20th Annual Conference of the European Cetacean Society

and

Associated Workshops

April 2-7, 2006
Gdynia, Poland

The Music Theatre of Danuta Baduszkowa

MARINE MAMMALS AND MAN IN COASTAL ECOSYSTEM: CAN THEY CO-EXIST ?

Content:

MARINE MAMMALS AND MAN IN COASTAL ECOSYSTEMS: CAN THEY CO-EXIST?

The European Cetacean Society was founded in 1987 after concerns were expressed over the status of the harbour porpoise in Europe. This followed widespread declines of porpoise populations in the face of the rising influence of human activities, particularly in near-shore waters. It therefore seemed fitting for the Society to celebrate its twentieth anniversary with the theme "Marine Mammals and Man in Coastal Ecosystems: Can They Co-exist?" and for the symbol of the conference to be a harbour porpoise.

Honourable sponsorship:

- Ministry of the Environment
- Rector of the University of Gdańsk
- Mayor of Gdynia City

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Financial sponsors:

- The National Found for Environmental Protection and Water Management
- Gdynia City
- University of Gdańsk
- The Faculty of Biology, Geography and Oceanology UG
- Institute of Oceanography UG
- PLUS GSM
- Regional Found for Environmental Protection and Water Management in Gdańsk
- KOŁO, Sanitec Group Co.
- Beckers Co.
- the Town of Hel
- mBank

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Conference guide:

Venue: the plenary sessions, poster sessions, workshop **2** (Climate Change and Cetaceans in Coastal Ecosystem: Past, Present and Future) and workshop **5** (Electrophysiological Measures of Hearing in Marine Mammals) will take place in the Music Theatre of Danuta Baduszkowa, Plac Grunwaldzki 1, 81-372 Gdynia. tel. +48 58 620 95 21, sekretariat@teatrmuzyczny.gdynia.pl (see **A** on the map)
Workshop **1** (Age determination in Marine Mammals)**,** workshop **3** (The second ECS workshop on cetacean pathology: dissection techniques and tissue sampling) and workshop **4** (Static acoustic monitoring of odontocetes: current issues and developments) will be held in an Institute of Oceanography of the University of Gdansk, Al. Piłsudskiego 46, 81-378 Gdynia, tel. +48 58 660 16 00 (**U** on the map).

Registration: registration desk will be open at the Music Theatre from 14:00 till 18:00 on Sunday, April 2nd and then from 8:00 on Monday, April 3rd. All participants are invited to check-in and get their conference material. Only cash money will be accepted for on-site payment.

Verbal presentation: 15 min talk + 5 min for discussion are available, please try to keep to your schedule. A speaker-ready room will allow speakers to make final amendments to their presentations. The presentation must be given to the session chair on CD or memory stick at the beginning of the preceding half day (preferably the day before !). All authors presenting their talks on Monday 3rd April – the first conference day - are kindly asked to give their presentations to the reception desk on Sunday, 2nd April from 14.00 to 18.00.

Posters presentation: posters (best format 70cmx100cm, max. 100cmx130cm) can be on display from Monday morning to Thursday (17:00). Posters stands will be made of cardboard so you can use adhesive tape or pins available in the poster hall and at the reception desk. Authors are requested to stand by their posters during the poster sessions. The numbers of the posters will be presented on the stands to help the authors identify the right location.

Internet centre: free access for participants and journalists will be available at the Music Theatre. 10 computers will be for your disposal in the internet room and wireless (WiFi) internet access in the main conference room and a foyer. Internet access will be available during the whole conference starting from Monday 3rd April. Information needed for wireless access will be given at the beginning of the conference.

Coffee/tea breaks: 30 min long coffee/tea breaks will be arranged every morning and every afternoon during the conference. Hot drinks, refreshments and snacks will be offered. Out of these breaks a bar will be open at a foyer during the conference.

Lunch breaks: there are several restaurants, bars and cafeterias available in the vicinity of the Theatre (most in Świętojańska Street). You can find a full list of them on the conference webpage www.ecs2006gdynia.univ.gda.pl Alternatively a bar in the Theatre will serve warm and cold modest meals for a very reasonable price.

Icebreaker: Sunday, April 2nd. Restaurant "Kapitan Cook", Skwer Kościuszki Str., Gdynia. Start – 20:00. All are invited !

Video night: Tuesday, April 4th - video session will be arranged in the Music Theatre. The session will be open to the public. Start – 20:00

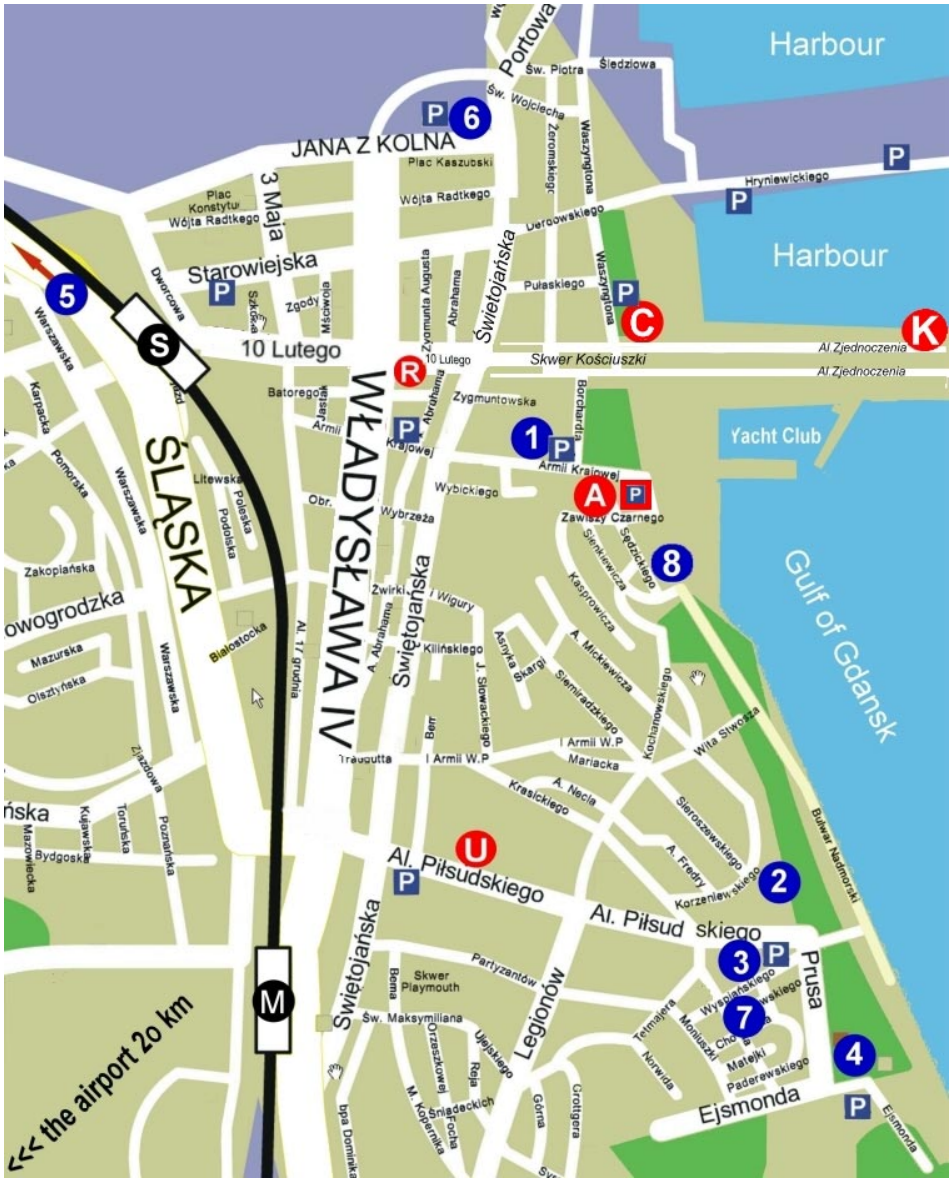
Unveiling of a harbour porpoise statue: Wednesday, April 5th. Skwer Kościuszki/Al. Zjednoczenia, Gdynia at 18:00. A special event on the occasion of the 80 years of the Gdynia City and to celebrate the 20th Conference of the European Cetacean Society in Gdynia. All participants are invited to see this spectacular event !

20th ECS Anniversary Reception: Wednesday, April 5th. Restaurant COCO (in Gemini), Skwer Kościuszki str., Gdynia. Start – 20:00. Continuation of the anniversary celebration in a nice COCO club atmosphere with a little taste of great ECS history enriched with a taste of excellent food and drinks.

Conference banquet: Thursday, April 6th . Restaurant "Pan Tadeusz", Chwaszczyno, Wiejska Str. 1. The banquet will start at 20:30 and the dancing at 23:00. We offer you an investigations of the diversity of the Polish traditional cuisine.

Buses will departure for the banquet at 20:00 and for the dancing at 22:30 from a car park situated between the Music Theatre and the seaside (**B** on the map). Buses will be available for the way back from 23:00 to 04:00 every hour (depending on the number of people eager to come back!). Banquet tickets (30 Euro) are still available at the conference desk.

MAP


Harbour
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Zgody
Mściwoja
Świętojańska
Zygmunta Augusta
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Al. Zjednoczenia
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Jagiellońska
Armii Krajowej
Zygmuntowska
Borchardta
Yacht Club
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Wybickiego
Wybrzeża
Zawiszy Czarnego
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Zakopiańska
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Skargi
J. Słowackiego
A. Mickiewicza
Siemiradzkiego
Kochanowskiego
Wita Stwosza
Gulf of Gdansk
Mazurska
Olsztyńska
Białostocka
Berr
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Mariacka
A. Necla
Krasickiego
Sierosławskiego
A. Fredry
Korzeniowskiego
Bydgoska
Kujawska
Toruńska
Poznańska
Mazowiecka
Al. Piłsudskiego
Al. Piłsud skiego
Partyzantów
Skwer Playmouth
Św. Maksymiliana
Legionów
Tetmajera
Norwida
Moniuszki
Matejki
Paderewskiego
Prusa
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<<< the airport 20 km

Legend:


Music Theatre (*Conference Centre*)


CoCo Bar *(Gemini)(Anniversary reception, 5th April)*


Institute of Oceanography, University of Gdansk


Kapitan Cook *(Icebreaker, 2nd April)*


Sphinx Restaurant (*open 11.00 - 23.00*)


BUS *(to banquet in "Pan Tadeusz" 6th April, 20.00)*


Gdynia Główna Osobowa (*Central Railway Station*)


Gdynia Wzgórze św. Maksymiliana

Hotels:


– Hotel Gdynia


– Hotel Antracyt


– Hotel Dom Marynarza


– Hotel Nadmorski


– direction to Youth Hostel (7 *min by bus*)


– Hotel Neptun


– Villa Bursztynek


– student hostel of Maritime Academy

Conference Programme

ECS Workshops:

Saturday 1st April, 08:30-17:00
Workshop **1**: Age determination of marine mammals
Institute of Oceanography, University of Gdańsk
Gdynia, Al. Piłsudskiego 46
Organizers: Fiona Read, Patricia Lastra, Christina Lockyer

Sunday 2nd April, 09:00-17:00
Workshops **2**: Climate Change and Cetaceans in Coastal Ecosystem:
Past, Present and Future
Music Theatre
Gdynia, Plac Grunwaldzki 1
Organizers: Colin MacLeod, Jennifer Learmonth, John Harwood, Graham Pierce

Sunday 2nd April, 09:00-17:00
Workshops **3**: The second ECS workshop on cetacean pathology:
dissection techniques and tissue sampling.
Institute of Oceanography, University of Gdańsk
Gdynia, Al. Piłsudskiego 46
Organizers: Paul Jepson, Manuel Garcia Hartmann, Thierry Jauniaux

Sunday 2nd April, 09:00-17:00
Workshops **4**: Static acoustic monitoring of odontocetes:
current issues and developments
Institute of Oceanography, University of Gdańsk
Gdynia, Al. Piłsudskiego 46
Organizers: Ruth Leeney, Nick Tregenza

Sunday 2nd April, 09:00-17:00
Workshops **5**: Electrophysiological Measures of Hearing in Marine Mammals
Music Theatre
Gdynia, Plac Grunwaldzki 1
Organizers: Michel Andre, Paul Nachtigall

Sunday 2nd April, 09:00-17:00
Workshops **6**: Europhlukes – Photo-Identification Workshop
Hotel Gdynia
Gdynia, Armii Krajowej 22 (opposite the Music Theatre)
Organizers: Eric Pauwels, Peter G.H. Evans

SUNDAY 2ND APRIL

14:00 – 18:00 Registration in the Music Theatre

20:00 Icebreaker – Restaurant "Kapitan Cook"
Skwer Ko□ciuszki, Gdynia

MONDAY 3RD APRIL

8:30-8:40	Introductory words and practical information
Session 1. Critical Habitats – (I) ***Chair:* Arne Bjørge**	
8:40-9:00	Praca, E., Gannier, A. & Das, K. SUMMER HABITAT SUITABILITY OF THREE TEUTHOPHAGOUS ODONTOCETES IN THE NORTH WESTERN MEDITERRANEAN SEA
9:00-9:20	Simon, M., Reyes Zamudio, M. M., Nuuttila, H. & Evans, P. G. TEMPORAL AND SPATIAL HABITAT PARTITIONING BETWEEN HARBOUR PORPOISES AND BOTTLENOSE DOLPHINS
9:20-9:40	Laran, S. & Gannier, A. SPATIOTEMPORAL PREDICTION OF FIN WHALE DISTRIBUTION IN THE LIGURIAN SEA (NW MEDITERRANEAN SEA
9:40-10:00	Bannon, S.M., MacLeod, C.D. & Pierce, G.J. SPATIO-TEMPORAL VARIATIONS IN HABITAT PREFERENCES OF HARBOUR PORPOISES IN THE WATERS NORTHWEST OF SCOTLAND.

10:00–10:30 Coffee/tea break

10:30–11:00 Official opening with the presence of Minister of Environment, Rector of the University of Gdańsk, Mayor of the Gdynia City

Session 2. Critical Habitats – (II) ***Chair:* Christina Lockyer**	
11:00-11:40	Invited speaker Peter G.H. Evans: MARINE MAMMALS IN THE EUROPEAN COASTAL ZONE: PAST, PRESENT, AND FUTURE
11:40-12:00	Bjørge, A. & Graner, F. AN UNEXPECTED EFFECT OF GLOBAL WARMING: INCREASED RISK OF HARBOUR PORPOISE ICE ENTRAPMENT
12:00-12:20	Vincent, C., Gérondeau, M., Barbraud, C., McConnell, B.J., Fedak, M.A. & Ridoux, V. SEASONAL HAULOUT PATTERNS OF THE SOUTHERN MOST COLONY OF EUROPEAN GREY SEALS: COMBINING INDIVIDUAL AND POPULATION-BASED STUDIES
12:20-12:40	Fury, C.A., Ross, G. & Harrison, P. FLOOD EVENTS AND THERE IMPACT ON BOTTLENOSE DOLPHINS (TURSIOPS ADUNCUS) HABITAT USE IN TWO ESTUARIES IN AUSTRALIA
12:40-12:50	Presentation of poster slides on related topic (CH1-CH6 & CM1-CM15)

12:50–14:20 Lunch break

Session 3. Conservation and management – Acoustic disturbance/Ship collisions ***Chair:*** **Peter Evans**	
14:20-14:40	Thomsen, F., Betke, K., Schultz-von Glahn, M. & Piper, W. NOISE DURING OFFSHORE WIND TURBINE CONSTRUCTION AND IT'S EFFECTS ON HARBOUR PORPOISES (PHOCOENA PHOCOENA)
14:40-15:00	Ashe, E. & Williams R. KILLER WHALE RESPONSES TO BOATS VARIES WITH BOAT NUMBER: IMPLICATIONS FOR EXPERIMENTAL DESIGN OF VESSEL IMPACT ASSESMENT
15:00-15:20	Firestone, J., Corbett, J.J., Taggart, C.T., Wang, C.F., Lyons, S.B. & Vanderlaan, A.S.M. SHIP COLLISIONS WITH NORTH ATLANTIC RIGHT WHALES: MODELLING ENCOUNTER PROBABILITIES FOR CONSERVATION MANAGEMENT
15:20-15:40	Corbett, J.J., Firestone, J., Taggart, C.T., Wang, C.F., Vanderlaan, A.S.M. & Lyons, S.B. APPLICATION OF SHIP SPEED AND MASS CHARACTERISTICS TO DESCRIBE POTENTIAL SEVERITY OF RISK-BASED SHIP COLLISIONS WITH WHALES

15:40–16:10 Coffee/tea break

Session 4. Conservation and management - acoustic monitoring/surveys ***Chair:*** **Ursula Verfuss**	
16:10-16:30	Rogan, E. & Philpott, E. PASSIVE ACOUSTIC MONITORING: A TOOL TO INVESTIGATE THE RESPONSE OF BOTTLENOSE DOLPHINS TO PINGERS
16:30-16:50	Swift, R. J. , Gillespie, D. M., Caillat, M., Macleod, K. & Hammond, P. S. PASSIVE ACOUSTIC MONITORING AS A TOOL FOR MONITORING HARBOUR PORPOISE POPULATIONS: PRELIMINARY RESULTS FROM THE SCANS II SURVEYS
16:50-17:10	Reyes Zamudio, M., Simon, M., Evans, P. & Goold, J. T-POD DETECTION AND ACOUSTIC BEHAVIOUR OF BOTTLENOSE DOLPHINS IN CARDIGAN BAY SAC: A COMPARISON BETWEEN VISUAL AND T-POD SURVEYS.
17:10-17:30	Visser, F., Hartman, K.L., Rood, E.J.J. & Hendriks, A.J.E. EFFECTS OF WHALE WATCHING ACTIVITIES ON RISSO'S DOLPHIN RESTING BEHAVIOUR AT THE AZORES
17:30-17:40	Presentation of poster slides on related topics (A1-A15)

17:40–19:30 Poster session

TUESDAY 4TH APRIL

Session 5. Conservation and management – habitats ***Chair:*** **Krzysztof E. Skóra**	
8:30-8:50	Sveegaard, S., Joergensen, P.B., Bech, N.I., Teilmann, J. & Rye, J.H. SELECTING SPECIAL AREAS OF CONSERVATION FOR HARBOUR PORPOISES (*Phocoena phocoena*) IN DENMARK
8:50-9:10	Panigada, S., Zanardelli, M., MacKenzie, M., Donovan, C., Mélin, F. & Hammond, P.S. MODELLING HABITAT PREFERENCES FOR FIN WHALES AND STRIPED DOLPHINS IN THE PELAGOS SANCTUARY (WESTERN MEDITERRANEAN SEA)
9:10-9:30	Murphy, S., Northridge, S. P., Jepson, P. D., Deaville, R. & Reid, R. J. ARE COMMON DOLPHINS IN THE NORTH-EAST ATLANTIC CLOSE TO THEIR CARRYING CAPACITY?
9:30-9:50	Cañadas, A. & Hammond, P.S. TOWARDS CONSERVATION OF THE SHORT-BEAKED COMMON DOLPHIN (*Delphinus delphis*) OFF THE SOUTHERN COAST OF SPAIN
9:50-10:00	Presentation of poster slides on related topics (CM16-CM30)

10:00–10:30 Coffee/tea break

Session 6. Conservation and management - populations ***Chair:*** **Emer Rogan**	
10:30-11:10	Invited Speaker Christina Lockyer: ALL CREATURES GREAT AND SMALLER: A STUDY IN CETACEAN LIFE HISTORY ENERGETICS
11:10-11:30	Lahaye, V., Bustamante, P., Dabin W., Das, K., Holsbeek, L., Law, R.J., Rogan, E., Pierce, G.J. & Caurant, F. COASTAL POPULATIONS OF SMALL CETACEANS ARE LESS EXPOSED TO TOXIC METALS THAN OCEANIC ONES IN EUROPEAN WATERS
11:30-11:50	Fortuna, C.M., Mackelworth, P.C., Wiemann, A. & Hammond, P.S. SURVIVAL ESTIMATES OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN KVARNERIC (CROATIA)
11:50-12:10	Jauniaux, T., Brenez, C., Das, K., Haelters, J. & Coignoul, F. BY-CAUGHT CETACEANS STRANDED ALONG THE BELGIAN AND NORTHERN FRANCE COASTLINE: ARE THEY A GOOD CONTROL POPULATION?
12:10-12:20	Presentation of poster slides (PA1 – PA9, P1)

12:30–14:00 Lunch break

Session 7. Conservation and management – Fishery regulations ***Chair:*** **Simon Northridge**	
14:00-14:20	Stenback, J., Amundin, M., Poulsen, L. R., Desportes, G., Larsen, F., Petersen, N. K., Bjørge, A., Bylund, K., Eskesen, I., Eriksen, N., Ingversen, S., Jepsen, T. B., Kindt-Larsen, L. & Vanman, C. COMPARISON OF THE REACTION OF WILD HARBOUR PORPOISES EXPOSED TO AN ARRAY OF INTERACTIVE PINGERS AND AQUAMARK 100's
14:20-14:40	Brotons, J.M., Munilla, Z., Grau, A.M. & Rendell, L.E. ARE PINGERS EFFECTIVE AT REDUCING INTERACTIONS BETWEEN BOTTLENOSE DOLPHINS AND ARTISANAL FISHERIES AROUND THE BALEARIC ISLANDS?
14:40-15:00	Leeney, R.H., Berrow, S. , McGrath, D. & Cosgrove, R. EVALUATING THE EFFECTS OF PELAGIC TRAWL PINGERS ON THE BEHAVIOUR OF BOTTLENOSE DOLPHINS TURSIOPS TRUNCATUS
15:00-15:20	Kuklik, I. & Skóra, K.E. IMPACT OF FISHERIES LEGISLATION ON THE RESEARCH OF HARBOUR PORPOISE BYCATCH IN POLAND AS DEMONSTRATED BY EC BYCATCH REGULATION
15:20-15:30	Presentation of poster slides on related topics (B1 -B 25)

15:30–16:00 Coffee/tea break

Session 8. Acoustics – vocal behaviour ***Chair:* Michel Andre**	
16:00-16:20	Blackwell, S.B., Greene, C.R. Jr. & Richardson, W.J. BOWHEAD WHALE (*BALAENA MYSTICETUS*) MIGRATION AND CALLING BEHAVIOUR IN THE ALASKAN BEAUFORT SEA IN AUTUMN 2001–2004 SHOWN BY PASSIVE ACOUSTIC LOCALIZATION.
16:20-16:40	Shapiro, A.D., Tyack, P.L. & Solow, A.R. ANALYSIS OF SPERM WHALE ORIENTATION RESPONSE TO CONTROLLED EXPOSURE OF SONAR.
16:40-17:00	Filatova, O.A., Burdin, A.M. & Hoyt, E. VOCAL DIALECTS AND POPULATION STRUCTURE IN KILLER WHALES OF EASTERN KAMCHATKA.
17:00-17:20	Ludwig, S., Corsten, A. & Knoll, M. ACOUSTIC DETECTION OF MARINE MAMMALS WITH DIFFERENT SONAR SYSTEMS.
17:20-17:35	Presentation of poster slides on related topics (A16 - A33)

17:35–19:30 Poster session 2

20:00–22:00 Video night
Music Theatre

WEDNESDAY 5TH APRIL

Session 9. Feeding ***Chair*: Florence Caurant**	
8:50-9:10	Santos, M.B., Pierce, G.J., Ieno, E.N., Addink, M., Smeenk, C., Kinze, C.C., Iverson, M. & Lockyer , C. TRENDS IN DIET OF HARBOUR PORPOISES *(Phocoena phocoena*) IN THE EASTERN NORTH SEA
9:10-9:30	Meissner, A.M. & Ridoux, V. FEEDING STRATEGY OF STRIPED DOLPHINS IN A NEAR SHORE AREA
9:30-9:50	Teloni V., Jonhson, M.P., Madsen P.T. & Miller P.J.O. FORAGING BEHAVIOR OF MALE SPERM WHALES OFF NORTHERN NORWAY
9:50-10:10	Walton, M.J. & Pomeroy, P.P. TRANSFER OF FATTY ACIDS FROM MOTHER TO PUP IN GREY SEALS (*Halichoerus grypus)*
10:10-10:20	Presentation of poster slides on related topics (E1 – E8 & F1 – F15)

10:20–10:50 Coffee/tea break

Session 10. Stock ID/distribution ***Chair:* Genevieve Desportes**	
10:50-11:30	Invited speaker Alex Aquilar: MANAGING PRE-EXTINCTION: THE CASE OF THE MEDITERRANEAN MONK SEAL
11:30-11:50	Galatius, A. & Kinze, C. C. DIFFERENCES IN TIMING OF SEXUAL MATURITY IN DANISH AND GREENLANDIC HARBOUR PORPOISES (*PHOCOENA PHOCOENA*): VARYING LEVELS OF PAEDOMORPHOSIS?
11:50-12:10	Särnblad, A., Danbolt, M., Dalén, L., Berggren, P. & Amir, O. POPULATION STRUCTURE AND PHYLOGENETIC PLACEMENT OF INDO-PACIFIC BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS*) OFF ZANZIBAR, TANZANIA
12:10-12:30	Barrett-Lennard, L. G. & Matkin, C. O. THE ROLE OF CULTURAL INNOVATION IN THE EVOLUTIONARY RADIATION OF CETACEANS
12:30-12:40	Presentation of poster slides on related topics (SD1 - SD24)

12:40–14:30 Lunch break

12:45–13:30 Annual Student Meeting in the auditorium

Session 11. New Technics (I) ***Chair:* Nick Tregenza**	
14:30-14:50	André, M., Coatanhay, A., Gervaise, C., Gracia, J., Delory, E. & van der Schaar, M. ACOUSTIC RELEASE OF GAS BUBBLES TO PREVENT CETACEAN ENTANGLEMENT IN FISHING NETS
14:50-15:10	Rendell, L.E., Schulz, T. & Whitehead, H. A DYNAMIC HYDROPHONE ARRAY FOR STUDYING UNDERWATER VOCAL BEHAVIOUR
15:10-15:30	Lonergan, M. & McConnell B. A SIMPLE METHOD TO EXTRACT ANIMAL'S PATHS FROM NOISY DATA (DEMONSTRATED ON GREY SEALS).
15:30-15:40	Presentation of poster slides on related topics (posters NT1NT5, NH1-NH3, LH1-LH2, G1-G5)

15:40–16:10 Coffee/tea break

Session 12. New Technics (II) ***Chair*: Lance G. Barrett-Lennard**	
16:10-16:30	Vanman, C., Bogomolni, A., Moore, M.J. & Touhey, K. WHO, WHERE, WHEN AND HOW - THE SPATIO-TEMPORAL DISTRIBUTION AND OCEANOGRAPHIC CORRELATIONS OF STRANDINGS IN A HOTSPOT REGION.
16:30-16:50	Rubio-Cisneros, N.T., Morin, P.A., Mesnick, S.L., Gendron, D., Nestler, A., Robertson, K.M. & Jaquet, N. DEVELOPMENT OF THE ZFX / ZFY 5'-EXONUCLEASE ASSAY, A NEW TOOL FOR SEX DETERMINATION IN CETACEANS AND ITS APPLICATION TO SPERM WHALES IN THE GULF OF CALIFORNIA.
16:50-17:10	Rokicki J., Kijewska, A., Kuklik, I. & □wi□tecka A. PCR METHOD FOR IDENTIFICATION OF NEMATODES FROM SUPERFAMILY ASCARIDOIDEA
17:10-17:20	Presentation of poster slides on related topics (posters MD1 – MD24)

18:00–19:00 Unveiling of the statue of the harbour porpoise on the occasion of the 80th Anniversary of the City of Gdynia and the 20th Conference of the ECS
Skwer Ko□ciuszki Str.

20:00–0:00 20th ECS Conference – Anniversary Reception at restaurant COCO (in Gemini)
Skwer Ko□ciuszki Str.

THURSDAY 6TH APRIL

Session 13. Surveys/Abundance (I) ***Chair:* Simone Panigada**	
9:00-9:20	Macleod, K., Scheidat, M. & Hammond, P. TAKING STOCK OF EUROPEAN CETACEANS: THE SCANS-II SURVEYS
9:20-9:40	Gomez de Segura, A., Hammond, P.S., Cañadas, A. & Raga, J.A. VALIDATING THE USE OF SPATIAL MODELS TO ESTIMATE CETACEAN ABUNDANCE
9:40-10:00	Karlsson, O. & Helander, B. COUNTING THE INVISIBLE. A COMPARISON BETWEEN ESTIMATES OF THE SIZE OF THE BALTIC GREY SEAL POPULATION DERIVED FROM TRADITIONAL COUNTS DURING MOULT AND PHOTO-IDENTIFICATION USING MARK RECAPTURE TECHNIQUE.
10:00-10:10	Presentation of poster slides on related topics (SA1 – SA27)

10:10–10:40 Coffee/tea break

Session 14. Surveys/Abundance (II) ***Chair:* Phil Hammond**	
10:40-11:20	Invited speaker: Giuseppe Notarbartolo di Sciara: CONSERVING CETACEANS IN A SEA OF UNCERTAINTIES
11:20-11:40	Piper, W., Laczny, M. & Thomsen, F. ABUNDANCE AND DISTRIBUTION OF HARBOUR PORPOISES (*Phocoena phocoena*) IN THE CENTRAL GERMAN BIGHT DURING 2002-2004
11:40-12:00	Abt, K. & Siebert, U. HARBOUR PORPOISES IN THE NORTH SEA: PEAK STRANDING NUMBERS IN THE SOUTH IN YEARS OF FOOD SHORTAGE IN THE NORTH — EVIDENCE OF OCCASIONAL MASS MIGRATION?
12:00-12:20	Verborgh, P., De Stephanis, R., Pérez, S., Sanchez, A. & Guinet, C. POPULATION ESTIMATION AND SURVIVAL RATE OF LONG-FINNED PILOT WHALES (*Globicephala melas*) IN THE STRAIT OF GIBRALTAR AND INTERACTIONS WITH THE MARITIME TRAFFIC

12:20–13:50 Lunch break

Session 15. Medicine/Diseases ***Chair:* Thierry Jauniaux**	
13:50-14:10	Deaville, R., Patterson, T., Baker, J., Ross, H., Simpson, V., Monies, B., Reid, B., Penrose, R., Sabin, R., Muir, A., Perkins, M., Turk, S., Cunningham, A. & Jepson, P. TRENDS IN CAUSES OF MORTALITY IN HARBOUR PORPOISES (PHOCOENA PHOCOENA) STRANDED IN UK WATERS (1990-2004).
14:10-14:30	Siebert, U., Wohlsein, P., Fonfara, S., Lehnert, K., Müller, G., Hasselmeier, I. & Baumgärtner, W. ASSESSMENT OF HEALTH STATUS OF HARBOUR SEALS (*Phoca vitulina*) FROM GERMAN WATERS AROUND TWO PHOCINE DISTEMPER VIRUS MASS MORTALITIES
14:30-14:50	Raverty, S., Gaydos, J. & Hanson, M.B. EPIDEMIOLOGIC AND PATHOLOGIC FINDINGS OF KILLER WHALES (*Orcinus orca*) STRANDED 1944-2003
14:50-15:00	Workshops report - 2

15:00–15:30 Coffee/tea break

Session 16. Medicine/Diseases ***Chair:* Paul Jepson**	
15:30-15:50	Castinel, A., Duignan, P.J., Donald, J., Pomroy, W.E., Lopez-Villalobos, N., Chilvers, B.L. & Wilkinson, I.S. PATHOGENIC ROLE OF THE HOOKWORM UNCINARIA SPP IN NEW ZEALAND SEA LION (*Phocarctos hookeri*) PUPS: EFFECT ON GROWTH AND BLOOD PARAMETERS
15:50-16:10	Stockin, K.A., Law, R.J., Duignan, P.J., Meynier, L., Thompson, E. & Orams, M.B. TRACE ELEMENTS, PCBS AND ORGANOCHLORINE PESTICIDES IN TISSUES OF COMMON DOLPHINS (*Delphinus sp.)* STRANDED IN THE HAURAKI GULF, NEW ZEALAND.
16:10-16:30	Duignan, P.J., Geschke, K., Stone, G., Teilmann, J., Hutt, A., Suisted, R., Russell,K., Jones, G.W., Cockrem, J. & Yoshinaga, A. MONITORING HEALTH AND STRESS INDICES IN HECTOR'S DOLPHINS CAPTURED FOR SATELLITE TELEMETRY IN NEW ZEALAND

16:45–18:30 Annual General Meeting

20:00–23:00 Banquet in "Pan Tadeusz"

(20:00 – take off, 20:30 – banquet)

23:00-04:00 Dancing in "Pan Tadeusz"

FRIDAY, 7TH APRIL

11:00 and 15:00 the Old Town of Gdańsk (optional) – 4 hours guided tour

TALK ABSTRACTS

TALK ABSTRACTS

MONDAY 3RD APRIL

SUMMER HABITAT SUITABILITY OF THREE TEUTHOPHAGOUS ODONTOCETES IN THE NORTH WESTERN MEDITERRANEAN SEA

Praca, E. (1,3), Gannier, A. (2) and Das, K. (3)

(1) Centre de Recherche sur les Cétacés – Marineland, 306 avenue Mozart, 06600 Antibes, France; (2) Groupe de Recherche sur les Cétacés, BP715, 06633 Antibes cedex, France; (3) Laboratoire d'Océanologie B6c, Université de Liège, Allée de la Chimie 3, Liège 4000, Belgique

The prediction of habitat suitability of a species provides information about the relation between its distribution and environmental factors and forecasts its potential presence. It's therefore an important tool for species conservation and management of protected zones. In the northwestern Mediterranean, sperm whales (*Physeter macrocephalus)*, pilot whales (*Globicephala melas*) and Risso's dolphins (*Grampus griseus*), all teuthophageous, may be in competition for the resource. Modelling their distribution allowed us to evaluate their possible competition for the habitat. The Ecological-Niche Factor Analysis (ENFA) is a recent multi-factorial analysis based on presence-only data. It gives an ecological mean to the resultant axes, representing the marginality (M, difference between the species habitat and the mean conditions available) and the specialization (S, difference between variance of the species observed habitat and variance of the study area) of the species. Data sampled in summer 1998 to 2005 (N=191 for sperm whale, 22 for pilot whale and 17 for Risso's dolphin) were compiled with topography, temperature and concentrations in chlorophyll factors. Sperm and pilot whales seemed to have close habitat suitability. Marginality (M=1.13 and 1.48 respectively) indicated their preference for colder and more productive waters than the mean of the study area. The pilot whale was more specialized than sperm whale (S=19.54 vs. 2.46) and principally influenced by the presence of thermal fronts in spring. Distribution of sperm whale was either related to fronts and to the slope. The principal habitat area for those species were then the central Ligurian-Provençal Basin, the more productive part of the northwestern Mediterranean, but more restricted for the pilot whale. The Risso's dolphin's model was less powerful, probably reflecting the migratory behaviour of this species. Nevertheless, the marginality (M=0.64) highlighted an important relation to waters closest to the shore, contrary to the previous species.

Day: Monday 3 April ; Time: 8:40; Eligible for Student Award: Postgraduate

TEMPORAL AND SPATIAL HABITAT PARTITIONING BETWEEN HARBOUR PORPOISES AND BOTTLENOSE DOLPHINS

Simon, M. (1, 3), Reyes Zamudio, M.M. (2), Nuuttila, H. (3) and Evans, P.G. (3)

(1) Greenland Institute of Natural Resources, Nuuk, Groenland; (2) School of Biological Sciences, University of Wales, Bangor, UK; (3) Sea Watch Foundation, Oxford, UK

During recent years, the frequency of porpoise deaths attributed to bottlenose dolphin kills in Cardigan Bay has increased markedly. The cause of this remains uncertain, but one hypothesis is that numbers and distribution of one or both species has changed so that the two species compete for some resource, such as space or prey. Analyses were undertaken of spatio-temporal patterns of stranded porpoises killed by dolphins, and generalised additive modelling was conducted on sightings data, to identify areas where the two species are concentrated, and from this to predict potential areas of competition and possible habitat partitioning. All of these analyses showed seasonal variations: dolphins being scarce or absent in the winter and abundant in the summer but no pronounced seasonal variation in presence of harbour porpoises. However, no clear patterns in spatio–temporal habitat partitioning were found. Passive acoustic monitoring using T-PODs can provide information of the presence of bottlenose dolphins and harbour porpoise at strategic locations over long periods of time, throughout 24-hours, and independent of sea state. We calibrated ten T-PODs in pool and field conditions, in order to ensure inter T-POD data comparability, and we deployed the ten T-PODs in Cardigan Bay SAC from March to December 2005. In order to gain insight to the behavioural context of the T-POD detections and the relationship between rate and intensity of detections, group size and behaviour, theodolite tracking was carried out for comparison of acoustic detections with visual observations. The T-POD data confirmed the seasonal variations but in addition revealed clear spatial-temporal habitat partitioning between the two species in some parts of the SAC. This might be a result of the aggressive behaviour of dolphins towards porpoises in the area. Further investigations, such as examination of dietary preferences, are needed to identify the factors promoting this unusual behaviour.

Day: Monday 3 April ; Time: 9:00; Eligible for Student Award: No

SPATIOTEMPORAL PREDICTION OF FIN WHALE DISTRIBUTION IN THE MEDITERRANEAN SEA

Laran, S. (1) and Gannier, A. (2)

(1) Centre de Recherche sur les Cétacés, 306 avenue Mozart, 06600 Antibes, France;
(2) Groupe de Recherche sur les Cétacés, BP 715, 06633 Antibes cedex, France

Prediction models were developed for fin whale (*Balaenoptera physalus*) in the Ligurian Sea. An effort of 2,745 km distributed on twelve dedicated surveys was carried out between mainland and Corsica from 2001 to 2003. Surveys were conducted on a monthly basis, using

the same platform and the same protocol. Using multiple logistic regression, presence of fin whales was related to predictor variables as topographic variables (Depth, Contour Index, distance to the shore) and oceanographic parameters from remote sensing (Sea Surface Temperature, Chlorophyll and Net primary production) on 8-day periods.
Simultaneous primary production, water temperature and distance to the coast were selected by stepwise procedure as influent on whale distribution. Model predicted correctly 62.5% of the sampled cells. The model predicted successfully the fin whale spreading between June and August and spatial shift of whale distribution from a year to the next. Cross validation of the predicted distribution was done with external data set from 1998 to 2002 (on 8,240 km). The selected model predicted correctly 74% of the external data set (73.8% of the presence and 74.1% of the absence). Reliable prediction were obtained for fin whale, providing promising results for the development of future applications. This project will contribute to understand fin whale distribution and links with environmental parameters in an area or whales are well known to concentrate each summer to feed. Prediction of weekly distribution of fin whale in relation to environmental parameters represent a very useful conservation tool to prevent collisions with ship or as conservation tool in the Marine Protected Area.

Day: Monday 3 April ; Time: 9:20; Eligible for Student Award: No

SPATIO-TEMPORAL VARIATIONS IN HABITAT PREFERENCES OF HARBOUR PORPOISES IN THE WATERS NORTHWEST OF SCOTLAND

Bannon, S.M., MacLeod, C.D. and Pierce, G.J.

School of Biological Sciences (Zoology), University of Aberdeen, Tillydrone Avenue, Aberdeen, AB24 2TN, United Kingdom

The relationships between eco-geographic variables (EGVs) and harbour porpoise (*Phocoena phocoena*) occurrence in the waters around the Scottish northwest coast were investigated. Data were collected throughout May to September of 2001 to 2004 via regular surveys conducted from a network of passenger ferries. A geographical information system (GIS) was constructed to process the field data and to allow integration of the eco-geographic variables. Generalised additive modelling (GAM) and generalised linear modelling (GLM) was used to identify relationships between the EGVs (seabed gradient, seabed aspect, water depth and distance to coast) and harbour porpoise occurrence. A single model covering the whole study area and all survey months explained only a small amount of the variation in harbour porpoise occurrence (10.9%). However, when the study area was sub-divided and data were examined for monthly differences, the performance of the models generally increased. For example, a model restricted to the Sea of Hebrides and the month of May explained 29.7% of variation in porpoise occurrence. In addition, different EGVs were significantly related

to porpoise occurrence in different areas and months. This suggests that habitat preferences of harbour porpoises vary both spatially and temporally in the waters of northwest Scotland. Similarly, the accuracy of the models spatial predictive abilities improved when monthly variations were examined within each geographic sub-division. The physical EGVs may be influencing the spatial and temporal occurrence of harbour porpoises by affecting the biological productivity of an area which will in turn, effect the distribution, abundance and availability of prey.

Day: Monday 3 April; Time: 9:40; Eligible for Student Award: Postgraduate

AN UNEXPECTED EFFECT OF GLOBAL WARMING: INCREASED RISK OF HARBOUR PORPOISE ICE ENTRAPMENT

Bjørge, A. (1) and Graner, F. (2)

(1) Institute of Marine Research, c/o University of Oslo, Department of Biology, P.O. Box 1066 Blindern, N-0316 Oslo, Norway; (2) Sealife Productions, 226 Walnut Street, Pacific Grove, CA 93950 USA

The fjords of Norway penetrate up to 200 km from the open coast into the mountain areas. Several fjords host resident stocks of sprat and herring, and they are important harbour porpoise foraging habitats. Historically, inner parts of the fjords froze during winter and ice entrapments of porpoises were known to occur. As autumn progressed the temperature dropped and the precipitation came as snow. The ground froze and the river water flow became strongly reduced. Winds caused vertical mixing of the fjord waters, and lower air temperatures only gradually cooled the surface water with subsequent gradual formation of ice. Frozen fjords often remained ice-covered until spring. We provide information on local climate change and formation of fjord ice during the 20th century. We give some recent examples of ice entrapment of porpoises, and we hypothesise that the increased winter temperatures in combination with passages of strong Atlantic low-pressure systems increase the risk of porpoise ice entrapment. In recent years the average winter temperature increased between 1o and 2oC and the fjords remain free of ice during large parts of the winter. Throughout the winter, passages of strong Atlantic low-pressure systems provide periods of mild westerly winds and rainfall, even at some altitude in the mountains. River floods form shallow fresh water surface layer in the fjords. After low-pressure passages, the clouds brake up, winds calm and temperatures drop to well below freezing. The thin fresh water surface layer freezes rapidly and ice expands over large fjord areas in matter of few hours causing frequent entrapment of porpoises. The salt water below the fresh surface layer might still hold temperatures well above freezing, and the ice might be broken by the next low-pressure passage, followed by new temperature drops and subsequent rapid re-freezing and new possibilities for entrapment of harbour porpoises.

Day: Monday 3 April ; Time: 11:40; Eligible for Student Award: No

SEASONAL HAULOUT PATTERNS OF THE SOUTHERN MOST COLONY OF EUROPEAN GREY SEALS: COMBINING INDIVIDUAL AND POPULATION-BASED STUDIES

Vincent, C. (1), Gérondeau, M. (1), Barbraud, C. (2), McConnell, B.J. (3), Fedak, M.A. (3) and Ridoux, V. (1)

(1) Laboratoire de Biologie et Environnements Marins, UMR 6217, CNRS/Université de La Rochelle, Avenue Michel Crépeau, 17 042 La Rochelle cedex, France; (2) Centre d'Etudes Biologiques de Chizé, CNRS UPR 1934, Villiers-en-bois, 79 360 Beauvoir sur Niort, France; (3) NERC Sea Mammal Research Unit, Gatty Marine Laboratory, School of Environmental and Evolutionary Biology, University of Saint-Andrews, Fife KY16 8LB, Scotland, UK

We studied year-round haulout site use by grey seals in the Molène archipelago, France, by combining individual and population-based approaches. We investigated how population patterns emerged from individual movements in a colony at the limit of the species' range. Monthly censuses (n=49) showed that the number of seals hauled-out in the archipelago peaked during the moult, and was at a minimum during reproduction. The sex ratio was highly biased towards males during the moult, but less so the rest of the year. Photo-identification indicated high inter-annual fidelity for the Molène archipelago for both sexes (70-95%). Multistate mark-recapture analysis showed that female fidelity was low from summer to breeding (34-43%) but higher from breeding to moult and then to summer (60-85%). However, all females observed during breeding were already photographed during summer. Males showed constant rates of fidelity/movements from one season to the next (56% and 44% respectively). Individual movements were assessed by fitting 16 seals with Satellite Relay Data Loggers (SMRU) during May-November in 1999, 2002 and 2003 (mean tracking duration: 104 days). While 56.8% of their tracking time was spent within the Molène archipelago, fourteen seals also hauled out in Northern Brittany, the Isles of Scilly, Cornwall, Wales, and the Channel Islands up to 400 km away. On average, we recorded 0.6 long-distance trip/seal/month before summer, 0.3 during summer and 1.2 before breeding. We suggest that male and female grey seals use the haulout site of the Molène archipelago during summer in the vicinity of their foraging grounds in order to replenish their fat reserves for breeding. However, most of them then breed elsewhere while a significant proportion of males return for moulting. A smaller proportion of male and female seals may remain in the archipelago during breeding and moulting, but almost all known individuals come back during summer.

Day: Monday 3 April ; Time: 12:00; Eligible for Student Award: No

FLOOD EVENTS AND THEIR IMPACT ON BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS*) HABITAT USE IN TWO ESTUARIES IN AUSTRALIA

Fury, C.A. (1), Ross, G. (2) and Harrison, P. (1)

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Habitat use of Bottlenose dolphins (*Tursiops aduncus*) were investigated in two estuaries in New South Wales, Australia. The study tested whether a flood event had any affect on dolphin habitat use within two estuaries. 118 boat-based surveys were undertaken in the Clarence River (CR) and Richmond River (RR) over 2 years comprising 618 hours (CR 290; RR 328) with 305 (CR) and 128 (RR) dolphins observed. The Clarence River has an estimated dolphin population of 58 SE 1.2 (58-73 95% CI) and the Richmond River 24 SE 0.9 (24-30 95% CI). Feeding was the major behaviour exhibited by the dolphins in both estuaries occurring 57% (CR) and 74% (RR) of their total time in the estuaries. A determining factor of the dolphins habitat use in the estuaries was 3 flood events that occurred during the 2 years of the study. The Clarence River dolphin abundance were estimated in non-flood periods at 1.13 per hour and in flood 0.29 per hour, additionally, in the Richmond River in non-flood periods 0.49 per hour and in flood 0.04 per hour making the difference statistically significant in both cases (Chi square CR 4.750, p = 0.029; RR 6.494, p = 0.011). These results indicate that during a flood event dolphins move out of the estuary. Water quality at this time is adversely affected by lowering pH, dissolved oxygen, turbidity, conductivity, water temperature and salinity. These changes also cause fish species to migrate out of the estuary and the dolphins movements are strongly related to the movements of their prey. This study demonstrates that flood events cause changes in Bottlenose dolphin habitat use in two Australian estuaries by leaving the estuary at times of flood. Management of agricultural practices in the catchments could improve water quality and would benefit estuarine fauna in times of flood.

Day: Monday 3 April ; Time: 12:20; Eligible for Student Award: Postgraduate

NOISE DURING OFFSHORE WIND TURBINE CONSTRUCTION AND IT'S EFFECTS ON HARBOUR PORPOISES (*PHOCOENA PHOCOENA*)

Thomsen, F. (1, 2), Betke, K. (3), Schultz-von Glahn, M. (2) and Piper, W. (1)

(1) Biologisch-landschaftsökologische Arbeitsgemeinschaft, Gotenstraße 4, D-20097 Hamburg, Germany; (2) Biozentrum Grindel, Universität Hamburg, Martin-Luther-King-Platz 3, D-20146 Hamburg, Germany; (3) Institut für technische und angewandte Physik, Marie-Curie-Straße 8, D-26129 Oldenburg, Germany

The extensive plans for installation of offshore wind farms in European waters have raised concerns about possible impacts on one of the most common cetacean species in the area, the harbour porpoise (*Phocoena phocoena*). Especially the noise generated

during construction of wind turbines is potentially harmful for the species. However, detailed information on sound pressure levels in frequencies relevant to the hearing abilities of harbour porpoises are rarely provided and impact assessments are therefore difficult to conduct. We measured peak sound pressure levels (Lpeak) and sound exposure levels (LE) in 1/3 octave bands (frequency range = 20 Hz – 20 kHz) during ramming of a jacket-pile construction in the German Bight in summer 2003 (distance = 400 m from the source). We then calculated sound pressure levels at various distances and assessed zones of noise influence based on published data. The broadband Lpeak at 400 m was 189 dB re 1µPa (LE = 166 dB re 1µPa), resulting in a peak broadband source level of 228 dB re 1 µPa @ 1m (LE = 206 dB re 1 µPa @ 1m). The 1/3 octave SPL was highest at the 315 center frequency (Lpeak = 218 dB re 1 µPa @ 1m) with considerable pressures above 2 kHz. We predict that the measured noise is loud enough to be audible for porpoises in distances beyound 80 km, can mask communication in the range of 30–40 km and might induce behavioural reactions at distances of 10–20 km. TTS is expected within 1 km around the source, with frequencies above 2 kHz most harmful. We conclude that noise during construction of offshore windfarms has the potential to affect porpoise behaviour and physiology at considerable distances and that mitigation should focuss on damping of the higher frequency part of the ramming noise.

Day: Monday 3 April ; Time: 14:20; Eligible for Student Award: No

KILLER WHALE RESPONSES TO BOATS VARIES WITH BOAT NUMBER: IMPLICATIONS FOR EXPERIMENTAL DESIGN OF VESSEL IMPACT ASSESSMENTS

Ashe, E. (1) and Williams, R. (2, 3)

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Vessel traffic has been implicated as a potential contributing factor to the at-risk status of two killer whale populations in western Canada and the US. Relevant guidelines can be informed by conducting experimental impact assessments that allow animal response to guide vessel management. Two published experimental studies documented stereotyped avoidance responses. Opportunistic observations from these studies suggested a shift in avoidance behavior when approximately 3 boats approached within 1000m. Our experiment was designed to test whether whales responded differently to approach by few (1-3) versus many (>3) vessels. Data were collected in summer 2004, in Johnstone Strait, British Columbia using a theodolite to track positions of boats and individually identifiable whales. Experimental trials included 20-minute “no boat” and 20-minute “boat” phases with local whalewatching vessels during which data were collected continuously on the focal whale. Responses of the 16 adult male killer whales

tracked differed significantly between treatment levels (Wilcoxon's test P =0.0148). Swimming path became less direct when approached by few boats, and whales increased path directness when approached by many boats. Consistent with previous experiments, inter-breath interval, swimming speed, angle between successive dives, and rates of surface behavior did not differ significantly. The distinction between "few" and "many" boats was supported by opportunistic observations on 26 whales from the population of 216. Pooling both treatments would have masked these significant responses with strong statistical confidence (Wilcoxon's test P > 0.999), falsely suggesting that boat presence had no effect. Generalized Additive Models were used to control for effects of potentially confounding variables, and confirmed a non-linear relationship between approach within 1000m and a whales' swimming path directness with an inflection point around 3 boats. Interpreting biological significance of null findings from impact assessments is problematic and therefore statistical power, experimental design, and appropriateness of response variables must be considered.

Day: Monday 3 April ; Time: 14:40; Eligible for Student Award: No

SHIP COLLISIONS WITH NORTH ATLANTIC RIGHT WHALES: MODELLING ENCOUNTER PROBABILITIES FOR CONSERVATION MANAGEMENT

Firestone, J. (1), Corbett, J.J. (1), Taggart, C.T. (2), Wang, C.F. (1), Lyons, S.B.(1) and Vanderlaan, A.S.M. (2)

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The risk of an interaction between the critically endangered north Atlantic right whale (*Eubalaena glacialis*) and a ship is asymmetric; the small population of right whales (300-345) and large number of ships makes the risk several orders of magnitude greater for a whale than a ship. Researchers have dedicated significant effort to understanding right whale distribution in breeding, feeding and calving areas; much less is known regarding both right whale migration among these areas and vessel traffic throughout the right whale's range. These are critical gaps given that ship strikes are the leading anthropogenic cause of right whale mortality. We have engaged in cross-border collaboration bringing together engineering, legal, statistical, oceanographic, and policy analytic expertise to develop statistical and GIS models to quantify the interaction probability of right whales and vessels along the North American Atlantic coast spatially, temporally, and by vessel characteristics (type, speed, tonnage). This work builds on the Canadian collaborator's work in the Bay of Fundy that led to the movement of shipping lanes. We employ data from the Right Whale Consortium database and ship position data (ICOADs, AMVER, ECAREG) for commercial and

fishing vessels, port entrance and clearance data, and Lloyds shipping data. The model establishes an empirical commercial ship traffic network from twenty years of historical ship observations, incorporates large fishing vessels based on three years of data, and employs fractional polynomial regression to estimate right whale distribution in migratory pathways. By overlaying whale and ship activities layers, we estimate the risk of an encounter between ships and whales spatially and temporally. This information can be used by decision-makers who are presently considering regulation or are parties to litigation (e.g., NOAA and the US Coast Guard) to create practical vessel management solutions that reduce the likelihood of ship strikes.

Day: Monday 3 April ; Time: 15:00; Eligible for Student Award: No

APPLICATION OF SHIP SPEED AND MASS CHARACTERISTICS TO DESCRIBE POTENTIAL SEVERITY OF RISK-BASED SHIP COLLISIONS WITH WHALES

Corbett, J.J. (1), Firestone, J. (1), Taggart, C.T. (2), Wang, C.F. (1), Vanderlaan, A.S.M. (2) and Lyons, S.B. (1)

(1) Graduate College of Marine Studies, University of Delaware, Robinson Hall, Newark, Delaware, 19716, USA; (2) Department of Oceanography, Dalhousie University, Room 4664 LSC, Halifax, Nova Scotia, B3H 4J1, Canada

The consequences of ship-strikes to the critically endangered north Atlantic right whale (*Eubalaena glacialis*) are understood mainly in terms of observed mortality and injury through a limited set of observations resulting from opportunistic and survey data for the small population of right whales (300-345). This work presents analysis of data from the Right Whale Consortium database, demonstrating that ship speed and mass are important predictors of whale lethality from a ship-strike. We then illustrate the geographic nature of these potential consequences using an empirical commercial ship traffic network from twenty years of historical ship position data (ICOADs, AMVER, ECAREG) for commercial vessels. By overlaying this consequence layer onto a GIS projection of the risk of an encounter between ships and whales, we are able to evaluate potential whale-recovery benefits such as modification of ship speed behaviour, route location, or other measures in terms of spatially and temporally varying whale habitat. This information can be used by decision-makers who are presently considering regulation or are parties to litigation (e.g., NOAA and the US Coast Guard) to create practical vessel management solutions that reduce the likelihood of ship strikes.

Day: Monday 3 April ; Time: 15:20; Eligible for Student Award: No

PASSIVE ACOUSTIC MONITORING: A TOOL TO INVESTIGATE THE RESPONSE OF BOTTLENOSE DOLPHINS TO PINGERS

Rogan, E. and Philpott, E.

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The acoustic response of bottlenose dolphins to two types of pinger (Dukane NetMark™ 1000 and AQUAmark 200) was examined in the Shannon Estuary, Ireland from 7th August-3rd October 2005. Three pingers spaced 100m apart, and a T-POD were moored in an array below the observation site. Control (non active) intervals separated the active pinger trials. The closest observed dolphin group was tracked using a theodolite. Data from the T-POD was downloaded every month and echolocation encounter rate, duration and minimum interclick interval were analysed. An encounter was defined as a series of click trains separated by no more than ten minutes (after Carlstrom 2005). A significant difference was found in echolocation encounter rate between the four trials (Kruskal Wallis $p<0.001$) with a much lower echolocation encounter rate during both active pinger trials compared with the control trials (Mann Whitney, $p<0.05$). No significant difference in encounter rate per day was found between pinger types (Mann-Whitney, $p>0.5$) (i.e. similar encounter rates for both active pingers). There was no difference in encounter duration between the trials (Kruskal Wallis, $p>0.05$) but there was a significant difference in the length of time between encounters (Kruskal Wallis, $p<0.005$), with longer time between encounters during active pingers trials. No significant difference was found in minimum interclick interval between control and both active pinger trials. During both active pinger trials, there was a difference in echolocation encounter rate among the diel phases (morning, day, evening and night) (Kruskal Wallis $p<0.05$) but not during the control trials (Kruskal Wallis $p>0.5$). There was a significant difference in encounter rate during both active pinger trials (Dukane $p<0.001$, AQUAmark $p<0.05$) with higher encounter rates recorded at night in both instances. Examination of echolocation behaviour suggests that bottlenose dolphins either echolocate less or are displaced from the area when pingers are active.

Day: Monday 3 April ; Time: 16:10; Eligible for Student Award: No

PASSIVE ACOUSTIC MONITORING AS A TOOL FOR MONITORING HARBOUR PORPOISE POPULATIONS: PRELIMINARY RESULTS FROM THE SCANS II SURVEYS

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The SCANS-II project (LIFE04 NAT/GB/000245) aims to recommend best practice for monitoring cetacean populations in shelf waters of the European Atlantic. Passive acoustic monitoring is an established method for monitoring harbour porpoise relative

abundance and, as such, was a core component of the July 2005 SCANS II survey. A hydrophone array, high frequency recording equipment and software designed to detect harbour porpoise clicks in real time were operated on each vessel taking part in the survey. Data were collected continuously on each vessel while it was on track, and candidate clicks from porpoises and other species archived for later analysis. Usable acoustic data were obtained from all seven survey ships and an eighth ship operating in the Baltic; 28,917km were surveyed 'on effort'. Acoustic data analysis was carried out independently of the visual survey data. Bearings to clicks were calculated using time of arrival differences on two hydrophones. Individual porpoise clicks were identified by using the peak frequency in the click spectrum and the ratio of the energy in the porpoise frequency band (100 – 150 kHz) and a lower control frequency band (40–90kHz). Clicks were then grouped into events (or click trains) by hand. Where a clear track could be seen as an animal passed astern, a location was calculated using target motion analysis. 432 multi-click porpoise events were detected, and 285 of these (66%) could be reliably tracked. Fitted detection functions indicated that porpoise can reliably be detected out to distances of 200-300m, and occasionally out to 600m, whist suggesting avoidance close (<50m) to the vessel. Noise levels were measured for each ship and the effects of noise levels in the porpoise band (100-150kHz), and of 'avoidance' in response to underway vessel noise were investigated. These results are discussed in terms of current and future monitoring programmes.

Day: Monday 3 April ; Time: 16:30; Eligible for Student Award: No

T-POD DETECTION AND ACOUSTIC BEHAVIOUR OF BOTTLENOSE DOLPHINS IN CARDIGAN BAY SAC: A COMPARISON BETWEEN T-POD RECORDINGS AND VISUAL OBSERVATIONS

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T-PODs are acoustic data loggers that detect echolocation clicks from harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*). T-POD research has focused mainly on harbour porpoises. This study aimed to investigate T-POD performance when studying bottlenose dolphins by: measuring the detection range, detection probability in the presence of dolphins and investigating the possibility of identifying dolphin behaviour from T-POD data. Two T-PODs were deployed for a period of six weeks (27th June - 8th August, 2005), at two different locations (Mwnt and New Quay, Cardigan Bay Special Area for Conservation, West Wales). Visual surveys using theodolites to calculate the distance between T-POD and dolphins, and observing the animal behaviour, were carried out at each location. Comparison between data obtained with T-PODs and simultaneous visual surveys showed that the maximum

T-POD detection range of bottlenose dolphin clicks was 650m. When the dolphins were present within this range, the T-PODs only detected them 11 percent of the time and there was a significant negative correlation between the distance and the T-POD detection probability. In addition, the detection probability varied with dolphin behaviour so that dolphins that were feeding had a significantly higher probability of being detected by the T-POD than dolphins that were travelling. T-POD data showed that dolphins that were feeding emitted click trains with significantly higher numbers of clicks, and had significantly lower inter click intervals than travelling dolphins, suggesting that click trains with high numbers of clicks (< 30) and low minimum inter click intervals (< 350 µs) identify feeding behaviour in T-POD data. This could be a first step to use T-PODs for abundance estimates.

Day: Monday 3 April ; Time: 16:50; Eligible for Student Award: No

EFFECTS OF WHALE WATCHING ACTIVITIES ON RISSO'S DOLPHIN RESTING BEHAVIOUR AT THE AZORES

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Whale watching activities at the Azores have been growing exponentially over the last decade, posing a high disturbance potential for the cetacean species present. In this study, we investigated Risso's dolphin (*Grampus griseus*) behavioural response to the presence of whale watching activities by comparison of the resting rate in the presence and absence of whale watching vessels. At the Azores, due to the species' daily presence in inshore waters, we have the exceptional opportunity to study Risso's dolphin behaviour from land. Land observations have the strong advantage that observers do not have an impact on the animals of focus, enabling comparisons of behaviour in undisturbed environment, with behaviour in the presence of vessels. Daily, binocular-aided focal follows of Risso's dolphin groups were conducted from a permanent observation platform on the south coast of Pico, Azores. Behavioural budget was determined per month and per 1-hour intervals over the day. Overall resting rate decreased from 25% to 21% in the presence of whale watching vessels. Risso's dolphin natural resting behaviour showed a clear, daily pattern, with distinct peaks in the morning and afternoon. During the high pressure months of whale watching (July-August; average daily vessel presence: 5), this pattern shifted completely towards a single peak around 1 PM, during the low pressure hours of whale watching activity (0-2 vessels present). As resting rate was shown to be negatively correlated to vessel abundance, this can not merely be a seasonal pattern. Apparently, Risso's dolphins adjust their patterns of resting behaviour to vessel abundance. The alteration of their

natural resting pattern implies that the dolphins have to adapt to an alternative and probably less favourable situation, especially as their resting behaviour shows a clear pattern. Adaptation to a less favourable situation can be directly translated to a less efficient time management of the dolphins and consequently to a negative impact on the population.

Day: Monday 3 April ; Time: 17:10; Eligible for Student Award: No

TUESDAY 4TH APRIL

SELECTING SPECIAL AREAS OF CONSERVATION FOR HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN DENMARK.

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The Habitats Directive (92/43/EEC) categorises the harbour porpoise as a species in need of strict protection and whose conservation requires the designation of Special Areas of Conservation. Hence, all EU countries are legally obligated to protect harbour porpoises in its natural habitat by selecting protected areas. However, the method to make this selection is still unspecified and no official guidelines have been published. The purpose of this study is to examine and evaluate biological methods used for studying harbour porpoises and suggest guidelines for future selection of important habitats. From 1997 to 2005, 57 harbour porpoises were tagged with satellite transmitters in Denmark. Data shows that two subpopulations exist; with a border in the northern Kattegat. Thus, protected areas should be selected for both populations. The southern population shows a preference of gathering in the southern waters around Flensborg Fjord. Consequently, Flensborg Fjord was selected as a candidate for harbour porpoise habitat protection. Two stationary acoustic loggers (T-PODs) were deployed in Flensborg Fjord during August-November 2005. Recordings by T-PODs can provide a continuous monitoring of relative abundance. In Flensborg Fjord an average of 8.6 encounters per day was detected. In comparison harbour porpoises were acoustically recorded on an average of 17.7 encounters per day in Jammerland Bay in the Great Belt and an average of 8.5 encounters per day at Gedser in the western Baltic. These results are consistent with the telemetry data and show the potential of using T-PODs for comparing seasonal importance between areas. Special Areas of Conservation for harbour porpoises may be localised by tracking harbour porpoises with satellite telemetry. The detailed use of the areas should be monitored using several methods like T-PODs, tagging and surveys to evaluate the relative importance of the area in relation to other areas.

Day: Tuesday 4 April ; Time: 8:30; Eligible for Student Award: Postgraduate

MODELLING HABITAT PREFERENCES FOR FIN WHALES AND STRIPED DOLPHINS IN THE PELAGOS SANCTUARY (WESTERN MEDITERRANEAN SEA)

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One of the needs of the Pelagos Sanctuary for the Conservation of Mediterranean Marine Mammals is information on critical habitats for cetaceans. This study modelled habitat use and preferences of fin whales and striped dolphins (the two most abundant species in the area) with the aim of providing this information. The study area was divided into a 2' latitude by 2' longitude grid. The explanatory variables considered in the models were physiographic variables (mean, range and standard deviation of depth and slope, and distance from the nearest coastline) and remotely sensed data (sea surface temperature and chlorophyll a concentration). The former were calculated for each cell using GIS tools, while the latter were obtained by AVHRR and SeaWiFS sensors. Generalized Additive Models (GAMs) with multidimensional smoothers were used to model the distribution of fin whales and striped dolphins in relation to these variables, and classification and regression trees (CART) were used for habitat characterization. The search effort, expressed kilometres surveyed in each grid cell under favourable conditions, was treated as an offset. To justify the complexity of the models, CART and GAMs were compared with a more conventional, more restrictive approach (Generalized Linear Models, GLMs). Chlorophyll, SST, depth and slope were found to be important predictors of habitat use, and substantial gains in predictive ability were made when CART and GAMs were used. The techniques applied to this dataset proved to be valuable tools to describe habitat use and preferences of cetaceans, and the use of the remotely sensed data substantially improved the predictions. The results of this study will be used for assessing critical habitats within the Pelagos Sanctuary and will provide information for conservation and management in the Sanctuary.

Day: Tuesday 4 April ; Time: 8:50; Eligible for Student Award: No

ARE COMMON DOLPHINS IN THE NORTH-EAST ATLANTIC CLOSE TO THEIR CARRYING CAPACITY?

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Concerns have been raised that incidental captures of common dolphins in fishing gear may be leading to a population level decline in common dolphins numbers in the Western Channel, Celtic Sea and Bay of Biscay area. Incidental captures are known to be at least in the hundreds of animals per year, but are only partially known at present, and have been ongoing for at least 15 years. In the absence of sequential abundance estimates, a population level decline may be observable in density dependent changes in population parameters. Specifically, substantial population declines would be expected to be accompanied by any or all of the following changes in population parameters: increased individual growth rates, decreased calving intervals, an increase in the pregnancy rate, or lowering in the age at sexual maturity. Samples obtained from the UK strandings and observer bycatch programmes, between 1990 and 2004 were analysed in order to examine some of these population parameters. In the sample, 87 females were identified as mature individuals, and of these 24 were pregnant. The annual pregnancy rate (APR) was calculated at 28.8%, and the inter-calving interval was estimated at 42 months/3.5 years. Excluding individuals that died during the mating period May to September, an APR of 31.6% was calculated. Similar results were found in a study examining the pregnancy rate and calving interval in common dolphin's inhabiting waters off the Irish coast. Age at sexual maturity in Irish samples was estimated at 9-10 years. Taken together, and when compared with populations elsewhere that are able to reproduce every two years, these data all suggest that common dolphins in the North-east Atlantic may in fact be close to their carrying capacity. However, it remains possible that low pregnancy rates could also be a result of high contaminant burdens causing reduced fertility in females.

Day: Tuesday 4 April ; Time: 9:10; Eligible for Student Award: No

TOWARDS CONSERVATION OF THE SHORT-BEAKED COMMON DOLPHIN (*DELPHINUS DELPHIS*) OFF THE SOUTHERN COAST OF SPAIN

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The short-beaked common dolphin is believed to have suffered a steep decline in the Mediterranean in recent years. ACCOBAMS (Agreement for the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic waters) is developing a Conservation Plan for this species. Effective conservation will depend critically on our understanding and ability to predict the relationship between the population and its habitats. The Alborán Sea is the most important remaining habitat for this species in the basin and constitutes, therefore, a vital source of information on its ecology, essential for the development of conservation measures.
Spatial modelling using GAMs was used to provide information on distribution and abundance of common dolphins in the area. In total, 37,385 km of non-systematic line transects conducted from 1992 to 2004, generating 738 sightings in a 19,189 km^2 study area, were analyzed. Analyses examined differences among sub-areas, years, seasons and 'intrinsic' factors (behaviour, calving, interespecies aggregations). Seasonal variation in abundance was detected, with higher average density in summer (1.0 animals/km^2) than in winter (0.5 animals/km^2). Geographical differences were also found, with higher density in the west (1.5 animals/km^2) than in the east (0.4 animals/km^2) during summer. No overall trend in abundance was observed in the whole area but a decline was observed in the eastern portion (Gulf of Vera) with a summer density of 0.34 in 1992-1995 and 0.11 in 1996-2004. With respect to depth, a bimodal distribution was predicted, with higher densities around the continental slope (100-400 m) and in deeper waters (800-1200 m). This can partially be explained by the difference in predicted habitat use depending on intrinsic factors: groups with calves, feeding groups and single species groups preferred shallower waters; socialising groups, groups with no calves and multi-species groups preferred deeper waters. These results will inform conservation efforts in the Mediterranean.

Day: Tuesday 4 April ; Time: 9:30; Eligible for Student Award: No

COASTAL POPULATIONS OF SMALL CETACEANS ARE LESS EXPOSED TO TOXIC METALS THAN OCEANIC ONES IN EUROPEAN WATERS

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Upper-level predators like small cetaceans can display particularly high concentrations of mercury (Hg) and cadmium (Cd) in their tissues. Given that exposure to these toxic elements may depend on metal bioavailability and feeding preferences, bioaccumulation in cetaceans may vary among species, habitat and geographical area. We focussed at the most abundant small cetaceans in European waters, i.e. harbour porpoises (n=102), common (n=230), striped (n=63) and bottlenose (n=15) dolphins. Most individuals were originated from stranding events along the coasts of France, Netherlands, Scotland, Ireland and Galicia, but sampling also included by-caught animals from Atlantic neritic and oceanic waters. Some prey were collected in order to infer about metal exposure. Hence, oceanic Atlantic prey displayed the highest concentrations of both Cd (*Cranchid cephalopod*) and Hg (*Myctophid fish*). High Hg levels were also encountered in Mediterranean prey (collected over the continental shelf), likely as a consequence of the natural Hg enrichment in this area. Regarding cetaceans, accumulation of renal Cd with age was the most important in the typically oceanic striped dolphin, but also in common dolphins by-caught in oceanic waters. With the two most representative species, increase of Cd concentrations also occurred with latitude. In addition, Hg accumulation in the liver was the most important in Mediterranean bottlenose and striped dolphins but also in Atlantic striped dolphins. The similar Hg levels in Atlantic and Mediterranean striped dolphins could be striking. However, regarding results from prey, offshore feeding in the Atlantic versus inshore feeding in the Mediterranean Sea could effectively lead to similar Hg exposure in these areas. Consequently, small cetacean populations that would be the most exposed to toxic metals would be those feeding in oceanic and northern ecosystems rather than coastal ones. Hence, in European waters, exposure to metals in cetaceans would be enhanced by natural processes rather than anthropogenic influence.

Day: Tuesday 4 April ; Time: 11:10; Eligible for Student Award: Postgraduate

SURVIVAL ESTIMATES OF BOTTLENOSE DOLPHINS *(TURSIOPS TRUNCATUS)* IN KVARNERIC (CROATIA)

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Survival estimates are of fundamental importance not only for a better understanding of the ecology of a population, but also to define effective conservation measures. Here we represent the first survival estimates for a Mediterranean population of bottlenose dolphins that inhabits Kvarneric waters (Croatia). We used capture–recapture models applied to nine years of photo-identification data (1995-2003) to estimate adult and calf survival. During 625 dedicated surveys, we made 370 encounters allowing photo-identification of 110 naturally well-marked adult individuals. Pollock's robust design models that estimate temporary emigration rates were fitted to these data. Two subsets were also considered: one of all 42 known mature females and the other of 9 confirmed males and 50 unsexed individuals, both males and immature females. We assumed this group to be mostly males. A Cormack-Jolly-Seber model was fitted to data on 48 known-age calves, to estimate survival during their first 4 years of life. The apparent survival of adults was S=0.924 (95%CI=0.895-0.949), with a low temporary emigration rate 5.7% (95%CI=0.022-0.136) and a very high probability of remaining outside the study area once outside (□'=0.499, 95%CI=0.160-0.838). Calf survival rates ranged between 0.500 and 0.912, with a maximum at Age 2-3. The apparent survival of the mostly male group was lower (S=0.907; 95%CI 0.853-0.942) than female survival (S=0.946; 95%CI 0.908-0.968). The adult female emigration probability was extremely low (near to zero), but the probability of remaining outside the study area was 0.215. The mostly male group had a temporary emigration rate of about 0.08 and a probability of remaining outside of up to 0.58. These results give an important insight into the ecology of Adriatic bottlenose dolphins. They also indicate the need for a strong synergic regional and local approach to the conservation of this population, rather then relying only on very localised protection measures.

Day: Tuesday 4 April ; Time: 11:30; Eligible for Student Award: Postgraduate

BY-CAUGHT CETACEANS STRANDED ALONG THE BELGIAN AND NORTHERN FRANCE COASTLINE: ARE THEY A GOOD CONTROL POPULATION?

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Since 1991, marine mammals stranded along Belgium and northern France coastline are necropsied and sampled using a standard protocol and a cause of death identified (MARIN project -Marine Animals Research & Intervention Network-). By-catch can be only diagnosed on stranded animals as fishermen release net-entrapped animals and such diagnosis is frequently based on external lesions. In addition, for comparison with sick animals, by-caught cetaceans are considered as being "control" animals for toxicological or biological studies, based on the assumption that they are healthy. The aim of the present study is to identify observations on stranded by-caught porpoises (*Phocoena phocoena*). From January 1995 to December 2005, 60 stranded porpoises out of 275 animals were diagnosed as being by-caught. Most of them were juvenile (90%), without sex predisposition. Observations related with net-entrapment were net marks (50%), amputation (10%), subcutaneous and muscular haemorrhages (30%), lung edema (63%), lung congestion (54%) and lung haemorrhage (10%). Surprisingly, lesions unrelated with net capture were observed in 50% of by-caught porpoises: mild to severely emaciation (42%), slight parasitism of airways and stomach (21%), severe parasitism with acute pneumonia (15%) or chronic gastritis (15%). The median blubber thickness was 16.2 mm and the gastro-intestinal tract was empty in 30%, without evidence of feeding. Some lesions were enough severe to be the cause of death if such animals were not by-caught. Our study showed that by-catch diagnosis can not be based on external observations only because such lesions are present in just half of the animals and that by-caught porpoises are not always healthy. Therefore, they should not be declared control animals by default without a detailed post-mortem examination. Such considerations should be taken into account in toxicological or biological investigations and confirm the rule of necropsies in multidisciplinary studies on the cause of death of marine mammals.

Day: Tuesday 4 April ; Time: 11:50; Eligible for Student Award: No

COMPARISON OF THE REACTION OF WILD HARBOUR PORPOISES EXPOSED TO AN ARRAY OF INTERACTIVE PINGERS AND AQUAMARK 100'S

Stenback, J. (1,2), Amundin, M. (3), Poulsen, L. R. (1), Desportes, G. (1,4), Larsen, F. (5), Petersen, N. K. (1), Bjørge, A. (6), Bylund, K. (1), Eskesen, I. (1), Eriksen, N. (1), Ingversen, S. (1), Jepsen, T. B. (1), Kindt-Larsen, L. (1) and Vanman, C. (3)

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Harbour porpoise (*Phocoena phocoena*) bycatch is of such a magnitude in European waters that EU regulations made it mandatory to use acoustic alarms (pingers) in many commercial fisheries. The pingers available emit displacement sounds continuously in regular or irregular intervals irrespective of the presence of porpoises. This excessive emission causes unnecessary disturbance of the marine life and may lead to habituation and thus reduced effectiveness. Thus, the effect of a more environmental and porpoise friendly interactive pinger, which only emits displacement sounds when triggered by porpoise sonar, was compared with the effect of an AQUAmark 100 (standard pinger). The study was conducted at Fyns Hoved, Denmark, in August-September 2005. Free-ranging porpoises were exposed to an array of four pingers in a simulated gillnet situation. Surface positions of the porpoises were obtained with a digital theodolite from a 20m high cliff, and combining subsequent surfacings formed tracks. Only data within a 400m range of the pingers were analysed (based on theoretical auditory detection range and tracking precision), and the interactive pingers and AQUAmark 100's were deployed for a day at a time, respectively. The results are based on 52 tracks/7days and 14 tracks/3days for the interactive pingers and AQUAmark 100's, respectively. The interactive pingers emitted on average less than 7 displacement sounds per hour, which is equivalent to 1-6% of the sound emissions from an AQUAmark 100. The median of the minimum approach distance was 29m for the interactive pinger and 44m for the AQUAmark 100 (not significantly different), and there was no significant difference in the usage of a 400m range around the pinger array. In conclusion, the porpoises reacted in the same manner to the interactive pinger and the AQUAmark 100. And with significantly less sound emissions the interactive pinger constitutes an interesting alternative to the standard pingers.

Day: Tuesday 4 April ; Time: 14:00; Eligible for Student Award: Undergraduate

ARE PINGERS EFFECTIVE AT REDUCING INTERACTIONS BETWEEN BOTTLENOSE DOLPHINS AND ARTISANAL FISHERIES AROUND THE BALEARIC ISLANDS?

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Interactions between marine mammals and fisheries represent a serious and growing conservation issue. Around the Balearics Islands bottlenose dolphins regularly interact with coastal artisanal fisheries. We estimate that this interaction results in an economic cost of 6.5% of the total landed catch value (95% CI 1.6%-12.3%), and the interaction also results in dolphin mortality. Pingers are one possible mitigation measure. We tested the efficacy of three brands of commercially available pingers using both inactive (placebo condition) and active (treatment condition) pingers and nets with no pingers (control condition). Each vessel was equipped with 15 identical bottom-set gill nets for the study, 60m long, 1.25m high and with 50mm mesh. Nets were equipped with either one of three brands of pinger (SavewaveTM, AquamarkTM and NetmarkTM) or with no pingers. Pinger activation was carried out such that those reporting on the fishing were unaware of the condition. Catch data were recorded for each operation on board the vessel. Up to November 15th, 39 of 59 participating vessels have reported on 719 fishing operations over 112 different days since July 1, 2005. Of these operations, 413 were with active pingers, 190 with inactive pingers and 116 with no pingers. Depredation was evidenced either by direct observation of dolphins taking from nets or by the presence of characteristically damaged fish in the hauled net. Preliminary data show that the frequency of depredation on nets with no pingers was 0.0345 (95% CI 0.0095-0.0859). Across all pinger types, there was no reduction in the probability of depredation with activated pingers (control vs. treatment, Binomial test, $p = 0.105$). However, there were differences in depredation probability between brands. Surprisingly, there was a significant increase in the probability of depredation when nets carried inactive pingers (control vs. placebo, Binomial test, $p = 0.004$).

Day: Tuesday 4 April ; Time: 14:20; Eligible for Student Award: No

EVALUATING THE EFFECTS OF PELAGIC TRAWL PINGERS ON THE BEHAVIOUR OF BOTTLENOSE DOLPHINS *TURSIOPS TRUNCATUS*

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Large numbers of dolphins and porpoises die in fishing gear worldwide, posing serious threats to several populations and species. Several mitigation measures, including acoustic deterrent devices or "pingers", have been used in attempts to reduce this bycatch. In order to reduce the number of common dolphins (*Delphinus delphis*) caught in pelagic trawls fishing for albacore tuna in Irish waters, two models of pinger are being tested. Standard "continuous pingers" (CP) produce a continuous, high intensity sound at 20-160 Hz. A new prototype "responsive" pinger (RP) produces an alarm activated by the reception of dolphin vocalisations, and also logs the dolphin clicks themselves. Prior to this study, both models had been tested in a controlled environment where they have been shown to alter dolphin behaviour, but had yet to be tested in the field. This study compared the responses of bottlenose dolphins (Tursiops truncatus) to both pinger models, in the Shannon estuary, southwest Ireland. This is the most reliable location in which to encounter dolphins in Irish waters. Pinger-T-POD pairs were individually deployed at, and alternated between, six sites for replicate 24-hour periods. Pingers were either active or inactive (control). T-PODs and the responsive pinger collected acoustic data on the vocalisation activity of dolphins within range. Behavioural sampling of dolphins in response to pingers was carried out during "observer-blind" boat-based trials. T-POD detection rates were significantly greater for inactive CPs than for active ones, whereas detection rates were similar for active and inactive RPs. Minimum inter-click intervals were lower for inactive CPs than for active ones. Observed responses of dolphins to active pingers differed significantly from responses to inactive pingers of both types. This study provides an important step towards the refinement of a dynamic tool for reducing bycatch levels in tuna trawl fisheries.

Day: Tuesday 4 April ; Time: 14:40; Eligible for Student Award: No

IMPACT OF FISHERIES LEGISLATION ON THE RESEARCH OF HARBOUR PORPOISE BYCATCH IN POLAND AS DEMONSTRATED BY EC BYCATCH REGULATION

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The harbour porpoise is considered a rare species in the Polish Baltic and in urgent need of well targeted conservation measures. Due to low abundance the collection of data is very difficult and would be impossible without voluntary involvement of the society, especially fishermen. Reports have been collected since 1990, initially limited to bycaught animals and delivered exclusively by fishermen. Later, additional reports on sighted and stranded porpoises were delivered by tourists and maritime administration. For the last five years data collected have been complemented by PODs registrations. The reporting system was largely based on cooperation with fishermen. In 16 years 92 reports were collected, of which 64 concerned bycaught animals. The majority were entangled in anchored nets in coastal waters, others in offshore set nets. In 2004, the European Union decided to ban drift net fishing in the Baltic Sea from 2008 onwards to help the harbour porpoise population recover. In the light of collected data, this ban was apparently not required and in fact inappropriate as a protective measure since so far no data have been collected to confirm the harmfulness of drift nets to porpoises in Polish Baltic waters. This decision has caused incomprehension and indignation among fishermen and a collapse of the voluntary reporting system on bycatch. Fishermen have qualified this regulation as incomprehensible and unjustified. It has also undermined the trust of fishermen in the use of research results. The number of reports has decreased. As a result of protests by fishermen the Polish government has officially asserted that harbour porpoises do not occur in the Polish Baltic. This demonstrates that taking generic decisions without bearing in mind the particularities of local problems can severely affect the process of creating a scientific and a socio-economic bases for sustainable co-existence of man and the marine environment.

Day: Tuesday 4 April ; Time: 15:00; Eligible for Student Award: No

BOWHEAD WHALE (*BALAENA MYSTICETUS*) MIGRATION AND CALLING BEHAVIOUR IN THE ALASKAN BEAUFORT SEA IN AUTUMN 2001–2004 SHOWN BY PASSIVE ACOUSTIC LOCALIZATION

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The westward migration of bowhead whales was studied during autumn 2001–2004 as part of a larger study investigating possible effects of an oil production island on whale behaviour. An array of directional autonomous seafloor acoustic recorders (DASARs) was deployed northeast of the Northstar oil production island close to Prudhoe Bay, in the Alaskan Beaufort Sea. Sounds were recorded continuously for 24–35 days per year. More than 130 000 bowhead calls were detected, and the directional capability of DASARs allowed triangulation of the whale position for ~93 500 of those calls. This showed that the migration pathway was closer to shore in 2003–2004 than in 2001–2002. Calls were clumped in space and time, with call detection rates varying between 0 and >600 calls per hour. There was significantly more calling at night than during the daytime. Sixty-five to 82% of calls were simple FM calls, and the percentage of complex calls was positively related to the daily number of calls. No songs were detected, but in 2004 there were a number of call sequences consisting of repeated identical calls in series lasting up to 30 min and more. During these long sequences the calling whale(s) could be tracked. The DASAR methodology is independent of weather and time-of-day constraints and provides a continuous acoustic record over several weeks. It provides detailed information on the temporal and spatial distribution of calling whales and on characteristics of their acoustic repertoire. It therefore complements aerial surveys carried out over a much larger geographical area, but with low spatial and temporal resolution and a low sample size.

Day: Tuesday 4 April ; Time: 16:00; Eligible for Student Award: No

ANALYSIS OF SPERM WHALE ORIENTATION RESPONSE TO CONTROLLED EXPOSURE OF SONAR

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Controlled exposure experiments of mid-frequency sonar were conducted on three adult male sperm whales in the Ligurian Sea tens of kilometers offshore. A digital archival tag on each whale recorded the received level (RL) of pings emitted once every 15s and

provided a 3D orientation and movement track of the animal throughout the exposure. The source vessel circled the animal and gradually increased the sonar source level from 160 dB RMS re 1 □Pa to an intensity designed to reach a predetermined RL at the whale below 160 dB. A directional time series was computed from the paths of the animal and ship, providing an angular measure of the direction in which the whale was pointing relative to the vessel. We developed a regression model based upon the von Mises distribution for circular random variables to assess dependence of the angular response variable on ping RL that tested the null hypothesis of no effect of RL on orientation against the alternative effects of avoidance or attraction. Based on the null that whale orientation was independent of RL, a randomization test was conducted where the RLs were randomly distributed among the angular variable data. Using a log likelihood ratio test to assess significance, two sperm whales significantly ($P<0.01$) and the third weakly significantly ($P=0.11$) oriented more towards the source vessel with increasing RL. The value of the regression coefficient had the same sign and magnitude across experiments. These results suggest that the RL ramp up procedure often proposed for mitigation purposes may, in certain cases where animals orient towards and approach the source, expose them to higher levels than anticipated. The novel experimental design and statistical approach described here offer insight into developing future controlled exposure experiments exploring the behavioral responses of whales to anthropogenic noise sources.

Day: Tuesday 4 April ; Time: 16:20; Eligible for Student Award: Postgraduate

VOCAL DIALECTS AND POPULATION STRUCTURE IN KILLER WHALES OF EASTERN KAMCHATKA

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Investigations of killer whale (*Orcinus orca*) behaviour in the Eastern North Pacific showed the existence of two ecotypes of killer whales: fish-eating (resident) and mammal-eating (transient). Each resident pod has its own unique repertoire of discrete calls. Pods that share calls belong to the same acoustic clan. Resident and transient whales share no calls and differ greatly by vocal activity, as well as by ecology, social organization and genetics. Until recently, the vocal repertoire of Western North Pacific killer whales remained completely unstudied. We now present a description of vocal dialects of killer whales from Eastern Kamchatka (Far East Russia). Materials and data being used for this study were collected in 2000-2005 in Avacha Gulf. Whales were individually recognized through photographic identification. We classified 25 discrete

call types and 24 more subtypes - a total of 49 calls. We identified individual group repertoires and measured the similarity of call repertoires between pods by calculating an index of the degree of call sharing. The index values were then used to calculate a dendrogram of the hierarchical structure of acoustic similarity. Most of the groups shared at least one call type with another group, which means that all are members of one clan. One group shared no calls with other groups, and their appearance and behaviour looked like mammal-eating (transient) killer whales from the Eastern North Pacific. These results enable us to demonstrate the existence of at least two sympatric populations of killer whales in the Western North Pacific. Through this work, we believe it will be possible to make important comparisons to the well-studied Eastern North Pacific killer whales, which will help to illuminate the function of vocal dialects and unlock the evolutionary mechanisms and the role of social learning or cultural transmission, in dialect formation and development.

Day: Tuesday 4 April ; Time: 16:40; Eligible for Student Award: No

ACOUSTIC DETECTION OF MARINE MAMMALS WITH DIFFERENT SONAR SYSTEMS

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We compared the passive detection abilities of different sonar systems used or planned to be used by the German Navy. This included hull-mounted sonar (HMS), Low Frequency Towed Active Sonar (LFTAS) and Intercept. The objective was to test if and how these sonar types can improve marine mammal risk mitigation by a timely detection of various marine mammal sounds in passive mode. Furthermore it was looked into how these sonar systems could be adapted and extended in the future to minimize the risk for marine mammals. In total sounds of 50 different marine mammal species were analyzed by generated MATLAB programs. Signals of 8 baleen whale species, 39 toothed whale species including 6 beaked whale species, 2 pinniped species and 1 sirenia species were available. 420 signals (e.g. whistles, chirps, clicks, bursts, grunts, moans) of marine mammals were used for the study. Signal signatures (source level, frequency, amplitude, duration of signal, sweep form, variance and repetition rate) were catalogued. The modification of the signals by the transmission channel of HMS, LFTAS and Intercept was simulated by signal processing and detection ranges were calculated. Best detection ranges for lower spectral source levels (SSL < 150 dB relµPa/Hz) of marine mammal signals were obtained by HMS. HMS and LFTAS showed detection ranges > 6 km in their frequency band when SSL 150 dB. In comparison, the detection range of the Intercept was much lower caused by the high medium absorption. The results showed that especially the use of HMS for detection

of marine mammals would improve risk mitigation. Future sonar types could have adaptable spectrogram displays and a memory for transient signals. For the detection of higher frequent signals of beaked whales (> 20 kHz) which is the major risk group, the additional use of high frequency antennas would optimize detection.

Day: Tuesday 4 April ; Time: 17:00; Eligible for Student Award: No

WEDNESDAY 5TH APRIL

TRENDS IN DIET OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN THE EASTERN NORTH SEA

Santos, M.B. (1,2), Pierce, G.J. (1), Ieno, E.N. (1,3), Addink, M. (4), Smeenk, C. (4), Kinze, C.C. (5), Iverson, M. (6) and Lockyer, C. (7)

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Results are presented of the analyses of harbour porpoise stomach contents from animals stranded and by-caught in Denmark and he Netherlands. Around 130 stomach content samples from Denmark (1985-92 and 1996-2000) were analysed, along with around 100 non-empty stomachs from the Netherlands (1985-2003). Cod, whiting (*Gadidae*), sandeels (*Ammodytidae*) and gobies (*Gobiidae*) were the most important prey. Diet was found to vary in relation to area, year, season, size-class and sex. Interannual dietary trends were apparently not related to known changes in large-scale fish abundance estimates. It has been suggested that the recent increase in porpoise sightings and strandings off and in the Netherlands could be associated with increased herring abundance. This prediction will be tested once new stomach samples from the Netherlands for 2004-05 have been analysed.

Day: Wednesday 5 April ; Time: 8:50; Eligible for Student Award: No

FEEDING STRATEGY OF STRIPED DOLPHINS IN A NEAR SHORE AREA

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Since 2003, a coastal part of the northwestern mediterranean population of striped dolphins, *Stenella coeruleoalba*, has been studied off Antibes, France, to understand habitat use of this oceanic species in a near shore area. Here, we focus on feeding tactics to underline influence of local environment on foraging strategies. Forty seven survey sessions (totalling 17 hours) in the inshore area allowed us to describe eighteen bouts of foraging behaviours. Two different feeding tactics came out by comparing distance to shore (Kruskal-Wallis, $p<0,01$, N=210). The coastal tactics involves dolphins structured into widely spread subgroups of one to a few animals. Dolphins foraging from dusk to dawn (4h30 after sunrise in average, N=7) are known to feed during the night. They forage within 5 km from the shore (SD=2 km, N=176) over steep slope (μ =14%, N=176) above 550 m deep (SD=270 m, N=176). The offshore behaviour is characterized by entire schools foraging in coordination: animals move forward in a line formation. Dolphins momentary take advantage of preys present underneath the surface (feeding extends from 15 min to 1 hour during daylight hours) and then return to their previous activity. Feeding dolphins were observed within15 km from the shore (N=34) above 1200 m deep (SD=385 m, N=24). Both tactics are used alternately by the same individual during a daily loop pattern of habitat use, inshore at night and offshore during the day. The coastal tactics appears to be a predictable activity, the specific offshore-inshore diel movement having previously been described. The second tactics seems to be more opportunistic, depending on prey availability. Resightings of eighteen dolphins throughout this 3-years-study suggests site fidelity between January and June. Knowledge of local habitat and understanding of prey behaviour could lead to this feeding strategy, reflecting an adaptation of the species to a specific feeding ground.

Day: Wednesday 5 April ; Time: 9:10; Eligible for Student Award: Postgraduate

FORAGING BEHAVIOR OF MALE SPERM WHALES OFF NORTHERN NORWAY

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Male sperm whales are known to frequent the submarine canyon northwest of Andenes (69N/15E) during summer. To uncover the dynamics of this foraging activity, the diving and acoustic behavior of four male sperm whales off Andenes has been studied

during the summer of 2005 by means of archival digital tags (Dtags). The Dtags recorded the whales' sound and movement patterns for 25, 26, 14 and 13 hours, during which the whales performed 35, 39, 17 and 11 dives, respectively. The diving depth ranged between 50 and 1860 m, where the same whale was foraging at depths as disparate as 100 and 1800 m. The acoustic repertoire was made of usual clicks, buzzes and slow clicks and the former two were consistent with hypotheses of use in echolocation of prey. In 30% of the dives, usual clicks were produced during ascent all the way up to the surface, whereas sperm whales are normally reported to stop clicking early during the ascent phase. Buzzes, which are considered indicators of the foraging phase in a dive, were emitted in both shallow and deep dives, during the bottom phase as well as the descent and ascent phases of the dives. The shallowest buzz was emitted at 20 m depth. The number of buzzes per dive (range 1-41) was higher during deep dives. It is concluded that male sperm whales in this habitat exploit a greater depth range than females and juveniles foraging at lower latitudes and employ a more dynamic foraging behavior.

Day: Wednesday 5 April ; Time: 9:30; Eligible for Student Award: Postgraduate

TRANSFER OF FATTY ACIDS FROM MOTHER TO PUP IN GREY SEALS *HALICHOERUS GRYPUS*

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Blubber fatty acids profiles (FAPs) are related to those found in the dietary prey but are not identical because individual fatty acids are subjected to differential metabolism, deposition, utilization etc. An understanding of these differences is important in the application of FAPs for quantitative dietary studies. One way to do this is to follow the transfer of fatty acids via milk from grey seal mothers to pups. After giving birth the mothers do not feed for about 3 weeks. Blubber triacylglycerols TAG are broken down and transported in the blood as free fatty acids FFA for conversion into milk or energy. The pups ingest the milk and the fatty acids are carried in the blood as TAG and stored as such in the blubber. Blubber, milk and blood samples were collected at early and late lactation from 25 mother/pup pairs. Blubber and milk lipids are predominantly TAG, but blood lipids were separated into TAG, FFA, sterolester and phospholipid fractions. The fatty acid profiles of all fractions were compared using multivariate statistical techniques.

Results indicated preferential release and retention of some fatty acids by blubber during lactation. The FAPs of the blood phospholipids and sterolesters were very different from the other fractions. Although not totally identical mother and pup blubber FAP were very similar and were more like milk FAP than to any of the blood fractions. Thus this similarity occurred despite differences seen in the milk and blood lipid

fractions. Thus it was not due to the mother's profile being simply released and transported as an entity in the blood and milk to the pup. The exact mechanisms involved are unclear, at present, but would appear to involve the uptake and release mechanisms acting at the blood/blubber interface.

Day: Wednesday 5 April ; Time: 9:50; Eligible for Student Award: No

DIFFERENCES IN TIMING OF SEXUAL MATURITY IN DANISH AND GREENLANDIC HARBOUR PORPOISES (*PHOCOENA PHOCOENA*): VARYING LEVELS OF PAEDOMORPHOSIS?

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Several characters of the skeletal morphology of the phocoenoids have been diagnosed as paedomorphic relative to their delphinid relatives. Phocoenids differ from delphinids in terms of life history: They have earlier onset of sexual maturity, higher pregnancy rate and shorter life span. This suggests that phocoenid paedomorphosis is caused by progenesis (onset of sexual maturity at a juvenile state of development). In order to elucidate this, we tested whether differences in timing of sexual maturity in porpoises were linked with the level of paedomorphosis. Differences in the timing of epiphyseal ankylosis and allometric growth and proportions of linear measurements of skeletal parts were investigated on 225 porpoise from the inner Danish waters and 101 from West Greenland and compared with life history data. Epiphyses in the postcranial skeleton matured later in males than females, despite earlier termination of growth and onset of sexual maturity in males. In fully-grown specimens, females had proportionally shorter skulls, while the vertebrae were relatively longer than in males. Since these characters show negative and positive allometry respectively and allometric growth patterns did not differ between the sexes, we suggest that males cease growing at an earlier stage of development than females, retaining more paedomorphic proportions. Porpoises from West Greenland attain smaller asymptotic sizes than their Danish conspecifics and data suggest that they have an earlier onset of sexual maturity. Compared to the Danish sample fully-grown West Greenland porpoises retained even more paedomorphic skeletal characters than their Danish peers. On the basis of these results, we suggest that phocoenid paedomorphosis is the result of progenesis and that differences in size and onset of sexual maturity between sexes and populations is the result of varying levels of paedomorphosis. Varying paedomorphosis may allow phocoenoids some flexibility in the specifics of life history.

Day: Wednesday 5 April ; Time: 11:30; Eligible for Student Award: Postgraduate

POPULATION STRUCTURE AND PHYLOGENETIC PLACEMENT OF INDO-PACIFIC BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS*) OFF ZANZIBAR, TANZANIA

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We examined the phylogenetic placement of bottlenose dolphins from Zanzibar, east Africa and the potential population differentiation between animals found off the southern and northern coasts of Zanzibar using variation in mtDNA control region sequences. Samples from animals incidentally caught in fishing gear and skin biopsies collected during boat surveys were used and comparisons made with published mtDNA sequences from populations of *T. aduncus* from southeast Australia, *T. aduncus* and *T. truncatus* off China and a proposed new species of Tursiops off South Africa. The phylogenetic analyses separated the haplotypes into three groups where Zanzibar and South African haplotypes grouped together in a lineage separated from both *T. truncatus* and Chinese and Australian *T. aduncus* haplotypes suggesting that the dolphins found off Zanzibar should be classified as *T. aduncus*, alongside the South African animals. This is based on the assumption that the animals in the western Pacific are given a new species name. Further, analyses of genetic differentiation showed a significant separation between the bottlenose dolphin populations off northern and southern Zanzibar indicating a limited exchange of reproducing females over this relatively short distance (approx. 80 km). No differentiation was found between southern Zanzibar and South Africa suggesting a more recent common evolutionary history for these populations than for the northern and southern Zanzibar populations.

Day: Wednesday 5 April ; Time: 11:50; Eligible for Student Award: Postgraduate

THE ROLE OF CULTURAL INNOVATION IN THE EVOLUTIONARY RADIATION OF CETACEANS

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A fundamental goal of evolutionary biology is to understand processes driving speciation. A critical prerequisite for speciation is the development of reproductive isolation, allowing populations to evolve genetic, morphological, and/or ecological differences. In the best understood situation, allopatric speciation, geographic separation prevents gene flow and allows separated populations to diverge. In contrast, relatively

few plausible mechanisms have been proposed by which positive assortative mating could allow sympatric speciation. Since physical barriers to dispersal by large mobile species are more rare in the ocean than on land, the extensive evolutionary radiation of cetaceans demands explanation. Here, we advance the hypothesis that sympatric speciation in cetaceans is facilitated by culturally-transmitted behavioural innovations combined with social conformism. In support of the hypothesis, we present recent findings from our field work on killer whales in western Alaska which, combined with earlier findings from British Columbia and the eastern Gulf of Alaska, indicate that the number of sympatric and parapatric populations in the north eastern Pacific Ocean numbers at least eight. All but one of the populations are distributed within previously-described mammal-eating and fish-eating ecotypes, indicating that diversification is common to both. Fixed differences in mitochondrial DNA control region sequences and/or microsatellite allele frequency differences indicate that there is little if any gene flow between populations. We describe a recently-discovered group of killer whales in False Pass, Alaska that uses specialized behaviours for hunting and feeding on gray whale calves as an instance in which innovation appears to be driving population segregation. We argue that the tendency form behaviourally distinct, socially and reproductively isolated subgroups occurs in other odontocetes species as well as killer whales and is capable of restricting gene flow enough to allow sympatric speciation and, in the long term, evolutionary diversification.

Day: Wednesday 5 April ; Time: 12:10; Eligible for Student Award: No

ACOUSTIC RELEASE OF GAS BUBBLES TO PREVENT CETACEAN ENTANGLEMENT IN FISHING NETS

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Cetacean entanglement in fishing nets has become a global conservation issue. Although acoustic deterrents appeared to be a promising solution to reduce bycatch, their general use in European waters may not be a definitive answer to the problem. The large scale introduction of these acoustic sources may also worsen the noise load in certain areas already heavily exposed to artificial sounds. We studied the properties of underwater sound backscattered from air bubbles to model their acoustic response to incident sonar waves from *Tursiops truncatus and Phocoena phocoena* (two of the most common cetacean species involved in fishing interactions). Depending on bubble size, incident angles and wave lengths, we defined the reflection coefficients and target strengths of single bubbles and bubble clouds in a dense and homogeneous medium. Modelling showed that the incident narrow-beam acoustic energy was backscattered nearly omnidirectionally, sending

acoustic "flashes" back to the source. To experimentally test the model and the deterrent effect on cetaceans, we developed a depth sensitive passive device that releases a cloud of air bubbles when detecting cetacean sounds (piezo ceramic hydrophone with a hybrid integrated DSP allowing the processing of received sounds), through a micro-electrovalve able to generate different sizes of bubbles and control the release parameters. The device was presented under different scenarios (presence and absence of fish) to captive bottlenose dolphins that immediately showed escape behaviour after the bubble reflection. Real-time acoustic recording confirmed the results indicating the potential use of air bubbles to prevent cetacean bycatch in fishing nets.

Day: Wednesday 5 April ; Time: 14:30; Eligible for Student Award: No

A DYNAMIC HYDROPHONE ARRAY FOR STUDYING UNDERWATER VOCAL BEHAVIOUR

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The difficulty of attributing sounds to individual marine mammals inhibits our understanding of how these animals use sound in social interactions. We have developed and trialed a dynamic hydrophone array system to overcome this difficulty at sea. The system is a simple extension of current fixed arrays whereby hydrophones are placed onboard small remote-operated (radio controlled) vessels which are launched from a main research vessel. Simple VHF transmitters broadcast acoustic signals back to the research vessel where they are received by handheld radios and simultaneously recorded by a digital multi-track recorder. GPS pseudo-range and phase data are received onboard the ROVs by OEM GPS boards, logged to flash memory cards and downloaded after recovery. The system can be stored, deployed and recharged onboard a small 40' sailing vessel. Once deployed, the vessels can be piloted to establish and maintain favourable array geometry, provided focal animals are not moving too rapidly. GPS error is a concern for localisation accuracy, however polynomial smoothing of GPS positions over time improves relative receiver positioning. Calibration trials with sound sources of a known separation distance have demonstrated accuracy in acoustic localisation of up to 0.5 metres. We have deployed the system several times at sea in the Northwest Atlantic and successfully localised social signals from sperm whales, showing the potential for this system in understanding social vocalisations. We present prelimary results on directionality in apparent inter-pulse intervals from coda clicks. We also show how the integration of inter-pulse-interval data provides extra information in unravelling vocal exchanges. Finally, recordings of northern bottlenose whales using this system show that its utility is not limited to sperm whales. However, improvements are possible in some aspects of the system including ROV mobility, reliability of the acoustic system and the robustness of GPS data-logging.

Day: Wednesday 5 April ; Time: 14:50; Eligible for Student Award: No

A SIMPLE METHOD TO EXTRACT ANIMAL'S PATHS FROM NOISY DATA (DEMONSTRATED ON GREY SEALS)

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Electronic tags have been attached to large numbers of marine mammals and provided many insights into their behaviour over the last twenty years. However, there are practical and technological limitations to the amount and precision of the information they provide. There are particular problems with location, which is both obviously important and difficult to measure accurately. In the case of ARGOS, a widely used satellite based system, the nominal accuracy of individual estimates ranges from 150m to several kilometres in each direction, though a small proportion of results are clearly far worse. We demonstrate a simple , and reasonably quick, Bayesian approach to reducing error in locational data and estimating the remaining uncertainty. The underlying behavioural model is based on the results produced by a novel FASTLOC GPS tag attached to a free-living grey seal (*Halichoerus grypus*) at Abertay Sands in eastern Scotland . The model is fitted to ARGOS data from other novel hybrid ARGOS/FASTLOC GPS tags attached to similar individuals, and evaluated using the separate and parallel GPS data they produce. The results are consistent and indicate that the method removes the majority of the noise and produces plausible estimates of the remaining uncertainty. It is then applied to data from other seals and its limitations and potential for improving the understanding of the animals' movment, behaviour and usage of the marine environment are discussed along with the importance of this information in the management of such areas and populations.

Day: Wednesday 5 April ; Time: 15:10; Eligible for Student Award: No

WHO, WHERE, WHEN AND HOW – THE SPATIO-TEMPORAL DISTRIBUTION AND OCEANOGRAPHIC CORRELATIONS OF STRANDINGS IN A HOTSPOT REGION

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Cape Cod, located in the Gulf of Maine, US, has been named a stranding hotspot for several species, among them Atlantic white-sided dolphin (*L. acutus*) and Common dolphin (*D. delphis*), yet the reasons for their occurrence have remained under-scrutinised in scientific terms. We present the results of a spatio-temporal analysis of *D. delphis* and *L. acutus* strandings in Cape Cod between 1968–2003 and the

environmental parameters surrounding those occurring during 1998–2003. The entire study period saw 55 mass- and 316 single strandings, of which 46 and 227, respectively, took place within Eastern Cape Cod Bay, particularly in the local area Wellfleet. Mass-strandings peaked in winter for D. delphis and in spring for *L. acutus*, mainly during storms, known as 'Nor'easters', with wind speeds of >72 m/s, while single strandings were linked to south westerly winds. An analysis in the statistical program PRIMER showed single strandings in Cape Cod Bay to be different from events in other areas and that they were defined by their similarities in wind direction and speed, sea surface temperature, state of tide and the time of year when they occurred. Single strandings elsewhere were more random in the environmental variables affecting them. Seasonal stranding peaks appeared to be an expression both of the seasonal peak abundance of the two species in the study region and the intensified weather conditions during winter and spring, while Wellfleets' highly complex bathymetry in tandem with certain meteorological settings make it a sub-region stranding hotspot. Local weather patterns, ecological conditions attracting cetaceans to Cape Cod waters and the movements of large water masses with which *L. acutus* and *D. delphis* are associated, are influenced by the North Atlantic Oscillation, strongly suggesting links between stranding trends and large-scale environmental variability in the Gulf of Maine.

Day: Wednesday 5 April ; Time: 16:10; Eligible for Student Award: No

DEVELOPMENT OF THE ZFX / ZFY 5'-EXONUCLEASE ASSAY, A NEW TOOL FOR SEX DETERMINATION IN CETACEANS AND ITS APPLICATION TO SPERM WHALES IN THE GULF OF CALIFORNIA

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Sex determination in cetaceans is essential for population studies, but is very difficult in the field because most species lack sexual dimorphism and have internal genitalia. Previous sexing methods have been limited to a subset of species and require sampling of high quality DNA. We developed a 5□exonuclease fluorescent assay based on ZFX/ZFY gene orthologs. This method produces a small 105-bp PCR product. Using primers and sex-specific fluorescent probes designed from conserved regions of seven families, a rapid, highly sensitive, and unambiguous sex determination assay is available. We demonstrated sex specificity for 33 cetacean species in nine families.

We found the ZFX/ZFY 5□-exonuclease assay method highly successful for sloughed skin of 66 samples of sperm whales from the Gulf of California taken during the field seasons of 1996-2004. This is important because sloughed skin usually bears low quality or low concentration of DNA. Of the 66 sperm whale samples, 16 had information form the dorsal fin callus. Ten animals bear the callus, of which nine were females of different age classes and one was a juvenile male. Three males and three females did not bear the callus. The high resolution of the ZFX/ZFY 5□-exonuclease assay in sloughed skin from sperm whales allows us to continue using a none invasive method for sampling tissue of free-living sperm whales in this region and enlarge our sample number of gendered samples with callus information. This will help to clarify whether the dorsal fin callus could be a sexual character useful for distinguishing male from female sperm whales at sea.

Day: Wednesday 5 April ; Time: 16:30; Eligible for Student Award: Postgraduate

PCR METHOD FOR IDENTIFICATION OF NEMATODES FROM SUPERFAMILY ASCARIDOIDEA

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Nematodes belonging to the Ascaridoidea superfamily are worldwide-distributed parasites. The life cycle include many species of invertebrates and teleostean fish as intermediate or paratenic host and marine mammals or fish – eating birds as definitive hosts. Their sources of infection are several fish species. Traditional classification of Ascaridoidea species bases on various morphological and anatomical criteria. Recently, molecular techniques have been introduced as a tool for nematode systematic, and PCR quickly became the standard technique. The choice of this ribosomal DNA as a target sequence for identification of species was motivated by the presence of the conserved region (the gene coding 5.8S RNA) and the variable flanking fragments (internal transcribed sequences ITS-1 and ITS-2). Analysis of sequences of both fragments would permit the analysis including also sibling species form *Anisakis simplex* complex and *Contracaecum osculatum* complex. In this work, we present the analysis of ribosomal DNA (ITS 1-5.8S-ITS2) of the representatives of Anisakidae (*Anisakis sp.* and *Contracaecum sp*.) collected from 13 porpoises (*Phocoena phocoena, L*.) and 1 grey seal (*Halioherchus grypus, L.)* bycaught in the Southern Baltic. Fourteen ascaridoid species was detected with the method of PCR-RFLP. Two species from the sister complex Anisakis – parasites of porpoises, dolphins and whales and different morphologically *Anisakis physeteris* (parasite of *Physeter catodon*). Also were investigated *Contracaecum osculatum C, C. radiatum, C. rudolphii* (the parasites of pinnipeds and fish eating birds), *Pseudoterranova decipiens* (seal parasite) and from family Rapidascarididae *Rapidascaris acus*, *Hysterothylacium bidentatum* and

H. aduncum (fish parasite). Super family Ascaridoidea is *represented Porrocaecum ensicaudatum*, *P. angusticolle*, *P. depressum* and *P. crassum*. For digestion were used endonuklease Taq I, Alu I, Bsu RI and Rsa I. This method is good for identification of nematods independent of the larval stage and geographical region.

Day: Wednesday 5 April ; Time: 16:50; Eligible for Student Award: No

THURSDAY 6TH APRIL

TAKING STOCK OF EUROPEAN CETACEANS: THE SCANS-II SURVEYS

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In EU Atlantic waters, the harbour porpoise and common dolphin suffer bycatch mainly in bottom set gillnets and pelagic trawls, respectively. The Habitats Directive specifies that Member States should employ conservation measures to ensure that bycatch does not have a serious negative impact on cetacean populations. Information on abundance is fundamental to an assessment of population status and to inform conservation actions. In 1994, the SCANS survey provided the first robust estimates of abundance for small cetaceans in the North Sea and adjacent waters. In July 2005, the SCANS-II surveys were carried out to generate new estimates of cetacean abundance for the whole European Atlantic continental shelf. Seven ships and three aircraft surveyed the area. Double platform line transect surveys were carried out by all ships to allow analyses to account for the probability of detection on the transect line to be less than one and for responsive movement of animals to the ship. Shipboard transects covered 19 000 km in an area of 1 011 000 km2. The “racetrack” method used for aerial surveying also allows analyses to take account of animals missed on the transect line. Aircraft flew 15 220 km on effort in an area of 353 000 km2. Over 1 900 encounters with thirteen cetacean species were recorded. The harbour porpoise was most commonly encountered and was widely distributed but there were few sightings south of 47ºN. Many more sightings were recorded in the southern North Sea than on the SCANS survey suggesting changes in distribution have occurred in this area. Common dolphin sightings were restricted to the west of the UK, Ireland, France and the Iberian Peninsula, where densities were highest. Abundance estimates will be calculated from these data and incorporated into the management framework being developed to allow safe bycatch limits to be recommended.

Day: Thursday 6 April ; Time: 9:00; Eligible for Student Award: No

VALIDATING THE USE OF SPATIAL MODELS TO ESTIMATE CETACEAN ABUNDANCE

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Spatial modelling is increasingly being used as an alternative to conventional line transect methods to estimate cetacean abundance. This new method can have several advantages including: the ability to use data collected from "platforms of opportunity" that are cheaper but do not give equal coverage of the surveyed area; the ability to estimate abundance for any defined area within the study area; and the possibility for increased precision if covariates explain sufficient variability in the data. One study has been conducted to compare these model-based methods with conventional design-based methods, but the use of covariates in detection function estimation and stratification by school size have not previously been investigated. In this study, the density of striped dolphins was estimated in Western Mediterranean waters using distance sampling models and spatially applied Generalized Additive Models (GAMs). This estimate was compared with density previously estimated in the same area using conventional line transect methods. The densities estimated were almost the same: 0.494 animals.km-2 (CV= 0.16) using spatial models and 0.489 animals.km-2 (CV= 0.19) using conventional line transect methods. Densities were also similar when they were calculated in stratified areas defined during the original line transect study. The precision of the estimates from spatial modelling was higher than that of the estimates obtained from conventional line transect analysis, particularly in the smaller areas. The results confirm that spatial modeling is a good approach for estimating cetacean abundance, although there are some factors that must to be borne in mind when this method is used.

Day: Thursday 6 April ; Time: 9:20; Eligible for Student Award: Postgraduate

COUNTING THE INVISIBLE. A COMPARISON BETWEEN ESTIMATES OF THE SIZE OF THE BALTIC GREY SEAL POPULATION DERIVED FROM TRADITIONAL COUNTS DURING MOULT AND PHOTO-IDENTIFICATION USING MARK RECAPTURE TECHNIQUE

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Counts of grey seals during moult have been the basis for population monitoring in the Baltic since the mid 1970s. In recent years combined counts over the distribution range in the Baltic have been performed. Moult counts is a useful tool for monitoring

population trends, but counted numbers just represent an index of population size, since the fraction of the population hauling out at any time is not known. It is therefore important to try to assess the proportion of the population at sea. A study of photo identification of individual seals was used to estimate the size of the summer population of grey seals in the Baltic Sea in year 2000 using mark-recapture. The point estimate was 15,631, with 95% confidence limits from 9,592 to 19,005. In 2000 the number of seals counted during moult was 9,700 representing 62% of the point estimate. Counted numbers varies between years, probably mainly due to differences in weather conditions during the census period that affect the probability for seals hauling out. We used the point estimate from the photo-identification study, increased with 7.49% per year (the mean annual growth rate estimated from the Swedish study), to compare with the results from the combined counts between 2000-2004 (table 1). The data suggests that an average 72% (SE 4.9) of the population is counted during moult census. The proportion varies widely between years (table 1), but moult counts at least give a rough lower estimate of population size.

Day: Thursday 6 April ; Time: 9:40; Eligible for Student Award: No

ABUNDANCE AND DISTRIBUTION OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN THE CENTRAL GERMAN BIGHT DURING 2002-2004

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The harbour porpoise (*Phocoena phocoena*) is widely distributed within the North Sea. Areas of highest population densities appear to be in the north- western North Sea and along the German and Danish west coast. During the first SCANS survey, in summer 1994, porpoises were also commonly encountered in offshore waters, for example in the central North Sea. However, precise information on year-round abundance and distribution of harbour porpoises in the central North-Sea is sparse. Between 2002 and 2004, we undertook 12 aerial line-transect surveys in a 2.500 km2 area in the central German Bight, 100 km north of the Island of Borkum (Eastern-Frisia). We also monitored porpoise activity with automated-porpoise-detectors (T-PODs) temporarily deployed from an anchorage in the study area. Data were analysed with distance-sampling and T-POD-software. A total of 303 harbour porpoises were sighted from the plane. Sighting rates peaked in July 2002, February, May and July 2003, and in January 2004. Absolute densities (g(0) corrected) ranged between < 0.4 and 1.22 animals / km2 (peak = February 2003). Calving rates varied between 3.2 and 9.6 %. The sightings were evenly distributed within the study area. The data from the T-PODs gave similar

results, however, porpoise-positive-minutes were highest during April 2003. Our results show a rather irregular appearance of harbour porpoises in one part the central German Bight. They also indicate that the area is used as a transitory route with harbour porpoise moving in from regions of high density in summer (Northern-Frisia) and early spring (Eastern-Frisia).

Day: Thursday 6 April ; Time: 11:20; Eligible for Student Award: No

HARBOUR PORPOISES IN THE NORTH SEA: PEAK STRANDING NUMBERS IN THE SOUTH IN YEARS OF FOOD SHORTAGE IN THE NORTH – EVIDENCE OF OCCASIONAL MASS MIGRATION?

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In spite of high scientific and public interest, little is yet known about harbour porpoise (*Phocoena phocoena*) population dynamics and migration patterns in the North Sea. As census data are still scarce, systematic stranding records remain a valuable source of information. Data collected in 1991–2004 in the northeastern German Bight were analysed for possible evidence of population change. The number of recorded dead strandings per year varied between 62 and 164, with no significant trend over time ($P = 0.49$). Year-to-year changes were generally moderate, remaining between –31% and +45% in 11 out of 13 cases. In 1998 and 2004, however, numbers increased by 132% and 125%, respectively. On a monthly basis, stranding numbers in both these years did not vary erratically, as may be expected if peaks were driven by weather or unusual mortalities through e.g. by-catch, infectious disease or sonar activity. Instead, numbers remained consistently above seasonal normal levels for 5 months (Apr–Aug) in 1998 and for 8 months (May–Dec) in 2004. Literature recherche revealed that in both these years there was a collapse of sandeel (*Ammodytes spec.)* stocks northeast of Scotland. Reported consequences included severe food shortage for seabirds, gadoid fishes, and larger cetaceans in Scotland, as well as unusual whiting (*Merlangius merlangus*) mass occurrence in the German Bight. Both sandeel and whiting are major prey species of harbour porpoise in Scotland. We suggest that the peak stranding numbers of porpoises at the German coast in 1998 and 2004 reflected temporarily increased population density due to immigration. Porpoises invading from Northeast Scotland may have been motivated by lack of one key prey and southward movement of another. Our results further suggest that systematic stranding records may be more useful in monitoring population changes of cetaceans than commonly thought.

Day: Thursday 6 April ; Time: 11:40; Eligible for Student Award: No

POPULATION ESTIMATION AND SURVIVAL RATE OF LONG-FINNED PILOT WHALES (*GLOBICEPHALA MELAS*) IN THE STRAIT OF GIBRALTAR AND INTERACTIONS WITH THE MARITIME TRAFFIC

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The distribution of long-finned pilot whales in the Strait of Gibraltar is analysed using GAMs (7521km sailed and 113 sightings) and the results shows that they are situated on the routes of 91009 cargos and ferries that crosses the Strait every year. They are then exposed to risks of collisions and probably also acoustic and physical disturbances. They are also the main target of the whale watching companies (13 boats). The aim of this study is to estimate the population and survival rate of long-finned pilot whales using photo-identification. Closed population models were applied using the program CAPTURE to estimate the population and the Cormack-Jolly-Seber model was used to estimate survival rate with the program MARK. A total of 8111 pictures representing 15 178 individual pilot whales were analysed. Between 1999 and 2005, 210 marked pilot whales have been identified in the catalogue. Corrected population estimations during summer for 1999 is 270 (95% CI:216-376), 2000 is 249 (95% CI:218-307), 2001 was not included for lack of data, 2002 is 259 (95% CI:202-380), 2003 is 270 (95% CI:206-415), 2004 is 267 (95% CI:238-330) and 2005 is 263 (95% CI:231-319). The survival rate of adults between 1999 and 2005 is estimated at 0.979 (95% CI:0.941-0.993) which is a life span of around 48 years. The same individuals have been observed all year round and from year to year which strongly suggests that there is a resident population of long-finned pilot whales in the Strait of Gibraltar. So far, the adult population does not seem to suffer great mortality. However, it is important to follow the population in the long term as a new important harbour is in construction on the Moroccan coast which will increase the passage of ferries and fast-ferries on the distribution area of the long-finned pilot whales.

Day: Thursday 6 April ; Time: 12:00; Eligible for Student Award: Postgraduate

TRENDS IN CAUSES OF MORTALITY IN HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) STRANDED IN UK WATERS (1990–2004)

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The most common UK-stranded cetacean species in 1990-2004 was the harbour porpoise (*Phocoena phocoena*) (n= 3005). No harbour porpoise mass mortality events were recorded during this period. The most common causes of mortality in 1310 necropsied UK-stranded harbour porpoises during this period were attack from bottlenose dolphins (*Tursiops truncatus*) (n=238), by-catch (n=225), pneumonias due to combinations of parasitic, bacterial and fungal infections (n=179), starvation (n=146), physical trauma (unknown origin) (n=55) and generalised bacterial infection (n=54). All porpoises fatally attacked by bottlenose dolphins stranded in northeast Scotland, west Wales or southwest England where porpoises share sympatric distributions with bottlenose dolphins. In Scotland, the spatial distribution of Tursiops-killed harbour porpoises occurred with increasing frequency outside the Moray Firth area consistent with a change in distribution of the Moray Firth bottlenose dolphin population. The number and proportion of stranded harbour porpoises killed by bottlenose dolphins has increased annually in West Wales between 1999 and 2004. The primary cause(s) of these violent inter-specific interactions remain inconclusive. The increasing number of harbour porpoise by-catches stranded in southwest England (Cornwall, Devon and Dorset) between December and April in recent years may reflect a genuine increase in (predominantly by-catch-related) mortality, although other factors such as changes in abundance and distribution of harbour porpoises and improved reporting of stranded carcasses in southwest England may also play a considerable role. Analyses of age and body-length data suggest that harbour porpoises stranding in southwest England (presumably from the Celtic Sea stock) are morphometrically distinct from porpoises in other UK regions. Cases of infectious disease mortality occurred more frequently in winter than summer months and have been linked to exposure to elevated blubber levels of polychlorinated biphenyls. Only 10 cases of fatal malignant tumours were recorded during this period consistent with low tissue levels of carcinogenic pollutants such as radionuclides and polycyclic aromatic hydrocarbons.

Day: Thursday 6 April ; Time: 13:50; Eligible for Student Award: No

ASSESSMENT OF HEALTH STATUS OF HARBOUR SEALS (*PHOCA VITULINA*) FROM GERMAN WATERS AROUND TWO PHOCINE DISTEMPER VIRUS MASS MORTALITIES

Siebert, U. (1), Wohlsein, P. (2), Fonfara, S. (3), Lehnert, K. (1), Müller, G. (2), Hasselmeier, I. (1) and Baumgärtner, W. (2)

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The population of harbour seals (*Phoca vitulina*) in the Wadden Sea was decreasing until the mid of the seventies. The banning of hunting and the installation of national parks in German waters allowed the recovery of the population size. But in 1988/89 and 2002 two Phocine Distemper Virus Mass Mortalities killed 40-65% of the population. Because pathological investigations outside the seal die-offs were rare in Schleswig-Holstein a health monitoring was established to gain more insight into the development of the health status of harbour seals. Here we present findings from investigations between1996 to 2004. A post mortem examination was performed according to the ECS guidelines modified for seals. The carcasses were weighed and measured, and a caninus from the upper jaw was removed for age determination by counting the annual growth layers. Histology, microbiology, parasitology and immunohistochemistry were performed. With regard to all findings the cause of death was determined. The respiratory tract was the organ system with the majority of pathological findings. Parasitic bronchopneumonia was most often diagnosed in animals younger than one year. Other findings were parasites in the alimentary system, displacement or invagination of the intestine, hepatitis, hepatocellular lipidosis, wounds/scars, dermatitis/panniculitis/cellulitis, polyarthritis and lymphadenitis. The cause of death or principal morphological changes for euthanatised animals were bronchopneumonia, emaciation and septicemia caused by hemolytic streptococci and *Escherichia coli*, in rare cases *Erysipelothrix rhusiopathiae* and *Brucella maris*. Phocine Distemper Virus (PDV) as cause of death was only found in 2002 during the seal epizootic. Overall, the frequencies of different diagnoses clearly differed between years as well in spontaneously died as in euthanatised seals. Compared to the pathological findings described before the first seal die-off the health status of the seal population has improved probably due to an improved management in the National parks of the German waters.

Day: Thursday 6 April ; Time: 14:10; Eligible for Student Award: No

EPIDEMIOLOGIC AND PATHOLOGIC FINDINGS OF KILLER WHALES (*ORCINUS ORCA*) STRANDED 1944–2003

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Within the northeastern Pacific Ocean, between 1996 and 2001, there was a significant decline in the population of southern resident killer whales (*Orcinus orca*) from 97 to 78. In order to put these mortalities in perspective, we solicited information globally from multiple electronic mailings lists including MARMAM, AAVLD, Marine Pathology, Australian Wildlife Health Network, as well as case records from the Armed Forces Institute of Pathology, Washington, DC and other diagnostic facilities. In response to these requests, over 60 individuals provided information and we compiled data from 198 killer whales that stranded and died between 1944 and 2003. Most (93%) strandings were reported from the last 3 decades and the majority of cases reported were from Brazil, Canada (British Columbia), Japan, Russia, United States (Washington and Alaska), and Western Europe. Complete necropsies were performed on 3% (6/198) of reported killer whale strandings and intermediate (select tissue sampling) examinations were conducted on 13% (26/198) of beach cast animals. A total of 309 tissues from 48 killer whales were evaluated. Histopathology of 309 tissues revealed abnormalities in 226 (73.1%) samples from 46 animals. Diagnostic interpretations were evaluated and diagnoses assigned according to relative significance: 70 (31%) diagnoses considered the proximate cause of death, 8 (3.5%) as secondary or contributory disease processes, and 17 (7.5%) as incidental findings. Primary disease processes included infectious and parasitic n=70 (33.6%), traumatic n=10 (4.4%), endocrine, metabolic and nutritional disorders n=7 (3.1%), neoplastic n=6 (2.7%), and was undetermined in 127 (56.2%) of the cases. Most commonly affected tissues included lung (50% of animals with abnormal tissues), lymph node (37%), liver (38%), skin/blubber (30%), and heart (26%). Each dead animal affords a valuable opportunity to further resolve the natural history and monitor for emergent and enzootic disease concerns which may impact this species.

Day: Thursday 6 April ; Time: 14:30; Eligible for Student Award: No

PATHOGENIC ROLE OF THE HOOKWORM *UNCINARIA SPP* IN NEW ZEALAND SEA LION (*PHOCARCTOS HOOKERI*) PUPS: EFFECT ON GROWTH AND BLOOD PARAMETERS

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The New Zealand sea lion (*Phocarctos hookeri*) is an endangered species restricted to a limited breeding area concentrated on the Auckland Islands, New Zealand. A mortality survey at Sandy Bay breeding colony (Enderby Island) from 1999 to 2005 found that hookworm was the primary cause of death for 13% of pups but a survey of live pups for fecal eggs suggests that the prevalence of infection is much higher. In dead pups heavy hookworm burdens (> 2,000 per individual) were often associated with intestinal petechiae or with severe diffuse haemorrhagic enteritis. Pups with lower burdens may not die from infection but may suffer sub-lethal effects such as growth retardation and/or hematological changes. An experiment was conducted to test this hypothesis using the negative controls created by treating pups (n = 24) with the anthelminthic ivermectin and were matched with untreated pups of the same sex and age. Blood samples were regularly taken from 1 to 58 days-old. The main hematological parameters were measured: microhematocrit, total white blood cells (WBC) count, leucocytes formula and platelets counts. The growth rate was estimated with the daily weight gain for every pup. Microhematocrit in the control group was 35.0±1.3% with no significant difference compared to the non-treated group (36.0±1.5%) but the parameter was strongly negatively correlated with the pups' age in all pups (n=44, r=-0.754, p<0.001). There was no significant effect of treatment, sex or age on the WBC and platelets counts. Hookworm infection did not significantly affect pups' growth with regard to the daily weight gain to two months-old (n=258, p=0.111). This it would appear that low to moderate hookworm burdens are generally well tolerated by sea lion pups.

Day: Thursday 6 April ; Time: 15:30; Eligible for Student Award: Postgraduate

TRACE ELEMENTS, PCBS AND ORGANOCHLORINE PESTICIDES IN TISSUES OF COMMON DOLPHINS (*DELPHINUS SP*.) STRANDED IN THE HAURAKI GULF, NEW ZEALAND

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Apex marine predators such as cetaceans are particularly susceptible to persistent pollutants that may bio-accumulate thorough the food chain. Despite this, few studies have examined contaminant levels in New Zealand marine mammals. Here we report trace elements, polychlorinated biphenyls (PCBs) and organochlorine (OC) pesticide levels as determined in tissues collected from common dolphins (*Delphinus sp*.) that stranded in the Hauraki Gulf, New Zealand. The concentration of Hg, Sn, Cr, Zn, Ni, Cd, Co, Mn, Fe, Cu, Ti, Pb, As and Ag was determined in liver, kidney, muscle and blubber tissue. PCBs (46 congeners) and a range of organochlorine pesticides concentrations including HCH, HCB, aldrin, dieldrin and DDE (plus derivatives) were determined from blubber tissue. Cr and Ni were not detected in any samples and concentrations of Co, Sn and Pb were generally low. Liver concentrations of Cu and Zn were within the normal ranges of homeostatic control (3-30 and 20-100 mg/kg wet weight, respectively). Concentrations of Hg ranged from 0.17 to 110 mg/kg wet weight, with the lowest concentrations in blubber and the highest in liver. The Hg:Se molar ratio varied from 0.02 to 1.11 reflecting the detoxification of MeHg. Of the organochlorines determined, HCB, dieldrin o,p'-DDT and p,p'-DDE were present at the highest concentrations in blubber. □DDT concentrations ranged from 17 to 654 µg/kg wet weight, and ICES7CBs from 29 to 289 µg/kg wet weight. Comparably, levels of organochlorines found in New Zealand common dolphins were more than an order of magnitude lower than those reported from European seas.

Day: Thursday 6 April ; Time: 15:50; Eligible for Student Award: Postgraduate

MONITORING HEALTH AND STRESS INDICES IN HECTOR'S DOLPHINS CAPTURED FOR SATELLITE TELEMETRY IN NEW ZEALAND

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Health and stress indices were measured in three Hector's dolphins *(Cephalorhynchus hectori hectori*) caught and released following attachment of lightweight satellite transmitters in New Zealand. The animals were an adult female and a juvenile of each sex. The trial was intended to evaluate the efficacy and safety of satellite tagging for potential application to the critically endangered Maui's dolphin *(Cephalorhynchus hectori maui*). The trial also provided the first baseline health data for this species to assess the physiological or behavioural effects of capture and handling on these animals. Body condition was assessed by standard measurements and ultrasound of blubber depth. Blood was collected for hematology, serum chemistry, serology (morbillivirus, calicivirus, influenza A, leptospirosis, and brucellosis), and endocrinology (cortisol, oestrogen, testosterone and progesterone). Expired breath and body orifice swabs were cultured for bacterial and fungal pathogens and viral culture was conducted on blood leukocytes. Heart rate and respiration rate were monitored and recorded throughout handling. No significant bacterial, viral, or fungal pathogens were isolated but one adult female was sero-positive for Brucella. Eosinophils were elevated in all dolphins suggesting endoparasitism. Cortisol levels were low (0.26 to 0.59 ug/dl) and similar to those of captive bottlenose dolphins. Breathing and heart rates remained constant throughout the handling period that ranged from 25 mins. to 29 mins. Progesterone was elevated in the adult female (30 ng/ml) suggesting early pregnancy. All dolphins were in good body condition and exhibited normal behaviour before and after release. The results indicate that capture and handling of Hectors dolphins can be conducted safely and with minimal stress on the dolphins for procedures such as satellite transmitter deployment.

Day: Thursday 6 April ; Time: 16:10; Eligible for Student Award: No

ABSTRACTS OF POSTERS

ABSTRACTS OF POSTERS

ACOUSTICS

A1 THE WHISTLE REPERTOIRE OF SHORT-BEAKED COMMON DOLPHINS, *DELPHINUS DELPHIS*, AROUND THE BRITISH ISLES

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Student award: Undergraduate

Most delphinids produce whistles, narrowband tonal calls, which are generally thought to have a communicative function. This study describes the whistle repertoire of short-beaked common dolphins (*Delphinus delphis*) around the British Isles. Surveys were undertaken in the Celtic Sea between May and August, 2005 during which 57.5 hours of recordings were made. From those, 1,835 common dolphin whistles were marked and analysed using computer software. A set of parameters (duration, number of inflection points and steps and various frequency variables) were measured and whistles were classified into six broad types and thirty sub-types. Upsweeps were the most common type and whistles covered frequencies between 3.56 and 23.51 kHz with durations ranging from 0.05 to 2.02 seconds. Whistle characteristics varied significantly depending on behavioural context, group size and recording session. This indicates a certain level of variation between different pods and/or contexts. A random sub-sample of these Celtic Sea whistles was then compared to whistles of short-beaked common dolphins recorded in the English Channel during a WDCS/Greenpeace survey between January and March 2004. This comparison showed that most whistle parameters were significantly different between the two locations; in particular, almost all means of frequency variables were significantly higher in the English Channel whistles. This implies inter-population variation and supports the hypothesis that common dolphins in these two locations may be distinct populations. In the English Channel, dolphins are exposed to high levels of ship traffic, causing low-frequency background noise. They may have adapted to this environment by shifting the frequencies of their calls up to avoid masking by ambient noise. If the common dolphins in the English Channel are in fact a separate population, this has important implications for management policies, particularly as common dolphins in this area experience high levels of mortality from incidental by-catch in fishing gear.

A2 AN ON-GOING INVESTIGATION OF ACOUSTIC BEHAVIOUR OF THE RISSO'S DOLPHIN (*GRAMPUS GRISEUS*)

Azzali, M. (1), Ascoli, L. (1), Catacchio, S. (1), Giacoma, C. (2) and Azzolin, M. (2)

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Very little is known about acoustic behaviour of Risso's dolphin. The present work reports preliminary results of a comparison among the acoustic signals emitted by a young Risso's dolphin, that had to face some traumatic events, and the acoustic signals of Risso's dolphins taken in their natural habitat. The subject of this study is a young dolphin female, rescued together with her mother in the harbour of Ancona (June 2005). After few days she lost her mother, remained in isolation from any cetacean acoustic signal for a period of two months, then was housed in a pool at the "Oltremare" Delphinarium, physically but not acoustically separated from a community of Bottlenose Dolphins. The acoustic development of the dolphin has been studied in monthly sessions, while the dolphin was freely swimming. The hydrophone selected for this study (range 0-150 kHz) was located 2 m depth inside a fiber-glass sphere, similar in shape and dimension to balls used by dolphins for playing. The comparison between those signals and the ones taken from Risso's dolphins in their natural habitat would allow us to make some considerations on the effects of learning, isolation and contamination from other species for the acoustic development of a young cetacean.

A3 NEW TYPES OF SIGNALS OF BELUGA WHALES (*DELPHINAPTERUS LEUCAS*) IN SUMMER ASSEMBLAGE OFF SOLOVETSKY ISLAND (THE WHITE SEA, RUSSIA)

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Beluga whale (*Delphinapterus leucas*) has a various acoustic repertoire. A summer assemblage of beluga whales off Solovetsky Island has been monitored since 1995. In this study we analyzed recordings made from 1999 to 2005. We described the new types of signals recorded during summer 2004 and 2005. Physical measures as well as spectrograms for vocalizations were given. Recordings were made using stationary hydrophones and recorders of different types. Analysis of all recordings (synchronous listening and visual inspection of spectrograms using Cool Edit Pro software) revealed that beluga vocal repertoire was relatively stable from 1999 to 2003. However, three new types of signals were found in 2004. Belugas emitted these signals quite frequently. These types were high-frequency whistles (F0 > 5 kHz): 1) three-component whistles,

2) ascending frequency whistles and 3) flattened whistles. Ascending and flattened whistles had a segmentation of a contour. Belugas continued to emit signals of these new types next season. Besides, in 2005, we found five new types of signals. Three types were high-frequency (F0 > 5 kHz) whistles: 1) with ascending contour transforming into sequence of V-shaped elements, 2) ascending-direct-descending contour (max. F0 = 7 kHz), 3) sequence of V-shaped elements (min. F0 = 7 kHz). Two other types of whistles had: 1) flattened contour (F0 = 3 kHz) and amplitude modulation, and 2) ascending contour (max. F0 = 2.2 kHz). Ascending whistles had very special sounding resulted from an amplitude modulation along with a noisy component. One of the new types of signals was found just one time during the season (a train of signals of given type), meanwhile signals of the other types were regularly emitted during summer 2005. These results indicated possible between-year variation in the vocal repertoire of the beluga whales.

A3 RISK ASSESSMENT OF ATLAS HYDROGRAPHIC HYDROSWEEP DS-2 DEEP SEA MULTI-BEAM AND PARASOUND DS-2 SEDIMENT ECHOSOUNDERS

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The hull-mounted Atlas Hydrographic multibeam deep-sea echosounder Hydrosweep DS-2 and the parametric Parasound DS-2 sediment echosounder are operated from several research vessels to explore the sea floor bathymetry and upper sediment layer stratification. This study analyses potential risks of the echosounders' usage with special emphasis on cetaceans present in the Antarctic Treaty region. The study presents a comprehensive description of the technical parameters (sound pressure level, effective pulse length and beam pattern) and continues by analysing three possible impact scenarios: a) Risk of direct damage due to immediate effects of sound; b) Risk of direct damage due to behavioural response; c) Risk of indirect damage due to changes to the habitat. For cruising ships, the study concludes that the cumulative risk of type (a) (i.e. the risk of causing a temporary threshold shift, TTS) during simultaneous operation of Hydrosweep and Parasound is estimated to be less then 2 % of the risk of a collision between ship and whale. For ships on station (zero velocity), the non-zero risk of ensonifying a marine mammal at TTS levels obviously exceeds the risk of collision, as the latter becomes zero. In this situation, mitigation methods such as a general or presence dependent shut down of the instruments on station could serve to eliminate any remaining risks. For both, cruising ships and stationary ships, the risk of behaviourally induced damage (type b) appears unlikely for cetaceans in the Antarctic Treaty region. This is due to fundamental hydroacoustic differences between the scientific echosounders and the naval mid-frequency sonars associated with recent atypical stranding events elsewhere. Similarly, the risk of indirect type c damages appears

unlikely. However, while we consider these risks to be significantly less likely than the risk of type (a), a quantification of these latter risks is outside the scope of this study.

A5 TIME-FREQUENCY ANALYSIS OF DOLPHIN VOCALIZATIONS USING A NOVEL COMPUTATIONAL PACKAGE

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Dolphin acoustic communication strongly relies on whistles, particularly on their instantaneous frequencies, which are commonly referred to as contours. The time–frequency visualization of whistles using commercially available software allows their contours to be manually extracted, for instance by sampling some of their points or retrieving their basic characteristics. However, more complete and accurate contour extraction methods, which correctly identify contours amidst noise, clicks, etc., require access to the data plotted in the time–frequency image. Here, a computational package for the time–frequency analysis of dolphin vocalizations is presented that calculates the short-time Fourier transform spectrogram of the vocalizations, thereby making it available for whistle contour extraction algorithms to be merged with the package. The package tools have been entirely developed in MATLAB. This allows full control of the source code for future upgrades and customization, which is particularly important since the package will eventually be available as open-source software. To assess its effectiveness, the package is applied to data from a population of bottlenose dolphins, Tursiops truncatus, resident in the Sado estuary, Portugal.

A6 SIGNIFICANCE OF CONTEXT-RELATED CHANGES IN COMPOSITIONS AND PERFORMANCES OF GROUP-REPERTOIRES: EVIDENCE FROM THE VOCAL ACCOMPLISHMENTS OF *ORCINUS ORCA*

Cirillo, J., Renner, S. and Todt, D.

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Most studies of communication are guided by the 'sender-receiver model' which requires an access to data documenting how particular individuals contribute to a given interaction process. In marine mammals, however, such data are usually difficult to assess, and this problem remains significant even in studies designed to investigate issues of vocal signalling. Our paper describes an approach which allows to expediently

deal with these difficulties. Instead of addressing particular individuals only, it concentrates on the behavioural accomplishments of a whole community of individuals. The framework of our approach is given by an hypothesis predicting that such community can be regarded as a kind of super-system characterized by its specific 'system properties'. Inasmuch as marine mammal vocalisations are concerned, an example of such properties seems to occur in killer whales (*Orcinus orca*), where different clans develop separate dialects. Our approach deals with killer whale vocalisations as well, but has concentrated on other issues, namely the acoustical composition of group-repertoires and also context-related changes of repertoire performance. Thereby, we want to characterize communities by relevant integrated accomplishments, such as properties of their group life or their states of well-being. Study subjects were whales of SeaWorld San Antonio (n=7) and Orlando (n=9). Behavioural data were recorded by RESON-TC4013 hydrophones connected to AVISOFT UltraSoundGate 416 and a SONY vaio-notebook, and additionally by a Digital Handycam SONY DCR-VX1000E. Data analyses revealed clear relationships between the composition of a group's vocal repertoire and general context-related properties as well as special activities of particular group members. Some of these results serve now to identify signal parameters that reflect state-related variables of groups, or to clarify how specific individuals contributed to the group-repertoires. Taken together, our results suggest that the applied method makes an appropriate tool to elucidate the vocal communication of marine mammals.

A7 FIELD CALIBRATION OF T-PODS – A NECESSARY PRODECURE FOR COMPARATIVE STUDIES

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During the last few years automatic porpoise detectors (T-PODs, Chelonia, UK) have become a standard tool for monitoring harbour porpoises, especially in European waters. Although T-PODs are widely used to monitor porpoises, only little consensus on standardisation exist.A main problem in the data analyses are the differences in sensitivity between individual T-PODs. Therefore intercalibration of T-PODs is required before data from two or more T-PODs are used for comparisons. We present a field study, conducted in two areas with high densities of harbour porpoises, one in the North Sea and the other one in the Baltic Sea. 3–7 T-PODs were taped together and deployed two metres above the bottom of the sea floor for periods of 2–5 days. Four different parameters (porpoise positive minutes (PPM) per time unit, number of clicks per time unit, number of encounters, waiting time) were analysed using different train

classifications classes find by the algorithm of the T-POD software. Altogether 24 PODs collected 3.835 hours of data (160 days). For all parameters significant differences between the T-PODs occurred indicating differences in sensitivity. For PPM per time unit, it is possible to calculate correction factors based on the data recorded during the intercalibration process. These correction factors can be applied for the data of each T-POD and thus allow direct comparisons between individual T-PODs in different areas. One can also modify the train classification classes, however, this will also change the differences between the T-PODs These differences in click detection, dependent on the choices made with regard to parameters and train classification, are discussed.

A8 ACOUSTIC IDENTIFICATION OF THE DOLPHINS IN THE BAY OF CALVI

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There is an important up welling about 30km of the coast of Calvi, which leads to the abundance of plankton all year around but especially in the early spring. Around this time, dolphins usually arrive in the Bay of Calvi to stay there until early summer. In order to find out the abundance of the main species, bottlenose dolphins and striped dolphins, and the group structure we installed a fixed hydrophone in the bay, which allows a constant acoustic survey. The hydrophone is connected to a computer that is installed at the marine biological research center (STARESO) where a software controls the recordings. The system records when frequency and power levels of a sound are higher than the minimum level that we decided. The recording range is according to the background noise of the sea. This system is called E.A.R.S.: Environmental Acoustic Recording System. Each dolphin has a specific “signature whistle”, which is analysed in order to identify them individually and to establish their abundance. In an earlier similar project in the same Bay in 2001, 33 Signature whistles were collected with a portable hydrophone. We compared these data with the signatures collected with the fixed hydrophone in 2005 in order to find out if the same dolphins return to the Bay of Calvi. Preliminary results confirm that certain individuals return to the Bay of Calvi which shows a behaviour of habit, but we found a different group composition. In conclusion the survey done with the E.A.R.S. System will characterize and determine abundance on the long term.

A9 A CLASSIFICATION SPACE FOR BOTTLENOSE DOLPHINS' SOUNDS

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Student award: Postgraduate

The spectral analysis of sound is one of the most effective technology in the bioacoustics research field but despite the advent of cheap and powerful computers, the recording analysis is still a time consuming activity. The present study tries to deal with this problem by creating an automatic classifier that – given a stream of sounds – outputs their labels according to a predefined set of classes. Our approach is to isolate each sound in a stream, calculate its spectrogram and transform it into a binary black and white image; from the image we extract three numbers – named density?, disorder d and distribution s – which will locate a point in a 3-dimensional classification space. Each sound corresponds to a point in this space and similar sounds will locate close points in Euclidean sense; groups of points form a class. We used a stream of 166 sounds produced by three bottlenose dolphins (*Tursiops truncatus*) housed at the Genoa Aquarium in 1994. We divided them into 7 classes in order to separate the 3D classification space so that a well-defined group of points or region corresponds to each class; 100 other sounds were then used to test the classifier. Results show that modulated sounds can be recognized with good accuracy (84% on average) while impulsive sounds are more difficult to classify due to their spectral similarities (only 45% on average); it must be said though that impulsive sounds with particular spectrogram – like echolocation clicks – reach greater accuracy levels, in some cases up to 90% (Sob class). It is also important to note that the classifier distinguishes impulsive sounds from modulated sounds almost perfectly well (with 99% accuracy). Future works will aim at improving impulsive sound classification capabilities and make the classifier run in real-time.

A10 CAN KILLER WHALES CALL FOR HELP?

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Many species of dolphins use cooperative hunting on schooling fish. It is known that some dolphins (for example, dusky dolphins *Lagenorhynchus obscurus*) call for

conspecifics if the number of animals in a group is not large enough to herd the school of fish. For other members of the Delphinidae including the killer whale (*Orcinus orca*), such behaviour is anecdotal but not well documented although killer whales are known to be cooperative hunters. During our 2005 field season in Avacha Gulf, Kamchatka (Russian Far East) we noted that slowly travelling killer whales started to move very quickly, even porpoising, and then joined some other group which was foraging. On five occasions we made acoustic recordings of vocal exchanges between quickly travelling and foraging animals. We compared the number of different categories of acoustic signals per minute in these recordings with the number of different categories of acoustic signals per minute during the slow-travelling and foraging alone. The number of discrete calls per minute during fast travelling/foraging was significantly higher than during the slow-travelling and foraging alone. The number of whistles and variable calls per minute during fast travelling/foraging was fewer than during the slow-travelling and foraging. Since discrete calls are believed to be long-range communicative signals and whistles and variable calls are usually used during close-range activities, our results indicate that vocal exchanges during fast travelling/ foraging may be used for long-range communication. Together with behavioural observations these data could be explained in several ways. One suggested hypothesis is that foraging killer whales can be calling for other members of the group to join them. Another explanation is that traveling killer whales could announce their presence to foraging ones by calling.

A11 NEW COMPUTATIONAL METHOD FOR ACCURATE EXTRACTION OF DOLPHIN WHISTLE CONTOURS

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Bioacoustics research on the classification of dolphin whistles relies on the extraction of whistle contours from time–frequency representations of dolphin vocalizations, which are usually based on the spectrogram. Although whistle classification studies can be based on a few, manually extracted contour parameters, using the full contours should be preferred as it carries the complete whistle information. The most basic automatic contour extraction approach follows the highest instantaneous peak and often leads to erroneous results whenever the second harmonic, clicks or noise have higher amplitude than the contour. Improved extraction methods take into account the existence of maxima at the second harmonic, but are still best suited for data with a high signal-to-noise ratio. A more sophisticated method uses digital filtering to enhance the contour in the spectrogram, by removing clicks and broadband noise, and then tries to follow a smooth path through the spectrogram plot. Still, such prior filtering may lead

to whistle distortions. Here, a new method is presented that does not require modifications of the spectrogram, thus extracting the contour from the whistle in its original background. Using this new approach, whistles have been successfully extracted even in situations when the signal-to-noise ratio is relatively low and clicks are abundant. The method is implemented in a computational package that has been specifically developed for this purpose – see Cascão et al. in this conference. Results are shown of the application to data from a population of bottlenose dolphins, Tursiops truncatus, resident in the Sado estuary, Portugal.

A12 COMPARISON OF WHISTLE CHARACTERISTICS OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATES*) IN CARDIGAN BAY (WALES) AND SHANNON ESTUARY (IRELAND) POPULATIONS

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Student award: Postgraduate

Comparisons of whistle characteristics between geographically isolated populations of delphinid species have reviled variance between locations. The waters of Britain and Ireland are home to three known resident populations of bottlenose dolphins *Tursiops truncates*: Cardigan Bay (Wales), the Shannon Estuary (Ireland) and the Moray Firth (Scotland). This study compared the whistle repertoires and characteristics of two of these populations; Shannon Estuary and Cardigan Bay. Whistles were compared using a series of quantitative parameters and sorted into categories using contour shape. A total of 32 different whistle categories were described of which 21 were observed in both populations 8 were exclusive to the Shannon Estuary and 1 was exclusive to Cardigan Bay. The average duration of whistles from the Shannon Estuary population was found to be longer than whistles from Cardigan Bay. The average starting, ending, maximum, minimum, and mean frequency of whistles from Cardigan Bay was significantly higher than Shannon Estuary whistles. There was no statistical difference in the whistle rate between the populations. The differences observed in the whistles characteristics between the two populations could be representative of behavioural, environmental, or morphological differences between the Cardigan Bay and Shannon Estuary populations. 66% of the whistles described in this study were common to both populations. This similarity of whistle repertoire between the populations could be the result of a recent divergence time between the populations or possible transition of individuals between the locations. To further understand the whistle characteristics of bottlenose dolphins in Britain and Ireland, it would be necessary to include whistles from the Moray Firth population in Scotland.

A13 TRAINING HARBOUR PORPOISE (*PHOCOENA PHOCOENA*) FOR AN ABR STUDY

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A male harbour porpoise (*Phocoena phocoena*) was trained to participate in an auditory study conducted at the research centre of the Dolfinarium, Harderwijk, The Netherlands. The aim of the study was to assess the potential masking effect of operational sounds of offshore wind turbines on the perception of important signals by the animal, especially communication signals of harbour porpoises. An active participation of the animal was needed to use the collection of data through the measurement of Auditory Brainstem Responses. The animal had to be desensitized for the equipment placed into and above the pool, acoustic stimuli used to evoke the ABR`s and the masking noise, which resembled the underwater sound emission of an operational wind turbine. In the experiment two suction cups were placed on the skin of the animal. Attached to the suction cups was five metres of electric wire. The animal was trained to swim with the suction cups and electric wire to the measuring position, a station three metres from the side of the pool at a depth of 0,75 metre. Here the animal had to remain stationary while measurements were done. After the initial training emphasis was laid on increasing the time per session the animal remained at the station thus increasing the efficiency of data collection per experimental session. In this presentation we present the training process and future opportunities for harbour porpoise research at the Dolfinarium.

A14 ASSESSMENT OF A LENGTH AND AGE DISTRIBUTION OF SPERM WHALES FROM THEIR SONAR CLICKS

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Student award: Undergraduate

Previous studies have shown that the interpulse interval of sperm whale sonar clicks can be used to estimate the body length of the animal. Thus, acoustics can be used to assess the length and age distribution of sperm whale populations, and in the long term describe population trends. The main aim of this study was to assess a length and age distribution of sperm whales from their sonar clicks. The recordings were performed at Bleik Canyon, Northern Norway, from a whale-watching vessel equipped with two directional hull-mounted hydrophones. The hydrophones were mounted on either side on the keel of the vessel approximately 2 meters below the surface and connected

directly to a laptop. The sperm whales were recorded right after descent. Out of 73 recordings lasting 7.5 h in total, 15 were chosen for analysis. The analysis resulted in a sperm whale size range between 12.8 and 15.0 meters. Transformation from a length distribution to an age distribution was possible by means of an age-length key. The calculated ages range from 16 to 26-year-old male sperm whales, suggesting that the investigated whales are sexually maturing. This study shows that hull-mounted hydrophones can be the well-suited for acoustic surveys of sperm whale populations.

A15 THE ECHOLOCATION OF KILLER WHALES DURING HUNTING BEHAVIOR

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Student award: Undergraduate

The purpose of our work was to measure and analyze the parameters of resident killer whale's echolocation from the Kamchatka Peninsula. Our data was collected around Starichkov Island in the Central Avacha Gulf of Kamchatka Peninsula. Underwater sound recording was conducted from an inflatable boat using a Sony TCD-D100 DAT recorder with a mono-hydrophone (Offshore Acoustics, Canada; frequency range 10Hz-40kHz) and a mobile hydrophone stereosystem (two hydrophones with a frequency range 300Hz-40kHz). Recordings were made with a sampling frequency 44, 1. Spectrographic analysis was carried out by Cool Edit Pro 1.2. For all trains we measured: length of the train, number of clicks in the train, interclick intervals and repetition rate (clicks/second). Also we measured regularity of the trains using a coefficient of variation (SD/mean interclick interval). We divided the hunting behavior into "hunting on a salmon" and "hunting on an Atka mackerel". During the "hunting on an Atka mackerel" 12% of the echolocation trains are "buzzes" which had such characteristics: the mean interclick interval of this trains is 3,85ms±0,11; these are short trains (length: 0,27±0,02ms) with a fast repetition rate (229,51±5 clicks/sec). We suppose that animals use them only when they are going to catch the fish. Also there are 33% of the trains that are from 0,125ms up to 1 second length: their repetition rate is 89,4±12,4 clicks/sec; the mean interclick interval is 38,16ms±4,33; probably these trains can be used during the fishing pursuit. 62% of the trains were from 1 to 10 sec length (repetition rate 10,49±1,41 clicks/sec) and only 4,6% from all the trains were greater than 10 seconds (length: 16,91±0,88ms), such trains had a lot of clicks (103±14,74) and the average repetition rate was very slow(6,39±0,75), it is possible that these trains are used to detect a fish at the bottom.

A16 ABR STUDY ON THE POTENTIAL IMPACT OF OFFSHORE WIND TURBINE RELATED SOUND ON THE SOUND DETECTION OF HARBOUR PORPOISES IN THE NORTH SEA

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An auditory study has been conducted on a harbour porpoise at the Dolfinarium Harderwijk, The Netherlands. The aim of the study was to assess the potential masking effect of operational sounds of offshore wind turbines on the perception of important signals by the animal, especially potential communication signals of harbour porpoises. The measurement of ABR's was chosen as method for achieving the data. A male harbour porpoise was trained to participate in the study, which involved an active participation of the animal. Due to its dimensions and material the research pool provided a difficult acoustic situation for conducting the study. ABR's were evoked with two types of acoustic stimuli, click type signals and amplitude-modulated signals. The masking noise resembling the underwater sound emissions of an operational wind turbine was simulated. At first the animal's hearing threshold was measured at frequencies between 0.7 and 16 kHz. Subsequently these measurements were repeated at frequencies between 0.7 and 2.8 kHz in the presence of two different levels of masking noise. Absolute hearing thresholds were established for frequencies between 2 and 5.6 kHz whereas at 8 kHz and above the resulting data are likely to represent masking threshold information.The resulting data show a masking effect of the simulated wind turbine sound at a level of 128 dB re 1µPa at 0.7, 1 and 2 kHz. This masking effect varied between 4.8 and 7.3 dB at those frequencies. No significant masking was measured at a masking level of ~115 dB re 1µPa. The available data indicate that the potential masking effect would be limited to short ranges in the open sea, but limitations exist to this conclusions and all estimates are based on existing turbine types, not taking into account future developments of larger and potentially noisier turbine types.

A17 CT SCAN 3D RECONSTRUCTION OF THE EAR RELATED WITH THE ACOUSTIC SENSITIVITY IN HARBOUR PORPOISE (*PHOCOENA PHOCOENA)*

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Student award: Postgraduate

Understanding the acoustic capacity of harbour porpoises to detect fishing nets is a key conservation issue to prevent their entanglement. Although the maximum auditory sensitivity of the species corresponds with the peak frequency of echolocation pulses produced by harbour porpoises (~120–130kHz), results from standard psycho-acoustic techniques suggest that this species is also sensitive to lower frequencies (below 20kHz). Here, we investigate the acoustic response through 3D reconstruction and measurements of the tympano-periotic complex (including cochlea lengths and volumes) and relate them with the reported auditory sensitivity. We further compare these measurements with the results (3D reconstructions and audiograms) from other echolocating species. A constant periotic-tympanic volume ratio is showed, that may indicate the functionality and the possible role of the middle ear during target acoustic detection.

A18 ACOUSTIC RECORDINGS OF CUVIER'S BEAKED WHALE (*ZIPHIUS CAVIROSTRIS*) WITH A WIDEBAND TOWED ARRAY OF HYDROPHONES

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In late September 2005 CIBRA carried out one of the coordinated bio-acoustic surveys during an extensive NURC (NATO Undersea Research Center, La Spezia, IT) research campaign (Zifio '05) in the Ligurian Sea. The aim of this study was to broaden the knowledge related to Cuvier's beaked whales, to characterize their habitat, and to remotely record their acoustic signals. CIBRA team was on board a 12 meter catamaran, named Krill, with own equipment based on a high quality towed array equipped with a low-noise front-end featuring digital recording and real-time spectrographic displaying with a nearly 90 kHz bandwidth. On September 25th, the Krill approached the spot where three Cuvier's beaked whales had been sighted by another vessel.

Two animals were sighted immediately before diving. No other animals were observed before and after this sighting. The boat was stopped and the engines turned off. The array sank more than 40 meters, but still not in a vertical stand due to strong drifting conditions. A few minutes after the animals started diving, high frequencies click trains were noticed on the real-time spectrograms (SeaProUltra, two channels, 96 kHz bandwidth). Later analyses on the recorded files showed click series with features matching the description given by Johnson et al. 2005. Frequency center, bandwidth, waveform, repetition intervals and amplitude variations related to head scanning movements confirm that recordings captured the emissions of two *Ziphius cavirostris*. This is relevant for setting up equipment needed for mitigation procedures where the presence of Cuvier's beaked whales must be estimated and to monitor critical habitats for this species. This cruise was carried out within the NURC – NATO Undersea Research Center SOLMAR project. We acknowledge ONR Office of Naval Research for having funded the development of the equipment. NURC website: http://nurc.nato.int ; SOLMAR website http://solmar.nurc.nato.int

A19 SONAR CLICK REPETITION RATE OF WILD HARBOUR PORPOISES, *PHOCOENA PHOCOENA*

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Student award: Undergraduate

The exact usage and extend of sonar use in wild harbour porpoises (*Phocoena phocoena*) is not known. Some knowledge of the sonar behaviour exists for harbour porpoises in captivity, but there is reason to believe that porpoises, like the thoroughly investigated bottlenose dolphin, will adapt the use of their sonar to their captive surroundings. A better knowledge of the sonar use in wild porpoises is, however, essential for understanding why these animals get entangled in fishing gear, thus making it possible to develop more effective ways of reducing this bycatch. The present study is based on day-time recordings made with a single hydrophone deployed below a small boat, anchored in the waters just West of Fyns Hoved, DK. The click trains generated by passing porpoises were recorded on an MD recorder, using a click detector to convert the ultrasonic clicks to the audible frequency range. In an attempt to make

the porpoises direct their sonar towards the hydrophone, "enticing" sounds (simulated porpoise click trains) were played from a transducer next to the hydrophone in some of the encounters. The surfacings of the porpoises were monitored by a team of observers operating a digital theodolite from a 20m high cliff next to the experimental area. Based on 37 click trains recorded without enticing sound emissions, a median inter-click interval (ICI) of 75ms was obtained, ICI varying from 23 to 397ms. In the presence of enticing sounds, the median ICI was 74ms, based on 74 click trains, here with ICI varying from 26 to 456ms. These data allowed for an evaluation of the probablility of the sonar beam "hitting" a single transducer in the test area, an important factor in the development of a new, biosonar-activated, "interactive" pinger concept.

A20 THE ACOUSTIC INFLUENCE OF THE INCREACING FAST FERRY ACTIVITY ON CETACEANS POPULATION IN THE STRAIT OF GIBRALTAR

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Student award: Undergraduate

The fast ferries activities in the Strait of Gibraltar have been going on for more than 75 years. However, an increase of this activity in the Strait has happened in the last five years. Numbers of boats, companies and trips per day per boat have increased dramatically (from a total of 13 boats in 2000 to 20 boats in 2005, increasing the number of fast ferries alone from 5 to 9). These fast ferry activity tendencies have a potential acoustic impact for cetaceans. To analyze the potential acoustic impact the fast ferries routes in the Strait and its overlapping with distribution of different cetacean species was identified. Secondly the fast ferries frequency spectrums were compared to the relevant cetacean species. The study shows that there is an overlapping between the distribution of cetacean species and fast ferry routes. Since 2000 the increace of fast ferry activity has resulted in a higher number of direct collicsions between fast ferries and cetaceans. Further more there is an overlap between the fast ferrys frequencies and cetacean emission and reception.

A21 DETECTION DISTANCE ESTIMATE FOR THE T-POD USING BOTTLENOSE DOLPHINS

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We investigated the detection range of a passive acoustic dolphin detector system 'T-POD' in a bottlenose dolphin habitat in the Shannon Estuary, Ireland, from 30th May to 18th August 2005. Land based theodolite tracking was carried out during the trial and one T-POD was moored in view of the observation site. The position of the leading animal, group size and behaviour (predominately; travelling, foraging, socialising and milling) of the closest dolphin group observed were recorded. All cetacean detections on the T-POD that corresponded with watch times in sea states ? 2 were analysed. The furthest distance dolphins were observed corresponding with acoustic data was 3,355m, suggesting a wide detection range for T-PODS. However, of the 111 groups observed, only 35.1% were detected by the T-POD; 33.3% were undetected even though they were within 3,000m of the T-POD (22% of these groups came within 100m) and 31.5% of groups were >3,000m from the T-POD. No significant difference was found in group size (Kruskal Wallis $p>0.1$) or behaviours (Kruskal Wallis $p>0.5$) between those groups that were detected acoustically and visually, and those that were only detected visually. Of the groups that were detected acoustically there was a relationship between group size and distance from the T-POD ($r^2=0.09$, $p=0.05$) with larger groups detected further away. A significant relationship was also found between group activity state and distance ($r^2=0.24$, $p=0.001$) with the furthest distances recorded for milling schools. Minimum interclick interval varied significantly with recorded behaviours (Kruskal Wallis $p<0.001$). Fastest clicks occurred during foraging behaviour and slowest during socialising. We suggest that T-PODs are very valuable tools in monitoring dolphin habitats but should be used in conjunction with visual surveys as often as possible to mitigate possible misclassification of clicktrains, absence of echolocation and occasions when dolphins are not directed towards the T-POD.

A22 PRELIMINARY RESULTS OF AN ACOUSTIC SURVEY ACROSS THE MEDITERRANEAN SEA

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A cetacean survey across the Mediterranean sea was carried out in October/November 2003, from a 13m, auxiliary powered, sailing catamaran. The objective of the survey was to record cetacean species distribution and abundance, with the aim to contribute to existing information about cetaceans in the Mediterranean sea, for their effective conservation and management. A combination of passive acoustic methods and visual observations were employed, with particluar emphasis on the acoustic detection of the sperm whale (*Physeter macrocephalus*). A two-element stereophonic hydrophone array was towed on a 100 m cable behind the vessel, sensitive to frequencies between 100 Hz and 20 kHz. Acoustic detections were made by listening for one minute every fifteen minutes, allowing an index of abundance to be calculated for sperm whales. Visual observations were carried out concurent to the acoustic effort during the day, whenever the sea conditions allowed. During the survey sperm whales were detected acoustically on 39 occassions. There were a total of 36 sightings of six species; striped dolphin (*Stenella coeruleoalba*), Risso's dolphin (*Grampus griseus*), short-beaked common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*), long-finned pilot whale (*Globicephala melas*), and sperm whale (*Physeter macrocephalus*). The striped dolphin was the species encountered most frequently, followed by the short-beaked common dolphin. Sperm whales, bottlenose dolphins and long-finned pilot whales were seen twice, while Risso's dolphins were encountered once. A mixed species association between striped dolphins, short-beaked common dolphins and Risso's dolphins was also observed.

A23 DO PINGERS ACOUSTICALLY IMPACT THE EARS OF HARBOUR PORPOISES?

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Acoustic deterrent devices, pingers, are developed to mitigate small cetacean by-catches in European fisheries. However, their effect on the hearing system of harbour porpoises is still unknown. In order to address this relevant concern, it is of major interest to collect morphologic data on the inner and middle ear and consequently an essential precondition to identify general and more specifically, acoustic pathologies. This study examined the inner ears of *Phocoena phocoena* for the first time from German and adjacent Danish waters of the North and Baltic Seas. Post-mortem examinations of the head were conducted by computerized tomography. The ear region was investigated by means of 20 µm celloidin histology sections with H/E staining. 28 harbour porpoises were sampled, 46.4% of which came from German waters, 53.6% from Danish waters, 71.4% from the Baltic, and 28.6% from the North Sea. Basic morphology data from inner and middle ears of harbour porpoises were collected. None of the fresh animals showed intravital atrophies of organ of Corti sensory cells or signs of neural degeneration. Nevertheless, several pathological changes were found, such as parasitic infestations and inflammatory reactions, each of which can be a cause of the other. Parasites were found in the middle ear, peribullar regions and sinuses, not in the inner ear. The effect of the common finding of parasites on hearing is still unknown. These and additional changes e.g. of the acoustic fat of the lower jaw, reduced 8th cranial nerve and soft tissue deposits will be demonstrated. Since June 2005, the use of pingers has become mandatory in parts of the cod fishery in European waters. Therefore it is even more important to continue the analysis based on a larger sample for comparison with animals not affected by pingers.

A24 BOATS AND PORPOISES: DOES SIZE MATTER?

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This study tests whether boats affect the presence of harbour porpoises, and whether this effect differs between areas with different general boat types. In the German Wadden Sea boats are mostly trawling fishing vessels and the German Baltic Sea is host

to many leisure crafts in summer time. T-PODs were deployed in a study to monitor both spatial and geographical variations in harbour porpoises activity. The T-POD cannot only record harbour porpoise echolocation activity, but also sonar and propeller noise from passing vessels if the frequency content fits the specifications of the acoustic filters. Boat and porpoise sonar is detected by algorithms and can automatically be extracted. Propeller noise appears as an increased level of random noise, which can only be found by manual visual inspection of the files. Through these two methods the start and end times of all boats recorded on the T-PODs as well as the appearance of harbour porpoises were collected. Then the waiting time was calculated as the time from which a boat no longer was present until the next appearance of harbour porpoise echolocation clicks. That boats had an influence on harbour porpoises is indicated by the fact that boat and porpoise sounds were only once recorded simultaneously. A Mann-Whitney U-test revealed no difference in waiting times between North and Baltic Seas. Waiting times generally ranged from 0 to 300 minutes, but on a few occasions were as high as 700 minutes. The median and average were 26 and 56 minutes, respectively. Whether boat noise differs between the two areas could not be measured since the T-POD gives no measure of sound level, and the porpoises may use the areas for different purposes influencing their response. Further investigations will be conducted in 2006.

A25 A LIBRARY OF MARINE ANIMAL SOUNDS: PROOF OF CONCEPT

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After three years of archival and database development, the marine collection at the Macaulay Library, Cornell Laboratory of Ornithology, is now in a proof of concept phase as a research resource for the marine bioacoustics community. The marine collection has restored and preserved acoustical data collected over more than four decades for research, conservation, and education applications. The recent release of an online interface to explore the marine collection brings the work of many individual researchers and institutions directly to scientists, educators, and the general public. A demonstration of the new online library will include the map-driven search and audition features and the online spectrogram tool. We will also provide an update on the progress of the collection and future developments planned and under progress for the online application, including annotation tools, feature extraction, and automatic detectors.

A26 USING ACOUSTIC DATA-LOGGERS TO DETERMINE TEMPORAL VARIATION IN LOCAL RANGING PATTERNS OF THE MORAY FIRTH BOTTLENOSE DOLPHIN

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Student award: Postgraduate

Acoustic data-loggers (TPoDs) have proved a useful tool for studying harbour porpoise distribution, but little information currently exists on the extent to which they can be reliably used to monitor the activity of bottlenose dolphins. This study aimed to monitor the frequency and duration of dolphin visits to three different areas within and adjacent to the Moray Firth Special Area of Conservation (SAC) in Scotland. Validation studies were first carried out to establish the temporal scale at which TPoD reliability is maximised. Land-based visual observations were compared with simultaneous TPoD detections at one of the sites. Detection on the TPoDs was highly likely (>85%) if dolphins were present in the study area for more than 40-50mins. Combining visual observations with simultaneous TPoD detections revealed that if an inter-click-interval (ICI) exceeded 50min, the dolphins had probably left the area. Dolphins visited more offshore areas least frequently, with 40-50 hours between visits, and showed variable visit lengths. Ranging patterns at the other two sites agreed with earlier boat-based surveys. A previously identified coastal hotspot in the inner Moray Firth was visited more frequently than the other (5 to 6 times per day), with visit lengths of up to 9 hours (mean 49 minutes). In contrast, dolphins appeared to be travelling through the second coastal site. Visits here occurred less than once per day, and showed greater temporal variation in length and frequency. Therefore, TPoD click detection time series can be used to compare visitation rates at different locations. These techniques can facilitate studies of ranging patterns in remote locations, or in conditions which are not amenable to visual surveys. Identifying the frequency and duration of site visits can provide insights into the possible impacts of proposed coastal and offshore marine developments on small cetaceans.

A27 DIURNAL CLICK PATTERNS OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN TWO DIFFERENT AREAS

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Student award: Undergraduate

Porpoises use echolocation for navigation (orientation) and investigation of objects at close ranges (‘feeding behaviour’). The animals emitt series of signals (click trains) with inter click intervals (ICI) between 20 and 60 ms for navigation and change the ICI up to 2 ms when they observe an object at a close range. (Verboom & Kastelein 1995, 1997)From June to September 2005 we deployed at 4 different positions TPODs (Click detectors, Chelonia,UK) 1.5 m above the sea bottom at 6-10 meters depth in two study areas. One area is west of Horns Reef (North Sea/Dk), the other south of Nysted (Baltic Sea/Dk).To study a diurnal rhythm of porpoises we measured the echolocation activity by the parameter Porpoise-Positive-Minutes (PPM) per hour and compared among four ‘daily phases’: dawn and dusk (3 hours around sunrise and sunset), night and day. In these phases we compared the proportion of click trains with a minimum ICI below 10 ms, which indicates feeding behaviour, to the number of all click trains. The echolocation activity during a 24 hour cycle showed similar rhythms in both areas.In Nysted the PPM within dawn are significantly higher than during the other phases. Regarding the proportion of feeding trains, the high rates whilst dawn and daytime, were significantly excelled at night.In Horns Rev at day were significant more PPM than in other phases, but in contrast that phase had the lowest rate of feeding trains. The highest rate of feeding trains was, like in Nysted, at night.Regarding the basic differences of marine conditions at North- and Baltic Sea, we expect variation in porpoise behaviour. However, it is not known, wether determining reasons are abiotic or biotic. The results of this investigation show that differences in fish densities could

A28 ‘APPROACH SEQUENCES’ IN THE SONAR OF WILD PORPOISES

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Porpoise click train data from Chelonia T-PODs was examined to look for progressively rising click rates after these had been noticed in data collected for other purposes. Several examples of a distinctive pattern of exponentially rising rates were found in data

from a POD suspended below a navigational buoy in deep water. A detection algorithm was developed to provide an objective means of identifying such events or their converse. The results indicate use of echo-location out to target distances of at least 150m, associated with realistic swimming speeds and acoustic parameters. At this site common dolphin detections are also frequent and a marked difference in 'approach sequences' between the two species was found.

A29 NEURAL NETWORK BASED SPERM WHALE CLICK CLASSIFICATION

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Student award: Postgraduate

Sperm whales often dive in groups for foraging, producing continuous series of clicks. Acoustic recordings of these dives result in a mixture of signals, making it difficult to segment and store the click sequences of individual animals. Since manual separation is an arduous task it would be preferable to automise this process. To this aim a suitable classification function needs to be found, and due to the directional properties of clicks, direct linear classifiers may only work for short sequences and fail when applied to entire dives. Here we study the use of a radial basis function neural network to separate clicks from different whales. Advantages of this type of network are a natural way of processing clustered data and a simple structure allowing fast training through a combination of unsupervised and (linear) supervised techniques. The algorithm is applied to six click series of individually diving males and data containing an entire dive to evaluate the capacity of the algorithm to generalise. It is shown that, depending on the classification parameters, around 90% of the click series can be classified correctly, while for the entire dive this percentage is around 77%.

A30 ACCURATE TDOA USING THE TEAGER-KAISER ENERGY OPERATOR

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The problem of position estimation from Time Difference of Arrival (TDOA) measurements occurs in a range of applications. It is especially necessary in the automatic detection and continuous localization of marine mammals using passive

acoustics. In this paper we are interested in the estimation of TDOA of regular clicks from sperm whales. A localization problem is usually split into three sub-problems: detection of clicks in four channels, association of the detected clicks and use of a three-dimensional positioning model based on intersections of hyperbolic functions. In contrast to previous techniques used in this domain that are based on frequency domain energy operators, we suggest the use of a real-time energy operator referred to as Teager-Kaiser (TK) operator. The TK energy operator is characterized by instantaneous tracking capability by using only three consecutive signal samples. The high time resolution property of TK operator is important in this task since the clicks are mainly transient signals. In contrast, frequency domain techniques are usually based on the use of Fourier Transform assuming implicitly that the underlying signal is stationary. Obviously this assumption does not hold in the case of click sounds. Moreover, these frequency domain methods are not as fast as the proposed detector where only two multiplications per sample are required. Using data from the Atlantic Undersea Test and Evaluation Center (AUTEC) we show that the proposed algorithm is capable in detecting accurately the time of arrivals of clicks (within an accuracy of 2 msec). The output of the TK energy operator is then used in a matching-type of filter to address the problem of associating clicks from different channels. The obtained accuracy of TDOA is expected to reduce drastically the uncertainty in the localization problem of sperm whales using passive acoustics.

A31 POTENTIAL ACOUSTIC IMPACTS OF OFFSHORE WINDFARMS

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Environmental and political concerns are resulting in increasing importance being attached to the need to generate electricity through renewable energy sources. Many European countries are meeting this need through the use of offshore windfarms. Concerns are arising however, that the sound generated by the wind turbines may add to the general noise levels underwater thus leading to potential acoustic impacts on marine life. Consequently, offshore windfarm development regulations recommend that underwater noise and vibration from windfarms be monitored during the operational part of its lifecycle. As part of this rationale, it is necessary to measure the background noise before any development takes place to put in to context the level of noise generated by windfarm development. This paper discusses the methodology for making meaningful measurements of background noise arising from anthropogenic and naturally occurring sources, and uses an example of a recent sea trial off the north coast of Wales to illustrate some of the scientific and technical issues that arise during such

activities. Measurements of background noise were made over two sites; the first being a site on which it is proposed to develop a 300 turbine windfarm while the second contained a fully operational wind farm of 30 turbines. Noise measurements were made over a frequency range of 10 Hz to 150 kHz using three calibrated hydrophones located approximately at mid water depth. The resulting sound pressure levels were compared with the thresholds of hearing for the harbour porpoise and the bottlenose dolphin. It was found that, in terms of permanent or temporary hearing damage, any potential acoustic impacts arising were minimal. In addition, using both measured and predicted sound pressure levels, distances from the windfarms were estimated where behavioural impacts may arise. The study concluded that the impacts were due to the low frequency acoustic signature of the wind turbine, the low sensitivity of hearing by the key marine species, and the generally lossy nature of the seabed sediments at the chosen sites. The importance of this result in connection with other potential sites for offshore windfarms is discussed qualitatively.

A32 ANTHROPOGENIC NOISE DERIVED FROM PASSING SHIPPING AND POSSIBLE INFLUENCES ON THE BEHAVIOUR OF BOTTLENOSE DOLPHINS

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Acoustic signatures of typical vessels using Durlston Marine Research Area (DMRA), ranging from RIBs to fast ferries to container ships, coupled with the seasonal variation of shipping (month to month and year by year), enable the determination of their likely influence on the presence of bottlenose dolphins. The concept of ‘dwell time’ has been invoked so as to enable the calculation of noise generation derived from shipping, within this research area. Using data collected from the DMRA, this calculation is made using the seasonal variation of shipping and correlated with the presence of bottlenose dolphins. The high increase in underwater noise at the start of and during the summer season, due to an upsurge in the presence of leisure craft, is likely to impact upon the marine life resident in, and visiting, the DMRA. The methodology can be applied at different coastal locations. Following the collection of data on boat traffic in an area, the calculation of shipping related anthropogenic underwater noise can be carried out based on these boat traffic statistics, and the possible influences on marine life estimated.

A33 ACOUSTIC MONITORING OF CETACEANS IN TERRITORIAL WATERS OFF LA MARTINIQUE (FWI), LESSER ANTILLES: GLOBAL ABUNDANCE AND FIRST DESCRIPTION OF *KOGIA SIMUS* VOCALISATIONS (NOVEMBER-DECEMBER 2004)

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For the first time was performed off La Martinique an acoustic monotoring survey due to a difficult wet season. Sampling effort was1200 km and practiced with a small boat during twenty-three days to assess cetaceans biodiversity, seasonal abondance, behaviour and distribution. Survey area is located at about 14°30'N and 61°W, a passive acoustic sampling was performed (each 2 nm) by using a towed hydrophone and a numeric recorder. Three additionnal observers on duty permitted visual searching in a distance comprised between 10 to 15 nautical miles from the coastline. Twenty-seven sightings obtained concerns ten species (in number of groups detected): for Delphinids, *Tursiops truncatus* (n=1), *Stenella attenuata* (n=5), *Lagenodelphis hosei* (n=2), probably *Feresa attenuata* (n=1) and *Stenella frontalis* (n=1), *Globicephala macrocephalus* (n=2); two new species, *Peponocephala electra* (n=1) and *Stenella longirostris* (n=1). Dominant species were *Physeter macrocephalus* (n=5) and *Kogia simus* (n=8) while Delphinids abundance was less comparing to usual spring season. Resident species used to travel slowly and improve mother/calves and groups cohesion. New species coming from high sea, were identified in deep waters near coastline when sea state was 3 to 4 Beaufort. Less than a thousand (n = 751) cetaceans was encountered during this earlier winter survey, and the acoustic relative abondance index (ARI, expressed in percent of sightings obtained) mentionned a low abundance (ARI=30.75%) particularly leeward side. No significant difference was observed between both north and south (T-Test: t=0.985, dl=53, p=0.328, p >0.05). Indeed, clicks produced by the most Kogiidae observed, *Kogia simus,* was recorded in depth varying between 700 to 1800 meters. Frequency range varying between 13 to 33 Khz, and sound follows an uncontinuous clicks pattern where clicks are separated by periods of 0.3 to 0.5 ms. If other field data confirm those results, specific monitoring would be developped and promote research toward such silent specie where strong sea state conditions limits surveys as is the Eastern Caribbean.

BEHAVIOUR

B1 HAWAIIAN SPINNER DOLPHINS AND THE GROWING DOLPHIN WATCHING ACTIVITY IN OAHU

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Hawaiian spinner dolphins (*Stenella longirostris*) feed offshore at night and come to shallow and protected waters in early morning to rest. In consequence this behavior potentially exposed them to several anthropogenic factors. The study I present here was conducted on Oahu during summers 2001, 2002 and 2003. At first, multiple, simultaneous observations of Hawaiian spinner dolphins were conducted (Delfour and Psarakos, 2003) in three study areas around the island. The primary value of this approach was to yield a more accurate picture of dolphin abundance and distribution and to possibly assess the effect(s) of human activities on their behaviors. We demonstrated heterogeneity in anthropogenic factors displayed and examined their possible effects on dolphin frequency or behavior. We also concluded that the parameters we studied were likely to evolve over time, and thus it was advisable to extend this kind of work over months and years in order to get a more accurate picture of the real impacts of anthropogenic factors on dolphin behavior and distribution. For this reason, we conducted a mid-term study over three summers in one particular location and we analyzed some of the dolphin oriented activities. Our results demonstrated a stable dolphin habitat frequency over the three summers which indicates that this resting area might be of some critical value for this spinner dolphin population. The results also showed an increase in dolphin oriented activities, but unfortunately it is premature to draw any definitive conclusion on their real impacts on spinner dolphin ecology and behavior. To conclude, more long-term studies that accurately explore the life dynamic of nearshore spinner dolphin populations, and evaluate the impacts of human activities on these dolphins, are needed.

B2 OCCURRENCE AND DIVING BEHAVIOUR OF FALSE KILLER WHALE OFF MADEIRA ARCHIPELAGO (NE ATLANTIC)

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False killer whales (*Pseudorca crassidens*) are known to have opportunistic predator behaviour, and consequently, their dive depths are inferred from the knowledge of the habitat of their prey. However, knowned dive depths of false killer whales are based on only three suction-cups attached time-depth recorder/VHF radio tags (16 hours of depth/velocity data) off the Hawaiian Islands, Central Pacific, and that we know it have not been previously documented on any Atlantic region. Between 1997-2005 false killer whales were encountered opportunistically on 7 occasions off Madeira Archipelago: Oct-1997, Jun-2001, Jun-2002, Sep-2003, Sep-2004, and twice on Sep-2005. All sightings occurred at depths between 900-2000m, except one at 100m (recorded pursueing and feeding on prey). On September 2005 a single suction-cup attached time-depth recorder/VHF radio tag was deployed on a false killer whale, during a survey to tag sperm and pilot whales (MACETUS's Project). The school, of about 25 individuals was seen travelling SSE at about 4 knots. The tag provided 5h12m of data (from approximately 4 to 9pm local time). The whale spent 96% of time above 20m depth and 4% on 5 deeper dives (maximum 72m). All dives were v-shape. Regression of dive depth vs time was positive, despite the R2=0.53 (based on 27 dives deeper than 10m), indicating that the dive profile is variable. Night vs day dive behaviour analyses (depth, time and velocity) showed no differences, however there was one hour period of higher activity with 14 short shallow dives (between 10-20m deep) just before dusk. Altough this analyses is based on a single deployment, it revealed similar dive patterns to the ones deployed on Hawaiian waters, which may indicate a similar species dive behaviour (variable and non-predictable).

B3 INTERSPECIFIC MATING BETWEEN BOTTLENOSE DOLPHIN AND LONG FINNED PILOT WHALE

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Student award: Undergraduate

Interspecific mating in cetaceans has been described in the literature. In some cases, hybrids were born, some of which were even fertile. Nevertheless, these cases remain uncommon. Our investigation took place in the Strait of Gibraltar, from an opportunistic platform of observation. We carried out our research from May to October in 2004 and 2005. Of all sightings, 12.8 % involved bottlenose dolphins (*Tursiops truncatus*) and

long finned pilot whales (*Globicephala melas*), either together or in close vicinity of each other. On two different occasions, we witnessed clear sexual behaviour between male bottlenose dolphins and female pilot whales. These matings involved several bottlenose dolphins and a single pilot whale. Both species displayed behaviours interpreted as relaxed and of apparent bilateral consent. Matings took place on the outskirts of each respective group of pilot whales, with no separation of the female from its pod. Violent interactions involving both species have also been recorded. In almost all cases, bottlenose dolphins are the disturbing element causing aggressive reactions. This results in interspecific tooth scars displayed by many individuals of both species in the Strait of Gibraltar. Two other cases of violent interactions were observed, in which two adult bottlenose dolphins violently separated a juvenile pilot whale from its group until an adult pilot whale came to the rescue. There is no clear explanation in the literature about the nature of the frequent association between both species. From our observations in the Strait of Gibraltar, this association seems to be detrimental for the pilot whales. The highly sexual nature of cetaceans in general and bottlenose dolphins in particular is well documented. The apparent bilateral consent evident in these current observations could, therefore, be interpreted as sexual play behaviour.

B4 BEHAVIOUR FEATURES OF THE INJURED STELLER SEA LIONS (*EUMETOPIAS JUBATUS*) ON A REPRODUCTIVE ROOKERY

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Student award: Undergraduate

There are a lot of information about harm which different objects inflicts to marine mammals. Also, some authors describe injured mammals behaviour different from healthy individuals. For example, wounded seals reduce there activity and continue stay to lay on the blocks of ice by danger approach. As result, many of them can perish, that is why these studies are important and useful. Compare some behaviour aspects of injured and healthy Steller sea lions. The study carried out at the South-Eastern rookery of Medny Island from May 26 to August 19, 2005. In the course of summer, there were two Steller sea lions with alien objects on there bodies: subadult female with closed plastic packing band deep grew in the neck and subadult male with same narrow packing band on the head. Traumas were good noticeable by the eyes. Over the period of the observation time wounded female appeared on the harem part of the rookery in total for 37 days. Days in which that animal contacted with other eared seals were only 14 (37,8%): 5 (35,7%) with northern fur seals and 9 (64,3%) with an other Steller

sea lions. And, 4 from 9 days wounded female was contacted with the same subadult Steller sea lion well known of it's natural markers. It communicated with Steller sea lions were not activity. Healthy Steller sea lion female (such age) was contacted with Steller sea lion groups only (there were not contacts with northern fur seal). During 42%of the days of it presented on the rookery it was manifestation high play activity as with one Steller sea lion or with their groups (m=79,7 min/day). During the other days, female was laid with eared seals groups of different age (m=389 min/day) on the rookery. Average duration time in which injured female was laid with other eared seals is 112 min/day, and in 92,8%- with young individuals. Injured male behaviour also sharply differs from healthy subadult males.

B5 IDENTIFYING AND MANAGING THE CAUSES AND IMPACTS OF RECREATIONAL ACTIVITIES ON THE THREATENED SOUTHERN SEA OTTER, *ENHYDRA LUTRIS NEREIS*, USING MULTIDISCIPLINARY METHODS

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In recent years there has been increasing concern regarding interactions between recreational activities and the threatened southern sea otter (*Enhydra lutris nereis*) in California. Kayaking is of particular concern as this activity occurs at high levels along the northern Monterey Peninsula. The current study employed multidisciplinary methods over a four year period to investigate this issue. Interviews with stakeholders determined attitudes toward otters and identified whether relationships between stakeholders contributed to disturbance. A survey of kayaking participants assessed motivation, tourist types, attitudes toward management and satisfaction with kayaking. These social research methods were used as previous studies show that involving stakeholders can improve management. Lack of awareness regarding disturbance, insufficient information on impacts of disturbance, poor communication between agencies and inadequate education of the public were identified as potential underlying causes for sea otter disturbance. Disturbance was manifested as short-term changes in otter behaviour including increased vigilance or avoidance of disturbance sources. These changes had impacts on otter time-budgeting which may lead to increased energy expenditure. Kayaks caused most disturbance events, although less than 25% of kayaks provoked a response from otters. Direct and very close approaches were identified as particularly disturbing. There was some evidence of tolerance in otters exposed to high levels of disturbance.This information has been used to improve collaboration, communication and information dissemination between stakeholders and to develop

wildlife watching guidelines for kayakers. It has also contributed to marine wildlife watching guidelines being developed for California. This is the first study to use multidisciplinary research methods to identify underlying social and biological causes of wildlife disturbance and to use this information to improve educational programmes and wildlife watching guidelines. These methods may also be of benefit in identifying and addressing causes of wildlife disturbance in other locations.

B6 ANALYSIS OF DIVING BEHAVIOUR OF A SOLITARY MALE BOTTLENOSE DOLPHIN IN THE INSHORE WATERS OF GALICIA (SPAIN)

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A solitary male Bottlenose Dolphin was first reported in Galician waters (Spain) on 2003, in Ferrol firth. The presence of the dolphin could generate considerable public interest, creating a situation of potential risk to the dolphin. The first stage to mitigate the risk of disturbance to the dolphin is the evaluation of its nature to describe in which way the human presence can influence on bottlenose dolphin's behaviour. For marine mammals, diving behaviour should reflect a species' ecology: how they use the water column should be influenced by a variety of factors. In this study we verified the importance in behavioural analysis on bottlenose dolphins through the direct observation of respiratory patterns. From April to August 2005 we studied the diving behaviour of a bottlenose dolphin in Ferrol waters with direct observations from land based points. We analysed the eco-ethological aspects of respiration events in order to detect changes in diving behaviour caused by human presence. A total of 4251 dive intervals were recorded during 49.3 hours of respiration samples distributed in 1072 respiratory sequences. The mean duration of dives was 41.79 seconds (SD=55.6, range=1-375). The most common respiration pattern was type B-2. During the study correlation was not found between duration of dives and number of boats in the area, but duration of dives was significantly higher in presence of boats. Bottlenose dolphin at Ferrol typically surface in five distinctive different ways prior to diving: regular dive, fast surface, tail stock, flukes up and "other" dives (that includes full leap, breach and spy-hope). Regular dive was the dominant dive type for all activities and moments. Mean dive time varied significantly by dive type and behaviour. This method of passive tracking represents a useful tool to assess solitary bottlenose dolphins to different kinds of human-caused interference.

B7 DIURNAL & NOCTURNAL BEHAVIOUR OF BOTTLENOSE DOLPHIN GROUPS WITH EMPHASIS ON FORAGING ACTIVITY ON THE NORTH-EASTERN COAST OF SARDINIA (ITALY)

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Optimal foraging models generally assume that predators make foraging decisions based on specific cues that they can readily perceive and accurately assess. It has been argued that generalist predators should exhibit plasticity in their behaviour, as this would allow them to take advantage of resources. In this paper we report the results of our research about ethology of bottlenose dolphin groups with emphasis on foraging activity, comparing behaviours in different time periods (day/night) and with environmental conditions. Observations were conducted from November 2004 to November 2005 in the North-eastern waters of Sardinia. Observations were made during daylight hours and night observations were made with night-vision binoculars. Continuous recording of dolphin behaviour were used to assess duration of states and 3-min samples were used to study the instant events. Video recordings and photos were made to document and verify behavioural interaction. A total of 142 sightings of bottlenose dolphins were recorded in 105 sighting hours over 12 months and 115 days at sea. About 75 hours of feeding were analyzed, 24h of travelling, 4,58h of socializing, and 1,5h of resting. Statistical analysis shows that the most relevant activity during the day/night and seasons was feeding. Dolphins were observed using a variety of feeding strategies. Dolphin behaviour was related to size group, with large groups during resting and small groups during feeding. In terms of energetic costs, foraging strategies were the most expensive, while the less energy consuming was during travelling and resting. Dolphin behaviour was influenced by fish farm's fishery activities. Opportunistic feeding is best exemplified by dolphins feeding on discarded farmed fish. The association of bottlenose dolphins with fisheries indicates the behavioural flexibility of these animals to capitalize on human activities. This pattern may be beneficial in that it reduces time and provides an easier way to obtain food.

B8 CONTEXT-SPECIFIC VOCALIZATIONS IN CAPTIVE BELUGA WHALES

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Student award: Yes

Behavioural contexts have been included in few beluga studies and scarcely achieve conclusive results. Acoustic behaviour of 2 captive belugas has been studied for a period of 3 years (2003-2005). One objective of this study is to determine context-

specific vocalizations. An acoustic repertoire of 31 vocalization types grouped in 7 categories (pure-tonal, mixed-tonal, pulses, pulse-trains, click-trains, mixed and noisy) was obtained from analyzing more than 43000 vocalizations. An ethogram including 68 behavioural categories has been obtained using continuous focal sampling techniques in more than 100 hours of observation.Statistically significant correlations (Chi-square, $p<0,05$) between behaviours and vocalizations ($N > 5000$) have been identified for 10 vocalizations (A, B, D, E, F, G, I, J, Y and Z). Presented here is a quantitative description of these vocalizations: initial, ending, maximum & minimum frequencies, frequency range, duration, number of harmonic, energy distribution and inter click interval ($N = 150$).These results demonstrate these belugas vocal production to be context-specific for at least 10 vocalizations of their repertoire. Each whale showed a predominant vocalization, A (12,1 %) for the female and F (11,1 %) for the male. Behavioural context associated with vocalization types A and Y (2,9 %) is 'keeper area inspection' which is related to the presence of staff. Vocalization types F and J (3,5 %) are associated with aggressive behaviour between whales, and have a use pattern parallel to the jawclap, B (21,4 %). Vocalization type I (10 %) is associated with visitor interactions. Echolocation clicks E (6,7 %) and Z (11,6 %) are associated with stereotypic behaviour.The obtained correlation between vocalizations and context suggests that the 2 predominant vocalizations of these captive belugas are not an individual signature but context-specific vocalizations from a repertoire of 31 individually distinctive and stereotyped vocalizations.

B9 A COMPARISON OF EAST AUSTRALIAN HUMPBACK WHALE MIGRATORY BEHAVIOUR BETWEEN THE NORTHERN AND SOUTHERN MIGRATIONS

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The migration of Group V humpback whales along the East Australian coast, from the Antarctic feeding grounds to the breeding grounds of the Great Barrier Reef, has been well documented over the past two decades, although few direct comparisons of migratory behaviour have been made between the northern and southern migrations. Two concurrent land- and boat-based surveys were conducted from Skennar's Head, New South Wales, during the humpback whale migrations from June-November 2005. A theodolite and Cyclopes real-time tracking software were used to compare 445 pods (926 whales) on the northern migration with 155 pods (362 whales) on the southern migration, in terms of pod size, speed, linearity, reorientation, course and average distance from shore. As with previous studies, non-calf pods were found to be significantly larger on the southern migration (mean 2.32) than on the northern migration (mean 2.07). Non-calf pods on the southern migration were also significantly closer to shore (mean northern 3177m; southern 2560m), travelling at slower speeds

(mean northern 5.74km/h; southern 5.02 km/h), and with more changes in direction than those on the northern migration. Calf pods on the southern migration also travel significantly closer to shore and at slower speeds (mean northern 5.03 km/h; southern 4.25 km/h) than those on the northern migration. The presence of calves on the southern migration appears to have a significant impact on most southward migrating pods, whether they include calves or not. This has serious implications in East Australia, where increasing vessel traffic and the presence of shark nets pose considerable threats for the recovering Group V population. Understanding migratory behaviour can help us more effectively manage the population from anthropogenic impacts, and improve estimates of population size and post-exploitation recovery; especially important in light of future exploitation of Antarctic

B10 COMPARISON BETWEEN TWO BREEDING SEASONS (2004-2005) OF BALTIC GREY SEAL (*HALICHOERUS GRYPUS*) IN FORSMARK BREEDING STATION, SWEDEN

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Student award: Undergraduate

Baltic grey seals (*Halichoerus grypus*) constitute a separate population of this phocid. The breeding season occurs at a different time (March) compared with the Atlantic populations (late July to December), and pups are born preferably spread out on ice and not in large breeding colonies, unless the ice conditions “force” the seals to breed on land.Two adult females, one male and their offspring were observed 24h a day in a semi-natural environment during winter 2004 (when one female pup was born) and 2005 (when two male pups were born). A comparison between the two seasons was conducted taking into account mother-pup behaviour and adult interactions. In 2005, two male pups were weaned after 15 and 23 days respectively. The total length of suckling was equal while the first pup had more, but shorter, suckling sessions. The female pup from 2004 (weaned after 16 days) suckled 52% less than male pups, with a lower total number and average length of suckling. These results support an hypothesis that grey seal females invest more in male than in female offspring (Anderson et al., 1987). Transfer of energy should have also been measured, but it was not possible. For all three pups, the average length of suckling increased while number of suckling bouts decreased during the breeding period.For 16 years, the smaller adult female has given birth to approximately equal number of males and females. They all seem to be more active and are suckled for a shorter time than the pups of the larger female, who almost exclusively has given birth to males. The female – male aggressive

interactions increased toward oestrus but the increase was much more significant between the male and female with a pup than between the male and the barren female in 2004, indicating that having a pup strongly influences female behaviour.

B11 THE DEVELOPMENT OF MOTOR AND COORDINATION SKILLS IN CAPTIVE BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) CALVES THROUGHOUT THE FIRST YEAR OF LIFE

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Student award: Postgraduate

Infant bottlenose dolphins undergo dramatic developmental changes during the neonatal period and first months of life, since the axial musculature evolvement allows the animals to acquire better motor coordination and to expand their potential behavioural capacity. In order to point out the effective age-dependent progression of movements interaction, this study intended to quantitatively investigate, in three bottlenose dolphin calves at the Rimini Delfinario (Italy), the evolution of 1) standing positions, 2) agile movements displayed in the water column and 3) aerial behaviours. Animals (one male and two females) were focally observed through systematic observations during the first 52 weeks of life for a total of 546 hours. A specific behavioural catalogue and Observer 3.0 were applied to measure the behavioural units frequency and duration. Data analysis indicates that, while “rest at surface”, the most common standing position displayed by the calves (frequency 64%, duration 70%), appears since the second week of life, the ability of remaining motionless in vertical or horizontal position under the water is completely absent or very weak until the end of the first month. As for nimble displays calves show when they move immersed, “roll” is the studied event they practice with the highest frequency (52%), followed by “somersaults” (33%). On the other hand, despite their performance complexity, aerial behaviours appear to be very precocious, as they are already carried out since the first days after birth. “Leaping” with the entire body outside the water surface predominates (63%), however quasi-leaping (37%) is the first to be performed. Finally, the significant increasing trends of the studied patterns during the year detailed the progressive steps of motor ability and coordination acquisition with growth, also underlining how systematic observations, even if conducted in a controlled environment, could provide reliable evidence on this topic.

B12 BOTTLENOSE DOLPHIN (*TURSIOP TRUNCATUS*) AND FISHERIES AROUND LAMPEDUSA ISLAND (SICILY – ITALY)

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Starting from 2003, in the framework of the LIFE project NAT/IT/000163, a dolphin-fishery interaction study has been conducted in the Archipelago of Pelagie Islands (South of Sicily, Italy). Since 1997 bottlenose dolphin population has been regularly monitored in the area by the Nature Conservation Department of CTS. During March-December 2004 and January-December 2005 the interaction of bottlenose dolphin with fishing activity was monitored by researcher directly boarded on fishing boats. In case of dolphins sighting, behavioral data were collected, in order to highlight positive or negative interaction among dolphin and fishery gears. The landed fishes was also weighted after any fishing trip. Due fishermen's complaints, the interaction was specially studied among dolphin and the "monoparete" gear. Preliminary results are presented. The analysis of dolphins presence during fishing activity shows a mean 2,5 animals per fishing acting boat. A separated analysis of surveys without and with dolphins shows that this number rise to 5,1 for the latter. The mean of total fishery catches, expressed in Kg/square meter of net, is 0,04. The analysis for fishery catches without and with dolphins shows a reduction from 0,06 to 0,02. More, the separated analysis among data of nets for Maena maena and other nets shows a reduction from 0,2 to 0,02 for the first, and from 0,006 to 0,0006 for the latter. The results of the present study would be integrated with further analysis and implemented in the Action Plan for Bottlenose Dolphin in the Pelagie Arcipelago, due by 2007 as part of the Life Project.

B13 INFLUENCE OF THE ANTHROPOGENIC IMPACT ON BELUGAS (*DELPHINAPTERUS LEUCAS*) BEHAVIOUR

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The object of our research was the summer reproductive gathering near the Beluzhy Cape, Solovetsky Island, White Sea. This period is the most important for reproduction; the animals are especially vulnerable to the influence of a various disturbing factors. The development of whale-watching is a reason of the increasing of anthropogenic

impact on belugas (vessels noise, presence of the divers or inflatable boats, carrying out of hydroengineering works, ets.). Therefore, the purpose of our work was the analysis of belugas behaviour before and after development of whale-watching. During the 1995-2004 the long-term steady avoidance reaction to the disturbing factor was observed for any anthropogenic influence. For the period from June to August 2005, 97 various situations of anthropogenic impact were analysed. However, it was obtained that the exploratory behaviour of belugas was not accompanied by a long-term departure from area of investigations. The animals returned to the area in 5-10 minutes or did not leave observed water area at all. The distance from animals to a source of disturbance was 5-20 m. Thus, us the development of whale-watching goes on, the reaction of habituation of belugas to presence of the man strengthens. The habituation could be evidence of both high adaptation abilities of belugas, and correct conducting of whale-watching. However, habituation is fraught with the potential threat because of the extinction of fear of the man can do much harm to animals in case of contact with the people in aggressive mood. The price of habituation could be especially high for the region of reproductive gathering, as there are the most vulnerable members of a population (mother-calf pairs), and the processes of reproduction take place here. The necessity of the strict regulation of all kinds of human activity in the reproductive gathering area is obvious.

B14 ABUNDANCE AND LOCAL MIGRATIONS OF HUMPBACK WHALES OFF ECUADOR

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Student award: Undergraduate

At the beginning of the austral winter, humpback whales (*Megaptera novaeangliae*) migrate from their Antarctic feeding grounds in high latitudes to their breeding grounds in tropical or subtropical waters. Every year in May they appear off the coast of Ecuador and remain until October, but little is known about the local migrations within this seasonal habitat.The present study was conducted in three different areas off Ecuador: Esmeraldas (2000-2004), Machalilla National Park (1996-2004) and the Gulf of Guayaquil (2004). Previous studies determined Machalilla National Park as a distinct reproductive area in Ecuadorian waters. The increase of the sightings of calves and the relative abundance of whales during the winter of 2004 showed that Esmeraldas also represents a breeding area for humpback whales.In the study areas, photo-identification was carried out during the seasons of 1996-2004. In total, 146 individual humpback whales were identified with the help of photographs of the right side and 136 of the left side of their dorsal fin. Individual animals were re-sighted in Esmeraldas and Machalilla

National Park as well as in Esmeraldas and the Gulf of Guayaquil within a season and across years. This shows that local migrations between different study sites take place. The minimum migration period of six days from Esmeraldas to Machalilla National Park as well as the low mean occurrence (1.1-1.3 days) found during the present study indicate that whales do not remain in one breeding site for long, but rather move within a large reproductive area along the coast off Ecuador and probably travel within an even larger breeding ground including the waters off Colombia and Panama.

B15 BREACHING BY HUMPBACK WHALES DURING MIGRATION OFF THE EAST COAST OF AUSTRALIA

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Humpbacks are well known for the frequency with which they engage in aerial, high-energy behaviours such as breaching. A clear role has not yet been defined for breaching, but it is thought to have multiple functions. Whilst breaching and other behaviours of humpback whales have been studied extensively in the breeding areas, few studies have studied breaching behaviour of humpbacks during migration. This work examines the context and function of breaching by humpback whales during migration past the east coast of Australia. Humpbacks were tracked using a theodilite and extra behavioural observations were entered into “Cyclopes” (a theodolite tracking programme), with special attention to breaches. Of the total number of pods observed 16% of them breached, 480 breaching pods were tracked using the theodolite and were used for behavioural assessment. Of the 480 pods, 275 did not appear to interact in any way with other whales. Of the other 182 pods, 153 pods were involved in distant interactions with other pods where the movement or behaviour of the other pod appeared to be influenced by the breaching pod. The remaining 23 pods joined with other pods. Rates of breaching per pod and per whale significantly decreased with the number of other pods ($p<0.0001$; $p<0.0002$) and whales ($p<0.0051$; $p<0.0112$) in the study area. Breaching rates significantly increased with increasing pod size ($p<0.01$). There was no significant diurnal variation of breaching rate, but peaks were observed early morning, midday and late afternoon. Nor were there significant effects of seasonality or sea state. Breaching therefore is more closely related to social influences, rather than temporal or environmental. However, a more clearly defined role is not apparent and breaching may possess multiple social functions.

B16 BEHAVIORAL RESPONSE OF SPINNER DOLPHINS (*STENELLA LONGIROSTRIS*) TO HUMAN ACTIVITIES IN THE ARCHIPELAGO OF HAWAI`I

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Student award: Undergraduate

Many cetaceans live in coastal waters that are accessible to humans, as occurs in Kealakekua Bay, Big Island of Hawai`i, USA. In the last years there has been an increase of human activities in the Bay, especially during morning hours when spinner dolphins rest and socialize (feeding occurs at night). In 1999, five human activities (number of swimmers, kayaks, and motorized boats, and narrow -or less than 8kHz- and broadband – or more than 8 kHz- engine noises) were monitored to investigate their effect on spinner dolphin aerial behavior. Aerial behavior was divided into three categories (high, medium, and low energy). Therefore, there was a total number of aerial behaviors in the presence or absence of each human activity. A total of 614 min were recorded, from which 71% included interactions between human activities and dolphins. The most frequent human activity was the presence of broadband engine noise (51%), followed by the presence of kayaks (40%), boats (34%), swimmers (27%), and narrowband engine noise (12%). Boats and broadband engine noise significantly increased the number of high and medium energy aerial behaviors ($Z>2.05$, $p<0.05$), whereas kayaks and narrowband noise showed significant differences for medium energy behaviors only when they were present in conjunction with other activities ($Z>2.31$, $p<0.05$, therefore, their effect was probably due to the presence of other activities). Swimmers did not modify the aerial behavior of spinner dolphins ($Z<1.14$, $p>0.05$). Broadband noise occurred simultaneously with the presence of boats (42%). As boats are probably a hazard to dolphins (by collision or by being acoustic maskers), it is possible that dolphins are relating the existence of broadband noise to boats in their vicinity. The changes found in the dolphin aerial behavior indicate that they may be interrupting their rest cycle to warn each other.

B17 REGISTERS OF PERSECUTIONS OF PILOT WHALE (*GLOBICEPHALA MELAS*) GROUP ON ORCA (ORCINUS ORCA) GROUP IN THE STRAIT OF GIBRALTAR

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During two whale watching trips in 2003 and 2004 two persecutions of a pilot whale group on an orca group were sighted and registered in the Strait of Gibraltar. Since 2002, during each whale watching season, a complete series of data has been collected

from the 24 meter long whale watching boat Jackelin. On the afternoon of the 22nd of September 2003 and the morning of the 30th of July 2004 persecutions of a pilot whale group on an orca group were registered in the Strait of Gibraltar. In both occasions the orca group was travelling very fast and swimming paralell to each other followed by a group of pilot whales. Both persecutions were photographed and filmed. The objetive of these persecutions seems to be the expulsion of orca from the typical pilot whale distribution area. A detail description of each sighting is

B18 OBSERVATIONS ON ROUGH-TOOTHED DOLPHINS (*STENO BREDANENSIS*) BEHAVIOUR IN LA GOMERA (CANARY ISLANDS)

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The rough-toothed dolphin (*Steno bredanensis*) is a very little known species with a distribution throughout tropical and subtropical waters of all oceans. Due to its oceanic condition it is mostly present around islands.The Canary Islands seem to be the one of the few places where this species can be observed regularly through the year. In a special area for conservation (SAC) located SW of the island of La Gomera, studies on the behaviour of rough-toothed dolphins have been undertaken in the last years.Its behaviour towards human presence is very changeable. They usually swim slowly, near the water surface and paralel to each other, in groups of about 7 individuals, changing its direction as a boat approaches, avoiding any contact. But we have also had contacts where rough-toothed dolphins showed a very strong interest towards humans with interactions that lasted several hours. When going into the water with them they prefer a high activity like diving repeatedly up and down or swimming fast in circles, otherwise they will lose interest and swim away.Regarding other cetacean species, rough-toothed dolphins have often been observed in the company of or feeding with other animals especially bottlenose dolphins (*Tursiops truncatus*) and fin whales (*Balaenoptera physalus*).Several remarkable behaviours related to interactions of rough-toothed dolphins with other marine species such as Cory's Shearwaters (*Calonectris diomedea*) and Loggerhead turtles (*Caretta caretta*) have been recorded. These interactions are mainly focused on “playing” with these animals immersing them or throwing them into the air. A similar behaviour has also been observed with their preys before feeding on them.

B19 OCCURRENCE OF SPERM WHALE CALVES (*PHYSETER CATODON*) IN THE LIGURIAN SEA OFF MONACO: USUAL OR EXCEPTIONAL?

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Student award: Postgraduate

Among the eight common species of the Mediterranean Sea, the Sperm Whale (*Physeter catodon*) is known to inhabit the entire sea. However, the frequency of sightings decreased over the past 20 years, which may point to a depletion of the Mediterranean stock; it has also been suggested that the occurrence of herds was more frequent in the past. Recent data indicates that large groups are usually sighted in the southern part of the Mediterranean Sea, and there has been no report of those in ligurian Sea. During a survey conducted on December 18, 2001, a herd of at least ten whales was sighted. The group was compounded of 12 meter-long young females and 5 meter-long calves. Swimming and diving behaviours confirmed the juvenility of the calves. This was the first report of a herd composed of newborn sperm whale in this area. A review of standings data was conducted, and the results for the animals measuring between 4 and 6 meters are mapped. Stranded calves are not rare on the northern coast of the Mediterranean Sea, and are found all year around. So, the absence of herd sightings could be both due to lack of field survey in seasons during which they are present (fall and winter) and due to the fact that animals are casually present in this part of the Mediterranean Sea, as a result of southern weather degradation. In fact, on December 16, 2001, an important depression was on Sicily, where past studies have report herd presences. This storm may have led females to leave this area because of possible danger for their progeny. In conclusion, it is very difficult to determine whether this report is usual or exceptional, and points out the necessityto campaign all year round.

B20 FROM LONG AND DEEP TO SHORT AND SHALLOW: HOW A HARBOUR SEAL PUP INFLUENCES THE DIVING BEHAVIOUR OF ITS MOTHER

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The harbour seal (*Phoca vitulina*) is a characteristic species of the Wadden Sea, where it often can be observed resting on sandbanks. Even though these seals spend significant amounts of time foraging in offshore areas, the Wadden Sea - with its shallow water

depths and protected sand banks – is a highly important area for both resting and reproductive activities. In the course of a larger study aiming at elucidating the spatial and temporal distribution as well as the diving behaviour of harbour seals in the German and Danish Wadden Sea, several seals were equipped with dead reckoners and satellite tags. One of these animals was a pregnant female for which data were recorded from mid-April to the end of June. Until the beginning of June her diving behaviour and foraging trip characteristics were very similar to those of other animals. However, in the beginning of June the diving behaviour and movement patterns changed drastically due to giving birth to a pup. The data show very clearly that this female harbour seal stayed inside a small area of the Wadden Sea with its pup. The diving behaviour suggests that the female and her pup only went into the water when the sand banks were flooded by the tide. This study clearly shows what restrictions can be imposed on a female harbour seal by its pup in terms of foraging activity. In addition, it provides a first insight into the debate about whether or not females leave their pups alone on sand banks. The latter being especially relevant for authorities dealing with abandoned pups.

B21 BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) BEHAVIOUR BEHIND TRAWLERS IN THE KVARNERIC (NORTHERN ADRIATIC SEA)

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Student award: Yes

The behaviour of bottlenose dolphins in the presence of demersal fishing trawlers was observed and analysed from the Kvarneric region of Croatia (Northern Adriatic Sea). Data on dolphin group size, composition and persistence behind bottom trawling vessels were collected by the Adriatic Dolphin Project in the research seasons from 1995 to 2003. Individuals were subsequently identified using photo-identification. Groups frequently followed trawlers, possibly to satisfy their energy requirements by feeding on the concentrated and disorientated prey around the fishing nets. Group size significantly differed among in groups composed by individuals of different age classes (Adults only vs. mixed age groups; Mann-Whitney test $U=-3.307$, $p<0.001$). Group size did not significantly differ among years (Kruskal-Wallis test $H=13.43$, $df=8$, $p=0.097$). All identifiable dolphin age classes were engaged in this specialised feeding strategy, except newborns. Groups were more often observed in the early afternoon hours. The presence of mother-immature pairs could indicate the importance of trawlers for lactating females and their young, who learn this alternative feeding strategy. Identification of individual dolphins suggests that female dolphins used this strategy more often. Individuals showed that they utilise the trawlers to different degrees. The distribution of the individuals feeding behind trawlers showed that they may have

some geographic preference. This may indicate the difference in individuals' behaviour or habitat use. Trawler frequency in the study area could influence dolphin home range and feeding behaviour. Enlargement of the study area would improve the understanding of the dynamics, social ecology and feeding behaviour of this population thus contributing to its conservation.

B22 FINBACK WHALE (*BALAENOPTERA PHYSALUS*) BEHAVIOR ON JEFFREYS LEDGE IN THE GULF OF MAINE

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Student award: Undergraduate

Jeffreys Ledge is a 54-km long rocky ridge in the Gulf of Maine located approximately 32-km off the northeast coast of the United States. Several commercial whale watch vessels visit this area on a daily basis during the whale watch season (May through October) each year. During the 2004 season, the dive time and behaviors of finback whales (*Balaenoptera physalus*) opportunistically sighted from commercial whale watch vessels were recorded. The dive times of finbacks times ranged from zero to 20 minutes. Differences in average length of submergence were found between morning and afternoon sightings (5.89 minutes in the morning and 5.83 minutes in the afternoon). Additionally, finback whales increased their dive times during the latter part of the season. Overall, the most common behaviors recorded were feeding and traveling, providing evidence that Jeffreys Ledge is an important feeding area for finbacks during the summer. Behaviors also varied slightly based on time of day. This study suggests that finback whales adjust their behaviors and submergence times based on time of day and season possibly in response to prey abundance. Continued studies are essential for the better understanding of finback whale behavior in the Jeffreys Ledge area.

B23 BEHAVIOURAL OBSERVATIONS OF FORAGING MINKE WHALES (*BALAENOPTERA ACUTOROSTRATA*) IN THE OUTER MORAY FIRTH, NE SCOTLAND

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The minke whale (*Balaenoptera acutorostrata* Lacepede, 1809), a widely distributed cosmopolitan cetacean species, shows a high degree of adaptability to different environments. Extensive research has been conducted on the foraging strategies

of B.acutorostrata in terms of prey aggregation. However, little has been published on the foraging association of this species with coastal seabirds. Over the past 5 years, during the summer and autumn months, minke whales along the outer coastline of the southern Moray Firth, NE Scotland, were recorded foraging in the presence of seabirds. Kittiwakes (*Rissa tridactyla*), herring gulls (*Larus argentatus*), guillemots (*Uria aalge*) and razorbills (*Alca torada*) were seen forming dense feeding 'rafts' at the water's surface. Observations show that the formation of bird 'rafts' often occur independently from B.acutorostrata, thought to be the successive result of prey concentrated at the surface by other species, predominantly schooling predatory fish, rather than activity by the whales when nearby. In this area of the North Sea, schooling mackerel (*Scomber scombrus*) constitute a significant component of the summer fish biomass and may perform this role of compacting targeted sandeel (*Ammodytes* spp.) prey into concentrated balls. Therefore, it is hypothesised from these observations that whales appear to expend little, if any, energy in aggregating fish schools together, instead waiting for other species to aggregate fish, opportunistically striking into balls of pre-aggregated prey. The role of mackerel in increasing both the rate and density of sandeel ball formation, indicated by the presence and activity of associated bird rafts, is thought to be very significant in this coastal Scottish location. Since changes in oceanographic variables e.g. water temperature have been directly correlated with the migration of S.scombrus, the observed inter-annual variability in B.acutorostrata distribution in the Moray Firth may subsequently be related to the distribution and abundance of this predatory fish species.

B24 DAILY AND SEASONAL BEHAVIORAL PATTERNS OF THE TUCUXI DOLPHIN IN NORTHEAST BRAZIL, RN

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We evaluated the seasonal and circadian variation of the behavior of the Tucuxi dolphin *Sotalia guianensis* and the effect of precipitation and photoperiod on their habitat use in Northeast Brazil (RN). The study was carried out in two natural populations: from São Cristovão beach (5° 10'S, 37° 14'W; from June 1999 to May 2000), and from Tabatinga beach (6° 03'S, 35° 05'W; from October 2003 to September 2004). Observations were from 0800 to 1600 h, two days a month, from the highest points of each observation area. Scans were run every 5 minutes to count the number of individuals (adults and calves) and behaviors (slow movement, aerial activity and feeding). The local precipitation and photoperiod were also associated with both the frequency and permanence of the dolphins in each area. The rainy season lasted from March to August in Tabatinga and from January to June in São Cristóvão, while the dry season lasted from September to February in Tabatinga and from July to December in São Cristóvão. The number of adults and calves and their

permanence in both studied sites were higher in the morning (0800 – 1200 h) and during the rainy season; these variables were also associated with precipitation and photoperiod. In Tabatinga beach the most frequent behavior was slow movement (65%), followed by feeding (20%) and aerial activity (15%). In São Cristóvão beach the most frequent behavior was feeding (52%), and then slow movement (32%) and aerial activity (16%). We conclude that seasonal variation of precipitation and photoperiod affects frequency, permanence, number of individuals and behaviors of the dolphins and characterizes in both studied areas a seasonal pattern for habitat use.

B25 BEHAVIOURAL SEQUENCES DISPLAYED BY A BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) COMMUNITY DURING SWIM PROGRAMMES DEDICATED TO AUTISTIC CHILDREN

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Dolphins show a huge behavioural capacity, as in potentially performable elements quality and amount as well as in events temporal concatenation. However, as for this last aspect, the transition probability to shift from an activity to another one, seems to be to a certain extent predictable in orderly sequences. Aim of this study was to analyse the linkage between behavioural units in a *Tursiops truncatus* community composed by two adults (a male and a female) and three juveniles (a male and two females) housed in the Rimini Delfinario (Italy), during dolphins/autistic children encounters. A specific ethogram, including 39 activities organized into 3 main categories ("Neutral", "Approach" and "Avoid"), was used during continuous focal observations lasting 20 minutes each. Frequencies were scored by means of a video camera for a total of 120h of sampling. Observer Lag Sequential Analysis was applied to obtain transition matrices and to construct significant flux diagrams ($p<0.05$). Since the instant the child came into the water, spontaneous animal reactions revealed to progress in distinctive sequences, reasonably relied on individual and group characteristics. In fact, while adults and still parent-dependent offspring, showed a quite simple way of acting, almost exclusively related to a series of neutral-locomotory behaviours, other juveniles started more complexes successions preferentially including interactions with children even via tactile displays such as "contact" or slightly "seize with the rostrum". In conclusion, even though the limited subjects number prevent a wider generalization of results, the plain positive approach to humans, together with the weakness of negative responses, seemed to confirm the promising value of bottlenose dolphin implication in encounters with children affected by communicative disorders. At the same time, since psychological stress measurements are quite difficult to obtain, behavioural quantification could represent a good indicator of cetacean status in these contexts. (Research supported by Ex 60% grants).

CONSERVATION/MANAGEMENT

CM1 MONITORING THE IMPACTS OF A PIPELINE INSTALLATION ON COASTAL MARINE MAMMALS USING VISUAL AND ACOUSTIC TECHNIQUES

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A survey was conducted during the summer of 2005 to assess the impact of a gas pipeline installation on marine mammals using the waters of Broadhaven Bay, SAC (County Mayo, Ireland). The survey comprised part of an ongoing monitoring program, and followed a baseline study conducted in the same area in 2002 by the Coastal and Marine Resources Centre (University College Cork). Cliff based surveys using telescopes and a theodolite was conducted for a total of 381.0 hours between June and September 2005 (the same period included 317.3 monitoring hours in 2002). Acoustic data loggers (T-PODs) were deployed to further investigate the presence of echolocating cetaceans close to the pipeline landfall site. The results showed a high diversity of marine mammal species using the area (8 cetacean and 2 seal species). While the total number of animals observed was identical (520) between the two survey periods there was a marked difference in number of sightings (47.5% less in 2005). The most noteworthy difference was the number of harbour porpoise sightings, which was 80% less in 2005. This species was nevertheless detected acoustically to a greater extent in 2005 (14%) compared to 2002 (7%). This discrepancy may be due to the absence of boat survey effort in 2005, on observer variability or on weather conditions. Due to interruption in the planned construction works, the pipeline was not installed in 2005 but the work is likely to recommence in 2006. The study provides valuable baseline information that will be used to investigate any impact on marine mammal presence and use of the area during the construction and post construction phase. The project team will continue to collaborate with the company installing the pipeline in order to devise ways of mitigating the impact of activities associated with a proposed development on marine mammals.

CM2 INVESTIGATING THE CAUSES OF DEATH IN MONK SEALS, STRANDED IN COASTAL GREECE (1986–2005)

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The main surviving population of the critically endangered Mediterranean Monk Seal, *Monachus monachus*, estimated at present at 250-300 animals, is found in Greece, while its worldwide population may not exceed 500 animals. In this study we examined the mortality of the species over the past 20 years, based on the results of necropsies conducted throughout Greece. Causes of death were grouped in three major categories: non-human induced, deliberate killing and accidental death. In total, from 1986-2005, 201 cases of dead seals were reported through a National Stranding Network, out of which in 84 cases full necropsies were conducted. In this study, data from only these 84 cases were included, divided in two study periods: 1986-1995 and 1996-2005. During the first decade, 19 necropsies were carried out, while the remaining 65 were conducted between 1996-2005. Irrespective of age categories, no difference was found in the patterns of mortality observed between the two study periods. Overall, the main causes of mortality were found to be non-human induced (40%), and deliberate killings (18%), while accidental death accounted for only 6% of all cases. In a considerable number of cases (36%), the cause of death could not be determined, either due to inconclusive evidence or to the decomposition of the carcass. Considering the various age categories, our results show that in adult seals deliberate killing is the most frequent mortality cause, accounting for 53% of such cases. In sub-adults accidental death was found to be the main cause of death (48%), whereas in pups non-human induced death accounted for 92% of the cases. The fact that fisheries related causes of death (deliberate killings and entanglements) remain at high frequencies, must be taken into serious consideration in the species overall conservation strategy and alternative approaches to mitigate the monk seal-fisheries conflict should be explored.

CM3 THE GREY SEAL (*HALICHOERUS GRYPUS*) BREEDING PROJECT IN SWEDEN: 1980-2006

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Student award: Undergraduate

In 1980 the Baltic grey seal population was below 4000 individuals. The reason for the dramatic decline – from some 100 000 grey seals in 1900 – was hunting and high concentrations of environmental contaminants in biota making females sterile. The breeding project started in 1980 with two juvenile females and two juvenile males. The purpose is to release pups from the breeding animals to the wild in southern Sweden, where the situation is most severe. The seals are fed on less contaminated Atlantic herring. Since 1985 thirty-one pups were born. Altogether four adult males have been included in the project, but probably only two of them have produced offspring. “Hilma” has given birth to significantly more males than females (12 males and 3 females) in contrast to “Sälma” (10 females and 6 males). All pups but one has been released to the wild in the southern parts of Sweden. They have been marked by plastic tags in the back flippers, microhips and/or frozemarked. Four pups have been found dead, drowned in fishing gear. Since 2002 the pups are deployed with satellite transmitters before release, and their movements have been followed up to nine months (Roos et al., ECS, 2004). All of them have stayed in the southern Baltic. A detailed behaviour study during the reproductive season has been conducted the last three years (Wisniewska et al. ECS 2005, Chudzinska et al. ECS 2006). The health status for the Baltic grey seal has improved since 1980 and the grey seal population is increasing (Karlsson and Helander, ECS 2006). However, some diseases remain, and some have increased in frequency (Bäcklin et al., ECS 2006). Nevertheless, the breeding project is soon terminated. In early spring of 2006 the last two pups will (probably) be born and released.

CM4 ETHICS IN CETACEAN RESEARCH: WHAT DO WE WANT?

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Research on Cetaceans is – like every research – not free from moral implications. The ECS is in the early phase of implementing its own ethical committee so it seems to be a good time now for some basic reflections regarding the main topics of interest. At least three fields of ethical questions can be distinguished: 1. Moral justification

of impacts on cetaceans caused by the research itself (or its accompanying circumstances like, e.g. captivity). 2. Conservation management and the need for balanced arguments versus politics with regard to the co-existence of man and cetaceans (from whaling to tourism). 3. The role of researchers with regard to the public perception and use of the 'whale and dolphin icon' (from Flipper to Free Willy and save-the-whale-campaigns). This presentation aims at elucidating these mayor fields

CM5 INTERACTIONS BETWEEN BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) AND THE ARTISANAL FISHERY IN FILICUDI ISLAND (ITALY)

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Competitive interactions between coastal bottlenose dolphins (*Tursiops truncatus*) and fisheries are a widespread problem in Mediterranean Sea, probably due to the species' coastal distribution and opportunistic feeding habits. In Italy, several marine sites are affected by this complex circumstances, highlighting conservation problems in specific locations. Filicudi Island (Eolie Archipelago, Italy) is one of the sites where competitive interactions with artisanal fishery and bycatch in illegal driftnets are the main reasons of persecution for bottlenose dolphins. Injuries or mortality from retaliatory measures taken by fishermen, or blame them for gear damage or catch reduction, are frequently reported in the area. A pilot study (June-September 2005) was performed to monitor the local situation. Boat and land-based surveys and photo-identification techniques were used to derive a population estimate and to examine distribution and movements of individuals whether or not related with presence of fishing gears. Instantaneous, focal group and ad libitum sampling methods were used to assess dolphins behavioural activity. Preliminary data on 40 sightings indicate that bottlenose dolphins have a regular distribution in coastal waters, in particular around the rock cliffs and where the sea floor drops at an average depth of 100 m. Proximity with fishing gears was recorded on 30 occasions. Seven photo-identified resident individuals appear to be involved in competitive interactions, spending a considerable amount of time associated with trammel nets, and decreasing natural feeding activities. The mean group size was 6.8 individuals (SD = 3.04, range 1-12) and calves were always present. Damage of various kind was detected on commercially relevant species such as Maena chryselis, Oblada melanura, and Loligo vulgaris. A total number of 10 boats carrying illegal driftnets was also recorded (mean length = 15 m, range=12-18 m). This fact, together with the findings of three dead animals due to fishing gears in June-July, underline the need of management strategies.

CM6 MARINE TRAFFIC AND THE CONSERVATION OF SPERM WHALE *PHYSETER MACROCEPHALUS* POPULATIONS IN CANARY ISLANDS. CETACEAN STRANDED CANARIAN NET 1980–2004

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Since 1980, the Cetacean Stranded Canarian Net, under the coordination of Canary Government, had recorded 462 cases of stranded cetacean. 121 cases (26,19%) are due to natural factors, 88 cases (19,04%) to human activities and 253 cases (54,7%) remain indeterminate. Within the cases died by human activities, collisions with ships represents the 42% (n=37). It is significant that since 1980 to 1999 have been only recorded 8 cases by collisions, and since this year, that it is in coincidence with the begin of Fast Ferries in the islands, the number of stranded cetaceans with signs of collisions had increase in a threatening way, reaching 37 cases in October 2004. In these cases by collisions, have been implicated 8 species, the sperm whale Physeter macrocephalus with 16 cases (43,2%), pigmy sperm whale *Kogia breviceps*, Cuvier beaked whale *Ziphius cavirostris* and short finned pilot whale *Globicephala macrorhynchus* with 4 cases each one. The main number of sperm whales with signs of collision have been detected in the north east coast of Tenerife, with 62,5% of the cases, mainly in July and August. The high non natural mortality showed in sperm whale, located in a very restricted area and critical habitat, and mainly in females and in a 62,5% young animals and females with calves in many cases, it could be turn the conservation of the sperm whale populations in Canary Islands in a difficult state.

CM7 BYCATCHES OF CETACEANS BY FRENCH DRIFNETS FOR TUNA IN THE NORTHWESTERN MEDITERRANEAN SEA

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For the second consecutive year the G.E.C.E.M. has been in charge of a study to estimate the number of cetaceans caught by the French tuna and swordfish driftnet fisheries in the north-western Mediterranean Sea. This study aimed also at understanding the parameters that influence the bycatches. From May to October 2005, 26 observers accompanied regularly the 9 fishing vessels that get longer nets and went frequently at sea. We gathered data from 82 fishing nights, which means 348 Nautical Miles of net observed. This represents 20% of the fishing effort of these nine

vessels (403 nights). The fishery includes 60 active vessels and we covered more than 10% of the total effort during the "at risk" period for bycatch running from June to September (788 nights). During our observations, 8 striped dolphins were caught by 5 different boats. Bycatches occur in 6 different nights: one in June, one in July and four in August, which correspond to the peak periods. Unlikely to the previous year, we only had one multiple bycatch of an adult and a calf. Data are under analysis to estimate the total number of bycatches for the whole fishery, taking into account the length of the net and the fishing effort of each vessel. It will be compared to similar previous study on this fishery in 2000 (without pingers) and 2001 (Imbert et al. 2001 and 2002). We will also highlight the role played by different parameters on the rate of bycatch such as characteristics of the net, use of "pingers", time and area, …The 10th of August, the French State Advisory banned this fishery, and some fishermen behaviour may have change since then. We thus have to be cautious, because our sampling could not be representative of all the other fishing vessels. Finally, we did not observe cetacean bycatches other than striped dolphin. However, we know that some other species are occasionally caught in these nets, as sperm whales (3 this year, 1 last year), pilot whales and probably also Risso's dolphins. These bycatches of less numerous and more vulnerable populations could indeed be more worrying.

CM8 SPATIAL AND TEMPORAL DISTRIBUTION, AND ABUNDANCE OF SPERM WHALES (*PHYSETER MACROCEPHALUS*) REALTED TO COLISIONS WITH THE MARITIME TRAFFIC O IN THE STRAIT OF GIBRATLAR BETWEEN 1998 AND 2005

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Student award: Postgraduate

In 2005 the Ministry of Environment of Spain financed a study whose aim was to analyse the risk of collisions between cetaceans and the maritime traffic. In this presentation the risk of collisions between Sperm whales and the maritime traffic is analysed. A total of 22 648 km of effort from the research boat Elsa, 348 sightings of Sperm whales, and 548 pictures of flukes were used to analyse the spatial distribution (using GAMs), the temporal distribution (using the Encounter rate per month), and the abundance (thru photo-identification). A total of 21 sperm whales are distributed between the month of March and August with a peak in May in the southern part of the deepest areas of the Strait. The maritime traffic was also analysed, giving a total of 91009 ferries and cargos crossing the area every year. A total of 13 whale watching

boats are also working in the Strait between March and November. This data suggest that there is a potential risk of collisions between the species and the maritime traffic. A total of almost two collisions were recorded between 2001 and 2005, one of them been seen directly by CIRCE in September 2002. Morocco is building a new harbour in the Strait, just in front of the main area for sperm whales, and will start to work ending 2007. This new harbour will change all the ferry and fast ferry lanes in the area, and these lanes will directly cross the main area of distribution of the specie studied in this work. This data shows clearly that the population of sperm whales has a real treat in the Strait of Gibraltar, and if no mitigation measures are taken into account in the area its survival rate could decrease dramatically

CM9 MEDITERRANEAN MONK SEAL AND FISHERY INTERACTIONS IN THE NATIONAL MARINE PARK OF ALONNISOS, NORTHERN SPORADES

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Some of the most serious threats to the survival of the critically endangered Mediterranean monk seal are fisheries related. In order to understand the nature and extend of these threats and effectively protect the species a questionnaire survey was carried out for the first time in the National Marine Park of Alonnisos, Northern Sporades (NMPANS). The questionnaire was designed so as to collect information on the size and nature of the fishing sector, the diversity and size of key elements of the marine fauna in the NMPANS, the marine fauna and the overall fisheries-related problems in the fishery sector and proposals for possible solutions. One quarter (n=26) of all the fishermen of the island of Alonnisos who operate in the Park were interviewed. The results of the questionnaires indicate that the fishing sector in the NMPANS is coastal and low scale. The marine mega fauna of the area is rich, both in terms of species diversity and population size. Dolphins and monk seals in particular, are observed frequently within the Park and are frequently reported to cause problems to the fishermen. Although such damage does affect fishing gear and fish catches and is on several occasions extensive, it is not considered by the fishermen in the NMPANS as the key problem for their livelihood. Based on the fishermen's opinion, over fishing and illegal fishing are the biggest threats to their activities, and most of the solutions proposed were related to stricter enforcement of the existing legislation and the promotion of sustainable fishing practices. Based on the information collected during this study and the experience gained through the implementation of conservation activities in the Park over the past years, an action plan was elaborated that aims in mitigating the existing conflict between monk seals and fishermen in the wider NMPANS area.

CM10 ASSESSMENT OF CETACEAN THREATS IN MADEIRA ARCHIPELAGO: AN APPROACH TO CONSERVATION MEASURES

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Anthropogenic threats, that significantly affected cetacens worldwide in the past, namely whaling, are now more subtle, but may also cause impacts that can result in habitat loss (e.g. pollution, boat traffic, fishery, whale watching). In Madeira Archipelago, despite all cetacean species are under international, national and regional legal protection, there are several threats that needed to be assessed due to the increase of human activities on the last 2 decades. The aim of this study is to describe, evaluate and classify human activities impact in all cetacean species that can be found in the Madeira Exclusive Economic Zone; evaluate legal and management measures that are in force to reduce or eliminate the identified threats; and to propose changes on these measures aiming a better adjustment to present reality. A total of 17 threats are described, from which 9 were found to have identified impacts and 8 considered as potential impacts. For each threat, the frequency or possibility of occurence and the level of impact on the animals is classify as low, medium, high or unknown. Four threats were considered needing imediate management measures and monitoring; 6 were considered needing monitoring; and 7 needing further specific studies to confirm potential impact. This study resulted on a document that was delivered to the regional governmental authorities in order to contribute as a tool for the management and conservation of cetaceans in Madeiran waters.

CM11 ANTROPOGENIC ACTIVITIES REALTED TO CETACEANS IN THE STRAIT OF GIBRATLAR AND THE GULF OF BARBATE

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Student award: Undergraduate

The Strait of Gibraltar, the only natural passage between the Mediterranean Sea and the Atlantic Ocean, characterized by a surface inflow of Atlantic waters and a deep outflow of dense Mediterranean waters, is inhabited by a 8 cetacean species. The object of this study is to make aware of the environmental impact that the following factors are imposing upon the population of cetaceans in this area. 1) The Strait is the second most

busy in marine traffic, amounting to more than 91009 passage annually (merchant, military ships and ferries). 2) Due to the importance of the fishing industry there are numerous interactions between the fishing fleets and cetaceans. 3) The increasing activity of whale watching is lacking regulations up until today, causing interactions in the habitat and behaviour of the existing cetacean species. 4) Due to the joined political interests in the area, the management of the problems posed in this study is quite difficult. The creation of a new harbour in the north of Moroco, that will start its activities will change all the shipping lanes in the area and the creation of wind farms in the Gulf of Barbate could affect 8 species of cetaceans present in the area. Mitigation measures have to be taken into account urgently to minimise the impacts of these activities

CM12 ASSESSMENT OF CETACEAN BYCATCH IN CENTRAL PORTUGAL

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Since the year 2000 the area between Furadouro and Marinha Grande (Centre Portugal) has been monitored to detect cetacean strandings and to evaluate death causes.The study area, with approximately 100 Km of coast, has two important fishing harbours and several locations where artisanal beach purse seine fishing is used. Between 2000 and 2005, 316 cetaceans belonging to 7 species were recorded. All animals were inspected to detect by-catch signs. The most collected species was common dolphin with 67% of the total stranded animals. The harbour porpoise accounts for 12%, being the second most common species.Analysing the collected data we can assume that fishing gears captured about 30% of the animals and that 14% of them are suspected to be by-caught.The most problematic incidental captures are related with harbour porpoise, where 38% of the detected animals were captured in the artisanal beach purse seine fishery. Information obtained from fishermen reports and records from the activity of the beach purse seine fisheries were crossed over with data obtained from stranded harbour porpoises in order to validate the by-catch signs observed in the stranded animals. The incidental captures in fishing activities, in this coastal area, seems to be a serious problem. A significant number of cetaceans stranded were incidental captured in fishing activities, predominantly common dolphins and harbour porpoises. Another

relevant discovery is that the artisanal beach purse seine fishery appears to be the major problem for harbour porpoises. The high number of stranded cetaceans due to by-catch in this area reveals that it is urgent to understand which type of interactions and scenarios contributes to cetacean mortality. Only with this information it is possible to implement physical actions that might help to reduce cetacean mortality induced by local fisheries.

CM13 BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN THE KORNATI NATIONAL PARK, CROATIA: "THE TOURIST SEASON BEGINS – WE LEAVE"

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Nowadays, bottlenose dolphins are the only regular component of the Adriatic cetacean fauna. The Kornati National Park is part of the Dalmatian Adriatic coast of Croatia. It covers an area of 220 km2 with about 89 islands. Even since the days of the Romans, this area was known for its abundance of fish. Today, against all expectation, the dolphins occur only in low densities there. Reasons for this phenomenon are still unknown, disturbance by increasing tourism or decreasing fish stocks could be obvious explanations. Therefore, our study dealt with the questions, how many dolphins inhabit this area and whether they are permanent or occasional residents. Does frequency and distribution of bottlenose dolphins change within and outside the tourist season in Kornati National Park. The main tourist period lasts from the beginning of July to the end of August, when many tourists visit the national park with their yachts. Surveys were carried out from May to October 2005 in cooperation with the National Park Administration and the Blue World Institute, Losinj. We recorded 28 individual dolphins with photo-identification. The dolphins were sighted more frequently during the months of May/ June and September / October with relatively few tourists. In July and August the dolphins appeared to avoid Kornati Channel, the core zone of the National Park, which at this time was densely populated by tourist boats. Sightings were mostly limited to the offshore area, or to very short encounters in the Channel area. Accordingly, the number and activity of boats appeared to influence the pattern of habitat use of the dolphins. As the research and knowledge of bottlenose dolphins in Kornati National Park is still in its infancy, future research projects will have to verify these results.

CM14 NORTHERN FUR SEAL ENTANGLEMENT IN MARINE DEBRIS

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The very important problem that arises from the marine mammal/fisheries interaction is the entanglement of marine mammals in marine debris. The study of northern fur seals involved in entanglement of marine debris has been made on South-Eastern rookery at Medniy I. (Commander I.) in 2005. The count of northern fur seals population and photographed by digital cameras with telephoto lens of entanglement animals were made. The photos are use for identified of animals. There are all northern fur seal age groups by sex and age class (excluding pups) is involved in entanglement debris. Some categories of debris account for the common of northern fur seals entanglement: closed plastic packing bands, net materials (trawl webbing, gill net etc.), ropes and do not identified items. From 26 May to 19 August the entanglement northern fur seals were registered 63 times. The analysis gathering data conducted by material of debris, it's colors and age-sex categories of animals are show present on the rookery 22 entanglement northern fur seals. The size of northern fur seals population on the rookery about 15200 animals. Hence, the proportion of entanglement animals is 0.14%. The analyses data was made by photo identification are shown 38 entanglement animals are present on the rookery (0.25%). The proportion of different debris on the animals is: closed plastic packing bands – 20.5%, net materials – 47.2%, other items – 32.3%. Results from the present study conduct that more often debris are the different net materials. It's same as in the other recent investigations for Steller sea lions (Calkins, 1987, Hoover, 1988, etc.) and northern fur seals (Robson and Fowler, 1994). For more acute data about number of entanglement animals is need use photo ID. The magnitude of observed entanglement in debris by northern fur seals do not sufficient but in sum with other human impacts (oil spill, PCBs, heavy metals etc.) it's became very important problems.

CM15 HOW DO STRANDINGS RELATE TO BYCATCHES OBSERVED AT SEA?

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Stranded cetaceans are often found to have been the victims of bycatch in various fishing operations. The numbers of stranded animals fluctuate markedly from year to year, due to -among other things- vagaries of the weather and in recording efficiency. It is sometimes also assumed that trends in strandings can be attributed to changes in fishing intensity in the fisheries responsible for bycatch. In this study we compare trends in the numbers of recorded stranded common dolphins and harbour porpoises in parts of the UK with trends in fishing effort in certain fisheries that are held to be responsible for bycatch mortalities. We also compare length frequency distributions and sex ratios among stranded animals with those recorded for animals observed taken in the same fisheries. There is little correlation between fishing effort and strandings, suggesting that other factors such as the weather are more important driving variables in determining the number of stranded animals. Furthermore, in the case of one intensively studied fishery, the pelagic pair trawl fishery for bass in the Channel, there are some significant differences between animals recorded on the boats and those recovered from the shore, suggesting that other fisheries are responsible for bycaught animals that end up stranding on shore in this region.

CM16 DOLPHIN TOURISM IN EAST AFRICA: TOWARDS SUSTAINABLE USE, CONSERVATION AND MANAGEMENT

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Sustainable dolphin tourism in East Africa is a collaborative effort launched in 2003 with participants from Mozambique, South Africa, Sweden and Zanzibar. The objectives are to build the capacity for sustainable dolphin tourism in the East African region. Basic and applied research is conducted to assess status and promote effective conservation and management of dolphin populations and tourism activities while accounting for local social and socio-economic aspects. In order to implement this, an interdisciplinary

approach have provided scientific information on the animals' distribution, abundance, mortality, stock structure, biology, ecology, and behaviour, and information on human social and socio-economic structure. The project is conducted in two geographical areas where dolphin tourism activities are ongoing; south coast of Zanzibar and Ponta do Ouro, Mocambique. We use questionnaires to collect data from stake-holders and local communities, boat based surveys to collect data and samples on local dolphin populations and observer programmes to investigate fisheries mortalities. The Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) is the focal species for the tourism, although Indo-Pacific humpback dolphins (*Sousa chinsensis*) are also affected by the activities. Photographic identification data of individual dolphins show limited distribution of small resident populations of dolphins in the two areas. There are about 170 bottlenose and 70 humpback dolphins off the south coast of Zanzibar and about 150 bottlenose dolphins off Ponta do Ouro. The animals are found year round in the areas based on high percentages of within and between year resightings. The studies show that both fisheries and dolphin tourism pose threats to the dolphin populations and that there is need to mitigate fisheries mortalities and to regulate the dolphin tourism. Questionnaire surveys show that the dolphin tourism has become very important to local economies in Zanzibar where a stake-holder association has been formed to ensure future sustainability of the activities.

CM17 OCCURRENCE OF CETACEANS IN S. TOMÉ AND PRÍNCIPE ARCHIPELAGO AND ITS RELATION WITH ENVIRONMENTAL VARIABLES

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Student award: Postgraduate

S. Tomé and Príncipe is an archipelago located in the Gulf of Guinea in front of the Gabonese coast. This equatorial archipelago seems to be an important area for cetaceans, probably due to large concentrations of prey, as well as the existence of several small bays and shallow water that constitute preferred rest areas. But in comparison to other areas of the world, little is know about cetacean communities in S. Tomé and Príncipe archipelago. A biological research to study cetacean's occurrence was conducted between 2002 and 2005. Sightings of humpback whales (*Megaptera novaengliae*), bottlenose dolphins (*Tursiops truncatus*), pantropical spotted dolphins (*Stenella attenuata*), orcas (*Orcinus orca*), sperm whale (*Physeter macrocephalus*) and pilot whales (*Globicephala spp*) were recorded. On the field, data such as photographic, GPS, acoustical and behavioural records, was obtained to study cetaceans' relative abundance and distribution, their group composition and habitat use. The main objective of this work was relate the occurrence of the different cetaceans' species with sea

surface temperature (SST), line distance to coast and depth, in order to understand their distribution around the main island of the archipelago. In the laboratory, using the GPS TracKeMaker 12.3, maps were produced for each species. We also used a GIS software (ArcView) to relate all the ecological and behavioural data, allowing to identify preferential areas for cetaceans and to establish a proposal to priority conservation areas. It is also important to refer that an important whale watching industry is now beginning in S. Tomé and Príncipe and efforts are being made to create a legal background to regulate this and other human activities that may affect directly or indirectly whales and dolphins in this archipelago.

CM18 CAN MONK SEALS IN MADEIRA COEXIST WITH MAN?

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In the end of the 80's decade the Mediterranean monk seal (*Monachus monachus*) status at Madeira archipelago was very critic. The population of 6-8 individuals was in regression and confined to Desertas islands. However, a conservation program developed by the Parque Natural da Madeira service initiated in 1988 inverted that situation. Nowadays, the population is around 30 individuals and seal sightings began to occur around Madeira Island being the Madeira community alerted for the importance of informing these sightings. Between 1988 and 2005, 274 sightings were registered. Analysing the information collected, we conclude that individuals from Desertas transit to Madeira and at least two individuals reside in Madeira. Sightings were detected all around Madeira but were more frequent on the South-eastern of the island where it was confirmed the use of one cave by two seals. It is here, where the human activity is higher (there are more potential observers), but it is also the closest area to Desertas having good orographic and climatic conditions for the species. Seals were more frequent during summer when exists more potential observers but also when at Desertas islands seals are more independent (out of the breeding season). It was also registered anecdotal negative interaction with men. In two occasions one seal bitted a diver and fishermen are complaining about damages caused by the seals. It is a fact that this species returned to Madeira and its interaction with man can be once more not pacific. What can be done to avoid this situation? The public awareness directed to the Madeira community mainly to the fisherman allied to compensatory measures should be maintained as well as the vigilance of the areas where seals are more frequent, and the real impact of the species in the fisheries should be studied.

CM19 SPATIAL DISTRIBUTION OF SMALL ODONTOCETES IN THE STRAIT OF GIBRALTAR IN RELATION WITH THE MARITIME TRAFFIC, THE FISHERIES AND THE WHALE WATCHING ACTIVITIES

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Student award: Undergraduate

The Strait of Gibraltar, the only natural passage between the Mediterranean Sea and the Atlantic Ocean, characterized by a surface inflow of Atlantic waters and a deep outflow of dense Mediterranean waters, is inhabited by a large number of cetacean species. The present study focuses on the occurrence and the spatial distribution of small odontocetes species within the Strait in relation to the maritime traffic, the fisheries and the whale watching activities. Shipboard visual surveys were conducted between 2001 and 2005, covering 11235 km. A total of 877 sightings of 6 cetaceans species were realised. The spatial distribution of 6 odontocete species: common dolphins (*Delphinus delphis*), striped dolphins (*Stenella coeruleoalba*), long-finned pilot whales (*Globicephala melas*), bottlenose dolphins (*Tursiops truncatus*) and killer whales (*Orcinus orca*) was examined with respect to the depth, the slope, the latitude and the longitude using GAMs. These analyses indicate that these species are directly related to the whale watching activities (13 boats), and the maritime traffic (91009 fast ferries, ferries and cargos crossed the area in 2004) and the fishing activities of red tuna tuna (*Thunnus thynnus*) fisheries occurring in the southwestern part of the Strait

CM20 FIRST REVIEW OF WHALE-WATCHING ACTIVITY IN THE PELAGOS SANCTUARY

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Since 1986, the whale-watching activity has grown considerably inside the Ligurian Sea, with the increase of boat and operator numbers. In 1999, the creation of the Pelagos Sanctuary proved the necessity to protect cetacean population and their respective habitat and to construct a structure incharge of the Pelagos area management.

Since today, no up-dated review is available on the whale-watching activity inside Pelagos. The purpose of this work is to present the first review of the whale-watching activity along the ligurian coast. Because it is commonly accepted that cetaceans are concentrated in special habitats with special oceanographic characteristics, the present work analyses oceanographic features of the whale-watching area to confront it with the known cetacean habitat. Navigation and sighting data were collected through a shared standard method by 7 whale-watching boats totalising 193 one-day surveys. On a total of 14147 NM (representing 1304 hours), 9118 NM were consecrated to survey activity (852 h) between Genoa and Imperia. Survey tracks were divided in 1-mile unit and bathymetry, slope, and daily Sea Surface Temperature values were determined. Results of the whale-watching effort were compared to usual animal distribution. Moreover, during the total of 187 hours spent with animals, 522 sightings were made, with 57 % striped dolphins, 23 % fin whales, 12 % Cuvier's beaked whales and 8 % other species. All results were monthly mapped, synthesized covered effort and sightings positions. This study shows the importance of cooperation between whale-watching operators, in order to share intelligibly Pelagos Sanctuary with the respect of cetacean measures of protection.

CM21 WHALES WATCHING ACTIVITIES IN THE SOUTHERN LAGOON OF NEW CALEDONIA: CURRENT STATUS AND EVOLUTION SINCE 1995

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Once considered a sustainable industry, whale watching is now often regarded as a potential threat for cetacean species. Many studies have shown the presence of whale watching vessels likely to affect whales and dolphins behaviour, emphasising the need to monitor populations subject to such activities. Whale watching in New Caledonia has become highly popular since the start of commercial operations in 1995. It specifically targets a small population of humpback whales wintering in the Southern Lagoon and using these waters as their main breeding ground. No regulations currently exist to control this growing industry. Between July 14th and September 4th of 2005, a specific study was carried out in order to assess whale watching activities in this area. Using a theodolite, whales and boats in the vicinity were tracked from a vantage point overlooking the Southern Lagoon. Data regarding the number of commercial boats and cruises, as well as the number of passengers were compared to historical data collected since the start of commercial whale watching. The number of cruises increased from 19 in 1995 to 238 in 2005. The number of passengers increased from 129 in 1995 to 3109 in 2005. Eighteen commercial boats operated in 2005, compared to four in 1995. Boats were observed within 1000 metres of humpback whales 70.4 % of the time, with

a mean number of 1.61 boats present at all times. These results show that humpback whales wintering in the Southern Lagoon of New Caledonia are highly exposed to whale watching boats. With the ongoing development of this industry, these whales are likely to face increased exposure in the years to come. Further research needs to be undertaken in order to assess the effects boats may have on whales behaviour and to instate appropriate regulations.

CM22 TEMPORAL DISTRIBUTION OF MARINE MAMMALS IN THE STRAIT OF GIBRALTAR IN RELATION WITH THE MARITIME TRAFFIC, THE FISHERIES AND THE WHALE WATCHING ACTIVITIES

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Student award: Undergraduate

The Strait of Gibraltar, the only natural passage between the Mediterranean Sea and the Atlantic Ocean, characterized by a surface inflow of Atlantic waters and a deep outflow of dense Mediterranean waters, is inhabited by a large number of cetacean species. The present study focuses on the occurrence and the temporal distribution of small odontocetes species within the Strait in relation to the maritime traffic, the fisheries and the whale watching activities. Shipboard visual surveys were conducted between 1998 and 2005, covering 22 648 km. A total of 2284 sightings of 10 marine mammals species were realised. The temporal distribution of common dolphins (*Delphinus delphis*), striped dolphins (*Stenella coeruleoalba*), long-finned pilot whales (*Globicephala melas*), bottlenose dolphins (*Tursiops truncatus*), killer whales (*Orcinus orca*), minle whales (*Balaenoptera physalus*), fin whales (*Balaenoptera physalus*), blue whales (*Balaenoptera musculus*) and hooded seals (*Cistophora cristata*) was analysed using encounter rates per month. These analyses indicate that these species are directly related to the whale watching activities (13 boats), and the maritime traffic (91009 fast ferries, ferries and cargos crossed the area in 2004) and the fishing activities of red tuna tuna (*Thunnus thynnus*) fisheries occurring in the southwestern part of the Strait.

CM23 HARBOUR SEAL FORAGING HABITAT IN THE WESTERN NORTH SEA: POTENTIAL CONFLICTS WITH OFFSHORE ENERGY DEVELOPMENTS

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Until recent strategic environmental assessments in relation to offshore oil, gas and wind farm licensing around Britain, knowledge of the offshore distribution, movements and behaviour of harbour seals was very limited. In this study, satellite telemetry was used for the first time to track more extensive movements of harbour seals from the Moray Firth, northeast Scotland (n=10), St Andrews Bay, southeast Scotland (n=24) and the Wash, eastern England (n = 24). The data was used to construct habitat models for harbour seals and to determine key foraging areas and their relation to human activities offshore. The three sampling areas have differing levels of anthropogenic activity enabling comparison between relatively low, moderate and intensive concentrations of oil and gas infrastructure. Predictors of foraging habitat characteristics were modelled using generalized linear models. Explanatory variables included the output from a null model of habitat accessibility, bathymetric, substrate features and proximity to oil and gas infrastucture. In all three areas telemetry positions were aggregated into localised 'hot-spots' of foraging activity between 10 and 120 km from the haul-outs, largely in waters shallower than 60 m. Harbour seals in the Moray Firth and St Andrews Bay were found to select sandy substrates with either higher percentages of gravel or lower percentages of mud than available. This describes the burrowing habitat of sandeels, one of the main prey species of harbour seals in these areas. Animals travelled significantly further than previously thought, demonstrating important overlap between foraging and offshore human activities. No consistent relationship with anthropogenic factors was found, in each case differing distributions could be explained by other habitat factors suggesting the need for further investigation and larger scale statistical analyses comparing regions.

CM24 CONSERVATION OF DOLPHINS IN ZANZIBAR

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Several dolphin species occur around Zanzibar, Tanzania. We have focused our studies on *Sousa chinensis* (Indo-Pacific humpback dolphin) and *Tursiops sp*. (Indo-Pacific bottlenose dolphin) off the south coast of Zanzibar island. Genetic analyses, using

mtDNA sequences, indicate that the Tursiops found off Zanzibar should be grouped with a proposed new species of Tursiops inhabiting the western Indian Ocean. There is also a genetic differentiation between the populations off northern and southern Zanzibar, indicating a limited exchange of reproducing females. Population estimates for the years 1999 to 2002 ranged between 71 and 77 for Sousa and 148 and 173 for Tursiops, using photo-identification and mark-recapture methods. Analysis of spatial density corrected for survey effort showed that the dolphins primarily utilised only a fraction (2% Sousa and 8% Tursiops) of the 26 km2 study area. Bycatch in gillnet fisheries has been estimated using independent observers. The annual bycatch estimates represent anthropogenic mortalities of 5.6% for the Sousa and 8% for the Tursiops populations. These mortality estimates are of serious concern and need to be mitigated given that levels over 2% are considered unsustainable. Dolphin tourism in the area poses an additional threat as behavioural changes have been demonstrated with increasing tourism activity. Although on a positive note, the tourism has replaced a former hunt conducted in the area. Preliminary results from socio-economic studies show that there may be room for further growth of the dolphin tourism. However, in order to be sustainable for the dolphins it has to be monitored and managed. A management plan for both species is under development. Introduction of guidelines for best practise as well as education of local guides will hopefully make dolphin tourism sustainable and bring socio-economic benefits to the rural coastal communities.

CM25 ABUNDANCE ESTIMATION OF GREY SEAL *HALICHOERUS GRYPUS* PUPS IN NORTH WALES, 2004

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Three Welsh Special Areas of Conservation (SAC) designated through the 1992 EC Habitats Directive have grey seal (*Halichoerus grypus*) populations. Pup production, pup distribution and habitat accessibility are aspects of grey seal populations in SACs that require monitoring under the UK's Common Standards Monitoring scheme. To determine pup production in North Wales and Pen Llyn a'r Sanau SAC, a random stratified plot sampling approach was used. Grey seal pups were counted at randomly selected pupping sites (plots) as a stratified sample of sites previously identified during seal censuses. Stratification was based on pup number (density). Sampling effort was apportioned to each stratum with Neymans Optimal Allocation and each plot was visited several times during the pupping season to provide a cumulative count per plot. Pup abundance was calculated using a Horvitz-Thompson intuitive estimator. Pup abundance was estimated as 96 (±9.57) and resembles past pup production estimates by full censuses. Plot sampling was an efficient and robust way of sampling the grey seal

pups in North Wales and will be instrumental in providing a technique to deliver pup production estimates for SAC monitoring and reporting on population condition.

CM26 FAMILY ZIPHIIDAE IN THE OCCIDENTAL CANARY ISLANDS: TENERIFE Y LA PALMA. CONSERVATION PROGRAMS

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The significance of the Family Ziphiidae in the Canary Islands has increasing in the scientific community as a consequence of the atypical strandings happened by the presence of navy exercises, completed near the islands coast. In this way, on account of an agreement between the Spanish Defense Ministry and Canary Government, it was started a multidisciplinary study developed by several institutions and scientific associations about the Ziphiidae family. The main aim was to increase the knowledge to guarantee the conservation of this populations in the islands. Thereby, Tenerife Conservación developed this study about the presence, abundance, distribution and ecology in the occidental island, Tenerife and La Palma by means of transect lines method and FotoID. In the course of 10.294,6 nm, the results obtained from 74 sightings make clear the presence of at least 3 species: Cuvier beaked whale Ziphius cavirostris (10,8%), Blainville beaked whale *Mesoplodon densirostris* (81%) and Gervais beaked whale *Mesoplodon europaeus* (1,3%). The remainder were indeterminate Ziphiidae sightings. The specie with the mayor presence, Balinville beaked whale, concentrated the 64,9% of the sightings throughout August, September and October, showing females with calves in the latter. Nevertheless has been observed all the year round, primarily in the SAC ES-7020017 of Tenerife, so this island is being proposed like a privilege place by the regular presence of these cetaceans.

CM27 WHAT TO DO WHEN CONSERVATIONS IS SUCCESSFUL? OR ATTEMPTS TO REFRAME THE FINNISH SEAL POLICY?

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A critical state of the Baltic Sea grey seal population lead in 1980's to stringent conservation in the Baltic Sea area. Since that the population size has multiplied and is steadily growing (Halkka et al. 2005). However, this positive development has had also negative consequences in Finland where coastal fishing suffers from economic losses caused by seals. Different mitigation measures have been introduced by state

authorities, but in recent years increasingly also by non-state actors like fishermen's organizations. However, activities have been weakly coordinated. A term 'institutional void' (Hajer 2003) captures the present situation well. The institutional void is a situation, in which the state institutions cannot anymore alone manage societal problems. Inability of the state actors stems from the complexity of problems and from an emergence of new powerful and legitimate actors. The situation of institutional void is especially susceptible to attempts of redefining the policy problems and the respective policy-making (Laws and Rein 2003). This paper studies various attempts in Finland to reframe 'the Finnish seal policies'. Interviews of key actors in Finland and relevant policy documents are the material for a qualitative content analysis. The reframing attempts have taken place on different governance levels and by different authorities. National authorities have introduced protective hunting, compensations and subsidies that are regulated also by international agreements and laws (HELCOM and EU). At the same time Finland has strengthened conservation of seals by designating seal reserves. On sub-national level there are activities to reframe the seal policies as 'sustainable use of seals as resource' while also environmental NGOs have actively tried to influence policies. The paper shows that the framing of seal policies on different levels or forums works partly on their own grounds, but interchanges between all levels take place. This opens a possible avenue to finding common grounds.

CM28 HUMAN IMPACTS ON COASTAL CETACEANS AROUND THE MALTESE ISLANDS

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The importance of assessing the extent to which each human activity may directly and indirectly impinge on the health and survival of cetacean species cannot be underestimated in any area of the Mediterranean Sea. The central and southern areas of the Mediterranean is a case in point where due to lack of funds and opportunities such research has been slow to develop in comparisons to some other areas. This situation is fast changing as research in this region is catching up and contributing to a fuller understanding of the Mediterranean-wide cetacean status and conservation needs. A detailed scientific research that has been undertaken utilizing both aerial and intensive boat surveys since 1997 has allow for the study of the abundance, distribution and human impacts on cetacean species utilising both offshore and coastal waters around the Maltese Islands in the Central Mediterranean Region.The numerous strip transects and large area covered by this long-term, year round and ongoing project has allowed for the discovering of important populations and representations of cetacean species thought to be found only in other parts of the Mediterranean, including the sperm and fin whales. The data analyses according to season and species allows for a clear indication of the environmental and human associations cetaceans live or die

with. Activities investigated include fisheries' gear (coastal and offshore), human coastal pollution due to sewage outflows and aquaculture, boat/vessel disturbance and coastal developments. Among the species most at risk are Bottlenose, Common, Risso's dolphins and Sperm whales. All these species have also been involved in clear incidences of fatalities caused by some human activities, over and above being still observed to be under serious danger through on going and developing regional marine activities.

CM29 BALTIC SEA PORPOISE DATABASE- SHARING DATA ACROSS BORDERS

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The Central and Eastern part of the Baltic Sea was once inhabited by a large number of harbour porpoises. Investigations have shown that the animals in this area belong to a distinguished subpopulation. This population has drastically decreased leading to an increased conservation concern. Standard methods for determining population size in low density areas are difficult to apply and alternatives for determining the status of the Baltic Sea harbour porpoise need to be considered. Overall knowledge on Baltic Sea porpoises is low, yet many of the bordering countries have unpublished anecdotal or scientific evidence of this species. With an international effort these data sources can be combined to provide us with more insight on the biology of this species. With this in mind, a database is being created as a part of the project "Assessment and Management-oriented Characterisation of Harbour Porpoises from the Baltic Sea and Investigations on Reproductivity, Age Distribution and State of Health" within the scope of the Jastarnia Plan (ASCOBANS Recovery Plan for Baltic Harbour Porpoises). The database includes recent and historical incidental and effort sightings, strandings and bycatches. Furthermore, information on acoustic monitoring of porpoises with towed or stationary hydrophones as well as information on parameters of the life history and health status will be included. The database will be presented at www.balticseaporpoise.org via an interactive map. The website is available for researchers as a forum to compare and share data and also to the general public as an educational tool. Several countries have included data, and more have shown a definite interest. The aim is that all countries and organisations around the Baltic Sea will be involved in this cooperation to ensure continuing research and improve protection and management of the Baltic Sea porpoise.

CM30 ALGECIRAS BAY: A POLLUTED AREA WHERE DOLPHINS AND MAN CO-EXIT

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Algeciras Bay, with about 50 squared kilometres, is located in the Strait of Gibraltar, Southern Spain. It is an important industrial area, with chemical factories, refineries, thermal power plants, iron works, paper mills and ship yards, along with a major harbour and intense shipping traffic. In spite of the high degree of pollution in this bay, resident populations of dolphins (*Delphinus delphis, Stenella coeruleoalba* and *Tursiops truncatus*) inhabit this area. The bay provides them with protection against the strong storms typical of the Strait of Gibraltar, and also with food, since biomass of marine mollusc and fishes is high in Algeciras Bay. *Delphinus delphis* is the most abundant resident species in this area, with an estimated group size of 50-60 individuals, followed by *Stenella coeruleoalba* with 40-50 and *Tursiops truncatus* with 5-15. Interestingly, Delphinus delphis has been recently considered in critic danger of extinction in Southern Spain, and it is rated as endangered in the Mediterranean, with its populations being in clear regression. We have conducted behavioural and ecological studies of the D. delphis populations inhabiting Algeciras Bay from 2003-2005 and we can confirm that this species uses the bay mainly as feeding, breeding and schooling area. Surface feeding represented near 40% of the total behaviour and in about 80% of all sightings, dolphins calves were present; furthermore, calves were seen all year round. For these reasons, this species need particular conservation assessment, monitoring and management planning in Algeciras bay, where a balance between conservation and industrial development should be reach. The present study is included in the Spanish project “Estudio y seguimiento de Cetáceos en el Estrecho de Gibraltar” inside the programme “Gestión sostenible de recursos para la conservación del Medio Marino Andaluz” funded by the “Consejería de Medio Ambiente de la Junta de Andalucía.

CRITICAL HABITAT

CH1 TRACE METAL CONCENTRATIONS AND ARSENIC SPECIATION IN THE LIVER OF HARBOUR PORPOISE (*PHOCOENA PHOCOENA*) AND BELUGA WHALE (*DELPHINAPTERUS LEUCAS*) FROM THE NORTH ATLANTIC COAST OF CANADA

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Concentrations of arsenic (As), cadmium (Cd), copper (Cu) and zinc (Zn) were determined in the liver of harbour porpoises (*Phocoena phocoena*) and beluga whales (*Delphinapterus leucas*) to elucidate their accumulation with age, sex, feeding habits, body weight and geographical distribution. Samples of liver were collected from animals stranded or by-caught between 1998 and 2003 from three geographical regions of the North Atlantic coast of Canada, Estuary and Gulf of St. Lawrence, and Labrador Sea. The inorganic elements were quantified in the marine mammal livers by inductively coupled argon plasma mass spectrometer (ICP-MS), arsenic speciation was performed by high performance liquid chromatography (HPLC) coupled to ICP-MS. Higher concentrations of hepatic As, Cu and Zn were correlated with smaller animals, and were present at significantly greater concentration in the liver of juveniles; counter intuitively lower concentrations of As and Zn were measured in juveniles of beluga whales. Lower hepatic Cd concentrations were measured in all juvenile animals. No correlation was determined in this study between trace metal concentrations in the liver and sex. Concentrations of total extractible arsenic and individual arsenic compounds (10 chemical species analysed) were also determined in liver samples. Total arsenic concentrations ranged from 0.27 to 0.91 µg/g dw. Harbour porpoises had the higher concentration of As. This study showed that harbour porpoises and beluga whales of the North Atlantic coast of Canada had similar concentrations of trace metals compared with other polluted geographical regions previously examined; this suggests that the occurrence of inorganic elements may be linked to differences in the diet of these marine mammals or due to proximity to anthropogenic or natural sources of contamination in the areas studied. Further work on various aspects of metal pollution in the marine environment is required to evaluate the cause-effect relationship on marine mammals in our seas.

CH2 LITERATURE REVIEW ON THE GLOBAL WARMING IMPACTS ON CETACEANS IN THE MEDITERRANEAN SEA

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The combustion of fossil fuels and the resultant impacts on climate may now represent one of the largest environmental threats for our planet. The impacts of global warming on marine ecosystems are today highly recognized by scientists and must be considered in the management of protected areas. This report presents a literature review to demonstrate the current and potential threats to populations of Mediterranean cetaceans and their habitats and prey. First, several studies show that Mediterranean sea temperature is rising. The decline of species which cannot adapt themselves to these new conditions could have a direct impact on predators, including cetaceans. Then, anthropogenic climate change may also affect habitats that have already become degraded by other human impacts. Moreover, the rise of atmospheric CO2 will also increase the acidity of seawater and is consequently expected to reduce the plankton calcification process. Many species of marine flora and fauna could therefore be affected by this acidification process, either directly or by impacts on associated species. Other global warming perturbations include changes in current patterns, which could alter the cetaceans' migration routes and communication capacity. This report is the first necessary step in order to direct further studies and take appropriate actions to limit the impacts of climate change on cetaceans.

CH3 HAS THE LINK BETWEEN MONK SEAL POPULATIONS OF THE AEGEAN SEA AND THE BLACK SEA BROKEN?

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This study was carried out to assess whether the link between monk seal populations of the Aegean Sea and the Black Sea still exists. For this purpose, the Istanbul Strait the northern part of the Turkish Strait System was chosen as the study area. The study was conducted at the pre-selected 8 fishing harbours in two periods from 28 May to 15 June 2005 and from 1 September to 15 November 2005 respectively. A brief questionnaire comprising 5 questions – 1. name and surname, 2. age, 3. fishing year experience, 4. ever encountered a monk seal in your fishing ground, and 5. the last time a monk seal encountered – was directed to randomly selected fishermen. During the study period,

each fishing harbour was visited every alternate day. As a result of the study, 55% of the fishermen (n=294) could have been interviewed. Among these fishermen, 53% (n=155) of them reported to have seen a monk seal. The minimum age of the fisherman who encountered a monk seal was found 38. When ranked in 10-year age intervals, there is an increasing trend from 31-40 year age group (6 %; n=50) to 71-80 year age group (94%; n=31). When fishing year experience considered, the minimum of 20-year experienced fisherman has seen a monk seal. If the fishing year experience ranked in 10-year intervals, the same increasing trend is also observed towards the more experienced fishermen rank categories. While, the last encounteers of the monk seals were in early 1980s at the Marmara exit of the strait, this was early 1990s at the Black Sea exit. It is believed that latter sightings were from the Black Sea population. Almost no individual seal encountered at the Marmara exit last two decades may indicate that the link between Aegean Sea and Black Sea monk seal populations has broken.

CH4 SITE FIDELITY OF INDIVIDUAL MINKE WHALES (*BALAENOPTERA ACUTOROSTRATA*) IN THE ST. LAWRENCE ESTUARY

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Boat-based photo-identification surveys conducted from 1999 through 2004 were used to assess habitat use of minke whales, *Balaenoptera acutorostrata*, in the summer feeding grounds of the St. Lawrence Estuary in Eastern Canada. 4’289 day-sightings of 209 individual minke whales were identified on 547 days. 35 regular visitors (i.e. seen on at least 40 different days in 4 to 6 different years) were included in this study. The sightings of these animals were analysed to identify individual preferences for one of the two main feeding sites found in the study area, which are (A) the slopes along the Laurentian Channel Head and (B) the confluence area of the Saguenay River as well as the Saguenay Fjord. On average these 35 whales were seen on 72.2 different days (SD = 25.1; range: 41-141) in 5.7 different years (SD = 0.6). 25 animals showed strong small-scale site fidelity with over 75% of sightings in their primary feeding area. These results indicate a strong specialisation of certain individuals to the unique environmental conditions of this area. This is further supported by the acquisition of individually distinguished feeding behaviour, observed over the last six years.

CH5 HABITAT PREFERENCE MODELS FOR BEAKED WHALES (FAM. ZIPHIIDAE) IN THE AZORES (PORTUGAL)

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Student award: Postgraduate

The beaked whales, family Ziphiidae, represent one of the least known and most elusive taxonomic group of cetacean species. Due to their long dive intervals, inconspicuous surfacing behaviour and apparent restriction to deep offshore waters, most beaked whales are infrequently encountered and difficult to identify at sea. Privileged settings make the Azores Archipelago a natural laboratory to test hypotheses about the ecological factors determining cetacean distribution and habitat preferences. However, in the Azores, knowledge on the distributional ecology of these odontocete species is largely unavailable, with most information stemming from scattered stranded specimens and opportunistic records. In this study, we quantitatively modelled beaked whale habitat selection from data collected on boat-based surveys conducted from 1999 until 2004 along pre-determined transects, covering a total of 28143 km on-effort. The research area was divided in grid cells of 1 nautical mile square, which were used as sampling units. Logistic GLMs were applied to model presence/absence of beaked whales and variation in encounter rates was estimated using krigging with external drift. The environmental variables analysed were: depth, sea-bottom slope, aspect, sea-surface temperature and ocean colour. In total, 67 sightings of beaked whale's groups were made: Mesoplodon beaked whales Mesoplodon spp. (40), bottlenose whales *Hyperoodon ampullatus* (12), Cuvier.s beaked whale *Ziphius cavirostris* (6) and non-identified beaked whales (9). Predicted distribution surfaces generated by the two different spatial modelling techniques differed in terms of smoothing, but evidenced similar general patterns, with overall preference for deep canyons, that possibly match with prey availability. This study represents a first attempt to describe habitats inhabited by beaked whales in this region. The application of GIS mapping allowed for visualization of highlighted habitat hot-spots which may help focus on-going research efforts in the context of management issues, namely the risk assessment of underwater noise pollution on ziphiids.

CH6 VALUING BASELINE SCIENCE: MARINE MAMMAL SIGHTINGS SURVEYS IN CANADA'S INSIDE PASSAGE

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If marine mammals and humans are to coexist in coastal ecosystems, then we need reliable information on animal distribution and abundance to guide conservation and management. But designing and conducting studies to collect such information is costly, and difficult to get funded if the value of the scientific output is judged solely in terms of the number and impact factor of resulting publications. Along the complex coastline of British Columbia (BC), Canada, bycatch of small cetaceans in commercial fishing nets has been identified as a conservation issue, but no estimates of porpoise or dolphin abundance exist for the area. Seismic surveys are proposed for the region, but systematically collected data on the distribution of acoustically sensitive cetaceans are scarce. Since 2004, my colleagues and I have worked to conduct design-unbiased surveys using limited funds, in order to obtain preliminary estimates of summer distribution and absolute abundance for marine mammal species in BC's inshore coastal waters. Judicious stratification, random sampling of substrata in proportion to area, and incorporation of shapefiles into the automated survey design algorithms in Distance 4.0 enabled us to plan a design-unbiased survey, given the amount of search effort our budget would allow. Our surveys were conducted between the BC-Alaska and the BC-Washington borders in the summers of 2004 and 2005, and more than 1000 sightings were recorded. Point estimates of abundance of two killer whale ecotypes obtained from this survey agreed well with those reported from annual censuses. This survey yielded the first coast-wide abundance estimates for five cetacean species, the first systematically collected snapshot of cetacean summer distribution in the area, and estimates of at-sea distribution for three pinniped species. It is hoped that this approach offers a general framework for cost-effective, efficient but unbiased surveys in other complex study regions.

ECOLOGY

E1 RELATIONSHIP BETWEEN FIN WHALE (*BALAENOPTERA PHYSALUS*) AND OCEANOGRAPHIC FEATURES IN THE LIGURIAN SEA DETERMINED BY GLM

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Student award: Undergraduate

The fin whale (*Balaenoptera physalus*) is one of the two most abundant species in the Pelagos Sanctuary (together with *Stenella coeruleoalba*). Because of the particular physical and biological features of this area, this species is present during the entire year, with different distribution and abundance. Since march 2004, 305 one-day surveys distributed at least during the three seasons (winter excluded), were conducted by the vessel of the Biology Department of Genoa University, Menkab, and by vessels of bluWest whale-watching operator. On a total of 36 098 km tracks, 174 sightings of fin whale occurred. The GLM technique was used in order to study the distribution of this species in respect to various parameters, such as remote-sensing Sea Surface Temperature, SST gradient, bathymetry, and slope. For this purpose, fin whale encounter rate was calculated for each class of parameters according to the univariate model and to multivariate model. The encounter rate is interpretable as a probability of sighting in a class calculated for each pixel of the covered area. Results produce the best function describing the encounter rate situation in respect to studied parameters. Increasing the number of data, the function shall become more and more accurate. A derived map of sighting probability could be daily designed and be available for update.

E2 QUANTIFYING BEHAVIOURS OF MINKE WHALE (*BALAENOPTERA ACUTOROSTRATA*) ACCORDING TO THEIR BREATHING ECOLOGY IN THE ST LAWRENCE ESTUARY

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In order to maximise the time submerged underwater, whales' breaths are often clumped together in short series, rather than being regularly spaced. The pattern in which whales come to the surface, respire, and dive again varies with behaviour and activity level. Minke whale blow rates were investigated in the St Lawrence Estuary. Samples of at least 25 minutes were collected throughout the summer feeding seasons (June to October) of 1995-1998 from presumably undisturbed minke whales performing four different behaviours; 1) Near-surface feeding (NS), at depths of 10-50m; 2) Deep feeding (DF), at depths >50m; 3) travelling (TRV) and 4) Surface feeding (SF). NS and DF samples were ascertained with SONAR. From these samples, various dive parameters were calculated and statistically assessed using Kruskal-Wallis Test across the four behaviours. Significant differences were found in all the dive features over all behaviour types: 1) overall mean surfacing intervals, ($H3 = 32.43$, $p = 0.000$); 2) mean dive duration, ($H2 = 46.86$, $p = 0.000$); 3) mean time between blows in a surfacing, ($H2 = 17.63$, $p = 0.000$); 4) mean surfacing duration, ($H2 = 36.84$, $p = 0.000$); and 5) mean number of blows in a cycle, ($H2 = 47.35$, $p = 0.000$). (SF does not show clearly measurable intervals and thus only parameter 1) was assessed). Further, when each behaviour was compared individually against each other for all the dive parameters, only 5 out of 18 showed no significance. This study has shown demarcated differences in the breathing regimes of minke whales according to their behaviour. Detailed knowledge of their blow patterns may provide a framework for defining activities by assisting in accurate determination and numerical categorisation of their specific behaviour types for future ethological studies.

E3 STRANDINGS OF MARIE MAMMALS IN SOUTH WESTERN EUROPE

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Student award: Postgraduate

An analysis of marine mammal strandings (1996-2004) was carried out for the ATLANCETUS project area which includes European Atlantic coasts: from the English Channel (France) to the entrance to the Mediterranean, as well as the Canary Islands (Spain), Madeira and the Azores (Portugal). A total of 5349 marine mammals belonging to 35 species was reported over the 9 years. Of these strandings, 777 animals (15%) could not be identified to species. The most common species were *Delphinus delphis* (2326 animals, 43%), *Tursiops truncatus* (432, 8%), *Stenella coeruleoalba* (427, 8%), *Phocoena phocoena* (374, 7%) and *Globicephala melas* (203, 4%). Although no consistent patterns were evident over the whole area, there was a trend of increasing numbers of strandings in Southern of Spain from 2001 onwards. Phocids were a minor component of strandings records until 2003-04, when they made up more than 25% of strandings. For areas with sufficient data, time series analysis (dynamic factor analysis) was carried out to quantify temporal trends in numbers of animals stranded and relate these trends to factors such as observer effort and climatic variation.

E4 ESTIMATING THE NUMBER OF WALRUSES ON ICE HAUL-OUTS USING AERIAL PHOTOGRAPHS

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In April 2005 aerial surveys of ice haul-out of the Pacific walruses in Bering Sea in Russian Territorial Waters were carried out. That was experimental Russian-American researches, support by American government grant 701815G329 US FWS. The purpose of our work was to compare aerial photographs, taken from different (from 800 till

2000m) altitudes, and determine the optimal altitude best suited for counting walrus hauled out on ice. In addition, we also compared the quality of Jpeg and Nef images to evaluate which format was better for this type of analysis. All image analysis was conducted using Photoshop 7.0. As part of the analysis we introduced a coefficient of haul-out compactness, which reflected the extent of compactness of individual walruses lying down in haul-out: “1” – 1 walrus, or several walruses positioned far apart; “2” – walruses lie some distance farther than side by side; “3” – walruses lie side by side; “4” – walruses lie compactness side by side, sometimes lean one's flippers on other walrus or put some other body part on a neighbor; “5” – walruses 1/2 of their body lie on a neighbor(s). The result of comparing aerial photographs made from different altitudes, show that a maximum height of 2000m still allowed walruses to be counted one by one and in turn provide a calculation of group size, however, exact calculation of walruses will depend on the following factors: angle of photograph (walruses may cover one another), angle of illumination (example, when sun near horizon – shadows are cast), quality of photo (i.e. focus), state of haul-out (example, haul-out “A” in one photo – all walruses lie on back, good to see males by large tusks, in other photo of the same haul-out – animals alarmed and all “on one's feet” and don’t see tusks). During analysis it was determined that Nef format images had several advantages– despite the larger size of the digital file (about 8 MB) as compared to Jpeg files (about 2 MB), the resolution of the Nef files was far superior when enlarged and did not show the “mosaic structure” distortion that Jpeg images did.. Exposures of 1/1000 to 1/2000 sec and resolution of 72 pix/inch (size file 106 sm/169 sm) in the aerial photographs was quite enough for this work.

E5 IS TOO MUCH FAT FATAL? MASS-DEPENDENT PREDATION RISK AND LETHAL DOLPHIN-PORPOISE INTERACTIONS

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In small birds, there is a trade-off between avoiding starvation and avoiding predation dependent on individual body mass. This occurs because carrying increased fat reserves reduces starvation risk but by being fatter, and therefore heavier, birds face a higher predation risk due to reduced escape flight performance or the increased foraging exposure needed to maintain a higher body mass. This trade-off is known as mass-dependent predation risk. In principle, the theory of mass-dependent predation risk

could also apply to any animal capable of storing energy reserves to reduce starvation and whose escape performance decreases with increasing mass. In the marine environment, many animals seek to escape from larger predators by out-manoeuvring them and turning ability will decrease as mass increases so predation risk should be mass-dependent. However, as most predator-prey interactions occur beneath the water surface, it has so far been impossible to make the detailed behavioural observation and mass measurements needed to test this prediction. In certain parts of coastal Britain, harbour porpoises (*Phocoena phocoena*) are known to be pursued and killed but, crucially, not eaten by bottlenose dolphins (*Tursiops truncatus*). This creates a unique situation, that allowed us to use porpoise stranding data to test the hypothesis that a mass-dependent predation risk effect may be occurring in the marine environment. Here we show that where dolphin 'predation' occurs, the porpoises carry significantly less fat reserves than would otherwise be expected, independently of a range of other potentially confounding factors tested, including body length, sex, season and cause of death. This reduction in energy reserves equates to reducing by approximately a third the length of time that porpoises could survive without feeding and provides the first evidence consistent with the hypothesis that starvation-predation risk trade-off is mass-dependent in animals other than birds.

E6 THE YEAR OF THE WHALE: EXTRAORDINARY OCCURRENCE OF BRYDE'S WHALES OFF LA GOMERA (CANARY ISLANDS)

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The waters off La Gomera (Canary Islands) are known for an extraordinarily high number of cetacean species. With more than 20 species identified, the regularly surveyed area (roughly 100 nm2) represents the highest species diversity in Europe. However, these waters predominantly are a habitat for medium sized and small toothed whales, such as several species of delphinids, short-finned pilot whales, beaked whales and others. Large baleen whales are seen regularly, but not very frequent, and mostly during certain periods during the year. This was different in 2005, when Bryde's whales (*Balaenoptera edeni*) were constantly seen from springtime on. During some months, they belonged to the most frequently seen species of the cetacean community. The observation of feeding behaviours indicated that these whales spent the greater part of the year in this area because they found enough fish to feed on. Preliminary analyses of the photographs taken suggest that the number of whales was within the range of dozens of animals. Mother/calf pairs were seen regularly. The extraordinary occurrence of Bryde's whales, together with some other remarkable changes within the cetacean community off La Gomera suggests that 2005 was an unusual year in terms of oceanographic conditions and fish abundance.

E7 HOME RANGE SIZE OF BOTTLENOSE DOLPHINS IN THE AZORES: A CONSEQUENCE OF PATCHY RESOURCES?

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Student award: Postgraduate

Home range size reflects the amount of space required by an animal, and is influenced by several intrinsic and extrinsic factors. We examined home ranges of bottlenose dolphins (*Tursiops truncatus*) inhabiting the oceanic islands of the Azores. From 1999 to 2004 we conducted 287 boat surveys in an area of approximately 5,400 km2. We estimated the size of the home range of 31 individuals sighted = 10 times, using both minimum convex polygons (MCP) and fixed kernel methods. Range areas of these dolphins varied in size and location, but considerable overlap was observed in the areas used by the dolphins. In all the dolphins studied, the 50% core area encompassed at least one extreme of a channel between two islands. Overall, the mean MCP area was 182.0 km2, varying from 62.9 to 725.1 km2. The kernel method produced a mean 95% utilization distribution (UD) area of 437.2 km2 (SD=320.4 km2) and a 50% UD of 86.4 km2 (SD=71.5 km2). Overall ranging areas and core areas were larger for subadults though differences were not statistically significant. Male and female dolphins had similar home ranges, though sample sizes were small. Estimates produced by the 95% kernel were higher and significantly different from the ones generated by the MCP. This result is not unexpected as it was found that, at small sample sizes, kernel methods tend to overestimate home range sizes, whereas MCP significantly underestimate them. Estimates of home range size of bottlenose dolphins in the Azores were found to be considerably larger than what has been previously reported for this species. We propose that the oligotrophic and highly dynamic oceanic ecosystem of the Azores, in contrast to the generally more productive coastal and inshore areas where the other studies took place, may be responsible for the observed discrepancy in home ranges.

E8 CASE REPORT : A STRANDED SPERM WHALE , *PHYSETER MACROCEPHALUS*, IN NORTH ADRIATIC SEA

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Sperm Whale, *Physeter macrocephalus*, the largest odontocete, have extreme dive depths, dive time and unusually large home ranges. This species typically inhabits deep water regions worldwide. Here a stranding event in the northern Adriatic Sea is reported. The central and north Adriatic Sea is characterized by relatively shallow waters with a mean depth of about 50 m. It is a semi-closed basin with large river contributions and a strong pressure by human activities. Although 8 cetaceans species are known living in the area, the Bottlenose dolphin, *Tursiops truncatus*, is the only one present in these waters on a regular basis. An approximately 9 meters long young male sperm whale was found washed ashore the 29th of January 2005 near Rimini. The carcass was largely decomposed and the tail was lost. Several scars caused by contact with vessels were observed but all characterized by post-mortem signs. The weight of the specimens was 7,2 tons, with a total measurable length of 8,25 m and a body height at dorsal fin of 1,90 m. Necropsy showed a low nutritional status. No fresh food was found in the stomach but a large amount of cephalopods beaks are now under study. No evident parasites were found analyzing the 72 m gut but the remains of 3 Penella sp., were found on the head.The GLGs (Growth Layer Groups) count led to an age estimation of 8-9 years.Sperm whale sightings or strandings in the described area are very rare events: in literature 7 to 13 events for any of the three last century are reported and this is the first one in this new millennium. The skeleton will be prepared and exposed in Fondazione Cetacea collection.

FEEDING

F1 DIET OF HARBOUR SEAL (*PHOCA VITULINA VITULINA*) AND GREAT CORMORANT (*PHALACROCORAX CARBO SINENSIS*) IN DANISH WATERS - COMPETITORS FOR FOOD?

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Seasonal and regional variation in the diet of harbour seals and great cormorants in the Limfjord, west Denmark, was determined from analysis of scats and cast samples, collected at breeding sites. Harbour seal diet was also compared with harbour seal scats collected in the western Baltic. Seasonal and regional variation in harbour seal diet composition reflected both prey availability and specialisation on certain species. During spring when Atlantic herring enters the Limfjord to spawn, harbour seals switched to this numerous prey with high energy content (accounting for 90% of the biomass consumed). While in summer and autumn they fed on a mixed diet. During all seasons Atlantic cod was of high importance in harbour seal diet in the western Baltic, while flounder and plaice were important only during summer and dab dominated during autumn. Great cormorant diet composition in the Limfjord were dominated by bull-rout during all seasons, and supplemented by eelpout and black goby during summer and autumn, respectively. Harbour seal and great cormorant diet overlapped very little in spring, when harbour seals almost exclusively fed on Atlantic herring, a prey species which constitutes a minor part of great cormorant spring diet. In summer and autumn harbour seal and great cormorant diet composition overlapped markedly, and they hence compete for the same food resources. However, harbour seals and great cormorants consumed prey of different sizes. Harbour seals and great cormorants are often blamed to have a negative impact on commercial fish species. However, in this study only few commercial species was found to be included in their diet, and in these cases much smaller specimens than the fishery minimum sizes were taken.

F2 INTERANNUAL DIFFERENCES IN MINKE WHALE FORAGING BEHAVIOUR AROUND THE SMALL ISLES, WEST SCOTLAND

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Student award: Postgraduate

The Hebrides in West Scotland are an important summer feeding ground for North Atlantic minke whales (*Balaenoptera acutorostrata*). Fieldwork on the foraging behaviour of minkes, including focal follows, collection of prey samples and distributional analyses were carried out around the Small Isles mainly during the month of August from 2003-2005. Identification of fish and scale samples from feeding locations showed that in late summer, minke whales as well as most seabirds were feeding mainly on sprat (*Sprattus sprattus*) in the area. Mean sighting rates of minkes varied between years from 1.14 in 2003 and 1.03 in 2004 to 0.08 whales/hour in 2005, which was by far the poorest season with respect to both minke and seabird sightings. Although the diving behaviour was similar between years, with average dive times of 1min 24s for both 2003 and 2004, and 1min 07s for 2005, and maximum dive times of 7min 02s, 7min 30s and 7min 43s respectively, the focal follows showed marked differences in habitat use between years. In 2003, ca. 70% of foraging (tracks with a high proportion of turns) occurred on the deep side of banks, although 52% of feeding activity was found over a deep channel (70-100m). In 2004, 71% of tracks interpreted as longer distance travel (few turns) occurred over deeper channels, but 98% of feeding activity was concentrated in these channels. Finally, in 2005, 7 out of 10 focal follows took place over the slope on the west side of the channel between the Isle of Eigg and the mainland, the area that seemed to be used mainly for foraging. However, no surface feeding was observed in 2005, and the overall absence of active seabird aggregations was interpreted as an indication of prey shortage, which may explain the low sighting rates of whales during this year.

F3 FIRST DIETARY STUDY OF NEW ZEALAND COMMON DOLPHINS (*DELPHINUS SP*.)

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Student award: Postgraduate

Despite the worldwide distribution of common dolphins, this is the first account of their diet in New Zealand waters. Stomach contents were analysed from 35 common dolphins stranded (n=25) and by-caught (n=10) between 1997 and 2005 around New Zealand.

Over 25 prey items were identified primarily by fish otoliths and cephalopod beaks. Squid (90% by Occurrence) and arrow squid *Nototodarus spp* (68%O) were the most frequently occurring prey items of by-caught and stranded dolphins respectively, followed by jack mackerel *Trachurus spp* (80%O) and warehou *Seriolella spp* (44%O). The next most frequent prey of by-caught dolphins were arrow squid (60%O) and anchovy *Engraulis australis* (40%O), both continental shelf/coastal species. In contrast, anchovy and mullet (Mugilidae) were the next most common prey of stranded dolphins (28%O, 24%O respectively). Large numbers (>150) of myctophids were found within the stomachs of two dolphins by-caught in oceanic waters beyond the continental shelf, consistent with myctophid distributions. The diversity of prey items varies in frequency of occurrence between areas, complementing literature that suggests common dolphins are opportunistic predators. More importantly, arrow squid and jack mackerel are two commercially important fish species in addition to being common prey of common dolphins, highlighting the potential for competition between common dolphins and fisheries in New Zealand waters.

F4 DIET OF THE STRIPED DOLPHIN (*STENELLA COERULEOALBA*, MEYEN 1833) AND INTERACTIONS WITH FISHERIES IN THE ADRIATIC SEA

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The striped dolphin (Cetacea: Odontoceti) is one of the frequently encountered cetacean species in the Adriatic Sea. This species feeds primarily on pelagic prey in deeper layers of the Mediterranean. However as only 26% of the Adriatic Sea is deeper then 200 meters, the deep-sea species are only present in the southern part. We hypothesised that the diet in the Adriatic would differ from Mediterranean data and have a closer relation to the bottlenose dolphin diet; as two of the pelagic cephalopods found in bottlenose dolphins diet are among the most abundant pelagic cephalopods in the area. Interactions with trawling fisheries off the eastern Adriatic coast were also discussed. We examined stomach contents of 12 striped dolphins stranded along the Croatian coast in the period from 1990 until 2004. Stomachs of 8 individuals had food remains: undigested cephalopods, cephalopod beaks, fish bones and otoliths. Teuthoidea represented the most abundant prey, both in frequency and mass. Illex coindetii was the most frequent individual prey, with total mass estimated between 2200 and 2500 g. Loligo vulgaris could be ranked as second in importance, present in 50% of the stomachs. Both are common prey of the bottlenose dolphin, however there is a difference in the size of consumed Illex coindetii and no differences in the size of consumed *Loligo vulgaris* (Mann-Whitney U-test, P=0.05). As Loligo specimens of 200 g and over are exploited by commercial fisheries, it is suggested that smaller specimens (<200 g) are more abundant and consequently the same size is consumed by both dolphin species. We concluded that the diet could be characterised as opportunistic, but fishing could have an impact that should be assessed in fisheries management plans.

F5 ANALYSIS OF THE DIET OF MINKE WHALES IN THE ANTARCTIC, WITH AN ACCENT ON SECONDARY-IMPORTANCE FOOD OBJECTS

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Examinations were conducted of stomachs of 11,652 minke whale, taken by the whaling fleet Sovietskaya Ukraina in Antarctic Areas I-IV and VI during the 1982/83 – 1985/86 seasons. Apart from the absolutely prevailing minke whales' food object *Euphausia superba*, ten species of secondary-importance food objects (SIFO) were found: four species of Crustacea and six fish species. Out of 5,354 stomachs examined and containing food, E. superba was the most prevalent species in 99.2%, and was absent in only 0.5%. The other ten species of Crustacea and fish found in stomachs had no essential importance for the whales' diet. The list of secondary-importance food objects is much shorter than that of species taken by krill trawls. This could be evidence of the whales' effective selectivity in favor of E. superba. Of all SIFO, only E.crystallorophias had some independent importance in the diet of minke whales in certain limited shelf areas. In rare cases, E. crystallorophias was the dominant organism in dietary composition, and the maximum quantity of this species in a whale stomach reached 50kg. This species of Crustacea was found in 1.3% of filled stomachs. The fish species most frequently found in minke whales' stomachs was Pleuragramma antarcticum (0.8% of cases). The locations of SIFO detection in the diet of minke whales in the investigated Antarctic Areas (I-IV, VI) were extremely irregularly distributed. 89.8% of such cases were in Area IV; 9.3 % in Area I; 0.9 % in Area VI; and none in Areas II and III, although the greatest number of minke whale stomachs was examined in Area III. In Area IV 86% of the cases of SIFO detection were in two discrete areas: Prydz Bay and Vincennes Bay. All cases of E. crystallorophias and Amphipoda detection in Area IV were in these bays alone.

F6 FORAGING BEHAVIOUR OF BOTTLENOSE DOLPHINS IN A BUSY ESTUARY: PUTTING UP WITH POLLUTION AND DISTURBANCE FOR THE SAKE OF PLENTIFUL RESOURCES

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The movements, distribution and activity patterns of the resident bottlenose dolphins (*Tursiops truncatus*) in the Sado estuary region, Portugal, have been studied in several different years, with abundant evidence of the estuary's importance as a feeding area for

this population. To improve the existing knowledge on its feeding ecology, the next step is a detailed inventory of prey species (potential and confirmed), an assessment of their relative importance and the analysis of dolphin habitat selection in relation to the known distribution of those species.During non-intrusive small-boat surveys, periods of up to six hours of group follows were carried out throughout a study area of approximately 200 km2, with the recording of locations, itineraries, dominant activities, group size, dispersion, and composition, sound emissions and other behaviour patterns. The predominance of foraging activities (over half of all sampling points) in the estuary expresses the animals' motivation to spend their days in this noisy, polluted habitat, heavily used by industries, shipping and also leisure boats. Direct observations of feeding behaviours at the surface with the identification of prey species have been compiled for presentation with photographic evidence. Published data on fish and cephalopod occurrence in the study area has been summarized, and the comparison of this review with our results pinpoints much needed faunistic and ecological information still lacking.For humans and dolphins to co-exist in this region, they must be allowed conditions to feed in the rich supply of some pelagic and benthic prey species. The existence of protected areas covering part of the dolphins' home range recognizes this need, but protection should be extended to the most important feeding areas identified outside of reserves, and the recent law regulating dolphin-watching must be observed.

F7 VARIABILITY IN DIET OF BOTTLENOSE DOLPHIN, *TURSIOPS TRUNCATUS*, IN GALICIAN WATERS , 1990–2005

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Student award: Postgraduate

Bottlenose dolphins, *Tursiops truncatus*, are common and resident in Galician waters with a population of at least 600 animals. Studies of bottlenose dolphin diet in Galicia have been carried out over the last 15 years with a total of 82 non-empty stomachs analysed from stranded individuals between 1990-2005. We describe dolphin diet and, as an alternatively to traditional summary tables, we construct feeding strategy plots in 3-dimensions (where each axis is an index of prey importance: percentage frequency of occurrence, percentage by number and percentage by weight). These 3-D plots are easier to interpret and provide indication of prey importance (dominant-rare) and of predator feeding strategy (specialized-generalized). Additionally, we represent and quantify interannual and seasonal variation in the diet, as well as differences between the diets of male/female and juvenile and adult dolphins. The most important prey

species were blue whiting (*Micromesistius poutassou*) and hake (*Merluccius merluccius*) both of high commercial importance in Galician waters. Estimates were also made for the amount of fish removed by the bottlenose dolphin population in Galician waters for the most important prey species.

F8 INDIVIDUAL FEEDING STRATEGY ON COMMON BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) AND INFLUENCE ON AGE, SEX AND REPRODUCTIVE STATUS IN NORTHERN SARDINIA (I)

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Different foraging behaviours have been documented in all populations of common bottlenose dolphins, but there are few research attempts on individual development in the specialisation of feeding strategies. In Northern Sardinia the Common Bottlenose dolphin population have been regularly monitored since 1999. This work considers the period between January 2003 – September 2005, and the research effort of 277 days was spent surveying, resulting in 981 hours of sea surveys, 174 sightings and 895 observations. Research was carried out through boat surveys, with the use of photo-identification techniques and with detailed recordings of behavioural data.Feeding strategies were divided into 4 categories: (FCA) feeding in coastal areas (0-0.5 nautical miles from the coast); (FPA) feeding in pelagic areas (over 0.5 nautical miles from the coast); (FFB) feeding following fishing boats; (FFN) feeding on fixed fish nets. Feeding activities represent 36% of the total registered behaviours. 40 of the photoidentified individuals (in total 92 exemplars were catalogued) were observed while engaged in one of the 4 feeding strategies. The analysis regard 14 dolphins observed at least 3 times over the study period. This sample shows data regarding age, sex and reproductive and hierarchical status evidencing the different strategies and habitat use between males and females, whit or without young. A long timeframe is needed to better describe possible specialization of single individuals and the potential existence of feeding territories. This work is very important for the management's implications for this costal species in relation to the zoning of Protected Marine Areas to minimize the interaction between fishermen and

F9 PRELIMINARY RESULTS OF 13C AND 15N STABLE ISOTOPE ANALYSES IN BOTTLENOSE DOLPHINS, *TURSIOPS TRUNCATUS*, IN GALICIAN WATERS (NW SPAIN)

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Student award: Postgraduate

Analysis of carbon and nitrogen stable isotopes profiles is a useful technique to assess trophic level and to indicate changes in diet composition during an animal's life. In contrast, stomach contents analysis can reveal the detailed composition of an animal's last meal. We present here the first results on 13C and 15N analyses for bottlenose dolphins, *Tursiops truncatus*, in Galician waters (NW Spain). Samples of skin and muscle from 40 stranded bottlenose dolphins were taken between 1998 and 2005. Interannual and seasonal variations in the isotopic profiles were investigated, as well as differences between male/female and juvenile and adult dolphins. We compare these results with results from stomach contents analysis (1990-2005) for the

F10 LATERALISATION OF MINKE WHALES (*BALAENOPTERA ACUTOROSTRATA*) WHILST SURFACE FEEDING IN THE ST. LAWRENCE ESTUARY

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Lateralisation behaviour has been studied in different non-human species, also in marine mammals, but not in minke whales. This study examined if minke whales have a predominant use of one side of their bodies during surface feeding. This includes manoeuvres in lateral plane (1), where the whale is lying on its right or left side, manoeuvres in ventral plane (2), involving rolling back to dorsal-ventral plane, and in regular surfacings (3), rolling to the right or left side. In addition, the incidence of these manoeuvres was examined over different feeding habitats and tide phases. In lateral plane manoeuvres (N=1828) the 45 identified whales occurred more frequently on the right side (97.6%) than the left side (2.4%). In the ventral plane manoeuvres (N=582) the 42 identified whales rolled back over the right side more often (96.9%) then over the left side (3.1%). In the normal plane manoeuvres (N=144) 10 identified whales exhibit a significant difference between the roll to the right side (95.8%) and rolling to the left

side (4.2%). There is no significant correlation for all behaviours when comparing the side of lateralisation in respect of tide phases ((1) p=0.211; (2) p=0.307; (3) p=0.862). Comparison between different feeding habitats and the side of lateralisation showed no significance in lateral manoeuvres ((1) p=0.302), but significant correlation in ventral and dorsal-ventral manoeuvres ((2) p=0.05, (3) p=0.016). This study indicates that minke whales (N=45) exhibit a lateralisation side with a strong preference to the right side on a population level. This can be correlated with the area but not with the tide phases. These results suggest behavioural lateralisation possibly related to an asymmetry of function in the brain. However, not much is known about the brain of minke whales to allow final conclusions.

F11 DIET OF THE BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*, MONTAGUE 1821) IN THE ADRIATIC SEA

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There is very little known about the diet of the bottlenose dolphin in the Adriatic Sea. The study aims to test two hypotheses, firstly that there are intraspecific differences in the diet of bottlenose dolphins in the Adriatic Sea and secondly, that the diet of bottlenose dolphins in the Adriatic Sea shows variability, since they are highly opportunistic feeders. Stomach contents from 40 animals stranded along the Croatian coast between 1990 and 2004 were analysed. 25 of the 40 stomachs analysed contained food remains (14 females, 10 males, 1 undetermined sex), and a total of 234 different prey items were found. Sparidae were found to be the most abundant fish, both in terms of percentage frequency and percentage occurrence. Hake (*Merluccius merluccius*) were the second most abundant fish type, present in one third of the stomachs analysed. Low hake frequency until 2000 corresponds to low hake biomass index in the Adriatic from 1993 until 2000 due to increased trawling. Cephalopods were found in 60% of all stomachs. Females had higher frequency of cephalopods then males, especially benthic octopods. 36% of females contained only cephalopods, while males contained either only fish (50%) or fish and cephalopods (50%). Comparison of the three regions of the Adriatic Sea shows that bottlenose dolphins feed predominantly on cephalopods in the central Adriatic but primarily on fish in northern and southern Adriatic. This study concludes that there are intraspecific differences in diet since males and females differ in their exploitation of food resources, and that the diet shows variability, both between years and geographic location.

F12 FATTY ACID SIGNATURES FROM BLUBBER: A GOOD DIET INDICATOR FOR THE NZ SEA LION?

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Student award: Postgraduate

Analysis of the fatty acid (FA) composition of blubber has proven its worth in term of interpreting the diet of marine mammals. The principle is that a FA in prey is incorporated into predator tissue stores with no or minor modification, providing biochemical signatures with which to identify prey species. The traditional techniques to investigate diet (stomach, faeces) are representative of the last meal eaten whereas FA analysis provides a long-term indication of diet history. But this method requires that there are significant differences between the FA signatures of the prey items for them to be distinguished in the blubber. In the present study, stomachs and blubber fatty acids were analysed from 28 NZ sea lion adults bycaught by the squid fishery around the Auckland Islands (50.5S, 166E) over three summers (2001 to 2003). Blubber FAs were compared with fish and squid FA profiles found in the literature. The major blubber FAs were 16:0 (10.8% - 18.0% by weight), 18:1n-9 (18.2% - 36.6%), 20:1n-9 (5.7% - 13.1%) and 22:6n-3 (DHA, 5.8% - 13.9%). These proportions were close to that found in the profiles of jack mackerel (Carangidae), hoki (Merlucidae) and barracouta (Gempylidae), suggesting a long-term fish-based diet. In contrary, the stomach analysis showed a dominance of squid, indicating that the NZ sea lion occasionally eat squid where the fishery occurs. However, some of the major FAs encountered in the blubber can also be biosynthesised, therefore it is difficult to quantify the proportion provided by the diet and to conclude on the long-term diet of the NZ sea lion without more FA investigation. More particularly, the FA analysis of fish and squid collected in the foraging area of the sea lion will clarify the potential of the FA analysis as a diet indicator for this predator.

F13 SEASONAL MOVING OF DOLPHINS IN WATER AREAS OF REGION OF THE BLACK SEA BIOSPHERE RESERVE (BSBR)

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Usual inhabitants of water areas of region of the Black Sea biosphere reserve are 3 species of dolphins: *Delphinus delphis*, *Tursiops truncatus*, *Phocoena phocoena*, all species are brought in the Red book of Ukraine (1994). Seasonal moving and occurrence of dolphins to these water are connected with migrations and number of flocking fishes. Shallow-water areas are used for spawning and a food and growth

of young pelagic and benthos fishes. Ways of seasonal migrations of these fishes take place lengthways Tendrovsky and Kinburnsky sand-bars. Potential objects of a food of dolphins -20 species of fishes. In last years 14 species from 20 have low number. Now 6 species of fishes are the most probable objects of a food for whales. It *Sprattus sprattus sprattus*; *Engraulis encrasicholus ponticus*, *Belone belone euxini*, *Liza aurata*, *Mugil so-iny*, *Atherina boyeri*. These fishes form congestions in areas which most suitable for active hunt of dolphins: - seacoast of the Tendra and Kinburn, - western parts of the Tendrovsky bay and of Dneprovsko-Bugsky estuary. Here more often and in the greatest quantities there are dolphins: 76,5% from the general amount of meetings (2000-2005). In our water areas dolphins appear in the end of March-April. That are terms of mass approach E.e. ponticus, A.boyer, M.so-iny, B.b. euxini, S.s. sprattus and L. aurata. In May-June M.so-iny go out of bays and follows lengthways about Tendra for spawning. These terms coincide and with terms of the most frequent meetings of dolphins (34,4% from total of meetings). The second less appreciable peak of frequency of occurrence of a fish and dolphins – September – October when fishes leave bays and follow to places of wintering. Those years when number of these species of fishes becomes less, frequency of meetings of dolphins in our water areas sharply falls (1983, 1995).

F14 SEASONAL AND SPATIAL PREY EXPLOITATION BY GREY SEALS (*HALICHOERUS GRYPUS*) AND FISHERIES IN THE IROISE SEA, FRANCE

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Student award: Undergraduate

In our exploited ecosystems, we are often faced with a controversial problem: the competition between marine mammals and fisheries for commercial species. This problem is particularly evident where pinnipeds may share the same coastal areas with commercial fisheries all year round. A small grey seal colony hauls out in the Iroise sea (France) within a Marine Protected Area which also includes fishing activity. We compared prey consumption by grey seals and fisheries landings for each quarter of the year in each of the four ICES statistical rectangles of the Iroise sea. To calculate energy consumption, we have used a model developed for UK North Sea grey seals by quarter and by sex and age classes. A combination of seasonal censuses on haulout sites and abundance estimation by mark-

recapture analysis of photo ID data allowed seasonal abundances of sex and age classes to be assessed. Proportion of individual time spent foraging in each area was obtained by satellite telemetry. Diet composition was obtained from faecal analyses. Thus, total annual food consumption by seals was 92 tons, including for commercial species 19 tons of sea bass, 11 of pollack and 3.4 of common sole. The consumption varied between quarters: 24% of annual consumption for Q1, 31% for Q2 and Q3, only 13% for Q4, and areas: 79% of prey consumption for the south eastern area. In this area the consumption by seal reached 22% of sea bass landings, 10% for common sole and 6% for pollack. Overall, prey consumption by seals could be compared to landings, principally in the south eastern area of the Iroise sea ; therefore the competitive interactions between seals and fisheries should be further investigated. In estimating the spatial exploitation by seals, this study also brings new elements for the definition of the MPA.

F15 FEEDING STATIONS FOR GREY SEALS *HALICHOERUS GRYPUS*: A WAY TO PREVENT SEAL DAMAGES IN GILLNET FISHERIES?

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Student award: undergraduate

Grey seals *Halichoerus grypus* in the Baltic Sea cause intense damages to gillnet fisheries. In this study we investigated if it is possible to feed seals in certain areas and thereby prevent them from damaging fishing gear.In 2004, feeding cages were placed in three areas. The cages were filled with herring every second day. Fishermen were responsible for filling the cages with fish and reporting amount of eaten fish. These fishermen and another two fishermen also reported their catch and effort. Seals came to two of the cages to feed. At these two cages during the light hours of the day, video recording was conducted. The amount of herring put out and left in the cages were weighed before and after filming. This gave us an estimation of the amount of fish seals can consume.In one area the video recording showed that there were more than seven seals feeding. In this area seals ate 35 kg herring per day. Fishermen´s catch in this area did increase both compared to journals from earlier years and compared to fishermen´s journals from close by areas. In the other area recording showed two seals feeding from the cage. These two seals could in 10 hours eat 32 kg of herring. There, the catch did not increase neither compared to earlier years. The project continued 2005. Seals that came to the feeding cages were hunted in the purpose of taking away individual seals that damage fishing gears. A seal that visited the cage in 2004 came back to feed in 2005. Looking at the results from this study it is impossible to say if this is an efficient method. Although it did give us an estimation of the amounts of fish seals

GENETICS/EVOLUTION

GE1 TESTING THE UTILITY OF COI BARCODES FOR RESOLVING THE PHYLOGENETIC RELATIONSHIPS BETWEEN THREE CLOSELY RELATED DELPHINID GENERA: *DELPHINUS*, *TURSIOPS* AND *STENELLA* OF EUROPEAN WATERS

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Student award: Undergraduate

The mitochondrial cytochrome-c oxidase I gene (COI) has gained particular popularity for estimating relationships among closely allied taxa. It has also become the potential gene to be used in the creation of a "barcode" system that would enable the identification of all animal life. We evaluated sequence diversity in 802 bp of COI as a tool for resolving differences among three closely related delphinid genera: Delphinus, Tursiops and Stenella inhabiting European waters. Samples from stranded animals collected in Scotland, Spain and Portugal were analysed. Nucleotide composition averaged over all taxa showed an A-T bias characteristic of mitochondrial genes in these group of animals. The mean sequence divergence between species was 5.6%, whereas sequence divergences within species were higher than expected for D. delphis and T. truncatus probably due to the paraphyly of these taxa. These paraphyly was also observed in the neighbour-joining phylogenetic tree constructed under the HKY model of evolution. Although COI has proved to be an effective tool in the analysis of very closely related species in various animal taxa, it does not seem to be the case in these delphind genera. However, it is worth to note that the taxonomy of this group of cetacens is not very clear and probably the best approach to a phylogentic study would be to compare various mitochondrial genes being one the cytochrome-c oxidase I gene.

GE2 MICROSATELLITE DIVERSITY AMONG WESTERN MEDITERRANEAN AND ADJACENT ATLANTIC STRIPED DOLPHIN POPULATIONS

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Student award: Postgraduate

The western Mediterranean and the north-eastern Atlantic are subject to notable anthropogenic perturbations. In such areas, assessing a species' population genetic structure and genetic diversity within populations should be an early step towards the design of proper conservation policies. The populations of striped dolphins (*Stenella coeruleoalba*) of these two regions have been shown to be quite distinct from one another regarding maternal lineages. Using microsatellites (autosomal markers), another study showed that within the Mediterranean, the geographic distance between sample locations did not seem correlated to a clear genetic differentiation. In this study, we investigate the autosomal genetic structure of a sample of striped dolphins from the western Mediterranean and the adjacent Atlantic. In order to determine how genetic diversity is distributed within and among populations, we genotyped 137 individuals (78 Mediterranean, 45 Atlantic, and 14 Alaskan as an outgroup) for five polymorphic independent microsatellite loci. Genetic diversity data: the Mediterranean, Atlantic and Alaskan samples displayed a mean number of different alleles per locus of respectively 11.2, 13.4, and 9.6. The Mediterranean sample had the lowest expected heterozygosis (HeMediterranean = 0.750, while HeAtlantic = 0.817 and HeAlaska = 0.812). Genetic structure data: between the Mediterranean and Atlantic populations, and between the Atlantic and Alaskan populations, Wright's FST values were low (respectively 0.0237 and 0.0145) but significantly different from zero after permutation tests. Both Mediterranean and Atlantic samples showed a highly significant departure from Hardy-Weinberg equilibrium (p-value = 0.001). FIS values were 0.0965 for the Mediterranean sample and 0.111 for the Atlantic sample (both were significant after permutation tests). These results suggest that, regarding autosomal markers, the western Mediterranean population 1) is genetically less variable than the two other studied populations, 2) is distinct from the Atlantic one, and 3) might possibly be further subdivided, as well as the Atlantic one.

GE3 AN APPROACH TO CHARACTERIZE THE MAJOR HISTOCOMPATIBILITY COMPLEX DQB IN *ORCINUS ORCA*

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This study is part of the Far East Research Orca Project studying *Orcinus orca* in the waters of Kamchatka, Russia. Here we report on the results of an investigation of variation at the MHC class II DQB locus in killer whales. This research was initiated to explore the fitness of Kamchatka killer whales and evaluate their level of DQB polymorphism in relation to other cetaceans. A 172 bp fragment of the DQB gene was amplified and cloned for 2 killer whales. Analysis of ten clones from each animal (Oror11 and Oror17) revealed two unique sequences. While a single sequence was obtained from the Oror11 clones, the Oror17 clones contained two distinct sequences, including one identical to that obtained from Oror11. Alignment of the two DQB sequences revealed 10 variable sites. All substitutions between sequences were nonsynonymous, suggesting that positive selection is acting on the killer whale DQB gene as indicated in other cetacean MHC studies. A neighbor-joining tree was constructed using our sequences and an additional 33 sequences collected from GenBank and representing 18 cetacean species. In the tree, our killer whale sequences clustered with those of small to medium-sized North Pacific delphinids, including Risso's dolphin, short-beaked common dolphin, Pacific white-sided dolphin and short-finned pilot whale. These results lead to two hypotheses to be tested: 1) These sequences arose before speciation (Hayashi et al., 2003) in delphinids and have been maintained since then. 2) These sequences formed in each species within the group independently in the evolutionary process due to exposure to the same pathogens or other selective forces. Given their worldwide distribution and the existence of sympatric, ecologically different populations killer whales could serve as the model species in cetacean MHC studies.

GE4 MOLECULAR ECOLOGY OF *LAGENORHYNCHUS ACUTUS* AND *L. ALBIROSTRIS* IN THE NORTH ATLANTIC AND NORTH SEA

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Student award: Postgraduate

Two species in the genus *Lagenorhynchus* are found in the North Atlantic, each of which is subject to fisheries bycatch and of conservation concern. In this study we present preliminary results on the genetic diversity of white-sided dolphins (*Lagenorhynchus acutus*) and white-beaked dolphins (*Lagenorhynchus albirostris*) in the Eastern North Atlantic. We examined variation at 10 microsatellite loci for 59 samples of L. acutus and 11 microsatellite loci for 80 samples of L. albirostris (in each case from a single putative population). We also tested mtDNA sequence variation at the control region (600 base pair) for 40 samples of *L. acutus* and 55 samples of *L. albirostris*. The mtDNA gene diversity was moderate in *L. acutus* and *L. albirostris* (0.959+/- 0.016 and 0.889+/-0.031 respectively), but nucleotide diversity (?) was low for both species (0.00604+/-0.00034 and 0.00625+/-0.000532 respectively). This level of nucleotide diversity is comparable with that found in some species that have gone through a population bottleneck (e.g. ?= 0.004 in the norther elephant seal). Data from mismatch distributions showing a unimodal shape, and the Fu Fs statistic (-9.915***) in *L. acutus* suggest a post-bottleneck expansion. The mismatch distribution in *L. albirostris* was multimodal, but Fs= -7.001***, suggesting a stable population with a low historical effective population size. Further data is available for *L. acutus* from Garza' M statistic and BOTTLENECK (which tests for excess H with respect to equilibrium expectations) in support of an ancient, but not a recent bottleneck in this species. These results could indicate that the two species have been affected by different demographic events in their past and recent life history, while both show reduced variation that should inform conservation and management efforts. Continuing analyses are addressing questions about populations structure of these dolphins in the North Atlantic.

GE5 ADAPTATIONS AND EVOLUTION OF STRUCTURES FOR INTRASPECIFIC COMBAT IN THE FAMILY ZIPHIIDAE.

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The beaked whales (Ziphiidae) are the only cetacean lineage in which large, sexually dimorphic teeth, which are used as weapons during male-male combat, are the rule rather than the exception. This study examined the form and development of structures in the head of beaked whales associated with intraspecific combat. The results help illuminate how specific structures and modes of combat may have evolved. Four species (northern bottlenose whale, Cuvier's, Sowerby's and Blainville's beaked whales) were examined in detail, while information on additional species was obtained from published sources as required. Beaked whales can be separated into three conditions based on the form of sexually dimorphic structures and mode of intraspecific combat. The first condition is 'jousting' using large, apical tusks. This is the ancestral condition in beaked whales and evolved from the 'bite and rake' combat found in many toothed whales. 'Jousting' using apical tusks risks damage to the melon, which is required for echolocation. This led to the evolution of a 'shield' made of dense connective tissue to protect the melon giving such species a charateristic rounded forehead. From this basic condition found in most genera, two derived conditions have evolved. In some Mesoplodon species, the tusks have been shifted into a more posterior position, reducing the likelihood of damage to the melon. As a result, in these species the melon 'shield' has been reduced resulting in a more sloping forehead. In the bottlenose whales, the melon 'shield' has increased in size to the point where the forehead is extremely bulbous in mature males and the 'shield' itself can be used as a weapon. As a result, the mode of combat has shifted from 'jousting' to headbutting. In the northern bottlenose whale, the 'shield' is further reinforced by bony maxillary crests to make the forehead a more effective weapon.

LIFE HISTORY (reproduction)

LH1 IS PORTH WEN A NURSERY AREA FOR HARBOUR PORPOISE (*PHOCOENA PHOCOENA*)? A COMPARISON OF TWO SITES OFF OF ANGLESEY, NORTH WALES, UK

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The harbour porpoise (*Phocoena phocoena*) is an abundant cetacean species found around the British Isles. Females with young have been recorded to avoid areas of turbulent water and have different habitat requirements. The following study was conducted at Point Lynas and Porth Wen to compare habitat use, abundance and behaviour of encountered harbour porpoise. Systematic scans were conducted at both sites during June – August 2005. A total of 291 hours 36 minutes of observer effort was recorded. Encounters with this species were recorded including behaviour and group composition. A higher percentage of scans encountered mother and calf pairs at Porth Wen in comparison to Point Lynas. Averages of 1?0.00 pairs were seen at Point Lynas and outer scans at Porth Wen; 1.665?0.066 pairs during inner scans at Porth Wen. Groups of up to 4 mother and calf pairs were seen at Porth Wen during August, the majority of sightings were of single pairs. There was a significant difference in the median number of pairs sighted between the months (Kruskal Wallis H = 9.57, df 2, p = 0.008). Pairs were observed close to shore at Porth Wen exhibiting various types of behaviour at all times and states of tide. Point Lynas is considered a foraging site for harbour porpoise due to its strong tidal features. Females have been recorded to seek out areas of calmer waters and are often separate from other individuals. Due to the lack of strong tidal features and high abundance of mother and calf pairs this site should be considered a significant area for the rearing of young and breeding. The dependence upon access to a reliable food source is highly important due to high energetic demands. The close proximity to Point Lynas is highly advantageous.

LH2 PERIOD OF IMPLANTATION AND FOETAL GROWTH IN BALTIC GREY SEALS

di Gleria, C.

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The period of implantation has to be established for studying pregnancy rates and foetal growth in the early stages of development. Pregnancy can only be confirmed when the embryo has reached a particular size. In placental mammals with "delayed implantation" the suspended period is followed by the blastocyst attachment to the uterine wall. This event was recently studied in the eastern and western Atlantic grey seals, but is poorly examined in the Baltic population. The suspended period differs between the two Atlantic populations, therefore it is important to investigate the period of implantation also in the Baltic population. To determine the period of implantation and foetal growth, morphological examinations of 144 reproductively active females were performed between 1976 and 2005 at the Swedish Museum of Natural History. A reproductive active female was defined by the occurrence of a corpus luteum or corpus albicans in the ovaries or by pregnancy. Foetal length was measured to the nearest millimetre. Crown-rump length was used in small foetuses (curved in shape), and nose-tail in older foetuses. Earlier, mean date of parturitions was estimated to be 8 March in Baltic grey seals. Mating takes place approximately 15 days after parturition. Foetal growth was determined and described by using the Gompertz function. Implantations were detected between the 3 and 27 July (n=5). In June no implantations were observed (n=17) and in August all embryos were longer than 12 millimetres. Duration of the suspended period and active growth were calculated using mean date of parturition (8 March), mating and the implantation date received from a regression of foetus length over time. The suspended period and active growth were 71 and 279 days respectively. A shorter suspended period and a longer period of active growth were found in the Baltic seals compared with the Atlantic grey seal populations.

MEDICINE/DISEASE

MD1 CIRCULATION OF CANINE DISTEMPER VIRUS IN LAKE BAIKAL ECOSYSTEM

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Student award: Postgraduate

Canine distemper virus (CDV) is a member of the morbillivirus genus, Paramyxoviridae family. CDV caused the epizootic in populations of Baikal seals in 1987-1988 practically simultaneously with PDV (Phocine distemper virus) morbilliviruses outbreak at seals in Northern Europe. Our CDV studies in the Baikal seal population revealed distinct differences of the development of epizooties on Lake Baikal and in Northern Europe. After the 1988 epizooty, PDV (Phocine distemper virus) in European seals was not registered, but in 2002 it caused another destructive epizooty, the virus of which was almost unchanged. CDV is constantly present in 40% of the Baikal seal population without causing a visible increase of mortality. Heterogeneity of virus in the population is high. It means that there is a high probability of frequent change of the host. In 2002, we showed for the first time that canine distemper virus was able to accumulate in organisms of poikilothermal animals (gastropods of the families Baicaliidae and Lymnaeidae) without loosing infectiousness. Limnea population is able to transfer CDV transovarian. The virus was isolated from Limnea in MDCK cell. Nucleotide sequence of a gene fragment of phosphoprotein was determined. Besides, we confirmed the ability of virus to replicate in organisms of gastropods. Thus, there has been found one of natural reservoirs of morbilliviruses. We examined other poikilothermal animals from Lake Baikal. Virus may be present in organisms of different species of amphipods and fish, the number of infected specimens varying depending on species, site and time of sampling. The data obtained prove the possibility of virus to be transferred along the food web and to circulate in the ecosystem without participation of homoitherms. However, it is necessary to carry out further research to test this hypothesis.

MD2 STRANDINGS AND BY-CATCH OF CETACEANS ON GALICIAN COAST (NW SPAIN)

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Student award: Postgraduate

From 1990 to 2005 a total of 2715 stranded cetaceans were found along the 1,195 km of Galician coast, that means 1 animal stranded each 7 km per year. According to the results from Atlancetus 1996-98 (Atlantic coast of Spain and Portugal) 1 cetacean stranded each 12.3 km. Animals of twenty different species were found stranded during these years, most common were common dolphin (*Delphinus delphin*) 51.3%, bottlenose dolphin (*Tursiops truncatus*) 9.0%, harbour porpoise (*Phocoena phocoena*), pilot whale (*Globicephala melas*) 5.6%, and Risso's dolphin (*Grampus griseus*) 2.4%. There were mass strandings of short-finned pilot whale (*Globicephala macrorhynchus*) and false killer whale (*Pseudorca crassidens*). Since 2000 the animals in state 1, 2 or 3 (437 animals, 32.7% of the total stranded) were carefully examinated to find out if there were signs of by-catch. The 31.8% of these examinated animals (139) had signs of interaction with fishing gears. The signs of by-catch were found mainly in Risso's dolphin (66.6%), harbour porpoise (44.4%), common dolphin (43.2%), bottlenose dolphin (10.2%), stripped dolphin (*Stenella coeruleoalba*) (9.2%) and pilot whale (8.7%). The data collected was also analysed to study the seasonal and spatial distribution of strandings, the proportion of animals that stranded alived (most common was stripped dolphin, 16% of stranded animals were alived), cause of dead and fishing gears most involved in by-catch, the results showed that gillnets marks animals more than other fishing gears and most animals captured for trawlers didn't present sign of capture.

MD3 COMPARISON OF ANTIBODIES FOR CETACEAN CENTRAL NERVOUS SYSTEM (CNS) TISSUES

Méndez, M., Sierra, E., Arbelo M. and Fernandez, A.

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Immunohistochemistry using policlonal and monoclonal antibodies has been widely used for histological and pathological studies in different animal species. Due to the scarce number of available specific antibodies in marine mammal, cross reacting antibodies may be a good approach to carry out similar studies in different organs of cetacean species.CNS sections from a total of twelve cetacean stranded in Canary Islands coasts were chosen from archived formalin-fixed and paraffin-embedded

samples tissues. The samples were taken from different parts of the brain and spinal cord. To assess a reliable inmunostaining for those tissues, different protocols were used for twelve primary antibodies: Vim (vimentin), Syn (synaptophysin), GFAP (Glial Fibrillary Acid Protein), HSP-70 (70kD-Heat Shock Protein), NSE(Neuron-Specific enolase), Beta-AP (Beta Amyloid Protein), MH (Myeloid/Histiocyte), S100 (S100 protein), FVIII (Factor VIII/ Von Willebrand), C-Jun (Jun protein) and C-Fos (Fos protein).Peroxidase technique with aminoethylcarbazol or with diaminobenzidine as chromogens were used. All cases were also processed and stained routenately with hematoxilyn and eosin.Each slide were assessed under light microscopic exam in order to obtain the most objective data as possible; they were evaluated in terms of sensitivity, specific and no specific background staining. An specific inmunoreaction was obtained with GFAP, HSP-70, NSE, MH, S100, FVIII, C-Jun and C-Fos antibodies in cetacean SNC tissues. These antibodies are being investigated for their usefulness at the detection in Central Nervous System tissue of different

MD4 DEPENDENCE OF THE STRUCTURE OF MICROBIOLOGOCAL ASSOCIATIONS OF BLACK SEA BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) OF THE CONDITIONS OF THE ENVIRONMENT

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Student award: Undergraduate

Finding in new conditions of area the animals are attacked by new pathogens. The most important it is when speaking about cetaceans as their living area is water. There many pathogens and conditionally pathogenic microbes may live. In the capture more frequently then in wild nature the possibility of situations of fast changing of microbiological composition is possible. There are the following: when capturing and adaptation, transporting the animal, changing of the foodstuff or the personnel, etc. According to this the goal of our research was the studying of microbes of wild, adapting and adapted dolphins and microbes of water they was. So as studying of biological properties of microbes extracted from them in order to prove their antropogenic origen. The following research was carried out at the Department of Microbiology and Immunology of Moscow Academy of Veterinary Medicine and Biotechnology named after K.I.Skriabin in 2003-2005. We investigated materials taken from 8 adapted animals, 13 adapting and 2 wild dolphins. As a result of our investigation of all animals' respiratory tract we extracted microbes of different species. The quantity and the special association differed according the different groups. The wild animals had no more then 3-4 kinds of pathogens in a little quantity, adapted had 8-9 species, and adapting had 15-17 kinds of pathogens in a very big quantity. It is

worth to be mentioned that the wild animals' microbes were avirulent, had no toxic neigher hemolityc properties. And had very high sensibility to the antibacterial agents. The pathogenic properties of microbes of adapted and adapting animals depended of sanitation of the environment and health of the dolphins. Studying the sensibility to the antibacterial agents of the pathogens the learned them to be high sensible to many antibacterial agents used this day. This fact can point their antropogenic origin.

MD5 MICROFLORA OF STELLER SEA LION PUPS (*EUMETOPIAS JUBATUS*) OF THE KAMCHATKA AND COMMANDOR ISLANDS

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Our study is concerned with the species composition of microbial associations of organism of wild Steller Sea Lion (*Eumitopias jubatus*). In addition, in a course of our studies, we investigated the biological properties of isolated microorganisms, including their pathogen factors. The material was taken from Steller sea lion pups (*Eumetopias jubatus*) at Kamchatka at the Medny Island and the Kozlov Cape in June-July of 2004. We examined 230 swabs from 46 pups. The swabs were taken from the skin surface, cavity of the mouth, nasal cavity, anus, genitals, conjunctiva of the eye, purulent exudation by the sterile tampon. Also we investigated the blood serum of animals with purpose the detection antibodies against *Leptospira interrogans* and Brucella. The blood serum were investigated from 17 pups. From all examined Steller sea lion pups, microorganisms belonging to various species were isolated. We found out more than 9 species of bacteria at every examined animal. The samples revealed members of the genera Staphylococcus, Streptococcus, Escherichia, Serratia, Proteus, Hafnia, Bacillus. In 71,74% cases *E.coli* were isolated, in 39,13% - Staphylococcus and in 43,48% - Streptococcus. Staphylococcus and Streptococcus were isolated from nasal cavity, genitals, conjunctiva of the eye, purulent exudation and Enterobacteriaceae were isolated from cavity of the mouth, nasal cavity, anus, genitals. Investigation of the pathogenic properties of the isolated microorganisms demonstrated that *E.coli*, Staphylococcus, Streptococcus exhibited a- and ß-hemolysis in relation to sheep erythrocytes and *E.coli*, Streptococcus were virulent to mice. Antibody to *Leptospira interrogans* were found in 52,94% cases. That properties of isolating microorganisms can show the changes of health of animals. So it is important to investigate the quantitative, consist of microbial association of organism of Steller sea lion pups.

MD6 BIOLOGICAL PROPERTIES AND ECOLOGICAL ROLE OF THE *E. COLI* ISOLATED FROM PUPS OF STELLER SEA LION IN MEDNY ISLAND (KOMANDORSRKY ISLANDS)

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Student award: Undergraduate

The structure of microbial association of an organism of wild animals can specify an ecological condition of an environment (the surrounding water, air, soil). *E.coli* is the most convenient microorganism to investigate of microbiological condition of an environment. So the structure of microbial association of an organism of pups of the Steller Sea Lion was studied in Medny island (Komandorsrky islands) in 2004. The goal of our investigation was to isolate *Escherichia coli* from the organism of pups. Also we find out antigen structure of this enterobacteria. Because serotypes of E.coli circulated in the population of animals can show the degree of environmental pollution. The studies were carried out at the Department of Microbiology of K.I. Skryabin Moscow State Academe of Veterinary Medicine and Biotechnology. We investigated a material from 14 puppies of the Steller Sea Lion in the age of 1 month from Medny island (Komandorsrky islands). We took smears from the throat, nasal, anus, vagina, prepuce and conjunctiva. During our investigations *Escherichia coli* was isolated from 13 pups in quantity 52 isolates from all of organs except conjunctiva. The different serotypes of *Escherichia coli* have different properties and the degree of their pathogenicity is also different. 74,3% of the isolated *Escherichia coli* had hemolytic properties and had virulent to white mice during experimental infection. As a result of the investigation of antigen structure 82, 86% of *Escherichia coli* belonged to the serotype O-18. Others Escherichia coli gave negative reaction with all diagnostic serums that we used. They are not identifying. We think the quantity and biological properties of an isolated *Escherichia coli* can show to contamination by pathogenic micro flora of pups of Steller Sea

MD7 CLINICAL AND PATHOLOGICAL APPLICATIONS OF COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE IMAGING OF ODONTOCETE PARAOTIC SINUSES

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The odontocete paraotic sinuses are relevant cavities due to its location and relation with the nasal and ear regions. Parasitism of these air-filled structures has been

described in numerous odontocete species; most of them as necropsy findings. Nematodes of the genus Crassicauda and trematodes of the genus Nasitrema have been reported causing severe lesions in these sinuses. The diagnostic methods for its clinical evaluation are limited to egg findings in cytologies of the blowhole swabs or blood extentions, WBC counts and endoscopical examination. Moreover, a laborious anatomical dissection is necessary to access to the paraotic sinuses in dead animals. Eight dolphins belonging to three species (common, striped and bottlenose dolphins) were explored by means of computed tomography (CT) and magnetic resonance (MR), and posteriorly cross-sectioned for carrying out bidimensional anatomical studies. The paraotic sinuses were clearly identified in CT and MR scans, and the corresponding head sections. The examination of one adult common dolphin head showed some image patterns (isointense (MR-T1), hiperintense (MR-T2) and isodense (CT)) suggesting the presence of parasites into the pterigoid and other paraotic sinuses. Lesions of the pterigoid and maxillary bones were also observed by CT. Numerous rounded parasites were identified in the corresponding sections of this animal, and the samples collected allowed a definitive diagnosis of Crassicauda infestation. The CT and MR has resulted to be very useful for the exploration of the normal paraotic sinuses as well as the diagnosis of its parasitism, demonstrating the utility of these imaging techniques for the inspection and pathogical evaluation of these structures presenting a difficult access both in vivo and post-mortem.

MD8 FIRST CASE OF MORBILLIVIRUS (CEMV) INFECTION IN A STRANDED PILOT WHALE IN THE CANARY ISLANDS.

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A male juvenile short finned pilot whale (*Globicephala macrorhynchus*) was found alive on the beach (Tenerife), the animal died a few hours later and the carcase was transported to the Environmental Protection Department of the Island Government, where a complete necropsy was performed by the veterinary pathologists of the Veterinary School (University of Las Palmas de Gran Canaria). The animal showed a good body condition. During the necropsy, no relevant gross lesions were detected. Tissue samples of all the organs were collected, fixed in formalin, and processed for a routinehistological study. Samples from muscle, lung, liver, kidney, spleen and brain were collected and frozen at -80ºC for microbiological studies. Microscopically, the animal showed a focal purulent pneumonia and a severe liver congestion. The most

relevant finding was a non-suppurative encephalitis, with diffuse gliosis and neuronophagia. Perivascular cuffing of lymphocytes and plasma cells was present in the cerebral cortex, thalamic areas and medulla oblongata. From nervous tissues a Cetacean Morbillivirus (CeMV) was identified. Results of sequencing and further comparisons with other sequences described previously confirmed a novel sequence of CeMV, showing a close homology with the long finned pilot whale (*Globicephala melas*) CeMV strain. The present work represents the first description of a CeMV in the Canary Islands.

MD9 PATHOLOGICAL CHANGES IN ORGANS FROM BALTIC GREY SEALS (*HALICHOERUS GRYPUS*) OBTAINED FROM TWO YEARS HUNTING

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Student award: Postgraduate

The health of Baltic seals has been investigated by dissections of by-caught animals and those found dead since 1970s at the Swedish Museum of Natural History. High prevalence's of several pathological changes, including sterility among females, with relations to environmental contaminants in biota have been reported. Since then, concentrations of PCB and DDT in fish from the Baltic have decreased, resulting in a recovery in reproductive health after 1997 and an increase in numbers of Baltic grey seals. Some pathological changes still persist and the prevalence of intestinal ulcers has even increased. In the year of 2002 and 2003, internal organs from 137 grey seals (63% females) obtained from Swedish hunt were examined. Fifty per cent of the investigated grey seals were between 4 and 10 years of age. Pathological changes recorded were severe adrenocortical hyperplasia (8 animals), cholangitis (4), salmonellosis (1) and moderate to severe (exceeding 10 mm in diameter) colonic ulcers. These intestinal lesions were found in 42% of the examined seals in 2002 and in 59 % in 2003. The prevalence of colonic ulcers is similar in by-caught grey seals and there is a significant higher prevalence in the Gulf of Bothnia compared to the southern part of the Baltic Sea. Salmonellosis caused by *Salmonella dublin* has also been recorded in one grey seal found dead on the shore in 2004. These are the first two cases of salmonellosis in seals reported from the Baltic.

MD10 ADAPTIVE CHANGES OF THE T-, B- LYMPHOCYTE SUBPOPULATIONS IN THE BLACK SEA BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*)

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This immunological investigation was conducted during 2000-2005 years on the Utrish marine station of the A. N. Severtsov IEEP RAS. Fifty five adult bottlenose dolphins were examined during the adaptation to captivity conditions. Two methodical approaches were used for T-, B- lymphocyte subpopulations investigation: 1) the immunological phenotyping of the lymphocyte subpopulations by the monoclonal antibodies (mAbs) panel (UCD-F21C and UCD::F21F.3Sup – homologues to ?D2/T-cells and CD21/B-cells accordingly, kindly donated by Dr. Jeffrey L. Stott, Davis, USA; and also TR 1-204...33 – homolog ?D4/Thelper, kindly donated by Dr. Tracy A. Romano, Texas, USA) by the indirect immunofluorescence reaction; 2) the reaction of the T-, B- lymphocyte division on the plastic surface which is loaded by antibodies to immunoglobulins (“panning”). Also we investigated some hematological indices for the estimation of the clinic health condition of animals. The relative quantity of T- lymphocytes were presented 55,50 + 0,71% positive cells during first month of the adaptation, the absolute quantity of T- lymphocytes came to 1, 073 + 0, 136 ? 106/l. The relative quantity of Thelper - lymphocytes were presented 32,50 + 13,43 % positive cells at the first month. The relative quantity of Thelper - lymphocytes came near to the value of parameters in the control group of animals (38,78 + 6,26%) during 3 - 4 month of the adaptation. The relative quantity of the B- lymphocytes were presented 9, 53 + 1, 13 % Ig-positive cells and also 4, 00 + 1, 41% by using mAbs at the first month of the adaptation. The mentioned indices by the both methodical approaches were significantly declined in comparison with its in the control group (21,53 + 0,54% and 21,89 + 5,53% accordingly). The obtained datum indicates to the possible B –cell immunodeficiency in bottlenose dolphins at early terms of the adaptation to captivity conditions.

MD11 POST MORTEM FINDINGS OF JUVENILE STRANDED GRAY WHALES (*ESCHRICHTIUS ROBUSTUS*) IN THE NORTHEASTERN PACIFIC, APRIL TO MAY, 2005

Calambokidis, J. (1), Raverty, S. (2), Lambourn, D. (3), Jeffries, S. (3) and Norman, S.

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The northeastern Pacific gray whales (*Escherichtius robustus*) migrate annually from summer feeding grounds in Arctic and subarctic waters to winter calving and breeding regions in temperature or subtropical southern regions. Over the course of the last 20 years, there have been sporadic increased grey whale strandings (1984 and 1990) along Washington State and British Columbia coasts and in 1999 and 2000 an unusual mortality event was designated. We conducted examinations of 10 juvenile gray whales stranded in Washington State from 18 April and 25 July, 2005. There were 5 males, 2 females and 3 whales of undetermined gender, measuring between 660-1230 cm total length. Comprehensive necropsies were conducted on 5 whales and more cursory examinations completed on 2 individuals. Three additional whales were sampled for genetics and contaminant work-ups, but not evaluated due to advanced decomposition. Five of the necropsied whales were severely emaciated and 1 whale presented in good body condition. There were 3 individual cases of presumptive net entanglement, blunt force trauma, and attempted killer whale predation. Two whales, recovered moribund or fresh dead, were lodged between pier pilings. The most salient microscopic findings included: splenic and hepatic hemosiderosis that was attributed to generalized emaciation, variable multisystemic accumulation of edema fluid consistent with hypoproteinemia, and an unusual proliferative dermatitis with superficial ballooning degeneration and intracytoplasmic inclusions suggestive of parapoxvirus infection. In select individuals, there was a multisystemic vasculitis suggestive of an acute viremia or septicemia. Microbiology of harvested tissues yielded either no bacteria or polymicrobial isolates. Polymerase chain reaction was negative for Brucella spp and dolphin morbillivirus. Efforts to quantify contaminant loads and domoic acid exposure are underway. Post mortem examination of stranded animals provides valuable insights into potential human interactions, pathogen recruitment and dissemination, contaminant loads, and the natural history of this species.

MD12 INTRACYTOPLASMIC EOSINOPHILIC GLOBULES IN HEPATOCYTES OF BY-CAUGHT HARBOUR PORPOISES (*PHOCOENA PHOCOENA*).

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Student award: Postgraduate

Intracytoplasmic inclusions have previously been described in cetacean hepatocytes. In those studies it was concluded that the globular inclusions were more frequent in animals that stranded alive with acute liver congestion. These globules are essentiality composed of glycoproteins that include alfa-1-antitrypsin and fibrinogen (acute phase proteins). These lesions are not species-specific because they have being described in 15 cetacean species. In this investigation we studied 27 liver samples that were collected from fresh or slightly autolytic harbour porpoises (*Phocoena phocoena*) by-caught in gillnet fisheries in UK waters. Histologically, intracytoplasmic hyaline eosinophilic globules were found in 26 of 27 livers with the same eosinophilic characteristics as those reported in other species but with a low degree of liver congestion. Fibrinogen was demonstrated immunohistochemically in all 26 animals which had globules. The only negative liver without globules belonged to a neonate porpoise. These results will be presented together with a discussion of their possible pathogenic mechanism.

MD13 SEROLOGICAL ANTIBODY LEVELS FOR BRUCELLOSIS, LEPTOSPIROSIS AND MORBILLIVIRUS IN SEALS STRANDED ALONG THE FRENCH COASTS: A PRELIMINARY APPROACH

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Grey seal (*Halichoerus grypus*), and Harbour seal (*Phoca vitulina*), free-ranging marine mammals, are distributed along the French coastline. Because of the small size of the French colonies, both are considered as vulnerable as well as of great interest in terms of wildlife patrimony. This is the reason why the assessment of factors threatening these species is essential despite the fact that “pathology” remains an insufficiently studied topic. This study presents the results of a serological approach, never completed in France before based upon three major infectious diseases affecting seals: Morbillivirus

infection, Brucellosis and Leptospirosis in about a hundred of Pinnipeds. The blood samples used have been collected on seals from the rescue centre of Oceanopolis in Brest since 1999, as well as on dead stranded animals. A seroprevalence of 6,33 % for Brucella sp. and 31,67 % for Leptospira interrogans have been highlighted, which indicates a likely circulation of these agents in the seals found on the French coast. These results emphasize the need to think about protecting measures for domestic or wild fauna, as well as for human beings. This preliminary study requires future investigations to evaluate the real impact of these infectious diseases on wild populations and to be able to take appropriate sanitary and conservation measures.

MD14 DIFFERENTIAL HEMOGRAMS OF FREE-RANGING AND REHABILITATED HARBOR SEAL PUPS (*PHOCA VITULINA*) OF THE GERMANY NORTH SEA

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In order to monitor the health status and to detect uprising diseases the hemogram is an established tool. Normal values are required, however, to evaluate the blood results. So far, only little is known about harbor seal reference values. Differential hemograms of two harbor seal (*Phoca vitulina vitulina*) groups were investigated and statistacally analyzed: samples were taken from free-ranging pups and from pups, rehabilitated in the Seal Center Friedrichskoog, Germany. The hemogram values date back from 1997 until 2004. The results showed significant differences between the two groups. Further comparisons – also with adult animals – proved the importance of differentiating carefully between different parameters (e.g. age, living conditions). A very high number of hemogram values has been collected of the two groups and baseline values (interpercentile ranges, 5-95 %; median) have been established. This study is an important contribution for understanding and assessing the health status of harbor seal pups. Further investigations and comparisons should be undertaken, as several blood values are still under-represented. Nevertheless, the interpercentile ranges given by this study are valuble guidelines for clinical assessments. Continuous efforts are also necessary to maintain a stable monitoring program.

MD15 ISOLATION OF HAPTOGLOBIN FROM HARBOUR SEALS (*PHOCA VITULINA*)

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In humans and animals the acute phase response as a defence to inflammation and stress leads to increased plasma level of acute phase proteins such as the glycoprotein haptoglobin.To investigate the potential of haptoglobin as biochemical indicator of stress in harbour seals (*Phoca vitulina*), an analytical strategy for the isolation of seal haptoglobin and the determination of its yet unknown structure is shown. The hereby used steps were optimised on easily accessible canine blood samples and transferred to plasma samples from wild living seals as well as from seals kept in captivity.The strategy for the isolation of haptoglobin includes the following steps: prefractionation of plasma samples by ammonium sulfate precipitation, isolation of haptoglobin by affinity chromatography and final purification by size exclusion gel chromatography. Biospecific interaction analysis by means of Surface Plasmon Resonance (SPR) was conducted to get more insight to the binding properties of the glycoprotein haptoglobin. The interaction to selected lectins (carbohydrate binding proteins) contains a reference to the glycan structures of the molecule and leads to isolation strategies by affinity chromatography processes. Further the attachment of haptoglobin to haemoglobin was investigated, which exhibits the biological relevance of this interaction.Isolated haptoglobin was subsequently analysed by mass spectrometry after development of important steps for structure determination with commercially available human haptoglobin.

MD16 RHABDOMYOLYSIS AND MYOGLOBINURIC ACUTE RENAL FAILURE (*CAPTURE MYOPATHY*) IN A STRANDED STRIPED DOLPHIN (*STENELLA COERULEOALBA*) IN THE CANARY ISLANDS.

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An adult male striped dolphin was found stranded alive on the coast of Fuerteventura. The animal had a good body condition and presented a rostral mandibular fracture attributed to a fishing interaction, which was considered the cause of the active strand. The animal was kept in a small private swimming pool and transported by car and

helicopter to Gran Canaria dying 48 hours after the stranding. During necropsy, no relevant gross lesions were detected and tissue samples were collected for histopathological examination. An immunohisthochemical study was performed using anti-fibrinogen and myoglobin as primary antibodies. Histologically, the main lesions were related to skeletal and cardiac muscle and kidneys. Muscular lesions were characterized by hyaline change in segments of fibers with no inflammatory response. Degenerated fibers did not present striations using PATH stain, and immunohistochemically showed complete depletion of myoglobin and a strong, diffuse, intracytoplasmatic immunorreaction for fibrinogen was detected. Renal lesions consisted with severe swelling of tubular cells and the presence of pigmented orange granules both in cells and in homogenous casts, which occupy the tubular lumen. Granules and casts presented in the lumen and in the cytoplasm of renal tubules were strongly immuno-labelled by myoglobin. Capture Myopathy is an acute myopathy characterized by rhabdomyolysis and acute tubular necrosis described in wild animals following a chase, a struggle or transport. Trauma, excessive muscle activity and prolonged muscle compression during the fishing interaction, the active stranded and the transport were considered the most probable origin of the muscle necrosis in this case. This disease should be included in the differential diagnostic of acute death in active stranded cetaceans, emphasizing the importance of an exhaustive examination of skeletal muscle in order to find degenerative changes and the usefulness of fibrinogen and myoglobin as markers of early ischemic muscle damage and myoglobinuric renal failure in dolphins.

MD17 CROSS-REACTIVITY OF HUMAN AND BOVINE CYTOKINES IN DOLPHIN PARAFFIN WAX-EMBEDDED TISSUES

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Impairment of immune function is suggested to play a contributing role for the increasing incidence of infectious diseases in marine mammals The integrity of the immune system is controlled by efficient cellular responses to cytokine stimulation Consequently, the understanding of the role of different cytokines during inflammatory diseases could lead to better knowledge of the marine mammal immune system. The aim of the present study was to investigate the cross-reactivity of a panel of eight cytokines in tissues of three species of cetaceans, most of them stranded alive in the shores of the Canary Islands. The IL-1a, IL-1b, IL-2, IL-4, IL-6, IL-8, IL-10, TNF-a, IFN-g and CD25 mAbs were used. The expression of cytokines varied in intensity and number of immunolabelled cells in the different organs examined. The anti-human IL-1a, IL-1b, IL-2, IL-6, IL-8, IL-10, TNF-a, CD25 and anti-bovine IL-4, IFN-g mAbs yielded immunolabelling in cetacean lymph node tissue

sections similar to that obtained in the species of origin and other species, a finding also reported in terrestrial mammals. The results obtained in this study suggest that these antibodies cross react with cetacean cytokines and therefore they are suitable for immunohistochemical studies in snap frozen tissue sections of different species of cetaceans.

MD18 HAPTOGLOBIN – A MULTIFUNCTIONAL PROTEIN IN HARBOUR SEALS

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Student award: Postgraduate

Haptoglobin (Hp) which is synthesized in response to infection, inflammation, trauma or toxicological damage is known as major acute phase protein in numerous species. Hp-concentrations change also with conditions not generally associated with inflammation e.g. fatty liver syndrome, starvation or neonatal jaundice. Quantification of the circulating concentration of this protein can provide an objective measure of the health status, but there is a lack of investigations on harbour seals.To study physiological ranges of Hp-levels in harbour seals and age-, sex- and catch location-correlated differences, we investigated the Hp-concentration in plasma samples of 71 free-living seals from the german and danish Wadden Sea (Lorenzenplate, Römö) as well as of 28 seal pups during their rehabilitation time in the Seal Station Friedrichskoog, Germany. In addition, we examined the correlation of Hp-concentration to other parameters of an acute phase reaction; with the number of leukocytes in general and with the number of neutrophile granulocytes in particular. To investigate the usefulness of Hp as an indicator of metal pollution we correlated the concentrations of 18 metals in whole blood with the Hp-levels.The results showed no differences in Hp-concentrations between females and males as well as both catch locations. In some pups investigated we found comparable to the ethiology of neonatal jaundice a low Hp-level short after the birth followed by a significant increase in the first weeks of life. In response to an acute phase reaction the Hp-level and the number of neutrophile granulocytes showed a significant positive correlation. In contrast, there was no correlation with the number of leukocytes. Finally, the investigation of the correlations between Hp- and different metal concentrations in blood showed a significant negative correlation between Hp and Chromium.The present study show the multiple biological function of Hp in seals and its usefulness in medical diagnosis.

MD19 HUMORAL IMMUNE RESPONSE *TO KLEBSIELLA PNEUMONIAE* IN NEW ZEALAND SEA LIONS, *PHOCARCTOS HOOKERI* AND INVESTIGATION OF THE PASSIVE TRANSFER OF IMMUNITY TO PUPS FROM 1997 TO 2005.

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Student award: Postgraduate

Klebsiella epidemics among New Zealand sea lions (NZSL) on the Auckland Island in the 2001/02 and 2002/03 breeding seasons resulted in a dramatic increase of pup mortality (up to 50%). To determine the prevalence of infection in the NZSL population as a whole, we developed a serological test that could be used on archived frozen sea lion sera collected on Enderby Island (Auckland Islands) from 1997/98 to 2004/05 and for future samples. We used a Western immunoblot technique: SDS/ME-extracted *K. pneumoniae* antigen (a 2002 isolate from a pup) was separated on 4-15%SDS-PAGE gels and semi-dry transferred onto Immobilon membranes. Various NZSL sera were incubated on the membrane using Immunetics® cassettes followed by protein A/G-AP conjugate and substrate (NBT-BCIP) reactions. Circulating Immunoglobulin G (IgG) in NZSL bounds predominantly to *K. pneumoniae* lipopolysaccharide (LPS) of a molecular weight range from 30 to 150kDa. All yearlings, sub-adults and adults tested for anti-Klebsiella IgG were positive (n=105, 96.2%pos.), regardless of the epidemics. Pup sera collected during the 2001/02 (n=19, 15.8% pos.) and 2002/03 (n=16, 6.2% pos.) autopsies were considered as negative for such antibodies. Repeated sampling in live pups during the austral summer 2004/05 demonstrated that antibodies against *K. pneumoniae* are detected by the present serological test from 46 days of age. Sera from pups were also tested for the presence of immunoglobulins in order to investigate the transfer of immunity through the colostrum in NZSL pups.

MD20 GASTROINTESTINAL PARASITES IN HARBOUR SEALS (*PHOCA VITULINA*) FOUND DURING THE 2002 SEAL EPIZOOTIC AROUND TEXEL, NETHERLANDS

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Phocine Distemper Virus was identified as the cause of the first (1988/89) as well as for the second (2002) seal epizootic occurring in the North Sea. During both epizootics the harbour seal population in the Wadden Sea was reduced by about 60% respectively 50%. While searching for the cause of the first epizootic, detailed necropsies were performed and since then different research projects have been established to monitor population dynamics and health status of seals. It became obvious that a thorough knowledge of the parasites of seals was needed to avoid misinterpretation in contributing factors to the die-off. Samples investigated originated from 113 harbour seals collected along the coasts of Texel, Netherlands, in 2002. Necropsies were performed according to international guidelines, all organs were examined macroscopically. Stomach and intestines were removed during necropsy and later washed out through a sieve. Parasites were collected and preserved in 70% ethanol. They were subsequently prepared in lactophenol and identified microscopically, counted and sexed. Three species of gastrointestinal parasites were found: two anisakid nematodes (*Pseudoterranova decipiens* and *Contracaecum osculatum*) and one acanthocephalan *Corynosoma strumosum* (Polymorphidae). Of the seals investigated, 62 (55%) were infected with *P decipiens* and 46 (41%) with *C. osculatum* in the stomach. Furthermore, 89 seals (79%) were infected by *C. strumosum* in the intestine. Larger animals were infected by a higher number of parasites and the prevalence in the three species was positively correlated with each other. The sex distribution of the parasite populations consisted of 45% female *P. decipiens*, 58% female *C. osculatum* and 66% female *C. strumosum*. The parasite species found are common in seal populations. To determine whether their prevalence and intensity is higher during an epizootic, this data serve as reference and will be compared to parasite prevalences in this seal population from earlier and following years.

MD21 ADAPTIVE CHANGES OF THE SERUM IMMUNOGLOBULINS LEVEL IN THE BLACK SEA BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*)

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This immuno-microbiological investigation was conducted during 2000-2005 years on the Utrish marine station of the A. N. Severtsov IEEP RAS. The fifty five adult bottlenose dolphins were examined during the adaptation to the captivity conditions. As earlier were proved the some researchers (Cordes (1982), Greenwood, Taylor (1979), Kolessa (1986), Romanov (1991), Sikalo (1982), Varaldo et al. (1988)), the main cause of the morbidity and mortality of bottlenose dolphins (about 50%) during the adaptive period to the captivity conditions are the infectious diseases of the bacterial aetiology. From them the Grampositive coccus (Staphilococcus and Streptococcus) are the disease causes about 80% cases at the captivity conditions. Therefore we decided to study the quantitative content and the specific composition of the Grampositive coccus microflora in the upper respiratory tract of the dolphins as the environment biotic limiting factors. Also we investigated the immunological parameters: the relative level of the serum immunoglobulins (IgG, IgM). The method of the radial immunodiffusion into gel was used for the serum immunoglobulins level investigation. As a result were obtained data which indicated on the development of the acute inflammatory process in the animals organism as the immune response to the invasion of the pathogenic microflora. In the early terms of adaptation (1-2 months) was observed the appreciable increase of the IgG, IgM indices in comparison with the control group of the adapted clinical healthy dolphins. Thus the relative level of the serum immunoglobulins in the animals during the catching was: IgG - 81,33 + 24,81%, and IgM - 206,33 + 118,02%. And these idices to five-seven weeks of adaptation were increased: IgG- 154,87 + 40,24%, IgM- 297,75 + 51,90%. During one year the relative level of the serum immunoglobulins was decreased to its in the control group (IgG- 99,42 + 17,52%, IgM- 163,58 + 23,30%).

MD22 TRACE OF HEAVY METALS POLYCHLORINATED BIPHENYLS (PCBS) AND ORGANOCHLORINE (OCS) IN ORGANS AND TISSUES OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) AND STRIPED DOLPHINS (*STENELLA COERULEOALBA*) STRANDED ON THE COAST OF THE NORTH-EASTERN SARDINIA – Mediterranean sea (Italy)

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Student award: Undergraduate

The North-eastern Sardinian coast is part of an International Cetacean Sanctuary that comprises the entire Provencal-Ligurian Basin. Between August 2002 and October 2005 20 stranded dolphins were found along the north-eastern coast of Sardinia. Of these, 9 animals were identified as bottlenose dolphins (*Tursiops truncatus*), 10 as striped dolphins (*Stenella coeruleoalba*) and 1 as rough-toothed dolphin (*Steno bredanensis*). 7 animals were found in good condition (3 bottlenose dolphins: 1newborn, 1 juvenile, 1 sub-adult; and 4 striped dolphins: 2 newborn, 2 adults) and were dissected to take tissue and organ samples, to investigate the bioaccumulation of heavy metals, PCBs and OCs. Samples of blubber, melon, liver and muscle are used to extract PCBs and OCs, while for the heavy metals skin, kidney, lung, liver and muscle samples are used. The coastal nature of many small cetaceans makes them particularly vulnerable to human impacts. The results of these analysis show the level of bioaccumulation of environmental contaminants in animals such as cetacean, that are at the top of food chain. The analysis is particularly important in newborns because the contamination happens only through the mother's milk. Using the data obtained through this research it is possible to know the habitat's status and suggest appropriate conservational strategies. The high toxicological charge doesn't give any definite information about the mortal causes of these animals, but we know that the contamination may contribute to development of pathological alterations.

MD23 IDENTIFICATION OF THE MORBILLIVIRUS RECEPTOR SLAM ON PHOCINE LYMPHOCYTES

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Morbilliviruses are highly contagious pathogens causing repeated mass mortalities in marine mammals. In 1988 and 2002 a phocine distemper virus (PDV) epidemic killed more than 18 000 respectively 21 000 harbour seals in the North Sea. After infection the virus dispread over the body via macrophages, lymphocytes or unattached in the blood. Catarrhal inflammation of the respiratory and digestive tract and lymphopenia are induced. For the infection of cells specific receptors are necessary. CD150 or "Signalling Lymphocyte Activating Molecule" (SLAM) is described as measles and canine distemper virus receptor on lymphocytes. The occurrence of CD150 as possible receptor for PDV on harbour seal lymphocytes using reverse Transcriptase-Polymerase Chain Reaction were investigated. As no phocine SLAM-sequence is known, we designed primers based on canine SLAM-sequence published in the GenBank (NCBI, accession No. AF325357). Lymphocytes from blood samples of juvenile and adult wild harbour seals, taken during seal catches in the North Sea, were investigated. Quantitative RT-PCR analysis demonstrated the expression of SLAM on phocine lymphocytes. PCR products were sequenced and compared with canine, human and murine sequences showing a similarity of about 93% (canine sequence), 84% (human sequence) and 78% (murine sequence). This is the first report of the morbillivirus receptor SLAM on phocine lymphocytes as potential binding site for PDV.

MD24 SCOLIOSIS IN BOTTLENOSE *DOLPHINS TURSIOPS TRUNCATUS* (MONTAGU) IN IRELAND AND BRITAIN

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A world-wide review of vertebral column malformities in delphinids has recently been published. Similar malformities have recently been recorded in bottlenose dolphins *Tursiops truncatus* in Ireland and Britain. Four bottlenose dolphins were observed with deformities in the Moray Firth, north-east Scotland between 1989 and 1993. In addition two stranded bottlenose dolphins with scoliosis have been recovered from the Moray Firth. A bottlenose dolphin with vertebral deformities has been frequently observed along the southwest coasts of England since 1991. Scoliosis has been observed in bottlenose dolphins stranded in separate incidences in the Thames. One with mild spondylosis (spinal osteoarthritis leading to partial or complete bony fusion) in 1999 and a case of mild kyphoscoliosis in 2001. At least two bottlenose dolphins with scoliosis were observed alive between 2001 and 2005 in Counties Clare and Galway in Ireland. The longevity of malformed dolphins is probably determined by the severity of the malformity, though with some reaching adulthood. Vertebral column malformities have been associated with a diverse range of causative factors. Congenital malformities have also been reported and are the most likely cause in those described here. These deformities are likely to be hereditary and genetic studies may be revealing, although samples would be difficult to obtain. We encourage observers to report incidences of vertebral column malformities in dolphins in Ireland so as to determine the extent of this condition. Records of malformed dolphins could give an insight into the movements of bottlenose dolphins as they are relatively easily recognised individuals.

NATURAL HISTORY

NH1 HISTORICAL AND CURRENT POPULATIONS' TRENDS OF MEDITERRANEAN MONK SEALS IN MADEIRA ARCHIPELAGO (PORTUGAL) AND RIO DO OURO (WEST AFRICA)

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Student award: Postgraduate

The Mediterranean monk seal (*Monachus monachus*) is presently a critically endangered species. In the Atlantic, it is restricted to Madeira and Desertas Islands, and from the Strait of Gibraltar south to Cape Blanc, Mauritania. Historically, this species inhabited the southeastern North Atlantic, from the Azores Islands and along the west coasts of Africa. Nowadays, environmental changes affecting suitability of habitat are suggested as major factors for the limited population's recovery, but many of the large monk seal colonies that existed in the past were dramatically reduced by intensive human persecution and exploitation. Objectives were to complete a wide research on descriptions of the nautical journeys along eastern Atlantic, mainly during the Portuguese Discoveries, in order to find historic references to Mediterranean monk seals and to understand its ecological meaning. This allowed to have new insights about this species past distribution and abundance, in the Rio do Ouro (Western Sahara) and Madeira (Portugal) populations, and to reveal the impacts of human actions in their colonies. Several descriptions and ship diaries referring the sea wolves, first sighted by Zarco in Madeira Island, and after that in several small sands islands in the Atlantic and along the coasts of West Africa, were found. Historic references, since the 15th century, refer thousands of these sea monsters, easy to capture and kill, that could provide great amounts of fur, meat and oil. This allowed calculating abundances and trends along the centuries and percentages of population size reduction within 500 years. A rough estimative of the initial population of monk seals in Madeira, before the Portuguese intensive exploitation, was obtained - mean value of 1604 individuals. Medium rates of increase and decrease for the two Atlantic Mediterranean monk seals populations were also obtained and compared with the similar populations of the Caribbean and Hawaiian monk seals.

NH2 WEAPON REINFORCEMENT: THE EXTENT AND DEVELOPMENT OF SEXUALLY AND AGE DIMORPHIC STRUCTURES IN THE SKULL OF THE NORTHERN BOTTLENOSE WHALE, *HYPEROODON AMPULLATUS*

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Student award: Undergraduate

Northern bottlenose whales, *Hyperoodon ampullatus*, are characterised externally by large and bulbous foreheads, and internally by the development of bony maxillary crests on the skull. These characteristics are both sexually and age dimorphic, with the oldest mature males exhibiting a large flattened, white forehead and huge maxillary crests. The maxillary crests have been hypothesised to function either as an aid to echolocation or as a battering ram in male-male head-butting contests. This study examined the skulls of 39 northern bottlenose whales covering both sexes and across all age groups. The extent and ontogenetic development of the maxillary crests was measured and related to published data concerning maturity, changes in forehead shape and colouration, and rare, but direct, observations of apparent agonistic 'head-butting' interactions in the wild. The results indicate that it is not the development of the maxillary crests per se that cause the changes in the shape of the forehead in males as they mature. Rather, it is the build up of a 'shield' of dense connective tissue around the melon that is initially responsible for the change in forehead shape, and some of this connective tissue is later replaced by the rapid development of the maxillary crests in the oldest males. Only once the maxillary crests have developed to a large extent, making the forehead a more effective weapon does the colouration of the forehead change from grey to white. This colour change may act as a 'badge of quality' that indicates the attainment of full morphological maturity, with the resulting ability to compete with a now fully reinforced melon, to any would-be opponents. The findings support the hypothesis that the maxillary crests function primarily as reinforcement in a weapon for male-male combat, rather than for other purposes such as echolocation.

NH3 THE USE OF SCALE INVARIANT FEATURES TO AID THE PHOTO-IDENTIFICATION OF CUVIER'S BEAKED WHALES

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Photo-identification is a key tool in the study of marine mammals. Considerable work has been dedicated in recent years to the development of methods to help the user search large databases of images. Automated tools have concentrate on the identification of animals through patterns on their flukes (be that the outline of the fluke or patterns of colouration on the fluke) and on anlysis of dorsal fin shapes. In this work we report efforts to classify animals through patterns of scars on their body. In particular we explore techniques for classifying Cuvier beaked whales (*Ziphius cavirostris).* The fact that photographs are recorded under a variety of photometric conditions, with the animal in different ranges and orientations means that the features used to represent the images must be invariant to such transformations. Scale invariant feature transformation (SIFT) operator offer just one such representation. A tool based on extract SIFT features and using the principles of text retival (as used in the web browsers) has been developed and tested. Results are presented on a library of 60 images. The effect of various design parameters in the system is explored. It is demonstrated how the system can rank the database of images to an order of resemblence to a test image, dramatically reducing the time needed to search a database.

NEW TECHNIQUES

NT1 SEALED WITH AN IP: A NOVEL METHOD TO AID INDIVIDUAL PHOTO-IDENTIFICATION OF GREY SEALS (*HALICHOERUS GRYPUS*)

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A system was developed for extracting an identifier patch (IP) from grey seal profiles. The patch was defined using fixed reference points of the eye and ear, which allowed for consistent extraction of the same IP from multiple photographs. Extracted IPs were converted to black and white masks, and the percentage dark score within the mask was evaluated. Variability of the dark score was evaluated from multiple images of individual animals, resulting in a mean standard deviation of 3.3% (± 1.6%). The low level of 'within-seal' variability enabled 'between-seal' images to be separated on the basis of the dark score. Although more than one animal in a catalogue may have the same dark score, the process enables a database search to be greatly focused. Subsequent pattern matching can be done by eye to complete the identification process. Successful matching of seal images, separated by 2 years and 9 months, at a North Wales field site was accomplished using this method. Pattern-matching trials using 88 untrained volunteers showed the extracted IP mask to be a superior visual cue for separating animals, compared to actual seal head photographs. All (100%) of the volunteers obtained a higher score for mask matching than for photograph matching. This method shows promise in providing a system to order and search image databases.

NT2 THE SIMPLE MINDS: BACK TO THE ORDINARY – STANDARDISATIONS OF APPROVED PHOTO-IDENTIFICATION METHODS OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

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Since Würsig (1977) and Defran et al. (1990) photo-identification is a common and well-tested standard for any population study or behavioural investigation of bottlenose dolphins. The advent of digital single lens reflex cameras as an affordable tool for field work, changed photo-ID to a much simpler and quicker method. Meantime some

professional software-tools, such as FINSCAN or EUROPHLUKES, with automated matching routines for individuals, or very complicated mathematical algorithms of describing fin shapes had been developed. However, easy criteria to characterize fins are still missing for a comparable standardisation. Up to now only the distance relations from the tip of the fin to each notch is used in simple methods to describe any individual marking of a dolphin. We tried another very simple algorithm to describe fins of bottlenose dolphins. For this, one only needs standard software, in particular an image editing programme with adjustable rulers and a relational database. The basic idea is to find a baseline of the fin, which should be selected reproducible by each person. We used the line between the tip of the fin down to its front end of the leading edge as a vertical 100% baseline of a virtual coordinate system. Now all other characteristics of the fin can be measured in relation to this reference line, such as the width of the fin or the positions and sizes of any notches. A fin can be measured and all 'coordinates' stored in a relational database in about five to ten minutes. The relative size and position of each attribute of the fin now allows the filtering of subsets of the database, for example with only the number of the biggest notches.We show examples of a numerical and graphical Access database of the bottlenose dolphin population of the Croatian National Park Kornati.

NT3 A MODEL-BASED APPROACH TO EXTRACTION OF ALL AUDIBLE CETACEAN WHISTLE CALL FEATURES AND ACCURATE NOISE-FREE CALL RECONSTRUCTION

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The analysis of cetacean calls and the use of recorded calls in playback experiments are important research methodologies. Playback experiments are frequently used and often to good success, but although call analysis has been used for example to distinguish between killer whale clans or to recognise individual bottlenose dolphins, there is a strong need for sufficiently potent analysis software. Indeed, the analysis of marine mammal calls is a difficult issue due to for example the often strong background noise and the variability of cetacean calls. This communication reports on and illustrates a signal processing method for extracting the amplitudes and frequencies of several simultaneous whistle calls, which works even in relatively strong background noise. The method is based on parametric modelling using an adaptive notch filter scheme. It is data-adaptive and requires only a minimum of input and signal processing knowledge from the user. If the conditions are not too adverse, the method can offer amplitude and frequency estimates that are accurate enough that they can be used to reconstruct the recorded whistles. We show that in many cases the human ear can not distinguish between reconstructed and recorded calls. Using known characteristics

of the marine mammal auditory system we argue that in favourable conditions, this conclusion should also extend to marine mammals. This in turn implies a) that the method offers amplitude and frequency estimates which have the potential to capture all relevant features of cetacean whistles, and b) that reconstructed calls can be used in playback experiments and function as noise-free replicas of actual recorded calls. Indeed, the playback of underwater noise together with recorded calls is undesirable but has previously been difficult to avoid, particularly since denoising methods often introduce some unwanted distortion to the recording.

NT4 COMPARISON ANALYSIS OF THE POLLING DATA AND THE RESULTS OF THE OWN SIMULTANEOUS OBSERVATIONS OF CETACEANS IN WATERS OF THE CRIMEA

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Student award: Postgraduate

The method of poll is one of the most come-at-able and it is widely used in study of cetaceans. During the investigation of 2003-2005 we managed to compare the polling data and the results of our own observations conducted in order to watch the same groups of cetaceans throughout the coast of Crimean peninsula in the Black Sea and in the Sea of Azov (bottlenose dolphin, harbour porpoise and common dolphin). As the respondents we interviewed people of the different target groups? fishermen, seamen; huntsmen; frontier guards; students and natural scientists; natives. The respondents were put more than 20 questions concerning the species identity, number of individuals in the herd, the presence of youth, behavior, strandings and other aspects. From 215 cases when we managed to compare the polling and our own data 167 mistakes were detected in 135 forms (63% of the forms contained the mistakes). 19 mistakes in the species identity were noted. In more than 50 cases we faced with in exaggeration of the number of dolphins (maximum in 7, 5 times). The main goal of exaggeration by fisherman was the demonstration of the dolphin's abundance and the absence of any danger from fishing activity. They also covered the cases of poaching (9 of them were discovered by us). Underestimation in the number of dolphins took place 13 times. 11 detected cases of false data were the result of the jokes of students. Due to the polling data we revealed 17 strandings of cetaceans in the indicated places. Conducted investigations show that the method of poll is no reliable for the estimation of the distribution, occurrence, trends in population dynamics and other aspects of cetaceans ecology, but can be used as supplement method in the process of the own research.

NT5 A COMPARISON OF MINKE WHALE (*BALAENOPTERA ACUTOROSTRATA*) DORSAL FIN EDGE MARKS (DEMS) BETWEEN TWO GEOGRAPHICALLY DISTINCT STUDY POPULATIONS

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Photo-identification is widely used as a tool for investigating the life history and behavioural ecology of cetaceans. However, there still remain a large number of assumptions, errors and bias which need to be overcome in its application to a wide range of differing species. Minke whales (*Balaenoptera acutorostrata*) have proven to be successful candidates for the use of photo-identification methods, although much work remains to refine and develop these techniques for effective use with this species. A comparative study was conducted on dorsal fin edge marks (DEMs) between two geographically distinct populations of *B.acutorostrata*, in the St. Lawrence Estuary (n 141 [257 DEMs]), Canada, and the Inner Hebridean Islands (n 76 [120 DEMs]), Scotland. A new dorsal fin layout system was used to test for significant differences occurring in the position (Anterior, Posterior, Upper, Lower, Tip) and morphology (Rounded, Squared, Triangular, Indented, Cut Off) of DEM's observed between the two populations. Results showed that there were slight variations in the positioning of marks along the dorsal fin edge between the two distinct areas. However, no significant difference was observed between the frequencies of DEM morphologies between the two regions (Chi-sq = 6.112, df = 4, p = 0.191). Therefore it was concluded that the unique processes by which these different shaped marks occur may be the same between the two distinct areas. Investigating the processes by which whales acquire markings can help to increase understanding of their life history and subsequent impacts that may affect them. Conducting comparative photo-identification studies of *B.acutorostrata*, between isolated studies, will help to increase our level of understanding but also develop and standardise the techniques used to investigate *B.acutorostrata*, allowing for future, more detailed, comparative research.

PHYSIOLOGY/ANATOMY

PA1 BREADING OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) AND FAR-EAST LIONS (*EUMETOPIAS JUBATUS*) AND FUNCTIONAL CONTROL OF THEIR STATE IN CAPTIVITY

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Sea lions and dolphins breeding in captivity seems to be an important task as it gives possible solving the problem of gene pool preservation. Information on bottlenose dolphins and sea lions breeding methods be evaluated on their functional state are fragmentary. Dolphins and sea lions are kept in near-shore cages of Sevastopol Oceanarium. Pregnancy was registered by progesterone level in blood serum with the help of radioimmunoassay technique. Heart rate and ECG indices were recorded on cardiograph in conditions of free animals behavior. Respiratory rate was checked in ten minutes period in the morning. Blood samples were taken from caudal fin's veins or arteries. Clinical blood indices were defined by standard methods. The animals were pretrained in these examination procedures. Dolphin and sea lion males are found to be fertile on reacihing 10-11 years, dolphin females - from 7-8 years, sea lion females-from 8-9 years in captivity conditions. In period pregnancy high concentration of progesterone was marked (up to 100 nmol/l). Dolphin pairing period takes place from June to October, in sea lions- during July. Pregnancy term in dolphins continues 12 months, in sea lions-11 months and 17-19 days. In first month of pregnancy progesterone concentration in blood serum rises up to 5-10 nmol/l and more. Late in pregnancy respiratory rate and heartbeat rhythm rise and behavior alter. Clinical blood indices in healthy animals remain normal during pregnancy. Female and calf separation takes place at the age of two in dolphins, and at the age of 8 months in sea lions. Functional state control methods as well as guaranteed captive animals breeding technique were developed. There were raised 8 dolphin and 10 sea lion calves.

PA2 PHOTOGRAPHIC IDENTIFICATION OF CUVIER'S BEAKED WHALES (*ZIPHIUS CAVIROSTRIS*): USING NATURAL MARKS TO IDENTIFY DIFFERENT INDIVIDUALS

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The use of natural marks in mark-recapture studies can be problematic and can lead to unequal capture probabilities. Marks on animals may not be equally distributed through-out the population: some individuals obvious markings while others appear unmarked even in high-quality photographs. Also, the appearance of natural marks may change over time. Up to now no long-term studies were carried out on mark types of Cuvier's beaked whales (*Ziphius cavirostris*), even though this species frequently shows different mark patterns. From 1996 to 2 005, one-day surveys were carried out in the Ligurian Sea, Italy, and 227 beaked whale sightings occurred. A catalogue of Cuvier's beaked whales was constructed and analyzed using over 1500 photographs. Photo-identification analysis was divided into two steps. The first was to determine the different types of marks such as notches, back indentation, scars etc. The second was to determine how the different mark types change over time, in order to identify witch mark types characterize reliably marked individuals. This information can be used to select appropriate photographs and individuals to include in long- term mark-recapture analysis. Besides, to define reliably marked individuals, more than 50 different well-photographed specimens were examined.

PA3 ROSTRUM OF TOOTHED WHALES: COMPARATIVE STUDY OF BONE DENSITY DISTRIBUTION AND MECHANICAL STRESS

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Previous observations in the literature indicate that some parts of the skull of toothed whales possess a very high Bone Mineral Density (BMD). Specifically, parts of the rostrum of some species of cetaceans belonging to the Ziphiidae family possess the highest value of density yet reported. In the present study we analyzed the distribution

pattern of bone density and the mechanical stress caused by the application of external loads in the rostrum of two odontocete families: Delphinidae and Ziphiidae. The Bone Mineral Density (BMD) of the rostra was measured using a Dual-Energy X-ray Absorptiometry (DEXA) device. A mathematical model was built up to analyze mechanical stress acting on the rostrum of toothed whales. Our results show that the two families Delphinidae and Ziphiidae have consistently different BMD distribution. A specifically devised model shows that the application of pluridirectional loadings cause distinct stress pattern in the rostra of the two families. Findings are discussed in relation to swimming, fighting and foraging behavior.

PA4 IN SEARCH FOR "ACOUSTIC VALVES" IN THE NOSE OF GIANT SPERM WHALES

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Clicks of giant sperm whales (*Physeter macrocephalus*) typically consist of trains of regularly spaced, decaying pulses, which are the result of reverberations of one initial pulse within a huge body of wax (spermaceti organ) between the frontal and the distal air sacs in the huge nasal complex. These vocalizations may serve communication and echolocation: communication clicks consist of a higher number of decaying pulses than the proposed sonar clicks and the latter can even be mono-pulsed when recorded directly in front of the animal. How sperm whales control the production of the two types of click sounds and how they can regulate the decaying rate is still not clear. Here we present a mechanism in which the right nasal passage serves as an "acoustic valve" that can switch between two modes of click production. In the right nasal passage, situated between the spermaceti organ and the junk, the second giant fat body in this area, a small volume of air may reflect and thus "trap" most of the sound energy within the spermaceti organ due to the impedance mismatch between air and tissue. During every reverberation within the spermaceti organ only part of the sound energy is transmitted via the junk into the water and thus multiple cycles of pulses are produced as is characteristic for coda clicks. In contrast, a collapsed right nasal passage, due to pressure in deeper water or muscle action, may let pass most of the sound energy into the junk immediately so that sound emission should result in sonar clicks. In consequence, the subhorizontal orientation and the central position of the right nasal passage between the two fat bodies could allow the emission of two different sound signals for communication and echolocation. (We cordially thank Ted W. Cranford and Bertel Møhl for helpful discussions).

PA5 UNEXPECTED HIGH NUMBER OF TOOTH ANOMALIES IN *LAGENORHYNCHUS ALBIROSTRIS*

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Student award: Undergraduate

Lagenorhynchus albirostris specimens that have stranded over the last two centuries along the Dutch coasts are kept in the collections of the Natural History Musea of Leiden, Rotterdam and Amsterdam. We have analysed teeth and/or stomach contents of these dolphins to find out more about their life histories. Here, we focus on age determination based on decalcified stained sections of teeth. About 25% of the teeth of young *L. albirostris* (under 6 years) show pulp stones. In contrast, these anomalies are found in more than 75% of older specimen's teeth. Although similar results have been documented for Inia geoffrensis, in most dolphin species the frequency of affected teeth is lower than 25%. Preliminary results of *Phocoena phocoena* show higher frequencies of affected teeth in individuals from the North Sea in comparison to those from other areas. Maybe the exceptionally high frequency of affected teeth in *L. albirostris spp.* from the North Sea is also a local effect rather than a characteristic of this species in general.

PA6 COMPARATION OF FLUCTUATE ASYMMETRY AMONG DIFFERENT SPECIES OF THE DELPHINIDAE FAMILY

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Student award: Postgraduate

Fluctuant asymmetry is the non directional differences between the right and left sides of bilateral characters during the development of organism Fluctuate asymmetry is believed to be caused by random developmental noise or perturbation. However, organisms have the ability to correct for these perturbations. Thus, character fluctuate asymmetry results from the opposing forces of developmental noise and developmental stability understood as the ability of an organism to develop a consistent phenotype in a particular environment. Consequently it is frequently used to calculate the stability of the development and therefore the fitness of an individual.It has been analyzed the fluctuant asymmetry in 166 skulls of the following species: *Delphinus delphis, Stenella coeruleoalba, Grampus griseus* and *Tursiops truncatus* coming from different locations in the North Atlantic Ocean.Our study assesses which of the four target species, shows the higher fluctuant asymmetry and therefore is the most sensitive to environmental changes, and also puts out how different species of the Delphinidae family can be affected by the same environmental stress.

PA7 PIGMENTATION PATTERNS VARIABILITY OF THE STRIPED DOLPHIN *STENELLA COERULEOALBA* (MEYEN, 1833) IN THE LIGURIAN SEA

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A few works on the variability in the pigmentation of striped dolphin (*Stenella coeruleoalba*) were published and a very few of those were carried out in the Mediterranean Sea. This lack is even worse since the striped dolphin is the most common species there. The aim of this research is to investigate and describe the main pigmentation characteristics and their relative variabilities within the population of *Stenella coeruleoalba* in the Ligurian Sea. This is the first study based on a quite large dataset. Photos have been collected during one-day surveys of cetaceans in the Ligurian Sea, from May 2004 to September 2005. During the study 12 964 km were covered and 206 sightings of striped dolphin occurred. Photos were taken on animals showing porpoising behaviour. Photos were taken parallel with the exposed side of the animal. Only pictures of animals completely out of water were inserted in the database, so each analyzed picture present the entire body-side. The database contains 450 good quality pictures of at least 130 specimens. Twenty different morphological features were identified, analyzed and selected to describe each individual. This has enabled to outline "typical" pigmentations of the striped dolphin in the Ligurian Sea.

PA8 IMMUNOHISTOCHEMICAL DETECTION OF FIBERS TYPE I AND II IN (*LONGISSIMUS DORSI*) MUSCLE OF STRANDED CETACEANS

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Fiber types can be differentiated by analyzing the specific myosin heavy chain (MyHC) isoforms expressed by each fiber's phenotype. The two major skeletal muscle fiber types are type I (slow-twitch) and type II (fast-twitch). Skeletal muscle type II fibers can be further subdivided intotypes IIa (fast red) and IIb (fast white). In several mammalian species a IIx (IId) myosin heavy chain isoform have been also described. Fiber-type composition varies extensively between muscles and in accordance with the functional requirements of the muscle. Endurance capacity is correlated with high percentages of type I and type IIa fibers whereas sprint capacity iscorrelated with high percentages

of type II fibers. Samples from the dorsomedial area of the Longissimus dorsi skeletal muscle were analysed in order to compare fiber type composition among different cetacean species with different dives behaviour. Samples were collected following a standard necropsy procedure and fixed in 10% buffered formalin. Two monoclonal Anti-Myosin (Skeletal-Slow and Skeletal-fast) antibodies have been used for the localization of slow (Type I fibers) and fast (Type II) MyHC by using the immunohistochemical technique.Previous studies based in the presence of intramyocellular lipids in cetacean skeletal muscles and these new results will be presented and discussed in relationship with their behaviour.

PA9 FLUCTUANT ASYMETRY AMPLITUDE IN MARINE MAMMALS

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Student award: Postgraduate

It is known that Fluctuant asymmetry (FA) has an important environmental influence and it is commonly considered as a measure of development instability which shows the individual inability to buffer random accidents of development, therefore it is habitually related in the literature as a reliable stress indicator of populations. We have obtained the fluctuant asymmetry from a total of 283 individuals of the following marine mammals species: *Delphinus delphis, Stenella coeruleoalba, Stenella attenuata, Stenella longisrostris, Grampus griseus, Tursiops truncatus, Cephalorhynchus commersonii* and *Phocoena phocoena*. All of them come from selected locations around the World, including The Atlantic Ocean, Pacific Ocean, Indic Ocean, the Persic Gulf and the North Sea. Skulls belong to CEMMA (Spain), the Natural History Museum of Paris, the National Museum of Scotland Granton Centre and the Swedish Museum of Natural History. From a number of different bilateral skull measures we obtained 13 measures carrying out the fluctuant asymmetry requisites, necessaries for the study. The total Fluctuant Asymmetry of each individual was obtained as an average of these 13.The aim of the study to is to develop a range of fluctuant asymmetry that will provide us information about the FA base line on marine mammals and to compare the range of FA variation among different species; this could give us an idea about the environmental stress sensibility of each specie which will provide us with useful information for following studies.

POLLUTION

P1 PERFLUORINATED COMPOUNDS IN HARBOUR PORPOISES FROM THE BLACK SEA (UKRAINE)

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Student award: Postgraduate

The global marine ecosystem is continuously under pressure due to expanding anthropogenic activities and the development of new contaminants. High contaminant burdens in upper trophic level animals have lead to a need for more information about the occurrence, distribution and fate of several toxic compounds. Marine mammals occupy the highest trophic positions in the marine food web and may therefore be more affected by pollutants than other animals. Recently, perfluorinated alkylated substances (PFAS) were measured in environmental samples, even in remote, non-industrialised regions. In this study we detected, for the first time, perfluorinated compounds in harbour porpoises (*Phocoena phocoena*) stranded along the Ukrainian coast of the Black Sea. Although concentrations of perfluorooctane sulfonate (PFOS) remain low, PFOS concentrations were the highest in liver and kidney tissue, and lower in blubber, muscle and brain. The results will be compared with PFOS concentrations in harbour porpoises from the southern North Sea and from northern Europe.

STOCK ID/DISTRIBUTION

SD1 OCCURRENCE OF CETACEAN IN THE SOUTHERN IONIAN SEA AND STRAIT OF SICILY

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During 2004 and 2005 four research cruises were conduced in the Southern Ionian Sea and in the Strait of Sicily, in the period between November and May. A total of 219 hours of observations and 28 hours of sighting were realized and 6 species were recognized: *Tursiops trunctus*, *Stenella coeruleoalba*, *Delphinus delphis*, *Grampus griseus*, *Ziphius cavirostris* and *Balaenoptera physalus*. In the Southern Ionian sea the encounter rate (sightings/hour observation) was high only for two species: *Stenella coeruleoalba* (0.268) and *Tursiops truncatus* (0,146). *Delphinus delphis* were observed only in individual relationship with group of striped dolphin or bottlenose dolphin. *Physeter macrocephalus* and *Grampus griseus* were observed only once. In the Strait of Sicily the frequency of sighting was greater for *Tursiops truncatus* (0,318), *Delphinus delphis* (0,110) and *Balaenoptera physalus* (0,335). *Stenella coeruleoalba* and *Grampus griseus* were sighted only once close to Malta, in the deepest part of the strait. We observed a group of five *Ziphiius cavirostris* in the north of Linosa island; this is the first sighting of beaked whale in that area. In 2005 we observed *Balaenoptera physalus* showing feeding behaviour; the average size group was 1,25, the average distance from the Lampedusa southern cost was 20,7 nm and the mean depth was 132 m. Fin whale's collected pray, Nyctiphanes couchi, associated with the mean depth of sighting, could explain this unusual superficial diurnal alimentation. In conclusion, this primarily study show that the eastern and southern water surrounding Sicily need more research to improve our knowledge of cetacean occurrence in this area, especially for the rare species, like beaked whale, those declining, like common dolphin, and those poorly known like fin whale.

SD2 VARIATION IN SADDLE PATCH PIGMENTATION IN THE KILLER WHALE (*ORCINUS ORCA*) FROM NORTHWEST (KAMCHATKA, RUSSIA) AND THE NORTH-EAST OF PACIFIC OCEAN

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An analysis of variation of saddle patch pigmentation was made to compare ecological types of killer whales from the Northeast and Northwest Pacific. Photos taken 1999-2005 of the Avachinsky Bay, Kamchatka, resident fish-eating community (AVR, n=147) and killer whales we called transient (AVT, n=13) were compared to published catalogues of Northeast Pacific killer whales including northern (NR, n=190) and southern (SR, n=79) Vancouver Island resident communities; Alaskan resident (AR, n=202) and transient (AT, n=47) communities; and the Northeast Pacific transient community (T, n=155). Two features were selected in the saddle patch pigmentation, “notch” and “saddle patch length”, and classification of variations was worked out (six variations for notch and two variations for length). No differences in saddle patch pigmentation were found between AVR and AR, AVR and NR, AR and NR ($p>0.1$). Comparisons between SR and other resident populations showed a significant difference ($p<0.001$). Saddle patch types for transients were similar between AT and T ($p>0.1$). The resident populations were significantly different from AT and T ($p<0.001$). Five notch variations were typical for residents but never found in transients. One variation in saddle patch length, typical for transients, was never found in residents. The number of identified animals from AVT was too small for statistical analysis. AVT had one notch variation typical both for residents and transients, one variation in saddle patch length typical only for transients was not encountered in AVR and other resident populations. The variations in saddle patch patterns are consistent with acoustic and association data showing that two genetically distinct populations might visit Avachinsky Bay. We suppose that AVR killer whales are not only ecologically but also genetically closer to residents than to transients from the Northeast Pacific, and killer whales from AVR, AR, NR are closer to each other than to killer whales

SD3 TOOTHED CETACEAN SPACIAL DISTRIBUTION DURING THE YEAR AND DESCRIPTION OF GROUPS IN THE COAST OF GIPUZKOA, SOUTHEASTERN BAY OF BISCAY

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Student award: Undergraduate

A study has been done to determine the annual distribution of the most frequent toothed cetaceans, in the adjacent waters of Gipuzkoa, Bay of Biscay. Shipboard visual surveys were conducted, in a motor boat according to the Spanish Cetacean Society methodological protocols. Samplings were made between April 2004 and October 2005 sailing a total of 1766,34 miles with correct observation effort, covering 1524,45 Km2. The data, both of sighting and observation effort, were analysed with a Geographic Information System (Arc view 3.2), and a Statistic program (SPSS 9.0). Six different species were studied of a total of 91 sightings. From the data collected, the encounter rates, according to the effort made, of each specie respect to the depth and season of the year was examined. The most frequent specie was the bottlenose dolphin (*Tursiops truncatus*), that was observed 35 times (39%) during all seasons and distributed uniformly, common dolphin (*Delphinus delphis*) was encountered 20 (22%) times all over the area , long-finned pilot whale (*Globicephala melas*) groups were found 20 times (22%) in areas between 400m and 1200m deep, striped dolphin (*Stenella coeruleoalba*) 9 times (10%) in pelagic waters (12 %), Cuvier´s beaked whale (*Ziphius cavirostris*) was observed in 5 occasions (5%) in the deepest areas between 1000m and 2300m and harbour porpoise (*Phocoena phocoena*) were observed twice (2%) in the continental platform, between 160m and 180m deep. Significant variations were observed in the annual distribution of species. The activity and description off groups has been analysed, showing these main conclusions; groups of bottlenose have 38 individuals for mean (sd 46,1), common 173 (sd 166,12) and striped dolphins 180 (sd 167,61), long finned pilot whales 20 (sd 20,71), cuviers backed whales were mostly lone individuals (sd 1,3), except one sighting of 4 young individuals, harbour porpoises were showed lonely.

SD4 ODONTOCETE POPULATIONS IN THE BAY OF BISCAY: DIVERSITY AND DISTRIBUTION SUMMER-AUTUMN 2003-2004-2005

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Student award: Undergraduate

During summer, the fishing boats of the Basque country sailed around the Gulf of Biscay aleatoricaly looking for fisheries of red tuna (*Thunnus thynnus*). These platforms are used since 2003 to determine the diversity and distribution of cetaceans in summer and autumn.

8010 nautical miles were sailed with adequate sighting effort, covering an area of 44.240,227 square nautical miles from the continental shelf to abyssal plains. The sighting and observation effort data were analyzed with a Geographic Information System (Arc view 3.2), and a Statistic program SPSS 11. Nine different species of odontocetes were encountered in a total of 185 sightings. The most frequent species of cetacean observed during the season was the common dolphin (*Delphinus delphis*) with 65 sightings (24 %), striped dolphin (*Stenella coeruleoalba*) with 51 (18 %), Cuvier´s beaked whale (*Ziphius cavirostris*) 38 (13%), long-finned pilot whale (*Globicephala melas*) 29 sightings (10 %), bottlenose dolphin (*Tursiops truncatus*) with 23 (8 %), orca (*Orcinus orca*) 8 (3%), sperm whale (*Physeter macrocephalus*) 4 (1%), harbour porpoise (*Phocoena phocoena*) 2 (1%), false killer whale (*Pseudorca crassidens*). From the data collected, the distribution of all the species with respect to the depth was examined. Significant differences were observed, between the encounter rates in relation to the effort made and according to the depth, showing a non uniform distribution in the area.

SD5 UNUSUAL MIGRATION PATTERNS OF ARCTIC MARINE MAMMALS IN THE COASTAL WATERS OF THE NORTH ATLANTIC IN XIX – EARLY XX CENTURIES

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A set of unusual migration patterns of seals and small whales in coastal waters of East Northern Atlantic has been taken from local and historical sources. There is information about the occasions when arctic species such as harp seal (*Pagophilus groenlandicus*), hooded seal (*Cystophora cristata*), white whale (*Delphinapterus leucas*), narwhal (*Monodon monoceros*) visited unusual for them southern areas (coastal waters of Norway, Denmark, Britain and Germany). Three narwhals and one white whale have visited the British waters in the period 1800–1815. There were 5 years when large herds of harp seals and white whales were observed in near the Murman (Russia), in 1800–1815. One hooded seal and one narwhal were recorded near the British coast between 1815–1860. The records show five single animals (4 hooded seals, 1 harp seal) sighted or captured in British and Norwegian waters between 1861 – 1880. A number of records increased dramatically between 1881–1905. Single marine mammals have been recorded in British (5 hooded seals, 5 white whales), German (1 harp seal), and Dutch (1 white whale) waters. From 1881 white whales (groups and individuals) and harp seals (large herds) were recorded near the East Norwegian and Russian in spring and summer. Most large herds of harp seals (1890–1903) and white whales (1902–1904) were observed along the coasts of East and West Norway and Murman (Russia) in winter-summer. There was only one record of estimating marine mammals (narwhal) in temperate waters between 1904–1915. According modern data, last decades there were often observed similar unusual migration patterns of arctic marine mammals. The historical and modern data allow to conclude that the changes in the way of arctic marine mammals migrations occurred at the 3 periods of time during the 19th–20th cc. (1800–1815, 1880–1905, 1970s-nowadays).

SD6 SEASONAL OCCURRENCE OF HUMPBACK WHALES AROUND SAINT HELENA, SOUTH ATLANTIC OCEAN: EVIDENCE OF A PREVIOUSLY UNKNOWN BREEDING GROUND?

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Within the South Atlantic, there are two known breeding grounds for humpback whales, one off Brazil and the other off West Africa. Here we provide evidence of a third, previously unknown breeding ground between these two around the Island of Saint Helena (15oS, 5oW). Data on the occurrence of cetaceans around Saint Helena was gathered from June 2003 to October 2005. A total of 399 cetacean sightings were recorded during this period. No humpback whales were recorded between January and May (the austral summer). However, in June humpback whales made up 35% of all cetacean sightings. This increased to a peak of 70% in September before falling to 25% by December. Out of a total of 192 humpback whale sightings, only 5% were recorded in June increasing to a peak of 32% in September. Only a small proportion of the total number of humpback sightings (under 10%) were recorded in each of October, November and December. Group size varied across the austral winter, peaking in August (Mean=3, SD=1, Max=6) and calves were observed in all winter months (June-December). However, the proportion of sightings with at least one calf present remained low from June to August (under 20%) before peaking in September (43%) and remaining high until December (29%). These observations suggest that humpback whales occur throughout the austral winter around Saint Helena, with a single peak in relative abundance. The peak in group size in August suggests mating groups may be present at this time, while the peak in the presence of calves in the latter half of the austral winter suggests calving mainly occurs around Saint Helena in these months. These observations are consistent with humpback whales coming to Saint Helena to breed rather than passing through these waters on the way to and from another known breeding ground.

SD7 WINTERING CONCENTRATION OF BLACK SEA CETACEANS OFF THE CRIMERIAN AND CAUCASIAN COASTS

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Until recently no special research had been carried out to study the winter distribution of Black Sea cetaceans including harbour porpoises (*Phocoena phocoena*), common dolphins (*Delphinus delphis*) and bottlenose dolphins (*Tursiops truncatus*). Since February 2004, a monthly vessel-based monitoring of coastal waters between Cape Fiolent and Cape Aya (SW Crimea, Ukraine) is being conducted in the area of 60 km^2 using line transect method (28km of observation effort along six zigzag tracklines) and photo-identification techniques. According to the obtained sighting statistics, bottlenose dolphins are concentrated here in tens during the whole cold-water season (from October-November to April-May, with a peak of their presence in winter), while harbour porpoises accumulate mainly in autumn and spring, and common dolphins visit this area quite irregularly. Furthermore, specially organized winter shipboard survey was carried out from 18–20 January 2005 in the SE Black Sea represented with 12-miles-wide territorial waters of Georgia, between Cape Anaklia to the north and the Turkish state border near Sarp to the south. A total of 211km of observation effort along eight tracklines crossed the study area of 2320km2. High indices of cetaceans density were estimated for harbour porpoises (1.5 individuals /km2; CV=26.5%) and common dolphins (4.2 individuals /km2; CV=31.4%), whereas bottlenose dolphins were not sighted at all, in spite of three additional days (23, 25 and 28 January) of fruitless search over the area. The results of above surveys suggest that inshore waters off the southern Crimea and southern Caucasus are important wintering grounds, correspondingly, for (a) bottlenose dolphins and (b) harbour porpoises along with common dolphins. Further monitoring and special (at least seasonal) protection of these wintering areas in Ukraine and Georgia seem to be essential for the improvement of Black Sea cetaceans conservation. It is expedient also to extend winter surveying to other parts of the basin.

SD8 EXCEPTIONAL PRESENCE OF BRYDE'S WHALES (*BALAENOPTERA EDENI*) IN LA GOMERA (CANARY ISLANDS)

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La Gomera, one of the seven Canary Islands, is an area of high cetacean species abundance. 21 species have been identified up to now. The study area off the SW coast of the island is a special area for conservation (SAC) that covers 80 nm² and with depths of up to 1500m.The main sighted species in the area are small delphinids while sperm whales (*Physeter macrocephalus*) are rare. Blainville's (*Mesoplodon densirostris*) and Cuvier's (*Ziphius cavirostris*) beaked whales can be observed on a regular basis. With regard to baleen whales most of the species (*Balaenoptera musculus*, *Balaenoptera physalus*, *Balaenoptera borealis* and *Balaenoptera edeni*) are present on a seasonal basis beeing the Bryde's whale the most abundant.However 2005 was an exceptional year for Bryde's whales with a very high presence of this species in La Gomera. From March until November it was the most sighted whale species with encounters during 57 out of 113 survey days (50,44 %). Some days with even more than one sighting.During this period 21 different individuals could be photo-identified and some of them observed more than once. Five females with calves were sighted and identified.Also, several different behaviours could be observed like feeding or young (7-11m length) individuals approaching the boat up to a few centimeters for bowriding. While feeding, other species like Cory's Shearwater (*Calonectris diomedea*), atlantic spotted dolphins (*Stenella frontalis*) and tuna fish were often present at hundreds. Even the presence of sharks could be stated once. During another sighting up to 5 Bryde's whales could be observed feeding together

SD9 CATALOGUE OF A BOTTLENOSE DOLPHIN POPULATION IN THE GULF OF CATANIA (IONIAN SEA), USING AND COMPARING TWO PHOTO-IDENTIFICATION METHODS

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(1) Ketos Scientific Association, Catania, Italy (2) Università degli Studi di Catania, Catania, Italy

Student award: Undergraduate

Ketos, no-profit Scientific Association, has monitored, during the period between 1997 and 2001 and between 2003 and 2005, a population of *Tursiops truncatus* living in the Gulf of Catania (Ionian Sea). Study area covers approximately 100 km². In the last two

years the effort was concentrated in the southern part of the gulf: a total of 133 surveys for an amount of 494 hours of observation, has been conduced. A total of 90 hours of sightings has been collected, most of all are in interaction with local fishery, in detail with a particular gillnet called Menaide. The aim of the research is to obtain an ID catalogue of the resident bottlenose dolphin population. The research produced a collection of 1924 shots, but only the 19% respects the parametres for photo-identification. For the analysis, we have used the Würsig's "Photo-ID" method and the new software "FinEx v.1.1.2" and "FinMatch v.1.2.1." and we have compared the results. With the Würsig and Würsig's method the population amount is of 22 individuals, while with FinEx and FinMatch' method the number derived is not real. In conclusion, by our point of view the new software, even if it is a good innovation, it requires other updating. We will continue this research next years to test these preliminary results and to obtain a real value of size population and the supposed migration around the study area.

SD10 SPATIAL AND SEASONAL DISTRIBUTION PATTERNS OF HARBOR PORPOISES IN THE GERMAN BIGHT OF THE NORTH SEA

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We investigated seasonal differences in the distribution of harbor porpoises *(Phocoena phocoena*) in German national waters of the North Sea (EEZ plus 12 nm zone) based on data collected between 2002 and 2005 during aerial surveys. Aerial surveys were conducted year-round following standard line transect methodology and covered a total area of about 28,600 km2. Survey effort amounted to 37,148 km that were flown on effort, during which a total of 3,856 harbor porpoises were seen. Using standard Distance procedures and a grid of 10x10 km, we converted the line transect point locations into mean density estimates. The density estimates were corrected for missed animals and sighting conditions, as effective strip widths (including g(0)) for good and moderate conditions were calculated. We then used permutation simulation analyses to investigate porpoise occurrence in relation to a number of predictor variables (depth, several depth derivates, distance to land and sea surface temperature) during different times of the year (spring, summer and fall). The results indicated significant seasonal similarity in porpoise spatial distributions in between seasons of the four study years. Seasonal shifts in distributions are most likely linked to changes in harbor porpoise habitat requirements associated with different stages of their annual life cycle. In particular, porpoises appeared to be aggregated and more closely associated with depth, contour index and sea surface temperature during the spring months than during other

times of the year. Our results emphasize the importance of year-round monitoring programs and the consideration of seasonal aspects when developing habitat prediction models and when investigating critical habitat, particularly in the context of anthropogenic impact assessments. However, harbor porpoise habitat selection on smaller geographic and temporal scales is likely influenced by additional environmental and biological parameters such as prey distribution which need to be taken into consideration in this context.

SD11 CETACEANS IN THE DONUZLAV LAKE (CRIMEA, UKRAINE)

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Since 2004 the Donuzlav Lake is in focus of environmental concern due to the plan of port complex building. Environmental assessment demonstrates that the project would have a strong negative impact on the whole coastal ecosystem. Donuzlav is a 27 km long and 27 m deep coastal lake. An artificial channel 7 m deep and 200 m wide joins it to the Black Sea. Maximum width of the estuary is 9 km. Lake area is ice-free. Water is saline in the lower part and fresh in the upper part of the lake. Fishermen and local residents repeatedly reported the sightings of cetacean schools and single specimens in the Donuzlav but the information was incomplete.Our research in 2002-2005 included dolphins survey and interviews of students – local residents. The occurrence of the cetaceans in the Donuzlav zone is the highest in the local sea area. The only definitely identified species is the bottlenose dolphin. Most often dolphins occur near the channel where they forage mullet: in channel and adjoining lake and sea areas. Dolphins were also recorded up to Novoozernoye (18 km from the sea), and interview data confirm the sightings and strandings of cetaceans of unknown species in the very upper part of the Donuzlav. Daily sightings of bottlenose dolphins are recorded during the mullet mass migration from mid-August to October; during the spring migrations they are less frequent. Daily activity observations: in the morning the dolphins appear in the sea area, then enter the channel and the lake, and after 14.00 return to the sea. School size numbers up to 12 specimens but usually schools of 2-8 animals occur. Only 2 strandings were reported but cases of food consumption by local residents are known. Regular migrations of cetaceans in the Donuzlav have to be taken into account while planning.

SD12 STATUS AND LIFE HISTORY OF HARBOUR PORPOISE IN THE SEA OF AZOV

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Data on sightings, strandings and life history were collected by the author in 1999–2005, mainly from the southern coast of the Sea of Azov.Harbour porpoise occurs in the Sea of Azov seasonally – from April to November. In spring and autumn porpoises migrate from the Black Sea and back, following the anchovy schools. Due to this migration pattern, the parturition season falls to the time when the Azov stock is isolated. Thus, an isolated population is formed. This population is characterized by a particularly large body size: mean body lengths of adults are ca.10 cm larger than in the neighbouring Black Sea populations.The harbour porpoise is distributed throughout all the sea area. Sightings from Sivash and Taganrog Gulfs were reported.Calving season lasts from April to August. In early June calves with erupted teeth are recorded. Peak of calving falls to late June – early July. This date is month later than in the Black Sea. Body length in neonates is 58-82 cm, mean length is 73 cm.Mean age of attaining of sexual maturity is 2.2–2.7 years in males, ca.3 years in females.Maximum life span recorded is 20 years. 95% of the population are 12 years old and less.Abundance fluctuates in the range of several thousands specimens. Abundance estimates are under discussion. Mass mortality events occur regularly and lead to apparent population decline. The last events occured in 1999 and 2002. Causes of mortality were not identified. After the last event, the occurence of strandings declined in 3 times (2003). By 2005, the occurence level restored. Percentage of neonates and calves rose substantially.The most frequent cause of death is incidental by-catch. A significant source of by-catch are illegal sturgeon gillnets. In 2000-2001 the percentage of by-caught animals in mortality structure reached up to 40%. In 2005 the number and percentage of by-caught animals.

SD13 CETACEAN DISTRIBUTION AND PRIORITY CONSERVATION AREAS IN THE GULF OF CALIFORNIA

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The Gulf of California actually represents one of the five most productive and diverse marine ecosystems in earth. Historically eight species of baleen whales have been registered (61% of all species) and twenty three toothed whales (31%). In 2001 an interdisciplinary group of specialists creates the Gulf of California Coalition, that

proposed the Biological Importance Areas (BIA) for the different aspects in this region, inlcuding the BIA for marine mammals. In this work we analize the relative abundance and distribution of cetaceans in Gulf of California for winter and summer of 2005 and compare with this proposed BIA. We made two aerial surveys along the Gulf of California, February 22 to March 2nd for winter and 21 to 28 of June for summer. The surveys were made following transect lines at 900 ft of altitude and 100 mph average speed, through 3700 miles and around 36 hours of efective effort for each one (winter and summer). For all cetacean sightings in winter the blue and fin whales were the most abundant misticetes (16% each one) and common dolphins (46%) and sperm whales (4%) for odontocetes. In summer the fin whale was the most abundant (11%) followed for bottlenosed dolphin (28%) and sperm whale (26%). About the distribution we registered many blue and fin whales in northern part of the gulf and many sperm whales in the big islands region. The same was for the middle part of the gulf. Considerng the BIA proposed areas, our results coincide with the northern part of the gulf and the big islands region. For the southwestern region the historical records coincide with this. The main diferences was in the midddle-south, where very few sighthings were recorded and in the middle with an important number of sighthings, mainly blue, fin and sperm whales.

SD14 POPULATION IDENTITY OF HUMPBACK WHALES (*MEGAPTERA NOVAEANGLIAE*) IN BAJA CALIFORNIA SUR, MÉXICO, BASED ON MITOCHONDRIAL DNA

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Every winter the humpback whales aggregate in the coasts of Baja California Sur, Mexico (BCS). Base on previous photo-identification studies the coasts of California-Oregon-Washington are their main migratory destination. As in other parts of the world, in the North Pacific the humpback whales show high fidelity to their feeding areas and they mix, in different degrees, in their breeding grounds. In order to identify their migratory connections, we analyzed the haplotype diversity of 149 skin samples of humpback whales from BCS, and 409 from their feeding areas (California 90, Oregon 11, Washington 11, British Columbia 40, Glacier Bay 100, Southeast Alaska 97, Prince William Sound 37, Shumagin and Kodiak Islands 19, and Aleutian islands and Bering

Sea 21). The humpback whales of BCS present the highest diversity of haplotypes in all the North Pacific, is the only region that presents the 9 haplotypes known in this ocean. The haplotype frequencies in BCS changed during the seasons and between years. The main migratory destinations were the Bering Sea the Aleutians, Shumagin and Kodiak Islands in the west coast and the coast off Oregon in the east coast of the North Pacific. The BCS Mexican waters represent an important breeding ground for humpback whales from both sides of the high latitudes of the North Pacific Ocean.

SD15 IMPACT OF HUMAN ACTIVITIES IN GERMAN WATERS ON HARBOR PORPOISE DISTRIBUTION

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Anthropogenic impacts on the marine environment are of growing concern. It is difficult to quantify the influence of human activities and their impact on marine mammals. This study evaluated the distribution of harbour porpoises with regard to human activities, particularly sea traffic. Sighting data from aerial surveys (May 2002 - November 2005) provided the base data for harbour porpoise distribution in German waters. Using a GIS application this information was compared to shipping lanes and estimated densities of daily ship movement. In addition, sighting data of vessels, obtained during the same survey flights, thus based on the same spatial and temporal scale, allowed a direct comparison with harbour porpoise data. 481 shipsightings were recorded in the North Sea, 1800 in the Baltic Sea. The most common ones were sailing boats (NS 93; BS: 837), container ships (NS:110; BS: 135), fishing vessels (NS173; BS144) and motorboats (NS: 44; BS: 532). 3112 harbor porpoise sightings were recorded in the North and 309 in the Baltic Sea. It was possible to reveal potential conflict areas. In both, North and Baltic Sea the main shipping routes were identified as areas of lower porpoise density. With the same survey effort, the number of detected ships in the Baltic Sea was almost 4 times higher than in the North Sea, whereas the number of porpoise sightings was 10 times higher in the North Sea. For the first time data on ships and porpoises was obtained under the same survey conditions and the results show that in further development this method could provide a means for comparing densities in a way impractical with simulated data.In continuation of this study more human influences, e.g. gravel extraction, oil platforms, fisheries, debris occurrence and offshore windmill farms will be included and areas of especially high human impact shall be

SD16 "OFFSHORE" HARBOUR PORPOISES IN THE CENTRAL BLACK SEA

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The Black Sea shelf area is known as a primary habitat of harbour porpoises (*Phocoena phocoena*) and bottlenose dolphins (*Tursiops truncatus*), whereas offshore waters over the continental slope and deep-sea depression of the Black Sea represent main habitat of common dolphins (*Delphinus delphis*). So far, there was no evidence that harbour porpoises can form sizeable accumulations in the mid part of the Black Sea beyond bounds of the shelf. A vessel-based line transect cetacean survey was carried out from 24 September to 7 October 2005 in the central Black Sea, between the Crimea peninsula, Ukraine, to the north and Sinop province of Turkey to the south. Six tracklines (660km of observation effort) crossed study area (31200 km2) leaving aside shallow (0-200m) shelf zone and territorial waters of the riparian states. A total of 169 harbour porpoises (22 sightings), 107 common dolphins (33 sightings) and none bottlenose dolphins were recorded in the study area. Harbour porpoises were sighted in groups of 1–50 animals (7.7 on average) at a distance of 38–215km from the nearest coast where depth comes to 450–2,170m. Usually, neighbouring groups of harbour porpoises were observed not far from each other suggesting their belonging to larger aggregations. The estimated density of harbour porpoises and common dolphins amounted to 0.26 (CV=78.7%) and 0.15 (CV=52.4%) animals per 1 km^2, respectively. The occurrence of harbour porpoise accumulations offshore in the deep-water area pretends to be crucial in view of resumptive estimation of this species abundance in the Black Sea in whole. At present available data are not sufficient for such comprehensive assessment. In this context, the preparation of basin-wide cetacean survey should be the priority of fundamental importance.

SD17 STUDY OF ABUNDANCE AND DISTRIBUTION OF CETACEANS IN GALICIAN (NW SPAIN) WATERS FROM LAND-BASED OBSERVATIONS

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Student award: Postgraduate

Galician waters contain one of the most important populations of cetaceans in Spain, specially bottlenose dolphin (*Tursiops truncatus*) and harbour porpoise (*Phocoena phocoena*). Until 2003 only data from strandings and ship surveys were used to study

the cetacean populations in Galicia. With the aim of complementing these data and improve the knowledge of the status and distribution along Galician coast, in 2003 a systematic land-based survey was developed. Along the 1,190 Km of coast 53 observation sites were established, the coordinates, height and vision angle of each site were calculated. The minimum time of observation in each site was 20 minutes and the maximum 60 using binoculars and telescope. Sea state, weather conditions and visibility were registered for each observation. From September 2003 to September 2005 the total time of land-based observations was 778 hours, during this time 253 sightings were registered with a frequency of 1 sighting each 3.07 hours of observation.The group size, behaviour, direction, distance and presence of calves were registered for each one. The 54.55% of sightings was bottlenose dolphin (*Tursiops truncatus*), 25.69% common dolphin (*Delphinus delphis*) , 9.49% harbour porpoise (*Phocoena phocoena*), 1.98% pilot whale (*Globicephala melas*) and 1.98% Risso's dolphin (*Grampus griseus*). There were 3 sightings (1.19%) of unidentified mysticeti and 13 sightings (5,14%) of unidentified odontoceti. All these data were analysed to study the abundance and the spatial and seasonal distribution of cetaceans in Galician waters. The relative density (animals/25 km2) for the three most common species was: 2.59 for common dolphin, 1.79 for bottlenose dolphin and 0.29 for harbour porpoise. Most cetaceans were observed from Cape Corrubedo to Cape Finisterre (on the west coast). The results show that systematic land-based surveys are an useful non-intrusive technique to study the distribution and estimate the abundance of coastal cetacean.

SD18 CHANGES IN THE SUMMER DISTRIBUTION OF CETACEANS IN THE UK FROM DATA COLLECTED DURING SIMULTANEOUS NATIONAL WHALE AND DOLPHIN WATCHES 2002-05

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A simultaneous National Whale and Dolphin Watch event has been organised over four consecutive years: 27-28 July 2002, 30-31 August 2003, 21-29 August 2004 and 13-21 August 2005. Its objective was a) to raise awareness of the diversity of cetaceans in the UK, and b) to collect sightings data to create a snapshot picture of cetacean relative abundance and distribution in coastal waters. During the watch period, experienced observers attended sites around the UK coastline, recording all cetacean sightings and associated effort-related environmental data. In addition to the organised land watches, several marine wildlife operators and ferry companies participated by sending in their sightings. Casual sightings reports were also sent in by the general public. The total number of sightings received during each of the four events varied from 326 to 578. Between seven and eleven species were seen

during each of the National Watches, with the harbour porpoise and bottlenose dolphin being the most common and widely distributed. The results showed some distributional differences between years but highlighted hotspots particularly for those two species. A notable finding was that in some years bottlenose dolphins were much more widely distributed than previously thought, in all three countries (England, Wales & Scotland). In the Irish Sea, for example, populations of the species clearly occurred simultaneously over a much wider geographical area than Cardigan Bay suggesting that they may be more than offshoots of that population. A similar finding occurred one year with bottlenose dolphins reported along the coasts from Northumberland northwards as far the Caithness & Sutherland coasts of Scotland rather than solely between the Moray Firth and Firth of Forth. This has important implications on conservation and management of the species, since their three current marine Special Areas of Conservation will not alone protect it from threats by human activities.

SD19 DISTRIBUTION AND RELATIVE ABUNDANCE OF CETACEANS OFF LA GOMERA (CANARY ISLANDS)

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The present study assess the distribution, relative abundance and variation in the probability of sightings, of cetacean species in the southwest of La Gomera. This is a special area for conservation (SAC) due to the presence of bottlenose dolphins (*Tursiops truncatus*) and loggerhead turtles (*Caretta caretta*). A total of 1205, 57 nautical miles and 210,25 hours of boat based survey (45 days) were conducted from August 2004 to June 2005 in the SAC (ES-7020123) which covers 131,39 km2. During this period we had a total of 110 sightings of 9 species, out of the 21 recorded until now in the island. Short-finned pilot whales, *Globicephala macrorhynchus* (28 sightings, 25,45%) and bottlenose dolphins, *Tursiops truncatus* (22 sightings, 20%) had the highest sighting abundance with peaks in the months of February, March and June. This peaks coincide with the highest probabilities of sighting recorded from the months of February to June, predominantly in March (0,61 sightings/nm; 2,62 sightings/hour) and June (0,23 sightings/nm; 1,48 sightings/hour). *Stenella frontalis*, a very seasonally distributed species, had the third highest score in abundance with 21 sightings (19,09%) and a very acute peak in the month of May (9 sightings). The other species were: *Balaenoptera edeni* (n:14; 12,72%), *Steno bredanensis* (n:11; 10%), *Delphinus delphis* (n:5; 4,55%), *Stenella coeruleoalba* (n:1; 0,91%), *Balaenoptera physalus* (n:1; 0,91%), *Balaenoptera borealis* (n:1; 0,91%) and undientified species (n: 6; 5,45%). As shown in this study, the waters off the southwest coast of La Gomera are of high abundance and diversity in cetacean species, mainly of the Delphinidae family, with the higest abundance in the months around the spring season probably due to the increase of food availabily in the area.

SD20 THE HABITAT USE AND SITE FIDELITY OF BOTTLLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN THE SLOVENIAN SEA AND BAY OF TRIESTE: A FIRST ESTIMATION

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The bottlenose dolphin (*Tursiops truncatus*) is the last remaining marine mammal in the Bay of Trieste, in the northern most area of the Adriatic Sea. The shallow bay, measuring just 33m at its deepest point, has, however, a surprisingly large biodiversity of species in the face of considerable, detrimental anthropogenic activities. Lying at the top of the food chain, the bottlenoses frequenting the immediate coastal habitat in this location are thus considered an important component of the marine ecosystem, serving as essential bio-indicators of the health and ecological status of the area. Between 2001 and 2005, dedicated boat surveys and opportunistic public sightings data were carried-out to better understand the fine-scale distribution / site fidelity of these animals in a 280 km^2 area comprising the Bay of Trieste and surrounding coastline, using photo-identification and mark-recapture techniques as central methodologies for this work. In the following presentation, preliminary results showing the seasonal habitat preference and group sizes of the dolphins observed in this location are expressed, and the human threats, such as ship traffic, commercial fishing and also tourist activities, for example, identified for those areas where animals were seen to be most prevalent. The significance of these results is discussed in view of the immediacy of management actions / precautionary conservation measures necessary for the protection of this top-level predator in the inshore coastal waters of the Slovenian Sea and Bay of Trieste. Suggestions are further made for a long-term research approach to provide a more comprehensive picture of the status of Tursiops trucatus in this vulnerable area of the northern Adriatic Sea.

SD21 PATTERNS OF CETACEAN STRANDINGS IN NE SCOTLAND (1992 TO 2005): HOW DOES STRANDINGS DATA COMPARE TO LIVE ANIMAL SURVEYS?

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To date, systematic studies of wild cetaceans in northeast Scotland have been largely restricted to just a handful of priority, coastal populations, but historical records, opportunistic sightings and dedicated surveys in the inshore waters of the outer Moray

Firth, have identified several other species of whale and dolphin which are not only present in considerable numbers but may also be of significant conservation importance. However, the inability to monitor year-round occurrences of animals at sea in such an extreme, temperate location may subsequently result in an incomplete picture of species composition. Therefore, in the present study, incidental strandings records were used to complement existing data from dedicated boat surveys (carried out annually between May & Oct), to provide a better determination of the biodiversity/occurrence of cetaceans in an 800 km2 area comprising the southern outer Moray Firth. A total of 10 species were recorded from the coupled datasets including: the Risso's dolphin (*Grampus griseus*), long-finned pilot whale (*Globicephala melas*), harbour porpoise (*Phocoena phocoena*), bottlenose dolphin (*Tursiops truncatus*), killer whale (*Orcinus orca*), sperm whale (*Physeter macrocephalus*), humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), Atlantic white sided dolphin (*Lagenorhynchus acutus*) and the white-beaked dolphin (*Lagenorhynchus albirostris*). Those species recorded in highest abundance during live surveys were also most highly represented in the strandings data. However, some species, such as the killer whale and humpback whale, which were sighted only erratically in the survey area across years, did not occur in the strandings data. Similarly, other species recorded in the strandings data were not encountered during boat surveys. This paper discusses the implications of these findings, summarising patterns and trends in the strandings data and considering the compatibility/significance of the combined data sets with respect to conservation management.

SD22 DISTRIBUTION AND MOVEMENTS OF SHORT-FINNED PILOT WHALE (*GLOBICEPHALA MACRORYNCHUS*) IN THE CANARY ISLANDS

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Short-finned pilot whales, *Globicephala macrorhynchus*, exhibit a wide distribution in warm and tropical waters of all the oceans. In the Canary Islands, this species, together with the bottlenose dolphin, represents one of the main targets of the whale-watching industry, particularly off the southwest coast of Tenerife island. The aim of this research was to know the possible movements of the species between the islands of the Canary archipelago. From 1999 until november 2005 we have collected information on distribution and photo-identification of short-finned pilot whales around the Canary Islands. In this period, we have completed 2.067,06 hrs of boat effort and have had 136 sightings of the target species. All pods of pilot whales were identified and a comparison was made with the catalogues

produced in 1990-1991 by James Heimlich-Boran and in 1992-1993 by ourselves on the short-finned pilot whales community of the southwest coast of Tenerife. The results of this research highlights a wide range of movements among the Canary Islands, mainly Tenerife-Gran Canaria and Tenerife-La Gomera, with records of movements between islands over a period of up to 10 years. The record of the same animal groupings is a direct indicator of long term association within social groups. There is a surprising permanence of some scars (i.e. tooth marks) for a long period of at least 10 years.

SD23 EVIDENCES OF BOTTLENOSE DOLPHINS MOVEMENTS IN THE CANTABRIAN SEA

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The bottlenose dolphin (*Tursiops truncatus*) is probably the most studied species of cetaceans in North European Atlantic waters. This species is included in the Anex II of Habitat Directive and because of this the member countries of the European Commission are required to implement management plans to assure their favourable conservation status. One of the main variables necessary to achieve this objective is to known the population structure of the specie. During the last decade there has been a growing effort for collecting data about this species in the Cantabrian Sea (North Spain). As in the rest of Europe this effort has been done in small areas: west Galicia, Asturias, and Basque Country. This work is the first attempt to elucidate if there are movements of bottlenose dolphins along cantabrian waters, trough the comparison between the photo-id catalogues of two organizations working in small areas of the Cantrabrian Sea: CEMMA (Galicia) and AMBAR (Basque Country). From 2000 until 2005 CEMMA have collected 1344 images and have identified 172 individuals. On the other hand, from 2002 until 2005, AMBAR have collected 1404 images and have identified 225 individuals. The number of recaptures per year, for the two areas, are relatively low (between 2 and 9 in Galicia and 1 in the Basque Country), suggesting first, that the bottlenose dolphins using west Galician waters are present during all the year, and second, that in both areas it seems that animals are using the food resources during relative small periods of time and, after this, they move to other areas. The presence of bottlenose dolphins in both areas in different years (2 animals) support this idea of a dynamic pattern of movements along cantabrian coast, and probably further, of at least some of the animals.

SD24 SIGHTINGS OF ROUGH-TOOTHED DOLPHINS (*STENO BREDANENSIS*) OFF ANGOLA AND GABON, SOUTH-EAST ATLANTIC OCEAN

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Rough-toothed dolphins are distributed in tropical and warm temperate seas around the world. Although documented off North-west Africa and in the western Gulf of Guinea, there are no published records of rough-toothed dolphins along the remainder of the African west coast. This paper presents four sightings of rough-toothed dolphins off Angola and Gabon, extending the confirmed distribution range of this species within the South-east Atlantic Ocean. Marine mammal observations were carried out off Angola, the Democratic Republic of Congo, Congo and Gabon during 2004 and 2005, in association with geophysical seismic surveys. During watches a single observer scanned 360º around the vessel with the naked eye and 10x42 binoculars. Effort logs (comprising position, water depth, vessel activity and environmental data including Beaufort sea state) were completed for every watch. Standardised positional, environmental and behavioural data were noted for cetacean sightings. A total of 3678.5 hr survey effort was collected over 14 survey months between March 2004 and September 2005. Survey effort covered water depths of 10–4000 m, and was concentrated off Angola. A total of four sightings of rough-toothed dolphins was recorded, three in Angolan waters and a single sighting off Gabon. Records occurred in March, September and November. The water depth of sightings ranged from 402 to 2139 m (mean = 1141), indicating that rough-toothed dolphins occupy shelf edge habitat in this region. Group size ranged from 11 to 20 animals. Three of the sightings occurred in association with other cetacean species, twice with short-finned pilot whales and once with an unidentified small ‘blackfish’ species. Bottlenose dolphins were also present during one mixed-species feeding aggregation with rough-toothed dolphins and pilot whales. These sightings provide novel information on the distribution and biology of rough-toothed dolphins off Angola and Gabon in the South-east Atlantic Ocean.

SURVEYS/ABUNDANCE

SA1 MONITORING SURVEY OF CETACEANS IN TERRITORIAL WATERS IN MARTINIQUE (FWI), LESSER ANTILLES: NEW RESULTS FOR *M. NOVAEANGLIAE*, *P.MACROCEPHALUS* AND DELPHININDS (APRIL-MAY 2005)

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A monitoring program was carried out in territorial waters off La Martinique (Lesser Antilles) between 18 april to 8 may 2005 to assess cetaceans abundance and distribution in the late spring. A particular attention was paid for : (1) Humpback whale distibution and behaviour, (2) Sperm whale habitat use and, (3) Delphinids population composition. Martinique is located at 14°30'N and 61°W, and a survey performed with three observers on a sailship duty for visual searching. While visual operation, a passive acoustic sampling (each 2 nm) was practiced with a towed mono-hydrophone. An effective effort of 1045 km was carried out in a distance of maximum 20 nautical miles from the coastline both leeward and windward sides. Twenty-one days allowed the identification of twelve species from thirty-two sightings. Near forty single animals or groups (n=34) were observed including (in number of groups detected): species clearly inditified, *Stenella attenuata* (n=9), *Physeter macrocephalus* (n=9), *Lagenodelphis hosei* (n=2), *Grampus griseus* (n=1), *Pseudorca crassidens* (n=1), *Globicephala macrocephalus* (n=3), *Megaptera novaeangliae* (n=2) and *Kogia simus* (n=1); probably *Feresa attenuata* (n=1), *Stenella frontalis* (n=1) and *Tursiops truncatus* (n=2). A single Balaenopteridae was not identified. More than a thousand (n=1044) cetaceans were encountered due to ecologic spring features. *M.novaeangliae* was present at this late period, both in shallow and deep waters, and a new song pattern called 'ambulancy' was record. *P.macrocephalus* was obtained both by visual and acoustic modes off-shore, only when social groups were feeding. During this survey, Delphinids feeding movements towards Sperm whale grounds were encountered for *L.hosei*, *G.macrorhynchus* and *S.attenuata*. Occasional species who present regional-scale migration such as *G.griseus* and *P.crassidens*, were sighted by any mode. This survey suggests that spring upwellings occurred in Eastern Caribbean improve production and could trigger cetaceans abundance off Island.

SA2 HARBOUR PORPOISE (*PHOCOENA PHOCOENA*) HAVE DECLINED IN THE SOUTHERN OUTER MORAY FIRTH, NE SCOTLAND – A SPATIAL AND TEMPORAL VIEW

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Despite being the most commonly sighted cetacean in UK waters, surprisingly little is known about the ecology, life history and distribution of the harbour porpoise (*Phocoena phocoena*). Systematic boat surveys were conducted along four survey routes in the southern outer Moray Firth, between May and October, 2002–2005, recording positions and numbers of porpoise encountered. Geographical Information Systems were also used to map and investigate the effects fixed environmental variables such as depth, aspect, slope and sediment type had on the spatial distribution of the harbour porpoise in this area. The results of the study showed the harbour porpoise to be commonly encountered throughout the study area and highlighted interesting correlations between the distribution of the harbour porpoise and the variables mentioned above. Harbour porpoise were found to be most commonly encountered on steep, northerly facing slopes compiled of sandy gravel sediments in average water depths of 36m. This habitat preference was found to be highly correlated to the feeding ecology of the harbour porpoise and particular related to the sandeel, (*Ammodytes marinus*). The temporal distribution of harbour porpoises in the study area was highly varied both within and between survey seasons. The relative abundance of porpoises in the outer Moray Firth has significantly declined during the study period of 2002-2005 from 0.75 animals/km2 to just 0.26 animals/km2 in 2005. Reasons for this decline include interactions with increasing fisheries and climate change, both linked to a decline in prey species, and the threat from the bottlenose dolphin. As the only long-term study to date on the species in this area of the Moray Firth, the study aids in the understanding of the ecology and distribution of this population of porpoise and highlights the necessity of developing immediate management plans directed at protecting the harbour porpoise in the Moray Firth.

SA3 STUDY OF BOTTLENOSE DOLPHINS' POPULATION, *TURSIOPS TRUNCATUS* (MONTAGU, 1821) RESIDENT IN PANAMA CITY, FLORIDA: ABUNDANCE, DISTRIBUTION AND BEHAVIOURS IN RELATION TO HUMAIN INTERACTION

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Student award: Undergraduate

The seaside resort of Panama City, Florida, in the Gulf of Mexico, is famous for its population of bottlenose dolphins, *Tursiops truncatus* (Montagu, 1821), living in the waters of St Andrew Bay. Although little is known about this dolphin population, it has become a major tourist attraction. A field survey was conducted from March to June 2004 in order to document the abundance as well as the distribution of bottlenose dolphins in this area. Moreover a behavioural study has been initiated to assess tourism impact on dolphins' behaviour. Photo-identification and mark-capture-recapture techniques were used to conduct this survey. The dolphin population was estimated to 51 individuals, among which 2 calves were observed. During the studied period, 101 dolphins have been photo-identified. Bottlenose dolphins were more often observed outside the bay and in the Pass. Behavioural results do not revealed any diurnal pattern in the activities of this dolphin population. Despite this fact, some trends emerged: (i) travelling was more frequent during the morning; (ii) hunting was more frequently observed at the end of the day in the West Pass area; (iii) frequency of spy hopping and begging was greatly increased while more than one ship was present and a decrease of social activities occurred in that situation (iv) flippering was more observed when number of ship increase. These results suggest that behavioural changes are induced by tourism activity.

SA4 ABOUT THE REASONS OF DEATH OF SEA MAMMALS IN WATERS BLACK SEA BIOSPHERE RESERVE

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The mammal's fauna in Biosphere Reserve includes three species of dolphins – *Phocoena phocoena, Delphinus delphis, Tursiops truncatus*. Long-term supervision are showed, that in our region *D.delphis* – most numerous species, *T.truncatus* – the least, *Ph.phocoena* quantitatively concedes *D.delphis*, but surpasses *T. truncatus*. Principal causes of death of

dolphins in our region - death in the fishing networks, storm activity, natural death. During 2000-2005 death of dolphins in fishing networks is noted only in 11% cases from the general number of corpses. A plenty of the corpses who have been found out after a storm is caused by geomorphologic and hydrological features of a northwest part of Black sea, and especially accumulative system Dzharylgach-Tendra. Superficial current in Black sea are caused by a field of a wind, they are characterized by the cyclonic activity, on periphery the ring stream directed counter-clockwise, with speeds 20-40 km/h. In a northwest part, the current becomes complicated though here again they have a cyclonic direction. Streams of a wind, a wave field, and also downward current currents with the compensatory streams accompanying them are basic factors of dynamics of waters in this area. Actually dead dolphins (corpses, fragments of a skeleton) which have been found out at coast have been cast ashore by these currents. More often detection of the residues of dolphins occurred on sea coast of the Tendra, Kinburn, island Long, on northern coast Jagorlytsky bay. Frequency and quantity of the residues of the dolphins that have been found out at coast, depends as well on storm activity. Activity of storms during last years in this region considerably became more strong. The reason of death of these animals can be as natural death (during a storm, the floating corpse is thrown out), and appreciable damage during the storm.

SA5 MONITORING A CHANGING WORLD - SEARCHING THE PAST FOR LONG-TERM TRENDS IN THE OCCURRENCE OF CETACEANS AROUND THE UK

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Human impacts on ecosystems that affect cetaceans, such as climate change or gradual habitat degradation through pollution or fisheries, can be difficult to detect without long- term sources of data on abundance and distribution. In this context, the Sea Watch Foundation database of cetacean sightings from around the UK is of great historical interest, holding data from the last 30 years or more. A variety of analytical methods was used to seek evidence in the database for relatively long-term spatio-temporal trends in the occurrence of some of the more common European cetacean species, including *Balaenoptera acutorostrata*, *Tursiops truncatus*, *Delphinus delphis*, *Stenella coeruleoalb*a, *Lagenorhynchus spp*. and *Phocoena phocoena*. Distributional changes were observed in *D. delphis*, *S. coeruleoalba* and *L. albirostris*, but species like *T. truncatus* and *P. phocoena* showed more complex patterns, with increases in abundance in some areas offset by decreases in others. Of the commoner species, only *B. acutorostrata* showed a consistent long-term increase across several areas. Reasons for long-term changes are difficult to establish and may vary between species and areas, although some possible causes are proposed.

SA6 PILOT CRUISE-SHIP BASED TRANS-ATLANTIC CETACEAN SURVEY

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Large scale cetacean surveys are logistically difficult and expensive. Using a large pasenger cruise-ship (MV Discovery) as a platform, a cetacean survey was conducted between 1st August and 3rd September 2005 across the northern North Atlantic Ocean, covering waters between the UK, Iceland, Greenland and Canada. The objective was to collect sightings data for all cetacean species encountered, to begin to collate information for a large scale sightings database. A team of two observers employed standard distance sampling techniques and visual observations (naked eye) to scan for cetaceans during daylight hours and favourable weather conditions (Beaufort sea state =4, swell height =2m). 7x50 reticle binoculars were used to aid species identification. The time, lat/long position, distance (reticles) and angle from the vessel track of each sighting were recorded, together with species information (species, number, behaviour, direction of travel). Environmental and effort data was recorded every half an hour, including; sea state, swell height, precipitation, glare, cloud cover (eighths) and percentage sea-ice cover. Approximately 112 hours were spent surveying over 23 seperate days. Over the survey period a total of 13 cetacean species were encountered, with 173 seperate sightings recorded, totalling over 2000 animals. The most commonly sighted species were minke whales (*Balaenoptera acutorostrata*) n=44, Atlantic white-sided dolphins (*Lagenorhynchus acutus*) n=34 (with group sizes of up to 600), and humpback whales (*Megaptera novaeangliae*) n=31. The shelf waters of west Greenland were the most diverse, with sightings including a large group of fin whales and several mixed feeding groups of humpback and minke whales. The survey highlighted the diversity of the northern North Atlantic region, and will be repeated annually in order to build up a long term database of sightings that will further our knowledge of species distributions and enable abundance estimates to be made.

SA7 SHIPBOARD SURVEYS FOR THE STUDY OF CETACEAN POPULATIONS IN GALICIAN WATERS (NW SPAIN) DURING 2004–2005

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First data about cetacean populations from ship surveys in Galician waters were obtained in 1998 and 2001 aboard fishing boats, mainly trawls. However, these data aren’t enought to know properly the status of cetacean populations. With the aim of improving these data in 2004 and 2005 standarized shipboard surveys aboard a 21 metres motor-sailing vessel were

conducted at speed of 5 knots approximately. The objective of this survey was to know which cetacean species are most common in galician waters and the use of habitat, abundance (relative density) and distribution of these species. The area of study was the coastal waters of Galicia from River Miño estuary to Cape Finisterre. This area was divided into grid cells with a resolution of 5x5 km. Line transects were disigned trying to cover the maximun surface and with a similar effort in each one. Sighting effort was carry out only under adecuate sighting conditions. The total number of days of survey was 29, during this time a total of 2681.1 km and a sea surface of 4000.8 km2 was surveyed. The number of observation hours was 244 hours and the number of sightings in this time was 123, the 57.7% of the sightings was common dolphin (*Delphinus delphis*),15.4% harbour porpoise (*Phocoena phocoena*), 8,1% bottlenose dolphin (*Tursiops truncatus*), 4.9% Risso's dolphin (*Grampus griseus*), 0.8% Minke whale (*Balaenoptera acutorostrata*), 9.8% unidentified dolphin and 1.6% unidentified mysticetis. The behaviour, group size, distance, angle and direction were registered for each sighting.The sighting frequency was 1 sighting each 2 hours of observation and the encounter rate was 1 sighting each 21.8 km. These data allowed us to estimate the abundance and distribution of cetaceans in Galician waters.

SA8 MEETING THE REGULARS: ROUGH-TOOTHED DOLPHIN OCCURRENCE OFF GRAN CANARIA

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Rough-toothed dolphins (*Steno bredanensis*) occur in tropical and sub-tropical oceans of the world, where they generally inhabit deep, offshore waters. The Canary Islands, off the west coast of North Africa, are located at the northern edge of this species' regular range in the North Atlantic. The undersea topography of the islands drops off steeply close to land and as a result, deep waters are readily accessible. Consequently, the Canary Islands are ideally suited to surveying deep-water species and are one of the few places where rough-toothed dolphins occur close to shore with any regularity. The occurrence of this species off Gran Canaria is presented using sightings and photo-identification data collected onboard a whale watching vessel operating from the south of the island. The whale watching boat conducts daily trips year-round, weather permitting, to the southwest of the island and all cetacean sightings are recorded on standardised data sheets. Over 50 sightings of S. bredanensis were documented during 2004-2005 with groups ranging in size from 2-50 animals. Although this species is generally considered to inhabit deep waters, all sightings occurred in water depths of less than 500m. Photographs of individuals within the groups were possible during 40% of the encounters. The fins of some animals show signs of damage from boat strike and the extent and effects of this warrant further investigation. Sightings occur year round off Gran Canaria and the movement of individuals and groups between the neighbouring islands is discussed. The catalogue of animals from this study is in its infancy but will provide a long-term means of monitoring this poorly known species and the population present around the Canary Islands.

SA9 TEN YEARS OF CETACEAN SURVEYS IN BISCAY – WHAT COULD THEY SHOW?

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Return trips on the Brittany Ferries Plymouth to Santander passenger ferry route have been made every month for the past ten years except for the winter three months. We examined the data to assess the major sources of error and how powerful these surveys might be at the tasks of mapping distribution and detecting trends in abundance. The effect of sea state appears less simple than the progressive decline of detectability of animals with rising sea state that has been widely reported or assumed, and variation of responsive behaviour with vessel characteristics also emerges as a significant source of error. We conclude that differing distributions can be identified by this method but only very large population trends will be detected reliably.

SA10 ABUNDANCE AND DISTRIBUTION OF COASTAL DELPHINIDS: ENCOUNTER RATES DECLINE SEASONALLY DUE TO INCREASES IN BOAT TRAFFIC

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Student award: Undergraduate

Little is known about cetacean abundance and distribution around the Greek Islands of Kefalonia and Ithaca, to date no published material for this area exists. A shore and boat based study was conducted between April 2005 and July 2005 to identify the species present, abundance, and habitat use. Data recorded included: date, time, species, number, location (GPS Co-ordinates), behaviour and direction of travel. Environmental variables were also recorded every 30 minutes, along with boat traffic numbers and the vessel type. Data from the public on dolphin sightings was collected but omitted due to the unreliability of species identification and essential information being absent. Boat studies were conducted on preset transects from two different sized vessels (3.5 m speedboat with outboard motor and a 8.9m fibre glass boat with 157 HP diesel engine). Common dolphins (*Delphinus delphis*), Bottlenose Dolphins (*Tursiops truncatus*) and Striped Dolphins (*Stenella coeruleoalba*) were the most frequently sighted cetaceans, with a peak in sightings being observed during early May. Whilst there is little tidal variation in the Mediterranean, there was a statistically significant difference in sightings with time of day, with 75% of sightings occurring between 9.30 and11:30 am. There was also a statistically significant difference in habitat use, with the majority

of sightings occurring in water <50m in depth. No variation in either abundance or distribution was observed with any environmental variables. Dolphin encounter rates showed a decline during the study as boat traffic increases in the channel. (Supported by historical records of cetacean observations in the area). The results of this study make a significant contribution towards understanding what determines dolphin distribution and will help address concerns for conservation management regarding the impacts of anthropogenic activity on coastal delphinids.

SA11 TO WHAT EXTENT CAN DISTANCE SAMPLING BE COMBINED WITH PHOTO IDENTIFICATION AS A MONITORING TOOL FOR *TURSIOPS TRUNCATUS*?

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The aim of this study is to estimate the abundance and distribution of bottlenose dolphins, using distance sampling and photo identification techniques, in the Cardigan Bay Special Area of Conservation (SAC). The SAC covers an area of 975km2 off West Wales, established to protect bottlenose dolphin in an area where it has a significant presence. From May to November 2005, line transect surveys were completed, comprising 1490km of evenly distributed effort. The observation team consisted of two primary observers, at a height of 3.5m and one independent observer. Photo ID was carried out opportunistically during these surveys and from New Quay pier. Abundance estimates from line transect data were calculated using DISTANCE 4.1 software, based on 47 encounters. Estimates using photo ID were obtained using the average proportion of well marked individuals per encounter and the total number of individuals in the catalogue (number of well marked animals plus the number of individuals recognisable only from their right or left side, whichever is highest). Estimated abundances were as follows: 150 (80-280, CV 32.53%) using Distance 4.1 and 163 and 172 respectively, using the aforementioned photo ID techniques. Power analysis will be used to determine how much more effort is required to decrease the CV of the Distance estimate by 10 to 15%. Effects of factors such as sea state and distribution, on the CV, will also be analysed. Despite limitations, this study concludes that distance sampling and photo ID techniques can be used synergistically to monitor bottlenose dolphins. Distance sampling also allows other techniques, such as acoustic sampling, to be carried out opportunistically and can be used to derive abundance estimates for other species, namely *Phocoena phocoena* and *Halichoerus grypus*, further increasing its value as a monitoring tool.

SA12 OCCURRENCE AND DISTRIBUTION OF CETACEANS OFF MADEIRA ARCHIPELAGO (PORTUGAL)

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Nautical (2001-2002) and aerial (2002-2004) surveys were carryed out year-round off Madeira Archipelago (NE Atlantic) to determine occurrence, distribution and relative abundance of cetaceans. Both surveys followed "Equal Spaced Zig-Zag" transects generated by Distance4 software and data was recorded with Logger2000 software. Nautical surveys covered 2667nm using visual and acoustic effort on a yatch-vessel (6 knots average speed) up to 12nm offshore, while aerial surveys covered 2696nm using visual effort on an helicopter (100 knots average speed and 500 feet high) up to 20nm offshore. A total of 148 sightings corresponding to 14 taxa (12 species and 2 Families) and 35 corresponding to 9 taxa (6 species, 2 Families and 1 Cetacea) were recorded during nautical and aerial surveys, respectively. Both methods revealed that most sighted species were *Delphinus delphis* (nautical: 30%, aerial: 11%), *Tursiops truncatus* (16%, 26%), and *Stenella frontalis* (17%, 21%), followed by *Physeter macrocephalus* (4%, 9%) and *Globicephala macrorhynchus* (7%, 3%). Beaked whales species showed high relative percentage (5%, 9%). Baleen whales (*Balaenoptera physalus, B. borealis*, and *B. acutorostrata*) represented 10% and 6% ot total sightings respectively. ANOVA tests showed no significant differences ($p>0.05$) for the most sighted species between different surveyed sectores around Madeira Archipelago. *D. delphis* and *S. frontalis* revealed high seasonality presence while *T. truncatus* and *G. macrorhynchus* were recorded year-round.

SA13 GROUP SIZE OF HARBOUR PORPOISES DIFFERS WITH PLATFORM!

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Reliable recording of group size is crucial for the calculation of Harbour Porpoise densities. In most cases, investigations about distribution and density use the "line transect distance sampling method" (Buckland et al. 2001). This state of the art method calculates the distance dependent detection probability of a sighting (one animal or a group of animals) and incorporates the group size information thereafter. Two different platforms are generally used for the line transect surveys: ship and airplane. From 2001 to 2004 we conducted aerial surveys of marine mammals at monthly intervals in three areas in the German Bight. In addition, we reviewed recent published aerial surveys. From 2001 to 2003 we conducted ship based surveys of marine mammals at monthly intervals in one area in the German Bight. Here too, we reviewed recent published ship based surveys. The group sizes differ

significantly between the two platforms: Platform plane: 1.40 (SD 0.31, n=8 studies), Platform ship: 1.96 (SD 0.36, n= 7 studies). The estimation of the detection rate at the transect line g(0) has to consider the availability bias and the perception bias and is generally difficult to estimate. A proper estimation of especially the availability bias (portion of animals at the surface), may overcome the platform immanent group size estimation bias. Reasons of the group size estimation bias will be

SA14 SPATIAL DISTANCE SAMPLING MODELING OF CETACEANS OBSERVED FROM SHIPS OF OPPORTUNITY

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The Biscay Dolphin Research Programme has carried out monthly, year-round cetacean monitoring in the English Channel and Bay of Biscay continuously for more than ten years, utilising a commercial Ship of Opportunity (ShOp) ferry sailing from England to Spain. In this research we investigated the Fin Whale Balaenoptera physallus data subset, to test the hypothesis that spatial distance sampling modelling methods can be applied to determine density. We applied standard distance sampling, multi-covariate distance sampling and generalized additive modelling methods using the approach of Hedley (2000) to model waiting distances between detections. These analyses enabled production of a density map of the area of interest (including showing locations of high density), together with season abundance estimates (with 95% confidence intervals). The spatial model produced, enabled evaluation of previous more simple (relative abundance) analyses (Brereton et al., 2000) describing B. physalus distribution and seasonal trends. Good agreement was found between the new and the older and simpler method; with the cross validation confirming that each can be successfully employed in research and monitoring of off-shore cetacean populations for conservation.

SA15 ANNUAL TRENDS IN HARBOUR PORPOISE MIGRATION IN THE GERMAN BALTIC SEA

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Over a 3.5 year period of time harbour porpoises (*Phocoena phocoena*) relative abundance and habitat use in the German Baltic Sea were investigated. We found clear seasonal changes annually repeated. Acoustic detectors (T-PODs), registering porpoise echolocation click trains and the corresponding time, were deployed on different

measuring positions. For comparability of data, obtained from different T-PODs, all devices were calibrated before deployment. Field data were checked for quality. False alarms caused by e.g. boat sonars/engines were excluded from data analysis. The results show similar pattern comparing study years in the proportion of porpoise positive days (i.e. a day with at least one porpoise registration) within all monitoring days per month. During summer and autumn, porpoises were registered nearly every day in the Fehmarnbelt. In the Kadet channel, we had registrations on 2/3 of the monitored days. East of the Darss rigde, registrations became less frequent. In winter, days with porpoise registrations dropped to minima in the Fehmarnbelt as well as in the Kadet channel, and rose again in spring and summer, respectively. Our results substantiate the historical assumed seasonal migration of harbour porpoises in these areas for more than three consecutive years.This study is financed by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the German Agency for Nature Conservation.

SA16 PRESENCE AND DISTRIBUTION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN THE AREA BETWEEN DUGI OTOK AND HVAR ISLANDS (CROATIA)

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In previous decades the Adriatic Sea was known to be frequented by various species of Odontocetes, in particular the bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*) and striped dolphin (*Stenella coeruleoalba*). However, at present the bottlenose dolphin appears to be the only species sighted regularly in the northern region of this sea. Little is known about the occurrence and distribution of Cetaceans in the Central Adriatic Sea, particularly on the bottlenose dolphin, with data available only from a long-term study (1987-present) in the Kvarneric (northern Adriatic Sea). During the Summer 2002, a feasibility study was started in order to identify the best area for conducting a long term study within the chosen area. The aims of this study are: 1) to understand the occurrence, distribution and habitat use of bottlenose dolphin within the Kornati National Park and adjacent areas; 2)- to assess if photo-identified animals from the Kvarneric are extending their home range to areas of the Central Adriatic Sea, and; 3) to outline suitable conservation measures for bottlenose dolphins frequenting this area, based on scientific knowledge and the comparison with the data from northern Adriatic Sea population segment. Standard research procedures included the collection of: navigation data; environmental data; photo-identification data; and behavioural data. The study area was different in the four study's years, and different were the results.

In general the sighting frequency in the study area was lower than the sighting frequency usually recorded in the Kvarneric. In four study's years 94 surveys were led, but taking into consideration only surveys carried out in good conditions they were 73, during witch we have navigated for 482 hours, covering 2396 marine miles, monitoring an area of about 3800 Km². During this period 34 sightings were done and 47 bottlenose dolphins were identified. No sightings were done for common dolphins or striped dolphins.

SA17 MONITORING THE TRENDS IN ABUNDANCE AND DISTRIBUTION OF A GREY SEAL (*HALICHOERUS GRYPUS*) COLONY, CORNWALL, UK

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Student award: Undergraduate

Grey seals (*Halichoerus grypus*) are found on the rocky shores of Britain, living in colonies of up to several dozen animals. During Spring, they migrate from breeding rookeries to other areas, returning during autumn to pup, mate and moult. This project aimed to monitor a colony's population trends near St Ives, Cornwall, from July to November 2005. Over 23 weeks, 69 hours were spent observing the seal colony, during which the relative abundance, distribution, gender and age structure were recorded, along with photo-identification. The results showed that during mid-August the total number of seals declined and remained low. There was little variation in distribution, with seals either hauling out on offshore rocks or appearing in the water either close inshore or at the islets. The ages and genders recorded during the first 7 weeks were primarily adult females, changing in mid-August to a relatively equal number of both sexes. A corresponding rise in pups equalled the decrease in adults, with a constant number of juveniles. More than sixty seals were photo-identified, with only one seal photo-identified multiple times. Four other seals were recognised from a database held by a local Seal Group from the next nearest colony. The results demonstrate this site is used on a seasonal basis for hauling out by larger numbers of seals during Summer than in Winter, likely due to the exposed nature of the site to storms and rough seas. As the breeding season starts in mid-August, adult females migrate away in significant numbers, followed by adult males, though precisely where is unknown. Very young pups were then sighted regularly whilst the number of juveniles remained the same. This study illustrates the seasonal importance of this site and has made a significant contribution to the photo-identification catalogue for the grey seals in South West Britian.

SA19 ESTIMATING THE ABUNDANCE OF KILLER WHALES (*ORCINUS ORCA*) OFF NORTHERN NORWAY USING PHOTO-IDENTIFICATION AND MARK-RECAPTURE METHODS

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Student award: Undergraduate

A long-term photo-identification study has been conducted since 1986 on killer whales (*Orcinus orca*) in the wintering grounds of Norwegian spring-spawning herring (*Clupea harengus*). The study site is located north of the Arctic circle, where there is little daylight in October-January. The short time available for photo-identification means that a total census (as conducted for the populations off the Pacific Northwest of America) is impossible. To estimate abundance, mark-recapture analyses were conducted using data on well-marked individuals for the years 1991, 1992, 2002 and 2003. Estimates were made using simple two-sample estimators on pairs of years and using closed capture models (available in program MARK) within years. In the latter analyses, the best models were selected using AIC; how well the models fit the data was explored using Goodness of Fit –tests in programs RELEASE and MARK. Estimated abundance for 1991/92 was 309 (95% CI = 295-323), and for 2002/03 347 (95% CI = 316-380). In individual years, estimated abundances were similar in 1992, 2002 and 2003 (296, 310 and 253) but significantly lower in 1991 (176). Goodness of Fit -testing showed that the data were compatible with the models in every year. The total number of killer whales identified during the study was 598; this implies that the mark-recapture analysis is underestimating the size of the population that uses this area, even accounting for births and deaths. A combination of some whales not being available to be sighted each year (so-called temporary emigration) and the fact that only part of the population is well marked could explain this. Future work will investigate these factors using data for all years.

SA20 SPERM WHALE ABUNDANCE ESTIMATES FROM ACOUSTIC SURVEYS OF THE IONIAN SEA AND STRAITS OF SICILY IN 2003

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Acoustic surveys for sperm whales, using line-transect methodology, were carried out in the Ionian Sea and Straits of Sicily, Mediterranean Sea, in 2003. A total of 17 whales were detected along 3486 km of designed survey track in the Ionian Sea, and 0 whales

along 892 km in the Straits of Sicily. This total was insufficient to estimate a detection function, so further data were obtained from pseudo-random passages made elsewhere in the western Mediterranean in the same year. The encounters included several tight aggregations with inter-animal spacing less than 1 km, primarily from the western Mediterranean. Including individuals from these aggregations distorted the detection function due to the small sample sizes, and they were therefore excluded from detection function estimation. The resultant effective strip half-width was 10.0 km (n=34). On the assumption that g(0)=1, the resulting abundance estimates for the Ionian Sea were 66 (with 95% lognormal confidence limits of [28,156]), and 0 for the Straits of Sicily. The low abundance estimate for the Ionian Sea indicates that careful monitoring of the population is needed in the future. During passages along the Hellenic trench that were not part of the designed survey, several sperm whales including two aggregations were detected, suggesting that this may be a higherdensity area and ought to be considered as a separate stratum whendesigning future surveys.

SA21 PATTERNS OF MATERNAL INVESTMENT ACCORDING TO POPULATION TRENDS IN THE SOUTHERN ELEPHANT SEAL (*MIROUNGA LEONINA*)

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Student award: Postgraduate

At Peninsula Valdés, Patagonia, Argentina, the southern elephant seal (*Mirounga leonina*) population is increasing. Still, there are large differences within sites. At the northern site, Punta Norte, the population is in strong decline, while at the southern end, Punta Delgada, there is a significant increase. This results in completely different breeding characteristics, with small harems spread over long distances in the north and a high density of large harems in the south. During the 2002 and 2003 breeding seasons we investigated population characteristics and maternal investment in male and female offspring at the level of individual and subpopulation. In the northern site females are significantly larger than in the south and this tendency was the stronger in 2002 than in 2003. This probably reflects the tendency of some older individuals to return to the pebble beaches in the north, the other preferring sandy beaches in the south. Punta Norte mothers invested as much suckling time in male as in female offspring and this was stable across the breeding season. Nevertheless, the offspring sex ratio at Punta Norte shows strong fluctuations across years with a female bias in 2002 and a male bias in 2003. We suggest the variable sex ratio not to be adaptive, but rather a consequence of the higher premature mortality of male offspring with increasing maternal age. In 2003 offspring sex ratio was the same in the north as in the south. Both are significantly different from the 1:1 sex ratio as expected from Fisherian models.

SA22 A STUDY OF SMALL CETACEANS IN GALWAY BAY AND NORTH CONNEMARA INCLUDING BOTH BOTTLENOSE DOLPHINS AND HARBOUR PORPOISES

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Student award: Postgraduate

Irish waters are some of the most important in Europe for cetaceans with 24 species recorded to date. Under the EU Habitats Directive, member states must designate SACs for harbour porpoise and bottlenose dolphin Tursiops truncatus. Site designation in Ireland has been constrained by lack of knowledge on distribution and relative abundance resulting in only three sites being designated. The present study is designed to meet the requirements for designation, monitoring and maintenance of cetacean populations within Galway Bay and North Connemara and to facilitate site designation. In the primary (Galway Bay) and secondary (North Connemara) sites, fieldwork consisted of a combination of dedicated shore-based watches where effort was quantified, dedicated boat transects, and the use of ships of opportunity (ShOP's) and was designed to determine the absolute and relative abundance and seasonal variation of small cetaceans in the area. Photo-identification was used in Galway Bay to identify individual bottlenose dolphins in attempt to match to other sites (e.g. Shannon estuary). To date a total of 81 land based watches have been carried out around Galway Bay each of 100 minutes duration and this has yielded a total of 17 sightings with a relative abundance of 0.67 animals per hour. Harbour porpoises were the most frequently sighted species, with single sightings of Bottlenose dolphins and a minke whale (*Balaenoptera acutorostrata*) recorded during the summer of 2005.

SA23 CETACEAN MONITORING IN THE SOUTHERN NORTH SEA

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This study aimed at mapping the distribution of cetaceans in the southern North Sea and laying down the trends over the years in order to study the status of the harbour porpoises in the southern North Sea. Appropriate measures to reduce anthropogenic influences like by-catch can only be taken when distribution and trends are known. This study involves two cetacean monitoring methods operational in the southern North Sea. First, the aerial surveys carried out by the Dutch National Institute for Coastal and Marine Management to monitor seabirds and porpoises on the Dutch continental shelf. The other data source are the shipboard surveys carried out onboard of Stena Line

ferries between the Netherlands and England. The harbour porpoise (*Phocoena phocoena*) is the most numerous species in the southern North Sea (73% of the sightings), also the whitebeaked dolphin (*Lagenorhynchus albirostris*) was observed regularly (27% of the sightings). Harbour porpoises were most numerous in Dutch waters and whitebeaked dolphins in British waters. The abundance strongly fluctuates with season, with the highest densities in spring (March-May). Harbour porpoises show a movement from the Dutch coast to the north-west starting in spring and visa versa in autumn. The study of trends showed a growth of 17% per year in the period 1991-2003. Different literature sources report a maximum natural growth of 10% per year, therefore it is concluded that next to reproduction migration took place to the southern North Sea. This supports the idea of the Dutch harbour porpoises being part of a larger North Sea population. Reasons for this increased migration to the southern North Sea are unknown, but is suggested to be related with fish abundance. This could be either be a food crisis elsewhere or increased fish abundance in the southern North Sea.

SA24 ABSOLUTE ABUNDANCE OF BOTLLENOSE DOLPHINS IN THE STRAIT OF GIBRALTAR

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The Strait of Gibraltar is the only natural connection between the Mediterranean Sea and the Atlantic Ocean. Seven species of cetaceans can be seen in this area, and the bottlenose dolphin is one of the most common. The aim of this study was to estimate the absolute abundance of bottlenose dolphins (*Tursiops truncatus*) in the strait of Gibraltar, based on mark-recapture analysis. Surveys were carried out during summers of 2004 and 2005, where photo-identification effort focused in an area of approximately 900 km2. During this time, dolphins were encountered on 30 occasions. We have identified 220 individual dolphins. Of these, 126 were seen in 2004 and 177 in 2005. We applied closed population models using the program CAPTURE, which produced an estimate of 231 dolphins (95% CI= 187-321 CV= 0.014) for 2004 with the model Chao (Mt) and 258 dolphins (95% CI= 226-316 CV= 0.08) for 2005 with the model Chao (Mth). We took into account the proportion of marked individuals, which was estimated to be 85% in both years. Here, we present the first estimations of total abundance on this area using photographic data. These estimations will be useful to monitor the population of bottlenose dolphins over the years. It is especially important to monitor these dolphins over several seasons because an increase in the maritime traffic in this area is expected during the next years. This increase will be due to the construction of a new harbour in Tanger, which will open new lines of ferry and fast ferry between Africa and Europe. The plans to increase human activity call for long term monitoring of the bottlenose dolphins and other species that inhabit the Strait of Gibraltar.

SA25 THE SOCIAL STRUCTURE AND POPULATION SIZE OF KILLER WHALES IN CROZET ARCHIPELAGO

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Killer whales are known to occur regularly along the coast of Crozet Archipelago. A long term study reveals that this population underwent a major size decline in the 1990s. Killer whales were also known to occur offshore, but with no regular access to these individuals. Between 2003 and 2005, intensive photo-identification of killer whales, occurring on pelagic area of the Crozet Archipelago, was conducted by observers onboard fishing vessels catching Antarctic cod and operating in the Exclusive Economic zone. Over 4000 pictures were obtained and analyzed to identify individuals. Using this data base, the size of the offshore killer whale population, interacting with the fishing vessels, was estimated using Mark recapture models provided by the program CAPTURE (Otis et al. 1978). Furthermore the association coefficient between individuals was calculated using the Half-Weight index. A bootstrap procedure allowed to evaluate its significance. The results reveal a decrease, from 77 in 2003 to 48 in 2005, of the estimated number of killer whales occurring near fishing vessels. Association indexes calculated for the two years also reveal a decrease of 1) the individuals associations strength and 2) the groups size. These preliminary results suggest either a reduction of killer whales interactions with fishing vessels or a large inter-annual (or seasonal) variation in the offshore killer whales number. In the light of the long term tendency to decline, detected for the inshore killer whales, the fact that individuals and not groups are disappearing suggests that this population had experienced recently major ecological-demographic changes.

SA26 PILOT CETACEAN SURVEYS IN CENTRAL PORTUGAL

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Despite of the occurrence of a large number of cetacean species in continental Portuguese waters there is a lack of information about their distribution or densities. Boat surveys were conducted in order to evaluate the importance of the central Portuguese coastal waters to cetacean populations. These surveys were conducted in an area that is known to be important to harbour porpoise and where the stranding numbers are high.There were registered 47 sightings of cetaceans of 3 species: common-dolphin

(n=29), harbour porpoise (n=15) and bottlenose dolphin (n=3), giving a frequency of 0.94 sightings/hour of effort. In what concerns the individual observations a total number of 219 animals were recorded with 192 common-dolphin, 21 harbour porpoise and 6 bottlenose dolphin.This pilot survey scheme was implemented in the study area in order to evaluate its importance for cetaceans and to optimize methods for a future program of surveys in large scale. The data obtained permits to confirm the importance of the area to cetacean populations, specially to common dolphin and harbour porpoise. It is also discussed the need to implement a large dedicated survey to evaluate the distribution and abundance of cetacean populations that occur in central Portuguese waters in order to implement effective strategies of conservation and management of small cetaceans.

SA27 SUMMER DISTRIBUTION AND RELATIVE ABUNDANCE OF CETACEANS OFF THE WEST COAST OF IRELAND

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From May to September 2004 a survey of cetacean distribution and relative abundance was conducted on board a 'ship of opportunity' off the west coast of Ireland. In total, 508 hours of survey effort were completed with 304.2 hours in Beaufort sea-state three or less. 231 sightings of eight species - common dolphin *Delphinus delphis* (L.), Atlantic white-sided dolphin *Lagenorhynchus acutus* (Gray), bottlenose dolphin *Tursiops truncatus* (Montagu), harbour porpoise *Phocoena phocoena* (L.), Risso's dolphin *Grampus griseus* (Cuvier), pilot whale *Globicephala melas* (Traill), minke whale *Balaenoptera acutorostrata* (Lacepede) and fin whale *Balaenoptera physalus* (L.) – were recorded, totalling 2,933 individuals. The greatest diversity and relative abundance was recorded on the Rockall Bank, with Atlantic white-sided dolphin being the most abundant species. The common dolphin was the most abundant species recorded on the continental shelf to the south-west of Ireland while the relative abundance of cetaceans off the north coast was very low. The data suggests that cetacean species composition and relative abundance can vary greatly between adjacent marine habitat types and over relatively small geographical distances.

SA28 ACCOUSTIC DISTURBANCE AND EFFICACY OF MARINE MAMMAL OBSERVERS

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OCEAN EYE is a Joint Initiative to investigate Cetacean Protection through Visual Search and Detection. Driven by a legal requirement to protect cetaceans and working towards the prevention of disturbance to cetaceans, especially of an acoustic nature. We have investigated the visual search methodology and factors that influence the effectiveness of marine mammal observers. The main aim of the project was to ascertain the strategies used by individuals to detect marine mammals and to establish the type of experience and training required to enhance observer effectiveness and performance. A number of individuals of differing experience were observed, skills they have already acquired and the consequence of differing levels of training on their efficacy. A ships bridge simulator was used to pre-test and post test the volunteers, with set training units, time lapse and practicals. Personality tests and visual perception tests were done to identify the differing types. It has been found that theory; practicals, testing and practice are important factors in efficacy of MMOs. The effects of age/sex/eyesight/height are not important factors in influencing MMO efficacy. Needs specific training standardises the performance of MMOs ensuring optimal quality in data recording, effective identification, and limited effects of acoustic disturbances. Results of the personality and visual perception tests are to be completed by Dec 2005, which we are expecting to demonstrate that certain personality types are best suited to MMO work.In conclusion, Development of a specification of the standards and core competencies required by MMO's will lead to the standardisation of a needs orientated training for novice MMO's. The training will enhance and standardise the performance of MMO's to ensure optimal quality in data recording, effective identification and limited effects of acoustic disturbances. Retention limits of training illustrate that time limited boundaries must be set, alongside with updated legal requirements.

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