signs of emaciation. Anomalies were found in the following species: bottlenose dolphin, pilot whale, Atlantic spotted dolphin, rough-toothed dolphin and common dolphin. Skinny animals were mostly bottlenose dolphins, also often concerning a number of animals in the same group, indicating affliction of this species on a larger scale. A number of causations for each category of anomalies were considered including for a) ship strikes and entanglements, for b) skin diseases such as infections and scars from predators/parasites and for c) food shortage or internal diseases. In most cases, the true reason for the anomaly will remain unknown. However, documenting anomalies over the long term, even if conducted in a more non-systematic way from platforms of opportunity can significantly contribute to assessing the health status of small cetacean populations. In multi-species habitats like the Canary Islands, the comparison of levels of affliction can help understand the impact of anthropogenic threats to different cetacean species sharing the same environment.

### **BEH-01: Association patterns of white-beaked dolphins *Lagenorhynchus albirostris* in Iceland: insights into social organization**

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To understand aspects of the ecology and biology of any species it is important to study its social system. Here, we quantitatively describe the association structure of white-beaked dolphins (*Lagenorhynchus albirostris*). Photo-identification was undertaken from whale-watching boats in Faxaflói (April-September in 2002–2011 and year-long in 2012-2013) and Skjálfandi Bays, Iceland (May-October in 2002–2013). Specifically we tested for our observed patterns against a null of random associations, and further examined patterns of association over time and across habitat between the two bays. We used network analysis, hierarchical clustering using modularity, standard lagged association rates (SLAR) and permutation tests to examine the sociality in this species. Analyses were undertaken in SOCPROG 2.5 and associations were weighted using the half-weight index (HWI). Visualizations were done using the program Gephi 0.8.2. We identified a total of 489 white-beaked dolphins, but restricted the analytical dataset to 37 adults which were sighted  $\geq 5$  times. Associations were non-random based on permutation tests ( $\phi = 2.569$ ,  $r = 1.876$ ,  $p = 1.000$ ) and social differentiation was high ( $S = 1.830$ ,  $SE = 0.369$ ) indicating diverse social relationships exist among white-beaked dolphins. The overall association index resulting from HWI had a mean of 0.39 ( $SD = 0.21$ ) and the coefficients of associations were for the majority low (37%,  $n = 13$ ), followed by moderate-low and moderate (each 23%,  $n = 8$ ) and moderate-high (17%,  $n = 6$ ). Maximum modularity (controlling for gregariousness,  $Q = 0.36639$  at  $HWI = 0.061$ ) generated seven different clusters ( $mean \pm SD = 5.0 \pm 2.38$ , range = 2-9). The best fit models to the SLAR of our data were of ‘casual acquaintances’ and ‘two levels of casual acquaintances’. The lagged association rate showed a rapid decrease after ten days, a final drop at around 450 days steadily declining and falling below the null association rate on two occasions. Our results on social structure are important to assist management decisions in the light of increased natural and anthropogenic disturbances in Icelandic waters.

### **BEH-02: Behavioural pattern for a small endangered population of wild bottlenose dolphin in the Aeolian Archipelago (southern Italy)**

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In this study, we established a complete catalog of behavioural activities for a small endangered population of wild bottlenose dolphin in the Aeolian Archipelago (southern Italy). Five behavioural categories (feed, travel, socialize, rest and play) were recorded at the water surface using a combination of focal group observations with instantaneous data sampling and photo-identification techniques. The states/events associated with each category were similar to those used in other behavioural studies. In particular, the feeding activities were identified in the field using the following criteria: 1) fluke up and tail stock, 2) fish in mouth, fish toss, and fish kicking, 3) defecate, 4) deep diving, 5) mud on rostrum, 6) zig-zag movement, 7) cooperative feeding strategies (circular/flower), 8) trammel net/fishing boat interaction, 9) rush/attack, 10) blood on rostrum, and 11) subsurface. Mixed state were recorded when different individuals in the focal group were simultaneously engaged in two or more activities. Each behavioural record (a three-minute interval) was assigned to individual scores (1/0). The behavioural records which included any interaction with the research boat (excluding play) or disturbed behaviour were deleted from the statistical analysis. From 2005 to 2011, 96 focal groups of dolphins were followed with a total of 987.5 hours during 400 boat surveys. A total of 813 behavioural records were collected (40.65 hours), the 38.6% of the total sightings time. Travel (36.7 %), feed (25.3%) and travel-feed (24.8%) were higher for resting, playing and socializing (12.4%). Feeding was higher in the presence of trammel nets (t- test,  $p = 0.001$ ). Resting, playing and socializing were higher for females than males (t- test,  $p < 0.0001$ ) and for dolphin groups  $> 5$  individuals (t- test,  $p < 0.0001$ ). Our results suggest that dolphins' behaviour may be influenced by ecological, demographic and anthropogenic factors.

### **BEH-03: Can cetaceans perceive smell and taste? Preliminary results from behavioral studies on bottlenose dolphins (*Tursiops truncatus*)**

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Communication studies in cetaceans have so far mainly focused on audition, due to their extensive use of echolocation and vocalization. However, our understanding of their use of olfaction and gustation remains surprisingly limited.

It is generally admitted that odontocetes are anosmic (i.e. unable to smell) because they lack olfactory bulb and peduncles, but the presence of an olfactory mucosa in the nasal air sacs has been evidenced. Previous works on their gustation abilities also yielded contradictory results: while most of their taste receptors genes seem to have lost their function, taste buds have been identified and it has been suggested that dolphins could perceive sour and bitter. In this context, behavioral studies are still needed to test whether odontocetes do respond to olfactory and gustatory stimuli.

We will present on this poster the preliminary results of experiments conducted on captive bottlenose dolphins (*Tursiops truncatus*) that included exposure to potential biologically-relevant substances and recording of their behavioral and physiological responses. Biological and ecological implications of these results as well as future prospects for research will be discussed.



### **BEH-04: Killer whale predation on pinnipeds at Sea Lion Island (Falkland Islands)**

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Killer whale (*Orcinus orca*, KW) predation on marine mammals has been widely reported in the southern Hemisphere. Anecdotal reports suggest that KW visiting Falkland Islands include pinnipeds in their diet, but strong evidences are lacking. Here we present the results of a study on KW at Sea Lion Island (SLI), which shelters the main southern elephant seal (SES) breeding colony in the Falklands, and a small southern sea lion (SSL) population. From September 2013 to March 2014 (210 days), we carried out: 1) shore-based surveys (6641 hours; 5542 km walked) of the SES and SSL breeding areas; 2) observation of KW behaviour; 3) regular counts of pinnipeds; 4) necropsies of dead SES and SSL. We observed 71 likely predation events (1.07 per 100 hours), 39 of which were sure. SES were targeted in 79.1% of predations, and SSL in 11.6%. Weaned SES pups were the main prey (38.2% of SES predations). The overall success rate was lower than expected (41.3% of predations). We also observed predations on SES sub-adult males and breeding females. Moreover, apart from this field season, males 6 to 12 years old were killed (but not eaten) by KW during last years. The first event occurred in 2007, and a maximum of 3 breeding males were killed during a season (in 2012). Peculiar injuries were observed in necropsies of breeding males, including significant damages of the ribs. The hunting behaviour of KW was characterised by cooperative strategies and long lasting handlings of prey. Simple energetic models suggest that pinniped preys do not meet KW feeding requirements. Therefore, although SES and SSL predation is probably the main reason of KW presence at SLI, these species should only represent one component of their diet. This suggests unusual generalist hunting habits for this still little known KW population.

### **BEH-05: Interactions between harbour porpoise and bottlenose dolphins in Liverpool Bay**

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Liverpool Bay has traditionally been regarded as an unsuitable habitat for cetaceans due to the high level of pollution in the 1980s. With the success of the Mersey Basin Clean Up campaign and an increased amount of effort based watches, however, the area has seen an upswing in sightings of dolphins and porpoise. The most commonly sighted species of cetacean in the past 7 years has been the harbour porpoise with majority of sightings being of this species. In recent years, particularly 2014, there seems to have been an increase in bottlenose dolphin sightings. While these species often occur symmetrically in the UK, spatio-temporal habitat pertaining has been observed in areas such as Cardigan Bay. While bottlenose dolphin do not predate on porpoise, attacks are well documented and avoidance behaviours are known. In this study we examine sighting rates for the two species from sighting records in the region, highlighting areas of high porpoise sightings and areas of high bottlenose dolphin sightings around Merseyside to help better understand the habitat usage in the region of the two species using data collected between 2007 and 2014.

### **BEH-06: Humpback whale (*Megaptera novaeangliae*) reactions to biopsy sampling in Ecuador**

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Biopsy sampling of whales has recently become a very popular research approach. It represents a cheap and effective non-lethal study technique for genetics, toxicology and ecological tracers. Most published studies report on the whales' reaction to biopsy sampling. The level of disturbance has been shown to be relatively low, even when calves are sampled. We biopsy sampled 28 humpback whales (27 adults and 1 calf) in the waters around Isla de la Plata, Machalilla National Park, Ecuador, from August 29th to October 4th 2014. All whales were monitored for reactions to both the approach of the vessel and to the biopsies themselves, through videos, photographs and data. Data recorded included reaction/no reaction, and in case of reaction: reaction to the vessel, or reaction to the biopsy. The type of reaction was categorized in 3 classes: minor reaction, major reaction, and change in behavior. In total, only 4 whales (14.28%) showed a reaction to the biopsy procedure, of which 1 whale (3.57%) reacted to the vessel's approach. Of the reactions to the biopsies, 2 (7.14%) were minor reactions (including the calf), and 1 (3.57%) was a major reaction (peduncle throw). No short- or long-term changes in behavior were observed. These results are similar to the ones described in the literature as for the low rate of reaction, differing only in that most reactions in the literature seem to be due to the vessels' approach, whereas in our study most whales reacted to the biopsy sampling itself. The absence of change in behavior may be due to the fact that most whales were involved in surface active groups. This study shows that humpback whales sampled in Ecuador during our study showed little reaction to biopsy sampling, and showed no short- or long-term change of behavior.





### **BEH-07: Fine scale habitat sharing between harbor porpoises and delphinids in the Istanbul Strait**

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There are many sympatric species in the world but how they share the habitat has been largely unknown because of the difficulties of continuous observation with species identification. In this study, we conducted fixed passive acoustic monitoring of odontocetes for 2 years with identifying porpoises and delphinids in the middle of the Istanbul Strait, Turkey. Both porpoises and delphinids appeared at the monitoring area in almost all months but porpoises signals increased in spring and summer. The observed locations and diel phase were species-specific within the monitoring area in spring. Encounters were categorized into groups and solitaries and analyzed separately. More than 80 % of the detections of porpoise groups were localized in the south from the monitoring station regardless of diel phase, whereas delphinids appeared in all direction during night time. In contrast, solitaries of both species showed no concentration in a specific direction in spring and summer. The estimated sensing distances of echolocation of the group of porpoises were mostly short with more than half of inter-click intervals about 20–50 ms in spring. However, it switched to bimodal distribution having a second peak around 120 ms in summer. Those of delphinids ranged from 20–70 ms in spring and summer. Previous studies showed that the porpoises in particular feed on sprats which migrate through the strait in spring. Our results suggest that the porpoises captured the migrating sprats at the narrowest point of the strait, south of the monitoring area, regardless of diel phase. On the other hand, delphinids, especially bottlenose dolphins were thought to prey grey mullet which are not recorded as seasonal migrating species in this strait. Harbor porpoises and delphinids share the same habitat in the same season but separation of prey could be the key to avoid the interspecific competition.



### **BEH-08: Direct behavioural responses of cetaceans, during seismic surveys in the southern Mediterranean Sea**

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Visual monitoring for cetaceans was conducted during summer of 2014, in the 26 daylight hours of the TOMO-ETNA active seismic experiment at Etna volcano's roots and surrounding areas, which is part of the MEDiterranean SUPersite Volcanoes and EUROFLEETS-2 European projects, coordinated by the Granada University (Spain) and the National Institute of Geophysics and Volcanology of Catania (Italy). The Sarmiento de Gamboa oceanographic vessel (CSIC-UTM, Spain) has covered 2454 nautical miles within the Ionian waters of the eastern coast of Sicily and the southern Tyrrhenian, in the Aeolian Islands area, adopting the protocol of the Joint Nature Conservation Committee as a measure of mitigation. Wide Angle Seismic and Multi-Channel Seismic surveys were carried out with refraction and reflection seismic methods, producing about 24,800 air gun shots. Observations undertaken during the seismic exploration, by an experienced marine biologist of the Ketos with the support of the crew members, were analysed to examine effects on cetaceans. On about 180 hours of observation, 47 sightings of five species of marine mammals (1, *Balaenoptera physalus*; 1, *Physeter macrocephalus*; 1, *Ziphius cavirostris*; 3, *Tursiops truncatus*; 15, *Stenella coeruleoalba*; 2, unidentified big species; 24, unidentified small species) have taken place. Sighting rates, distance and orientation from the airguns were compared for different volume categories of the airgun arrays. The results show that cetaceans can be disturbed by seismic exploration, since the Encounter Rate calculated in good sea conditions (sea state  $\leq 3$  of the Douglas scale) increase with reducing volume (0,53 with the source silent; 0,24 with the activated airguns). Furthermore, during the Soft Start phase and the reduction of the power of the airguns subsequently to a sight, animals travelled towards the vessel or adopted an indifferent behaviour. Animals travelling away from the vessel were observed within the 500 metre Mitigation Zone during periods of high power shooting.

### BEH-09: Gluttony, the deadliest of the seven sins

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On the evening of 3rd May 2014, the UK Cetacean Strandings Investigation Programme (CSIP) received a report of a dead stranded bottlenose dolphin (*Tursiops truncatus*) at Hell's mouth, Gwynedd, Wales. A CSIP team conducted a full field necropsy to ascertain cause of death. The 334 cm adult male was in good nutritional condition, and had no obvious external lesions, apart from fresh abrasions on the leading edges of both tail flukes. The cardiac stomach was distended with a variety of fish species in various states of digestion, indicating that the bottlenose dolphin had been feeding very well up until the point of death. Live stranding was demonstrated by the presence of a degree of hypostasis on the ventral regions of the left and right lungs, as well as the tail fluke abrasions and extensive submandibular and sub-sternal cutaneous bruising, with an absence of any other physical trauma. The cause of this live stranding event was soon discovered. A small flat fish, later identified as a dab (*Limanda limanda*), was found rolled up 'cigar like' and oriented tail first within the nasal cavity. The rolled up fish had dislodged the larynx and completely occluded the nasal cavity, causing asphyxiation and the death of the animal after stranding alive in extremis. A similar cause of death has occasionally been recorded in other countries, but this is only the second recorded case in the UK in over 3500 necropsies conducted in the UK since 1990. The other UK stranded case was a white-beaked dolphin (*Lagenorhynchus albirostris*) examined in Scotland in 1999.

### **BEH-10: The significance of respiration frequency and timing in the energetics of killer whales (*Orcinus orca*)**

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Accurate estimates of energetic requirements of top predators at sea are essential to improve sustainable management of marine ecosystems. Yet, obtaining direct energetic measurements of cetaceans at sea is unfeasible. Breathing rate has been used as indicator of cetacean metabolic rates to evaluate their role in food webs, though it does not account for breath-by-breath variation in gas exchange. Our aim was to investigate the potential influence of including respiratory timing (in addition to rate) and oxygen uptake dynamics on in-situ cetacean energetic studies. Kinematic data from 12 adult free-ranging North-Atlantic diverse sized herring-feeding killer whales (*Orcinus orca*) were recorded with high-resolution tags (DTAGs) to reveal individual breathing events. Three-axis accelerometer and flow noise data were used to derive stroking rate and speed as metrics of underwater activity level. An oxygen exchange model, including an oxygen uptake curve as key feature, was established to estimate oxygen extraction dynamically per individual breath, based upon modelled oxygen store at the time of each breath. Results showed that correlations between predicted oxygen uptake and stroking activity over 15 min periods were relatively weak when using constant uptake per breath ( $r^2 < 0.5$  for 8 individuals). Including fluctuating oxygen uptake per breath significantly improved the correlation between modelled oxygen uptake and fluking rate ( $r^2 > 0.9$  for 10 individuals). The same result was found using speed as activity metric; using constant uptake per breath  $r^2 < 0.5$  for 8 individuals and including the fluctuating oxygen uptake per breath improved the model again significantly so that  $r^2 > 0.9$  for 7 individuals. Hence, taking into account respiration timing, in addition to rate, is crucial in making accurate cetacean energetic estimations.

### **BEH-11: Shedding light on the phenomenon of grey seal predation on marine mammals**

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In 2012 scientists described for the first time that grey seals (*Halichoerus grypus*) are likely predators of harbour porpoises (*Phocoena phocoena*). Several publications adding extra knowledge to this phenomenon followed, not only showing that grey seals are indeed the predator of harbour porpoises but also of harbour seals (*Phoca vitulina*). It is likely that grey seals in other areas of their occurrence show similar behaviour, thus it is important that scientists working in these areas are able to recognise distinct patterns of lesions produced by grey seal predation. Here we describe in detail the patterns of lesions that have been found on carcasses of marine mammals potentially being preyed on by grey seals as well as describe an experimental approach for assessing the formation of these distinct lesions on harbour seals. Additionally data is presented regarding the occurrence frequencies of such cases for the coastal waters of Schleswig-Holstein, Germany from 1990 until 2014. We conclude that this behaviour might not be a new behaviour after all as similar cases can be found in the database of the local stranding network reaching back several years.

### **BEH-12: Temporal changes in site usage by bottlenose dolphins (*Tursiops truncatus*) in New Quay Bay, Wales**

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Within the Cardigan Bay Special Area of Conservation (SAC), established to protect bottlenose dolphins, a particularly important area for the species is New Quay Bay. Increasing boat activities here, and possible negative effects on the dolphins have recently raised conservation concerns. This study investigated changes in bottlenose dolphin presence in New Quay Bay over time, as well as examining site usage for recognisable individuals. Boat-based and land-based surveys were conducted between 2001 and 2013, resulting in a total of 81 identifiable individuals from 752 sightings in the small delimited area of New Quay Bay. 39% (81/207) of the individuals seen in the SAC, were recorded within New Quay Bay. Individual re-sighting rates indicated that the local population did not have the same characteristics as that in the wider SAC (One-way ANOVA:  $F_{2,6} = 5.14$ ,  $p = 0.3$ ), being largely transient. The Bay appeared to be important for both feeding and calving, with particular areas favoured as foraging locations (G-test:  $p < 0.001$ ), whilst 17 out of 81 identified individuals were recognised as mothers with calves. There were significant spatial and temporal (seasonal and longer term) differences in the usage of the Bay depending on gender, age, or presence of calves, with a general increase in dolphin presence since 2007 and a peak in recognisable individuals between June and September (One-way ANOVA:  $F_{1,10} = 4.96$ ,  $p = 0.001$ ). Interactions between bottlenose dolphins and boats were also analysed annually, and showed that the responses varied significantly (One-way ANOVA:  $F_{3,26} = 2.97$ ,  $p < 0.001$ ), but with a general increase in tolerance (observed as a neutral reaction) towards the presence of boats. It may be that an increase in boat activity is causing some individuals to spend less time in New Quay Bay, thus encouraging more dolphins to be transient, and leaving a minority of animals habituated to boats.

### **BEH-13: Sleeping behaviour in Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) off Hurghada, northern Red Sea, Egypt**

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While all animal studied to date sleep, cetaceans are among the few that engage in the unusual practice of unihemispherical sleep, where only half of the brain displays typical signs of sleeping. Certain behaviours, such as circular swimming, have been associated with sleeping in captive cetaceans, but little remains known about sleeping behaviours in the wild. While some inferences have been made about certain behaviours, confirmation requires a simultaneous assessment of eye state (i.e., closed/open). Underwater behavioural surveys using video of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) off Hurghada, Egypt, have been conducting since 2009 in a location where the dolphins are habituated or tolerant of SCUBA divers, and underwater visibility is excellent. Eye state is typically easy to assess in the video record, providing the first confirmed observations of sleeping during swimming behaviour in wild cetaceans. Sleep represents a behavioural state often protected in wildlife by law. The association of this behaviour with reefs in Hurghada suggests an important role for this habitat in the behaviour and thus a conservation concern in the region facing increasing disturbance from tourist activities. This discovery also has important implications for assessing responses of cetaceans to disturbance. Such responses are highly context dependent and are affected by various factors, including behaviour at the time of exposure, prior experiences and motivational state. Sleep not only represents a potential behavioural state at the time of exposure, but the need for sleep may also be a motivational driving force for cetaceans. Such considerations have not yet been incorporated into environmental impact assessments.

### BEH-14: Predation of harbour porpoises by grey seals in Wales

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The grey seal (*Halichoerus grypus*) and the harbour porpoise (*Phocoena phocoena*) are species of considerable local, national and international conservation interest that co-exist across most of their range. As sympatric top predators, these species usually do not interact. However, we present evidence of predation of harbour porpoises by grey seals. This unusual phenomenon is receiving growing attention since lesions consistent with grey seal predation were observed in stranded harbour porpoises in Belgium, and direct observations of depredation were recorded off France and in the English Channel. Our work now documents this behavior in Ramsey Island, Wales (UK). This extends the geographic range of these observations and highlights that this predatory behaviour is firmly established in the largest colony of grey seals in southwest UK.



### **CON-01: Complex social structure of an endangered population of bottlenose dolphins (*Tursiops truncatus*) in the Aeolian Archipelago (Italy)**

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We investigated social structure and association patterns for a small population of Mediterranean bottlenose dolphins, *Tursiops truncatus*, inhabiting the Aeolian Archipelago (southern Italy). Specifically we evaluate the role of sex and age composition, residency patterns and interaction with trammel nets on this social organization. Association data for 23 regularly sighted individuals were obtained from summer photo-identification surveys collected from 2005-2012. Using a combined cluster and social network analysis approach, we found associations between dolphins hierarchically structured, where two mixed-sex social units were subdivided into smaller temporarily dynamic groups. We found non-random and long-term preferred associations in the population; however, the degree of social cohesion, residence pattern and interaction with trammel nets differed considerably between the two social units. Six of 8 females occurred in the more resident social unit-1; in addition, social unit-1 individuals had significantly stronger associations, higher preferred associates, lived in larger groups and occurred less frequently with trammel nets. Nine of 11 males were clustered in social unit-2 and 5 of these males, interacting with trammel nets, formed small groups and preferred associations. We propose that female and male groups associate in the study area during the breeding season and that some males choose to interact with reproductive females forming a distinct but interrelated social unit. Other males may be associating in a larger fission–fusion network, which consists of dolphins that appear to temporarily join the network from the coastal population. We cannot exclude that some males specialized in trammel net foraging, suggesting that this foraging technique may favor a solitary lifestyle. Large group sizes and high degree of social cohesion for females could be an indication of greater protection and more efficiency in detecting, deterring or repelling anthropogenic pressures. Most likely dolphins' social organization depends on a combination of socio-ecological, demographic and anthropogenic factors.

### CON-02: The significance of the east coast of the Isle of Lewis for the harbour porpoise (*Phocoena phocoena*)

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With anthropogenic activities having increasingly negative impacts on nature, it is important to learn more about local wildlife populations for effective conservation. Little is known about harbour porpoises (*Phocoena phocoena*) around the east coast of the Isle of Lewis, Scotland and so from 2011-2014, CPODs were deployed across six sites in this location. These passive acoustic monitoring devices detect odontocete echolocation, discriminating between narrowband high frequency harbour porpoise clicks and “other cetacean” clicks. Harbour porpoise Detection Positive Minutes (DPM) were recorded, allowing for site usage to be investigated. Harbour porpoises utilised each site all year round. Monthly activity variation occurred, peaking in summer months and from December-January. The summer peak indicates an increased presence during the reproductive season, suggesting that the east coast of Lewis offers important habitat features at this time. A general diel pattern of increased nocturnal activity was also found; however in March and December increased daytime echolocation occurred. The winter peak may reflect winter energy demands, prey availability, or reduced anthropogenic disturbance. The highest mean DPM/hr and total DPM were recorded at Loch Erisort, indicating that this site potentially offers more beneficial habitat features such as prey availability. There were no strong negative correlations between DPM for harbour porpoises and DPM for “other cetaceans”, despite reports of interspecific aggression and avoidance of bottlenose dolphins by harbour porpoises elsewhere. This could be due to local differences in habitat characteristics such as resource availability, or to bottlenose dolphin scarcity in the area. Sparse sightings data indicate that the latter is most likely. Overall, our data indicate that the east coast of the Isle of Lewis is an important site for harbour porpoises all year round, highlighting the need for appropriate conservation and management of the marine environment in this area.

### **CON-03: Identification of potential SACs through the presence of seabirds and bottlenose dolphin in central Tyrrhenian coast (Italy, Mediterranean Sea)**

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The bottlenose dolphin (*Tursiops truncatus*) is one of the Mediterranean cetaceans listed in the Annex II of Habitat Directive for which the designation of Special Areas of Conservation (SACs) is required. Bottlenose dolphins occur regularly in most coastal waters of the basin and around many of the region's offshore islands and archipelagos. Within their overall range, gaps with very low densities of animals have been documented, likely due to lack of data. It has also previously shown that non-random associations among marine top predators such as seabirds and cetacean could strengthen the criteria for SACs' identification. The aim of this work was to quantify the presence of bottlenose dolphin along with some seabird species (*Calonectris diomedea*, *Puffinus puffinus*, *Larus cachinnans*, *Ichthyaetus audouinii*) in a poorly studied area at the southern border of the Pelagos Sanctuary in order to identify potential target areas. A total surface of 191 nm<sup>2</sup> in the north-central Tyrrhenian Sea (Civitavecchia – Monte Argentario) has been covered by 12 sailboat-based transects carried out in good sea conditions (Beaufort scale  $\leq 3$ ). The presence of bottlenose dolphins, seabirds and associated "mangianze" (baitfish breaking the surface) was recorded by four observers. Interpolation by geostatistical kriging was applied in order to identify the most visited areas by dolphins and seabirds, defined as core areas. Georeferenced maps were compared to evaluate habitat's overlap among marine top predators. This approach allows implementing objective criteria to be used for management, protection and conservation strategies of the marine environment.

### **CON-04: Cetaceans in the extension of the Natura 2000 to the marine environment in Portugal – The M@rBis Project**

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In 2009, Portugal made a proposal regarding the extension of the continental shelf of the country which was submitted to the United Nations Convention on the Law of the Sea. Since then several projects have been developed to study the maritime area, namely the M@rBis project which is a GIS platform for the Portuguese marine biodiversity. It intends to support the extension of the Natura 2000 network to the marine environment. This work presents the results obtained for the cetaceans group during the surveys of 2013 and 2014. The methodology used was fixed surveys, since the vessel was mainly stationary and very close to shore (1 mile). In 2013 the survey was in the Algarve region in the southern part of the country, resulting in 32 cetacean sightings over a period of 16 days and 116 hours of visual effort. In 2014 the campaign took place in the Arrábida region, located in the central coast of mainland Portugal, and 13 cetacean sightings were registered over a period of 12 days and 109 hours of visual effort. This year stationary passive acoustic monitoring was additionally used to cover night periods and to complement visual effort, corresponding to 208 hours of acoustic records. The most observed species in both areas was the short-beaked common dolphin (*Delphinus delphis*), followed by the bottlenose dolphin (*Tursiops truncatus*) and the harbour porpoise (*Phocoena phocoena*). Mysticetes occurred twice in the Algarve area (2013). The M@rBis project and its results are a valuable source for the scientific community, allowing access to the information and culminating a gap of knowledge. Expanding the Natura 2000 network to the marine environment allows the implementation of broader marine conservation strategies, which is particularly important for protected cetacean species by the EC Habitats Directive (92/43/EEC), such as some of those observed during these campaigns.

### CON-05: Identifying critical areas and key habitats of bottlenose dolphins in Arrábida's coast (Portugal)

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Understanding species-habitat relationships are critical in order to identify special areas for conservation. In the Arrábida's coast (Portugal) is documented the occurrence of two sympatric populations of bottlenose dolphins (*Tursiops truncatus*) – the small resident population of the Sado estuary and the coastal population, however the level of interaction between these two groups is unknown. The aim of this work was to study the habitat use in order to identify critical areas and suitable habitats for these populations in this region. Boat-based surveys were conducted between 1998 and 2013. Home ranges estimates were performed using the Minimum Convex Polygon and the Kernel Density Estimator. The results showed that the two groups of bottlenose dolphins occupy the area in a different way, home ranges and critical areas are different in size and location. Therefore, the overlap area of occurrence observed is minimal, decreasing the likelihood of interactions between the two groups. Maximum Entropy Modelling showed that the most suitable areas for the two groups of bottlenose dolphins differ in location, similar to what was observed for the estimated critical areas. Part of the suitable areas identified by modelling was located mostly within the boundaries of Professor Luiz Saldanha Marine Park, highlighting the importance of this marine protected area in the near future, for the occurrence of this species in the region. This study evidences a degree of segregation of these two groups of bottlenose dolphins and identifies potentially relevant habitats to the conservation of this species in the study area. Thus, this study reinforces the need to conduct further research in this region and in particular these areas and highlights the importance of understanding the mechanisms that influence the distribution of this species on a local scale to implement effective conservation and management measures.

### CON-06: Restoration and protection of grey seals in Poland

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The population of the Baltic grey seal (*Halichoerus grypus macrorhynchus*) has been decimated in the twentieth century from 100,000 to approximately 3,000 as a result of hunting and intoxication with, inter alia, DDTs and PCBs. Despite the conservation efforts and presence of potentially suitable haul-out sites, seals have not re-established colonies on the Polish coast. In 1996, Hel Marine Station started the ‘Restoration and Protection of Grey Seals in Poland’ program as advised by HELCOM and the Polish Ministry of Environment. Between 2002 and 2014, 51 captive-bred and wild-born juvenile grey seals were equipped with satellite transmitters and released into the Baltic Sea. Contact with the deployed transmitters was maintained for up to 326 days. During that time, animals explored most of the Baltic Sea. Between 11 and 51 days young seals started to regularly occupy first haul-out sites, referred to as the exploratory phase. Most animals joined colonies along the southern coast of Sweden. Since 2007, an increasing number of wild grey seals have occupied the Vistula River estuary (Poland), including five of the tagged individuals. The remote sandbank provides them with peace and close proximity to target fish species. The appearance of seals in the southern Baltic is potentially related to population growth. The Polish coast is highly popular among tourists, and not many quiet and secluded places are available for seals’ rookeries. However, beaches within National Parks and military areas have some potential. A difference in migratory behaviour (haul-out sites locations, length of the exploratory phase) between captive-bred and rehabilitated seals was observed. Besides, only captive-bred seals (eight) were subject to by-catch. Further investigation of movement and habitat selection of juvenile seals might be vital to identify important areas for this species and their protection.

### CON-07: Prometeos Project: results from two years of research. Knowledge improvements on Mediterranean seamounts

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PROMETEOS (IUCN project, financed by MAVA Foundation and carried out by MENKAB: il respiro del mare association and DISTAV – University of Genoa) aimed to fill the gap of knowledge regarding Mediterranean seamount. Although these structures are well reckoned as aggregation sites of pelagic species and as biodiversity hot spots, specific knowledge within the basin is incomplete and mostly focused on benthic communities. During the two years of the project, "MENKAB: il respiro del mare" association conducted two surveys, respectively "Tirreno 2013 - 2014", in order to investigate the relationship between Tyrrhenian seamount and large pelagic species. The study area covered from 9.1° to 16° longitude E and from 37.6° to 42.9° latitude. N. 3250 nautical miles were sampled by visual census. Results of two sampling campaigns are N=107 cetaceans sightings recorded: *Stenella coeruleoalba* N=81, *Physeter catodon* N = 2, *Balaenoptera physalus* N = 5, *Grampus griseus* N = 2, *Ziphius cavirostris* N = 4, *Delphinus delphis* N = 6, *Tursiops truncatus* N = 7. Moreover N = 24 *Xiphias gladius*, N = 42 *Thunnus thynnus*, N = 4 unidentified shark species, N = 1 *Mobula mobular*, N = 128 *Caretta caretta*, N = 434 marine birds sightings recorded. A GIS based study performed by University of Genoa and ISMAR- CNR (Bologna section) brought to the revision of Mediterranean seamounts Atlas to be published by IUCN-MED. In this study a seamounts habitat model (Tirreno 2013-2014 and aerial survey of Tethys Institute-ISPRA data), based on distribution of striped dolphin (intended as biodiversity indicator) allowed the identification of Vercelli SM, Anchise SM, Vespasiano SM as the most attractive structures of Tyrrhenian Sea. Field survey observation revealed these seamounts are most probably exploited as a feeding area by striped dolphin and other top predators.

### CON-08: Cetaceans in the Crimean marine protected areas

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There are 32 marine protected areas (MPAs) in the Crimea; these objects have a different level of protection – Natural Reserves (Sary Bulat Islands, Karadag, Martyan Cape, Kazantip, and Opuk), National Natural Park in Tarkhankut Peninsula (Beautiful Harbour), nature sanctuaries (Aya and Fiolent Capes, Bakal Spit, Kazak Bay, etc.), fragmentary small “coastal aqueous complexes” (Ay Todor and Placa Capes, some rocky coastal complexes and bays in the different parts of coastline, Donuzlav Lake, Arabat Spit, Hersonissos, etc.) as a part of terrestrial reserved objects. The materials obtained from polling of 3,512 university students, specialists of reserved structures, local residents and volunteers in 2002-2014, and some field excursions in 1997-2014 were analyzed; 591 sightings and 245 strandings were reported. Harbour porpoises, bottlenose and common dolphins were observed in the different parts of MPAs, but the most of sightings/strandings we recorded in coastal part of Nikita Botanical Garden and Martyan Cape (18/7 cases), Karadag (21/6), Kazantip (14/29), Opuk (17/6), Tarkhankut Cape and adjoining area, (20/7), Aya (16/6) and Fiolent (32/9) Capes, Artek (15/5), Bakal Spit (126/33), Kazak Bay (17/11), Ay Todor (21/5) and Placa (23/12) Capes, Donuzlav Lake (23/8), Arabat Spit (32/24), Hersonissos (6/11), Novy Swet Bay and adjoining coastline (50/6), Kuchuk Uzen – Kuru Uzen Coastline (48/24) and Meganom Cape (20/5 cases). Bottlenose dolphins and harbour porpoises dominated in sightings (44.9% and 42.8%), while harbour porpoises dominated in strandings (72.4%). Sightings/strandings registered mainly in summer (75.6%/63.3%), but also in spring (10.0%/14.3%), autumn (7.8%/4.5.8%) and winter (1.2%/4.5%). Winter occurrence was recorded in Kazak Bay, Aya, Ay Todor, Placa and Meganom Capes, Karadag. The highest peaks of sightings/strandings were observed in 2005 (8.1/9.0%), 2006 (8.6/10.0%), 2008 (9.5/7.8%), and 2009 (8.3/8.2%). We suppose, MPA should expand to all coastal region (ecosystem-based management) rather than be a system of new protected small seascapes.



### **CON-09: Creating a network of contacts with local fishermen as a fundamental tool to provide data consistently throughout the year: Fin whale project**

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*EDMAKTUB Association, Spain*

Collaboration between local fishermen and scientists has contributed to a better understanding of marine species in many cases. EDMAKTUB association carried out a study on the annual presence of fin whales (*Balaenoptera physalus*) in the Garraf coast (central-south Catalonia) from February to June 2014, as part of the long-term 'Fin whale Project'. One of the most important aims of this project is to establish a network of contacts with local fishermen from three different guilds within the study area (Vilanova i la Geltrú, Barcelona and Tarragona). In order to confirm fin whale presence in the Garraf coast, EDMAKTUB first conducted interviews with fishermen who used different fishing gears and who have more than 20 years of fishing experience. All interviewees confirmed fin whales' annual presence within the Garraf area and reported that every year they have been able to see them most frequently during spring season. They usually encountered single fin whale individuals, although some stated to have seen two individuals, at about 5-6 miles from the coast (the same was observed throughout our dedicated study this year). Among the fishermen interviewed, 43% contributed actively as a citizen scientist by providing us with fin whales' sightings and their exact GPS position. After our dedicated study in the area, we have now been able to confirm a previously unknown presence of fin whales within the Garraf coast. These findings together with the interviewees' accounts highlight the importance of the study area for fin whales in the Mediterranean. Interviews constitute therefore an important management tool, contributing to an improved knowledge of cetacean species and consequently their conservation. The network created by the collaboration between scientists and the fishing industry could also constitute a marine stewardship that would allow for an appropriate conservation management plan to be applied within the Garraf area.

### **CON-10: From local to regional educational programs of cetacean research and collaboration for conservation**

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The Centro Studi e Ricerca Ambiente Marino (CE.S.R.A.M.) has been visiting Malta with youths to enhance their cultural and knowledge-based experience many times. In so doing this NGO has become aware of the long-term Maltese Cetacean Research Project that has been running since 1997, by the Conservation Biology Research Group of the University of Malta (CBRG-UoM) together with the Biological Conservation Research Foundation (BICREF-NGO). This awareness has developed into an opportunity that allows Italian volunteers to join in ongoing central Mediterranean research and conservation work organised in Malta – right in the centre of a region considered important for cetacean conservation but also strongly influenced by human activities.

BICREF makes available training sessions not only to Maltese entities, such as the Armed Forces of Malta, fishermen, SCUBA divers, various sea-users, interested public and NGOs but has widened its scope to include NGOs and volunteers from abroad, such as our NGO. The set-up established by the CBRG-UoM together with BICREF-NGO to involve various stakeholders through effective citizen science programmes in the field of marine conservation and cetacean research, has been encouraging other NGOs to do the same. However instead of reinventing the wheel, we have found it best to join forces with these Maltese entities who have extensive experience in the field of cetacean research and awareness projects in this part of the Mediterranean. Our NGO joins in training and research experiences in summer to allow youths and adults to join in and learn about marine life and its conservation in this part of the Mediterranean. During the rest of the year we may run comparable projects with stakeholders in Italy too. Such initiatives need to be encouraged throughout the Mediterranean to allow for effective networking with dedicated and experienced NGOs and researchers.

### **CON-11: A contribution to conservation of the short-beaked common dolphin *Delphinus delphis* in the Pelagos Sanctuary**

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From the perspective of marine mammals conservation issues in the Mediterranean Sea, the almost total disappearance of the short beaked common dolphin (*Delphinus delphis*), included in the 2003 IUCN list of endangered species, from the Pelagos Sanctuary is of great concern. This dolphin was probably one of the most common in the Mediterranean Sea until the early 20th century; nevertheless since 1960s it underwent a rapid decline, as confirmed by historical records on south France coasts. Currently, available data allows the identification of the Alboran Sea, waters of the Maltese Islands, Sicily Channel, northern Aegean and eastern Ionian Sea as areas with the common dolphins as most probable. In this work we show data on common dolphin presence within the Pelagos Sanctuary obtained by analysing sightings in the period 1998-2014. Data show that the common dolphin has almost disappeared from the study area (20 sightings in 16 years, mean group size = 2.35, SD = 1.53). Interestingly, it was often observed in association with the striped dolphins (*Stenella coeruleoalba*), a total of 16 sightings = 80%. When possible, the photo-ID technique was applied in combination to morphological markers and dorsal fin pigmentation patterns. Observations allowed repeatedly identifications of the same dolphins (11 individuals photo-identified), especially in the Tuscan waters, without new born or young individuals. The too small number of individuals may account for the absence of reproduction in the study area. Another classical advanced explanation takes into account the reproductive impairment caused by the effects of contamination by xenobiotics. Other causes commonly taken into account, deal with the decrease of the availability of prey, or the impact of fisheries. The cumulative and synergistic importance of these causes is poorly understood and worthy of further in-depth studies. The common dolphin is thus disappearing from the Pelagos Sanctuary or not?

### CON-12: Bardsey Island: An example of marine mammal monitoring by a bird observatory

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All nineteen of the bird observatories in Britain and Ireland are positioned at the coast and most have been in continuous operation for several decades, the oldest being founded in the 1930s and '40s. In addition to their widely recognised role in bird monitoring, all regularly record marine mammals. Some are involved in regular seal counts and cetacean watches. The Bardsey Island Bird and Field Observatory (BBFO), situated at the end of the Lleyn Peninsula in North Wales was founded in 1953 (and accredited the following year). The BBFO runs regular sea watches as part of its daily activities and whilst the primary aim of these surveys is bird census, cetaceans are also regularly observed, carefully identified and recorded into the daily log. Harbour porpoises (*Phocoena phocoena*) and Risso's dolphins (*Grampus griseus*) are regularly recorded and rarer occurrences include common minke whales (*Balaenoptera acutorostrata*) and orcas (*Orcinus orca*). A seasonal pattern of sighting is apparent for Risso's dolphins, with peak occurrences in September and October. In addition, to regular sightings of cetaceans, the island hosts a breeding colony of grey seals (*Halichoerus grypus*) and these too are monitored. BBFO has facilitated the research of visiting researchers into cetacean and pinniped biology resulting in a number of recent scientific publications. The bird observatories take a great pride in the quality of their monitoring work and this extends to the identification of non-avian fauna. Here we present some of the marine mammal data collected by the BBFO, outline associated research and suggest mechanisms to allow for more systematic data collection. Coastal bird observatories could potentially provide long term data-sets that may reveal changes in marine mammal populations.

### **CON-13: New conservation method: Improving the breeding conditions of the Saimaa ringed seal (*Phoca hispida saimensis*) with man-made snowdrifts**

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Successful breeding of the critically endangered Saimaa ringed seal (*Phoca hispida saimensis*) depends on adequate ice and snow cover, and therefore climate change poses a long-term threat to the seal population. A method of man-made snowdrifts has been developed to improve the breeding conditions of the Saimaa ringed seal. As the winter 2013-2014 was extremely mild and there were no natural snowdrifts for seal lairing a large-scale implementation of the man-made snow drifts was needed. All together 225 man-made snowdrifts were piled up all around Lake Saimaa together with about 150 volunteers as a part of the ongoing EU-funded Life Saimaa seal project. The sites for the man-made snowdrifts were based on the known breeding sites of Saimaa ringed seals. The lairs were made during the first two weeks of February leaving practically two weeks for Saimaa seal females to find the lairs before giving birth. The lairs were counted in April: in total 79% of the man-made snowdrifts were used by Saimaa ringed seals as a haul-out or breeding lair. The count by Metsähallitus Parks & Wildlife Finland was 64 pups, of which 59 were born in man-made snowdrifts and only 5 pups were observed to be born on open ice. In general, the observed mortality of the seals is concentrated on animals less than 1 year old, mainly due to fishing bycatch, and only 20% of the seals reach maturity. Hence, the man-made snowdrifts offer a new and unique conservation method to enhance the survival of seal pups and ensuring the breeding success of the Saimaa ringed seal under the threat of warming climate.

### **CON-14: Use of habitat and impact of aquaculture industry in two populations of bottlenose dolphins from Galicia (Spain) and Sardinia (Italy)**

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Conservation of a species requires the collection of reliable information about the distribution and habitat use, so that protection measures can be implemented in the future. The growth of aquaculture and the frequent exposure to motorised boats are likely to affect coastal populations of bottlenose dolphins, such as those found in north-east Sardinia and north-west Spain. Assessing the distribution and habitat use of these populations is important to implement Special Areas of Conservation (SACs), following European guidelines. A total of 947 research vessel based surveys were conducted (625 in Sardinia (Italy) and 323 in Galicia (Spain)) from March-July 2013 and in the same period in 2014, respectively. The habitat use of the dolphins was represented using Minimum Convex Polygons (MCPs). Bottlenose dolphin groups showed a preference for coastal waters at both sites, as well as a strong interaction with a marine fin fish farm in the Sardinian population and with the mussel rafts in the Galician population. Results showed no significant correlation between group size and habitat use area for both sites. Knowing the distribution and habitat use of the two populations is important for the development of future management and conservation strategies in areas where marine traffic and aquaculture can have a positive or negative impact on the distribution of the species.

### **DIS-01: Cetacean monitoring onboard ferries in the central Mediterranean Sea**

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From September 2013 to July 2014 the marine mammal observers of the ATUTAX (Tunisian NGO) and Ketos (Italian NGO) conducted a survey of top predator (whales, dolphins and sea turtles) distribution and relative abundance (abundance per unit effort) using ferries as platform of observation. This first major offshore cetacean survey was conducted in the central Mediterranean area, being part of the network survey programme coordinated by ISPRA since 2007.

In total, more than 250 h of monitoring spread over 45 working days resulted in hundreds of cetacean sightings. Six common species were identified: fin whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*), Cuvier's beaked whale (*Ziphius cavirostris*), bottlenose dolphin (*Tursiops truncatus*), striped dolphin (*Stenella coeruleoalba*) and common dolphin (*Delphinus delphis*). The most observed pelagic species were striped dolphin followed by fin whale, Cuvier's beaked whale, common dolphin and sperm whale. Coastal species were almost bottlenose dolphins.

These preliminary results of the first phase of the project co-funded by ACCOBAMS add important information about cetacean species distribution and long-term use of this area characterized by heterogenic topography like seamounts and submarine canyons. Collected data contribute to the large-scale cetacean survey network which monitors one of the potential critical habitats for cetacean species believed likely to be a “migratory” ground for large cetaceans and which is one of the areas in the Mediterranean region with highest maritime traffic density. The data from this survey has begun to highlight major differences in species occurrence and relative abundance between the Pelagos sanctuary and beyond this international MPA itself.

### **DIS-02: Occurrence of short-beaked common dolphins (*Delphinus delphis*) near the seamounts of the Tyrrhenian Sea**

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In 2003, the short-beaked common dolphin (hereafter referred to as the common dolphin), once one of the commonest species in the Mediterranean Sea, has been listed as 'endangered' in the IUCN Red List, due its' reported decline since the middle of the 20th century. Research on these animals is limited and a large-scale systematic effort to assess and monitor their distribution is not still available. The common dolphins have apparently vanished in some Mediterranean regions, among them the Provençal basin, and the Ligurian Sea, even if some specimens have been sighted in large groups of striped dolphins (*Stenella coeruleoalba*). Isolated groups have been described around Sardinia, particularly off its' western coasts, where animals alone or in small schools (four or five individuals) were observed. In this area some animals associated to larger schools of striped dolphins were recorded too. The common dolphin is also present in the Sicily Channel. This study has been carried out in order to improve the knowledge on the presence of this understudied species in the Tyrrhenian Sea. During two consecutive summers (2013 and 2014), 3250 nautical miles were sampled by visual census. Of the 107 cetaceans sightings recorded, only six were of common dolphins, one of which was in association with striped dolphins. The common dolphin's occurrence near seamounts was also investigated and the group composition was analysed through the photo-identification technique. This work is part of the project PROMETEOS - PROtection of the MEdiTERRanean Open Seas: Contributing to the establishment of Marine Protected Areas over off shore seamounts and submarine canyons, founded by MAVA foundation and actualized by MENKAB: il respiro del mare association with Units of Cetaceans Research (DISTAV – UniGe) in collaboration with IUCN-Med.



### **DIS-03: High local site fidelity demonstrated within Cardigan Bay, Wales, by bottlenose dolphins (*Tursiops truncatus*)**

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Cardigan Bay, Wales has one of the largest coastal populations of bottlenose dolphins in Europe with an estimated size (from line transect surveys) varying between 250 and 400 individuals. The bay is relatively shallow with depths reaching no more than 60 metres, and with a range of habitats grading from gravel and cobbles off-shore to a finer sand and silt near-shore with patches of cobble and boulder along the coast where the dolphin population is concentrated in summer. The area is utilised by the dolphins both for feeding and calving. Between April and October 2014, the abundance and site fidelity of the bottlenose dolphins was investigated, with emphasis upon the southern portion of Cardigan Bay, particularly around New Quay. 427 hours of boat surveys and 950 hours of land watches were conducted, and individual dolphins were identified using photo-identification. The average group size was  $2.88 \pm 0.17$  (mean  $\pm$  SE). During the season, we identified 99 well-marked individuals in the area, 46% of which were seen two times or more. Out of the identified individuals, the most frequently sighted individual was 074-03W (Bond), with 26 separate encounters between mid-April and mid-October. The average number of re-sightings of any one individual was 2.5, and the majority of those seen in 2014 have been sighted over multiple years. From these results, we have identified ten individuals with suspected high site fidelity within a relatively restricted area (with five or more sightings per individual). There is direct evidence that a wide variety of both benthic/demersal and open water prey species are consumed by the dolphins, including common sole, brill, red gurnard, conger eel, garfish, sandeel, sea bass, salmonids, herring and mackerel and it is suggested that the high site fidelity might be correlated with the availability of prey species in the area.

### **DIS-04: Cetacean occurrence and spatial distribution in the Portuguese Economic Exclusive Zone (NE Atlantic)**

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The expansion of commercial activities in European marine areas, such as fisheries, shipping, dredging, oil exploitation, tourism, mineral extraction or recently wind energy and offshore marine aquaculture, and several problems in managing the use of marine space have been documented by the European Commission, leading to the establishment of a framework for maritime spatial planning for Member States to manage human activities, uses and interests in their maritime areas (European Union Maritime Spatial Planning Directive, 2014). However, in the particular case of the Portuguese Economic Exclusive Zone (PEEZ), knowledge in cetacean occurrence and distribution is limited to a few miles from the coast and to the islands, preventing efficient conservation measures for cetacean species in offshore regions. Within the future expanded PEEZ, a total of 103 sea surveys were performed along fixed transects within Continental Portugal (between Porto and Lisbon) and to the islands (Madeira and Azores), from July to October, 2012 to 2014, using platforms of opportunity. Effort was concentrated in offshore areas, and a total of 12 species were identified: 12 in the route to Madeira, with 336 sightings in 14619 nautical miles of effort, resulting in an overall Encounter Rate of 2.30 (sightings/100nm); and 8 species in the route to Azores, with 130 sightings in 5577 nautical miles of effort, resulting in an overall Encounter Rate of 2.33 (sightings/100nm). Spatial analysis suggests different species profiles between and along the routes; and allows the identification of potential hotspots of species diversity and for species occurrence within the area. Considering the Habitats Directive resolutions, ACCOBAMS priorities, EEZ extension for the area and Maritime Spatial Planning Directive, and the urgent need for management plans, we suggest that the sampling strategy here presented is a cost-effective method to gather valuable data to support conservation measures.

### **DIS-05: Local coastal stocks of common bottlenose dolphins occur in the northern Black Sea**

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Common bottlenose dolphins *Tursiops truncatus* (Montagu, 1821) in the coastal waters of Crimea permanently occur along the Black Sea coast. They form the groups of tens to hundreds of individuals in a few local areas. The vessel surveys using photo-identification were conducted in 2009 and 2011-2014 in the area between the Cape Bashennyi and Cape Meganom (Sudak region), and in 2012-2014 from Cape Phiolent to Cape Sarych (Balaklava region). 70 bottlenose dolphins were identified from the waters of Sudak and 80 bottlenose dolphins from Balaklava. The Sudak dolphins were frequently re-sighted: 30% of the identified dolphins were recorded more than once, some of them from year to year. Since 2011, the unusual white bottlenose dolphin was recorded in a large group (usually more than 20 animals) feeding near trawlers. In the waters of Balaklava re-sightings are rare, and all of them within the same year. No movements of the identified dolphins between two areas were recorded, except for the single case in summer 2012. Thus, at least two relatively isolated stocks of different stability, different foraging habits and possibly, different ranges co-exist in the small coastal area at a distance of 100 km from each other. Frequent resightings in the waters of Sudak indicate on the relative stability of the local stock. In the area of Balaklava the stock composition is unstable, or it occupies a larger area. Further studies using photo-identification would allow specification of the details in the structure of local populations and their habitat boundaries.



### **DIS-06: Presenting the first recurrent sightings data of dolphins in the Laamu atoll, Maldives**

**Rachel Lambert**

*Six Senses Laamu, Olhuveli Island, Laamu Atoll, Maldives*

Located south of India in the Indian Ocean, the Republic of Maldives consists of a chain of 26 atolls located between latitudes 7°N and 0.5°S. The waters of the Maldives are part of the International Whaling Commission's Indian Ocean Sanctuary and have recorded 23 species of cetacean (Anderson *et al.*, 2012), which are protected under Maldivian law. Six Senses Laamu operates, throughout the year, a one-hour long daily sunset (5pm to 6pm MVT), dolphin cruises observe spinner dolphins, *Stenella longirostris*, as they exit the Laamu atoll. Sightings data from the boat trips has been recorded since March 2013 with confirmation of sightings of both spinner and bottlenose (*Tursiops* sp.) dolphins within the atoll and photo-identification of the observed dolphins has been conducted since September 2013. A total of 335 boat trips were conducted between 14th March 2013 and 31st October 2014 with 154 trips in 2013 and 181 in 2014. The percentage of dolphin cruises recording dolphins was consistent between the two years, 68% in 2013 and 72% in 2014. Spinner dolphins were sighted on 47% of the trips in 2013 and 43% of the trips in 2014; whilst bottlenose dolphins were recorded on 17% of the trips in 2013 and 11% of the trips in 2014. The sightings data has revealed that spinner and bottlenose dolphins are not usually seen on the same trip; only 2.1% of the trips between March 2013 and October 2014 had sightings of both species. On cruises where both species have been sighted the species are in separate groups and often kilometers apart. The recorded sightings data suggests that the Laamu atoll appears to host a continued year round presence of spinner dolphins and the photo-identification results are being used to establish whether or not it is the same individuals using the area.



### **DIS-07: Moving around: short and mid-distance movements of bottlenose dolphins in central waters of mainland Portugal**

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The bottlenose dolphin is a cosmopolitan species that often displays three broad types of “ecotypes” (resident, transient, offshore) that are used to define management units for the north-east Atlantic. The complex dynamics of bottlenose dolphins around the Iberian Peninsula and the rest of Europe, and the consequent difficulty of defining meaningful management units, indicates the need for regional research on the status and connectivity between different groups or populations. In Portugal, bottlenose dolphins have been reported at a few locations along the coast, and a recent study found coastal groups around Setúbal Bay with some animals showing a certain degree of residence, however no long-term and consistent monitoring of bottlenose dolphins have been undertaken, except for the Sado community. Our study aims to undertake a preliminary assessment of the existence and degree of connectivity between bottlenose dolphins in central mainland Portugal. Photo-ID data has been collected since 2008 using both dedicated and opportunistic surveys. A total of 209 surveys were conducted, from which mid-distance movement sightings were recorded in four opportunistic sightings in three areas between 2013 and 2014: From the 27 dolphins sighted in the Tagus mouth (central), 12 were re-sighted in the two other areas: Four out of 52 in Arrábida (southeast) and 8 out of 11 in Nazaré (northeast). There was no re-sighted individual between the areas of Nazaré and Arrábida. The dolphins that were re-sighted between areas travelled at least 110 km north and 58 km south from the first sighting. Several individuals showed dorsal fin alterations (notches addition and enlargement) even being sighted 19 months apart. These results show that future focused studies on bottlenose dolphins’ movements in mainland Portugal may need to comprise multiple areas to accurately assess the dynamics of this species, and extend to areas of Atlantic coasts of Iberian Peninsula.



### **DIS-08: Movement patterns of Chilean dolphins (*Cephalorhynchus eutropia*) in southern Chile**

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Determining home ranges of individuals (i.e. the areas used by individuals while carrying out everyday activities) could provide valuable insight into their habitat use and potential threats to them. Identifying the intensively used core areas within the home ranges can reveal patterns of resource use and potentially help to identify anthropogenic impacts on local populations.

Chilean dolphins (*Cephalorhynchus eutropia*), a coastal delphinid in southern Chile, show high site fidelity and prefer specific areas within their selected habitat. Available habitat is potentially being impacted by the fast growth of aquaculture farming. The Chiloé Archipelago in southern Chile - home to the best studied population of this species - is a good representation of areas, where the aquaculture farms are present in high numbers within the area of distribution of the local dolphin population.

This study used photo-identification data of individually identifiable Chilean dolphins collected during the summers of 2001 to 2012. Maximum alongshore ranges were determined as the shortest path between sighting locations for 70 individuals for which 1282 sighting locations were available. Average movement ranges were 31.7 km (SD = 12.7 km) with a maximum of 49.6 km observed. Kernel density home range estimates were determined for 26 individuals which had more than 20 sightings revealing individual differences in core area location, but all core areas were relatively small (6.8 km<sup>2</sup>). In order to account for spatially unequal survey effort that could affect the home range estimates, Generalized Additive Models were also used to determine spatial distribution of individuals in relation to covariates (latitude, longitude) which gave similar home range estimates to the Kernel methods. The identified core areas likely included reliable food resources but also overlapped substantially with aquaculture farms. This overlap is thought to result from preference for the same habitat not from dolphins seeking out aquaculture farms.



### **DIS-09: Spatial distribution of Dall's porpoise (*Phocoenoides dalli*) along the southern coast of Kamchatka and the northern Kuril Islands related to climatic and oceanographic characteristics**

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Dall's porpoise (*Phocoenoides dalli*) is a porpoise which inhabits the North Pacific Ocean. We surveyed the waters around the northern Kuril Islands (eastern Sea of Okhotsk) and the waters of Avacha Gulf (southeast coast of Kamchatka). The study was conducted in July and August 2014. Observations were made from inflatable motor boats and from a yacht.

We counted Dall's porpoise groups at the distance up to 500 m from the boat. We surveyed about 7,300 square kilometers. We met a total of 67 groups of Dall's porpoises, totalling about 335 individuals. Most groups consisted of about 4 individuals (Median = 4, Mean = 5) and were encountered at about 4.5 km (Median = 4.3 km, Mean = 8.3 km) from the coast at about 250 m depths (Median = 245 m, Mean = 296 m).

We found that around Kuril Islands Dall's porpoises were encountered much more frequently than in Avacha Gulf (relative density of population, Kuril Islands: 0.16 – 0.47 ind./km<sup>2</sup>, Avacha Gulf: 0.00038 ind./km<sup>2</sup>).

We compared the average monthly oceanographic and meteorological spatial variables between these areas during the study period: sea surface temperature, sea surface salinity, chlorophyll a concentration, wind direction and depth. The areas differed significantly by the following parameters: sea surface temperature in July and August, sea surface salinity in August, chlorophyll a concentration in July and August, northward wind in July and in August, eastward wind in July, and depth (Mann-Whitney test:  $p < 0.05$ ).

Our results show that Dall's porpoises prefer waters with lower average temperatures and chlorophyll a concentration and greater depths.



### **DIS-10: Long-term boat-based surveys in the central Spanish Mediterranean (2003-2013): Cetacean diversity and distribution**

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Since 2003, 61 boat-based surveys have been carried out to evaluate species richness and the spatial and seasonal distribution of cetaceans in the western Mediterranean waters off Valencia (east Spain), with 6,222 nm surveyed on effort. Eight cetacean species were recorded, the striped dolphin (*Stenella coeruleoalba*) being the most frequently observed (60% of the sightings), followed by the fin whale, (*Balaenoptera physalus*), (10%), the common bottlenose dolphin (*Tursiops truncatus*) (6%) and the Risso's dolphin (*Grampus griseus*)(6%). The long-finned pilot whale (*Globicephala melas*), short-beaked common dolphin (*Delphinus delphis*), Cuvier's beaked whale (*Ziphius cavirostris*), and sperm whale (*Physeter macrocephalus*) were the less sighted species (all <5%). Calves and juveniles were recorded for striped dolphins, Risso's dolphins, long finned pilot whales, short-beaked common dolphins and fin whales. The only two species showing seasonality were the fin and the sperm whale, which were observed mainly in spring and summer. Preferred waters for sperm whales, Risso's dolphins, short-beaked common dolphins, long finned pilot whales, and Cuvier's beaked whales were between 600 to 1,200 m isobaths, whereas fin whales, short-beaked common dolphins and striped dolphins occurred mainly in shallower waters. In fact, striped dolphins showed a shifting trend in habitat preference in recent years, expanding its range to the continental shelf. Previous aerial surveys in this area had demonstrated to be a useful tool for monitoring cetacean populations, with well-documented abundance and density estimations for the three most frequently species observed in these surveys: striped dolphins, common bottlenose dolphins and Risso's dolphins. In contrast, our boat-based surveys sustained over a long period of time, allowed to improve information of the less frequent species in the area and to reveal long-term shifts in cetacean occurrence.



### DIS-11: Using two methods in the study of cetaceans species in Pelagie Islands Archipelago

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The Pelagie Islands represent a high biodiversity area for cetaceans in the Mediterranean Sea. *Tursiops truncatus* is the most frequently sighted species in the Strait of Sicily and along the African platform. This work aims to improve the knowledge about bottlenose dolphins in the waters around Lampedusa. The results of the 2013-2014 monitoring activity are presented in order to evaluate abundance, distribution and acoustic behaviour of dolphins. Data collection was performed by dividing the study area into four quadrants among the coast. Thirty-three surveys were carried out for a total of 69 h of sampling effort and 593.63 nm of area covered. For each sighting, we reported group size, young specimens and associated species. The acoustic data were recorded deploying a hydrophone when the engine was turned off. The dorsal fin photo-id method was adopted. A total of 34 sightings of *T. truncatus* were collected (no significant difference was observed in the sightings rate between morning and afternoon: mean 1.92 (SD  $\pm$ 2.1), 1 of *Delphinus delphis*, 1 of *Grampus griseus*, for a total of 19.63 hours. For *T. truncatus* sighting frequency is 0.68, the encounter rate is 0.03. The mean size of the groups was 4.96 (SD  $\pm$ 3.7). The analysis showed a mean of 3.75 (SD  $\pm$ 4.1) individuals sighted from 3 p.m. to 8 p.m., compared to 4.18 individuals (SD  $\pm$  3.4) from 8 a.m. to 1 p.m. Young specimens represented the 19.35% of the total number recorded during 2013 and 6.52% during 2014. We collected 200 min of dolphins' acoustic data (both impulsive and modulated vocalizations) in which we observed 81 min (40.5%) of overlap within noise from boats engine and sonars. Our data confirm the constant presence for this species in the coastal area, where noise pollution could be influencing the state of conservation of inshore populations.

### **DIS-12: 2000-2014 cetacean sighting records in the central Mediterranean region from sea-users: An evaluation of long-term trends**

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The Biological Conservation Research Foundation (BICREF-NGO) has found the support of different sea-users in collecting cetacean sighting data while promoting cetacean conservation. The Royal Malta Yacht Club in association with the Rolex Middle Sea Race (RMSR) participants have assisted BICREF in collecting information of cetacean sightings during this 1127 km track race from Malta to Sicily, down to Lampedusa and back to Malta. The data collected included details of each boat's track and cetacean sightings. Participating RMSR sailing yachts ranged between 30 and 120 per race and each yacht's track is recorded through a satellite based tracker. A fill-up questionnaire which was returned with the filled-up sighting forms was considered to study the relationship between experiences out at sea, sighting feedback and quality of data provided. Most cetacean species typically found in the region have been spotted by these opportunistic observers with the most common species being striped dolphins. This annual data collection in autumn allows for comparative presence and abundance estimates during this time of year. The data are also analysed with various parameters linked to location, weather conditions, wind force and travel speed. These data (N = 3596 cetacean sightings) have contributed to test the efficacy of opportunistic data collection from sailing enthusiasts with well-defined tracks and effort. Also due to the fact that the number of replicates is high, statistical and modelling applications are used to estimate the effectiveness for this annual effort in monitoring cetacean presence and abundance in the region with minimal costs. Additionally enormous outreach, educational and awareness-raising is achieved as participants originate from various parts of the world. In this case marine mammals conservation awareness is being promoted from a local project to a global scale while contributing to complement data gathering efforts at regional level in the central Mediterranean.

### **ECO-01: Insights on the foraging ecology of the Mediterranean monk seal**

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The Mediterranean monk seal is a critically endangered marine mammal species whose habitat and behaviour are in great part still unknown in the Mediterranean. In this study we present some insights about the foraging of this predator.

Scat samples from north Adriatic (Istria-Croatia, n=4) and south Tyrrhenian (Sicily-Italy, n=4) seas were collected and analyzed for dietary investigations. In all samples, only fish bones and scales were recovered. Most of the prey items (36%) consist on Sparidae fish, where saddled seabream and surmullet were the most common identified prey. Other remains were only possible to classify as Perciformes due to the digestion degree of the bones. Although the study was carried out with limited sample size, we underline the importance of this information for an endangered mammal such as the Mediterranean monk seal, and the use of scats for the first time for this species.

### **ECO-02: Stomach contents of Cuvier's beaked whales, *Ziphius cavirostris*, stranded in southern Italy**

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The stomach contents of four Cuvier's beaked whales (*Ziphius cavirostris*), all adult females, stranded in southern Italy in separate events, were examined. The most abundant prey items were represented by cephalopod beaks, belonging to at least 12 different species. *Octopoteuthis sicula*, *Histioteuthis reversa*, *Galiteuthis armata*, *Ctenopteryx sicula* and *Chiroteuthis veranyi* were the most frequently recorded species. In only one stomach content a big amount of fish remains were found, the majority belonging to viperfish, *Chauliodus sloani*. This represents a rare case, the first recorded in the Mediterranean Sea, of direct consumption on fish by Cuvier's beaked whale. A review of the few data available for the area is also discussed.

### **ECO-03: Life tables of harbour porpoises in the Sea of Azov and the Black Sea: regional aspects and annual trends**

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Porpoises (Phocoenidae) are characterized with relatively short life span and reproduction-oriented life history. Their ontogenetic trajectories and demographical trends rapidly evolve under the changing ecological conditions. The Black Sea harbour porpoise (*Phocoena phocoena relicta*), the smallest porpoise in the world, is a good model indicating life history variations in unstable environments.

We examined the age structures of 549 porpoises stranded on the 35 km southern coast of the Sea of Azov in 1999–2014: within it, we identified sub-samples of strandings by year and cohorts by year of birth. In addition, we examined the age structure of the mass stranding in the north-eastern Black Sea in 2012 (163 porpoises). The sample from Sea of Azov was characterized by the low or decreasing maximum and mean life spans and high juvenile mortality. However, the comparison of cohorts born in 1999–2000 and 2002 showed the increase of life expectancy and the transition from the uniform yearly mortality rate to the mortality plateau at the age of 2–6 years. The age structure of stranded porpoises in 2002 was similar to the mortality in 2000 born cohort, and the age structure of 2013 was similar to the 2002 born cohort. Thus, the age structure reflected the natural patterns of mortality. Changes in the Azov life tables can be explained by the pressures of bycatch, shortening the overall life span and the simultaneous increase in ecosystem productivity. On the contrary, the Black Sea sample was characterized by the high life span, relatively low juvenile mortality and the longer mortality plateau, all indicating more favourable environmental conditions. Also this is clear evidence for different porpoise stocks in the north-eastern Black Sea and the neighbouring Sea of Azov, and notable is the high regional and temporal variability of life history parameters.

### ECO-04: Diet of bottlenose dolphin (*Tursiops truncatus*) of the Gulf of Ambracia, Greece, through stable isotope analysis

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The interactions among diet, ecology, physiology and biochemistry affect C and N stable isotope signatures in animal tissues; therefore, their analysis provides an effective means to investigate their diet and trophic relations. In this study, skin samples of 16 bottlenose dolphins (*Tursiops truncatus*) obtained through biopsy techniques in the Gulf of Ambracia, north-western Greece, in July 2013, were analysed for stable isotopes. Ongoing research showed the Gulf hosts a highly 'resident' community of about 150 dolphins. Since all 16 animals were photo-identified during the sampling process, based on our existing dolphin catalogue, it was possible to establish that 4 of them were younger than 5-years (i.e., first identified as newborns/calves in 2008/9) and 12 older. The stable isotopes of potential prey locally available in the Gulf, which included 11 species of fish, 1 crustacean and 1 cephalopod, were also analysed and the diet of the dolphins determined through a mixing model. Results indicated that dolphin diet was mostly based on horse mackerel (*Trachurus trachurus*), which represented about 25% of the biomass ingested, followed by species of the family Sparidae (*Diplodus annularis* and *Lithognathus mormyrus*) and of the order Clupeiformes (*Engraulis encrasicolus*, *Sardinella aurita* and *Sardina pilchardus*). When age-related variation was examined, younger dolphins were found to present values of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  lower than the others, which indicated that young animals are likely to exploit a lower trophic level than the adults, probably due to inexperience in foraging or due to some particular behavioural adaptation. It is noteworthy that bottlenose dolphins inhabiting this almost enclosed embayment are frequently engaged in surface-feeding. Gaining a better understanding of their feeding habits not only provides important information about the species, but also may be key to identify adequate management measures consistent with an ecosystem-based approach.



### **ECO-05: Reduction of killer whale (*Orcinus orca*) encounter rate in Avacha Gulf of Kamchatka (northeast Pacific, Russia) in years with low salmon abundance**

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Avacha Gulf of Kamchatka is an important habitat for fish-eating killer whales. They hunt, mate, socialize and rest there. Foraging takes about 50% of killer whale time budget in the Gulf. About 33 killer whale units use Avacha Gulf regularly from year to year, and other 30+ units visit the Gulf occasionally. Variations in killer whale encounter rate could indicate the changes in area usage related to the changes in ecosystem parameters. In the last two years we have observed a considerable reduction of resident killer whale encounter rate in Avacha Gulf. In this study we compared killer whale occurrence frequencies and diversity of killer whale units met in the area across 10 field seasons (July-August 2005-2014). In total we had 349 survey days and 227 days with fish-eating killer whales. The number of survey days in different seasons varied from 25 to 51 and the number of days with killer whales varied from 10 to 36. The killer whale occurrence frequencies in 2005-2012 varied from 0.5 to 0.9 (mean=0.76). In 2013 and 2014 it was significantly lower than in 2005-2012 (2013 – 0.2, 2014 – 0.3, 2005-2012 vs 2013-2014: Chi-square test,  $p < 0.05$ ). The diversity of killer whale families met in Avacha Gulf was also significantly lower in 2013-2014 compared to 2005-2012 (Chi-square test,  $p < 0.05$ ). The changes in killer whale encounter rate coincided with unexpectedly low abundance of spawning pink salmon (*Oncorhynchus gorbuscha*) observed in 2013-2014.

### **ECO-06: Does top predators response to their environment vary according to seasons?**

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Cetacean conservation can be achieved by the combined use of spatially defined local management regulations like marine protected areas (MPA) and more general policies such as fisheries regulations. In both cases understanding how cetacean distribute and use marine habitats is crucial as well as how this relationship changes over time because this determines how cetaceans overlap with sources of anthropic pressures and how spatially defined conservation tools can play their role. The SAMM surveys (Suivi Aérien de la Mégafaune Marine, Aerial Survey of Marine Megafauna), that were conducted in French and adjacent waters of eastern North Atlantic and the Mediterranean seaboards, explore seasonal variations in cetacean distribution and habitat use for the first time at such a large scale. The survey followed a line transect methodology, covering about 90,000 km on effort providing a total number of 2,877 cetacean sightings. In order to explore cetacean answers to the seasonal variability of their environment, we performed habitat modelling, through GAMs, using physiographic variables as well as weekly and monthly averaged oceanographic predictors (as SST, altimetry, currents, chlorophyll and NPP) for both seasons. Five groups of cetaceans: harbour porpoise, small-sized delphinids (common and striped dolphins), bottlenose dolphin, Globicephalinae (Pilot whales, Risso's dolphins) and fin whale. Pilot whales, Risso's dolphins, bottlenose dolphin (in the Atlantic only), small-sized delphinids (in the Mediterranean only) and fin whale showed essentially identical distributions and habitat preferences in both seasons. All other species showed marked seasonal shifts in distribution and habitat use (harbour porpoise and small-sized delphinids in Atlantic, bottlenose dolphin in the Mediterranean). Such seasonal patterns would be driven by foraging opportunities and determine how spatially defined conservation tools can efficiently cope with anthropogenic pressures.



### **GEN-01: Fine-scale social and population structure of bottlenose dolphins in the English Channel**

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Studying social and population structure has both fundamental implications (i.e. understanding the underlying ecological and evolutionary processes) and practical implications for conservation (i.e. the delineation of management units). For large social mammals, social, genetic and ecological structures are tightly interconnected, and influence each other. It is thus essential to study them jointly to thoroughly understand population structure. Photo-identification data and biopsy samples (N = 90) were collected from resident coastal bottlenose dolphins in the Normano-Breton Gulf (English Channel) to define their social and population structure. A multi-tracer approach including association, stable isotope and genetic analyses was used. Social structure analyses revealed that the community was organized in three social clusters that were not completely isolated from each other. The three social clusters had distinct but overlapping ranging patterns. A single genetic population was identified by applying Bayesian clustering analyses on microsatellite data. Stable isotope clustering analyses revealed three ecological clusters, consistent with social structure results. In contrast to many studied bottlenose dolphin populations, individuals did not preferentially associate with kin. Instead they associate with individuals of similar ecology. Several hypotheses might explain this social organization. Bottlenose dolphins in coastal waters of the north-east Atlantic have been more recently founded from a pelagic population than in other parts of the world. Thus, their social structure might have been derived from a pelagic social organization. A combination of ecological conditions, individual behavioural preferences and population structure history may have shaped the social organization of this population. This study has also implications for conservation. A single management unit may be designated based on genetic results and because there is no completely segregated social or ecological clusters. It will however be important to monitor the evolution of the social and ecological structure and take them into account when estimating demographic parameters.

### **GEN-02: Genetic structure of harbour porpoises in the Black Sea and adjacent waters: Where do we stand now?**

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In the Mediterranean basin, the harbour porpoise (*Phocoena phocoena*) lives mainly in the Black Sea, and it is less common in the Turkish Straits System and the Aegean Sea. The Black Sea population is recognized as the subspecies *Phocoena phocoena relicta* distinct from the Atlantic subspecies both morphologically and genetically. It has also been listed as endangered in the IUCN Red List since 2008. A good understanding of the genetic structure of the Black Sea porpoises is crucial for their conservation management, since they are threatened by many factors including bycatch, overfishing, habitat loss, and pollution. Previous studies on the genetic structure of the species compared different lengths of mtDNA control region fragments of 287 individuals and found different numbers of haplotypes (394 bps; 4 haplotypes / 364; 25 / 607; 12 / 705; 32 / 5085; 11). The general pattern that emerges from these studies is that Black and Aegean Sea haplotypes form a cluster together, different from the Atlantic and Pacific clusters. The results also suggest the Black Sea to be as the source for the Aegean porpoises. In addition, unique haplotypes (n=5) that have been only detected in the Marmara Sea, point out to a potential isolated population. More recently, nuclear DNA of a Black Sea population (n=4) were analyzed by next generation sequencing (RAD-seq) methods. These methods allow to obtain high resolution genetic data to detect genetic differentiation between individuals and populations. RAD-sequencing results supported previous inferences showing Black Sea population to be genetically differentiated from the North and Baltic Sea populations. However, no differentiation was found within the Black Sea population itself. Further studies with these new molecular techniques including more samples will be useful for a better understanding of the population structure of this endangered population, and to help guide efforts for its conservation.



### HI-01: Interaction between *Tursiops truncatus* and fishery in a commercial fishing area of Mazara del Vallo

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The aim of this work was to investigate the interaction between *Tursiops truncatus* and the fishery activities in a commercial area extending between Mazara del Vallo and Capo San Marco at about 25 miles from the coast. Surveys at sea (observation of trawl activities and dolphin behaviour, photo-ID techniques) and research of stranding specimens were carried out. Data belonging to 78 surveys performed in seven years (2003-2007 and 2011-2012) were analysed and 227 trawl fishing trips sampled. The association pattern of 40 re-marked dolphins in relation to trawls activities was analysed and the half-weight index (HWI) was calculated.

It was found that 72% of a population of 135 specimens interacted with trawl activities assuming opportunistic behaviour and observed only one bycatch event (one mother-calf pair died in the trawl). The association mother-calf pair was observed only in trawl dolphins. Furthermore, by analysing the presence of cuts on the fins we found that the no-trawl dolphins lack evident marks, while the 56 % of trawl dolphins have cuts on the fin tip. We collected 39 stranding cetaceans from 2000 to 2012 and found that 9 adults and two juveniles on 16 specimens of *Tursiops truncatus* have signals of interaction injuries possibly caused by trawl net.

This study confirms a strong interaction between a population of *Tursiops truncatus* and trawl activities and the presence of two separated communities of bottlenose dolphins: trawl and no-trawl dolphins. The members of these communities appear to be separated by feeding preferences. Moreover, the presence of mother-calf pair only in trawl dolphins allows us to conclude that this is a feeding and reproductive area and that the opportunistic behaviour is transmitted from one generation to another.

### HI-02: Do oil and gas platforms attract or deter harbour porpoises?

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Noise in the marine environment is increasing and for harbour porpoises this may have a great impact on their behaviour and overall fitness. The effect of offshore activities such as seismic surveys and pile driving has led to the implementation of mitigation measures followed by the oil and gas industry. However, the sound emitted by routine operations at production platforms has not been covered in detail and may represent an important contributing component of the acoustic marine environment. Porpoises may react to such continuously imposed industrial sounds by avoiding an area or changing their behaviour. However, the platform may also act as an artificial reef with increasing fish density that may attract porpoises. In July 2013 an acoustic study was initiated around an oil platform in the North Sea using 15 static Porpoise click detectors (C-POD's) and four noise loggers (SM2M+'s) placed at distances from 0 m to 13 km on a southern and easterly transect away from the platform. The main objective was to determine diurnal, seasonal, and annual porpoise presence at various distances from the platform and relate this to the underwater noise produced by the platform. Data displays a spatial trend of mean harbour porpoise detections above 200 Positive Porpoise Minutes per day in close proximity of the platform showing decreasing detection rates moving away from the platform. Porpoise activity was concentrated during night which indicates a diurnal porpoise utilisation of the platform area. Noise data collected in the same period displays large variation in received Sound Pressure Level (SPL) over time up to around 150 dB re 1 $\mu$ Pa rms Third Octave Level (TOL). The constant detection rates of porpoises close to the platform experiencing such SPL's suggests that porpoises make a trade-off between elevated noise levels and potential improved foraging conditions close to the platform.

### HI-03: Cetaceans and tuna fishery in the Atlantic and Indian Oceans: interaction but few mortalities

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Fisheries bycatch is considered to be one of the most significant causes of mortality for many marine species, including vulnerable megafauna. In the open ocean, tuna purse seiners are known to use several cetacean species, including threatened and endangered species, to detect tuna schools. It exposes them to encirclement which can lead to incidental injury or death. While interactions between fishers and cetaceans have been well documented in the eastern tropical Pacific Ocean, very little is known about these interactions and potential mortalities in the tropical Atlantic and Indian Oceans. Here, we provide the first study quantifying these interactions in both oceans by analysing a large database of captain's logbooks (1980–2011) and observations from on-board scientific observers (1995–2011). Distribution maps of sightings per unit of effort highlighted two main centers of co-occurrence: east of the Seychelles (December–March) and the Mozambique Channel (April–May). The percentage of cetacean associated fishing sets was around 3% in both oceans and datasets, including mostly voluntary whale associated-sets. Of the 194 cetaceans encircled in a purse seine net (122 baleen whales, 72 Delphinidae), immediate apparent survival rates were high (Atlantic: 92%, Indian: 100%). Of the mortalities recorded in the Atlantic Ocean, eight were pantropical spotted dolphins (*Stenella attenuata*) and three were humpback whales (*Megaptera novaeangliae*). These high survival rates suggest setting nets close to cetaceans has a low immediate apparent impact on species involved. Our findings will contribute to the development of ecosystem approach to managing fisheries and accurate cetacean conservation measures.

### HI-04: Caught in the net: prolonged partial entanglement of a bottlenose dolphin calf in fishing gear

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Interactions between cetaceans and fisheries are a widespread occurrence worldwide, with bycatch in fishing gear one of the main threats to these animals globally. We report on a prolonged partial entanglement of a bottlenose dolphin (*Tursiops truncatus*) calf in a fishing net, documented during a long-term study on bottlenose dolphin population ecology in the northern Adriatic Sea. The calf was first observed entangled in March 2014. A part of a fishing net (likely trammel net) was embedded in the anterior part of the dorsal fin, cutting into the tissue, and hanging off the sides of the dolphin. The calf, first seen in 2013 and presumed about a year old in 2014, was accompanied by its mother, with about 40 other dolphins in the group. The mobility of the animal and the depth of water in the study area precluded any potential attempts of intervention. Furthermore, it was considered that any intervention would likely be more detrimental. The calf, its mother and the rest of the group were continuously encountered in 19 sightings over the summer. The calf could apparently swim normally and its behaviour did not deviate from behaviour observed in other calves or other dolphins generally. The calf was last seen in October 2014. By this point the net was on the animal for a minimum of 203 days. At the time of last sighting, the calf was apparently still viable. However, the net has cut deeper into the dorsal fin, with the likely result of future loss of the dorsal fin. Previous data showed that bycatch is a source of calf mortality in this population. This case shows that incidental entanglement in fishing gear is not only a conservation concern, but also an animal welfare issue.

### HI-05: Bottlenose dolphin (*Tursiops truncatus*) responses to vessel activities in New Quay Bay

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Anthropogenic activities are intensifying throughout the world in coastal areas, leading to a higher probability of interactions with wildlife. This study aimed to ascertain the nature of vessel-dolphin interactions in New Quay Bay, Wales. Systematic land-based surveys including behavioural observations were undertaken at two sites between June and July 2014, in order to assess vessel-dolphin interactions.

Despite the majority (51%) of dolphins showing no response to vessels, behavioural interactions have significantly increased over the past five years (GLM:  $df=2$ ,  $P<0.001$ ). Positive interactions increased by 19% and negative ones by 24%. Small motor boats elicited the highest percentage of negative responses (27%), followed by row boats (22%) and speed boats (20%). A significant relationship was found between dolphin response and named vessels (ANOVA:  $df=1$ ,  $P=0.002$ ) and engine size ( $\chi^2$ :  $df=60$ ,  $P<0.001$ ). Comparisons of residency revealed that resident dolphins displayed a degree of habituation to specific vessels, thus resulting in fewer response behaviours (ANOVA:  $df=2$ ,  $P<0.001$ ). Transient dolphins consistently exhibited more negative response behaviours (ANOVA:  $df=2$ ,  $P<0.001$ ). Inter-breath interval (IBI) analysis found that surfacing interval decreased significantly in the presence of vessels, with the greatest effect occurring on mother and calf pairs ( $\chi^2$ :  $df=102$ ,  $P<0.001$ ). Males and females differed significantly in their responses to vessel interactions (ANOVA:  $df=2$ ,  $P<0.001$ ). During peak times (according to season and time of day), when vessel traffic was high, dolphin sightings decreased significantly ( $\chi^2$ :  $df=116$ ,  $P<0.001$ ). The results suggest that dolphins in New Quay Bay are engaging in short-term avoidance in the presence of vessels. In the long-term, this may result in reduced energy intake, lowered reproductive success, and ultimately, permanent emigration from the area.

### **HI-06: Monitoring of recreational vessels and bottlenose dolphins' presence to determine overlapping areas of occurrence (Sado Estuary, Portugal)**

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Considering the occurrence of a small and threatened resident population of bottlenose dolphins (*Tursiops truncatus*) in the Sado Estuary (Portugal) where a large number of human activities take place, a monitoring campaign with environmental awareness and education objectives was conducted. This campaign occurred between July and September 2014, during 47 days and a daily period of about 5 h, and was directed to the users of boats for recreational purposes towards the education and the safeguarding of the bottlenose dolphins. A total of 351 boats were approached and to each person responsible for the vessel a leaflet with a code of conduct for dolphin watching was delivered. About 50% of the boats were registered in Lisbon and the nearby large cities (Setúbal, Cascais, Sesimbra and Barreiro). Over 90% of the people approached were receptive to the campaign and the information provided. The large majority of users of the Sado Estuary are aware of the population of bottlenose dolphins and consider important such initiatives and their conservation. The observation and approach of dolphins by this type of boats was opportunistic and they don't seem to be actively looking for a dolphin sighting. Only two small areas of large overlap between vessels and dolphins were found, one inside the Estuary and another one outside. This may be related to; preferential use of the sheltered areas of the Sado Estuary and the adjacent coastal area both by the boat users and the dolphins, boats not following directly the dolphins but only occasionally taking advantage of their presence or movements to observe them and some negative behaviors by the boat users being reduced due to the presence of the campaign observers. This campaign alerted the general public for the presence of bottlenose dolphins in the Sado Estuary and the need to maintain them in their habitat.



### HI-07: The use of deep water berths and the effect of noise on bottlenose dolphins in the Shannon Estuary SAC

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The Shannon Estuary on the west Coast of Ireland is one of Europe's premier deep water berths catering for ships of up to 200,000 deadweight tonnage. Additionally the area is currently one of two designated Special Areas of Conservation (SAC) for bottlenose dolphins in Ireland under the EU Habitats Directive. Long-term Static Acoustic Monitoring (SAM) was carried out at five deep water jetty locations in the estuary at Money Point, Tarbert, Foynes, Aughinish and Shannon Airport. SAM was carried out using C-PODs. A total of 1,963 C-POD days were monitored across each of the five sites over an 18 month period. Additionally, between June and September 2012, a noise monitoring network using the LIDO system was deployed at Tarbert Jetty following an EPA funded collaboration between the GMIT and UPC. This included an SMID digital hydrophone which was connected to an embedded SBC that performed the data analysis including noise measurement in 3rd octaves bands centred on 63 and 125 Hz as highlighted under the MSFD. Results showed that shipping activity produced noise between 120-140 dB for the channel at Tarbert. Additionally, Biospheric Engineering Ltd. made short duration noise measurements at two further locations in the estuary and found the mean of mean noise levels was 103 dB re 1 uPa. Dolphins were recorded at the Tarbert site on 53% of days monitored. In order to effectively monitor Annex II species, it is imperative that the effect of ocean noise on dolphin distribution and behaviour is explored through seasonal, diel and tidal patterns.

### HI-08: Does vessel traffic affect the abundance and behaviour patterns of bottlenose dolphins?

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There are many studies showing that vessel traffic has both long- and short-term negative effects on marine mammals, from declining populations and habitat displacement to behavioural changes that could affect their fitness. To determine the importance of this factor, we compared behaviour and abundance patterns in the presence and absence of vessels in the Archipelago de La Maddalena (Italy). This is a critical area of study because the entire zone is included within an International Park between France and Italy, and is part of the Pelagos Cetacean Sanctuary. Also, these waters have high levels of vessel traffic as they are one of the most important connections between the Balearic and the Tyrrhenian Sea. During the sampling period, the study area was divided into four subareas and each one was monitored for 40 h following random transects. Data collected included geographical conditions (depth and seabed), moon phase, time (season and time of the survey), spatial location, number of vessels, typology of vessels (fishing or recreational vessels), and in case of sighting, school size, presence of calves and behaviour. For each sighting, a focal individual was selected and respiration rate (RR) was recorded. All these collected variables were used in General Linear Mixed Models, as candidate explanatory factors for differences in dolphin abundance and behaviour. Results showed that season, moon phase and presence of calves positively affected the abundance of dolphins, as well the spatial effect. On the contrary the number of vessels was negatively related to abundance and variability in RR. In particular, when more than three boats were present in the area, RR increased and behaviours such as feeding and socializing were not detected. Our findings provide additional support for the need to consider disturbance as vessel traffic in management plans for cetacean conservation.

### HI-09: Interaction between cetacean and maritime traffic in the “Sicilian-Tunisian” channel

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Within the Mediterranean Sea marine region the “Sicilian Channel” is the one with higher intensity of maritime traffic, created by ships that from the south-east of the Mediterranean Sea move to the Strait of Gibraltar, the pressure is even greater in the constriction area of the Strait between Sicily and Tunisia where the density increases. The area, due to the presence of high productive values, is considered one of the potential wintering grounds for fin whale. While several Multilateral Environmental Agreements (such as ACCOBAMS, Barcelona Convention SPA/BD) require for States Parties to evaluate and manage the interactions between cetaceans and vessels, there has never been such assessment in the area. For this reason, since winter 2013, using ferries as observation platforms, along a fixed transect line between Palermo and Tunisia, started a study, co-funded by ACCOBAMS, that monitored systematically cetacean distribution and the interaction with maritime traffic. Along the ferry route, dedicated cetacean observers, through seascape scan sampling, computed the number of large vessels detected both during cetacean sightings (n=80) and randomly (n=250). About 260 hours of observation were undertaken in good sea conditions ( $\leq 3$  of the Douglas scale), covering over 4,000 nautical miles. Differences in percentage, distribution and frequency of the values of the two computations were tested. Overall results showed that during sightings, values of maritime traffic were reduced to about 35% with a significant difference in distribution and frequency (M-W and K-S both  $P < 0.01$ ). The reduction was not uniform across the species. In particular *S. coeruleoalba*, and *Balaenoptera* spp. sightings occurred with lower maritime traffic intensity, while *T. truncatus* sightings occurred with a higher number of vessels compared to random vessel detection. One near event ( $< 50$  m from the bow of the ship) was recorded.

### HI-10: Is this the last supper? Green turtles in the stomach content of a Mediterranean monk seal

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Stomach content of the Mediterranean monk seal (*Monachus monachus*) which was deliberately killed and stranded in the Turkish eastern Mediterranean Sea coast on May 2, 2013 was examined. In total, 9 taxa were identified to species or family level and 69 individual food items were counted. Sparidae was the most important family of prey fish and the only cephalopod species found in this stomach was *Octopus vulgaris*. *Ariosoma balearicum* and *Argyrosomus regius* were encountered for the first time in the monk seal diet in the Mediterranean. The prey remains also consisted of several body parts (three heads, six forelimbs, neck bones and fractured upper forelimb bones) of newly eaten green turtles (*Chelonia mydas*). Based on the size and similarities, they could belong to three individual turtles. Although predation or suspected predation on the green and loggerhead turtle had been reported for the Mediterranean and Hawaiian monk seal, there has been no actual report of any sea turtle remains in the stomach contents until this study. Considering the size of the found body parts (head length 7-10 cm; forelimbs length 16-20 cm) and no other parts such as carapace was found, it is unlikely that this seal preyed on the whole turtles, but rather bit off those body parts from the entangled turtles in fishing nets. In the Turkish eastern Mediterranean coast, one of the most important nesting and foraging areas for green turtles, bycatch rate in set nets is very high. The pieces of gillnet found in the stomach were not surprising, because such cases were reported and stealing fish by seals from nets is well known. In the light of this information we assumed that the seal was deliberately killed during or after its' attack to the fishing gear while biting off the bycaught turtles from the nets.

### **HI-11: Trends of cetacean bycatch along the north coast of Catalonia (NW Mediterranean): fishing harbour surveys and analyses of stranding records**

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The coastline of Catalonia is almost straight, with the length exceeding 500 km and delimited by two landforms Ebro Delta at the south and Cape of Creus at north. The south area presents a wide continental slope. The central and north coasts are categorized by narrow slope and the presence of different submarine canyons that reach 2000 m depth. These characteristics allow the presence of 11 species of cetaceans, 8 of them being common in the area.

Almost 900 fishing vessels operate in the area. There is a wide variety of fishing activities: 272 trawlers, 57 longliners (both bottom and surface), 87 purseiners of small pelagics and 6 tuna purseiners, and different fishing gears from 447 artisanal boats.

Coexistence of cetaceans and fishing activity evolves in fishing interactions and bycatch. In early 90's, a study on cetacean interaction in the area was conducted covering 10% of the trawler fleet and 20% of the purseiner fleet. In 28% of the trawling operations, cetacean interaction resulted in a bycatch of 1-3 dolphins/year. Purseiners reported interaction in 82% of the cases. 24% of the operations resulted in a bycatch of 1-3 dolphin/year, and in 18% of the cases bycatch raised to 3-6 dolphins/year. The range of cetaceans stranded annually was 25-75, and the percentage of those showing signals of fishing interactions was about 10% (range 5-18%).

The present study analyzes the evolution of cetacean interaction cases conducting a survey on 30% of the fleet of the 8 main fishing harbours in the area using the same methodology that was used in previous studies in the 90's. Results suggest that the percentage of interactions has increased in recent years, and that stranded dolphins with evidences of bycatch have doubled the former values of the 90's reaching 20% of the cases.

### HI-12: Responses by dolphins to marine traffic mirrors responses to natural predators

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Human disturbance has become a topic of interest to wildlife biologists and managers. Changes to behavior, which can include short-term (e.g. decrease in foraging activity) and long-term impacts (e.g. habitat shifts) can affect fitness and so should be considered. Disturbance of cetaceans by vessels has been studied in multiple locations, with a primary focus on direct approaches by eco-tours. Indirect effects from uninterested vessel traffic have not received much attention. And in particular, how the level of traffic and predictability of traffic might impact these animals. This is important to consider in relation to trade-offs between the risks of using such areas and the ability to effectively forage. To examine this, we measured dolphin habitat use in relation to traffic (traffic volume and predictability of traffic direction) and prey abundance for bottlenose dolphins in the Lower Florida Keys. We found that in areas with low traffic, dolphins were most often where the prey biomass was greatest. In high traffic areas with predictable patterns of traffic flow (i.e. primarily north-south movement), dolphins could still be found, but did so in a way that allowed them to potentially reduce risk (staying on the edges). Dolphins however, underutilized other high traffic areas where vessel movement was less predictable (i.e., with frequent changes of heading), even though there was high prey availability. These findings indicate that similar to natural predators, vessel traffic can present a level of risk that is likely considered in trade-off decision making (weighing locating food with potential risk of strike).

### HI-13: Behavioural reaction of three species of cetaceans to the dense marine traffic in the Istanbul Strait, Turkey

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The Istanbul Strait is an important corridor for both marine vessels and cetaceans. As it is a very confined space, the route of vessels and cetaceans often coincide. To understand the marine vessels' effect on cetacean in the Strait (bottlenose dolphins, common dolphins, harbour porpoises), behavioural reactions were analysed. Vessel type, speed, vessel-dolphin distance and vessel densities, were recorded during the surveys carried out in August 2011-October 2013 (total 366 survey days). All cetacean species had the highest encounter rate in spring and summer, while there was a rapid decline in autumn which is the start of fishing season. More than 50% of the observation time, vessels were present in 400 m zone with cetaceans. While the research vessel, fishing boats and cargo ships were the highest recorded vessels for all three species, they only caused the least negative reaction, which implies that cetaceans are habituated to the presence of these vessels. High speed ferries, high speed boats and regular ferries caused the highest negative reactions with the magnitude of such reaction increasing as the distance decreased. Additionally, increasing vessel density resulted in less surface-active behaviour, while resting behaviour was never recorded with more than two vessels in a 100m-zone. In conclusion, although all three species showed some degree of habituation towards slow speed vessels, high speed vessels with unpredictable routes caused behavioural changes. Area avoidance was observed in autumn due to the high fishing vessel density. While bottlenose dolphins and harbour porpoises were the most reactive to vessel presence by increasing their diving behaviour, common dolphins kept their behaviour constant. Moreover, harbour porpoises were actively avoiding high marine vessel density areas. Our findings indicate that vessel type, speed, distance and density have to be considered together for elaborating an effective conservation strategy against marine traffic in the Strait.

### **HI-15: Building big: The potential effects on cetaceans from marine development on Merseyside**

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Liverpool bay and the Mersey estuary have historically been heavily developed and the estuary is widely used by industry. At present, three projects are taking place in the region with the expansion of the Burbo Bank wind farm, the creation of the Liverpool 2 deep water container port and the Mersey gateway development in Runcorn. Historically the Mersey has been one of the most polluted rivers in Europe but has seen dramatic improvement since the Mersey basin campaign which has led to significant improvements in biodiversity including the return of cetacean species. We examine the locations of these developments in relation to areas of high cetacean sightings and discuss the potential effects of the work. We also discuss the potential for high levels of pollutants in the sediment being disturbed and entering the water column.

Finally we will examine the proposed underground coal gasification development in the river Dee and the environment issues involved in the work and potential for negative effects on local cetaceans. For our cetacean habitat use data we will be using sightings recorded by Liverpool Bay Marine Life Trust and the Sea Watch Foundation between 2007 and 2014.



### **MN-01: Plastic debris and megafauna in the CW Mediterranean marine region: synoptic multidisciplinary monitoring as tool for addressing one of the major threats in the marine ecosystem**

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Marine plastic debris has direct impacts on marine megafauna which can be harmed through ingestion or entanglement and regularly plastic items are found in stomach contents of stranded cetaceans and turtles. Despite legislative requirements, few data are available in the Mediterranean basin on marine macro-litter distribution, composition and source and there is a lack of knowledge on sensitive areas where the potential damage to the biota is greater due to the overlapping of marine debris and megafauna. For this reason, cetacean and sea turtle distribution and data on plastic macro-debris (>20-25 cm) were monitored simultaneously for one year in 2013/2014 (50 surveys) along a fixed-line transect crossing the western Mediterranean marine region (from Civitavecchia, Italy, to Barcelona, Spain). Distribution of megafauna and plastic items were overlaid in order to highlight areas at major risk for sea turtle and squid-eater cetacean species. During the surveys more than 1,000 plastic items were georeferenced along the transect. Kernel analysis was performed and distribution of items showed high density areas in central Tyrrhenian Sea, Strait of Bonifacio and along the Spanish continental shelf. Spatial analysis performed on high density areas of plastic component and distribution of species, exposed some sensitive areas especially in central Tyrrhenian Sea for Cuvier's beaked whale, in Sardinia sea for sperm whale and along the Spanish continental shelf for Risso's dolphin. Loggerhead sea turtle seems to be particularly at risk during spring-summer giving the greater occurrence in these seasons. Results show the potential for gathering real-time data on megafauna and potential threat in high sea areas and put the basis for setting up an Ecological Quality Objective (EcoQO) in the western Mediterranean Sea region based on plastic macro-debris densities coming from collected data and related with data on stomach contents of dead cetaceans and turtles.

### **MN-02: Method for investigation of communication in the dolphins**

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The investigation of the features of communication in the dolphins is important not only as a zoopsychological problem, but also in a broader context.

The proposed method consists in simultaneously applying miniature acoustic recorder fixed on the body of the dolphin which allows to record labels of acoustic signals of the concrete dolphin in a range up to 22 kHz, and stationary underwater recording system that is configured accordingly of acoustic features of the pool and has frequency and dynamic characteristics accordingly of full signals of the dolphins. The novelty of this method is the ability to study the acoustic signals of moving dolphins with the definition of the producer of signals.

It is also possible modification of the method, which includes only a stationary system of underwater recording. This is a modification of Bastian experiment. In this case the first dolphin should be quasi-stationary relative to hydrophones that can be implemented in a small pool, associated underwater acoustic channel with a large pool. The experiment should be constructed in such a way that the first dolphin passed to another dolphin information given by the experimenter. Behaviour of the second dolphin, connected with the first dolphin only by acoustic channel, acts as the demonstration of allegiance the understanding a command. We must teach the first dolphin to pass commands through the acoustic channel without performing them, and we must teach the second dolphin execute commands sent not from the man, but from the first dolphin. In such conditions it was possible to talk about creating a dictionary of dolphin “language”.



### **MN-03: A case study on moist method transportation of two bottlenose dolphins in Turkey**

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Two male bottlenose dolphins (*Tursiops truncatus*) were used in “swim with dolphin programs” in a variety of facilities in Turkey from 2006 to 2010. Tom was 228 cm and Misha was 269 cm in body length. In March 2010, they were moved to a pool in Fethiye, Hisarönü, on the Mediterranean coast of Turkey. Poor maintenance of their living conditions resulted in protests from the public and non-governmental organizations, and appeals were made to move the dolphins to another location with better conditions, which later became ‘Back to the Blue Project’. This study aims to report and discuss the transportation of these dolphins as well as compare commonly accepted techniques of transportation of cetaceans: ‘moist transport’ and ‘wet transport’. Even though wet method is preferred for long distances, moist method can be satisfactorily used in emergencies and for short-term transportations if it is correctly applied. In this case, the moist transportation technique was used. The dolphins’ health conditions were stabilized and they were left for a fasting period for 24 hour prior to transport. They were carried in a refrigerated truck and temperature was set around 5°C. They were dominantly maintained in sternal position with their pectoral fins folded against their chest. Their health status was monitored during the operation. Individuals’ body temperatures monitored by rectal thermometers. Mean body temperature was 37.6°C. On one occasion, Misha’s breathing rate increased to 5 breaths per minute. It was returned to the normal value of 1-3 breaths per minute by repositioning for more comfortable posture. The team did not face any other serious situation. In our opinion, the moist method is more suitable for transportation in Turkey compared to the wet method considering applicability, affordability, availability of materials and logistics.



### **MN-04: Dual mode surveys: a method for providing cost effective absolute abundance data for small cetaceans at scales "beyond the local"**

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European instruments such as the Habitats Directive and the Marine Strategy Framework Directive, designed to achieve good environmental status in European seas, include an obligation to monitor populations of marine mammals. Clearly, for cetacean monitoring to take place at the appropriate scale requires programmes coordinated at scales which are significantly larger than the “local” scale at which most marine mammal survey programmes are conducted. It is likely that many different research groups within a range of EU states will be able to contribute to the overall monitoring effort, but to be able to combine these efforts they must provide comparable estimates. This will require a method that can estimate absolute abundance. Traditional methods for determining cetacean absolute abundance require large teams of observers and expensive vessels. There is a clear need to develop more robust and cost effective methods for determining absolute abundance.

A number of surveys have been conducted in recent years from small vessels with the aim of providing data for Environmental Impact Assessment of off-shore wind farm developments. Sighting data from single platform visual observers, do not provide abundance estimates. Passive acoustics provide an automated and an efficient way of detecting harbour porpoises and target motion analysis techniques give estimates of the perpendicular distance to each detection. We describe the development of an approach using visual and acoustic data to set up trials to estimate  $g(0)$  for each detection method. These have allowed cost effective surveys providing density estimates and density surfaces for harbour porpoises from year round surveys covering significant areas in the North Sea.

### **MN-05: Investigating the effect of recording depth on delphinid whistle characteristics**

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Over the past decade, Passive Acoustic Monitoring (PAM) methods have been adopted as effective tools for obtaining information about the occurrence, distribution and behavior of marine mammals. Delphinid species identification using whistle classifiers with relatively high correct classification scores have been developed and are now frequently used in combination with seafloor recorders. However, these classifiers are usually trained and tested using data collected near the sea surface with dipping or towed hydrophones, whereas the recorders used for species monitoring are often deployed at depths of hundreds or thousands of meters. This raises the possibility that the sounds arriving at a seafloor recorder may have different characteristics than those observed at the sea surface, thereby biasing species classifications. To investigate this possibility, a study was conducted to examine the characteristics of some dolphin whistles recorded at different depths in the water column. To this end, a 300 m bottom-moored array of four Ecological Acoustic Recorders (EAR), each spaced 90 m apart, was built and deployed at two locations off the island of Oahu, Hawaii for periods of 10 and 30 days. Dolphin encounters were manually identified in the data set and the whistle parameters commonly used for species classification were extracted using a custom Matlab algorithm. Preliminary results indicate that certain whistle parameters (including frequency range, whistle duration, beginning and end frequency) indeed differ between recording depths and that further investigation on the effect on automated classifiers is warranted.

### **MN-06: Baleen plates as a continuous-time recorder of fin whale migration: Results of nitrogen and carbon stable isotopes analysis**

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Like most mysticetes, fin whales undertake annual migrations that involve seasonal movements from productive high-latitude feeding grounds, occupied in summer, and low-latitude breeding grounds, occupied in winter. The destination and pattern of migration is central for understanding the range and degree of connectivity between populations or stocks, issues that in the North Atlantic still remain unclear. Baleen plates are a useful source of information for investigating these aspects because they are composed of keratinous tissue with no turnover. As a consequence, they preserve the isotopic signal of the metabolic precursors along their growth axes and therefore constitute a continuous-time record of the isotopic variations that occur during the migratory cycle of the whale. Here we investigate the pattern of migration of fin whales summering off W Iceland through detailed analysis of the nitrogen ( $\delta^{15}\text{N}$ ) and carbon ( $\delta^{13}\text{C}$ ) isotopic values occurring along the growth axes of the baleen plates of 5 individuals. The isotopic fluctuation of the stable isotope values of both elements confirmed previous findings in the Iberian and Mediterranean fin whale populations that the growth rate of the plate is about 20 cm per year. The  $\delta^{15}\text{N}$  value presented a regular sine wave pattern similar to that observed in other populations and species. The  $\delta^{13}\text{C}$  also showed a similar pattern, this time strongly in contrast with the absence of fluctuations found in other fin whale populations, particularly that occurring off NW Spain. Examination of the individual pattern of variation of  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  combined suggests that the whales studied here may be assigned to two groups characterized by dissimilar migratory patterns, a possible indication of the existence of heterogeneities in the composition of the Icelandic fin whale stock.

### **MN-07: Evaluation of the immunotoxic effects of environmental contaminants through the expression of MIC-A as a toxicological stress marker in fibroblast cell cultures**

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The unusual mortality event occurred during the first three months of 2013, which mainly involved striped dolphins (*Stenella coeruleoalba*) along the Tyrrhenian coast of Italy, underscores the need to get proper insight into the dynamics involved in the interaction with dolphin morbillivirus and other "emerging" pathogens, such as *Brucella ceti* and *Toxoplasma gondii*, with special emphasis on the cetaceans' immune system. In fact, several xenobiotics accumulating in cetacean tissues are powerful immunosuppressants reducing their immune capacity, therefore, the susceptibility of aquatic mammals to these contaminants and, consequently, to a number of neurotropic and non-neurotropic pathogens, is increased and these agents can cause their death. Herein, we have evaluated the immunotoxic effects caused by some of the main organochlorine compounds (OCs), such as DDTs and PCBs, as well as by methyl-mercury (MeHg) and gold nanoparticles (AuNPs), on fibroblast cell cultures obtained from both stranded (12-24 hours after their death) and free-ranging cetaceans. We also used a human skin biopsy sample for comparing the investigated parameters among different mammalian species. In particular, we investigated, by means of indirect immunofluorescence, the expression levels of the protein encoded by the MIC-A gene (MHC class I chain-related gene A). MIC molecules are considered to be stress-induced antigens that are recognized by cytotoxic T cells and natural killer (NK) cells, which play an important role in the surveillance of transformed, infected and damaged cells. We detected a MIC-A activity that was more inducible in human cells, following their exposure to environmental toxic compounds (both xenobiotics and natural), than in cetacean fibroblasts. In conclusion, the stress of the immune system seems to coincide with an increased expression of this protein both in human and in cetacean fibroblast cell cultures.

### **MN-08: An innovative device for measuring underwater noise pollution**

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Underwater noise pollution caused by human activities has been one of major issues in environmental conservation as it may have negative effects on marine species. Its actual impact on marine mammals is still under investigation. Recent increase in maritime traffic, pile driving activities and geophysical surveys are all activities that generate high levels of underwater noise, and require tools able to accurately monitor these phenomena. To this aim, an innovative measurement system is proposed, which consists of the integration of a digital hydrophone and a CTD sensor. The system is capable to acquire simultaneously along the water column both acoustic noise data and oceanographic measurements, such as temperature and salinity, necessary for the computation of the sound speed profile, and hence, subsequent analysis/prediction of sound propagation. Correlating acoustic and oceanographic data provides more reliable and complete sensing of the environment. The digital hydrophone includes a two-channel, analog-to-digital converter, directly connected to the ceramic sensor through two low-noise preamplifiers with different gains. The wide bandwidth (up to 80 kHz) allows monitoring a variety of noise sources. Using the double gain implies an increase of the dynamic range, making it possible to record either strong or very weak signals. The fact that the digitalizer is very close to the hydrophone makes the data immune to any electromagnetic interference and to signal weakening along the data transmission cable.



### **MN-09: How do multi-target protocols affect cetacean detection in aerial surveys?**

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Abundance and distribution of pelagic megafauna are key indicators for monitoring marine ecosystems. Ideally, taxon specific protocols for cetaceans, seabirds or sea turtles should be adapted. However, optimization of monitoring costs, encourages the development and implementation of multi-target surveys. The present work aimed at determining the consequences of implementing a multi-target protocol on small cetacean detection. We compared the performance of two observer platforms in aerial transect surveys conducted in the NW Mediterranean and the NE Atlantic. One platform recorded cetacean sightings only, whereas the other one recorded all taxa of the pelagic megafauna (cetacean, seabirds and sea turtles). Two different situations were investigated regarding seabird abundance and cetacean detectability: in summer 2012 seabird densities were fairly low and small cetaceans were mostly; striped *Stenella coeruleoalba* and common *Delphinus delphis* dolphins, whereas in winter 2014 seabird densities were high and small cetaceans were mostly constituted of the harbour porpoise, *Phocoena phocoena*. When seabird densities were low and small cetacean had fairly conspicuous surface behaviours (delphinids), the multi-target protocol did not show significant negative bias on small cetaceans detection and abundance estimate. However, with 151 distinct sightings, the power to detect changes was limited (80% probability to detect a 45% bias). When seabird densities were high and small cetacean more elusive (harbour porpoise), the multi-specific protocol unexpectedly led to better detection and higher abundance estimates of small cetaceans than the cetacean-specific protocol did. However, the possibility of an observer-related bias rather than a protocol-related one, could not be excluded. This study is a first step towards the assessment of multi-target aerial survey methodology. To confirm that multi-target survey protocols are acceptable, further double platform surveys for different sighting conditions and with a larger sampling effort should be conducted.

### **MN-10: Identifying when narwhals *Monodon monoceros* feed using changes in diving, buzzing and stomach temperature**

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Understanding the role of large marine predators is a key component in adequate descriptions of marine ecosystems. Despite this, relatively little is known about the fine scale temporal and spatial exploitation of food resources for most cetaceans due to instrumental limitations. This study presents the first attempt to apply data from both time-depth recorders (TDRs), acoustic recorders (ARs), and stomach temperature sensing pills (STPs) to describe free-ranging cetaceans hunting behavior and success rate. Four narwhals were instrumented with satellite-linked transmitters including varying combinations of TDRs, ARs, and STPs in 2013 and 2014 in east Greenland. One narwhal carried both TDR, AR and STP while two carried TDR and AR, and one carried TDR and STP. So far, analyses of feeding attempts in odontocetes have often been limited to presence of buzzes which are thought to be associated with prey capture. The success rate of such feeding attempts are by their nature difficult to quantify and other techniques such as identifying specific dive shapes e.g. wiggles have therefore also been attempted for some marine mammals. STPs ability to monitor ingestion events based on drops in stomach temperature hereby represent a mutual validation method with buzzes as indications of foraging activity in cetaceans. Further we argue that data from STPs and ARs can be used to define specific dive shapes as indications of successful foraging which again can be applied to the already existing TDR data. The combination of this type of fine-scale temporal and spatial description of feeding events with classic analysis of stomach content should thus also provide a strong basis for management concerned with the potential resource conflict between fisheries and whales.

### **MN-11: The effect of variable detectability on density assessments of bowhead whales during seismic survey operations in the Beaufort Sea, Alaska**

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Aerial surveys are a common means to assess the density of wide ranging animals such as bowhead whales (*Balaena mysticetus*). In the Alaskan Arctic, aerial surveys are part of environmental monitoring programmes for oil and gas exploration. Sighting data collected during such surveys are used to estimate bowhead density, particularly, the number of whales exposed to different received levels of seismic sound, as required by regulators. However, the estimated abundance may be over- or under-estimated if seismic operations affect how visible a whale is to aerial observers. The objective of our study was to determine the extent to which density assessments of bowhead whales are affected by changes in availability caused by seismic operations. We used bowhead sighting data collected during industry monitoring surveys of seismic operations conducted in the Beaufort Sea from late August to early October 2008. We then fit density surface models to these sighting data and incorporated availability correction factors to determine the sensitivity of density estimates to variable availability of bowhead whales. Finally, we evaluated the influence of behavioural responses to seismic, through a series of realistic simulated scenarios in which density assessments with undisturbed and seismic disturbance related correction factors were compared. Preliminary analyses suggest that the actual numbers of whales present in areas ensonified by seismic operations may be 25% to 64% higher than estimates that only account for changes in availability of undisturbed whales. Our study highlights the influence of whale behavior on density assessments of bowhead whales in the vicinity of seismic operations.

### **MN-12: Power and efficiency of hind flipper tags for the identification of subadult grey seal individuals**

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To date, Helgoland is the major breeding site for grey seals in German waters. Since 2002, specially trained staff tag grey seal pups when possible. Besides photo-ID, flipper tagging is a powerful and important method to re-identify grey seals. In this study, the current stock of grey seals (*Halichoerus grypus*) on Helgoland has been used to study the efficiency of hind flipper tags for the identification of individuals.

To minimize disturbance, pups are only tagged, when the mother animal is absent or shortly after weaning. Especially for subadult animals in the first years, flipper tags are almost the only reliable way to identify the individual undoubtedly. Due to growth, the individual pelage pattern still gets distorted. Thus identification via photo-ID is harder to accomplish or even impossible.

During moulting season between March and May 2014, sightings of flipper tags were recorded and evaluated on the Dune of Helgoland. During a period of 18 days (140 hours) a total of 891 flipper tags were recorded and 237 different flipper tags identified and confirmed. The data was further analyzed with respect to gender distribution, short-term and long-term site-fidelity, origin and age of the animal. In addition, the difficulties of data capture and clear identification of hind flipper tags are described and discussed.

### **MN-13: A data-driven Bayesian Network to model the effect of dolphin watching on environmental attitudes: an application of the Theory of Planned Behaviour**

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Much discussion has taken place around the positive effect of whale-watching on visitors' environmental attitude, suggesting that an encounter with wildlife, combined with a good interpretative programme, can lead to an actual behavioural change. However, this outcome might be very difficult to detect, as people are likely to respond differently to the same experience depending on their different backgrounds, values and beliefs. While such complex patterns are very difficult to capture with classical statistical techniques, this study uses a novel approach employing a Bayesian Network (BN) modelling framework to explore possible changes in visitors' attitude about (a) environmental conservation and (b) cetacean captivity, in response to a dolphin-watching experience.

BNs are models that graphically and probabilistically represent correlative and causal relationships among variables, thus offering a versatile framework for handling uncertainty, imprecision and complexity within a single model. In this study the graphical structure is based on the Theory of Planned Behaviour, according to which human actions are guided by Behavioural Intentions, which in turn depend on the general attitude toward the behaviour, the beliefs about the expectations of others, and the perceived difficulty of performing the particular behaviour. The Conditional Probability Tables of the model are derived from a database of cases, through a machine learning process. Data were collected in the Shannon region (Ireland), through questionnaires (n=175) targeting dolphin-watchers before and after a boat trip, as well as general tourists in the area and local residents.

The resulting model represents a tool with utility for improving our understanding of how dolphin-watching trips affect people's attitudes and, potentially, their future behaviour, according to their personal values, beliefs and demographic parameters. This understanding is fundamental for designing tailored interpretation programmes and achieving positive environmental outcomes from whale-watching worldwide.

### **MN-14: High resolution digital video surveys for environmental monitoring of marine mammals**

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Rapid growth of anthropogenic maritime activities require robust data on marine mammal distribution and abundance in order to balance economic activities with conservation demands. Due to safety regulations, digital aerial surveys replaced visual aerial surveys for assessing environmental impacts of offshore wind farms in German waters in 2014. Digital aerial surveys were conducted at an altitude of 550 m using a high definition video survey techniques developed by HiDef Aerial Surveying Ltd. with a strip width of 500 m and a ground resolution of 2 cm whereas the former visual surveys were performed at an altitude of 183 m or 76 m. In order to evaluate the new technique, five comparison flights using two aircrafts were made. The aircraft with the digital survey was starting slightly earlier to avoid a disturbance effect of the low flying aircraft. In addition results of digital aerial surveys were compared with results of visual aerial surveys from previous years. With approximately a threefold coverage of the study area compared with conventional surveys the videos provided clearly higher sighting rates per flight km of both surfacing and submerged harbour porpoises (*Phocoena phocoena*) and pinnipeds. The higher spatial coverage of digital aerial surveys make them much more effective at identifying shifts of distribution in the study area and are much more appropriate to identify potential effects of environmental impacts. Calculating abundances from digital survey data obtained similar results as for visual surveys for which a distance sampling approach was used. Further advantages of the digital technique are the elevated altitude, which allows to fly over already constructed wind farms and decreases animal disturbance and the possibility to validate species identification afterwards.

### **PATH-01: Investigation of spatio-temporal trends in skin lesions of bottlenose dolphins in Wales**

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Over the last 20 years, skin lesions in different populations of bottlenose dolphins have been studied worldwide using photo-ID techniques, with lesions categorised according to their colour and texture. Climate change and anthropogenic activities appear to contribute to their appearance and development. The prevalence of skin lesions has been used, among others, as a health indicator.

Cardigan Bay hosts the largest coastal bottlenose dolphin population in the UK. This study aimed to investigate spatio-temporal trends in skin lesion prevalence on the Welsh dolphins over the period 2001-2014 using photo-ID techniques. The possible effect of age, gender, residency and sea surface temperature (SST) on skin lesion prevalence and extent was explored. Overall, 260 individuals were analysed for 15 skin lesion categories, of which nine were observed regularly over time. The most common were tooth rakes/scars (84% of individuals), white lesions (44%) and cloudy lesions (23%). 73% of individuals were affected by at least one type of lesion and 56% by more than two different types. Skin lesions were more prevalent on females than males. In contrast to some other studies, skin lesions were less prevalent on calves than upon adults. No significant association was found in skin lesion prevalence between SST, geographical area, or between residents, visitors and transient individuals. The presence of dark fringed spots (DFS) and white fringed spots (WFS) (lesions from which pox viruses and herpesviruses have been isolated previously) and the analysis of photographic data indicated the possible presence of pox-viruses and/or tattoo lesions in the Welsh dolphin population. Further systematic and quantitative study of the prevalence and extent of skin lesions is needed in order to assess whether skin lesions actually impact survival or reproductive rates of this bottlenose dolphin population.

### **PATH-02: *Toxoplasma gondii* detection in *Globicephala melas* and other cetacean species stranded between 2011 and 2014 along Sardinian sea coast, Italy**

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*Toxoplasma gondii* is an intracellular parasitic protozoan, spread worldwide, virtually capable of infecting all warm-blooded animals, including cetaceans species, and considered one of the most successful pathogens on Earth. The aim of this study was to investigate the presence of *T. gondii* in wild, free living cetaceans found stranded along the sea coast of Sardinia, in the western half of the Mediterranean sea between 2011 and 2014. A total of 30 animals were examined post mortem on site or in the Istituto Zooprofilattico Sperimentale della Sardegna laboratories. The sample included 15 striped dolphins (*Stenella coeruleoalba*), 13 bottlenose dolphins (*Tursiops truncatus*), 1 pilot whale (*Globicephala melas*) and 1 Cuvier's beaked whale (*Ziphius cavirostris*), with a code of carcass classification varying from 2 to 4. From the examined animals, when possible, samples of brain, liver, muscle and lung were collected and subjected to the search of *T. gondii* DNA by Nested PCR. Positive results were found on 5/13 bottlenose dolphins (38.4%), 1/15 striped dolphins (6.6%) and 1/1 pilot whale. Our results show higher incidence of the protozoan in bottlenose dolphins than other species, and is generally consistent with data available in literature. It is in fact widely accepted that bottlenose dolphin, a coastal species, is believed to acquire *T. gondii* infection more easily than pelagic species as striped dolphin and pilot whale, which lives in the open sea. But an important point to emphasize is the positivity registered in the liver and lung of the pilot whale, this finding seems until now not reported in literature. Could this mean that for certain diseases, such as toxoplasmosis, in the rather closed basin of the Mediterranean sea the distinction between coastal and pelagic species is less clear?



### **PATH-03: Capture myopathy after surgery in striped dolphin (*Stenella coeruleoalba*): a case report**

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In the summer 2014, a male juvenile live striped dolphin (*Stenella coeruleoalba*) was stranded alive along the Ionian Calabrian coast (Italy) due to a severe wound close to the tail likely caused by entanglement in fishing gears. Radiographic exam during first medical evaluation evidenced a Salter-Harris fracture type 1 of a lumbar vertebra. Since the animal survive for three days, a surgical approach with a ‘hand-made’ external fixator specifically designed for this animal was attempted. Serum samples were collected the day before the surgery, during the surgery and the day after to evaluate renal and hepatic functions and muscular condition; unfortunately, the striped dolphin died suddenly the day after the surgery. A detailed necropsy was carried out within 12 hours, tissue samples were collected and routinely processed for histopathological examination.

Immunohistochemistry (IHC) analysis using anti-myoglobin and anti-fibrinogen was performed on skeletal and cardiac muscles and on kidney. A urine sample was also collected during the necropsy and proteinuria analysis with SDS-age was performed. Biochemical values of BUN, ALT and AST values were above the upper limits of reference range in all the three serum samples while creatinine values were below the lower limit. Also the serum amyloid A (SAA) was markedly higher, in particular in the post-surgical samples, while an increase in total serum protein was noticed only in samples collected after surgery. Post-mortem analyses did not showed any relevant pathological changes. IHC revealed severe muscular damage with myoglobin staining evident in renal tissues. Urinalysis showed urinary protein-to-creatinine ratio of 5:3 with glomerular proteinuria. Clinical-pathological and pathological findings suggest that cause of death was capture myopathy (CM) related to ischaemia-reperfusion damage due to elevated concentrations of catecholamines. This case point out as CM could have a role in mortality following the live-stranding event and compromised subsequent rehabilitation.



### **PATH-04: Dolphin morbillivirus infection on a cetacean stranded in Sardinia: a preliminary study**

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Morbillivirus, Paramixoviridae family, a high-pathogenicity virus with localization mainly lymphotropic and neurotropic, become endemic in the Mediterranean sea with cyclical reappearances characterized by mortality peaks. This paper describes the incidence of dolphin morbillivirus (DMV) in some cetaceans stranded along the sea coast of Sardinia in the period 2010-2014 when it has been possible to perform a necroscopic examination and viral detection: 14 striped dolphins (*Stenella coeruleoalba*) and 9 bottlenose dolphins (*Tursiops truncatus*). By the necropsy of the 23 subjects it has been estimated; the carcass classification code, the nutritional status and the different level of parasitic infestation. Biomolecular investigation for dolphin morbillivirus was performed by RT-PCR technique on selected tissue specimens (brain and lung), using primers targeting the highly conserved region of the nucleocapside (N) gene.

All positive samples were confirmed by direct sequencing (3500 Genetic Analyzer, Life Technologies). Our results showed the viral genome presence in 12 animals: 5 bottlenose dolphins and 7 striped dolphins. Among bottlenose dolphins 2 animals were found positive at lung level and 4 at brain level; only in one subject viral positivity was found on both organs, brain and lung. In striped dolphins 4 animals were positive at lung level and 3 at brain level; none of them showed virus presence in both organs sampled.

Results showed molecular positivity in about 50% of the cetaceans examined, more than 41% reported on 2013 strandings in western Mediterranean sea. The use of new molecular methods and virus detection on other organs, such as lymph nodes, tonsils and spleen, could improve the diagnostic potentialities, especially when it is impossible to perform standard sampling because of the bad carcasses condition.

### **PATH-05: Malta fever in a minke whale: the first confirmed report of the isolation of *Brucella ceti* in a minke whale (*Balaenoptera acutorostrata*) with associated pathology**

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*Brucella ceti* infection has been reported in cetaceans from many parts of the world; however the isolation of *Brucella* in mysticetes has been described only in minke whales (*Balaenoptera acutorostrata*) in Norway and Scotland respectively. In September 2014, a further isolation was made from a pregnant adult female minke whale found stranded at Whitehills, Aberdeenshire, UK. There were numerous excoriations to the ventral abdomen extending caudally from around the navel to the tailstock and fluke and cranially to a large swelling in the throat. This swelling extended from the pharyngeal region to the thoracic inlet area. Upon incision this swelling was shown to be a very large abscess approximately 1 metre in length and full of yellow fluid and necrotic material. The associated retropharyngeal lymph nodes were fibrous and contained caseous yellow lesions 1 mm to 3 cm in diameter. There was no obvious associated foreign body or trauma associated with this. The excoriations, haemorrhage within the blubber and preservation of the carcass would suggest the animal had live stranded. The presence of the very large pharyngeal abscess is significant and may have hampered recent foraging by making swallowing difficult. Cultures from the abscess fluid produced a pure growth of *Brucella* species. The isolate was characterised using a derivative of the Infrequent Restriction Site-PCR (IRS-PCR). Primers designed for PCRs II, III and IV contain portions of the IS711 element and are intended to be specific for cetacean isolates. The profile type was identified as positive for cetacean PCR IV previously associated pelagic delphinids in the north east Atlantic.



### **PATH-06: Results of research of microflora of polar bear (*Ursus maritimus*) at Russian Arctic**

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The polar bear is at the top of the food chain in the Arctic. Its' main prey are different marine mammals (ringed seals, sea hare and walrus). Therefore, the presence of pathogens in the microflora of the polar bear may indicate the circulation of these microorganisms in the ecosystem, including in populations of marine mammals.

Since 2006, the Marine Mammal Council in cooperation with the WWF Russia, have been conducting community based coastal monitoring of polar bear in north-eastern Russia. However, studies of health status were not conducted and little is known about the microbiology, immunology, and hematology of the polar bear.

In August and September 2014, material from five animals (two male and three female) were taken. We selected smears from the conjunctiva, nose cavity, mouth and anus with the rules of asepsis to tubes containing Ames' medium. Additionally, samples of blood were taken. The studies were conducted according to standard microbiological methods. For the isolation of microorganisms we used cultural methods. The species and quantitative composition of microbiota was studied. Identification of isolates was performed by investigating their biological properties including pathogenic factors.

As a result of our research from all samples, different species of microorganisms were isolated from the cultures. The greatest species composition and number of bacteria, was noted from samples of the anus. Not more than two or three species of microorganisms were isolated from the conjunctiva of the animals. Microflora of the nose cavity was mostly represented by *Staphylococcus*. It should be noted that cocci isolated from three of the animals showed hemolytic properties. In materials from two polar bears, hemolytic staphylococci were found not only in the nasal cavity, but also in all other samples. In correlation with hematological indices, the presence of pathogenic *Staphylococcus* may indicate possible health problems of these individuals.



### **PATH-07: The vaginal microflora of bottlenose dolphins in normal and various pathologies in captivity**

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Holding dolphins in captivity at dolphinariums is one way of preserving the wild populations of its species. However, for the fullness of their lives these animals need constant veterinary health monitoring. One of the methods to assess the health status of bottlenose dolphins is the microbiological monitoring of these animals. One of the main problems with holding cetaceans in captivity are diseases related to genital organs which are often asymptomatic. For this reason the purpose of our study was to examine the composition of the vaginal microflora of bottlenose dolphins at the oceanarium.

The study took place at an oceanarium in Moscow where we noted the presence of gynecological pathologies in female dolphins. The main methods of diagnosis were: observations of their behavior and feeding activities, daily clinical examinations, and laboratory diagnostic techniques including hematological, biochemical and of course microbiological methods.

Microbiological diagnostics was performed by bacteriological culture methods and by PCR diagnostics. Vaginal samples were collected by sterile swabs for the study. At the same time, blood samples were collected for hematology studies from each animal. The total number of swab samples from each animal we investigated throughout the process was 11 and the total number of blood samples was 19.

As a result of the study we found that: 1) clinically healthy animals with hematological parameters within normal vaginal microflora were *Enterococcus faecium*, *E. coli*, *Citrobacter freundii*, *Enterobacter*, *Aeromonas hydrophyla* and *Vibrio alginoliticus*, 2) clinically healthy animals but with presence of conditionally pathogenic microorganisms in the vaginal microflora were *Enterococcus faecium*, *E. coli* and *Enterobacter* and 3) Two clinically unhealthy animals with latent pathology vaginas had bacteria: *Enterococcus faecium*, *E. coli*, *Enterobacter* and *Staphylococcus epidermidis* detected.

In spite of similar species consistency of microorganisms in the three groups, we noticed a significant change in the quantity ratio of microorganisms in the vagina.



### **PATH-08: Mediterranean cetacean parasites: the role of lantern fish (Myctophidae) and cephalopods in their life cycle**

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Myctophids and cephalopods are fundamental in trophic webs from sea waters, linking the zooplankton to top predators. Many cetaceans feed on lantern fish and cephalopods, and such prey would thus be expected to bridge the trophic gap in the life cycles of cetacean helminths. However, life cycles of most of these helminths are unknown. We examined the parasite fauna of myctophids and cephalopods from the western Mediterranean, where around 21 helminth taxa from cetaceans were reported and both cetacean diversity and abundance is high. Eight myctophid, *Ceratoscopelus maderensis*, *Lampanyctus crocodilus*, *Notoscopelus elongatus*, *Benthoosema glaciale*, *Myctophum punctatum*, *Lobianchia dofleini*, *Diaphus holti*, *Hygophum benoiti*, and 2 cephalopod species, *Alloteuthis media*, *Sepietta oweniana*, were examined for helminths. These species are prey for some cetacean species in the area. Only 5 helminth taxa were found. Nematodes *Anisakis pegreffii* and *A. physeteris* in *N. elongatus* and *C. maderensis* (prevalence 8.1% and 0.5%, respectively). Their prevalence in *N. elongatus* was significantly higher than that from the other three myctophid species with  $n > 50$  individuals. One *Hysterothylacium* sp. was found in *N. elongatus* (prevalence: 0.5%) and Raphidascarididae in *N. elongatus* and *L. crocodilus* (prevalence: 20.3% and 0.7%, respectively). Juvenile didymozoid digeneans appeared in *N. elongatus* and *L. crocodilus* (prevalence: 18.5% and 4.3%, respectively). Two unidentified cestode plerocercoids were collected from *N. elongatus*. Our study suggests, for the first time, that myctophids could play a role as paratenic hosts in the oceanic life cycle of species of *Anisakis* in the western Mediterranean. The rest of larvae do not infect cetaceans, but some can be transmitted to large predatory fish. The extreme scarcity of such cetacean parasites in this, and previous similar surveys contrasts with the key role of these prey in the diet of oceanic cetaceans.



### **PATH-09: Cross-reactivity evaluation of commercial antibodies against acute phase proteins in striped dolphins (*Stenella coeruleoalba*) and bottlenose dolphins (*Tursiops truncatus*)**

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An initial health assessment in stranded marine mammals, including evaluation of clinico-pathological variables, is a preliminary and critical step to define treatment and assessing the suitability of the animals for rehabilitation. However, the use of validated methods and the definition of the baseline values for clinico-pathological parameters is crucial to correctly identify a pathological status. Acute phase proteins (APPs) are sensitive markers of inflammation, infection and trauma, widely studied in small and large animals, but information in cetaceans is scarce and not supported by complete validation studies. The aim of this study was to preliminarily assess the cross-reactivity of commercially available anti-human and anti-canine antibodies (Abs) used in immunological automated assays for APPs in striped dolphins (*Stenella coeruleoalba*) and bottlenose dolphins (*Tursiops truncatus*). Seven Abs against C-reactive protein (CRP) and two against serum amyloid A (SAA) were tested on serum obtained from stranded striped dolphins and bottlenose dolphins living under human care. The cross-reactivities were tested by the Outcherlony double diffusion (ODD) method and western blotting (WB). Furthermore, a preliminary evaluation of automated immunoturbidimetric assays designed for canine CRP and multispecies SAA was performed in 20 samples (from 6 striped dolphins and 14 bottlenose dolphins). Abs against CRP did not cross-react in dolphin sera with ODD, while an uncertain positivity with one anti-canine Ab was evident by WB analysis. CRP automated immunoturbidimetric assays showed discouraging results, revealing very high imprecision. On the contrary, even if Abs against SAA did not show cross-reactivity in ODD and WB, the automated assays revealed a good precision, with an acceptable coefficient of variation in both species. Despite the highly conserved homology in APP sequence among mammals, these preliminary results underline the need of an accurate validation process to identify suitable immunological methods, with high diagnostic accuracy, to evaluate these inflammatory markers in cetaceans.

### **PATH-10: Skin lesions occurring on bottlenose dolphins (*Tursiops truncatus*) in the Aeolian Archipelago (southern Italy)**

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Skin lesions (natural marks, anthropogenic lesions and skin diseases) occur frequently in many cetacean species across the globe and they can be used for risk analysis. The current study used photo-id data from 2005-2014 to estimate skin lesion type and prevalence on 38 bottlenose dolphins (*Tursiops truncatus*) in the Aeolian Archipelago (southern Italy). Twenty-four skin lesion types were classified. Of these, 16 were classified according to those found in other areas while 8 were original. Principal Component Analysis revealed the overall abundance (on PC1) and temporal stability (on PC2) of lesions in the population. Natural marks were more abundant than the other lesions while anthropogenic lesions were more persistent. The occurrence of lesions increased with age class ( $p < 0.005$ ) and degree of residence in adult dolphins ( $R^2 = 0.31$ ,  $p < 0.01$ ). The dolphin's abundance (the total amount of lesions on body), distribution (the mean of lesions on different part of the body) and the richness (the number of different kinds of lesions present on the animal) were highest among males than females ( $p < 0.0001$ ). Regression analysis revealed a significantly higher incidence of lesions type "nicks", "straight deep cuts" and "jagged fin edge" for dolphins interacting with trammel nets. The incidence of mark type "indentations" was higher for dolphins living in larger groups. Although generally considered nonfatal, skin lesions may be indicative of animal health and exposure to anthropogenic or environmental threats, and photo-id data provide an efficient and cost-effective approach to document the occurrence of skin lesions in free-ranging populations, that is important to provide cause-effect relationships with significant consequences in terms of conservation strategies.



### **PATH-11: The alarming symptoms of the world ocean: investigation of the possible causes of appearance of "stinky whales" in western gray whale (*Eschrichtius robustus*) population**

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In the last decades, concern of scientists about the status of the western population of a gray whale amplified. In spite of the fact that, in number, the population is restored after the International Whaling Commission banned commercial hunting of gray whales in 1946, increase of cases of detection of so-called "stinky whales" is noted. Thus only aboriginal hunters have a quota of 140 individuals per year, which is split between the Chukchi people of Siberia and the Makah people of Washington State. The Chukchi hunters (Siberia, Russia) who have part of the quota and hunt gray whales for meat have reported that around 10% are inedible. The Chukchi hunters noted that the smell from meat reminds them of medicine tablets and it was so foul that even dogs won't eat them. The few people who have tried the meat suffered numb mouths, stomach ache and skin rashes. Also hunters have reported finding stinky whales' stomachs full of seaweed and cod when usual food for gray whales are amphipods. Some versions of the possible reasons of the events are considered: "ketosis from exhaustion", "fundamental change in diet", "accumulating a marine biotoxin".

In 2011, the exhaled breath condensate (blow) sampling from 20 free-swimming gray whales in the Olga's Bay (Kamchatka Peninsula) was made into account a smell. The smell was conditionally divided into three categories: 1. smell hard "unpleasant", 2. smell a little and 3. no smell. As a results: from 1 category of samples have been isolated microorganisms of genres: *Staphylococcus*, *Streptococcus* and *Bacillus*; from 2 category have been isolated Enterobacteriaceae, *Staphylococcus* spp., *Candida* spp., *Pseudomonas* spp., rode-like Gr+; from 3 category have been isolated only *Candida* spp. and rode-like Gr+. Some bacterial cultures from 1 and 2 categories of blow samples were with pathogenic factors: haemolytic (binary zone of haemolysis) and plasma-coagulase positive.



### **PATH-12: First Gammaherpesvirus detection in a free-living Mediterranean bottlenose dolphin**

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Recently, herpes viruses have been detected in different cetacean species from the Atlantic and in Mediterranean striped dolphins (*Stenella coeruleoalba*). While pathogens such as cetacean morbillivirus have been widely studied following recent epizootics, herpesvirus (HV) distribution and pathogenic effects in cetaceans are still understudied. This report describes the identification and molecular typing of a Gammaherpesvirus in the genital mucosa of a free-living Mediterranean bottlenose dolphin (*Tursiops truncatus*) stranded off the coast of central Italy, that was detected during a screening conducted on Mediterranean dolphins (*Stenella coeruleoalba* and *Tursiops truncatus*) for the presence of HV, cetacean morbillivirus and papillomavirus nucleic acids. Sequenced herpesviral PCR product, when analysed phylogenetically, was closely related to other HVs recently isolated in the genital mucosa of various cetacean species. Although in this particular case no genital lesions were found, this is explicable as most known herpesviruses undergo persistent infection with periods of latency and reactivation. Further research should attempt viral isolation, elucidate its pathogenic potential, and determine the distribution and emergence of Gammaherpesviruses in Mediterranean dolphin populations as well as their role as a possible stranding cause.

### **PATH-13: Pleuropneumonia associated with a mycoplasma-like agent in a bottlenose dolphin (*Tursiops truncatus*) stranded along the coast of Abruzzo, Italy**

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In recent years, growing interest has developed on marine mammals regarding their health, along with their environment, ecology and conservation. This has enabled the acquirement of important knowledge on infectious diseases of cetaceans, which are also considered emerging public health issues. In this context, a national cetacean stranding and health surveillance network was created under the auspices of the Ministries of Health and Environment, in order to standardize diagnostic protocols and increase data collection. Within this framework, an adult male bottlenose dolphin (*Tursiops truncatus*) found stranded in July 2014 in Pineto (Teramo), Italy, was subjected to a detailed *post mortem* examination at Istituto Zooprofilattico Sperimentale dell' Abruzzo e del Molise "G. Caporale". An extensive and severe pleuropneumonia with several areas of necrosis involved both lungs, being also accompanied by a loco-regional lymphadenopathy. Such pneumopathy, histologically characterized by the presence of numerous Splendore-Hoeppli bodies scattered throughout the lesions, was the likely cause of death for this dolphin. A mycoplasma-like organism was grown on modified PPLO medium from the lung of the animal. A portion of about 1400bp of the 16S rRNA was amplified and sequenced. The BLAST analysis revealed 97% identity with an uncultured *Ureaplasma* sp.. Further studies are needed to better characterize the microorganism and elucidate its pathogenic role.

### **PHOTO-01: The first photo-identification of bottlenose dolphins (*Tursiops truncatus* Montagu, 1821) in the Foça Special Environmental Protection Area, Turkey**

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This study was the first photo-identification (photo-ID) effort on the bottlenose dolphin in the Foça Special Environmental Protection Area (SEPA), which is one of the 11 coastal and/or marine SEPAs in the Turkish coasts. The site was declared as a protected area in 1990, primarily due to presence of the critically endangered Mediterranean monk seal (*Monachus monachus* Hermann, 1779). The area is also important for cetacean species, seagrass meadows (e.g. *Posidonia oceanica* (L.) Delile) and seabirds and is also the biggest fishery port on the Turkish Aegean coast.

The paper presents the results of the first photo-ID study on the bottlenose dolphin (*Tursiops truncatus* Montagu, 1821), which has a resident population in the region. The aim is to help conservation of the species by establishing a photo-ID catalogue of the local population. The survey was performed by an inflatable boat in order to catch images of individuals that can be processed. During the study, we observed several groups consisting of up to 45 individuals. After image processing procedures, 11 individuals were well-marked in the study area. The results will help us to determine local population of the species in the near future.

### **PHOTO-02: Study of population of orca using photo-identification techniques from opportunistic platforms in the Strait of Gibraltar**

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In the Strait of Gibraltar up to seven species of cetacean can be found including the orca (*Orcinus orca*). There are 5 social groups involving approximately 47 individuals and their preferred area is the contiguous Atlantic waters of the Strait of Gibraltar. Data were collected in accord with protocols of the Spanish Cetaceans Society and pictures were collected from opportunistic platforms of whale watching between March and October (2011-2014). A total of 66,858 kilometres navigated and 3,701 hours were spent during the study period obtaining 91 sightings. In 52 sightings more than 70% of the individuals present were identified without uncertainty. Up to 3,767 individuals were observed in 2,620 analyzed images, identifying 28 different individuals. Individuals belonging to 3 social groups of the 5 existing in the Strait of Gibraltar were observed interacting with artisanal fishing (drop line). A total of 12 individuals were identified like the most frequently sighted, being present in the Strait of Gibraltar during the 4 years. Of them, 2 individuals belonging to the same social group, have been sighted in over 50% of the cases; however, in 33% of the sightings were mixed with members of a second group. Sporadically individuals belonging to a third group were observed mixed with individuals of the other 2 social groups of orcas. This could be an indication of a social restructuring of the population of orca in the waters of the Strait. It is recommended to continue studying the social structure of orca to clear up the association patterns of this species in this area. Opportunistic platforms are a very efficient and important tool to know better populations of cetaceans like the orca population of the Strait of Gibraltar, which is catalogued as Vulnerable by IUCN and proposed as Critically Endangered.

### **PHOTO-03: First photo-identification of fin whales feeding in the mid-southern Catalan coast**

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Fin whales (*Balaenoptera physalus*) migrate every year along the Catalan coast, across the Balearic Sea (north-western Mediterranean basin). Despite being previously unknown by the scientific community, sightings are common in the Garraf area (central-south Catalonia) wherein local fishermen have reported to have seen them for decades. However, fin whales' migration movements within the Mediterranean are still poorly understood. Edmaktub association has conducted the first dedicated systematic study of fin whales (part of our long-term 'Fin whale project'), in order to investigate their presence within the Garraf area. Visual surveys were conducted through random transects on our dedicated research boat (a 47ft catamaran); with a total of 2,300 km sailed throughout the four-month study period (March-June 2014). 1,188 photographs were obtained. These were then classified according to the quality and distinctiveness of individuals based on their dorsal fin and "chevron" patterns, resulting in a photographic efficiency ratio (valid photographs divided by all pictures taken) of 59.68% and a photo-identification efficiency ratio (photo-identified specimens divided by the total observed) of 77.42%. We registered a total of 62 sightings, from which 48 individuals have been identified to date following photo-ID standardized methodology. Feeding activity was detected (red-stained faeces observed provided evidence), a behaviour never described before in the area but which actually enabled us to obtain decent photo-ID data. We hereby present new evidence for a potential strategic foraging habitat for fin whales during their migrations, which is in turn an area of recognized ecological importance (a 'Natura 2000 Network' marine protected area and Site of Community Importance). We therefore stress the need for further research through a basin-wide monitoring program through which we can compare all existing photo-identification catalogues, in order to identify each individual's population origin and study fin whales' migration movements within the Mediterranean (necessary to provide proper conservation measures).

### **POLY-01: Evaluation of monitoring incidental catch of cetaceans scheme in Poland**

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Council Regulation (EC) No.812/2004 of 26 April 2004 established measures concerning incidental catches of cetaceans. It anticipated the monitoring of that phenomenon in European waters, including the Baltic Sea, where there is a critically endangered population of harbour porpoise *Phocoena phocoena*. Monitoring programme of incidental catches implemented under this Regulation has been realized in Poland since 2006. It is being carried out by the fishery sector. Practically throughout the whole period of its duration, the programme covered only symbolic part of fishing effort (not exceeding 5%) recommended by the Regulation for pilot monitoring schemes, since it had never been estimated what the minimum fishing effort necessary for detection of bycatch is. Observations were conducted on board the fishing vessels  $\geq 15$  under the Polish flag. Monitoring on the smaller fishing vessels has been introduced since 2012, but it only encompassed a symbolic part of the real existing fishing effort. During the eight years of the programme, monitoring included 1,301 days of fishing. Despite the information that the bycatch of harbour porpoise comes mainly from gillnet fishery (82%), fishery which uses trawl constitutes only small part of it (6%), the monitoring programme mainly focused on vessels over 15 m long that use trawls. The excessive monitoring effort in that fishery segment makes the assessment of the incidental catches of cetaceans and conclusions inferred from its results far from the actual reality. Despite the lack of reports on bycatch of harbour porpoise in the scheme for incidental catches of cetaceans, in its duration on the Polish coast there were 24 strandings and 2 voluntary reports of bycatch in gillnets. The current state of knowledge indicates the necessity of increasing the monitoring effort of the catch on the vessels  $< 15$ m, which operate in the coastal zone using the gillnets.

### REPR-01: Field observation of hooded seal twin pups

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Some observations of two pups of identical age suckling from the same female phocid seal have previously been reported. These events were either assigned to twin births or to alloparenting, where two pups of similar age but not genetically related shared the parental cares of the same female. Twinning, whether true or apparent, is generally avoided in seals. Overall fitness can be reduced for females providing for two pups, therefore it is speculated that pinnipeds have evolved to minimize twinning. Hooded seal (*Cystophora cristata*) lactation takes place for 3-4 days. The mother loses 10 kg/day and the pup gains 7 kg/day, posing high metabolic demands on the mother. Female hooded seal mothers are also aggressive towards other seals attempting to share the same ice floe and therefore usually breed alone. On March 26, 2013, during a research expedition to the area known as the West Ice, northwest of the Island of Jan Mayen, we observed two newborn hooded seal pups suckling simultaneously from an adult female. The three animals were alone on an ice floe, there was no evident sign of the presence of other adults. During the course of the brief period of observation of about one hour the adult female did not display aggression or in any way a preference for either of the two pups. These were both females and had near-identical dimensions, thus it cannot be excluded that the two were born within a few hours from each other. We deduce therefore that this was likely the first observation in the field of a twin birth of live and viable pups of hooded seal even though, in the lack of other evidence it cannot be excluded that this could have been a case of alloparenting instead.



### **REPR-02: Cape Verde: a new breeding site for both northern and southern hemisphere humpback whales?**

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Humpback whales typically calf in Cape Verde waters off west Africa from March to May, before leaving to high latitude feeding grounds off Norway and Iceland. The population in Cape Verde is very small (<200 individuals) and genetically isolated from the larger North Atlantic population breeding in the Caribbean. There are casual sightings and anecdotal records of humpback whales in Cape Verde from July to September. These could be northern hemisphere whales that have not migrated north or southern hemisphere, whales from breeding grounds south in the Gulf of Guinea and have crossed the equator, or a combination of both. In September 2014, during a two week humpback whale survey in Cape Verde we recorded at least eight sightings of a total of 11 individual humpback whales from four different islands in both the leeward and windward archipelagos. These included two mother-calf pairs one with an apparent escort and some whales were observed breaching. Images were taken including two fluke shots suitable for photo-id and biopsy samples from three individuals. All whales photographed lacked the all-white pectoral fins, typical of northern hemisphere humpback whales. Fluke shots could not be matched to any individuals in the North Atlantic Humpback Whale catalogue and will be compared to catalogues of individuals from west and southwest Africa. Genetic analysis of biopsy samples is ongoing. It is most likely these humpback whales are from the southern hemisphere making Cape Verde not only a new breeding ground for southern hemisphere humpback whales but the only site in the Atlantic Ocean where humpback whales from both hemispheres breed but at different times of year.

### **REPR-03: Phenological influences on pup production and survival in the grey seal, from twenty years of monitoring in Wales, UK**

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The grey seal, *Halichoerus grypus*, is an iconic marine mammal of north Atlantic waters. The UK population is estimated to comprise 40% of the world population and 95% of the European population. At the turn of the millennium, the UK population was estimated at 124,000 individuals and is increasing in many locations around the country. Within the UK, the Scottish population has been the most intensively monitored. However, Wales is the location for a substantial breeding population that is thought to have limited contact with Scottish seals, although detailed information on movement is severely limited at the population level. The Skomer Marine Nature Reserve is a key haul-out site for pup production and detailed records of grey seal reproduction there, have been made under the auspices of Natural Resources Wales, or its precursors, since 1993. Records include dates and individual beach locations of neonates. Subsequently, pups are monitored and accurate stage estimates are made until moulting or death. The resulting dataset provides a spatially explicit daily record of dynamics for key stages in the life history of the grey seal. Here, we present local and aggregate trends in time series, as well as a detailed analysis of phenology over a twenty-year period. This is conducted in a framework that is appropriate to develop a matrix model of grey seal population dynamics. While important information on adult survival and movement is currently unavailable, we also report ongoing developments using photographic identification that will ultimately integrate with pup monitoring to allow population dynamic modelling to inform management policy.

### **REPR-05: The reproductive histories and inter-birth calving intervals of female bottlenose dolphins in northeast Scotland**

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Where coastal bottlenose dolphin populations range over great distances, establishing robust estimates for individual birth rates can be inherently difficult. Nevertheless, ascertaining reproductive histories is particularly significant for management, as between-female variation in reproductive output provides a strong measure of individual fitness. Accordingly, the intervals between births are one of the most important determinants for reproductive success in these animals.

In the Moray Firth in NE Scotland, studies have been carried-out since the 1980s, and integrated datasets provide a current estimate of 195 animals for this region. The southern coastline of the outer Moray Firth is an known calving area for the population, and dedicated studies in this region between 1997 and 2013 have documented 135 calves by 61 mothers during this period. In the present investigation, the reproductive rate and inter-birth period (IBIs) for established females were examined from this dataset. IBIs ranging from 2 to 8 years with an average of  $3.72 \pm 1.29$  ( $n=74$ ) were determined. However, the IBI between first and second-born calves was significantly higher than for all subsequent IBIs, suggesting that female bottlenose invested greater effort in raising their first offspring. The rate of calf production appeared to decrease with age; however, females with IBIs of six or more years were likely approaching menopause or were unhealthy.

An average calf mortality of 10.37% was determined, with first year calves accounting for 89% of all calf losses in animals aged from 0 and 4 years. Whilst congenital deformities, late weaning and maternal inexperience could account for a significant proportion of the calf mortalities recorded in this population, poor body condition of females, related to limited resource access and subsequently resulting in poor calf condition, is likely to be the primary cause of calf mortality and between-female variation in reproductive output and success.



### REPR-06: Grey seal maternal philopatry on Bardsey Island

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Photo-identification studies on grey seals on Bardsey Island in North Wales were initiated by the late Mandy McMath in 2006. In a follow-up study that covered the 2013 and 2014 breeding seasons on the island, photo-identification revealed that several previously-identified females had returned to the same parts of the island's extensive (~8670m) and varied shore-line to rear their pups. Of the females re-identified in 2013, based on examination of some 1,300 photographs (and some video films), 3 returned to the same sites (analysis of 2014 photographs is still in progress). There is also growing evidence that some bulls return to the same locations during the breeding season. An assessment of pup rearing sites around the island (noting that many parts of the coast do not appear to be used at all) indicates that they offer varying degrees of protection to the mothers and pups from factors including human disturbance and incursion of storm surges. The rearing sites range from deep ravines backed by sheer cliffs, at the north and south of the island, to the more open central bays where the seals are able to retreat onto the land in some places. Some sites also seem to facilitate swimming activities by the pups before they moult. The choice of breeding locations may therefore play a significant role in pup survival.

### **REPR-07: The missing years: fecundity estimates based on mass changes in UK grey seals**

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Fecundity is a key parameter needed to improve understanding of grey seal population dynamics at colony and larger spatial scales. However, it is difficult to estimate fecundity rates in a free-ranging marine mammal. We present the results of a hidden process model fitted to long-term observational and capture data from mark-recapture studies at grey seal breeding colonies on the Isle of May (IM) and North Rona (NR). We assume that mass changes between years are dependent on environmental factors and on the breeding status of animals, and explore the influence of an individual's mass on apparent survival, and fecundity. There was general annual variation in mass gain, especially at IM, presumably due to fluctuating resource availability. We find that females whose mass is low are less likely to breed, but that there is no strong evidence for a similar effect on survival. We are also able to arrive at general estimates of fecundity for females using each of these 2 colonies, including years in which they are not observed to attend the breeding colony. Overall fecundity estimates were different at the two colonies: NR 0.784 (0.756-0.809), IM 0.860 (0.835-0.882).

### **STR-01: Historical cetaceans' occupancy of an estuarine ecosystem (Portugal): A former area of residency or a mistaken public perception?**

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In Portugal people are, historically, aware of the local presence of coastal dolphins. A resident population of bottlenose dolphins is known to occur in the Sado Estuary (Setúbal) since the late 19th century. Sayings have long existed regarding a former population of dolphins in the Tagus Estuary (Lisbon) that had supposedly disappeared from the area, by the 1960's, due to poor environmental conditions. Recently, news in media and social networks pointed out that dolphins were returning to this region and occupying a former area of residency, leading to the implementation of an investigation on this matter. A review of historical sources (naturalists' papers, newspapers, local and oral stories) as well as of photographs, strandings and observation of opportunity has been conducted since October 2013 allowing for the gathering of information on cetaceans' presence. It indicates the regular, but episodic, presence of cetaceans in the Tagus estuary: bottlenose and common dolphins, sperm whales and common whales. We have found no evidence of a resident population of dolphins occurring in this area at any time for the past 100 years. But recent observations had shown that bottlenose and common dolphins enter occasionally in the estuary which may be a feeding area in, at least, parts of the year due to the migration into the estuary of preferential prey. The possible increasing in recent observations of dolphins in the Tagus estuary and the dissemination of news and photos results from a larger awareness from the public to marine conservation. However, this may also lead to a mistaken perception of changes occurring in the ecosystem since the past to present days. The compilation of different types of data helps to reconstruct local (or global) histories of cetaceans' occurrence and the analysis of historical documents offers biologists and policy makers new important sources of information.

### **STR-02: A long-term monitoring of dead harbour porpoises in the German Baltic Sea**

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Harbour porpoises are the only resident cetaceans in the Baltic Sea. However, in recent decades the population has declined considerably. Only a few hundred porpoises may be left in the central Baltic Sea. These small toothed whales are exposed to many dangers such as accidental bycatch in fishing nets, acoustic impacts of increased shipping traffic, construction work at sea and chemical pollution.

Since many years the German Oceanographic Museum collects dead harbour porpoises, which are found at the German coast in Mecklenburg-Western Pomerania. Basic data, like year, month, geographic area and sex were gathered, and pathological anatomical investigations were conducted. From 2003 to 2013 nearly 400 dead porpoises were reported. Over 70% of them were in unsuitable conditions for continued analyses. Therefore no causes of death could be determined. Approximately 40% of all death porpoises in good condition lead to assume that they died as bycatch. Either they were given directly by fishermen or pathological-anatomical examination strongly indicated bycatch as cause of death based on net marks; pulmonary oedema and blood stasis were also found in these animals. 18% on average were lethal on parasitosis. Only a few died on bacterial infection, pneumonia or dystocia.

With the extended knowledge it is possible to supplement the picture about the harbour porpoises in the Baltic Sea. Each report of dead porpoise provides important information about the population and helps to develop a comprehensive protection for these endangered species in the Baltic Sea.



### **STR-03: Historical records of fin and sperm whale mortality events in the waters around Italy, 1584-2014**

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Fin and sperm whales are the largest cetaceans regularly occurring in the Mediterranean Sea where they classify as ‘Vulnerable’ and ‘Endangered’, respectively, according to the IUCN criteria. Considerable knowledge on their ecology has been gained during the last decades, yet limited information exists on their past mortality patterns. Here we present a review of fin and sperm whale mortality events in the seas around Italy encompassing 5 centuries. Through a review of historical and recent sources a total of 144 (46.8%) and 164 (53.2%) records were validated, for fin and sperm whales, respectively. For both species the most common event was a stranding (60.9%, 61.4%), followed by floating carcasses (15.8%) and collision events (12.8%) for fin whales and by-catch (15.7%) and deliberate killings (9.8%) for sperm whales. The spatial and temporal patterns were only investigated for strandings. Kernel Density Estimation and Hexagonal Polygon Binning showed an uneven occurrence of strandings for both species, with the majority of events occurring along gently sloping beaches, away from suitable species habitat. Strandings occurred at all times of year, but specific seasonal differences were observed. While fin whales mostly stranded during summer, the majority of sperm whale strandings occurred during spring and winter. Although strandings of both species showed a negative trend after peaking in the 1990’s, an overall increase of mortality records was apparent throughout the centuries when considering all different types of events. This is most likely the result of rising research effort, as well as greater awareness of the general public. This review presents valuable baseline information for environmental history of cetaceans in a region where sea-related human activities have a long historical presence. Furthermore, they represent a useful tool to investigate the natural and man-related processes and dynamics responsible for cetacean mortality, in particular strandings.



### **STR-04: Annual dynamics of strandings of harbour porpoises (*Phocoena phocoena*) and anchovy catches in the Sea of Azov**

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The harbour porpoise in the Sea of Azov (*Phocoena phocoena relicta* Abel, 1905) is a vulnerable or endangered population or sub-population, which dynamics is unknown and can be only estimated by the analysis of strandings. Also there is the migrating population of the European anchovy *Engraulis encrasicolus* in the Sea of Azov, the important prey object for harbour porpoises during their annual seasonal migrations from the Sea of Azov to the Black Sea. We analyzed the annual dynamics of harbour porpoise strandings on the southern coast of the Sea of Azov in 1999–2014, and we compared it with the catch statistics of the Azov stock of anchovy. We found that the porpoise stranding rate with its fluctuations closely correlated with the dynamics of the anchovy stock. In the time interval of study, it was well described by a cosine function, which was explained by the anchovy stock fluctuations. The function based on the data of 1999–2012 precisely predicted the maximum of strandings in 2013 and their substantial decline in 2014. The best results were obtained on the sub-sample cleared from the possible sources of biases affecting the carcass preservation. Thus, this stranding rate can be used as an indicator of population trends at certain conditions neutralizing possible biases, such as discovery rate, drift conditions and buoyancy, and at certain time intervals; and its usability can be verified by external factors, such as dynamics of prey stocks.



### **STR-POLL-01: Cause of death and contaminant concentrations (metals and organotin compounds) for harbour porpoises from Swedish waters**

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The harbour porpoise (*Phocoena phocoena*) is highly threatened in the Baltic Sea, but is not uncommon along the western coast of Sweden. We collected 44 porpoise carcasses from 2005-2013 to investigate health and contaminant burden in animals from Swedish waters. Carcasses were examined by necropsy, and sampled for contaminant analysis. Contaminant analysis was performed on a subset of animals (n=27) from 2005-2011. Data on monobutyltin, tributyltin, dibutyltin, tributyltin, tetrabutyltin, mono-octyltin, di-octyltin, trifenylytin and tricyclohexyltin as well as metals (Al, As, Cd, Co, Cr, Cu, Fe, Ni, Pb, Sb, Sn and U) are presented here. Contaminant data were compared among four regions: The Skagerrak, The Kattegat and Öresund along the Swedish west coast, as well as from the southern Baltic Sea.

Cause of death included fishery interaction (10), emaciation (8), blunt trauma (2), infectious disease (2) and other (3). Although a definitive cause of death could not be determined for 19 animals, 11 of these were in good nutritional condition without evidence of underlying disease and fishery interaction could not be excluded.

No contaminant concentrations differed significantly between the four regions (ANOVA:  $p = 0.17-0.94$ ) apart from uranium, which was below detection limit in all samples except for four porpoises from the Skagerrak and one from the Baltic. The highest individual concentration of Hg was 57.3  $\mu\text{g/g}$  wet weight which is higher than concentrations found in adult grey seals (*Halichoerus grypus*) from the Baltic Sea. Two specimens had higher concentrations of Hg compared to Se based on molar weight, indicating an excess of Hg, or Se deficiency.

As for organotin compounds, only mono-, di- and tributyltin were found in measurable concentrations in most samples. Concentrations were similar in all areas. Dibutyltin was found in highest concentrations (6.4-346  $\text{ng/g}$  wet weight), followed by tributyltin (1.3-166  $\text{ng/g}$  wet weight). No age correlation was observed.



### **STR-POLL-02: Marine debris in gastric contents of sperm whales stranded in Italy**

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Studies on the feeding habits of cetacean carried out through the analysis of their stomach contents allow to describe also the finding of inorganic parts, often of anthropogenic origin. We report the results of the gastric analyses we performed on nine sperm whales (*Physeter macrocephalus*) stranded on the southern Adriatic coast of Italy, in two different mass events, focusing on the marine debris findings. The first case was of seven males sperm whales stranded together in 2009. Gastric contents were examined in six out of the seven specimens. Inorganic remains were found in each sperm whale and were represented by foreign bodies of human origin, including fishing gear and hooks, ropes and several plastic objects. The total weight of the inorganic parts varied from 9.5 g to 4,935.3 g. The second case occurred in 2014 and involved 7 specimens again, 4 of which were safely rescued at sea. The gastric contents of the 3 dead whales, all females, were characterized by the presence of organic matter, represented by cephalopod beaks, and a high level of parasitic infestation. Objects of anthropogenic origin (plastic bags, ropes, etc), weighing 1,340.2 g, were found in the stomach contents of one specimen only, a pregnant female. We report a description of the objects, the weight comparison between the organic and inorganic remains and a review of the published data on this subject for the Mediterranean Sea.

### WW-01: Baleen whales in southern Portugal: new insights

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Baleen whales occurring in mainland Portugal are poorly studied and the conservation status of most of the seven species recorded in these waters is classified as “not evaluated”. Fin whales (*Balaenoptera physalus*) and minke whales (*Balaenoptera acutorostrata*) are categorised as “endangered” and “vulnerable”, respectively. Most of the information on mysticetes in the mainland comes from strandings. However, there are historical records on whaling showing that this activity had a significant economic importance in mainland Portugal, being the three most captured species of baleen whales; the fin whale, blue whale (*Balaenoptera musculus*) and humpback whale (*Megaptera novaeangliae*). This work intends to bring new insights on the occurrence of mysticetes along the south coast of Portugal. Whale-watching boats were used as platforms of opportunity to collect data during 5 consecutive years (2010-2014). Four species of mysticetes were observed in 64 encounters, corresponding to ca. 3% of the total number of sightings. The most observed species was the minke whale with 46 sightings, followed by the fin whale with 4 sightings, the sei whale (*Balaenoptera borealis*) was sighted twice and finally the humpback whale registered one encounter. Photographs of the individuals were collected whenever possible to create photo-ID catalogues. Ten individuals of fin whale and four of minke whale were identified so far. One of the individuals of minke whales was recaptured in different days of the same year. This data is limited by the fact that whale-watching vessels do not go beyond 10 nautical miles from shore. Therefore dedicated surveys should be conducted allowing to explore deeper areas. Further studies are necessary to better understand the presence of baleen whales in mainland Portugal and to provide a better assessment of these species’ conservation status.

# Addendum

### **DIS-13: New data revealing remarkable fin whale (*Balaenoptera physalus*) presence within Catalanian shallow waters**

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Fin whales (*Balaenoptera physalus*) are known to migrate every spring along the Catalanian coast (North-Western Mediterranean) towards the Ligurian-Corsican-Provençal Basin. However, there is a specific small area within Catalanian shallow waters which fin whales visit every year from February to June. Despite being a remarkable location for their distribution, no studies have previously been carried out in this area. The ‘Fin whale project’ performed by EDMAKTUB Association is the first study conducted in the area. During 2014, visual maritime surveys consisting of random transects were conducted with a 47 ft. catamaran as research platform. After 4 months of study, 51 single-day surveys have been conducted with a total of 2300km travelled within the 840 km<sup>2</sup> study area. Furthermore, 62 fin whale individuals were sighted at a distance of between 8km to 25km from the coast (50 to 200m depth), of which 48 individuals have been identified by photo-ID. Additionally, there were re-sightings of some individuals over several days. Sightings consisted of single individuals and groups of up to 4 individuals. We observed mainly foraging and resting behaviours, as well as travelling and feeding behaviours (red-stained faeces evidence). The results highlight the importance of this area since it is a small region of shallow waters close to the coast with a high rate of fin whale encounters and where unexpected foraging and feeding behaviours are observed (denoting a potential feeding ground). Since no similar situation has been described before in the NW-Mediterranean, except for the Ligurian Sea, this new data could contribute to a better understanding of fin whales’ distribution. We stress the need for a long-term monitoring program in order to define the factors that explain fin whales’ high presence and behaviour in this region, as well as to determine their identity using blow sampling techniques for genetic studies.

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