European Cetacean Society

21st conference of the european cetacean society

DONOSTIA-SAN SEBASTIAN april 22-25 2007

Integrating Science & Management for Marine Mammal Conservation

Conference Guide & Abstracts

Organised by:

azti tecnalia

AQUARIUM DONOSTIA-SAN SEBASTIAN

21th Annual Conference of the European Cetacean Society and Associated Workshops

April 23-25, 2007
Donostia - San Sebastian, Basque Country - Spain

Kursaal Conference Center

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D.L:

21st conference of the european cetacean society

INTEGRATING SCIENCE & MANAGEMENT FOR MARINE MAMMAL CONSERVATION

Content:

INTEGRATING SCIENCE & MANAGEMENT FOR MARINE MAMMAL CONSERVATION

The European Cetacean Society (ECS) was established in 1987 to promote and co-ordinate the scientific study and conservation of cetaceans and to gather and disseminate information to members and the general public. Conferences are the major and most successful accomplishment of the ECS. It therefore seemed fitting for the ECS Society to celebrate its twenty first edition with the theme "Integrating Science & Management for Marine Mammal Conservation" in a city like San Sebastian open to the sea and its wealth.

Honourable sponsorship:

- Minister of Agriculture, Fisheries & Foods – Basque Government
- Minister of Environment and Land Use Planning – Basque Government
- Society of Oceanography of Gipuzkoa

Local partners:

Aquarium of San Sebastian, AMBAR, E.I.B.E., S.E.C., Untzi Museoa-Museo Naval.

Organising committee:

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Tregenza, Frank Thomsen, José Antonio Vázquez, Ursula Verfuss, Rob Willians.

Workshops Convenors

Cristina Brito, Peter Evans, Kristina Salzer, Kevin Robinson, Sarah Dolman, Deborah Benham, Nick Tregenza, Phil Hammond

Sponsors:

Basque Government Agriculture, Fisheries & Foods Department, and Environment and Land Use Planning Department. Spanish Minister of Science and Education, Council of Donostia-San Sebastian, Foral Council, of Gipuzkoa Kutxa, Ternua, Grafinorte.

Student volunteers:

Maria Morell, Alex Mas, Irene Weinberger, Ana Pinela, Magda Chudzinska, Valentina Islas Becci Jewell, Pablo Arechavala, Monika Dyndo, Krzys Debniak, Lamya Essemlali, Giacomo Gorli Lotte, Kindt-Larsen, Jitka Rynekrova, Luca Mirimin, Paula Mendez Fernandez, Uxue Oyarbide

Conference Guide:

Venue: The plenary sessions and poster sessions will take place in the KURSAAL Congress Hall in San Sebastián, Avda. de la Zurriola, 1 Tel: +34 943 00 30 00 www.kursaal.org.

Workshops: All workshops will take place at the Aquarium in San Sebastián, Karlos Blasco de Imaz plaza, 1 Tel: +34 943 44 00 99 www.aquariumss.com

Workshop 1 - *Marine Mammal History*
Workshop 2 - *Wind Farms & Marine Mammals*
Workshop 3 - *Tips for a Scientific Communication*
Workshop 4 - *Minke Whales*
Workshop 5 - *Marine Protected Areas & Cetaceans*
Workshop 6 - *Beaked Whales*
Workshop 7 - *Marine Interpretation and Training of Marine Guides*
Workshop 8 - *Validation of external signs to identify by-catch in stranded small cetaceans*
Workshop 9 - *SCANS II*

The **ASCOBANS AC meeting** will take place on the 19-21 of April at AZTI-Tecnalia in Pasaia.

Registration: Registration desk will be open at the KURSAAL Congress Hall from 16.00 to 19.00 on Sunday, April 22nd and from 08.00 on Monday, April 23th.
All participants are invited to check-in and get their material.
Only cash money will be accepted for on-site payment.

Oral presentation: 10 min talk + 5 min for discussion are available, please try to keep your schedule. A speaker-ready room will allow speakers to make final amendments to their presentations.
The presentation must reach one of the chairs on CD or memory stick at least 30 minutes before the session, better in the beginning of the day and best the day before. All authors presenting their talks on Monday 23rd April – the first conference day- are kindly asked to give their presentations to the receptionists on Sunday 22nd April from 16.00 to 19.00.

Poster presentations: Posters (best format 70cm x 100cm, max. 100cm x 130cm) installation will be on Sunday 22nd April from 16.00 to 19.00.
They will be on display from Monday morning to Wednesday (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 attend their posters during the poster sessions. The poster number will be presented on the stand to help the authors to identify the right location.

Internet Centre: Free access for participants will be available at the conference hall. 5 computers will be for your disposal in the internet corner.

Coffee Breaks: 20 min. coffee breaks will be arranged every morning and every afternoon during the conference. Hot drinks and water will be offered.

Lunch Breaks: There are several restaurants around the conference center. You can get a list of all of them asking at the reception desk.

Icebreaker: Sunday 22nd April. Aquarium San Sebastian Carlos Blasco de Imaz plaza, 1 – 20:00/90'. All are invited!

Public Video Sessions: Video session will be arranged on Tuesday 24th April at the KURSAAL Conference Hall, starting at 20.00

Social Program: Several visits and excursions have been arranged for all participants. You can get information about them at the reception desk. Also an exhibition about cetaceans "Cetáceos a la vista" would take place at the Commercial Shopping Center Urbil. Ask reception desk for more information.

Conference Banquet: Wednesday 25th April, Petritegi Cider House in Astigarraga (located 25 min drive form San Sebastian). The banquet will start at 21.00 and the dancing at 23.00. You will be able to taste the basque cuisine and the wonderful cider that, the Petritegi family manufactures for their guests.
Free connections by bus will depart for the banquet from the Conference Center main entrance at 20.30 and at 22.30 for the dancing. Buses will be available for the way back from 24.00 to 02.30

Thanks to our sponsors and partners

21ST CONFERENCE OF THE EUROPEAN CETACEAN SOCIETY
Donostia-San Sebastian, April 2007

Workshops

Aquarium

Saturday 21

9:00-13:30 ***Marine Mammal History*** Cristina Brito

15:00-19:30 ***Wind Farms & marine mammals*** Peter Evans, Erich Hoyt, Sonia Mendes, Mandy Mcmath, Giuseppe Notarbartolo di Sciara, Ana Cañadas & Simone Panigada

Sunday 22

9:00-13:30 ***Tips for a scientific communication*** Kristina Salzer

Non-lethal research on minke whales Kevin Robinson, Peter Stevick & Colin McLeod

9:00-18:00 ***Marine Protected Ares & cetaceans*** Peter Evans

Thursday 26

9:00-13:00 ***Beaked Whales*** Sarah Dolman

Marine Interpretation and Training of Marine Guides Deborah Benham

14:00-18:30 ***External signs of by-catch in stranded small cetaceans*** Nick Tregenza, Jan & Jeff Loveridge & Nynke Osinga

14:30-19:30 ***SCANS-II*** Phil Hammond, Ana Cañadas & José Antonio Vázquez

Conference Programme
KURSAAL

SUNDAY 22

16:00-19:00 Registration & Poster Set-up
20:00 Icebreaker at the Aquarium

MONDAY 23 APRIL

9:00 Welcome & summary of workshop on Marine Mammal History
9:05 THE BAY OF BISCAY: FROM WHALING TO WHALEWATCHING Santiago Lens (Invited)
9:40 summary of workshop on Wind Farms
9:45 STRATEGIES FOR CONSERVATION OF MARINE TOP PREDATORS Mark Tasker (Id.)
10:20 Coffee break

10:45 Official Opening with the presence of the Minister of Fisheries of the Basque government

11 :00 Session I on Acoustics Michel André & Lee Miller

11:05 GEOGRAPHICAL VARIATION OF SPERM WHALE CODA REPERTOIRES IN THE NORTH ATLANTIC
Antunes, Ricardo** (eligible for postgraduate Student award), Rendell, Luke, Hammond, Phil & Gordon, Jonathan
11:20 TEMPORARY THRESHOLD SHIFT IN THE BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*): THE EFFECTS OF VARYING NOISE DURATION AND INTENSITY
Breese, Marlee, Mooney, T. Aran, Nachtigall, Paul E., Au, Whitlow W.L & Vlachos, Stephanie
11:35 CAN SEALS BE DETERRED BY SOUNDS THAT ARE LESS AVERSIVE TO ODONTOCETES?
Götz, Thomas** & Janik, Vincent M
11:50 WEDDELL SEAL AUDIOMETRY
Kindermann, Lars, Bornemann, Horst, Plötz, Joachim, Boebel, Olaf
12:05 ACOUSTIC BEHAVIOUR OF FREE-RANGING TAGGED HARBOUR PORPOISES (*Phocoena phocoena*)
Linnenschmidt, Meike, Miller, Lee A., Akamatsu, Tomonari & Teilmann, Jonas
12:20 HOW TO PROTECT SENSITIVE EARS UNDER WATER?
Lucke, Klaus, Lepper, Paul, Blanchet, Marie-Anne & Siebert, Ursula
12:35 IS THERE AUTOMATIC GAIN CONTROL IN HARBOR PORPOISE BIOSONAR?
Beedholm, K. & Miller, Lee. A.
12:50 TEMPORAL RESOLUTION AND BROADBAND CLICK THRESHOLDS IN A CAUGHT-AND-RELEASED WHITE-BEAKED DOLPHIN (*LAGENORHYNCHUS ABIROSTRIS*)
Mooney, T. Aran**, Nachtigall, Paul E., Taylor, Kristen T., Miller, Lee A. & Rasmussen, Marianne
13:05 SHIPBOARD MEASUREMENTS OF THE HEARING OF THE WHITE-BEAKED DOLPHIN *Lagenorynchus albirostris*
Nachtigall, P. E., Mooney, T. A., Taylor, K. A., Miller, L. A. & Rasmussen, M. H.
13:20 Poster slides
13:30 Lunch break

15:00 Session II on Acoustics John Goold & Ursula Verfuss

15:05 KILLER WHALES DO IT IN THE DARK: NOCTURNAL ACTIVITY BY TRANSIENTS AT ST. PAUL ISLAND, ALASKA
Newman, Kelly** & Springer, Alan
15:20 A SYNCHRONISED ACOUSTIC ARRAY, RANGEFINDER AND VIDEO SYSTEM WITH EXAMPLES FROM 'SINGING' HUMPBACK WHALES (*MEGAPTERA NOVEANGLIAE*).
Potter, John Robert; Hoffmann-Kuhnt, Matthias;Koay, Teong Beng: eekings, Paul &Chitre, Mandar
15:35 CODA DIVERSITY IN MEDITERRANEAN SPERM WHALES
Rendell, Luke, Alexiadou, Voula, Mussi, Barba/ra , Miragliuolo, Angelo & Frantzis, Alexandros
15:50 SEASONALITY OF "ANTARCTIC" AND "PYGMY" BLUE WHALE CALLS RECORDED IN THE SOUTHWESTERN INDIAN OCEAN.
Samaran, Flore**, Cansi, Yves; Ruzié, Gérard ; Motsch, Jean-François ; Adam, Olivier & Guinet, Christophe
16:05 APPLICATION OF A NEW DIVER-OPERATED 4-CHANNEL ACOUSTIC/VIDEO DEVICE TO RECORD AND LOCALIZE HIGH FREQUENCY DOLPHIN SOUNDS.
Schotten, Michiel**, Lammers, Marc, Herzing, Denise L, Sexton, Ken D & Au, Whitlow W.L.
16:20 THE CODA REPERTOIRES OF INDIVIDUAL SPERM WHALES IN A SOCIAL UNIT
Schulz, Tyler, M**., Whitehead, Hal & Rendell, Luke
16:35 ACOUSTIC MONITORING OF ENDANGERED GRAY WHALES FEEDING AREA NEAR OIL AND GAS ACTIVITY OFF SAKHALIN ISLAND: NEW TECHNIQUES AND NOISE EXPOSURE CRITERIA
Vedenev, Alexander
16:50 Poster slides
17:00 Summary of student workshop
17:10 Coffee break

17:30 Annual Student & NCP Meetings

TUESDAY 24

9:00 Session III on Anatomy, Disease, Parasites & Phisyology Thierry Jauniaux & Josep Alonso

9:05 FIRST CASE OF A MONITORED PREGNANCY OF A HARBOUR PORPOISE (*Phocoena phocoena)* UNDER HUMAN CARE.
Blanchet, Marie-Anne, Nance, Tiffany, Ast, Colleen & Acquarone, Mario

9:20 PRELIMINARY RESULTS OF MULTI-ELEMENTARY MICRO-ANALYSE OF DENTINE USING LASER ABLATION ICP-MS: A NEW TOOL FOR THE OBSERVATION OF INDIVIDUAL AND SMALL CETACEAN POPULATION LIFE HISTORY?
Tabouret, Hélène**, Barats, Aurélie, Pecheyran, Christophe, Amouroux, David, Dabin, Willy & Caurant, Florence

9:35 VAGINAL *CALCULI* IN COMMON DOLPHINS (*DELPHINUS DELPHIS*), THEIR INDUCTION AND POSSIBLE EFFECTS ON FECUNDITY
Dabin, Willy, Rochowski, Bastien , Daudon, Michel, Duguy, Raymond & Ridoux, Vincent

9:50 TRENDS IN INFECTIOUS DISEASE IN UK STRANDED CETACEA (1990-2005)
Deaville, Rob, Patterson, Tony, Baker, John, Ross, Harry, Simpson, Vic, Monies, Bob, Reid, Bob, Barley, Jason, Penrose, Rod, Law, Robin, Sabin, Richard, Perkins, Matt & Jepson, Paul

10:05 LIFE CYCLE OF LUNGWORMS IN PORPOISES AND SEALS: MOLECULAR TOOLS DETERMINE VERTEBRATE INTERMEDIATE HOSTS
Lehnert, K., Samson-Himmelstjerna, G., Fonfara, S., Walter, T. & Siebert, U.

10:20 Poster slides

10:30 Coffee break

11:00 SCIENCE FOR MANAGEMENT OF CETACEAN POPULATIONS Arne Bjørge (Invited)

12:00 Session IV on Behaviour & Ecology Arne Bjørge & Toni Raga

12:05 SYNCHRONICITY IN DEEP-DIVING BEAKED WHALES AND PILOT WHALES WITH IMPLICATIONS ON PARENTAL CARE
Aguilar Soto, Natacha; Johnson, Mark; Madsen, Peter; Tyack, P.; Aparicio, Cristina; Domínguez, Iván & Díaz, Francisca

12:20 SITE FIDELITY AND MOVEMENTS OF CUVIER'S AND BLAINVILLE'S BEAKED WHALES AT THREE SPATIAL/TEMPORAL SCALES: COMBINING VHF RADIO TRACKING, SATELLITE TAGGING AND LONG-TERM PHOTO-IDENTIFICATION
Baird, Robin W. McSweeney, Daniel J., Schorr, Gregory S., Mahaffy, Sabre D., Webster, Daniel L., Barlow, Jay, Hanson, M. Bradley & Andrews, Russel D.

12:35 USING ENVIRONMENTAL MODELS TO PREDICT HARBOUR PORPOISE DISTRIBUTION AND RELATIVE ABUNDANCE FROM VISUAL AND ACOUSTIC SURVEY DATA
Embling, Clare B**., Gordon, Jonathan, Shrimpton, Juliet & Hammond, Philip S.

12:50 HE FORAGING STRATEGY OF SPERM WHALES IN THE NORTH-WESTERN MEDITERRANEAN SEA
Gannier, Alexandre, Petiau, E & Witz, C.

13:05 HABITAT AND RESOURCE USE AMONG A COMMUNITY OF TROPICAL DELPHINIDS IN MAYOTTE, SW INDIAN OCEAN
Kiszka, Jeremy**, Gross, Alexandra, Richard, Pierre & Ridoux, Vincent

13 :20 Poster slides

13:30 Lunch break

15:00 Session V on Feeding, Genetics & Habitat Simone Panigada & Florence Caurant

15:05 IS THERE A COMPETITION FOR THE RESOURCES WITHIN THE SOCIAL GROUPS OF LONG FINNED PILOT WHALES IN THE STRAIT OF GIBRALTAR ALONG THE YEAR?
De Stephanis, R.**, Verborgh, P., Esteban Pavo, Seller N., Pérez, S., Garcia-Tiscar S., Minvielle Sebastia, L. & Guinet C.

15:20 BRYDE'S WHALE (*BALAENOPTERA EDENI*) DIVE PROFILE AND INDIVIDUALS ASSOCIATION: NEW PERSPECTIVES ON FEEDING STRATEGIES
Freitas, Luis, Alves, Filipe & Dinis, Ana

15:35 THE USE OF BLUBBER FATTY ACIDS PROFILES IN DIETARY STUDIES OF HARBOUR PORPOISES IN THE NORTH AND BALTIC SEAS
Walton, M.J., Gilles, A., Budge, S., Kuklik, I., & Siebert, U

15:50 DO NORTH ATLANTIC MINKE WHALES SHOW POPULATION SUB-STRUCTURING?
Anderwald, Pia**, Daníelsdóttir, Anna K., Haug, Tore, Larsen, Finn, Lesage, Véronique, Reid, Robert J., Víkingsson, Gísli A. & Hoelzel, A.Rus

16:05 APPLICATION OF MOLECULAR GENETICS TO THE STUDY OF POPULATION AND SOCIAL STRUCTURE OF SHORT-BEAKED COMMON DOLPHINS (*DELPHINUS DELPHIS*)
Mirimin, Luca, Westgate, Andrew J. Stockin, Karen A. Rosel, Patricia E. Read, Andrew J. Coughlan, Jamie P. Rogan, Emer & Cross, Tom F.

16:20 GENETIC POPULATION STRUCTURE OF BALTIC HARBOUR PORPOISES (*PHOCOENA PHOCOENA*)
Wiemann, Annika** & Tiedemann, Ralph

16:35 DETERMINATION OF MUTATION RATES AND EFFECTIVE POPULATION NUMBERS BY MEANS OF DNA MICROSATELLITES IN FOUR LATIN AMERICAN DOLPHINS (*INIA GEOFFRENSIS*, *INIA BOLIVIENSIS*, *PONTOPORIA BLAIVILLEI* AND *SOTALIA FLUVIATILIS*)
Ruiz-Garcia, Manuel & Escobar-Armel P

16:50 AN EVALUATION OF HABITAT USE OF THE INDO-PACIFIC HUMBACK DOLPHIN (*Sousa chinensis*) IN HONG KONG SHA CHAU AND LUNG KWU CHAU MARINE PARK AND VICINITY
Tsang, Yin Ting Anton** & Ang, Put, Jr.

17:05 A NEW BREEDING GROUND? THE SPATIO-TEMPORAL DISTRIBUTION AND BATHYMETRIC PREFERENCES OF SPERM WHALES (*PHYSETER MACROCEPHALUS*) IN THE BAY OF BISCAY
Hobbs, Matthew, Macleod, Colin, Brereton, Tom, Harrop, Hugh, Cermeño, Pablo & Curtis, Dave

17;20 SEASONAL VARIATIONS IN BOTTLENOSE DOLPHIN AND HARBOUR PORPOISE HABITAT USE WITHIN CARDIGAN BAY SAC IN RELATION TO TIME OF DAY AND TIDAL CYCLE FROM T-POD RECORDINGS
Nuuttila, Hanna, Simon, Malene, Alford, Lucy & Evans, Peter

17:35 HABITAT USE AND PREFERENCES OF CETACEANS IN THE STRAIT OF MESSINA (ITALY) THROUGH SPATIAL MODELLING: IMPLICATIONS FOR MANAGEMENT
Panigada, Simone, Notarbartolo di Sciara, Giuseppe, Zanardelli, Margherita, Agazzi, Stefano, Bendinoni, Federico (1), Costa, Marina & Pesante, Giovanna

17:50 COMPARISON OF ENFA AND GLM MODELLING FOR SUMMER HABITAT SUITABILITY OF THE SPERM WHALE IN THE NORTHWESTERN MEDITERRANEAN SEA
Praca, Emilie**, Gannier, Alexandre, Das, Krishna & Laran, Sophie

18 :05 Poster slides

18:30 Poster Session (coffee available)

20:00 Public Video Session Jan Willem Broekema & José Antonio Vázquez

WEDNESDAY 25

8:30 Session VI on Surveying Phil Hammond & Sami Hassani

8:35 LAND OBSERVATIONS AT THE AZORES: EFFICIENT TOOL FOR MANAGEMENT
Visser, Fleur, Hartman, Karin L & Hendriks, Arthur J.E.
8:50 INCREASE IN THE NUMBER OF SOUTHERN RIGHT WHALES *EUBALAENA AUSTRALIS* IN THE NEIGHBORHOOD OF PENÍNSULA VALDÉS DURING THE PERIOD 1999-2006
Crespo, Enrique A., Dans Silvana L., Svendsen, Guillermos M., Pedraza Susana N., Coscarella, Mariano A. & Berón-Vera, Barbara
9:05 MODELLING SEASONAL HABITAT USAGE OF HARBOUR PORPOISES IN THE GERMAN BIGHT - IMPLICATIONS FOR MANAGEMENT
Gilles, Anita, Kaschner, Kristin, Adler, Sven, Mundry, Roger, Scheidat, Meike & Siebert, Ursula
9:20 ABUNDANCE OF HARBOUR PORPOISE AND OTHER SMALL CETACEANS IN THE EUROPEAN ATLANTIC AND NORTH SEA
Hammond, Philip, Berggren, Per, Borchers, David, Burt, Louise, Cañadas, Ana, Desportes, Geneviève, Donovan, Greg, Gilles, Anita, Gillespie, Douglas, Gordon, Jonathan, Hedley, Sharon, Hiby, Lex, Kuklik, Iwona, Leaper, Russell, Lehnert, Kristina, Leopold, Mardik (16), Lovell, Phil, Macleod, Kelly, Øien, Nils, Paxton, Charles, Ridoux, Vincent, Rogan, Emer, Samarra, Filipa, Scheidat, Meike, Sequeira, Marina, Siebert, Ursula, Skov, Henrik, Swift, Rene, Tasker, Mark, Teilmann, Jonas, Van Canneyt, Olivier & Vázquez, José Antonio
9:35 PRESENT-DAY STATUS OF A VULNERABLE SUBSPECIES – THE LADOGA RINGED SEAL (*PHOCA HISPIDA LADOGENSIS*) AND TECHNICAL GUIDELINES FOR FURTHER RESEARCH, MONITORING AND MANAGEMENT OF THE POPULATION
Medvedev, Nikolai, Sipilä, Tero & Verjovkin Mikhail
9:50 SMALL-BOAT SURVEYS TO ESTIMATE CETACEAN ABUNDANCE IN WESTERN CANADIAN COASTAL WATERS
Williams, Rob & Thomas, Len
10:05 SEASONAL DISTRIBUTION AND ABUNDANCE OF BRYDE'S WHALES IN THE HAURAKI GULF, NEW ZEALAND
Wiseman, N.J.** Stockin, K.A. & Baker, C.S.
10:20 CAN OCCUPANCY BE USED AS AN 'EASY-TO-MEASURE' INDEX FOR MONITORING TRENDS IN CETACEAN POPULATIONS?
Hall, Karen, MacLeod, Colin D, Mandleberg, Laura, Schweder, Caroline, Pierce, Graham J & Bannon, Sarah M.

10:30 Coffee break

11:00 Session VII on Management Peter Evans & Giuseppe Notarbartolo di Sciara

11:05 FORAGING HOTSPOTS AND WHALEWATCHING "NOT-SPOTS": USING KILLER WHALE BEHAVIOUR TO PRIORITISE VESSEL EXCLUSION ZONES
Ashe, Erin** & Williams, Rob
11:20 BASELINE INFORMATION ON BOTTLENOSE DOLPHINS OFF SOUTHERN SPAIN: TOWARDS SCIENTIFICALLY SOUND CONSERVATION
Cañadas, Ana, Carbó, María, de Stephanis, Renaud, Fayos, José Antonio, García, Pedro, García-Tiscar, Susana, Marcos, Pilar, Ovando, María, Padilla, Mar, Pérez-Gimeno, Neus, Pérez, Sergi, Sagarminaga, Ricardo, Vázquez, José Antonio & Verborgh, Philippe.
11:35 TOURISM IMPACT ON DOLPHINS POPULATIONS: LINKING BEHAVIOURAL RESPONSES TO ENERGETIC COSTS
Dans Silvana L., Crespo, Enrique A., Pedraza Susana N., Degrati Mariana & Garaffo, Griselda V.
11:50 HUMAN ACTIVITIES AND BOTTLENOSE DOLPHINS' SOCIAL STRUCTURE
Díaz López, Bruno & Bernal Shirai, Julia A.
12:05 INTERACTION BETWEEN KILLER AND SPERM WHALES WITH THE PATAGONIAN TOOTH FISH FISHERY IN CROZET AND KERGUELEN EXCLUSIVE ECONOMIC ZONE
Guinet, Christophe; Gasco, Nicolas; Roche, Cécile & Duhamel, Guy
12:20 IDENTIFYING IMPORTANT HABITAT FOR COASTAL DOLPHINS IN A MARICULTURE GROWTH REGION IN SOUTHERN CHILE
Heinrich, Sonja & Hammond, Philip
12:35 ASSESSING HUMAN IMPACTS: VESSEL DISTRIBUTION IN GERMAN WATERS – A MODELLING APPROACH
Herr, Helena, Gilles, Anita, Scheidat, Meike & Siebert, Ursula
12:50 A POSSIBLE ECOLOGICAL BASIS TO COMMON DOLPHIN BY-CATCH IN PELAGIC FISHERIES IN THE BAY OF BISCAY
Spitz, Jérôme**, Van Canneyt, Olivier, Morizur Yvon & Ridoux, Vincent.
13:05 CAN THE USE OF ACOUSTIC DETERRENTS INCREASE THE SEALS-FISHERIES CONFLICT?
Sara Königson**, Heide Stridh , Sven-Gunnar Lunneryd & Jacob Hagberg
13:20 A TALE OF TWO MPAs, THE VAQUITA AND DECEMBERS'MISTAKES
Rojas-Bracho, Lorenzo, Jaramillo-Legorreta, Armando & Urban, Jorge

13:30 Summary of workshop on Marine Protected Areas
13:40 Lunch break

15:00 Session VIII on Management Iwona Kuklik & Raul Castro

15:05 DEVELOPING MANAGEMENT FRAMEWORKS FOR MARINE PELAGIC SPECIES: THE CASE OF THE BOTTLENOSE DOLPHIN CONSERVATION PLAN
Sagarminaga, Ricardo, Cañadas, Ana, Urquiola, Erika & Tejedor, Ana
15:20 EFFECTS OF OFFSHORE WIND FARMS ON HARBOUR PORPOISES IN DENMARK
Teilmann, Jonas (1), Tougaard, Jakob (1) & Carstensen, Jacob (2)
15:35 ECOLOGICAL RISK TO CETACEANS FROM ANTHROPOGENIC SOUND: CHARACTERIZATION ANALYSIS USING A PROFESSIONAL JUDGMENT APPROACH TO UNCERTAINTY
Truett, Amanda
15:50 MANAGEMENT PROCEDURES FOR DETERMINING APPROPRIATE LIMITS TO THE BYCATCH OF SMALL CETACEANS IN THE EUROPEAN ATLANTIC AND NORTH SEA
Winship, Arliss J. Berggren, Per & Hammond, Philip S.
16:05 DON'T QUOTE ME ON THAT: BRIDGING THE LANGUAGE GAP BETWEEN SCIENTISTS AND POLICY-MAKERS
Wright, Andrew J., Parsons, E. C. M., Rose, Naomi A. & Vos, Erin

16 20 Summary of workshop on minke whales
16:30 Coffee break

17:00 Annual General Meeting

21;00 Banquet (20:00 departure of buses to Petritegi cider bar)
23:00 Dancing (22:30h departure of bus to Petritegi disco bar)

INVITED TALKS ABSTRACS

THE BAY OF BISCAY: FROM WHALING TO WHALEWATCHING

Santiago Lens
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The Bay of Biscay is an oceanic region closely related to cetaceans. It was from localities around these shores that a long whaling tradition started in the XI century. For more than 600 hundred years the Right whale was caught along these coasts until the decline of whaling in the XVIII century. Modern whaling started in Spain at the beginning of the XX century in the Gibraltar Straits. In the second half of the century whaling activity continued in the north west of the Iberian Peninsula. The target species were sperm and fin whale. The interest in cetacean studies on the Spanish coast goes back to the XVIII century with the works of pioneers such as Sarmiento and Cornide and continued with the monographic works by Graells and Cabrera. Since the last quarter of the past century an extraordinary boom in the number of studies on cetaceans in the Bay of Biscay has taken place. About thirty cetacean species have been reported in the Bay of Biscay, seven belonging to Mysticeti and twenty three to Odontoceti. Precise knowledge on the biology, distribution and migratory patterns are restricted to some of them whilst absolute abundance estimations are lacking for the majority of the species. Further research is needed in these areas. One of the main concerns for the conservation of cetacean populations in the Bay of Biscay is the interaction with fisheries. Other threats are related to the degradation of the marine environment due to chemical waste and the increase in noise pollution. Several conventions deal with the management and conservation of cetaceans. At the European and Spanish level, there are also several regulations concerning the protection of the local populations and their habitats. A Spanish Decree on whale watching is in an advanced state of development. Humans and cetaceans are both part of complex marine ecosystems. For an ecosystem approach to the management of the marine environment it is essential to know the role of all components and the consequences of the human impacts.

Monday 23 April 9:05

STRATEGIES FOR CONSERVATION OF MARINE TOP PREDATORS

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Several mammals, birds, fish and invertebrates are marine top predators. These predators are often highly mobile and are frequently not predictable in their location. Many of these predators are also relatively difficult and expensive to detect and survey. These characteristics mean that the classic conservation method of determining locations of the feature that you wish to protect and then applying management to that area is often not appropriate. An alternative to this approach is to examine which human activities might affect top predators and regulating those activities to achieve conservation aims. In the marine context, the critical pressure is from unwanted catching by fishing gear. The method by which fishing gears affect top predators varies with predator. Conservation of top predators is thus dependant on regulating fisheries appropriately. Fisheries are already regulated for fish stock conservation purposes and there are several possible regulatory mechanisms including catch limits, gear restrictions and area-based management (or a combination of these). The choices relating to fisheries management are essentially societal, expressed through elected representatives (or officials working on their behalf). The efficacy of any management is though also dependent on the degree of adherence to any regulations by fishers. Strategies to conserve top predators therefore have to include influencing both society and fishers. Basing any proposed measures in impartial scientific and

technical advice is also essential if conservation efforts are not to be discredited. These principles can be applied to other human pressures on marine top predators, with precise methods to achieve better conservation of marine top predators varying by user group. This talk will use cases from Europe and wider to illustrate success and failure.

Monday 23 April 9:45

SCIENCE FOR MANAGEMENT OF CETACEAN POPULATIONS

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Science for management of cetacean populations can broadly be categorized in two main bins: 1) science aimed at understanding the behaviour, physiology, ecology and population biology when the cetaceans are in their pristine habitat generated by natural geological, oceanographical and ecological processes, and 2) science aimed at understanding how cetaceans respond to anthropogenic impact on the individual, the population or on the cetacean habitat. Again, in the real world there is hardly any cetacean habitat left that is not impacted by man.
Conservation of biodiversity and maintaining species at favourable conservation status are management objectives that are commonly recognized in Europe. However, these are general, more overarching management objectives, and not very operative in practical management. Therefore, more specific management objectives with a set of management actions based on an understanding of what are the actual and potential threats to cetacean, and what is needed to eliminate, or reduce these threats to acceptable levels, are required.
In this presentation I will use examples to illustrate science relevant to such management actions. I will discuss the conservation status of the vaquita (the highly endangered porpoise endemic to the upper Gulf of California), bycaught harbour porpoises; "whalewatched" bottlenose dolphins and harvested minke whales. In addition, I will also touch upon some of the more global threats to cetaceans, such as climate change, anthropogenic sound and ship traffic. However, I will put these examples into management concepts to illustrate the importance of clearly defined management objectives and robust management procedures, which will help define appropriate management actions required to reach the management objectives.

Tuesday 24 April 11:00

ORAL ABSTRACTS ON ACOUSTICS

GEOGRAPHICAL VARIATION OF SPERM WHALE CODA REPERTOIRES IN THE NORTH ATLANTIC.

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Codas are patterned series of clicks, often given as exchanges, and are the principal recognized form of acoustic communication among sperm whales. To look for the geographical variation of sperm whale coda repertoires in the North Atlantic, recordings from Iceland, the Gulf of Mexico, Azores, Caribbean, and the Sargasso Sea, were analyzed and compared. The recordings were made during several research campaigns between 1989 and 2006, and analyzed using Rainbow Click. The resulting 10912 codas were grouped into 56 repertoires per day of recording containing more than 25 codas. The repertoires were compared using a multivariate similarity measure and its robustness was tested using a bootstrap procedure (255 iterations).The majority of the Gulf of Mexico (GoM) repertoires showed separation from the

Atlantic repertoires, with three exceptions. Single repertoires from Cuba and Panama clustered together with a single Gulf of Mexico repertoire, and a repertoire from the Western GoM clustered with some Caribbean ones, suggesting some link between these areas. Another GoM repertoire showed more similarity with Azorean, Sargasso Sea and Iceland repertoires which in general tended to cluster together. The results show that sperm whale coda repertoires are geographically structured in the North Atlantic. Previous studies observed low nuclear DNA diversity, within and across ocean basins, therefore not supporting a genetic determination of repertoires. Ecological factors are also unlikely to determine vocal output, leaving cultural transmission as the possible explanation for repertoire variation. This suggests that as found for the Pacific, sperm whales populations in the Atlantic are culturally structured. This supports the idea that for this species, cultural variation should be considered for conservation and management, particularly in spatial and time scales for which genetic variation is more homogeneous.

Monday 23 April 11:05; eligible for Student Award: Postgraduate

TEMPORARY THRESHOLD SHIFT IN THE BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*): THE EFFECTS OF VARYING NOISE DURATION AND INTENSITY

Breese, Marlee (1), Mooney, T. Aran (1,2), Nachtigall, Paul E. (1), Au, Whitlow W.L. (1), Vlachos, Stephanie (1)
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There is much concern regarding increasing noise levels in the ocean and how it may affect marine mammals. However, there is a little information regarding how sound affects marine mammals and no published data examining the relationship between broadband noise intensity and exposure duration. This study explored the effects of octave-band noise on the hearing of a bottlenose dolphin by inducing temporary hearing threshold shifts (TTS). In an effort to predict TTS levels we addressed the Equal Energy Hypothesis which models threshold shifts based on fatiguing noise energy. Sound pressure levels (SPL) and exposure duration were varied to measure the effects of noise duration and intensity. Hearing thresholds were measured using auditory evoked potentials before and after sound exposure to track and map TTS and recovery. Shifts were frequency dependent and recovery time depended on shift and frequency, but full recovery was relatively rapid, usually within 20 and always within 40 minutes. As exposure time was halved, TTS generally occurred with an increase in noise SPL. However, with shorter, louder noise, threshold shifts were not linear but rather shorter sounds required greater sound exposure levels to induce TTS. This is in contrast to an assumed equal-energy linear trade-off between sound intensity and time found in the literature and suggests that bottlenose dolphins may have a protective mechanism that reduces harmful physiological noise damage at shorter duration exposures. From the data a novel algorithm was written that predicts the physiological effects of anthropogenic noise if the intensity and duration of exposure are known. Thus, this research examined the relationship between noise intensity and duration as it relates to TTS and developed a threshold-shift model based on concurrently collected data.

Monday 23 April 11:20

CAN SEALS BE DETERRED BY SOUNDS THAT ARE LESS AVERSIVE TO ODONTOCETES?

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Acoustic deterrent devices (ADDs) are used on many fish farms to reduce pinniped predation. Recently, ADDs have been highlighted as a conservation concern since they exclude odontocetes from their habitat with only limited effects on seals. To test the efficiency of these devices and potentially increase their target-specificity we compared the effects of current ADD sounds on seals with those of novel, lower-frequency sounds which cause lower sensation levels in odontocetes. We conducted 6 playback sessions with each of 8 captive harbour and grey seals when they were close to an underwater feeding station. A playback session consisted of 11 different sound types separated by 5 min intervals of silence. Received levels at the feeding station were 145 dB re 1 µPa (rms) and sounds were played for 1 min with a 40% duty-cycle. We found substantial individual variation in the amount of time that animals spent close to the feeding station. However, escape responses declined rapidly over the first few playbacks in all animals. Similarly, feeding was only prevented during the first few exposures. In playback sessions without food presentation seals spent more time close to the feeding station than in those with food. Further tests with wild grey seals around haulout sites showed that 5 out of 8 sound types significantly reduced the number of surfacings at distances of up to 70 m from the playback boat. The measured received level at this distance was 138 dB. Since our novel sounds proofed to be at least as effective as sounds of current ADDs in all seal experiments, we would recommend their use in ADDs to minimise the potential effects on odontocetes. However, our results also show that ADDs are of only limited use if food motivation is high and the target had previous experience with the food source

Monday 23 April 11:35; eligible for Student Award: postgraduate

WEDDELL SEAL AUDIOMETRY

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Audiograms describe the fundamental ability of the sense of hearing for any species as a function of hearing threshold in respect to frequency. For most marine mammals, including all Antarctic seals, audiograms have not been described yet. In this study, we determined audiograms of Weddell seals (*Leptonychotes weddellii*) by auditory evoked potential (AEP) measurements. Our experiments were conducted in the wild at Atka Bay, Antarctica, (70°31'S – 8°13'W) on sea ice in December 2005. One adult male and eleven non-lactating females, with estimated body masses between 300 and 450 kg, were sedated prior to the audiometric measurements. We determined optimal electrode positions for the auditory brainstem responses (ABRs) on the scalp of the seals, and obtained a total of 120 measurements using stimulus frequencies from 1 kHz to 80 kHz and different sound levels. Sampling of the sensitive bio-potentials was affected by signal to noise ratios, environmental conditions, and course of narcosis. Hence, the results were pooled to obtain an integrative Weddell seal audiogram. ABR measurements in the wild are unprecedented. Technical experience developed continuously during the experiments progressively improved the signal to noise ratio and resulted in an increasing success rate. The know-how developed during these initial trials will significantly benefit future studies in Weddell seals and other species.

Monday 23 April; 11:50

ACOUSTIC BEHAVIOUR OF FREE-RANGING TAGGED HARBOUR PORPOISES (*Phocoena phocoena*)

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Long-term acoustical recordings (89.5 hrs.) were conducted on three free-ranging harbour porpoises in Danish waters. We used small data loggers (A-tag) attached to the dorsal fin to record sonar activity. The A-tag logs the time for each maximum click level (sampling rate 1 or 2 kHz) and the time of arrival difference between the two on-tag hydrophones. Additionally, dive depth is recorded with a DST-milli-logger. Here we concentrate on diurnal acoustical behaviour, foraging and sonar activity near the bottom. We found 75 possible prey capture sequences in recordings of two individuals from the Great Belt. Approaches start with an average ICI of 56 ms and decrease to a mean buzz-like ICI of 5 ms. Most (63 %) of the potential prey capture sequences occur near the surface and the rest during the descending-, bottom- and ascending phases of a dive. Most recordings of possible prey capture were between 14:00 and 15:30 hrs (n=34) and 20:00 to 22:00 hrs. (n=16). The fact that approaches are observed at different depth and up to six times a minute suggests multiple encounters with pelagic schooling fish. At the bottom, one animal used on average 156 clicks/dive (126 dives) while the other animal used on average 23 clicks/dive (966 dives). Both animals were silent or produced clicks below the tag threshold during more than 25% of the bottom-time. Long silent periods near the bottom (up to 124 s) are potentially dangerous to porpoises due to entanglement in bottom-set gill-nets. A third porpoise from the Kattegat gave recordings showing complex sonar behaviour with many click sequences of constant ICI (6 to 10 ms) that may be used for communication or during a different feeding strategy (bottom-grubbing). Although the three porpoises use their sonar most of the time, the data show very different sonar behaviour between areas.

Monday 23 April 12:05

HOW TO PROTECT SENSITIVE EARS UNDER WATER?

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In 2005 construction work to replace a harbour wall was started in Kerteminde harbour, Denmark. A total of 175 wooden piles were piled into the ground over a period of 3 months. Up to 430 impacts were needed to ram the individual piles into the ground. At the same time three harbour porpoises were situated in the Fjord&Baelt on the opposite side of the harbour. These animals are housed in an open water pool. Harbour porpoises are known to have sensitive hearing and the animals showed strong aversive reactions upon the start of the piling activities. Received sound levels of 183dB re 1µPa (pk) were observed just outside the enclosure with an Energy Flux Density of 154 dB re μPa^2-s. As an immediate action to reduce the sound exposure for the animals a 40m long air bubble curtain was constructed in a direct path between the piling site and the opening of the pool. Attenuation of the ramming impulse noise was observed in the range of 11dB to 19dB in signal peak and 13dB to 19dB in the impulse energy. No further adverse behavioural reactions of the animals to the ramming activities were observed when the bubble curtain was active. During a later experiment additional sound protection measures were required to protect the animals from being exposed to a nearby airgun sound source within the scope of an ongoing hearing study. A floating pen was therefore covered with a double layer of closed cell foam. A reduction in received sound pressure of up to 28dB was observed at frequencies up to 22,4 kHz. To further increase sound reduction a bubble curtain was also placed around this pen. Using both methods three harbour porpoises showed no adverse behavioural reaction to the presence of a close proximity airgun transmission

Monday 23 April 12:20

IS THERE AUTOMATIC GAIN CONTROL IN HARBOR PORPOISE BIOSONAR?

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There is conflicting evidence for automatic gain control (AGC) in bat biosonar. Two studies indicate that the received echo sensation level is constant (full AGC) and under complete central nervous system (CNS) control independent of distance to the target. Two other bat studies suggest that the received echo sensation level is constant, but two mechanisms, half (6 dB) contributed by central mechanisms and the other half by the peripheral mechanism of sound production. The latter results from an attenuation of the outgoing sonar signal by 6 dB for each halving of distance to the target. A study based on auditory evoked potentials in the false killer whale showed a full CNS mechanism that totally compensates for real target distances since the whale did not change the level of the emitted signal. In contrast a stationary harbor porpoise showed no CNS compensation for changing artificial echo delays, but did show a reduction in emitted click levels as the click interval shortened. The same harbor porpoise showed a reduction in click levels by 6 dB per halving of distance to the target and a decrease in click interval during prey capture (a half AGC). If these studies hold true then the sensation level of the received echo increases by 6 dB for each halving of distance to the target during prey capture. This will contribute to a more uniform perception with level dependent auditory filter tuning, but may also reflect purely mechanical properties of the sound generator. The signal to clutter ratio should also be improved giving the harbor porpoise a distinct advantage when hunting in cluttered environments

Monday 23 April 12:35

TEMPORAL RESOLUTION AND BROADBAND CLICK THRESHOLDS IN A CAUGHT-AND-RELEASED WHITE-BEAKED DOLPHIN (*LAGENORHYNCHUS ABIROSTRIS*)

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Toothed whales and dolphins (Odontocetes) are known to echolocate, producing short, broadband clicks and receiving the corresponding echoes, at extremely rapid rates and must consequently analyze sounds with equally sophisticated temporal processing abilities. However, sound temporal processing characteristics has been investigated in a relatively few Odontocete species. This study used auditory-evoked potentials (AEP) to obtain sensitivity thresholds and estimate the maximum rate of temporal processing abilities of broadband clicks by a white-beaked dolphin (*Lagenorhychus albirostris*). The dolphin was part of a larger study to catch-and-release wild white-beaked dolphins in Keflavik, Iceland. Results are the first field AEP measurements on this species or genus. To estimate temporal resolution, click stimuli were played at varying rates up to 2500 Hz. The subject's auditory system followed click stimuli at a rapid rate, up to 1300 Hz indicating high temporal resolution characteristic of echolocating Odontocetes. The corner frequency of the estimated temporal resolution was determined to be 1125 Hz and used for consequent threshold measurements of both click stimuli and two frequencies, 50 and 64 kHz. This rate is slightly faster than most other Odontocetes tested indicating high resolution abilities and a potential adaptation for utilizing the unusually high frequencies produced during white-beaked echolocation clicks. From the results it is predicted that the white-beaked dolphin should have the ability to follow clicks and echoes while foraging up to an extremely close range.

Monday 23 April 12:50: eligible for Student Award: postgraduate

SHIPBOARD MEASUREMENTS OF THE HEARING OF THE WHITE-BEAKED DOLPHIN *Lagenorynchus albirostris*

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White-beaked dolphins *Lagenorynchus albirostris* have been assumed to hear very high frequencies based on responses to high frequency sonars. An Icelandic fishing boat was modified to catch and release white beaked dolphins and temporarily hold them onboard while their hearing was tested using evoked potential techniques. Two bow-riding animals were individually hoop-netted, brought on board, temporarily placed in a 1x1x3.5 m waterfilled, foam-lined plastic box, and fitted with soft latex suction cup sensors while sounds were transmitted to them at various levels. The sounds were amplitude modulated and their brainwaves were monitored to see whether they followed the amplitude modulation rates of the sounds. Those following the rates could be presumed to be heard while those that did not were presumed to not be heard. This allowed hearing measurements at a variety of frequencies to be made and an audiogram to be plotted. The white beaked dolphins were found to have excellent high frequency hearing - up to 181 kHz, but not as high as had been previously proposed.

Monday 23 April 13:05

KILLER WHALES DO IT IN THE DARK: NOCTURNAL ACTIVITY BY TRANSIENTS AT ST. PAUL ISLAND, ALASKA

Newman, Kelly &¡Error! No se encuentra el origen de la referencia., Alan
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Observations of transient killer whales in the act of predation are rare because transients hunt by stealth, their range is large, feeding bouts are infrequent in terms of sighting opportunities, and they apparently feed at night as well as during the day. We used a “Pop Up” Autonomous Recording Unit (ARU) to expand the observation window of transient killer whales by monitoring them acoustically from June 22 - July 12, 2006 near a fur seal rookery at St Paul Island, Alaska, an important predation hot-spot in the Bering Sea. The ARU recorded continuously with a sampling rate of 0.1-16,000 Hertz. Killer whale vocalizations were detected on all of the 13 days analyzed so far. Whales were most active from the end of civil twilight (00:26 on 1 July) through mid-morning. Fewest vocalizations were recorded between 1800-2400. We presume that vocal whales were feeding, based on the paradigm that transients are most vocal when attacking and feeding on other marine mammals, and only transient killer whales have been identified at St Paul I. We also presume that they were preying upon fur seals, as numerous observations have been made during daytime at St. Paul I. of killer whales attacking fur seals, and only fur seals. Nocturnal hunting is an important reason why it has been difficult to understand the foraging behavior and diets of these elusive predators, and must be considered when drawing conclusions about the roles transient killer whales play in marine ecosystems.

Monday 23 April 15:05: eligible for Student Award: postgraduate

A SYNCHRONISED ACOUSTIC ARRAY, RANGEFINDER AND VIDEO SYSTEM WITH EXAMPLES FROM ‘SINGING’ HUMPBACK WHALES (*MEGAPTERA NOVEANGLIAE*).

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As technology improves and microprocessors become both smaller and less power-hungry, several combined acoustic and video systems have been proposed and some built to study marine mammal behaviour, with the intention to provide simultaneous recordings to associate visual behaviour with acoustic emissions. We present the latest and most capable to date, a novel system that provides an acoustic beamforming capability in both azimuth and elevation via a three-channel planar array, sampled at an aggregate rate of up to 200 kSa/s. The angular acoustic resolution attains 0.5 deg. for high signal-to-noise ratio signals. The system is also equipped with a low-power ultrasonic active sonar operating at 200 kHz that is able to determine the range of objects in the acoustic and video field of view with an accuracy of 0.5m and record these ranges to disc simultaneously with the acoustic data. High-Definition video is recorded by an infra-red controlled Sony HD camera co-located with the acoustic array and with its axis aligned. The 2-D acoustic intensity map for the Visual Field of View is calculated and overlaid onto the video image, with range results providing the third acoustic dimension. Using two divers on rebreather scuba, this equipment has been used to estimate source levels, emission beam directivity and source locations for sounds from Humpback Whales (*Megaptera noveangliae*) and could be used for many other species. The system was first deployed in 2006, recording Humpback Whales at ranges of 1-20m at 'wintering grounds' in the Caribbean on the Silver Bank and in the Au Au channel off Maui in Hawaii. This systeem is capable of providing information crucial to formulating representative models for potential communication masking, detection and abundance issues for endangered marine mammal conservation and management. A 5-minute video of singing humpack whales with acoustic intensity overlay will be shown.

Monday 23 April 15:20

CODA DIVERSITY IN MEDITERRANEAN SPERM WHALES

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Research in the Pacific indicates sperm whale groups can be assigned to vocal clans based on their coda production. However, vocal variation at the group level has been little investigated in other locations. Here we looked at coda repertoires from Mediterranean sperm whales, that occupy a much more restricted, 'island' habitat relative to the Pacific population; the population size is also likely much lower. In birds, island populations have been shown generally to have vocal repertoires that contain fewer elements but have more variety within elements. We recorded coda repertoires from sperm whale social groups in three locations - the Balearic Islands, Ischia Island off Italy and along the Hellenic Trench off Greece. Several previous studies have reported regional repertoires dominated by a 3+1 type, and this is what we found in all cases in the Western Mediterranean. Four click codas dominated the coda repertoires in all three areas. However, some groups recorded in the Eastern basin made a different coda type. Although having a similar structure of three clicks followed by a longer pause, this type was shorter in length and more compressed in the first two intervals relative to the third. These codas were distinct enough to be statistically recognised as a separate coda type, 3++1. Dendrograms of repertoire similarity showed a deep split between groups that made the different coda types. However, all recorded repertoires were more similar than the mean between-clan similarity in Pacific studies and bootstrap support for the split was low, so unequivocal evidence for clan structure similar to that found in the Pacific was absent. Therefore patterns of diversity mirrored those found in birds, with reduced clan level diversity but more variation within coda types of the same general structure, indicating that similar processes of cultural evolution may be occurring.

Monday 23 April; 15:35

SEASONALITY OF "ANTARCTIC" AND "PYGMY" BLUE WHALE CALLS RECORDED IN THE SOUTHWESTERN INDIAN OCEAN.

Samaran, Flore, (1) Cansi , Yves (2) Ruzié, Gérard (2) Motsch, Jean-François (3) Adam, Olivier (3) and Guinet, Christophe (1)

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During the 20Th century, many species of large whale such as blue whales (*Balaenoptera musculus*) were severely depleted by commercial harvest in the Southern Ocean and current research highlight the lack of information on large whale abundance and migrations. Data on long-term acoustic monitoring of whale provides valuable information on their presence in this area. Large whale calls were detected from data recorded over one year (2003/2004) from six hydrophones of the International Monitoring System. This network was deployed in two triads (northern and southern networks) off Possession Island in the Indian Ocean and located on SOFAR where the acoustic energy from sound could travel over long distances. The low frequency (< 100 Hz) sea noise spectrum was dominated by a band of sound at 18-35 Hz corresponding to abundant baleen whale calls of which intensity varies over one year. Among the call detected, the Antarctic blue whale call (*B. m. intermedia*) and the Pygmy blue whale call (*B. m. brevicauda*) "Madagascar-type" were clearly identified. A call detector was developed for each sub-species and data were screamed automatically to assess seasonal variations of calls production by each sub-species. Antarctic-type blue whale calls were the most commonly recorded and detected all year long with peak detections during the austral winter suggesting an annual presence in subantarctic-antarctic area. The annual pattern of Pygmy blue whale calls exhibited a strong seasonality. Calls were detected mostly from December to May and were not heard in winter. This result suggests either an interruption in vocal activity or that Pygmy blue whales are leaving subantarctic waters likely to go northward as no increase in call detection occurred in the southern hydrophone network. These results need further investigation using acoustic triangulation techniques to assess seasonal change in the localization of calling individuals of both subspecies.

Monday 23 April 15:50; eligible for Student Award: Postgraduate

APPLICATION OF A NEW DIVER-OPERATED 4-CHANNEL ACOUSTIC/VIDEO DEVICE TO RECORD AND LOCALIZE HIGH FREQUENCY DOLPHIN SOUNDS.

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From decades of research on captive dolphins much is known about their sound production, reception and discrimination capabilities, but the study of wild dolphin echolocation and communication is only since recently becoming more accessible with the advancement of new technologies. Traditionally, recording dolphins in the wild has been difficult because of: (1) The broadband nature of dolphin signals, with some signals extending over 200 kHz in frequency; (2) The directional properties of dolphin signals, with only signals recorded from the center of the beam being undistorted; (3) The difficulty of identifying which and how many individual dolphins produced the recorded signals; and (4) Being confined to recording equipment on a boat, which complicates the recording of significant behaviors. To resolve each of these difficulties, an underwater portable battery-operated digital recording device was

developed that is capable of capturing acoustic signals beyond 220 kHz on 4 channels, as well as dolphin behaviors on simultaneous video. By localizing the sounds using a 4-hydrophone method, recorded sounds can be attributed to individual dolphins on the video. The new system consists of a custom-made underwater housing, containing two batteries, a digital camcorder, tv-screen, and an acoustic recording unit with custom-made signal conditioning board, 4-channel data acquisition card, PC/104-plus single board computer and power supply, and a notebook hard disk. Attached to the housing is a 4-hydrophone star array. Post-recording, acoustic signals recorded within 15 m are accurately localized in 3-D and attributed to individual dolphins on the video. Thus, acoustic signal features can be correlated with different echolocation behaviors and communicative signal exchanges among dolphins can be assessed. Recordings were made of a population of wild Atlantic spotted dolphins (*Stenella frontalis*) and bottlenose dolphins (*Tursiops truncatus*) in The Bahamas. Some of the *Stenella* echolocation clicks had significant energy past 220 kHz.

Monday 23 April 16:05; eligible for Student Award: Postgraduate

THE CODA REPERTOIRES OF INDIVIDUAL SPERM WHALES IN A SOCIAL UNIT

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Due to the difficulties of studying the vocalizations of individual marine mammals in the field, almost nothing is known about the coda repertoires of individual sperm whales, thereby severely limiting our understanding of sperm whale communication. To examine the vocal repertoires of individual sperm whales within a well-studied social unit (consisting of 5 adult females, one juvenile male, and one calf), we took advantage of a fortuitous feature of sperm whale clicks, the inter-pulse interval (IPI), and used the similarity between the IPIs of usual clicks made by whales when fluking alone and the IPIs of coda clicks recorded during social sessions to assign codas to individual whales. Although the calf in the unit did not fluke, codas with IPIs less than 2 msec recorded while the calf was present were assumed to have been made by the calf. Comparing both continuous and categorical measures of the similarities of codas within and between whales and recordings, we found that only the calf and its mother had coda repertoires that were significantly different than the repertoires of other whales. These results suggest that in general, adult females in a unit possess similar coda repertoires, refuting previous suggestions that codas function exclusively in individual identification and that variation in repertoires between units could be a result of differences in coda repertoires between individuals. Despite the rarity of coda production in adult males, our findings also indicate that the coda usage repertoire of a juvenile male is similar to that of adult females in the unit. The fact that the coda repertoires of the calf and its mother were the only repertoires that were significantly different than those of other whales suggests that their repertoires function in part to permit their discrimination from others in the unit, perhaps to facilitate localization and reunion.

Monday 23 April 16:20; eligible for Student Award: Postgraduate

ACOUSTIC MONITORING OF ENDANGERED GRAY WHALES FEEDING AREA NEAR OIL AND GAS ACTIVITY OFF SAKHALIN ISLAND: NEW TECHNIQUES AND NOISE EXPOSURE CRITERIA

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Small population of western gray whales (WGW) of only about 100 animals is listed by IUCN as 'critically endangered'. The only known foraging grounds for this population lies along the northeastern coast of Sakhalin Island where concurrent and planned large-scale offshore oil and gas activity poses potentially catastrophic threat to the population. Underwater noise associated with the construction of Sakhalin II project nearest to the near shore feeding area is one of the major concerns with regard to the conservation of WGW. Since 1998, acoustic monitoring of the WGW feeding area was supervised solely by the oil companies. In 2004, independent research organizations have got involved into acoustic monitoring. This report presents new methodology along with renewed noise exposure criteria of the acoustic monitoring conducted by P.P. Shirshov Institute of Oceanology, RAS during offshore pipeline construction works on the Sakhalin shelf in 2006. Our team used specially designed bottom buoys with satellite communication for Independent acoustic monitoring. Unlike conventional technique such as radio- transmitting of raw acoustic data, our instrument calculates noise levels and spectra in real time and transmits the result directly to the internet website. This data could be used immediately to study whale behavior response on noise or trigger mitigation action when permitted noise exposure levels is exceeded. Unlike oil companies, in 2006, we used a new energy-based exposure scale for the noise exposure criterion. New criterion is based on the sound intensity level, the duration of exposure, but don't use 'equal- energy rule'. The results of noise levels measurements at different points of the Piltun feeding area are presented. These show that inadmissible acoustic impact on the WGW was lacking during the Independent monitoring in July 22-30 2006. IFAW sponsored both satellite buoy construction and field monitoring on board of Sailing Ship "Nadezhda".

Monday 23 April; 16:35

ORAL ABSTRACTS ON ANATOMY, DISEASES, MEDICINE & PHYSIOLOGY

FIRST CASE OF A MONITORED PREGNANCY OF A HARBOUR PORPOISE (*Phocoena phocoena)* UNDER HUMAN CARE.

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Most of the data collected on the reproduction of harbour porpoises *(Phocoena phocoena)* originate from by-caught or stranded animals and therefore represent only point sample information. Harbour porpoises kept in a human controlled environment offer a unique opportunity to gather data on individual animals over a long period of time. Freja a 10 years old captive, primiparous Harbour Porpoise became pregnant in September 2005 and gave birth during the night between July 24th and 25th 2006. Freja's morphometry, food intake and blood parameters were monitored as routine in this lapse of time through trained voluntary behaviours. Food intake, weight, blubber thickness, girth size and breathing rate didn't follow the seasonal patterns observed during the previous years. Normally these parameters would decrease starting at the beginning of the Spring, but during the pregnancy they either increased or stabilised on "Winter" values. The development of the foetus was occasionally followed by ultrasound imagery and its heart pulse was visible at the last examination a week before delivery. A dramatic drop in food intake occurred eight days prior to the parturition. Body temperature, a well known indicator of the imminence of delivery, decreased of one degree between 62h and 67h before the birth event. Inter-mammary distance increased as the date of the birth approached (increasing of up to 8 cm 24 h prior to the delivery). A fully grown calf was delivered naturally but was found dead in the morning shortly after the birth. The necropsy

performed the following day showed that the calf never breathed but no evident cause of death was found. Freja recovered quickly from the event and resumed eating in the evening of the delivery day.

Tuesday 24 April 9:05

PRELIMINARY RESULTS OF MULTI-ELEMENTARY MICRO-ANALYSE OF DENTINE USING LASER ABLATION ICP-MS: A NEW TOOL FOR THE OBSERVATION OF INDIVIDUAL AND SMALL CETACEAN POPULATION LIFE HISTORY?

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During toothed whales' life, a succession of hydroxy-apatite layers is laid down in tooth dentine that can be observed on a longitudinal tooth section. During their formation, these structures called "Growth Layer Groups" (GLG) accumulate trace elements which would depend on environmental and/or physiological factors. Because of its large spatial resolution (µm) and low detection limits ($ng.g^{-1}$), Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry has been previously used to determine temporal variations of trace elements in similar structures such as bivalve shells and fish otoliths. The aim of this study was to perfect a protocol allowing the analysis of trace elements in the different GLGs and thus compare and date the variations. Teeth of 33 common dolphins stranded along the French Atlantic coasts were collected, 22 of which from a single mass stranding. Because of a lack of reference materials, hydroxy-apatite pellets were made with dolphin teeth ground, sifted and enriched with a solution containing eleven elements (Zn, Sr, Cu, Mn, Pb, Ba, U, Sn, Cd, Mo, Hg). All the elements except Cd, Cu and Sn exhibited different profiles: no peak (1), one to several peaks (2), numerous peaks at regular intervals along the individual lifespan (3). One single peak of U close to the enamel appeared in ten individuals, born at the end of the 80s and could be related to the Chernobyl catastrophe. Pb exhibited the three patterns and must probably be related to migration patterns or dietary changes. It is suggested that regular movements between the Channel and the Bay of Biscay would be completed by part of the individuals only. The individuals from the mass stranding group did not exhibit the same profiles, which would confirm the fluidity of school composition. This preliminary study is promising and teeth can probably be considered as records of individual historical events.

Tuesday 24 April 9:20; eligible for Student Award: Postgraduate

VAGINAL *CALCULI* IN COMMON DOLPHINS (*DELPHINUS DELPHIS*), THEIR INDUCTION AND POSSIBLE EFFECTS ON FECUNDITY

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The proper management of cetacean populations requires the estimation of demographic characteristics at population level. In small cetaceans, the examination of stranding events represents a major source of samples from which reproductive parameters can estimated. In addition to reproductive parameters *sensu stricto*, pathologies of the genital tract can be relevant as well, in that they can be associated to sterility. In this work, we focus on vaginal *calculi*, their prevalence, composition, likely condition of formation and associated sterility. Necropsies and reproductive tract examinations were performed on 435 female common dolphins (*Delphinus delphis)* since 1972 along the French coasts, of which 14 showed vaginal *calculi*. Age determination, reproductive tract examination and vaginal *calculi* measurements were performed. Additionally, composition and crystalline structure of these *calculi* were analyzed by Fourier Transformed InfraRed spectroscopy (FTIR). Volume (2 to 850 ml) and weight (3.6 to 1460 g) of the *calculi* varied largely. The structure revealed a primary formation of vaginal stones, excluding a secondary origin due, for instance, to foetal abortion. The composition was almost identical in all *calculi* with a common base of struvite (magnesium-ammonium-phosphate hexahydrate). The precipitation of this struvite crystals requires an alkaline pH. Supersaturated urine and concomitant urinary tract infection with urease-producing microbes are the most likely causes of these *calculi*. Twelve of the 14 *calculi* were big enough to prevent successful copulation by occlusion of reproductive tract. Furthermore, the chemical conditions and patho-physiology processes associated to these *calculi* are sufficient to create situations of reproductive dysfunction and infertility. This reproduction pathology, which appears to be associated to sterility, occured in 3.2% of examined females and would therefore be a pathological factor with important demographic implication.

Tuesday 24 April 9:35

TRENDS IN INFECTIOUS DISEASE IN UK STRANDED CETACEA (1990-2005)

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Between 1990 and 2005, 2217 cetaceans (comprising 18 species) that stranded around the coast of the UK were necropsied using standard methods. Harbour porpoises (*Phocoena phocoena,* n=1357) and common dolphins (*Delphinus delphis*, n=444) were the most commonly examined species. A cause of death was established in 1870 individuals. Of these, infectious disease was conclusively identified as the cause of death in 356 individuals (comprising eight species). Harbour porpoises (n=304) died of pneumonias of bacterial and/or parasitic and/or fungal origin (n=193), generalised bacterial infections (n=63), gastro-intestinal tract infections (n=24, often parasitic in origin), meningo-encephalitis (n=5) or other causes of infectious mortality (n=19). Twenty common dolphins died of pneumonias of bacterial and/or parasitic and/or fungal origin (n=6), gastro-intestinal tract infections (n=6), generalised bacterial infections (n=2), or other causes of infectious mortality (n=6). Individuals of six other species (n=32) died as a result of meningo-encephalitis (n=9), pneumonias of bacterial and/or parasitic and/or fungal origin (n=7), generalised bacterial infections (n=6), gastro-intestinal tract infections (n=6) or other causes of infectious mortality (n=4). Harbour porpoises that had died due to infectious disease had a UK wide distribution, whereas other species (particularly the common dolphin) were more spatially explicit. Proportionally more stranded harbour porpoises were found to have died as a result of infectious disease in winter months (n=182, 33% of established causes of death) than in summer months (n=122, 20% of established cases). A case-control study comparing contaminant levels in harbour porpoises that had either died of infectious disease or of acute physical trauma

(control group) found significant associations between elevated PCB levels in the infectious disease group, suggesting that elevated PCB levels may predispose individuals to infectious disease mortality.

Tuesday 24 April; 9:50

LIFE CYCLE OF LUNGWORMS IN PORPOISES AND SEALS: MOLECULAR TOOLS DETERMINE VERTEBRATE INTERMEDIATE HOSTS

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Metastrongylids, or lungworms, infect a wide range of mammals and are usually found in the bronchi, parenchyma or blood vessels associated with the lungs. Most terrestrial metastrongylids are heteroxenous, using a mollusc as intermediate host. The biology of metastrongylids infecting marine mammals is little known and their transmission in the marine environment has been poorly studied. Lungworm disease and its associated pneumonia are particularly important in the health of wild populations. Parasitic bronchopneumonia and secondary bacterial infections are a common cause of mortality in harbour porpoises and especially in young seals. Experimental infections using metastrongylid species infecting marine mammals have indicated that they may use a vertebrate as intermediate host while other studies have found evidence for prenatal infections with lungworms in cetaceans. In this study various species of benthic fish from the Wadden Sea were dissected. Larval stages of nematodes from the gastrointestinal tract were removed while still alive. Larval DNA was isolated and primers were used to amplify the ITS-2 region from their rDNA. The same primers had been designed to sequence ITS-2 regions from adult specimens of all metastrongylid species infecting *Phoca vitulina* and *Phocoena phocoena* in the North Sea. ITS-2 regions of larvae found in European plaice (*Pleuronectes platessa*) were sequenced and identified as belonging to *Pseudalius inflexus*, a lungworm of porpoises. ITS-2 of larvae from Dab (*Limanda limanda*) were sequenced and determined as belonging to *Parafilaroides gymnurus,* a lungnematode of seals. This is the first study to determine intermediate hosts for metastrongylid parasites of marine mammals in the wild. It elucidates the life cycle of two lungworm species of seals and porpoises in the Wadden Sea. Molecular tools proved to be highly suitable for the determination and differentiation of larval lungworm stages while microscopic identification of tiny larvae without well-defined characteristics remains difficult and imprecise.

Tuesday 24 April 10:05

ORAL ABSTRACTS ON BEHAVIOUR, ECOLOGY, FEEDING, GENETICS, & HABITAT

SYNCHRONICITY IN DEEP-DIVING BEAKED WHALES AND PILOT WHALES WITH IMPLICATIONS ON PARENTAL CARE

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Deep-diving cetaceans must combine foraging at depth with care of the young. Alloparental care of calves at the surface has been suggested as one strategy to achieve this. Here we study the diving coordination of Blainville´s beaked whales (*Md*) and short-finned pilot whales (*Gm*) off the Canary Islands and Cuvier´s beaked whales (*Zc*) in the Ligurian Sea using sound and orientation tags (DTAG´s) attached with suction cups. Dive profiles from contemporaneously tagged pilot whales (n=15 pairs) ranged from fully synchronous to completely asynchronous. Calves and juveniles were observed to remain at the surface while some adults dove supporting the notion of alloparental care. In contrast, contemporaneously tagged Md and Zc (n=2 pairs) dove synchronously, and simultaneous diving has been observed frequently by visual observers in other groups of the same species. Click sequences from untagged whales are often detected on stereo DTAGs attached to *Md* and reveal the minimum number of individuals diving in the vicinity of the tagged whale. Results from 5 deep dives performed by 2 whales tagged in groups with 5 and 3 individuals observed at the surface, respectively, showed that the same number of individuals were also detectable vocalizing during each dive. The first group included two juveniles leading us to suspect that even juveniles may dive synchronously with adults. If adults must accommodate the limited diving capabilities of juveniles, this may relate to the large birth size reported for ziphiids, favouring the fast acquisition of diving capabilities by the juveniles. Results are thus indicative of two different strategies of parental care involving altruistic behaviours in pilot and beaked whales and highlights the importance of social cohesion in these deep-diving species, with strong implications for the conservation of their populations.

Tuesday 24 April 12:05

SITE FIDELITY AND MOVEMENTS OF CUVIER'S AND BLAINVILLE'S BEAKED WHALES AT THREE SPATIAL/TEMPORAL SCALES: COMBINING VHF RADIO TRACKING, SATELLITE TAGGING AND LONG-TERM PHOTO-IDENTIFICATION

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The Ziphiidae are the second-most speciose family of cetaceans, yet little is known of movements or site fidelity of any species. This lack of information has hampered efforts to understand and potentially mitigate anthropogenic impacts. Our study focuses on Cuvier's and Blainville's beaked whales, both known to be impacted by navy sonar. Based on site fidelity patterns in other mammals, we hypothesize that females show fidelity to foraging areas and males move between areas. We use three methods to study site fidelity and movements at different temporal and spatial scales: VHF radio tracking, satellite tracking, and photo-identification. The study area encompassed ~5,000 km^2 off the west coast of the island of Hawai'i. Short-term movements (over hours/days) were examined using suction-cup attached VHF transmitters deployed on 11 individuals in 2002-2006. Medium-term movements (over weeks) were studied using satellite tags that were deployed on three Blainville's beaked whales and one Cuvier's beaked whale in November/December 2006. Long-term site fidelity (over years) was assessed using a 21-year photographic dataset (1986-2006). Short-term horizontal rates of movements were low, from 1.52-1.94 km/hour for Cuvier's and Blainville's beaked whales, respectively. Satellite data collection is ongoing (as of 8 December 2006) but locations received in the first two weeks from two adult male Blainville's indicate movements out of our study area. Photographic re-sighting rates of both species were high (~25% of individuals were seen more than once) and re-sightings spanned 15-years, suggesting long-term fidelity to the area. Long-term re-sightings were documented primarily from adult females of both species, suggesting adult males may not be long-term residents. Individuals seen on multiple occasions

were typically documented in multiple months/seasons, suggesting they may use the study area throughout the year. Such long-term site-fidelity has implications both for potential population structure and for susceptibility of beaked whale populations to anthropogenic impacts.

Tuesday 24 April 12:20

USING ENVIRONMENTAL MODELS TO PREDICT HARBOUR PORPOISE DISTRIBUTION AND RELATIVE ABUNDANCE FROM VISUAL AND ACOUSTIC SURVEY DATA

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Effective SAC designation and conservation management of harbour porpoises is constrained by a lack of understanding of distribution, abundance and habitat use. We present a novel approach using a predictive modelling framework applied to both visual and acoustic detection data from the Inner Hebrides in western Scotland. Detections obtained from intensive surveys were used to model distribution and relative abundance of harbour porpoises as a function of environmental covariates to determine habitat preferences and areas of concentrated use. Monthly visual and passive acoustic surveys were conducted from the Hebridean Whale and Dolphin Trust's (HWDT) motor-sailor, *Silurian*, in 2004 in the Inner Hebrides, Scotland. Generalise Additive Models (GAMs) were used to relate the number of groups detected per 2km segment of survey track to temporal, topographical, and oceanographic covariates. There was over 1200km of survey effort, comprising 594 segments in sea state 3 or less. Twice as many porpoise detections were made acoustically than visually with sightings in 8% of all segments, and acoustical detections in 18% of all segments. The data was randomly divided into a training (75%) and test (25%) data set. Different models were fitted to visual and acoustic data, after compensating for survey variables (e.g. sea state). The best model for visual data included seabed slope, position in the tidal cycle, and halocline depth, explaining 21.9% of the deviance. The best model for acoustic data included sediment type and thermocline strength, explaining 14.4% of the deviance. Both models performed well, with no statistical difference in the errors between the test and training data sets (visual $z = 1.753$, acoustic $z = 0.348$, $p > 0.05$). Combination of both visual and acoustic models can be used together to determine areas of high usage and to better inform the selection of SACs for harbour porpoises.

Tuesday 24 April 12:35; eligible for Student Award: Postgraduate

THE FORAGING STRATEGY OF SPERM WHALES IN THE NORTH-WESTERN MEDITERRANEAN SEA

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Sperm whale foraging was studied with 2D passive acoustics off French continental coast from 2002 to 2005, in a study area characterized by intense merchant shipping. Creak emissions were counted from 109 dive recordings on 43 individuals, whose length was estimated between 9.5 and 13.8 meter from IPI evaluation. Body mass was estimated from published length/mass relationship. We determined the foraging time as the interval beween first creak and last click, and the ascent time as the interval between last click and surfacing. Our primary aim was to determine if sperm whale horizontal movement was influenced by feeding success. Sperm whales emitted 24.8 creaks in average (SD= 5.5) during dives of 43.9 minute mean duration (SD= 6.2), and the feeding success was positively correlated with their estimated mass ($p<0.001$). A distance of 3065m (SD= 1085) was covered between two successive dives. Creak

count was not linked to the between-dive distance, but was higher when whales were moving offshore. Estimated feeding success was not linked to a zigzag index calculated in 21 cases from successive dive positions. The feeding success expressed as creak rate was significantly corretated to foraging time, ascent time and estimated body mass (R2= 52.6%, p <0.001). Higher than average feeding success were obtained by heavier individuals with longer ascent time (7 min. vs 4 min.), suggesting that older animals were feeding deeper than younger ones. Sperm whales of northwestern Mediterranean Sea apparently have a complex strategy to obtain the desired number of preys, including moving offshore and probably foraging deeper. There is a clear indication that larger individuals forage at deeper levels, although this has to be demonstrated by 3D acoustic passive tracking techniques.

Tuesday 24 April 12:50

HABITAT AND RESOURCE USE AMONG A COMMUNITY OF TROPICAL DELPHINIDS IN MAYOTTE, SW INDIAN OCEAN

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In any habitat a species occupies its own ecological niche. If several species exploit the same limiting resources, inter-specific competition should occur. The coexistence of competing species is often made possible by ecological niche differentiation. Mayotte is characterized by an important delphinid species richness. Their coexistence in a fairly small area around the island might be possible by exploiting neither the same preferential habitats nor the same resources. The present study aimed at investigating ecological niche segregation among the delphinid community of Mayotte, mainly constituted of four species: the indopacific bottlenose dolphin, *Tursiops aduncus*, the pan-tropical spotted dolphin, *Stenella attenuata*, the spinner dolphin, *Stenella longirostris*, and the melon-headed whale, *Peponocephala electra*. Two approaches were combined: the study of preferential habitat by the analysis of dolphin distribution with the observation data and the physiographical characteristics associated to each sighting location, and the study of resource partitioning by the analysis of C and N stable isotopes from skin and blubber biopsies. Principal Components Analysis was used to investigate the differences between environmental caracteristics for each species and Ecological-Niche Factor Analysis allowed for a better description of their ecological niches. Only T. aduncus, which showed clear association with coastal habitats in the lagoon, differed from the others in terms of habitat characteristics. All other species shared similar oceanic habitats immediately outside the lagoon, used either in single-species or mixed-species groups. The analysis of stable isotopes confirmed the ecological isolation of T. aduncus and revealed a clear segregation of P. electra compared to the two *Stenella*, that was not apparent in the habitat analysis. This may reflect differences that were not observable from diurnal surface observations.

Tuesday 24 April 13:05; eligible for Student Award: Postgraduate

IS THERE A COMPETITION FOR THE RESOURCES WITHIN THE SOCIAL GROUPS OF LONG FINNED PILOT WHALES IN THE STRAIT OF GIBRALTAR ALONG THE YEAR?

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Long finned pilot whales have been suggested as being a species with a strong matrilineal social structure. A group of pilot whales is mainly found over the deep waters of the central part of the Strait of Gibraltar. The aims of this study are 1) to evaluate the degree of residence of the pilot whales, 2) to analyse the social structure of the animals, and 3) to evaluate if there is intraspecific competition for the habitat in the Strait of Gibraltar for pilot whales along the year. Between 1999 and 2006, a total of 15678 images of dorsal fins have been taken for photo-identification purposes. 92% of the individuals seen between 1999 and 2003 were seen in 2004 and/or 2005. The population estimation of summer 2005, 263 (95% CI: 231-319) is very similar to winter 2005-2006, 286 (95%CI 263-338) with 72% of recapture from summer to winter. These data put together with the low emigration rate (8-15%) between 1999 and 2005 show that this population is resident all year around. During the photo-id sessions, group structure was noted, and then, the catalogue was analysed with the social-programme, resulting to a total of 17 long term social groups, if we take an association index of 0.6, including 121 well marked individuals. A total of 54 skin and blubber biopsies were taken from identified individuals during 3 consecutives days in the summer 2006 to study the differences in stable nitrogen (δ15N) and carbon (δ13C) isotope ratios, in order to determine if there is differences between groups at their trophic level. A total of 12.256 kilometers have been sailed in the Strait of Gibraltar, resulting in 456 sightings of pilot whales. The normalized distribution maps of the sightings as well as the levels of stable isotopes of each social group have been compared between them,

Tuesday 24 April 15:05; eligible for Student Award: Postgraduate

BRYDE'S WHALE (*BALAENOPTERA EDENI*) DIVE PROFILE AND INDIVIDUALS ASSOCIATION: NEW PERSPECTIVES ON FEEDING STRATEGIES

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Very little is known about the social organization and foraging behaviour of Bryde's Whales. Apart from fin, humpback and blue whales, there is no knowledge on the dive profile for other baleen species. Also, the information on long-term individuals association is scarce for any baleen whale species. The diving behaviour of two Bryde's whales was analysed using suction-cup TDR/VHF radio tag during June 2006 off Madeira Island (NE Atlantic). The two adult whales were tagged within 11-min interval and followed during 2h30m. A total of 27h57m (14h32m and 13h25m from each tag) track time (from 2:15pm until 04:47am, local time) showed a synchrony on the dive profile between both whales, indicating a strong association. For one whale, the maximum number of dives deeper than 10m was 145, from which 29 were deeper than 40m (deep dives). Deep dives ranged from 2m55s to 6m28s and to a maximum of 292m. Dive profiles revealed both V- and U-shape, suggesting lunge-feeding at depth. Data showed a differential day-night activity, as deep dives took place during night, with an upwards tendency at early night and downwards at early morning, probably following prey vertical migrations. Photo-identification revealed that these two individuals have been previously sighted together on 2005, and one on 2004. Considering the fact that this species is also known to lunge-feed at surface during day, it is suggested that Bryde's whale, and possible other baleen whales, may use different strategies to feed upon different preys during day (schools of small pelagic fishes) or night (masses of zooplankton). Individuals association can also be a possible strategy to increase foraging success and feeding efficiency as described for other baleen whales, but the dive synchrony and the same individuals association during consecutive years or even, at long-term level, brings a new perspective on the social organization and foraging behaviour on baleen whales.

Tuesday 24 April 15:20

THE USE OF BLUBBER FATTY ACIDS PROFILES IN DIETARY STUDIES OF HARBOUR PORPOISES IN THE NORTH AND BALTIC SEAS

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In order to gain a better understanding of the diet and ecological stock structure of porpoises in the Baltic and North Seas studies have been performed on 109 stranded or by-caught animals (n=49 German North Sea, 46 German Baltic, 14 Polish Baltic). Stomach contents have been examined to determine prey items and the results will be presented elsewhere. These findings are being complemented by analysis of fatty acid profiles (FAP) of inner blubber layer, which may provide both qualitative and (via the QFASA method) quantitative dietary data. Thus, the FAP were subjected to several multivariate statistical techniques (PCA, DA, CART and Dfap measures). No strong significant differences were seen according to the year of sampling; probably indicating that although diets were not completely identical between years, no major dietary shifts occurred. No significant difference was seen in relation to sex; thus there were no indications of any foraging differences between the 2 sexes as has been reported in some dolphin species. However there were differences seen relating to location (North and Baltic Seas). Also there appeared to be differences within the Baltic Sea between animals found in Polish and German waters indicating possible ecological stock differences. QFASA analysis is somewhat controversial and novel and has not yet been fully tested in any species, but it is of interest to run the analyses and see how diets predicted from the model compare with data obtained from stomach analyses. We first analysed several fish species (150 individuals) to obtain a database of prey FAPs with which to compare the porpoises profiles. Calibration coefficients were calculated from a captive porpoise, which had been fed on a known diet. Overall, the results predicted that the main dietary items were, by weight, about 60% clupeids (herring & sprat) and 25 % gadoids (whiting & cod).

Tuesday 24 April 15:35

DO NORTH ATLANTIC MINKE WHALES SHOW POPULATION SUB-STRUCTURING?

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High degrees of genetic differentiation exist for minke whale (*Balaenoptera acutorostrata*) populations between the North Atlantic, North Pacific and Antarctic, and Northern and Southern Hemisphere minkes have actually been assigned separate species status. Within the North Atlantic, however, studies to date have found variable evidence for structure depending on the markers used, whilst efforts have been confined to the traditional whaling grounds. In the present study, 9 polymorphic microsatellite loci were amplified from 262 minke samples spanning the entire North Atlantic from the UK to Canada, complementing Andersen *et al*.'s (2003) work by including samples from areas outside the whaling grounds, as well as from Iceland. 30 samples from the Sea of Japan were used as an out-group. Using both infinite allele

and stepwise mutation models, no significant differentiation could be detected between 7 putative populations within the North Atlantic after Bonferroni correction (F_{st}<0.014, Rho_{st}<0.015), whereas strong differentiation was found between all North Atlantic samples and Japan (0.18<F_{st}<0.21, p=0.0001; 0.33<Rho_{st}<0.38, p<0.00001). However, using an assignment test, most samples were assigned correctly to their original putative populations, suggesting that low levels of population differentiation do exist between different regions in the North Atlantic, but are too weak to be detected by Fst given the level of power provided by this study. This may suggest large effective sizes for minke whale populations in the North Atlantic. It is also possible that current minke whale population structure in the North Atlantic was only established after a post-glacial re-expansion, and that population differentiation between regions is still in the early stages.

Tuesday 24 April 15:50; eligible for Student award: Postgraduate

APPLICATION OF MOLECULAR GENETICS TO THE STUDY OF POPULATION AND SOCIAL STRUCTURE OF SHORT-BEAKED COMMON DOLPHINS (*DELPHINUS DELPHIS*)

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The extent of incidental kills (bycatch) of short-beaked common dolphins (*Delphinus delphis*) reported in fisheries in recent decades has raised concerns about the status of the species. The lack of information on population structure and social organisation hampers effective monitoring and conservation of common dolphins in many areas affected by human-related mortality. In the present study, a total of 286 short-beaked common dolphins were collected opportunistically (strandings or bycatch), or using biopsy darting techniques, from the northeast Atlantic, northwest Atlantic and northwest New Zealand regions. A suite of 14 polymorphic microsatellite loci and a 360bp portion of the mtDNA control region were employed in estimates of genetic differentiation between sampled areas, and for parentage and relatedness analyses among groups of individuals bycaught or stranded together within sampled areas. Levels of genetic diversity were high and no evidence of recent reduction of effective population size (bottleneck) was found in any of the sampled areas. Genetic differentiation was strong between ocean basins, moderate between northwest and northeast Atlantic regions but lacking within regions. These results indicate the presence of three genetically differentiated aggregations of common dolphins in the sampled regions, suggesting high mobility and possible long-range dispersal across the North Atlantic, which appears to be mediated by both sexes. Parentage and relatedness analyses indicate that groups of dolphins are mainly composed of unrelated individuals, with the exception of mother-calf pairs. This suggests no kin-selection within groups of stranded or bycaught individuals. Furthermore, individuals from the same group rarely shared the same mtDNA haplotype, revealing the presence of multiple maternal lineages, hence dispersal from the natal group. These findings provide information on population structure, dispersal and social organisation of common dolphins, which have implications in management and conservation of the species in the studied areas.

Tuesday 24 April 16:05

GENETIC POPULATION STRUCTURE OF BALTIC HARBOUR PORPOISES (*PHOCOENA PHOCOENA*)

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The assessment of population structure of a species is fundamental to the development of effective conservation and management programmes.Harbour porpoises (*Phocoena phocoena*) are widely distributed around the world, however populations may be locally or regional threatened by various environmental and anthropogenic factors. Limited individual number and limited migration due to female philopatry can cause limited gene flow among porpoise stocks. Previous studies suggest a possible subpopulation in the Baltic, supported by genetic, morphological and seasonal abundance data. In the course of an integrative project on the status of the Baltic harbour porpoises (Jastarnia Project) we compiled available genetic information as well as we analyzed additional tissue samples for mitochondrial DNA control region and 11 microsatellite loci. Our study focused on the population structure of this species, comparing the Baltic regions of Skagerak, Kattegat, Inner-Danish-Waters, and Baltic Proper and the southeastern North Sea. Data were stratified according to type of sample (stranding/by-catch), season, and gender in order to evaluate genetic properties of the putative breeding stock and limiting artefacts (e.g., post-mortem drift, seasonal migrations). A spatial autocorrelation analysis and a Principal Component Analysis (PCA) revealed significant genetic population structure within the analyzed geographic area, which can serve as a criterion for the identification of Management Units (MUs). This data thus provide a strong bases for implementation of conservation strategies for the stock recovery of harbour porpoises in the Baltic Sea.

Tuesday 24 April 16:20; eligible for Student Award: Postgraduate

DETERMINATION OF MUTATION RATES AND EFFECTIVE POPULATION NUMBERS BY MEANS OF DNA MICROSATELLITES IN FOUR LATIN AMERICAN DOLPHINS (*INIA GEOFFRENSIS, INIA BOLIVIENSIS, PONTOPORIA BLAIVILLEI* AND *SOTALIA FLUVIATILIS*)

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Ten heterologous DNA microsatellites were applied to four Latin America dolphins (*Inia geoffrensis* n = 130 *, Inia boliviensis* n = 70*, Pontoporia blainvillei* n = 31 and *Sotalia fluviatilis* n = 24). Employing some mathematical and evolutionary properties of the $\delta\mu^2$ genetic distance and of the maximum likelihood estimation of the θ parameter, we obtained microsatellite mutation rates among these four cetacean species. The average mutation rate between the two *Inia* species ranged from 2.96×10^{-6} to 4.94×10^{-6} , meanwhile between *Inia* and *Pontoporia* they oscillated from 1.21×10^{-5} to 3.58×10^{-5} and between *Inia-Pontoporia* and *Sotalia* ranged from 2.95×10^{-6} to 6.76×10^{-6}. Therefore, the mutation rates seem to increase in the *Pontoporia blainvillei* branch. This last species also showed the highest level of genetic richness ($\theta = 33.85$), meanwhile *Inia boliviensis* showed the lowest one ($\theta = 3.91$). If we take arithmetic mean values, the long-term historical effective population sizes for the four species were 260.000 individuals for *Inia boliviensis*, 350.000 for the western Amazonian population of *Inia geoffrensis*, 440.000 for *Pontoporia blainvillei* and 520.000 for *Sotalia fluviatilis*. If we take the harmonic mean, the effective numbers were 24.000 for *Inia boliviensis*, 144.000 for *Inia geoffrensis*, 105.000 for *Pontoporia blainvillei* and 210.000 for *Sotalia fluviatilis*. In whatever case, *Inia boliviensis* showed the lowest effective numbers. Additionally, a bottleneck event was detected in the Bolivian population of *Inia* (Garza & Williamson, 2001), which agrees quite

well with the founder event origin of this species, 5 MY ago. *Sotalia* showed the highest historical effective numbers which is in accordance with the highest geographical distribution of this species. These historical effective numbers could be contrasted with current censuses of these species to determine how habitat destruction and fisheries are diminishing the population size of them.

Tuesday 24 April 16:35

AN EVALUATION OF HABITAT USE OF THE INDO-PACIFIC HUMBACK DOLPHIN (*Sousa chinensis*) IN HONG KONG SHA CHAU AND LUNG KWU CHAU MARINE PARK AND VICINITY

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The marine protected area – Sha Chau and Lung Kwu Chau Marine Park (SLMP) was established in November 1996 as a major conservation effort to protect the Indo-Pacific Humpback Dolphin (Sousa chinensis) in Hong Kong. However, 10 years since its establishment, the effectiveness of this MPA for dolphin conservation has never been evaluated. For this purpose, seven sites in western Hong Kong are chosen as land-based observation stations for monthly dolphin monitoring surveys to assess their habitat use. Among these, four sites are within SLMP and three are outside. Dolphin activities in these sites are recorded and compared, including their group size, composition, movement and activities like breaching and spy-hopping. Apart from this, monthly fish surveys and vessel traffic count are also conducted to evaluate food availability and traffic disturbance as possible factors that could affect the quality of these habitats. From October 2005 to October 2006, 218 dolphin sightings were observed in the seven sites. The share of each of the fours sites within SLMP ranged from 9 – 18% of the total, compared with 34% for Tai O (comparatively undisturbed) and <5% in the two other urban sites. From the fish surveys, the SLMP area had significantly higher yield of total and food biomass and its mean percentage of food biomass was also the highest. However, the group size distribution, dive time and behavioural patterns of the dolphins were not significantly different among the sites within and outside SLMP. In addition, a number of dolphins were observed utilizing waters outside the northern SLMP, which experiences busy vessel traffic. Based on these results, SLMP can be considered to serve as a reasonably good habitat for the dolphins but further efforts to reduce vessel traffic and illegal fishing activities are undoubtedly needed in order to improve its effectiveness.

Tuesday 24 April 16:50; eligible for Student Award: Postgraduate

A NEW BREEDING GROUND? THE SPATIO-TEMPORAL DISTRIBUTION AND BATHYMETRIC PREFERENCES OF SPERM WHALES (*PHYSETER MACROCEPHALUS*) IN THE BAY OF BISCAY

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Sperm whale distribution was investigated in The Bay of Biscay from both dedicated surveys and casual off-effort data collected year-round from a commercial ferry during 1995-2006. In total 185 sightings of 387 animals were recorded. Sightings were recorded primarily during

April-October with a peak during July-September (n=122). The distribution was examined in relation to two physiographic variables, depth (metres) and slope (degrees). Analysis of $\chi 2$ showed that animals were non-randomly distributed in relation to both depth and slope and that sperm whales preferred very deep waters, with most sightings in waters beyond 2000m deep (n=155, mean=3087m), and slopes of greater than 2 degrees (n=109, mean = 3.96 degrees). These habitats comprise the complex canyon area of the lower northern Celtic-Biscay shelf-break, the edge of the Biscay abyssal plain and the Santander canyon, near Bilbao. Kruskal-Wallis tests showed that there was seasonal differences in terms of depth with whales found in shallower waters in the autumn ($H = 12.09$, $p = 0.007$). Group size composition was largely typical of northern temperate waters with most sightings of 1-2 animals (mean = 2.1) but there is evidence that the area may also be a breeding/nursery ground with seven sightings, totalling eight animals, of calves recorded. Calves were recorded between April-August and, notably, only in recent years (2003-2006). The group size of adults in association with calves was significantly higher than those without ($W = 960$, $p = 0.01$). It is currently uncertain whether calves have been over-looked in the past or reflect a change in the age/sex structure of this population.

Tuesday 24 April 17:05

SEASONAL VARIATIONS IN BOTTLENOSE DOLPHIN AND HARBOUR PORPOISE HABITAT USE WITHIN CARDIGAN BAY SAC IN RELATION TO TIME OF DAY AND TIDAL CYCLE FROM T-POD RECORDINGS

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Passive acoustic monitoring using T-PODs can provide information of the presence of bottlenose dolphins and harbour porpoise at strategic locations over extended periods of time, in both daylight and hours of darkness, and independent of sea state. Ten T-PODs were calibrated in pool and field conditions, in order to ensure inter T-POD data comparability, and then deployed within Cardigan Bay Special Area of Conservation from March 2005 to December 2006. The T-PODs' settings and channels were selected so that they were able to log echolocation clicks from both bottlenose dolphins and harbour porpoise simultaneously. The T-POD data were extracted and analysed using T-POD exe v.8.18, to examine seasonal, monthly and daily variations, as well as diurnal patterns in habitat usage for each of the T-POD sites, for bothspecies. The relationships of dolphin and porpoise presence with the tidal cycle including tidal height, amplitude, time, and velocity were also examined. Previous studies have established the foraging click characteristics for bottlenose dolphins and harbour porpoise, and we used those characteristics to further examine the data and establish the importance of the T-POD locations as feeding sites. The results show some marked seasonal differences between the species. Dolphin detections, measured as Detection Positive Minutes (DPM) per week, increased significantly during the period from May to September and declined again from October to December. By contrast, harbour porpoise detections increased between September and January. Results of the tidal analyses indicate a trend for increased detection with increased tidal height for bottlenose dolphins, but a decreased detection with increased tidal height for harbour porpoise. Together, these may help porpoises minimise potential conflict with bottlenose dolphins.

Tuesday 24 April 17;20

HABITAT USE AND PREFERENCES OF CETACEANS IN THE STRAIT OF MESSINA (ITALY) THROUGH SPATIAL MODELLING: IMPLICATIONS FOR MANAGEMENT

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The Strait of Messina is a narrow area between mainland Italy and the Island of Sicily, where the construction of a suspension bridge, spanning between Messina and Reggio Calabria, has been proposed. This paper presents and discusses data on cetaceans habitat use and preferences collected in the area from June 2005 to May 2006, as part of a study aimed at assessing the potential impacts on the cetaceans derived by the bridge construction and use. The study area, covering approx. 2,300 km2, was surveyed along pre-defined transects, using a 18 m-long motor boat. A total of 125 days were spent at sea, covering 4,612 km surveyed under favourable conditions. Over the 12 months of field work 80 cetacean sightings have been made, and six cetacean species were observed: striped dolphin (51.3%), common bottlenose dolphin (21.3%), sperm whale (13.8%), Risso's dolphin (1.2%), short-beaked common dolphin (1.2%), Cuvier's beaked whale (1.2%) and unidentified small delphinids (10.0%). GLMs and GAMs were applied to characterize the habitat of the cetacean species regularly observed; the response variable was the number of sightings, while the survey effort was treated as an offset. 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). Despite the limited data-set available, this study represents the first year-round systematic survey of the area, which resulted regularly frequented by at least three species. The models provided evidence on each species distribution in relation to the variables selected, and predicted presence outside the survey area. The narrowest portion of the Strait, close to the proposed area of construction, resulted regularly used by bottlenose dolphins, stressing the need for proper management measures.

Tuesday 24 April 17:35

COMPARISON OF ENFA AND GLM MODELLING FOR SUMMER HABITAT SUITABILITY OF THE SPERM WHALE IN THE NORTHWESTERN MEDITERRANEAN SEA

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In the northwestern Mediterranean, the sperm whale (*Physeter macrocephalus*) is exposed to anthropic disturbances (*e.g.* ship collision, drift net entanglement). Informations were needed on its critical habitat, especially in the International Sanctuary for Marine Mammals, Pelagos. We modelled the habitat of this species by comparing two methods: a presence-only based method, the Ecological Niche Factor Analysis (ENFA) and a presence/absence method, a Generalised Linear Model (GLM) with a binomial distribution and a logit function. Data collections were realised during summers from 1998 to 2005 on a motor-sailing boat. The study area was transformed in a 9*9 km grid cell, where presence/absence cells of the species and environmental data were computed. The Eco-Geographical Variables (EGVs) were data related to topography, temperature, salinity and chlorophyll concentrations. The hydrological and biological EGVs were monthly maps averaged from 1998 to 2005, during the summer period (June, July and August) and the phytoplankton bloom period (February, March and April). The

Receiver Operating Characteristic (ROC) plots indicated that both methods created models significantly different from random distribution ($p<0.001$ for both methods).The GLM model had a better Area Under the Curve (AUC) of 0.859 in comparison to the ENFA, which has an AUC of 0.803, but this difference was not significant ($p=0.20$). Both models indicated a core habitat for the sperm whale on the continental slope near French and Balearic coasts and in the Gulf of Lions. Those results show that ENFA is a relevant method and could then be used for modelling habitat suitability for species when absence or effort data are not available.

Tuesday 24 April 17:50; eligible for Student Award: Postgraduate

ORAL ABSTRATCS ON SURVEYING

LAND OBSERVATIONS AT THE AZORES: EFFICIENT TOOL FOR MANAGEMENT

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Despite their isolated situation, the Azorean waters form one of the richest cetacean habitats in Europe. The twenty-five species of resident and migratory cetaceans observed occupy a wide range of niches and include several endangered species. This indicates that the area could form a critical habitat for cetaceans in the North Atlantic Ocean. In this study, we investigated the use of land observations for the determination of habitat-functionality of the Azores for cetaceans. Observations from land can provide a highly efficient and cost-effective tool. At oceanic islands, such as the Azores, usual drawbacks of this method are partly eliminated: due to the absence of a continental shelf, open ocean ecosystems –and the cetaceans- occur very close to the coast. Habitat-use, population size and –structure and spatial and temporal patterns of abundance were classified as essential parameters. Therefore, land observations should be able to provide structural data on species' presence, group size, presence of calves, behaviour and location. Binocular-aided survey observations were conducted from thirteen fixed look-out platforms on Pico island, recording all cetacean sightings (point sampling; theodolite). Based on life history patterns and diet, species were divided in six functional groups. Control of the observations was performed by simultaneous observations from vessel platforms. From 2003-2006, 18 cetacean species were observed during 3011 surveys (8262 sightings). 84% of sightings could be determined at species' level (functional group: 99%). For all species, it was possible to estimate group size and determine calf presence and location. Behavioural state could be recorded in 87% of sightings. Sampling was determined accurate up to 12 km offshore, depending on functional group. The results show that land observations form an ultimate opportunity to study cetacean habitat functionality at the Azores, providing the exceptional possibility of studying population structure and behaviour from land. Also, it can be regarded a valuable tool for management and conservation of the Azorean marine ecosystem.

Wednesday 25 April 8:35

INCREASE IN THE NUMBER OF SOUTHERN RIGHT WHALES *EUBALAENA AUSTRALIS* IN THE NEIGHBORHOOD OF PENÍNSULA VALDÉS DURING THE PERIOD 1999-2006

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Payne and colleagues carried out long term studies in Southern right whales since the early 70´s and estimated population size and other parameters derived from sighting data based on individual pattern of callosities. The rate of increase r was estimated close to 8%. We developed a method for monitoring the population, which could lead to study seasonal changes within and through years. Whales were classified as: a) mother-calf pairs (MC), b) solitary individuals (SI), c) breeding groups (BG) considering one female and n-1 males. Twelve aerial surveys were performed between May 1999-December 2000 and 16 between October 2004-December 2006, flying parallel to the coastline at a distance of 500-1000m and an altitude of 500 feet, from the mouth of Chubut River (42°30´) to Puerto Lobos (42°) totalling a coastal strip of 350 nm. Around 95% of the whales are within the strip and the number of whales in the strip can be considered a measure of relative abundance. The period between flights ranged from 40-50 days which is beyond the average permanence of whales in the area, so ideally during each census new individuals were being counted. Every year a bell shaped curve was obtained increasing in May and declining in December when no whales remain in the area. Maximum number of whales is counted always during September and was as follows: 556 in 1999, 566 in 2000, 732 in 2005, 798 in 2006. The rate of increase for the period 1999-2006 was estimated from the slope of the linear regression of the log-number of whales through time. Despite there is a short period of time between the series of flights, the rate of increase was estimated to be 5.1% (CI=3.4-6.8), lower than that estimated by mark-recapture methods but with confidence intervals in the same order of magnitude.

Wednesday 25 April 8:50

MODELLING SEASONAL HABITAT USAGE OF HARBOUR PORPOISES IN THE GERMAN BIGHT - IMPLICATIONS FOR MANAGEMENT

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Seasonal differences in the distribution of harbour porpoises (*Phocoena phocoena*) in German national waters of the North Sea (EEZ plus 12 nm zone; 41,000 km2) were investigated. Data was collected during aerial surveys conducted year-round between 2002 and 2005 following standard line transect methodology. Survey effort amounted to 39,000 km during which a total of 3,890 harbour porpoises were seen. Using standard Distance procedures and a grid of 10x10 km, we converted the line transect point locations into mean density estimates, correcting for missed animals and sighting conditions. We investigated spatial patterns to identify the environmental parameters and spatial processes that may determine harbour porpoise seasonal distribution. The results indicated significant seasonal similarity in porpoise spatial distributions between seasons of all study years. We detected a distinct north-south density gradient during spring and, more pronounced, during the summer season. In contrast, animals appeared to be more evenly distributed during autumn. Using a combination of generalized additive modelling (GAM) and permutation simulation analysis we investigated porpoise density in relation to potential static and dynamic predictor variables (e.g. depth, slope, distance to coast, sea surface temperature SST, sea surface chlorophyll). Statistically significant relationships between porpoise densities and environmental parameters were found for all three seasons and fitted models explained a high proportion of deviance (> 60% in summer). Observed seasonal shifts in distributions are most likely linked to changes in harbour porpoise habitat usage associated with different stages of their annual life cycle. In particular, porpoises appeared to be more closely

associated with depth, contour index and SST during the spring months than during other times of the year. Our results emphasise the importance of year-round monitoring programs and the need to consider seasonal aspects in habitat prediction models used to identify critical habitat, particularly in the context of anthropogenic impact assessments.

Wednesday 25 April 9:05

ABUNDANCE OF HARBOUR PORPOISE AND OTHER SMALL CETACEANS IN THE EUROPEAN ATLANTIC AND NORTH SEA

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Estimates of cetacean abundance are needed to assess the impact of bycatch and other threats. The SCANS survey in 1994 provided estimate of abundance for harbour porpoise that allowed bycatch to be put into context for the first time. Abundance was also estimated for the white-beaked dolphin and minke whale. In 2005, all European Atlantic continental shelf waters south of 62ºN were surveyed as part of the SCANS-II project to update earlier abundance estimates and to obtain estimates for areas not previously surveyed (west of Britain/Ireland and off the coasts of France, Spain and Portugal. Methods similar to SCANS (but updated) were used: double-platform mark-recapture distance sampling using tracker and primary platforms on each of seven ships, and circle-back ("racetrack") line transect sampling from three aircraft. Ships surveyed ~20,000km and aircraft flew ~16,000km on effort in a survey area of 1,370,000 km2. Abundance estimates for harbour porpoise totalled 386,000 (CV=0.20) in the survey area and ~335,000 (CV~0.21) in an area approximately equivalent to the 1994 survey area. The latter estimate was very similar to the SCANS estimate of 341,000 (CV=0.14). However, average density in survey blocks north of 56ºN in 2005 was approximately half that estimated in 1994, and average density in survey blocks south of 56ºN in 2005 was approximately twice that in 1994. Density surface modelling of the data allowed this change to be investigated in more detail. The possible contribution to these changes in distribution of bycatch, immigration, climate change, and changes in distribution/availability of prey will be discussed. New

estimates of abundance were obtained for white-beaked dolphin (22,700; CV=0.42), minke whale (18,600; CV=0.30), bottlenose dolphin (12,700; CV=0.27) and common dolphin (63,400; CV=0.46). Estimates for white-beaked dolphin and minke whale in the North Sea were larger, but not significantly, than estimates from 1994.

Wednesday 25 April 9:20

PRESENT-DAY STATUS OF A VULNERABLE SUBSPECIES – THE LADOGA RINGED SEAL (*PHOCA HISPIDA LADOGENSIS*) AND TECHNICAL GUIDELINES FOR FURTHER RESEARCH, MONITORING AND MANAGEMENT OF THE POPULATION

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The Ladoga ringed seal is a relict freshwater seal. In 1975 Ladoga seal hunting was totally banned and the animal was included in the Red Data Book of Russia. Since 1996 it has been on the IUCN Red List of Threatened Species. According to data from aerial counts and analysis of annual by-catch, the Ladoga seal population size can be estimated at no less than 5,000 individuals. A great number of animals (up to 500 a year) die in fishing gears. The population has for several years suffered from the "seal pox" epizootic, first cases of which were recorded in 2001. The proportion of infected animals reaches 15-20% of their number in insular groupings, and the disease peaks (external manifestations) in August and September. Research into the characteristics of the Ladoga ringed seal overwintering and breeding in southern parts of the lake has shown that in contrast to northern Ladoga, where most birth and haul-out lairs were situated on islands and the rocky mainland shore, the main breeding and haul-out habitats in the southern part of the lake is pack ice. To get a closer insight into the Ladoga ringed seal population structure in-depth DNA analysis should be continued, and better understanding of the patterns of seal migrations in the lake requires radiotelemetry studies. Our recommendations for monitoring and management are as following: Once in five years: aerial counts to determine the population size; surveys of snow lairs in the southern part of the lake – main breeding sites of Ladoga seal; analysis of concentration of heavy metals and organochlorine compounds in seal organs and tissues. Annually: counts of the number of seal deaths in fishing gear; determination of the per cent of sick animals in haul-outs; surveys of snow lairs in the northern, skerry-&-island part of the lake.

Wednesday 25 April 9:50

SMALL-BOAT SURVEYS TO ESTIMATE CETACEAN ABUNDANCE IN WESTERN CANADIAN COASTAL WATERS

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Information on animal distribution and abundance is integral to wildlife conservation and management, but acquiring this information can be costly. One approach to this dilemma is to rely on newly developed model-based abundance estimators and ships of opportunity, but this has serious limitations. An alternative is to conduct design-unbiased, systematic surveys using inexpensive small boats, which carries a different set of problems. In contrast to the well-studied killer whale populations, abundance estimates have been lacking for many cetacean

species inhabiting coastal waters of British Columbia, Canada, including those that were heavily depleted by commercial whaling. This lack is due in part to the generic problem of the expense of conducting systematic surveys, but also to the specific logistical challenge of designing cost-effective surveys for geographically complex regions like the fjords, inlets and islands of the Inside Passage. We developed a novel cluster-sampling algorithm to provide a design-unbiased survey for this region, and conducted systematic sightings surveys using small (22m), dedicated research vessels in the summers of 2004 and 2005. Preliminary abundance estimates (with 95% log-normal confidence intervals, and assuming certain trackline detection) were obtained for seven cetacean species: harbour porpoise, 9,120 (4,210-19,760); Dall's porpoise, 4,910 (2,700-8,940); Pacific white-sided dolphin, 25,900 (12,900-52,100); humpback whale, 1,310 (755-2,280); fin whale, 496 (201-1,220); minke whale, 388 (222-680); and 'northern resident' killer whale, 161 (45-574). These are new estimates for this region for each of these species except killer whales. These data also provide a systematic snapshot of summertime distribution and abundance of marine mammals in the Queen Charlotte Basin, where offshore oil and gas development is being proposed. These data are being used in a quantitative risk assessment of proposed seismic surveys on acoustically sensitive mammals, and in a simulation framework to assess sustainable limits to incidental by-catch of porpoises in commercial fisheries.

Wednesday 25 April 10:05

SEASONAL DISTRIBUTION AND ABUNDANCE OF BRYDE'S WHALES IN THE HAURAKI GULF, NEW ZEALAND

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Bryde's whales are the most frequently sighted large whale in the Hauraki Gulf; a large, shallow embayment off the north-eastern coastline of New Zealand, in the South Pacific Ocean. Seasonal distribution and occurrence of Bryde's whales was investigated in relation to sea-surface temperature and water depth using sightings from a whale-watch and directed surveys. The abundance of this population was investigated using photo-identification. Photographs showing congenital and acquired scars on the dorsal fin and body have been collected for individual identification since 1996, with considerable effort from March 2003 to February 2006. A total of 3,667 photographic frames were taken, representing 365 sightings with one to eight whales. From these, 76 whales have been individually identified and 40 of these whales were sighted across more than one year. Repeated sightings of some individuals, up to 28 sightings across five calendar years, suggest some individuals are semi-resident. A discovery curve of newly identified individuals shows evidence of an asymptote, suggesting that most whales in the population have been identified. Seasonal distribution and occurrence was based on sightings obtained over 1102 days between March 2001 and February 2006. 1059 sightings of Bryde's whales were documented over 521 days. These whales were sighted throughout the year, with the highest occurrence during winter, which coincided with the coolest mean sea-surface temperature (14.8oC). In general, Bryde's whales were sighted throughout the Hauraki Gulf, at water depths ranging from 12.1 to 59.8 meters. Current genetic and morphological evidence suggests that the Bryde's whales in the Hauraki Gulf correspond to the same species or form described in the offshore waters of the western North Pacific, and referred to as *Balaenoptera brydei* by Wada et al. (2003). Despite this, their habitat use is more consistent with the 'inshore' form found in some parts of the world.

Wednesday 25 April 10:20; eligible for Student Award: Postgraduate

CAN OCCUPANCY BE USED AS AN 'EASY-TO-MEASURE' INDEX FOR MONITORING TRENDS IN CETACEAN POPULATIONS?

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Traditionally, changes in abundance have been used to monitor trends in cetacean populations. However, collecting data to accurately estimate abundance can be logistically complex and extremely costly, especially for large, widespread populations. This study assessed whether changes in an alternative measurement, occupancy, that can be calculated from data that are logistically, and financially, easier to collect could also be used to monitor trends in population size. Occupancy refers to the proportion of an area occupied by a species and is calculated from presence-absence data. Positive abundance-occupancy relationships have been found in many taxa and this study investigated whether they also exist in cetaceans using data from the west coast of Scotland. Occupancy rates were calculated and compared to two measures of cetacean abundance: relative density and sightings rate. A significant, strong and positive trend was found for both the sightings rate-occupancy relationship and relative density-occupancy relationship, however the relationship was strongest when using sightings rate, explaining 62.3% of the variation in occupancy. This relationship means that when cetaceans are more abundant, they not only occupy more space, but are also at higher density within the area they occupy. As occupancy and abundance are positively and strongly related, changes in occupancy will reflect changes in abundance. Therefore, this study provides evidence that changes in occupancy could be used as a rapid and easy-to-measure index for monitoring trends in cetacean populations, particularly as a 'first response' before abundance is estimated, to 'fill-in-the-gaps' between more detailed surveys aimed at estimating absolute abundance or when it is not logistically or financially possible to conduct surveys to estimate abundance (a situation that exists in most places most of the time).

Wednesday 25 April 10:30; eligible for Student Award: Undergraduate

ORAL ABSTRACTS ON MANAGEMENT

FORAGING HOTSPOTS AND WHALEWATCHING "NOT-SPOTS": USING KILLER WHALE BEHAVIOUR TO PRIORITISE VESSEL EXCLUSION ZONES

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Among other factors, vessel traffic is implicated in the decline of the Endangered "southern resident" killer whales in the northeast Pacific. Notwithstanding recreational and industrial traffic, commercial whalewatching alone comprises more boats than there are killer whales to be watched. Requiem or refuge reserves present an obvious impact mitigation option, but they run the risk of tokenism if arbitrarily placed. Recent studies reported that resident killer whales were most vulnerable to vessel disturbance while feeding; therefore targeting foraging hotspots for protection should confer greater conservation benefit to whales than protecting their habitat generically. We present new results from two analyses of killer whale habitat use, using classification trees and spatial models, from data collected during May-September 2006 in the inshore waters near San Juan Island, Washington State (USA) and adjacent Canadian waters.

The spatial resolution of our prediction grid was influenced by interviews with on-the-water boater education coordinators, which yielded a practical grid cell size within which boats could feasibly be excluded with existing financial resources and reasonable boater compliance. Our results showed that fairly minor adjustments to the boundaries of existing no-go zones would encompass greater portions of killer whale feeding areas. A recurring theme in the use of MPAs to protect cetaceans is the need to identify areas that are large enough to be biologically meaningful while being small enough to allow real management of human activities within those boundaries. Our approach, identifying areas that whales use primarily for activities in which they are particularly sensitive to anthropogenic disturbance, balances pragmatism and conservation benefit by identifying small, but important areas to prioritise for protection.

Wednesday 25 April 11:05; eligible for Student Award: Postgraduate

BASELINE INFORMATION ON BOTTLENOSE DOLPHINS OFF SOUTHERN SPAIN: TOWARDS SCIENTIFICALLY SOUND CONSERVATION

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Efforts to ensure the recovery or maintenance of a favourable conservation status for cetaceans, either within the framework of management plans for an MPA or of conservation plans of species, must have a solid scientific basis. However, the present pressures on the marine environment, does not allow for the luxury of waiting to have "all" the data before taking any action. Nevertheless, it is possible to establish at least which basic data are indispensable. "Baseline Information" provides the data foundation to a conservation plan, comprising fundamental information on both the target species and relevant human activities required to scientifically support management actions and to establish whether they are working successfully. In particular: (1) it provides the data to determine whether management actions are necessary and can be viable, and to assign priorities where necessary; and (2) it establishes the reference level(s) to allow for the monitoring and analysis of trends and hence to provide a feedback mechanism to determine the effectiveness of the conservation plan and determine whether adjustments to the plan are necessary. Baseline information on bottlenose dolphins off Southern Spain was generated in the context of developing a Bottlenose Dolphin Conservation Plan under the LIFE-Nature project "Conservation of cetaceans and sea turtles in Murcia and Andalucía". Baseline information (together, where appropriate, with indications on how this information should be used in the context of future monitoring) is presented in this paper, for: (a) size of the areas used by the dolphins; (b) frequency of use of the adequate areas; (c) site fidelity; (d) current abundance; and (e) diet.

Wednesday 25 April 11:20

TOURISM IMPACT ON DOLPHINS POPULATIONS: LINKING BEHAVIOURAL RESPONSES TO ENERGETIC COSTS

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Behavioural pattern of dusky dolphins was modelled by matrix models and Markov chains theory, in a way that behavioural changes due to tourism vessels may be translated into changes in the time budget. This approach allows quantifying the response of this budget to changes in behaviour by a perturbation analysis. Behavioural data were gathered from group follows by a research boat in the absence of commercial vessels and denominated as "control". Follow time was divided in 2-min intervals and predominant activity was assigned in each one by instantaneous sampling. A probability matrix was constructed from transition probabilities from one activity to other. Activity budget, bout length, recurrence time and first passage time were derived from ergodic properties. Also, behavioural data was recorded when commercial boats were present at the same time that the research-boat, and then an "impact" matrix was also constructed. Whatever the preceding behaviour, the most probable succeeding behaviour was the same. In a second place, the activity most probable to succeed whatever the preceding one, was travelling, however, feeding had the highest probability of succeeding a travelling bout. This result suggests a strong relationship between feeding and travelling. There were significant differences in only two transitions between "control" and "impact" probabilities. However, sensitivity analysis showed that the time budget is more sensitive to changes in transitions that did not show significant differences, suggesting that small changes may produce significant differences in time budget. The transition that would mostly alter feeding time budget is travelling feeding, suggesting that a decrease in this transition would decrease feeding time budget and vice versa, even that this transition did not significantly differ between control and impact. In this sense, perturbation analysis plays an important role in detecting what transitions would produce the major effects on activity budget.

Wednesday 25 April 11:35

HUMAN ACTIVITIES AND BOTTLENOSE DOLPHINS' SOCIAL STRUCTURE

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Bottlenose dolphins live in fission-fusion societies within which individuals associate in small groups that change in composition, often on a daily or hourly basis. Human activities can affect the behaviour of dolphins through the modification of habitats or alterations in food distribution and availability. This long-term study carried out year round from 2000 to 2006 represents the first attempt to obtain information on group composition and preferences of bottlenose dolphins in an area characterized by important interaction with human activities (aquaculture and coastal fisheries). Here we describe the patterns of association of bottlenose dolphins in northeastern Sardinia (Italy) and describe the way in which their social separation is related to the way in which animals respond to the food patches created by humans. All parts of the study area received approximately equal coverage over the course of the photo-identification surveys. Resident and non resident dolphins occurred in the area. We analyzed the patterns of association of 504 bottlenose dolphin groups and distinguished clear preferences in habitat use in relationship with human activities. There was a correlation between the dolphins' responses to fishing activities and group membership. Members of one association composed only by males (sexed by underwater observations) feed in relationship with a marine fin fish farm and other associations do not. The different associations that we describe appear to display cultural differences. Our finding has implications for managing populations of coastal bottlenose dolphins in the many areas world wide where fisheries are present. We suggest that the main management issues raised by our finding relate to the dolphin behavioural traditions. Managers need to consider the different associations differing behavioural traditions in conservation planning.

Wednesday 25 April 11:50

INTERACTION BETWEEN KILLER AND SPERM WHALES WITH THE PATAGONIAN TOOTH FISH FISHERY IN CROZET AND KERGUELEN EXCLUSIVE ECONOMIC ZONE

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A long term photo-identification monitoring study reveals that killer whales occurring around the Possession Island, Crozet archipelago, underwent since the 90's a major decrease in number. These declines co-occurred with the development of Dissostichus eligenoides illegal fishing, within the Exclusive Economic Zone. Since 2003, a significant photo-identification effort was undertaken offshore, by fishing observers onboard legal fishing vessels. Between 1964 and 2005 over 7600 pictures have been collected, 5200 from fishing vessels, and allowed to identify a total of 192 individuals. Using Mark-recapture models 122 ± 34 killer whales were estimated to occur in the Crozet waters in 2003. 103 photo-identified individuals were observed interacting with the fishery. Sperm whales were also reported to interact with these activities. In order to evaluate depredations levels, the demersal long-lines fisheries efficiency, expressed as the quantity of fish caught per hook, in presence or absence of killer whales and/or sperm whales, was compared for 9 fishing sectors. Results for the 2300 fishing set available show that interactions with killer whales, sperm whales, or both occurred in 14%, 28% and 29% of the cases while no interaction was reported for 29% of the lines. The level of interaction was found to vary between fishing vessel, and this difference was mainly explained by differences in fishing line length. A mean loss of 22 ± 5 %, 12 ± 6 % and 42 ± 8% of the fish was estimated when killer whales only, sperm whale only and both killer and sperm whales were interacting respectively with the fishery. Such losses have both strong economical and fish stock management implications. Anti depredation measures such as non whale rewarding fishing techniques, the use of fish pot and/or stopping fishing activity long-lines sinking in presence of killer whales will be discussed in the light of these results.

Wednesday 25 April 12:05

IDENTIFYING IMPORTANT HABITAT FOR COASTAL DOLPHINS IN A MARICULTURE GROWTH REGION IN SOUTHERN CHILE

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Identifying the location and extent of important habitat for cetaceans has become a powerful approach to guide the establishment of coastal protected areas with potential conservation benefits for the entire ecosystem. Habitat selection models were developed for two poorly known coastal delphinids, Chilean dolphins (Cephalorhynchus eutropia) and Peale's dolphins (*Lagenorhynchus australis*), inhabiting the inshore waters of the Chiloé Archipelago (42-43°S) in southern Chile. This area forms part of the most intensively used farming region for shellfish and salmonids in Chile. Occurrence of dolphins in relation to selected environmental and anthropogenic variables was recorded during 166 systematic sighting surveys conducted from a small outboard-powered boat. Occurrence data collected during the austral summers and autumns of 2002 and 2004 were used to develop species-specific habitat models using logistic regression (GLMs with logit link function) in a model selection framework. Predictive performance of the derived habitat models was evaluated with cross-validation and randomization tests on an independent dataset collected during 2003. Chilean dolphins showed a restricted distribution and selected shallow coastal habitat (distance from shore < 500 m, depth < 20 m) in the vicinity of rivers. Probability of occurrence was highest in inshore channels and bays in southern Chiloé and was restricted to isolated patches in central Chiloé. Peale's dolphins

occurred in a similar range of depth and distance to shore. Their probability of occurrence was highest over several shallow shoals in central and southern Chiloé. Unlike for Peale's dolphins the preferred habitat of Chilean dolphins overlapped widely with areas used intensively for mussel farming. Both species showed a positive relationship with distance from salmon farms. The predictive models developed in this study have identified important habitat for each species at Chiloé and provide a rigorous framework to test the generality of the observed habitat selection patterns in other areas.

Wednesday 25 April 12:20

ASSESSING HUMAN IMPACTS: VESSEL DISTRIBUTION IN GERMAN WATERS – A MODELLING APPROACH

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Sea traffic is known as one of the major human impacts on the marine environment. Nevertheless, neither information on the distribution of vessels at sea, nor area-wide density estimates are consistently available. However, for the assessment of human impact on marine mammals, e.g.harbour porpoises (*Phocoena phocoena*), knowledge of sea traffic distribution and local vessel densities within their habitat is crucial. Thus, aerial survey data were used to quantify and map sea traffic in the German EEZ. In a strip transect survey design with strips of 1 km width, 48700 km2 of the North and 36500 km2 of the Baltic Sea were effectively covered between May 2002 and July 2006. 589 vessels were recorded in the North Sea, 2472 in the Baltic. Sightings were assigned to 7 vessel categories. In a GIS based analysis, distribution and density of all vessels and vessel categories were spatially and temporally evaluated and mapped. Areas of high vessel density were identified in both Seas. Specific spatial distributions for 5 vessel categories were found, as well as seasonal changes in recreational vessel densities and fishing vessel distribution. For finer scaled inferences about unsurveyed areas within the study region, a modelling approach was attempted. By means of a beta version of the program "Distance 6", a density surface model was fitted to the data. Depth, distance to coast, proximity to ports as well as traffic rules were used as predictors in a multivariate analysis and to make a prediction for sea traffic density. These results will finally permit evaluation of porpoise sighting data, synchronically obtained during the same survey, with respect to vessel distribution. A modelling technique, conventionally used for animal abundance and distribution estimation was successfully applied to vessels, providing fine scale information on vessel distribution as important baseline data for human impact studies and conservation concerns.

Wednesday 25 12:35

A POSSIBLE ECOLOGICAL BASIS TO COMMON DOLPHIN BY-CATCH IN PELAGIC FISHERIES IN THE BAY OF BISCAY

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In the bay of Biscay, operational interactions are known to occur between pelagic trawl fisheries and common dolphin. However, by-catch mortality appears to be unevenly spread in time as suggested by episodes of multiple stranding events observed since the late 80's. Hence, it is hypothesised that dolphin vulnerability would respond to specific ecological mechanisms. We analysed by-catch data collected on board by independent observers during fishing activities in order to detect if by-catch events are dependent on fishing circumstances (target species, day

periods,…). We measured overlap between the diet of common dolphin documented from stomach contents collected during two peaks of multiple stranding (2000, 2002) versus collected on board (2005) and also with published diets in the area. The result of on board observations confirms the existence of precise circumstances linked to by-catch. Hence, different fish species are targeted in pelagic trawl fisheries, but over 90% of cetacean by-catches occur in the sea-bass fishery. The probability of by-catch seems to be higher during the night ; over 30% were captured during the last haul before the day. All stomachs of by-caught animals were non-empty and close to 50% were at least half full with fresh prey remains, suggesting dolphins were captured as they were feeding. Lastly, the projection of stomach contents in a correspondence analysis indicated a large overlap between diet compositions from individuals collected on board and from multiple stranding events in different years compared to the more catholic general diet of the common dolphin. This approach confirmed dolphin by-catch may result from particular ecological circumstances where feeding activities could be the major component. A better comprehension of the ecological processes involved in by-catch events would improve the scientific basis for a balanced management strategy.

Wednesday 25 April 12:50; eligible for Student Award: Postgraduate

CAN THE USE OF ACOUSTIC DETERRENTS INCREASE THE SEALS-FISHERIES CONFLICT?

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The European Union has introduced regulations in the purpose to reduce the by-catch of small cetaceans. Acoustic deterrent devices known as 'pingers' are acquired on gillnets used by boats over 12 meters in length when fishing in certain areas. In Swedish waters the Harbour porpoise (*Phocoena phocoena*) is the species protected by the regulation. Pingers are effective and do reduce by-catch. However it has been suspected that pingers can work as a dinner-bell, attracting seals to the nets. The seals-fisheries conflict along the Swedish coast is of serious concern and Grey seals (Halichoerus grupus) are the species of interest. If the pingers have a dinner-bell effect this could intensify the conflict by means, increase both damages and by-catch of seals. An observer joined a professional fisherman fishing for cod in the proper Baltic Sea for 14 weeks in 2006. Active pingers (Aquamark 100 20-160kHz) where fastened to nets and set out. In another area nets with inactive pingers were set out. The amount of catch, effort and catch damaged by seals were noted by the observer. Both active and inactive nets were baited with marked cod to estimate hidden losses, i.e. fish removed from the nets by seals, leaving no trace. Active links were set at 38 different occasions and inactive links at 39 occasions. A significant less catch per unit effort was found in the active link compared to the inactive link. There was no difference in damaged fish per unit effort between active and inactive nets. However the hidden damage was significantly higher in active nets compared to inactive nets i.e in active nets more of the marked fish were taken by seals without them leaving any trace. The results do indicate that seals can use pingers to locate the fishing gear and thereby increase the seals-fisheries conflict.

Wednesday 25 April 13:05; eligible for Student Award: Postgraduate

A TALE OF TWO MPAs, THE VAQUITA AND DECEMBERS'MISTAKES

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In 1995 the Management Plan of the Biosphere Reserve of the Upper Gulf of California and Colorado's River Delta (UGBR) was published. The UGBR was designated UNESCO-MAB Biosphere Reserve that same year. One of the key elements to designate it a Reserve was the protection of the vaquita. In this work we analyze the motivations, how it was created and the objectives of the UGBR. Has the Reserve worked?. The reasons for the null success in the case of vaquita are analyzed. To do this, all by-catch and sightings records, historical and current, of vaquita were tracked in published and grey literature, as well as field note books from different researchers. A comparison analysis of these historical as well as recent data on the distribution of vaquita was made: reports from early 1970's, the line transect surveys of the 1990's and of the investigations with passive acoustic methods. All these results allowed us to identify which is the vaquita hot spot through time and determine why the Biosphere Reserve failed in its goals. What alternative is there?. Passive acoustic surveys plus all sighting records allowed us to propose a specific protection area to compensate for the failure of the Reserve, as well as to determine the size of this area considering vaquita's behaviour in relation to their ability to navigate their whole common distribution area during a single tide cycle of flow or reflux. Later on we contrast our proposal to those made from different social sectors (e.g. fishermen, academia) to establish a protected area or refuge. In terms of number of vaquita, habitat use and enforcement our proposal is a better management option. Lastly, we also analyze which obstacles are remaining that is necessary to overcome to avoid the extinction of this critically threatened species.

Wednesday 25 April 13:20

DEVELOPING MANAGEMENT FRAMEWORKS FOR MARINE PELAGIC SPECIES: THE CASE OF THE BOTTLENOSE DOLPHIN CONSERVATION PLAN

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The particular spatial requirements of marine pelagic species such as the bottlenose dolphin pose a series of important challenges for biodiversity conservation frameworks. For example, the limitations of marine reserves are apparent for marine species that extend across large areas. It is thus important to develop a conservation plan that incorporates the requirements of the species at an appropriate scale. The core action of the LIFE-Nature project "Conservation of cetaceans and sea turtles in Murcia and Andalucía" was to develop a Conservation Plan proposal. Development of an effective Conservation Plan is a complex process requiring a lengthy process from collection and analysis of scientific data through to development of an appropriate management and monitoring regime. This process must take into account specified conservation objectives, the status of the animals, actual and potential threats to those animals, mitigation measures to reduce or eliminate those threats, management measures, and effective monitoring and compliance schemes. The paper provides a practical example of developing a Conservation Plan for bottlenose dolphins in the region according to a process which takes us from science to management following these steps: (a) analysis of the situation; (b) establishment of overall conservation objectives; (c) definition of attributes for the target feature; (d) definition of specific conservation objectives for these attributes; (e) definition of indicators and targets for the attributes with respect to the conservation objectives; (f) identification of threats to conservation objectives; (g) definition of baselines for the attributes; (h) establishment of a monitoring plan; (i) establishment of actions to be undertaken; (j) establishment of an action follow-up process; and (k) proposal for how the conservation plan should function. The result of this process is the establishment of a series of general guidelines as well as concrete actions to be carried out by the involved relevant authorities and actors.

Wednesday 25 April 15:05

EFFECTS OF OFFSHORE WIND FARMS ON HARBOUR PORPOISES IN DENMARK

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The worlds two largest offshore wind farms (Horns Rev and Nysted) came in operation by the end of 2003 in Denmark. Offshore wind farms can potentially affect marine mammals in several ways. The physical presence of the turbines, construction activities and the operating wind farm could cause animals to avoid the area. The most important factor in this respect is likely to be underwater noise. Between 1999 and 2006 harbour porpoises were studied by ship surveys to evaluate their use of Horns Rev, and the potential effect of construction and operation. At both Horns Rev and Nysted Offshore Wind Farms the potential effect of construction and operation was also investigated by means of acoustic monitoring from 2001 to 2005. A BACI design was used to compare the presence of harbour porpoises before, during and after the construction of the wind farms. Only a slight decrease in porpoise abundance was found at Horns Reef during construction and no effect was observed during operation. A clear decrease in the echolocation activity of porpoises was found at Nysted during construction and operation of the wind farm. This effect still persisted after two years of operation, however with some signs of recovery. At both wind farms a substantial but short lived effect of pile driving was observed with larger responses at Nysted, where periods without porpoise sound recordings after pile driving lasted several days compared to hours at Horns Rev. The effects on porpoises were mainly connected to the construction phase, and only for porpoises at Nysted did the negative effect persist into the operation phase. Since the effects on harbour porpoises were different in magnitude at the two wind farms, it can be concluded that harbour porpoises from different habitats or populations may react differently to similar disturbances.

Wednesday 25 April 15:20

ECOLOGICAL RISK TO CETACEANS FROM ANTHROPOGENIC SOUND: CHARACTERIZATION ANALYSIS USING A PROFESSIONAL JUDGMENT APPROACH TO UNCERTAINTY

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Anthropogenic ocean sound criteria development and discussion among expert scientists for management of cetaceans has been independently monitored over a 10–year period from 1996 – 2006 for the purpose of exploring trends and developing methods in caucusing expert scientific judgment for policy recommendations when uncertainty is high. This interdisciplinary case study utilized three approaches; 1) meta-analysis of 94 peer-reviewed publications specific to ocean sound representing scientists from 20 countries, 27 species of cetaceans, and virtually all oceans, 2) an anonymous Internet survey administered to 91 authors of these 94 publications, designed to identify common patterns and points of departure in how these scientists characterize their data in terms of ecological risk to the species they study; and 3) identification of impediments to this science-policy interface. Analysis of the literature suggests that behaviors described by the authors as 'disturbance' become obvious beginning at 140dB re1µPa peak-to-peak (p-p) pressure (~131dB re1µPa root mean square (rms)) with more than half the animals' behaviors escalating to 'distress' at or below 180dB p-p (~171dB rms); further, there appears a difference of approximately 20dB p-p in the observed onset of these behaviors by free-ranging vs. captive cetaceans. Survey results suggests that the majority of expert scientists recommend maximum standard criteria which begin at the observed onset of disturbance behaviors, and are as follows: Up to 120dB p-p: 35%; up to 140dB p-p: 53%; up to160dB p-p: 69%; 161-200dB p-p: 31%; >200dB p-p: 0% (N=102). This recommended criteria distribution suggests a significant increase in concern by scientists, and assuming a 100 dB rms ambient

ocean sound, represents more than a 50% shift downward from the 10-year "status quo" criterion of 180dB rms. Impediments to the science-policy interface are identified and discussed and recommendations include open data base collaborations.

Wednesday 25 April; Time 15:35

MANAGEMENT PROCEDURES FOR DETERMINING APPROPRIATE LIMITS TO THE BYCATCH OF SMALL CETACEANS IN THE EUROPEAN ATLANTIC AND NORTH SEA

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Bycatch of small cetaceans in European Atlantic and North Sea fisheries is an international conservation issue. Following the recommendations of international scientific working groups we developed management procedures that can be used to calculate bycatch limits that will achieve specific management objectives. We adapted two existing management procedures: the Potential Biological Removals (PBR) procedure used by the USA government, and the Catch Limit Algorithm (CLA) of the International Whaling Commission's Revised Management Procedure. We developed a simulation model (operating model) to compare and contrast the performance of the two management procedures and to 'tune' the procedures so that our management objectives were achieved. Our management objectives were conservation-focused and related to long-term population status (maintain populations at 80% of carrying capacity) and delay in recovery of depleted populations. The procedures were subjected to a series of simulation trials that considered uncertainty in population dynamics and structure, environmental variability, and bias and error in estimates of population size and bycatch. The trials ensured that the tuned procedures were robust to uncertainty in these factors. The trials also highlighted key differences and similarities between the two procedures. For example, short-term recovery of a highly depleted population (but not long-term recovery) was sometimes faster under the CLA due to an internal protection mechanism. Bycatch limits were more variable over time under the PBR. Both procedures were inherently conservative with respect to errors in estimates of population size: lower precision estimates resulted in lower bycatch limits. We use harbour porpoise in the North Sea to illustrate how recommended bycatch limits would be calculated using the tuned management procedures in conjunction with estimates of absolute abundance from the SCANS and SCANS-II surveys (July 1994 and 2005), estimates of bycatch from observer programmes and fishing effort, and other data.

Wednesday 25 April 15:50

DON'T QUOTE ME ON THAT: BRIDGING THE LANGUAGE GAP BETWEEN SCIENTISTS AND POLICY-MAKERS

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The language barrier between science and policy is as large and often underestimated as that between British and American English. Although most of the words used by scientists and policy makers are the same, they often carry different meaning. One good example of this is the term 'theory,' which has caused much trouble for those making policy regarding school curricula on evolution. There are many other words that have one specific meaning when used by scientists, another, more common meaning in everyday use, and still another definition in

legal circles. Translation difficulties may also arise from the particular phraseology and writing conventions used by scientists. These are often more subtle, but they can create just as much trouble in the sound bite world of mass media, especially in high-profile subject areas such as the effects of noise on marine mammals. Using a recent report in this subject area by the US National Research Council as a case study, the authors will provide some examples of where scientific language use can be misunderstood by policy-makers and offer some possible solutions to these issues. The intent is to facilitate better communication between scientists and policy-makers in order to improve management decisions.

Wednesday 25 April 16:05

POSTER ABSTRACTS ON ACOUSTICS

A1 COMPARISON OF ECHOLOCATION BEHAVIOR BETWEEN COASTAL AND RIVERINE PORPOISES

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Echolocation behavior of a harbor porpoise and six finless porpoises were recorded in open water systems using acoustic data loggers (A-tag). In total 1,359 click trains were recorded during 4.6 h for the harbor porpoise and 46,240 click trains were recorded during 82.3 h for the finless porpoises. The harbor and finless porpoises produced sonar click trains every 12.3 s and 6.4 s on average, respectively. During the inter click-train interval, the porpoises were silent or produced clicks below 148 dB re. 1 µPa, the detection threshold of the tag. Ninety percent of the inter click-train intervals were 20 s or less in both species. This means that porpoises frequently produce intense click trains. Click-train intervals lasting over 50 s constituted one percent of the total intervals in finless porpoises and four percent in the harbor porpoise. Both species swam without intense clicks for less than 10 m in most cases, but occasionally remained silent or used undetected low intensity clicks for more than 1 min. During these periods the porpoises would be susceptible to entanglement in fishing nets.

A2 ODISEA: RAPID ASSESSMENT OF HEARING IN CETACEANS WITH AUDITORY EVOKED POTENTIALS

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An auditory screening unit was designed and tested, with the objective of enabling the rapid assessment of auditory function in cetaceans. The unit is splash-proof, portable, battery operated and self-configurable for routine tasks. It is flexible enough to permit customization of key parameters in minutes for psychoacoustic and general hearing research activities. The overall idea was to provide the scientific community with a tool that minimizes the stress provoked by otherwise long lasting auditory screening sessions. First validation results were obtained on a human subject and one dolphin through the acquisition of auditory brainstem responses to broadband click stimuli. Amongst numerous routine applications, this method allows fast decision taking in emergency situations where the diagnosis of potential deafness is crucial. Having tested the envelope following response (EFR) protocol, we are now optimising and accelerating the complete audiogram measurement procedure with multiple frequency stimuli, with the aim of reducing audiogram assessment time to less than 30 minutes. It is hoped that this unit will help accelerate the timely collection of audiograms from the numerous unreported, or sparsely documented, cetacean species

A4 THE USE OF T-PODS TO IDENTIFY ECHOLOCATION BEHAVIOUR IN BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) IN NEW QUAY BAY, WALES

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The odontocete echolocation system has evolved as a dynamic and specialised process for spatial orientation and the detection and localisation of prey, thus optimising the chances of survival in an aquatic environment. This study was carried out primarily to explore the possibility of using T-POD acoustic data as a means of identifying the echolocation behaviour of bottlenose dolphins (Tursiops truncatus) in New Quay Bay, Wales. Dolphins were monitored through land-based visual surveys from May to September 2006, and observations were compared to corresponding click train parameter data collected with two T-POD units deployed in the study area. It was found that click trains produced by foraging dolphins had both significantly lower mean inter-click intervals and train durations and a significantly higher number of clicks than those emitted by dolphins observed in the behavioural states of travelling and foraging/travelling. These findings were applied to T-POD data collected in the study area throughout the year, revealing both significant diel and monthly variation in the number of foraging click trains acoustically detected. The secondary aim of this investigation was to broadly determine the influence of directionality, group size, distance and behavioural state on T-POD detection rates. The collective evaluation of data obtained over the study period indicated that a combination of these variables had an effect on T-POD detection rates. However, further work is required to determine the extent to which each of these factors influences acoustic detection rates, and how environmental variables may also contribute to the detection of echolocating dolphins with T-PODs. It was concluded that if the limitations of using T-PODs are accepted, the methodology employed in this study has the potential to monitor long-term changes in dolphin behaviour. Consequently, such monitoring could provide a method for monitoring fine-scale temporal changes in habitat use.

A5 SOUND PROCUTION OF NEONATE CAPTIVE BELUGA WHALES

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Knowledge of the ontogeny of odontocete vocalizations is scant, being mostly limited to bottlenose dolphins (Tursiops truncatus). We describe vocal production of a neonate captive beluga whale born in 2006 at L'Oceanogràfic (LO), Spain, during its first month of life, and compare it to the first month of the vocal development of a male beluga calf born at the Vancouver Aquarium (VA) in 2002. Together, these provide the first detailed accounts of vocal acquisition in beluga whales. The first sounds emitted by VA neonate appeared within the first hour of life but for LO neonate in the third day of life. For both neonate whales, sound production during the first weeks of life was exclusively low frequency, short duration broadband pulse trains. The average pulse repetition rate during the first month of life for the VA calf was 34.2 + 18.6 pulses per second, and the average duration was 1.7 + 1 seconds. Peak energy centred at 2.9 + 0.8 kHz. Pulse trains from LO neonate were similar to those from VA. Mean pulse repetition rate was 19.1 ± 8.6 pulses per second and mean train duration of 2.4 ± 1.1 seconds. Pulse bandwidth ranged from 2.8 to 11.2 kHz with peak energy centred at 6.72 ± 1.39 kHz and duration of 23.8 ± 5.88 milliseconds. Despite differences in origin populations (VA-

Canadian and LO-Russian), in facilities and in vocal context, acoustic parameters of both neonate pulse trains revealed similarities. These observations suggest structural stability in this particular vocalization regardless of geographic variation, captivity or social context. The nature of sound production observed in these two neonate whales, which has not been described in adult belugas, further suggests developmental stages in vocal acquisition, contributing to current theories of sound production mechanisms in odontocetes.

Eligible for Student award: Postgraduate

A6 ACOUSTIC MONITORING OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN LOW DENSITY AREAS

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Recent genetic and morphological research points towards the existence of two distinct harbour porpoise sub-populations in the Baltic Sea. The Baltic proper sub-population east of the Darß Sill and south of the Limhamn Sill is highly endangered as stated in the Jastarnia Plan for the recovery of the Baltic Sea Porpoise (ASCOBANS). To study the habitat use of the animals, we deployed T-PODs in the German part of the Pomeranian Bay starting with 3 measuring positions from August 2002 on and increasing the number to 15 positions in April 2005. Until April 2005 we found 0 to 3 % Porpoise Positive Days per month (monthly proportion of monitored days with at least one acoustic porpoise detection, PPD/month) over the 2 ½ years study period. While these low numbers of registrations were confirmed using more measuring positions from April 2005 on, we also registered an exceptional high number of PPD/month for this area from January to March 2006 with a peak of 5.6 PPD/month in January. The winter of 2006 was extremely cold (ice-formation) possibly leading to a migration explaining the higher number of porpoise registrations. Nevertheless, natural variation in stock distribution or a regular seasonality could also explain this phenomenon found during the first winter with a high acoustic monitoring effort. Calculating the time between two detections at different measuring positions as well as the positions distance to each other and assuming a maximum swimming speed of 22.2 km/h for porpoises (Gaskin et al. 1974), we could substantiate the simultaneous presence of at least two animals or groups in the area at certain times. Using T-PODs in sufficient numbers proved to be a good method to find even small temporal changes in the presence of the highly endangered Baltic Sea porpoise.

A7 TESTING POTENTIAL ACOUSTIC DETERRENT SIGNALS ON BOW RIDING DOLPHINS

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Bycatch in pelagic trawlers in the NE Atlantic is currently of great concern. In situ experiments using pingers in pelagic trawls have faced difficulties. However, testing deterrent acoustic signals on bow riding dolphins could be a possible “first step” in the assessment of their effect. The main objective of this study was to develop and test a method to conduct playback experiments on bow riding short-beaked common dolphins. The animals were exposed to acoustic signals and their reactions monitored using both acoustic and video recordings. In 2005 seven custom designed signals were generated and transmitted using a waveform generator and an HS150 or B&K8100 hydrophone as transducers, which were secured on the bow. The playback signals were 130 ms in duration with 1 sec repetition rate repeated over 10 sec and of constant amplitude from 25 to 150 kHz. The source levels were between 132-154 dB

rms re 1 µPa @ 1 m. Seventy seven tests were conducted. A noise signal worked best at deterring bow riding dolphins. A "no signal" control validated the method; all 14 tests gave no deterrent responses. In 2006 a controllable version of the interactive Aquatec AQ636 was tested using the same approach. This device uses three stereotyped signals with SL in the range of 158-167 dB rms re 1µPa @ 1m (up to 175dB pp re 1µPa @ 1m). The playback period was increased to 20 sec. In total 113 tests were conducted. No signal/playback interval combinations with signal length of 500ms up to 5000ms were able to deter the animals 100%. A general trend was a strong reaction to the first playback, but the animals apparently habituated quickly and were not deterred on following playback tests. The observation that animals seemingly habituate very quickly questions the effectiveness of this device.

A8 DO OFFSHORE WIND FARMS INFLUENCE THE TIME SCHEDULE OF HARBOUR PORPOISES? - DIURNAL RHYTHMS OF HARBOUR PORPOISE ECHOLOCATION ACTIVITY LOGGED BY T-PODS

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The study was conducted at Nysted offshore wind farm (DK) from May 2005 to October 2006. The wind farm consists of 72 wind turbines with a power of 2.3 MW each.
To detect small scale differences in echolocation activity of harbour porpoises related to the wind farm, in total 10 T-PODs were used. T-PODs were deployed in linear arrays consisting of 5 devices each and spanning approximately 2.4 km from inside to outside the wind farm. Each row was considered as an independent experiment and row positions were changed in intervals of nine weeks. In total we achieved 10 independent experiments (four in 2005).To check for potential diurnal patterns in harbour porpoise echolocation activity, we calculated the proportion of porpoise positive minutes (PPM) for each of the four different light phases dawn, day, dusk and night, whereas the twilight phases were defined as 1.5 hours before and after sunrise or sunset respectively. At positions inside the wind farm, nocturnal echolocation activity was significantly higher than diurnal activity during all experiments conducted in 2005. Outside the wind farm, no difference was found between nocturnal and diurnal click activity. The patterns observed may indicate an impact of offshore wind farms on spatial and temporal distribution patterns of harbour porpoises. We suggest that the diurnal rhythms of porpoises were caused by the behaviour of prey species associated with wind turbine foundations. This view is supported by the hydroacoustic monitoring report of the Danish offshore monitoring program (Leonhard et al. 2006), documenting that fishes gather around the hard substrate of wind mill foundations mainly at night. In consequence and together with the known considerable diurnal rhythms in activity of a lot of fish species, diurnal patterns in click activity of porpoises observed here are likely to be responses on prey availability.

A9 GEOGRAPHIC VARIATION IN INFRASONIC CALLS OF THE NORTH ATLANTIC BLUE WHALE (*BALAENOPTERA MUSCULUS*)

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Geographic variation of acoustic signals can help getting insight into dispersal patterns and population structure, thus providing important information for management. Little is know about the population structure and migratory behaviour of the endangered North Atlantic blue whale (Balaenoptera musculus). Identifying geographic differences in vocalisations within the North Atlantic may be useful in discriminating populations and tracing their movements. We studied the variation in the vocal repertoire of two most likely distinct blue whale populations of

the North Atlantic. We compared the phonic structure of the most common infrasonic call types from 22 individuals form the Northwest and Northeast Atlantic. Acoustic recordings and behavioural observations were made between August 2004 and January 2006. Cross-validated discriminant function analysis showed that 90% of the individuals could be correctly classified to their geographic areas. Frequency variables appeared to be the most important ones in this process. These results suggest that the observed differences in the vocalisations may reflect the occurrence of two distinct populations of blue whales in the North Atlantic and that measuring the most discriminating acoustic variables can be used to assign individuals to their respective populations.

Eligible for Student award: Postgraduate

A12 WHAT IS THE RIGHT TIME SCALE? T-POD CALIBRATION AS A NECESSARY TOOL TO ANSWER THIS QUESTION

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T-PODs (Automatic Porpoise Detectors) registering echolocation clicks of odontocetes have been widely used as a tool to monitor harbour porpoises Phocoena phocoena in European waters. A major issue to be solved in the analyses is the comparability of data gained by different T-PODs. Questions concerning this issue point at the parameters T-POD sensitivity and porpoise density. To investigate the variation of these factors we measured the hearing threshold of 22 T-PODs (Version 4) in a test tank calibration in the German Oceanographic Museum Stralsund, Germany, using a recorded porpoise click with decreasing amplitude. The thresholds measured ranged from 126.2 to 128.9 dB re 1Vpp/µPa at sensitivity setting 8 and were compared to a (chosen) standard T-POD. The same T-PODs were then deployed in a field calibration setup for 100 to 356 hours between spring and autumn 2006 in Danish waters by BioConsult SH. Differences in the margin of recorded porpoise positive time units (hours, 10 minutes, minutes) and total amount of recorded clicks per T-POD in relation to the standard T-POD were analysed. The amount of clicks/minute compared to the standard T-POD were similar as stated in the test tank calibration. Results of porpoise positive time units showed that different time intervals influence the explanatory power: small intervals like minutes result in higher variances compared to larger time intervals (10 minutes or hours), which weakens the statistical power. For the smallest time unit, porpoise positive minutes per hour, we measured a maximum variance of 10% per hour comparing the standard to the most sensitive T-POD. High porpoise densities, on the other hand, limit the time scale to small units to identify possible differences between locations. In conclusion these results show the importance of a dedicated approach to find the best parameter for a comparison of data from different T-PODs.

A13 DIEL AND SPATIAL PATTERNS IN THE SINGING BEHAVIOR OF HUMPBACK WHALES OFF OAHU, HAWAII

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The singing behavior of male humpback whales on the winter breeding grounds is still a poorly understood phenomenon. Previous work indicates that the chorusing levels of singing whales

off west Maui are higher at night than during the day. However, the cause of this variation is not yet known. To investigate whether more whales sing at night or whether the same number simply move closer to near-shore recorders following sunset, the abundance and location of singing whales along the leeward coast of Oahu, Hawaii was examined. A bottom-moored recording system was used to establish that the same diel pattern observed off Maui in fact also occurs off Oahu. The location of singing whales, both during the day and at night, was determined by localizing singers along a preset transect track using a towed hydrophone array. More whales were found singing along the coastline at night than during the day. However, there was no indication of a shoreward migration of singers that could account for the higher chorusing levels received by the moored recorder. These results suggest that, at night, more males sing and that singing displays may therefore be a more effective behavioral tactic than direct competition for females in a pod. Also, more singers were found along the northern part of the coastline, which is dominated by a shallow bank, indicating that singers were selective with respect to where they chose to sing.

A14 DISCRETE CALLS OF KILLER WHALES DURING THE HUNTING BEHAVIOR

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Killer whales live in stable groups that include maternal relatives. Groups of killer whales that have common types of discrete calls form one acoustic clan. Discrete calls are highly stereotyped pulsed calls that can be divided into distinct call types. These calls are mostly produced during the hunting behavior of resident killer whales. We analyzed how the usage of killer whales discrete calls depends on the number of groups present during the hunting behavior. Our data was collected in June-September 2005-2006 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 10 Hz-40 kHz) and a mobile hydrophone stereosystem. Recordings were made with a sampling frequency 44, 1 and 48 kHz. Spectrographic analysis was carried out by Cool Edit Pro 1.2. Discrete types of sounds were classified according to the existing catalog (Filatova et al., 2004). In our analysis we compared the acoustical behavior during the hunting activities of single group or several different groups. The results showed that when a single group was hunting, killer whales mostly produced K12 and K1 discrete calls that apparently are used for communication in close distances. And when several different groups were hunting they more often use K5 and K7 discrete calls. Our results allow us to suppose that killer whales use different discrete calls during the hunting behavior for communication with members of their own group and with killer whales from other groups.

Eligible for Student award: Postgraduate

A15 SIMULATION OF BIO-SONAR SIGNALS 3D PROPAGATION IN HETEROGENEOUS MEDIA

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Finite difference algorithms were investigated to simulate the propagation of biosonar signals in a 3D heterogeneous medium. The equations that were used to propagate the signals include data

on pressure and velocity to provide a precise description of the acoustic field. We analysed the possible applications to biological tissues and sea water, the limitations of the models and the extensions with finite elements. The accuracy and speed of the simulation were then compared with a finite difference model that alternatively integrates the wave equation.

A16 CONTRIBUTION TO A PROTOCOL TO DECALCIFY ODONTOCETE EAR SAMPLES WITH RDO

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The study of the organ of Corti is essential to understand cetacean hearing. While classical histology techniques have been previously considered, the process is time consuming and artifacts, probably directly deriving from the protocol, often appear and difficult the analysis. However, no matter the choice of the analysis technique, one of the challenging step after extraction and fixation of the samples is to decalcify the bone envelope to access the cochlea without damaging the soft tissues. Here, we propose to use a fast commercial decalcifier (RDO®) that allows the direct observation of the inner structures through Scanning Electronic Microscopy (SEM). 50 odontocete ears have been used to precisely determine the decalcification time which ranged from several hours to a few days, depending on the species.

Eligible for Student award: Postgraduate

A17 PINGER EXPERIMENTS ON GROUPS OF COMMON DOLPHINS (*DELPHINUS DELPHIS*) IN THE BAY OF BISCAY (PART OF THE NECESSITY PROJECT)

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Experiments were carried on in southern Brittany in august 2006 with the objective of testing the effects of commercial and experimental pingers on groups of common dolphins before trials on the pelagic trawls in fishing condition. Fifteen groups were observed and the behaviour was recorded using a standard method. When the groups were showing a constant travelling behaviour, pingers were immerged on their way at a planned distance from the animals. The experimental pingers were directional CETASAVER prototypes (from the French IxTrawl company) well suited for trawl applications. The commercial pingers (DDD models from STM) are omnidirectional and sold for mitigation in set netting. The reaction behaviour was video recorded and the intensity of reaction was described and quantified. For directional pingers a difference was observed in the behaviour reaction according to the direction of emission and the direction of dolphins. Lateral testing was not found appropriate compared to frontal conditions. One of CETASAVER prototypes (Ixtrawl electronics / signals of 1 sec/ ceramic disc, average sound level of 178 dB ref. 1 µPa at 1 m) was selected by taking into account the intensity of reaction, the quality of reaction and the maximal range for efficiency. This pinger was found able to stop all the groups tested at a distance of 200 meters. The common dolphins avoid that acoustical source with no panic effect. Further trials are planned for mitigation on commercial pelagic trawlers. The DDD were also tested with and without starting sequence. When working with their acoustics starting sequences, the maximal range for reaction was evaluated around

1000 meters for DDD01- DDD02 and 600 meters for the DDD02F. The reaction behaviour for DDD models was observed variable between groups and being more a stress reaction compared with the different from the "Cetasaver-3" model.

A18 PITCH AND ROLL: WHAT DO THEY TELL US ABOUT THE DIVING BEHAVIOUR OF SEALS?

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Hydrostatic pressure sensors and the resulting dive profiles have been a milestone in studying the at-sea behaviour of pinnipeds. In recent years, however, more and more additional sensors, such as those for speed, pitch, compass heading and acceleration, have become available. Here we present data on depth together with frontal and lateral inclination (pitch and roll) from a dead-reckoning system deployed on the back of free-ranging Harbour seals (Phoca vitulina). The results show that some activities, e.g. resting dives, can easily be identified based on patterns in pitch and roll values. In addition, small and concurrent changes in depth and pitch during the bottom phase are suggested to represent foraging activity. Thus, the use of these sensors allows a much more detailed investigation of the diving behaviour and highlights the advantage of incorporating such sensors in behavioural studies of pinnipeds.

A19 DETECTION AND LOCALIZATION OF BLUE WHALE CALLS RECORDED ON A SEAFLOOR HYDROPHONE ARRAY NEAR THE EAST PACIFIC RISE

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Low frequency calls produced by blue whales were recorded near the northern East Pacific Rise on a seafloor hydrophone array moored in the area. Data from the hydrophones were examined and during 3 of 20 days of recording, blue whale calls were found on 11 hydrophones. We studied the characteristics of the blue whales'calls and their different patterns and add additional information about Blue whale calls to the small body literature on the subject. More than 3 whales were recorded during these 3 days and 2 or 3 different whales were tracked using a grid search algorithm that is based on inverse theory. We determined that these whales were of the Northeastern Pacific Blue population. We detected call types known as A, B, C, and D in various patterns. Over the course of a day, the whales moved approximately west to east at about 4.5 km/hr. During 2 of the 3 days that we tracked the whales, a seismic ship, the R/V Ewing, carried out an active-source seismic experiment using an air-gun source. We examined the whale calls and locations with respect to the times of air-gun activity and we did not find any correlation between the whales'behaviour and the air-gun activity. Nevertheless, this result in itself is significant and indicates then that for whales located at 30 km or more from a 139 liter, 20-gun air-gun source, there is little or no detectable behavioural response.

Eligible for Student award: Postgraduate

A20 LONG TERM ACOUSTIC MONITORING OF SPERM WHALES OFF CATANIA (EAST COAST OF SICILY, ITALY)

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Within the large NEMO Project that addresses the underwater detection of high energy neutrino, an experimental deep station, named ONDE, has been deployed on the sea bottom 21 km offshore Catania (Sicily, Italy), at 2000 m depth, at the end of January 2005. Connected to the shore labs through electro-optical cables to provide real-time monitoring and data acquisition, it was continuously operative since April 2005 to the end of November 2005 and then again in the period June to November 2006. Four calibrated broad-band hydrophones, sampled at 96 kHz, sent digital data to the shore lab 24/24h; as the continuous recording was not possible due to storage space constraints (uncompressed recording would require 124GB/day), recordings were made for 5 minutes every hour. For short periods of time it was also possible to record continuously to test the sampling strategy. The experiment provided long term data on the underwater noise and an unique opportunity to study the acoustic emissions of marine mammals living in the area or passing through it during their seasonal movements within the Mediterranean basin. This reports concerns the analysis of sperm whales' detections made in the period April to December 2005. The detection of their characteristic clicks indicate a presence of sperm whales more consistent and frequent than previously believed. Against detections of whales in more than 30% of the recorded days, only few sightings are available for the whole year 2005. Sperm whales, solitary or in groups of 2 to several individuals, were often detected for few hours only and this may mean they were just in transit. Clicks are the most common vocalizations, chirrups and codas have been recorded frequently, but creaks were seldom heard.

A21 FIRST DEPLOYMENT OF AN ACOUSTIC TAG ON A WHITE-BEAKED DOLPHIN

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The purpose of the study was to use an acoustic tag to investigate how individual free-ranging dolphins use their echolocation. Two goals were: to describe how often dolphins use their clicks in their natural environment and to study the acoustic foraging behavior used by dolphins. The acoustic tag was developed by T. Akamatsu and consists of two hydrophones, a time-depth recorder and a VHF transmitter. All clicks produced by the dolphin are recorded as well as the dive profiles. In this way diving behavior and acoustic behavior can be correlated. On August 2, 2006, we caught a white-beaked dolphin (*Lagenorhynchus albirostris*) near Keflavik (N64°04´ W22°38´) in Faxaflói Bay, Iceland. The dolphin was caught in a hoop net and was temporarily held in a tank to test its hearing. The dolphin was a female 2.17 m long. Before releasing her, an acoustic tag was deployed with a suction cup. After detachment we tracked and found the acoustic tag the next day 6 NM off the lighthouse in Gardur, which was quite close to where the animal was caught. We got 13 hours and 40 minutes of recordings. The data were analyzed using the software program IGOR. We looked at diving behavior, clicks emitted, pulse intervals and the time difference between the two hydrophones, which can indicate the presence of other dolphins. The dolphin emitted rather few clicks near the bottom and most of the clicks had intervals of about 100ms. Hardly any clicks were emitted while diving and ascending. The dolphin dove to 40 m, which is close to the maximum depth of Faxaflói Bay, suggesting the animal did not leave the bay while the acoustic tag was attached.

A22 WHISTLES AS POTENTIAL INDICATORS OF STRESS IN BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

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There are few reliable indicators of stress in dolphins. We are examining the possibility that whistle parameters such as repetition rate and number of loops (repetitive elements) may serve as indicators of stress. Bottlenose dolphins (Tursiops truncatus) in Sarasota Bay, Florida, USA, have been recorded during brief capture-release events, which are likely to act as a source of short-term stress to these dolphins, although no effects of chronic or long-term stress have been observed over the 36+ year duration of the research. Whistles recorded both during brief capture-release and undisturbed, free-ranging conditions were used to address the following hypotheses: Whistle rates and number of loops will be greater 1) during capture-release than during undisturbed conditions; 2) at the beginning of a capture-release session than at the end of a session; 3) during an individual's first capture-release session than during later capture-release sessions; and 4) when a mother is captured and released with a dependent calf than without a dependent calf. We also examined a variety of other acoustic parameters, such as maximum and minimum frequency, and loop, inter-loop, and whistle duration. We found that: 1) whistle rate and number of loops were greater during brief capture-release events than during undisturbed conditions; 2) number of loops decreased over the duration of a capture-release session; 3) whistle rates tended to decrease over subsequent capture-release sessions; and 4) females caught and released with dependent calves produced whistles with higher maximum frequencies. Thus, whistles appear to have potential to serve as non-invasive indicators of stress in bottlenose dolphins. Further research is warranted in this area, for example by correlating cortisol levels to whistle parameters under varying levels of stress. Reliable, non-invasive correlates of stress could be used to monitor dolphins in a variety of circumstances, such as during exposure to anthropogenic noise.

A23 SOUND PROPAGATION IN SHALLOW COASTAL WATERS: IMPLICATION FOR HUMPBACK WHALE CONSERVATION

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Marine mammals rely heavily on acoustic communication to locate one another in low-visibility marine environments. Noise pollution can disrupt such social interactions without producing obvious changes in behavior. For example, an animal that cannot hear another individual due to noise will behave the same as an animal when no other individual is present. The purpose of this study is to identify spectral properties of sounds that humpback whale could use to localize vocalizing whales, and hence to predict which types of anthropogenic noise are most likely to interfere with these sounds. Sound propagation experiments were conducted in shallow, coastal waters near Rincon, Puerto Rico. Narrowband tones and broadband sounds of similar frequency content (100-22000 Hz) and duration (2.0 s) to sound units of humpback whale song were broadcast from an underwater speaker. Sounds were recorded at known distances ranging from 70-850 m from the sound source. Analysis of the spectral content of these recordings revealed that mid-range frequencies (200-8000 Hz) propagate farther than high or low frequencies and that this band of frequencies narrows as propagation range increases. Furthermore, the distribution of peaks and notches within the frequency band alternate periodically as a function of distance providing additional information that may be useful in source localization by whales. These data suggest that anthropogenic noise with high spectral content between 200-8000 Hz is likely to interfere with humpback whale social interactions by decreasing an individuals' ability to locate singing whales.

A24 OPTIMIZING THE AEP-METHOD IN HARBOUR SEALS

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Within the project MINOS+ a study is conducted to examine the acoustic impacts of offshore windfarms within the German parts of North and Baltic Seas on marine mammals like harbour seals. Therefore it was necessary to find a method to collect audiometric data from free ranging seals. The most appropriate method is the evoked potential audiometry, which is already used in some marine mammal species. The aim of this study was to optimize and test this method for an application on harbour seals in the field.
In this context a captive female harbour seal (Phoca vitulina) was trained to participate in this auditory evoked potential (AEP) study in order to test different methodological parameters. It was found to be important that the animal was laying down as calm as possible to reduce interfering myogenic activities. Headphones and loudspeakers as well as different types of electrode models like surface and needle electrodes were compared. Different positions for electrode placement were tested. Both in captivity and in the field headphones lead to better results than loudspeakers, while no differences between surface and needle electrodes were found. The best placement for positioning the active electrode was the vertex on the mid-line between both ear openings and for the reference electrode on shoulder level. After establishing the setup has been used in immobilized wild-caught seals. Thresholds have been measured in a juvenile harbour seal (1, 2, 4 and 8 kHz) and a juvenile grey seal (2, 4 and 8 kHz) during a seal catch. In this study thresholds were recorded from a grey seal (Halichoerus grypus) for the first time. Results demonstrated that measuring AEPs is an applicable technique for obtaining audiometric data from different seal speices in the field.

Eligible for Student award: Postgraduate

A25 NOVEL FINDINGS IN AN AUDITORY EVOKED POTENTIAL HEARING STUDY OF *TURSIOPS TRUNCATUS*

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We have created a portable system that is capable of measuring the hearing thresholds of marine mammals using auditory evoked potential (AEP) techniques. This portable system has enabled us to obtain audiograms in many locations quickly, non-invasively, and with little to no training required of the subject. In the fall of 2006, we were invited to measure the hearing of the bottlenose dolphins at Kolmården Djurpark, Sweden. The goal of our research was to explore hearing capabilities of dolphins housed in quiet environments with emphasis on age related hearing variation. We had originally hypothesized that dolphins may lose their high frequency hearing with age similar to what is observed in humans. Also, because of behavioral observations made by the training staff, we suspected that the male dolphin may have a hearing disorder. We collected audiograms on two dolphins and measured the modulation rate transfer function (MRTF) results on two animals as well. A complete audiogram from 4 kHz – 200 kHz was obtained for the oldest dolphin, a 34 year old female named Vicky. Her audiogram showed no evidence of high frequency hearing loss. Notwithstanding this finding, her click evoked auditory brainstem response (ABR) revealed a marked increase in interpeak latency that could be indicative of an underlying hearing difference from younger animals. An audiogram, from 4 kHz-107 kHz, was also obtained for the male dolphin, a 24 year old named Pichi, was indeed found to have pronounced hearing loss across all frequencies measured.

Eligible for Student award: Postgraduate

A26 CHOICE OF HABITAT USE STATISTIC IN STATIC ACOUSTIC MONITORING

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There is, at present, no generally accepted approach to choice of habitat use statistic in static acoustic monitoring. A theoretical relationship between commonly used units, detection positive minutes, detection positive hours etc. is derived and indicates that measures with levels of positive time units logged above 30% will incur potentially significant loss of information. However, because of the temporal clustering of logged echo-location activity, larger time units will also effectively reduce the apparent variation between logging devices. The choice of which time unit to use as a measure of habitat use can be made using these two contrary selection factors. Actual inter-calibration data from 9 T-PODs deployed close together for 25 days in an area with a low density of porpoises gave 2.1% of minutes with porpoise detections, and a coefficient of variation of 10% between loggers. The CV was reduced to 6% using a measurement unit of 10minutes (9% positive) and to 4% using 30minutes (16% positive). This is consistent with the theoretical prediction and shows that significant improvement in data quality on habitat use can be obtained by optimal selection of the duration of the measurement unit.

A27 SUPPORT VECTOR MACHINE METHODS APPLIED TO THE CLASSIFICATION OF SPERM WHALES

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It is difficult, but often desirable, to acoustically identify and separate the sperm whales that are diving together within a group. One technique that has been used to classify sperm whales by their clicks, is the use of a radial basis function network with a Gaussian kernel. This type of network achieved reasonable results in the classification of a small group of whales. Based on these results we looked at the use of support vector machine networks, also using Gaussian kernels. Support vector machines have a good reputation towards generalisation, and they have performed very well in other classification problems. In the case of identifying whales during a group dive, we needed an algorithm that can be trained with a few clicks from the start of the dive, and then generalise to the remainder. The main difference between the application of radial basis function and support vector machine networks is that RBF focus on the centres of the clusters that represent the classes, while SVM focus on the boundaries between these clusters. We tried the support vector machine approach with two different training approaches, known as C-SVM and v-SVM. We used data from seven individual animals, consisting of six click trains and one complete dive. The outcomes of the two support vector machine algorithms were similar, and compared to radial basis function network they showed better generalisation. Depending on parameters, typically around 85% of the data of the click trains could be classified correctly, while this was around 77% for the complete dive.

Eligible for Student award: Postgraduate

A28 LEARNING ABOUT SOUND THROUGH INQUIRY IN A SEMI-AUTHENTIC ENVIRONMENT WITH MARINE MAMMALS

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A new structure has been incorporated into the Danish high school system, which involves natural sciences stretching across disciplines. Furthermore, the subject of "sound" is a compulsory part of the first year of the physics curriculum. The aim of this interdisciplinary study was two-fold. 1) Designing an educational segment around a one-day session in a semi-authentic environment in order for students to obtain a rich understanding of the phenomenon of sound. 2) Reveal how the students´ understanding of sound is affected by their first-hand experience with the animals and recordings of different animal and human sounds. During the 4 hour segment, the students worked in groups with mini-projects, recording sounds from harbour seals (*Phoca vitulina*) and harbour porpoises (*Phocoena phocoena*), making their own hydrophone, observing animal behaviour and participating in interactive theory on sound and marine mammals. The segment was tested in May 2006 with 2 Danish high school classes. 28 students from NordFyns and 26 from Tornbjerg high school. The test was held at the Fjord&Bælt centre, a marine biology exhibition in Denmark with 3 Harbour porpoises and 5 harbour seals. Before the students arrived they were tested on their preliminary conceptions and understandings of sound and sound production in marine mammals. During the exercise the students were video recorded. The following week the students were tested again and individuals as well as focus groups were interviewed. This study found that being in an environment working with marine mammals made the students interested in, and able to relate to, the subject of "sound". Hands-on experience with sound recordings, experiencing sound waves and making homemade hydrophones also helped students contextualize the phenomenon of sound. After the exercise, all students were able to explain the difference between frequency and decibel. The segment is now part of Fjord&Bælts educational programmes.

Eligible for Student award: Undergraduate

A29 CETACEAN STRANDING EVENT MANAGEMENT: CONTRIBUTION TO A PROTOCOL TO ASSESS CETACEAN HEARING

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While noise is now considered a marine hazard that can directly affect cetaceans and induce stranding, no clinical approach has yet introduced the detection of a possible hearing loss on a stranding site as a necessary practice. This can be explained by the lack of time when facing vital decisions for the animal welfare as well as the unavailability of a reliable light-weight autonomous portable equipment, easily deployable in the field. Here, we correlate the measured electrophysiological evidence of a Permanent Threshold Shift in a rehabilitated striped dolphin that prevented its release, with the post-mortem analysis of an abnormal dilatation of the Central Nervous System Ventricles that canceled the correct acoustic reception of the animal. We further propose to follow a five minutes AEP standard protocol of in air hearing measurements on stranding sites that includes the use of a light portable autonomous device allowing the stimulation and acquisition of Auditory Brainstem Responses with a single 4 µsecond broadband (> 150 kHz) pulse at three decreasing levels (129, 117 and 105 dB pp re 1mµPa at 15cm). This stimulus covers most of the known odontocete maximum acoustic sensitivity and allows the immediate sensing of the individual hearing capability before any final clinical decision is taken

A30 HE AUTOMATIC DETECTION OF SPERM WHALE CLICKS

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Many algorithms have been proposed in the literature for the automatic detection of clicks in sperm whales recordings and some of them have been implemented in publicly available software like the Rainbow Click proposed by D.Gillespie and Ishmael proposed by D.K. Mellinger. Most of the existing methods have a high rate of false detection and false rejection especially when the recorded clicks do not conform to the expected click pattern or more important, when the recordings have a low Signal-to-Noise Ratio (SNR). A nonlinear energy operator, referred to as the Teager Kaiser (TK) energy operator, has recently been proposed by the authors as an enhancement method of recordings with sperm whale clicks. The TK energy operator has been shown to increase the SNR of the recordings even for very low initial SNR conditions. An automatic detection system is then proposed based on a Bayesian classifier using the output of the TK energy operator while the final detection of clicks is performed by a forward-backward search algorithm. In this work, the proposed detection system is compared to the Rainbow Click detector and to the Matched Filtering automatic detection algorithm used in Ishmael. Extended tests were conducted using data provided by the Naval Undersea Warfare Center (NUWC) and collected at the Atlantic Undersea Test and Evaluation Center (AUTEC). To test the efficiency of the detection systems we have manually marked the clicks on some of the recordings (about 1500 regular and 1300 creak clicks). For 2ms accuracy, the proposed detection system is more effective in detection rate by 32% compared to the Rainbow Click detector and by 134% compared to the Matched Filtering based detector. The detection efficiency of the proposed detector compared to the other two detectors is also demonstrated by using Receiver Operating Characteristics (ROC) curves.

POSTER ABSTRACTS ON ANATOMY, DISEASES, MEDICINE & PHYSIOLOGY

D1 SPECIES DISCRIMINATION OF THE DELPHINIDAE FAMILY IN ANY STAGE OF THE DEVELOPMENT USING THE SKULL ANATOMY

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We analyzed 27 morphometric cranial traits of 251 specimens of seven species (*Delphinus delphis*, *Sousa teuszii, Stenella attenuata*, *S. coeruleoalba*, *S. longirostris*, *Steno bredanensis* and *Tursiops truncatus*) of the Delphinidae family from the Atlantic, Pacific and Indian Oceans and from the Mediterranean Sea. Specimens were classified in three stages of development: young, subadult and adult. Using factor and discriminant analysis, 9 cranial traits made four groups with the studied species: a)*D. delphis* and *S. coeruleoalba*, b)*S. attenuata* and *S. longirostris,* c)*Sousa teuszii* and *Steno bredanensis* and d)*T. truncatus*. At the same time, these 9 cranial traits discriminated the four groups of species in each one of the three stages of development. Our cranial results agree, univocally, with the genetic results of other authors.

D2 NEW APPROACHES RELATING TO AF MEASURES IN DELPHINUS DELPHIS SKULLS

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Fluctuant asymmetry (FA) refers to random deviations from the perfect symmetry when bilateral symmetry is the natural state; it can be assumed as environmentally induced and therefore it can be used as a measure of the influence of the environment on the development stability. Because it is the unique environmentally influenced asymmetry it is a very useful stress indicator of populations. This study extends the number of individuals of our previous work; A total of 192 common dolphin (Delphinus delphis) individuals including 40 skulls measured at the Natural History Museum of London and others belonging to the collections of CEMMA (Spain), the Natural History Museum of Paris, The National Museum of Scotland Granton Center and the Swedish Museum of Natural History were used in order to show the FA evolution of this species in the North Atlantic Ocean, along the time, as indicator of the environmental stress during the ontogeny of young individuals during the last century. 13 of the bilateral skull measures extracted from the individuals carried out the requisites to be considered as a fluctuant asymmetry measure. The total fluctuant asymmetry of each individual was obtained as an average of 13 skull measures. Finally, results were statistically analyzed. Preliminary results will confirm the use of the FA in marine mammals as environmental conditions indicator

Eligible for Student award: Postgraduate

D3 AGE RELATED FLUCTUANT ASYMMETRY IN *TURSIOPS TRUNCATUS*

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Fluctuant asymmetry refers to random deviations from the perfect symmetry when bilateral symmetry is the natural state; it can be assumed as environmentally induced and therefore it can be used as a measure of the influence of the environment on the development stability. Because it is the unique environmentally influenced asymmetry it is a very useful stress indicator of populations. The study checks the fluctuant asymmetry (FA) suffered by the bottlenose dolphin (Tursiops truncatus) in the North Atlantic Ocean, FA aged compared in a sample of 81 individuals belonging to the collections of CEMMA (Spain), the Natural History Museum of Paris, The National Museum of Scotland Granton Center ,the Swedish Museum of Natural History and the Natural History Museum of London. 13 of the bilateral skull measures extracted from the individuals carried out the requisites to be considered as a fluctuant asymmetry measure. The total fluctuant asymmetry of each individual was obtained as an average of these 13 skull measures. Results were statistically analyzed in order to contrast the results obtained in this species with other conclusions shown by the international literature that describes young organisms to be more vulnerable to show fluctuant asymmetry, Authors explain this conclusion for the raising of the FA during the ontogeny in young individuals in opposing to mature individuals that could have lost it afterwards.

Eligible for Student award: Postgraduate

D4 CROSS-SECTION TOPOGRAFICAL ANATOMY OF DOLPHINS AND ITS APPLICATION FOR DIAGNOSIS IMAGING TECHNIQUES

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Nowadays, the diagnostic imaging techniques: ultrasound, computed tomography (CT) and magnetic resonance (MR) are increasingly being used by veterinary practitioners. Its specific use in marine species has been limited due to a number of factors, particularly the scarcity of bidimensional topographical anatomy studies. The aim of this work is to overcome this limitation by describing the different anatomical cross sections that we have made in the three body planes of three species of dolphins: common *(Delphinus delphis)*, striped (*Stenella coeruleoalba)* and bottlenose *(Tursiops truncatus)*. Before proceeding to the cross-sections, CT and MR examinations were carried out, and 50 individuals were ultrasonically explored during the study. As a result of this research, we have developed a comprehensive bidimensional topographical anatomy atlas of the whole dolphin body. We have also compared the anatomical sections with their corresponding ultrasound, CT and MR images. Soft tissues, as well as cavitary structures with fluids inside were observed with a higher definition through MR and ultrasound techniques. On the other hand, CT provided better images of the shapes and margins of the bony structures or those ones with air/gas inside. The Atlas presented has been successfully achieved the identification of the dolphin's internal anatomic structures and determined their ultrasound, CT and MR image patterns, in order to set up the baseline to identify lesions. CT and MR explorations of the most internal structures such as the ear, the paraotic sinuses, the brain, the spinal cord or the vertebral column, have validated these imaging techniques for the pathogical evaluation of these structures presenting a complicated access "in vivo" or a complex "post-mortem" dissection. We conclude that the imaging techniques are a very interesting choice to study the internal anatomy of death dolphins that cannot be dissected, as well as for pathological diagnostic purposes in living animals.

D6 BONE MINERAL DENSITY OF THE ARM AND FOREARM OF TURSIOPS TRUNCATUS

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Bone mineral density (BMD) has been shown to be a reliable tool for age determination in *Stenella coeruleoalba* (Guglielmini *et al*., 2002). To investigate whether this applies also to *Tursiops truncatus*, we analyzed the bone density of the arm and forearm of 23 bottlenose dolphins stranded along the Italian coastline with a medical densitometer [Hologic QDR-1000™, USA]. We analyzed also the BMD of 3 animals born and maintained in confined waters for several years. Our data show that BMD values differ significantly in age classes in free-ranging dolphins and may indicate that the deposition of bone substance varies during lifetime. Preliminary results indicate that values of bone mineral density in the 3 captive animals are lower than BMD values in free-ranging animals. Additional investigations in progress will be helpful to understand whether the BMD can be used as a reliable age indicator in *Tursiops truncatus* as already known for *Stenella coeruleoalba* and if free-ranging and confined dolphins indeed have forelimbs of different mineral density.

D7 EXTERNAL SERRATIONS IN THE COMMERSON'S DOLPHIN: IS SKELETAL ANATOMY A CLUE TO FUNCTION?

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The Commerson's dolphin, *Cephalorhynchus commersonii*, presents saw-tooth serrations on the leading edge of the flippers that develop with growth. The cause of serrations or their function is unclear, but they are apparently not caused by wear or damage and seem to be the normal state for adults. Mechanical loading determines development and size of bones. We conducted a survey on individuals from the Tierra del Fuego Commerson's dolphin population to investigate whether flipper bone anatomy might throw some light on the function of serrations. The study was performed on 164 skeletal specimens from the *Museo de Aves y Mamíferos Marinos Australes Acatushún*, (Ushuaia, Argentina). Skeletal morphometrics and meristics were obtained both from prepared bones and radiographs. Preliminary analysis of the results did not show significant differences between the two methods of data collection. The data were then analysed to investigate: i) the relationship between serration and development (size and maturity) of flipper bones, and ii) the existence of lateralization and sexual dimorphism in these variables.

Eligible for Student award: Postgraduate

D8 THE ZIPHIUS CAVIROSTRIS EXPERIMENTAL CHARACTERIZATION OF ITS LOWER MANDIBLE AS A SOUND WAVE TRANSMITTER. COMPARATIVE ANALYSIS WITH OTHER ODONTOCETES

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In recent years strandings of members of the ziphidae family has been closely related to military maneuvers. In the present work the mandible of a Cuvier's beaked whale as an acoustic longitudinal compression wave transmitter is experimentally characterized. A comparative study with other seven toothed whales in the waters of the Canaries which could, presumably, have been subjected to the same sonar is presented. In order to measure the admittance, the toothed part of the mandible, mainly composed of porous bone, is submerged in water. Sound intensity and excitation frequency in water are controlled. The experiment is carried on with frequencies in the 500-8000Hz band. An accelerometer directed in the bone axis is placed in the other extreme of the mandible, in the porous apophysis. The mandible admittance is computed as the ratio of the bone surface speed in the accelerometer versus water pressure. The results show a high admittance of the ziphius mandible in many frequencies associated with midrange sonars. The results also show that the lower jaw behaves as a complex structural component and not as a wave guide where thickness and density are the key factors in sound transmission. In fact, the beaked whale's mandible has a smaller cross section than either the dolphin's or the pilot whale's ; however, its admittance is much higher than either of these in the frequency ranges considered.

D9 THE STRUCTURAL COUPLING OF THE CUVIER'S ZIPHIUS MANDIBLE AND THE MANDIBULAR FAT BODIES AS A PRESSURE BUILD UP SYSTEM

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In recent years strandings of members of the ziphidae family has been closely related to military maneuvers. Looking for organs that can be excited by the midrange sonars frequency in the

3000-4000 Hz band the acoustical engineer will look for a fluid cavity 30 cm long and for very thin bones. Very thin bones are searched in order to compute high displacement amplitudes at high frequencies. In the Cuvier´s ziphius both things are placed together and connected to the tympanic bulla. They are the ziphius mandible and the mandibular fat bodies. But, although both elements isolated can have resonant frequencies in the band of interest, it can happen that placed together the resonant properties change. In this work we have measured the elastic properties of the mandible bone and prepared a numerical model of the coupled system. The model is solved with an ad hoc finite element program running in MATLAB. In our model bending of the jawbone is allowed, in contrast with other models that only assume compressive behavior of the organs. The resulting resonant frequencies are in the sonar range. Moreover, the results show that some of them can be easily excited trough the animal lower jaw oval window. Pressure distribution inside the fat cavity and the system response to an external excitation are shown. For some frequencies the pressure buid up inside the cavity is higher than the excitation value.

D10 DENTINAL ANOMALIES IN TEETH OF COMMON DOLPHINS (*DELPHINUS DELPHIS*) AND HARBOUR PORPOISES (*PHOCOENA PHOCOENA*): ARE THEY LINKED TO SEXUAL MATURATION AND ENVIRONMENTAL EVENTS?

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We examine the tooth ultra-structure of harbour porpoises (*Phocoena phocoena*) from Scottish waters and common dolphins (*Delphinus delphis*) from Galicia (Spain) to determine whether the incidence of mineralization anomalies could be related to certain life history events (e.g. the achievement of sexual maturation) as well as other factors that affect the general health of the individual (e.g. persistent organic pollutant (POP) concentrations in blubber). Five distinct types of mineralization anomalies were identified and recorded: accessory layers, marker lines, pulp stones, dentinal resorption and cemental disturbance. The incidence of mineralization anomalies was generally higher in porpoises than in common dolphins and tended to increase with age in both studied species. Generalized linear (GLM) and generalized additive modelling (GAM) indicated that in harbour porpoises three co-varying life-history variables (i.e. age, length and maturity) all had significant effects on the occurrence of both dentinal resorption and cemental disturbance, but age was the best predictor. In common dolphins, length was the best predictor for both types of anomaly although the effect of age was also significant in both cases and maturity contributed significantly to the incidence of cemental disturbance. Overall, the results provide only weak evidence that mineralization anomalies were associated with specific life history events. The occurrence of marker lines was very weakly related to length and maturity in common dolphins and unrelated to the life history variables considered in harbour porpoises, suggesting that environmental factors may also play a role in the formation of marker lines. We found no evidence that the presence of anomalies was related to POP concentrations in the blubber.

Eligible for Student award: Postgraduate

D11 SOME ASPECTS ON THE LIFE HISTORY OF THE RISSO'S DOLPHINS *Grampus griseus* (Cuvier, 1812) IN THE WESTERN MEDITERRANEAN SEA

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Although the Risso's dolphin is common in the Mediterranean, information about many of its biological aspects is scarce, especially in this sea. We used data on sex, date, location of capture, total length and teeth of 51 specimens collected from 1973 to 2003 to shed light on some aspects related to growth. Eighteen animals (nine males and nine females) were used to establish a correspondence between age and length. Age was determined by counting dentinal layers. The oldest animal was a male of 308 cm and 29+ GLGs. The teeth were formed but not protruded in a 53 cm length foetus, and one individual of 172 cm was the shorter with protruded teeth. The teeth number varied between three and six in the lower jaw, and no teeth were observed in the upper jaws in any case. The maximal teeth length found was 41.29 mm, somehow longer than reference data. We observed that at 231 cm of dolphin length, the growth rate remained fairly constant. According to our data, we estimated that births may occur during the end of winter and spring. The average length at birth was estimated as 135 cm, with a gestation period of 13.87 months. Foetal growth and associated calving parameters were also studied.

D12 LEVELS OF PROGESTERONE AND TESTOSTERONE IN BLUBBER FROM CETACEANS OF THE STRAIT OF GIBRALTAR

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The knowledge on cetacean reproduction is limited. From calculating pregnancy rates it is possible to determine the reproductive success of each species, and therefore obtain the reproductive potential of the populations. This is essential in order to predict the growth of a population in the future. The main goal of this work is to study the reproductive cycle of two cetacean species that inhabit the Strait of Gibraltar. This area is one of the places with the highest density of cetaceans in the Mediterranean, where seven species can be seen along the year. Here we present a method to predict the pregnancy of living cetaceans in the field. During the study skin and blubber biopsies were collected in the field from identified cetaceans. The sex of the individuals was determined through genetic analysis. Finally, progesterone and testosterone levels (in females and in males, respectively) were measured. Cross-sectional subsamples of blubber biopsies (ca. 50 mg) were homogenized in liquid nitrogen using a mortar and pestle and extracted as previously described and the steroid concentration (ng / g adipose tissue) were quantified by enzyme immunoassay. A total of 31 blubber samples were analyzed, 26 of bottlenose dolphins and 6 of pilot whales. High values of progesterone were correlated with those animals that were seen with newborns a few months after the biopsies were taken. This methodology can give directly the reproductive status of different individuals in a population.

Eligible for Student award: Undergraduate

D13 ASPECTS OF LIFE HISTORY OF WHITE-BEAKED DOLPHINS (*LAGENORHYNCHUS ALBIROSTRIS*) FROM DANISH WATERS

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The white-beaked dolphin is the second most common cetacean species in Danish waters. Since 1986, due to an intensified collecting effort, a larger sample has become available through the Danish Marine Mammal Stranding Contingency Plan, enabling us to elucidate specifics of the hitherto poorly known life history of the species. Based hereupon we have found that both males and females get sexually mature between 9 and 14 years. Males exhibit a seasonal fluctuation in total testis weight with an apparent quadrupling of the testes mass from in the mating season (May through August as deduced from literature). Mean testis weight for mature males outside the mating season was 500 g, while the maximum observed during the mating season was ca 2100 g. Males with testis weights below 200 g were consistently immature. Age determinations using cementum layers of the teeth revealed a maximum age of 39 for females and 32 for males. Ovarian asymmetry was observed on one occasion, while multiple numbers of corpora albicantia were counted in females older than 20 years. Unfortunately there was a scarcity younger mature females in the sample. The youngest males showing full ankylosis of all vertebral epiphyses were 12 and 14 years old. The youngest females were 10 and 12 years old. Physically mature males had a mean total length of 278 cm (n=3), while females had a mean length of 251 cm (n=14). Gompertz growth models suggested an asymptotic length of 272 cm for males and 250 cm for females. Males reached 95% of asymptotic length at 11.6 years, while females did so at 8.2 years.

Eligible for Student award: Postgraduate

D14 ATYPICAL BEAKED WHALE MASS STRANDING IN ALMERIA´S COASTS: PATHOLOGICAL STUDY

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A pathological study was carried out in beaked whales (BWs) massively stranded in the coast of Almería (Southeast Spain) on January 2006. This work has provided new data about the relationship between naval exercises and the stranding and death of marine mammals. Two animals stranded alive on 26th and other two were founded dead on 27th. Four Cuvier's BWs (*Ziphius cavirostris*), two juvenile females and two adult males were examined postmortem and studied histopathologically, three of the four animals were in a very fresh state. All animals were in a good body condition, no inflammatory or neoplastic processes were noted, and no pathogens were identified. Macroscopically, whales had a severe venous gas embolism, diffuse congestion and haemorrhage, especially around the acoustic jaw fat, ears, brain, and kidneys. Gas bubble–associated lesions and fat embolism were observed in the vessels and parenchyma of vital organs. Severely injured whales died or became stranded and died due to cardiovascular collapse during beaching. Based on current scientific knowledge, and the pathological findings in this study, the most likely primary cause of this type of beaked whale mass stranding event is naval exercises, most probably anti-submarine active mid-frequency sonar used during the military naval exercises (*Jepson et al. 2003, Fernandez et al. 2004, 2005, Cox et al. 2006*). No

official information about sonar activities has been released, but naval activities have been reported spatially and temporally related to that atypical beaked whale mass stranding.

D15 CAUSES OF DEATH IN HARBOUR PORPOISES, STRANDED ON THE COAST OF SCOTLAND, 2000 TO 2005

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Introduction: In 1990 the Collaborative UK Marine Mammal Strandings Project was initiated. The project involves detailed pathological and other investigations of stranded marine mammals carcases [mostly cetacean] from UK waters including the coast of Scotland. The programme forms part of UK 's obligations towards international conservation agreements including ASCOBANS. Materials and methods: A total of two hundred and sixty five harbour porpoises, stranded on the Scottish coast between January 2000 and December 2005 were subject to necropsy by a recognised protocol for cetaceans.In all cases,as appropriate carcases were subject to gross,microbiological and histological examination to establish the most likely cause[s] of death. Results: Pneumonia [24%], bottlenose dolphin attack [24%],starvation / hypothermia [14%] and physical trauma,including but not exclusively bycatch [10%] were the most important causes of death. Others included septicaemia, live stranding and neonatal death. In 9% of cases a cause of death could not be established. Live stranded animals most frequently presented with severe and compromising respiratory disease [parasitic with secondary bacterial or fungal infection], but cases of meningoencephalitis were also seen in this group. The most common microbiological isolates associated with significant or severe lung pathology were *Brucella, Aspergillus fumigatus*, members of the *Pasteurellaceae*, *Edwardsiella tarda* and *Streptococcus phocae* .The relationship between these isolates and the pathology appears to be most clear for *A.fumigatus* and the *Pasteurellaceae* members. Conclisions: Respiratory disease is an important cause of death in harbour porpoises found stranded on the Scottish coast. Potential arasitic,bacterial and fungal causes have been identified and the relationship between pathogen and pathology is becoming more clear in some cases. *.A.fumigatus*, members of the *Pasteurellaceae*, *E.tarda* and *S.phocae* appear to be among the most significant isolates.

D16 BRUCELLA ASSOCIATED PATHOLOGY IN THE TESTICLE OF A HARBOUR PORPOISE *[Phocoena phocoena]*

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Introduction: Brucella species have been recovered from various tissues in free living cetaceans and pinnipeds.With the exception of the brain,pathology is not frequently correlated with isolation .Little is known regarding the natural transmission of Brucella between marine mammals nor of its possible effects on fertility or population dynamics.This paper is the first to describe pathology associated with a Brucella isolate in the testis and epididymis of an adult sexually mature male harbour porpoise, suggesting the potential for sexual transmission and/or sterility as a sequel to infections. Materials and methods: A dead stranded harbour porpoise was found on Isle of Mull Scotland,UK.Tissues were subjected to gross, microbiological and histological examination by standard techniques as part of the Defra funded UK strandings project. Results: The left testicle was enlarged due to a mature abscess contained in the body of

the testis and extending into the head of the epididymis. It was lined by a diptheritic membrane and contained pale yellow fluid of low viscosity and many solid floccules of pus. A profuse growth of Brucella with characteristics typical of the proposed species *Brucella cetaceae* was cultured from the testicular abscess and mesenteric lymph node, a moderate growth from the spleen and a scant growth from the brain,liver lung and intestine were also cultured. Many small acid fast coccobacilli were present in a smear of the aspirated pus stained by modified Ziehl – Neelsen method. Histologically the mature fibrous capsule of the abscess was surrounded by zones of coagulative necrosis with substantial alteration of the normal architecture of the affected testicle and associated epididymis. Multiple,predominantly mononuclear cell inflammatory foci were present in the fibrous capsule and adjacent tissue. Conclusion:These findings allow speculation that the lesions may be the result of or result in the sexual transmission of *B.cetaceae* in marine mammals and may play a role in infertility and thereby population dynamics.

D17 ISOLATION OF *BRUCELLA* SP. FROM A DISEASED ATLANTO-OCCIPITAL JOINT OF AN ATLANTIC WHITE-SIDED DOLPHIN (*LAGENORHYNCHUS ACUTUS*)

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Introduction: *Brucella* spp. bacteria have been recovered from various tissues in free living cetaceans. However, in many cases, especially when the brain was not involved, *Brucella*-associated pathology was absent and the cause of death was due to other, non-related, causes. Unlike land mammals, cetaceans have very few synovial joints; only the atlanto-occipital, scapulo-humeral, some cranial rib and some vertebral joints. Materials and Methods: A dead stranded Atlantic white-sided dolphin (*Lagenorhynchus acutus*) was found in Shetland, Scotland, UK. Tissues were subjected to gross, microbiological and histological examination by standard techniques as part of the DEFRA funded UK strandings project. Results: The carcase weighed 143.0kg and was 240cm long (tip of upper jaw to tail notch) with a girth measurement immediately anterior to the dorsal fin of 118.0cm and was in good bodily condition. The atlanto-occipital joint was completely immobile and inseparable using normal techniques. However, no other joints appeared to be affected. A profuse growth of *Brucella cetaceae* was recovered from the adhered meninges/atlanto-occipital joint along with a scant growth from the brain. Upon removal of all soft tissues the component parts of the atlanto-occipital joint could be separated. Severe remodelling of the occipital condyles and the atlas (C1) was present and a complete absence of all smooth sub-chondral bone normally found beneath the articular surfaces of healthy synovial joints. The dorsal and transverse processes of the atlas were also severely affected along with the margin of the foramen magnum. In addition to this, a generalised non-suppurative meningo-encephalitis was present which was more severe in the medulla and pulmonary lesions suggestive of a live-stranding prior to death. Conclusion: This case highlights the necessity to attempt to determine the reason for live-standing in cetaceans on a case by case basis as multiple re-floatation attempts may compromise the animal's welfare in some instances.

D18 POSSITIVE PRESSURE PNEUMOTHORAX ASSOCIATED TO PULMONARY BAROTRAUMA IN THREE STRIPED DOLPHINS IN CATALUNYA, SPAIN

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Pulmonary barotrauma is well known in scuba divers, associated to emergency ascends without expelling the inhaled air. Pathological manifestations of this process involve pneumothorax, mediastinal emphysema, and pulmonary bullous emphysema, among others. Diving in apnoea, as cetaceans do, is not associated with this kind of accident, and to our knowledge, pulmonary barotrauma has not been described in cetaceans. We describe three cases of positive-pressure pneumothorax in striped dolphins (*Stenella coeruleoalba*), showing that under certain circumstances, cetaceans can suffer pulmonary barotrauma. The three dolphins were found dead, as a single stranding event, along the Catalan coast (Spain), from 1995 to 2006. All animals presented with unilateral positive pressure pneumothorax, with large amounts of air flowing out of the thorax when incised. The lung on that side was collapsed, and the mediastinum was displaced to the other side of the thorax, compressing the contra lateral lung against the chest wall. In two of the dolphins, the collapsed lung presented a bulla, with a perforation that allowed air to flow from the lung to the pleural cavity. In the third dolphin, there was a tiny perforation of the lung parenchyma near a hilar bronchial branch. The ethiology of the pulmonary bulla could not be determined in these cases, but small lung nematodes could be involved. It is hypothesized that, once a communication between the lung and the pleura is established, air can easily flow towards the pleura while the animal is diving, due to the compression of the lungs. When the dolphin ascends again, the air in the pleural space increases its volume, causing a positive-pressure pneumothorax, which severely collapses the lung. Clinical signs associated to this condition are unknown, but dyspnoea, abnormal flotation and thoracic pain could all occur. This is the first time that this pathology is fully described in cetaceans

D19 ADRENALITIS ASSOCIATED WITH A HERPES VIRUS INFECTION IN A STRANDED BOTTLENOSE DOLPHIN IN CANARY ISLANDS

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Herpesvirus infections have been documented in a wide range of vertebrates, including pinnipeds; however, only few cases of herpesvirus infection have been reported in cetaceans. The purpose of this case report is to document histopathological and molecular evidences of a herpesvirus infection in a stranded dolphin in the Canary Islands. An adult male bottlenose dolphin (*Tursiops truncatus*) was found dead on the coast of Tenerife and a complete necropsy was performed. The animal was in a poor body condition with an empty stomach and serous atrophy of the subcutaneous adipose tissue. Tissue samples were fixed in 10% buffered formalin and embedded in paraffin, sectioned and stained with haematoxylin and eosin for a routine light microscopical study. Histopathological examination revealed multifocal adrenalitis with adrenal cell necrosis, characterized by scattered foci of cell necrosis in the adrenal cortex associated with a mixed inflammatory cell reaction. Some of those adrenal cortical cells showed cytopathic effect characterized by intranuclear inclusion like bodies. Within the lymph nodes there were numerous necrotic foci and accumulation of karyorrhectic and eosinophilic cellular debris, accompanied by a high amount of eosinophils and a small number of syncytial cells. Other histological lesions detected were: pneumonia of parasitic origin, a discrete non purulent leptomeningitis and multifocal areas of degeneration in heart and skeletal muscle. Samples of muscle, lung, liver, spleen, kidney and brain were frozen to -80ºC until assays. DNA was extracted from tissues and a molecular assay in the form of RT polymerase chain reaction (PCR) was performed. A herpesvirus was identified in lung and brain samples of this dolphin.

D20 MAMMARY GLAND DEVELOPMENT AND LACTATION IN A JUVENILE FEMALE OF CUVIER'S BEAKED WHALE (*ZIPHIUS CAVIROSTRIS*) WITH AN OVARIAN GRANULOSA CELL TUMOUR

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Ovarian tumours are classified on the basis of the cell of origin as epithelial tumours, germ cell tumours and stromal tumours. In this latter group is included the granulosa cell tumour, the most common ovarian neoplasm in domestic animals. Granulosa cell tumours may secrete a variety of hormones, including progesterone, oestrogen, testosterone and inhibin. The production of hormones is frequently associated with abnormal behaviour and physiological events. In cetaceans, granulosa cell tumours have been described only in four species of cetaceans: blue whale, fin whale, short-finned pilot whale and beluga. In all the cases, the animals were adult and two of them were pregnant. In this communication, the gross and histopathological features of a granulosa cell tumour are described in a juvenile female of Cuvier's beaked whale (*Ziphius cavirostris*) found stranded in the coast of La Garrucha (Almería, Spain). Grossly, the right ovary was diffusely enlarged (6.5 x 2.5 cm) and on a sagital section was white to yellow and included both solid and cystic areas. Microscopically, the ovary was replaced by neoplastic cells arranged in variable sized lobules, cysts, nests and cords separated by dense fibrous trabeculae. The cells were round to polygonal, with vacuolated cytoplasm and round nuclei. There was mild anisokariosis and nuclear pleomorphism. Some tumour cells were arranged in radial aggregates about a central deposit of eosinophilic material (Call-Exner bodies). Other lesions observed in the animal were a moderate development of the mammary gland with normal in appearance milk secretion and mild oedema in the external genitalia. To the authors' knowledge, this is the first description of an ovarian granulosa cell tumour in a juvenile female of Cuvier's beaked whale (*Ziphius cavirostris*). Furthermore, the animal showed an unexpected mammary gland development and lactation presumably occurred secondary to oestrogen and progesterone production by the tumour.

D21 ULTRASTRUCTURAL FINDINGS OF INTRACYTOPLASMIC EOSINOPHILIC GLOBULES IN HEPATOCYTES OF STRANDED CETACEANS

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This work describes the ultrastructure features of intracytoplasmic eosinophilic globules founded in hepatocytes of seven stranded cetaceans. Previous ultrastructural studies of these findings were performed by other authors, being described as diffusely moderately electrodense inclusions with an occasionally central or eccentrical core of highly electron-dense material. Kennedy *et al.* suggested that those structures could be of lysosomal origin containing serum proteins and other materials within intracytoplasmic vacuoles. To carry out this work we selected livers of seven animals stranded in Canary Islands (two *Delphinus delphis*, one *Stenella coerulealba*, three *Stenella frontalis* and one *Tursiops truncatus*) which showed immunohistochemically positive globules to fibrinogen and/or alpha-1-antitrypsine. Six of these animals stranded alive and one was found dead but with signs of a possible alive stranding. Those liver samples were processed routinely for electron-microscopy. Results indicated that fibrinogen positive inclusions presented different morphological shapes, without a visible

membrane and a moderate uniform electron density. In some of those inclusions a core with higher electron-dense material and radial finger like structures were also detected. Alpha-1-antitrypsine positive globules presented a more granular appearance and a visible membrane. In some of the hepatocytes a central core was also observed. Preliminary conclusions indicate that a central core could be found in globules immunohistochemically stained with both fibrinogen and/or alfa-1-antitrypsine. These results contribute to a better knowledge of these characteristic morphological changes found frequently in whales and dolphins stranded alive as well as in by-catch dolphins, reported previously by our group.

Eligible for Student award: Postgraduate

D22 PATHOLOGICAL STUDY OF A MASS STRANDING OF SPINNER DOLPHINS (*STENELLA LONGIROSTRIS*) IN THE CANARY ISLANDS

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A mass stranding of spinner dolphins (*Stenella longirostris*) took place in Tarajalillo (San Bartolome de Tirajana), located in the southeast coast of Gran Canaria (Canary Islands), the 27th of August, 2004. A total of five spinner dolphins beached, and two of them were returned alive to deeper water. Two of the remaining three animals were a juvenile and a subadult dolphins, which died after a short period of time; the third one, an adult male, was transported to the Marine Wildlife Rescue Centre where it was euthanized a few hours later due to its bad health condition. This record should be considered like extralimital and it was associated to the highest SST (Sea Surface Temperature) values known for the Canarian Archipelago. A pathological study was carried out at the Veterinary School of the University of Las Palmas de Gran Canaria where all three animals were examined post-mortem following a systematic necropsy procedure. Macroscopically, the most relevant findings in the young dolphins were a strong parasitation by nematodes in the lungs and a moderate infestation by trematodes (*Nasitrema* sp.) in the pterygoid sinuses. The adult one presented a severe generalized chronic dermatitis associated with a marked poor body condition microscopically characterized as an interstitial exudative dermatitis with a hyperplasic epidermis. Other histopathological lesions in this animal were a broncho-interstitial pneumonia and a chronic reactive hepatitis. Social cohesion is suspected to be the cause implicated in this mass stranding event of spinner dolphins, as one of the animals (the adult one) was clearly sick comparing with the rest of the dolphins (the subadult and the juvenile), but a final diagnosis is lacking.

Eligible for Student award: Postgraduate

D23 MYCOTIC OTITIS MEDIA IN A HARBOUR PORPOISE OFF BRITISH WATERS: A CASE STUDY

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The hearing organ is one of the major senses in cetaceans. Little is known about the exact mechanism and even less about relevant negative impacts. We herewith present results of a case report of severe mycotic otitis media in a juvenile female harbour porpoise (*Phocoena*

phocoena) coming from British waters that stranded alive and was euthanised due to poor nutritional and health status. Gross examinations were added by histological and microbiological investigations. Post mortem examination in the head region showed intact tympanic bullae but copious greenish-yellow purulent and caseous material within both tympanic cavities and periotic sinuses while no nematodes were found. Microbiological examinations of the middle ears showed fungal infections with *Aspergillus terrus* in both tympanic cavities but not in any other site in the body. In and around the oval and round windows a massive deposition of proteins and infiltration of inflammatory cells surrounded a prominent mycelium reaching far into the tympanic cavity. Stapes and lateral side of the petrous bone near the oval window were affected by osteolysis. Cyst-like structures, lymphocytes and newly formed vessels filled the space beyond the round window membrane. Within the cochlea, massive deposits of fibrin fibers replaced ¾ of perilymphatic fluid and reached far into the cochlea. Neutrophils, lymphocytes and plasma cells were attached to the otherwise intact Reissner's membrane, spiral ligament and the fibrin fiber's net. The Organ of Corti showed massive malformation. Sensory cells and supporting cells were missing throughout most parts of the cochlea. We conclude that this together with the massive changes in the Organ of Corti were responsible for severe hearing impairment or even deafness leading to the poor nutritional status. Systematic examinations on the middle and inner ear are important to understand the health status of cetaceans and should therefore be included in routine pathological investigations.

Eligible for Student award: Postgraduate

D24 IMMUNO-HISTO-CHEMICAL CHARACTERIZATION OF SELECTED LEUKOCYTE MARKERS FOR THE DETECTION OF HEMATOPOIETIC CELLS IN FORMALIN-FIXED AND PARAFFIN-EMBEDDED TISSUE SAMPLES OF HARBOR SEALS (*Phoca vitulina*)

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Despite current efforts to improve the knowledge about the immunology of marine mammals, a phenotypical characterization of inflammatory responses in harbor seal tissues have been hampered by the lack of appropriate markers for the detection of different leukocyte subsets. To facilitate a detailed investigation of pinniped lymphoid organs, sixteen canine-, two human- and one bovine-specific monoclonal marker as well as four human and one bovine polyclonal antibody, directed against different cell antigens of the hematopoietic system were tested for immunohistochemical cross-reactivity on formalin-fixed and paraffin-embedded spleen and lymph node of a harbor seal. Five polyclonal and three monoclonal antibodies showed a specific immunoreactivity with harbor seal hematopoietic cells. T lymphocytes were labeled in the splenic periarteriolar lymphoid sheaths (PALS) and paracortex of lymph nodes by a polyclonal human-specific anti-CD3 antibody. A monoclonal human CD79α-marker stained the majority of lymphocytes in follicles of investigated lymphoid organs, while different plasma cell subpopulations were recognized by a polyclonal human-specific kappa and lambda light chain markers. Cells of the histiocytic lineage were recognized by a human polyclonal lysozyme- and monoclonal MAC 387-marker. Furthermore, antigen-presenting cells in different compartments, such as follicular dentritic cells were detected by a bovine anti-S100 antibody. The MHC class II-antigen, labeled by a bovine-specific monoclonal antibody, was expressed on T and B lymphocytes as well as on antigen-presenting cells. Thus, using these antibodies from various species, it is now possible to determine phenotypical changes in lymphoid organs and to detect different leukocyte subsets involved in inflammatory responses in archived tissue samples of the harbor seal.

D25 THE IMMUNE-MICROBIOLOGICAL ANALYSIS IN SOME SPECIES OF MARINE MAMMAL AS A METHOD OF ESTIMATION THEIR ANTI-EPIZOOTIC STABILITY

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During the recent decades problems of protection of rare marine mammal species have become very acute. The important factor directly causing population decline are the highly-contagious polyethiological infection epizootics resultant in mass mortality of animals. In this case of great importance for the species survival is high level of anti-epizootic effectiveness of immune system of population members. The immune-microbiological study was fulfilled in Steller sea lion pups (*Eumetopias jubatus*) at natural environment, and in bottlenose dolphin (*Tursiops truncatus*) and in beluga whale (*Delphinapterus leucas*) at captivity conditions. 26 Steller sea lion pups (3-4 weeks old) from Medny Island and 14 pups from Cape Kozlov (Kamchatka Peninsula) were studied in 2004, 55 adult Black Sea bottlenose dolphins at various terms of adaptation 2001–2004, and also twelve beluga whales in 2003. Were investigated immune status indices: in all animals–phagocyte activity of leucocytes; in beluga whales and bottlenose dolphins–absolute and relative number of lymphocytes and leucocytes, G/M-immunoglobulins, T/B-lymphocytes. In microbiological studies: species and quantitative composition of microflora of upper airways (as unfavorable biotic factor) was analyzed. Also smears from anus, external sexual organs, conjunctiva and mouth cavity, and selectively from wounds and abscess cavity were taken in sea lion pups. The performed analysis showed similar picture of the interconnected change in immunological and microbiological indices both in the monitoring of the above parameters in wild animals at natural environment and also during adaptation to captivity conditions. In this case, there was the general trend in decrease of immune status indices compared with high level of the infection by pathogenic microflora in all investigated species. The findings can indicate that low level of anti-epizootic effectiveness of immune system was detected in the investigated marine mammal species, which can also indicate about high degree of their vulnerability to epizootics, if they occur.

D27 RESPIRATORY FEATURES OF *INIA GEOFFRENSIS HUMBOLDTIANA* IN A CONTROLLED ENVIRONMENT

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All cetaceans show well adapted respiratory systems for aquatic habitats; however, despite the existence of individual variabilities, breathing patterns, as well as morphological or behavioural characteristics, reveal to be to a certain degree species-specific. The opportunity to detail this physiological aspect in a not exhaustively known river taxon as *Inia geoffrensis humboldtiana*, was given by the study of two adult males present at Duisburg Zoo (Germany), one of the only three facilities in the world housing this species. In particular, the aim of the study was to quantitatively investigate: a) apnoea mean durations and maximum ranges, b) inter-animal synchronization abilities, c) different surfacing modalities. Respiratory parameters were collected in May 2006 in a total of 120 sessions lasting 15 minutes each (15 hours/subject), randomized among 2-hr periods and balanced for equal representation at different times of the day. The results pointed out a nexus between breathing abilities and animal age, with the older *Inia* (about 55 yrs. old) showing an apnoea mean value of 60.19 ± 27.38 seconds (range 8.23 - 155.01, n=923) *versus* 64.82 ± 31.26 (range 9.49 - 186.41, n= 862) of the younger one (about 30 yrs. old). Moreover, while the latter improved its breathing performances with the hours of the

day, nearly the opposite was shown by the elder. This trait found a further evidence in animal breathing synchronization, with a maximum in the morning (62.2%) and a minimum in the evening (46.0%). As for emersions, two different modes came into view: a) "regular", with the animal breaking the surface only with the upper part of the melon and both inhaling and exhaling out of the water; b) "exploding", where the dolphins, producing a large bubble cluster, expire under the surface then emerge with the whole head and reenter the water bending the body. This latter modality revealed to enable them to perform longer dives.

Eligible for Student award: Undergraduate

D28 IMMUNE STATUS OF THE BLACK SEA BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) INFECTED WITH PATHOGENIC GR"+" COCCAL MICROFLORA DURING ADAPTATION TO CONDITION OF CAPTIVITY

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The immuno-ecological approach was used to estimate the degree of adaptation of Black sea bottlenose dolphin (*Tursiops truncatus*) to captivity conditions, based on complex examination of immunological, hematological and microbiological indices. 55 bottlenose dolphins were studied during various periods of adaptation (from 1 to 14 weeks and after 1 year). These studies were performed at the Utrish marine station of the A. N. Severtsov Institute of Ecology and Evolution Problems of the Russian Academy of Sciences from 2000 to 2005 years. The greatest changes in the immune system of the animals were observed during 2–3 weeks of the adaptation: the absolute and relative lymphopenia, decrease in T– cell and particularly in B– cell count, suppression of the phagocyte activity of neutrophils and monocytes, accompanied by the accelerated ESR and absolute leucocytosis. During this period the dolphins showed a sharp increase in the pathogenic Gr"+" coccal microflora of the upper airways (as an unfavorable biotic factor), which was represent by *Staphylococcus aureus, Staphylococcus epidermidis, Staphylococcus saprophyticus, Streptococcus pyogenes u Streptococcus pneumoniae.* Starting with the 5–7 weeks was observed an increase in the relation amount of serum G and M immunoglobulins, which may be the consequence of the humoral immune response to an invasion of pathogens. The normalization of the immunological, hematological and microbiological indices was observed if the dolphins were kept in captivity for one year. All their indices corresponded to those of the clinical healthy animals. Compensatory immunological mechanisms (increased amount of phagocytic eosinophils and atypical monocytes) that enable the bottlenose dolphins to survive at the unfavorable biotic factors in conditions of captivity were found.

D29 TRACE ELEMENTS IN SIX ODONTOCETE SPECIES STRANDED IN THE BAY OF BISCAY (FRANCE)

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Liver, kidney and muscle tissues of 14 toothed whales belonging to 5 different species, i.e. Gervais' beaked whale (*Mesoplodon europeaus*, n=1), long-finned pilot whale (*Globicephala melaena*, n=5), short-finned pilot whale (*Globicephala macrorhynchus*, n=1), pygmy sperm whale (*Kogia breviceps*, n=4), dwarf sperm whale (*Kogia simus*, n=1) and Cuvier´s beaked

whale (*Ziphius cavirostris*, n=2) stranded on the Atlantic coast of France have been analysed for 13 trace elements (Ag, As, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, V, Zn) by ICP-MS in order to compare their accumulation in these pelagic mammals. Liver appears as the most important accumulating organ for Ag, Fe, Mn, Pb and Se in all species, whereas kidneys show the highest concentrations of Cd, reaching up 130 $\mu g.g^{-1}$ dwt in *G. melaena*. Concentrations of Cu, V and Zn were not significantly different between both tissues and Co, Cr and Ni were generally below the detection limit whatever the species and the tissue were. In muscle, element concentrations fall below the detection limit except for the essential elements Cu, Mn, Fe and Zn, but also for V. Such relatively elevated concentrations of V are consistent with previous records on small delphinids from the Bay of Biscay (Ridoux et al. 2004), pointed out the global contamination by oil releases of the Bay of Biscay food webs. Among factors of variations, age influenced significantly only the Cd concentrations in both liver and kidney ($r = 0.719$ and 0.780, respectively). Taking age into consideration, renal Cd levels are more than one order of magnitude higher compare to fish-eating dolphins (Lahaye et al. 2005). As cephalopods represent the main source of Cd for squid-eating predators (Bustamante et al. 1998), the elevated concentrations measured in liver and kidney suggest that cephalopod would represent the major source of food for these pelagic mammals.

D30 TRACE ELEMENT CONCENTRATIONS IN FOETUS-MOTHER PAIRS OF SHORT-BEAKED COMMON DOLPHINS (*DELPHINUS DELPHIS*) STRANDED ALONG THE FRENCH COASTS

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Tissues of foetus-mother pairs of common dolphins (*Delphinus delphis*) stranded along the French coasts (Bay of Biscay and English Channel) were analysed for their Cd, Cu, Hg, Se and Zn contents. In the kidneys, foetal Cd levels were extremely low, and strong relationships between Cu and Zn suggested the involvement of metallothioneins since early foetal life. The results also indicated a limited maternal transfer of Hg during pregnancy since concentrations in the tissues of foetuses were below 1 $\mu g.g^{-1}$ w.wt. However, hepatic Hg concentrations in foetuses increased with body length, and were also proportionate to maternal hepatic, renal and muscular Hg concentrations. Lastly, affinities between Hg and Se in tissues would participate in Hg neutralisation in both mothers - through tiemannite granules - and foetuses - through reduced glutathione -, counteracting the toxic effects linked to the particularly high quantities of methyl-Hg to which marine mammals are naturally exposed.

D31 THE USE OF TRAZE ELEMENTS (Cd, Cu, Hg, Se and Zn) TO ASSESS THE IMPACT OF THE PRESTIGE OIL SPILL IN SMALL CETACEANS IN GALICIAN COAST (NW SPAIN)

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On November 2002, the oil tanker Prestige sank off northwest coast of Spain after he broke in two. Around 2000km of European coast was affected by the oil slick, which may have an effect

on small cetacean populations of the Galician coast (NW Spain). The study has been carried out analysing the most common species in the area (*Delphinus delphis* (n=145), *Stenella coureoalba* (n=19), and *Phocoena phocoena* (n=13)). Samples of liver and kidney from animals stranded before and after the accident have been analysed using five heavy metals (Cd, Cu, Hg, Se, and Zn). No comparison of heavy metals results have been conducted in Galicia due to the lack of studies in this topic. Due to the lack of this studies in Galicia, no comparison of the results have been conducted, and the comparison are making with others similar studies, for example the Erika in France. The heavy metal accumulations in marine mammals depend on several biological factors such as age, sex, species, diet, and geographic distribution. Therefore, age determination has been carried out by counting GLG (Growth Layer Group). All species had higher concentration of Zinc, but it has been found higher in liver than in kidney. The variability of Zinc was important, and an increase of this substance in all species in both organs has been detected from April 2003 with the maximum peak value in February 2004.Although high Zinc concentration was not found in the Prestige oil (as it was happened with the Vanadium and Nickel), it may be possible to consider as a contamination index due to the Prestige oil slick in this cetaceans populations.

Eligible for Student award: Postgraduate

D32 ORGANOCHLORINES LEVEL IN THE BLUBBER OF *ZIPHIUS CAVIROSTRIS* STRANDED IN THE CANARY ISLANDS

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Cuvier`s beaked whale (*Ziphius cavirostris)* is a pelagic cetacean with a wide geographical distribution occurring from the tropics to cold-temperated regions. Strandings of this specie are infrequent. Few studies on organochlorine levels in the tissues this odontocete have been published. In the present study residues of dichlorodiphenyl trichloroethanes (DDTs), chlordanes (CHLs) and polychlorinated biphenyls (PCBs) were analysed in the blubber of nineteen *Ziphius cavirostris* stranded along the coast of the Canary Islands (Atlantic Ocean), over the period 1999-2006. Samples were obtained from the marine mammals tissue bank of Veterinary School of the ULPG (Gran Canaria). Organochlorine analyses were made by gas chromatography following the international recommendation. The detection limit was > 2 ng g^{-1} wet weight and the recoveries efficiency were > 85%. Percentage of hexane-extractable lipid obtained in the blubber of the studied animals ranged from 50 to 80%. The detected concentration of PCBs (7ICES congeners) varied between 500 to 11540 ng g^{-1}w wt. PCB153, PCB138 and PCB180 were the prominent congeners, accounting for > 75% of the total PCBs. The DDTs levels were from 600-28000 ng g^{-1} w wt. The main DDTs metabolite was *pp´*-DDE. Also low concentrations of chlordane, *cis*-nonachlor, *trans*-nonachlor were detected. In general the levels of PCBs and DDTs detected in this study were lower than those observed in stranded ziphius in UK.

D33 CORRELATION BETWEEN METAL BODY BURDEN AND DISEASE MORTALITY IN HARBOUR PORPOISES OF THE GERMAN AND DANISH COASTS

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The influence of metals on marine mammal health is still in the focus of interest and not totally investigated. Harbour porpoises (*Phocoena phocoena*) are exposed to metals predominately through their position in the food web. Only a few actual studies have been carried out

concerning metal accumulation in harbour porpoises of the German and Danish North and Baltic Sea respectively as well as the metal influence on mortality. The purpose of this study is to analyse a broad range of metals in liver, kidney, muscle and blubber samples from porpoises. One group of animals were found dead along the coasts, probably died due to infectious diseases. The second group encloses by-catch animals which died as a consequence of physical trauma (most frequently entrapment in fishing gear). Tissue samples were collected from 28 harbour porpoises died between 2004-2006. The concentration of 21 metals/metalloids (Al, As, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Mn, Mo, Ni, Pb, Pd, Pt, Rb, Se, Sn, Sr, Zn) in tissue samples were analyzed using inductively coupled plasma source mass spectrometry (ICP-MS) and total reflection X-ray fluorescence spectrometry (TXRF). The median concentrations and range values of the metals will be shown and differences between the tissues and between both groups of porpoises as well as the influence of age and sex will be discussed. This indirect approach should investigate the thesis that increased exposure to metal pollutants results in lowered resistance to infection diseases in harbour porpoises. For porpoises living in the North and Baltic Sea, this investigation could help to evaluate influences caused by changes in the environment and to support pollution assessment of the ecosystem.

Eligible for Student award: Undergraduate

D34 METAL CONCENTRATION IN BLOOD IN HARBOUR SEAL PUPS (*PHOCA VITULINA*) OF THE GERMAN NORTH SEA

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Each year, several harbour seal pups come ashore on the German Wadden Sea coast as natural behaviour but also as result of weakness, potential illness, weather conditions or human impact. During the early postnatal nursing period, the newborns are particularly susceptible to the influence of pollutants including metals. Metal exposure may result from the transplacental transfer from mother to foetus or through the milk and by contaminated prey. The aim of this study was to investigate the concentration of 21 metals/metalloids in whole blood samples of harbour seal pups of the Seal Station Friedrichskoog, Germany during their rehabilitation. The first blood sampling was performed directly after collecting the seals. Information to the intake of breast milk were not available. Second sample of each pup was taken 2-3 month after rehabilitation before their release back into the wildlife. In the Seal Station the animals were fed with fish from the local fishery. Inductively Coupled Plasma Source Mass Spectrometry (ICP-MS) and Total Reflection X-ray fluorescence spectrometry (TXRF) have been used to determine the metal concentrations in the samples. We found contrarily metal specific changes of blood concentrations during the rehabilitation period. Some metals showed high levels in the newborns, probably caused by a transplacental transfer from mother to foetus or through the milk, followed by a decrease. In contrast, some metals showed low concentrations to the beginning of rehabilitation and increasing concentrations in the following months probably by contaminated fish. This investigation shows the strong influence of nutrition on the metal concentration in the whole blood of seals. This study suggests that newborn seals of the North Sea have high body burdens of selected metals, which indicates a general problem of animals living in polluted coastal areas.

Eligible for Student award: Postgraduate

D35 SPATIAL VARIATIONS OF PCB AND DDT IN HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN KATTEGATT-SKAGERACK SEAS AND THE BALTIC SEA

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Blubber was collected from 36 harbour porpoises (*Phocoena phocoena*) between 1998-2005 from Swedish-, Polish- and German waters. The samples were analysed for ΣPCB and ΣDDT The porpoises were divided into 4 areas; Skagerack-Kattegatt, Öresund, the Baltic sea and German inner seas. The samples were run through a gas chromatograph after extraction. Age determination was performed on 17 animals from Swedish waters, the other animals where either already age determine or no teeth were available for analyze. Age determination was done by counting the annual layers in the cementum from three teeth. Harbour porpoises have become extremely rare, and are almost only found in the southern parts of the Baltic. The reason for the decline in the Baltic is not properly evaluated, but bycatches in fishing nets are a problem of concern, as well as environmental contamination. The purpose of the study was 1) to elucidate if there are any geographical differences between the 4 areas 2) study more recent contaminant data in harbour porpoises. Contaminant levels in Harbour porpoises are of concern. However, as always with studies on rare species, the sample sizes were very small. There are differences between specific PCB:s and area. The German inner seas has higher concentrations of PCB202, PCB206 PCB194 and *o,p*-DDT than the other areas. (p=0,044, p=0,011, p=0,021 and p=0,054). The Anova showed no significant differences in ΣPCB and ΣDDT between the 4 areas. The results show that the animals have been subjected to different amounts and in time separated discharges of pollutions.

Eligible for Student award: Undergraduate

D36 EVALUATION OF SOME HEAVY METALS IN FOOD WEB (WATER-FISH-DOLPHINS) FROM THE BLACK SEA

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Introduction Because of poorly available data the aim of the present study was to evaluate the contamination level with Aluminium, Copper, Iron, Manganese, Nickel and Zinc in the food web (water - fish - dolphins) from Romanian Black Sea waters. Materials and Methods Sea water, fish (Sprattus sprattus) and three dolphins liver (Phocaena phocaena) samples were taken. The samples were specifically analyzed by atomic absorbtion spectrophotometry on AA-6650 Shimadzu Spectrophotometer with graphite owen. The obtained data were compared with data from references. Results. In Black Sea water were found higher concentration than in references for Fe (+244.8%/ EQS), Mn (+6150%/ Schafer), Ni (+1328%/ EQS) and lower for Al, Cu and Zn. Levels in Black Sea water samples were: Al 0.05, Cu 0.006, Fe 0.1, Mn 0.01, Ni < 0.01 and Zn < 0.02. Mean levels in fish samples were: Al 1.524, Cu 0.508, Fe 15.244, Mn 1.524, Ni 0.762 and Zn 22.231. Mean levels in dolphin liver samples were: Al 1.586, Cu 6.217, Fe 397.3, Mn 1.602, Ni 1.24 and Zn 33,425. A tendency of increasing levels along food web was noticed for all studied metals. Dolphin hepatic levels were compared between Black Sea and Pacific Ocean, North Sea and Mediterranean Sea. It was pointed out that Cu, Mn and Zn mean concentration were lower in Black Sea dolphins, no available data for North Sea; Fe and Ni mean concentration were higher in Black Sea dolphins (Fe + 65.5%/ Pacific; + 17.8%/ North Sea; +36.48%/ Mediterranean Sea and Ni +148%/ North Sea, no available data for Pacific and Mediterranean Sea). There were no data for dolphin Al hepatic levels in studied references. All concentrations are expressed in ppm. Conclusions Studied heavy metals concentration increase along food web. Warning levels for Fe and Ni in Black Sea dolphins and water.

Eligible for Student award: Postgraduate

D37 ANALYSIS OF POLLUTANT-INDUCED PROTEIN EXPRESSION IN PRIMARY HEPATOCYTES FROM HARBOUR SEALS (*PHOCA VITULINA*)

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Contaminants influence a broad range of physiological processes on cellular level. To study these effects in harbour seals, which accumulate pollutants as top predators of the food web, a strategy with *in vitro* liver preparations is presented. In 2006 we took liver samples on four pups shortly after their death. A full postmortem investigation was performed on all four animals showing that their death was caused by various reasons (e.g. bacterial infection). The yielding primary cell cultures were incubated with mixtures of PCBs. A protein expression profiling based on two dimensional gelelectrophoresis as separation technique identified proteins with up- or downregulated expression after incubation with pollutants.The amino acid sequence of selected proteins were investigated using mass spectrometic techniques. These sequence data were also compared with related sequences from data sets of other mammals. Data from the cell culture experiments as well as from the protein sequencing will be shown. This strategy aims at identification of a set of specific proteins with their expression correlated to the effects of pollutants. The evaluation of the species-specific impact of exposure of contaminants on seals also for yet unknown substance classes should be possible in future.

Eligible for Student award: Postgraduate

D38 FISH-HOOK INGESTION IN SEALS, THE SCALE OF THE PROBLEM AND REMOVAL AFTER INGESTION

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In the period of 1975 to 2005, the Seal Rehabilitation and Research Centre (SRRC) in Pieterburen was confronted with twelve cases of seals that had ingested a fish-hook. Eight of these seals were already dead when they washed up, two died soon after arrival at the centre and two seals survived. All except three were common seals, the others being grey seals. During the necropsies, perforations were found in the oesophagus, stomach and intestines. Due to the poor health of the live stranded seals surgery was not a viable option, therefore a non-invasive method for removing fish-hooks was developed. By feeding cotton wool a perforation could be prevented and two seals survived the ingestion of a fishhook. In both cases the stomach wall was not yet perforated and the cotton wool finally encapsulated the hook, preventing it to perforate the stomach. Radiographs were taken, showing that the hook was decaying and falling apart in the acidic stomach environment. The cotton wool with the remains of the hook were later defecated and both animals were released successfully. Most hooks were identified as hooks used in fisheries around wrecked vessels to catch cod. Fishing on wrecks increases the chance that fishing equipment becomes entangled on the wreck and equipment is frequently lost in this way. Hooks with bait or hooked-fish might attract seals. Hooks, knots and lines recovered during autopsies were studied, which led to the belief that a contributing factor to the

loss of recovered gear had been the careless use of fishing gear, probably by inexperienced recreational fishermen. Fishermen are therefore advised to take preventive measures.

D39 THE ROLE OF MEDITERRANEAN CETACEANS IN THE LIFE CYCLE OF SOME PARASITES (PLATYHELMINTHES: CESTODA: TETRAPHYLLIDEA)

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Mediterranean cetaceans are usually infected with four types of tetraphyllidean cestode larvae: two mobile forms (plerocercoids) differing in size, 'small' (SP) and 'large' (LP), occurring in the digestive tract and liver, and two cystic forms named *Phyllobothrium delphini* and *Monorygma grimaldii*, in subcutaneous blubber and abdominal peritoneum and mesenteries, respectively. Adult stages are unknown for any of these larvae. A molecular analysis of the D2 variable region of the lsrDNA gene of several individuals of each larval type collected from Mediterranean striped, bottlenose and Risso's dolphins showed consistent and unique molecular signatures for each type regardless of host species. The inclusion of the larval signatures in a partial phylogenetic tree of the Tetraphyllidea showed that all larvae formed a clade together with a species of the genus *Clistobothrium*. A small degree of divergence between sequences of the clade was observed, suggesting separate although congeneric species. However, SP differed only in 1 bp from *M. grimaldii*, suggesting intraspecific variation. Some species of the genus *Clistobothrium* parasitize sharks such as the great white which is known to feed on cetaceans. These tetraphyllidean larvae are common among marine mammals that feed on fish and/or cephalopods at offshore habitats. The evidence suggests that cetaceans act as natural intermediate hosts for *P. delphini* and *M. grimaldii* as within these hosts they undergo development from the plerocercoid stage to the cystic stage. Cetaceans could be paratenic host for LPs since they remain as plerocercoid, but show high prevalence and abundance as well as a high degree of site specificity (anal crypts and bile ducts). Cetaceans are large, long-lived, endotherm predators, being able to accumulate larger quantities of larvae than other marine animals. The inclusion of cetaceans in the life cycle of these cestodes could facilitate their transmission to apex predators, such as the large, lamnid sharks.

D40 PARASITE TRANSMISSION IN SYMPATRIC CETACEANS OF THE PATAGONIAN ECOSYSTEM

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Marine mammal endoparasites are transmitted through prey, therefore, feeding habits should always be considered. We provide information on prey consumption in relation to parasite transmission. Latitudinal gradients in larval parasites of preys are reflected in marine mammals. Over the continental shelf, *C. cetaceum* is characteristic in northern dolphins (common dolphins, franciscanas). In accordance to this, it was also present in one dusky dolphin from sympatric areas, contrary to others from higher latitudes. *Cynoscion guatucupa* harbors juveniles so we assume that they become infested consuming this prey. Larval *A. simplex* are present in northern Patagonia and infestations are not as high as expected (common dolphins, Burmeister´s porpoise). The opposite is seen in duskies from central Patagonia. This is related to a latitudinal rather than to a longitudinal gradient as previously suggested. Common dolphins feed on Argentine anchovy where *Anisakis* is less frequent, so its recruitment to final hosts turns

low. At higher latitudes, this fish is an important prey of duskies, showing higher infestations and is, then, the major intermediate host in its transmission to duskies. Commerson´s dolphins, however, they feed on small fish (juvenile Argentine hake, Fuegian sprat) and are lightly infested with larval *Anisakis*. So, to the north, *C. cetaceum* is characteristic of franciscana, common and dusky dolphins. To the south *A. simplex*, *B. cordiformis* and *P. gastrophilus* parasitise dusky, common and Commerson's dolphins. Besides, *A. simplex* and *O. rochebruni* are common to hourglass dolphins. Not enough data is available to account for latitudinal gradients outside the continental shelf but, as a common pattern, cestodes appear in the blubber. Narrow diets reflect low species richness. In general, these marine mammals concentrate only on a few most abundant prey species out of their whole diet; while other species rarely appear what may directly reflect parasite aggregation in the preys consumed.

D41 REPLICATIVE AGING IN MARINE MAMMALS

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The telomere-based replicative senescence process is thought to function as a potent mechanism of tumor protection in humans. Whether this mechanism is conserved in other vertebrate species is still unclear. In this work we investigate the role of telomeres and replicative aging in the orders Cetacea (Mysticeti & Odontoceti), Pinnipeda and in their philogenetically related orders Artiodactyla and Carnivora. We grew fibroblasts from the skin of Gray Whale (*Eschrichtius robustus*), lung of Bowhead Whale (*Balaena mysticetus*), cornea of Bottlenosed Dolphin (*Tursiops truncates*) and kidney of California Sea Lion (*Zalophus Californianus*). We also grew skin fibroblasts from several Artiodactyla (ex: Hyppopotamus) and Carnivora species. Cells grown in low oxygen (2-5%) were examined to see if the exhibited growth arrest due to replicative senescence. For cells that enter stasis due to inadequate growth conditions, we overexpressed HPV 16 E6/E7 and/or SV40 Large-T antigen to overcome cell cycle checkpoints. Telomere length was determined by terminal fragment restriction analysis (TRF) and fluorescence *in situ* hybridization (FISH) techniques. Telomerase activity of these cells was determined using the telomere repeat amplification protocol (TRAP) assay. Our results indicate that members of the order Cetacea are telomerase negative and repress telomerase efficiently in culture. Mysticeti have short "human like" telomeres (7-15 Kb) and Bottlenosed Dolphin has a wider range of telomeres (7->25 Kb). Cells from California Sea Lion are telomerase negative but we observed the occurrence of spontaneous immortalization, accompanied by the reactivation of telomerase. These results suggest that Cetacea and Artiodactyla use replicative senescence as a tumor protection mechanism. This mechanism was conserved in these long lived animals even after the adaptation to their new environment. The California Sea Lion behaves more similarly to some Carnivores, many of which have extraordinary long (>50Kb) telomeres and do not appear to use replicative senescence to count cell divisions.

Elegible for Student award: Undergraduate

D42 CROSS-REACTION OF CYTOKINES IN CETACEAN SNAP FROZEN TISSUE SECTIONS

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The understanding of the role of different cytokines during inflammatory diseases could lead to better knowledge of the marine mammal immune system. This study evaluates the cross-reactivity of a panel of ten monoclonal antibodies to human and bovine cytokines in snap frozen tissue sections of lung, spleen, liver and mesenteric lymph nodes of three species of

cetaceans: Atlantic spotted dolphins (*Stenella frontalis*), striped dolphins (*Stenella coeruleoalba*) and fin whale (*Balaenoptera physalus*). In serial sections, anti-human CD3, IgG, and lysozyme polyclonal antibodies (pAbs) were used to labels T and B cells, and macrophages/monocytes respectively. The anti-human IL-1α, IL-1β, IL-2, IL-6, IL-8, IL-10, TNF-α, CD25 and anti-bovine IL-4 and IFN-γ mAbs yielded immunolabelling in cetacean snap frozen lymph node tissue sections similar to that obtained in the species of origin, but they did not react in formalin-fixed tissue sections. The anti-human CD3, IgG, and lysozyme pAbs reacted both in formalin-fixed and snap frozen tissue sections of the three cetacean species. Macrophages and lymphocytes were the most common cell population immunolabelled with the anti-cytokine mAbs. The results of the present study suggest that this panel of anti-cytokine mAbs may be useful to evaluate cytokine expression in snap frozen tissue samples of the species of cetacean tested. This is of interest because all these antibodies could be used to evaluate the immune status in these animals, testing cytokine expression in several pathological processes, such as bacterial, viral, parasitic or toxic diseases.

D43 VISUALLY DETECTABLE ATTRIBUTES OF SPINAL MALFORMATIONS IN FREE-RANGING BOTTLENOSE DOLPHIN CALVES IN NORTHEAST SCOTLAND

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Scoliosis in free-ranging vertebrates may be either congenital or acquired. In most models studied, congenital scoliosis is associated with a high incidence of both spinal and extra-spinal defects, including hemi-vertebrae, incomplete vertebral segmentation, supernumerary ribs or rib fusion, whereas acquired scoliosis may result from neurological disease, environmental contamination or may be idiopathic. In aquatic mammals such as cetaceans, however, vertebral malformations may additionally result from traumatic injury such as boat strikes, interspecific aggression and the agonistic behaviour of con-specifics, all of which have been implicated in this respect. In the Moray Firth bottlenose dolphin (*Tursiops truncatus*) community in Scotland, the trauma-inducing capability and lethality of intraspecific attacks on calves is well documented; the resulting fatalities commonly displaying multiple compression fractures of the spine and dislocations of the intervertebral joints. In the present paper, 4 cases of mild to severe scoliosis are reported for bottlenose calves from this northeast dolphin community. Photographs taken during the course of a 10-yr photo-identification study were used to describe the visual attributes of spinal deviations present in each case. The pathogenesis of this condition and its causative role is discussed. And whilst the longevity of animals exhibiting these malformations could not be determined in the limited scope of this study, it seems some individuals do survive well into adulthood which underscores the extraordinary ability of this species for adaptation to such gross structural deformation.

D44 ADAPTATION OF A NON-RADIOACTIVE ASSAY TO DETERMINE THE PROLIFERATION OF LYMPHOCYTES OF BOTTLENOSE DOLPHIN AND BELUGA WHALE AND DETECTION OF CYTOKINES USING RT-PCR

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Impairment of immune function is suggested to play an important role for the increasing incidence of infectious diseases and other pathologies in marine mammal species. Considerable efforts have been made to standardize methods to characterize the immune functions of cetaceans. In immunological research and in studies with species with difficulties in sample

collection such as cetaceans, the need to perform multiple analyses on the same cells is increasing. The aim of this work was to adapt methods to evaluate the lymphocyte blastogenesis and cytokine expression in vitro of bottlenose dolphin (Tursiops truncatus) and beluga whale (Delphinapterus leucas). We determined the optimal conditions for the lymphocyte blastogenesis by using a non-radioactive colorimetric assay, the Alamar Blue dye, which did not require cell lysis. Peripheral blood mononuclear cells (PBMCs) of bottlenose dolphin and beluga whale were stimulated with different concentrations of concanavalin A (Con A) and pokeweed mitogen (PWM). Our results obtained with alamar blue technique were similar to those desctribed in other currently available assays such as 3H-thymidine uptake, for these species. The alamar blue assay is a safe and simple method that allows further analysis on cultured cells. In the same cultured cells we have investigated the gene expression of two cytokines by using reverse-transcription polymerase chain reaction (RT-PCR). Primers for IL-2 and IFN-γ were designed from published RNAm sequences of cetaceans, and established human primers were taken for the detection of the house keeping transcript GAPDH. We set up a method for amplification of these cytokines. Transcription of both cytokines was observed after incubation with both mitogens. PCR products were sequenced and were compared with nucleic sequences of other species. This knowledge of cytokines in cetaceans is a very interesting approach for the understanding of the immune status of cetacean populations.

D45 THE ROLE OF *STREPTOCOCCUS* IN INFECTIOUS DISEASES OF MARINE MAMMALS

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The bacteria of the genius *Streptococcus* are the causative of a number of diseases in mammals and humans. Streptococcoses of marine mammals have not received enough attention. The streptococcal infections of cetaceans are similar in terms of clinical traits to streptococcoses of terrestrial mammals and human. The most important indices are changes in the physiological indices of the blood in sick animals in contrast to healthy individuals, the number of leukocytes and ESR increase, and the number of erythrocytes and hemoglobin declines. Our study is concerned with the microflora of some species of marine mammals both in captivity and natural populations. We determined the major species of *Streptococcus* isolated from marine mammals, and their etiological role in infection pathologies was demonstrated.The study was performed in Department of Microbiology of K.I.Skryabin MSAVN&B between 1999 and 2006. The subject were the following marine mammals: the Black sea bottle-nosed dolphin (*Tursiops truncatus*), beluga (*Delphinapterus leucas*), Steller sea lion (*Eumetopias jubatus*). To asses the clinical conditions of the animals, the hematological indices were studied using standard techniques. As indices of the immune status, the phagocyte activity of blood leukocytes was investigated. Bacteriological investigating was performed using standard methods. In cetaceans, material was collected from the upper airways. In Steller sea lion pups, material was collected from the mouth and nasal cavity, eye conjunctiva, external sex organs, anus. In result, pathogenic isolates of *Streptococcus* were revealed in animals with various deviations from the physiologically normal hematological indices and with low level of phagocyte functional activity. The rate of isolations these microorganisms from marine mammals with changes of physiological conditions, the pathogenic factors of these Streptococcus indicate an important role of streptococcoses in the general structure of contagious diseases of the Black sea bottle-nosed dolphin, beluga and Steller sea lion.

D46 PRESENCE OF CETACEAN MORBILLIVIRUS (CEMV) IN STRANDED CETACEANS IN CANARY ISLANDS

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Cetacean Morbillivirus (CeMV) is a virus belonging to the *Paramyxoviridae* Family. It has caused the most important panzootic outbreak reported in cetaceans affecting several species worldwide. Canary Archipelago is an important area to cetacean diversity and abundance. Recently, one case of CeMV in a stranded short-finned pilot whale has been reported in this Archipelago, with morbilliviral associated lesions. The aim of this study was realize a retrospective study on some stranded cetaceans in Canary Islands since 1996 to 2005 to determine the presence of CeMV. It would let to improve the knowledge about the health status of the cetacean populations. 27 individuals stranded in Canary Islands since 1996 to 2005, belonging to five species were necropsied and samples of lung and brain were frozen to -80ºC until assay. The species studied were: bottlenose dolphin (*Tursiops truncatus*) (n=9), Cuvier´s beaked whale (*Ziphius cavirostris*) (n=9), short-finned pilot whale (*Globicephala macrorhynchus*) (n=6), Blainville's beaked whale (*Mesoplodon densirostris*) (n=2) and True's beaked whale (*Mesoplodon mirus*) (n=1). CeMV was detected using an one step RT-PCR of a 427 bp. conserved region of the phosphoprotein gene, described previously and modified under our laboratory conditions. Additionally, a control of CeMV kindly provided by Dr. Tom Barrett (Pirbright Institute, UK) was included. Three samples were positive to CeMV RT-PCR, two short-finned pilot whales and one bottlenose dolphin. All beaked whales were negative. The overall prevalence for all species was 11.11% (3/27). This work is the first about prevalence of CeMV in the Canary Archipelago, finding CeMV in two species of cetaceans: bottlenose dolphin and short-finned pilot whale. Molecular evidence of CeMV has been demonstrated in two cetacean species of the Canary Archipelago. Further histopathological studies are necessary to identify morbilliviral lesions and consequently elucidate the role of this virus in their health status.

D47 VISUALLY DETECTABLE ATTRIBUTES OF SPINAL MALFORMATIONS IN FREE-RANGING BOTTLENOSE DOLPHIN CALVES IN NORTHEAST SCOTLAND

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Scoliosis in free-ranging vertebrates may be either congenital or acquired. In most models studied, congenital scoliosis is associated with a high incidence of both spinal and extra-spinal defects, including hemi-vertebrae, incomplete vertebral segmentation, supernumerary ribs or rib fusion, whereas acquired scoliosis may result from neurological disease, environmental contamination or may be idiopathic. In aquatic mammals such as cetaceans, however, vertebral malformations may additionally result from traumatic injury such as boat strikes, interspecific aggression and the agonistic behaviour of con-specifics, all of which have been implicated in this respect. In the Moray Firth bottlenose dolphin (*Tursiops truncatus*) community in Scotland, the trauma-inducing capability and lethality of intraspecific attacks on calves is well documented; the resulting fatalities commonly displaying multiple compression fractures of the spine and dislocations of the intervertebral joints. In the present paper, 4 cases of mild to severe scoliosis are reported for bottlenose calves from this northeast dolphin community. Photographs taken during the course of a 10-yr photo-identification study were used to describe the visual attributes of spinal deviations present in each case. The pathogenesis of this condition and its causative role is discussed. And whilst the longevity of animals exhibiting these malformations could not be determined in the limited scope of this study, it seems some individuals do survive well into adulthood which underscores the extraordinary ability of this species for adaptation to such gross structural deformation.

D48 CROSS-REACTION OF CYTOKINES IN CETACEAN SNAP FROZEN TISSUE SECTIONS

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The understanding of the role of different cytokines during inflammatory diseases could lead to better knowledge of the marine mammal immune system. This study evaluates the cross-reactivity of a panel of ten monoclonal antibodies to human and bovine cytokines in snap frozen tissue sections of lung, spleen, liver and mesenteric lymph nodes of three species of cetaceans: Atlantic spotted dolphins (*Stenella frontalis*), striped dolphins (*Stenella coeruleoalba*) and fin whale (*Balaenoptera physalus*). In serial sections, anti-human CD3, IgG, and lysozyme polyclonal antibodies (pAbs) were used to labels T and B cells, and macrophages/monocytes respectively. The anti-human IL-1α, IL-1β, IL-2, IL-6, IL-8, IL-10, TNF-α, CD25 and anti-bovine IL-4 and IFN-γ mAbs yielded immunolabelling in cetacean snap frozen lymph node tissue sections similar to that obtained in the species of origin, but they did not react in formalin-fixed tissue sections. The anti-human CD3, IgG, and lysozyme pAbs reacted both in formalin-fixed and snap frozen tissue sections of the three cetacean species. Macrophages and lymphocytes were the most common cell population immunolabelled with the anti-cytokine mAbs. The results of the present study suggest that this panel of anti-cytokine mAbs may be useful to evaluate cytokine expression in snap frozen tissue samples of the species of cetacean tested. This is of interest because all these antibodies could be used to evaluate the immune status in these animals, testing cytokine expression in several pathological processes, such as bacterial, viral, parasitic or toxic diseases

D49 UNUSUAL BY-CATCH OF LONG-FINNED PILOT WHALES (*Globicephala melaena*) BY TRAWLING FLEET IN ASTURIES (NORTHERN SPAIN), DURING THE FIRST SEMESTER OF 2006

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Since 1996, the strandings network of Asturies (CEPESMA) has been attending all the strandings of marine fauna, and analysing the causes of death of cetaceans. All the records are incorporate to a data base that allows an analyse of interannual variations. Moreover, CEPESMA staff carries on interviews to fishermen, with the purpose of approach to the by-catch incidence in the mortality of marine mammals. The amount of strandings of long-finned pilot whales (*Globicephala melaena*) in Asturies reached a mean value of 2 individuals per year. Between February and July of 2006, this value raised significantly to 21 specimens. The size and sex ratio of the stranded pilot whales has been very variable, including total lengths from 209 to 660 centimetres (63% males and 37% females). Although some specimens were by-caught and transported by fishermen to harbour, just a few of studied individuals showed signs of incidental capture in fishing gears. Moreover, the interviews made to trawling fleet fishermen during the first semester of 2006, revealed a high interaction between this gear and the pilot whales. The interviews also brought information about an unusual higher presence of this species in Cantabrian sea waters during the period described, in comparison with precedent years. Causes of this high number of pilot whales, as well as the presence of other non-usual species in these waters, are under the scope of scientific community. Although there were no definitive evidences of incidental captures in the majority of animals studied, the collaboration with the fishermen allowed obtaining very valuable information about cetacean by-catch. So, the significant increase in stranded pilot whales can be clearly related with the high incidence of

trawling fleet in the by-catch of this species, as well as the unusual high number of pilot whales in these waters during this period of time.

D50 POPULATION DYNAMICS OF THE LICE *ANTARCTOPHTHIRUS MICROCHIR* PARASITISING SOUTH AMERICAN SEA LION PUPS

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Antarctophthirus microchir are lice of pinnipeds. These hosts alternate between two different habitats: the sea, where they feed, and the land, where they reproduce. Therefore, their lice are restricted in their biology, especially because eggs do not develop in the sea. We analysed the population dynamics of *A. microchir* on South American sea lions. This study was undertaken in Punta León, Argentina, during 2005-2006. Parasite parameters were analysed in 2 locations of the rookery, i.e., a traditional, well-structured breeding area and an expanding area with juveniles and a lax social structure. We examined 94 pups, determined their sex, age, weight and number of lice present. The lice were classified in nymph stages (N1, N2, N3) and adults. Eighty-five percent of the pups were infected. The probability of infection was calculated through a logistic regression, and it only considered the age of the pups. A mixed linear model showed that both age and location were the predicting factors of the number of lice per pup. We observed changes in the population structure with the age of the pup, independently from the location or the year. Based on our results we can conclude that female *O. flavescens* would infect their newborn pups with N2, N3 and mainly adults. Once on the pups, adult lice would reproduce immediately and N1 would develop from eggs after 10 days. Through day 30, and after successive molts, the number of N2 and N3 would increase. However, the life cycle would be restricted to one reproductive event during the breeding season because pups start getting into the sea once they are about a month old. Therefore, there would not be time enough for the development of a new generation of lice and this would be the reason why we did not see a new appearance of N1

Elegible for Student award: Undergraduate

D51 DETERMINATION OF IMMUNOTOXIC POTENTIAL OF HEAVY METALS ON BOTTLENOSE DOLPHIN LEUKOCYTES IN VITRO

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Heavy metals are detected in marine environments throughout the world. Toothed cetacean are at the top of the food chain and accumulate these contaminants. In Canary Islands the main heavy metals found in the tissues of stranded cetaceans are mercury, aluminium, cadmium, lead and chromium. These chemicals are considered immunotoxic in different mammal species, but there are few reports of the effects on the cetacean immune system. In Canary Islands, the bottlenose dolphin is one of the most representative cetaceans. In an attempt to understand the possible immunotoxic potential of these five metals in the cetacean immune system, bottlenose dolphin leucocytes were exposed in vitro to various concentrations of these metals, and viability, apoptosis, phagocytosis and lymphocyte proliferation were evaluated. Viability and lymphoproliferation were measured with the alamar blue assay, and apoptosis and phagocytosis were evaluated with flow cyotmetry. Viability was decreased with the highest concentrations of

mercury (10 ppm) and cadmium (20 ppm). In both metals, apoptosis was detected as mechanism of cell death. Decreased phagocytosis was observed at 5 ppm of mercury, 50 ppm of aluminium and 10 ppm of cadmium. The proliferative response of bottlenose dolphin lymphocytes stimulated with Con-A was significantly reduced by exposure to 1 ppm of mercury, 10 ppm of cadmium and 20 ppm of lead. Concentrations tested of chromium did not show any significant effect on the analysed parameters. Concentrations of the other four metals that were found to affect the function of bottlenose dolphin leucocytes are between those detected in tissues from some Canary Islands bottlenose dolphins.

D52 THE CROSS-REACTIVITY OF THE BLOOD SERUM ALBUMENS FROM THE STELLER SEA LION PUPS (*EUMETOPIAS JUBATUS*)

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As is well known the Steller sea lion in Far Eastern Russia have undergone population declines in recent decades. In order to determine the cause this phenomenon the many-sided investigations were conducted, including the immune status. The fraction of (γ)- globulins were obtained from 101 pups blood serum samples by method of proteins sedimentation by 35-50% saturation ammonium sulphate. The analysis by electrophoresis of the isolated fraction by SDS-PAGE (Laemmli-PhastSystem) showed the presence of four stripes, at that three stripes were situated into the proteins zone (67kD) and fourth into zone of (γ)- globulins (160 kD). As is well known the electrophoretical mobility is differently for proteins, even if it is belong to one fraction. Probably the fraction of blood albumins in Steller sea lion is the heterogeneous fraction. The cross-reactivity of blood albumins in Steller sea lion was investigated by reaction of the dual radial immunodiffusion (Ouchterlony) with antiserums to blood proteins of cattle, horse, pig, rabbit, dog and mouse. The protein fraction (alb+ γ) of blood serum of the Steller sea lion was precipitating by antiserums to proteins of the horse, pig and dog. The cross-reactivity by cattle antiserums was registered by the monospecific antiserum to immunoglobulin G only. The analysis by immunoelectrophoresis corroborated preferential content albumins in the isolated fraction. By the method of the simple radial immunodiffusion (Mancini) were established that alb+ γ- fraction and blood serums of Steller sea lion is forming rings of precipitation by the antiserum to γ- globulins of pigs. The pool from 101 blood serum of Steller sea lion pups was used as standard. Were showed that the diameter of the alb+ γ- fraction precipitate was two times as smaller then the precipitate of the native blood serum from Steller sea lion. It is necessary to note that precipitation rings diameter of the investigated blood serum was different. Thus as a result of investigations were established the immunochemical affinity between albumins and (γ)- globulins of the pig blood serum and its of Steller sea lion.

POSTER ABSTRACTS ON BEHAVIOUR, ECOLOGY, FEEDING, GENETICS, & HABITAT

E1 HARBOUR PORPOISE (PHOCOENA PHOCOENA) AND HERRING (CLUPEA HARENGUS) IN SOUTHERN NORTH SEA

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Harbour porpoises have returned to the southern North Sea since a period of absence from 1940-1980. There is a trend in years as well as in seasons observed by aerial surveys (RIKZ), coastal survey's (Camphuysen), boat surveys (Project Rugvin) and strandings of both dead animals (Naturalis) and living porpoises (SOS Dolfijn Harderwijk). Also SCANS II confirms that harbour porpoises move southwards.The year trend (1970-2004) of harbour porpoises is significant correlated with that of herring (P=0,000). Harbour porpoises in southern North Sea are most often observed in the months February and March. This coincides with the seasonal abundance of herring. Herring disappeared in our waters early 1970's due to overfishing. The fishery was closed to allow stocks to recover. Since 1995 herring is recovering again. Herring is also an energy rich fish species, which could explain the food preference. Whiting populations, as the prey that porpoises used to feed on in the southern North Sea, has decreased since the late 1990's. Harbour porpoise do feed on herring again, but herring is not the dominant prey found in stomachs. Most likely this is caused by bias in data of young stranded animals and the fact that herring otoliths are most sensitive to digestion. Other factors that could move harbour porpoises south are the decrease in sandeel stocks near Scotland and the rise in water temperatures. It is believed that harbour porpoises move south because of recovery in herring and that adult harbour porpoises feed on herring again in southern North Sea. Sustainable fishery should be promoted in order to recover Atlantic ecosystems. Genetical research should be carried out to study movements of harbour porpoise between Scotland, southern North Sea (Dutch coast) and German and Denmark waters.

Elegible for Student award: Undergraduate

E2 EFFECTS OF DYNAMIC AND NON-DYNAMIC ECOGEOGRAPHIC VARIABLES (EGVS) ON THE OCCURRENCE AND HABITAT ECOLOGY OF HARBOUR PORPOISES OFF THE NORTH-WEST COAST OF SCOTLAND

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To gain a better understanding of cetacean occurrence, it is necessary to identify the underlying relationships between a species' distribution and its habitat ecology. This study investigated the effects of environmental ecogeographic variables (EGVs) on the distribution and habitat choices of harbour porpoises (*Phocoena phocoena*) in waters off the north-west coast of Scotland. Systematic surveys of the region were conducted via a network of passenger ferries throughout 2001-2005. Field data and dynamic and non-dynamic EGVs were integrated within a Geographical Information System (GIS), and generalised additive modelling (GAM) was used to identify relationships between harbour porpoise occurrence and the EGVs (i.e. time of day, tidal phase and range, distance to coast, aspect, slope and chlorophyll-a concentration). A final model was produced for August 2001-2005, which described 26.1% of variation in porpoise occurrence. Of the dynamic variables, tidal phase and range had a significant effect on porpoise distribution, with a peak in occurrence 0-2 hours after high tide and at a tidal range of 1.75 metres. In addition, occurrences were significantly more likely to be recorded around mid-afternoon (14.00 hours) and in areas with low variability in chlorophyll-a concentration. Of the non-dynamic variables, depth and distance to coast had a significant effect on porpoise distribution, with occurrence greatest at 10-15 kilometres from the shore, in water depths of around 125 metres and over slopes running from east to west. Spatial predictions for porpoise occurrence in this region highlight daily and tidally influenced expansions and contractions in distribution. These changes in distribution may be influenced by aggregations of prey within certain habitats, perhaps resulting from interactions between tidal currents and variable bottom topography. It may also reflect the behavioural ecology of the prey, which could be reacting to external environmental stimuli, such as changes in light intensity, plankton availability and tidal fronts.

Elegible for Student award: Postgraduate

E3 HOMOGENEITY OF STRANDED COMMON DOLPHIN AND PORPOISE ALONG BRITTANY COASTS: A PRELIMINARY MOLECULAR ANALYSIS

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Since 15 years, the "laboratoire d'Etude des Mammifères Marins" of Oceanopolis-Brest is monitoring the cetaceans stranded along the coasts of Brittany (North-west of France). Since 5 years, skin and muscle samples of stranded individuals have been collected as often as possible, conserved either in ethanol or at -20°c, thus allowing their further analyses. Common dolphins (*Delphinus delphis*) are classical inhabitants of Brittany coasts, and are believed to form homogeneous local populations, whereas porpoises (*Phoconea phoconea*) populations, strongly impoverished since some years, are just recently reappearing. The geographical origin(s) of these migrating porpoise populations are unknown. We have extracted DNA from all collected samples, and tested these DNA extracts for their capacities to be analysed using PCR-based approaches. For a preliminary, approach, thirty common dolphins and seven porpoise DNA extracts have been analysed using ISSR (Inter-Simple Sequence Repeats) – amplification. Electrophoresis of ISSR amplicons produces profiles that have been demonstrated in numerous eucaryots to be reproducible and highly informative. All dolphin and porpoise DNA extracts except two allowed us to amplify ISSR and produced clear profiles.The profiles, although being clearly species-specific, showed almost no variation inside the two species and do not show strong genetic diversities. For common dolphins, these results were predictable regarding recent studies and other genetic approaches. They were less expected for porpoises, but the low number of analysed porpoises, the fact that they all are stranded individuals and the question of their geographical origin prompt us to increase as much as possible the sample collection in Brittany but also from individuals of the North of France (North Sea coast).

E4 COASTAL HABITAT USE OF HARBOUR PORPOISE (PHOCOENA PHOCOENA) IN CARDIGAN BAY SPECIAL AREA OF CONSERVATION, WALES

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Small-scale habitat use of harbour porpoise was investigated using non-intrusive land-based watches in the southern part of Cardigan Special Area of Conservation, where relatively little such data had been previously available. Previous research has indicated that local porpoise abundance may respond to several oceanographic and bathymetric features, substrate type, and anthropogenic point sources. Using geographic information system software, this study confirms that harbour porpoise habitat use can be site-specific even at a small scale. Two hypotheses were tested: 1) that sightings are distributed non-randomly in the study area and 2) if sighting clusters exist, they can be related to environmental variables. To test the first hypothesis, the nearest neighbour-method was used in ArcGIS. Whereas sighting rates did not differ from one vantage point to another, the average observed distance between sightings was found to be significantly lower than expected distance, indicating clustering at a finer scale. Sighting densities were mapped and 467 individual sightings related to maps of sediment type and bathymetry. Sighting rates, and average individual counts per 15-minute interval were treated as indices of abundance. Sighting rates increased towards the end of the two-month study period in July. Sighting rates were lower and transiting behaviour more frequent around

the Teifi Estuary than at the other four studied sites. Of environmental variables, sighting rates and clustering tended to be higher during ebb tide and in the afternoon. Staying behaviour and associations with birds were also more frequent during ebb tide. The highest sightings frequency was found at depths of 16-20 m. Sightings also tended to be aggregated around steeper slopes. Most sightings were situated over cobbles with sand/silt and either sparse or moderate turf. These patterns area likely to relate to prey availability, which would be of interest for future study and management of the species' habitats.

Elegible for Student award: Undergraduate

E5 SOCIAL NETWORKS OF BOTTLENOSE DOLPHINS IN CARDIGAN BAY, WALES

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The social structure of a population is a fundamental component of its biology and ecology. Mating, foraging strategies and the ability to explore surrounding environment are closely related to the network of relationships between individuals. In the present study network analytical techniques were employed to construct and investigate bottlenose dolphins' social networks in Cardigan Bay, Wales. Density, the average shortest path length, and clustering coefficient were calculated to determine the average structure of a network. The pooled data social network for the period 2001-2006 was moderately dense (ρ=0.60) with a high number of direct ties among individuals (k=27.48). The variability of properties in annual networks indicated the dynamics of relationships. Divisions within networks were detected using the Girvan-Newman algorithm and modularity index, and could have been influenced by the degree homophily of individuals, while gender did not seem to play a significant role in the association pattern. Highly central individuals positioned on the boundaries of network components were identified. Their importance was discussed in relation to the transfer of information and spread of disease. Epidermal skin abnormalities (lesions) were categorized. Their prevalence was examined in regards to the topology of individuals in the network. Non-random frequencies in the distribution of lesions in network components were observed, and a high prevalence of cloudy lesions and black-fringe spots was recorded in two components. The network approach was found to be useful in exploring the social structure of this population. The potential to combine such characteristics as individual position in the network, spatial distribution and skin anomalies highlighted the efficiency of this technique to further our knowledge in understanding the processes of social organization. It also emphasised the importance of examining for networks of relationships when defining management and conservation guidelines for this, and other cetacean populations.

E6 DIFFERENCES IN SOCIAL STRUCTURE, PUP MORTALITY AND RATE OF INCREASE BETWEEN TRADITIONAL AND NEW OCCUPIED AREAS IN SOUTH AMERICAN SEA LION (*OTARIA FLAVESCENS*) AT PUNTA LEÓN, NORTHERN PATAGONIA

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The population of South American sea lions in northern Patagonia is in increasing at a rate close to 5.7 % annually, fact which is associated to new breeding areas where juveniles are the main

social component. Punta León is a traditional breeding rookery, expanded to new beaches in the last 15 years giving place to old and new areas. The objective of this work was to test the null hypothesis that some variables remain constant when comparing old breeding areas (*zone a: north*) and new ones (*zone b: south*). These variables included: a) age composition, b) pup mortality during the breeding season and c) rate of increase. Age composition was studied by Principal Component Analysis (PCA) for 2002, 2003 and 2004 breeding seasons. PCA results showed that *zone b* presents a larger proportion of juveniles and subadult males among adult females, while *zone a* was characterized by a larger proportion of pups. For 2002, 2003 and 2004 breeding seasons *zone a* showed 1.9-2.8% of pup mortality, while *zone b* 3.6-5.6% ($p<0,05$). This in part could be explained by the absence of the typical breeding structure which gives protection to the pups from solitary males, or in addition to younger females with lesser experience in nursing pups. Finaly, *zone a* showed a rate of increase of 3% for the period 1983-2004, and not statistically different from 0 for 1994-2004 while *zone b* increased at a rate of 17% for the period 1994-2004, in agreement with a theoretical decrease in high density conditions. Why females breed and nurse their pups in areas where pup survival is lower is still to be understood.

E7 A FINE-SCALE STUDY INVESTIGATING TEMPORAL AND SPATIAL USE OF NEW QUAY BAY, WALES, BY BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

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This study is an investigation into the use of a small bay by a coastal bottlenose dolphin population. New Quay Bay, is a shallow, sheltered bay, within Cardigan Bay, Wales, which has been frequented by dolphins since at least the 1920's. Using land based observations, dolphin presence was recorded between May and September in 2004, 2005 and 2006. In addition, more detailed information about the numbers of animals, their behaviour and habitat use was collected in 2006. Dolphins were found to be present in an average of 29.6% of 15-minute observation intervals, although there was significant monthly variation. September was found to have the highest proportion of dolphin positive intervals, as well as having the highest average group size, compared with other months. The majority of sightings in all months were of single individuals, with a mean group size in all three years of only 1.8 animals. Although group sizes were small, they showed a high degree of fluidity, with groups remaining in the same composition for a mean duration of 30 minutes. Tidal state was shown to have a strong influence on dolphin presence, with an increase during the ebb stage. Dolphins were found to use the bay predominantly for feeding, with this behavioural state being observed 71.1% of the time. However, not all areas of the bay were used with the same frequency. Feeding was shown to occur primarily in two areas at either side of the bay, with the majority of travelling behaviour being across the bay between the two feeding spots. New Quay Bay is thus an important area for bottlenose dolphins, especially as a feeding hotspot, and continued monitoring of this area is vital for the management of the Cardigan Bay bottlenose dolphin population.

E8 RE-EVALUATING THE GENETIC DIVERSITY OF THE EAST SCTOLAND POPULATION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

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The East Scotland population of bottlenose dolphin (*Tursiops truncatus*) is the northernmost population of this species. Its distribution has been documented from the Moray Firth in the north to Fife Ness in the south. The size of the resident core of this population is estimated to be 120 to 150 different individuals. Due to the small size of this population and its geographical isolation from other populations, it has been assumed to be inbred. In a previous study, Parsons *et al*. (2002) found low mitochondrial genetic diversity in a 549 bp section of the control region with only two haplotypes in 15 samples from stranded animals. The aim of our study was to re-evaluate the genetic status of the East Scotland population by using live animals along with a larger set of genetic markers. We took skin biopsy samples of 24 live animals and extracted DNA by standard phenol-chloroform techniques. We developed primers that amplified a larger fragment of the mitochondrial control region and sequenced approximately (640 bp). We found an estimate of nucleotidic diversity (Π=0.00720) similar to that reported by Parsons *et al*. (2002) and the presence of the two previously characterised haplotypes. However the additional 91 bp that we sequenced, revealed a third haplotype in the population. These results confirm that the low level of genetic diversity found in the mitochondrial control region is unlikely to be due to small sample size or the use of stranded animals.

Elegible for Student award

E9 BEHAVIOURAL RESPONSES OF BOTTLENOSE DOLPHINS, *TURSIOPS TRUNCATUS* TO BOAT TRAFFIC IN THE KVARNERIĆ, NORTH-EASTERN ADRIATIC SEA

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The objective of the study was to examine the effects of exposure to boat traffic on the behaviour and respiration of a small, resident bottlenose dolphin population in the Kvarnerić, North-eastern Adriatic Sea. A focal group was followed during boat-based surveys and behavioural data sampled at 3-minute intervals whilst respiration data were collected, by applying a continuous sampling procedure during focal individual follows. The results suggested that boat traffic had a significant impact on the Kvarnerić dolphin behaviour. The behavioural budget in the presence of boats showed a decrease in activities associated with feeding and resting whilst travelling behaviour increased. In terms of behavioural responses, neutral and negative were observed while there were no positive responses of a group. The particular features such as type of boat, propulsion or speed, type of approach, distance from the animals and duration of encounter were important factors in eliciting the behaviour responses. Primarily fast and erratically moving vessels caused negative responses, particularly over extended periods of time. Alternatively, neutral responses were mainly associated with fishing boats, slow moving or stationary vessels. Behavioural responses were observed when boats were within a 300m range of the dolphins, becoming accentuated within 100m. Additionally, it was found that dolphins formed tighter groups when within close proximity of the vessels (χ^2=39.271, df=4, $p<0.001$). No significant differences in respiration pattern were found when in the presence or absence of boats (W=17.0, n=6, $p>0.05$) but it was shown that dolphins performed longer dives during encounters with speedboats than with other boat types (73.8 sec, SD=39.4 *vs.* 19.7sec SD=9.5 respectively). The results obtained during this study may play an important role in defining a code of conduct for tourist boats during dolphin encounters within the borders of the recently established "Lošinj Dolphin Reserve".

E10 FEEDING BEHAVIOUR OF BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) AND FISHING ACTIVITIES IN FILICUDI ISLAND (ITALY)

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Filicudi island is characterized by a great marine biodiversity, favoured by geo-morphological and oceanographic parameters. Accidental captures in driftnets and conflicts with artisanal fishery are the major threats for a local population of bottlenose dolphins. A study over two summer periods (June-September, 2005-2006) was performed in order to assess population size, distribution and both natural and fishing-related behaviours of bottlenose dolphin in the area. Boat and land-based surveys using videocamera and tape voice recorder, photo-identification techniques and instantaneous, focal group and *ad libitum* sampling methods were used. A behavioural catalogue containing 7 modes, formations, configurations and 59 displays was applied to this study. Principal Component Analysis on 49 behaviour characteristics and environmental parameters was used to investigate co-regulated structures in the data. 65 sightings were recorded during 90 survey trips. The social groups showed an irregular distribution in coastal waters, in particular along the rock cliffs and where the sea floor drops to an average depth of 60-100 m. Behavioural activities, mainly related to feeding and travelling, were differently located around the island. Proximity with fishing gears was recorded during 40/65 sightings. Specific actions characterized bottlenose dolphins feeding behaviour in association with fishing gears. First animals were dispersed, then showed a "flower" formation (Bel'kovich *et al*., 1990) with frequent tail slaps. Fifteen individuals were photo-identified. Eight were localized more than one time during the observation period, indicating high site fidelity. Finally, twenty-two boats with driftnets were recorded, 13 of them operating consistently in the area. Over three observations, a total of 40 swordfishes, weighing between 20-150 kg, and 10 tuna, weighing between 20-200 kg, were checked. These data, together with the findings of five dead animals due to bycatch, suggest the need of a conservation plan.

E11 AGONISM DEVELOPMENT IN BOTTLENOSE DOLPHIN CALVES IN A CONTROLLED ENVIRONMENT: EVENT TIME SEQUENCES

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Agonism represents a fundamental element for the establishment of hierarchies in such complex societies as cetaceans ones. In some circumstances agonistic behaviours occur together in a concerted manner; in others, the events are discrete, with recognizable intermediates occurring between them. Since the time sequence of events could provide a means of classification, the aim of this study was to draw the attention to the development of bottlenose dolphin (*Tursiops truncatus*) calf behavioural series, starting from an aggressive display, such as "chasing", "biting" or "tail hitting". In particular, the acts' concatenations were analyzed according to the growth (first semester *vs* second semester of life) of the calves and on the basis of different animals (mother *vs* non-mother) interacting with them. Three subjects (one male and two females) at the Rimini Delfinario (Italy), were focally observed, in three different periods (1995, 1997 and 2003), through systematic observations during the first year of life, for a total of 546 hours. A specific behavioural catalogue and Observer Lag Sequential Analysis were applied to obtain transition matrices and to construct significant flux diagrams ($p<0.05$). Despite subjects' different characteristics (e.g. sex, parents, group composition), after an aggression, independently given or received, young reactions revealed to progress in complex sequences since the early stages of life. Moreover, during the first six months, the direction of the flux leaded the calves to mainly exhibit, after the conflict, locomotory behaviours; in particular, leaping (probability range: 22-100%) and swimming alone (75-100%) were the most probable displays after an active assault, while moving in tight association with other dolphins (37-63%) predominated when the attack was suffered. On the other hand, even if bigger, in the second semester calves frequently showed sequences including reiterated aggressions by conspecifics.

Finally, social interactions, such as contacting or rubbing, immediately appeared only after mother-calf conflicts.

Elegible for Student award: Undergraduate

E12 AGONISM DEVELOPMENT IN BOTTLENOSE DOLPHIN CALVES IN A CONTROLLED ENVIRONMENT: QUANTITY AND NATURE OF INTERACTIONS

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The development of agonism, a survivalist animal behaviour that includes aggression, defence and avoidance, seems to be crucial after the birth, when the calf activities are subject to the most important changes. This study intended to investigate this maturing process in bottlenose dolphin (*Tursiops truncatus*) offsprings, pointing out the gradual appearance of active aggressive acts and quantifying their amount and typology at different ages. Three subjects (one male and two females) at the Rimini Delfinario (Italy), were focally observed, in three different periods (1995, 1997 and 2003), through systematic observations during the first 52 weeks of life, for a total of 546 hours. A specific behavioural catalogue and Observer (Noldus) were applied to measure the frequency and duration of seven conflictual behaviours *a priori* chosen for this study. Despite generalized all over the year low levels (1.00 ± 0.96 events/hour), all calves revealed a significant increase of agonistic rate with growth, with values rising at least seven times in the second semester of life. However, a clear sex difference emerged, with the male showing levels constantly higher than females. Moreover, while the latters received, rather than gave, aggressions throughout the whole first year, the former, from the seventh month on, succeeded in inverting this condition. While threatening behaviours such as "jaw clapping" were never registered in the first year, a non-physical assault such as "chasing" seemed to be the first to be performed, at around two months of life; on the other hand, "tail hitting" was the preferred display between offensive contacts (frequency 36%). As for the dynamics of the conflict, the results showed all the calves attacking and winning more often as they grow up and this probably lead to the observed decrease in reconciliating interactions performed by them.

E13 SEASONAL DISTRIBUTION AND BEHAVIOUR OF BOTTLENOSE DOLPHINS' POPULATION IN PANAMA CITY, FLORIDA

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We evaluated the seasonal variation of the distribution and behaviour of a coastal population of bottlenose dolphin, *Tursiops truncatus*, living in Panama City, Florida. This study was carried out in St Andrew Bay (30°08'N, 85°44'O), from March to June 2004 and October to December 2005. Systematic surveys were conducted using a pontoon boat with 75 horse power in sea state lower than 3 Beaufort. In total, 484h36 were spent at sea to search and observe dolphins. Study area was divided into six zones in order to document preferential use of areas by dolphins. Six behavioural states were recorded following an *ad libitum* method: Playing, social, sexual, begging, foraging and travelling. Results indicate that the mean group size is not different during the day and is approximately of 5 individuals ($p<0.0898$), however the presence of dolphins is not equally distributed in zones ($p<0.0001$). Diurnal behavioural patterns were observed in this dolphin population ($p<0.005$). In this case, foraging and begging activities are more frequently observed at the end of the day (16h00-20h00) and travel does not cease to decrease during the day. A seasonality of behavioural activities is revealed ($p<0.0001$): social behaviour are more often observed during October and November than April and May, when human activities are lower. Begging behaviour are more frequently observed during April and

May while a decrease of foraging activities are established in the month of May. Sexual behaviour are mostly observed during April. The presence of new-born occurred only during the summer. Analysis of behaviours within the different zones is highly significant ($p<0.0001$): Begging behaviours are higher in zone 5 and zone 6 while foraging activities increase in zones 1, 4 and 6; travel budget shows a predominance of occurrence in zones 3 and 6.

Elegible for Student award: Postgraduate

E14 SITE FIDELITY OF BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS* EHRENBERG) IN PLETTENBERG BAY, SOUTH AFRICA

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Site fidelity, group size and the number of groups of bottlenose dolphins (*Tursiops aduncus*) using Plettenberg Bay, South Africa, were determined using systematic survey trips in whale and dolphin watching boats, data collected in an opportunistic manner and photo-identification techniques. For the period of May to August 2006, 56 survey trips were conducted and 29 groups of bottlenose dolphins were encountered. Group size ranged from 1 to 350 dolphins with an overall average of 111.5 (SD ± 102.3). Group size varied by season, with the smaller groups in winter (June, July and August) and larger in autumn (May). The number of groups using the bay was estimated to range between a minimum of three and maximum of five, with the exact number unable to be determined. Five hundred and forty eight individuals were photo-identified during a ten-year period, but resightings were low with a resighting rate of 4.01%. The most frequently sighted dolphins were observed on 3 occasions. A low level of site fidelity was observed, with only 22 dolphins being resighted more than once. In spite of this, different degrees of site fidelity were observed, long-term and short-term. Evidence for site fidelity of up to nine years was observed for one individual. The reasons for such low resighting rate and consequent low level of site fidelity are thought to be: large group and population size affecting the ability to ensure photo-identification of all individuals during an encounter, openness of habitat, potential more extensive home ranges, and possible seasonal migration due to the sardine run.

E15 IMPACT OF TOUR BOATS ON THE BEHAVIOUR AND ENERGETIC OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) OFF CHOROS ISLAND, CHILE

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The aim of this study was to examine how the activities and energetics of bottlenose dolphins off Choros Island, Chile are affected by boats. Swimming speeds and movements of dolphins were recorded via theodolite tracking (n=21.3 observation hours). The results show that close boats (<100 m) affect the behaviour of bottlenose dolphins more strongly than boats further away (>100 m). The activity budget of dolphins did not change significantly with distant boats compared to controls. Close boats, however, induced a decrease of feeding (from 6% to 0%), resting (15% to 5%) and social behaviour (15% to 5%). The proportions of high-speed swimming (5% to 11%) and slow swimming (20% to 38%) increased. In the presence of close boats, dolphins were observed 6 times more frequently to leap and 3.6 times more frequently to tail-slap than under control conditions – an indication of disturbance. Dolphins responded to close boats with evasive manoeuvres similar to predator avoidance. With more than two close boats, animals swam approx. 37% faster than without close boats – a horizontal avoidance strategy. Diving as a vertical avoidance strategy constituted 16% of dolphin reactions towards

close boats. In 14% of the cases, there was a simultaneous occurrence of horizontal and vertical avoidance behaviour. That was mostly the case, when several boats stayed a long time in the proximity of the dolphins. An energy consumption of 2.93 W kg-1 was calculated. This corresponds to a daily energy demand of 50.6 MJ per dolphin assuming 200 kg body mass. With boats at close range, the mean power requirement of dolphins was around 15.4% higher than during controls. With close boats, dolphins used a third of their energy budget to avoid boats by swimming at high speed. In the light of these findings, recommendations for dolphin-watching guidelines are given.

E17 FISH QUALITY AND PREY SELECTION BY DOLPHINS OFF THE BAY OF BISCAY

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To maintain a positive balance between energetic cost and benefit, marine mammals have developed multiple feeding strategies in connection with their specific energy requirements. Oceanic dolphins have high rates of energy expenditure and therefore need to maximise their energy acquisition. Among available prey, do they select the most profitable food source? We conducted 10 hauls with a pelagic trawl over the slope of the bay of Biscay in order to determine relative abundance of epi- and mesopelagic fish species. We analysed body composition (fat, protein, ash and water content) of the ten most abundant ones. These data were compared to published diets of striped and common dolphins in the area. Off the bay of Biscay, a large diversity of fish was observed but only few species were abundant : myctophids (mainly *Notoscopelus kroeyeri* and *Benthosema glaciale*) represented 38% by number of the catch, sternoptychids (*Argyropelecus* spp. and *Maurolicus muelleri*) 31%, alepocephalids (*Xenodermychthys copei*) 21% and paralepidids (*Arctozenus risso*) 7%. The diets of the two dolphins did not reflect these relative abundances. Indeed, myctophids exceeded 50% by number of ingested prey in both species diets, *M. muelleri* amounted to less than 10%, paralepidids less than 5% and alepocephalids were absent. The analysis of fish body composition revealed some important interspecific variations. Lipids were the most variable body component (0.4-11.9 %). This resulted in an important discrepancy in terms of calorific values amongst species. Extreme values were 2.5 kJ/g for *X. copei* against 7.9 kJ/g in *N. kroeyeri*. In dolphin diets, prey species with higher lipid contents and calorific values were more prevalent than predicted from their abundance in pelagic trawl surveys, and conversely for the low energy species. Hence, dolphins in the oceanic part of the bay of Biscay would actively select their prey in order to maximise their energetic intake.

Elegible for Student award: Undergraduate

E18 CONSIDERING DIGESTIBILITY BIASES IN DIETARY ANALYSES OF MARINE MAMMALS: *IN VITRO* AND MODELLING EXPERIMENTS

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Stomach content analyses provide detailed accounts of marine predator diet that are central to many ecological and management issues. However, all prey types are inequally digestible, leading to dramatic biases in the calculated composition of the diet. In this work we aimed at (1) quantifying digestibility for a variety of dolphin prey species by *in vitro* experiments, (2) modelling effect on dietary results by simulation trials and (3) comparing the performances of three correction strategies. Twenty different prey species were digested *in vitro* in fresh water, at 38°C, with pepsine and hydrochloric acid. Prey items were graded every hour on a digestion scale. Species-specific digestion kinetics were obtained by fitting polynomial models to experimental data. In the simulation trials, a thousand virtual stomach contents were created by uniformally drawing prey items from a set of 14 fish species at fixed time interval. Upon ingestion, each prey experienced a virtual digestion simulated by the kinetics obtained *in vitro*, thus creating a stomach containing prey items in various digestion stages. The composition by number of each stomach was then calculated in 4 different ways: no correction (1 diagnostic part present = 1 prey) or three distinct correction strategies allocating more or less importance to every item according to its digestion condition. The complete digestion duration varied, from 14 hours in *Arctozenus risso* to 67 hours in *Trisopterus minutus*. The dietary results obtained without correction differed significantly from the ingested composition, with, for instance *Trachurus trachurus* being overestimated by +120% while *A. risso* and *Engraulis encrasicolus* were underestimated by -60%. All correction strategies resulted in an improved representation of the ingested composition (all biases < 15%) and were ranked according to their performances. It is suggested that previous dietary analyses could be re-examined in the light of these experiments

Elegible for Student award

E19 SPATIO-TEMPORAL NICHE SEGREGATION BETWEEN TWO SYMPATRIC SPECIES OF DOLPHINS IN THE AZORES

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Sympatry between biologically and ecologically similar species implies the existence of mechanisms that reduce competition, such as segregation of ecological niches. In the Azores, two of the most abundant species of cetaceans, the common dolphin (*Delphinus delphis*) and the spotted dolphin of the Atlantic (*Stenella frontalis*), are of similar size and have presumably similar diets. Previous studies suggested that they tended to occupy different habitats and that *S. frontalis* occurred seasonally in the Azores. The aim of the present study was to evaluate the actual degree of spatio-temporal niche segregation between these two species, and to determine whether *D. delphis* switched its spatial niche during the period of occurrence of *S. frontalis*. For this purpose, long-term data obtained during dedicated surveys (1999-2004) and by observers posted on-board tuna fishing vessels (2001-2004) were analysed in relation to physiographic and oceanographic factors, by means of a GIS. *S. frontalis* was observed exclusively during summer (essentially from July to September). *D. delphis* was present year-round, but less abundant during summer. *S. frontalis* preferred rather deep waters situated 2-6 nm from the coast, and was rarely observed in shallow coastal waters. While *D. delphis* exhibited the same preferences as *S. frontalis* between October and May, it switched to shallow coastal waters in summer. *S. frontalis* did not exhibit any preference with respect to water temperature. *D. delphis* preferred cooler waters and areas with medium to high chlorophyll concentrations throughout the year. In conclusion, results indicated partial spatio-temporal segregation between the two species, and a switch in the spatial niche of *D. delphis* in summer. Whether this switch is the fate of the presence of *S. frontalis* or a consequence of temperature variations and prey species distribution is not known, and should be investigated in the future.

E20 COMPARING THE DIET OF COMMON AND SPOTTED DOLPHINS IN THE AZORES AND MADEIRA BASED ON BLUBBER FATTY ACIDS

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The short-beak common dolphin (*Delphinus delphis*) and the Atlantic spotted dolphin (*Stenella frontalis*) are very common species around the Azores and Madeira. Preliminary data suggest that the maximum abundance of one species in a given archipelago corresponds with the minimum of the other. These two species seem to segregate spatially and temporally, but on the other hand, are often involved in poly-specific associations. As the two species presumably have comparable diets, this temporal exclusion could be the result of trophic competition. The aim of this work was to investigate trophic niche partitioning between the two dolphin species using blubber fatty acid profiles. Eighty-six biopsy samples were obtained from live dolphins in the Azores and Madeira. Fatty acids methyl esters (FAME) were prepared directly from the whole blubber and analysed by gas chromatography. The log-transformed proportions of the main fatty acids were analysed by univariate and multivariate methods. In total, 45 fatty acids were identified, 21 of which were present in levels < 0.5% of total fatty acid (comprising 91-94% of total fatty acids). Results showed that gender did not affect fatty acid composition in either dolphin species. There was also no clear separation of the populations according to archipelagos. Nevertheless, comparison between species indicated that they presented distinct blubber fatty acid profiles. Although this result is suggestive of diet differences between the two dolphin species, several confounding factors may also be responsible for this pattern. Sorting out between these factors cannot be achieved by biochemical methods alone. In the future, more effort should be put on trying to identify prey items which are consumed in the wild, and prey samples should be collected for biochemical analyses.

Elegible for Student award

E21 LONG-FINNED PILOT WHALES (*Globicephala melas*) IN THE STRAIT OF GIBRALTAR: DISTRIBUTION AND MOVEMENTS IN RELATION WITH THE TIDES

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The Strait of Gibraltar is well known for its cetacean occurence, but also for strong surface currents wich are affected by the tidal changes. The Spanish foundation firmm® (foundation for information and research on marine mammals) has been studying cetacean abundance, distribution and behaviour in this area since 1998. 1117 recorded sightings between 2001 and 2004 indicate that the resident long-finned pilot whale population uses almost exclusively the southern part of the Strait, above the deeper zones (average ~700 m). Furthermore, there is no evidence from our data for tidal influence on the local distribution or the movement behaviour of these animals. Although the dimension of the currents changes with the tides, pilot whales stay in the same area and show no significant differences in their motional pattern. This information is important basic knowledge to study the potential impact the new commercial harbour close to Tangier is going to have on the resident pilot whale population, and by extrapolation, on all the other resident cetacean populations in the Strait of Gibraltar.

E22 SHORT SEASONAL ABSENCE OF LONG-FINNED PILOT WHALES IN THE STRAIT OF GIBRALTAR

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Long-finned pilot whales (*Globicephala melas*) are resident in the Strait of Gibraltar. Because of their predictable presence and distribution, they account for most of the sightings and represent the main target for whale-watching operators. The total population of resident pilot whales has been estimated to about 300 individuals. Nevertheless, these groups have been reported to disappear for one or two weeks each spring/summer, causing certain stress among whale-watching operators. Our research took place in the Strait of Gibraltar from an opportunistic platform of whale watching, from May to October 2003 through 2006. During each sighting, large numbers of offspring were observed. Although newborns are present throughout the entire sighting season, a peak of neonates has been observed just after the pilot whales return from their absence. The Strait of Gibraltar has very strong currents and winds, and it is the second busiest place in the world for shipping. Additionnally, interactions between long-finned pilot whales and killer whales (Orcinus orca) in the Strait of Gibraltar have recently been described, the former chasing the latter. The period during which long-finned pilot whales disappeared in 2003 and 2004 coincided with the apparition of killer whales in the Strait of Gibraltar, but it did not coincide in later seasons. We postulate that the majority, or the totality of the long-finned pilot whale population moves from the Strait of Gibraltar to calmer and safer waters of the Alboran Sea during this time to give birth.

Elegible for Student award: Postgraduate

E23 ANALYSIS OF THE DIET OF PILOT WHALE (*GLOBICEPHALA MELAS*) FROM THE STRAIT OF GIBRALTAR

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Differences in stable nitrogen (δ15N) and carbon (δ13C) isotope ratios have provided valuable insights into the trophic ecology and movements of many species. In contrast stomach contents can reveal the detailed composition of the diet. The aim of this work is to determine the diet of the long finned pilot whales that inhabit the Strait of Gibraltar. A total of 70 skin biopsies were taken during the winter 2005 (n=6), and the summer 2006 (n=64). We analyzed δ13C and δ15N in skin samples collected, in order to determine their trophic level and get information on the ecosystem where they live. After lipid extraction from samples using chloroform and methanol rinses, δ13C and δ15N were performed by mass spectrometry. The stable isotopes are then compared with the stomach contents of the animals resulting from a mass stranding in the Strait (6 animals) in 2006. The stable isotopes and the stomach contents show that their diet would be based mainly on cephalopods and small fishes. This poster compares the diet between sexes (known from genetic analysis of the skin sample), and the season of the year (summer vs. winter).

Elegible for Student award: Undergraduate

E24 SEX DETERMINATION FROM BIOPSIES OF LONG-FINNED PILOT WHALES

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The population of long-finned pilot whales is studied by the research group CIRCE in the Strait of Gibraltar since 1999. So far the gender of the individuals could only be attributed to very large individuals (males) or mother closely associated with a calf. Twelve males and 21 females were known from observations at sea and through picture analysis. Therefore biopsies were taken from 56 known individuals in order to sex them among the 264 known individuals occurring in the Strait. The DNA was extracted from the skin sample. A first PCR was then conducted with the primers specific for an intron in the ZFX and ZFY genes. The results were analysed by agarose gel electrophoresis. These primers allow the differentiation between males (2 bands X and Y) and females (1band XX). A confirmation of the results was carried out using the primer specific for the SRY gene which is positive for males (1 band) and negative for females (no band). In total 23 females and 33 males were identified and confirmed from both techniques. These sex identifications are required to investigate the future possible sex differences in vital parameters as well as the social grouping of individuals according to their sex. This ongoing study will be further completed by the sampling of a larger number of pilot whales. The social structure and mating system will also be investigated using microsatellite genetic technique.

Eligible for Student award: Postgraduate

E25 LONG-FINNED PILOT WHALE RESPONSE TO WHALE-WATCHING VESSELS IN THE STRAIT OF GIBRALTAR

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Four resident species of cetaceans coexist in the Strait of Gibraltar, among which the long-finned pilot whale (*Globicephala melas*) is the most frequently sighted. Our study has been conducted during the past four years (2003-2006), from April to November. The amount of whale-watching operators, as well as the amount of whale-watching tours per boat has increased during the study period. We have recorded the response of the targeted species towards the whale-watching boat from which we collected our data. The response was categorised in 3 different types: approach, indifference and avoidance. The number of avoidances was compared from year to year with a t-test, which showed significant differences (p-value < 0.05). The 3 types of response were statistically confronted (ANOVA 1) against all the variables collected (e.g. wind strength, direction, tides,...). The avoidance response differed significantly (p-value < 0.05) according to the seasons and to the presence/absence of offspring. Most avoidance behaviour was found to be concentrated in the years 2004 and 2005, coinciding with an increase in whale-watching vessels and with a time when no coordination efforts amongst whale-watching operators existed. We thus conclude that the response behaviour of pilot whales in the Strait of Gibraltar is directly linked to the presence of calves in the group, as well as to the amount of whale-watching vessels actively operating and their mutual collaboration.

Elegible for Student award: Postgraduate

E26 KILLER WHALE (*ORCINUS ORCA*) DIET IN THE STRAIT OF GIBRALTAR

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Killer whale presence in the Strait of Gibraltar is related to the migration of bluefin tuna (*Thunnus thynnus*) through the area. Two groups of orcas feed on tuna during 2 different seasons and using 2 different hunting strategies. Nevertheless, field observations since 2004 have allowed to witness orca predation on other fish species, including sunfish (*Mola mola*), "Voráz" or Blackspot seabream (*Pagellus bogaraveo*) and "palometa negra" or Atlantic pomfret (*Brama brama*). In the case of sunfish, on several occasions adult killer whales were observed catching the fish, and then leaving it to the calves to train their skills. Regarding both other fish species, there seem to be interactions between orcas and the fisheries. Common cuttlefish ("Choco", "sepia común", *Sepia officinalis*) has also been reported as being preyed upon by killer whales, maybe explaining a possible competitive exclusion between pilot whales and killer whales, the former chasing the latter. A female adult killer whale stranded in May 2006 presented a few cephalopod beaks in her stomach. So far no predation of killer whales on other cetaceans has been observed in the Strait of Gibraltar, although there are historical accounts of orcas attacking fin whales (*Balaenoptera physalus*) in the area. Killer whale diet has also been determined by fatty acid analysis in different areas of the world, but as these groups in the Strait of Gibraltar are small, probably isolated and already under constant anthropogenic pressure, we would not recommend taking biopsies of this population.

E27 TOWARDS AN UNDERSTANDING OF THE POPULATION STRUCTURE OF THE KILLER WHALES (ORCINUS ORCA) OF AVACHA GULF (KAMCHATKA, RUSSIA, NORTHWEST PACIFIC)

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A study of the population structure of killer whales in Avacha Gulf, Russia, looked at (1) stability and composition of killer whale groups and associations between groups, (2) frequency of use of Avacha Gulf, and (3) ecological types of killer whales present. The main data were collected during summer seasons in 2005-2006 when 434 killer whales were identified and 928 groups encountered. Additional data from 1999-2004 were used to establish the regularity of occurrence in Avacha Gulf by each group, and the relationships between and within groups. Using SOCPROG 2.2 and a simple ratio index, 55 stable groups were distinguished. 29 "local groups" visited the gulf during 4-7 years while 22 "strange groups" were encountered during 1-2 years. The relative frequency of encounters per season was greater in local groups than in strange groups ($p<0,001$). Three groups visited the gulf during three years. Members of most of the groups (AVR) looked like resident killer whales (fish-eating) of the Northeast Pacific by dorsal fin shape and saddle patch pigmentation. Killer whales from seven strange groups (AVT) showed morphological features known for transient (mammal-eating) killer whales. We also compared sizes of encounters between AVR ($n=75$) and AVT ($n=8$) and found significant differences ($p<0,001$). AVT killer whales were found in the gulf alone or in pairs while the minimum encounter size of AVR killer whale groups was four. The sex and age compositions and sizes of AVR groups were similar to those of matrilines/subpods of resident killer whale groups. Our results indicate that: (1) the killer whales of Avacha Gulf form stable groups that include maternal relatives, (2) some groups use Avacha Gulf regularly and some only

occasionally, (3) most killer whales of Avacha Gulf are the resident ecological type but a few are the transient type

Elegible for Student award: Postgraduate

E29 A TROPHIC SHIFT OFF WEST SCOTLAND: MINKE WHALES AND BASKING SHARKS

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The distribution of large marine predators is primarily determined by the distribution of their prey. Changes in the observed distribution and abundance of cetaceans and basking sharks along the west coast of Scotland during 2005 and 2006, coinciding with substantial declines in reproductive success in several species of seabirds, suggests that a prey shift has occurred in the region. Surveys for cetaceans and basking sharks were conducted throughout the Inner Hebrides during summer months from 2003-2006. The minke whales sighted per hour of on-effort transect sampling from June through August declined by 66% during this time, corresponding to a 285% increase in basking shark sightings (R = -0.762). The decline in minke whale sightings was most pronounced in the waters from the north coast of Mull to the south coast of Skye, the area which also saw the largest increase in basking shark sightings. These observations are consistent with a shift in available prey from fish to large zoo-plankton. Minke whales on the west coast of Scotland have been described as feeding primarily on lesser sand lance and Atlantic herring. Both of these species are largely planktivorous, and reduced predation pressure resulting from a simultaneous decline in both appears to have resulted in an increase in prey for planktivourous basking sharks.

E30 DATA ON THE DISTRIBUTION AND FEEDING OF FIN WHALES OFF THE GALICIAN COASTS

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One of the aims of a next CODA (Cetacean Offshore Distribution and Abundance in the European Atlantic)-IEO survey, is to investigate the presence of fin whales and their prey off the Galician coast. As a preparation it was considered useful to look at the available historical information regarding fin whale presence off Galicia. Some observations about fin whale feeding are also presented here. The catch statistics for 1952 – 1985 were analysed for patterns of seasonal distribution. Information about the geographic distribution of fin whales was obtained from positions in the catch statistics, from sightings made by the whaling boats and from several sighting surveys. These positions were represented in charts with bathymetric profiles to visualise the distribution of whales in relation with the sea bottom topography. The prey species found in the stomachs of 17 individuals caught during the 1983 season were identified and their degree of digestion and semi-quantitative abundance evaluated. Throughout the historic series more than 70 % of the catches occur between July and September. Some temporal distributional patterns can be described along the time series and in relation with annual values of NAO and Gulf Stream indices. Positions of catches and sightings data were plotted by months and compared to show the seasonal distribution and relative movements of fin whales. Only 3 of the 17 stomachs were empty. The prey most commonly found (85.7 % of the stomachs with food) was the euphausiid *Meganycthiphanes norvegica*. One whale has only the gadoid fish *Micromesistius poutassou* and another whale a mixture of both items. The

degree of digestion and the amount of food in the stomachs suggest a morning feeding period. The position and dates of the catches of these specimens could also indicate areas where euphausiids and fish were locally abundant in that particular year.

E31 DIETS OF PISCIVOROUS SMALL CETACEANS FROM THE SCOTTISH AND GALICIAN COASTS

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Although published data are available on diets of the most common small cetacean species from Scottish and Galician waters (harbour porpoise *Phocoena phocoena* and common and bottlenose dolphins *Delphinus delphis* and *Tursiops truncatus*), information on the diets of other small cetaceans in these areas is scarce. During 1991-2004, we analysed stomach contents of 20 common dolphins, 22 white-beaked dolphins (*Lagenorhynchus albirostris*), 18 white-sided dolphins (*Lagenorhynchus acutus*), 21 striped dolphins (*Stenella coeruleoalba*) stranded on the Scottish coast, as well as 32 harbour porpoises, 28 striped dolphins and two white-sided dolphins from the Galician coast. Here we summarise these unpublished data, comparing feeding niches of the different species and comparing with dietary data on the same species from other parts of Europe. Gadid fish, notably whiting, were the most important prey of small delphinids in Scottish waters, except for white-beaked dolphins in which haddock was the most important species; white-beaked dolphins were also the only species in which cod made up more than 10% of the diet. Only common dolphins had taken a significant proportion of pelagic fish (mackerel, clupeids). In Galicia this species eats mainly blue whiting and sardine. White-sided dolphin was the only species in which sandeels were important in the diet. In striped dophins, gonatid squid were the third most important prey. The most important prey of porpoise from Galicia were scad, blue whiting and *Trispoterus*: only the latter features significantly in the diet of this species from Scottish waters, where sandeel and whiting are the most important prey. The two white-sided dolphins from Galicia had eaten mainly blue whiting, mackerel and silvery pout. The diet of striped dolphins from Galicia was diverse, with scad, blue whiting and gonatid squid all important. In general, more pelagic species appear in cetacean diets from Galicia, even in the case of porpoises.

E32 DIETS OF TEUTHOPHAGOUS SMALL CETACEANS FROM THE SCOTTISH AND GALICIAN COASTS

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During 1991-2004, we analysed stomach contents of 11 Risso's dolphins (*Grampus griseus*) and 6 long-finned pilot whales (*Globicephalus melas*) stranded on the Scottish coast, as well as 16 Risso's dolphins and 21 long-finned pilot whales from the Galician coast. Here we summarise these unpublished data, comparing feeding niches of the two species in terms of the species and size of prey eaten, and comparing our results with dietary data on the same species from other parts of Europe. Both species feed primarily on octopods and ommastrephid squids. The diets of the two species in Scotland consisted almost exclusively of cephalopods; ommastrephid squid in pilot whales and octopus (*Eledone cirrhosa*) in Risso's dolphin, in

which octopus make up almost 90% of the diet. In Galicia, pilot whales had eaten mainly the octopuses *Eledone cirrhosa* and *Octopus vulgaris*, with ommastrephid squid being the third most important prey category. *Octopus vulgaris*, a species that is absent from Scottish waters was the main prey of Risso's dolphin, making up over 80% of the diet. Pilot whales have a broader diet than Risso's dolphins, including some fish: remains of gadid fishes were present in pilot whale stomachs from both areas.

E33 DO FEEDING HABITS FROM CANARY ISLANDS CETACEANS DIFFER FROM THOSE OF THEIR COASTAL RELATIVES?

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The Canary Islands are a major hotspot for marine mammals in European waters with 28 cetacean species recorded in the archipelago. Unique oceanographic characteristics are adequate for tropical and temperate-water cetaceans while the small extension of the continental shelf leads to the presence of both oceanic and inshore species. The aims of this study are to compare feeding habits of Canary Island cetaceans with other European populations that inhabit more coastal environments and to consider the likehood of competition for food between different cetacean species in the area. We analysed 23 non-empty stomachs from animals stranded between 1996 and 2006 including 13 species from the families Delphinidae, Physeteridae, Kogiidae and Ziphiidae. Two stomach did not contained hard remains and prey identification to species level was not possible. Cephalopod beaks were found in the remaining 21 stomachs whereas fish remains (otoliths and bones) were found only in 4 stomachs. Cephalopods of the families Ommastrephidae, Sepiidae and Enoploteuthidae were an important resource for dolphins whereas whales showed a preference for the oceanic families Histiotheutidae, Chiroteuthidae and Mastigoteuthidae. Almost 30% of the animals had plastics among the stomach contents with big plastic items being eaten by deep diving teuthophagous species. Plastic could be an important threat that needs to be considered in future conservation plans.

Elegible for Student award

E34 HIGH WHALE WATCH VESSEL ABUNDANCE AFFECTS THE DAILY RESTING PATTERN OF RISSO'S DOLPHIN

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Off the coast of Pico island, Azores, Risso's dolphins (*Grampus griseus*) can be observed from land on a daily basis. Within the light of a growing whale watching industry, we studied the effects of the presence of whale watching vessels on the resting behaviour of Risso's dolphins. The dolphins' behaviour and whale watching vessel abundance were observed from a permanent land-based platform, using 25x80 binoculars. During 2004 and 2005 (370 observation days), 275 hours of Risso's dolphin behaviour (focal group follow) was recorded. Risso's dolphins were present on 315 days during 85% of the observations. Whale watching vessels were present on 190 days during 41% of the observations. During both seasons, whale watching pressure changed over the season, with significant higher vessel abundance during the months of July and August (high season). The average daily vessel abundance increased from 1,9 in the low season (May, June, September and October) to 5.0 in the high season. Also,

vessel abundance showed a bimodal distribution over the day, with high abundance from 10 AM-12 PM and 3-5 PM, and low vessel abundance from 1-3 PM. Analysis of Risso's dolphins daily behavioural patterns, revealed a negative correlation between the dolphins' resting rate and vessel abundance. In the high season, resting rates peaked when vessel abundance was low between 1-3 PM, whereas no such peak was observed during the low season. Although overall resting rate between the years differed significantly, the observed daily resting patterns, including the shift during the high season, remained identical. This strongly suggests that patterns of Risso's dolphin resting behaviour are influenced by high pressure activities, whereby the timing of resting behaviour is shifted towards lowest vessel abundance.

Elegible for Student award: Postgraduate

E35 CETACEAN IN THE WESTERN MEDITERRANEAN AND THE OCEANOGRAPHIC CONTEXT

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Most studies on cetacean distribution in the Western Mediterranean were performed from visual observations. The observation effort has been essentially carried out in the Northern part of the basin and during summer. From such available datasets, distribution and abundance at basin spatial scale and annual temporal scale cannot be assessed. Since September 2006, an observation program is conducted twice a month along a transect realized on a ferry-boat between Marseille (France) and Algiers (Algeria), which is equipped with a thermosalinometer (measuring surface temperature and salinity) and a fluorometer (for phytoplankton chlorophyll estimation) within the framework of the TRANSMED (monitoring program of the surface of the Mediterranean). The aim of the study is to create the first annual series of cetacean – oceanographic environment at high temporal resolution and at basin scale. The strategy is to acquire on board simultaneous in-situ oceanographic parameters and visual observations in accordance with the oceanographic context in the basin from the satellite imagery. This database should allow us to analyse the variability of cetacean distribution in agreement with the spatio-temporal variability of oceanographic features. We will especially look for the influence of mesoscale phenomenon such as eddies in the Algerian basin, where very few data exists, on cetacean distribution. Moreover this program should give new information on suspected cetacean movements, with a special focus on fin whales. First results obtained during fall indicate the presence of 6 identified species, 4 north of the Balearic Islands (fin whale, striped dolphin, Risso's dolphin and sperm whale) and 5 in the south (fin whale, striped dolphin, short beaked common dolphin, sperm whale, long-finned pilot whale).

Elegible for Student award: Postgraduate

E36 PRELIMINARY CHARACTERISTICS OF WINTER HABITAT OF THE FIN WHALE IN THE MEDITERRANEAN SEA AND COMPARISON TO THE SUMMER ONE

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The conservation of the cetacean population inhabiting in the *Pelagos Sanctuary* lays on an integrative protection of all critical habitats. The first step was to search oceanographic indicators of fin whale aggregations during summer in the north-western Mediterranean Sea. Results pointed out that fin whales mostly feed on *Meganyctiphanes norvegica*, abundant Euphausiid during this period of the year, in the area. However, indications lack on the species distribution during winter. Recent information identified one of the possible wintering habitat, in the south-western Mediterranean Sea, off the Lampedusa Island. This winter feeding ground may depend on another Euphausiid, *Nyctiphanes couchi*, linked to specific oceanographic features. Though the analysis of the oceanographic relationships with fin whale presence in the north and the south part of the Mediterranean Sea, this study propose to compare the two habitats. A common protocol was followed to monitor the Ligurian sea and the two southern areas: the Messina Strait and the offshore of the Lampedusa Island. 124 sightings were recorded in the Ligurian Sea, 31 sightings in the Messina Strait and 16 sightings off the Lampedusa for a total of more than 25,000km surveyed. Oceanographic parameters analyzed to describe the habitats were the depth, the bottom slope and the daily-remote-sensing SST. In the Messina strait, the mean depth of fin whale positions is 187m (SD=149), the mean bottom slope is 54m/km (SD=32) and the temperature is 16.7°C (SD=2.2°C). Off the Lampedusa, the mean depth is 47m (SD=62), the mean bottom slope is 8m/km (SD=6) and the temperature is 17.9°C (SD=1.4°C). The results are clearly different from those obtained in the Ligurian Sea (mean depth=1967m, bottom slope=53m/km and daily-SST=22.2°C). Considering that summer and winter habitats appear different, it is fundamental to improve southern surveys for reliable conservation of probable unique Mediterranean population.

E37 PRELIMINARY RESULTS ON CUVIER'S BEAKED WHALE SOCIAL STRUCTURE IN THE NORTHERN LIGURIAN SEA

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The northern part of the Pelagos Sanctuary it is inhabited by a population of ~90 Cuvier's beaked whales (Ziphius cavirostris G.Cuvier, 1823) but the social structure of this population, defined as the pattern of relationship between individuals, is still unknown. The social structure of a population plays a key role in many aspects of ecology and biology of cetacean specie even though, it's very difficult to abstract social structure for the deep-diving specie like the Ziphiidae specie. To fill this gap we tracked the grouping structure of Cuvier's beaked whales at an individual level, over a period of three years from 2003 to 2006 (73 photo-id surveys, a total of 81 group sighted) using photo-identification and recently developed analytical techniques. Fifty-five different individuals photographed on both left and right sides were distinguished and sexed on a basis of distinctive marks, the head coloration patterns and the presence/absence of two teeth on the lower mandible. We have made average-linkage cluster analyses of associations between well-marked individuals (n=38) seen on ≥2 days using only encounters in which at least 50% of all whales estimated to be present had been photo-identified. The null half-weighted index (HWInull) grouped the individuals in seven different mixed-age sub-groups. Associations within immature classes present a HWI significantly higher than associations within mature male and mature female classes. The assortativity coefficient shows there is not assortative mixing by age or sex classes, instead individuals seem to be randomly mixing. Following these results the Cuvier's beaked whale social structure seems to be one of a fission-fusion society. In other words, the Cuvier's beaked whale seems to live in communities whose members form frequent changing schools.

Elegible for Student award: Postgraduate

E38 BIOLOGICAL CONSEQUENCES OF GLOBAL WARMING: DOES SEA SURFACE TEMPERATURE AFFECT CETACEAN DISTRIBUTION IN THE WESTERN LIGURIAN SEA?

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For over a century, the important role that the climate plays in the geographic distribution of the world's ecosystems and of the wildlife they support has been documented. It is now quite evident that the climate these species depend upon is changing. One of the major, most well-documented, and robust findings in ecology over the past century has been the crucial role of climate in determining the geographical distribution of species and ecological communities. Climate variability and change can affect biomas in a number of ways, including shifts in species distribution. These ecological responses to changes in climate have important implications, given historical and continuing human-induced changes in the global climate. Aim of this study was to assess if sea surface temperature does affect cetacean distribution in the Western Ligurian Sea. Relationships with temperature were investigated for: striped dolphin (*Stenella coeruleoalba*), fin whale (*Balaenoptera physalus*) and sperm whale (*Physeter macrocephalus*). Remotely sensed Sea Surface Temperature (SST) data were studied. A series of 20 monthly images (i.e. June to September monthly images from 1996 to 2000) was considered. Concurrently, distribution data collected during shipboard summer surveys, and covering an area of about 20,000 km^2 in the Western Ligurian sea, were analysed. The relationship between the three species presence and SST was investigated by using a grid of 3x2 nautical miles cell units. For every cell the SST mean, SD, CV and the deviation from the monthly average were calculated. Finally, binary logistic regression functions allowed to assess significant ($P<0.05$) relationships with temperature in these species. These logistic models, were able to predict 60-78% of the species presence(1)/absence(0) cells, and suggest the need for further investigations spanning on longer time periods to assess how the global climate change has been changing and will change in the future cetacean distribution in The Western Ligurian Sea.

E40 TEODOLITE OBSERVATIONS OF THE GRAY WHALE IN THE REGION OF THE INTENSIVE GAS AND OIL EXTRACTION

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Teodolite observations were made during 2004-2006s (financed by IFAW and WWF) near offshore feeding region of western gray whale (Sakhalin Island, Russia), which counts approximately 100 animals. In this region intensive gas and oil extraction are executed, and on 30 July 2005 a new sea oil platform was deployed. Observations were done in 2004 from Pil'tunskaya Spit which is situated along the animals feeding region, and in 2005-2006 from the lighthouse 32 m high, which is situated opposite the entrance to the Pil'tun Bay. Teodolite survey was made with digital teodolite Topcon DT-102. Program Pythagoras (Glenn Gailey and Joel Ortega) recalculated angles to geographic coordinates in real-time, but also travel speed of the whale, track movement and etc. For analyze we took all whale tracks that we observed not less than15 minutes and compared average parameters of every whale before and after the platform deploying. Using ANOVA method and Mann-Whitney U Test (program Statistica 6.0) we have found reliable dependence changes parameters: ANOVA - Sum Bearing Change &

Distance Good Made (F=4,79948; Effect df= 2; p= 0,010037) and Sum Bearing Change & Total Distance Traveled (F= 8,68111; Effect df= 2; p= 0,000316) depending on absence/ presence of the sea platform and Mann-Whitney U Test - Avg Dist Btw Fixes (p=0,000015), Avg Time Btw Fixes (p=0,000019), Distance Made Good (p=0,006953), Total Distance Traveled (p=0,032535), Sum Bearing Changes (p=0,001864), Reorientation Rate (p=0,000010). For the analyses we took 72 whales before and 41 whales after construction of the new sea oil producing platform. We saw that the intensive navigation and construction of the new platform exerted some influence on behavior of the gray whales.

Elegible for Student award: Undergraduate

E41 RESEARCH OF CHANGE SOME ASPECTS OF GRAY WHALES BEHAVIOR IN THE REGION OF THE INTENSIVE GAS AND OIL EXTRACTION

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Observations of endangered population of western gray whales were made from the shore in summer-autumn period of 2004-2006 and were sponsored by the IFAW (2005-2006) and WWF (2004). The feeding region of the gray whales is offshore of the northern-eastern part of the Sakhalin Island, Russia. Every year the development of gas and oil extraction and navigation grow in this region, and of July 30, 2005 a new sea platform was constructed 6 km from the animals' feeding place. We made a comparison analysis of aspects of behavior of every whale individually in program Pythagoras (on real-time), writing – blow, deep diving and est. We made comparison analyses of behavior of the gray whales before and after platform construction. For the analysis intervals between blow (breath) whales were taken, which breaks up in 3 types: 0-29 seconds – a whale rest after deep diving (feeding, traveling), 30-120 seconds – whales traveling (not deep diving), 121-400 seconds – deep diving (feeding). We made analysis using program Statistica 6.0 - method ANOVA and Mann-Whitney U Test (nonparametric methods). We found reliable dependence changes (Mann-Whitney U Test) between monthly changes with traveling (feeding and resting p= 0,000000) whales and platform absence/ presence (p= 0,000000; p=0,041512), monthly changes with resting whales and platform absence/ presence (p= 0,000000)/ etc. Method ANOVA showed reliable dependence of changes of all patterns of behavior - monthly and yearly - depending on absence/ presence of the platform. For the analyses we used data for 57 whales before and 39 whales after platform construction. From these results a conclusion can be made that intensive anthropogenic factor influenced all aspects of gray whales behavior.

Elegible for Student award: Undergraduate

E42 TIDAL INFLUENCES ON NARWHAL MOVEMENTS AND POD SIZE

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In the summer, narwhals show daily movements in and out the fjords and bays of Baffin Island and Greenland. Past research has demonstrated that oceanic currents produced by the tide can influence daily movements. For example, species of cod, sole and silver heel travel with tidal currents to reduce the energetic costs of locomotion. We tested the hypothesis that narwhals time their daily movements to travel with the tidal currents. We observed narwhals in Koluktoo Bay (Baffin Island) during the summer of 2006. We recorded the size of narwhal pods and their movement patterns, in relation to the tidal cycle. We used in part circular statistics to analyse the data. We observed that narwhals enter the bay in bigger pods than when they leave it. Their movements in an out of the bay are neither uniformly nor normally distributed around the tidal cycle (Watson test: $p < 0.01$). Narwhal entries were highly cluster at high tide and to a lesser extend at low tide while narwhal exits were more evenly distributed at high and flood tide. Given that the presence of narwhals in the bay relates more to social behaviour than to foraging behaviour, we suggest that the tide serves as a cue to synchronize the gathering of narwhals in the bay.

Elegible for Student award: Postgraduate

E43 EVOLUTION OF PUP PRODUCTION AND PUP MORTALITY RATE OF THE MEDITERRANEAN MONK SEAL COLONY OF CABO BLANCO (MAURITANIA-MOROCCO) AFTER A MASS MORTALITY EPISODE

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The Mediterranean monk seal is one of the most threatened species of mammals in the world. No more than 500 individuals survive in its distribution range. The Cabo Blanco peninsula population (Mauritania-Morocco) is considered the largest aggregation for the species and the only one that still keeps a colonial structure. A continuous monitoring of the population productivity and pup annual survival rate has been performed from 1995 to 2006. Reproductive females use the narrow beaches of the interior of two caves to breed their pups. This suboptimal habitat has been related to high pup morality rates (PMR) during the bad sea conditions season (October-march). Births are distributed all along the year, although a peak is produced during some months. In 1997, the colony suffered a massive die-off that drastically reduced population size and productivity. After this episode, productivity has began to progressively increase from 25 pups in 1998 to 48 in 2006. An increase of 65,52 % has been produced between 2005 and 2006. Also, the peak of births has been producing sooner year by year, from october-november before 1997 to august-september in 2006. This fact has lead to a reduction in the PMR from a 0,53 in the period 1995-1997 to a 0,36 in the four last years (2003-2006). This reduction in PMR and the increase in pup production suggest the progressive recovery of the Cabo Blanco monk seal colony.

E44 FACTORS INFLUENCING HARBOUR SEALS HAULOUT BEHAVIOUR IN THE *BAIE DU MONT SAINT MICHEL*, FRANCE, AS ASSESSED BY GPS/GSM TELEMETRY

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Harbour seals *Phoca vitulina* of the *Baie du Mont Saint Michel*, France, have to deal with one of the highest tidal ranges in the World (14 meters). This dramatic environmental influence and the absence of high tide haulout sites allowed us to assess the influence of environmental factors on seals' haulout behaviour, and use these results for local abundance estimates. We used a new generation of telemetry tools, the Fastloc® GPS/GSM tags (Sea Mammal Research Unit). Five seals were tracked for 52 days on average (range 16-95) from January to July 2006. None of them moved outside the Bay, using a home range of less than 130 Km². They hauled out during 70 to 95% of the days, spending on average 20% of their tracking time on land (range 12-30%). Cumulative haulout durations showed a clear Gaussian distribution around time of low tide, haulouts usually starting 2.5 hours before and finishing 2.5 hours after. Diurnal influence varied among individuals but most seals hauled out more during the afternoon, and less in the early morning and early night. These last two periods corresponded to periods of higher diving activity, but it must also be noted that low tides at these times of the day corresponded to the smallest tidal ranges. We suggest that time of low tide mainly influences haulout behaviour in the Bay, but that both foraging activity and smallest tidal ranges (reducing the haulout site availability) reduce this haulout activity at dawn and dusk. Air temperature and sea state also significantly influenced haulout: lower temperatures and heavy seas reduced haulout frequency. As a consequence, we recommend that aerial surveys be conducted on days with low tides in the afternoon, and our results suggest that the proportion of seals hauled out during these winter surveys is of 55%

E45 DETERMINATION OF A PREFERENTIAL PUPPING AREA FOR HARBOUR SEALS IN THE *BAIE DU MONT SAINT MICHEL*, FRANCE

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A small harbour seal colony is settled in the *Baie du Mont Saint Michel* since the 1980's. Monitoring this southernmost colony for the species in Europe remains difficult due to the extent of the estuary (25000 ha) and the highest tidal range in Europe. Since 2002 aerial surveys of the colony are conducted by ULM. This method particularly suits the geomorphology of the bay. It allows, thanks to GPS and photography, a high precision in localisation and identification of individual seals. Surveys are conducted twice a week, 30 minutes before low tide. More surveys are conducted during the breeding period (July) in order to detect all births. Aerial surveys follow the track of the channels of the bay and last 20 to 30 minutes. On average 8 pups are born each year in the *Baie du Mont Saint Michel*. Spatial results from these last 5 years highlight the precise location of pupping sites, in the south part of the bay where tidal currents are weaker than in other channels. This pupping area is located close to high-tide haulout sites, but also in the vicinity of human activities (fisheries, ecotourism) which expose mother-pup pairs to disturbance. This long-term spatial information provides managers with crucial ecological bases for the conservation of the colony during summer, when dense human presence coincides with the critical breeding period of the seals.

E46 MOVEMENTS OF CAPTIVE BRED AND REHABILITATED JUVENILE GREY SEALS (*HALICHOERUS GRYPUS*) RELEASED IN THE BALTIC SEA

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The Baltic grey seal (*Halichoerus grypus*) population size was depleted from an estimate of 100 000 individuals in the early 20th century to less then 4000 in the 1970s. The decline was due to hunting and a disease complex caused by environmental toxins such as polychlorinated biphenyls (PCBs). In 1980 the Swedish museum of Natural History and the World Wide Fund for Nature, WWF, and in 1996 the University of Gdansk, started a breeding program for the Baltic grey seal and seals born in captivity were released to the Southern Baltic.To monitor how seals bred or rehabilitated in captivity behaved when released to the wild and to monitor their survival, eight juvenile seals from Sweden and thirteen juveniles from Poland were tagged with satellite transmitters (SPOT-tags, Wildlife computers, Seattle, WA, USA) between 2002-2006. The deployments lasted from seventeen to 227 days, except for four animals that drowned in fishing gear shortly after release. Seals released in Poland differed from seals released in Sweden in distance from release site to best coordinate per day. The mean distance were 200 km (mean range: 128 - 323 km) by seals released in Poland and 68 km (mean range: 10-153 km) by seals released in Sweden. Seal movements could in general be divided into two phases; one exploratory phase when seals moved rapidly from the release site and one more stationary phase when seals settled in an area with other seals. This pattern differed between the groups; all the Swedish seals returned to the release site area after the exploratory phase and 11 of 13 seals released in Poland settled on average 250 kilometers (mean range: 157-430 km) from the release site. We consider the longer movements by polish seals as an effect of that Poland host no permanent grey seal haul outs.

Elegible for Student award: Undergraduate

E47 SEALS AT SEA – DISTRIBUTION AND HABITAT USE AWAY FROM THE SANDBANK

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The German Wadden Sea is an important habitat for about 12,000 harbour seals and 200 grey seals. Counts conducted of hauled-out seals on sandbanks and islands are used to estimate population size and provide information on coastal distribution, particularly during low tides. However, little is known about how seals use the Wadden Sea and offshore waters of the German Bight when they are not hauled-out. This information is vital for the conservation and management of these animals as the human use in offshore waters, e.g. the construction of wind farms, is increasing steadily. From 2002 to 2006 aerial line-transect distance sampling surveys for marine mammals were conducted in German North Sea waters. For each seal sighting the distance to transect line, group size, behaviour and a wide range of environmental parameters were collected. Distance sampling methodology was combined with GAM (generalized additive model) and GIS analyses to conduct a spatially explicit analysis of seal habitat in the German North Sea. During the survey a total of 364 seals was recorded. Distribution and relative densities (animals/km) were visualized in a grid of 10x10km cell size. A detection function for seals was fitted, taking into account multivariate parameters. The results showed that the detection function did not change with tidal state or sea state but was dominantly influenced by cloud cover. Relationships between environmental parameters and seal distribution were further investigated using GAMs. Distance to coast and depth proved to be highly relevant for seal distribution.The results provide baseline data on the offshore distribution of seals and their habitat requirements.

E48 THE ROLE OF STELLER SEA LIONS OLFACTORY CONTACTS IN CONNECTION WITH THE ROOKERY LIFE

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The olfactory contacts play the important role at the predatory communications. On the rookery where large number of animals present in a limited space this type of animal's communication may be very different than among terrestrial predators. The main aim of our study was description the specialty of Steller sea lions olfactory communication in connection with the rookery life. The study carried out at the Yugo-Vostochnoe rookery on Medny Island during breeding season between June 1 and July 20, 2006. Total observation time was 425 hours. We directed our observation to only on marked animals with exact known age and sex. The major portion of juvenile SSL females olfactory contacts direct to the adult females (53%, sd = 34%, n=9), juvenile (34%, sd = 38%,n=9), pups (10%, sd = 13%, n=9), and only 3%(sd=8%, n=9) to bulls. During our research we have not observed any olfactory contacts young animals with bachelors. Juvenile males did not have an olfactory contacts with bulls nor bachelors. The most olfactory contacts of juvenile males and females with conspecifics were directed on the genital area (females: 23%, sd=29%, n=9; males: 47%, sd=36%, n=4) and nose (females: 57%, sd=24%, n=9; males: 32%, sd=28%, n =4). We also found that females significantly more often direct contact to nose than to genital area (ANOVA: df=7, F=14, $p<0.005$). The most olfactory contacts were directed to other animals (63%, sd=34%, n = 18) then to abiotic objects on rookery (37%, sd = 34%, n=18) (ANOVA: df=1, F=5.1, $p<0.05$). It means that in contrast to terrestrial carnivoras for juvenile Steller sea lions mediate information channel is not so informative as the direct contacts to other animals.

Elegible for Student award: Undergraduate

E49 CONSISTENCY OF STELLER SEA LION BREEDING BEHAVIORS ON DOLGAYA ROCK AT LOVUSHKI ISLANDS, RUSSIA

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The Steller sea lions on the reproductive rookery of Dolgaya Rock have been monitored annually since 2002. One of the main objectives of this research has been to obtain data on the patterns of reproductive behaviors of sea lions in the region. An important indicator of the status of a reproductive assemblage is it's interannual stability. In this report we attempt to quantify this indicator. The proportion of females that give birth from year to year did not change significantly from 2002, remaining at 63.7% (s.d. 5.81). The great majority of females that do not give birth skip only one year (84.6%). Fewer skip two seasons (13.6%), and only about 1.8% miss giving birth for three or more seasons. As a rule, females haul out onto the same rookery to give birth. However, we have observed a 12% frequency, of switching of reproductive rookeries for 9 females (5 from Dolgaya Rock, 4 from neighboring rookeries on Raykoke Island and Antsiferov Island). Of these switching events, 55% were departures from Dolgaya Rock and 45% were arrivals. Females that did return to the rookery to reproduce displaced on average 11 meters (n=31, s.d.=7) from the precise location of the previous year's birth. However, these displacements are limited spatially, and occur typically within a 6 m radius (n=19, s.d.=3) of some geometrical center point. We did not observe a relationship between the number of skipped years and the extent of the displacement of birth position. Nor was there a detectable relationship between age of female and extent of displacement. In summary, on the Dolgaya Rock rookery a high percentage of females gives birth annually, with inter-parturition periods rarely exceeding one year. The contingent of females giving birth is stable, and females display high fidelity to specific sites within the rookery.

E50 THE INFLUENCE OF PRESENCE YEARLING ON MATERNAL BEHAVIOR OF STELLER SEA LIONS ON DOLGAYA ROCK AT LOVUSHKI ISLANDS, RUSSIA

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The Steller sea lion female may continue to nurse their yearling even she gives birth to a new pup. The research was conducted between May and July, 2006 on the Dolgaya Rock sea lion rookery. Activity budgets of lactating females with pup (FP), females with pup and yearling (FPY), and females with yearling (FY) were compared. Three FP, five FPY, and ten FY were the subject of focal sampling. Time spent for nursing and moving on the rookery was examined. FP spent about 10% of their daytime moving, while FY and FPY spent 24% and 33%, correspondingly (ANOVA: df=2, F=14.09, $p<0.005$). FY and FPY spent more time nursing their offspring than FP(ANOVA: df=1, F=27.4, $p<0.005$). FYP nursed the pup more than the yearling (16 vs 10%, $p<0.05$, Mann-Whitney U Test). We did not reveal any negative influence of the yearling on the pup surviving.

E53 MARINE MAMMALS IN ANCIENT ESKIMO PREY OF CHUKOTKA

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Studies of secular dynamics are necessary for revelation of ecosystems regularity evolution and anthropogenic, climatically and other factors action. Archeological and other research concerning the early sites on the coast of Chukotka has clearly indicated the influence of ancient hunters on marine mammals populations. The trade species quantity dynamic of this region are discovering after study of animals osteologic remains from hunters ancient coastal settlements We try to study the dumps material and dugout ruins of ancient Eskimo settlement Paipelgak on the Chukchi sea shore. The age of settlement is about 1468 years ago on radiocarbon dating. At the colony occupation horizon we have found out bonds of 4 seals species and 5 tundra habitant species. Sum total we find and identified 2466 seal bones and 77 whale bones. 90% of all seal's bones belong to ringed seal (*Pusa hispida)* and common seal (*Phoca largha),* 5% belong to the walrus (*Odobenus rosmarus)* and 5% to bearded seal (*Erignathus barbatus).* 90% of whales bones belong to gray whale (*Eschrichtius gibossus*) bones and 10% bowhead whale (*Balaena mysticetus*). Whale's bones where ranged and such a way, we find, that 81% of whales at Eskimo prey was younger then 1 year old. So we see, that seals and the gray whale tooks the main places in ancient Eskimo prey.

E54 THE GROWTH RATE OF LACTATING PUPS OF THE SOUTH AMERICAN SEA LION (*OTARIA FLAVESCENS*) DEPENDS ON THE FEEDING STRATEGY OF THE FEMALE

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A study was conducted in Northern Patagonia to determine the influence of female feeding strategy on the growth rate of lactating pups in the South American sea lion. The $\delta^{13}C$ and the $\delta^{15}N$ signals of plasma and erythrocytes from 27 suckling pups were determined with the

objective of assessing the composition of the mother's diet. To do so, it was assumed that the isotopic signatures of the pup reflected those of mothers' milk and that the latter was in its turn reflecting the nutrients incorporated by the mother approximately 1 week (plasma) and 1-2 months (erythrocytes) prior to collection. Parallel to this, the isotopic signal of potential prey was analysed to establish baseline values. Also, pups were weighted and the specific growth rate at the age of 21 days was computed. The IsoSource programme was used to calculate the relative contribution of each prey species to the mother's diet. Total fractionation factors for plasma were assumed to be 4.6 for $\delta^{15}N$ and 0.5 for $\delta^{13}C$, and for erythrocytes were assumed to be 3.4 for $\delta^{15}N$ and 1.2 for $\delta^{13}C$. IsoSource revealed that a lowly negative $\delta^{13}C$ signal was due to a high consumption of benthic prey, mainly *Enterocotpus megalocyathus*. In females, the contribution of this species to diet increased after parturition (31±10% before and 53±14% after; Student t test, t=-8.315; p<0.001), but individual variability was large both before and after parturition. Also, a negative correlation was found between the specific growth rate of pups and the plasma $\delta^{13}C$ (r^2=0.482; p=0.003) and $\delta^{15}N$ (r^2=0.350; p=0.016) signals, thus indicating that a higher consumption of benthic prey negatively affected pup growth rate. Therefore, we conclude that the foraging strategy of lactating females has a dramatic influence on the growth rate of the pups.

Elegible for Student award: Postgraduate

E55 VIABILITY COSTS OF SEXUAL SELECTION IN THE NEW ZEALAND FUR SEAL, *Arctocephalus forsteri*

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Polygyny is the most common mating system in mammalian species (95%), yet our understanding of polygynous systems is still limited. Traditionally used as polygynous models, some pinniped species display a highly skewed operational sex-ratio (i.e. extreme polygyny) and male reproductive success is typically much more variable than in females. Pinnipeds are mainly social during the breeding season, when they can form large aggregations, as is the case for the polygynous New Zealand fur seal. Recent studies in pinnipeds have shown that observed male mating success was correlated to male paternity success in some species (elephant-seals), but not in others (grey seals). Several factors could explain those discrepancies, such as evidence of alternative mating strategies (Caudron *et al.*, in prep.) or general health in socially dominant males *versus* subordinate males. To investigate these factors, we focused on two main objectives: (1) to examine the paternity success of focal New Zealand fur seal males for which behavioural data are available, using 10 microsatellites and, (2) to examine health parameters such as testosterone levels which are known to be associated with dominance and aggression, but are also known to have a negative effect on immunity, and pathogen loads, which could impact on the individual health and ability to sire offspring. Through these objectives, we aim at better understanding the complex mechanisms underlying the diversification and the maintenance of different male reproductive strategies under a strong sexual pressure (competition).

Elegible for Student award: Postgraduate

E56 MICROSATELLITE ANALYSES CONFIRM THAT SPERM WHALES TRAVEL WITH KINS

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Sperm whales present a highly complex social structure. Photo-identification studies revealed their social organization extend from temporary aggregations to stable groups of individuals sharing more complex social bonds and possibly relatedness. Genetics were used as a tool to study relatedness and relationships between individuals or groups. Genetic analyses were used to investigate population and social structure of the sperm whale (*Physeter macrocephalus*) in the Azores. In total, 151 skin samples were collected between May 2002 and August 2004 in the three groups of islands of the Azores. Samples were genotyped at 9 highly polymorphic microsatellite loci, and sex was determined by molecular sexing. Since most samples were sloughed skin, genotypes were checked for potential errors and replicated samples. Tests were performed to determine if all individuals belonged to the same population and evaluate the genetic differentiation between individuals and social groups. Age at dispersal from their primary social groups was evaluated for male sperm whales, based on the estimated sex ratio for the population. Results indicate that the individuals who visit the Azores all belong to the same population, as there is no distinctive geographical or annual genetic structure. These results are indicative of site fidelity in relation to the study area, but not to a specific group of islands. With respect to social structure, the distribution of genetic diversity within and between social groups of various levels suggests that relatedness is higher within than between the social groups. According to these results, it makes sense to consider that individuals observed in the same area and on the same day belong to the same social group and that these individuals are highly related. It would be interesting to analyse a higher number of samples from a longer term study, since only a small proportion of animals of the presumed population was genetically identified.

Elegible for Student award: Postgraduate

POSTER ABSTRATCS ON SURVEYING & STRANDINGS

S1 GEOGRAPHICAL AND TEMPORAL VARIATIONS OF COMMON DOLPHIN (*DELPHINUS DELPHIS*) ON THE CENTRAL CANTABRIAN SEA

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Although stranding records are considered inadequate to determine the status of several species of cetaceans, in most cases they constitute the only source of information. Temporal and geographic patterns distribution of common dolphin *Delphinus delphis,* off Asturias coast (North Spain) for the year 1985-2005 were examined using a database of 154 stranded specimens and 48 confirmed by-catches. *D. delphis* strandings were recorded throughout the year, suggesting that the species was present off the Asturian coast all year round. Significant differences were found in the number of strandings per season, with 42.9% occurring in the winter and 37.0% in the spring months. These differences may reflect changes in species distribution, but it could also reflect changes in likelihood of dead animals reaching the shore due to the severe weather and sea conditions at this time of the year. However, geographic distribution was not homogeneous; the incidence of strandings and captures was higher in the central area of Asturias. This could be explained by differences in spatial distribution and/or abundance of common dolphin, oceanographic conditions (e.g., coastal currents) or coastal topography of the area (in this case, Cape Peñas). Sex ratio of the stranding and by-catch

records was significantly biased toward males in all seasons. Likewise, a significant higher proportion of immature individuals were found both in the stranding and by-catch dataset. These results could suggest either the existence of differential mortality by sex and maturity, or the occurrence of sex and age segregation in the population. Considering the specimens incidentally captured and stranded animals that displayed physical signs of entanglement, fishery interactions could be responsible for up to 39% of mortalities for this species.

S2 TRENDS OF DEAD ANIMALS IN GALICIA (NW SPAIN) AND THEIR ENVIRONMENT (2000-2004)

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Since 1990, it has been carried out several studies about strandings of marine mammals in Galician coast (northwest of Spain). These studies mainly investigate the trends of these strandings depend on a variety of variables such as area, period of the year, species, by-catch. This study was carried out in order to investigate if in there is environmental variables affecting the trend of the stranding that have been already found. We focused in the animals recorded from 2000 to 2004, due to the consistency of the data. 875 animals from the 8 main species stranded in an area of 1195km of coastline were recorded. GIS application was applied to evaluate the relationship of the trends of these strandings with environmental variables, and they were modelling in order to find the relationship with them. From 2002 and 2004 were recorded 75% of the total strandings, were more than 60% were *Delphiniums delphis*. Most of the strandings occurred mainly in the mouth of two Rias Baixas (latitude 42.867-42.251 N) in all the period of study. Also, relationship with the area was found for some of the species studied. Other variables such SST and NAO does not seems to reflect any relationship with the strandings during the period of study.

Elegible for Student award: Postgraduate

S3 UNEXPECTED ARRIVAL OF HOODED SEALS (*Cystophora cristata*) TO THE NORTH-WESTERN COAST OF SPAIN DURING 2006 SUMMER MONTHS

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Although there aren't historical evidences of the presence of pinniped species colonies in the northern coast of Spain, every winter several strandings of Grey seals (*Halichoerus grypus*) are attended during winter months. Moreover, from 1960 to 2000, seven cases of sporadic appearances of Hooded seals (*Cystophora cristata*), have been recorded along the Cantabrian and Galician Atlantic coasts. Exceptionally, in the summer of 2001, a massive arrival of Hooded seals individuals took place along the American and European Atlantic coasts, arriving to the Canary Islands and the Caribbean. The stranding networks of Galicia (CEMMA) and Asturias (CEPESMA) attended 4 cases: one individual could be released, and the other 3 died during the rehabilitation attempt. Between July and September of 2006, 5 juveniles (3 females and 2 males) of Hooded seals arrived to Cantabrian cornice and Galician coast. After diagnostic

procedures, clinical evaluations, medical cares, and an intense attention about the specific management that this artic species requires, 3 individuals were released in *Grand Sole.* The 2 remaining animals died during the 3-4 hours after arrival, due to an intense and persistent hyperthermia because of summer days high temperatures on the beach. The unusual and seasonal arrivals to the north-west coast of Spain described in the summer months of 2001 and 2006, could be related to post-weaning dispersions further away than usual distribution areas. The causes of that massive approach of this artic species to southern zones still remain unclear. The stranding of artic seals implies a dare for the technical staff of the stranding networks, seeing that special protocols for this species must be strengthened in summer months. The bad and fast evolution presented in dead animals, strongly recommends quick clinical actions to control the hyperthermia; a critical factor for the survival of stranded alive individuals.

Elegible for Student award: Postgraduate

S4 MORPHOLOGY AND COLORATION PATTERN OF THE OCEANIC FORM OF THE ATLANTIC SPOTTED DOLPHIN IN THE CANARY ISLANDS

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The taxonomy of the spotted dolphins (*Stenella* spp) was resolved recently (PERRIN *et al*., 1987). Two species: *S. frontalis* and *S. attenuata* are currently recognized. The former species is endemic of the warm temperate waters of the Atlantic, showing geographic variations in the morphology, the coloration and teeth count. A smaller and less spotted oceanic form is distributed in the offshore waters and waters around oceanic islands. The Atlantic spotted dolphin is one of the most frequent cetacean species in the Canary Islands during autumn and winter months. The aim of this study was to provide a description of the external morphology of this species in the Canary Islands. The stranded dolphins were systematic photographed and measured according to NORRIS (1961) and when it was possible we performed a systematic post mortem analysis of the animals. To date, we have examined 68 beached dolphins (36 mature dolphins and 13 immature dolphins). The mean length for the mature males was 181.4 cm (n=23, range: 170-194 cm, SD: 7.1), and 176.4 cm (n=13, range: 164-193 cm, SD 7.4) for the mature females. Average body length of mature specimens is smaller than found in other regions (except for Azores, Madeira and Caribbean). We found differences in the external body proportions. Atlantic spotted dolphins showed a spotted pattern less extensive in the cape, flanks and an unspotted belly. This morphology is related with the foraging strategies in an oceanic ambient.

S5 TEMPORAL PATTERNS OF DISTRIBUTION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) OFF THE SOUTH COAST OF PICO ISLAND, THE AZORES

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Pico Island, one of the nine islands belonging to the Azores archipelago, situated in the Central North Atlantic Ocean, represents a special area, because its surrounding waters harbour a high cetacean diversity throughout the year. Bottlenose dolphins, *Tursiops truncatus,* are a common species in this area. Though common, little is known about the residential status or migration patterns of the population(s) in the Azorean waters. Aim of this study is to (1) estimate

population size of bottlenose dolphins off the south coast of Pico Island and (2) to determine residency and migration patterns of the bottlenose dolphins in the same area. To derive population size and to estimate patterns of distribution, primarily photo-identification and mark-recapture methods were used on well marked individuals for three consecutive years: 2004-2006. Land-based observations were made from fixed points along the south coast of Pico daily. During land surveys the presence of bottlenose dolphins, group size, direction and behaviour were registered. Photographs of dorsal fins were taken during boat-based surveys. To form an ID-catalogue, these photographs were visually matched, based on natural markings. Both land and boat-based data were used to estimate population size. To determine residency and migration patterns only boat-based data was used. During the period studied, a total number of 420 ±25 individual dolphins have been identified. Preliminary results will show the importance of the waters surrounding Pico for bottlenose dolphins. First, it will be demonstrated that part of the population is residential to this area. Second, a description will be given of the migration patterns of the bottlenose dolphins off the south coast of Pico Island. These results might help to determine adequate measures for conservation of this unique area, where pressure of whale watching and dolphin tourism is growing.

Elegible for Student award: Undergraduate

S6 DAILY SPECIES CHECK LIST FROM AZOREAN WHALE-WATCHING COMPANIES: LIMITATIONS AND POTENTIALITIES FOR RESEARCH

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Daily check list of species boat sighted from Whale-watching companies operating in the mid-Atlantic Azores archipelago represent a seasonal but multi-year source of data on cetaceans temporal occurrence. This small environmental window has been used as a reference by several authors in the past but none ecological statistical approach has been published. Records from one of the oldest Azorean whale-watching companies are analysed and limitations and potentialities for the study of different species are debated. Data collection depends on clients favourable weather conditions, and varies with the number and type of boats, creating a discontinuous and incomplete record of the overall species present, allowing little estimation on the natural populations. A non parametric approach is proposed to analyze sighting frequencies with surface water temperature for migratory and year round sighted species, based on recent records. More years should be undertaken in the analyses to validate results. This data contains unique information on rare and less frequent species, ultimately evoking the need for a concerted effort to adequately register these sightings.

Elegible for Student award: Postgraduate

S7 PHOTO IDENTIFICATION AND ECOLOGY OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN SÃO TOMÉ AND PRÍNCIPE ARCHIPELAGO, WEST AFRICA

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São Tomé and Príncipe archipelago is situated in the Gulf of Guinea and little is know about cetacean communities in this small archipelago. Since 2002 an effort has been made in order to

study the occurrence, distribution and behaviour of cetaceans in this equatorial region. Along the years and throughout several field seasons sightings of humpbacks whales, bottlenose dolphins and pantropical spotted dolphins were the mainly records. For the present study, we present the data for 2004 and 2005 of bottlenose dolphin's sightings in order to understand the ecology of this species in this particular region. So we conducted 57 boat-based surveys surrounding the island of São Tomé, during which we recorded GPS positions, group composition, size, behaviour and photographic records. Bottlenose dolphin's sightings represent 20.5% of the total cetacean sightings, being the third most frequently observed species. Groups of twenty to one hundred individuals were sighted. In 72% of sightings the groups had calves. We observed some animals with a low body condition. Until now 49 individuals were identified photographically and in 2005 we observed the same individuals in different days in the same area, and some of them are also the same observed in the year before, suggesting a certain degree of residency. With this study we intended to find out if there are any local or resident, permanently or seasonally, populations of bottlenose dolphins living off São Tomé and Príncipe archipelago. Since commercial and subsistence fisheries intensity in S. Tomé waters, their implication to prey resource availability and its potential for disturbance and mortality is high.

Elegible for Student award: Undergraduate

S8 A LAND-BASED TRIAL OF A DIGISCOPE SYSTEM FOR PHOTO IDENTIFICATION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

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Photo identification (ID) has been a widely used tool in the study of marine mammals for over thirty years, but has typically been limited by the availability of boat platforms or the ability to approach animals. Several populations of marine mammals are regularly seen close to the coastline, making land-based photo ID a less invasive alternative, although this is currently limited to animals within about 100 metres from land. This study tested the use of a digiscope system, to determine whether it could be used successfully for marine mammal photo ID from land. The digiscope system consisted of a compact digital camera attached to a fieldscope. The fieldscope was aligned with a rifle sight to allow tracking of animals. The digiscope was initially tested on a land target and on buoys at sea, to determine its power and precision. It was then used to take images of bottlenose dolphins (*Tursiops truncatus*) that utilise New Quay Bay, West Wales. The images produced of both land and sea targets were of a high quality, with excellent resolution of detail. Dolphins could be individually identified up to approximately 850 metres away, although at this distance only well marked animals were identifiable. The success of the images was dependent not only on the range of the animals, but also on their behaviour and the sea conditions. These results show that a digiscope system can be successfully used to take photo ID images of animals at far distances. It was also shown that images suitable for photo ID of grey seals (*Halichoerus grypus*) could be taken, and the system would potentially work for many other species. Therefore, a digiscope is a valuable tool for non-invasive photo ID of marine mammals, which will get more powerful as technology progresses.

S9 CHARACTERISTICS OF THE BOTTLENOSE DOLPHIN (*Tursiops truncatus*) POPULATION OFF THE WEST COAST OF SCOTLAND

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Historically, groups of bottlenose dolphins (*Tursiops truncatus*) have been reported off the west coast of Scotland. However, despite their documented occurrence in this region, little is known about the frequency, population size, range or movements. This study provides a first insight into the distribution and abundance of the bottlenose dolphin population off the west coast of Scotland. Identification photographs were collected between 2001 and 2005 from three sub-regions in the study area (North Skye, Mid-Argyll and South Argyll) covering a distance of approximately 125 nautical miles. Data included a combination of photographs from dedicated surveys and opportunistic encounters from local whale watch vessels. A total of 28 individuals were identified during 27 encounters of which 14 (50%) individuals contained distinctive nicks in the dorsal fin. Ten individuals (all nicked) were identified in more than one year. Movements of individuals extended across the entire study area with 12 (46%) individuals re-sighted in more than one sub-region in the same year and 9 (34%) individuals re-sighted in more than one sub-region between years. The rate of discovery of new individuals is consistent with a low number of dolphins using the area. Together, these preliminary results suggest that the west coast of Scotland is host to a relatively small population of geographically wide-ranging bottlenose dolphins.

S10 CETACEAN DITRIBUTION IN THE STRAIT OF GIBRALTAR AND ANALISYS OF THE MOST OBSERVED SPECIES FROM WHALE WATCHING PLATFORMS

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It was in 1998 that the whale-watching activity began in the Strait of Gibraltar, constituting a strong economic industry nowadays. The different whale-watching companies that operate in Tarifa have developed several conservation projects, supporting on education and scientific programs. During the last years scientific data was compiled by the different companies, determining the distribution of the seven cetaceans species that live in the Strait of Gibraltar, and at the same time determining which of this cetaceans is subject to an increasing pressure from the boats carrying out the activity in the area. We can conclude that this whale watching companies can be used as a useful tool to match cetacean studies in the area, as it can work as both an educational and scientific tool.

Elegible for Student award: Undergraduate

S11 FIN WHALES OFF GIBRALTAR

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Fin Whales are known to stay all year long in the Mediterranean, comprising a population of about 3000 individuals, genetically distinct from those of the North Atlantic population (Bérubé *et al*, 1998). Fin Whales are also known to migrate though the Strait of Gibraltar (Stephanis R., 2001), possibly connecting both populations. Analysis of iodine content of blubber oil (Jonsgård, 1966) and of carbon isotopes (Guinet, 2005) reveal that some individuals may feed both on Mediterranean and Atlantic krill. Satellite tagging exposed one individual migrating from the Liguria Basin to Island (Guinet, 2005). On behalf of sighting data taken during summer seasons from 1999 to 2006 on board of a whale watching vessel from Tarifa, an attempt to quantify the migration is done. On a first step an estimate of the number of migrating Fin Whales is done by extrapolation of sightings, corrected for effort, to 24 hours of whale

watching activity. On a second step an absolute number is calculated using the model of ship strikes developed by Dr. Tregenza. Considering the resumption of Icelandic whaling and the resulting potential catch of mediterranean Fin Whales, to know the numbers of migrating animals may be important for management purpose, especially in view of the possibility that those Fin Whales might be residuals of a former Gibraltar population (Clapham & Hatch, 2000).

S12 MYSTICETI POPULATIONS IN THE BAY OF BISCAY: DIVERSITY AND DISTRIBUTION (SUMMER-AUTUMN 2003-2004-2005)

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During the summer months, the Basque country fishing fleet sailed the Gulf of Biscay waters in search of red tuna (*Thunnus thynnus*) fisheries. This resulted in aleatoric transects in the area. These platforms are used since 2003 to determine the diversity and distribution of cetaceans in summer and autumn. 8012 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 using Geographic Information System (Arc view 3.2), and a Statistic program SPSS 11. Three different species of mysticeti were encountered in a total of 138 sightings. The most frequent species of cetacean observed during the season was the fin whale (*Balaenoptera physalus*) with 100 sightings, minke whale (*Balaenoptera acutorostrata*) with 9, sei whale (*Balaenoptera borealis)* with 2, and *Balaenoptera sp*. with 27 sightings. From the data collected, the distribution of all the species was examined with respect to the depth. Significant differences were observed between the encounter rates according to the depth and the effort made, results show a non-uniform distribution in the area.

Elegible for Student award: Undergraduate

S13 ANNUAL MONITORING OF CETACEAN ABUNDANCE AT A EUROPEAN SCALE: A COLLABORATIVE APPROACH

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There is a pressing need to develop biodiversity indicators at a European Scale to assess the state of biodiversity and progress in the European Union target of halting biodiversity loss by 2010. Indicators are particularly poorly developed for the marine environment, yet cetaceans are strong candidate indicators by being flagship species and top predators. In recent years a number of research groups have established low cost cetacean monitoring programmes using Ship of Opportunity in European waters, though their geographical coverage has typically been insufficient to enable annual monitoring of species status. In an effort to overcome this limitation, the Atlantic Research Coalition (ARC) was established. ARC aims to link up research groups collecting annual monitoring data by similar scientific methods, to work on project-based analyses, especially assessment of cetacean distribution and relative abundance changes at a regional scale and the development of biodiversity indicators. This poster summarises the results of the latest collaborative effort by the ARC partners - a report of cetacean abundance in the North-east Atlantic (Celtic Seas, English Channel section of the

North Sea, and the Bay of Biscay) over the period 2002-2003. ARC partners which supplied data for the analysis included Aberdeen University, Scotland; the Biscay Dolphin Research Programme, England; the Irish Whale and Dolphin Group, Ireland; Plymouth to Santander Marine Survey, England and Sociedad Ambar, Spain;). The report describes the distribution, relative abundance and inter-annual variations in status of individual species and groups of species at different spatial scales over 2002/3. Novel techniques were employed. A surrogate measure of annual cetacean abundance for each species in each area was calculated using abundance-occupancy models, whilst multi-species indices were calculated by log-linear regression. A (provisional) composite annual index of cetacean abundance at a North-east Atlantic scale is presented to demonstrate the potential of the approach.

S14 ZERO-INFLATED MODELLING: A NEW METHOD TO PREDICT THE HABITAT PREFERENCES OF COMMON DOLPHIN (*DELPHINUS DELPHIS)* IN THE BAY OF BISCAY AND WESTERN ENGLISH CHANNEL

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We studied the spatio-temporal distribution of common dolphins (*Delphinus delphis*) in the western English Channel and Bay of Biscay using single line transect surveys from a commercial passenger ferry, totalling over 62,000 km of survey effort during 72 monthly surveys between 1995 and 2002. We used remotely-sensed as well as standard survey data, to give a range of environmental variables for model construction. Depth, slope, distance to thermal front, sea surface temperature (SST) and near-surface chlorophyll (CHL-a), were included to define habitat preferences using a Geographical Information System. Dolphin distribution was related to covariates through a variety of models. When attempting to model count and presence/absence data for a scarce species a high proportion of zero counts is often recorded. This can result in over-dispersion when linear models are fitted. Four different models were compared to establish the best solution to this problem: generalised linear models (GLM), generalised additive models (GAM), zero-inflated models (ZIP) and hurdle models. Non-linearities in the variables were investigated using GAMs and a test for zero inflation (the Van den Broek test) was applied. The results showed that the data (except 1999) was zero-inflated and the best fit was provided by ZIP and hurdle models. These models treat the zero counts as a separate process from the non-zeros to combat the over-dispersion shown by GLMs in particular. The models showed a significant relationship between dolphin distribution and water depth, slope, SST, CHL-a and proximity to a front and that dolphins were more likely to be sighted in areas of high values for all these variables. The use of zero-inflated models appears to be effective in producing a well-fitting, appropriate multivariate model to model dolphin distribution. However, using non-linear terms might make predictions more realistic, but computational power prohibited the use of these methods in this study.

S15 SPATIAL AND TEMPORAL DISTRIBUTION OF CUVIER'S BEAKED WHALE, *ZIPHIUS CAVIROSTRIS*, INFLUENCED BY DEPTH AND SEA SURFACE TEMPERATURE, IN THE BAY OF BISCAY

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While remaining poorly known, a number of studies of Cuvier's beaked whale, *Ziphius cavirostris*, have found associations with canyons or steep escarpments. This study investigated the distribution of Cuvier's beaked whale in the Bay of Biscay. Data were gathered during twice monthly surveys were conducted by Biscay Dolphin Research Programme (BDRP), using the same platform and the same protocol from 1996-2005. A geographic information system (GIS) was used to compare the distribution of Cuvier's beaked whales to a number of eco-geographic variables (EGVs) such as topography and Sea Surface Temperature (SST). Cuvier's beaked whales were primarily recorded over the CapBreton canyon and in water depths exceeding 1000m. Interestingly surveys carried out in 2002 and 2003 show Cuvier's beaked whale to be distributed over Northern Continental slope area where water depth is also greater than 1000m. The sightings around the Cap Breton canyon show a seasonal distribution with a greater number of encounters during the spring and summer months compared to autumn and winter. This may relate to variations in SST between seasons as the occurrence of Cuvier's beaked whales in this region is linked to warmer water temperatures. Therefore, this study has identified two important areas for Cuvier's beaked whales in the Bay of Biscay (the Cap Breton canyon and the northern continental slope) and that within these areas depth and temperature are both important variables in determining the distribution of Cuvier's beaked whale.

S16 DIVER BEHAVIOUR AND PHOTO ID STUDIES OF BEAKED WHALES IN TORRELAVEGA CANYON (NORTHWEST SPAIN) DURING DIVER PROJECT

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Beaked whales appear to be particularly sensitive to acoustic sound sources (e.g. Simmonds and Lopez-Jurado, 1991) but as one of the least known cetacean groups, they present considerable problems to managers aiming to mitigate acoustic activities. The Spanish coast of the Bay of Biscay is one of the few locations in the world that supports a large and accessible population of Cuvier's beaked whales (*Ziphius cavirostris*). The aim of DIVER project is to study distribution, relative abundance and habitat preferences of Cuvier's beaked whale in the Torrelavega Canyon, southern Biscay. Visual and acoustic surveys using line transect methodology developed in SCANS-II project were conducted between mid-June and end of July 2006 onboard the 60' sailing ketch "Bluefin". During encounters with beaked whales and other deep divers Photo-ID shots were taken and data about diving behaviour was collected during created fields on the sightings and re-singting form of the Logger 2000 database. In 7 of the 17 encounter was possible to take ID shots identifying 9 individuals. No recaptures were found during the period of study. In 12 of the 17 encounters more than one re-sighting was recorded. The encounter period varied between 2 and 65 minutes and number of re-sighting between 1 and 12. Three types of behaviour were identified in relation to diving behaviour; Avoid the vessel, Indifferent to the vessel and Variable.

S17 USE OF OPPORTUNISTIC SIGHTINGS DATA FROM MARINE MAMMAL OBSERVERS ON SEISMIC SURVEYING VESSELS

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Seismic surveys are currently essential to locate and utilise oil and gas deposits at sea. Due to limited research the full effects of such activities on many cetacean species remains unknown. The Joint Nature Conservation Committee (JNCC) has implemented guidelines to mitigate any potential harmful effects of anthropogenic noise from seismic activity and underwater explosives on marine mammals in UK waters. For several years, Gardline Environmental Ltd.

(GEL) has been placing qualified and experienced Marine Mammal Observers (MMOs) aboard vessels during seismic surveys and wellhead abandonment operations to monitor and record sightings before, during and after such operations. Seismic activity in UK waters still occurs on a large scale, making this a valuable and often overlooked source of data. Large numbers of marine mammal surveys are conducted in the coastal waters of the UK, but data for offshore waters is scarce. Working throughout the year, GEL has built up a large database of offshore sightings information, which could be utilised to learn more about marine mammals inhabiting offshore waters. Surveys conducted by GEL, for a single client, BP Exploration, over the past five years resulted in 61 sightings and a total of 295 animals of 11 species. Seasonal data has been displayed and analysed using ArcView and Surfer software revealing trends in the presence and distribution of marine mammals and shows that much useful data can be gathered by MMOs. Conducting marine mammal research at sea is often difficult and expensive; thus the collection of sightings during such seismic surveys and wellhead abandonment provides an efficient way of attaining a large data set over an internationally important area such as the North Sea. Such data is available, and demonstrates that the energy industry is willing to cooperate and assist with marine mammal research where possible.

S18 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) OF PLANNED OFFSHORE WIND FARMS IN THE MEDITERRANEAN COAST OF SPAIN

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The construction of offshore wind farms in the Mediterranean coast of Spain has been applied to the Spanish Government. Here we report the activities conducted during the baseline study, to assess the dolphin population that might be affected during construction and operation of the wind turbines. Aerial and boat surveys were conducted, during 2005-2006, to obtain information about cetacean abundance and distribution in an area limited by a distance of 50 km from the projected wind farms. Photo-identification was used during boat surveys to identify sighted individuals and determine home range and patterns of permanence. As visual methods are constrained by weather conditions and daylight, passive acoustic detection techniques were also applied to allow continuous monitoring using six acoustic data loggers (T-PODs version 4) since January 2006, and taken as a measure of dolphin presence. Settings were established according to previous tests on bottlenose dolphins in captivity. Sightings showed the presence in the total area of study of three dolphin species: the striped dolphin (*Stenella coeruleoalba*) and the Risso's dolphin (*Grampus griseus*) in offshore waters, and the bottlenose dolphin (*Tursiops truncatus*) on and out of the continental shelf. The last species was the closest to the planned wind farms area (at 11 km). During the 2-months boat survey, 36% of identified bottlenose dolphins were found more than once, suggesting at least some degree of fidelity to the area. Consistently with the sightings data, preliminary results from the T-PODs showed intermittent presence of bottlenose dolphins in the proposed wind farm area throughout 10-moths (5.4% total positive days and between 3.3%-15.6% per month, as a mean of all T-PODs). Although there were some problems mooring the T-PODs and lost of data, results gathered from the passive acoustic detectors seem that it is a successfully method to get continuous data from bottlenose dolphins in these wind farm areas.

S19 CETACEAN STRANDINGS AND SIGHTINGS ALONG THE BALEARIC ISLAND BETWEEN 1998 AND 2006

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In 1993 the Foundation Aspro Natura Marineland Majorca started to establish a stranding network in order to attend stranded cetaceans along the Majorcan coast. In 1998 cooperation with the Balearic government was initiated and also sightings were recorded and annual reports were prepared. Carcasses, whenever possible were sexed and biometric data was recorded. Moreover carcasses in good conditions were prepared for necropsy and samples for future investigations were taken. For reasons of methodology only data from 1998-2006 were considered and stranding data was compared and completed with sighting information. During the examination period 253 specimens of eight different species were found stranded along the Balearic coast, revealing an annual average of 32 animals. The most abundant species were the striped dolphins (Stenella coeruleoalba, 42%) and the bottlenose dolphins (Tursiops truncatus, 27%). Whereby 15% of the carcasses could not be identified, but belonged mainly to the delphinidae family. The most carcasses were found during spring and winter. The sighting data reveals a different picture: 70% were bottlenose dolphins, indicating the coastal habitat of this species and only 9% of the sighted cetaceans were striped dolphins. The low sighting number for the striped dolphins is in accordance with the pelagic habitat of this species and its evasive behaviour towards boats. The most sightings were recorded during spring and summer. Of special interest was also the amount of human interaction (15%) found on stranded specimens. The bottlenose and the striped dolphin revealed an interesting sexual difference concerning the stranding data: Most recorded specimens were males (60% for the striped dolphin and 65% in case of the bottlenose dolphin) indicating that males are more vulnerable to stranding. These two specimens will be discussed in more detail comparing stranding and sighting data concerning seasonal and geographic distribution as well as biometrical data

S20 PRESENCE AND ABUNDANCE OF BOTTLENOSE DOLPHINS ALONG THE EAST LIGURIAN COAST IN RELATION TO THE PLEASURE BOATING

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This work investigates the presence and abundance of Cetaceans along the East Ligurian coast, in relation to the presence and abundance of the pleasure boat traffic. The study area is included in the Santuario Pelagos protected area, still being characterized by a high tourist activity. The presence of Cetacean in this coastal area has never been investigated and no data are available about the pleasure boat activity and its potential impact on the Cetacean fauna. The study area was divided in two zones: zone A includes the costal waters between Portofino and Punta Mesco; zone B the waters between Punta Mesco and Lerici. Data were collected between January and December 2006 using a rubber boat equipped with a GPS. A digital reflex photo-camera was used for individual photo-identification. For abundance estimation, we used the mark-recapture technique, using the Schnabel and Schumacher-Eschmeyer estimators. 44 surveys were carried out for a total of 260 hours spent at sea and 29 sightings: 25 of bottlenose dolphins (*Tursiops truncatus*) and 4 of striped dolphins (*Stenella coeruleoalba*). The bottlenose dolphin presence seems to be confined within the 100-m isobath. 91 bottlenose dolphins were photo-identified in total, 27 in zone A and 64 in zone B. Photo analysis showed no animals shared between A and B. In A 31 animals were estimated with both Schnabel and Schumacher-Eschmeyer methods. In B 136 animals were estimated with the Schnabel method and 163 animals with the Schumacher-Eschmeyer method. The pleasure boat activity is associated mainly with the summer season and is confined within 3 nm from the coast line. This produces

a complete overlapping with the bottlenose dolphin habitat in zone A, where the 100-m isobath runs close to the coast line, and only a partial overlapping in B, where the 100-m isobath runs more out to sea.

Elegible for Student award: Undergraduate

S21 REPORT ON THE SIGHTINGS OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN COASTAL WATERS OF SOUTH-WESTERN SICILY DURING SURVEYS CARRIED OUT BETWEEN 2003 AND 2006

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The number and distribution of sightings, group size and site fidelity of bottlenose dolphins (*Tursiops truncatus*) were assessed in coastal waters of south-western Sicily from October 2003 until September 2006. During sightings, information about position, group size, presence of calves and presence of fishing boats were always registered. The surveys were conducted on board of the harbour office patrol boat of Mazara del Vallo (TP), a 740 rubber boat and flying rubber boat covering an area of 1426 Km^2. Bottlenose dolphins were encountered on 56.7% of all surveys (n, surveys=37) with a total of 27 sightings. A wide range of group sizes were recorded for bottlenose dolphins from 1 to 17 and the mean group sizes per month varied from 2 to 12.7 specimens per groups. Photo-identification was performed throughout this study from October 2004 until September 2006. A total of 46 specimens of bottlenose dolphins (total sighted specimens=131) were individually photo-identified based on long-term natural marks on their dorsal fins. Sixteen specimens were re-sighted in the same area over the years. The high sighting rates of bottlenose dolphins provided evidence of a large distribution of this specie in coastal waters of south-western Sicily but the low re-sighting levels of known individuals provided little evidence of long-term year-round site fidelity for this area. Moreover the 74% of bottlenose dolphin groups were sighted near fishing boat, as a proof of the strong interaction between this specie and the local fishing activities.

S22 SOCIAL ECOLOGY OF BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) IN THE PELAGIE ARCHIPELAGO

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Starting from 2003, in the framework of the LIFE project "Del.Ta." (NAT/IT/000163), a bottlenose dolphin community has been studied, in an area of about 1000 square kilometres in the Pelagie Archipelago (Sicily, Italy), that includes a wide portion of a "Pelagie" Marine Protected Area. Previous studies were carried out in the same area since 1997, but just at the end of 2003, thanks to the LIFE project, the bottlenose dolphin community has been studied year round, allowing to better asses its site fidelity and social ecology. From 2003 to 2005 212 surveys were conducted from a small inflatable boat, 176 sightings were realized, and 117 dolphins were photoidentified, based on natural permanent marks on their dorsal fins. Among the photoidentified dolphins, 53 were resighted more than once in the study area, and 38 of them were resighted in more than a year, indicating some year round site fidelity. The mean group size was of 3 individuals, ranging from 1 to 18. Groups with juveniles and calves were the largest. The results of the present study, in terms of site fidelity, group composition and social structure, would be presented and discussed. These results, integrated with the ones of

2006, would be successively implemented in the Action Plan for Bottlenose Dolphin in the Pelagie Archipelago, due by 2007 as part of the Life Project.

S23 SUMMER DISTRIBUTION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN SLOVENIAN WATERS AND NEIGHBOURING AREA (NORTHERN ADRIATIC SEA)

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A local population of bottlenose dolphins (*Tursiops truncatus*) in Slovenian waters and the neighbouring area (northern Adriatic Sea) was studied by Morigenos since 2002, prior to which no systematic research on cetaceans had been carried out in the area. Dolphin numbers and distribution were monitored to determine potential area preference and the influence of anthropogenic and environmental factors. Land- and boat-based surveys were conducted throughout the year, however survey effort was most concentrated during summer months. Although dolphins would appear to use the area year-round, we only considered summer months of 2004-2006 in the analysis, due to the consistency of survey effort. GIS software was used to analyse sightings data. This was complemented with systematic photo-identification throughout the study. We recorded 47 sightings of bottlenose dolphins. Evidence suggests that particular identified individuals preferred specific localities within our study area. There were great differences in the degree of residency among different individuals. Dolphin summer distribution in the area was influenced by at least two anthropogenic factors: maritime traffic (resulting mostly from tourism) and fisheries (mostly bottom and pelagic trawlers). The maritime traffic was a negative influence on sighting numbers (deterring dolphins), while fishery provided a positive influence (attracting dolphins). Further research is required and will be carried out to corroborate these findings and evaluate their implications on conservation, however these preliminary results have immediate consequence for conservation actions for this local population of bottlenose dolphins.

Elegible for Student award: Undergraduate

S24 ECOLOGY, DISTRIBUTION & POTENTIAL DISTURBANCE OF DOLPHINS IN KEFALONIA, GREECE DURING 2005 & 2006

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Although a large amount of data has been collected on dolphins in the Mediterranean Sea there is a lack of quantitative data for the dolphin species found around the coast of Kefalonia, Greece. Work presented here began in 2005 and was continued during 2006 when additional surveys were carried out, resulting in a total of 268 hours of observation. This work was conducted in collaboration with FNEC (Fiskardo's Nautical & Environmental Club). Boat-based transects were conducted during daylight hours in sea states of ≤4 (Beaufort scale) surveying the northern tip of the island, when the following data were recorded: date, time, route, weather, cloud cover, sea state, wind direction, depth, visibility, group size, behaviour, direction of travel. In addition to this monthly harbour boat counts, opportunistic shore-based observation, and anecdotal data from visitors to the island were also collated. Common dolphins (*Delphinus delphis*) were the most frequently recorded cetacean, with only single sightings of other or unidentified species. Despite neither year having significantly more sightings, the highest sighting frequency month did vary between years; July in 2005, September in 2006. More dolphin encounters were observed during summer months compared to autumn in both years. A statistically significant difference was found with time of day, with

more sightings being made in the afternoon (>12pm). Trends suggest that within the years the dolphins have been found to occupy different habitats. In 2005 40.9% of sightings were from the fish farms, (average water depth 15m) compared to 2006 where 54.4% of sightings were in the channel (average water depth 164m), between Kefalonia and Ithica. The number of boats present does not significantly affect sightings, however further work is required to establish whether duration of encounter, proximity, vessel type or boat manoeuvres affect the dolphins and their behaviour.

Elegible for Student award: Undergraduate

S25 WINTER DISTRIBUTION OF CETACEANS IN THE WATERS OF CRIMEA AND ADJOINING AREAS

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Data on winter distribution of cetaceans in the northern Black Sea and the Sea of Azov are sparse. The only thing proven so far is the occurrence of cetaceans in the coastal waters of the Southern Crimea. We have examined the data obtained from a non-stop student poll (since 2002) and from our own field excursions (since 2001), as well as the data reported by the colleagues and local residents, for season from November to March. Sightings (55) and strandings (34) were recorded in all the regions of the Crimean Black Sea coast (including the Karkinit Gulf) and in the Sea of Azov coast. The southern and south-eastern coast of Crimea appeared to be an area of the most frequent sightings (42% of the total reported) and strandings (38%), just as it was expected; however, in the western Crimea, e.g. Sevastopol region (20 and 12%) and the Calamita Gulf (24 and 24%), high occurrence of cetaceans has also been demonstrated. Sightings and strandings in the Sea of Azov (particularly, in Mariupol) in January and February seem quite unusual, since this area is generally left by cetaceans in autumn. Also, winter findings of cetaceans in Armiansk region (Karkinit Gulf) are reported for the first time. Harbour porpoises, common dolphins and bottlenose dolphins were recorded among winter findings in the Black Sea. Bottlenose dolphins probably dominate but in many cases the species was not identified. The minimum number of records falls into December and January; in November, February and March this number is considerably higher. These findings show that cetaceans are distributed along the Azov and Black Sea coastline in winter much further to the north than it was expected.

S26 ESTIMATION OF HARBOUR PORPOISES' ABUNDANCE OF IN THE SEA OF AZOV AND ITS TRENDS

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The Sea of Azov is a habitat for a separate population of harbour porpoises. Monitoring of mortality is being conducted there since 1999. Population abundance and its trends were estimated on the base of the age structure of the population, life history parameters and mortality data. Number of stranded neonates and yearlings, their percentages and ratios, and changes of these parameters were used as the main criteria for the abundance trend estimation. It was shown that the abundance in 1999–2006 was generally stable with a slight tendency to decline, although annual fluctuations were evident (see also Gol'din, 2003; 2005). However, the abundance has somewhat declined in comparison with 1990s. The life table modeled according to the age structure with assumed constant values of survival rates also agrees with the concept

of stable population. The mortality data allow to conclude that the overall abundance of porpoises in the Sea of Azov reaches at least 5–6 thousand animals. This doubles the estimate obtained from the aerial surveys (Birkun et al., 2002; 2003). Incidental by-catch remains the main factor affecting the porpoise abundance.

S27 A REVIEW OF CETACEANS FROM THE RED SEA

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Cetaceans from the Red Sea still remain among the world's least known, and some uncertainty surrounds even the species composition in the region. Personal observations combined with a review of the literature suggest that nine cetacean species occur regularly in the Red Sea: one mysticete (*Balaenoptera edeni*), and eight odontocetes (*Delphinus capensis, Grampus griseus, Pseudorca crassidens, Sousa chinensis, Stenella attenuata, S. longirostris, Tursiops aduncus,* and *T. truncatus*). Six other species also occur in the region, but are apparently rare: one mysticete (*Megaptera novaeangliae*) and five odontocetes (*Globicephala macrorhynchus, Physeter macrocephalus, Orcinus orca, Stenella coeruleoalba,* and *Steno bredanensis*). The presence in the Red Sea of minke whales (*Balaenoptera acutorostrata*) is mentioned in the literature, but we consider these records unlikely. While the regular species are found throughout the basin, most of the rarer species were recorded from the southern portion of the Red Sea, suggesting that such occurrences involved visitors from the Gulf of Aden and the wider Indian Ocean. No evidence exists of Mediterranean cetaceans visiting the Red Sea, while there are rare records of *S. chinensis* entering the Mediterranean through the Suez Canal. Although Red Sea cetaceans may be considered today among the world's least impacted by man, mostly due to the low human densities along the region's desert coasts, likely increases in activities in the near future (e.g., tourist coastal development, shipping) suggest the need for a greater effort at collecting knowledge of the local cetacean populations, their ecological characteristics, potential threats and conservation status.

S28 EFFICIENCY OF WEIGHTING FOR IRREGULAR SURVEY EFFORT

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It is relatively common in studying marine mammals to use an irregular search effort when looking for the animals in the field, especially when the main focus is to study behavior or to identify individuals. To be able to use the data collected for other purposes it is necessary to weight data to account for the irregular survey effort. Here we elaborate on a simple method for weighting data for use in geographical analyses. This method uses the regression of the number of sightings to survey effort, to find the weighting factor. The survey effort is equal to the amount of time spent in each grid cell on a map over the study area. The number of sightings is calculated by a moving window so that the number of sightings for each cell is the number found in a larger circle around its center. The weighting factor used is equal to the resulting slope of the regression. To enable a relevant judgement of this method, it is first applied to a simulated population. This population is sampled in an irregular fashion similar to what could be done in a real field work project. A regression is made between sample number of sightings and survey effort as described above, and the sample is weighted using the slope of the regression. The resulting density map is compared to the original simulated population, to examine the method's ability to approximate a true population. This shows how well this

method can compensate for irregular survey effort. This is exemplified on a population of Indo-Pacific bottlenose dolphins on the south coast of Zanzibar, to show the method's usefulness in real life. The resulting weighted density maps can be important when taking conservation action.

S29 CAN OCCUPANCY BE USED AS AN 'EASY-TO-MEASURE' INDEX FOR MONITORING TRENDS IN CETACEAN POPULATIONS?

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Traditionally, changes in abundance have been used to monitor trends in cetacean populations. However, collecting data to accurately estimate abundance can be logistically complex and extremely costly, especially for large, widespread populations. This study assessed whether changes in an alternative measurement, occupancy, that can be calculated from data that are logistically, and financially, easier to collect could also be used to monitor trends in population size. Occupancy refers to the proportion of an area occupied by a species and is calculated from presence-absence data. Positive abundance-occupancy relationships have been found in many taxa and this study investigated whether they also exist in cetaceans using data from the west coast of Scotland. Occupancy rates were calculated and compared to two measures of cetacean abundance: relative density and sightings rate. A significant, strong and positive trend was found for both the sightings rate-occupancy relationship and relative density-occupancy relationship, however the relationship was strongest when using sightings rate, explaining 62.3% of the variation in occupancy. This relationship means that when cetaceans are more abundant, they not only occupy more space, but are also at higher density within the area they occupy. As occupancy and abundance are positively and strongly related, changes in occupancy will reflect changes in abundance. Therefore, this study provides evidence that changes in occupancy could be used as a rapid and easy-to-measure index for monitoring trends in cetacean populations, particularly as a 'first response' before abundance is estimated, to 'fill-in-the-gaps' between more detailed surveys aimed at estimating absolute abundance or when it is not logistically or financially possible to conduct surveys to estimate abundance (a situation that exists in most places most of the time).

Elegible for Student award: Undergraduate

S30 DOES AGE INFLUENCE THE PHOTOGRAPHIC CAPTURE PROBABILITY OF LONG-FINNED PILOT WHALES?

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The photographic capture probability is known to change between individual cetaceans. However the effect of age status on the capture probability has not been investigated on pilot whales. Long-finned pilot whales have been studied and photographed since 1999 in the Strait of Gibraltar and analysed by the research group CIRCE. Population estimations are constant and survival rates high. Age status was analysed using digital pictures taken in 2004 and 2005. Four status were defined: newborn, calf, juvenile and adult. All individuals were identified within each sighting from notches in the dorsal fin, scars, foetal folds, saddle patches and general dorsal fin shape and given an age status. A total of 3477 pictures were analysed for age status

during the summer of 2004 and 2005. 264 individuals were identified in 2004 and 218 in 2005 with an increase of 4.5% to 8.7% newborns and calves from one year to the next. From these data the number of picture per individual of known age status could be calculated. Although no significant differences were found between the different age status in 2004 (One way ANOVA, F=0.75, df=3, p=0.53), the adults in 2005 were significantly more likely to be photographed than juveniles, calves and newborns (One way ANOVA, F=14.51, df=3, p>0.01). In this population, 98% of the juveniles, calves and newborns are not marked and therefore do not enter in the mark recapture analysis. If this part of the population is less represented in number of picture, it should be taken into account when calculating the correction factor of the population estimation. An underestimation of the population could result from it.

Elegible for Student award: Undergraduate

S31 INDICATIONS OF A REGULAR PRESENCE OF SHORT-FINNED PILOT WHALES (*GLOBICEPHALA MACRORHYNCHUS*) IN MADEIRA ISLAND: PRELIMINARY ANALYSIS

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Short-finned pilot whales are known to form large social schools, containing animals from all sexes and ages, and can travel long distances or be confined to a certain area. Photo-identification allows studying a population social structure and its preferences to a certain area. In Madeira Island (NE Atlantic), photo-identification effort on short-finned pilot whale was carried out between June 2004 and November 2006 using digital equipment. From a total of 32 photo-identification events, 1470 photographs were processed and 241 individuals were catalogued using 588 photographs. From the 32 events (corresponding to 18 months), 21 events (14 months) had individuals resighted and 11 events had no matches. The 14 months presenting matches showed 45 individuals resighted, with 17 individuals sighted twice, 21 sighted three to four times, 6 sighted five and 1 sighted six times. Despite short-finned pilot whales were encountered throughout the year, the photo-identification effort was conducted only between June and February, and during that period (except February) there were always resightings. A preliminary analysis may indicate a regular presence of a pod of about 50 individuals of short-finned pilot whales, which may be a part of a larger population, inhabiting the madeiran waters at least on a seasonal basis. Also, two individuals were resighted when compared to opportunistic photos from October 1997, which suggest a long-term fidelity to the area. The 11 events with no matches suggest transient groups travelling or using this area for short periods. Further effort, especially on the remaining months (from February to June), is needed to confirm this analysis, or to assess the hypothesis of a resident population in madeiran waters.

S32 THE USE OF NATURAL MARKINGS IN STUDIES OF LONG-FINNED PILOT WHALES (*GLOBICEPHALA MELAS*) AND NARWHALS (*MONODON MONOCEROS*).

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Photo-identification is a widely used research method in cetacean studies. It has been used in pilot whale (*Globicephala melas*) studies, although none of these studies investigated the reliability of the marks used. Photo-identification has never been used in narwhal (*Monodon monoceros*) studies. The goal of this study was to identify reliable mark types for photo-identification of these species. All mark types, their distribution within the population, and their variability in visibility were investigated. For pilot whales, the rates of gain and loss of each mark type was also calculated. Although the mark types associated with the current photo-

identification method for pilot whales, the notch and the protruding piece, appear to be permanent, they allowed us to identify only 33% of our sample. Using saddle patches in combination with the current photo-identification method would double the percentage of identifiable pilot whale individuals. As many narwhals have notched dorsal ridges this feature appears to be most promising for photo-identification.

Elegible for Student award: Postgraduate

S33 PRELIMINARY PHOTO-IDENTIFICATION ANALYSIS OF INDIVIDUAL MINKE WHALES ON THE EAST COAST OF SCOTLAND

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Whether conducting behavioural research or establishing population parameters, photo-identification is generally regarded as the most effective non-invasive methodology available to researchers for gathering information about cetacean societies in the wild. On the west coast of Scotland, researchers have been using this technique as a central tool for studies on minke whales (*Balaenoptera acutorostrata*) since the mid-1990's, but, until comparatively recently, little attention has been focused on the minke whale community on the neighbouring east coast. Since 2001, however, progressive studies by the CRRU in coastal waters of the outer southern Moray Firth have examined the spatial distribution and habitat use of these animals and have highlighted the importance of this northeast location as a favourable summer feeding ground. These and ongoing focal studies by the team have subsequently facilitated the *in situ* photography of a number of individually-recognisable whales in this area, many of which may already be known to researchers from the opposing west coast. In this paper, the results of a preliminary analysis of the type, quality and prevalence of dorsal fin markings (recorded opportunistically from 2001 to date) are presented. This examination provides a positive first step towards a more integrated east-west coast approach to minke whale studies in Scotland. Such an approach would be important to present interpretations of intra-population dynamics and the underlying behavioural ecology of these small rorqual whales in our inshore, coastal habitats.

Elegible for Student award: Postgraduate

S34 THE SPATIAL AND TEMPORAL DISTRIBUTION OF CETACEANS WITHIN SKJÁLFANDI BAY, NORTH EAST ICELAND

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The distribution of cetaceans at spatial and temporal scale has been considered by many authors who focused their studies on the interactions occurring between species and ecogeographic features. However the complexity of ecological relationships linking cetaceans and their surrounding environment is still far from being completely known. This is particularly true for some areas, like Iceland. The distribution of three cetacean species (*Balaenoptera acutorostrata*, *Megaptera novaeangliae* and *Lagenorhynchus albirostris*) was studied in Skjálfandi Bay, north east Iceland, in order to investigate interactions occurring with five environmental variables (depth, slope, aspect, sea surface temperature and chlorophyll-*a* concentration) and among species in relation to the same

parameters. Sighting and effort data were collected using whale watching boats and the Geographical Information System and Remote Sensing constituted useful tools in the analysis of these. The most important factor was found to be the fixed parameter slope which influenced the distribution of all species encountered in steeper areas where nutrient mixing and upwelling are known to enhance primary productivity. The non-fixed parameter sea surface temperature was found to be significant for one species, *Balaenoptera acutorostrata*, and not for the others. An unexpected negative correlation was found for chlorophyll-*a* concentration. The low variability in chlorophyll-*a* concentration was thought to be the reason of such finding, as only a few limited hotspots of higher chlorophyll-*a* concentrations were observed during the study period. These values are thought to have skewed results. The hypothesis of habitat and resource partitioning was then considered in light of the interesting findings observed at interspecific level. All species showed different spatial distribution within the bay and in relation to the environmental variables. Carrying on such research might in the long term give a better appreciation of ecological relationships occurring among cetaceans in Skjálfandi Bay. Further implications include conservation management.

S35 SPECIES COMPOSITION AND DISTRIBUTION OF THE CETACEANS IN THE COASTAL ZONE OF THE ANTARCTIC PENINSULA (ACCORDING TO VESSEL OBSERVATIONS)

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Presented is contemporary data on species composition, distribution features, number, group structure, behavior, interspecies relations of the cetaceans in the Antarctica Atlantic sector of Antarctic peninsula coastal zone. The on-the-route accounting (577 hours) of cetaceans was performed from the board of SRV "Academic Ioffe" in the course of three voyages (01/24/05 to 03/15/05). Humpback whales were recorded along the whole Antarctic peninsula. The voyages followed the same routes in 85% of their length, allowing showing the non-occasional character of animal distribution (the whales recorded in the same bays during different voyages were not summarized). Both single animals and groups consisting 2-3 or, more rarely, 5-6 animals have been registered. In the major straits (Gerlach) and bays (Wilchemina-bay) – in the feeding grounds whales gathered into bigger groups – up to 7-10 animals in the sight horizon, but in clearly distinctive groups of 2-3 animals. Only 4 times these groups contained the immature animals. In the bays, 73% of observations the whales were resting. Minke whales – up to 16 -20 animals per voyage (70-94,1% of singles) have been registered in the area of the Cape of Horn, in the Drake strait, along the Antarctic peninsula, especially in the strait of Lemaire. Finwhales have been registered in the Drake strait (13 whales – 5 encounters per voyage maximum, once there was an immature animal in the group). Sei whales (up to 7 animals – 2 encounters, one of them immature). Dolphins were represented by 3 species. Killer whale – 6 encounters, 9 animals, one of them immature; peale's dolphin (16 animals maximum, 4 encounters, usually quickly passed the ship) and hourglass dolphin (11 animals – 3 encounters, usually followed the ship for 15-20 min.). Despite of the krill abundance, cetaceans' number and species composition haven't restored during the no-hunt years. Young animals were presented in groups episodically.

S36 THE FIN WHALES FROM THE GULF OF CALIFORNIA: A RESIDENT AND ISOLATED POPULATION

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Since the 50's exists the hypothesis of a resident population of fin whales *Balaenoptera physalus* in the Gulf of California, different to the other populations from the North Pacific. However this statement had been questioned based on the lack of conclusive data. Here we present the results of three independent studies that support this hypothesis. 1) Based on the individual photo-identification of 517 fin whales in ten different areas of the Gulf of California, between 1982 and 2000, it was estimated and abundance of close to 400 whales and a permanency of at least 18 years. 2) After the mitocondrial and nuclear DNA analysis of 77 fin whales from the Gulf of California and 12 from the coast of California it was concluded that the fin whale populations from the Gulf of California has a very low degree of genetic variation and constitute a highly isolated and thus evolutionary unique population. 3) Finally, in March 2001, there were attached satellite tags to 11 fin whales. All tagged whales remained inside the Gulf of California. The three fin whales for which it we obtained the longest location signals (> 100 days) spent most of the summer in the mid-riff islands. These results demonstrated that this population constitutes a unique and separate stock, which should be managed accordingly. For this, it's necessary, among other aspects, a better knowledge of their feeding ecology and population dynamics.

S37 COMPÂRISON OF ODONTOCETES POPULATIONS IN TWO ARCHIPELAGOS OF FRENCH POLYNESIA

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Archipelagos of French Polynesia in the central tropical Pacific provide the opportunity to compare odontocete populations in near-pristine conditions and to discuss the influence of environmental conditions on both relative abundance and diversity. Small boat surveys were organised to study cetaceans of the Marquesas (9°S and 140°W) and the Society Islands (17°S and 150°W). Prospections took place from 12-15 meter sailboats, between 1996 and 2001 with systematic visual and acoustic searching. Boats moved randomly according to sea conditions, at a mean speed of 10 km/h. Effective effort was 4,174km in the Marquesas and 14,297km in the Societies. The diversity and sighting rate for individuals were processed using data obtained with Beaufort 4 or less conditions. In the Marquesas, a total of 153 on-effort sightings were obtained on 10 delphinids species including: the spotted dolphin, spinner dolphin, bottlenose dolphin, melon-headed whale and rough-toothed dolphin. In the Societies, 199 sightings of 12 odontocetes included delphinids (spinner, rough-toothed and bottlenose dolphins, short-finned pilot and melon-headed whales, Fraser's dolphin, Risso's dolphin, pygmy killer whale), two beaked whale species, the sperm and dwarf sperm whale. Sighting rates for individuals were higher in the Marquesas than in the Societies both inshore (with 0.53 delph./km, against 0.18 delph./km) and offshore. Shannon diversity was higher for the Marquesas (2,53) than for the Societies (1,79). Differences in trophic conditions (Marquesas are mesotrophic and Societies oligotrophic) and topography (there is a narrow shelf around the Marquesas) account for the higher "carrying capacity" of the Marquesas. Only two delphinid species were not present in both archipelagos (Fraser's dolphin absent from the Marquesas, spotted dolphin absent from the Societies). A striking result was the absence of sperm whales from the Marquesas, when the no-record status of beaked and dwarf sperm whales in the same archipelago was attributed to the higher Beaufort conditions.

S38 HARBOUR PORPOISE SURVEY OFF NORTHWESTERN AFRICA; FURTHER EVIDENCE FOR A DISCRETE WEST AFRICAN POPULATION?

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The distribution of harbour porpoises (*Phocoena phocoena*) in southern Europe and along the Atlantic African coast is poorly understood, with tentative assessments suggesting a discrete West African population with a northern limit at the Straits of Gibraltar. This study describes visual and acoustic surveys for porpoises in the Atlantic waters of northwest Africa in spring 2005 between latitudes of 20°N and 37°N. During this period, 275 hours of acoustic data were collected in all sea states and 60 hours of visual effort were conducted in sea states of three or less from IFAW's research vessel Song of the Whale. Harbour porpoises were seen three times on the survey trackline and on four additional occasions off the trackline. The encounters included four individuals seen in Agadir Bay at latitude 30°N, representing to the authors' knowledge, the most northern living porpoises reported from the Atlantic African coasts and the first sightings of porpoises reported in Moroccan waters. In addition, 31 acoustic detections of porpoises were made on the survey trackline, with a further 19 detections made off the trackline. There was a marked lack of acoustic detections in the north of the study area. Some historical evidence suggests that the northern limit for this population may be Agadir; however elevated noise levels from inshore fishing vessels may have masked acoustic detections in the north of the study area. Fishing activities off northwest Africa are intense, ranging from small-scale artisanal gillnetters to international freeze-trawlers. As harbour porpoises are highly susceptible to fisheries bycatch in many other parts of the North Atlantic, further monitoring of the status of this remote and isolated population is required for effective conservation management.

S39 DISTRIBUTION AND ABUNDANCE OF BOTTLENOSE DOLPHINS ON THE WEST COAST OF SCOTLAND

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Whilst bottlenose dolphins using the East coast of Scotland have been the subject of intensive research since 1989, very little information exists relating to their distribution and abundance on the west coast. As part of a government funded national study of bottlenose dolphins in Scottish coastal waters, the west coast of Scotland including the Hebridean islands was surveyed using a RIB during July to September 2006. Field effort was directed in response to reports from the Hebridean Whale and Dolphin Trust sightings network resulting in 28 days of survey effort and 5 encounters with bottlenose dolphin schools. Photo-identification results showed encountered dolphins to belong to two small coastal groupings, one apparently resident in the Sound of Barra (n=13) and the other ranging over larger distances on the mainland coast and Inner Hebrides (n=21). Of 193 useable photos sent by other organisations and members of the public from 15 incidental sightings, only a single image of one calf was not matched with the catalogue of individuals identified during our surveys. At least 2 dolphins identified from the Sound of Barra match animals identified during previous surveys conducted in 1995 and 1998 suggesting long term site fidelity in this area. Efforts are being made to match the inner Hebridean dolphins with archives of identification images held by the HWDT since 2001. Preliminary indications are that the west coast is used by relatively few bottlenose dolphins. Mark-recapture methods will be applied to these data together with photo-identifications of bottlenose dolphins using the Moray Firth and St Andrews Bay on the east coast to estimate abundance throughout Scottish coastal waters

S40 TRENDS OF ABUNDANCE OF BOTTLENOSE DOLPHINS AND HARBOUR PORPOISES IN THE CARDIGAN BAY SPECIAL AREA OF CONSERVATION, WALES (2001-2006)

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The Cardigan Bay Special Area of Conservation (SAC) was established in 2004 following the 1992 EU Habitats and Species Directive, in order to protect its bottlenose dolphin populations. Since 2001, the Sea Watch Foundation, with funding from the Countryside Council for Wales, has been running a monitoring programme within the SAC for both bottlenose dolphin and harbour porpoise, so that those populations can be better managed. A combination of distance sampling line-transect surveys and capture-mark-recapture methods have been used in order to determine the abundance of the species between 2001 and 2006. Bottlenose dolphin and harbour porpoise sightings have been analyzed with the software DISTANCE, and for bottlenose dolphins with the MARK-CAPTURE programme using the Chao(mth) model for closed populations. The results show no clear trend in abundance for the two species, although an increase is observed for bottlenose dolphins in the years 2005-06. Harbour porpoise numbers were lowest in 2001 when 176 were estimated, then showed an increase in 2003, levelling off thereafter at around 220 animals, but with yearly fluctuations. These data may help to explain a recent rise in porpoise deaths caused by bottlenose dolphins in Wales, possibly due to increased competition for food or habitat. The annual population size estimates derived from the proportion of well-marked individuals per encounter and the discovery rate for bottlenose dolphins suggest that an open population model might be more appropriate to describe the dynamics of this population, when analysed over more than one year. The results suggest that our study area is probably quite small relative to the range of the population, with the dolphins in the SAC being just a portion of a wider population encompassing the West and North Welsh coasts or even Irish Sea. Further research is needed to test this hypothesis

S41 CHARACTERISATION OF BOTTLENOSE AND COMMON DOLPHINS HABITAT IN THE BAY OF BISCAY: EVIDENCE OF A STRONG SPATIAL SEGREGATION

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Preferential habitats of predators are the combination of abiotic and biotic parameters. In the case of delphinids, it is rarely possible to measure simultaneously the physical characteristics of the habitats used by a population and its biological characteristics, such as prey abundance. In this work we aim at examining dolphin distribution in the Bay of Biscay in relation to bathymetry, hydrological landscape and pelagic fish. Since 2003, cetaceans sightings were collected during 18 000 km of transects, achieved during PELGAS surveys (IFREMER) in spring, on the continental shelf of the Bay of Biscay (100 000 km²). These surveys have recorded simultaneously pelagic fishes, plankton, physical parameters and top predators. Transects are separated by 20 km and directed from coast towards the slope, between the Spanish coast and Brittany. These surveys totalized 189 observations of cetaceans, containing 3411 individuals. Among these, the two most abundant cetaceans in this area were the common dolphin (29 % of observation) and the bottlenose dolphin (35 % of observation). We studied their distribution with a particular attention to their preferential habitat. We report a strong spatial segregation between both species and we have characterized their main habitat using

several discriminating variables such as bathymetry, hydrological landscape and distribution of their potential preys. We observed that common dolphins were associated to shallow bathymetry and coastal waters while bottlenose dolphins were distributed in the outer shelf and shelf break areas, mainly south of the Bay of Biscay.

POSTER ABSTRACTS ON MANAGEMENT

X1 MEDITERRANEAN MARINE RESOURCE ASSESSMENT (MRA) – MAPPING MARINE MAMMAL DISTRIBUTION AND OCCURRENCE

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The U.S. Navy is committed to protecting the marine environment while performing its military mission. Effective environmental planning requires accurate information on the distribution, abundance, and seasonality of protected marine species and habitats. In an effort to provide consistently high quality data to support this planning, the U.S. Navy has developed the Marine Resource Assessment (MRA) program. The goal of this program is to gather, compile, and synthesize available data, literature, and other information on marine resources of concern into a single reference document that serves as the basis for environmental assessment and planning. Currently, a MRA is in preparation for offshore regions of the Mediterranean Sea. The data and analysis in the Mediterranean MRA will detail the distribution of 24 species of marine mammals (21 cetacean and 3 pinniped) documented in the region. All marine mammal species receive protection under the U.S. Marine Mammal Protection Act; six of which are also protected under the U.S. Endangered Species Act. In addition to marine mammals, this MRA will present data and information for other important or rare marine species and habitats in the region. A rigorous, systematic literature search and extensive data collection effort is being conducted, cataloging available information for analysis. Through cooperation with regional experts, marine mammal distributions are delineated based on occurrence data, including sighting, stranding, and bycatch records, as well as scientific literature. The final report and extensive Geographic Information System (GIS) will provide the most up-to-date and relevant information on distribution, abundance, and seasonality of marine resources found in the Mediterranean Sea. This MRA will be an invaluable resource to the U.S. Navy and foreign partners; supporting environmental stewardship, exercise planning, and helping to determine appropriate mitigation measures for future navy training.

X2 MANAGEMENT OF HARBOUR PORPOISE INCIDENTAL CATCH: THE CANADIAN APPROACH

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Recent studies indicate that several hundred to several thousand small cetaceans (particularly harbour porpoises *Phocoena phocoena*) are captured each year in gillnet fisheries off Newfoundland and Labrador, Canada, despite a reduction in the usage of such nets during the last decade. Populations of northwest Atlantic harbour porpoises in Canadian waters are currently listed as "Special Concern" under Canada's Species At Risk Act, indicating that the species has the potential to become less abundant, and therefore warrants special attention by managing authorities. Although the overall impact of current levels of incidental catch on this population is unknown due to lack of abundance data, it appears to be a concern. However,

there are conflicting approaches to reduce this mortality.Management of incidental catch in Newfoundland and Labrador is unlikely to be achieved through a single measure, due to the extensive geographical scale of the problem, the number of fisheries involved, and the lack of resources for wide-scale monitoring and enforcement. Instead, management should be flexible, make use of a series of complementary approaches, and be aware of both short- and long-term costs of each of these approaches. The measures that provide the best chance to appreciably reduce incidental catch of harbour porpoises include time-area closures, using pingers or acoustically-enhanced gillnets, using new gears or new fishing methods, changes in fishing seasons, broader economic incentives to discourage the use of gillnets, and legislative measures. Potential benefits and costs of these measures are discussed on the basis of Canadian adaptive management, with particular focus on the current situation in Newfoundland and Labrador. Based on previous management experience, time-area closures are deemed the most practical method to reduce incidental catch in this region. However, any management scheme must demonstrate its effectiveness in reducing harbour porpoise incidental catch through concurrent improvements in monitoring.

Elegible for Student award: Postgraduate

X3 19TH AND 20TH CENTURY WHALING IN FLORES AND SANTA MARIA (AZORES, PORTUGAL) AND S. TOMÉ AND PRÍNCIPE (GULF OF GUINEA): A BRIEF REVIEW FOR THE EASTERN ATLANTIC WHALING

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An historic and socio-cultural research has been conducted to collect whaling information in order to recognize temporal and spatial changes of this activity on the Eastern Atlantic. Also, we tried to obtain baseline biological information usable to understand the size, occurrence and distribution cetaceans' populations. We consulted the Portuguese "Fund of Whale Fishery Cooperative", for the 20th century data, and published works of Clarke, Puim, Gomes and Townsend, for the 19th and 20th century data. Flores and Santa Maria are on opposite extremes of the Azores archipelago (Portugal) and, as in some of the other islands, an important whaling industry was established there. In fact, Flores was the first island to conduct commercial whaling in the 19th century under the American influence, probably due to its western geographical localization. In Flores whaling started in 1864 with small capture rates which increased after 1935 until 1949, with a total of 769 sperm whales captured. In Santa Maria whaling started in 1896 and ended in 1966, with a total capture of 867 sperm whales. Another Atlantic archipelago, S. Tomé and Príncipe, is also historically known for being a breeding ground for humpback whales, which have been the main target of whale captures since the 19th century. In this equatorial archipelago, located in the Gulf of Guinea in front of the Gabonese coast, there is no known deliberate exploitation of cetaceans at the present moment. It was early in the 20th century, and until 1959, that large numbers of sperm whales, humpbacks whales, and other great whales were captured off S. Tomé and Príncipe. Flores, Santa Maria, S. Tomé and Príncipe may be representative of whale captures throughout the Atlantic and especially the abrupt end of whaling in all these small oceanic islands may be indicative of natural population status.

Elegible for Student award: Postgraduate

X4 ACOUSTIC DEVICE REDUCE NEGATIVE INTERACTION BETWEEN FISHING ACTIVITIES AND *TURSIOPS TRUNCATUS*

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An increasing amount of evidence has shown that presence of *Tursiops truncatus* in fishing areas represents a growing concern for fishermen because dolphins can competes by feeding from the entangled fishes. This results in a damaging the nets and in a reduction of fished. However, past studies have focused attention on efficiency of some acoustics deterrents to reducing dolphin by-catch and not considering the economic damage to fishermen. Experiments to assess the efficiency of an acoustic device (DDD02 STM-SEAMED) were planned in a Mediterranean area (Egadi Island Sea, W-Sicily; April and May 2006) where *Tursiops truncatus* is observed to frequently interact with bottom set net and by-catch is not reported. Two identical monofilament bottom set nets (900 m length), one of them equipped with acoustic device and the other one without, were used to assess the effect of acoustic device on: 1) fished abundance 2) fished species, 3) *Tursiops truncatus* interaction with the bottom set nets. For each catch, data concerning dolphin sightings in the fishing area and fished (species, length, weigh) were collected. A total of 29 catches were carried out. Dolphins in the fishing area were sighted 11 times over 29 (38%) confirming the interaction with fishing activities. Significant differences between control and pinger nets were detected as refers to the fished abundance and fished species. The study demonstrated that acoustic device reduce dolphin's feeding from entangled fishes.

X5 SOCIO-ECONIMIC ANALISYS OF THE WHALE-WATCHING INDUSTRY IN ANDALUCIA, SPAIN

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The majority of Spanish whale-watching operations are based out of Andalucia and the Canary Islands. In particular, this industry has had significant effects on the economy of the coastal regions of Cadiz and Malaga on the main land. This has been partly explained by the favourable environmental conditions suitable for cetaceans, allowing for population aggregations and elevated numbers of resident individuals. These conditions offer easy and regular cetacean detectability for whale-watching activity, and in conjunction with the appeal of tourists for the region in general, have led to a continued development and importance of this industry in the area. With recognission of this development, the Government of Andalucia commissioned CIRCE to determine the socio-economic impact of whale-watching to the local economy. During 2006 extensive field visits where carried out at all operational whale-watching companies, using a predefined questionnaire survey based on interviewing whale-watchers, tour operators, company owners and their staff. Additional data was gathered from direct observations during operations. A total of 30 boats are operating in Andalucia (and Gibraltar) owned by 19 companies, with a maximum capacity of 861 passengers. Only in Tarifa, its is estimated that the number of visits increased from 400 in 1998, to 20000 in 2003. This value has increased even further in the last years. Only 4 of the companies offered a trained guide on board to answer any questions. It was also these companies which were the only ones that offered an educational chat about the area and the animals.

Elegible for Student award: Undergraduate

X6 DO MARINE RENEWABLE ENERGY DEVICES GIVE SUFFICIENT WARNING TO MARINE MAMMALS TO AVOID HARMFUL COLLISIONS?

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This study focuses on the collision risk to marine mammals from devices designed to extract energy from the waves and tides. Most marine renewable energy devices are at the developmental stage but because the UK has set a target of 10% of energy production from renewable sources by 2010 (18% in Scotland) it is likely that devices will be placed in UK waters in the near future. Little is known about their environmental impacts especially marine mammal collision risks because they are relatively new compared to other renewable technologies (*e.g.* wind turbines). We therefore reviewed existing and developing marine renewable devices from a marine mammal's perspective in terms of their size and position in the water column as well as the speed and movement of mobile parts. To then determine how much warning (and avoidance time) marine mammals swimming underwater would get of a device ahead of them we constructed a detection model (based upon source path receiver models). This combined the sensory cues produced by the devices (acoustic & visual) with the physical characteristics (vision, hearing and swimming abilities) of representative UK marine mammal species. The model estimated the detection distance away from source, and was run for a range of environmental scenarios (light levels, background noise, and water clarity). For conditions where detection may be too late for avoidance the model was also run with cues from acoustic deterrents such as pingers. The model gives an indication of the time / distance available for marine mammals to avoid these devices but emphasises the need for information on the underwater cues (particularly the levels and frequencies of underwater noise) produced by these devices.

Elegible for Student award: Postgraduate

X7 OBSERVATIONS OF BELUGAS DURING REALIZATION OF PIPELINE CONSTRUCTION IN NEVELSKOY STRAIT

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Investigations were performed in the Nevelskoy Strait during summers of 2005 and 2006. Exxon Neftegasz Company organized marine mammal observations from vessels used for pipeline construction. The main purpose of the observers was to assess a level of impact of industrial activity on marine mammals (MM), to prevent incidents with MM and to study species composition and abundance of MM in the work area. Previous studies suggest that this beluga population inhabits the Amur Firth and southern part of the Sakhalin Gulf. The reproductive gatherings of belugas are located near Chkalova and Baidukova islands. However there were no observations of belugas in the Nevelskoy Strait. According to our data belugas regularly occur in this Strait. Before the beginning of August migration of belugas northward to the Amur Firth has been observed (up to 100 animals during a day), and in September and October animals move south to the Sea of Japan. Our observations revealed that: 1. underwater pipelining and the pipeline itself have not caused any negative impact on belugas. On the August 9, 2005 belugas did not cross the pipeline which the saw first time. On the August 11, 2005 some belugas crossed the pipeline. After that all belugas crossed the pipeline back and forth. Vessels stopped and work ceased in immediate vicinity of belugas. 2. Belugas give birth not only in the southern Sakhalin Gulf but also in northern part of the Sea of Japan. In early summer we 3 times observed female belugas with calves of the year moving north. Thus we can conclude that even under the conditions of intense human economical activity, the involvement of marine mammal specialists can not only minimize the negative influence on marine mammals, but also make an important contribution to MM investigation.

X8 'AVOIDANCE' AS A MARINE MAMMAL CONSERVATION STRATEGY: SPATIO-TEMPORAL MANAGEMENT OF ANTHROPOGENIC SOUND SOURCES

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During the last decade, the potential impacts of anthropogenic sound sources on marine mammals have received increasing focus. The impulsive sound produced by seismic airguns during geophysical exploration, and the mid- and low-frequency active sonars emitted by naval frigates have both been implicated in marine mammal stranding events, and mitigation of these sound sources at sea is increasingly standard practice. Worldwide marine mammal mitigation guidelines vary considerably in operational and real-time measures such as exclusion zone radius, the marine mammal species included, and delay/shut-down procedures, although relatively little mitigation has a firm scientific basis and proven efficacy in the field. The avoidance of key marine mammal habitat via the implementation of 'spatio-temporal management' has been frequently identified as the most effective means of mitigating the impacts of sound on marine mammals. The potential implementation of spatio-temporal management of sound sources to avoid key marine mammal habitat, relies on defining geographical and seasonal 'key habitat' and 'key marine mammal species'. Planning of seismic and sonar surveys around these criteria requires year-round distributional and abundance data for marine mammals in each relevant geographical survey area. We present case studies where spatio-temporal management has been used to implement 'closed zones' for anthropogenic sound sources in sensitive areas. Predictive spatial modelling of cetacean habitats is a novel and powerful scientific tool that may assist in identifying key habitat and managing anthropogenic sound to minimise impacts on marine mammals.

Elegible for Student award: Postgraduate

X9 BEAKED WHALE STRANDINGS IN RELATION TO MILITARY EXERCISES: A COMPARISON BETWEEN THE CANARY AND HAWAIIAN ISLANDS

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Mass stranding events of beaked whales have occurred in association with recent naval exercises, with two species most affected, Cuvier's and Blainville's beaked whales. Six events have been recorded in the Canary Islands involving naval exercises over 20 years. Regular naval exercises occur in Hawai'i involving mid-frequency sonar use, and both species are resident to the area, yet no beaked whale mass strandings have been reported there. We hypothesize that the likelihood of detecting beaked whale mass strandings, if they were to occur, would be lower in Hawai'i than in the Canaries. We analyze and discuss various factors that should influence the likelihood of a beaked whale stranding and the probability of detection once stranded, including near-shore bathymetry, coastline slope, the occurrence of fringing reefs, human population density, presence of large scavenging sharks, water temperature, and currents. Near shore bathymetric comparisons indicate that the Canaries have deeper water closer to shore, with a steeper slope (avg. slope Canaries -133.71 m/km, Hawai'i -94.96 m/km). Within 3km of shore, Hawai'i has only 59% of suitable beaked whale habitat compared to the Canaries. Coastal slope analyses indicate Hawai'i is more dominated by steep cliffs (6% of shorelines vs. <1% for Canaries). Human population density in Hawai'i is 28% of that in the Canaries, and population per kilometre of shoreline is 53% of that in the Canaries. Suitable habitat closer inshore, more easily accessible coastlines, and a higher population per kilometre of shoreline all suggest that

there is a higher probability of a carcass washing onshore and being detected. Beaked whale strandings in Hawai'i may be detected less frequently due to limiting factors of an animal reaching shore and lower detection probabilities, and thus are likely occurring more frequently than is evident by the stranding record.

X10 EFFECTIVENESS OF THE MARINE MAMMAL STRANDING NETWORK IN CENTRAL PORTUGAL

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In the year 2000, the Portuguese Wildlife Society, in accordance with the Nature Conservation Institute, took over the activities of the dedicated local branch of the Portuguese stranding network (Central Portugal, 140km-long coastline), considering the high number of strandings in the area and its importance for the conservation of harbour porpoises. Local authorities were informed of the presence of a research team thus ensuring that all stranded animals got declared. Furthermore, a 30km constant-effort transept was defined in a remote area, allowing the detection of animals that had been unaccounted for by the authorities. The goal of this local network was to detect all stranded marine mammals in order to: (1) determine species occurrence and causes of death and (2) establish a tissue bank for future research. The present work evaluates the effectiveness of the activities developed by this local stranding network during the past 6 years. There was an important increment in the number of animals detected (360 animals between 2000-2005) in comparison to previous years (209 animals between 1976-1999). In fact, apart from those animals detected during dedicated surveys, authorities declared more animals because, for the first time in this area, a team was on the field to collect the animal immediately after a stranding alert. The authorities' alerts gave access to fresher animals than those produced by dedicated surveys (χ^2=10.23; P=0.0014). More animals were collected in the area covered by the dedicated surveys, (1.7 animals/10km versus 0.3 animals/10km, in 2005). Since the implementation of the local network, the number of detected by-catches increased considerably, when compared with other years mostly because animals collected by the research team are submitted to necropsy and therefore produce more data than those recorded by local authorities.

Elegible for Student award: Postgraduate

X11 MOVEMENTS AND CONSERVATION PROBLEMS OF COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus*) ALONG THE NORTH EASTERN COAST OF SARDINIA

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The priority to implement conservation measures for cetacean species, like common bottlenose dolphin (*Tursiops truncatus*), is to know movements and home range. Common bottlenose dolphin have been monitored in Northeastern Sardinia since 1999. In 2006 Marine Protected Area Tavolara-Punta Coda Cavallo was included in study area. Research was carried out through boat surveys, with the use of photo-identification techniques and with detailed reports of behavioural data. Between January 2001 and November 2006, 484 days were spent surveying, resulting in 1770 hours of sea surveys, 303 sightings and 1511 observations. We investigated the movements of a sample of 15 photo-identified dolphins in the sea between

Bocche di Bonifacio and S.Teodoro in relation with sex, age and presence of calves and juveniles in the groups. The study shows how common bottlenose dolphins move through three Protected Areas: Bocche di Bonifacio Marine International Park, La Maddalena National Park, Tavolara-Punta Coda Cavallo Marine Protected Area. As few protected areas are properly designed or large enough to provide comprehensive protection to a cetacean population, the study shows how it is urgent to adopt common conservation strategies for this specie between the three protected areas and to implement a local action plan.

X12 CAN ALERTING SOUNDS REDUCE BY-CATCH OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA)*?

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Coastal and high seas gillnet fisheries results annually in the take of large numbers of harbour porpoises (*Phocoena phocoena*) in the Danish Waters. Acoustic alarms commonly referred to as pingers are effective in displacing porpoises. The reasons why porpoises are caught in gill nets are not well known, but a contributing factor could be that porpoises are not paying sufficient attention to their surroundings. There fore the main objective of this study was to find out if alerting sounds could reduce by-catch. Alerting sounds in this case are artificial porpoise click trains (series of clicks, SL = 125-138 dB peak-peak re 1µPa @ 1 m, 80 kHz, 50-2500 clicks per sec) simulating the clicks porpoises often use investigating targets. The idea is that alerting sounds can stimulate porpoises to echolocate at the net. The porpoise will get reflections back from the pinger and the net, thereby detecting the barrier ahead. This concept was tested by deploying custom made pingers, called PAS pinger (Porpoise Alerting Sound pinger), in the Danish hake fishery during July and August 2006. Conventional nets with mesh size 130 mm, twine size 0.57mm, 40.5 meshes high and a length of 2000 knots were used, of which 50% had PAS pingers and 50% dummy pingers attached at intervals of 180m. Onboard observers collected data on fishing activity, fish catches and porpoise by-catch. The trips had a total by-catch of 17 porpoises in PAS nets and 15 in the control nets. Statistical analyses showed no difference in by-catch rates of harbour porpoise between the PAS pinger nets and the controls. Our results indicate that the sounds used as alerting sounds can not reduce by-catch of harbour porpoises, but the results can contribute to determine why harbour porpoises are by-caught in gillnet.

Elegible for Student award: Undergraduate

X13 WHALEWATCHING IN NORWAY: EFFECTS OF INCREASED WHALEWATCHING TRAFFIC ON SPERM WHALES

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Bleik Canyon is considered an important summer habitat for male sperm whales in Norway. Commercial whalewatching in the area first begun in 1988 as a small-scale business . The number of tourists has recently grown to over 12 000 per season, mainy in July and August, and we investigated if increased whalewatching activities disrupt or change sperm whales behaviour. During the 2006 whalewatching season, between 20 June and 27 August observations were carried out from two whale-watching boats to quantify short-term reactions of sperm whales to the presence and manoeuvres of boats. In 150 encounters we recorded surface and diving times, blow interval and surface behaviour in absence (>1000m distance) and presence of boats. Results were compared with data obtained 10 years ago. Our results have

shown no clear pattern of short-term reaction to presence of one to four boats, and an overall high fluking rate (>96%), but there was a significant increase in changing direction, higher number of shallow dives, and reduced surface time when any of the boats approached in high speed. We concluded that at present state whalewatching off Andoya does not show a measurable impact on sperm whales when guidelines are met, but that approaching a whale in high speed must be avoided as it disrupts regular diving patterns, and that slowing down distances should be reconsidered for boats with stronger engines.

X14 PINGER SPACING – WIDENING THE GAP

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Pingers deployed to reduce bycatch of harbour porpoises became mandatory in some European fisheries following EU Council Regulation 812/2004, which also includes the technical specifications and conditions of use of pingers. With respect to pinger spacing, *i.e.* the maximum spacing between two pingers along nets, the Council Regulation specifies 200m and 100m, respectively, for the two different types of pingers defined in 812/2004. Experiments conducted with porpoises in the wild suggest, however, that pingers may be effective at longer ranges than 200m. As pingers are both expensive and present practical handling problems in commercial fisheries, it is important that pingers are used optimally, *i.e.* that they are deployed with the largest spacing possible without reducing their effectiveness in mitigating porpoise bycatch. This will also help to minimise any environmental effects of widespread pinger use. Therefore a trial was conducted in the Danish North Sea gillnet fishery in July-September 2006 with the objective to determine if pinger spacing could be increased without reducing the effectiveness. In the trial nets without pingers formed the control group and nets with pingers spaced at 455m and 585m, respectively, formed the two experimental groups. Altogether 108 hauls were conducted during the trial, catching a total of 48 porpoises. Nets without pingers had a bycatch rate of 0.54 porpoises per haul, nets with pingers spaced at 455m had a bycatch rate of 0 and nets with pingers spaced at 585m had a bycatch rate of 0.12. The bycatch rates for the two experimental groups were both significantly different from that of the control group ($P<0.0001$; 1 d.f.; $\alpha=0.95$). We conclude that spacing for the pinger tested could be extended to at least 455m without loss of deterrence efficiency. We recommend that further trials are conducted to determine how well these results apply to other pingers.

X15 FACTORS DRIVING SPATIAL AND TEMPORAL PATTERNS IN CETACEAN STRANDINGS IN CORNWALL OVER A CENTURY

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The cetacean community of this area has, to date, been poorly described, despite the Cornish coast consistently receiving the greatest proportion of reported UK strandings. A long-term dataset of cetacean stranding records from Cornwall, south-west Britain, was made available by the Cornwall Wildlife Trust Marine Strandings Network. We investigated spatio-temporal patterns in recorded strandings and their possible underlying causes. Between 1900 and 2004, a total of 1916 records of 16 cetacean species were documented. There was a statistically significant increase in number of strandings per year, from the early 1970s onwards. This increase was largely due to an exponential rise in the numbers of common dolphins *Delphinus delphis* and harbour porpoises *Phocoena phocoena*. These also represented a significantly

increasing proportion of total strandings. There was a distinct seasonal pattern in strandings, peaking between the months of December and April. Confirmed cases of bycatch comprised up to 22% of all records, between 2000 and 2004. Spatially, stranding frequency was markedly higher on the south coast with four distinct 'hot-spots' for harbour porpoises. These are likely the result of prevailing currents and the presence of embayments which may aggregate carcasses. Analysis of large fishing vessel density of the UK fleet showed the western approaches near Cornwall to be one of the most heavily-fished areas in UK waters, but there was no temporal correlation between seasonal peaks in strandings and fishing effort. We recommend a more detailed analysis of fishing pressure, including all EU vessels operational in the area. The recent reduction in funding for post-mortems of stranded cetaceans by the UK government will complicate efforts to understand the relationship between fishing effort and observed rates of cetacean stranding. Quantifying such relationships has become paramount as responsibility for the mitigation of cetacean-fisheries interactions increases at a national, European and global level.

X16 MONOFILAMENT BYCATCH EVIDENCE IN CETACEANS STRANDED IN CORNWALL

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Cornwall has the highest rate of cetacean mortalities in the UK. Data collected by the Cornwall Wildlife Trust Marine Strandings Network on cetaceans that stranded on the shores of Cornwall in 2006, during one of the recognised peak months for fisheries-related cetacean strandings (January), were analysed. The carcasses of 47 cetaceans – 35 common dolphins (Delphinus delphis), 5 harbour porpoises (Phocoena phocoena) and seven unknown species (due to inaccessibility or decomposition) were recorded. Of these, 42 were photographed and examined for causes of mortality. Data from animals subjected to post-mortem examination by a veterinary pathologist, and those inspected by the Network that were unsuitable for autopsy, were analysed. From the combined findings, a strong pattern of bycatch (69% of all cetaceans) was established in which evidence of gill or tangle net injuries was seen. 27 of the animals identified as bycaught were common dolphins – two were harbour porpoises. In a number of carcasses, monofilament net was found embedded in, or wrapped around the carcass. No conclusive evidence of trawl net was found. In some cases, carcasses were too autolysed to confirm the cause of mortality. In others, although the specific type of fishery could not be identified, lesions consistent with having been bycaught were noted. In animals that underwent post-mortem examination (n = 18), 33% were confirmed as having been bycaught. Gill and tangle nets were therefore shown to present a major threat to common dolphins as well as harbour porpoises in Cornwall. The Marine Strandings Network's Bycatch Evidence Evaluation Project (BEEP) aims to identify more accurately the type of fishery responsible for mortalities. This research is vital in light of the UK Government cuts in funding for post-mortem examinations.

X17 USING ANIMAL TRACKS TO ASSESS THE IMPACT OF COASTAL DEVELOPMENT

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Increasing concern on the impact of coastal development is bringing the relationship between ecologists and managers into the public domain. One example is the proposal to establish an underwater turbine in Strangford Lough Narrows (Northern Ireland). This has generated a need to quantitatively predict and monitor the risk to local harbour seals (*Phoca vitulina*) and requires

methods to model and communicate uncertainty in our knowledge. One (of several) metrics of risk used is proximity (in the example here - being within 500 m) to the turbine site. Proximity is certainly necessary for actual risk, though it is not, in itself, sufficient. Among other approaches, 12 seals were fitted with SMRU GSM/GPS tags to track, and provide a baseline of their behaviour before the installation of the turbine. The resulting 769 seals-days of track and behavioural data were automatically subdivided into foraging trips (our basic sampling unit), indexed with the haulout site (total of 32) of departure. 564 trips were identified and had mean duration of 22.8 h (95% percentile range 3.0-69.9 h). 84 of these trips were at least partially within the turbine area, for a total of 239 h. The probability of these *study* seals being within the turbine area, given they were in a trip, was thus 0.0144. The uncertainty of this as a *population* estimate was calculated by resampling by seal. This produced a 95% percentile range of 0.0025 to 0.0321. The magnitude of this range reflects the high degree of individual variability in behaviour. The range increases further if the study seals were not an unbiased sample of the population. The uncertainty in our risk metric decreases the effective power of a monitoring programme. We assess these effects and develop this framework to provide a statistically robust yardstick with which to compare pre- and post-installation behaviour.

X18 CONSERVATION OF CETACEANS IN S. TOMÉ AND PRÍNCIPE ARCHIPELAGO: FROM WHALING TO WHALE WHATCHING

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S. Tomé and Príncipe is an archipelago located in the Gulf of Guinea, and is composed by two main islands and several small islands. Despite their small size, these islands have a great marine biodiversity. The underwater world around the islands has a very rich and diverse fauna, with sharks, cetaceans and sea turtles in the top of the food chain. A preliminary historic research was conducted between 2002 and 2005, simultaneously with the biological research to study cetaceans' occurrence, but a significant effort was made in 2004 which allowed obtaining data in the National Archive of S. Tomé and Príncipe. Our objectives in this study were : to determine which species of cetaceans occurred and where along the coast of the S. Tomé island; to understand which human activities could affect the presence of cetaceans in coastal waters and to give some preliminary indications on possible priority conservation marine areas for whales and dolphins. Commercial whaling in the Gulf of Guinea began in the 18th century and several different species of great whales have been captured. Nowadays no longer exits, except for occasional catches of small dolphins. Moreover, a detailed review of the legislation from this former Portuguese colony showed that between 1913 and 1955 extensive regulations exited referring to whaling grounds and permits. Since that time and until the country independence no nature related legislation existed at all. Presently, and since 1999 a most general and clearly insufficient legislation exit regarding the fauna, flora and ecosystems conservation. The development and implementation of effective marine conservation measures require, however, detailed knowledge about the geographic occurrence of a species. Conservation measures that are already in force need to be evaluated and re-evaluated, and new approaches need to be developed to address threats that were unrecognized or non-existent until recently.

Elegible for Student award: Postgraduate

X19 CONSERVATION STATUS AND PRIORITIES OF THE CRITICALLY ENDANGERED MEDITERRANEAN MONK SEAL *MONACHUS MONACHUS* IN THE ARCHIPELAGO OF MADEIRA

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The Mediterranean monk seal is critically endangered and in urgent need of effective conservation measures. Following a steep decline of population numbers in the past century, Parque Natural da Madeira Service initiated efforts to protect the species in the archipelago of Madeira, which included habitat protection, scientific research and public awareness. The aim of this study was to analyse data collected during a monitoring project (1989 – 2005) in order to assess the current conservation status of the species in the area and identify priority conservation actions for the future. The study recorded the intense presence of the species at key pupping sites in a strictly protected area at the Desertas Islands as well as increased sightings in recent years around the main island of Madeira. It recorded also an increase in the number of pups born in the archipelago as well as a low number of deaths. The findings suggest that the species remains critically endangered in the area but that its conservation situation has improved since and due to the implementation of effective conservation actions. Conservation priorities identified, include protecting suitable monk seal habitat at Madeira, investigating seal – fisheries interactions, increasing environmental education and strengthening the regional legislation regarding the protection of the species.

X20 ANTHROPOGENIC NOISE AND ITS IMPACT ON BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) DISTRIBUTION IN THE LOŠINJ DOLPHIN RESERVE (CROATIA)

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The primary source of the sea ambient noise (SAN) is sea traffic, which dominates the range of low frequencies (10-1000 Hz). This is especially so in areas with strong nautical tourism. The Lošinj Dolphin Reserve is an important area for nautical tourism, located in the northern Adriatic, Croatia. This study aims to assess the extent of the anthropogenic pressure in the Reserve, looking at the relationships between boat traffic and underwater noise, and their relationship with bottlenose dolphin distribution. SAN was made sampled on 10 acoustic stations, between November 2004 and October 2005, within the Reserve by using a Reson TC4032 hydrophone and Pioneer DC-88 DAT recorder. Cool Edit and Matlab software were used to calculate the average Root mean square (RMS) value (intensity of the energy of each acoustic sample, in relative dB), and to obtain octave bands analyisis for each acoustic sample. Recordings of noise, and data on vessel presence were compared to the spatial distribution of bottlenose dolphins' groups collected in the same period. Results show a clear correlation between the areas of high anthropogenic pressure, and strong dolphin avoidance. This was particular so on the 'boat highways' within the Reserve, and during the summer months. Data collected on vessel presence indicates how this dolphin displacement can be attributed to a significant seasonal increment in the number of very fast and noisy vessels, such as motor cruisers, and medium or large speed boats, with high powered engines. This study shows the existence of a direct link between anthropogenic noise and traffic on the habitat use of the Kvarneric bottlenose dolphin population. Moreover, it is demonstrated that the SAN is a good indicator of anthropogenic impact due to the presence of sea traffic.

X21 ARE THE KILLER WHALES "ENDANGERED" IN THE STRAIT OF GIBRALTAR?

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Killer whales have been described in the Strait of Gibraltar in recent years. A total of 33 individuals, belonging to 3 social groups, are present all year around in the waters of the Strait of Gibraltar and the Gulf of Cadiz. They feed on red tunas (*Thunnus thynnus*), in the shallow waters of the Bay of Barbate during the spring, exhausting the tunas, and around fishing boats in the deep waters of the Strait of Gibraltar the rest of the year. In 2004, the Spanish Ministry of Environment proposed new guidelines to evaluate the species of the National and Regional Catalogue of Endangered Species. In those guidelines, the species can be included in three categories. Two of them ("vulnerable" and "endangered"), will have the category of endangered while the third one ("of special interest") will not have this category. The category "vulnerable" will obligate the regional or national government to set up a conservation plan for the specie, while the category "endangered" will force them to set up a recovery plan for this specie. Up to date, the Killer whales in Spain, are included in the category of "special interest", and then don't have any conservation measure. In this presentation we describe evidences, following the criteria included in the guidelines, to include the Killer whales in the category "Endangered" in the "Comunidad Autónoma de Andalucía".

Elegible for Student award: Undergraduate

X22 RUSSIAN MARINE MAMMAL COUNCIL: TEN YEARS OF ACTIVITY

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In 1995 at the instance of researchers and managers dealing with marine mammals in Russia Regional Nonprofit Organization "Marine Mammal Council" (MMC) was founded. The foundation of the MMC and its activity has been kindly supported by International Fund for Animal Welfare (IFAW). Today the MMC unites 115 members – active researchers, managers and other people who share its objectives. The main goal of the MMC is to promote and coordinate study and conservation of marine mammals. It is open for new members from any country. Major tasks of the organization are: 1) development of primary directions and programs for research, protection and sustainable use of marine mammals; 2) arrangement of scientific and practical workshops, conferences and meetings. Current activity and certain projects are supported by IFAW, "Utrish Dolphinarium" Ltd. (Russia), Marine Mammal Commission (USA), WWF, Society for Marine Mammology (USA), North Pacific Research Board USA, National Marine Mammal Laboratory (USA). The MMC works in close cooperation with Scientific-Advisory Committee on Marine Mammals of Interdepartmental Ichthyology Commission (Russia). The MMC actively contributes to development of recommendations for International Whaling Commission, Russian-Norwegian Commission on harp seals and Russian-American marine mammal working group. It organized four international conferences "Marine mammals of the Holarctic" in 2000, 2002, 2004 and 2006. The fifth conference is planned for autumn 2008. The MMC also regularly holds sittings to discuss important problems relating to marine mammals and deliver conclusions and concerns to policymakers and research community. The MMC supervises a number of marine mammal research projects: investigations of the White Sea belugas; acoustic monitoring of industrial noise pollution in the feeding area of western gray whales on the Sakhalin shelf; development of method for aerial survey of pacific walruses. The MMC issues periodical Information Bulletin and supports publications of Russian researchers. The MMC website MARINE MAMMAL

NEWS (http://2mn.org) presents information about current marine mammal problems. The MMC collects scientific library numbering now over 2,000 publications relating to marine mammals

X24 BOAT TRAFFIC EFFECTS ON THE DIVING BEHAVIOUR OF BOTTLENOSE DOLPHINS (*Tursiops truncatus*) IN SARDINIA, ITALY

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Marine traffic has previously been observed to elicit responses in cetacean behaviours, but the cause and effects of these interactions has yet to be fully understood. This study aimed to determine the relationship between bottlenose dolphin dive behaviour and boat traffic. Diving behaviour of free ranging wild bottlenose dolphins on the northeastern coast of Sardinia, Italy was observed using non-invasive direct observations of focal individuals and groups. A total of 1012 dives, totalling 160 hours, were observed. Short and long dives were discriminated between by using the median dive duration (12 seconds) as a cut-off. Five dive parameters (dive rate, short dive rate, long dive rate, dive efficiency and maximum duration) were used to facilitate and enhance dive analysis. Boat data, type and level of presence clearly demonstrated a seasonal trend between peak and non peak periods. Tourist boats were most present during peak summer season, whereas fishing boat presence was uniform throughout the year. Dive behaviour also differed seasonally. When tourist boat presence was at its highest, there was an observed increase in travelling behaviour; this was reflected by low short dive rates, and shorter long dives. In absence of tourist boats, and during feeding behaviour, dive behaviour was represented by increased long dive durations, and increased frequency of short dives. Fishing boats did not elicit any changes in dive behaviour. The residential tendencies of this bottlenose dolphin community may have lead to some tolerance to marine traffic, but it is obvious that they are still responding to tourist boats. Group surfacing rates did not differ between boat approach and non approach situations, which may be suggestive of a "safety in numbers" strategy. Finer scale behavioural observations, such as dive behaviour analysis, could prove to be vital for understanding the potential long term implications of dolphin-boat interactions.

X25 A COST OF GREEN ENERGY: ARE WAVE AND TIDAL ENERGY DEVICES A THREAT TO EUROPEAN CETACEANS?

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The need to reduce atmospheric carbon emissions is driving the development of a new range of renewable energy devices. The wind turbine concept is now well established but the imminent launch of a new generation of machines that extract wave or tidal energy from coastal waters is also now likely. A variety of designs have been proposed from flexible floating structures to underwater turbines. Many are still conceptual but several are already being tested at sea. In this presentation we review the potential range of devices that may be deployed in European coastal waters and consider the risks to cetaceans that they pose. These are compared with existing industrial activities such as fisheries and shipping. We then focus on a prominent concern - collisions between cetaceans and underwater tidal turbines. To investigate the magnitude of the threat, we consider the risks posed by likely blade rotation speeds and then model the potential frequency of encounters between a commercial-scale coastal development (100 turbines) and the harbour porpoise population off western Scotland. Because cetacean responses to turbines are unknown we assume that they are neither attracted to nor avoid these devices. The model predicted that in a year of operation 1300 individuals (10.7% of the population) would encounter a rotating blade. This interaction rate is an order of magnitude greater than local bycatches. The model highlights body size as a critical factor and so individual collision rates

for larger species are likely to be even greater than for the porpoises. We conclude that the introduction of these new energy generation technologies may pose a significant new threat to European coastal cetacean populations. We also emphasise the urgent need for consideration of how cetaceans may perceive and then respond to these devices underwater to reduce the potentially high rates of interaction predicted.

X26 SOCIAL ATTITUDES TO MARINE CONSERVATION IN NE SCOTLAND: PUBLIC PERCEPTIONS AND CETACEANS IN THE MORAY FIRTH.

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Humans rely on marine resources for a range of recreational, aesthetic and economic activities, but, because of the inter-connected nature of these different activities, an agreeable balance between species preservation and the needs of the public and industry needs to be accomplished. The Moray Firth in northeast Scotland is a recognised area of outstanding biological importance, hosting the only resident bottlenose dolphin population in the North Sea. Consequently, marine and wildlife tourism plays a vital role in the area's economy, but conflicts between commerce/industry and environmental conservation inextricably exist. In the present study, social science methods were used to examine the attitudes of local inhabitants, visitors and stakeholders to marine wildlife conservation in the Moray Firth. 64 structured and 12 semi-structured interviews were carried out to investigate local awareness of cetacean species present, the threats facing them, and the public's conceptual support for Marine Protected Areas (MPAs). Results indicated considerable support and awareness for marine wildlife. More than 70% of interviewees recognised the presence of the principal cetacean species occurring in the firth, but the majority were unaware of any Special Area of Conservation (SAC) designation. 45% of respondents believed that cetaceans were not sufficiently protected in these waters, whilst 64% agreed that an MPA for the entire Moray Firth would be desirable. In addition, several stakeholders positively evaluated wildlife conservation in the region, but criticisms were raised concerning present limitations of the existing SAC and the need for legislative enforcement for particular activities. Since public perceptions and attitudes are known to have an impact on environmental conservation, even if the measurement of said perception is imprecise, the results of this investigation are thought to be highly significant to precautionary management directives for the sustainable protection of such valuable marine resources.

Elegible for Student award: Postgraduate

X27 DENSITY ESTIMATES OF MARINE LITTER IN A KEY CETACEAN HABITAT IN NORTH WEST SCOTLAND

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Marine litter is a conservation concern for cetaceans owing to entanglement and ingestion. In the waters of the Hebrides, North West Scotland, there have been several incidents of cetacean mortality attributable to interactions with marine litter. This is of particular concern as this area is an important habitat for cetaceans, and also remote from major identifiable direct sources of pollution. However, no attempts have been made to quantifiably assess the extent of floating pollution in the area. Line transect surveys were conducted from research vessel SV Silurian over the 2006 research season, to quantify the level and composition of marine litter in Hebridean waters. For each litter sighting, the type of litter was recorded, and its distance from the beam of the vessel. A total of 547 items was observed, 71% of which were confirmed as plastics. Plastic bags and plastic bottles were the items most commonly observed (37% and 18%

of total respectively). Data collected within our core sampling area of the Inner Hebrides, at sea state less than 3, when 2 or more observers were on station were used for analysis, a total of 460 survey hours. Rubbish density was estimated to be a minimum of 4.62 pieces per km^2 (95% CI 3.31 – 6.47), using standard distance sampling methodologies. Given that this figure draws solely on floating rubbish observed at the surface, the total levels of marine litter are likely to exceed this estimate. This represents a conservation challenge for the region's marine ecosystem

X28 IMPACT OF CETACEAN BY-CATCHES IN GALICIAN WATERS (NW SPAIN): EVALUATION THROUGH STRANDINGS DATA

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By-catch mortality is one of main threats for cetaceans. In Galician waters there is a very important cetacean community, with 20 species, and there works one of the more important fishery fleet in the world. Between 2000 and 2005 the stranded cetaceans along the whole Galician coast were recorded and analysed, taking care of looking for criteria for the diagnosis of by-catch in well preserved carcasses. Moreover, data from proven by-catches and animals with a poor health condition were recorded. Considering only the six species that had a higher stranded frequency for this period, the total number of stranded animals was 1105, and 54% of them had been proven or diagnosed by-catches. The percentage of mortality due to by-catch for these species were: *Delphinus delphis* 73%, *Phocoena phocoena* 40%, *Grampus griseus* 13%, *Globicephala melas* 10%, *Tursiops truncatus* 9% and *Stenella coeruleoalba* 8%. We estimate that 31% of stranded animals died because of pathologies. Knowing that only 14% of animals that die at the sea arrive stranded to the coast, the total number of dead cetaceans due to interaction with fisheries would be 708 animals each year, 410 would die because of pathologies, and 197 would die without knowing the cause, but maybe some of them would die because of fishery trawlers. This value of 708/year dead animals represents the minimum value for the whole community of cetaceans. There are other species that die due to by-catch. The signs of by-catch were related mainly with entanglement fisheries, so the effect of trawler, the one that causes the higher mortality, would be underestimated, since this gear produces almost no signs on carcasses. Then, an estimation for annual mortality would be 708-905 animals. By-catch is a very strong threat for cetaceans in Galician waters, mainly for the *Delphinus delphis* and *Phocoena phocoena* populations.

X29 DETECTING TRENDS IN HARBOUR SEAL POPULATIONS: IMPLICATIONS FOR MANAGEMENT

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Detecting trends in abundance is a central requirement for the conservation and management of a species. Pinnipeds spend considerable time in the water and so are only visible for counting when they haul ashore. Numbers of pinnipeds are therefore often monitored at haul-out sites, thus justifying legislation that protects these marine mammals at land-based sites. However, practical limitations on the number and frequency of monitoring surveys mean that it is important to determine whether trend sites can be used for assessing trends in abundance of the wider population. Mantel tests were used on aerial surveys, collected over an 18 year period, to investigate the biological and statistical validity of current protected areas for harbour seals in

Scotland as designated under the European Habitats Directive. This study showed that trends in abundance at pairs of haul-out sites were not significantly correlated and exhibited asynchrony in population trends. Thus it is likely that there is a complex pattern of connectivity between haul-out sites and that the conclusions appropriate at one scale of population patterning may be inappropriate at other scales. Moreover, trends in harbour seal abundance in selected land-based protected areas deviated by up to 100% from the general trend observed in the population at large over four-year intervals. Consequently the use of these protected areas for estimating trends in abundance and conservation status may be limited due to the apparent individuality of the haul-out sites and the deviation in observed population trends between these areas and the overall population. It is unlikely that they provide biologically and statistically appropriate trend sites and the consequences of focusing monitoring programmes on individual haul-out sites should be considered carefully. Instead, consideration should be given to monitoring larger areas, which in this study reflected trends in the overall harbour seal population more closely.

X30 THE WHALE WATCHING ACTIVITY IN THE AZORES ARCHIPELAGO

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Azorean whale watching activity started around 1993 and it has been growing very rapidly during the last 10 years. This work characterizes the Azorean whale watching activity social-economically, identifies the potential impacts on cetaceans and contributes to the sustainability of the activity through some recommendations/suggestions. The sample survey was made through enterprise's and tourist's inquiries. Fifteen enterprise's and 146 tourist's inquiries were analysed.. In 2004 there were records of 15 licensed operators, 35 boats, 85 job positions and around 30.000 clients (mostly in July and August). On the central group of the islands, the whale watching activity started on April and ended on October and on the eastern group in January and December, respectively. The most representative tourist's nationalities were, decrescently, portuguese, german, english and french. The most frequently sighted cetacean species were: common dolphin, sperm whale, bottlenose dolphin, spotted dolphin and Risso's dolphin. However, the sightings reveal some selectiveness on the observational effort towards the sperm whale. The majority of the inquired tourists were women, had between 35 and 44 years old (most frequently), had a university level background, travelled in the company of friends or family and stayed in the Azores around 7 days. The tourists' satisfaction level was very high. However, some of the tourists reveal a lower satisfaction level on the quality and quantity of information and on the climate conditions of the whale watching trip. The potential impacts of this activity may be the way boats approach the animals (e.g. speed, distance, noise production) and the location and duration of the observations. The whale watching enterprises may increase their benefits through a diversification on the target-species, dispersion of the boats, improvement of the workers' whale watching background, increase of the quantity of information given during the trip, and improvement of the safety measures on board.