



ABSTRACT BOOK

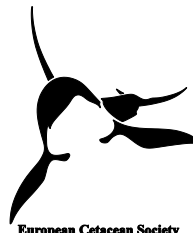
# 24<sup>th</sup> CONFERENCE OF THE EUROPEAN CETACEAN SOCIETY

MARINE MAMMAL POPULATIONS:  
CHALLENGES FOR CONSERVATION  
IN THE NEXT DECADE

22<sup>nd</sup> – 24<sup>th</sup> MARCH 2010, STRALSUND/GERMANY



**Deutsches  
Meeresmuseum  
Stralsund**



European Cetacean Society

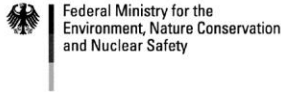
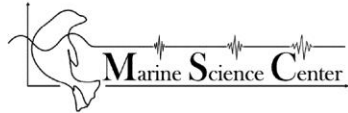
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Organizing Committee

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

**22<sup>nd</sup> – 24<sup>th</sup> March 2010, Stralsund, Germany**

## **THEME**

Marine Mammal Populations: Challenges for Conservation in the Next Decade

## **VENUE**

Alte Brauerei, Stralsund  
German Oceanographic Museum, Stralsund  
OZEANEUM, Stralsund

## **HOST**

German Oceanographic Museum, Stralsund  
OZEANEUM, Stralsund

## **CO-OPERATING PARTNERS**

Research & Technology Centre Westcoast, University of Kiel, Germany; Marine Science Center, University of Rostock, Germany; Institute of Biochemistry & Biology, Unit of Evolutionary Biology, University of Potsdam, Germany; Federal Maritime & Hydrographic Agency, Germany; United Nations Environment Programme, Tunisia; Society for the Conservation of Marine Mammals, Germany; Hel Marine Station, University of Gdansk, Poland

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### **TO AND FROM THE VENUE “ALTE BRAUEREI” (OLD BREWERY)**

During the main conference days (22.-24.03.2010) you can use your name tag as ticket for free rides with the busses of the local bus company (SWS). Please show your name tag to the bus driver or controller. Next to the regular bus traffic, additional busses (ECS bus) will be mobilized at the beginning and the end of the conference days to get you to the venue and back to the city of Stralsund. They have the conference logo in the front window.

A selection of bus stations can be found in the maps of Stralsund (see following pages). Route No 3 is the bus route to choose to get to the Brauerei (direction Andershof/Devin/Andershof Ausbau) and back to the city (direction Strelapark). Please check the black board for bus connections.

The ECS busses leaving from Homa (busstation near Brauerei) will stop at Hafenstrasse, Wasserstrasse, Busbahnhof and Hauptbahnhof. On Tuesday, 23<sup>rd</sup> March the ECS busses will pass by the Theatre, the venue of the Video night, and reach the “Hauptbahnhof” a few minutes later than on the other days.

### **BUS TIMES TO THE VENUE**

<b>Station</b>	<b>ECS bus</b>	<b>Regular bus</b>
Strelapark/Zoo	-	06:25-17:55: ~every 15 min, 18:19, 18:51, 19:21, 19:51, 20:16, 20:50
Hauptbahnhof	07:50	06:41-18:11: ~every 15 min, 18:35, 19:07, 19:37, 20:07, 20:32, 21:06
Busbahnhof		2 minutes later than from „Hauptbahnhof“
Wasserstrasse		4 minutes later than from „Hauptbahnhof“
Hafenstrasse		5 minutes later than from „Hauptbahnhof“
Homa		8 minutes later than from „Hauptbahnhof“

### **BUS TIMES FROM THE VENUE**

<b>Station</b>	<b>ECS bus</b>	<b>Regular bus</b>
Homa	19:10	06:03-17:18: ~every 15 min, 17:46, 18:14, 18:31, 18:56, 19:21, 19:51, 20:26, 20:51

**VIDEO NIGHT**

The video night is open to the public, and video arrangements in the theatre of Stralsund are well visited. Please make sure that you are early for the video night to be able to attend it. As mentioned above, the ECS bus that is leaving the Brauerei on Tuesday evening to the city centre of Stralsund will pass by the theatre. You should use this advantage to reserve your seat for the video night!

## MAP OF STRALSUND, LARGE VIEW



### VENUES

- 1 **Old Brewery** | Stralsunder Brauerei GmbH | Greifswalder Chaussee 84-85 | 18439 Stralsund
- 2 **GERMAN OCEANOGRAPHIC MUSEUM (GOM)** | Katharinenberg 14-20 | 18439 Stralsund
- 3 **OZEANEUM** | Hafenstraße 11 | 18439 Stralsund
- 4 **Theatre „Vorpommern“** | Olof-Palme-Platz 6 | 18439 Stralsund

### ACCOMMODATIONS

- 1 **Steigenberger Hotel Baltic** | Frankendamm 22 | Stralsund | [www.steigenberger.com](http://www.steigenberger.com)
- 2 **Hotel am Jungfernstieg** | Jungfernstieg 1b | 18437 Stralsund | [www.hotel-am-jungfernstieg.de](http://www.hotel-am-jungfernstieg.de)
- 3 **Radisson** | Grünhufener Bogen 20 | 18437 Stralsund | [www.radissonblu.com/hotel-stralsund](http://www.radissonblu.com/hotel-stralsund)
- 4 **Younior Hotel Stralsund** | Tribseer Damm 78 | 18439 Stralsund | [www.younior-hotel.de](http://www.younior-hotel.de)
- 5 **Hostel Stralsund** | Reiferbahn 11 | 18439 Stralsund | [www.hostel-stralsund.com](http://www.hostel-stralsund.com)
- 6 **Pension Peiß** | Tribseer Str.15 | 18439 Stralsund | [www.altstadt-pension-peiss.de](http://www.altstadt-pension-peiss.de)
- 7 **Pension Cobi** | Jacobiturmstraße 15 | 18439 Stralsund | [www.pension-cobi.de](http://www.pension-cobi.de)
- 8 **Pension Stralsund-Rügenbrücke** | Ziegelstraße 4 | 18439 Stralsund

### BUS STATIONS

- 1 **Old Brewery** | (H) "Homa"
- 2 **Central Station** | (H) "Hauptbahnhof"
- 3 **Radisson I** | (H) "Strelapark Zoo"

## CITY OF STRALSUND

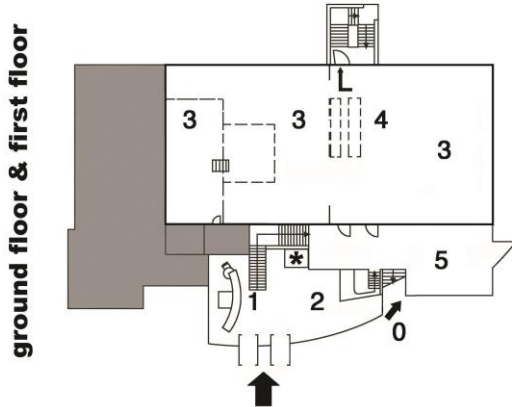
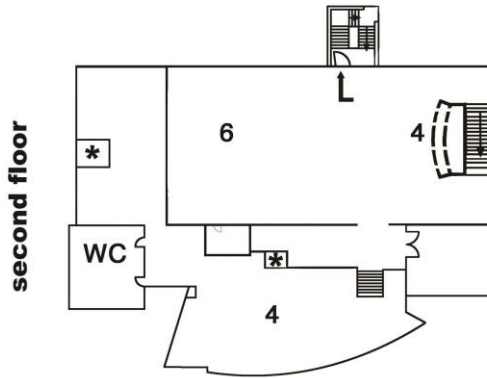
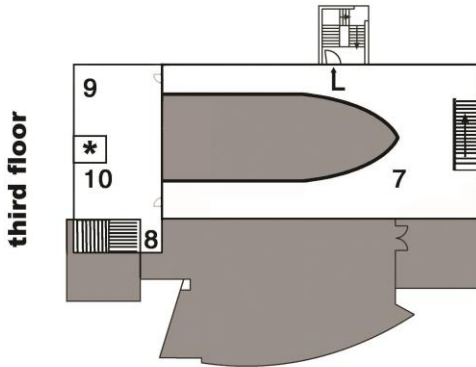
**MAP OF STRALSUND, CLOSE UP**



- 1 GERMAN OCEANOGRAPHIC MUSEUM (GOM) |** Katharinenberg 14–20 | 18439 Stralsund
- 2 OZEANEUM |** Hafenstraße 11 | 18439 Stralsund
- 3 Theatre „Vorpommern“ |** Olof-Palme-Platz 6 | 18439 Stralsund

- 1 GERMAN OCEANOGRAPHIC MUSEUM (GOM) | **H** “Kütertor”
- 2 OZEANEUM | **H** “Ozeaneum”
- 3 Theatre “Vorpommern” | **H** “Olof-Palme-Platz”
- 4 Central Bus Station | **H** “Busbahnhof”
- 5 City | **H** “Wasserstraße”
- 6 Steigenberger Hotel Baltic | **H** “Hafenstraße”

**CONFERENCE GUIDE: VENUE "ALTE BRAUEREI"**



- 0 = Council room  
(access from outside)
  - 1 = Registration
  - 2 = Wardobe
  - 3 = Posters
  - 4 = Coffee & Snacks
  - 5 = Organizers' room
  - 6 = Auditorium
  - WC= Restrooms
  - 7 = Gallery
  - 8 = Speaker Preparation
  - 9 = Internet
  - 10 = Vendors
  - \* = Elevator
- L** = Way to "Alter Fritz"  
(Lunch)

## **SNACKS & BEVERAGES**

During the whole conference snacks and beverages can be purchased at several places in the Brauerei. You can also visit the “Alte Fritz” to have a beer with your colleagues. During coffee breaks, coffee and other beverages as well as small snacks are offered for free.

## **MEETINGS**

If you wish to have a meeting with your colleagues in a quiet room without drinking beer, you can use the “Maschinenraum”, a room situated in the “Alter Fritz”. You’ll pass it when you go via the stairway into the restaurant area. The Maschinenraum will be used during lunch time, and is therefore unavailable for meetings between 12:30 and 15:15.

## **POSTER GUIDE**

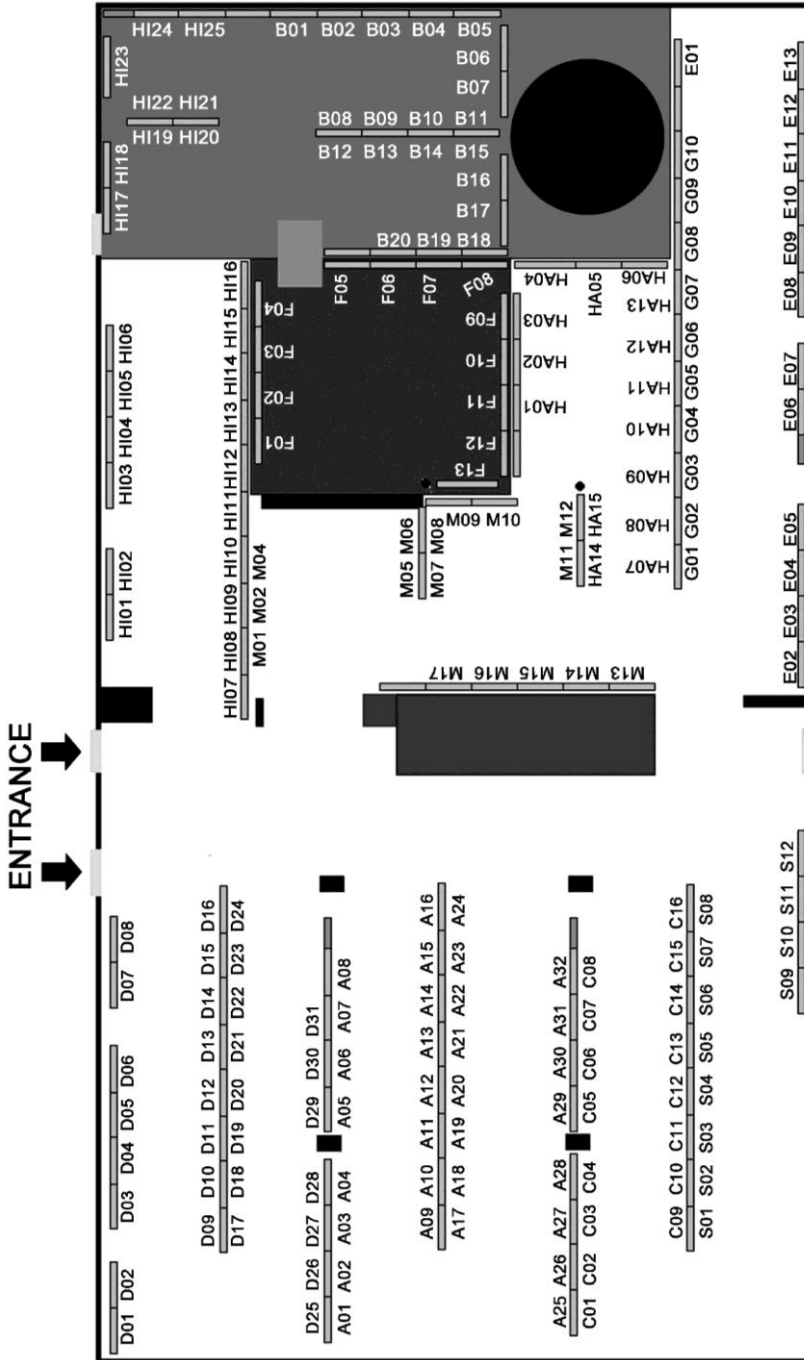
Posters can be set up on Monday 22<sup>nd</sup> March from 8:00 am on. You can find the poster place assigned to you on the poster-plan shown below. Please ONLY use the poster-pins provided by the organizers. They will be distributed at several spots in the poster area. If you need assistance for setting up your poster, please ask one of the student volunteers.

Presenting authors are asked to be at their posters during poster sessions:

Monday 22<sup>nd</sup>: Poster session I: Authors of posters with uneven numbers

Tuesday 23<sup>rd</sup>: Poster session II: Authors of posters with even numbers

POSTER GUIDE





## CONFERENCE PROGRAMME

Saturday, 20<sup>th</sup> March 2010

### WORKSHOPS

#### **CETACEAN BYCATCH: EFFECTIVENESS OF CURRENT MITIGATION MEASURES AND POSSIBLE IMPROVEMENTS IN THE FUTURE**

Organizers: Peter Evans\*, Marije Siemensma\*, Stefan Bräger\*

\*on behalf of ECS/ASCOBANS

Morning: Open workshop

Venue: GERMAN OCEANOGRAPHIC MUSEUM - Forum

Afternoon: Closed meeting

Venue: GERMAN OCEANOGRAPHIC MUSEUM - Vortragsraum

#### **VISION IN MARINE MAMMALS**

Organizers: Frederike D. Hanke\*, Guido Dehnhardt\*

\*Marine Science Center, University of Rostock (Germany)

Morning

Venue: GERMAN OCEANOGRAPHIC MUSEUM - Vortragsraum

#### **BEST PRACTICES IN MARINE MAMMAL RESEARCH**

Organizer: ECS Science Advisory Committee

Afternoon

Venue: GERMAN OCEANOGRAPHIC MUSEUM - Forum

#### **C-POD WORKSHOP**

Organizer: Nick Tregenza\*

\*Chelonia Ltd. (United Kingdom)

Whole day, Venue: OZEANEUM - Mehrzwecksaal

#### **MARINE MAMMAL MORPHOLOGY**

Organizers: Stefan Huggenberger\*, Helmut Oelschläger\*\*

\*University of Cologne (Germany), \*\*University of Frankfurt (Germany)

Whole day, Venue: OZEANEUM - Seminarraum

**Sunday, 21<sup>st</sup> March 2010**

**WORKSHOPS**

**SAMBAH – STATIC ACOUSTIC MONITORING OF THE BALTIC SEA HARBOUR PORPOISE**

Organizers: Mats Amundin\*, Ida Carlén\*\*, Julia Carlström\*\*

\*Kolmarden Wildlife Park (Sweden), \*\*AquaBiota Water Research (Sweden)

Morning: Closed meeting, Afternoon: Open workshop

Venue: GERMAN OCEANOGRAPHIC MUSEUM - Forum

**FIXED TRANSECT SURVEYS FOR CETACEANS ON FERRIES AND OTHER RESEARCH PLATFORMS - BEST PRACTISE AND COLLABORATION ON RESEARCH AND POLICY APPLICATIONS**

Organizers: Antonella Arcangeli\*, Tom Brereton\*\*, Colin D. Macleod\*\*

\*Institute for Environmental Protection and Research (ISPRA) Land

\*\*Atlantic Research Coalition (ARC) Land

Afternoon, Venue: OZEANEUM - Kursraum

**GIS STUDENT WORKSHOP**

Organizers: Polona Kotniak\*, \*\*, Tilen Genov\*\*

\*ECS-student representative; \*\*Morigenos (Slovenia)

Whole day

Venue: GERMAN OCEANOGRAPHIC MUSEUM - Vortragsraum

**PILE DRIVING IN OFFSHORE WINDFARMS: EFFECTS ON HARBOUR PORPOISES, MITIGATION MEASURES AND STANDARDS**

Organizers: Kristin Blasche\*, Maria Boethling\*, Christian Dahlke\*

\* Federal Maritime and Hydrographic Agency (BSH) (Germany)

Whole day, Venue: OZEANEUM - Mehrzwecksaal

**WHITE-BEAKED AND WHITE-SIDED DOLPHINS: TWO NORTH ATLANTIC SPECIES IN THEIR ENVIRONMENT**

Organizers: Carl C. Kinze\*, Anders Galatius\*\*, Marianne Rasmussen\*\*\*, Peter Evans\*\*\*\*

\*(Denmark), \*\*Institute of Biology, University of Copenhagen (Denmark), \*\*\*Húsavík Research Center, University of Iceland (Iceland), \*\*\*\*Sea Watch Foundation (United Kingdom)

Whole day, Venue: OZEANEUM - Seminarraum

## OFFICIALS

**16:30 - 20:00 REGISTRATION**

Venue: GERMAN OCEANOGRAPHIC MUSEUM

**19:00 - 22:30 ICEBREAKER**

Venue: GERMAN OCEANOGRAPHIC MUSEUM

**Monday, 22<sup>nd</sup> March 2010**

**8:00 - 10:00 REGISTRATION**

**9:00 OPENING**

Dr. Harald Benke, Director of the German Oceanographic Museum

Dr. Alexander Badrow, Lord Major of Stralsund

n.n., Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Dr. Simone Panigada, Chair of the European Cetacean Society

### INVITED TALK

**9:50 ENDANGERED CETACEAN POPULATIONS WORLDWIDE**

Bernd Würsig, Randall R. Reeves

**COFFEE BREAK 10:30 – 11:00**

### POPULATION STRUCTURE

*Chair: Valerio Ketmaier*

**11:00 FINE SCALE POPULATION STRUCTURE OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATES*) OFF GALICIAN WATERS NW SPAIN**

Ruth Fernández, Graham J. Pierce, M. Begoña Santos, Alfredo López, Susana García-Tiscar, Jason Newton, Santiago Lens, Stuart Piertney

**11:20 PAEDOMORPHIC TRAITS IN KILLER WHALES *ORCINUS ORCA***

Pavel Goldin

**11:40 FINE-SCALE POPULATION STRUCTURE OF INSULAR INDO-PACIFIC BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS*) OVER TEMPORAL SCALES**

Jeremy Kiszka, Benoit Simon-Bouhet, Caroline Gastebois, Ludivine Martinez, Claire Pusineri, Vincent Ridoux

**12:00 SOCIAL STRUCTURE OF INSULAR INDO-PACIFIC BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS*) ASSESSED THROUGH ASSOCIATION PATTERNS AND KINSHIP ANALYSES**

Benoît Simon-Bouhet, Jeremy Kiszka, Vanessa Becquet, Caroline Gastebois, Claire Pusineri, Vincent Ridoux

**12:20 POPULATION STRUCTURE OF LONG-FINNED PILOT WHALES IN EUROPE**

Philippe Verborgh, Renaud de Stephanis, Pauline Gauffier, Susana García Tiscar, Ruth Esteban, Lionel Minvielle-Sebastia, Vincent Ridoux, Willy Dabin, Angela Llavona, Enara M. Ipiña, Silvia Monteiro, Nigel Monaghan, Simon Berrow, Maria Christina Fossi, Letizia Marsili, Sophie Laran, Emilie Praca, Ana Cañadas, Ricardo Sagarmínaga, Jose L. Murcia

**12:40 GENETIC ANALYSIS OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) REVEALS POPULATION DIFFERENTIATION IN THE BALTIC SEA AND ADJACENT WATERS: A COMBINED ANALYSIS OF NUCLEAR MICROSATELLITES AND MITOCHONDRIAL DNA**

Annika Wiemann, Liselotte W. Andersen, Per Berggren, Ursula Siebert, Harald Benke, Jonas Teilmann, Christina Lockyer, Iwona Pawliczka, Krzysztof Skóra, Anna Roos, Thomas Lyrholm, Kirsten B. Paulus, Valerio Ketmaier, Ralph Tiedemann

**LUNCH BREAK 13:00 – 14:45**

**HUMAN INTERACTIONS**

*Chair: Peter Evans*

**14:50 FEEDING ECOLOGY AND DIET SHIFT OF LONG-BEAKED COMMON DOLPHINS (*DELPHINUS CAPENSIS*) INCIDENTALLY CAUGHT IN ANTI-SHARK NETS OFF KWAZULU-NATAL SOUTH AFRICA**

Shan Ambrose, William Froneman, Malcolm Smale, Stephanie Plön

**15:10 HARBOUR PORPOISES AND OFFSHORE DEVELOPMENT: INCREASED PORPOISE ACTIVITY IN AN OPERATIONAL OFFSHORE WIND FARM**

Jakob Tougaard, Meike Scheidat, Sophie Brasseur, Jacob Carstensen, Tamara van Polanen Petel, Jonas Teilmann, Peter Reijnders

**15:30 INTERACTIONS BETWEEN DOLPHINS AND AN AUSTRALIAN DEMERSAL SCALEFISH TRAWL FISHERY: IMPLICATIONS FOR BYCATCH MITIGATION**

Vanessa Jaiteh, Simon Allen, Jessica Meeuwig, Neil Loneragan

**15:50 RESPONSES OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) TO PILE DRIVING MEASURED WITH PASSIVE ACOUSTIC MONITORING**

Ansgar Diederichs, Miriam Brandt, Laura Wollheim, Caroline Höschle, Georg Nehls

**16:10 MANAGING FOR ROBUSTNESS: POTENTIAL EFFECTS OF CLIMATE CHANGE AND MUSSEL FARMING ON DUSKY DOLPHINS (*LAGENORHYNCHUS OBSCURUS*) IN ADMIRALTY BAY NEW ZEALAND**

Heidi Pearson, Robin Vaughn, Mridula Srinivisan, Timothy Markowitz, Bernd Würsig

**16:30 FIELD TESTING OF BARIUM SULPHATE GILLNETS TO REDUCE THE INCIDENTAL MORTALITY OF FRANCISCANA DOLPHIN (*PONTOPIA BLAINVILLEI*) IN ARGENTINA**

Edward Trippel, Pablo Bordino, Norman L. Holy

**COFFEE BREAK 16:50 – 17:20**

**POSTER SESSION**

**17:20 – 19:00 POSTER SESSION I (UNEVEN NUMBERS)**

**SOCIAL PROGRAMME**

**20:00 PUBLIC TALK: "WALE VON DER OSTSEE BIS ZUR ANTARKTIS - FASZINIERENDE LEBEWESSEN IN EINER SICH SCHNELL WANDELNDEN WELT"**

Thomas Henningsen

Venue: OZEANEUM - Riesen der Meere

Tuesday, 23<sup>rd</sup> March 2010

ABUNDANCE

Chair: Emer Rogan

- 8:30 TRENDS IN ABUNDANCE OF A SMALL RESIDENT POPULATION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) INHABITING PATOS LAGOON ESTUARY SOUTHERN BRAZIL**  
Eduardo Secchi, Juliana Di Tullio, Pedro Fruet
- 8:50 OPPORTUNISTIC SIGHTINGS OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN THE BALTIC SEA AT LARGE – KATTEGAT, BELT SEA, SOUND, WESTERN BALTIC AND BALTIC PROPER**  
Philip Loos, Petra Deimer, Hans-Jürgen Schütte, Justin Cooke, Katharina Fietz, Veit Hennig
- 9:10 MONITORING WINTER AND SUMMER ABUNDANCE OF CETACEANS IN THE PELAGOS SANCTUARY THROUGH AERIAL SURVEYS FOR CONSERVATION**  
Simone Panigada, Giancarlo Lauriano, Louise Burt, Nino Pierantonio, Greg Donovan
- 9:30 CORRELATION OF HARBOUR PORPOISE DISTRIBUTION AND ITS PREY IN SCANDINAVIAN WATERS**  
Signe Sveegaard, Jonas Teilmann, Karl-Johan Stæhr, Torben F. Jensen, Kim N. Mouritsen

INVITED TALK

- 9:50 CONSERVATION AND MANAGEMENT OF MARINE MAMMALS – ARE THEY COMPATIBLE ISSUES AT REGIONAL AND GLOBAL ECOSYSTEM LEVELS?**  
Christina Lockyer

**COFFEE BREAK 10:30 – 11:00**

## CONSERVATION / MANAGEMENT

*Chair: Christina Lockyer*

- 11:00 FIN WHALE (*BALAENOPTERA PHYSALUS*) POPULATION IDENTITY MIGRATION MOVEMENTS AND NOISE IMPACT IN THE WESTERN MEDITERRANEAN SEA**  
Manuel Castellote, Christopher W. Clark, Fernando Colmenares, Marc O. Lammers
- 11:20 REPRODUCTIVE SUCCESS OF BOTTLENOSE DOLPHINS IN WELSH WATERS 2001-08**  
Giovanna Pesante, Peter G.H. Evans
- 11:40 THE VAQUITA'S STORY: TOWED ARRAY SURVEYS FOR MONITORING TRENDS IN THE ABUNDANCE AND DISTRIBUTION OF A CRITICALLY ENDANGERED SPECIES**  
Rene Swif, Shannon Rankin, Denise Risch, Tim Gerrodette, Barbara Taylor, Douglas Gillespie, Jonathan Gordon, Lorenzo Rojas-Bracho, Armando Jaramillo-Legorreta

## PHYSIOLOGY

*Chair: Guido Dehnhardt*

- 12:00 AMPHIBIOUS VISION IN HARBOUR SEALS (*PHOCA VITULINA*)**  
Frederike D. Hanke, Guido Dehnhardt
- 12:20 CIRCULATING MELATONIN IN THE BOTTLENOSE DOLPHIN**  
Mattia Panin, Cristina Ballarin, Gianfranco Gabai, Bruno Cozzi
- 12:40 USING DTAG DATA TO ASSESS THE PHYSIOLOGY OF DEEP DIVING CUVIER'S BEAKED WHALES**  
Walter Zimmer, Peter Teglberg Madsen, Mark Johnson, Peter L. Tyack

## LUNCH BREAK 13:00 – 14:45

- 13:00 - 14:30 ANNUAL STUDENT MEETING**  
Venue: Main lecture hall
- 13:00 - 14:30 MEETING OF THE NATIONAL CONTACT PERSONS (NCP)**  
Venue: Council room



## ACOUSTICS

*Chair: Klaus Lucke*

- 14:50 USING ON-ANIMAL ACOUSTIC REMOTE SENSING TO STUDY THE FORAGING ECOLOGY OF BLAINVILLE'S BEAKED WHALES IN THE CANARY ISLANDS**  
Patricia Arranz Alonso, Natacha Aguilar de Soto, Mark Johnson, Alberto Brito, Peter Teglberg Madsen
- 15:10 HEARING PROCESSES MEASURED DURING ECHOLOCATION IN A FALSE KILLER WHALE**  
Paul E. Nachtigall, Alexander Ya Supin
- 15:30 SPECTRAL ESTIMATION METHODS FOR THE REAL-TIME LOCALISATION AND TRACKING OF CETACEANS**  
Ludwig Houégnigan, Serge Zaugg, Mike van Der Schaar, Michel André
- 15:50 DO BOTTLENOSE DOLPHINS USE SIGNATURE WHISTLES OF CONSPECIFICS WHEN THEY ENCOUNTER THEM?**  
Vincent Janik, Heidi Lyn
- 16:10 INFLUENCE OF CONTINUOUS MASKING PURE TONES ON ABR CLICK RESPONSES IN A HARBOUR PORPOISE**  
Meike Linnenschmidt, Kristian Beedholm, Janni Damgaard Hansen
- 16:30 REDUCING THE POTENTIAL FOR SEISMIC AIRGUN IMPACTS ON CETACEANS THROUGH ALTERNATIVE TECHNOLOGIES FOR OIL AND GAS EXPLORATION**  
Lindy Weilgart, Ron Brinkman, Chris Clark, John Diebold, Peter Duncan, Rob Habiger, Leila Hatch, John Hildebrand, Phil Nash, Jeremy Nedwell, Dave Ridyard, Rune Tenngamn, Peter van der Sman, Warren Wood, John V. Young

**COFFEE BREAK 16:50 – 17:20**

## POSTER SESSION

**17:20 – 19:00 POSTER SESSION II (EVEN NUMBERS)**

## SOCIAL PROGRAMME

**20:00 - 22:00 VIDEO NIGHT**  
Venue: "Theatre Vorpommern"

Wednesday, 24<sup>th</sup> March 2010

ECOLOGY

*Chair: Graham Pierce*

- 8:30 SURVIVAL RATE ESTIMATIONS FOR STELLER SEA LIONS (*EUMETOPIAS JUBATUS*) ON THE KURIL ISLANDS RUSSIA**  
Alexey Altukhov, Vladimir Burkanov
- 8:50 GEOGRAPHICAL VARIATION OF SKELETAL PAEDOMORPHOSIS IN THE HARBOUR PORPOISE: DOES ECOLOGY MATTER?**  
Anders Galatius, Pavel E. Goldin
- 9:10 DIFFERENT RESULTS IN DIET OF PORPOISES USING FATTY ACIDS AND STOMACH CONTENTS: GENUINE TEMPORAL CHANGES IN DIET OR AN ARTEFACT?**  
Okka Jansen, Sophie Brasseur, Mardik F. Leopold, Peter J.H. Reijnders
- 9:30 CFD STUDY OF NEW NON-INVASIVE DESIGN OF DOLPHIN TELEMETRY TAG**  
Vadim Pavlov, Muhammad A. Rashad

INVITED TALK

- 9:50 PROTECTION OF CETACEANS UNDER NATIONAL AND EUROPEAN LAW: IMPACT OF THE HABITATS DIRECTIVE ON THE COMMON FISHERIES POLICY**  
Alexander Proelß

**COFFEE BREAK 10:30 – 11:00**

HABITAT USE

*Chair: Bernd Würsig*

- 11:00 SEQUENTIAL HABITAT USE OF RESURRECTION BAY ALASKA BY RESIDENT KILLER WHALES AS DETECTED BY PASSIVE ACOUSTIC MONITORING**  
Harald Yurk, Olga Filatova, Craig O. Matkin, Lance. G. Barrett-Lennard, Michael Brittain

- 11:20 PREDICTION OF FIN WHALE'S AND SPERM WHALE'S DISTRIBUTION LINKED TO TOPOGRAPHIC AND ENVIRONMENTAL PARAMETERS IN THE PELAGOS SANCTUAR**  
Tiziana Di Fulvio, Sophie Laran, Léa David, Nathalie Di-Megliio, Pascal Monestiez
- 11:40 CHARACTERISTICS OF HUMPBACK WHALE HABITAT IN THE SCOTIA SEA AND THE ANTARCTIC PENINSULA**  
Carole Durussel, Sue Moore, Nancy Friday, Alexandre Zerbini, Sharon Hedley
- 12:00 SPATIAL MODELLING OF HARBOUR PORPOISE (*PHOCOENA PHOCOENA*) DISTRIBUTION BASED ON SATELLITE DATA**  
Susi Edrén, Mary Wisz, Jonas Teilmann, Rune Dietz, Johan Sørderkvist
- 12:20 WATER TEMPERATURE AND THE DISTRIBUTION OF THE COMMON DOLPHIN (*DELPHINUS DELPHIS*) IN BRITISH SHELF WATERS: A POTENTIAL INDICATOR OF CLIMATE CHANGE IMPACTS**  
Tom Brereton, Colin D. Macleod, Kevin Robinson, Emily Lambert, Sarah M. Bannon, Karen Hall, Marina Costa
- 12:40 ZOOGEOGRAPHY OF THE CETACEANS IN ALGOA BAY SOUTH AFRICA**  
Brigitte Melly, Gillian McGregor, Stephanie Plön

**LUNCH BREAK 13:00 – 14:45**

**STRANDINGS**

*Chair: Ursula Siebert*

- 14:50 METHODOLOGY FOR FIELD-GAS SAMPLING TRANSPORT AND ANALYSIS IN THE LABORATORY OF GAS EMBOLISM FOUND IN STRANDED CETACEANS**  
Yara Bernaldo de Quirós, Oscar González-Díaz, Pedro Saavedra, Manuel Arbelo, Eva Sierra, Mariña Méndez, Antonio Fernández
- 15:10 WHAT CAUSED THE UK'S LARGEST COMMON DOLPHIN (*DELPHINUS DELPHIS*) MASS STRANDING EVENT?**  
Paul D. Jepson, Robert Deaville, Karina Acevedo-Whitehouse, James Barnett, Robert L. Brownell, Frances C. Clare, Nick Davison, Robin J. Law, Jan Loveridge, Shaheed K. Macgregor, Steven Morris, Rod Penrose, Matthew Perkins, Eunice Pinn, Victor Simpson, Mark Tasker, Nick Tregenza, Andrew A. Cunningham, Antonio Fernández

## WORKSHOP REPORTS

**15:30** REPORTS ON THE PROGRESS AND OUTCOMES OF THE WORKSHOPS HELD ON  
THE 20<sup>TH</sup> & 21<sup>TH</sup> MARCH 2010 IN STRALSUND, GERMANY

**COFFEE BREAK 16:50 – 17:20**

## AGM

**17:20 - 19:00 ANNUAL GENERAL MEETING**

## SOCIAL PROGRAMME

**20:00 DINNER & DANCE**

Venue: OZEANEUM

**Thursday, 25<sup>th</sup> March 2010**

**EXCURSION TO THE ISLAND OF HIDDENSEE**

Details will be announced on the black board

## POSTER LIST

### ACOUSTICS

A01

**Hearing measurements from a rehabilitated stranded long finned pilot whale (*Globicephala melas*)**

Meike Linnenschmidt, Paul E. Nachtigall, Laura N. Kloepper, Aude Pacini

A02

**In-air hearing sensitivity in harbour seals (*Phoca vitulina*) from the North Sea as a baseline for long-term auditory monitoring**

Janne K. Sundermeyer, Klaus Lucke, Sven Adler, Jörg Driver, Tanja Rosenberger, Ursula Siebert

A03

**Describing odontocete inner ear ultrastructures: contribution from scanning electron microscopy**

Maria Morell, Marc Lenoir, Jean-Luc Puel, Thierry Jauniaux, Willy Dabin, Marisa Ferreira, Michel André

A04

**Unsuccessful attempt to measure sound related evoked potentials on cuttlefish (*Sepia officinalis*)**

Alex Mas, Marta Solé, Joan Castell, Michel André

A05

**Hearing measurements of a stranded pygmy killer whale *Feresa attenuata***

Aude Pacini, Paul E. Nachtigall, Laura N. Kloepper, Meike Linnenschmidt

A06

**Analysis of whistle characteristics of short-beaked common dolphins from surrounding British waters and the Eastern Tropical Pacific Ocean**

Emily T. Griffiths, Peter G. H. Evans

A07

**The typology of underwater sounds of beluga whales (*Delphinapterus leucas*): the stereotype and the variability in signals**

Alexandr Agafonov, Vsevolod Belkovich

A08

**Long-term study of whistle contours and repeated whistles of free-ranging bottlenose dolphins**

Julia A. Bernal Shirai, Bruno Díaz López, Milla Mihailova, Claudia Casas

A09

**Variety of biphonic discrete calls in North Pacific resident killer whales**

Olga Filatova, Harald Yurk, John Ford, Craig O. Matkin, Lance G. Barrett-Lennard

A10

**Mutual dependence of beluga whales calves presence on the herd's acoustic repertoire**

Ludmila Osipova, Alexandr Agafonov, Vsevolod Belkovich

A11

**Toothed whale click production: in porpoises click frequency content is coupled to click amplitude in the same way as in dolphins**

Kristian Beedholm

A12

**Acoustic signals of minke whales in the Gulf of St. Lawrence**

Dany Zbinden

A13

**Recordings of blue whales (*B. musculus*) in Skjálfandi Bay, Iceland**

Maria Iversen, Marianne H. Rasmussen, Vigdis Sigurðardóttir, Erla B. Örnólfsdóttir

A14

**Acoustic crypsis in small cetaceans: Narrow band high frequency clicks to avoid killer whale predation?**

Line A. Kyhn, Jakob Tougaard, Peter Teglberg Madsen

A15

**Comparison of the songs of smaller and larger humpback whales (*Megaptera novaeangliae*)**

Elisa Girola, Jim Darling

A16

**Possible dialect in white-beaked dolphin whistles**

Marianne H. Rasmussen, Marie-Louise Schmidt, Viola Pavlova, Lee Miller

A17

**Buzz rates comparison between two sperm whale feeding grounds**

Luca Lamoni, Camilla Ilmoni, Paola Tepsich, Aurélie Moulins, Massimiliano Rosso, Maurizio Wurtz

A18

**Differences in whistle structure between parapatric coastal bottlenose dolphin communities**

Anneli Englund, Simon Ingram, Emer Rogan

A19

**The dynamic nature of social communication in humpback whales: Temporal changes to social vocalizations and their relationship with song**

Melinda Rekdahl, Rebecca Dunlop, Anne Goldzien, Michael Noad

A20

**Long term automated detection and classification of cetacean clicks for population monitoring and mitigation**

Serge Zaugg, Mike van der Schaar, Ludwig Houégnyan, Cédric Gervaise, Michel André

A21

**Listening to the deep**

Michel André, Mike van der Schaar, Serge Zaugg, Ludwig Houégnyan, Antonio Sanchez, Alex Mas, Maria Morell, Marta Solé, Joan Castell

A22

**T-Pods, an effective management tool to determine the use of habitat by bottlenose dolphins in Medes Island Marine Protected Area (North eastern Spain)**

Carla A. Chicote, Manel Gazo, Manuel Castellote



A23

**Passive acoustic monitoring of Cuvier's beaked whales and other Odontocetes in the Alboran Sea, Mediterranean, using click detectors (T-PODs)**

Stefan Ludwig, Nick Tregenza, Michaela Knoll

A24

**Estimating the number of sperm whales in a group through variational clustering of acoustic features**

Mike van der Schaar, Serge Zaugg, Ludwig Houégnigan, Michel André

A25

**Performance of a whistle contour extraction software for the classification of five Mediterranean delphinid species**

Sandra Fuchs, Alexandre Gannier, Paméla Quebre, Julie N. Oswald

A26

**Using calls to measure group size of inshore bottlenose dolphins within a special area of conservation**

Sophie Hansen, Simon Berrow, David McGrath

A27

**Imaging techniques to study the ultrastructures of statocysts in Cephalopods spp.**

Antoni Lombarte, Marta Solé, Alex Mas, Manel López-Bejar, Michel André

A28

**DSGLab: Managing the passive acoustics data deluge**

David Mann, Peter Simard, Carrie Wall

A29

**Using Static Acoustic Monitoring to describe echolocation behavior of Heaviside's dolphins in Namibia**

Ruth H. Leeney, David Carslake, Simon H. Elwen

A30

**The "biggest nose on record": 3D anatomy of the sperm whale nasal complex**

Stefan Huggenberger, Michel André, John C. Goold, Helmut H. A. Oelschläger

A31

**Morphological analysis of the superior olive in dolphin brainstems using cluster analysis**

Lyuba Zehl, Helmut H.A. Oelschläger, Stefan Huggenberger

A32

**A System for Monitoring Acoustic emissions of Cetaceans**

Didier Fusaro, Alexandre Gannier

BEHAVIOUR

B01

**Perception of optic flow in harbour seals (*Phoca vitulina*)**

Nele Glaeser, Björn Mauck, Farid Kandil, Guido Dehnhardt

B02

**Visual Abilities of a Visually Impaired Harbour Seal**

Nina Wengst, Frederike D. Hanke, Guido Dehnhardt

B03

**Control of Heat Dissipation through Thermal Windows in Harbour Seals**

Nicola Erdsack, Frederike D. Hanke, Guido Dehnhardt, Wolf Hanke

B04

**Spectral sensitivity in the harbor seal *Phoca vitulina*: Facts and open questions**

Christine Scholtyssek, Almut Kelber, Guido Dehnhardt

B05

**Different mechanisms for the detection of hydrodynamic events in seals and sea lion**

Lars Miersch, Johannes Oeffner, Wolf Hanke, Sven Wieskotten, Guido Dehnhardt

B06

**Discrimination of hydrodynamic trails by a harbor seal (*Phoca vitulina*)**

Sven Wieskotten, Wolf Hanke, Lars Miersch, Guido Dehnhardt

B07

**Can seals extract information from self-generated water movements?**

Wolf Hanke, Guido Dehnhardt

B08

**The relationship between the behavioral activity and underwater vocalizations of beluga whales (*Delphinapterus leucas*) of the Myagostrov local stock (Onega Bay, the White Sea)**

Elena Panova, Roman Belikov, Alexandr Agafonov

B09

**The patterns of socio-sexual behaviour in killer whales (*Orcinus orca*) of Avacha Gulf**

Tatiana Ivkovich, Olga Filatova, Alexandr Burdin, Erich Hoyt

B10

**Playing and cognitive behavior of Belugas in the White Sea natural conditions**

Vladimir Baranov, Vsevolod Belkovich, Anton Chernetsky

B11

**Cetacean behaviour in the Black Sea coastal waters**

Elena Gladilina

B12

**Longterm interspecific association and calf kidnapping between a bottlenose dolphin and common dolphins**

Pierre Gallego, Marta Acosta Plata

B13

cancelled

B14

**Play behaviour with objects and bubbles in Orinoco river dolphins (*Inia geoffrensis humboldtiana*)**

Guglielma Torre, Raffaella Tizzi, Manuel G. Hartmann

B15

**First recording of short finned pilot whales and bottlenose dolphins interspecific mating**

María del Mar Cañado Caparrós, Marcos G. Rubio

B16

**The role of play in feeding behavior shaping in calves of bottlenose dolphins and sea lions in oceanarium**

Olga Chechina

B17

**Case of killer whales hunting on walruses in the Bering Sea, Chukotka**

Natalia Kryukova, Denis Ivanov

B18

**TrackBrowser - Visualizing data and tracks in motion**

Olaf Jaeke

B19

**Behavioural response of cetaceans to biopsy darting**

Joan Giménez, Pauline Gauffier, Susana G. Tiscar, Ruth Esteban, Lionel Minvielle-Sebastia, Pedro Finamore Amaral, Philippe Verborgh, Carolina Jiménez Torres, Renaud de Stephanis

B20

**Post-release dive ability in rehabilitated harbour seals: as success story**

Bernie McConnell, Catriona Morrison, Carol Sparling, Laila Sadler, Alison Charles, Ruth Sharples

**CONSERVATION / MANAGEMENT**

C01

**NMFS International Action Plan for Marine Mammals**

**Phase 1: Priorities and Current Actions**

Michael Simpkins

C02

**How can we monitor the favourable conservation status of cetaceans (whales, dolphins and porpoise) in Ireland?**

Simon Berrow, David McGrath, Joanne O'Brien, Ian O'Connor, David Wall

C03

**A framework for assessing cumulating impacts in marine mammals**

Andrew Wright

C04

**The interface and implementation of regional management regimes in the conservation of the Baltic harbour porpoise**

Richard Caddell

C05

**Information and education tools in the protection of the harbour porpoise (*Phocoena phocoena*) in Poland**

Monika Konkel, Klaudyna Sergot, Krzysztof E. Skóra, Iwona Pawliczka

C06

**Conservation of the threatened Atlantic humpback dolphin (*Sousa teuszii*) in southern Angola: an uncertain future?**

Caroline Weir

C07

**Can indices of cetacean population status be extracted from historic datasets? Implications for understanding cetacean responses to climate change**

Karen Hall, Colin D. Macleod, Tom Brereton

C08

**Mapping marine mammal distributions for conservation management**

Peter G.H. Evans, Mick E. Baines

C09

**Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) population study of Kisite-Mpunguti Marine Protected Area, East Africa**

Sergi Perez Jorge, Ines Gomes, Rachel Crouthers, Richard Lemarkat, Graham Corti

C10

**Marine protected areas and *Tursiops truncatus* in the Balearic Islands: conservation involvement**

José M. Brotons, Alexander Martin, Jorge Jiménez, Yann Chastaing, Manolo Castellote

C11

**Conservation of the short-finned pilot whale in SW Tenerife, Canary Islands**

Antonella Servidio, Vidal Martín, Ana Cañadas, Silvana Neves, Mónica Pérez-Gil, Enrique Pérez-Gil, Philip Hammond

C12

**Evidence of a striped dolphin (*Stenella coeruleoalba*) nursery zone in the waters adjacent to the terrestrial Natura 2000 Area „Gerania Mount“ (Gulf of Corinth)**

Marta Azzolin, Marianna Anichini, Alice Galli, Elena Papale, Cristina Giacomini

C13

**When it comes to whales' conservation, is a recommendation enough?**

Pauline Gauffier, Philippe Verborgh, Ruth Esteban, Renaud de Stephanis, Joan Giménez, Carolina Jiménez Torres, Ezequiel Andréu, Baldomero Medina, Eric Kniest

C14

**Who will be the first?**

Ruth Esteban, Philippe Verborgh, Pauline Gauffier, Carolina Jiménez Torres, Joan Giménez, Renaud de Stephanis, Christophe Guinet

C15

**The missing tool in whale watching management strategies: the tourist profile**

Bruno Claro, Sara Magalhães, Margarida Castro

C16

**Ethical eco-tourism and the benefits to research**

Angela Gullen, S. West, L. Walker, A. Guissamulo

**ABUNDANCE / DISTRIBUTION**

D01

**Potential and limits of aerial surveys for the monitoring of marine mammals**

Léa David, Nathalie Di-Méglio, Benoît Paklepa, Pascal Monestiez

D02

**'Time Present' - a metric for Estimation of Density without use of a  
DISTANCE detection function**

Nick Tregenza

D03

**Harbor Porpoises in the Weser River**

Denise Wenger

D04

**Harbour porpoise survey in the Oosterschelde estuary**

Frank Zanderink, Nynke Osinga, Arjan Berkhuyse

D05

**Guess what! its the new world natural habitat, and there are porpoises  
(*Phocoena phocoena*)**

Caroline Höschle, Ansgar Diederichs, Miriam Brandt, Laura Wollheim, Georg Nehls

D06

**A preliminary study of fin whales (*Balaenoptera physalus*, Linneaus 1758) in  
the Channel of Sicily**

Eugenio Internullo, Ubaldo Cella, Chiara Copat, Giuseppina Corrente, Stefano Florida, Valeria Grasso, Clara Monaco, Letterio Mario Tringali

D07

**2009 summer sightings of common dolphin (*Delphinus delphis*) in the Ionian  
Islands**

Elena Papale, Marianna Anichini, Alice Galli, Cristina Giacomina, Marta Azzolin

D08

**Spatial and temporal distribution of *Hyperoodon ampullatus* of Pico Island,  
Azores**

Andrea Cosentino, Karin Hartman, Dominique Weilermann, Laura González García, Fleur Visser

D09

cancelled

D10

**Sperm whale sightings in the Turkish part of the Aegean and Mediterranean Sea**

Ayaka A. Öztürk, Arda M. Tonay, Ayhan Dede, Bayram Öztürk

D11

**Spatio-temporal analysis of cetacean distribution in PELAGOS Sanctuary related to environmental parameters**

Fabienne Delacourtie, Sophie Laran, Léa David, Nathalie Di-Méglio, Frank Dhermain, Denis Ody, Pascal Mayol, Céline Arnal, Davide Bedocchi, Max-Olivier Bourcoud, Guido Gnone Jacques Landron Frédéric Larrey Thomas Roger, Pierre Serra Jean-Pierre Sidois

D12

cancelled

D13

**Spatial distribution of cetacean sightings from the first Trans North Atlantic Sightings Survey (T-NASS)**

Mario Acquarone, Geneviève Desportes, Jean-F. Gosselin, Thorvaldur Gunnlaugsson, Mads Peter Heide-Jørgensen, Jack Lawson, Bjarni Mikkelsen, Droplaug Ólafsdóttir, Daniel G. Pike, Gisli A. Víkingsson, Lars Witting, Vladimir Zabavnikov, Nils Øien

D14

**Critical areas of abundance & distribution of *Balaenoptera edeni* of the northeastern coast of Venezuela: implications for management and conservation**

Noemi Silva-Schwarzberg, Lenin Oviedo Correa, Romina A. Galindo, Maria A. Esteves

D15

**Yearly round monitoring of cetacean populations in the Northern Tyrrhenian Sea (Pelagos Sanctuary) using ferries as research platform**

Elisa Muzi, Antonella Arcangeli, Alberto Castelli, Roberto Crosti

D16

**Large scale monitoring in the Northwestern Mediterranean Sea - results of two years of research using fixed transect surveys**

Antonella Arcangeli, Paola Tepsich, Ilaria Campana, Stefania Carcassi, Roberto Crosti, Cristina Luperini, Silvia Morgana, Elisa Muzi, Anna Ruvolo, Luca Tassara



D17

**Riding ferries from XX to XXI century: results from a long term monitoring program in the Central Tyrrhenian Sea**

Luca Marini, Antonella Arcangeli

D18

**Movements of grey seals (*Halichoerus grypus*) in South West England using photo-identification**

Sue Sayer, Dan Jarvis, Rebecca Allen, Terry Hocking, Kate Hockley, Dave Jarvis  
Lesley Jarvis, Dave McBride

D19

**Assessing the potential of a long-term photo-ID data collection scheme for sperm whales (*Physeter macrocephalus*) in cooperation with whale-watching operators - The Azores: a case study**

Anja Wittich, Eric Rexstad, Maria Joana Cruz, Lisa Steiner, Jonathan Gordon

D20

**Photographic evidence for movements of summer resident Humpback whales (*Megaptera novaeangliae*) in Iceland**

Christian Schmidt, Chiara Bertulli, Michael J. Tetley

D21

**Catalogue of a bottlenose dolphin population resident in the gulf of Catania**

Clara Monaco, Chiara Copat, Giuseppina Corrente, Stefano Florida, Eugenio Internullo, Letterio Mario Tringali

D22

**First ID - catalogue of Northern bottlenose whales (*Hyperoodon ampullatus*) off Pico island, Azores**

Dominique Weilermann, Karin Hartman, Andrea Cosentino, Laura González García, Fleur Visser

D23

**Photo-identification of Risso's dolphin (*Grampus griseus*) in the waters of the island of Ischia, Tyrrhenian Sea, Italy**

Monica Mariani, Barbara Mussi, Angelo Miragliuolo, Daniela S. Pace

D24

**Experimentation of Photo-Identification technique on striped dolphin (*Stenella coeruleoalba*, Meyen 1833) in Ligurian Sea**

Alessio Maglio, Guido Gnone, Fulvio Fossa, Michela Bellingeri, Fernando Liebana, Massimiliano Carnabuci

D25

**Estimates of abundance of harbour porpoises in Dutch waters**

Meike Scheidat

D26

**Combined acoustic and visual survey for sperm and beaked whales in off-shore waters around the Canary Islands**

Andrea Fais, Natacha Aguilar de Soto, Tim Lewis, Lucía Martín, Omar Álvarez, Myriam Rodriguez

D27

**Preliminary results of the first census of sperm whale (*Physeter macrocephalus*) in the Canary Archipelago**

Mónica Pérez-Gil, Vidal Martín, Antonella Servidio, Marisa Tejedor, Bernd Brederlau, Rosa Brito, Nuria Varo, Silvana Neves, Enrique Pérez, Alexandros Frantzis

D28

**Optimising survey design for Scandinavian harbour seals: Population trend as an ecological quality element**

Jonas Teilmann, Frank Riget, Tero Harkonen

D29

cancelled

D30

**The earliest archeological findings of marine mammals in the Northern Black Sea region**

Yuriy Liashenko

D31

**First survey of cetaceans in the South of Portugal**

Joana Castro, Sara Magalhães, Philippe Verborgh, Renaud de Stephanis

E01

**Ecotypes of killer whales from the Northwestern Pacific based on the results of photo-identification and acoustic study**

Tatiana Shulezhko, Evgeny Mamaev, Petr Permyakov, Vladimir Burkanov

E02

**Variation in external morphology of resident bottlenose dolphins (*Tursiops truncatus*) in Bahia-a San Antonio, Patagonia, Argentina**

Els Vermeulen, Alejandro Cammareri

E03

**Killer whale saddle patch pattern variation around the world**

Pirjo Mäkeläinen, Ingrid Visser

E04

cancelled

E05

**Brain circuitry and ecophysiological adaptations of toothed whales**

Helmut H. A. Oelschläger

E06

**Niche competition between Common dolphin (*Delphinus delphis*) and Striped dolphin (*Stenella coeruleoalba*) within the Bay of Biscay: an ecological niche modelling approach**

Marcel Clusa Ferrand, Gay Mitchelson-Jacob, Mike Tetley, David Smith

E07

**Habitat partitioning by cetaceans in a multi-species ecosystem around the oceanic island of La Gomera (Canary Islands)**

Volker Smit, Fabian Ritter, Volker Boehlke

E08

**Sympatric occurrence of common and bottlenose dolphins in two areas off the Portuguese coast: Future research and conservation**

Cristina Brito, Vieira Nina, Inês Carvalho

E09

**Ecology and conservation of bottlenose dolphins (*Tursiops truncatus*) in Slovenian and adjacent waters (north Adriatic)**

Tilen Genov, Polona Kotnjek, Jan Lesjak, Ana Hace, Caterina M. Fortuna

E10

**Strange absence of the killer whales (*Orcinus orca*) during the summer 2009 in the Strait of Gibraltar (Spain)**

Teresa Abaurrea, Belen Fernández-Gil, M. Isabel Hermoso, Beatriz Sobradillo, Baldomero Medina, Ezequiel Andréu

E11

**Killer whales in the Canary Islands**

Enrique Pérez, Joana Castro, Ruth Esteban, Sara Magalhães, Vidal Martín, Monica Pérez, Marisa Tejedor, Rosa Brito, Silvana Neves, Antonella Servidio

E12

**Pupping and moulting phenology of the harbour seal (*Phoca vitulina vitulina*) in southwest Ireland**

Michelle Cronin, Sue Gregory, Emer Rogan

E13

**Contribution of microbiological monitoring to conservation of wild populations of marine mammals**

Tatyana Denisenko, Olga Sokolova

**FEEDING & FORAGING**

F01

**Humpback whales feed on bight-balls formed by bird feeding flocks**

Ivan Fedutin, Olga Filatova, Alexandr Burdin, Erich Hoyt

F02

**Identification of fin whale feeding areas in the Western Ligurian Sea**

Alessia Scuderi, Arianna Azzellino, Maddalena Jahoda, Caterina Lanfredi

F03

**Stable isotope analysis of Irish fin whale tissues and the effects of lipid extraction on  $^{13}\text{C}$  and  $^{15}\text{N}$  signatures**

Conor Ryan, Brendan McHugh, Simon Berrow, Pádraig Whooley, Ian O'Connor, David McGrath

F04

**The killer whales (*Orcinus orca*) predation events on northern fur seals (*Callorhinus ursinus*) near the Commander Islands (Russia)**

Olga Belonovich, Evgeniy Mamaev, Vladimir Burkanov

F05

**Killer whale feeding strategies in the Gulf of Cadiz**

Ambra Blasi, Ruth Esteban, Philippe Verborgh, Pauline Gauffier, Carolina Jiménez Torres, Joan Giménez, Renaud de Stephanis

F06

cancelled

F07

**What makes dolphins turn vegetarian?**

Kathrin Bacher, Holly Smith, Ewa Krzyszczyk, Janet Mann, Anna M. Kopps

F08

**Feeding ecology and habitat use of odontocete cetaceans from the NW Iberian Peninsula inferred from stable isotopes**

Paula Mendez-Fernandez, Paco Bustamente, Marisa Ferreira, Alfredo López, Graham J. Pierce, Jérôme Spitz, Jose Vitor Vingada, Florence Caurant

F09

**Atlantic white-sided and bottlenose dolphins: the unknown foraging ecology in the waters around Ireland**

Emer Rogan, Gema Hernandez-Milian

F10

**Summer Foraging Behaviour of Female Sea Otters (*Enhydra lutris*) with Pups in Simpson Bay, Alaska**

Sylvia K. Osterrieder, Randall W. Davis

F11

**Long-term variation in harbour seal diet in Orkney (NE Scotland) and relationships with fish abundance**

Graham J. Pierce, Elena N. Leno, M. Begoña Santos, Alain F. Zuur, Alex Edridge, Paul M. Thompson

F12

**Water movements from stationary fishes and their possible relevance to prey detection by marine mammals**

Alexander Bublitz, Guido Dehnhardt, Wolf Hanke

F13

**Feeding Strategies of Harbour Seals (*Phoca vitulina*) Hunting Schooling Fish**

Meike Kilian, Frederike D. Hanke, Wolf Hanke, Guido Dehnhardt

GENETICS / POPULATION STRUCTURE / LIFE HISTORY

G01

cancelled

G02

**Ambiguous evidence of a recent bottleneck in the Adriatic bottlenose dolphins (*Tursiops truncatus*)**

Ana Galov, Ivna Kocijan, Martina Đuras-Gomerčić, Tomislav Gomerčić, Haidi Arbanasić, Snježana Vuković, Hrvoje Lucić, Hrvoje Gomerčić

G03

**Genetic diversity and population structure of the European harbour seal (*Phoca vitulina vitulina*) in Western Europe**

Ulrika B. Malone, Sophie Brasseur, Jeff A. Graves, Ailsa J. Hall, Cécile Vincent

G04

**Mediterranean haplotypes in striped dolphin (*Stenella coeruleoalba*, Meyen 1833)**

Stefano Florida, Maria Catena Cristaudo, Agata Longo, Letterio Mario Tringali, Eugenio Internullo, Giancarlo Rappazzo

G05

**Reproduction of Black sea bottlenose dolphins (*Tursiops truncatus*) in oceanarium conditions**

Lyudmila Bogdanova

G06

**The dynamics of white whales (*Delphinapterus leucas*) reproductive gathering and its determinants (1995-2009) in the White Sea, Solovetsky Island**

Vera Krasnova, Anton Chernetsky, Vsevolod Belkovich

G07

**Study of the structure of White Sea Belugas reproductive gatherings using the photo ID method**

Anton Chernetsky, Vera Krasnova

G08

**Life-history data of Dutch harbour porpoise *Phocoena phocoena***

Marjan J. Addink, Chris Smeenk, Graham J. Pierce, Kees Camphuysen, Mardik F. Leopold

G9

**Survival rate, abundance and residency of bottlenose dolphins (*Tursiops truncatus*) in Strait of Gibraltar**

Carolina Jiménez Torres, Sergi Pérez, Philippe Verborgh, Pauline Gauffier, Ruth Esteban, Joan Giménez, Renaud de Stephanis

G10

cancelled

**HABITAT USE**

HA01

**Residence and ranging patterns of bottlenose dolphins (*Tursiops truncatus*) in the waters around Filicudi island, Aeolian archipelago, Italy**

Valeria Casciello, Monica F. Blasi

HA02

**Relationship between the semi-resident bottlenose dolphin (*Tursiops truncatus*) population and ecological factors in Cardigan Bay, Wales**

Daphna Feingold, Caroline Vestey, Giovanna Pesante, Peter G. H Evans

HA03

**Present Status of Common Bottlenose Dolphin (*Tursiops truncatus*) along the Northeastern coast of Sardinia (Italy) after nine years of field-research...what future?**

Alberto Fozzi, Francesca Magnone, Rita Falconi, Roberto Fozzi, Alberto De Lazzari, Egidio Trainito, Augusto Navone

HA04

**Habitat use and the effects of boat traffic on bottlenose dolphins at New Quay harbour, Cardigan Bay**

Gemma Veneruso, Helen Bates, Lucy Buckingham, Edita Magileviciute, Peter G. H. Evans

HA05

**Habitat Use of Bottlenose Dolphin (*Tursiops truncatus*) and the Potential Overlap with Artisanal Gillnet Fishing in Patos Lagoon Estuary and Adjacent Coastal Waters, Southern Brazil**

Juliana Di Tullio, Pedro Fruet, Eduardo Secchi

HA06

**Bottlenose dolphin (*Tursiops truncatus*) seasonal pattern and habitat use in the Coastal reserve of Serra Gelada (Alicante, Spain)**

José Antonio Esteban, Manuel Castellote

HA07

**Summer habitat use of fish-eating killer whales in southeast Kamchatka coastal waters**

Mikhail Nagaylik, Olga Filatova, Tatiana Ivkovich, Alexander Burdin

HA08

**GIS spatial analysis as management tool to describe the habitat use of bottlenose dolphins in the Lampedusa waters (Italy): results from eleven years of observation**

Marina Pulcini, Caterina M. Fortuna, Gabriella La Manna, Francesca Triossi, Daniela S. Pace



HA09

**Habitat use of pantropical spotted dolphins (*Stenella attenuata graffmani*) off the Southern Pacific coast of Costa Rica**

Lenin Oviedo, David Herra Miranda, Juan Diego Pacheco Polanco, Noemi Silva-Schwarzberg, Marc Fernández

HA10

**Distribution and ecology of Risso's dolphin, *Grampus griseus* (Cuvier, 1812), in the Western Ligurian Sea in relation to physiographic, oceanographic and intrinsic biological parameters**

Sabina Airoidi, Arianna Azzellino, Enrico Pirotta, Caterina Lanfredi

HA11

**Modelling distribution of bottlenose dolphin with physiographic features on Filicudi island (Southern Tyrrhenian Sea, Italy)**

Monica F. Blasi, Luigi Boitani

HA12

**Habitat modelling of fin whales in the Gulf of California, México**

Wezddy Del Toro-Orozco, Colin D. Macleod, Graham J. Pierce, Gustavo Cárdenas-Hinojosa, Alejandro Gómez-Gallardo, Jorge Urbán

HA13

**Modelling habitat preferences of Mediterranean cetacean species within a risk mitigation framework**

Arnold B-Nagy

HA14

**Influences of Tanger Med II harbour on the cetacean populations of the Strait of Gibraltar**

María I. Hermoso, Belen Fernández-Gil, Teresa Abaurrea, Beatriz Sobradillo, Baldomero Medina, Ezequiel Andréu

HA15

**Local movement patterns of minke whales in the Northeast Atlantic**

Nils Øien, Gjermund Bøthun, Lars Kleivane

HI01

**Aquaculture & Dolphins: how to use ecosystem models to address the impacts caused by the interactions**

Bruno Díaz López

HI02

**Interactions between bottlenose dolphins (*Tursiops truncatus*) and fish farms in Cyrenaica, Libya**

Ibrahim Benamer, Esmail Shakman

HI03

cancelled

HI04

**Commercial fisheries induced seal mortality in the Gulf of Finland: conflict and its consequences**

Irina Trukhanova, Elena Andrievskaya, Vyacheslav Alekseev

HI05

**Competition between common bottlenose dolphin (*Tursiops truncatus*) and Israeli bottom trawl fishery for limited resources? Assessment by stomach contents and stable isotopes**

Aviad P. Scheinin, Dan Kerem, Sonja Lojen, Jon Liberzon Ehud Spanier

HI06

**Marine mammal by-catch by the Japanese salmon gill net fishery in the Russian exclusive economic zone, 1992-2008**

Vladimir Burkanov, Victor Nikulin, Yuri Artukhin

HI07

**Conflicts between fisheries and cetaceans in Galicia, NW Spain: Preliminary results of an interview survey with local fishermen**

Sabine Goetz, Fiona L. Read, M. Begoña Santos, Graham J. Pierce

HI08

**An analysis of fishery in the Puck Bay (Southern Baltic/Poland) from the perspective of reducing the bycatch of harbour porpoises**

Krzysztof E. Skóra, Iwona Pawliczka, Radomi Koza

HI09

**The importance of life history parameters for assessing marine mammal and fisheries interactions**

Fiona L. Read, Ángel F. González, M. Begoña Santos, Marisa Ferreira, Alfredo López, Graham J. Pierce

HI10

**Marine noise pollution in the light of the EC-Marine Strategy Framework Directive**

Stefanie Werner, Karsten Brensing

HI11

**Long-term monitoring surrounding the construction of a gas pipeline in Broadhaven Bay (cSAC) and its implications for marine mammal conservation**

Evelyn Philpott, Mairead O'Donovan, Hannah Denniston, Anneli Englund, Mary Coleman, Fleur Visser

HI12

**Marine mammal observations during seismic surveys offshore Portugal**

Inês Figueiredo, Luis Goncalves, Simon Poles, Manuel Fernandes

HI13

**Case study on potential effects of the Great Belt Bridge, Denmark, on harbour porpoise (*Phocoena phocoena*) behaviour**

Laura Wollheim, Miriam Brandt, Ansgar Diederichs, Caroline Höschle, Georg Nehls

HI14

**Planning is critical to ensure effective mitigation of naval activities**

Sarah J. Dolman

HI15

**Design of an effective air bubble curtain for noise mitigation in offshore construction work**

Michael Dähne, Klaus Lucke, Manon Jacobson, Jan H. Weyhardt, Ursula Siebert

HI16

**The use of seal scarers during offshore pile driving - an effective mitigation measure for harbour porpoises (*Phocoena phocoena*)?**

Miriam Brandt, Ansgar Diederichs, Caroline Höschle, Laura Wollheim, Georg Nehls

HI17

**The most intense ocean noise pollution around the Strait of Gibraltar concentrates into bubbles located at cetacean prey hunting depths**

Thomas Folegot

HI18

**Wind farm construction: Various ways of monitoring effects on harbour porpoises (*Phocoena phocoena*) -Ship surveys-**

Sabine Müller, Anita Gilles, Verena Peschko, Ursula Siebert

HI19

**Wind farm construction: Various ways of monitoring effects on harbour porpoises (*Phocoena phocoena*) -Aerial surveys-**

Verena Peschko, Anita Gilles, Sven Adler, Ursula Siebert

HI20

**Wind farm construction: Various ways of monitoring effects on harbour porpoises (*Phocoena phocoena*) - Passive acoustic monitoring-**

Klaus Lucke, Michael Dähne, Sven Adler, Anja Brandecker, Kathrin Krügel, Janne K. Sundermeyer, Ursula Siebert,

HI21

**Ship strikes with cetaceans in the Mediterranean Sea: assessment, public awareness and mitigation measures**

Elisabetta Remonato, Simone Panigada, Russell Leaper, Greg Donovan

HI22

**Short description of a near-miss event involving a large vessel and humpback whales (*Megaptera novaeangliae*) off Antarctica**

Fabian Ritter

HI23

**Whale-watching vs. whaling in Iceland: a survey of whale-watching tourist attitudes to conservation issues**

Chiara Bertulli, Thomas Barreau Danilo Swann Matassa

HI24

**Ecotourism and bottlenose dolphins, *Tursiops truncatus*, in the Shannon estuary, Ireland**

Róisín Pinfield, Emer Rogan

HI25

**Behavioural response of southern right whales (*Eubalaena australis*) to anthropogenic approaches in Bahía de San Antonio, Río Negro Argentina**

Alejandro Cammareri, Els Vermeulen

MEDICINE / ECOTOXICOLOGY

M01

**Lampreys (*Lethenteron camtschaticum*) parasitize humpback whales.**

Evgenya Lazareva, Alexander Burdin, Erich Hoyt

M02

**Macroparasites in cetaceans stranded along the Italian coasts during the period 2006-2009**

Claudia Zanardello, Federica Marcer, Sandro Mazzariol, Monica Caffara, Mario Pietrobelli

M03

cancelled

M04

**Difficult labours with fatal consequences in bottlenose dolphins (*Tursiops truncatus*) from the Adriatic Sea**

Martina Đuras-Gomerčić, Tomislav Gomerčić, Ana Galov, Hrvoje Lucić, Darinka Škrtić, Snježana Ćurković, Snježana Vuković, Hrvoje Gomerčić

M05

**TiO<sub>2</sub> nanoparticle genotoxicity assessed in isolated bottlenose dolphin (*Tursiops truncatus*) leukocytes**

Morgana Vighi, Margherita Bernardeschi, Patrizia Guidi, Vittoria Scarcelli, Giada Frenzilli, Marco Nigro

M06

**Some aspects of research of cellular immunity in the Black Sea bottlenosed dolphin (*Tursiops truncatus*)**

Olga Sokolova, Tatyana Denisenko, Elena Komogorova, Yuriy Mikhalev

M07

**Pathological and ecotoxicological analysis on two specimens of *Balaenoptera physalus* stranded along the Italian coasts**

Linda Turba, Letizia Marsili, Silvia Maltese, Nicola Bianchi, Maria Cristina Fossi, Emanuele Zanetti, Federica Marcer, Sandro Mazzariol

M08

**Cell viability and specific metabolism in primary seal hepatocytes after in vitro exposure to PFOS and PCBs**

Vera Korff, Kristina Lehnert, Antonia Wargel, Ursula Siebert, Veronika Hellwig

M09

**Detection of specific antibodies to virus series of mammals in Steller sea lion (*Eumetopias jubatus*) of the Kuril Islands**

Marina Kozyreva, Olga Sokolova, Gleb Yurov, Svetlana Alekseenkova, Vladimir Burkanov, Konstantin Yurov

M10

cancelled

M11

**Pulmonary pathology: a comparison between bottlenose dolphins (*Tursiops truncatus*) and striped dolphins (*Stenella coeruleoalba*) stranded along the Italian coastline.**

Valentina Innocente, Maristella Giurisato, Federica Marcer, Bruno Cozzi, Sandro Mazzariol

M12

**Toxoplasmosis in *Tursiops truncatus* stranded along Italian Adriatic Coast**

Federica Marcer, Cinzia Tessarin, Luana Salvador, Sandro Mazzariol, Maristella Giurisato, Mario Pietrobelli

M13

cancelled

M14

**Dolphin Morbillivirus (DMV) and Herpesvirus (HV) co-infection during re-emerging striped dolphin mortality (2007) in Mediterranean Sea**

Antonio Fernández, Fernando Esperón, Edwigen N. Belliere, Manuel Arbelo, Maria J. Reoyo, J. M. Sánchez-Vizcaino

M15

**Laser ablation ICP-MS semi quantitative determination of trace element concentrations in franciscana dolphin teeth: differentiating regional uptakes of elemental toxicants**

Silvina Botta, Cristiano Albuquerque, Valentina Franco Trecu, Norbert Miekeley, Aleta Hohn, Eduardo Secchi

M16

**Thyroid and stress hormones in wild and captive harbour porpoises. First assessment of possible relation to organochlorine pollutants**

Ursula Siebert, Blazer Pozniak, Genevieve Desportes, Jonas Teilmann, Niels van Elk, Arndt Vossen

M17

**Biopsy wound healing on long-finned pilot whale (*Globicephala melas*)**

Renaud de Stephanis, João Nuno Gonçalves, Joan Giménez, Jesus de la Fuente, Zaida Munilla, Philippe Verborgh, Pauline Gauffier, Susana García-Tiscar, Ruth Esteban, Lionel Minvielle-Sebastia

S01

**Insights on the skeletal structure of a stranded *Kogia breviceps* in the Canary Islands**

Marisa Tejedor, Vidal Martín, Manuel Arbelo, Antonio Espinosa

S02

**Polycyclic aromatic hydrocarbons and heavy metal monitoring in tissues from a stranded *Stenella coeruleoalba* in the Ionian coast of Sicily**

Chiara Copat, Gea Oliveri Conti, Caterina Ledda, Giuseppina Sabella, Maria Cunsolo, Filippo Giacone, Clara Monaco, Giuseppina Corrente, Salvatore Sciacca, Roberto Fallico, Margherita Ferrante

S03

**Stomach content analysis from Pilot Whales (*Globicephala melas*) stranded on the Portuguese, Galician and Scottish Coasts.**

Sílvia Monteiro, Marisa Ferreira, José Vitor Vingada, Alfredo López, Angela Llavona, José A. Martínez-Cedeira, Roberto Reid, M. Begoña Santos, Graham J. Pierce

S04

**Dolphin deaths due to trauma in the waters of the Canary Islands: Interaction as a cause?**

Simona Sacchini, Isabela Gomez Luna, Manuel Arbelo, Eva Sierra, Ana Godinho, Yara Bernaldo de Quirós, Antonio Fernández

S05

**Pathological and ecotoxicological analysis of Odontocetes stranded along the Italian coasts from 2004 to 2008**

Alessandro Biscaro, Sandro Mazzariol, Silvia Maltese, Federica Marcer, Maristella Giurisato, Giuseppe Palmisano Zanetti, Maria Cristina Fossi, Letizia Marsili

S06

**Factors affecting strandings of cetacean carcasses at the coast of the Sea of Azov**

Karina Vishnyakova, Pavel Goldin



S07

**Long-term dynamics of cetacean strandings at the Crimean coast (Ukraine): data from questionnaire survey**

Evgeny Goldin, Pavel Goldin

S08

**From the coast line to the sea surface: spatializing stranding data**

Hélène Peltier, Mathilde Huon, Pierre Daniel, Olivier Van Canneyt, Vincent Ridoux

S09

**Cetaceans in Alcobça's beaches: from strandings to research**

Sofia Quaresma, Cristina António

S10

**Unusual mass mortality of cetaceans on the coast of the Turkish Western Black Sea in summer 2009**

Arda M. Tonay, Ayhan Dede, Ayaka A. Öztürk, Didem Ercan, Antonio Fernández, Bayram Öztürk

S11

**A review of Northern bottlenose whale (*Hyperoodon ampullatus*) strandings in the UK, 1990-2008**

Matthew Perkins, Robert Deaville, John Baker, Jason Barley, James Barnett, Andrew Brownlow, Jim Chimonides, Antonio Fernández, Colin D. Macleod, Rod Penrose, Robert Reid, Trevor Weeks, Paul D. Jepson

S12

**A review of live stranded cetaceans in the UK between 1990 and 2008**

Robert Deaville, Baker John, Andrew Brownlow, James Barnett, Jim Chimonides, Nick Davison, Jan Loveridge, Tony Patterson, Rod Penrose, Matthew Perkins, Robert Reid, Harry Ross, Vic Simpson, Paul D. Jepson

# ABSTRACTS



## TALKS

### INVITED TALK

**22<sup>nd</sup> March 9:50**

### **ENDANGERED CETACEAN POPULATIONS WORLDWIDE**

**Bernd Würsig (1), Randall R. Reeves (2)**

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Worldwide, a handful of cetacean species/sub-species and hundreds of populations are endangered or critically endangered. Among those in the species/sub-species categories, apart from the probably-extinct Yangtze River baiji (the loss of an entire taxonomic family), are the North Pacific and North Atlantic right whales, Gulf of California vaquita, Antarctic blue whale, and North Island New Zealand Maui's (Hector's) dolphin. Among populations are those of gray whales in the western Pacific and several of killer whales, bowhead whales, Irrawaddy dolphins, belugas, harbour porpoises, bottlenose dolphins, and Ganges dolphins. Reasons for low and stagnant or declining numbers are many, ranging from the historic due to overhunting (NE and SE Pacific right whales, Svalbard bowheads, Ungava Bay belugas) to present-day ongoing concerns: overfishing of their primary food supplies (Gibraltar killer whales), ship strikes and probably noise (N. Atlantic right whales), bycatch mortality in net and other fisheries (vaquita), habitat degradation generally (river dolphins and some near-shore dolphins and whales), and many unknowns, including the effects of climate change. Some problems are wide-spread and systemic, not likely to be fixed in the next several decades (habitat loss for South Asian river dolphins is but one example), but others are more direct or acute and thus perhaps solvable, such as the decimation of vaquitas in nets set for fish and shrimp. In this latter case, concerted government and NGO efforts may force needed changes in fishing practices, but decisive action must be immediate. A few species and populations are well studied and have potentially effective advocates; most are languishing for lack of good population and trend data, local and international conservation interest, and – of course – funds. Potential ways forward are: a) updated and improved science coupled with publicity campaigns, b) true government buy-in (instead of all-too-often lip service), c) threats of economic sanctions where governments could do more but hesitate, and d) help with funding to curb or re-

direct harmful human activities. While good information is vital, there are many situations where rapid action is warranted based on available data, and adaptive (flexible) management, with set goals and timelines, is better than comprehensive-sounding protection “on paper only.” Besides paying attention to what has and is going wrong, we encourage colleagues to also highlight what is going right – e.g. which populations are apparently robust and why this is so – so that we may learn from our mistakes and successes.



22<sup>nd</sup> March 11:00

**FINE SCALE POPULATION STRUCTURE OF BOTTLENOSE DOLPHINS  
(*TURSIOPS TRUNCATES*) OFF GALICIAN WATERS NW SPAIN**

**Ruth Fernández-García (1), Graham J. Pierce (2), M. Begoña Santos (2),  
Alfredo López (3), Susana García-Tiscar (4), Jason Newton (5), Santiago Lens  
(2), Stuart Piertney (1)**

(1) School of Biological Sciences, University of Aberdeen

(2) Instituto Español de Oceanografía (IEO)

(3) Coordinadora para o Estudio dos Mamíferos Mariños (CEMMA), Gondomar

(4) Ecology Department, Universidad Autónoma de Madrid

(5) NERC Life Sciences Mass Spectrometry Facility

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Bottlenose dolphins are known to have high dispersal potential that predicts high levels of gene flow among populations. However, local resident populations have been reported worldwide, though the ecological causes and genetic consequences of such demography remain unclear. Here we explore whether population substructure and habitat segregation exist within the Galician (NW Spain) bottlenose dolphin community. Samples from 48 bottlenose dolphins stranded or by-caught in Galicia between 1994 and 2008 were genotyped at 10 microsatellite loci and sequenced at the highly variable mitochondrial control region. In addition, variability of stable isotope ratios ( $^{13}\text{C}$  and  $^{15}\text{N}$ ) was assessed for 43 dolphins (5 calves, 38 juveniles and adults) stranded or by-caught in Galicia between 1998 and 2007. Genetic results highlighted the existence of two populations in the area with dolphins from southern Galicia being assigned to a single genetic group. Seven dolphins were classified as possible migrants between putative populations as their genetic makeup did not correspond with their geographical stranding location. Values of  $^{13}\text{C}$  and  $^{15}\text{N}$  were significantly different between the two populations, suggesting resource specialization and partitioning. Dolphins from southern Galicia (inhabiting coastal inlets) showed more variation in their diet, higher trophic levels and greater  $^{13}\text{C}$  compared to animals from northern Galicia (present in more open waters). The existence of fine scale population substructure should be considered in the future designation of Special Areas of Conservation (SACs) for the species as required by the European Habitats Directive.

22<sup>nd</sup> March 11:20

## PAEDOMORPHIC TRAITS IN KILLER WHALES *ORCINUS ORCA*

Pavel Goldin (1)

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Paedomorphosis (retaining of juvenile traits in adults) can be the mechanism explaining great body size variety in cetaceans. It was reported or hypothesized for several taxa (*Phocoena*, *Cephalorhynchus*, *Orcaella*, *Pontoporia*), however, these are animals of small body size and their paedomorphosis can be explained as progenesis (Galatius, 2009).

Skulls and/or postcranial skeletons of adult killer whales from Antarctic and North Pacific collected in museums of Simferopol, Odessa, Moscow and Kaliningrad and photos of other skeletons were examined for this study.

The following paedomorphic traits in the skull of killer whales were found: unfused skull bones (e.g., frontals and maxillae), unfused or poorly fused sutures (e.g., parietal/frontal, parietal/squamosal sutures), separate interparietal bone, small antorbital process, short rostrum and small number of teeth. Some of these traits (e.g., interparietal bone) orcas share with snubfin dolphins (*Orcaella*) which are believed to be paedomorphic (Beasley et al., 2005). A paedomorphic trait in the flipper skeleton is poor manus ossification, especially poor epiphyseal development in carpal bones and phalangae and relatively small size of carpal bones. Delayed epiphyseal fusion in vertebral column is suspected but is to be proved by further study. Small number of vertebrae and their large length (Buchholtz and Shur, 2004) also can implicate paedomorphosis.

Killer whales have traits untypical for paedomorphosis, like angulated skull with crests or rostral and cervical fusion. Yet these can be a result of later functional adaptations.

At that, killer whales demonstrate remarkably long body growth (at least, 20-25 years in males (Christensen, 1984)), while their age at sexual maturation is typical for delphinids in general.

Thus, two hypotheses are proposed which are not mutually exclusive. First, paedomorphic traits in *Orcinus* could be inherited from small-sized *Orcaella*-like ancestors affected by progenesis. Second, *Orcinus* as a taxon could evolve in the way of neoteny (retardation of somatic growth).



22<sup>nd</sup> March 11:40

## **FINE-SCALE POPULATION STRUCTURE OF INSULAR INDO-PACIFIC BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS*) OVER TEMPORAL SCALES**

**Jeremy Kiszka (1), Benoit Simon-Bouhet (1), Caroline Gastebois (1), Ludivine Martinez (1), Claire Pusineri (2), Vincent Ridoux (1)**

(1) Littoral Environnement et Sociétés (LIENSs), Université de La Rochelle

(2) Office National de la Chasse et de la Faune Sauvage

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Understanding population structure requires information on rates of gene flow and patterns of genetic structure. This information is widely used to define and manage stocks, particularly in cetaceans. However, genetic data potentially conceals segregation processes that may occur within a population at the individual's life scale. In order to assess the population structure of an insular indo-pacific bottlenose dolphin (*Tursiops aduncus*) population (100 individuals across a 1500 km<sup>2</sup> lagoon) in the southwest Indian Ocean (Mayotte Island, 45°10' E/12°50' S), we combined several approaches based on their temporal resolution: genetic analyses (over several thousand years), home range (over years) and stable isotope analyses in blubber (over months) to assess fine-scale population structure. Photo-identification data and biopsy samples were collected during small-boat dedicated surveys from 2004-2008. Photo-identification data were used to calculate individual home range size using minimum area polygons, as well as individual habitat preferences (related to physiography). Stable isotope analyses of <sup>13</sup>C (feeding habitats) and <sup>15</sup>N (trophic level) were performed using 31 skin and blubber samples from distinct individual dolphins. Finally, genetic analyses using mtDNA (254 bp region of the cytochrome b gene) and 14 microsatellite markers were performed using the same skin samples. The analyses revealed no mitochondrial polymorphism and the presence of a single population at Hardy-Weinberg equilibrium around Mayotte. From stable isotope analyses, <sup>13</sup>C and <sup>15</sup>N values were highly variable among individuals, highlighting a non-specialized feeding behaviour and the absence of structure across the population. Finally, home range analysis revealed the presence of two to three groups of bottlenose dolphins around Mayotte, based on their individual habitat preferences, home range size and location. This may suggest the presence of more than one Indo-Pacific bottlenose dolphin social unit around Mayotte. This study suggests that combining analytical tools is relevant to assess fine-scale population structure, particularly at a small spatial scale.

22<sup>nd</sup> March 12:00

## **SOCIAL STRUCTURE OF INSULAR INDO-PACIFIC BOTTLENOSE DOLPHINS (*TURSIOPS ADUNCUS*) ASSESSED THROUGH ASSOCIATION PATTERNS AND KINSHIP ANALYSES**

**Benoit Simon-Bouhet (1), Jeremy Kiszka (1), Vanessa Becquet (1), Caroline Gastebois (1), Claire Pusineri (2), Vincent Ridoux (1)**

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Delphinids display two main social structures: matrilineal (e.g. killer and pilot whales) and fission-fusion societies (e.g. bottlenose dolphins). Some species might display variable features in social structure in relation to their environment, such as the insular Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). Developing and implementing appropriate conservation strategies requires a good knowledge of the social structure of populations. In this study, we tested whether the association patterns of *T. aduncus* individuals from the island of Mayotte (45°10'E/12°50'S) in the southwest Indian Ocean (~100 individuals across a 1500 km<sup>2</sup> lagoon) were related or independent to kinship. In order to assess the social structure of the population, photo-identification data for 71 dolphins and 30 biopsy samples were collected during surveys over four years (2004-2008). To achieve this, we combined association patterns using the Half-Weight Index and molecular analyses using both mitochondrial (254 bp fragment of the cytochrome-b gene) and microsatellite markers (14 loci). Although strong and significant associations were found between small groups of same-gender individuals, the population as a whole appeared to be at Hardy-Weinberg equilibrium. Moreover, we showed an absence of correlation between association patterns and genetic relatedness which is typical of fission-fusion societies. Finally, in order to explain the poor genetic diversity observed in the population, we used numeric simulations to estimate the age of an hypothetical founder effect or strong bottleneck. We found that the highest microsatellite diversity measured in the population (i.e. gene diversity: 0.735, 6 alleles) could be reached from a strictly monomorphic situation in as low as 1000 to 2000 generations (~15000-30000 years). A wider sampling of the region is now required to fully understand the structure and migration patterns of bottlenose dolphin populations in this area.





22<sup>nd</sup> March 12:20

## POPULATION STRUCTURE OF LONG-FINNED PILOT WHALES IN EUROPE

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Long-finned pilot whale population structure has been studied in the North Atlantic but only for the northern European countries. This species is listed as data deficient in the last IUCN-ACCOBAMS meeting. The aim of this study is to identify population structure and genetic diversity of long-finned pilot whales (*Globicephala melas*) from Ireland to Italy covering 10 different areas in-between. A total of 251 samples were analysed for 13 microsatellites and mtDNA. Significant FST differences were found between the Atlantic population (Ireland, French Atlantic, Galicia and Portugal) and the Mediterranean Sea population (Alborán, Murcia, French Mediterranean and Italy). Individuals from the Basque Country in the Bay of Biscay formed a unique population as they were significantly different from all the other individuals from the other areas except for Portugal. The individuals from the Strait of Gibraltar formed a unique population. Four different haplotypes were found for all the areas. Two haplotypes were found in all the populations, one was unique to an Irish individual, and one was

unique to the Mediterranean Sea and the Strait of Gibraltar. The genetic diversity is lower in the Mediterranean Sea ( $H_o=0.47$ ) than in the Atlantic ( $H_o=0.76$ ). The individuals from the Strait of Gibraltar had an intermediate value ( $H_o=0.58$ ) that gave them a special importance as they could be the source of a potential higher genetic diversity to the Mediterranean Sea population. The Basque Country population had a similar genetic diversity ( $H_o=0.69$ ) than the Atlantic population. These results offer for the first time management stock structure for long-finned pilot whales in Europe. It also shows that the Mediterranean Sea population is clearly different from the Atlantic one which confirms the observation made in the Strait of Gibraltar where a resident population lives and no migration of this species has been observed.



**22<sup>nd</sup> March 12:40**

**GENETIC ANALYSIS OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) REVEALS POPULATION DIFFERENTIATION IN THE BALTIC SEA AND ADJACENT WATERS: A COMBINED ANALYSIS OF NUCLEAR MICROSATELLITES AND MITOCHONDRIAL DNA**

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In spite of the general abundance of harbour porpoises (*Phocoena phocoena*) and the species' wide distribution in the Northern Hemisphere, concern has been raised regarding the vulnerability and population status of the harbour porpoises inhabiting the Baltic area.

Here we present the most comprehensive assessment of the genetic population structure to date for this region, both with regard to geographic coverage and sample size.

In total 497 porpoise samples from North Sea, Skagerrak, Kattegat, Belt Sea, and Inner Baltic Sea were sequenced at the mitochondrial control region and 305 of these specimens were typed at 15 polymorphic microsatellite loci. Samples were stratified according to sample type (stranding vs. by-caught), sex, and season (breeding vs. non-breeding season).

Congruence between the two marker systems and a highly significant association between microsatellite assignment and unlinked mitochondrial haplotypes strongly supports the existence of a population split between the Skagerrak and the Belt Sea, with a transition zone within the Kattegat region. Furthermore we found consistent evidence for a small, but significant genetic divergence between the Inner Baltic Sea and the Belt Sea population.

The observed genetic structure suggests male-mediated gene flow and limited dispersal of females. In light of the environmental and anthropogenic threats on the Baltic porpoises and their low abundance, we argue in favour of precautionary acknowledgement of the Inner Baltic porpoises as a separate management unit.



22<sup>nd</sup> March 14:50

**FEEDING ECOLOGY AND DIET SHIFT OF LONG-BEAKED COMMON DOLPHINS (*DELPHINUS CAPENSIS*) INCIDENTALLY CAUGHT IN ANTI-SHARK NETS OFF KWAZULU-NATAL, SOUTH AFRICA**

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Unpredictable inter-annual variations in the timing, spatial extent and intensity of the Sardine Run (*Sardinops sagax*) have been documented in recent years off the coastline of KwaZulu-Natal, Southern Africa. Although a number of apex predators in the Sardine Run have been studied in detail, little is known about the diet of long-beaked common dolphins (*Delphinus capensis*). The objective of this study was to determine if variations in the availability of sardine are reflected in the condition and diet of the dolphins over the past three decades. Blubber thickness was assessed as an indicator of animal condition. No significant change in blubber total weight ( $R^2=0.0016$ ,  $N=185$ ), nor dorsal, lateral or ventral blubber thickness ( $R^2=0.0044$ ,  $R^2=0.0003$ , and  $R^2=0.0003$  respectively,  $N=74$ ) was seen over the last 30 years (1970 to 2007). Stomach contents from 97 common dolphins (57 females, 40 males) caught between 2000 and 2009 were analysed, and compared to historical data between 1972 and 1992. The results suggest some resource partitioning between adult males and females. Mesopelagic fish and squid dominated the diet, with 23 fish and 5 squid species represented in adult dolphins. A shift in the principal prey species consumed by the dolphins was observed. Prior to 1992, sardine comprised up to 48% of the total stomach contents, while mackerel (*Scomber japonicus*) was the dominant prey recorded in the stomach contents between 2000 and 2009. As common dolphins feed opportunistically, this dietary shift appears to indicate changes in the shoaling characteristics of the most abundant fish prey. Given the „Data Deficient“ status of the long-beaked common dolphin on the IUCN Red Data List, and the strong climatic forcing of the Sardine Run, such dietary data have important implications in the light of expanding fisheries and climate change.

22<sup>nd</sup> March 15:10

## HARBOUR PORPOISES AND OFFSHORE DEVELOPMENT: INCREASED PORPOISE ACTIVITY IN AN OPERATIONAL OFFSHORE WIND FARM

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The offshore wind farm “Egmond aan Zee” was constructed in 2006 in the Dutch North Sea. The impact of an operational wind farm on harbour porpoises (*Phocoena phocoena*) was monitored with stationary acoustic monitors (T-PODs). Two T-POD stations were placed inside the wind farm and 3 + 3 T-POD stations were placed in two reference areas to the north and to the south of the wind farm. Monitoring was conducted for approximately one year prior to construction and during the two first years of operation.

The results show a pronounced and significant increase in harbour porpoise acoustic activity both inside and outside the wind farm, compared to the baseline conditions before construction began. Furthermore, this increase was significantly higher inside the wind farm than in the two reference areas. The increase in porpoise acoustic detections inside the operating wind farm is interpreted as an increase in porpoise abundance and is considered a genuine effect of the wind farm.

The finding of a positive effect of the operational wind farm on harbour porpoises is in contrast to other studies, where either no effect or a negative effect has been observed.

The cause of this effect is unknown, but could be due to attractive features of the wind farm, such as the creation of an artificial reef or a protected area for fish since no trawling is allowed, possibly with an associated increase in fish abundance. In addition, the wind farm may act as a refuge for porpoises, in which they are protected from negative effects occurring outside the wind farm, such as heavy shipping and fishery.



22<sup>nd</sup> March 15:30

## INTERACTIONS BETWEEN DOLPHINS AND AN AUSTRALIAN DEMERSAL SCALEFISH TRAWL FISHERY: IMPLICATIONS FOR BYCATCH MITIGATION

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Most studies on interactions between dolphins and trawl fisheries have focused on the opportunistic feeding of dolphins on discards. Little is known about associations between dolphins and active trawl nets. Using underwater video footage recorded inside trawl nets, we evaluated behavioural aspects of interactions between common bottlenose dolphins (*Tursiops truncatus*) and trawl nets in a Western Australian demersal trawl fishery. The interaction rates were very high; in 85 hours of footage collected from 36 trawls, dolphins were recorded inside trawl nets during 29 (81%) trawls and outside trawl nets in 34 (94%) trawls, and for up to 98% and 99% of the trawl duration, respectively. The proportion of foraging behaviours was significantly higher for dolphins inside the net (54%) than those outside the net (31%), indicating that dolphins are presented with a concentrated food source inside the net. Dolphins observed outside the net spent a large proportion of time ‘trampolining’ (63% of behaviours), whereby they bounced on the net, often twisting and rubbing their bodies on the net. Dolphins thus appear to be motivated by several factors to approach and interact with trawl nets. Inside the net, 29 individuals were identified based on various morphological characteristics. Some individuals returned to the net numerous times during single trawls, multiple trawls within a given fishing trip, or during separate fishing trips. Although most trawls featured a single adult dolphin inside the net, groups of up to nine individuals were also recorded (mean =  $2 \pm 0.4$ ). These observations suggest that entering trawl nets may be a specialisation only exhibited by a subset of the dolphin population in the region. We conclude that these dolphins are strongly motivated to interact with trawl nets and recommend that effective by-catch reduction devices have the highest potential to successfully reduce dolphin by-catch in the fishery.



22<sup>nd</sup> March 15:50

## RESPONSES OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) TO PILE DRIVING MEASURED WITH PASSIVE ACOUSTIC MONITORING

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Offshore wind farming is a rapidly expanding industry in European waters. Up to now most turbines are founded on either monopile, tripod or jacket constructions. All consist of large steel piles, which are driven into the seafloor. Noise emissions from pile driving may injure marine mammals in the vicinity and cause large-scale disturbance and habitat displacement.

BioConsult SH investigated spatial and temporal responses of harbour porpoises to pile driving during the construction of two large wind farms in the North Sea using passive acoustic monitoring (T-PODs).

One wind farm consisting of 91 mono-piles is located in the Danish North Sea, approximately 30km west of Esbjerg in water depths of 15m. Construction took place from May to October 2008.

The other wind farm is located in the German North Sea, 90km north of the island Borkum in water depths of 30m. This wind farm consists of six tripod and six jacket founded turbines. Construction lasted from April to August 2009.

We found a clear impact of pile driving on harbour porpoise click recordings during both projects. GAM analysis on relative porpoise activity measured by porpoise positive minutes per hour revealed a clear gradient with distance to the construction site.

Whereas at the Danish site porpoise activity and possibly density was reduced near the construction site over the entire five months period that pile driving occurred, porpoise activity increased at the German construction site during the last month of the five month construction period.

The results of both projects will be compared and discussed in relation to measured noise levels.



22<sup>nd</sup> March 16:10

**MANAGING FOR ROBUSTNESS: POTENTIAL EFFECTS OF CLIMATE CHANGE AND MUSSEL FARMING ON DUSKY DOLPHINS (*LAGENORHYNCHUS OBSCURUS*) IN ADMIRALTY BAY, NEW ZEALAND**

**Heidi Pearson (1), Robin Vaughn (1), Mridula Srinivisan (1), Timothy Markowitz (1), Bernd Würsig (1)**

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Dusky dolphins in New Zealand form a robust population, which may be threatened by climatic and anthropogenic effects. We examined potential effects of climate change and mussel farming on dusky dolphins in Admiralty Bay, New Zealand where they forage primarily in winter. During August 2001-2006, we conducted boat-based surveys to determine dusky dolphin encounter rate (used as a proxy for abundance). These data were related to patterns of variation in sea surface temperature (SST) and the Southern Oscillation Index (SOI). During June-October 2005-2006, boat-based surveys were conducted to determine dusky dolphin encounter rate and presence in mussel farms, and underwater behavioral observations were used to examine dusky dolphin coordinated foraging behaviors on prey balls that moved into mussel farms. During August 2001-2006, dusky dolphin encounter rate decreased from 5.9 groups/h to 0.71 groups/h, SST cooled from approximately 12° C to 11.5° C, patterns of variation in dusky dolphin encounter rate and SST were similar, and dusky dolphin encounter rate tended to increase during neutral SOI years. During winter 2005-2006, dusky dolphin groups occurred significantly more often outside mussel farms than inside mussel farms, correcting for area ( $p < 0.001$ ). Prey balls entered mussel farms during two feeding bouts; in both cases, dusky dolphin feeding behavior ceased when prey balls moved adjacent to mussel farm lines. Results of this study indicate that mussel farms exclude dusky dolphins and interfere with coordinated foraging behaviors; however continued monitoring is required to determine if these effects result in long-term impacts on dusky dolphins. While we found potential relationships between dusky dolphin encounter rate, SST, and SOI over a 6-year time series, long-term data are needed to fully understand the effects of climate change on dusky dolphins in New Zealand.





22<sup>nd</sup> March 16:30

**FIELD TESTING OF BARIUM SULPHATE GILLNETS TO REDUCE THE INCIDENTAL MORTALITY OF FRANCISCANA DOLPHINS (*PONTOPORIA BLAINVILLEI*) IN ARGENTINA**

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Incidental mortalities of Franciscana dolphins (*Pontoporia blainvillei*) in the artisanal demersal gillnet fishery of Argentina, Uruguay and Brazil have occurred with the onset of nylon gillnet fisheries several decades ago. Incidental capture represents a major threat to the species survival, and the species is currently considered the most threatened cetacean in the South Western Atlantic. The objective of this study was to evaluate the efficacy of barium sulphate modified gillnets in reducing Franciscana dolphin by-catch. The area of fishing occurred within a few kilometres of the Argentine coast in the Bahia Samborombon, near to San Clemente del Tuyu. Water depth range was 3 to 7 m, and water was a murky gray colour with a Secchi disc < 1 m. Field testing occurred from January to February, 2008 and November to March, 2009. Monofilament nylon gillnets containing BaSO<sub>4</sub> (6% by weight) were deployed and had a stretched mesh size of 110 mm and twine thickness of 0.6 mm. The twine was dyed grey to match the water colour. Nets were commonly set and retrieved within 13-24 h by fishermen using small boats (length 5 to 7 m) launched from the beach. Two 50 m x 3 m net panels were attached to each other such that a single set was 300 m<sup>2</sup>. Standard nylon nets from the same manufacturer using new mesh provided appropriate controls. Based on observer data, in the first year, a total of 4 and 7 dolphins were caught in 55 sets of BaSO<sub>4</sub> and 57 sets of standard nylon gillnets, respectively, and in the second year, 11 and 19 dolphins were caught in 198 sets of BaSO<sub>4</sub> and 211 sets of standard gillnets, respectively. Commercial fish catch rates were very similar among the two net types.



23<sup>rd</sup> March 8:30

**TRENDS IN ABUNDANCE OF A SMALL RESIDENT POPULATION OF BOTTLENOSE DOLPHINS, *TURSIOPS TRUNCATUS*, INHABITING PATOS LAGOON ESTUARY, SOUTHERN BRAZIL**

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A small resident population of bottlenose dolphins inhabits the Patos Lagoon estuary, southern Brazil. Since 2002, there was a great increase in the number of dolphins found dead on the beach, many of which presenting net marks or mutilated body parts. The aim of this study was to investigate trends in population abundance to investigate whether the Patos Lagoon population is declining due to levels of bycatch. A total of 106 surveys were carried out in Patos Lagoon estuary between 2005-2009 to photo-identify naturally marked individuals using a digital camera with a fixed 300mm lens. Abundance estimates were based on closed population model (Petersen model with Chapman's modification estimator), taking into account the annual proportion of marked individuals in the population. For each year we selected data from 18 surveys to generate abundance, except for 2008, when sampling effort decreased due to logistical constraints. Total population size and 95% log-normal confidence intervals (CI) were estimated at 87 (CI: 79-96), 85 (CI: 77-94), 87 (CI: 79-96), 76 (CI: 69-83) and 87 (CI: 81-93) individuals for each year. Our results suggest that the population is stable and, based on previous abundance estimates, this population is at or near the carrying capacity of the estuary. Plausible argument to explain the stability of the population is that the some carcasses found on the oceanic coastal beaches near Patos Lagoon estuary come from animals that do not belong to the estuary community. Future studies should investigate fine-scale habitat partition between estuarine and adjacent coastal dolphins. If confirmed the existence of different communities living in close proximity (estuarine and coastal areas near to the estuary) a new abundance estimate is needed to access the conservation status of bottlenose dolphins in this region. Financial support: Yaqu Pacha, Capes e CNPq.



23<sup>rd</sup> March 8:50

**OPPORTUNISTIC SIGHTINGS OF HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) IN THE BALTIC SEA AT LARGE - KATTEGAT, BELT SEA, SOUND, WESTERN BALTIC AND BALTIC PROPER**

**Philip Loos (1), Petra Deimer (1), Hans-Jürgen Schütte (1), Justin Cooke (2), Katharina Fietz (1), Veit Hennig (3)**

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In order to supplement current knowledge on trends in harbour porpoise (*Phocoena phocoena*) density, incidental sightings of harbour porpoises have been collected in the Baltic Sea. During the seasons 2003-2008 a total number of 5561 sightings were collected and saved for further analysis. Seasonal variation of harbour porpoise sightings, group size and group composition were examined. Sightings with juveniles (n = 539) were of special interest and were therefore analysed separately. Possible calving and nursing grounds (proposed by Koschinski, 2002) have been mapped together with all juvenile sightings in order to see if there are any notable clusters of juvenile sightings within these (or other) areas. To investigate seasonal and spatial trends in porpoise densities, sightings have been divided into five different geographical and five different temporal subsets. Corresponding indices of relative density were computed using an adaptation of an effort correction method, described by Cooke (1984).

Obtained results indicate that the seasonal distribution of porpoise sightings is strongly influenced by the activity patterns of water sports enthusiasts. Group size was relatively low as in most sightings one single individual was observed. Only very few reports refer to sightings with more than five individuals. Juvenile sightings were found in nearly all proposed calving and nursing grounds and three additional areas with a cluster of juvenile sightings could be identified.

Harbour porpoise densities were found to severely decline from (north-) west to (south-) east in the Baltic Sea. A seasonal variation in porpoise densities was detected at the end of summer with dropping densities in August and September. The study shows that incidental sightings of non-professional observers can be analysed and interpreted from a scientific perspective and thus provide important information on distribution, occurrence and relative densities of harbour porpoises.



**23<sup>rd</sup> March 9:10**

**MONITORING WINTER AND SUMMER ABUNDANCE OF CETACEANS IN THE PELAGOS SANCTUARY THROUGH AERIAL SURVEYS FOR CONSERVATION**

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This paper presents data on aerial surveys conducted throughout the Pelagos Sanctuary in winter and summer 2009. The survey comprised 82 parallel transects 10km apart covering an area of 88.267 km<sup>2</sup>. A total of 467 (131 in winter, 336 in summer) cetacean sightings were made: striped dolphins (n=114, n=280), common bottlenose dolphins (7, 8), fin whales (1, 24), sperm whales (1, 5), pilot whales (0, 5), Cuvier's beaked whales (1, 4), Risso's dolphins (0, 4), unidentified small dolphins (7, 5), and unidentified large whales (0, 1). Sample sizes allowed reliable abundance estimates of the number of animals in the survey area to be obtained, using both conventional and multiple covariate distance sampling methods, for striped dolphins and fin whales (summer only). Akaike's Information Criteria values were used to select the best detection function models. Abundances are underestimates in that the data are not available to correct for availability or perception bias. The estimated abundance of striped dolphins in the area was some 19,600 (95% CI=12,300-27,000), in winter and 39,000 (95% CI=28,000-54,300) in summer. Winter and summer school sizes and distribution are compared. The estimated abundance of fin whales in summer was 147 individuals (95% CI=86-250). The paper illustrates that in this area, aerial surveys allow more robust estimates than ship-based surveys. These results represent vital baseline data for the Pelagos Sanctuary. However, eventual assessment of population trends will require an understanding of stock structure (distribution data from the surveys show that the Sanctuary does not cover the full population ranges). Determination of absolute abundance (but not necessarily trends) will require bias correction factors to be developed. Systematic monitoring is essential to inform conservation measures throughout the Basin and represents a current commitment of the Italian Ministry of the Environment.

23<sup>rd</sup> March 9:30

## CORRELATION OF HARBOUR PORPOISE DISTRIBUTION AND ITS PREY IN SCANDINAVIAN WATERS

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Our knowledge of harbour porpoise (*Phocoena phocoena*) distribution on a fine spatial scale has significantly improved in the last decade due to development of new monitoring methods including satellite tracking, acoustic surveying and passive acoustic monitoring. Evidently, porpoise densities may vary both seasonally and diurnally, and although the exact cause behind these movements is unknown, harbour porpoise distribution is presumably related to distribution of prey. This hypothesis has been tested indirectly by modeling environmental factors such as water temperature, salinity and depth as proxies for prey distribution, but the direct correlation between prey and predator distribution has not previously been studied. Here, we establish such a relationship between distribution of porpoises and their prey by comparing the relative densities of porpoises in Kattegat, Skagerrak and the eastern North Sea based on satellite tracking of 18 individuals with the distribution of herring (*Clupea harengus*) obtained through annual acoustic surveys. Studies of stomach content have shown that herring is one of the major prey items in these waters. The comparison was conducted using only satellite data from the months matching the annual acoustic fish surveys in June, July and August from 2000 to 2006. The distribution of herring and porpoises was highly correlated with high densities of both species along the Norwegian Trench, which represents a steep drop from 100 to 700 meters depth. This is a particular productive area that attracts pelagic fish species such as herring and in turn porpoises. These results give the first evidence of porpoise-prey relationships which may be important in management of the species and identification of key habitats.



**23<sup>rd</sup> March 9:50**

**CONSERVATION AND MANAGEMENT OF MARINE MAMMALS – ARE THEY COMPATIBLE ISSUES AT REGIONAL AND GLOBAL ECOSYSTEM LEVELS?**

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Popular interpretations of the two terms conservation and management of marine mammals superficially appear similar, but indeed often carry dissimilar nuances. Although both approaches aim to promote marine mammals, conservation tends to preservation and management to sustainable use, although these are generalisations. Today there are several organisations – inter-governmental, governmental, non-governmental and private that purport to carry out conservation and management as goals, and some more prominent ones will be presented and discussed as examples. In reviewing the goals and activities of these organisations, benefits and disadvantages of acting at local, regional and global levels of authority will be explored; what controls these bodies can exert over members; and also, the individual organisation's breadth of overview of marine mammals and whether this is at single or multiple species level, or at ecosystem level. The author will try to summarise with examples, some of the more important approaches which have proven successful, and try to identify where and why some may have failed or be failing.



23<sup>rd</sup> March 11:00

**FIN WHALE (*BALAENOPTERA PHYSALUS*) POPULATION IDENTITY,  
MIGRATION MOVEMENTS AND NOISE IMPACT IN THE WESTERN  
MEDITERRANEAN SEA**

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Seafloor recorders were deployed in the western Mediterranean Sea, Strait of Gibraltar and in adjacent Atlantic waters during 2006-2009 to further contribute to knowledge regarding fin whale (*Balaenoptera physalus*) movement patterns and population structure within and outside of the Mediterranean basin. Analysis of 24,280 recording hours revealed typical long, patterned sequences of 20-Hz pulses, back beats, 135-140 Hz notes and downsweeps. Acoustic parameters (inter pulse interval, pulse duration, bandwidth, centre and peak frequency) were compared between signals from the Mediterranean Sea and northeast North Atlantic Ocean (NENA) to compare and characterize fin whale sounds from the Mediterranean population. Detection results suggest that an important number of Mediterranean fin whales aggregating in the northwestern Mediterranean basin during summer migrate through French and Spanish waters towards Southern Mediterranean regions, but do not migrate into the Atlantic Ocean. Fin whale calls attributable to the NENA population were detected off northern Morocco, crossing the Strait of Gibraltar and wintering in the southwestern Mediterranean basin (Alboran Sea). These results suggest that the NENA fin whale wintering grounds extend into the southwest Mediterranean basin, and spatial and temporal overlap may exist between this population and the Mediterranean fin whale population. Continuous airgun impulses from a seismic survey were detected during 8-17th December 2006 off southern of Spain. A concurrent fin whale response was documented: bearings to singing fin whales indicated that all singing whales moved away from the seismic area and out of the detection area during the following 20 days, even after the seismic noise ceased after 10 days, and receive song levels remained weak after the 20-day period. We

therefore conclude that the seismic activity caused fin whales to avoid their potential winter ground for a period of time that extended beyond the duration of the detected seismic survey activity.



**23<sup>rd</sup> March 11:20**

## **REPRODUCTIVE SUCCESS OF BOTTLENOSE DOLPHINS IN WELSH WATERS, 2001-09**

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In Cardigan Bay the bottlenose dolphin population has been protected since 2004 through two Special Areas of Conservation (SACs), following the 1992 EU Habitat and Species Directive. One of the population's attributes to be monitored to help assess "Favourable Conservation Status" is its reproductive success: calf production and survival, birth rates, as well as calving season and interval. So far, despite the extensive scientific work conducted in this area, little has been published on this subject. Since 2001, the Sea Watch Foundation has been running a monitoring programme within the SACs. Data collected from 1,296 boat trips and from 921 photographic surveys over the period 2001-08 have been analyzed to better define the population's reproductive success. Out of a total number of 206 marked individuals estimated through photo-identification to have used the area within the 8 years of data collection, a total of 30 reproductive females were identified with confidence. Calving is known to regularly take place within Cardigan Bay, with intervals ranging from 3 to 5 years, and newborn and very young calves found mainly in spring and late summer/early autumn, suggesting a seasonal pattern, although bias is likely since relatively little data collection has occurred in winter. Between 13 and 20 calves have been recorded born annually in the Cardigan Bay SACs; from the population estimates, this provides a mean crude birth rate of 0.104. These results compare favourably with other bottlenose dolphin populations, indicating that the Cardigan Bay population could be healthy and that the conservation measures now in place may be appropriate.





23<sup>rd</sup> March 11:40

## THE VAQUITA'S STORY: TOWED ARRAY SURVEYS FOR MONITORING TRENDS IN THE ABUNDANCE AND DISTRIBUTION OF A CRITICALLY ENDANGERED SPECIES

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The vaquita (*Phocoena sinus*) is the most endangered marine mammal species and is found only in the upper Gulf of California. Fisheries bycatch remains a significant and acute threat. To determine the effectiveness of conservation measures introduced by the Mexican government a monitoring scheme capable of detecting a 4-5% change in population size over 5-10 years is required. Vaquita vocalisations are virtually identical to those of the harbour porpoise (*Phocoena phocoena*) for which reliable acoustic monitoring methods exist. An international effort to review and determine the efficiency of different acoustic monitoring methods for vaquita was conducted in 2008: Here we report on the application of towed-hydrophone passive acoustic surveys. Surveys were conducted between September and November 2008 from a 24' trimaran to minimise vessel avoidance. The size, draft and light weight of this vessel allowed transects to be completed under sail or with a small outboard engine in shallow, heavily fished areas not easily accessible by larger platforms. Transects were sailed on 49% of days, and 31 vaquita groups were detected. Although very high levels of ambient noise presented challenges for acoustic monitoring perpendicular distances were estimated to 30 groups giving an estimated strip width of 198m. Acoustic and visual density estimates within a calibration area were very similar suggesting acoustic  $g(0)$  for vaquita is close to 1. Visual and acoustic population estimates for the entire survey were also similar. Considerably greater survey effort is required to meet the criteria of detecting a 4-5% / year recovery rate. However, towed acoustic surveys offer a viable and cost effective alternative to visual abundance surveys, have provided data from parts of the species' range not previously surveyed, and may be the only solution for monitoring in shallow, heavily fished areas.

23<sup>rd</sup> March 12:00

## AMPHIBIOUS VISION IN HARBOUR SEALS (*PHOCA VITULINA*)

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The amphibious lifestyle of harbour seals is a challenge for their visual system as the eye has to cope with two optically very different media. The main problem resides in the cornea being optically nearly ineffective under water. We first performed refractive measurements using infrared-photoretinoscopy to reveal if ametropia exists in one medium. Emmetropia was found under water, whereas the eyes were highly myopic and astigmatic in air. Studying corneal topography with the help of a Placido's disc, the astigmatism proved to be mainly of corneal origin as the seal's cornea displayed a central flat stripe in the vertical meridian. It was hypothesized that the interaction of the vertical slit-shaped pupil with the corneal flattening leads to acute vision in air if the vertical pupil diameter is not exceeding the flat corneal stripe. With decreasing ambient light, visual acuity should be highly deteriorated due to unfocused light from the stronger curved peripheral parts of the cornea. In order to test this hypothesis, visual acuity was measured in a behavioural experiment in three harbour seals under six values of ambient luminance monitoring pupil diameter. The results support an interaction of the slit-pupil with corneal astigmatism as a means of obtaining sharp vision in air. Retinal resolution assessed on the basis of ganglion cell topography is in good agreement with the best visual acuity values obtained in air and under water. Thus, harbour seals seem to possess a means of obtaining a good resolution in air in bright light, and the high degree of aerial myopia reflects a methodological problem related to the specific corneal topography and does not represent the general refractive state of harbour seals' eyes in air.



23<sup>rd</sup> March 12:20

## CIRCULATING MELATONIN IN THE BOTTLENOSE DOLPHIN

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Melatonin, a pineal-produced indole, plays a critical role in the entrainment of circadian rhythms in mammals. The pineal gland is apparently absent in cetaceans, although an anlage may be present during development, as shown in some foetal whales. A recent study described a complete pineal gland in a bottlenose dolphin, and we also observed a rudimentary one in an old specimen of the same species we received for necropsy. So the question is whether the absence of a fully developed pineal gland in cetaceans (with few exceptions) indicates also the lack of circulating melatonin. It is also possible that the hormone is produced in the Harderian gland, in the gut or elsewhere, similarly to what already described in other mammals. Here we report, for the first time, a quantitative assessment of melatonin production in a cetacean species. We collected plasma and serum samples from 12 captive bottlenose dolphins (*Tursiops truncatus*) for a period of 7 months spanning from winter to summer. Sampling occurred as follows: a) once a day in the morning, in the first week of each month, to test for circannual rhythmicity, b) twice a day (early morning and late afternoon), for three subsequent days, to test for circadian rhythmicity. Night sampling unfortunately was impossible. Melatonin concentration was determined by a properly validated radio-immunoassay (RIA). Our data indicate that melatonin concentration is comparable to that of terrestrial mammals (mean daylight concentration =  $13.35 \pm 4.44$  pg/ml). The presence of a circadian rhythm is suggested by the increase of melatonin from early morning to dusk. Furthermore, values decrease from winter to summer months, following the lengthening of the photoperiod, although the patterns of secretion show a considerable individual variation. Possible explanations of this heterogeneity are discussed also in relation to diet and health status of individual specimens.



23<sup>rd</sup> March 12:40

## USING DTAG DATA TO ASSESS THE PHYSIOLOGY OF DEEP DIVING CUVIER'S BEAKED WHALES

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Beaked whales are one of the least known groups of mammals, but have attracted increasing attention due to reports that connect naval sonar exercises to atypical mass strandings. Recent field studies using non-invasive archival tags that measure detailed behavioural parameters have revealed that beaked whales are extreme divers with behaviours that challenge standard physiological models. Extended breath-hold durations, which frequently exceed 60 min and may reach 85 min, make the Cuvier's beaked whale (*Ziphius cavirostris*) a champion among deep diving cetaceans. Understanding the physiology of such extreme diving capabilities is challenging, but analyzing the details of the diving behaviour should provide some insight into physiological limits. Here, we present modelling of the oxygen intake of Cuvier's beaked whales that is derived from the dive profiles of whales that were tagged in the Mediterranean Sea. A total of 55 deep dives of 12 Cuvier's beaked whales were available for this analysis. The dive profiles indicate that the oxygen store of Cuvier's beaked whale is not sufficient to support exclusively aerobic metabolism during long deep dives. By analyzing the long term dive behaviour and in particular number of the surface respirations one can show that, while the availability of oxygen is indeed limited, the oxygen intake is on average compliant with the allometric expression found by Williams (1999) for the total cost of transport (COT) of swimming marine mammals. This leads to the suggestion that the dynamic of oxygen intake and consumption is consistent with temporary anaerobic metabolism during deep dives. The dive profiles reveal further pronounced single fluke stroke and glide swimming patterns during deep dives that seem to be tuned to save oxygen facilitating longer dives with partly anaerobic metabolism.



23<sup>rd</sup> March 14:50

**USING ON-ANIMAL ACOUSTIC REMOTE SENSING TO STUDY THE FORAGING ECOLOGY OF BLAINVILLE'S BEAKED WHALES IN THE CANARY ISLANDS**

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Blainville's beaked whales (*Mesoplodon densirostris*) inhabit oceanic waters and forage on a range of low energy-content deep-sea prey. Here, we study the niche of this species using new techniques to combine acoustic data from the whales and their environment. Suction-cup-attached acoustic and orientation recording DTags were deployed on eight Blainville's whales off El Hierro (Canary Islands) spanning 40 deep-foraging dives. Echolocation clicks and buzzes, interpreted as prey-search and capture attempts, respectively, indicated the foraging activity of the whales. Echoes from the clicks reflected by the seabed provided the altitude of the whale above the bottom, while echoes from organisms in the water column rendered a depth-related biomass index. Biomass index peaked at the deep-scattering layer depth (DSL, 500-700m), however Blainville's whales did not concentrate their foraging effort (i.e. the time invested echolocating at a given depth) at this depth, feeding both within and below the DSL. Whales foraged on mesopelagic and benthopelagic prey at depths shallower than 800m, but almost exclusively on benthopelagic prey when deeper than 800m. Blainville's whales performed at least 30% of buzzes closer than 200m to the sea-floor (minimum distance 3m), coinciding with the so-called benthic boundary layer (BBL). The absence of mesopelagic foraging deeper than 800m, in the vicinity of deeper waters, may be explained by the drop in productivity in waters below the DSL, increasing only at the BBL. Foraging deeper involves greater locomotion costs to Blainville's whales, suggesting that the whales are seeking special types of prey, that renders the biggest net energy returns, rather than feeding where organisms are more abundant. Mammals inhabiting terrestrial low-productivity habitats often switch food preferences to maximize energy returns. Similarly, the dual foraging strategy of Blainville's whales may enable them to occupy an extensive niche

with prey of low energy content that also may explain the broad geographic range of this species.



**23<sup>rd</sup> March 15:10**

## **HEARING PROCESSES MEASURED DURING ECHOLOCATION IN A FALSE KILLER WHALE**

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An echolocating false killer whale hears the echoes from a small aluminum cylinder at a level higher than it hears the 180 dB clicks that it emits to produce those echoes. Working with a well-trained echolocating false killer whale (*Pseudorca crassidens*) wearing latex surface suction cup electrodes, we have measured echolocation hearing Auditory Evoked Potentials (AEP) in response to outgoing echolocation clicks, returning echoes, and comparable simulated whale clicks and echoes in a variety of situations. We have found that the false killer whale adjusts its level of hearing using at least three processes: (1) a forward masking of the return echo by the outgoing signal that changes the level at which the echo is heard, (2) a self-dampening of the outgoing signal, and (3) an additional active hearing control process that changes the level at which signals are heard. Recently collected data measuring hearing in response to clicks generated by the whale and the echoes from targets and hearing to arbitrarily present sound, show that overall hearing sensitivity to an arbitrary 22.5 kHz sound changes by over 20 dB depending on whether a target is located or not. When the whale is searching for a target, its overall sensitivity to arbitrary sound is at least 20 dB better than when after a target has been located.



23<sup>rd</sup> March 15:30

## SPECTRAL ESTIMATION METHODS FOR THE REAL-TIME LOCALISATION AND TRACKING OF CETACEANS

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The localisation of cetaceans permits non-invasive behaviour and population dynamics studies and hence helps with their conservation. The most frequently used class of localisation methods is based on time difference of arrival (TDOA). Its capabilities are appreciable even in adverse situations (few sensors, high noise levels and/or poor calibration). A second class of methods, the spectral estimation methods, originated in underwater applications such as sonar but had its most significant achievements in digital communications over the last twenty years. Revisiting these developments can bring significant improvement to the localisation and tracking of cetaceans. In the frame of the European network ESONET and the LIDO project, vocalising sperm whales were detected offshore the port of Catania (Sicily) with a bottom-mounted (around 2080m depth) tetrahedral compact array intended for real-time detection, localisation and classification of cetaceans. Various spectral estimators were implemented and permitted to make three-dimensional maps of the sound radiated during the detected clicks and to consequently localise and track sperm whales. The method also tracked other detected sound sources, mainly boats. In the case of broadband signals such as those emitted by sperm whales, the obtained results showed that spectral estimation, through its multi-channel signal processing, outperforms TDOA-based methods in robustness (better resolution and signal-noise separation). A transformed version of the Multiple Signal Classification estimator (MuSiC) was found to produce high-resolution location estimates for each click. The small variance obtained for these estimates reduces the necessity of additional statistical clustering. This method does not only provide useful information concerning the number of simultaneously vocalising cetaceans and their locations but also dynamic information concerning calibration. Equally informative localisation results were obtained by hybridising spectral estimators with a noise-robust and whitened cross-correlation function, the Generalised Cross-Correlation. This more importantly yielded a reduction of computations to the benefit of real time.



23<sup>rd</sup> March 15:50

## DO BOTTLENOSE DOLPHINS USE SIGNATURE WHISTLES OF CONSPECIFICS WHEN THEY ENCOUNTER THEM?

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Bottlenose dolphins (*Tursiops truncatus*) use individually distinctive signature whistles for individual recognition and group cohesion. Signature whistle development is influenced by vocal learning, which helps to increase inter-individual differences in the frequency modulation pattern of the fundamental frequency. Dolphins are able to extract identity information from this modulation pattern even from a synthetic signal. Furthermore, bottlenose dolphins can copy the signature whistle modulation pattern of other individuals. It has been hypothesized that bottlenose dolphins use such copying to address the owner of the whistle. In our study, we tested this hypothesis using video playback experiments on 3 captive bottlenose dolphins at the Dolfinarium Harderwijk in the Netherlands. We showed silent video recordings of known but absent conspecifics to the animals, and observed their acoustic response using a passive acoustic localization technique to ascribe whistles to callers. Signature whistles of our stimulus animals were collected when they were in isolated from other dolphins. Dolphins approached the video screen readily and investigated the screen repeatedly. In two cases, we found that the animals produced the signature whistle of the shown individual. However, this did not occur immediately after the start of the video suggesting that this is not an automatic response. This result demonstrates that (1) bottlenose dolphins can recognize known conspecifics visually on a video, (2) that they remember the signature whistle of conspecifics and (3) that they use signature whistles of other animals spontaneously when seeing but not hearing them. Our findings support the idea that signature whistle copies in the wild are used in addressing conspecifics.





23<sup>rd</sup> March 16:10

## INFLUENCE OF CONTINUOUS MASKING PURE TONES ON ABR CLICK RESPONSES IN A HARBOUR PORPOISE

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Echolocation click envelopes and auditory evoked potentials (AEP) of a male harbour porpoise were recorded while masking with continuous sinusoidal amplitude modulated (SAM) tones. AEP responses were collected with stainless steel surface electrodes, band-pass filtered between 300 Hz and 10 kHz and sampled at 50 kHz. Simultaneously, the recording system picked up the click envelopes with a B&K 8103 hydrophone, which were sampled and saved as a second channel in the same file. A HS/150 hydrophone projected the SAM tones (AM rate= 800 Hz) with carrier frequencies between 60 and 160 kHz. Received levels (RL) varied between 80 and 130 dB re 1  $\mu$ Pa. Running on-line averaging and frequency analysis allowed us to monitor the presence of SAM tone responses, but the actual analysis of the continuous recordings took place off-line. We found that the AEPs evoked by the porpoise's own echolocation sounds were largely independent of the source level (SL) of the clicks. These responses were also relatively unaffected by variations in click repetition rate and (less surprisingly) position in the click train. The degree to which the SAM tones masked the click AEP depended on the carrier frequency and RL of the masker. Thus, at 125 kHz the AEP of the outgoing click reduced to about half when RL was increased from 80 to 130 dB, while for other frequencies (e.g. 80 kHz) the masking effect was absent altogether. The data from Kastelein (2002) indicate a discrepancy between frequency range of best sensitivity to pure tones and spectrum range of echolocation clicks in harbour porpoises. The present study suggests that the discrepancy can be explained by a change in apparent hearing sensitivity during active echolocation. If the animal clicked during the psychophysical trials (and harbour porpoises always click), the stimulus tones may possibly have been masked.



**23<sup>rd</sup> March 16:30**

**REDUCING THE POTENTIAL FOR SEISMIC AIRGUN IMPACTS ON  
CETACEANS THROUGH ALTERNATIVE TECHNOLOGIES FOR OIL AND  
GAS EXPLORATION**

**Lindy Weilgart (1), Ron Brinkman (2), Chris Clark (3), John Diebold (4), Peter  
Duncan (5), Rob Habiger (6), Leila Hatch (7), John Hildebrand (8), Phil Nash  
(9), Jeremy Nedwell (10), Dave Ridyard (11), Rune Tenngamn (12), Peter van  
der Sman (13), Warren Wood (14), John V. Young (15)**

- (1) Dalhousie University and Okeanos - Foundation for the Sea
- (2) U.S. Minerals Management Service
- (3) Cornell Laboratory of Ornithology
- (4) Lamont-Doherty Earth Observatory
- (5) Microseismic, Inc.
- (6) Spectraseis AG
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- (8) Scripps Institution of Oceanography
- (9) Stingray Geophysical Ltd.
- (10) Subacoustech
- (11) EMGS - Electromagnetic Geoservices ASA
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Evidence on the pervasiveness of noise from the world-wide use of seismic airgun surveys for hydrocarbon exploration is mounting. Airgun surveys can last months, producing loud, sharp impulses. Impacts from airgun noise on cetaceans and their prey have been well documented. Though the extent of these impacts remains unknown, enough evidence exists to warrant investigation of ways to reduce airgun noise. Supported by the Okeanos Foundation, an international, multi-disciplinary group of geophysical scientists, seismologists, biologists, and regulators met in Monterey, California, in 2009, to seek more environmentally benign alternatives and/or modifications to airguns and survey configurations to minimize potential impacts. Participants concluded that some airgun sound represents "waste sound" (too high frequency or lateral propagation), which, if eliminated, would have no effect on the quality of data acquired. Peak sound levels required for exploration might also be reduced by increasing receiver density and sensitivity, spreading the source energy out over time, and moving

sources and/or receivers closer to the seafloor. Controlled sources (e.g. electro-mechanical modern marine vibrators, low frequency acoustic projectors, and other non-impulsive, oscillating sound sources) generally introduce the same level of geophysically useable energy into the water as impulsive airguns, but over longer duration, and are thus quieter. Furthermore, they can produce sound only at the frequencies desired, generating signals specifically designed to reduce impacts on cetaceans while maximizing geological interpretability. For example, a 1-s oscillatory/vibrator/projector pulse puts the same energy into the water as a 10 ms airgun pulse, but is 100 times quieter, with a 10,000 fold reduction in the ensonified area. Panelists also discussed promising new technologies that are either completely silent (e.g. electromagnetics, passive seismics) or that can lessen the amount of sound required to gather seismic data (e.g. through more sensitive fiber optic sensors).



24<sup>th</sup> March 8:30

## **SURVIVAL RATE ESTIMATIONS FOR STELLER SEA LIONS (*EUMETOPIAS JUBATUS*) ON THE KURIL ISLANDS RUSSIA**

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In the last half of the 20th century, a severe population decline in Steller sea lion (SSL) abundance was observed in the northern Pacific. There are several hypotheses for the decrease (food limitation, killer whale predation, etc), but no single one can explain all details of the observed decline. The decline might be due to several factors, which are hard to evaluate because of limited historical information. To monitor current demographics of SSL, permanent marking using hot-iron branding was conducted at five major rookeries in the Kuril Islands since 1989. We analysed 4794 recapture events of 3547 branded SSL pups from four rookeries. Survey effort between 1990 and 2001 was low so recapture probability was less than 0.1. Starting in 2002, we monitored each rookery for up to two months during the breeding season, which increased recapture probability to between 0.4 and 0.9. To estimate survival rates, we used the Cormack-Jolly-Seber model. Survival rates for the pups were lower compared with other ages, and ranged 0.5-0.6 across all rookeries. Pup survival was a little higher on the central Kurils at Lovushki (0.62, SE=0.03) and Raykoke (0.61, SE=0.03) in comparison with Antsiferov (0.54, SE=0.03) and Brat Chirpoev (0.57, SE=0.03), but these differences were insignificant. For animals aged 1+ yrs, estimated survival rates (~0.8-0.9) were higher than for pups, and did not differ significantly between rookeries. Survival rates of all age groups did not change significantly over the last eight years. Our estimates, combined with observed reproductive rates and abundance trends, allow us to predict that the number of SSL will not decrease in the Kuril Islands in the near future, as long as environmental conditions do not change dramatically.



24<sup>th</sup> March 8:50

## GEOGRAPHICAL VARIATION OF SKELETAL PAEDOMORPHOSIS IN THE HARBOUR PORPOISE: DOES ECOLOGY MATTER?

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All extant porpoise species show paedomorphic traits in the skeleton, such as shape of bones and incomplete suture fusion in the skull and epiphyses. These traits are hypothesized to be connected with their rapid growth to reproductive size and could thus be expected to show geographical variation according to ecological circumstances. In order to investigate this, growth and paedomorphosis were analyzed and compared using skeletal material from 608 harbour porpoises from California, West Greenland, the inner Danish waters and the Sea of Azov. Porpoises from California grew to larger sizes than Danish porpoises, which were again larger than Greenlandic porpoises, while Sea of Azov porpoises were the smallest. Size differences were largely attributable to differences in timing of offset of growth. Paedomorphosis was investigated in the fusion of skull sutures and ankylosis of epiphyses in the flipper skeleton and vertebral column and by allometric progression of skull shape assessed by three-dimensional geometric morphometrics. Expression of paedomorphosis followed the same pattern among populations and sexes as adult sizes; Californian porpoises were less paedomorphic than the other populations across all the assessed traits, while porpoises from the Sea of Azov were most paedomorphic. It is suggested that the lower magnitude of paedomorphosis and corresponding larger size of Californian porpoises are attributable to higher variability of prey availability, owing to variation in the upwelling on which productivity in Californian waters depends. Porpoises along the northwestern African coast, where productivity is also dependent on a fluctuating upwelling system also show large body sizes and are presumably less paedomorphic. The most profound paedomorphosis and fastest growth to reproductive size may only be feasible where prey is abundant and predictably found, as the consequent small adult body size infers high heat loss and limited capacity for energy storage.



24<sup>th</sup> March 9:10

## DIFFERENT RESULTS IN DIET OF PORPOISES USING FATTY ACIDS AND STOMACH CONTENTS: GENUINE TEMPORAL CHANGES IN DIET OR AN ARTEFACT?

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Harbour porpoise (*Phocoena phocoena*) abundance and distribution has changed significantly over the past decades with a shift in distribution towards southern areas. It is hypothesized that animals moved south due to decreased fish stocks in northern areas. This may be reflected in their diet. We are studying the diet of porpoises that stranded along the Dutch coast (1990-2007) in relation to changes in porpoise distribution and to changes in local prey abundance and distribution. The diet of porpoises is commonly reconstructed by indirect methods (e.g. stomach contents analysis 'SCA', quantitative fatty acid signature analysis 'QFASA' and stable isotope analysis). Combining methods promises a more complete picture of the diet, e.g. in the identification of temporal changes (days versus months). We used QFASA (n=74) and SCA (n=208) to reconstruct the diet composition. For 45 porpoises, both methods were applied and results are compared. Diet composition modelled by QFASA appeared considerably different to diet composition as reconstructed by SCA. Main prey species with QFASA modelling were identified as smelt (24%), gobies (22%) and dab (18%) whilst SCA identified gobies (42% Weight) and whiting (19% Weight) as the main prey species. This could indicate a shift in diet just before the animals' stranding compared to their overall diet of the recent months. However, it is conspicuous that whiting, one of the main prey species with SCA was not identified by QFASA at all. It is discussed whether these differences reflect actual temporal changes in diet or are a result of insufficiencies in the QFASA modelling. The influence of the available prey FA database and species specific correction factors are discussed. Our results illustrate the need for a shared prey FA database that could improve QFASA modelling and reduce research costs. We also underline the possible bias in diet analysis, when using one method only.



24<sup>th</sup> March 9:30

## CFD STUDY OF A NEW NON-INVASIVE DESIGN OF DOLPHIN TELEMETRY TAG

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The impact of attached devices on animals remains a problem in telemetry studies of dolphins. It was supposed that the hydrodynamic design of a tag could provide a stable attachment to the dorsal fin by the hydrodynamic force resulting during swimming. To verify this hypothesis, a CFD study of tag performance and its impact on dolphin hydrodynamics was undertaken. A CAD model presenting an authentic geometry of an adult female common dolphin was constructed with SolidWorks software. Data from direct measurements of a stranded dolphin, photographs, measurements of the fin's cross-section, and laser scanning data of the rigid model of the dolphin, were used for model construction. A parametric model of the telemetry tag attached to the dolphin's dorsal fin was also constructed. The hydrodynamic performance of the tag was studied with CFD simulation of the flow around the dolphin using Fluent software. A dolphin model without a tag was used as a reference. The tag impact was estimated with calculated coefficients of drag, lift, and moment for the range of simulated velocities from 2 to 8  $\text{ms}^{-1}$ . Pitch and yaw angles varied from -10 to +10 and from 0 to 5 degrees respectively. The drag coefficient decreased with increasing swim speeds from 0.055 to 0.037 for the reference model, and from 0.056 to 0.039 for the attached tag. The incremental increase in the drag coefficient relating to the presence of the tag varied in range by 2-3% at zero pitch and yaw angles. Data obtained support the idea of a non-invasive tag attachment by appropriately orienting the resulting force so as to keep the tag on the fin. These results can be used for setting up an experimental study of any new tag design.



**24<sup>th</sup> March 9:50**

**PROTECTION OF CETACEANS UNDER NATIONAL AND EUROPEAN LAW:  
IMPACT OF THE HABITATS DIRECTIVE ON THE COMMON FISHERIES  
POLICY**

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The Habitats Directive of the European Union (EU) intends to maintain or restore, at favourable conservation status, natural habitats and species of wild flora and fauna of Community interest. It aims to contribute to the implementation of the commitments of the EU and its member States undertaken under the 1992 Convention on Biological Diversity (CBD). The main goal of the Directive, which also applies to the maritime territories and the Exclusive Economic Zones (EEZ) of the Member States, is to create a coherent European ecological network known as Natura 2000. This network consists of a series of Special Areas of Conservation (SACs) within which habitats and species of Community interest such as, e.g., the harbour porpoise, are to be protected. Once established, the Member States are obliged to protect and restore the sites included in the network in accordance with the procedural and substantial minimum standards specified in the Directive. In addition, the Habitats Directive obliges the Member States to establish a system of strict protection for the animal species listed in Annex IV (a). This obligation covers all European cetacean species and includes the prohibition of deliberate capture or killing the species in the wild as well as that of deliberate disturbance. Consequently, any human activity undertaken within the area of national jurisdiction of the Member States, which is likely to have an impact on cetaceans, is to be measured against the protection standards of the Habitats Directive. Against this legal background, the talk will focus on the sensible issue of compatibility of fishing activities conducted within European waters with the conservation and protection standards deriving from European law. In particular, the question will be addressed whether the EU Member States are legally prevented from implementing the Habitats Directive by adopting strict conservation standards which impact on fishing activities (such as, e.g., mesh size requirements) due to the exclusive competence of the EU on the field of conservation of marine biological resources under the common fisheries policy.



24<sup>th</sup> March 11:00

**SEQUENTIAL HABITAT USE OF RESURRECTION BAY, ALASKA, BY  
RESIDENT KILLER WHALES AS DETECTED BY PASSIVE ACOUSTIC  
MONITORING**

**Harald Yurk (1), Olga Filatova (2), Craig O. Matkin (3), Lance. G. Barrett-  
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Killer whales are sighted regularly along Alaska's north gulf coast during the summer, but little is known about their movements and use of habitats during the winter when low levels of light and adverse weather conditions discourage regular boat-based surveys. Remote acoustic monitoring of resident killer whale groups provides a practical alternative to study movements because each extended family group or pod has a unique dialect that can be discerned by differences in their repertoires of stereotyped calls. In this study we used remote acoustic monitoring to investigate the occurrence of killer whales in Resurrection Bay Alaska. A remote hydrophone was monitored at irregular intervals during the fall, winter and spring months of 1999 to 2004. In total, seven pods of resident killer whales from two acoustic clans were identified: four pods from AB clan (AB, AJ, AN, AF) and three pods from AD clan (AK, AD5, AD16). The frequencies of occurrence of the two clans differed between the November to March period, when AB clan occupied the area, and the April-May and September-October periods when AD clan was predominant. The sequential use of this habitat during periods of relative prey scarcity has the effect of limiting inter-group resource competition and is consistent with earlier findings demonstrating divergent resource specialization by sympatric killer whale populations.



24<sup>th</sup> March 11:20

## **PREDICTION OF FIN WHALE'S AND SPERM WHALE'S DISTRIBUTION LINKED TO TOPOGRAPHIC AND ENVIRONMENTAL PARAMETERS IN THE PELAGOS SANCTUARY**

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The aim of this study is to identify suitable habitat for the fin whale and sperm whale and to give managers of the PELAGOS Sanctuary maps of predictable risk areas regarding marine traffic. For that purpose we compare results given by a presence-absence habitat modelling method with Generalized Linear Model (GLM) to a presence-only modelling method with Ecological Niche Factor Analysis (ENFA) in the northwestern Mediterranean Sea including PELAGOS Sanctuary. The same dataset of sightings recorded from 1998 to 2008 is being used with both modelling methods: on 872 opportunistic sightings of fin whales and 243 of sperm whales and 349 and 68 respectively in-effort sightings, collected in 41269 km of transect. The habitat maps were built using topographic variables like depth, slope and distance to main bathymetric contours and also environmental parameters from satellite like Net Primary Production (NPP), Chlorophyll concentration and Sea Surface Temperature. GLM and ENFA models concluded both to similar favourable habitats, showing that fin whale distribution is closely related to topographic with depth factor being the most significant but also environmental variables as NPP and SST. 1. Suitable habitat for the fin whale appears in offshore waters, while for sperm whale it is more related to continental slope. Correct predictions of 68% and 65% of the presence for fin whale and sperm whale respectively on the total data set used to build the GLM have been found while the Boyce Index is 0.56 and 0.2 for ENFA. 2. Both techniques provide complementary results especially for fin whales and have been compared to geostatistical analysis conducted with on effort data.



24<sup>th</sup> March 11:40

## CHARACTERISTICS OF HUMPBACK WHALE HABITAT IN THE SCOTIA SEA AND THE ANTARCTIC PENINSULA

**Carole Durussel (1), Sue Moore (2), Nancy Friday (2), Alexandre Zerbini (2), Sharon Hedley (3)**

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Based on the CCAMLR/IWC 2000 survey, this study focused on the highly dynamic and biologically important Scotia Sea and Antarctic Peninsula region to characterise the feeding habitat of humpback whales in relation to prey availability and environmental features. We investigated environmental parameters as a natural boundary between breeding stocks and assessed Piatt and Methven (1992)'s hypothesis of prey density thresholds. Survey transects were divided into segments of three to five nautical miles, for each of which the presence or absence of whales was recorded. Model parameters included prey (krill density minimum, average, maximum), environmental (chlorophyll, distance to the ice, salinity, sea surface height deviation, sea surface temperature), bathymetric (depth, slope) and geographical variables (an east-west and a north-south division of the study area). Krill densities were obtained from hydro-acoustic data and environmental variables from remote sensing data. Random forests were constructed to evaluate environmental parameters. The relationship between humpback whale presence and the random forest-selected variables was explored using generalised additive models. The best models were selected using a backward selection process and their predictive capability was assessed. Some models were fitted excluding the estimated krill density data and, although parameters ranked slightly differently, the set of explanatory variables selected remained consistent with the model including krill data. Prey concentration is likely the main factor influencing humpback whale distribution with other environmental variables, such as chlorophyll levels, acting as proxies. The probability of humpback whale presence was associated with increasing chlorophyll and salinity levels and with decreasing temperatures, depths and distance to the ice. Results indicate towards the possible existence of a krill density threshold below which humpback whales may not feed. A natural boundary is defined through the north-south delimitation in environmental variability, particularly through sea surface temperature, but its effects on whale distribution need to be further investigated.

24<sup>th</sup> March 12:00

## SPATIAL MODELLING OF HARBOUR PORPOISE (*PHOCOENA PHOCOENA*) DISTRIBUTION BASED ON SATELLITE DATA

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Our understanding of the distribution pattern of harbour porpoises (*Phocoena phocoena*) in EU waters is incomplete, and modelled predictions of their distributions could inform the strategic spatial planning of future exploitation of the marine environment to avoid potential conflicts. We analysed satellite telemetry data from 39 harbour porpoises in inner Danish waters using a modelling tool rooted in maximum entropy: Maxent. By comparing the known distribution of harbour porpoises with their modelled potential distribution we can learn a lot about what effects the distribution of the species. We used an iterative bootstrapping procedure to randomly select among the most accurate records from each of the 39 tagged individuals, and ran Maxent on pooled records based on explanatory environmental variables hypothesised to serve as good proxies for harbour porpoise prey abundance. Most areas match the known distribution of harbour porpoises while e.g. the Sound (Øresund) was predicted as highly suitable for harbour porpoises year round, though only very few satellite locations were recorded in the area. Harbour porpoises used to be abundant in the Sound, but have nearly disappeared from the area since the middle of the 20th century. The area has ample suitable prey but also intense ship traffic of all kinds, a busy ferry connection, a large bridge, several wind farms and the highest density of harbours and large cities anywhere in the study area, which may keep porpoises from staying in the area for more than short visits. However in 2009 several tagged porpoises used considerable time in the Sound suggesting a shift in habitat use. Our methods have implications for the analyses of satellite tagged animals in terrestrial and marine environments. By coupling a bootstrapping procedure with Maxent we circumvented many of the statistical challenges presented by satellite telemetry data.



24<sup>th</sup> March 12:20

## **WATER TEMPERATURE AND THE DISTRIBUTION OF THE COMMON DOLPHIN (*DELPHINUS DELPHIS*) IN BRITISH SHELF WATERS: A POTENTIAL INDICATOR OF CLIMATE CHANGE IMPACTS**

**Tom Brereton (1), Colin D. Macleod (2), Kevin Robinson (3), Emily Lambert (2), Sarah M. Bannon (2), Karen Hall (2), Marina Costa (3)**

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Climate change is predicted to result in a poleward expansion in the range of species limited to warmer waters. Here, we assess whether the occurrence of one warm water species, the common dolphin (*Delphinus delphis*), is expanding in British shelf waters as water temperatures increase. Based on a meta-analysis of trends from six separate studies, we present evidence that in recent years common dolphin occurrence has expanded from a core area to the south and west of the British Isles (occupied during the 1970s-1990s) into northwest Scotland, the northern North Sea and, most recently, the coastal Moray Firth, in northeast Scotland. In addition, in the British North Sea, the presence of common dolphin strandings is related to water temperature, indicating a greater occurrence at higher temperatures. This has resulted in two main peaks in common dolphin occurrence in the British North Sea, during the 1930s-1950s and since the 1980s. During both periods, summer water temperatures were consistently high. Based on estimates of the lower critical limit to the thermal neutral zone of common dolphin, this relationship between common dolphin occurrence and water temperature is likely to be directly related to the thermal niche occupied by the species. From this, we produced a model of the thermal niche common dolphin which captured the changing distribution in relation to water temperature and used it to predict what is likely to happen under various climate change scenarios between 2010 and 2099. This model suggests that the distribution of common dolphin is likely to continue to expand in the foreseeable future throughout the northeast Atlantic. Based on this study, we suggest that the common dolphin has the potential to act as a good indicator of the effects of climate change in cetaceans both in the northeast Atlantic and throughout the world.



24<sup>th</sup> March 12:40

## ZOOGEOGRAPHY OF THE CETACEANS IN ALGOA BAY, SOUTH AFRICA

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Algoa Bay is a large (1225km<sup>2</sup>), south-east facing bay in the Eastern Cape Province, South Africa. To date there has been no survey on the cetaceans in Algoa Bay. A number of developments in recent years such as a deep-water port, a proposed oil refinery, two potential wind power plants, increased recreational boating and fishing (commercial and recreational) as well as a proposed large Marine Protected Area (MPA), and increased interest in whale watching, highlight the need for a baseline study on cetaceans. The present study will determine the spatial and temporal distribution, and habitat preference of cetaceans in Algoa Bay. Boat-based surveys are being carried out monthly between June 2008 and May 2011. At each sighting the GPS location, species, number, composition, and behaviour are recorded. To date 300 hours of surveys have been conducted with a total of 258 sightings. Species observed to date are: the southern right whale (*Eubalaena australis*), humpback whale (*Megaptera novaeangliae*), Bryde's whale (*Balaenoptera brydei*), Indian Ocean bottlenose dolphin (*Tursiops aduncus*), Indo-Pacific humpback dolphin (*Sousa plumbea*), and long-beaked common dolphin (*Delphinus capensis*). 66% of all mysticete mother/calf pair sightings occurred in the proposed MPA, compared to 33% in the rest of the bay. There was no significant difference in the depths among humpback dolphins, bottlenose dolphins and southern right whales ( $p > 0.01$ ), and similarly between Bryde's whales and humpback whales ( $p > 0.01$ ). However, there was a significant difference between the inshore and offshore species in all cases (one-way ANOVA;  $p < 0.01$ ). These results indicate how cetaceans utilise the bay in significantly different ways, with key areas of high use differing between species, and results of a more detailed GIS analysis will illustrate that. Such data will aid in determining preferred habitats that need to be defined for future management strategies in the bay.



24<sup>th</sup> March 14:50

**METHODOLOGY FOR FIELD-GAS SAMPLING, TRANSPORT AND ANALYSIS  
IN THE LABORATORY OF GAS EMBOLISM FOUND IN STRANDED  
CETACEANS**

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Several atypical mass strandings of beaked whales have occurred in spatio-temporal concordance with military maneuvers world-wide. Gas-bubble associated lesions and fat embolism suggesting a decompression-like disease has been found on the strandings in the Canary Islands in 2002. This paper raised an important public controversy, requiring further investigations including an analysis of the composition of the gas in the bubbles. Gas composition analysis might elucidate some of the questions raised by the gas-bubble findings. We propose a methodology for in situ extraction, transport and later analysis on the laboratory. Taking in mind transport and possible non-comfortable stranding sites, methodology has been developed to remain as simple as possible and with non-breakable materials whenever this was possible. Gas samples from cavities are sampled with a double pointed needle coupled directly to a vacutainer. Bubbles are extracted with a plastic-insulin syringe, and gas from heart is extracted and separated from the blood with the use of a home-designed spirometer. All samples are stored in vacutainers at room temperature. Analyses of permanent gases and hydrocarbons up to 4 carbons are done by gas chromatography. Atmospheric air pollution has been avoided to the maximum possible extent along all the procedure, and correction factors have been introduced into calculations. This methodology has been tested for adjustments in 41 cetaceans that stranded in the canaries coast between 2006 and 2008. A total of 132 gas samples were analysed. We present a new methodology that enables in situ gas sampling of stranded cetaceans and gas analysis base lines that contributes to identify the gas composition.

24<sup>th</sup> March 15:10

## WHAT CAUSED THE UK'S LARGEST COMMON DOLPHIN (*DELPHINUS DELPHIS*) MASS STRANDING EVENT?

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On 9 June 2008, the UK's largest mass stranding event (MSE) of common dolphins (*Delphinus delphis*) occurred in Falmouth Bay, Cornwall. At least 26 dolphins died and a similar or larger number were refloated/herded back to sea. On necropsy, all 26 dead dolphins were in good nutritive status with empty stomachs. There was no evidence of significant infectious disease or acute physical injury. All seven adult dolphins tested were free of harmful algal toxins and had low chemical pollutant levels. The auditory apparatus (ears) were grossly normal in all cases. Pathological evidence of inhalation of seawater (n=11) was used as a novel forensic technique for establishing that the MSE probably occurred on a rising tide after 06:30-07:00hrs and before 08:21hrs. Potential causes either excluded or considered highly unlikely included infectious disease, gas/fat embolism, boat strike, by-catch, predator attack, stranding immediately after feeding unusually close to shore, chemical or algal toxin exposure, abnormal weather/climatic conditions and high-intensity acoustic inputs from seismic airgun arrays and natural sources (e.g. earthquakes). Although a definitive cause of the MSE could not be identified, the international naval exercises occurring in close proximity remain the only known cause of



cetacean MSEs that cannot be excluded. The most intense part of the naval exercises in the preceding week (including sonars) may have driven a large group of common dolphins unusually close to shore where they were at increased risk of stranding. A second event, such as noise from naval helicopters, may have caused panic response(s) leading to at least some of the milling and stranding behaviours seen on 9 June. Greater insight into the causes of any future MSEs may require either a direct observation of the onset, or the emergence of an unusual level of coincidence.



## POSTER

### ACOUSTICS

A01

#### HEARING MEASUREMENTS FROM A REHABILITATED STRANDED LONG FINNED PILOT WHALE (*GLOBICEPHALA MELAS*)

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Pilot whales are highly social odontocetes, and are one of the species that frequently mass strand. Although the reasons behind most mass stranding events are unknown, excessive anthropogenic sound has been suggested to play a role in stranding events. Previously, no audiometric data existed on pilot whales. Recently, the hearing of a rehabilitated stranded long finned pilot whale (*Globicephala melas*) was measured at the Jardim Zoologico de Lisboa in Lisbon, Portugal. Using auditory evoked potential (AEP) techniques, the modulation rate transfer function (MRTF) was recorded between 375 and 2000 Hz, with a best response found at 1250 Hz which is higher than many species. Hearing sensitivities were measured between 4 and 100 kHz with best hearing sensitivity found between 20 and 50 kHz. The pilot whale did not hear well at high frequencies (above 50 kHz) predicted by other odontocete audiograms, but this may be the result of exposure to ototoxic drugs that were given during the initial stranding to save the animal's life. Obtaining audiograms from stranded animals that are rehabilitated in a variety of facilities, including zoos and oceanariums, aids in the development of a better understanding of the impact of noise on odontocetes in the wild.



A02

## IN-AIR HEARING SENSITIVITY IN HARBOUR SEALS (*PHOCA VITULINA*) FROM THE NORTH SEA AS A BASELINE FOR LONG-TERM AUDITORY MONITORING

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The planned construction of a large number of offshore wind turbines (OWTs) in the German Bight raised concern because of the potential auditory impact on the harbour seal (*Phoca vitulina*). Due to the comparatively high level of anthropogenic activities in the southern North Sea it is likely that the ambient noise level is raised already prior to the installation of the OWTs. It was therefore hypothesized that adult harbour seals may already show a reduced hearing sensitivity compared to individuals from other areas. In contrast, juvenile and sub-adult individuals from the North Sea have been exposed to no significant levels or lesser amounts of noise. Consequently, these animals should have an undisturbed hearing sensitivity or show a lower grade of hearing impairment compared to adult animals. Individuals from these age groups were chosen for auditory measurements to acquire reference data for the southern North Sea sub-population of harbour seals. This information will serve as the baseline for monitoring long-term development of the acoustic health of these animals. Harbour seal pups and sub-adults were tested for their in-air hearing sensitivity. The AEP method was used to conduct the auditory measurements while the animals were immobilized. Their hearing sensitivity was measured at frequencies between 0.7 kHz and 22.4 kHz short tone pips presented via headphones. The resulting thresholds measured in all animals are in good agreement with previously published hearing data from other studies on harbour seals from the North Pacific and North Atlantic. This indicates that the chosen approach is suitable for further auditory monitoring of this sub-population. Moreover, the gathered data define a level of a healthy hearing system in harbour seals and can be used as a baseline for the assessment of auditory effects of an acute or chronic increase in their acoustic environment due to anthropogenic activities.



A03

**DESCRIBING ODONTOCETE INNER EAR ULTRASTRUCTURES:  
CONTRIBUTION FROM SCANNING ELECTRON MICROSCOPY**

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The description of the cetacean auditory pathways morphology is a key conservation issue to assess the effects of acoustic pollution on marine ecosystems. Because odontocetes produce species-specific sounds at diverse frequency ranges, differences in echolocation signals could reflect morphological cochlear differences. One of the challenging steps after extraction and fixation of fresh ear samples from stranded individuals is to decalcify the bone envelope to access the cochlea without damaging the soft tissues. 111 ears from 13 different odontocete species stranded in the Mediterranean Sea, the North Atlantic and the North Sea were processed to build a decalcification protocol using the following solutions: RDO®, EDTA and EDTA in a microwave oven. Here, we show scanning electron microscopy images that reflect the presence of 1) outer hair cells in a fourth row at the first apical cochlea turn in *Phocoena phocoena* and 2) outer hair cells stereocilia prints in the tectorial membrane of *Delphinus delphis*, *Phocoena phocoena* and *Stenella coeruleoalba*. These ultrastructures have not yet been reported in the literature for these species.



**A04**

**UNSUCCESSFUL ATTEMPT TO MEASURE SOUND RELATED EVOKED POTENTIALS ON CUTTLEFISH (*SEPIA OFFICINALIS*)**

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Depending on the species, cephalopods are presumably sensible to low frequency waves up to 1000Hz. This range of frequencies overlap with noise associated to many human activities at sea such as shipping or seismic surveying. Because cephalopods spp. represent the main preys for many cetaceans, the mechanisms of sound perception and the sensitivity of these species to sound exposure should be investigated. Here, we describe an attempt to obtain central nervous system responses to sound stimuli in cuttlefish. The animals were captured from the sea during the mating season through traditional fishing techniques with no hooks and no physical damage. They were fed and kept in large sea water tanks until they were considered to be behaviourally stable enough to perform the tests. The measurement hardware consisted of a sound projector and a biopotential signal amplifying system (subdermal electrodes and a custom biopotential amplifier), both controlled via a Labview Interface. The animals were anesthetized and injected with a muscle relaxant to prevent them from moving and saturating the biopotential amplifying stage. The acquisition of the responses failed because of the animals' reactions to anesthesia and the effects of the muscle relaxant as well as the fast corrosion of the subdermal electrodes. There was also a problem with the electrode impedance match with the amplifier stage. The consecutive corrections to the protocols and hardware design are presented for the next season attempt.



**A05**

**HEARING MEASUREMENTS OF A STRANDED PYGMY KILLER WHALE  
*FERESA ATTENUATA***

**Aude Pacini (1), Paul E. Nachtigall (1), Laura N. Kloepper (1), Meike  
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We investigated the hearing abilities of a poorly known species, the pygmy killer whale *Feresa attenuata*. Pygmy killer whales are mainly found in tropical and sub-tropical oceanic waters. Little is known about the biology of the species but several mass stranding events have been recorded worldwide. In May 2009 an adult male stranded on the coast of Kihei, Maui, USA. Hearing measurements were conducted in a temporary pool set on the beach, while the health of the animal was continuously assessed. Two veterinarians monitored the health of the animal during the entire hearing diagnostic exam, which took approximately an hour. Auditory Evoked Potential (AEP) techniques were used to collect all the hearing measurements. This non-invasive physiological method was used to collect a complete modulation rate transfer function (MRTF) with modulation rates ranging from 500 to 2000 Hz, as well as an audiogram with acoustic stimulus frequency ranging from 4 to 128 kHz. The results indicated that this individual had very good hearing compared to other species with a best sensitivity between 32 to 100 kHz. The MRTF showed that the animal's best response was at 1000 Hz, which is similar to what has been previously obtained with other species. This study represents the first audiogram for that species and provides valuable information about a rare pelagic odontocete. These results also demonstrate that this technique allows for rapid assessment of hearing on the beach and could be used to quickly test for anthropogenic noise effects on hearing.



A06

## ANALYSIS OF WHISTLE CHARACTERISTICS OF SHORT-BEAKED COMMON DOLPHINS FROM SURROUNDING BRITISH WATERS AND THE EASTERN TROPICAL PACIFIC OCEAN

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Understanding the vocal repertoire of a cetacean species enables us to understand how they interpret their environment and their social interactions. The short-beaked common dolphin *Delphinus delphis* is one of the most widely distributed dolphins in the world. They emit narrow-band tonal whistles generally between 5-20 kHz, but can range from 1-50 kHz. Whistle characteristics from two geographically separate populations of *D. delphis* were analyzed and compared: British (from the Celtic Deep and English Channel) and Eastern Tropical Pacific (ETP) communities. The whistle parameters of both populations were measured, external confounding factors assessed to determine how they contributed to variation, and visual whistle contour classification was tested against a quantitative whistle contour classification. The frequencies emitted by British common dolphins were generally found to be significantly higher than those emitted by dolphins in the ETP ( $t=-4.911$ ;  $p<0.001$ ). The different populations also showed differences in their whistle contour composition (Pearson: chi square = 11.188;  $p<0.05$ ). Spatial and temporal factors such as depth, time of day, ambient noise, year and location were examined and their effects on the common dolphin repertoire were investigated. Year, depth and ambient noise were all found to have a significant influence. The visual classification system used by Ansmann et al. (2007) and the quantitative contour similarity (CS) technique used by McCowan (1995) were both applied to classify whistle contours from the ETP. The CS technique mostly mirrored the visual categories, but differences between the two techniques did occur. A cluster analysis within the CS technique identified more categories than the predetermined visual classification system. The different vocal repertoires of the two communities could be attributed to the nature of the different locations, environmental and anthropogenic factors.



**A07**

**THE TYPOLOGY OF UNDERWATER SOUNDS OF BELUGA WHALES  
(*DELPHINAPHTERUS LEUCAS*): THE STEREOTYPE AND THE VARIABILITY  
IN SIGNALS**

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The typology of signals of belugas, and the definition of their variability inside types, is very tangible, when we compare behavioral situations with corresponding acoustic fragments. The purpose of such comparisons is the detection of the „ethologic-acoustic correlation“, which further provides an understanding of the semantic dimensions of signals.

Integrated studies on ecology, behavior and underwater acoustic activity of the White Sea belugas conduct by the Institute of Oceanology yearly. During 2006 to 2009 the researches carried out in 3 local herds (regions of Solovetsky Island, Sosnovets to Myagostrov Islands and Cape Gluboky). After the processing it were defined several functional categories of sounds: a) „identification“ signals, b) „strict command“ signals, c) emotional signals, d) short-distant „contact“ signals, e) communicative signals proper (long- and short-distant).

Besides, it was shown the phenomenon of the sequences of stereotype and changeable signals. The release of such sequences is characteristic for the underwater sound activities of the belugas. Serial signals are primarily pulse-tones, with some sequences of emitting tonal signals as well. The analysis of such sequences is expedient while we detect an ethologic-acoustic correlation.

The acoustic material recorded during a fieldwork is rather chaotic. The signals are uttered by several animals simultaneously and are superimposed with each other. By analyzing sequences of stereotype signals, it is logical to assume, that every signal in a series is emitted by one individual. Thus, we can more definitely calculate the number of the producers of signals.

Then we compare signals inside sequences using statistical methods. It is more reliable, than the comparison of separate signals as long as the whole sequence is emitted by one beluga. The individual vocal peculiarities of different animals are excluded while the real limits of variability in signals are measured, which facilitates the understanding of the significance of signals.





**A08**

## **LONG-TERM STUDY OF WHISTLE CONTOURS AND REPEATED WHISTLES OF FREE-RANGING BOTTLENOSE DOLPHINS**

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Bottlenose dolphins are an extremely vocal mammalian species and vocal communication plays an important role in mediating social interactions. High intra-specific variability in whistle characteristics may indicate transmission of emotional information but also may reflect inter-individual variation, aiding individual differentiation. This is the first detailed long-term study of whistle contours of free-ranging bottlenose dolphins in Mediterranean waters. We recorded and analyzed whistles from resident bottlenose dolphins engaged in different behaviours from 2005 to 2008. The study area provides a unique opportunity to study vocal production of wild bottlenose dolphins because on a year-round, daily basis, groups of dolphins tend to follow predictable spatial patterns foraging and socializing onshore. The contour of 2609 whistles was determined by visual analyses of the frequency modulation by at least two experienced observers. Selected whistles were transcribed by noting the date, time, social group composition, and behavioural category. The results of this study, verify that upsweeps and multi-looped whistles play an important role in the natural communication system of wild unrestrained bottlenose dolphins. Repeated whistle contours were found in 53 groups of bottlenose dolphins. Whistle contours were repeated among groups, days and years. Past studies have suggested that the production of repeated whistles by bottlenose dolphins may indicate the use of stereotyped signature whistles. However, during this study was not possible to draw any conclusions on what represents a stereotyped whistle type, because was not possible to determine the whistler. Even if these results could be biased by the effect of individual identity, they are nonetheless of great interest as the basis for inference and comparison in other dolphin populations.



**A09**

**VARIETY OF BIPHONIC DISCRETE CALLS IN NORTH PACIFIC RESIDENT  
KILLER WHALES**

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Biphonic calls of resident killer whales from Kamchatka (Northwest Pacific) fall into two distinct classes by the frequency of low-frequency and high-frequency components. In this study we analyzed the frequency of both components in calls of resident killer whales from other North Pacific populations: Commander Islands, Eastern Aleutian Islands, Alaska and British Columbia. We measured the frequency in the middle of low-frequency and high-frequency components in 5 calls of each type (when available), total of 347 calls were included in the analysis. Commander Islands killer whale calls fell into the same two clusters as Kamchatkan calls. Calls of killer whales from Alaska and British Columbia fell into these clusters and also formed the third cluster, which differed by the lower frequency of both low-frequency and high-frequency components. This cluster included all calls of Alaskan AD-clan, while AB-clan calls divided in half between the 1st and the 3rd clusters. Calls of British Columbia A-clan mostly fell into 1st cluster except N18 type that fell into 3rd cluster. All calls of G-clan were close to the 2nd cluster, while calls of R-clan belonged mostly to 3rd and partly to 2nd cluster. Calls of J-clan (Southern resident BC population) fell into all three clusters. Calls of Eastern Aleutian residents were less divisible into clusters than calls of all other populations: they fell into all three clusters as well as between them. We suggest that three clusters probably reflect call structure of the North Pacific resident proto-dialect. Alternatively, the 3rd cluster can be unique feature of the Northeast Pacific residents that formed after the division of Northeast and Northwest infrapopulations. J-clan is the only clan that has all three clusters. It can be caused by the absence of other clans in Southern resident population, which stimulated maximum variability in call repertoire.



A10

## MUTUAL DEPENDENCE OF BELUGA WHALES CALVES PRESENCE ON THE HERD'S ACOUSTIC REPERTOIRE

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Vocal repertoire of beluga whales (*Delphinapterus leucas*) of the White Sea was described by various investigators. However, there are some difficulties in correlations between acoustic repertoire and herd's structure and behavior. Still no one knows, which types of signals belong to adults or calves in the social group. Since calves always remain near the adult animals, separating of their signals became an unresolved problem.

In this research we observed videotapes of behavior types and analyzed audiotapes of acoustic features of beluga whales from the region of Myagostrov Island, White Sea, Russia. All events, when adults came with calves or without them, were registered and all types of group behaviors were extracted. According to these data acoustic tapes were processed.

Videotapes contain three main types of group behaviors: calm swimming, feeding and social behavior. In order, there were extracted main types of acoustic signals from the records: broad-band pulse signals and three types of whistles, divided by frequency threshold. All records contain all mentioned types of group behaviors and acoustical signals, in spite of presence or absence of adults or calves in the water area. Nevertheless, strong differences were found in whistles proportion in groups with and without calves' presence. Number of mid and high frequency whistles increased greatly, whereas number of low frequency and pulsed trains decreased.

These results could be interpreted in two ways. First, it can indicate that the proportion of types of signals of calves and youth may differ greatly from adult animals. Second, the presence of calves and young animals could produce qualitative changes in the repertoire of adults. The second assumption is confirmed by the fact of changes in proportion of main types of behavior, when calves were represented on the record: more cases of social interactions and less of feeding behaviors were registered.



A11

## **TOOTHED WHALE CLICK PRODUCTION: IN PORPOISES CLICK FREQUENCY CONTENT IS COUPLED TO CLICK AMPLITUDE IN THE SAME WAY AS IN DOLPHINS**

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The most common toothed whale echolocation signal is a broadband click of just a few cycles. However, several times during evolution, so-called narrow-band high-frequency (NBHF) signals have arisen. I address here the mechanism of click production in general by comparing the acoustic behavior of broad band dolphins to that of porpoises, which use clicks of the NBHF type.

The hypothesis in question states that dolphins utilize left and right sound sources with different sizes, which arrangement then results in a broadband combined click when they are excited simultaneously. NBHF signals could then emerge by either using only one side or by evolving similarly sized clicking apparatus in both sides. And, porpoises indeed do have similarly sized apparatus left and right.

Dolphins increase the high frequency content of their clicks when click amplitudes increase. According to the hypothesis of the two simultaneously excited left-right sound sources, this should stem from a disproportional increase in the contribution from the high frequency side to the overall click. But since the porpoises have similar clicking apparatus in both sides (or use only one), that effect should not be there if the differential size explanation for broadband clicks holds.

We analyzed >5000 clicks recorded directly in front of a stationed porpoise. The animal voluntarily varied the click amplitude and the clicking rate. We also scrutinized several click sequences from the animal approaching a food reward directly in front of a hydrophone.

Both sets of data clearly show that porpoises also increase high frequency content systematically with increasing click amplitude and falling clicking rate. This constitutes negative evidence for the notion of simultaneously excited sound sources with different resonances in dolphins.



## A12

### ACOUSTIC SIGNALS OF MINKE WHALES IN THE GULF OF ST. LAWRENCE

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Sounds produced by minke whales (*Balaenoptera acutorostrata*) and their general behavioural activity were recorded during the summer feeding seasons 1997-2002 in the estuary and the Gulf of St. Lawrence (Canada). A calibrated omnidirectional hydrophone with a built-in preamplifier and a Sony DAT recorder with a linear system frequency response from 18 Hz-22 kHz were deployed from a rigid-hulled inflatable boat, covering a total area of 8000 km<sup>2</sup> in three distinct coastal habitats. Behavioural data sampling was conducted simultaneously with the sound recordings by doing focal animal or focal group sampling, using a microcorder and applying a standardized ethogram. The pulse trains of minke whales in the St. Lawrence are highly regular pulse sequences that show very little variation in frequency content and pulse repetition rate, unlike the „slow-down“ type pulse trains attributed to minke whales in most other locations of the North Atlantic. Pulse trains recorded in the St. Lawrence were always associated with the proximity of minke whales showing sub-surface feeding behaviour. These pulse trains typically consist of 30 and more pulses in the frequency range of 40-400 Hz. Interpulse intervals are in the range of 0.15-0.25 sec and pulse length is 0.2-0.25 sec, with energy peaks at 110-180 Hz and 300-340 Hz. In conclusion, these data support the hypothesis that minke whales of the Gulf of St. Lawrence produce a distinct type of pulse trains and that these vocalizations are associated with feeding behaviour. However, further research is required to determine the geographical variation of acoustic signals of North Atlantic minke whales, and to evaluate the potential of these vocalizations (1) for passive acoustic monitoring and (2) as a tool to determine stock identity of individual minke whales.



A13

**RECORDINGS OF BLUE WHALES (*B. MUSCULUS*) IN SKJÁLFANDI BAY,  
ICELAND**

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Blue whales have a large geographical distribution and occur both in migrating and more resident populations. Previous studies have found that 9 distinct regional calls remain stable over decades and therefore, sounds has been suggested to be a good indicator of subdivisions of the species.

In 2009, a total of 19 individuals were photo-identified in the fjord creating a good background for sound recordings. Calls of blue whales were recorded on three days from the 21st to 23rd of June 2009. Fifteen out of 94 recordings (144 min) contained blue whale sound. The files were analyzed both aurally and with BatSound Pro software and all files were amplified and filtered 3 times. Spectrograms of blue whale calls were done using a 512-point FFT, 85% overlap, and Hanning window. A total of 56 calls were analyzed (52 audible and 4 infrasonic). Twenty five down sweep calls (frequency range: 107 Hz (Mean = 81) to 21 Hz (Mean = 46) with an average duration of 1.8 seconds. Typically, these calls would have 2 or more harmonics. Often short constant calls with an average duration of 0.5 (N = 20, frequency range: 54 Hz (Mean = 68 Hz) to 86 Hz (Mean = 68 Hz)) were often followed after upsweep calls, but also occurred in rows or singularly. Further, 7 upsweep calls (frequency range: 56 Hz (Mean = 75 Hz) to 93 Hz (Mean = 80 Hz) with an average duration of 0.8 seconds where found in the fjord. Only 4 infrasonic calls were found in the recordings, 1 upsweep (frequency range: 19 Hz to 20 Hz) and 3 down sweep (frequency range: 28Hz (Mean = 25 Hz) to 19 Hz (Mean = 22 Hz). The recorded calls and their frequencies are comparable to previous studies from Icelandic and Atlantic waters.



A14

## ACOUSTIC CRYPTISIS IN SMALL CETACEANS: NARROW BAND HIGH FREQUENCY CLICKS TO AVOID KILLER WHALE PREDATION?

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Within the order of toothed whales a special sonar signal of narrow bandwidth and high frequency has evolved. Because this signal is markedly different from the echolocation clicks produced by other toothed whales its evolution has been puzzling biologists since the 1970es when it was first recorded from the harbour porpoise (*Phocoena phocoena*). Since then the signal has been discovered in several groups of toothed whales and it is now clear that it has arisen by means of convergent evolution at least four times. The signal is produced by small dolphins (Cephalorhynchus dolphins, two Lagenorhynchus species and the Franciscana river dolphin), all porpoises and the pygmy sperm whale. Altogether at least 14 species use the signal and is thus widespread among the odontocetes. We made a model comparing the physical pros and cons of the NBHF signal to examine whether it is produced at a cost in echolocation of prey. The model shows that for the same source level the NBHF signal is most effective for sonar detection out to app. 150 m when background noise level, masking noise and absorption is taken into account, and as such best suited for short range echolocation. Along with results from the model, acoustic wide band field data from a multiple element (4-6) hydrophone array of 6 NBHF species are presented (Dall's and Pacific harbour porpoise (*Phocoenoides*), Peale's and hourglass dolphin (Lagenorhynchus) and Hector's and Commerson's dolphins (Cephalorhynchus)) showing that offshore species use clicks of higher source level than costal species do, likely to increase detection range to compensate for the inherent higher absorption of the NBHF click. These data are discussed in relation to the hearing abilities of killer whales (*Orcinus orca*).



A15

**COMPARISON OF THE SONGS OF SMALLER AND LARGER HUMPBACK WHALES (*MEGAPTERA NOVAEANGLIAE*)**

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The size of an animal could affect sound production in two ways: it could determine the characteristics of the sound production mechanism, and thus the characteristics of the sounds produced; it is usually related to the age of the animal, and could therefore reflect different stages of a vocal ontogeny process. Main aims of this project are to provide an objective description and classification of units that constitute the basic components of humpback whale songs; to investigate the presence of acoustic cues to body size these units may contain; and to assess the presence of differences in song composition and structure that could be related to different levels of vocal development. Data were collected in the winters of 2000 to 2003, in the Hawaiian Islands. A total of 25 singers were recorded and measured. For each year, four whales were selected, each of them representing a size class. First, sound characteristics such as: duration; noisiness; fundamental frequency; waveforms, spectrograms, and spectra profile were analyzed in order to identify distinguishing features and grouping criteria. Then, recordings from whales of different size classes were compared, considering both units characteristics, and songs characteristics. 33 different unit types were identified and classified into four categories: low-, mid- and high-frequency harmonic sounds, and broadband sounds with a harmonic component. Sound characteristics were distinctive for each singer and in some cases they correlated with body size, while song characteristics didn't show consistent differences associated with this parameter. These results support the hypothesis that humpback whales sound production mechanism is similar to that found in most terrestrial mammals, and thus the same theories could be applied to study their vocalizations. Different individuals can be distinguished from the sounds they produce. All whales in our sample have a completely developed song, and most likely have reached vocal maturity.





## A16

### POSSIBLE DIALECT IN WHITE-BEAKED DOLPHIN WHISTLES

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The aim of the study was to investigate possible dialects in whistles from white-beaked dolphins recorded in Icelandic waters. Two locations were chosen for this purpose; southwest Iceland (Faxaflói Bay) and northeast Iceland (Skjálfandi Bay). Currently very little is known about the movements and population structure of white-beaked dolphins. However, one white-beaked dolphin was equipped with a satellite tag in Faxaflói Bay, but did not swim to Skjálfandi Bay. Another individual was identified in a bay just north of Faxaflói Bay and re-sighted two months later in Skjálfandi Bay. Results from a photo-identification study from Faxaflói Bay showed re-sightings of the same individuals from one year to the next. The recordings in Faxaflói Bay were made during the summers 1997 and 1998 and were from five recording days. Recordings in Skjálfandi Bay were done during the summers 2008 and 2009 and were from three different recording days. Spectrograms of whistles were visually analyzed using BatSound Pro. Twenty one different categories were defined based on frequency contour and duration. A total of 1536 whistles were analyzed from Faxaflói Bay and 305 whistles were analyzed from Skjálfandi Bay. All twenty one different whistle categories were recorded from both locations. Only 4 % of all whistles from Faxaflói Bay and 3 % from Skjálfandi Bay could not be placed in the defined categories. Most likely the whistles were not recorded from the same dolphins owing to the long geographical distance (ca. 500 km) and time difference (10 years). Icelandic white-beaked dolphins shared 96 % of their whistle repertoire while Hawaiian spinner dolphins share only 48 % of their whistle repertoire. Thus it is astonishing that the whistles from white-beaked dolphins that are greatly separated in distance and time are so similar, providing evidence for stability in whistle repertoire and no evidence for dialects.



**A17**

## **BUZZ RATES COMPARISON BETWEEN TWO SPERM WHALE FEEDING GROUNDS**

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The global sperm whale population is divided in sub-populations isolated from each other by water masses and by different seasonal movements. The north Atlantic and in particular, the Bleik canyon (off Norway) is known to be a high productive area where sperm whale males feed, while the Mediterranean sea, and in particular the Pelagos Sanctuary, the feeding grounds seem to be used by males, females and juveniles. This study is focused on the comparison of some particular aspects of the acoustic behavior of sperm whales in both areas. Bleyk Canyon was investigated during summer 2009, all the acoustic data (100 hours) were recorded using M/S Reine, the whale watching vessel of Whalesafari, through a two fixed hydrophone array. The Pelagos area has been monitored since 2004 utilizing Menkab, the research boat of the University of Genoa. All the recordings (20 hours) analyzed in this study were collected during the ISHMAEL project campaigns during 2009 and 2010; data were recorded through a single hydrophone or through the C.L.I.C.S (Cetacean Localisation Integrated Customized System). Assuming that a buzz can be used as an index of attempted prey capture, buzz rates from both study areas were analyzed on a spatial level and on a temporal level. Sperm whales seemed to concentrate more in the Bleyk canyon while they seemed more dispersed along the continental slope in the Pelagos area, the first goal of this study was to understand if there was a reflection of the different geographical distribution on the buzz rates. The second level of analysis regarded the temporal variations, identified individuals were recorded in different periods of the day to investigate if there were any differences in the buzz rates that can lead to different feeding strategies or unequal prey availability during daylight.



**A18**

## **DIFFERENCES IN WHISTLE STRUCTURE BETWEEN PARAPATRIC COASTAL BOTTLENOSE DOLPHIN COMMUNITIES**

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Photo-identification and genetic analyses have shown that at least two parapatric communities of dolphins use the coastal waters of western Ireland. One community is seasonally resident in the Shannon estuary and another community ranges more widely in coastal waters, with no evidence of social mixing between the two. We investigated social association, relatedness and vocal variation between members of these two communities using recordings of dolphins from the Shannon estuary and from animals sampled 200km away, in Cork Harbour. The recordings (96kHz/24bit) were made using a single element hydrophone and a solid state recorder. Photo-identification (2,360 photographs) indicated that no animals were observed at both sites and results from a parallel mtDNA study demonstrated shared haplotypes between the sites. A total of 710 whistle contours were extracted using Raven software. Of these, 120 whistles from Cork and 390 from the Shannon were distinct enough from background noise to be included in subsequent analyses. Whistle type (characterised according to 'shape' of frequency contours), duration and various frequency parameters were extracted. A significant difference ( $t=3.238$ ,  $df=508$ ,  $p<0.05$ ) was found between the mean duration of whistles from Cork (mean=0.52s, SE=0.04) and whistles from the Shannon (mean=0.40s, SE=0.02). Mean start frequency ( $p<0.01$ ), range ( $p<0.05$ ) and max frequency ( $p=0.05$ ) also differed significantly between the sites with the highest frequency (31.7kHz) recorded in the Shannon. Significant variation was also found in the frequency of different whistle types ( $\chi^2 = 17.76$ ,  $df=5$ ,  $p=0.001$ ). These groups may have experienced isolation long enough for vocal behaviour to diverge but not for genetic divergence to occur. Alternatively, vocal variation could represent a response to higher levels of acoustic pollution in the Shannon (e.g. ship traffic or water flow) or reflect differences in age structure, social cohesion, behaviour or habitat differences between the sites.



**A19**

**THE DYNAMIC NATURE OF SOCIAL COMMUNICATION IN HUMPBACK WHALES: TEMPORAL CHANGES TO SOCIAL VOCALIZATIONS AND THEIR RELATIONSHIP WITH SONG**

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In many species, modifications to vocal signals can occur over time through genetic or cultural evolution. The rate and degree to which signals change provide insights into the biological function of the signals as well as the evolutionary processes driving change. Male humpback whales are well known for their complex, temporally changing song displays and less well known for their social vocalizations. Social vocalizations differ to song in that they are less well structured, produced in close range interactions and are produced by all social cohorts. Song and social vocalizations appear to be linked, with some units of the song also produced in social vocalization bouts (termed song-unit social vocalizations). In order to determine the relationship between song and social vocalizations we investigated the temporal stability of social vocalizations in the east Australian humpback whales. Song and social vocalizations were recorded during the southward migration off the coast of south-east Queensland from 1997, 2002-2004 and 2008. Social vocalizations were classified subjectively via visual and aural inspection of spectrograms and objectively using statistical techniques. We found 26 different sound types in 1997, 36 in 2002-2004 and 37 in 2008. The majority of social vocalizations from all years were found to be similar to song units of surrounding years (1997, 62%; 2004, 61%; 2008, 53%). Ten sound types not found in song were stable across all years. Our study shows a core set of stable non-song social vocalizations and an array of song unit social vocalizations that change in relation to the song of surrounding years. These results suggest that changes to song-unit social vocalizations, like song, are culturally transmitted throughout the population and their function may relate to song function. However, the stable non-song social vocalizations may have evolved to function more in social cohesion and mediation amongst social groups.



A20

## LONG TERM AUTOMATED DETECTION AND CLASSIFICATION OF CETACEAN CLICKS FOR POPULATION MONITORING AND MITIGATION

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Conservation of cetacean populations often requires knowledge about their geographical distribution, migration patterns or long-term trends in population sizes. Passive acoustic methods have proven to be valuable tools to study cetaceans in the wild and to detect them to activate mitigation measures. The representativeness of results from passive acoustic monitoring increases as longer time periods and larger number of locations are considered. But this typically requires the fully automated and real time processing of large amounts of audio data. Yet, the fully automated detection and classification of many cetacean species remains challenging, especially when it must be performed reliably under the diversity of background noises and acoustic events expected over long time periods. When processing ultrasonic clicks, the high sampling frequency represents an additional challenge to achieve real time processing. As part of detection, classification and localization system for marine mammals and anthropogenic sound sources, we present several modules aimed at the real time detection and classification of several classes of cetacean clicks and anthropogenic impulses. A first detection stage detects impulsive sounds in several frequency bands. Detected events include regular clicks and buzzes from dolphins, beaked whales and sperm whale, impulsive sounds from ships and explosions. A second stage is composed of several classifications and sequence analysis modules. The performance of the modules was tested and validated with several representative datasets. For the classes sperm whale clicks, ultrasonic cetacean clicks and shipping impulses, the rate of correctly and falsely classified segments was typically above 0.90 and below 0.10 respectively. Over 40 % of buzzes recorded from a deep sea hydrophone were detected with only 2 false detections in 20 hours of recording. The practical applications for long term monitoring of cetacean populations, of anthropogenic acoustic pollution and for real time mitigation are discussed.



**A21**

## **LISTENING TO THE DEEP**

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The development and broad use of Passive Acoustic Monitoring techniques have the potential to help assessing the large-scale influence of artificial noise on marine organisms and ecosystems. Deep-sea observatories are meant to play a key role in understanding these recent acoustic changes. LIDO (Listening to the Deep Ocean environment) is a European project that is allowing the real-time long-term monitoring of marine ambient noise as well as marine mammal sounds in European waters at cabled and standalone observatories. Here, we present the overall development of the project and the use of Passive Acoustic Monitoring techniques to provide the scientific community with real-time data at large spatial and temporal scales. A series of detectors covering different frequency bandwidths allows the detection of broad classes of events. For the classification and feature extraction of the sources a more complex approach was adopted. A short pieces of audio (21ms) centred on the detected event is extracted and enters a feed forward neural network that gives as output the estimated probability of positively classify the detected source. False positive detection rates range from 3 to 6% depending on the sources. Special attention was given to the extraction and identification of high frequency cetacean echolocation signals. This was done considering the relevance of immediately detecting target species, like beaked whales, in mitigation processes, e.g. during military exercises or pile driving operations. The online connection to the Flash client currently allows following the real-time tagging (detection, classification and tracking) of the acoustic events, especially marine mammals, at three European locations: the West-Mediterranean coast (OBSEA), the Ligurian Sea (ANTARES) and the East-Sicily coast (NEMO).



A22

## **T-PODS, AN EFFECTIVE MANAGEMENT TOOL TO DETERMINE THE USE OF HABITAT BY BOTTLENOSE DOLPHINS IN MEDES ISLAND MARINE PROTECTED AREA (NORTH EASTERN SPAIN)**

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The establishment of Marine Protected Areas is one of the most effective strategies for preserving habitats and species as it is considered a fundamental tool for biodiversity conservation. Medes Islands is a small archipelago located off the northeast coast of Catalonia (north eastern Spain) established as Marine Protected Area since 1990. Although sporadic opportunistic sightings of bottlenose dolphins had been reported in the area, no information on the use of the area by the species has been collected in order to improve the management of the MPA. This study investigates the use of the protected area by bottlenose dolphins using passive acoustic monitoring (T-Pods) to detect echo-localization activity. A monitoring program was established with the aim to obtain the daily and seasonal patterns and the encounter ratio during one year study period (January 2009 - January 2010). Two T-Pods were moored at 18 and 25 m depth respectively attached to two of the border buoys of the MPA (bottom depth 60 m). T-Pods were located at 0.2 nm and 0.5 nm from the archipelago and distance between both was 0.5 nm. Data was recovered monthly. Acoustic detections were compared with opportunistic sightings in order to quantify the correlation. Results described different patterns in the use of habitat, showing preferences (71.8 % of presence) for night period (7:01 pm - 7 am) with a clear tendency for the first hours of the night (23pm - 2am). Seasonal pattern shows a clear preference for winter months, decreasing the presence toward summer period. Percentage of fast click trains, associated to feeding activity, reached 20 % with strong night time prevalence, these results suggests that the MPA is used as a nocturnal feeding ground by the species. The passive acoustic monitoring using T-pods proved to be a successful tool for the management of MPA but also a good tool for the conservation of bottlenose dolphins.



**A23**

**PASSIVE ACOUSTIC MONITORING OF CUVIER'S BEAKED WHALES AND OTHER ODONTOCETES IN THE ALBORAN SEA, MEDITERRANEAN, USING CLICK DETECTORS (T-PODS)**

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Visual sightings of beaked whales are difficult because of their very long dive periods, lack of any good visible blow and unspectacular surface behaviour. Acoustic observation at the surface is also difficult because they are rarely acoustically active near the surface. We sought to assess the feasibility of static acoustic monitoring by deploying acoustic loggers (T-POD) in a slope area at 1000 m for 3 weeks in the Alboran Sea, Mediterranean, during the research cruise SIRENA 2008. The habitat is expected to be used frequently by Cuvier's beaked whales. Approximately 400000 clicks in more than 20000 click trains were identified at each of the two mooring stations, against a generally very quiet background. A part of the recorded click trains showed clicks with click durations and patterns of inter-click intervals consistent with the production by Cuvier's beaked whales. Other recorded click trains were identified as sounds from the regular abundant striped dolphins in this area. A very strong diurnal acoustic activity pattern was evident throughout the sampling period, showing more click trains during night time hours. The deployment at the second site gave very similar results. Apparently many recorded click trains during night time hours belong to the acoustic behaviour of the striped dolphins at this site, but a considerable part contained Cuvier's beaked whale clicks. The data were collected without concurrent visual observation, but confirmed the regular abundance of Cuvier's beaked whales in this area, as observed during the visual and acoustic survey of SIRENA 2008. We conclude that static acoustic monitoring for beaked whales with click detectors is very useful for long term monitoring to study habitat use and acoustic activity. More studies with these devices are needed to extract beaked whale characteristics for further investigation on acoustic activity patterns.





A24

## ESTIMATING THE NUMBER OF SPERM WHALES IN A GROUP THROUGH VARIATIONAL CLUSTERING OF ACOUSTIC FEATURES

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Density estimation of sperm whales based on acoustic recordings can be difficult, especially when positioning of the sources cannot be done, which is often the case when single hydrophone is used. One feature that is sometimes used is the time delay between pulses in the click, when the orientation of the animals does not change too much with respect to the hydrophone, this can be a distinctive feature. But for applications in PAM it is preferred that this estimation is done automatically and this time delay can be difficult to measure, particularly in poor signal to noise conditions. One approach to count the animals is to use a clustering algorithm using acoustic features. Many of these algorithms need to know the number of clusters in advance, and in practice the data is then clustered for different numbers to see which one fits best using a model complexity based criterion. A statistically based algorithm that does not have this drawback is known as a 'variational mixture of Gaussians'. As applied here, a Gaussian mixture model is fit on the data with the mean and variance of the mixtures described by Gaussian-Wishart prior distributions. The parameters of the prior distributions are then estimated from the data through expectation maximization. The initial number of mixtures can be overestimated as their role will be minimized during algorithm updates (while avoiding the problems that occur when a centre is placed on top of a data point). Mixed data sets were created with a varying number of animals that could be estimated correctly in most cases, although the algorithm showed a tendency to underestimate the count by 1.



A25

## PERFORMANCE OF A WHISTLE CONTOUR EXTRACTION SOFTWARE FOR THE CLASSIFICATION OF FIVE MEDITERRANEAN DELPHINID SPECIES

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Whistles from five delphinid species commonly observed in waters of the western Mediterranean Sea (*Stenella coeruleoalba*, *Grampus griseus*, *Delphinus delphis*, *Tursiops truncatus*, *Globicephala melas*) were taken from GREC sound archives. FFT contours (window size 512, hanning, sampling frequency 44.1 kHz) were extracted with a custom developed Matlab software: 277 samples of striped dolphins (northwestern basin), 158 whistles of Risso's dolphin, 120 of common dolphins, 76 of bottlenose dolphins and 66 of long-finned pilot whales were selected. Seafox software extracted fifteen variables from the digitized contours, including: duration, frequency range, number of frequency extrema, beginning, ending, maximal and minimal frequencies, initial, final, maximal and minimal frequency slopes, presence of harmonics. Four of five species were significantly different (Mann-Whitney test) for average durations (respectively 0.73, 0.65, 0.47 and 0.90 seconds for Sc, Gg, Dd, Gm) while the average duration of bottlenose dolphins was 0.71 sec. On the contrary, *Tursiops* whistles had a different average frequency (9.5 kHz) compared to the three other species (range 10.5-11 kHz). Frequency ranges (respectively 7.3, 6.3, 4.6, 6.3 and 3.2 kHz) were significantly different for all species pairs, the bottlenose and Risso's dolphins excepted. Initial slopes were generally significant to discriminate species. From a global point of view, pilot whale calls were the most distinct, with 48 significant pairwise tests out of a total of 60, followed by the common dolphins. Risso's dolphin whistles were close to other species whistles. The multivariate discriminant analysis showed that the data set could be discriminated with a good global confidence level (Chi<sup>2</sup> test,  $\alpha=0.05$ ). 57.6 % of vocalisations being correctly classified with this model. Also, a CART classification model showed that classification rates are significantly different than classification by chance (Chi<sup>2</sup> test,  $\alpha=0.05$ ). This method achieved an overall classification rate of 62.9%.



**A26**

**USING CALLS TO MEASURE GROUP SIZE OF INSHORE BOTTLENOSE DOLPHINS WITHIN A SPECIAL AREA OF CONSERVATION**

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Acoustic techniques have long been used to record the presence of animals in the absence of visual detections. Although acoustic monitoring techniques have proved to be quite powerful, they are restricted by the absence of a clear relationship between group size and acoustic activity.

The present study was conducted on resident inshore bottlenose dolphins in the Shannon Estuary, candidate Special Area of Conservation. Acoustic recordings of bottlenose dolphins were obtained from a shore-based fixed hydrophone together with visual observations of group size from land. We tested the hypothesis that more vocalizations per unit of time should be recorded from a larger group of dolphins, and thus we investigated whether the vocalization rate (Number of vocalizations per minute) was correlated with the number of animals observed at the surface and within acoustic range.

Using correlation and regression analysis, an equation was established to predict the relationship between group size and vocalization rate. For this, the total number of whistles and burst-pulsed sounds, excluding clicks, was counted and only those acoustic samples, which could be clearly identified as units, were included in the analysis.

A total of 117 samples recorded over 23 days were analysed during which 34 schools of dolphins were sighted, varying in size from 2 to 15 individuals. The results showed that there was a significant regression between the estimated number of dolphins observed at the surface and the vocalization rate using the regression equation:

Group size = 2.117 x vocalization rate - 2.972



A27

## IMAGING TECHNIQUES TO STUDY THE ULTRASTRUCTURES OF STATOCYSTS IN CEPHALOPODS SPP.

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The introduction of artificial sound sources in the marine environment has shown to have negative effects on marine organisms. While marine mammals have attracted most of the attention of the research conducted in that area, invertebrates, in particular, are also suspected to be negatively affected after an exposure to loud low frequency noise. However, there is not much information available in the literature on that trophic level that represents the main preys of many cetaceans. A comprehensive study was therefore needed to assess the direct effects of acoustic exposure on these species. The first step was to choose which organ, found in all cephalopods spp. could be an indicator of noise-induced damage. Amongst other less sensitive-to-noise tissues, the statocysts are presumably the best candidates to injury if exposed to loud sources: these structures are analogous to the vestibular system of the inner ear of vertebrates and their components (macula/statolith, crista/cupula) are responsible for the sensory perception. The aim of this ongoing project of the Laboratory of Applied Bioacoustics (Technical University of Catalonia) is to conduct a thorough analysis of possible lesions associated to low frequency source exposures of individuals that belong to three different species of cephalopods (*Sepia officinalis*, *Loligo vulgaris* and *Octopus vulgaris*) by imaging techniques (histology and electron microscopy, SEM). Here, we present the first SEM images of statocysts obtained from control animals.



**A28**

**DSGLAB: MANAGING THE PASSIVE ACOUSTICS DATA DELUGE**

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Passive acoustic recording systems to detect sound production by cetaceans generate large amounts of data, especially given the increasing availability of inexpensive flash memory. Thus it is easy to collect more data than can be efficiently analyzed by hand. One approach to this problem is to minimize data collection on the recorder by performing real-time automated detection of acoustic targets of interest. An alternate approach, where one does not know what signals may be present, is to record large amounts of data over extended periods of time. DSGlab is an open-source database and data analysis system implemented with MATLAB that is designed to manage large amounts of raw data. The database aspect of the program implemented with MySQL allows querying of data by latitude, longitude, depth (or altitude). Each recorded data file is tagged with header information including lat/lon/depth, timestamp, sample rate, and calibration. The data analysis section processes the files according to a user-specified signal processing chain, which does not require a knowledge of programming to generate, and returns results to a database and to individual files. The results of signal processing can then be quickly browsed and mapped with the DSGlab data viewer. DSGlab is designed to allow inter-laboratory collaboration and data sharing and supports parallel processing for rapid computation. This presentation will illustrate the use of DSGlab to automatically detect bottlenose dolphin echolocation clicks and whistles from a two-month deployment of 15 acoustic recorders in the Gulf of Mexico.



A29

## USING STATIC ACOUSTIC MONITORING TO DESCRIBE ECHOLOCATION BEHAVIOR OF HEAVISIDE'S DOLPHINS IN NAMIBIA

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Static Acoustic Monitoring is a cost-effective, low-effort means of gathering large datasets on echolocation click characteristics and habitat use by odontocetes. Heaviside's dolphins (*Cephalorhynchus heavisidii*) were monitored using two acoustic monitoring units, a T-POD and a C-POD, in July 2008, at a site of known high abundance for this species in Walvis Bay, Namibia. The T-POD and C-POD both successfully detected clicks from Heaviside's dolphins. The frequency of the clicks was largely in the 120-140 kHz range, and the distribution of click frequencies recorded by the C-POD was unimodal, in contrast to the bimodal energy distribution often seen in clicks received from some dolphin species. A distinct diel pattern to the mean hourly mean inter-click interval was observed, with higher values during daylight hours than at night; however there was no apparent diel pattern in the proportion of feeding buzz trains produced. A diel pattern in click activity was observed, with many more detection-positive minutes per hour recorded between dusk and dawn, and vocalization activity dropping to low levels in the middle of the day; this corresponded with visual observations made on abundance of dolphins in the study area. Data collected by C-PODs at three sites along the coast, over a subsequent three month period in 2009 showed markedly different patterns of activity. Static Acoustic Monitoring proved to be an effective technique for monitoring habitat use by Heaviside's dolphins.



A30

## THE “BIGGEST NOSE ON RECORD”: 3D ANATOMY OF THE SPERM WHALE NASAL COMPLEX

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Next to respiration, toothed whales use their forehead (nasal complex) for the generation and transmission of echolocation and communication sounds. In giant sperm whales (*Physeter macrocephalus*), the absolute and relative size and the structure of the nasal complex are unique among toothed whales, including the high degree of its directional asymmetry. Here we present a three-dimensional model of the nasal complex and skull of an adult sperm whale. This model is based on in-depth examinations (CT, MRI, macroscopic and histologic analysis) of two male neonate animals. Allometric changes from the neonate to the adult were calculated using (a) data from superficial dissections of the nasal complexes of two young sperm whale bulls, (b) photos of an adult female skull (length 3.3m), and (c) measurements of the adult male skull (length ~5m). Moreover, a series of underwater photos showing lateral views of adult sperm whales found in text books and other publications were included. Nevertheless, since the generation of the model was fully computer-animated (3ds max, Autodesk GmbH, Germany), there are still some weak points regarding the anatomy of the adult (in comparison to the calves): (i) the number, shape, and alignment of the lens-like fat bodies in the junk, (ii) the exact shape of the spermaceti organ, (iii) the exact topographic relationships of the nasal components with respect to each other. This is the first complete 3D model reconstruction of the adult sperm whale nose useful for mechanic and acoustic modelling in future research. It may help to get new insights in the function of the sperm whale head and the ecophysiological adaptations of these giant whales. We thank AnthroMedia (Berlin, Germany) and Lynda L. Goold for supporting the project.



A31

## MORPHOLOGICAL ANALYSIS OF THE SUPERIOR OLIVE IN DOLPHIN BRAINSTEMS USING CLUSTER ANALYSIS

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Toothed whales are the only aquatic animals known to use echolocation. Considering the fact that sound travels much faster in water than in air, the question arises as to potential adaptations of these animals to acoustic perception and processing. Although the outstanding hearing capacity of toothed whales has been investigated since the middle of the last century, only a few papers were dedicated to the cellular and fibre architecture of subcortical auditory nuclei. In this context the comparatively large superior olivary complex (SOC) is of special interest since it is the first auditory centre to receive binaural information and known to be largely responsible for the localization of sound sources in mammals. Accordingly, we analysed the histology of the SOC in coronal microslide series (Nissl stain) of the La Plata dolphin (*Pontoporia blainvillei*), a pristine dolphin-like species from coastal and estuarine habitats of Uruguay echolocating with narrow-banded high-frequency clicks, and the common dolphin (*Delphinus delphis*), a typical off-shore species with world-wide distribution using broad-banded low-frequency clicks. For our investigation we developed a statistical procedure to distinguish subnuclei within the SOC by means of morphological characters such as perikaryon size, shape, orientation, localization and density of the neurons. Therefore, the neuronal perikarya were manually segmented in a 25-times magnified picture of each microslide in order to calculate these cytological characteristics using the imaging software CellF (Olympus, Germany). Via cluster analysis of these characteristics we could define four subnuclei of the SOC in both dolphin species. This is in contrast to previous results of toothed whales in literature revealing only two SOC subnuclei. With this new statistical method which is largely “observer-independent” and based on quantitative analysis of whole populations of Nissl-stained neurons, we have now an effective tool for future neuroanatomical investigations of brainstem nuclei in routine-stain microslide series.





**A32**

## **A SYSTEM FOR MONITORING ACOUSTIC EMISSIONS OF CETACEANS**

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A new passive acoustic monitoring system is compatible with a light boat and capable of detecting continuously, recording and classifying the acoustic emissions of cetaceans. GREC is one of European teams which have very early integrated systematically the acoustic technologies during surveys : since 1994, an hydrophone is permanently towed during our samplings to record sounds emitted by cetaceans. GREC is the unique French team to have bet on this method.

Since the summer 2009, this new software allows to record acoustic signals on a file in the .wav standard (not compressed), to filter them and to integrate it many variables like time, position, marine environment and acoustic environment. It is also logging survey routes and events, much like existing software suite. Thanks to a system of regulation of thresholds, the system can be let in permanent sleep mode in order to start automatically the recording during an acoustic emission. An event-logging console allows to add information on the acoustic recording, such as any cetacean behaviours seen at the surface, thus enabling a new range of studies to be carried out. The integration of a tool box, allowing to classify the acoustic emissions and to determine the most likely species is currently in course.



B01

**PERCEPTION OF OPTIC FLOW IN HARBOUR SEALS (*PHOCA VITULINA*)****Nele Glaeser (1), Björn Mauck (2), Farid Kandil (3), Guido Dehnhardt (1)**

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For marine mammals migrating under water, vision is often restricted because of darkness and/or turbidity, so that usage of this sensory modality for underwater orientation seemed doubtful. However, particles in the water column principally would allow for the use of an orientation mechanism called „optic flow“, the perceived visual motion of objects as the observer moves relative to them. Experiments on optic flow in humans showed that it can be used for orientation not only by estimating the direction of self motion (‘heading’), but also for more complex tasks like path-integration. In a first step we determined the ability of a harbour seal to estimate its heading by means of optic flow. A computer-generated 3D scatter-plot was presented on a projection screen (2x3m) under water. The origin of each single point (focus of expansion, FOE) was programmed to be on various positions around the centre of the projection screen, covered by a ring-like mask that impeded the direct view on the FOE’s. For a trial the test animal had to station in front of the projection screen. After a few seconds of projection, a small reticle was projected, congruent or deviating from the FOE from 0.25 ° up to 8 °. Positions of FOE and different deviations were pseudo-randomly presented, congruent and deviating trials were counterbalanced from session to session. The task of the animal was to decide whether the position of the superimposed reticle matched that of the FOE. The results of this experiment showed, that the tested seal was able to determine the focus of expansion within the scatter-plot with an accuracy of less than 1 ° deviation. Thus, using optic flow the animal would be able to keep its swimming direction constant, an important prerequisite to perform path-integration.



**B02**

## **VISUAL ABILITIES OF A VISUALLY IMPAIRED HARBOUR SEAL**

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Vision is one sensory system pinnipeds can rely on for various tasks such as orientation or prey detection and pursuit. However, some pinnipeds develop cataract. In captive seals and sea lions, cataract most likely develop the older the animal and the more it has been exposed to UV light during its lifetime. In this study, we determined the visual abilities of a 27 year old harbour seal with a mature cataract in both eyes with both lenses luxated in the anterior chambers. We performed two experiments using a two alternative forced choice paradigm: in experiment 1, two light boxes were presented in a darkened chamber at a distance of 50 cm to the seal and the seal was required to move its snout to the response target on the side on which the light was turned on (positive stimulus). In experiment 2, a black and a white card were presented and the seal had to indicate the position of the white card (positive stimulus). In both experiments, the seal was finally able to discriminate the positive from the negative stimulus. In experiment 1, it achieved a constant performance above the significance level ( $p = 0.05$ ) after session six. In experiment 2, the seal only learned to successfully discriminate when the targets were as close as 40 cm in front of its eyes. Then it achieved correct responses above significance level in ten out of eleven sessions. Here we present the first data on the visual abilities of a cataract seal showing that it retains some visual abilities. In future experiments, we will assess visual acuity in the same seal using acuity gratings in air and under water, before and after lens extraction which will be performed due to medical indication.



**B03**

## **CONTROL OF HEAT DISSIPATION THROUGH THERMAL WINDOWS IN HARBOUR SEALS**

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Pinnipeds have to cope with the thermoregulatory demands their amphibious way of life requires. As they are effectively insulated against heat loss in water by their blubber, they have to bypass the blubber for heat dissipation while staying on shore. Evidence for that gave Mauck et al. (2003), who identified thermal windows on the body of phocid seals as areas of heat dissipation in air. Here, we investigated harbour seals by infrared-thermography. We examined the impact of several parameters on the development of thermal windows such as meteorological parameters, exercising in water before coming on land and how long the seal expects to stay ashore. The latter question was addressed by thermographing the seals in training situations, where they expect to be sent back into water within minutes, or while hauling out voluntarily, where they use to stay on shore for hours. Additionally heat loss through thermal windows was quantified. Seals in training situations did not develop thermal windows, unless they were exposed to insolation. On the contrary, voluntarily hauling out seals developed thermal windows within a few minutes under comparable environmental conditions. Intense exercising induced the development of thermal windows. The calculation of heat loss through thermal windows resulted in considerable values in air, but above all in water, which is especially significant as we determined that it takes up to four minutes to close a thermal window in the water. Heat loss by an involuntary, unexpected retreat to the water can easily cost a seal 10% of its daily calorie intake or more. We conclude that harbour seals can control the appearance of thermal windows (presumably by vegetative control of the skin blood flow), and that unexpected disturbance of hauled out seals can lead to an especially high loss of energy.



**B04**

## **SPECTRAL SENSITIVITY IN THE HARBOR SEAL *PHOCA VITULINA*: FACTS AND OPEN QUESTIONS**

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On their way back to an aquatic life style, the ancestors of marine mammals experienced an environment with a spectral composition shifted towards shorter wavelengths with increasing water depth and a much stronger light attenuation than air. In order to improve gain of visual information, the visual system of marine mammals should have adapted to the spectrum dominating their underwater environment. In fact, selective pressure caused a loss of functional SWS-cones in pinnipeds and cetaceans but in the latter group, it has been shown that the absorption maximum of the remaining MWS-cones is shifted towards shorter wavelengths. Such a blue shift of sensitivity is still questionable in pinnipeds. Molecular biological analyses revealed that the spectral tuning of the MWS-cones of the harbor seal is equivalent to that of most terrestrial carnivores with  $\lambda_{\max}$  ranging from 550 to 552 nm. Contrary to this finding flicker-photometric ERG indicated that  $\lambda_{\max}$  is shifted towards 510 nm.

We investigated spectral sensitivity in one harbor seal by means of color intensity adjustment. Experiments were conducted in air under an illumination of 9 lx. Stimulus pairs consisted of circular blue, green and grey discs of different intensity that were presented on a TFT monitor. The seal was trained to indicate the position of the brighter stimulus in a two alternative forced choice task. The observed point of equal brightness of the colored stimuli was compared to their point of equal brightness calculated from spectral sensitivity functions that were generated using the Govardovskii template.

Our results indicate a blue shift of spectral sensitivity in the harbor seal, with  $\lambda_{\max}$  at 510 nm. However, a detailed investigation on spectral tuning as a function of luminance is necessary in order to exclude that the observed blue shifts are resulting from mesopic rather than photopic vision.



**B05**

**DIFFERENT MECHANISMS FOR THE DETECTION OF HYDRODYNAMIC  
EVENTS IN SEALS AND SEA LION**

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In terrestrial mammals a typical vibrissal hair-shaft is round in cross-section, while those of eared seals and walruses as well as those of some phocid species like the bearded seal are oval. As in terrestrial mammals, vibrissal hair-shafts of all eared seals, walruses, the bearded seal, and Monk seals are smooth in outline. In contrast, those of all other phocid species are extremely flattened and have waved surfaces. Here we show that in contrast to a cylindrical structure the undulatory shape of harbor seal whiskers does not cause a flow generated Karman vortex street, so that the noise usually caused by this vortex shedding is minimized. This noise reducing effect leads to a high signal to noise ratio (SNR) which makes seal vibrissae an optimized hydrodynamic sensor. Smooth sea lion whiskers produce a vortex street, which masks signal detection by a relatively high noise level. If signal processing in both animals would be identical seal whiskers show a much better SNR. However, sea lions might use a detection mechanism different from seals. A hydrodynamic event may disturb the eigenfrequency caused by vortex shedding, which may represent useful information. Taking this into account, calculated SNRs were within the same range for seal and sea lion whiskers. The quantitative comparison of seal and sea lion whiskers regarding the sensory efficiency reveals the evolutionary development of two different working principles for the detection of hydrodynamic stimuli.



**B06**

**DISCRIMINATION OF HYDRODYNAMIC TRAILS BY A HARBOR SEAL  
(*PHOCA VITULINA*)**

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Harbor seals can use their mystacial vibrissae to detect and follow hydrodynamic wakes of biotic and abiotic origin. The hydrodynamic parameters of natural trails as generated by swimming fish are dependent on various factors like shape, size and swimming style of the species. We therefore investigated by using a two alternative forced choice paradigm if and how accurate a blindfolded harbor seal is able to distinguish different shaped objects by means of their hydrodynamic trails. When paddles of different shape were identical in width, the tested animal was able to discriminate flat paddles from cylindrical, triangular and undulated paddles, but it failed to distinguish undulated ones from round and triangular paddles, as well as cylindrical from triangular paddles. Since Particle Image Velocimetry (PIV) has shown that the generated trails differed not only in the spatial arrangement of vortices within the wake but also in their spatial expansion, the seal could have used the spatial expansion as an unequivocal cue to distinguish between different shaped paddles. We tested for this hypothesis in a second experiment by varying the width of the paddles randomly, such that the spatial expansion alone did not provide an unequivocal cue. Here, the seal was not able to discriminate flat from cylindrical paddles anymore, as well as it failed to distinguish the flat paddles from the undulated paddles. Nevertheless it was still able to discriminate between flat paddles and triangular paddles. Our results indicate that the seal primarily used the spatial expansion of the hydrodynamic trails for its discrimination, although the spatial arrangement of vortices within the trails had an influence on the seal's performance.



**B07**

## **CAN SEALS EXTRACT INFORMATION FROM SELF-GENERATED WATER MOVEMENTS?**

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Seals (*Pinnipedia*) use their vibrissae for the detection and discrimination of objects by active touch, and of hydrodynamic stimuli, i. e. water movements that act on them without direct touch of an object. Hydrodynamic stimuli of high biological relevance are certainly the water movements caused by prey fish or by other seals, but also small-scale surface waves or the relative flow passing the vibrissae that is caused by the seal's own swimming movements may be detected. Here we discuss and estimate, in the light of preliminary behavioral data, the possible relevance of yet another type of hydrodynamic stimuli that can bear information. Fish, all of which possess a lateral line that serves as a hydrodynamic sensory system, have in several cases been shown to detect the alterations that an immobile object causes to the water movements that they themselves generate while swimming. This way they can either read their own bow wave and stop short of a wall, or discriminate between immobile objects that they pass at close range. The same ability in seals might enable them to navigate close to the bottom in dark and turbid waters, or even to detect immobile objects on the ground without direct touch. While preliminary results from one seal indicate that a detection of an immobile vertical plate (35 cm \* 35 cm) was not possible without the vibrissae actually touching the plate, we have reason to believe that the ground or objects on the ground should be easier to detect.





**B08**

**THE RELATIONSHIP BETWEEN THE BEHAVIORAL ACTIVITY AND UNDERWATER VOCALIZATIONS OF BELUGA WHALES (*DELPHINAPTERUS LEUCAS*) OF THE MYAGOSTROV LOCAL STOCK (ONEGA BAY, THE WHITE SEA)**

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The underwater vocalizations of the beluga whale (*Delphinapterus leucas*), summering in Onega Bay (64°24' N, 35°49' E), were recorded during June-July of 2008. The vocalizations were classified into five major whistle types, four types of pulsed tones, click series and noisy vocalizations. To determine the relationship between behavioral activity and underwater vocalizations, a total fifty-one 2 minute samples of audio records were analyzed in six behavioral circumstances: (1) directional movements, (2) quiet swimming, (3) resting, (4) social interactions, (5) individual hunting behavior and (6) the exploration of hydrophones by beluga whales.

The overall vocalization rate (signals per minute and signals per whale per minute) that was established strongly depends on the underlying behavior. The beluga whales were most vocally active during social interactions (58.9 ± 20.6 signals/min). The percentage of the main types of signals is related to the behavior of the belugas. We suggest that one of the whistle types (the „stereotype“ whistle) is used by belugas for long distance communication and coordination. While other whistle types (with the exception of the type „squeaks“) and three types of pulsed tones (with the exception of the type „vowels“) are used for short distance communication. The percentage of „squeaks“ and „vowels“ was equally high in all behavioral situations. So we suggest that „squeaks“ are the contact signals. The „squeaks“ have a specific physical structure and probably play a role in identification signals. A high rate of the click series existed during social interactions. It seems very likely that belugas use these types of signals not only for an echolocation, but for short distance communication as well.

These results reveal general correlation trends between the behavior and the acoustic activity of belugas.



**B09**

**THE PATTERNS OF SOCIO-SEXUAL BEHAVIOUR IN KILLER WHALES  
(*ORCINUS ORCA*) OF AVACHA GULF**

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Patterns of socio-sexual behaviour in mammals may reflect social roles of individuals in a group, hierarchical relationships as well as mating preferences and may be part of play, affiliative or mating behaviour. We studied the socio-sexual behaviour in pairs of killer whales where one individual was active (actor) and another passive (recipient). Four age-sex killer whale classes were determined: mature males, mature females, immatures of both sexes; and other whales that were either immatures or mature females. Three types of behavioural acts were considered a socio-sexual event: (1) following the recipient on its back with erection, (2) following the recipient on the back without erection, (3) following the recipient on its side. Either the actor's head (acts 1 and 2) or the actor's genital area (act 3) was in front of the recipient's genital area. In total, 88 observations of six types of actor-recipient interactions were made: 17 male-female, 25 male-other, 24 male-male, 7 male-immature, 6 immature-male, and 9 immature-immature interactions. Differences occurred between age-sex classes in the frequencies of active or passive role in the socio-sexual interactions. Mature males behaved as actors more often than as recipients ( $p < 0.005$ ), juveniles were observed equally as actors or recipients, mature females were never seen to behave as actors and were observed in socio-sexual interactions only in pairs with mature males. Individuals of different age-sex classes preferred to interact at different levels of social organization (matrilines, acoustic pod and acoustic clan) presumably reflecting different levels of kinship relationships. Male-female interactions occurred significantly more often between individuals from different acoustic clans than from the same clan ( $p < 0.001$ ). All male-female interactions were observed in killer whale aggregations consisting of members from several acoustic clans. Our results provide behavioural evidence for the hypothesis that killer whales prefer to mate outside their own clan.



**B10**

## **PLAYING AND COGNITIVE BEHAVIOR OF BELUGAS IN THE WHITE SEA NATURAL CONDITIONS**

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The water area (aquatory) regularly visited by belugas since late May to September is located in Solovetsky Islands, the White Sea around the Belugas Cape. The underwater ground most frequently visited by belugas is a sandy bottom area without stones and algae (unlike the surrounding water area) and is spaced 20-30 meters from coastline. Different forms of rubbing, hierarchical and sexual behavior as well as copulation were registered. To identify specific details of belugas behavior a sensor was positioned to attract them within the TV camera observation area. This sensor was constructed as a metallic 0.7 m-long tube. Its distal part carried underwater lamps, a low-frequency generator and clicker (a U-shaped unit with metallic membrane producing an acute click when pressed). It was adapted to underwater functioning and made convenient for belugas to press. Pressing the clickers also switched on two waterproof contacts. An 80 m-long sound cable was positioned on marine bottom and extended to the coast observation tower. This cable was used to switch on the underwater lamps, generator and to control the belugas contacts with the clicker. The belugas positive attraction reaction was registered in answer to switching on of generator and underwater lamps. As the signals were switched on, the animal present in the nearby water area approached the camera and examined it closely. Within the TV camera observing area, a plastic balloon (15 cm in diameter) was positioned at one-meter level from the bottom. It was anchored by a weight tied-up with a rope. The belugas reactions to the balloon appearance, their close group examination and efforts to play with the balloon were video-recorded with a synchronic registration of acoustical signals. Photos and film "*Belukha Ludens* (lat.\*)" is currently mounted based on the underwater initial video records.



**B11**

## **CETACEAN BEHAVIOUR IN THE BLACK SEA COASTAL WATERS**

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Coastal observations of behaviour of bottlenose dolphins and harbour porpoises were conducted in April 2006 - October 2009 at the south-eastern and eastern coast of Crimea (Black Sea and Kerch Strait). A 1 km-wide coastal sea area (up to 50 m deep) was studied.

Harbour porpoises approaching the coastline demonstrated foraging and migrating behaviour, both individual and group. In all cases the behaviour was characterized by low activity.

Bottlenose dolphins approaching the coastline demonstrated foraging, migrating, game and learning behaviour. Individual and group migrations and hunting were observed. Migrating groups approached the bank as close as 150-200 m. Foraging animals approached the bank as close as 50 m during prey search and 4 m during hunting. Hunting groups included 2-8 animals, among them 1-2 calves. Foraging was clearly divided into the search and hunting stages, the latter characterized by a high variety of maneuvers.

“Bank attacks” were regularly observed during cooperative hunting: a dolphin group drove fish (usually mullet, *Chelon haematocheilus*) against the bank. Then one animal separated from the main group, approached the bank at high speed, rotated on its long axis, turned back and took a fish. Usually attacking adults were observed but once (July 7, 2008; Karadag coast) a calf performed the attack as a part of learning behaviour in the hunting group.



## B12

### LONGTERM INTERSPECIFIC ASSOCIATION AND CALF KIDNAPPING BETWEEN A BOTTLENOSE DOLPHIN AND COMMON DOLPHINS

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The Bay of Algeciras is host to a resident population of common dolphins, and is regularly visited by striped dolphins, non-resident common dolphins, and bottlenose dolphins. Despite very intense human activity in the bay, including the 3rd largest harbour in Spain, heavy industry and very heavy shipping, this population of common dolphins remains in the bay, probably due to the high availability of prey fish species. In addition, this population is the target of 4 all year round whale-watching operators from Gibraltar, and 3 seasonal whale-watching operators from Tarifa. This study was carried out from platforms of opportunity departing from the harbour of Algeciras during April to October 2006 to 2009. Since 2006, a solitary bottlenose dolphin was observed to associate with common dolphins on a regular basis. In general, observed interactions appeared to be mutually tolerated with no sign of aggression, and included resting, socialising, traveling and hunting. In August 2009, the bottlenose dolphin was seen travelling very fast with a calf in echelon position and 4 to 7 common dolphins chasing them with fast and frequent changes of direction. This behaviour was captured on photographs and video. The chase was followed for one hour, after which our boat had to return to the harbour. Analysis of the photographs confirmed the calf as being a common dolphin. The most probable hypothesis is that the calf was a common dolphin stolen by the bottlenose dolphin right after birth. The outcome of this kidnapping for the calf could not be ascertained, but the fact that the bottlenose dolphin was observed again on later occasions with no accompanying calf, and that a dead common dolphin calf was found washed ashore some days later, suggests that it may have died.



## B13

cancelled



**B14**

**PLAY BEHAVIOUR WITH OBJECTS AND BUBBLES IN ORINOCO RIVER  
DOLPHINS (*INIA GEOFFRENSIS HUMBOLDTIANA*)**

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Play behaviour is sometimes considered as not directly essential for the satisfaction of primary needs, such as other activities like swimming, food catching, inter-individual social interactions; however, play behaviour represents a crucial component of dolphins' life. Similarly to other cetaceans, Orinoco river dolphins play alone or in a group, often using different objects like brush, leaves, fish. Moreover, these animals are able to produce very different kinds of bubbles, with which they interact in a playful manner. This study intended to provide detailed quantification and dynamics of this phenomenon. A total of 120 focal observations, lasting 1-hr each, were carried out at Duisburg Zoo (Germany) in May 2006, on two males approximately 35 and 55 yrs-old. Playing with objects was a very frequent activity, expressed every five-six minutes. The elder dolphin was more active than the younger one (21.4 and 3.8 events/h respectively). Both subjects spent a major portion of time involved in this behaviour in the afternoon and clearly preferred to interact with objects, by transporting and balancing them on their long rostrum (49.8% of times). On the other hand, play behaviour connected to bubbles was only observed three times during the study. In all situations, the dolphins directly acted towards the bubbles by biting them. Moreover, the two *Inia* showed „mixed category“ behaviours, with playing performed simultaneously to other locomotory, postural or social behaviours. These activities primarily consisted in manipulating the object while rubbing the tank with different parts of the body (frequency 37.1%), stay still in a horizontal (19.9%) or vertical (7.5%) position or swimming belly-to-belly with his conspecific (8.4%). Play behaviour in *Inia* isn't only restricted to individuals of young age, but also adults play actively, for their own enjoyment or because, as in nature, playing is a vital part of learning and honing skills.



**B15**

## **FIRST RECORDING OF SHORT FINNED PILOT WHALES AND BOTTLENOSE DOLPHINS INTERSPECIFIC MATING**

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Bottlenose dolphins (*Tursiops truncatus*) have been known to mate and even hybridize with different cetacean species, such as spotted dolphins (*Stenella frontalis*) or tucuxi dolphin (*Stenella fluviatilis*) in wild or rough-toothed dolphins (*Steno bredanensis*) in captivity. However, it is known very little about short-finned pilot whales (*Globicephala macrorhynchus*) interspecific mating.

The 18th of October 2009, we could record for first time an interesting mating attempt which involved two males of short-finned pilot whales (adult and subadult) and at least five females of bottlenose dolphins. The encounter took place in the southwest of Tenerife Island (28°07'53N, 16°51'39W), where both species present resident populations. Surface photographs were taken opportunistically using a Canon EOS 30D photo camera with a 55-200 mm lens. Underwater behavior was recorded during 10 minutes from the observation platform (a 4.80 m inflatable boat), directing by hand an Aiptek video camera with a 7.5-21.5 mm objective.

During first 18 minutes of sighting, bottlenose dolphins socialized while at least five couples of pilot whales travelled slowly to the south in a widely dispersed disposition. After that, bottlenose dolphins joined two pilot whales and started travelling in the same direction at a medium speed of 4 kt. From this moment on pilot whales' surface behavior included beating water with the head, pectoral fin exposition, intraspecific body contact with head exposition, encircling with caudal fin exposition and porpoising. Bottlenose dolphins performed different simultaneous leaps and intraspecific body contact on surface. Underwater recording shows five interspecific belly to belly behaviors, three pilot whales erections, one of them with direction, three bottlenose dolphins belly up, two bottlenose dolphins intraspecific belly to belly, one pilot whale and two bottlenose dolphins bubbles display and one bottlenose dolphin defecation. Bottlenose dolphin whistles can be also heard. Both species follow each other indistinctly on surface and under.



**B16**

## **THE ROLE OF PLAY IN FEEDING BEHAVIOR SHAPING IN CALVES OF BOTTLENOSE DOLPHINS AND SEA LIONS IN OCEANARIUM**

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We've studied feeding behavior shaping in three dolphin calves and four sea lion calves born in Oceanarium and kept within open-air cages. Visual observations are accompanied by photo, video behavior registration, and ethogram making. Results obtained have proven that feeding behavior shaping in dolphin and sea lion ontogenesis realized through play manipulation - firstly with environmental subjects and then with fish.

Sea lion calves had usually small play subjects in their cages: pieces of rope, net, little stones, sticks, mussel shells, seaweeds. Dolphin calves chose seaweeds (growing on walls of their cages and floating in the water), jelly-fish, and rope pieces as play manipulation subjects. Dolphins unlike sea lions played with water. Playing operations with subjects and fish in dolphin calves and sea lion calves were of the same kind, namely: gripping, holding in jaws, biting, pushing, throwing up and tousling - in sea lions. Firstly sea lion and dolphin calves (in the 1-2 months and up) gripped play subjects and held it in the mouth for a short time while moving. Then calves had new elements and subjects for play (including fish), play manipulation structure was getting more complex and augmented.

The most representative play manipulation structure in sea lions and dolphin calves was the following sequence of operations: gripping subjects - holding it in jaws while locomotion - subject manipulation (biting, throwing up, tousling - in sea lion). Just that very sequence of operations is representative for the final phase of feeding behavior in adult animals. During playing with fish dolphin and sea lion calves swallowed sometimes by chance age fish and that consolidated the practiced sequence of operations. The results obtained implicate that manipulation play with environmental subjects is an important factor in feeding behavior shaping in marine mammals.





**B17**

## **CASE OF KILLER WHALES HUNTING ON WALRUSES IN THE BERING SEA, CHUKOTKA**

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The investigation was held as a part of a program Chukot-TINRO „Monitoring shore haulouts of Pacific walrus“. Observation area is located in the Anadyr Gulf of the Bering Sea near the seashore Retkin Spit. Killer whales (KW) were encountered very seldom. During 64 days only 3 group (n=21) were seen. However, observations of KW predation in the Bering Sea are quite usual events. We observed KW hunting in the evening on 18 August 2008. Duration of this event was 95 min. The group of KW included two young and 6 others animals. The male was absent. He joined the group only in half an hour after attack. The specific feature of the hunting was in the following: two KW trying to block one walrus from the group jumped out of the water on the shore. Video review showed that 55 attacks (direct contact with walrus) and 288 movements around walrus were made by KW during 17 minutes of recording. During hunting KW showed several behavioral patterns: „simple move“ (11.68), „quick move“ (4.97), „move with changing the course“ (1.45), „drowning walrus“ (0.98), „attack under water“, „hit walrus by fluke“ (1.39), „hit walrus by head“ (0.52). The element „hit walrus by fluke“ prevailed over others and occurred in 43.63% cases. Hunting activity of KW was not constant. The frequency of occurrence of attacks was increasing and the max was on the 6th min (8 attacks/min) to compare with previous period (3.4 attacks/min). It started with simple strategy (participated 2-3 KW) with low frequency of attacks, and then it became more complex by involving more KW and increasing frequency of attacks and movements near walrus. Perhaps, it was training hunting for young animals, because after 95 minutes the walrus was alive and KW didn't lose their interest to it.



**B18**

## **TRACKBROWSER - VISUALIZING DATA AND TRACKS IN MOTION**

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Dedicated GIS software was developed to visualize and analyse tracking data of migrating marine mammals over a wide range of charts and scales. The functionality comprises dive histograms, 3D plots of data bins, statistics over selected groups of track points, position density plots, and the combination of tracks. As an example, track plots of southern elephant seals were overlaid to show their pathways through the polar seas. Tracks and dive data show the difference between small scale diving behaviour related to feeding and large scale swimming behaviour when heading for remote locations. Correlations with the sea floor topography can be revealed clearly. Charts of any scale and projection can be included to emphasize different perspectives of the migratory behaviour of the animal. The program permits to play back the positions of the migrating animal as a movie in fast or slow motion. TrackBrowser is easy to use and can be adapted to other sensors and species.



**B19**

## **BEHAVIOURAL RESPONSE OF CETACEANS TO BIOPSY DARTING**

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Behavioural response to biopsy sampling of the seven cetacean species inhabiting southern Spanish waters have been analysed to determine if this technique provoked an important disturbance to the animals in four different areas. A total of 459 attempts were done from October 2003 to August 2008, 407 using crossbow and 52 using spear. In 419 occasions the response intensity was recorded, 15% of occasions showed no detectable change in behaviour, 51% presented low-level reaction, 26.5% moderate reaction, 7% strong reaction and only 0.5% showed very strong reaction. Significant differences in type of reaction, intensity and individual/group response have been found between shooters, species and areas. Sex did not significantly affect the behavioural response to sampling. The area of impact presented significant differences in type of reaction and in individual/group response but no difference was found in intensity. Finally, the type of biopsy device used was not significantly different for intensity and type of reaction. In conclusion, these results show that these techniques normally provoke mild reactions in cetaceans due to the impact of the arrow but also to the surprising stimulus received. It is an important research tool for conservation biology because it provides important biological information, causing only short-term disturbances to both target and non-target individuals.



**B20**

**POST-RELEASE DIVE ABILITY IN REHABILITATED HARBOUR SEALS: AS SUCCESS STORY**

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The efficacy of seal rehabilitation is examined in a post-release study of dive ability in harbour seal pups (*Phoca vitulina*) in the Wash (UK). Six rehabilitated seals were fitted with SMRU Argos SRDL tags and their individual dive behaviour was monitored for an average of 122 days. The upper 90 percentile edge of dive behaviour (dive duration - DD90 and percentage of time at-sea spent in a dive - PD90), in 7-day bins, was used as a proxy for physiological dive ability. The results are compared with appropriately scaled data from five wild adult harbour seals tagged at the same time and place. Pup dive duration is also compared with their estimated ADL's.

1. There was no statistically significant difference ( $p=0.108$ ) between the mean track duration of rehabilitated seals (126.20 days (27.48)) and wild seals (150.2 days (24.62)), indicating no evidence that survivorship was less in the rehabilitated group. 2. The mean of the DD90's for the individual rehabilitated seals was 3.6 mins (0.36), and all individuals exceeded their estimated ADL values at least once. In addition the mean mass-scaled DD90 of the rehabilitated seals was in close accord with that of wild adult conspecifics. 3. There was no statistically significant difference ( $p=0.943$ ) between the mean PD90 of rehabilitated seals (81.62 % (1.21)) and adult wild seals (81.48 % (3.93)).

These three results all suggest the success of the rehabilitation programme in terms of survivorship and dive ability. We suggest that our method provides more appropriate measures of post-release fitness - and is preferable to a simple comparison of patterns of movement.



**C01****NMFS INTERNATIONAL ACTION PLAN FOR MARINE MAMMALS  
PHASE 1: PRIORITIES AND CURRENT ACTIONS****Michael Simpkins (1)**

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The U.S. National Marine Fisheries Service (NMFS) has a long history of working collaboratively with other nations to address international marine mammal conservation issues. These diverse efforts include (a) negotiation and implementation of international agreements, (b) training and capacity building in developing nations, (c) cooperative research in international and foreign waters, (d) response to foreign mass-stranding events, and (e) participation in scientific committees of various international research and management bodies. To ensure that these activities are coordinated in a strategic fashion, NMFS is developing an action plan that will guide its international efforts to protect and conserve marine mammals. An analysis of species status and threats suggests high-priority species, threats, and regions for focused action. An inventory of NMFS' international marine mammal activities over the past 5 years provides insight into the agency's existing approach to address those priorities. The comparison of priorities and existing actions highlights additional efforts required to address any gaps as well as the need for interagency, international, and public-private partnerships to address some of the more challenging threats or species.



**C02**

## **HOW CAN WE MONITOR THE FAVOURABLE CONSERVATION STATUS OF CETACEANS (WHALES, DOLPHINS AND PORPOISE) IN IRELAND?**

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Ireland, like all EU member states, is legally obliged to ensure the favourable conservation status of all cetacean species within the EEZ. In Ireland, this amounts to 24 species within 200 nmls of the coast. An assessment of conservation status requires data on population dynamics, range of distribution and the availability of appropriate habitat to maintain species populations on a long-term basis. The geographical location and variety of marine habitats present within the Irish EEZ contributes to the diversity of cetacean fauna. This includes migratory species such as large baleen whales, elusive deep-diving species such as beaked whales and coastal species like harbour porpoise which can at times be extremely difficult to observe. The IWDG and GMIT are currently involved in a number of monitoring projects including offshore and aerial surveys, passive acoustic monitoring (PAM) and photo-identification to address this issue. Platforms of opportunity provide cost effective survey platforms but there will be geographical and seasonal gaps in coverage and they do not provide appropriate survey design for surveys wishing to derive absolute abundance estimates. PAM has great potential for monitoring small cetaceans but can be constrained by detection distance, reliability of equipment and difficulties in mooring systems at sea. Towed hydrophone surveys are very efficient for some species but PAM cannot distinguish between many species and does not generally provide information on absolute abundance. Photo-identification can provide high quality data on a local scale and provide life-history data as well as population status but can be expensive and requires significant resources. In this paper, we review these monitoring techniques, including constraints, present results from ongoing monitoring studies and discuss how we can use the resources available to meet Ireland's legal obligations.



**C03**

## **A FRAMEWORK FOR ASSESSING CUMULATING IMPACTS IN MARINE MAMMALS**

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As part of their ongoing work on the impacts of anthropogenic noise on marine mammals, Okeanos - Stiftung für das Meer held an international, multi-disciplinary workshop on the cumulative impacts of ocean noise and other anthropogenic stressors on marine mammals in Monterey, California in August 2009. Short presentations on topics as diverse as bioacoustics, current management practice and network theory allowed for longer discussions on the various difficult facets of this issue. Specifically, participants considered three aspects: how currently available tools for regionally mapping anthropogenic pressures on the environment could be applied to the management of species, how the reported consequences in marine mammals of exposure to these pressures, and their known interactions within an individual, could be modeled, and how population modeling could best include cumulative impact assessment. The availability of data in many marine mammals is often sparse, but participants felt this could all be achieved in at least two data-rich populations: southern resident killer whales and northern Atlantic right whales. These could then be used as examples of how different pressures can combine and impact populations (e.g., through changes in demographic rates), and inform management decisions, perhaps based on exposure data alone, in other odontocete and mysticete species, as well as other marine mammals. Participants believe this could be applied with great effect to marine spatial planning. Letters with supporting information about this framework were sent to the U.S. Interagency Ocean Policy Task Force, working at that time to construct a new National Policy for the Oceans, Coasts, and the Great Lakes. Additionally, these letters noted the signing participants believe reducing ocean noise to be achievable goals that will help marine life cope with less tractable threats such as climate change. Several participants continue to work to realize these goals beyond the scope of the workshop.



**C04**

## **THE INTERFACE AND IMPLEMENTATION OF REGIONAL MANAGEMENT REGIMES IN THE CONSERVATION OF THE BALTIC HARBOUR PORPOISE**

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The legal and political implications for cetacean conservation in European waters post-2004 EU enlargement have been little explored in the current specialist and interdisciplinary literature. This study examined the particular context of multilateral regulatory endeavours in the context of the Baltic harbour porpoise. Regulatory policies have been advanced for this species in three specific regional management organisations: the European Union, the Baltic Marine Environment Protection Commission (HELCOM) and most specifically through the Agreement on the Conservation of Small Cetaceans of the Baltic, North-East Atlantic, Irish and North Seas (ASCOBANS), for which the latter has adopted a distinct Recovery Plan. This study, which was primarily desk-based, sought to evaluate the effectiveness of the regional management responses to the conservation needs of the Baltic harbour porpoise. In so doing, the fragmentary legal and policy documents adopted by the disparate regulators were aggregated, while targeted questionnaires were also sent to pertinent officials within the Baltic Sea region. The phenomenon of “treaty congestion” - the creation of a legislative bottleneck of competing norms and obligations - is identified as a key inhibiting factor to the implementation of commitments in respect of the conservation of the Baltic harbour porpoise. This study nevertheless identified the regional cooperation obligations mandated under the EU Marine Policy as a key means of improving the current position and facilitating the further implementation of conservation policies and initiatives for cetaceans resident within the Baltic Sea region, which may serve as an indicative model in other European regions in which competing management regimes present similar operational challenges.





C05

## INFORMATION AND EDUCATION TOOLS IN THE PROTECTION OF THE HARBOUR PORPOISE (*PHOCOENA PHOCOENA*) IN POLAND

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The rarity of porpoises in the Baltic Proper has resulted in low acquaintance with the species in society. Considering the critically threatened resources and the relatively high level of bycatch of this species in the Polish EEZ, the basic tools for its protection are the dissemination of information and education about porpoises. For around 25 years, the Hel Marine Station has been the only institution in Poland carrying out a range of activities disseminating the image and information about the porpoise, and the threats and methods for protecting it. These activities, from the 1990s and the first decade of this century, have been illustrated by the appropriate documentation. A measure of the progress in the raising of public awareness of the sea mammals living in the Baltic is the results of two sociological questionnaires. The first was carried out in the 1980s among secondary school pupils studying biology, and the second among tourists representing a variety of age groups and levels of education visiting Hel in 2009. The results of the first poll showed that only about 10% of the children were aware that porpoises live in the Baltic. Thirty years later 87% of the tourists polled knew that cetaceans live in the Baltic, of whom 84% were aware of the fact that they are porpoises. 16% of the tourists polled were able to say how big the population of porpoises in the Baltic was, and 83% of the abovementioned knew that they are protected by law. These results show the effectiveness of an educational method which prepares public opinion for dialogue on the necessity for reducing the threats in order to save the Baltic porpoises. The problem which remains is to transform this result into appropriate action on resource management of the porpoise, particularly in the sea exploitation sector.



C06

## CONSERVATION OF THE THREATENED ATLANTIC HUMPBACK DOLPHIN (*SOUSA TEUSZII*) IN SOUTHERN ANGOLA: AN UNCERTAIN FUTURE?

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Atlantic humpback dolphins (*Sousa teuszii*) are endemic to tropical and subtropical waters along the west coast of Africa. They are considered vulnerable by the IUCN based on low abundance, discontinuous distribution and widespread decline, and are among the most endangered cetacean species worldwide. Despite this, the species receives minimal research focus or management. A total of 71 Atlantic humpback dolphin sightings were recorded along 55 km of coast in Namibe Province, Angola, during two three-week periods in the summer and winter of 2008. Combined boat- and shore-based photo-identification during 49 sightings documented a total of 10 dolphins (with high re-sighting rates and no unmarked animals encountered), indicating that the Angola Management Stock proposed for this region is extremely low. Most sightings (N=46, 65%) occurred within 300 m of shore, rendering dolphins highly susceptible to various anthropogenic pressures. Inshore gill nets were observed daily and incidental capture likely represents the largest source of mortality for dolphins in Namibe Province. There is also potential for deliberate capture of dolphins for bait or human consumption; humpback dolphins were not sighted in the vicinity of artisanal fishing villages in the southern study area, and marked avoidance of artisanal fishing boats was observed. Humpback dolphins preferentially used small bays and reef breaks for foraging, and any future coastal development would be highly likely to impact dolphins. The challenges in conserving Atlantic humpback dolphins in Namibe Province include a paucity of relevant biological data, lack of enforcement of legislation (including coastal gill net bans), absence of education and awareness programmes, and difficulties in gaining political and financial support given widespread poverty amongst coastal communities and their reliance on natural resources, particularly fishing, for subsistence. Potential impacts from climate change (particularly for a species at the edge of its range) and genetic isolation present further long-term challenges.



C07

## CAN INDICES OF CETACEAN POPULATION STATUS BE EXTRACTED FROM HISTORIC DATASETS? IMPLICATIONS FOR UNDERSTANDING CETACEAN RESPONSES TO CLIMATE CHANGE

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Understanding how cetacean populations will be affected by future climate change requires a detailed understanding of how they have been affected by past changes in climate. Therefore, we need to identify past and current trends in cetacean populations and link these to climatic conditions for the same time period. However, in many cases, the only available historic datasets are not suited to the traditional techniques used to monitor cetacean populations. This is particularly true of sightings databases, which may cover long time periods, and are often the only potential source of historic data, yet usually lack associated effort data. We propose an approach which could allow indices of past and current population status to be extracted from sightings databases and test this using data collected over four years in the Bay of Biscay. Effort-related data, collected during dedicated ferry surveys conducted once a month by trained observers following a strict protocol, were used to calculate sightings rates and relative abundance. Non-effort related data, collected opportunistically throughout the month by a trained observer along the same ferry route but independently of the dedicated surveys, were used to calculate a measure of “occupancy”. “Occupancy” (the proportion of an area occupied by a species) was then compared to sightings rates and relative abundance for the same species within the same time period. Both measurements of cetacean density from systematic surveys correlated well with “occupancy” measurements from the sightings database. Therefore, this study provides evidence that changes in “occupancy” calculated from a sightings database may reflect changes in actual population parameters for the same area and time period. Subsequently, using this approach, information on population status can be extracted from sightings databases, allowing trends to be identified for past and current time periods and cetacean responses to changes in climate to be better understood.



**C08**

## **MAPPING MARINE MAMMAL DISTRIBUTIONS FOR CONSERVATION MANAGEMENT**

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Accurately determining species distribution patterns and how these vary in space and time are central to conservation management. Commonly the main limitation is lack of sufficient data to draw inferences, so that it is often necessary to combine datasets derived from diverse sources. Proposals are underway for a major international collaborative project to produce detailed species distribution maps for Northwest Europe. A first step has been to analyse marine mammal distributions in Welsh waters (and adjacent Irish Sea). Sixteen groups contributed 37,266 h of survey effort data, spanning the years 1990-2007. Spatial coverage amounted to 376 (>90%) of the 414 cells, into which the region was divided. The project database comprised 22,422 sightings (77,799 individuals) of 12 species. In addition, the Welsh stranding database, managed by Marine Environmental Monitoring, was reviewed and records of 1,724 individual cetaceans of 15 species included. Grey seal haulout and breeding data were analysed along with 2,586 at-sea sightings (3,424 individuals). Potential biases in sightability relating to survey/platform type and speed, were assessed using data gathered from different activities in the same area over the same time period. GIS maps of sighting rates were prepared using a grid with resolution of 10' latitude x 10' longitude, following correction for variation in sightability of different species at different sea states, for land based watches using scan sampling, and for aerial vs. vessel surveys. A variety of kriging methods were examined to assess the best way to interpolate the data and for plotting smoothed maps of relative abundance. Distribution patterns for minke whale, harbour porpoise, bottlenose, common and Risso's dolphins were analysed in more detail, including variations both seasonally and over the long term. Hotspot regions for particular species were identified along with areas of high species diversity. The techniques elaborated upon here should have wide applicability.



**C09**

**INDO-PACIFIC BOTTLENOSE DOLPHIN (*TURSIOPS ADUNCUS*)  
POPULATION STUDY OF KISITE-MPUNGUTI MARINE PROTECTED AREA,  
EAST AFRICA**

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Kisite-Mpunguti Marine Protected Area (KMMPA) lies on the south-coast of Kenya and incorporates the 28 km<sup>2</sup> Kisite Marine Park, the largest marine park in Kenya, and the adjacent 11 km<sup>2</sup> Mpunguti Marine Reserve. It is an important dolphin-watching location and, as a result, over the last 15 years it has been a great resource for Shimoni and the surrounding communities. However, very little scientific research has been conducted on the cetaceans of East Africa and little information is available on the baseline ecology of these species. Photo-identification studies were carried out between 2006 and 2008 in order to estimate demographic parameters and residency rates of bottlenose dolphins inhabiting the inshore waters of KMMPA. Mark-recapture techniques with closed population models were used to calculate absolute abundances every three months of the study period. The models estimated a population size of around 119 (95% CI 108-146) individuals between January and March 2006, and 122 (95% CI 110-143) individuals between October and December 2008. A total of 66% of the bottlenose dolphins were identified over two years and 40% of them were present over three years. This is the first absolute abundance estimation of Indo-Pacific bottlenose dolphins in Kenya. It shows that this species is present all year round in Kisite-Mpunguti MPA. It provides the baseline data that will help to ensure that the habitats and species are conserved and managed sustainably, whilst generating much needed revenue. It will also help inform long term management and monitoring programmes for the KMMPA.



**C10**

**MARINE PROTECTED AREAS AND *TURSIOPS TRUNCATUS* IN THE  
BALEARIC ISLANDS: CONSERVATION INVOLVEMENT**

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The highest amount of marine protected surface in Spain occurs within the Balearic Islands. However, these protected areas, especially coastal marine reserves, are small. Managed by the Balearic Fisheries Service, they have already demonstrated their validity for the recovery of fish communities. But, what is the involvement of this management plan for the conservation of cetaceans? Of all Mediterranean species, the bottlenose dolphin is the one with strongest coastal preference, and the only one with regular presence in the Balearic archipelago. In order to better understand the ecological involvement of coastal marine reserves in the conservation of the bottlenose dolphin in the Balearic Islands, 3 Timing Porpoise Detectors (T-POD, Chelonia Ltd.) were moored within the coastal marine reserve “dels Freus d'Eivissa i Formentera” covering 13.617 Ha. Results of the detection of bottlenose dolphin echolocation activity show year-round dolphin encounters with strong seasonal and diel differences, with preference for the winter season and night time. This could be related to anthropogenic effects. Habitat use was also explored identifying fast click trains associated to feeding activity. This behaviour exceeded 25% of all detected events in specific locations of the reserve emphasizing the ecological value of this protected habitat. These results evidence the benefit of a coastal marine reserve for the bottlenose dolphin. If this positive effect is also observed in all other coastal marine reserves of the Balearic network, being the aim of the next study phase, our results could confirm that coastal marine reserves are an important management tool for the conservation of the bottlenose dolphin population in the Balearic archipelago.



C11

## CONSERVATION OF THE SHORT-FINNED PILOT WHALE IN SW TENERIFE, CANARY ISLANDS

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In the southwest of Tenerife, Canary Islands, the short-finned pilot whale is the main target species of a prospering whale-watching industry, and is consequently the species most affected by anthropogenic activity in this area. However, very little is known about the distribution, seasonality, abundance and habitat use of the species; the only significant study was conducted in the early eighties. Furthermore, current conservation status and the impacts of increasing human activities remain unknown. Between April 2007 and March 2009, the Society for the Study of Cetacean in the Canary Archipelago (SECAC) carried out an intensive study on the ecology of the short-finned pilot whale. Line transect surveys were conducted in the Special Area of Conservation (SAC) Punta Teno-Rasca over 226 days. A total of 3.296 nmi were surveyed on searching effort, during which 983 sightings were recorded of 11 different species, with an overall encounter rate of 22.5 sightings per 100 nmi. The most frequently encountered species was the short-finned pilot whale (*Globicephala macrorhyncus*), with 637 sightings (64.8% of the total) and an encounter rate of 18.9 sightings per 100 nmi.

The average group size was 14.4 (SE=7.8), ranging from 1 to 80. Distribution and habitat use are being investigated for this species. The study area was divided for analysis into grid cells with resolution of 2 minutes of latitude by 2 minutes of longitude, with associated values of dynamic and fixed environmental and geographic variables. Preliminary analysis indicates that this species has a preference for depths between 1000-2000 m (64% of the sightings occurred during 33% of nmi searching effort). Analyses are ongoing. The results will help inform conservation of this species and management of human activities in the SAC.



C12

**EVIDENCE OF A STRIPED DOLPHIN (*STENELLA COERULEOALBA*)  
NURSERY ZONE IN THE WATERS ADJACENT TO THE TERRESTRIAL  
NATURA 2000 AREA „GERANIA MOUNT“ (GULF OF CORINTH)**

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During the summer 2009 (July-August) a research study was conducted in order to define the habitat use and distribution of cetaceans inhabiting the Eastern portion of the Gulf of Corinth (GOC), a long and almost enclosed sea of Greece, Eastern Mediterranean. The GOC presents a small incidence of pleasure boats and, with a depth often over 900m, represents an area of high biodiversity, elected by small pelagic species. Surveys were carried out aboard a 12m sailing vessel, covering an area of about 600 square km, in the waters of the Natura 2000 Area „Gerania Mount“. About 600km of route were surveyed. Three species were sighted: striped dolphin (*Stenella coeruleoalba*), common dolphin (*Delphinus delphis*), and Risso's dolphin (*Grampus griseus*). The mean cetacean sighting frequency for the area resulted of 0.78 (sightings/monitored hours), while the encounter rate was 0.046 (sightings/monitored km). Striped dolphin was present in every sighting. Average school size for this species was of 12 individuals. A heavy presence of newborns and calves was recorded for this species: the 50% of groups had newborns and calves, the 10.7% had juveniles and adults, while the remaining 39.3% had just adults. The results of 2009 survey document the importance of this zone as nursery area for striped dolphin, possibly due to the low boat traffic and to the high availability of preys. Further studies on behavior and habitat use would be useful to better understand the importance of this area for managing the species. To continue monitoring the species in the future would be also important because the area is developing fast in spite that is located in the waters of a terrestrial Natura 2000 Area.





## C13

### WHEN IT COMES TO WHALES' CONSERVATION, IS A RECOMMENDATION ENOUGH?

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The Strait of Gibraltar is the world's second highest maritime traffic area, with more than 90.000 vessels crossing the Strait every year. However, in 2005 a critical area for Sperm whales was identified in the zone. A Notice to mariners was published in January 2007 by the Instituto Hidrográfico de la Marina under the Ministry of Defence establishing a security area characterized by high densities of sperm whales, where ships should limit their maximum speed to 13 knots and navigate with particular caution. The same Notice was included on Nautical Charts and was supposed to be broadcasted regularly by VHF radio from April to August. The objective of the study was to assess the effectiveness of this measure, i.e. the speed limit compliance. A survey was realized in summer 2009 using the real time theodolite tracking system Cyclops Tracker. Positions of cargos and tankers passing through the area along its east-west axis, as well as ferries and fast ferries crossing between its northern and southern shores, were recorded and vessel speeds calculated. Mean vessel speed was faster than 13 knots for all three categories, reaching 13.9 knots for cargo ships, 15.3 knots for ferries and 24.4 knots for fast-ferries. Moreover, tracking data showed that only 45.5% of cargos, 15.6% of ferries, 7.1% of fast-ferries complied the 13 knot-recommendation in the Strait of Gibraltar. This could suggest that the recommendation is poorly known by the mariners; in that case it could be improved by the Notice being broadcasted regularly by VHF radio as originally planned and training the ferry companies. Vessels could also have chosen not to follow the recommendation; in that case this measure may not be strong enough, as at least one new collision occurred this year in the Strait of Gibraltar between a ferry and whale.



**C14**

**WHO WILL BE THE FIRST?**

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Interactions between Killer whales and long-line fisheries have been observed all over the oceans, for a large variety of preys. However, the impacts that these interactions may cause to the whales' populations remain unknown. In the Strait of Gibraltar, the Killer whales are known to feed mainly on Bluefin tuna, using two feeding strategies, the endurance-exhausting technique and the depredation on long-line fishery. A total of 9,156 pictures of Killer whale's dorsal fins were analysed, taken from 1999 until 2008, allowing the identification of 43 individuals, from which 19 belong to the two pods that interact with the tuna fishery during summer months. Catches of Bluefin tuna by the long-line fisheries in the Strait of Gibraltar were analysed during summer 1999-2008 and a decreased of 80% was observed from 2003 onward. The life-history parameters of these Killer whales were estimated for the same period. From 1999 to 2005, all 5 newborn calves had a 100% first-year survival rate. However, a critical change was observed from 2005 onward, where none of the 3 newborn calves survived through their first year of life. A two-year delay was observed between the decrease in the Bluefin tuna captures and the decrease of the orcas first-year survival rate. This corroborates the strength of the interaction between Killer whales and tuna fisheries in the Strait of Gibraltar and shows how the decrease of the captures of Bluefin tuna may affect the survival of the whales' population.



C15

## THE MISSING TOOL IN WHALE WATCHING MANAGEMENT STRATEGIES: THE TOURIST PROFILE

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There are several assessment studies about the whale-watching impact on cetaceans, but studies about the nature of whale-watchers are scarce, and this information is essential for the management of the industry. In 2007, a survey was conducted in SW Algarve, Portugal, obtaining 364 questionnaires. This study aims to determine the whale-watchers ecologic profile index (IPE), „willingness to pay“, socio-economic level, and the variables that contribute to their satisfaction in order to provide tools for management. Tourists were mainly middle aged (38 yrs average) females (53%), highly educated, with an income between 1000 to 2500 Euros. Most of them traveled to the region with the intention of doing whale-watching, as they do in other places. This activity was not their main reason for coming to the Algarve (88%), but it contributed for their general satisfaction (97%). Once tourists received information about the existence of whale-watching in the region, they went to do it by their own initiative (86%). The majority was willing to pay more than 5 Euros extra in the ticket price if this contributed for cetacean research and conservation, probably due to the fact that trip satisfaction was considerably high ( $p=0.002631$ ). The majority (56%) did not receive any information about the existing regulations' code of conduct, but 66% believed that these were complied. An average IPE of 7.6 was obtained, meaning that whale-watchers had a high ecological awareness profile, significantly correlated with age and education ( $p=0.037234$  and  $p=0.00571$ , respectively). Results herein presented provide basic tools that can both benefit the management of the industry in the region and the operators. We highly recommend an investment in educational programs, improved marketing strategies and the creation of a fund for cetacean research and conservation. These measures might contribute for the still possible sustainable growth of the industry in the region.



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Human-cetacean interactions are gaining in popularity as non-lethal alternatives to whaling and marine exploitation. Apparently contradictory needs of social and economic development are in tension with environmental conservation. Our work confronted the challenges to developing tourism that arise when human-dolphin encounters are inevitable in a given habitat. Research shows that human activities have serious negative impacts on cetacean habitats and populations. This is exacerbated by underdevelopment in countries of the Southern Hemisphere. In Ponta D'Oura Mozambique tourists arrive seasonally to enjoy the beaches, dive the reefs, fish and engage in related leisure activities. This brings temporary and transient transformation to an isolated rural area. Terrestrially and in the marine environment noise levels increase as all-terrain vehicles traverse the dunes, and a wide range of motorised watercraft are deployed up and down the coastline. Within this context a growing provision of swim-with-dolphin programmes threatens the resident and transient populations cetacea, particularly the numerous in-shore bottle nosed dolphin. In this context Dolphin Care Africa, a small resident organisation has gathered multiple strands of information from long-term behavioural studies of dolphins. Working within a framework of strict fieldwork ethics a way forward has emerged. A combination of attitudinal and methodological elements to produce human behaviour that is consistent and predictable is advocated and taught. This demonstrably brings benefits to both eco-tourism and research.



D01

**POTENTIAL AND LIMITS OF AERIAL SURVEYS FOR THE MONITORING OF MARINE MAMMALS****Léa David (1), Nathalie Di-Méglio (1), Benoît Paklepa (2), Pascal Monestiez (2)**

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The monitoring of protected species like marine mammals is a basic need for conservation purposes. The vast areas occupied by these animals and for some of them their very low density need often several days of survey when monitoring is performed from boats. Aerial surveys, by helicopters or planes, can be an interesting alternative since several hundred of kilometers of transect can be realized in few hours. The question is then to assess the efficiency of aerial survey compared to more classical surveys on different opportunity platforms.

Our objective consists in quantifying the efficiency of aerial survey alone or in complement of boat survey for two target species: the fin whale and the striped dolphin in the Northwestern Mediterranean Sea over the last five years (2005 to 2009) during the summer period (May to October).

For the same marine area, we apply a line transect approach by distance sampling for boat survey (effective detection half width around 650 m) and a more adapted strip transect approach for aerial survey (detection strip width around 720 m).

Our main result is that aerial surveys by helicopter detect from four to seven less schools of mammals than classical line transect performed from boats and for equivalent transect length . We suppose that it could be due to animal diving behavior for fin whales, to poorer detection rate caused by the high flight speed and to poor transparency of water leading to lose animals rapidly underwater.

A correction of the bias is proposed for helicopter data depending on studied species and flight characteristics, and the computation of error variances gives indication on the minimal flight transect density needed to reach a given accuracy or to be able to map relative abundance from aerial survey alone.



**D02**

**'TIME PRESENT' - A METRIC FOR ESTIMATION OF DENSITY WITHOUT USE OF A DISTANCE DETECTION FUNCTION**

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Current transect methods for estimation of cetacean density are based on counting individuals and quantifying the spatial reach of the detection method which may be visual or, in some cases, acoustic. Cue counting methods have developed from this with the advantage that they allow multiple counting of individuals, but they still require a spatial detection function. Static acoustic monitoring methods for species that are potentially continuously detectable present severe problems for analytical methods that require no double-counting. For cue-counting they introduce a time element into spatial detection functions by raising the questions 'How long is a cue?' and, 'How long do we allow for a monitor to detect an animal at a certain distance?' A novel method is proposed here for discussion. It uses a metric of 'time present' for density estimation by static monitors of species that are nearly continuously potentially detectable, as in the case of monitoring porpoise echo-location. The method proposed requires a close-spaced array (perhaps 25 monitors in 1 sq.km) that will allow detection of the entry and exit of animal(s). Then, during the presence of the animal(s) within the array the density is known and the mean animal 'time present' per minute detected by the loggers can be found. The resulting factor relating 'time present' to density and logging duration can be used to average density over time for a single logger or for a more widely spaced array that monitors a wider area. The applicability and necessary qualifications to this method are discussed, and the case is advanced that this is an appropriate and powerful approach to static acoustic monitoring data that merits field testing.



**D03**

## **HARBOR PORPOISES IN THE WESER RIVER**

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Since 2007, data (sighting reports by sailors, boaters, hikers and local residents) on the appearance of harbor porpoises in the German river Weser are collected to determine their riverine range. The data showed that in April and May the harbor porpoises congregate in the Weser estuary and the lower Weser River. Some animals even migrate upstream towards the center of the city of Bremen and a weir, which prevents them from moving further upstream. In 2009, 72 harbor porpoises have been sighted (including outer Weser estuary) during 37 sightings. Most sightings (43 %) involved single individuals; about 32 % involved groups of two; rarely groups of three or even up to 8 animals were reported. Even young calves have been sighted in the river. Each year two to four dead harbor porpoises were found at the Weser bank. In order to obtain systematic information on their temporal and spatial distribution in the river we plan to deploy two porpoise click detectors (C-PODS) in addition to the existing sighting scheme. Monitoring porpoise echolocation activity may also help to get additional information on their behavior (e.g., by logging typical feeding-like click trains). The reasons for the porpoises' journey into the Weser River are yet unknown. Overfishing in the North Seas is discussed being a possible reason why they venture far into the Weser River. Another possibility is that they follow fish schools migrating into the Weser River to spawn.



**D04**

## **HARBOUR PORPOISE SURVEY IN THE OOSTERSCHELDE ESTUARY**

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The Dutch Delta comprises several estuaries in the south-western part of the Netherlands. One of the estuaries, National Park the Oosterschelde (370 km<sup>2</sup>), is separated by a storm-surge barrier. This barrier limits the flow of water and sediments from the North Sea to the estuary and closes in cases of severe weather conditions. The area is unique for its frequent occurrence of marine mammals in the immediate vicinity of a densely inhabited coast. Incidental sightings of harbour porpoises were recorded in the Oosterschelde in the past, however no information was available on the abundance and distribution of these animals and if calves were born here. To prove the reproduction of animals and the existence of a population, on September 19th 2009 the first research ever, a survey sponsored by WWF Netherlands, was carried out in the Oosterschelde to estimate the total abundance of harbour porpoises. Eight boats sailed in parallel formation from west to east. The speed was 6 knots and the total observation time was up to 6 hours per boat. Observation conditions were optimal with Bft 0-1. The data were corrected for double counts. This led to an estimation of at least 37 harbour porpoises being present. Five of these were calves.

Apparently the Oosterschelde's storm-surge barrier hasn't prevented some migration of harbour porpoises from the North Sea coming to the Oosterschelde, although the frequency of migration and if porpoises swim back through the barrier is still unknown. Further research on migration through the barrier is being prepared with the use of C-PODs and a second survey is planned for May 2010. In order to develop adequate conservation strategies it is essential to continue monitoring of marine mammals in this area.

The release of the results was broadcasted on National television, radio, many websites and newspapers.





D05

**GUESS WHAT! ITS THE NEW WORLD NATURAL HABITAT, AND THERE ARE PORPOISES (*PHOCOENA PHOCOENA*)**

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Since June 2009, UNESCO placed the Wadden Sea on the World Heritage List due to its uniqueness in demonstrating how nature, plants and animals adapt themselves to constantly changing conditions in an area where freshwater and salt water meet.

Knowledge on distribution, abundance and habitat use of harbour porpoises in the Wadden Sea area is restricted to the offshore areas, especially west of the islands Sylt and Amrum. Due to its importance as a breeding area, it was designated as a whale sanctuary in 1999.

Astonishing little is known about harbour porpoises in the water of the Inner Wadden Sea. The Inner Wadden Sea is characterised by a vast, varied area, sculpted by the constant flow of tides with noticeable changes even on a daily basis. A complex system of channels and streams alternates with exposed mudflats and sand banks.

We conducted a four month study on the occurrence of harbour porpoises within one tidal system in the Inner Wadden Sea area east of Sylt using static acoustic monitoring (SAM). Three C-PODs were deployed at different locations within a channel in the Lister basin since August 2009.

All C-POD's regularly detected numerous harbour porpoise clicks and thus provided detailed information with a high temporal resolution on harbour porpoise presence in the tideways. This is the first evidence of regular harbour porpoises presence in tideways more than 20km away from the open sea. Porpoise activity is analysed in relation to tidal changes, day time and distance from the open sea.



**D06**

**A PRELIMINARY STUDY OF FIN WHALES (*BALAENOPTERA PHYSALUS*, LINNEAUS 1758) IN THE CHANNEL OF SICILY**

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Since 2004 KETOS Scientific Association has carried out research cruises in winter in the Channel of Sicily. Five research cruises have been completed, using a motor-sail vessel as a survey platform, usually between the second half of February and April. We focus research surveys in the area surrounding the island of Lampedusa, which appears to be the chosen wintering area for fin whales (*Balaenoptera physalus*). Fishermen reported fin whale sighting in the southeastern area of the island during every year of the study period. We had the opportunity to see fin whales in 2005 and in 2009. In 2004 and 2007, ICRAM reported sightings of whales. In 2008, due to lack of funding, it was not possible to carry out any research activity in that area, but we have reports from fishermen of fin whale sightings. In 2005 we spent 10.3 % of survey time with fin whales while in 2009 we spent 6.2 % (10 and 9.2 hours of sightings respectively). In 2009 we observed fin whales in association with common dolphins (*Delphinus delphis*). Fin whales were seen feeding, especially in 2005, when it was possible to observe a particular surface feeding behaviour, due to the presence of euphasids of the species *Nyctiphanes couchi*, which perform diurnal migration from bottom to superficial layers of the water column. It is suggested that the prevalence of this feeding behaviour in 2005 was related to oceanographic conditions, specifically upwelling, with increased productivity leading to higher abundance of prey species of the fin whale. More studies are needed to confirm the importance of this area for Mediterranean fin whales.



D07

## 2009 SUMMER SIGHTINGS OF COMMON DOLPHIN (*DELPHINUS DELPHIS*) IN THE IONIAN ISLANDS

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During the months of July and August 2008 and 2009, vessel based surveys were carried out in the waters of the northern Ionian Islands, in order to assess the occurrence and distribution of cetacean species in relation to ecological and anthropogenic parameters. Surveys were carried out aboard a 12 m sailing vessel, covering an area of about 3,500 km, located between northern Kerkira and northern Cephalonia, and characterised by a massive presence of pleasure boats during the summer. A total of about 2,000 nm were travelled in search of cetaceans. Four species were sighted during the period of study, for a total of 29 sightings of a single species and one of a mixed group: 17 sightings of bottlenose dolphin (*Tursiops truncatus*), five sightings of striped dolphin (*Stenella coeruleoalba*), three sightings of common dolphin (*Delphinus delphis*), and five sightings of fin whale (*Balaenoptera physalus*). During 2008, there were no sightings of common dolphin, but in 2009 21.4% of sightings were of this species in the study area: two sightings in single species groups and one sighting in a mixed group with striped dolphins. Only one sighting was located in the area where the species was reported to be common before its drastic reduction in recent years. The other two sightings were located in the waters between the Islands of Kerkira and Paxos. During all common dolphin sightings, the presence of calves was documented. The mean sighting frequency for this endangered species was 0.01 sightings / monitored hour. The results from 2009 highlight the need to investigate the range of the species on a large scale, in order to determine whether its distribution and habitat use could have changed from previous years, as a response to prey reduction and/or increasing boat traffic in the area of Lefkada and the neighbouring mainland.



**D08**

**SPATIAL AND TEMPORAL DISTRIBUTION OF *HYPEROODON AMPULLATUS* OF PICO ISLAND, AZORES**

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The Azorean archipelago is characterized by deep coastal waters (ca. 2000 m) hence it is possible to observe deep diving cetaceans close to shore, such as Sperm whales, Northern Bottlenose whales, Sowerby's and other beaked whales. The aim of the present study was to determine the temporal and spatial distribution of *Hyperoodon ampullatus* of Pico Island, Azores. The analyses were based on data gathered from 2003 to 2009, using both land and boat-based surveys. A total of 87 groups were recorded, distributed over 33 days, ranging from 1 to 11 days a year. Most of the observations were made in the summer, from mid July to the beginning of August, with 2 additional sightings at the end of August and September. They were observed mainly in the morning (63% of all observations), between 7.30 to 12.00 am. Their spatial distribution ranges from 38°18 to 38°23 N and from 28°02 to 28°27 W, which correlates with an area of 400 to 1200 meters deep. Using photo-ID, we encountered resightings of different individuals both within the day and within the year. We conclude that *H. ampullatus* is a regular migratory species of the Azorean archipelago and probably spends more time in the sea surrounding the Islands, thus we believe it is necessary to obtain more data, by collaboration with researchers from other islands in order to achieve a better understanding on species' habitat use in the Azores.



**D09**

cancelled



D10

## SPERM WHALE SIGHTINGS IN THE TURKISH PART OF THE AEGEAN AND MEDITERRANEAN SEA

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The sperm whale is a cosmopolitan species and known to occur in the Mediterranean Sea, which includes the Turkish waters. There has been, however, no report concerning the distribution of this species in the Turkish waters. We have summarized the sightings reported by local fishermen and sailors during 1999-2009. There are 18 sightings in total: 14 sightings were made off Fethiye on the southwestern coast of Turkey along the Mediterranean, 3 were made in the northern-central Aegean Sea coast, and 1 made in Antalya Bay on the central coast of Turkey along the Mediterranean. The reef off Fethiye drops down to 5000m and it is assumed that sperm whales feed on deep-water cephalopods in that area. Seasonally, 15 sightings were made during summer months (May-August). This may be due to the high season for yachting, but also indicates that these animals migrate to somewhere else outside the Turkish waters during winter months. This study provides the basic information on the sperm whale distribution in the Turkish waters but there should be more effort to be made for better understanding of their population in the Turkish waters, especially off Fethiye.



D11

**SPATIO-TEMPORAL ANALYSIS OF CETACEAN DISTRIBUTION IN  
PELAGOS SANCTUARY RELATED TO ENVIRONMENTAL PARAMETERS**

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One of the needs of the PELAGOS Sanctuary management is to better understand the distribution of the main cetacean species occurring in the Sanctuary area. Many surveys have already been conducted in the area since the nineties by several groups but most of the time without any connexion between them. The aim of this study was to produce synthesis of all these results and identify favourable habitat for cetaceans species, in gathering data from a large number of structures. A total of 16 structures answered favourably allowing the sharing of their data for this purpose. These data were then verified and homogenized to obtain two different databases encompassing June to September, from 1994 to 2008. The first database contains 6 096 opportunistic sightings: 3474 sightings of striped dolphins, 1707 of fin whales, 340 of sperm whales, 137 of Risso's dolphins, 134 of long-finned pilot whales and 291 of bottlenose dolphins. The second database includes a total effort of 68620 km realized in line transect conditions with 2584 associated sightings.

This data set allows us to produce an index of relative abundance (ind.km<sup>-1</sup>) for each of the six common species and a characterization of their distribution

according to topographic parameters: depth, distance to the coast, 200 m and 2,000 m contours ; and remotely sensed parameters: sea surface temperature (SST), chlorophyll a (Chla) and net primary production (NPP).

In a first step, favourable habitat were characterised for each species using an interval of three variables (depth, temperature and chlorophyll a) estimated monthly by subtracting first and last quartile of each data set. These results allow us to extrapolate these results in potential area of distribution used by this six species in the entire PELAGOS Sanctuary.



## D12

cancelled



D13

**SPATIAL DISTRIBUTION OF CETACEAN SIGHTINGS FROM THE FIRST  
TRANS NORTH ATLANTIC SIGHTINGS SURVEY (T-NASS)**

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T-NASS, planned under the auspices of the Scientific Committee of NAMMCO, mobilised 11 vessels and 5 aeroplanes during summer 2007 to collect data for line transect abundance estimates throughout the Northern North Atlantic. The seas of the four NAMMCO member countries (Norway, Faroe Islands, Iceland and Greenland) were surveyed together with adjacent areas in Canadian waters. Furthermore, T-NASS was coordinated in time, spatial contiguity and methodology both with the European CODA and the US SNESSA surveys. The 12 platforms of the core survey covered over 54,000 nm of transects in effort in an area of about 1.8 mill. nm<sup>2</sup>, spanning from the Eastern Barents Sea to the East coast of Canada and from 78°N in the north to 52°N in the east and 42°N in the west to the south. TNASS observers placed on opportunistic surveys (MarEco, ICES Redfish and Norwegian pelagic) conducted a supplementary effort of 5,253 nm, in the Irminger Sea, the Norwegian Sea and the Mid Atlantic Ridge. Cetacean encounters numbered over 3,000 of eighteen species. T-NASS adds to the series of North Atlantic Sightings Surveys (NASS) conducted in 1987, 1989, 1995 and 2001, thus forming a 20-year time series. In this work we present the synoptic sightings distribution of the main target species: minke, fin, humpback, blue and pilot whales, white sided, white beaked and common dolphins and harbour porpoises. Though qualitative in nature, this kind of data is useful as base reference of overall cetacean distribution over a large area.





D14

**CRITICAL AREAS OF ABUNDANCE & DISTRIBUTION OF *BALAENOPTERA EDENI* OF THE NORTHEASTERN COAST OF VENEZUELA: IMPLICATIONS FOR MANAGEMENT AND CONSERVATION**

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The northeast coast of Venezuela hosts a great diversity of megafauna, particularly related with the existence of big sardine schools (*Sardinella aurita*) along an important community of top predators, including *Balaenoptera edeni*. Bryde' whales are still classified as Data Deficient by the IUCN. Locally there is a considerable lack of knowledge on baseline information such as abundance and distribution (indicators of habitat use), necessarily to assess predatory patterns of *B. edeni* on the local fishery resources. The aim of this contribution is to describe the species' pattern of relative abundance (Abundance per Unit of Effort: APUE) and distribution along the shelf and transitional- oceanic marine habitat. We base our assessment on the hypothesis considering *S. aurita* as the major food source of the local population of Bryde' whales, therefore, distribution should emulate that of the most important prey. Opportunistic and systematic sightings records (published and non- published accounts) from 1998 - 2005 were pooled together and integrated into a Geographical Information System (ArcGIS 9.2), with information on date, time, group size, sea state (Beaufort scale), geographic coordinates, and effort-corrected (days invested during searches) relative abundance and sighting indices. Areas of higher densities for *B. edeni* seemed to be closely related with the focal location of sardine fisheries and the most active upwelling in the area, overlapping with areas of major concentration of common dolphin (*Delphinus* spp). Management and conservation strategies should consider the areas of major productivity along this coast as potential critical habitat for the species.



D15

## YEARLY ROUND MONITORING OF CETACEAN POPULATIONS IN THE NORTHERN TYRRHENIAN SEA (PELAGOS SANCTUARY) USING FERRIES AS RESEARCH PLATFORM

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Long-term monitoring programs can provide information to improve conservation and adaptive management of marine mammals and MPAs.

In this paper, we present the results of weekly observations undertaken for a year-round from February 2008 to February 2009 in „passing mode“, along fix transect, using ferries as research platforms for dedicated surveys along the Livorno-Bastia route (Northern Tyrrhenian Sea). This research allowed getting data on distribution, relative abundance and seasonality of cetacean population in the South-Eastern Pelagos Sanctuary (including the Tuscan Archipelago PA) and provides a comparison database useful to continue long-term and large-scale monitoring through next years. Each transect was considered as an independent statistical unit, after the performance of autocorrelation test. Observations were undertaken in fine weather condition and sightings were also associated to environmental parameters and nautical traffic (boat > 5 m). Moreover, possible episodes of „ferry-whale“ collisions were recorded.

During the 78 transects, in a total of 239 hours of survey effort, 82 sightings of totaling approximately 322 individuals were recorded; mean encounter rate was 0.35 sightings/hour. Along the Livorno-Bastia transect, three species were sighted: *S. coeruleoalba* (36% of sightings, 71% of sighted animals), *T. truncatus* (32% of sightings, 20% of sighted animals) and *Balaenoptera spp.* (26% of sightings, 8% of sighted animals). Results, however, showed differences in presence and relative abundance of animals during the year. No cetacean ship strikes were recorded over 4300 NM travelled. During cetacean sightings the amount of detected nautical traffic was lower (-180%;  $P < 0,05$ ) than in absence of cetacean („control“).



D16

## LARGE SCALE MONITORING IN THE NORTHWESTERN MEDITERRANEAN SEA - RESULTS OF TWO YEARS OF RESEARCH USING FIXED TRANSECT SURVEYS

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The use of ferries as research platform to survey fixed transects allows a large scale and simultaneous monitoring of cetacean distribution in the Northwestern Mediterranean Sea. In particular, ferry routes going from Liguria, Tuscany, Latium, Sardinia and Corsica fall inside and just off the southern boundaries of the Pelagos Sanctuary. Cetaceans are known to concentrate in this area during summer, which is also the season when nautical traffic increases. From June to September 2008 and 2009, ferries on respectively 3 and 4 different routes hosted dedicated Marine Mammal Observers once a week. MMO collected data on cetacean presence following the distance sampling protocol and warned ferries crew about cetacean presence in order to avoid ship strikes. In total, 206 journeys were made with MMO on board. In 752 hours on effort 673 cetacean sightings were registered and over 19,000NM travelled only a „near collision“ event was reported. All 8 cetacean species were observed during the monitoring period: the most observed species was striped dolphin (58% of sightings), followed by fin whale (26%), bottlenose dolphin (9%) sperm whale (2.4%), Cuvier's beaked whale (1.9%), common dolphin (0.9%), Risso's dolphin (0.7%), and long finned pilot whale (0.3%). Fin whales sightings were concentrated mainly in two specific areas, which are at the extreme boundaries of the Pelagos Sanctuary. On the contrary, sperm whale sightings were more abundant in the heart of the Ligurian Sea. This monitoring offers new insight into summer distribution of these species within and off the southern boundary of the Pelagos Sanctuary and provides useful indications for further conservation needs.



D17

## RIDING FERRIES FROM XX TO XXI CENTURY: RESULTS FROM A LONG TERM MONITORING PROGRAM IN THE CENTRAL TYRRHENIAN SEA

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From 1989 to 1991 yearly round cetacean monitoring along fixed-transect was weekly carried out in the Central Tyrrhenian Sea, using passengers ferries as research platform. Collected data gave new information about some species and their distribution in the region. The most important findings were the observation of cyclical variations in the presence of *Balaenoptera spp.* in different seasons and the existence of a “hot-spot”, east of Sardinia, where more than 75% of sightings occurred. In 2007 research restarted with same protocol and under supervision of same investigators. The new monitoring was carried out every summer, up to 2009. This paper presents the results of one of the longest quantitative comparisons on temporal differences of cetacean presence, relative abundance and distribution in the Mediterranean Sea. The transect, from Civitavecchia (Rome district) to Golfo Aranci (Sardinia), is 122 NM long and includes different habitats such as shelf, shelf-edge and deep sea.

Data from 87 summer weekly runs (totaling 580hr on-effort) undertaken in the “1990s” were compared with data obtained from 97 runs (406h) in the “2000s”.

In the 1990s, 281 sightings of 7 cetacean species ( $0.69 \pm C.I.0.10$  sighting/hr) were recorded, compared to 315 sightings ( $0.94 \pm 0.15$ ) of the same species in the 2000s ( $P < 0.001$ ).

Results showed a surprisingly increase in ER of *Balaenoptera spp.* (200%,  $P < 0.0001$ ) while ER of the other commonly sighted species (*S. coeruleoalba*, *T. truncatus*, *Z. cavirostris*) showed a slight increase, which was however not statistically significant. In both periods *P. macrocephalus*, *D. delphis* and *G. griseus* were spotted only few times. Over 22,503 NM travelled only a “near collision” event was recorded. The 2000s surveys confirmed the existence of the hot-spot, in coincidence with local high-productivity area, and the consequent need of conservation measures such as an extension of Pelagos Sanctuary Southern border and a “code-of-conduct” adopted by the shipping industry to avoid the collisions risk.



D18

## MOVEMENTS OF GREY SEALS (*HALICHOERUS GRYPUS*) IN SOUTH WEST ENGLAND USING PHOTO-IDENTIFICATION

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Long term photo-identification is being used to learn about complex grey seal movements around South West England (Cornwall, Devon and Isles of Scilly). A database of left/right seal profiles has been collected since 2000 from Godrevy, Cornwall. These were visually compared to images from other sites and matched with 5 marker patterns to ensure a positive identification, through a non-invasive capture-mark-recapture methodology. 29 different seals from Godrevy were identified at a second location. 6 seals (3 male, 3 female) were seen at St Ives/Carracks, which is 6-11km west by shortest sea distance route (SDR) with the average number of days between sightings at the two different sites (AS) being 126 days. 1 seal (male) was seen at Portreath, 8km east by SDR with an AS of 3 days. 12 seals (8 male, 4 female) were seen at Porth Joke/Newquay 26-31km east by SDR with an AS of 123 days. 1 seal (male) was seen at Nanjizel, 43km west by SDR and was recaptured at Godrevy 13 days later. 8 seals (4 male, 4 female) were seen at the Isles of Scilly, 71km west by SDR with an AS of 200 days. 1 seal (female) was seen at Morte Point, Devon, 89km east by SDR and was recaptured at Godrevy 12 days later. Several notable movements were recorded, including DP41 Seahorse (male) at Godrevy on 01/09/03, Porth Joke 09/09/03 and Godrevy 13/09/03; DP143 3 Pearls (male) at Godrevy on 15/03/08, Scillies 25/03/08 and Godrevy 27/03/08 and S262 Ghost 2 at Morte Point on 08/09/08, Godrevy 20/09/08 - pupping on 23/09/08. As research continues and expands to other sites, a much greater understanding of individual seal (and age/gender group) seasonal movement patterns can be learned, to better inform conservation efforts of the species.



D19

**ASSESSING THE POTENTIAL OF A LONG-TERM PHOTO-ID DATA COLLECTION SCHEME FOR SPERM WHALES (*PHYSETER MACROCEPHALUS*) IN COOPERATION WITH WHALE-WATCHING OPERATORS - THE AZORES: A CASE STUDY**

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Whale-watching boats are regularly used as „platforms of opportunity“ by scientists for mark-recapture studies. The proposed scheme will utilise the whale-watching crew itself to collect the data (photo-ID) combining whale-watch tours with scientific research. Advantages include supplied equipment, independence from scientific funding and the possibility of long-term data sets.

A pilot study in the Azores, where sperm whales are the main target species, was launched to assess the practicality (incorporating sampling into the tours) and shortcomings (non-random sampling design) of this scheme. The major operating biases were temporal (seasonal and diurnal bias) and spatial bias (same area).

The main objective was to assess the severity with which the operating biases influence the accuracy of abundance estimates by using the simulation package WiSP. The simulation incorporated individual, temporal and behavioural heterogeneity. Accurate abundance estimates have high statistical power and can determine population trends, which is the ultimate goal of introducing the scheme. To quantify accuracy the following parameters were used for the data analysis: variance, bias, root mean squared error, coefficient of variation and percent relative bias. Different scenarios with varying population sizes and capture probabilities (different behavioural modes) were carried out. There was a threshold value (0.3) for the mean capture probability of unmarked animals („trap happy scenario“) which when surpassed yielded a good estimation process for different population sizes even with increased modeled heterogeneity. Lower capture probabilities (unmarked) resulted in very inaccurate estimates.

Recommendations to reduce operating bias include using GPS loggers to account for effort, extending the whale-watching season to increase the sampling occasions and offering day trips to increase spatial coverage and decrease

diurnal bias. Dedicated research might be necessary to cover offshore areas and winter months. Applied as a network and as a long-term project this scheme could potentially collect valuable data.



## D20

### PHOTOGRAPHIC EVIDENCE FOR MOVEMENTS OF SUMMER RESIDENT HUMPBACK WHALES (*MEGAPTERA NOVAEANGLIAE*) IN ICELAND

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The humpback whale (*Megaptera novaeangliae*) is a medium sized baleen whale, which occurs within the cold waters of the North Atlantic. The productive waters around Iceland provide an important habitat for this species, which is regularly observed from April to August each summer. Among mysticetes humpback whales are notable migrants, although details of migration patterns are poorly known. *M. novaeangliae* were studied using photo-identification during whale-watching operations from 2001-2009 in Faxaflói Bay (FB) and Skjálfandi Bay (SB) in Iceland. In 2009 two images were suitably matched, suggesting that they were of the same individual (MN110\_SB)/Snake skin\_FB). These images were compared using dorsal fin matching software FinEx and FinMatch developed for the “Europhlukes” project. FinEx was used to extract the position and relative morphology of dorsal edge marks occurring along the contour line of the dorsal fin. FinMatch was then used to compare similarity by comparing each contour feature against one another. Europhlukes found that the contours and dorsal edge marks extracted for fins shared a match coefficient of 100 % similarity. These results confirm that individual *M. novaeangliae* around Iceland may conduct highly dynamic movements. In this study alone the individual featured travels approximately half way around the Icelandic coast within a twentyone day period. This represents the first case of an individually recognized Humpback whale traveling from SW to NE in Icelandic waters within a single summer season. This example further emphasizes the importance of long-term research projects to better understand *M. novaeangliae* movements, habitat use and collaboration among research groups on exchanging photo-identification material.

D21

## CATALOGUE OF A BOTTLENOSE DOLPHIN POPULATION RESIDENT IN THE GULF OF CATANIA

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Ketos researchers wanted to update their catalogue of bottlenose dolphins of the Gulf of Catania, a 300 km<sup>2</sup> area in the Ionian Sea. The method of photo-identification was used, a non-invasive technique that allows to identify Delphinidae on natural morphological characteristics to get data on size and distribution of the population. A first catalogue with photos collected from 1997 to 2005 contains 20 individuals identified approaching the manual Würsig&Würsig method to the software FinEx for the recognition. Considering the problems resulting from the software, the photos collected during the surveys conducted from spring to autumn 2008 have been analyzed with the manual Würsig&Würsig and Defran methods. At 4136 minutes of observation vessel, 179 minutes were marked by sightings of bottlenose dolphin and 608 photos were taken, 364 of which were used for comparisons. The new catalogue contains 27 photo-identified individuals, 3% of the photos not included consists of good quality shots belonging to identified individuals with less than 4 reference photos, according to the method of Würsig&Jefferson. The photographic efficiency of surveys calculated by the Defran&Hansen method is 1.004, an excellent value that increased last year due to the pass from a photographic methodology based on films to one on both negative and digital. The results from the estimated population with different methods are discordant, this means that the population has not been all identified, as evidenced by the high slope of the discovery curve of new samples obtained with the software Socprog. The study demonstrated the permanence of the population in the Gulf, sighting in 2008 the same individuals identified in the first years of research, and has underlined the coincidence of the leaders with the dolphins with more reference photos. The Northern area of the Gulf has finally revealed the presence of specimens never seen before, inviting to new investigations.





D22

**FIRST ID - CATALOGUE OF NORTHERN BOTTLENOSE WHALES  
(*HYPEROODON AMPULLATUS*) OFF PICO ISLAND, AZORES**

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Northern bottlenose whale (*Hyperoodon ampullatus*) is a deep-diving species belonging to the family Ziphiidae. This species can reach up to 9.5 meters in length and is distributed in the North Atlantic ocean, preferring cold waters. Very little is known about this species, except for a well-studied population appearing at the Gully, an underwater canyon off Nova Scotia, Canada. This population has been monitored since 1988 and consists of about 160 identified individuals. To date, nothing has been published about bottlenose whales sighted around the Azorean archipelago.

Here we present the first catalogue of the individuals off Pico Island based on photo-ID techniques. We had 36 boat-based group encounters from 2003 to 2009 (except in 2004) occurring during July and August. The group size varied between 3 and 26 individuals. A total of 14,460 pictures were taken, of which 5,784 were chosen for analyses and only pictures with  $Q > 3$  were selected for the catalogue. Based on several identification markings on the dorsal fin and body such as notches, spots, scratches and coloration patterns, we were able to identify 135 individuals (61 both sides + 74 left side). One resighting was found between years: NA\_Hamp\_003 has been seen first in 2003 and later in 2008. The individuals spend between 1 and 13 days in the area. We believe the number of animals that appear in the study area could be significantly higher since there are 53 animals identified only on the right side, and many individuals were impossible to photograph during the surveys. In the future, matching with other catalogues is necessary in order to know more about their migratory behaviour.



D23

**PHOTO-IDENTIFICATION OF RISSO'S DOLPHIN (*GRAMPUS GRISEUS*) IN THE WATERS OF THE ISLAND OF ISCHIA, TYRRHENIAN SEA, ITALY**

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In the Mediterranean Sea, very little is known about the behaviour, social and population structure, and movements of the Risso's dolphin (*Grampus griseus*), a species listed in the IUCN Red List as Data Deficient. A small population of Risso's dolphin has been monitored in the waters off the island of Ischia since 1996. The animals were sighted on a seasonal basis, mostly in the summer, over a highly productive marine area characterized by a complex canyon system. We conducted surveys in the June-October period, 1998-2008. Risso's dolphins were sighted on 23 occasions and were occasionally seen in association with striped dolphin (*Stenella coeruleoalba*) and sperm whale (*Physeter macrocephalus*). Photo-identification technique was applied in order to investigate some population parameters. The analysis of good quality digital pictures taken in the 2004-2008 phase and the review of the videos taken in the previous years resulted in a photo-id catalogue holding 39 individuals. Many of these were re-sighted in 2 or more seasons (with 10 animals located for 4 years and one for 9 years), indicating a high level of year-round site fidelity for at least part of the population. Mean group size was 11.9 (range: 1-40), with an increasing trend over the years. The age classes were defined from the degree of scarring on the body of the dolphins (adults=30; subadults=9) and the sex identified examining underwater footages (male=1; females=10; unsexed=28). An adult accompanying a calf was considered a female. We found that some individuals form stable bonds over the years. The social structure appeared to be stratified based sex classes, with strong associations between adult females. These preliminary findings seem to suggest a specific model of social structure in this small population; however, further studies are necessary in order to comprehend better the social structure of Risso's dolphin in the [...].



D24

## EXPERIMENTATION OF PHOTO-IDENTIFICATION TECHNIQUE ON STRIPED DOLPHIN (*STENELLA COERULEOALBA*, MEYEN 1833) IN LIGURIAN SEA

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Photo-Identification technique has been successfully used with different species of Cetaceans, leading to results concerning abundance estimation, spatial distribution, spatial behaviour and social relationships. The aim of this study is to apply this technique on the striped dolphin and to evaluate its suitability. Data were collected between 2001 and 2009 in Ligurian Sea and 163 sightings were carried out both in offshore waters (depth >100 meters), and inshore ones (< 100 meters). About 4000 photographs were collected and 128 individuals were included in a photographic catalogue. Four criteria were used for the identification: dorsal fin notches, patches and scrapes (usually on the back side of the animal), colour pattern and other marks (injuries, scars, malformations, etc.). Five individuals were sighted twice and only one was sighted three times. Each criterion (except colour pattern) led to recaptures. The largest period between sightings of the same individual is 281 days, while the shortest is 12. Calculating the encounter rate (ER), sighting probability resulted higher in open water (ER = 0.0524) than in coastal waters (ER = 0.0018), according to the pelagic habits of this species. Furthermore, a difference in group size between inshore and offshore sightings was observed and analyzed through an ANOVA test. The results show a statistically significant difference ( $p < 0.01$ ): inshore groups are smaller than deeper water ones. Furthermore, results confirm the spatial separation existing between habitat of *S. coeruleoalba* and *T. truncatus*. As well as increasing knowledge of Cetaceans into the Pelagos Sanctuary, these results may contribute to better understand and to evaluate the status of striped dolphin in Ligurian sea.



**D25**

## **ESTIMATES OF ABUNDANCE OF HARBOUR PORPOISES IN DUTCH WATERS**

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Over the last decade there has been an increase in the occurrence of harbour porpoises in Dutch waters. An increase in strandings with a high percentage of by-caught animals has also been observed, in particular from autumn to early spring. The objective of this project was to conduct aerial surveys in the Dutch North Sea to obtain density and distribution data and to investigate the potential impact of by-catch on this local population. When considering by-catch limits, the ASCOBANS agreement (used in the North Sea and adjacent waters) proposes two objectives of 1 % (precautionary) and 1.7 % (unacceptable) annual anthropogenic removal. Surveys were conducted following standard line transect distance sampling methodology on track lines providing a representative coverage of the study area which ranged from the Dutch coast to about 120 km offshore, thus covering approximately half of the Dutch EEZ (exclusive economic zone). The "early spring" survey (3rd February 2009 to 3rd April 2009) resulted in a density of 1.12 animals per km<sup>2</sup>, corresponding to an estimate of harbour porpoise abundance for this study area of 36 825 animals (95% C.I. 19090 – 68130, 0.33 C.V.). Application of this abundance estimate to five different scenarios for acceptable anthropogenic removal resulted in a range of 56 to 626 porpoises per year. These results are discussed in the context of the minimum by-catch estimates available for Dutch waters.



D26

## COMBINED ACOUSTIC AND VISUAL SURVEY FOR SPERM AND BEAKED WHALES IN OFF-SHORE WATERS AROUND THE CANARY ISLANDS

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Sperm whales (*Physeter macrocephalus*) and Cuvier's and Blainville's beaked whales (*Ziphius cavirostris* and *Mesoplodon densirostris*) are present year-round in the Canary Islands, but little is known about their off-shore abundance and distribution. Here we present results of an acoustic and visual line-transect survey carried out in autumn 2009 for these species. A randomized set of lines summing 1700nm was designed with the software Distance to cover the slope and 30 km off-shore from it. This included the abyssal plain and two sets of seamounts currently proposed for protection as Nature 2000 areas. Cetaceans were detected acoustically using a two-element hydrophone array towed at 15 km/h at some 12m depth. Acoustic data were sampled at 96 kHz and high-pass filtered to reduce engine and water flow noise. Acoustic signals were monitored in real-time using Rainbow Click detection software. A simultaneous visual survey was conducted from two independent platforms. Effective visual survey was defined as that performed in good visibility and <4 sea state, rendering a lower visual than acoustic coverage. Sightings and acoustic detections of at least ten cetacean species showed a non-random distribution. Sperm whales were the most detected whale due to the large acoustic range of their powerful clicks, rendering enough detections to estimate the population abundance of this species using Distance protocols. The results of the survey have implications for conservation: i) some hot-spots of sperm whale detections coincide with fast-ferry lines and sperm whales are the most abundant species recorded in strandings with signs of boat collision in the Archipelago; ii) beaked whale detections were high in the seamount Concepcion, some 200nm NE from Lanzarote, suggesting that the existing moratorium on the use of military sonar closer than 50nm from the Canary Islands should be extended to include a similar region around the Concepcion seamount.



D27

**PRELIMINARY RESULTS OF THE FIRST CENSUS OF SPERM WHALE  
(*PHYSETER MACROCEPHALUS*) IN THE CANARY ARCHIPELAGO**

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The limited information existing about the sperm whale (*Physeter macrocephalus*) in the Canary Islands, located in the lower North Atlantic, contrasts with other mid-Atlantic archipelagos, such as the Azores or Madeira. One of the principal threats of this species in the area is the collision with high speed vessels. We present preliminary results on the frequency and distribution of this species in the Canary Islands. From November 2008 to October 2009, the Society for the Study of Cetaceans in the Canary Archipelago (SECAC) carried out a census of sperm whale in the meridian islands of this archipelago as part of a long-term project that includes photo-ID, diet, acoustics, genetics and habitat use. The area was surveyed by visual and acoustic census in lineal transects from the coast to 20 nautical miles offshore, investing an effort of 703.5 hours and covering 3,310 nautical miles. Sperm whales were regularly present in the study area. We had 25 encounters with groups of sperm whales during these surveys. To date, 80 animals have been photo-identified, with recaptures of specimens of the same group in consecutive days in April and May of 2009. The acoustic detection of a solitary adult male permitted the recording of a 73 minute dive, one of the longest registered for this species.



**D28**

**OPTIMISING SURVEY DESIGN FOR SCANDINAVIAN HARBOUR SEALS:  
POPULATION TREND AS AN ECOLOGICAL QUALITY ELEMENT**

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Marine mammal surveys are often affected by high variation and little statistical power to detect changes in abundance over time. This is due to the difficult access to the animals and the variable time available to an observer. To optimize the statistical power for detecting changes in abundance the aim is to minimise sources of within- and among-year variance within a reasonable timeframe. Thirty years of monitoring data from seven distinct sub-populations of harbour seals (*Phoca vitulina*) in southern Scandinavia were used to investigate the relative contribution of factors affecting the power to detect changes in abundance trends. The power to detect changes in abundance is typically doubled under the conditions tested when carrying out annual surveys as compared with every second year. The power is also substantially increased when carrying out replicate surveys during the annual moulting period. The gain in power increases steeply up to three annual replicates, but then levels off. Using the mean of the two highest counts of three annually repeated counts, further increases the power, while the point estimate for the rate of change remains the same as for the mean of all surveys. We recommend surveying harbour seal haul-out sites every year during the moult with at least three replicate surveys per year. This will give robust data for analyses of abundance trends, and will help managing populations, e.g. identification of potential influences of diseases and anthropogenic activities.



**D29**

cancelled



**D30**

## **THE EARLIEST ARCHEOLOGICAL FINDINGS OF MARINE MAMMALS IN THE NORTHERN BLACK SEA REGION**

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Archeological data on marine mammals of the Northern Black Sea region are very scarce. The more important it is to review all of them to get the background for further studies of the marine mammals origin, ancient geographic distribution and history of interaction with humans.

The earliest cetacean bone was found in Neolithic stratum in Alekseevka-I settlement, Kerch Peninsula (Ukraine). The bone was dated approximately as the 45th century BC (Matskevov, 1977). Dolphin vertebrae were found in Matveevka settlements of the Catacomb culture, to the north of Nikolaev (Ukraine), and are dated approximately as the 15th century BC. Similar findings were made in Livenzovka-I settlement in the Don estuary (Russia): cetacean vertebrae of the end of the 2nd millennium BC (Zhuravlyov, 1991). Interestingly, all the settlements are inland. Another remarkable archeological finding was made in 2005 in Gleyki-II settlement in the east of Kerch Peninsula near the Fonar Cape. It contained 12 vertebrae of harbour porpoise (*Phocoena phocoena*), that is about 3% of all maritime fauna remnants found in the settlement of Gleyki-II (Lyashenko, 2005). It is interesting that a fragment of fossilized marine mammal rib found in this settlement was used as a polisher. Gleyki-II settlement is dated as early 3rd millennium BC (Kisly, 2005). Porpoise vertebrae were found in Kamenka settlement of Kamenka culture. Kamenka culture is dated as 18th -15th centuries BC (Kisly, 2000). Also, a few vertebrae of harbour porpoise (*Phocoena phocoena*) were found in early Bronze Age stratum in Generalskoe-Zapadnoe settlement, Kerch Peninsula (Danovsky, 2007).





D31

## FIRST SURVEY OF CETACEANS IN THE SOUTH OF PORTUGAL

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The south of Portugal is one of the most popular areas to observe cetaceans in the country, although until now no studies have ever been carried out in the area. The present work will give a first approach about the existence species in the area. Until today, the only existing information was based on technical reports from stranding records, indicating the possible presence of 11 cetacean species. A considerably large industry of whale watching has been set up in this area, with more than 11 companies and 17 boats, for this reason, during the year 2009, a survey was carried out using these platforms of opportunity. Between February 14th and October 26th 2009, the effort was 9601 km in 233 different trips, corresponding to approximately 412 hours, carried out from one vessel. The spatial distribution of the animals was then analysed, and showed the presence of 6 different species of cetaceans. A total of 228 sightings were registered, in which the most frequent specie was the Short-beaked Common dolphin (*Delphinus delphis*), with 182, corresponding to an encounter rate (ER) of 1.9 sightings/100km. The Harbour porpoise (*Phocoena phocoena*) occupied the second place with 22 sightings, corresponding an ER of 0.2 sighting/100km and the Atlantic Bottlenose dolphin (*Tursiops truncatus*), with 20 (ER of 0.2 sighting/100km), was the third most frequent specie. The rest of the species seen occasionally, were the Risso's dolphin (*Grampus griseus*) with 2 sightings, Minke whale (*Balaenoptera acutorostrata*) and Humpback whale (*Megaptera novaeangliae*) had both 1 sighting. Most of the animals were found near the coast line up to 5 nautical miles offshore. These results strongly suggest that the South coast of Portugal is an important area for different species of cetaceans. Photo-identification work is in process in the area to look at residence patterns of the different species.



E01

**ECOTYPES OF KILLER WHALES FROM THE NORTHWESTERN PACIFIC BASED ON THE RESULTS OF PHOTO-IDENTIFICATION AND ACOUSTIC STUDY****Tatiana Shulezhko (1), Evgeny Mamaev (2), Petr Permyakov (3), Vladimir Burkanov (1)**

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Proper conservation management of species requires knowledge of its population structure. It is known that fish-eating and mammal-eating killer whales belong to different populations genetically isolated from each other. Earlier for killer whales from the waters of the Commander Islands we showed that identification of ecological types is possible using non-invasive acoustic and photo-identification methods. Here we present the results of photo-identification and acoustic study of ecotypes of killer whales inhabiting Northwestern Pacific. Killer whale photos and acoustics records were collected in 2001-2009 during vessel surveys and onshore observations in the waters of Eastern Kamchatka, Sea of Okhotsk, Commander and Kuril Islands. Total 10603 photos and 799 minutes of killer whale vocalization records were obtained and 1245 discrete calls were analyzed. After photo-identification analysis 310 killer whales were identified. According to the phenotype features 276 of the animals were classified to a fish-eating and 34 to mammal-eating types. Acoustic analysis confirmed these results: fish-eating killer whales had high vocal activity and wide variety of sounds. Some of the discrete calls recorded from Kamchatka, Commander and Kuril groups of fish-eating killer whales were classified into the same type that means that these groups are related to each other and belong to one population. Mammal-eating killer whales vocalized very rare and a few obtained calls were different from discrete calls of fish-eating whales. In general fish-eating killer whales were present almost everywhere in the study area, while mammal-eating killer whales were found only in a few specific locations: for example, near pinniped rookeries in Commander and Kuril Islands. Whale behavioral data confirm our conclusions, the killer whales classified to fish-eating type were

observed feeding on salmon, while mammal-eating killer whales were hunting on northern fur seals and Steller sea lions.



**E02**

**VARIATION IN EXTERNAL MORPHOLOGY OF RESIDENT BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN BAHIA-A SAN ANTONIO, PATAGONIA, ARGENTINA**

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Two geographic variations of bottlenose dolphins were described in Argentina (Bastida & Rodriguez, 2003); bottlenose dolphins characterized by their triangular dorsal fin shape (coast of the province of Buenos Aires), and bottlenose dolphins characterized by their falcate dorsal fin shape (coast of the province of Chubut). It was stated that their clear difference would indicate that both geographic forms are isolated' (Bastida & Rodriguez, 2003 p.137).

A photo-identification study carried out in Bahía San Antonio (BSA), North Patagonia Argentina, showed a similar variation in external morphology among year-round resident bottlenose dolphins. Out of the 15 bottlenose dolphins considered year-round resident in the bay (Vermeulen & Cammareri, 2009), three are clearly distinguishable by a more falcate dorsal fin, a darker coloration and a notably shorter beak. These individuals, with one associated calf, were first identified in September 2008 and could be re-identified in the study area up to 13 days over all the different seasons. On all occasions, they were re-identified in close association with each other and on 10 occasions in close association with triangular dorsal fin shaped bottlenose dolphins. Behavioural observations made during these associations indicated that these mixed dolphin groups were 18% of their time feeding, 18% socialising, 17% slowly travelling and resting, 16% travelling in medium and fast speed and 7% milling (n=380 min). Although both forms show variations in external morphology, the extent to which this phenotypic variation is genetically correlated remains unknown. A clear insight on the differentiation between these regional forms might have important conservation implications for this species in Argentina.



**E03**

**KILLER WHALE SADDLE PATCH PATTERN VARIATION AROUND THE WORLD**

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Killer whales are distributed all over the world from arctic waters through tropics down to Antarctica. Due to the wide distribution and specializing on different prey species, populations have developed different lifestyles and also different ecotypes have evolved. Populations may have become so different from each others, that they are not interacting anymore, even they have partly overlapping living areas. Killer whales have a grey saddle shape pattern behind the dorsal fin. In this poster we will present the color pattern variation from different populations and describe killer whale ecotypes. In some populations there is not much variation in saddle patch pattern, while in some populations there are more variables.



**E04**

cancelled



E05

## BRAIN CIRCUITRY AND ECOPHYSIOLOGICAL ADAPTATIONS OF TOOTHED WHALES

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Toothed whales (odontocetes) are a challenging paradigm for neurobiology and evolutionary biology. Both the size and structure of their brain seem to reflect profound adaptations to the physical requirements of their aquatic habitat. Thus odontocetes echolocate, navigate, hunt, and communicate via ultrasound and sound signals, respectively, which they generate in peculiar structures of their nasal complex. Whereas most components of their auditory system are strongly hypertrophied in absolute and relative terms in comparison with terrestrial mammals, the olfactory system and the vestibular system are strongly reduced. The same is true for the archicortex (hippocampus). The brain as a whole is very large due to a considerable amount of neocortex, and the ventral pons and cerebellum are also well developed, particularly the paraflocculus. In the brainstem, some premotor and motor nuclei also show exceptional size with respect to the situation in other large-brained mammals. Thus the elliptic nucleus, the facial nucleus, and the inferior olivary nuclear complex (particularly the medial accessory subnucleus) are impressive.

Taking into account functional correlations between these prominent structures, it becomes evident that many of them have evolved together as part of a specific brain circuitry which includes loop connections dedicated to acoustically-guided locomotion and vocalization. Whereas the latter needs complicated and precise efferent innervation of the blowhole muscles via fast and direct projections (pyramidal tract) and the facial nucleus, the smooth but strong mass movements of the body in propulsion are the result of diffuse projections of the reticular formation into the spinal cord. Interesting accordances and differences exist with other large-brained mammalian species as the elephant and the human. Again, we can find here correlations between brain structure, brain composition, and ecophysiological adaptations.



E06

**NICHE COMPETITION BETWEEN COMMON DOLPHIN (*DELPHINUS DELPHIS*) AND STRIPED DOLPHIN (*STENELLA COERULEOALBA*) WITHIN THE BAY OF BISCAY: AN ECOLOGICAL NICHE MODELLING APPROACH**

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By understanding the distribution of key species, management and legislation demands can be met and implemented. Ecological niche modelling (ENM) has been found to be a useful approach when only limited data on species' distribution is available. A total of 362 and 304 sightings of the Common dolphin (*Delphinus delphis*) and the Striped dolphin (*Stenella coeruleoalba*), respectively, were recorded from platforms of opportunity surveys (ferries) across the Bay of Biscay. However modelling, using a maximum entropy (MAXENT) approach, revealed clear temporal differentiation for *D.delphis* distribution, with changes in occurrence patterns observed between the northern continental shelf waters (2002-2004) and the southern abyssal plane (2006-2008) - explained as a response to fishing pressure and prey depletion in the northern region. This observed southerly shift was thought to affect not only the Common dolphin population but also the ecological/trophic structure of the Biscay area. A posteriori analysis showed a negative correlation between sightings per unit of effort and habitat distributions predicted for Striped and Common dolphin (Kruskal-Wallis:  $p < 0.01$ ). *S. coeruleoalba* presence was observed to be higher in the southern, deeper waters during the 2002-2004 period, when Common dolphins were located in northern shelf areas. With the arrival of Common dolphins to southern waters by 2006, the number of striped dolphin sightings significantly decreased within the region (Kruskal-Wallis:  $p < 0.01$ ). It is hypothesised that potential interspecific competition, explained by the presence of overlapping diets and similar habitat requirements, would allow *D. delphis* to take a predominant role in defining the distribution of *S.coeruleoalba*, which has been displaced to other regions since 2006. Overall, ecological niche modelling has proven to be an important tool for the conservation and management of cetaceans within the Bay of Biscay, allowing further understanding of habitat use and allowing the detection of high density areas warranting further conservation priority.

E07

## HABITAT PARTITIONING BY CETACEANS IN A MULTI-SPECIES ECOSYSTEM AROUND THE OCEANIC ISLAND OF LA GOMERA (CANARY ISLANDS)

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Off the coast of La Gomera (Canary Islands), a multitude of cetacean species can be sighted. The presence and distribution as well as the combined occurrence of different species were monitored from regular whale watching vessels between 1995 until 2007. 5741 cetacean sightings of 21 species were made. For the five most abundant species - bottlenose dolphins (*Tursiops truncatus*), short-finned pilot whales, (*Globicephala macrorhynchus*), Atlantic spotted dolphins, (*Stenella frontalis*), common dolphin (*Delphinus delphis*) and rough-toothed dolphins (*Steno bredanensis*) - physical characteristics of the sighting locations (distance to coast, depth and slope) were analysed and compared. It could be shown that each species prefers a specific set of habitat characteristics, while there is still a substantial overlap in distribution. Thus, off this subtropical oceanic island, where niche selection appears especially difficult because of relative homogeneity of the environment, it appears that a species' habitat selection can be driven by a combination of physical characteristics and the presence/absence of other cetacean species.

This was underlined by the fact that none of the most abundant species occurred exclusively alone. Some of the multi-species aggregations were observed regularly, e.g. bottlenose dolphins were seen together with pilot whales during a large proportion of total sightings. On occasion the animals behaved like one group rather than an aggregation of two species. Other species, on the contrary, mostly, if not generally avoided any other cetaceans, i.e. the propensity of a species to mingle with another was selective. Some of the underlying reasons for this selectivity are discussed.



E08

## SYMPATRIC OCCURRENCE OF COMMON AND BOTTLENOSE DOLPHINS IN TWO AREAS OFF THE PORTUGUESE COAST: FUTURE RESEARCH AND CONSERVATION

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In two coastal regions off the West Portuguese shore (Peniche and Sesimbra) several species of cetaceans occur in sympatry. This is the result of 77 boat based surveys that were conducted in the two sites between December 2004 and October 2009. In these surveys common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*), striped dolphins (*Stenella coeruleoalba*), porpoises (*Phocoena phocoena*) and minke whales (*Balaenoptera acutorostrata*) were sighted. In both areas, common dolphins (55% in Peniche and 60% in Sesimbra) accounted for the majority of encounters followed by bottlenose dolphins (27.5% in Peniche and 28% in Sesimbra). Mixed groups of the two species were never sighted but they generally occur at similar water depths and distances to shore. To coexist this two species must differ to some degree in their ecological requirements in order to avoid interspecific competition. Use of different foraging tactics and exploration of diverse prey items most probably explain this sympatric occurrence. The two study sites are in the vicinity of marine protected areas and also encompass important oceanographic features which may allow greater prey richness and some habitat diversity than in other locations of the Portuguese coast. Future research will include studies on resource partitioning and habitat use by common and bottlenose dolphins in relation to social and oceanographic characteristics. The need of special conservation measures will also be addressed.





E09

**ECOLOGY AND CONSERVATION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN SLOVENIAN AND ADJACENT WATERS (NORTH ADRIATIC)**

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A local population of bottlenose dolphins in Slovenian and adjacent waters (north Adriatic) was studied between 2002 and 2008. Given the complete lack of previous research into the ecology of any cetaceans in the area, an attempt was made to provide information on bottlenose dolphin distribution, site fidelity, abundance, population structure and conservation issues. Standardized boat-based surveys and land-based surveys were carried out, together with standard photo-identification procedures. GIS mapping was used for the analysis of spatial distribution. A total of 120 sightings were recorded and 101 well-marked dolphins of both sexes photo-identified. Resighting rates within and between years showed a high rate of site fidelity for some individuals, while many were seen rarely. Frequent sightings of mothers-offspring pairs (including newborns) indicated breeding and nursing in the study area. Observations of feeding activities, both surface feeding and interactions with trawlers, suggest that particular sub-areas are important for feeding. Some of the prey species have been identified. Interactions with fisheries were frequent and dolphin distribution overlapped with fishing grounds. Annual abundance estimates showed that approximately 70 dolphins use the area regularly. Density estimates of 0.069 dolphins/km<sup>2</sup> seem to be good baseline information for the area. Interestingly, photo-ID comparisons between this catalogue and a catalogue of another local population studied only about 150 km away did not yield a single match. This provides useful insights into the population structure of bottlenose dolphins in the north Adriatic and has conservation implications, as the two local populations should be regarded as two units to conserve. This study provides the first dolphin abundance estimates for this area and documents the 2nd known and studied local population of bottlenose dolphins in the Adriatic. It is expected to contribute to conservation, e.g. through the National Cetacean Conservation Plan, resulting from this work and currently being drafted.



E10

**STRANGE ABSENCE OF THE KILLER WHALES (*ORCINUS ORCA*) DURING THE SUMMER 2009 IN THE STRAIT OF GIBRALTAR (SPAIN)**

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In the Strait of Gibraltar we can observe up to seven species of cetaceans, among which there are two half-residents, being one of them the killer whale. Three families of killer whales come to the area to feed on the bluefin tuna (*Thunnus thynnus*) from July until the middle of September, to take advantage of the captures of the longline fisheries located opposite to Tanger. In the season 2007 the total population was censused around 40 individuals. Analyzing the data taken between the years 2003 and 2009 from opportunistic platforms of whale watching, we observed a continuous fall of the sightings from 2006, when the encounter rate (number of sightings/total trips) was 0.18. During this summer the absence of the orcas had been even more marked, reaching an encounter rate of 0.02 in 2009. To this situation, we have to add the lack of the male and one adult female from a group of 12 individuals approximately, that reappeared in October including a newborn in the group. This fall could be related with the decrease of the populations of bluefin tuna of the Mediterranean Sea and the Eastern Atlantic Ocean. Due to the descent of the fisheries, the orcas have to look for other strategies. In the same way, the whale watching vessels loose the point of reference of the fishing boats, so the search and finding of the killer whales is more complicated. In spite of the bibliography that connected the population dynamics of the orcas with the decrease of the bluefin tuna stock of the Strait of Gibraltar, we can't rule out the influence of other factors, like changes in their strategy owing to variations in their habitat related with climate change or the opening in 2007 of the Tanger Med harbour, located in the Moroccan coast.



E11

## KILLER WHALES IN THE CANARY ISLANDS

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A group of 16 killer whales (*Orcinus orca*) was sighted in the waters of the Canary Island; this species is uncommon in this Archipelago. The sighting took place in June 2009 in the waters of Lanzarote Island during 7 hours. Their dorsal fins were photographed in order to identify the individuals and compare them with the killer whales of the North Atlantic populations, and especially with the individuals of the Strait of Gibraltar. Sixteen individuals were identified, of which 2 were adult males, 8 adult females, 2 juveniles and 3 calves. No matches were found either the catalogues of the Strait of Gibraltar and Algarve's one (South of Portugal). In the Strait of Gibraltar the killer whales use the endurance-exhausting technique to hunt bluefin tuna, where they chase the tuna during roughly 30 minutes, until the tuna gets tired enough so they can catch it. The same behaviour was observed during the sighting in the Canary Island, so the tracking was analyzed in order to compare it with the tracking observed of the Strait of Gibraltar. The killer whales of the Canary Islands performed the same behaviour as the one described in the Strait of Gibraltar. Further genetic and morphological analyses have to be carried out, but it seems like they belong to the same population.



**E12**

**PUPPING AND MOULTING PHENOLOGY OF THE HARBOUR SEAL (*PHOCA VITULINA VITULINA*) IN SOUTHWEST IRELAND**

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The pupping season in the harbour seal varies widely across its geographical range. The timing of the annual moult also varies with location. Studies on the phenology of harbour seal pupping and moult have been carried out in the Atlantic and Pacific, however there has been no research into either process in the Republic of Ireland, at the southern edge of the species range in the NE Atlantic. Population estimates of harbour seals are derived by counts during the moulting and breeding seasons. In the absence of information on the timing of pupping and moulting planning the optimal timing of such surveys is impossible. Furthermore, changes in pupping and moult phenology may reflect changes in resource availability or competition, or demographic changes. The phenology of these two events was investigated in southwest Ireland. Pupping began in early July and peaked in late July, approximately 40-65 days later than in other parts of the species range. The timing of the moult period was also different to other parts of the species range. It highlights the importance of identifying the timing of significant events in seals annual cycles with implications for the planning of surveys to accurately determine estimates of population size.



E13

## CONTRIBUTION OF MICROBIOLOGICAL MONITORING TO CONSERVATION OF WILD POPULATIONS OF MARINE MAMMALS

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Microbiological investigations of wild populations of marine mammals help not only to reveal the pathogenic microorganisms circulating in the given area, but also to define population health. Microorganisms, as part of an ecosystem, can serve as indicators of environmental health. The structure of microbial communities present in an animal directly depends on its physiological condition, hence, can serve as an indicator of the health of the individual and population as a whole.

A microbiological study was carried out on wild Steller sea lion pups and captive Black Sea bottlenose dolphins, belugas, adult Steller sea lions, walruses, Baltic ringed seals, and grey seals from 1999 to 2009. We also studied changes in microflora in some species of marine mammals during adaptation to captivity. Smears were taken from the upper respiratory tract of cetaceans and from oral and nasal cavities, conjunctiva, genitals, and anus of pinnipeds. Blood samples were taken for examination of physiological condition of animals. Water samples were taken from pools in the case of captive animals and from the sea near the haulout in the case of sea lion pups.

The abundance and species ratio of bacterial associations in marine mammals differed considerably in wild and captive animals. The effects of the physiological condition and degree of adaptation to captivity of the study animals are described, also the effect of environmental health. Possible causative agents of infectious diseases of marine mammals have been identified.

Results of our investigations can be used for studying the condition of wild populations of different species of marine mammals and will help to establish the possible reasons for population declines.



F01

**HUMPBACK WHALES FEED ON BIGHT-BALLS FORMED BY BIRD FEEDING FLOCKS****Ivan Fedutin (1), Olga Filatova (1), Alexandr Burdin (2), Erich Hoyt (3)**

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Marine birds often gather into mixed-species flocks to feed on fish schools. Birds participating in the flocks are assigned to four functional groups: „catalysts“ (kittiwakes) are highly visible birds that other birds watch and follow to food sources, „divers“ (murre) pursue the fish underwater and drive the school up to the surface, „kleptoparasites“ (jaegers and kittiwakes) steal food from other flock members, and „suppressors“ (shearwaters, cormorants) reduce the effective prey availability by driving down or reducing the prey concentrations. Bird flocks often associate with feeding humpback whales, and it is commonly accepted that the whales perform as „divers“ by driving up the prey and concentrating it near the surface. We observed associations of humpback whales and bird flocks feeding on sand lance in June-July 2009 in Litke Strait of Karaginsky Gulf, Kamchatka. Our observations suggest that humpback whales acted as „suppressors“ rather than „divers“. Humpback whales were moving directly from one bird feeding flock to another guided by unknown acoustic or visual cues (probably by the appearance or calls of kittiwakes). When approaching the intensively feeding flock, the whale swallowed the major portion of the bait ball, whereupon the birds stopped feeding and the flock dissolved. Our observations show that interactions between whales and marine birds can vary from mutualism to commensalism and parasitism at both sides: in some situations birds benefit from feeding whales, in other cases the opposite is true. More research is necessary to find out what cues do whales use to detect and localize feeding bird flocks.



F02

## IDENTIFICATION OF FIN WHALE FEEDING AREAS IN THE WESTERN LIGURIAN SEA

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Mediterranean fin whales are known to concentrate in high numbers in the Corso-Ligurian Basin, their main summer feeding ground, within the Pelagos Sanctuary for marine mammals. Passive tracking studies conducted from 1995 to 2003 highlighted two different swimming-surfacing patterns, mainly based on the linearity of the tracks, correlated with feeding/foraging and travelling behaviours. In our study the tracks of the research vessel during whale sightings were used as a proxy of fin whale swimming patterns at the surface, with the aim of characterizing and identifying feeding areas. Vessel track data were collected by means of a data-logging system (Logger, Logger 2000) from 1995 to 2005, and appropriate parameters calculated (e.g. boat speed statistics, length and linearity of the track). A total of 46 vessel tracks were included in these analyses and were classified as travelling or feeding/foraging by means of a Cluster Analysis. Moreover feeding/foraging and travelling tracks were geo-referenced using a Geographic Information System (G.I.S., Arcview 3.2). A grid measuring 6.8 x 9.3 km was created and environmental characteristics (depth, slope, and remote sensed data such as SST and Chl-a) associated with the two tracks categories. Feeding/foraging tracks were found significantly associated with lower surface temperature and higher chlorophyll concentrations than travelling tracks. This was consistent with the hypothesis that foraging whales select high primary productivity areas with specific environmental characteristics. These results allow a first characterization of fin whales foraging areas, and may provide new insights to be taken into account in the management of anthropogenic activities known to impact on marine life (e.g. whale watching, ship traffic).



F03

**STABLE ISOTOPE ANALYSIS OF IRISH FIN WHALE TISSUES AND THE EFFECTS OF LIPID EXTRACTION ON  $^{13}\text{C}$  AND  $^{15}\text{N}$  SIGNATURES**

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Despite the annual occurrence of fin whales (*Balaenoptera physalis*) inshore over the Celtic shelf off southern Ireland during autumn and winter, little is known about their diet. Indeed, given the difficulty in obtaining fresh specimens, there have been few studies on the diet of fin whales anywhere by conventional means such as gut content analysis. Stable isotope analysis by remote biopsy darting provides a non-lethal means of acquiring this information from healthy individuals.

Biopsies were taken from adult fin whales (n=12) between November and December 2008 within six nautical miles of the southern coast of Ireland. Four individuals were known from a photo identification catalogue with interannual re-sightings between 2004 and 2008. Skin samples were analysed for  $^{13}\text{C}$  and  $^{15}\text{N}$  stable isotopes. The presence of lipids in biological material is known to alter the true stable isotope signature in tissues, as such, information is presented on  $^{13}\text{C}$  and  $^{15}\text{N}$  stable isotope ratios in fin whale epidermis and blubber pre and post lipid removal. A trophic model based on stable isotope ratios from potential prey items (*Calanus sp.*, *Euphausia sp.*, *Sprattus sprattus* and *Clupea harengus*) sampled in known fin whale feeding grounds and among feeding whales is presented. The relative trophic position of fin whales (as determined by  $^{15}\text{N}$  stable isotope ratios) when in Irish inshore waters is reported. The merits of a multi-tissue approach to stable isotope analysis of baleen whales are also investigated.





F04

**THE KILLER WHALES (*ORCINUS ORCA*) PREDATION EVENTS ON  
NORTHERN FUR SEALS (*CALLORHINUS URSINUS*) NEAR THE  
COMMANDER ISLANDS (RUSSIA)**

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One possible reason for the decline on the population of certain marine mammal species is killer whales predation. The northern fur seals (NFS) population has declined steadily on the Pribilof islands (Northeastern Pacific) and has remained stable on the Commander Islands (Northwestern Pacific) during recent decades. Since the year 2000 we have regularly observed killer whales predation on NFS near Medny Island but, at the same time, the killer whales have never been seen hunting on marine mammals near Bering Island. The observations were conducted on a mutual NFS and Steller sea lion rookeries of Medny Island from June through August 2005-2009, and on Bering Island from July through August 2008-2009 from 6:00 to 23:00. On Medny I. the killer whales predation on NFS has been observed 2-16 times per season (average 8.8, max=16, min=2) at a distance of about 1 km off the NFS rookery. The killer whales grouped in 2-7 individuals. We did not observe killer whales near the rookeries of Bering Island in 2008, but they preyed on NFS twice in 2009. The killer whales group consisted of 1 female with a calf and another medium size killer whale. The group consumed at least 1 fur seal (medium size) on July 7th, 2009 in very shallow water at 0.3 km of the Severo-Zapadnoe NFS rookery. The hunting event lasted 8 minutes. A group of 7 killer whales attacked NFS fourteen times during 182 minutes (average 5.7min, max=15min, min=2min, SD=3.9, n=14) on July 14, 2009 at 1.5-3 km off the Severnoe NFS rookery. The killer whales used identical hunting techniques near both islands. Many other marine mammals were present near or on NFS rookeries, but the killer whales were preying on NFS only.



**F05**

## **KILLER WHALE FEEDING STRATEGIES IN THE GULF OF CADIZ**

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Killer whales have been described in the Gulf of Cadiz associated with bluefin tuna fisheries (trap nets) for at least 2000 years. The tuna trap nets are fixed nets going from the coast to 5km offshore consisting of a labyrinth of nets where the tunas caught all end up in the same chamber. During Spring months the killer whales are known to travel to the Strait of Gibraltar looking for Bluefin tuna on their migration to the Mediterranean Sea. A previous study by Guinet et al. (2007) shown that killer whales used endurance-exhaustion technique to catch tunas between 1 and 1.5m. This study was boat- and land-based to confirm the same technique described and to better understand the association with the trap nets. Boat surveys were carried out in May-June 2007 while the land-based survey was in March-May 2009, from three sites placed above three different trap nets (Barbate, Conil and Zahara de los Atunes). Binoculars with reticules and compass were used to determine the position of the whales at sea. A total of 230 hours of effort were made from land, of which killer whales could be tracked for 15 hours. The four sightings from land were all near the trap net, although, the killer whales were never observed inside the trap nets. Three active pursuits at high speed were observed during the sightings. The same technique was observed where killer whales chased tunas during nearly 30 minutes, at fairly high maintained speed (3.7 m/s), until they would stop and unite to feed on the tuna. The same behaviours were observed from the boat survey where 6 sightings and 18 hours for tracking were made. A land-based survey could be a non-invasive procedure to realize behavioural studies with low cost resources.



**F06**

cancelled



F07

## WHAT MAKES DOLPHINS TURN VEGETARIAN?

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Bottlenose dolphin (*Tursiops sp.*) calves acquire information about foraging strategies from their mothers during the prolonged period of dependence (3-6 years). The necropsies of 4 bottlenose dolphins found dead in Shark Bay and Bunbury, Western Australia, yielded unusual stomach contents. The stomachs of 3 calves (1-7 months) and one recently weaned male (3-4 years), were packed with seagrass (*Posidonia australis* and *Amphibolis antarctica* respectively). None exhibited external injuries, although their body condition was poor. Dolphins are known only to be piscivorous. No literature has documented dolphins actively feeding on seagrass. However, the interaction of dolphins with seagrass is well described, dolphins often inhabit and forage on fish in shallow seagrass beds and have been observed playing with seagrass. The quantity of seagrass and the absence of milk in the stomachs of the calves suggest that their mothers were absent (e.g. death or separation) at the time of seagrass ingestion. We infer that the calves were hungry, and either ingested the easily available seagrass or attempted to catch associated prey and subsequently died from obstruction or starvation. These findings indicate that factors other than predation and poor body condition, namely the separation from the mother, also contribute to the high percentage of calf mortality (44% in Shark Bay). The male with known life history provides a different case as he was recently weaned. Besides seagrass his stomach also contained fine clay-like mud and numerous otoliths. It is unknown why this animal was not able to forage sufficiently either due to a compromised immune system (i.e. lesions, parasites) or premature weaning. These cases provide an interesting insight into the factors that influence survivorship of immature dolphins in terms of foraging and independence.



F08

## FEEDING ECOLOGY AND HABITAT USE OF ODONTOCETE CETACEANS FROM THE NW IBERIAN PENINSULA INFERRED FROM STABLE ISOTOPES

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In the marine environment, stable isotope ratios of carbon ( $^{13}\text{C}/^{12}\text{C}$ ,  $\delta^{13}\text{C}$ ) and nitrogen ( $^{15}\text{N}/^{14}\text{N}$ ,  $\delta^{15}\text{N}$ ) are indicators of the foraging areas and trophic levels of consumers, respectively. Here, we investigated the feeding ecology and habitat use of several odontocete cetaceans from the Northwest Iberian Peninsula (*Delphinus delphis*,  $n=114$ ; *Globicephala melas*,  $n=9$ ; *Phocoena phocoena*,  $n=19$ ; *Tursiops truncatus*,  $n=9$  and *Stenella coeruleoalba*,  $n=21$ ), using analysis of carbon and nitrogen stable isotopes in the muscle of by-caught and stranded individuals. Results were compared with a previous study carried out on the same species in the Bay of Biscay. Striped dolphin exhibited the lowest mean  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values ( $-17.57\pm 0.13$  and  $10.80\pm 0.18$ , respectively), which confirms the oceanic character of this species and its lower trophic level compared to the other species. Common dolphin exhibited mean  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  values which were at an intermediate level ( $-17.01\pm 0.05$  and  $11.68\pm 0.06$ , respectively), and similar to the results found in the Bay of Biscay. In contrast, harbour porpoise, bottlenose dolphin and pilot whale exhibited higher and very similar signatures of  $\delta^{13}\text{C}$  and  $\delta^{15}\text{N}$  (mean values:  $-16.52\pm 0.17$  and  $13.04\pm 0.29$ ;  $-16.48\pm 0.29$  and  $12.64\pm 0.32$ ;  $-16.46\pm 0.16$  and  $12.20\pm 0.20$  respectively). Moreover, bottlenose dolphin and pilot whale exhibited significant lower mean  $\delta^{15}\text{N}$  values in the Iberian Peninsula than in the Bay of Biscay ( $12.64\pm 0.32$  vs  $14.39\pm 0.46$  and  $12.20\pm 0.20$  vs  $13.86\pm 0.29$ ;  $p<0.01$ ). These results for the two largest species illustrate the difference in the prey availability between the two areas. The narrow Iberian Peninsula shelf is characterized by the predominance of *Micromesistius poutassou* and the lack of large prey. An analysis of stable isotopes in the forage species should highlight the differences observed in this study.



F09

## ATLANTIC WHITE-SIDED AND BOTTLENOSE DOLPHINS: THE UNKNOWN FORAGING ECOLOGY IN THE WATERS AROUND IRELAND

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Very little information is available on the diet of bottlenose and Atlantic white-sided dolphins in Irish waters (O'Brien and Berrow, 2005, Rogan et al., 1997). Here, we present additional information from stranded animals. Oesophageal, stomach and intestinal contents of six bottlenose dolphins and nine white sided dolphins were analysed from stranded individuals between 1994 and 2002. While no prey remains were found in two bottlenose dolphins, a total of 194 prey items, representing 27 prey species of both fish (75.9%) and cephalopods (23.6%) were found in the remaining animals. Within the fish category, gadoids (mainly pollock, saithe, and haddock) were the most commonly recorded species (60.5%), followed by horse mackerel, *Trachurus trachurus* (29.0%), conger eel, *Conger conger* (11.2%), flatfish (11.2%), and dogfish *Scyliorhynchus spp.* (10.3%). Within the Cephalopod category, oceanic species (87.5%) (e.g. *Histioteuthis spp.*) were found as the principle prey item in one carcass. Food remains within white-sided dolphins stomachs consisted of 352 prey items of 15 species; 70.5% of the diet consisted of fish, where blue whiting, *Micromesistius poutassou* and silvery pout *Gadiculus argenteus* made up to 68% of the fish, while 29.6% were cephalopods. Bottlenose dolphins in Ireland appear to be generalist predators, however, each animal seems to be specialised on particular prey species. However, white-sided dolphins seemed to be more specialized on oceanic mesopelagic fish species. Further analysis with a larger sample size and fatty acid analyses will be necessary to confirm these results.



F10

**SUMMER FORAGING BEHAVIOUR OF FEMALE SEA OTTERS (*ENHYDRA LUTRIS*) WITH PUPS IN SIMPSON BAY, ALASKA**

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In altricial mammals, the mother's care and attendance are essential for the young to acquire survival skills. Not much is known about mother/pup behaviour in the sea otter population of Simpson Bay, Prince William Sound, Alaska. In this study, water depth and location of feeding females with pups of different ages were recorded. Shallow (0-20 m) and deep (60-80 m) waters were preferred for foraging, over those of intermediate depths. There was no significant difference in foraging water depth relative to pup maturity, but female dive duration changed significantly with the age of the pup likely resulting in increasing surface time for unattended pups. The range of measured dive durations increased with older pups. Dive duration was highly significantly dependent on foraging water depth.



F11

## LONG-TERM VARIATION IN HARBOUR SEAL DIET IN ORKNEY (NE SCOTLAND) AND RELATIONSHIPS WITH FISH ABUNDANCE

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Long time series of dietary data can potentially provide information on how predator diets respond to changing prey abundance, e.g. due to overfishing and/or climate change. The present study examines long-term variation in the summer diet of harbour seals (*Phoca vitulina*) in Orkney (NE Scotland), based on faecal sampling at haulout sites on the island of Eynhallow during 1986-2006. In summer, haulouts are used mainly by harbour seals while grey seals (*Halichoerus grypus*) use the island mainly in autumn and winter. Samples were collected in the summers of 1986-88, 1993-96, 1998, 2000-03 and 2005-06. The main component of the diet in summer is sandeels (*Ammodytidae*, mainly *Ammodytes* spp.). Average sandeel size in the diet increased by around 6 % over the study period while numbers of sandeels in scats declined. Both harbour seal and sandeel abundances have fallen markedly since the mid-1990s but, although dietary trends were statistically significant, harbour seal diet has remained remarkably constant over the study period, suggesting a degree of dietary specialization. Thus harbour seals in Orkney may currently depend on sandeels as their main food source.



F12

## WATER MOVEMENTS FROM STATIONARY FISHES AND THEIR POSSIBLE RELEVANCE TO PREY DETECTION BY MARINE MAMMALS

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Harbour seals and possibly other marine mammals can detect hydrodynamic trails of fishes (Dehnhardt et al., Science 293, 2001, 102-104). This enables them to find prey at a distance at least in the order of tens of meters even in dark or turbid waters. However, little is known about the water currents caused by stationary fishes that do not generate a trail. We used Particle Image Velocimetry (PIV) to quantify the water movements caused by stationary fishes. In PIV the water is seeded with neutrally buoyant particles and illuminated with a laser light sheet. The particles are filmed and their movements are analysed using correlation techniques. Three species were investigated: Eel (*Anguilla anguilla* L: 40-45 cm, W: 108-118 g), Rainbow Trout (*Oncorhynchus mykiss* L: 23cm, W: 127g) and Flounder (*Platichthys flesus* L: 22cm, W: 86g). Fishes were placed in a water tank of 80x35x40cm (LxWxH) in sea water (7 PSU, 21 °C) and allowed to rest for half an hour. A laser light sheet was generated with a 500 mW solid state laser. Particles (Pliolite, mean diameter 45 µm) were filmed with a Phantom V12 high speed camera and analysed with DaVis software (LaVision, Göttingen). Flounders usually rested at the bottom completely motionless except for eye and breathing movements. Flow measurements revealed a strong breathing current from the upper gill slit (approx. 1cm/s at a distance of 10cm). Eels rested motionless for extended periods of time. They produced a breathing current that was usually weaker and was directed downwards to the ground. The trout, if not resting on the ground, performed small corrective fin movements causing a water flow and produced a breathing current in the horizontal plane. We conclude that water movements caused by stationary fishes can be of high significance for prey detection by marine mammals.





F13

## FEEDING STRATEGIES OF HARBOUR SEALS (*PHOCA VITULINA*) HUNTING SCHOOLING FISH

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There are only a few studies describing hunting behaviour of pinnipeds, and little was known about hunting strategies and the sensory systems involved. We had the opportunity to systematically observe harbour seals hunting on a school of herring in the seals' seawater enclosure. Observations were made day and night during the whole period in which the seals preyed upon the fishes. Several hours of video recordings of daytime hunting behaviour from above the water surface were obtained. The results indicate that the seals always adopted the same relative body position towards the fishes: they swam and attacked upside-down when approaching from the water surface, which they did mostly and which has never been described as a hunting tactic for pinnipeds before; they swam upright when approaching from below, a behaviour which was already described and which might have the adaptive value of silhouetting the prey against the bright water surface. This relative position appears to indicate that the seals used their visual system keeping the school inside their large dorsal visual field. Interestingly, the seals divided the school mostly asymmetrically resulting in a smaller and a bigger school and successful prey catch was only observed when a small group of or a single herring had been separated. Thus the seals probably avoided the confusion effect of the school as a whole. The seals were occasionally observed to use suction feeding in the final stages of prey pursuit and capture. We could not clearly observe any systematic cooperative feeding; however, we recorded opportunistic behaviours such as stealing the fish caught by conspecifics. To conclude, further insight in pinniped hunting was gained, and a new hunting strategy could be described. The observations strongly favour visual prey pursuit in the respective hunting conditions in which light was not limiting.



**G01**

cancelled

**G02**

### **AMBIGUOUS EVIDENCE OF A RECENT BOTTLENECK IN THE ADRIATIC BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)**

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The bottlenose dolphin (*Tursiops truncatus*) is an endangered and legally protected species in Croatia, whose demographic history is poorly known. It is the only resident marine mammal species in Croatian part of the Adriatic Sea, with number estimated at around 250 individuals. There are indications that there has been intensive eradication operations in the mid 20th century that might have caused reductions in the effective population size and might have resulted in a loss of genetic variation. Therefore, we aimed to investigate a possibility of recent population size contraction and to compare the level of genetic diversity in the bottlenose dolphin population from the Croatian part of the Adriatic Sea with other bottlenose dolphin populations. Thirty samples were genotyped at 12 dinucleotide microsatellite loci. Bottleneck analysis gave ambiguous evidence for a recent population decline in the investigated bottlenose dolphin population. M ratio test, with two sets of parameter values, suggested a recent bottleneck; whereas analysis by Bottleneck program under two mutation models (TPM and SMM) showed no evidence for a genetic bottleneck. In addition, there was no evidence for a significant deviation from the normal L-shaped distribution of allele frequencies as expected for a stable population under mutation-drift equilibrium. Furthermore, both allelic richness (6.956) and expected heterozygosity (0.676) of the Adriatic population are above mean of all compared populations (5.993 and

0.658, respectively), confirming relatively high level of genetic diversity in the investigated Adriatic population. Due to ambiguous results, further research is needed to elucidate demographic history of this bottlenose dolphin population.



### G03

## GENETIC DIVERSITY AND POPULATION STRUCTURE OF THE EUROPEAN HARBOUR SEAL (*PHOCA VITULINA VITULINA*) IN WESTERN EUROPE

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The European harbour seal, (*Phoca vitulina vitulina*), has been subjected to a number of demographic perturbations, both natural and anthropogenic. Two epizootics of phocine distemper virus affected up to 50% of the population in some areas. Some of these areas are showing signs of recovery, such as in the Netherlands, whereas other regions show signs of further decline, such as in Scotland. Contaminants, hunting pressure and habitat loss have also contributed to population declines in parts of their range. Such contractions and expansions in population size can have an effect on the overall population structure. Eight regions in Western Europe (Western Scotland (n=15), Orkney, Scotland (n=15), Eastern Scotland (n=15), the Wash, Eastern England (n=8), the Thames, Eastern England (n=8), Chichester, Southern England (n=6), Baie du Mont Saint Michel, France (n=5), Dutch Wadden Sea, the Netherlands (n=8)) were sampled. Samples were analyzed for genetic differences based on variation at 6 microsatellite loci to investigate population structure over Western Europe. There was a significant correlation ( $p < 0.05$ ) between geographic distance and genetic distance and a significant  $F_{ST}$  value of 0.25 between Scotland and southeast England-western Europe. This suggests two distinct subpopulations. These results are consistent with the findings of previous studies where regional philopatry was observed on the range of 300-500 km.



**G04**

**MEDITERRANEAN HAPLOTYPES IN STRIPED DOLPHIN (*STENELLA COERULEOALBA*, MEYEN 1833)**

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The mitochondrial control region, or D-loop, is often used in studies of microevolution because its mutation rate is much higher than in the rest of mitochondrial DNA. In cetaceans, it is also a good genetic marker for the study of communities, since they often exhibit a matriarchal social organisation.

We have analysed D-loop sequences of four specimens of striped dolphin (*Stenella coeruleoalba*, Meyen 1833) stranded on Sicilian coasts. Three out of four specimens share very similar haplotypes; the fourth apparently came from an Atlantic ancestor. Database searches followed by computer analysis of genetic divergence showed that 59 out of 100 entries were attributable to Mediterranean specimens, which overall showed lower divergence than other, mainly Atlantic, ones, and gave more clustered phylogenetic trees. We found a small cluster composed primarily of specimens coming from Sicilian coasts (five specimens), Adriatic coasts (one); and the Pelagos Sanctuary in the Ligurian Sea (three). The time of genetic divergence for this cluster dates back to 200,000 years ago, in a period recently classified as interglacial. A common ancestor of Mediterranean haplotypes could be dated back to more than 600,000 years ago. However, in the latter hypothesis, the topology of the phylogenetic tree could lead to alternative interpretations.

These data, as well as others reported in the literature, show that Mediterranean populations of striped dolphin are isolated from Atlantic populations. The lower rate of genetic divergence could be due to recurrent colonisation of the Mediterranean Sea by gene flow from Atlantic phyletic branches, which took place repeatedly during the interglacial period. The «Sicilian» phyletic line shows high patrifilia, which is a characteristic of cetacean population that are matrilineally structured (Whitehead, 1998).



G05

## REPRODUCTION OF BLACK SEA BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN OCEANARIUM CONDITIONS

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Nine calves were born by the bottlenose dolphins kept in coastal pile-net open-air cages. Techniques of dolphin coupling, pregnancy detection and successful delivery were developed. Coupling and birth in bottlenose dolphins are seasonal, from April till October. Before coupling, male and female health states are estimated through breathing rate, alimental and motion activity, clinical and biochemical blood values. Healthy males 17 y.o. and up and non pregnant females 10 y.o. and elder were chosen. Duration of being together is estimated by results of coupling. An indication of successful coupling is the absence of sexual behavior between a male and a female. Females are tested on progesterone concentration in blood by radioimmunoassay technique. If progesterone level is 5 nmole/l and higher during 10-15 days, we made retest to eliminate ovulation, as during ovulation progesterone concentration increases as well but only for 3-5 days. A pregnant bottlenose dolphin female is fed with various species of fish and vitamins required. Pregnant females are not caught and lifted to prevent miscarriage. A female gives birth to a calf being alone in a spacious open air cage and without any people being near the cage. In first days after birth a female swims near its calf blocking the way to the net by its body. A female trains a calf to swim in a circle within the cage. That is why fish is thrown forward in 1.5 m to the place of their surfacing. If a female has no milk we give it bee royal jelly and vitamin C which stimulates lactation. If nursing female and its calf are sick they are treated with medicines not having bad influence on them. Weaning occurs after 2.5-3 years when a calf is beginning to eat fish and being trained special training elements.



G06

**THE DYNAMICS OF WHITE WHALES (*DELPHINAPTERUS LEUCAS*)  
REPRODUCTIVE GATHERING AND ITS DETERMINANTS (1995-2009) IN THE  
WHITE SEA, SOLOVESKY ISLAND**

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Every year from June to August the monitoring of number, age and sex composition of belugas is carried out in reproductive gathering (RG), Beluzhy Cape, Solovetsky I., White Sea. The records of the above parameters were carried out by video and photography observations. All the factors affecting the population dynamics of belugas in the RG were recorded specially. The number of animals varies by day and up to 2002 remained relatively stable at approximately 80 - 100 individuals. In 2003 and 2004 the first decrease of belugas number up to 57 individuals was recorded in the RG. In our opinion the reason for this has been a sharp increase in ecotourism, with uncontrolled motor boats passing through the aggregations of beluga whales, causing the stress in the animals. In these cases, the number of individuals decreased by 80 %, or belugas just left the RG. In 2005-2007 the number of beluga whales of RG gradually increased up to 90 individuals, which can be partly explained by beluga habituation to human presence. However, in 2008-2009 it was recorded a decrease in beluga whale number in the waters (about 60 individuals). Summer of 2008 differed from previous ones by frequent storms (15 days of 47) and reduction of the number of belugas at cape was mainly due to adverse weather conditions, which also reduced the amount of ecotourists. The weather conditions in summer 2009 were perfect because of the absence of storms that caused a sharp increase in ecotourism. 4-5 "contacts" with motor boat were enough for in 35-60 min all the belugas left the area. The studies of the fluctuations of belugas number represented by us certainly should be continued. Natural fluctuations in the population number of beluga whales in the White Sea should be taken to account as well.



**G07**

## **STUDY OF THE STRUCTURE OF WHITE SEA BELUGAS REPRODUCTIVE GATHERINGS USING THE PHOTO ID METHOD**

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Based on photo-identification data of individual animals in 2007-09, we studied the structure of the Solovetsky (Cape Beluzhy, Solovetsy Is., White Sea) beluga reproductive gatherings (RGs). We investigated the features of seasonal dynamics of RGs visiting the area. A gathering consists of females and calves of different ages forming stable “family” groups. Some females come to Cape Beluzhy every year and stay there throughout the summer. They form a permanent component of the gathering. Another part of the gathering visits the area only at a particular time of year, that seems to be defined by the physiological readiness of some females for pairing and reproduction. Comparison of photos of belugas with the catalogue of visually registered markings (1996-2009) has revealed that some part of the herd was observed near Cape Beluzhy from year to year. However, most of the recognized animals were observed in RGs during a single season or with breaks of some years. Possibly it is a result of a modification of natural markings during moult or on a 2-3 year reproductive cycle. Our 15-year visual observations set the number of animals in Solovetsky RG at c. 100 animals. Photo ID studies suggest that the number of belugas in RGs is more than 200. We reveal the rotation of animals during summer season. We suggest that the summer habitat of Solovetsky belugas includes a wide area of the White Sea Onega Bay.



G08

LIFE-HISTORY DATA OF DUTCH HARBOUR PORPOISE *PHOCOENA PHOCOENA*

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We present a summary of 20 years' life-history data on southern North Sea (Dutch) harbour porpoise *Phocoena phocoena*. Data were collected at the National Museum of Natural History, Naturalis, Leiden, and more recently (since 2006) at IMARES, Texel. The life table shows that most porpoises sampled and aged are dead by age 12 (over 98 %), this is not very different from other populations studied. The oldest animal found until now was 16 years old, relatively "young" compared to ages found in some other studies, with the three next oldest animals being only 13 years of age. Over 50 % of the sampled animals showed evidence of fishery by-catch.

Southern North Sea females give birth for the first time about a year later than animals in some other populations studied, some females are still sexually immature at 6/7 years of age. In addition, relatively few are simultaneously pregnant and lactating, possibly indicating longer calving intervals. There are indications for a parturition period which is somewhat extended from May to the end of August and into September, with the mating season following suit. About 10 % of Dutch female porpoises have both ovaries developed instead of only the left ovary (development of both ovaries is a pattern found in *Delphinidae*, but is generally considered rare in *Phocoenidae*).

Some of these observations (low reproductive rate, high by-catch) suggest that the Dutch porpoise population may be vulnerable or at risk.





## G9

### **SURVIVAL RATE, ABUNDANCE AND RESIDENCY OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN STRAIT OF GIBRALTAR**

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The bottlenose dolphins of the Strait of Gibraltar have high contaminant levels, are targeted by whale watching companies and are distributed in the middle of the main entrance channel to the Mediterranean Sea for cargos and ferries which could cause physical and acoustical disturbances. The objective of this study was to estimate the level of residency, survival rate, population growth rate and population size of bottlenose dolphins in the Strait between 2002 and 2007 using photo-identification techniques and mark recapture models. A closed robust design with heterogeneity and the Pradel population growth rate estimator was used to estimate the different parameters. A total of 10,836 individual dorsal fin images were analyzed allowing the identification of 318 individuals. A total of 71% of the animals were identified in two or more years over the study period. The annual survival rate estimate was 0.920 (95% CI: 0.895-0.944) while the population growth rate was estimated at 1.076 (95% CI: 1.035-1.117). The population size, during spring and summer months, increased from 200 individuals in 2002 to 282 in 2007 not showing significant variation between 2003 and 2007. The mean number of bottlenose dolphins present in the Strait was estimated to be 259 individuals between 2003 and 2007. The results of this study suggest that the bottlenose dolphins of the Strait of Gibraltar belong to a population of 259 individuals, resident from April to September and from year to year.



## G10

cancelled



**HA01****RESIDENCE AND RANGING PATTERNS OF BOTTLENOSE DOLPHINS  
(*TURSIOPS TRUNCATUS*) IN THE WATERS AROUND FILICUDI ISLAND,  
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This study investigated residence and ranging patterns of a group of *Tursiops truncatus* occurring on the coastal waters around Filicudi, an island of the Aeolian archipelago, Sicily (Italy). Data were collected during boat-based surveys conducted from June to September (2005-2009) in a predefined area of approximately 200 km<sup>2</sup>. Individual dolphins were identified by distinctive fin and body characteristics using the photo-identification method, and categorized as resident, transient or non-resident inhabitants based on resighting patterns. Home range boundaries and core areas were defined for 8 resident dolphins, sighted  $\geq 10$  times. Ranges of individual dolphins were calculated using Minimum Convex Polygon method (MCP) and the fixed kernel method using a GIS software (Arcview 3.2). Distinctive ranges for resident individuals were evidenced according to habitat characteristics. Resident individuals exhibited a strong site-fidelity to the area and showed preferential use of shallow areas in the NW of the island. These results will be surely useful to plan any conservation management strategy in the water around Filicudi island.



HA02

**RELATIONSHIP BETWEEN THE SEMI-RESIDENT BOTTLENOSE DOLPHIN  
(*TURSIOPS TRUNCATUS*) POPULATION AND ECOLOGICAL FACTORS IN  
CARDIGAN BAY, WALES**

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Cardigan Bay, West Wales, is one of two areas of UK territorial waters where there are semi-resident groups of bottlenose dolphins, the other being eastern Scotland, particularly the Moray Firth. Both populations are afforded protection by the establishment of Special Areas of Conservation (SAC) under the EU Habitats Directive. This study examined the relationship between groups of bottlenose dolphins and their local environment. Group sizes ranged from one to 46 but the majority of groups were of five or less. Seasonal fluctuations in numbers were observed, which corresponded with an influx of migratory prey into Cardigan Bay. Statistical analysis revealed that of a variety of ecological parameters tested, depth, distance to coast, and distance to estuary were the most significant influences on the presence and distribution of groups of bottlenose dolphins in Cardigan Bay. Groups were most commonly seen within 10 miles of the coast, particularly within two miles, e.g. at New Quay, Aberporth, Mwnt, Cemaes Head and around the Teifi estuary, from April to October. All groups were distributed along the coast with larger groups being found further offshore within the Bay. Further data have confirmed that bottlenose dolphins are associated with sheltered conditions, taking advantage of the shallow coastal habitats for calving, nursing and feeding. The study demonstrates that the bottlenose dolphins utilize the entire Bay. This has implications for conservation and SAC protection which currently only extends to two designated areas within Cardigan Bay. A number of interrelated environmental factors were seen to affect the distributions of groups, suggesting that a multivariate ecosystem approach is required to ensure the health of the local bottlenose dolphin population. Protection needs to include consideration of the bottlenose dolphins' prey and to the Cardigan Bay ecosystem in its entirety.



HA03

**PRESENT STATUS OF COMMON BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) ALONG THE NORTHEASTERN COAST OF SARDINIA (ITALY) AFTER NINE YEARS OF FIELD-RESEARCH...WHAT FUTURE?**

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Long-term monitoring research on Common Bottlenose Dolphin along the Northeastern coast of Sardinia has entered its ninth year. A great deal about some aspects of their biology and conservation status had been learnt over the past years. In the study area were established some different protected areas for the great value of marine biodiversity. Between January 2001 and August 2009, 627 days were spent surveying, resulting in 2.243 hours of sea surveys, 421 sightings and 1.960 observations. From 2001 to 2009 were photo-identified 149 dolphins and were investigate the abundance, social organisation, distribution and habitat use of the dolphins as well as the threats faced by them. The analysis of group composition showed a high percentage of females and calves. These results strongly imply that the Northeastern coast of Sardinia is an important feeding ground and nursery for this population. For this coastal dolphin population the major threats are by-catch (direct) and vessel traffic (indirect). The present status is clear, but the future is very uncertain, because the exponential anthropic growth in coastal areas reduced the available habitat. In this work are shown all results and the future prospects for middle and long term survival of this population and the effective role play of Protected Areas.



**HA04**

**HABITAT USE AND THE EFFECTS OF BOAT TRAFFIC ON BOTTLENOSE DOLPHINS AT NEW QUAY HARBOUR, CARDIGAN BAY**

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New Quay harbour in Ceredigion is one of the key sites for bottlenose dolphins in Cardigan Bay, which hosts the largest resident population of this species in the UK. Bottlenose dolphins are observed almost daily from New Quay pier in summer and it is thought that the animals use this site predominantly for feeding. However, other behaviours have been observed in parts of the survey area. The Sea Watch Foundation has been performing regular land based surveys annually at this site from May to October since 2005. Surveys were carried out in shifts from 07:00 to 21:00h, or whilst sufficient light allowed. Dolphin behaviour and location in the bay were recorded, along with boat traffic and subsequent boat interactions, during which any changes in behaviour were noted. There has been a concern that an increase in boat traffic may have an effect on the animals that visit the area. However, over the past five years, levels of boat traffic have fluctuated but not steadily increased, presumably as a result of weather conditions. Dolphins seem to be spending more time at the site than previous years. In 2005, sightings occurred at rate of 1.6 animals per hour. This has steadily increased over the years and reached a maximum in 2008 with 2.5 animals per hour, with 2.2 dolphins per hour in 2009. Sighting rates did not correlate with the changes in levels of boat traffic. Most boat operators in New Quay harbour adhere to a code of conduct implemented by Ceredigion County Council which has been enforced to minimise disturbance to the dolphins. These results suggest that despite the relatively high levels of boat traffic in the harbour, this has not deterred the animals from entering the survey area, and they continue to visit it frequently.



**HA05**

**HABITAT USE OF BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) AND THE POTENTIAL OVERLAP WITH ARTISANAL GILLNET FISHING IN PATOS LAGOON ESTUARY AND ADJACENT COASTAL WATERS, SOUTHERN BRAZIL**

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The aims of this study were to describe patterns of habitat use of the bottlenose dolphin population inhabiting the estuary of the Patos Lagoon and adjacent coastal waters as well as to determine the potential overlap between dolphins and artisanal gillnet fishing distribution. From September 2006 to August 2008, 47.7km-long zig-zag (n=16) and 100.4km-long perpendicular to coast (n=31) surveys were taken place in the estuary and coastal areas, respectively. Oceanographic sampling for water temperature, salinity and transparency was conducted in pre-defined stations in both areas. The study area was split in 0.25km<sup>2</sup> grids. The number of bottlenose dolphins and fishing nets observed on survey effort were used to estimate their density within each grid. Generalized Linear Models (GLM) were run to identify environmental, spatial and temporal explanatory variables that better describe the patterns of density of dolphins and nets. In the estuary, higher density of bottlenose dolphins was observed during spring and autumn in steep depth gradients near the estuary mouth. In the coastal adjacent area, dolphin densities increased as the distance to the coast and the estuary mouth decreased. Fishing effort was higher in spring and autumn and was distributed along the entire surveyed area in the estuary. In the adjacent coast, the fishing effort was intensified during spring and summer near the estuary mouth. The results presented here suggest a higher risk of dolphin entanglement in fishing nets during summer in areas near the estuary mouth. If proved necessary, dolphin bycatch reduction plans should take into account area closures for gillnet fisheries up to 5km inside the estuary and within 1km from shore in the coastal adjacent areas.

Financial support: YAQU PACHA, Rufford Small Grant and CNPq.



**HA06**

**BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) SEASONAL PATTERN AND HABITAT USE IN THE COASTAL RESERVE OF SERRA GELADA (ALICANTE, SPAIN)**

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Fixed passive acoustic monitoring of cetaceans is becoming a powerful tool that improves results from visual survey effort in specific areas of interest such as critical habitats. At the same time, the interaction between bottlenose dolphins and fish farms is becoming an interesting subject since their ecological effect is not well understood but their habitat is directly affected. This study aims to better understand the seasonal pattern, diel pattern and habitat use in the coastal reserve of Serra Gelada (Alicante, Spain) of 3,920 ha including fish farms within the protected marine area. Three Time Porpoise Detectors (T-POD, Chelonia, Ltd.) were moored at 15 m depth in this protected area next to fish farms and in control zones away from these farm structures. Deployments started progressively in June 2008 and will end in January 2010. This study design allowed the description of an attraction effect to bottlenose dolphins by fish farms. Positive detection days in fish farm areas reached 57.3 % of the sample period in contrast to 15 % in control areas. Seasonal presence results show continuous detections through the year without significant differences between seasons. Click interval analysis indicated the presence of fast click trains with terminal buzzes typical of feeding behaviours. These particular click trains were identified through the year. Permanent presence of bottlenose dolphins in this coastal marine reserve is believed to be related to the existence of fish farms in the area, which play an important role in the feeding habits of this population. The observed interaction between bottlenose dolphins and fish farms is further discussed in the framework of the management of marine protected areas.



**HA07**

**SUMMER HABITAT USE OF FISH-EATING KILLER WHALES IN SOUTHEAST KAMCHATKA COASTAL WATERS**

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The studies in the Northwest Pacific (Far East Russia, Kamchatka) showed high similarity of killer whale populations to well studied populations that inhabit the Northeast Pacific. Specific features regarding space use were discovered recently for killer whales in North American Pacific coastal waters. The great differences in landscape and character of the shore line in Kamchatka waters compared with British Columbia and Alaska could lead to the particular differences observed in habitat use by killer whales. We used two motor powered boats to collect spatial data during 148 whale encounters in Avacha Gulf (July-August of 2005-09). Photo identification and acoustic data were used for killer whale group recognition. Group position and type of activity were sampled every 5 min. The samples were assigned to the corresponding centre points of a standardized 4 km<sup>2</sup> cell. Four geographic features of a grid cell were analysed: longitude, latitude, depth, and distance to shore. Nonparametric statistical methods (Mann-Whitney U test with Bonferroni correction) and kernel estimations were used to compare the distribution of killer whale groups relative to different factors – 1) type of activity, 2) type of movement, 3) pod composition, and 4) tidal cycle. We found that all these factors influenced the distribution of killer whale groups. The locations of feeding places differed significantly from locations of traveling paths (n=1843, Mann-Whitney U test, p<0.05). Killer whales preferred different areas for different types of movement: traveling, slow traveling and milling (n=1843, Mann-Whitney U test, p<0.05). The distribution of killer whale groups was also associated with the tidal cycle (n=1655, Mann-Whitney U test for longitude, p<0.05). Multi-pod aggregations differed significantly in area usage compared to single pods (n= 1597, Mann-Whitney U test, p<0.05.). Our results highlight the differences in space use between several resident pods.





**HA08**

**GIS SPATIAL ANALYSIS AS MANAGEMENT TOOL TO DESCRIBE THE HABITAT USE OF BOTTLENOSE DOLPHINS IN THE LAMPEDUSA WATERS (ITALY): RESULTS FROM ELEVEN YEARS OF OBSERVATION**

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Bottlenose dolphins (*Tursiops truncatus*) were studied around Lampedusa Island (Sicily Channel-Italy) from 1996 to 2006 through boat-based surveys, land-based surveys and standard photo-identification. A total of 746 sightings were recorded and 102 well-marked dolphins photo-identified. Resighting rates within and between years showed a relatively high rate of site fidelity of at least 30 individuals. Annual mark-recapture abundance estimates ranged between 69 and 244 individuals for different areas. Kernel maps based on sightings of the most resident bottlenose dolphins were developed using ArcGIS Spatial Analyst.9.3 (ESRI) to highlight potential important habitats. Results of this study provide useful baseline data for conservation and management of bottlenose dolphins in the Pelagian area. The demonstrated importance of the Lampedusa waters for the bottlenose dolphin and other threatened species encourages the adoption of measures aimed to conserve its valuable ecosystems and raises the naturalistic profile of the area, while promoting environmental-conscious development. In 2003 this area was designated as Marine Protected Area, nevertheless dolphins were not mentioned in its conservation objectives. On the contrary our results support the expansion of these objectives to include the conservation of the bottlenose dolphin. At the present, in Italy there are not designated or proposed SACs for this species and this represents a serious issue to be quickly addressed by relevant authorities.



HA09

**HABITAT USE OF PANTROPICAL SPOTTED DOLPHINS (*STENELLA ATTENUATA GRAFFMANI*) OFF THE SOUTHERN PACIFIC COAST OF COSTA RICA**

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Pantropical spotted dolphins is possibly the most widespread and representative odontocete in Costa Rica's Pacific waters. These dolphins constitute a key staple for a growing whale watching industry along several locations of the Southern Pacific coast of the country (Drake Bay, Golfo Dulce). The aim of this contribution is to elucidate spatial and seasonal characteristics in the abundance and distribution of the species, complemented with insights on behavioral observations to structure habitat use patterns. Opportunistic and systematic sightings records (published and non- published accounts) from 2001 - 2009 were pooled together and integrated into a Geographical Information System (ArcGIS 9.2), with information on date, time, group size, sea state (Beaufort scale), geographic coordinates, behaviour at first encounter and effort-corrected (time invested during searches) relative abundance indices (Abundance per Unit of Effort: APUE). Seasonal patterns would reflect a remarkable abundance with localized key areas of mayor density at the transition - oceanic habitat at the shelf break off Osa Peninsula, while in Golfo Dulce, *Stenella attenuata graffmani* would have a major density in the deepest portion of the inner basin. Behavioral observation at first encounter suggested interplay between traveling and foraging within an important portion of the shelf habitat, and shelf break. Therefore, *S. a. graffmani* is not only relevant in the removal of prey (fishery resources biomass) due to their significant dominance in term of predator' occurrence, but as a non consumptive resources itself, threaten by coastal development, tourism mismanagement and by the imminent establishment of mariculture facilities along the species range.



HA10

**DISTRIBUTION AND ECOLOGY OF RISSO'S DOLPHIN, *GRAMPUS GRISEUS* (CUVIER, 1812), IN THE WESTERN LIGURIAN SEA IN RELATION TO PHYSIOGRAPHIC, OCEANOGRAPHIC AND INTRINSIC BIOLOGICAL PARAMETERS**

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Despite their widespread distribution, Risso's dolphins are still a scarcely known species and this is particularly true for the Mediterranean population. Aim of this study was to investigate the species' habitat use and preference in relation to physiographic, oceanographic and intrinsic biological parameters in the North-Western part of Pelagos Sanctuary (Western Ligurian Sea). A total of 29 sightings collected across an area of 24.000 km<sup>2</sup> in the period 2005-2008 during dedicated summer research cruises were analysed. A grid of 5\*5 nm cell size was applied over the study area and descriptive statistics of the different parameters were calculated for each cell. Relative abundance, estimated as encounter rate, was computed (median=0.00006 encounters/km) and did not vary through the study period neither among years or months (Kruskal-Wallis test,  $P>0.1$ ). Logistic models were used to study the relationships between Risso's dolphin's occurrence and the environment: SST, Chl-a, STD and range of slope were found to be significant ( $P<0.05$ ), underlining the preference for areas with a high topographic and oceanographic complexity (i.e. the slope area). The models predicted 57-77% of presence(1)/absence(0) cells. In addition, intrinsic biological parameters were found to influence the species' distribution: presence of calves was associated with a higher variability in STD and mean slope; larger group size was correlated with areas with lower slope and higher Chl-a (i.e. external to the continental slope); finally, the analysis of respiratory patterns showed that the performance of long dives was negatively affected by the presence of calves in the group and that a higher degree of animals' activity was associated with a higher C.V. of depth (Mann-Whitney test,  $P<0.5$ ). The identification of the key-parameters that drive the habitat preference of Risso's dolphin is the first step for the elaboration of specific conservation and management measures in this protected area.



HA11

**MODELLING DISTRIBUTION OF BOTTLENOSE DOLPHIN WITH  
PHYSIOGRAPHIC FEATURES ON FILICUDI ISLAND (SOUTHERN  
THYRRENIAN SEA, ITALY)**

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Modelling the distribution of marine vertebrates is crucial to understand the ecology of species and the starting point to analyze how movement patterns change over time and space also in relationship to changes in the environment. In this study, a new statistical approach was implemented to model distribution of cetaceans using environmental factors and to explore the relationship between distribution and physiographical parameters. We applied this method to the bottlenose dolphin (*Tursiops truncatus*) distribution in Filicudi island, Southern Italy at a fine scale. Our approach proved to be a valuable tool as (1) it provides a more accurate description of the structural features of the dolphins' habitat, (2) it models habitat preferences combining the mutual contribution of two response variables based on movement patterns. The method could be especially useful in situations, in which animals may have to trade-off food and safety when selecting a habitat on a fine spatial/temporal scale. In our study, dolphins distribution was significantly related to topography: encounter rates were most frequently associated to fewer deep regions and higher bottom sea gradients, but clear spatial/temporal use patterns were observed. In particular, three different habitat clusters were related to the diurnal dolphin activities. This could be attributed to the fact that the most productive shallow habitats are also the most dangerous, given the massive presence of fishing gear and, consequently, of fishermen. As a result, dolphins may have to trade-off food and safety habitat type on the diurnal cycle. On the other hand, artisanal fishing gears may offer an opportunity for easily accessible food resources, particularly, when these are lacking. Feeding habits may also shape the spatial behaviour of these dolphins, whose diet switches between natural and opportunistic food resources.



HA12

## HABITAT MODELLING OF FIN WHALES IN THE GULF OF CALIFORNIA, MÉXICO

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The Gulf of California (GC), México, is one of the few sites that have a resident population of fin whales. The aim of this study was to investigate the spatial distribution of fin whales in the GC by modelling the relationship between fin whale occurrence and characteristics of the habitat. The model was constructed based on eight environmental variables using a dataset that comprised of 282 fin whale sightings from boat surveys. However, these surveys only covered coastal sections of the western part of the Southern Gulf of California, and most of the Northern Gulf of California. Therefore, to ensure that this data coverage was not creating a bias within the model, the predictions of the model were validated using a smaller set data from aerial surveys which covered the whole of the GC. This validation found that the model performed significantly better than a random model and accurately predicted the distribution of fin whales throughout the GC from habitat variables. The model found that fin whale occurrence was primarily related to slope, standard deviation of slope and depth. According to the model, fin whales in the GC prefer shallower areas with a more complex seabed, factors that may contribute to mixing, upwelling, high production and frontal areas. This is also associated with the secondarily important variables related with their distribution (standard deviation of sea surface temperature and chlorophyll concentration). This suggests that fin whales are responding to aggregations of prey associated with such habitat features, and that this represents important feeding habitats for fin whales in the GC. This model is important not only for our ability to understand the ecology of these animals but to enhance the ways in which we conserve, manage and protect this resident population of fin whales.



HA13

## MODELLING HABITAT PREFERENCES OF MEDITERRANEAN CETACEAN SPECIES WITHIN A RISK MITIGATION FRAMEWORK

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The development and implementation of marine mammal risk mitigation policies in support of naval operations requires an in-depth knowledge of the distributions of the focal species, as well as the processes impacting on their variability in space and time. In practice, such knowledge is bound to be incomplete; predictive habitat models make use of available species and environmental data and can be integrated into the planning stage of naval exercises as baseline estimators of risk. The SIRENA cruises, organized by the NATO Undersea Research Centre beginning in 1999 as part of its Marine Mammal Risk Mitigation program, have provided a platform for visual and passive acoustic monitoring of Mediterranean cetacean species.

I present initial results of the habitat modelling effort based on visual and acoustic sighting data collected during the SIRENA cruises. A comparative analysis of visual and acoustic sighting data showcases the strengths and weaknesses of each approach, but also the ever increasing potential of passive acoustic methods for monitoring elusive species. Models employing both presence/absence (GLM, GAM) and presence-only methods (ENFA) were used to characterize the preferred habitat of several representative Mediterranean species/groups (delphinids, *Ziphius cavirostris*, *Physeter macrocephalus*). A number of commonly used predictors were tested, including bathymetric features, SST and Chl-a concentration. The results highlight the importance of the former, in particular to beaked whales, but also the difficulty of interpreting even the statistically significant terms within a predictive framework, given the variability in distribution patterns associated with the free-ranging species considered. Specific aspects of using acoustic sighting data for distribution models are considered (e.g. the need to control for the diel vocalization pattern, where present). Finally, the results provide an insight for the process of improving sampling strategies for focal species.



HA14

## INFLUENCES OF TANGER MED II HARBOUR ON THE CETACEAN POPULATIONS OF THE STRAIT OF GIBRALTAR

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Seven species of cetaceans occur in the Strait of Gibraltar: four of them are resident (*Delphinus delphis*, *Stenella coeruleoalba*, *Tursiops truncatus*, *Globicephala melas*), two partly-resident (*Physeter macrocephalus* and *Orcinus orca*) and one is migratory (*Balaenoptera physalus*). Tanger Med II harbour, which started commercial activities in 2007, is located on one of the most hotspot for cetacean on Moroccan coast in the Strait of Gibraltar. These activities represent a new source of pollution point in the range of these species. The presence of the new harbour has also resulted in shifts in shipping routes, taking boats into area with the highest density of cetaceans. In this study data were collected from platforms of opportunity, namely whale-watching boats of Turmares Tarifa S.L. Company (Spain), during April to September in 2003 to 2009, following SEC (Spanish Cetacean Society) protocols. The data show a decrease in the encounter rate (sightings/total trips) for the sperm whale (*P. macrocephalus*) from 0.65 (2007), to 0.59 (2008) and 0.084 (2009). In five other cetacean species the encounter rate also decreased (e.g. striped dolphin: 0.49 in 2007, 0.37 in 2008 and 0.17 in 2009). No trend was seen in the bottlenose dolphin (*T. truncatus*) and pilot whale (*G. melas*). Encounter rates have decreased since the Tanger Med II harbour opened, suggesting a negative effect on environmental carrying capacity for the cetacean species that inhabit the Strait of Gibraltar.



**HA15**

## **LOCAL MOVEMENT PATTERNS OF MINKE WHALES IN THE NORTHEAST ATLANTIC**

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One objective of our instrumentation experiments on minke whales since 2001 is to learn about their local movement patterns which might be of importance in interpreting their feeding ecology as well as distributional aspects with respect to migration on different time scales. For instrumentation we have used VHF tags and satellite transmitters (SPOT5, Telonics Inc., USA) which have been applied to minke whales by use of the launching system ARTS. The VHF tags were followed by a directional finder while satellite data were transferred through the Argos data collection and location Service. VHF tagged minke whales have been followed in periods from 4 hours and up to 120 hours. Their tracks seem to follow irregular patterns which may be anticipated to express behaviour related to search for food. The estimated track lengths of the tagged individual animals have been estimated to be up to 178 km and with mean speeds over the tracked periods of up to 3.7 km/h (corresponding to about 2 knots). One VHF tagged minke whale explored an area of approximately 50km x 50km over the 5-day period it was followed. A satellite tag was successfully applied to one minke whale on 22 August 2007 and then followed until 8 September. This whale showed a calculated displacement per day varying between 30 and 60 km and an overall minimum track length over the 10-day period 22 August to 1 September of 472 km. This whale moved back and forth within an area approximately 180km x 40km over the recorded 16 days. In conclusion, from the data presented here, minke whales move around at speeds of 1-2 knots in a non-random manner and can apparently stay for prolonged periods within a larger bounded area while continually revisiting parts of it.





HI01

**AQUACULTURE & DOLPHINS: HOW TO USE ECOSYSTEM MODELS TO ADDRESS THE IMPACTS CAUSED BY THE INTERACTIONS****Bruno Díaz López (1)**

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The worldwide expansion of aquaculture industries has caused growing concern regarding their environmental impact. Coastal sea-cage fin fish farms have been introduced into an environment that has a natural complement of fish eating predators. Therefore, a science-based response to the conservation problems created by interactions between fish farms and dolphins depends critically on accurate knowledge of the impacts caused by the interactions. In that sense, an ecosystem modelling approach becomes an interesting tool to examine the impact of aquaculture on bottlenose dolphins and vice versa. Within the many types of software available, Ecopath with Ecosim (EwE) is a reliable and convenient tool to examine the long-term responses of bottlenose dolphins to aquaculture induced changes in system energy flow and biomass. Mass-balance models were built to characterize the role of dolphins in a coastal ecosystem conditioned by aquaculture. The case study has shown the appropriateness of the models to describe the modifications induced, at an ecosystem level, particularly by the nutrient loading into the area. The data obtained are consistent with field studies and they do not show any „ecological nonsense“. In that sense, the EwE software provides innovative results. For example, consumption by bottlenose dolphins has important influences on the community structure by reducing the pressures imposed by predators and thus competition between species. Similarly, these results also support the notion that dolphins could play an important role as buffers to the eutrophication process. On the other hand, the possible effect of dolphins in the fish farm industry is not substantial, one important reason to control the implementation of anti-predator methods in fish farms. From these models, I present the strengths and weaknesses of using the EwE approach to support the design of policies aimed at implementing marine mammals' conservation.



**HI02**

**INTERACTIONS BETWEEN BOTTLENOSE BOLPHINS (*TURSIOPS TRUNCATUS*) AND FISH FARMS IN CYRENAICA, LIBYA**

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Little is known about the occurrence of cetaceans in Libyan waters. The few studies which have been conducted have concentrated on offshore species with limited reference to distribution or density. In Cyrenaica (the eastern province of Libya), research was conducted to assess potential interactions between bottlenose dolphins (*Tursiops truncatus*) and eight fish farms in Ras Alhellal Bay (32.907° N, 22.178° E). Along with questionnaires and boat surveys, dedicated land-based observations were conducted from February to September 2009. The boat survey frequently encountered the same pod of bottlenose dolphins in the area between Bast bay (32.871° N, 21.550° E) and Bombah Gulf (32.352° N, 23.140° E) which includes the study area. The pod encountered often consisting of between 20 to 30 individuals. This information corresponds with form questionnaires distributed among the local fishermen. During a total effort of 106 hours of land-based observations, 31 of bottlenose dolphins were recorded mainly around the fish farms. The average number of individuals in each sighting was four with a maximum of seven. The sightings rate was significantly higher between February and April than between May to September 0.772 vs 0.446 sighting/day. This change coincided with expanding the old harbour in the bay, which involves activities such as sea bed dredging, soil digging and piles driving. Heavy equipments and vehicles such as hydraulic excavators and soil compactors are working continually producing high noise and changing water clarity. Therefore, this coastal development may have negatively affected this group of apparently resident bottlenose dolphins. In the last five years, coastal areas development has been expanding rapidly in Libya, increasing the risk of negative impacts on coastal cetacean species. This current study highlights the need for a greater understanding of cetacean occurrence in coastal Libyan waters in order to minimise potential negative impacts on local cetacean populations.



**HI03**

cancelled

HI04

## COMMERCIAL FISHERIES INDUCED SEAL MORTALITY IN THE GULF OF FINLAND: CONFLICT AND ITS CONSEQUENCES

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This study presents the results of investigations of the conflict between commercial fisheries and marine mammals (Baltic ringed seal *Pusa hispida bothnica* and grey seal *Halichoerus grypus macrorhynchus*), inhabiting the Gulf of Finland. On the one hand, there is a problem of seal-induced gear and catch damage, which has increased in recent years due to declines in the fish stocks in the Gulf of Finland. On the other hand, bycatch of the seals in fishing gear becomes an increasingly significant factor, affecting seal populations worldwide. The aim of this research was to produce a questionnaire for the fishermen, working in different parts of the study area. Data collected contained information about the frequency and type of seal-fishery interactions and the number of marine mammals caught in fishing gear in 2007 and 2008. In addition, oral interviews of fishermen were implemented in the years 2006-09. This research follows on from the work started in 2003, and reveals the dynamics of a developing conflict: in 2008, 11 cases of bycatch were registered by comparison with zero bycatch rate in 2003. Moreover, each year we have monitored the shore zone to count the number of dead seals. We conclude that at least 30% of 32 dead seals found on the shore from 2006 to 2009 resulted in a violent death. It has become clear that seal bycatch along with poaching and illegal kills of the seals feeding in fishing areas is becoming a significant factor affecting subpopulations of seals in the Gulf of Finland.



HI05

**COMPETITION BETWEEN COMMON BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) AND ISRAELI BOTTOM TRAWL FISHERY FOR LIMITED RESOURCES? ASSESSMENT BY STOMACH CONTENTS AND STABLE ISOTOPES**

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Common bottlenose dolphin (*Tursiops truncatus*), hereafter CBD, and bottom trawlers (BT) are known to exploit the same niche, consequently, interaction is to be expected wherever the two overlap. Along the Israeli coastline, 20-25 BT work continuously, with a mean annual yield of 1,300 tons. The year round resident Israeli CBD population, estimated at 360 individuals and a rough annual consumption of 1,280 tons of prey, shows marked interaction with bottom trawlers. The potential for competition thus exists, but do the two indeed harvest the same trophic level of the foodweb and the same members of that level? We tried to address this question by use of stable isotope and stomach content analyses.

Stomach contents of 26 beached and/or by-caught CBD, analyzed by otoliths and cephalopod beaks were compared to items in a three year record of the bottom trawl catch. Muscle samples of 23 CBD and 158 commercial fish and invertebrates were analyzed for stable isotopes composition of Nitrogen and Carbon ( $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$ , respectively).

The 59.3 kg combined stomach content included at least 754 prey items 97.3% of which were fish belonging to 22 identified species. The most important prey was the Balearic conger *Ariosoma balearicum*, a non-commercially important fish. When assessing the commercial impact of the CBD population on the local trawl fishery fleet, only 46.4% of the prey mass had medium-to-high commercial value. Sparidae (sea breams), with a relatively low commercial value, was the only family showing significant and equal frequencies between the potential competitors. Estimating the mean  $\delta^{15}\text{N}$  value of CBD prey by subtracting the

trophic enrichment factor from the mean  $\delta^{15}\text{N}$  value measured for the CBD (10.1‰), most tested commercial species had higher  $\delta^{15}\text{N}$  values, also suggesting that CBD is not directly competing with the BT catch.



## HI06

### MARINE MAMMAL BY-CATCH BY THE JAPANESE SALMON GILL NET FISHERY IN THE RUSSIAN EXCLUSIVE ECONOMIC ZONE, 1992-2008

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After closure of high seas gillnet salmon fishery in the North Pacific in 1992, Japanese fisherman continued fishing inside the Russian exclusive economic zone based on bilateral intergovernmental agreement. Up to 100 fishing vessels fished from 1992 to 2008 in up to six permitted areas in the Bering Sea, the Sea of Okhotsk and the Pacific Ocean. This fishery was conducted for a period of up to two months during May through July. Fishing effort varied significantly in space and time. Marine mammal by-catch was monitored only in 1993-1998. We used survey results from 105,164 km of nets (16.8% of total net length in 1993-1998) for estimations. Mean by-catch rates for each fishing season and area were calculated. For years when monitoring was absent we used mean rates for each area, extrapolated from data for all years when monitoring was conducted. Average by-catch rate for all areas and years was estimated to be  $2.78 \pm 0.24$  individuals per 100 km of net. We estimate  $32,226 \pm 3,026$  marine mammals were entangled in salmon gill nets of which  $25,588 \pm 2,494$  died. Species composition was obtained from identification of 2,907 individuals. Thirteen species of marine mammals were entangled in the nets (*Physeter macrocephalus*, *Megaptera novaeangliae*, *Balaenoptera acutorostrata*, *Ziphius cavirostris*, *Phocoenoides dalli*, *Phocoena phocoena*, *Lagenorhynchus obliquidens*, *Tursiops truncatus*, *Callorhinus ursinus*, *Eumetopias jubatus*, *Histriophoca fasciata*, *Phoca largha* and *Pusa hispida*) and eight species were found dead. Top three species, which suffered 95% of the total by-catch were *P. dalli*, *H. fasciata*, and *C. ursinus*. The most diverse species composition was in the western Bering Sea (11 species recorded of which 8 were found dead), but the highest by-catch rates were in the eastern and northern parts of Sea of Okhotsk. Four species entangled in the nets were endangered species listed in the Russian Red [...].

HI07

## CONFLICTS BETWEEN FISHERIES AND CETACEANS IN GALICIA, NW SPAIN: PRELIMINARY RESULTS OF AN INTERVIEW SURVEY WITH LOCAL FISHERMEN

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The Galician fleet is amongst the largest in Europe covering all main gear types (lines, trawls, seines, traps and gillnets) and cetacean by-catch is suggested to be unsustainably high. However, cetaceans cause problems for fisheries by damaging gear and catch. Face-to-face interviews were conducted in the main Galician harbours asking fishermen about conflicts with cetaceans, species involved their attitudes and the consequences of such interactions. Conflicts were mainly reported for gillnets and purse seines, gear damage and catch loss (fish consumption and scattering) being the main problems and *Tursiops truncatus* the most problematic species. However, the majority of interviewees (68%) did not report conflicts. Depredation was mostly considered minimal (< 10% of total catch) and high losses (> 50%) were only mentioned for gillnets. Associated economic loss was generally considered minimal. Cetacean by-catch was reported most frequently for trawls, followed by purse seines and gillnets. By-catch frequency was highest for *Delphinus delphis* (52% of all interviewees) and *T. truncatus* (15%) in trawls and gillnets, respectively. For all gear types the annual by-catch rate was mostly thought to be low (< 10 animals). Survival rate after capture was almost 100% for purse seines, however no animals survived capture in trawls and gillnets. The majority of interviewees (72%) did not use any mitigation measures. If measures were taken, the most popular strategies were to move to „cetacean free“ fishing areas (66%) or to scare dolphins away from the vessel (36%). Most fishermen had no suggestions to solve the conflicts or mentioned that they have to accept it as it is nature. We conclude that the majority of Galician fishermen do not consider cetacean-fishery interactions problematic and to be only of major concern in certain fisheries. More detailed analysis is being carried out in order to propose suitable management approaches.



**HI08**

**AN ANALYSIS OF FISHERY IN THE PUCK BAY (SOUTHERN  
BALTIC/POLAND) FROM THE PERSPECTIVE OF REDUCING THE BYCATCH  
OF HARBOUR PORPOISES**

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The Puck Bay, a NATURA2000 site, forms around 1% of the Polish EEZ and belongs to the territorial waters where the EU regulations concerning the bycatch of small cetaceans do not apply. Fish are caught here by small boats. In the 1990s a 40% of total reported bycatch of porpoises was noted here. In order to find the right method of reducing this threat, appropriate to the fishing strategy in use, attempts have been made to draw up a method of managing the fishing and protecting the species in a way which minimises the conflict between the two needs. An attempt has been made to investigate the gillnet fishing strategy which carry of the danger of bycatch of harbour porpoises. Each month a count has been performed in situ, and the positions and types of the fishing nets used is noted. Polish law allows fishing in the Puck Bay exclusively to small boats using set nets. In 2009 117 boats below 15 m in length fished here. Of these, 112 are boats up to 10 m long, of which 88 did not exceed 8 m. Depending on the season, the fishermen put out from 800 to 1200 set nets in varying numbers and locations in the bay. Between 55 and 82% were anchored at one end, floating, surface gillnets (GNS). Bottom set nets (GNS, FYK, LLS) were from 5 to 26%, and from 13 to 19% nets were marked such that their type could not be determined. Because of the particular strategy of gillnet fishery in the Puck Bay, it is proposed that the bycatch should be reduced by placing a temporary acoustic pinger barrier at the entrance to the Bay. The introduction of this and other protective regulation is [...].



HI09

## THE IMPORTANCE OF LIFE HISTORY PARAMETERS FOR ASSESSING MARINE MAMMAL AND FISHERIES INTERACTIONS

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Life history studies provide valuable information about the age structure, age at sexual maturity and longevity of a population. Many fisheries interactions projects only concentrate on evidence of interactions on carcasses. However, life history data (age, maturity and pregnancy rate data) from stranded and by-caught cetaceans are essential for constructing life tables and age-at-death data are particularly important in estimating overall mortality and fisheries mortality rates. The north-west Iberian Peninsula (Galicia, north-west Spain and northern Portugal) is one of the world's main fishing areas and cetacean by-catch rate is thought to be unsustainable although no mortality rates exist. *Delphinus delphis* is the most abundant cetacean in the area and accounts for over half of the strandings, 60% of which have indications of fisheries interactions. The Iberian *Phocoena phocoena* is a genetically isolated population and 50% of strandings have indications of fisheries interactions and due to its small population size is of concern for its conservation. Age and maturity were determined from stranded and by-caught *Delphinus* and *Phocoena* along the north-west Iberian Peninsula between 1990 and 2008 using standard methods. Results from life tables indicate 12 and 15% annual mortality in the *Delphinus* and *Phocoena* populations respectively, and necropsy data suggests almost half of this mortality is attributable to fisheries interactions. These estimated values greatly exceed the 2% limit set by ASCOBANS and the IWC. By-caught *Delphis* were found to die significantly younger than non-by-caught animals although no sex related difference in by-catch rate was observed for either species. Threatened populations are thought to reach age-at-sexual-maturity younger and smaller. Currently, temporal trends in the populations, such as changes in age at sexual maturity, reproductive output and mortality rates are being determined and the importance of such data in assessing fisheries interactions will be presented.



**HI10**

**MARINE NOISE POLLUTION IN THE LIGHT OF THE EC-MARINE STRATEGY  
FRAMEWORK DIRECTIVE**

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Human activities introduce sound into the marine environment either incidental to their activities (e.g. pile driving) or intentionally for a particular purpose (e.g. active sonar to detect objects). Most, if not all, marine vertebrates rely to some extent on sound for a wide range of biological functions, including orientation, communication and/or detection of predators and prey. Anthropogenic underwater noise can have various impacts on marine species, ranging from exposure causing no adverse impacts to behavioural disturbance to loss of hearing to mortality.

With the implementation of the EC-Marine Strategy Framework Directive (2008/56/EC) underwater noise now for the first time became a subject of European relevance and its impacts need to be carefully and fully evaluated. The member states are obliged to conduct assessments of each of the eleven descriptors listed in Annex I (with the introduction of energy including underwater noise being the eleventh) to define the current status and describe a Good Environmental Status until 2012, which needs to be achieved in 2020.

The European Community has already made progress in a similar process on land (2002/49/EC) and it is appropriate to use the experience gained from this process for the marine equivalent.

The presentation will present first results and suggestions of a visibility study for a potential marine noise mapping funded by the Federal Environment Agency (UBA) and a lookout how descriptor 11 could become congruously implemented.



HI11

## **LONG-TERM MONITORING SURROUNDING THE CONSTRUCTION OF A GAS PIPELINE IN BROADHAVEN BAY (CSAC) AND ITS IMPLICATIONS FOR MARINE MAMMAL CONSERVATION**

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Broadhaven Bay is located in Co. Mayo on Ireland's northwest coast. Proposed installation of a gas pipeline through the bay prompted the implementation of a marine mammal monitoring programme in 2001, which to date has afforded four field seasons involving baseline monitoring and monitoring effort concurrent with construction activities. Construction activities will resume during 2010 alongside continued monitoring. Earlier studies and historical records highlighted the importance of the waters off the Mayo coast to marine mammals, while within Broadhaven Bay the presence of other important marine species and communities with high species richness has contributed to its designation as a candidate Special Area of Conservation. This designation does not yet include any provision for marine mammals. The visual component of surveying utilised cliff-based observations with theodolite tracking, boat-based line transects and photo-identification, in concurrence with acoustic monitoring using T-PODs and C-PODs. Visual and acoustic effort provided recurrent sightings of nine cetacean species and two seal species, implying an unusual level of marine mammal species richness for such a small area of inshore waters (70km<sup>2</sup>). The first sei whale sighting in Irish coastal waters was made in Broadhaven Bay in 2009. Such species richness has not to date been documented from any other comparable studied area on the Irish coast. A significant decrease in sighting rates of bottlenose dolphin and harbour porpoise was recorded between 2002 and 2005/2008, coinciding with increased levels of construction activities in the area. Photo-identification of bottlenose dolphins indicates that the area is being used by a substantial number of individuals as well as showing a degree of site fidelity in the area. The area's ecological significance for cetaceans and other marine species undoubtedly merits further study and continued awareness from a conservation perspective with the potential for optimising mitigation measures for use in other similar developments.

HI12

## MARINE MAMMAL OBSERVATIONS DURING SEISMIC SURVEYS OFFSHORE PORTUGAL

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Marine mammal observations were recorded for the first time during two separate seismic surveys off Portuguese mainland waters in the summer and autumn of 2008. The first survey covered an area of approximately 15000 km<sup>2</sup>, from Oporto to Lisbon (northern and central coast), and the second covered an area of approximately 8000 km<sup>2</sup>, from Sines to Sagres (southwestern coast). The operations included two vessels towing seismic equipment, including an acoustic source. One dedicated marine mammal observer was onboard each vessel and a total of 1344 hours of observational effort was performed during daylight period. Observations were carried out from the highest point of the vessel with naked eyes and with the aid of binoculars. Photos were taken to assist the identification of animals to the lowest possible taxonomic level. For every sighting event, ship's GPS position and depth were recorded and distance to the animals was estimated. Sightings depth ranged from 106 to 4744 meters. Considering both surveys, a total of 154 sightings were recorded. During both surveys, 11 species were positively identified with the common dolphin (*Delphinus delphis*) being the most observed species (26.6%). The geomorphology of the continental shelf, the oceanographic processes and the existence of a Marine Reserve (Berlengas Islands) may explain why the northern and central areas showed a higher number of sightings per hour (0.118), higher cetacean diversity (11 species) and a higher estimated number of animals observed (minimum of 3735). During the southwestern survey, 0.096 sightings per hour were recorded, 5 different species were observed and a minimum number of 181 animals were estimated. Data on marine mammal's occurrence and abundance offshore Portugal is scarce. However, these results are in accordance with generalist literature describing cetacean distribution in the northeastern Atlantic Ocean.



HI13

**CASE STUDY ON POTENTIAL EFFECTS OF THE GREAT BELT BRIDGE,  
DENMARK, ON HARBOUR PORPOISE (*PHOCOENA PHOCOENA*)  
BEHAVIOUR**

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Only limited information exists on how cetaceans behave close to bridges and whether bridges impose a barrier effect to them. Possible effects were studied at Great Belt Bridge in Denmark, a 16km long bridge connecting Funen and Zealand. The area around the bridge is characterised as an area of high porpoises abundance. Porpoise behaviour was observed at 10 observation points (OP). Four positions were located at each end of the bridge on the mainland. 4 positions were chosen on a small island which is located in the middle of the bridge. Additionally, 4 reference points (RP) at 5km distance north and south of the bridge were used. Each observer monitored an area 3km ahead in a 90° angle. For each observation number of animals, age, behaviour, swimming direction and distance were observed. Behaviour was classified following an ethogram of 4 categories: resting, feeding, porpoising and swimming. Further it was noted whether porpoises swam underneath the bridge. First results reveal a mean sighting rate of about 6,01 animals/hour at the western part of the bridge while only 1.94 animals/hour were observed at the eastern part of the bridge where the main shipping route is located. For 2% of all observed harbour porpoises a crossing from one side to the other side of the bridge could be proved. With 0.86 animals/hour the mean sighting rate at RPs was 89% lower than at OPs. Most observations at the RPs succeeded far away from the observation standpoint, whereas at OPs also sightings close to shore were often noted. Behaviour and swimming direction of the observed animals are analysed with respect to possible effects of the bridge. First results show that the bridge does not function as a strong barrier to the animals. In contrast, bridge pillars may even represent attractive feeding habitats.



HI14

## PLANNING IS CRITICAL TO ENSURE EFFECTIVE MITIGATION OF NAVAL ACTIVITIES

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Navies self-regulate their impacts and set their own mitigation strategies. Current on-board mitigation efforts are generally untested but are probably insufficient for many species. Further, increasing scientific evidence demonstrates that ranges required for successful mitigation based upon safety zones are usually larger than is feasible to monitor with current practices. Additionally, the potential exists for detrimental cumulative impacts arising from multiple exposures to sonar in conjunction with other military (or also civilian) activities. The adoption by all navies of effective management measures in the planning stage is an urgent priority. Fortunately, a number of navies have already undertaken considerable work to protect marine wildlife, demonstrating that environmental duty of care does not need to come at the expense of navy training. An ongoing commitment on all, but not limited to, exercise areas, should include: (1) conducting full environmental assessments; (2) funding for ongoing (long-term) and independent collection of field survey data (marine mammal distribution and abundance, and sound propagation including modeling verification); (3) explicitly identifying and avoiding sensitive areas (including bathymetric features of possible importance to cetaceans), and employing other spatio-temporal restrictions in known sensitive and legislated protected sites; (4) identifying a limited number of exercise locations where cetaceans are found in low densities; (5) conducting in-situ real-time PAM and aerial surveys to ensure a more effective detection of cetaceans than by using visual surveys alone; (6) reporting back to enable better understand how effective guidelines are and how well implemented, any observed impacts to cetaceans, and helping to understand the effectiveness of any mitigation measures undertaken, as well as employing adaptive management procedures to update mitigation practices accordingly; (7) transparency and enforcement in legislative compliance; and, (8) transparency and co-operation with stakeholders throughout (including nature conservation agencies within governments, conservation groups, scientists, those involved with stranding / incident response).



HI15

## DESIGN OF AN EFFECTIVE AIR BUBBLE CURTAIN FOR NOISE MITIGATION IN OFFSHORE CONSTRUCTION WORK

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Human contribution to the noise level in the sea increased during the last decades. Ship traffic, underwater explosions through military actions and ordnance removal, seismic exploration, mid and long range sonar as well as offshore construction work have added up to the noise pollution. Most of these sound sources cannot be easily attenuated, but for ordnance removal and construction work a quite simple solution - air bubble curtains (ABC) - exists to prevent negative effects on the hearing of marine mammals. While the efficiency of this tool has been proven from the acoustical perspective, it has not been shown yet, that deployment of an ABC can be inexpensive compared to the costs of the whole wind generator and handling can be time and labor efficient. Showing the effectiveness of this tool will hopefully result in the obligation to use sound reduction measures during all piling and explosion events. We currently design a modular ABC-system deployable at first in water depth up to 10 m. The system will be easy to use ideally taking up not more construction time than the piling of the foundations itself needs. Trials to design the air pipes in relation to water depth and currents are carried out in a test tank (4x5x3 m) to find the optimum spacing and sizes of air holes prior to the construction. We will present the first results of these trials and show schematics of the system. Field trials in Kiel harbor will be carried out during summer months 2010.



HI16

**THE USE OF SEAL SCARERS DURING OFFSHORE PILE DRIVING - AN EFFECTIVE MITIGATION MEASURE FOR HARBOUR PORPOISES (*PHOCOENA PHOCOENA*)?**

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Pile driving noise emitted during offshore wind farm construction can potentially harm marine mammals. From noise measurements during pile driving at Horns Rev II it was estimated that harbour porpoises could suffer hearing loss at distances up to about 1 km from the sound source. In order to avoid any physical damage in porpoises and seals the use of seal scarers during offshore windfarm construction is mandatory in German waters. However, little information exists as to how far deterring effects of seal scarers on harbour porpoises reach and existing knowledge is ambiguous.

We investigated the spatial and temporal effect of a seal scarer (Lofitech) on the acoustic activity of harbour porpoises. Five C-PODs were deployed along three transect lines running from 0.75 to 7.5 km distance to the seal scarer, which was deployed next to an additional C-POD in the middle. We conducted 10 trials during which the seal scarer was activated for 4 continuous hours. Trials were separated by at least 5 days between them. Data were analysed using porpoise positive minutes per hour (PPM/H). Porpoise activity during the 4 hours of seal scarer deployment was compared to 4 hours prior and after deployment at the different distances.

Results are discussed with respect to the effectiveness of seal scarers as a mitigation tool during windfarm construction, and recommendations for future use of seal scarers are formulated.



HI17

## THE MOST INTENSE OCEAN NOISE POLLUTION AROUND THE STRAIT OF GIBRALTAR CONCENTRATES INTO BUBBLES LOCATED AT CETACEAN PREY HUNTING DEPTHS

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It is recognized that the ocean noise pollution is a major threat to cetaceans. The rapidly increasing pollution generated by the shipping activities has chronic impacts on the marine mammal populations, since it reduces their faculty to communicate, and detect preys. This effect is augmented by the fact that the increasing world shipping traffic concentrates at passages that very often are located along migration routes or habitat of particularly sensitive species. This is typically observed around the Strait of Gibraltar, on both the Atlantic and Mediterranean sides. It is therefore relevant to understand how the noise pollution is distributed in space and time in such a place like the Strait of Gibraltar. The fusion of oceanography, bathymetry, and real-time ship traffic data has been implemented to dynamically monitor the ocean noise pollution at 250Hz during June 2008 in a 400km times 200 km area centred on the Strait of Gibraltar. The output of the one image-per-hour ocean noise monitoring has shown three major discoveries: 1- the most intense noise levels are concentrated inside the narrowest and shallowest part of the Strait but expand on both sides in very large areas in both the Atlantic and the Mediterranean basins; 2- the distribution of the pollution levels is quickly variable in space and time, bellow the hourly timescale; 3- on both sides of the Strait, the most intense noise pollution sinks between 700m and 1300m depth in the form of sound bubbles. Local cetaceans such as Fin Whales (*Balaenoptera physalus*) migrating through Gibraltar, or Pilot Whales (*Globicephala melas*) and Cuvier beaked Whales resident in Gibraltar and in the Alboran sea usually dive at those noisiest depths for hunting purposes. This result suggests that they probably experience increasing difficulties to operate their bio-sonar to detect preys and to provide for their feeding needs.





HI18

## WIND FARM CONSTRUCTION: VARIOUS WAYS OF MONITORING EFFECTS ON HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) -SHIP SURVEYS-

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The German offshore wind energy production will be largely expanded during the next years. The construction of the first German offshore wind farm “alpha ventus” has just been completed. Possible impacts on harbour porpoises (*Phocoena phocoena*) caused during the construction and while operating offshore wind farms have to be assessed. Several standard monitoring methods have been used on a larger scale, among others, in order to evaluate the scale of monitoring which is now mandatory for environmental impact studies by the permitting agency in Germany: ship surveys, aerial surveys and passive acoustic monitoring devices (CPODs, Chelonia Ltd.). The ship-based surveys were planned to be performed before, during and after the construction phase. In March and April 2009 the first two surveys were carried out. The applied method was double platform line transect sampling with two teams of observers. Performed effort covered 859 km during the first survey and 1113.38 km during the second survey in sea conditions  $\leq$  Beaufort 3. The preliminary analysis of the obtained data provides information on density and distribution of harbour porpoises in this area. As the construction phase was postponed and interrupted several times, the second survey included mainly pre-and post-building days. Pile driving activities occurred only during two days of the survey. Therefore, clear statements on acute effects caused by pile driving cannot be drawn.



HI19

## WIND FARM CONSTRUCTION: VARIOUS WAYS OF MONITORING EFFECTS ON HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) -AERIAL SURVEYS-

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The German offshore wind energy production will be largely expanded during the next years. The construction of the first German offshore wind farm “alpha ventus” has just been completed. Possible impacts on harbour porpoises (*Phocoena phocoena*) caused during the construction and while operating offshore wind farms have to be assessed. Several standard monitoring methods have been used on a larger scale, among others, in order to evaluate the scale of monitoring which is now mandatory for environmental impact studies by the permitting agency in Germany: ship surveys, aerial surveys passive acoustic monitoring devices (CPODs, Chelonia Ltd.). Between 2002 and 2009 line transect distance sampling was applied during dedicated aerial surveys of harbour porpoises in the southern North Sea. This study focused on the density and distribution of porpoises in the area of “alpha ventus” prior to and during its construction. During a survey effort of 24 898 km, 1198 harbour porpoises were detected. Porpoise density was highest during spring and relatively low in summer and autumn. Distributional patterns, analyzed using Generalized Additive Models, differed significantly between the seasons and a hot spot was identified around the Borkum Reef Ground, occurring from 2005 onwards in spring. During the pile driving activities in April 2009, porpoise density was lower (0.55 animals/km<sup>2</sup>) than before the construction period in March 2009 (0.90 animals/km<sup>2</sup>). The spatial distribution of porpoises during the construction activities differed strongly from patterns observed in former years. No animals were sighted within a distance of 20 to 40 km around the construction site. Porpoises were obviously displaced from critical habitat since the area of avoidance largely overlapped with the hotspot observed in spring. It has to be further investigated whether this effect is of long or short-term character and whether it may affect porpoises on the level of populations.



HI20

**WIND FARM CONSTRUCTION: VARIOUS WAYS OF MONITORING EFFECTS ON HARBOUR PORPOISES (*PHOCOENA PHOCOENA*) - PASSIVE ACOUSTIC MONITORING-**

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The German offshore wind energy production will be largely expanded during the next years. The construction of the first German offshore wind farm “alpha ventus” has just been completed. Possible impacts on harbour porpoises (*Phocoena phocoena*) caused during the construction and while operating offshore wind farms have to be assessed. Several standard monitoring methods have been used on a larger scale in order to evaluate the scale of monitoring which is now mandatory for environmental impact studies by the permitting agency in Germany: ship surveys, aerial surveys and passive acoustic monitoring devices (CPODs, Chelonia Ltd.). CPODs were used to detect effects on the habitat use and behavior of harbor porpoises. The CPOD data revealed that during the pile driving activities for the construction of the transformer platform as well as for the first OWTs the detection rate for harbor porpoises decreased significantly. The variance of the data is constant throughout the seasons, but strongly reduced in the pile driving period, indicating a correlation with the piling activity. However, correlation of porpoise occurrence with intense noise sources such as military sonar, fish sonar, geological surveys e.g. carried out within/ adjacent to the study area has also to be taken into account for the analysis. The number of porpoise detections increased during the pile driving activities towards the end of the construction period. Habituation, ecological parameters or cumulative effects are considered as potential reasons for this effect.



HI21

## SHIP STRIKES WITH CETACEANS IN THE MEDITERRANEAN SEA: ASSESSMENT, PUBLIC AWARENESS AND MITIGATION MEASURES

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Collisions between ships and cetaceans occur throughout the world, with the fin whale *Balaenoptera physalus* being the species most often involved. In the Mediterranean Sea, ship strikes with the two large Mediterranean cetaceans, the fin whale and the sperm whale *Physeter macrocephalus*, are relatively common, due to the high volume of maritime traffic concentrating in areas and seasons in which these species occur in high densities. The Mediterranean populations of both species are reproductively isolated from the Atlantic populations and thus would benefit from science-based conservation plans addressing anthropogenic impacts. In cooperation with ACCOBAMS and the IWC, the Tethys Research Institute is developing a series of initiatives, funded by the Italian Ministry of the Environment, to investigate and mitigate the risk of collision in the Mediterranean, particularly in the Pelagos Sanctuary. One of the first aims of this initiative is to improve and increase the dataset for the Mediterranean basin and raise public and institutional awareness. A dedicated web site ([www.tethys.org/collisioni/](http://www.tethys.org/collisioni/)) presents latest updated information about ship strikes, helps disseminate awareness materials to inform ship crews and the general public and includes reporting forms. In its first three months the website averaged 130+ new visitors per month, of which 78% were from countries bordering the Mediterranean Sea. This regional database is compatible with the global IWC database ([www.iwcoffice.org/sci\\_com/shipstrikes.htm](http://www.iwcoffice.org/sci_com/shipstrikes.htm)) and the Mediterranean data will form an integral part of it. An important component is also the collaboration among shipping companies, port authorities and scientists, along with the provision of public information on reporting. The available information for the Mediterranean sea is sparse. Reliable estimates of fatality rates and associated information are essential to assess impacts at the population level and design effective mitigation measures.



HI22

## SHORT DESCRIPTION OF A NEAR-MISS EVENT INVOLVING A LARGE VESSEL AND HUMPBACK WHALES (*MEGAPTERA NOVAEANGLIAE*) OFF ANTARCTICA

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During recent decades the worldwide number of collisions between vessels and cetaceans has increased steadily. Not much is known about how collisions occur, because they are rarely directly observed. Likewise, reports of near-miss events are virtually non-existent in the scientific literature. Here, a near-miss event is described, involving a cruise ship and humpback whales (*Megaptera novaeangliae*) off Antarctica. On 22 February 2009, the cruise ship encountered two humpback whales while approaching Cuverville Island (Antarctic Peninsula, approx. 64°43' S, 62°36' W). The animals were sighted logging on the surface at a distance of approximately 500 meters. The ship travelled at less than 10 knots, thereby closing in on the whales without purposefully approaching them. At a remaining distance of roughly 100 m, now clearly on collision course, the vessel crew initiated an avoiding maneuver, but due to the low speed the vessel reacted only slowly. The animals did not react until the vessel was within a few meters. At a distance of about 10 m, one of the whales appeared to „wake up“ and performed a startle reaction by sharply as well as vigorously turning away from the vessel. The other whale did so likewise. The ship had come up to approximately 3 meters of the animals, but did not collide with them.

The most likely explanation for this incident is that the whales were resting and therefore had a reduced alertness to outside stimuli. They apparently neither saw nor heard the vessel in a way that made them aware of a risk of collision. These observations contribute to a better understanding of cetaceans' behaviour in the context of the issue of vessel-whale collisions.



HI23

## WHALE-WATCHING VS. WHALING IN ICELAND: A SURVEY OF WHALE-WATCHING TOURIST ATTITUDES TO CONSERVATION ISSUES

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Whale-watching activities, one of the fastest growing sectors of the world tourism market, began in Iceland in 1990, and have enjoyed over 250% annual growth in recent years. In 2002 Iceland has rejoined the IWC and started scientific whaling in 2003. Although Iceland's scientific whaling programme provided no immediate monetary benefits, Iceland resumed commercial whaling on 17th October 2006. According to Parsons (2003), 79% of potential whale-watchers would boycott a country conducting hunts for cetaceans. Our survey was based on the assumption that the opinions of whale-watchers in Scotland would be echoed by whale-watching tourists in Iceland. Using Parsons' results as a starting point, we investigated tourist opinions about whaling and whale-watching in Iceland. The influence of nationality, whale-watching experience and sensitivity to environmental problems were also considered. In 2009 (June-August), questionnaires were distributed to 1474 tourists boarding daily whale-watching boat tours in Faxaflói bay, Reykjavik, Iceland. The vast majority of those surveyed expressed opposition to hunting whales (76%). Regarding whale-watching, the tendency of most participants (70%) was to respond that whale watching operations do not harm whales and dolphins and that whaling does in fact interfere with whale-watching operations (52%). Contrary to Parsons' predictions, 81% of the whale-watchers with no prior knowledge of the whaling situation in Iceland before planning their trip, mentioned that whaling was not a good reason to avoid visiting Iceland. Whale meat consumption among tourists was also analyzed, with 19% having actually tried it and 86% of potential consumers stating that they would have done it out of curiosity. Although focusing on only one aspect of the issue, the current study suggests that a highly visible national policy promoting cetacean conservation and aimed at tourism as well as other sectors could be beneficial in terms of enhancing Iceland's image.



HI24

## ECOTOURISM AND BOTTLENOSE DOLPHINS, *TURSIOPS TRUNCATUS*, IN THE SHANNON ESTUARY, IRELAND

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Since 1993, commercial dolphin watching has been in operation in the Shannon estuary. Using a dolphin-watching tour boat as a “Platform of Opportunity”, group data and individual photo-identification was used to survey bottlenose dolphins in the outer part of the estuary. The main aim of the study was to assess the level of exposure that individual dolphins are subjected to from dolphin-watching tours, on a trip, daily and weekly basis and to provide management advice based on the outcome of the analysis. Boat-based surveys were carried out from the 22nd June to the 13th August 2009. A total of 36 survey days, with 61 survey trips were conducted, resulting in 110 encounters with dolphin schools. In total, 132 well-marked individuals were placed into a catalogue and given a unique identification number. Of these, 90 were re-captured during the study period. The rate of recruitment of well-marked animals into the catalogue declined over the last three weeks of the study, suggesting residency in the outer part of the Shannon estuary, at least for the duration of the study, and that most individuals using the outer estuary had been encountered. The re-capture rate was high, with several individuals being re-sighted on the same trip more than once, on different trips during the same day and on consecutive days. Nine individuals were re-captured three times in a day, in all cases amounting to over an hour of exposure. At least two individuals experienced over 3 hours contact with the tour boat over three consecutive days. It is clear from the study that the voluntary Code of Conduct currently followed does not take into consideration the accumulative exposure to tour boats and a revised Code of Conduct with regard to the number of encounters permitted per trip or encounter duration is recommended.



HI25

**BEHAVIOURAL RESPONSE OF SOUTHERN RIGHT WHALES (*EUBALAENA AUSTRALIS*) TO ANTHROPOGENIC APPROACHES IN BAHÍA DE SAN ANTONIO, RÍO NEGRO ARGENTINA**

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The behavioural response of southern right whales (SRWs) to human approaches was studied in Bahía San Antonio, Río Negro Argentina, to obtain essential information for the evaluation of a recent authorized whale-based tourism and the implementation of accurate regulations and conservation measurements.

A total of 50 SRW groups were approached with a zodiac (4.6m; Suzuki 40Hp outboard motor) during the whale-seasons (June-October) of 2008 and 2009, accounting for a total of 39h of behavioural observations (8h “undisturbed” and 31h “disturbed” behaviour). The approaches occurred in a slow and controlled way up to a minimum distance of 100m. A focal animal observation (instantaneous point sample) was used to record three mutual exclusive behavioural states: rest, travel and socializing and/or aerial activity. Groups (chosen at random) consisted out of solitary animals (0.52), Surface Active Groups (SAG; 0.32) and non-SAG (0.13). Nevertheless, because of the low amount of data, up to now all behavioural responses were analysed regardless the group composition.

Results indicated that whales continued travelling during an approach, but doubled their time resting after an approach had finished ( $22\% \pm 40\%$ ) and decreased drastically their time socializing or aerially active ( $21\% \pm 2\%$ ).

Although the probability that a whale remains in a social/aerially active behaviour when affected by anthropogenic approaches decreased notably (-22%), no significant effect could be found up to now (Z-test for 2 proportions,  $p > 0.05$ ), probably due to the small dataset. Nevertheless, the apparent change in SRW social behaviour requires urgently more detailed information to implement conservation strategies regulating adequately the commercial whale-based tourism in the area.





M01

**LAMPREYS (*LETHENTERON CAMTSCHATICUM*) PARASITIZE HUMPBACK WHALES.****Evgenya Lazareva (1), Alexander Burdin (2), Erich Hoyt (3)**

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Few data exist on host organisms of the parasitic pacific lamprey, *Lethenteron camtschaticum*. It is known that the pacific lampreys use salmon to transport themselves to rivers, where they spawn. In addition, we know that several species of fishes such as cod, salmonids and halibut are the ordinary hosts of these lampreys, but no lamprey-cetacean interactions have been described yet in the Kamchatka region. For the first time in 5 years of research, we have found lamprey parasitizing humpback whales. Here, we discuss 17 records of pacific lampreys that were observed while attached to humpback whales. All the attachments were recorded in the Commander Islands area during the summer months (late August - September 2009) when lampreys are gathering in schools and preparing to spawn. All these observations were photographically documented with images of sufficient quality to identify the lamprey from morphological characteristics. It is not known how lampreys might benefit from this association or what cost may be incurred by their humpback whale hosts. Feeding and transport are two possible reasons for the attachments. Since the abundance of salmon (that is the main transporting host) was very high in this year in this region, we suppose that feeding is the main reason for these attachments.



## M02

### MACROPARASITES IN CETACEANS STRANDED ALONG THE ITALIAN COASTS DURING THE PERIOD 2006-2009

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The study of marine mammals parasites is increased in the last years. This research was aimed to contribute at the description of the parasitofauna of cetaceans stranded along the Italian coasts, detailing the morphological features of the parasites and their topographical distribution within the hosts.

**METHODS:** Since March 2006 to September 2009 a parasitological survey was carried out on 19 stranded cetaceans belonging to 7 of the most representative species of the Mediterranean Sea: 11 *Tursiops truncatus*, 2 *Stenella coeruleoalba*, 2 *Balaenoptera physalus*, 1 *Ziphius cavirostris*, 1 *Grampus griseus*, 1 *Globicephala melas*, 1 *Physeter catodon*. The parasites were fixed in 70% ethanol and identified using both light and stereo microscope. ESEM (Environmental Scanning Electron Microscope) and molecular analyses were also implemented for some samples. **RESULTS:** *Digenea*: trematodes *Heterophyidae* (*Pholeter gastrophilus*) were found in four *T. truncatus*, one *S. coeruleoalba*; *Brachycladiidae* in four *T. truncatus*, one *S. coeruleoalba* and in *G. melas*; *Notocotylidae* (*Ogmogaster antarcticus*) in one *B. physalus*; *Brauninidae* (*Braunina cordiformis*) in one *T. truncatus*. *Cestoda*: tapeworms belonging to family *Tetrabothriidae* were recovered in *G. griseus*, *G. melas* and *P. catodon* and cestodes *Diphyllobothriidae* in one *T. truncatus*; tetraphyllidean plerocercoids in *G. griseus* and one *S. coeruleoalba*; tetraphyllidean merocercoids in *G. griseus*, *G. melas*, *P. catodon* and two *S. coeruleoalba*. *Nematoda*: spirurid nematodes of the genus *Crassicauda* were observed in one *T. truncatus*, *G. griseus*, *Z. cavirostris* and *B. physalus*; lungworms *Pseudallidae* were recovered in six *T. truncatus*. *Crustacea*: copepods *Pennella balaenopterae* were found in one *B. physalus* and in *G. griseus*. **CONCLUSION:** Parasites were found in all stranded cetaceans. Future researches should investigate more deeply the host-parasite-environment relationships and the evolutionary history of these organisms. Actually, for many parasitic species there is taxonomic ambiguity and the use of modern identification techniques in addition to classical ones is desirable.

**M03**

cancelled



**M04**

**DIFFICULT LABOURS WITH FATAL CONSEQUENCES IN BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) FROM THE ADRIATIC SEA**

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Difficult labour (dystocia) has an important role in human and veterinary obstetrics and often requires an assisted delivery to prevent complications, both in the mother and the newborn. Its main causes are abnormal fetal positions, fetal abnormalities, and disorders in the form and function of the reproductive tract of the mother. In animals in the wild difficult labours proceed unassisted and they can end fatal for the fetus, mother or both. As part of a long-term project to investigate marine mammal strandings, 139 bottlenose dolphin (*Tursiops truncatus*) carcasses found in the Croatian part of the Adriatic Sea were examined from October 1990 to November 2009. In five cases we observed dystocia with fatal consequences. The age of the females ranged from 6 to 22 years. The causes of dystocia were abnormal fetal positions (dolphin No. 8 and 159) and a fetal congenital abnormality (dolphin No. 183). In two dolphins the cause of dystocia could not be observed but there were evidences of a difficult labour in form of a prolapsed uterus (dolphin No. 17) and prolapsed vagina and urinary bladder (dolphin No. 35). The bottlenose dolphin is the only resident marine mammal species in the Adriatic Sea, with an estimated number of around 200 adult individuals and around 20 cubs living in the Croatian area. It is estimated that between 15 and 20 bottlenose dolphin births occur there annually, so the estimated total number of births since 1990 is between 270 and 360. This means that dystocia with fatal consequences appears in between 1.4% to 1.9% of all births in the bottlenose dolphin from the Croatian part of the Adriatic.

**M05**

**TiO<sub>2</sub> NANOPARTICLE GENOTOXICITY ASSESSED IN ISOLATED BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*) LEUKOCYTES**

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The growing development of technologies based on nanoparticles (materials with at least one dimension between 1 and 100 nm) is enhancing research interest about their interactions with living systems and potential health hazard. Most of recent studies concern risks for human exposure, while little information exists about their impact on environment and endangered species, like marine mammals. The input of nanoparticles in aquatic environments is both industrial and non-industrial, and due to large scale production, most of these products and their by-products reach the sea and accumulate there. Endangered species, like cetaceans, prone to contaminants bioaccumulation and pollution impacts, need preferential monitoring. For those reasons, we used a non-invasive approach in order to assess the susceptibility of toothed cetaceans to particulate TiO<sub>2</sub>, using isolated blood cells from five specimens of captive bottlenose dolphin.

For in vitro exposure, isolated leukocytes were exposed for 4, 24 and 48 hours to 20, 50 and 100 µg/ml of two forms of TiO<sub>2</sub>: rutile (5000 nm), and anatase (< 25 nm) previously suspended in RPMI and sonicated. Genotoxic effects were evaluated by the Comet assay, cells viability by the Trypan blue exclusion assay, Electron Microscopy was used to assess the aggregation of particles in experimental suspensions.

Results show a statistically significant increase of DNA fragmentation after 24 and 48 hours of exposure to the highest doses of rutile and after 48 hours of exposure to anatase, suggesting a slight genotoxic effect of titanium dioxide particles on isolated dolphin leukocytes. Cell viability was always high, excluding significant cytotoxic effects. Comparing our results with those from other studies, bottlenose dolphin leukocytes seem to be less susceptible to TiO<sub>2</sub> than human ones. However, more studies are requested to investigate the influence of physical-chemicals factors and interactions with living systems in determining the effects of nanoparticles on organisms.



**M06**

**SOME ASPECTS OF RESEARCH OF CELLULAR IMMUNITY IN THE BLACK SEA BOTTLENOSED DOLPHIN (*TURSIOPS TRUNCATUS*)**

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During recent decades the problems of protection of rare species of marine mammals have become very acute. There are two main trends in possible solutions to this problem. One is conservation of the species under natural habitat conditions. In this case the focus is on investigating factors, including anthropogenic factors, that may impact species numbers in the natural range. An important factor directly causing population decline are highly-contagious polyethiological infection epizootics, which result in mass mortality of animals. In this case a high level of antiepzootic effectiveness in the immune system of population members is of great value for species survival. Another possible method for protecting marine mammals is adaptation to life in captivity with subsequent investigation, breeding and recovery of their numbers in natural populations. The end results of the adaptation process basically depend on the level of antiepzootic effectiveness of the immune system of the individual in the course of adaptation to qualitatively new environmental conditions. The above considerations led us to investigate aspects of cellular immunity in the Black Sea bottlenose dolphin (*Tursiops truncatus*). In the course of studies 55 adult dolphins were examined at various stages of adaptation, from 2001 to 2004. These investigations were conducted at the marine research station of the Severtsov Institute of Ecology and Evolutionary Problems RAS (Russia). also In addition ten Black Sea dolphins were examined in 2009 at Odessa dolphinarium (Ukraine). The level of phagocyte activity of leucocytes was determined in all animals. During the early stages of adaptation, phagocytotic activity decreased to 30-40 % of initial levels, rising again to 70-90 % in healthy adapted animals. Thus, assessment of immune competence can serve as marker to evaluate the extent of resilience of the organism to environmental changes.



**M07**

**PATHOLOGICAL AND ECOTOXICOLOGICAL ANALYSIS ON TWO SPECIMENTS OF *BALAENOPTERA PHYSALUS* STRANDED ALONG THE ITALIAN COASTS**

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Mediterranean *Balaenoptera physalus* population seems to be menaced by many threats related to human activities, but very few studies were performed to confirm this situation. In this report pathological and ecotoxicological analysis on two fin whales (*Balaenoptera physalus*), stranded along the Italian coasts, are described. A complete necropsy was performed on the two animals and immunohistochemical investigations were performed on spleen to state any change in leucocytes populations. HCB, DDTs, PCBs and PAH were evaluated in blubber, liver and muscle of both whales and trace elements were investigated in the liver. The first whale was a newborn male, 5.40 mt long, not well preserved, dead along Ligurian coast in 2006. During the necropsy, severe, multifocal, sub-endocardial granulomatous myocarditis possibly due to parasites and parasitic cysts with ova in bladder's ligament suggest a mother-calf trans-placental migration of a parasitic agent, probably *Crassicauda spp.*

The second whale stranded alive along the Tuscany coast in 2008 and died during rescue operations. It was a 10.4 mt long juvenile. During necropsy a high parasitic infestation was observed: some Pennella balaenoptere were observed associated to blubber cavitation fullfilled of bloodish material; in the uro-genital system and in renal vessels, several parasites (*Crassicauda boopis*) were observed with a severe vascular reaction and thrombosis Cardiac conduction system mineralization was also observed at microscopic examination. The animal died for arterial hypertension, complicated by severe vascular parasitism and mineralization of Purkinje cells in the heart.

The levels of all the organic compounds detected in blubber and muscle were most lower in the first animal due to the age of the two whales. This study is an example as a complete and integrated post-mortem examinations on stranded animals could give many important information on the health status of this species.

**M08**

**CELL VIABILITY AND SPECIFIC METABOLISM IN PRIMARY SEAL  
HEPATOCTES AFTER IN VITRO EXPOSURE TO PFOS AND PCBs**

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Marine mammals are highly burdened with persistent organic pollutants, such as perfluorooctane sulfonate (PFOS) and polychlorinated biphenyls (PCBs). Chronic exposure to PFOS and PCBs causes severe effects in organisms. For the early detection of health risks for harbour seal (*Phoca vitulina*) populations in the North Sea, it is indispensable to discover the effects of contamination on the cellular and molecular level. As PFOS and PCBs accumulate in the liver and due to its central role in the metabolism of xenobiotics, the liver is particularly affected by contamination. We developed an in vitro method to investigate effects of PFOS and PCBs on primary hepatocytes of *Phoca vitulina*. Hepatocytes were isolated by a biopsy perfusion method. After three days of cultivation, the cells were incubated for 24 hours with environmentally relevant concentrations of PFOS and an Aroclor-mixture respectively. In the present study the effects were examined on the cellular level. During the experiments three indicators for cell viability were assessed: (1) The activity of mitochondrial dehydrogenases (XTT assay), which gives information about the overall functional cell viability; (2) the release of the intracellular enzyme lactate dehydrogenase (LDH), which indicates a loss of membrane integrity; and (3) the urea synthesis, which reveals the maintenance of the hepatospecific metabolism. Analogous experiments were performed with primary porcine hepatocytes to allow a presumption on the species specificity of the reaction to these xenobiotics and on the necessity of specific biomarkers for seals. The experiments were conducted with livers of five freshly dead seal pups from the North Sea and three porcine livers. Our assessment of cell viability and specific metabolism did not reveal any significant changes after incubation on the cellular level. Subsequent toxicoproteomic and genomic studies will be performed to determine sublethal effects on the molecular level.



## M09

### DETECTION OF SPECIFIC ANTIBODIES TO VIRUS SERIES OF MAMMALS IN STELLER SEA LION (*EUMETOPIAS JUBATUS*) OF THE KURIL ISLANDS

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The end of the 20th century saw a considerable decline of the numbers of the Steller sea lion in the bulk of its range. It is known that mass mortality in the course of epizootics caused by highly-contagious pathogens may have a substantial effect on populations of marine mammals. The objective of the study was investigation of possible cross-reactions to reveal antibodies in sea lion serum to the viruses of other mammals. For the serological survey, the ELISA method was used. The reaction was assessed on the basis of a diagnostic titre of specific antibodies known for horses and cattle. The study was carried out using serum samples from 44 Steller sea lion pups aged 5-6 weeks, belonging to the same population but born in various rookeries.

Results revealed that antibodies to cattle and horse herpes virus were present in the majority of serum samples. According to published data, the herpes virus has been circulating in pinniped populations and has resulted in reduced immunity. Of especial interest was the detection of antibodies to horse influenza of type 1 H7N7 in virtually in all the animals, which suggests the possibility of infection of Steller sea lions with pinniped influenza virus phenotype H7N7. In two cases, antibodies to the horse influenza-1 were present in high titres. Antibodies to the horse influenza-2 were found in a small number of serum samples. We plan further studies to support the results obtained and to investigate both the immune response and morbidity of Steller sea lions in the rookeries.



## M10

cancelled



**M11**

**PULMONARY PATHOLOGY: A COMPARISON BETWEEN BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) AND STRIPED DOLPHINS (*STENELLA COERULEOALBA*) STRANDED ALONG THE ITALIAN COASTLINE.**

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Many studies on stranded cetaceans show the respiratory tract and, in particular, the lungs to be the most affected by pathological changes. In this survey, a deeper insight into respiratory injuries has been conducted, comparing pulmonary samples preserved in the Mediterranean Marine Mammal Tissue Bank, collected from stranded animals of the two most abundant Mediterranean species. A total of 25 lung specimens from nine free-ranging bottlenose dolphins (*Tursiops truncatus*) and 16 striped dolphins (*Stenella coeruleoalba*), stranded along the Italian coasts between 2000 and 2009, were routinely processed for microscopic observation. The most frequently observed lesion was a chronic multifocal bronchopneumonia, associated with parasitic granulomas in 56% of cases, generally due to *Pseudalidae* spp. infestation. The inflammatory population was mainly composed of macrophages, with an obvious activation of interstitial and intravascular subpopulations. Microbiological examinations, when performed, showed opportunistic bacterial or mycotic pathogens. An interesting finding was the presence of anthracotic pigments in the cytoplasm of interstitial macrophages at peribronchial sites, possibly due to carbon particles: in bottlenose dolphins, these were observed in 25% of the animals with a moderate severity, while mild pigmentation was evident in 17% of striped dolphins. Lung fibrosis was found in 23% of examined subjects, often associated with an inflammatory reaction and, occasionally, a changed feature of bronchioles with a consequent deficiency of respiratory aspecific defences. Alveolar keratine scales were seen in all pulmonary samples collected from three newborns. This study confirmed the high incidence of pathological changes in the lungs of odontocetes in the Mediterranean Sea, and the peculiar physiopathology of these organs involving mainly macrophages in inflammatory reactions. Pulmonary injuries are mainly due to parasitic infections. Even if parasites are not the main cause of

death, they could pre-dispose it to secondary infections by opportunistic pathogens, sometimes lethal.



**M12**

## **TOXOPLASMOSIS IN *TURSIOPS TRUNCATUS* STRANDED ALONG ITALIAN ADRIATIC COAST**

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Toxoplasmosis is a widespread parasitic disease caused by *Toxoplasma gondii*, intracellular protozoan of all hot-blooded animals, including marine mammals. In Mediterranean Sea, toxoplasmosis was reported in bottlenose dolphins (*Tursiops truncatus*), striped dolphins (*Stenella coeruleoalba*) and Risso's dolphins (*Grampus griseus*) stranded along the Spanish and Tuscany coastline (Tirreanean Sea). MATERIALS & METHODS: Tissue samples (brain and all the available organs depending on the preservation status) of 13 bottlenose dolphins (*T. truncatus*), stranded along the Italian Adriatic coast between March 2006 and July 2009, were investigated for *T. gondii* evidences by molecular and microscopic techniques. RESULTS: All tissues from 2 animals (1 female and 1 male), analysed by PCR assay and DNA sequencing, were positive for *T. gondii*. In the female, cerebral cysts with mild non purulent encephalitis and gliosis foci were observed at histological observation of cerebral cortex; in other positive tissues by PCR, no inflammatory changes related to *T. gondii* were noticed. In the male, tachyzoites were observed in brain cortex samples, associated with mild chronic encephalitis and gliosis; in liver, muscle and kidney, no parasites or associated lesions were observed. In the heart, a chronic myocarditis was suggestive of *T. gondii* infection, but the parasite wasn't observed. In all other animals negative by PCR, also microscopic examination did not show evidence of *T. gondii*. CONCLUSION: This is the first report of toxoplasmosis in cetaceans of Adriatic Sea. The molecular analyses, to detect *T. gondii* directly from tissue samples, could be a valuable method to check the presence of the parasite in these species. The genotyping of the isolates is still in progress.

## M13

cancelled



## M14

### **DOLPHIN MORBILLIVIRUS (DMV) AND HERPESVIRUS (HV) CO-INFECTION DURING RE-EMERGING STRIPED DOLPHIN MORTALITY (2007) IN MEDITERRANEAN SEA**

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Ten striped dolphins (*Stenella coeruleoalba*) that stranded during the re-emerging dolphin morbillivirus mortality in the Mediterranean Sea in summer of 2007 (Raga et al., 2008), were studied immunohistochemically and by RT-PCR for detection of Cetacean Morbillivirus (CeMV) and Herpes Virus (HV). All ten dolphins were immunohistochemically and RT-PCR positive for Dolphin Morbillivirus (DMV) and five out of ten were RT-PCR positively co-infected with Herpes Virus (HV). HV infection causing clinical disease in free ranging cetaceans has been rarely reported. Although HV does not seem to have played a principal role in the ethio-pathogenesis of the re-emerging epizootic dolphin mortality that occurred during 2007 in the Mediterranean Sea, its detection merits reference to it as a secondary viral co-infection not described previously during the first striped dolphin epizootic caused by DMV in the Mediterranean Sea (Domingo et al., 1992). All the evidence would support the primary pathogenic role of DMV (Domingo et al., 1992). This immunosuppressive ability of CeMV has been demonstrated «in vitro» by inhibition of lymphocyte proliferation (Heaney et al., 2002). However, during the first striped dolphin epizootic, abnormally high polychlorinated biphenyl levels were detected in those dolphins (Aguilar et al., 1994), raising the question of the role of pollutants as a previous or concomitant condition in the disease break-out. No pollutant data have been published from the last striped dolphin mortality, however. This work reports HV in *S. coeruleoalba* in the Mediterranean Sea, and new HV sequences not previously described to date.

**M15**

**LASER ABLATION ICP-MS SEMI QUANTITATIVE DETERMINATION OF TRACE ELEMENT CONCENTRATIONS IN FRANCISCANA DOLPHIN TEETH: DIFFERENTIATING REGIONAL UPTAKES OF ELEMENTAL TOXICANTS**

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The franciscana, *Pontoporia blainvillei*, is possibly the cetacean most vulnerable to incidental catch in coastal gillnets in the western South Atlantic. It is distributed from Itaunas (Brazil) to Golfo San Matias (Argentina). Four Franciscana Management Areas (FMA I-IV) have been proposed. Franciscanas from FMA III include animals from Rio Grande do Sul State (RS - Brazil) and Uruguay. In this work we differentiate individuals from these two areas based on teeth's semi quantitative concentration of trace elements. Teeth from 10 dolphins from RS and 12 individuals from Uruguay were used. Profiles of deposition of various elements (138Ba, 208Pb, 87Sr, 86Sr, 25Mg, 55Mn and 43Ca) along the dentin in a mid-longitudinal cut tooth were obtained using Laser Ablation-ICP-MS. Elemental signal intensities were normalized against the intensity of the 43Ca signal. Elemental intensities of Pb and Mn were higher in Uruguay than in RS (Mann-Whitney U tests,  $p < 0.001$ ), which might be explained by higher concentrations of these elements in the environment in Uruguay. The coastal waters of these two areas are highly influenced by large estuaries, the La Plata river and the Patos Lagoon estuaries in Uruguay and RS, respectively. The later is also seasonally influenced by the La Plata river. These two estuaries receive the outflow of Montevideo, Buenos Aires and Rio Grande, which may strongly determine the level of pollutants in the ocean's food chain. Due to the process of bioaccumulation of trace elements in long-lived marine animals and because of cetacean teeth are chemically inert and not replaced during life, it is expected that this kind of analysis should be an alternative method for monitoring environmental pollution as well as to help identify ecological stocks of franciscana and other marine animals. S. Botta has a scholarship provided by Brazilian Council for Research and Technological Development (CNPq).

## M16

### THYROID AND STRESS HORMONES IN WILD AND CAPTIVE HARBOUR PORPOISES. FIRST ASSESSMENT OF POSSIBLE RELATION TO ORGANOCHLORINE POLLUTANTS

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Environmental pollution, apart from direct toxic effects, is associated with subtle influences on the homeostasis of organisms and imbalance are considered indicators of stress. Although research on stress in marine mammals is constantly developing, knowledge about the influence of chemical stressors on the endocrine status in these animals is still scarce. The aim of this study was to investigate stress hormone and thyroid hormone profiles in the blood of harbour porpoises and search for their potential correlation with organochlorine body burden. Cortisol, adrenocorticotropic hormone (ACTH), catecholamines (adrenaline, noradrenaline, dopamine) and the thyroid hormones triiodothyronine (T3) and thyroxine (T4) were measured. Concentrations of individual polychlorinated biphenyl (PCB) congeners, p,p'-dichlorodiphenyltrichloroethane (DDT), and p,p'-dichlorodiphenyldichloroethylene (DDE) were measured using standardized methods. Median levels of the catecholamines adrenaline, noradrenaline and dopamine were higher in wild harbour porpoises compared to the captive ones. The measured levels of ACTH varied significantly. No significant correlation was found between PCBs, p,p'-DDT and p,p'-DDE, on the one hand, and the hormones cortisol, ACTH, adrenaline, noradrenaline, dopamine, T3 and T4, on the other hand. The absence of such a correlation in the present study may be a result of the relatively small specimen group and limited sample volumes for pollutant analysis. Therefore more data on stress hormones need to be collected to increase the understanding effects of stress on harbour porpoises.



M17

**BIOPSY WOUND HEALING ON LONG-FINNED PILOT WHALE  
(*GLOBICEPHALA MELAS*)**

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In the last decades, the use of biopsy darting increased to address several questions on cetacean biology, population structure, contaminant loads, social structure, feeding ecology, and evolutionary relationships. So it is necessary to study the process of wound healing to assess the potential risks to the target species and different populations. Using a crossbow, biopsy samples were successfully collected on 87 occasions from pilot whales in the Strait of Gibraltar but it was possible to monitor the wound healing only in 35 occasions (40% monitoring rate) with high quality photographs on at least one different day after the biopsy attempt. Wound healing was monitored on 15 males, 14 females and 6 of unknown sex. Four different wound healing stages were used following Weller et al. (1997). Stage 1, where the wound was pinkish in colour and several millimetres deep, was found between 1 and 17 days, stage 2, where no pink was present, only white without other discoloration and normally with a lighter gray halo surrounding the wound, was observed between 4 and 255 days. Stage 3, when the wound was grey in colour and with no evident epidermal depression, was noticed between 8 and 352 days. Finally, the wound was considered repigmented in stage 4, which was observed after a minimum of 95 days post-biopsy. Bacteria on the epidermis and in the sea can be sources of infection when a biopsy is done. However, in this monitoring study no infection or other kinds of pathologies were detected in the animals. This study provides evidence that the healing rate is fast with the wound closed after a maximum of 17 days generally a complete healing after 3 months. From the pilot whales monitored in this study, the biopsy procedure does not cause long-term complications to the individuals.



S01

**INSIGHTS ON THE SKELETAL STRUCTURE OF A STRANDED *KOGIA BREVICEPS* IN THE CANARY ISLANDS****Marisa Tejedor (1), Vidal Martín (1), Manuel Arbelo (2), Antonio Espinosa (2)**

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As part of a comprehensive study of the biology of *Kogia breviceps* in the Canary Islands, a study of the bone/skeleton structure is being carried out on stranded specimens. Post-mortem examination of a 294cm (CBL=434mm) adult male stranded in Lanzarote in March 2006 revealed several lesions in the skeleton bones, mainly located in cervical and thoracic vertebrae. There was loss of bone tissue in the humeral diaphysis, especially closer to the condylus, as well as in the dorsal regions of vertebral bodies and intervertebral disc surfaces. Hyperostosis, reflected in an irregular growth of the bone surface, was also observed in the vertebral bodies and in the surface of the vertebral joints, being more evident in the first caudal and thoracic vertebrae and in the cervical complex. The left extremity has a fusion between the ulna and the cuneiform. All these anomalies are more evident in the left lateral side of the skeleton. It seems that there is no literature on bone lesions in pygmy sperm whale, so it is not possible to make any comparisons. A very curious and unusual bone, a cervical rib, only described for one beaked whale, *Mesoplodon densirostris*, in 1942, was also found.



S02

**POLYCYCLIC AROMATIC HYDROCARBONS AND HEAVY METAL  
MONITORING IN TISSUES FROM A STRANDED *STENELLA  
COERULEOALBA* IN THE IONIAN COAST OF SICILY**

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It's well known that persistent pollutants can reach high concentrations in the organs and tissues of organisms, especially in marine mammals that are good indicators for the long term monitoring of some metals and polycyclic aromatic hydrocarbons (PAHs) in the marine environment. This study analyzes muscle and blubber from *Stenella coeruleoalba* stranded along the western Ionian Sea in June 2009, for their heavy metals and PAHs content. The heavy metals extraction was carried out with acid digestion of the sample and measured by ICP-MS for Cu, Pb, Ni, Cr, Cd, As, Se, Co, Fe and Zn, and by FIAS 100 for Hg. Fingerprint of 16 PAHs was performed with sonication of homogenized sample and measured by HPLC-UV-FL. Our results of heavy metals fall in the concentration range found by Cardellicchio et al. (2002) in stranded *S. coeruleoalba* along the southern Italy coasts, except for Hg, which concentration is lower than those found in dolphins from the eastern and the northern Mediterranean coast of Italy (Cardellicchio et al., 2000; Capelli et al., 2000), and the French Mediterranean coasts (Auguer et al., 1993). Total PAHs ( $\Sigma$ PAHs tot.) (ppb w.w.) were 1465 and 95734 in the blubber and muscle respectively, instead total carcinogenic PAHs ( $\Sigma$  PAHs carc.) were 46.09 and 79.66 in the blubber and muscle respectively. Comparing our data concerning  $\Sigma$ PAHs tot. with those collected by Marsili et al. (2001) in *S. coeruleoalba* from the Ionian Sea, they have the same pattern of distribution for  $\Sigma$ PAHs tot., but the opposite one for  $\Sigma$  PAHs carc. Further studies should be necessary to improve the state of knowledge on heavy metals concentrations and the relative toxicity equivalency factors (TEFs) proposed by Nisbet and LaGoy (1992) for estimate the cancer potency of the carcinogenic PAHs on their relative potency to benzo(a)pyrene.





S03

**STOMACH CONTENT ANALYSIS FROM PILOT WHALES (*GLOBICEPHALA MELAS*) STRANDED ON THE PORTUGUESE, GALICIAN AND SCOTTISH COASTS.**

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The feeding ecology of cetaceans can be determined through the examination of the stomach contents of accidentally killed or stranded animals. In this study, stomach contents from pilot whales (*Globicephala melas*) recently stranded in Portugal (n=4) and Galicia (n=8) were analysed and all prey remains identified. In all cases, food remains consisted almost entirely of cephalopod beaks. Diet was quantified using three standard indices: of occurrence, number and biomass for each prey species. Results were compared with previous available information for the species in Galicia (n=21) and Scotland (n=6). Both in Portugal and Galicia, octopus (*Eledone cirrhosa*) was the most important prey, followed by Ommastrephidae squids. However, in Scotland the predominant prey were Ommastrophidae squids, followed by species of the Gonatidae and Octopodidae families. Results from this study are in agreement with those of previous authors indicating that cephalopods in general are the main prey of pilot whales.



**S04**

**DOLPHIN DEATHS DUE TO TRAUMA IN THE WATERS OF THE CANARY ISLANDS: INTERACTION AS A CAUSE?**

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The University Institute of Animal Health (IUSA) has been routinely conducting post-mortem examinations of cetaceans found stranded in the Canary Islands in order to diagnose the cause of death. In the last three years, thirteen cetaceans were found stranded with traumatic lesions consistent with violent interactions, of which three animals were calves and one was a juvenile: two common dolphins (*Delphinus delphis*) and two striped dolphins (*Stenella coeruleoalba*). These dolphins exhibited injuries characterized by extensive bruising and hemorrhage in the subcutis and underlying musculature, particularly over the dorsum and flank. The four animals showed several ribs fracture, three of which presented massive hemorrhage on pleura and lungs associated with broken ribs. Both common dolphin calves and striped dolphins presented deep parallel linear skin abrasions similar to interespecific tooth-rakes seen in cetaceans. Interactions between bottlenose dolphin (*Tursiops truncatus*) and delphinid calves had been seen occasionally in the waters of the Canary Islands. These results are highly consistent with inter or intraespecific interactions causing death of young dolphins as it has been described in other areas of the world. These are the first cases reported in Canary Islands and more attention to this cause of death should be taken into account when young dolphins are found stranded.



S05

**PATHOLOGICAL AND ECOTOXICOLOGICAL ANALYSIS OF  
ODONTOCETES STRANDED ALONG THE ITALIAN COASTS FROM 2004 TO  
2008**

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The Mediterranean Sea is often described as one of the most polluted in the World and high levels of Persistent Organic Pollutants (POPs) have frequently been reported in the blubber of stranded cetaceans, in comparison to those of other areas. POPs are described to have a role in the health of cetaceans populations increasing the incidence of acquired diseases, acting as immunomodulators and endocrine disruptors. Post-mortem examinations on 2 *Tursiops truncatus*, 2 *Grampus griseus*, 1 *Stenella coeruleoalba*, 1 *Delphinus delphis*, 1 *Globicephala melas*, 1 *Ziphius cavirostris*, 1 *Physeter macrocephalus*, stranded along the Italian coasts from 2004 to 2008, were performed to investigate the relationship between pathological findings and organic pollutants. When the entire animal was available, a complete necropsy was done and tissues for microscopical and toxicological investigations were collected by personal of the Mediterranean Marine Mammal Tissue Bank of the University of Padova. Severe, multi-visceral, parasitic infection is one of the most common findings. Other frequent lesions include chronic hepatitis, pneumonia (often associated to parasitic infestation), and changes of spleen and lymphoid tissues. At toxicological analysis high levels of hexachlorobenzene (HCB), dichlorodiphenyltrichloroethane and its metabolites (DDTs) and polychlorobiphenyls (PCBs) were detected in all specimens through gas-chromatography technique. Animals with most severe lesions were those with higher levels of POPs in the tissues. Thyroid fibrosis were observed in bottlenose and Risso's dolphins and its severity was related to PCB levels. Even if these results are not enough to confirm a cause-effect relationship, they support the hypothesis of an involvement of POPs in determining a decreased immune response to infectious agents.



**S06**

## **FACTORS AFFECTING STRANDINGS OF CETACEAN CARCASSES AT THE COAST OF THE SEA OF AZOV**

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The south coast of the Sea of Azov is the area of intensive stranding of cetacean carcasses (mostly harbour porpoises). 80-90% occur on coasts with northern and north-eastern aspects (Goldin, 2008) implying that carcass beaching is partly determined by physical factors (probably wind, but not the main current). The relationship between the frequency of strandings at a monitored coastal site (ca. 35 km long) in 1999-2003 and 2005-07, along with physical/temporal factors (mean and maximum wind speeds, wind direction, season) and the cause of death (mainly by-catch, up to 2008), was studied.

Stranding rate was shown to depend upon all the factors examined. High stranding rates (estimated as more than 10 strandings per 2-month interval and/or 40% of the annual rate) were positively and significantly correlated with the season (July-August) and with wind direction (combined north/north-easterly/easterly winds observed during more than 50% days over a 2-month interval). Wind speeds (mean values more than 3 m/s or maxima more than 5 m/s observed during more than 90% days over a 2-month interval) did not significantly correlate with the stranding rate itself but improved the model with the other parameters. Season was the most important predictor: July-August was the time of high stranding rate in all years except 2005.

Stranding rate of animals with evidence of by-catch (in the cases where presence or absence of such evidence could be identified) was 44%, which is 2.2 times greater than predicted by the population dynamics model (Goldin, 2009).

Thus, the high stranding rate at the coast of the Sea of Azov has a clear seasonal peak and is associated with north, north-easterly and easterly winds and windy periods (even with low wind speed). By-caught animals are more likely to be stranded. Porpoises stranded in the study area probably belong to the eastern Azov aggregation (Kondakov & Oleinikov, 2009).



**S07**

## **LONG-TERM DYNAMICS OF CETACEAN STRANDINGS AT THE CRIMEAN COAST (UKRAINE): DATA FROM QUESTIONNAIRE SURVEY**

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Questionnaire survey proves to be a cost-effective method of retrospective cetacean study. This study covers the period of 2000-2007, the region studied is Crimea and adjoining coast of the Sea of Azov. Data from 2540 questionnaire forms filled in 2002-2009 were analysed, 619 positive answers were obtained. 688 reports on 653 stranding events were recorded, among them 119 (18.2 %) from the coast of the Sea of Azov and Kerch Strait, 208 (31.9 %) from the south and south-eastern Crimean (Black Sea) coast and 326 (49.9%) from the western Crimean (Black Sea) coast. The number of recorded events slightly fluctuated interannually, reaching its maximum (101) in 2003 and minimums (64 and 71) in 2001 and 2007. Fluctuations primarily affected the western region, they seem to be unconnected with the number of respondents. The Azov sample does not show long-term dynamics, this fact contradicts field study data and is caused by too small sample. Most findings fall into summer, spring findings reached their maximum in 2003 and 2007. In cases when species was identified, harbour porpoises and bottlenose dolphins dominate. Their ratio varied significantly across regions and changed during the course of study. In the Sea of Azov and Kerch Strait, harbour porpoises dominated during all the study period. In the eastern Black Sea region, porpoises prevailed over bottlenose dolphins up to 2004, since 2005, bottlenose dolphins have been stranding more often than porpoises. In the western Black Sea, porpoises presented the vast majority of strandings up to 2005. Since 2006, percentage of bottlenose dolphins has been increasing. 0-1 live strandings were recorded annually, mainly in the western region, with the maximum (3) in 2003. Marks of starvation, by-catch and ship collision were reported.



S08

## FROM THE COAST LINE TO THE SEA SURFACE: SPATIALIZING STRANDING DATA

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Stranding of marine mammals is an important source of information on cetacean population status and biological samples. Nevertheless, collecting stranding data remains opportunistic and representativeness must be improved. In particular, it would be highly interesting to identify areas of origin of stranded animals, notably because this would allow the identification of which population is actually sampled in this way. The aim of this study was to determine areas of mortality for small cetaceans found stranded along the French Atlantic coasts. In a first step of the experiment, external visual criteria of post-mortem drift duration were obtained from a series of photographs of dead small cetaceans maintained in a floating cage for 2 months and from individuals found by-caught during fisheries monitoring projects and subsequently released dead with a numbered collar fitted to the tail fluke. The second step consisted in collecting pictures of stranded cetaceans taken at random in order to assess their drift duration from the criteria defined above. Finally, likely mortality location of each photographed animal was determined by back-calculating its drift by using the Météo-France model MOTHY. Pictures of 91 stranded common dolphins (*Delphinus delphis*) and 25 harbor porpoises (*Phocoena phocoena*) were obtained; average drift duration was estimated to be 13 days (range: 0-45 days) for both species. Reverse drifts calculated for each individual highlighted two likely areas of origin for both species: a coastal area, from the coast to approximately the 80m isobaths, and a continental slope area, centered on the 500m isobaths. These areas fit well with current knowledge on the common dolphin distribution in the Bay of Biscay, based on at-sea sightings. Through these results, the representativeness of stranding data was improved and a new method was developed to spatialize stranding data and samples and hence strengthen their potential for monitoring cetacean populations.



S09

## CETACEANS IN ALCOBAÇA'S BEACHES: FROM STRANDINGS TO RESEARCH

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Strandings are an ancient occurrence worldwide and the Portuguese coast is not an exception. In 2004, when the Alcobaca Municipality (west central Portuguese coast) initiated this work, it became evident that stranded cetaceans were going straight into the municipal embankment. From that time forward a new procedure was implemented including recording of detailed biometry, species identification, gender and body condition determination, as well as detailed photographs. Full necropsy was rarely possible due to the badly state of carcasses. The main objective of this ongoing project is to understand the causes of death (notably fisheries) associated with strandings across 16 km of the Portuguese coast. The data have been sent to the Portuguese Institute of Conservation and Biodiversity which holds the national stranding database. National data from 1989 to 1994 indicate the *Delphinus delphis* is the main species stranded in this region followed by unidentified Odontoceti. Looking at the regional data (from 2004 to 2009) a total of 78 strandings occurred and common dolphin was the most common stranded species (n=47; mainly adults). Strandings also included 18 carcasses that could not be identified to species due to advanced decomposition (11 dolphins and 2 whales). *Tursiops truncatus* (n=2), *Stenella coeruleoalba* (n=3), *Phocoena phocoena* (n=2), *Globicephala melaena* (n=1), *Baleanoptera auctorostrata* (n=2), *Grampus griseus* (n=1) and *Phoca vitulina* (n=1); Live strandings have also been recorded. Future goals include correlation of cetaceans strandings with occurrences along the coast as well as detailed analysis of tissue samples obtained in order to try to understand the geographic origin of these animals. Data collection will continue and rapid removal of the animals from the beaches will be implemented to avoid environmental contamination from the corpses' decomposition and to allow a better identification of species as well as the determination of mortality causes. Comparisons with other international stranding databases will also be implemented, particularly along the coasts of Spain (Vigo) and France (La Rochelle).



**S10**

**UNUSUAL MASS MORTALITY OF CETACEANS ON THE COAST OF THE  
TURKISH WESTERN BLACK SEA IN SUMMER 2009**

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Between mid-July and early August, a series of cetacean strandings were reported on the 43km of the 200km-long Turkish western Black Sea coast between Yalıköy and Sile. During this mass mortality event, at least 114 cetaceans (harbour porpoises, bottlenose dolphins and common dolphins) were reported dead (2.7 individuals per km). Besides, eight common dolphins stranded alive. In the field study, total 23 cetacean specimens (7 bottlenose dolphins, 7 common dolphins, 6 harbour porpoises, 3 unidentified specimens) were found. Strandings per km were 2.9, 0.5, 0.07, 0.3 and 0.1 individuals for 2003, 2004, 2005, 2007 and 2008 all in early summer (June), respectively. The seasonal average of the strandings per km of 2008 was 0.1. Compared to these stranding rates in the past, the present event is considered to be an unusual one. As many individuals were at the advanced stage of decomposition due to heat, only two fresh common dolphin specimens were examined. Currently, different hypothesis are been taken into account and analysis are in progress.





S11

**A REVIEW OF NORTHERN BOTTLENOSE WHALE (*HYPEROODON AMPULLATUS*) STRANDINGS IN THE UK, 1990-2008**

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Northern bottlenose whales (NBW) (*Hyperoodon ampullatus*), are a deep water, pelagic species, usually found beyond continental shelf edges. Between 1990 and 2008, the UK Cetacean Strandings Investigation Programme received reports of 28 NBW strandings in the UK, including the now famous „Thames whale“ in 2006. Although the majority of strandings took place on the west and north-west coast of the UK, recent strandings have occurred more frequently on the east coast of the UK. The majority of strandings occurred between July and November and generally involved juvenile or sub-adult animals with no apparent sex bias. Ten individuals were subjected to a full necropsy. The causes of death were live stranding (n=7) and infectious disease (fungal encephalitis, n=1). A cause of death was not established in two cases. The stomach contents were examined during necropsy. Recently ingested prey was absent in all cases, but squid beaks were found in several of the animals and subsequently identified as *Gonatus fabricii*. It is not known how long these may persist within the animals digestive system to give an accurate indication of how long the animals had not been able to feed. Three animals that stranded alive had blood samples taken pre-mortem. Results showed severe dehydration, renal failure and muscle damage in all three cases. Dehydration may result from an inability to feed and uptake water from prey. Pathological evidence of skeletal and myocardial rhabdomyolysis and myoglobinuria was evident in these cases and is likely to be exacerbated by crushing under the animal's own body weight once the animals had stranded alive. The reason/s for these NBWs finding their way into the

shallow coastal waters of the UK are still not known, but potential causes include anthropogenic noise from a variety of sources (including mid-frequency [...]).



**S12**

**A REVIEW OF LIVE STRANDED CETACEANS IN THE UK BETWEEN 1990 AND 2008**

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Between 1990 and 2008, the UK Cetacean Strandings Investigation Programme received reports of 9094 cetaceans found around the UK coast, of which 622 were known to have stranded alive. Of these, 2608 were necropsied and a cause of death was established for 2227 (85%). Following necropsy, an additional 311 animals that were found dead were also considered to have stranded alive. Of the 933 individuals that stranded alive, 654 were necropsied, comprising 18 species; Delphinidae (n=352); Phocoenidae (n=246); Ziphiidae (n=27); Physeteridae (n=15); Balaenopteridae (n=10); and Kogiidae (n=4). Necropsies determined that infectious disease (n=149), poor nutritional condition (n=110) and trauma or various non-infectious diseases (n=53) were significant conditions that probably caused individuals to strand alive in extremis. Twenty four live stranded individuals were too autolysed to establish a cause of death. The cause of death of „Live Stranding“ (n=318) was only ascribed to individuals, that were in apparent good health and nutritional status with no significant pathologies that may explain stranding. Common pathological findings in „Live Strandings“ included fresh carcasses with little or no scavenger damage, abrasions on the leading edges of fins and flukes, agonal ingestion of beach material, hypostasis

and sub-mandibular bruising. Proportionally more pelagic species died as a result of „Live Stranding“, than coastal species such as the harbour porpoise (*Phocoena phocoena*) and bottlenose dolphin (*Tursiops truncatus*). Several mass strandings took place during the period of this study, including a mass stranding of common dolphins in Cornwall, England in June 2008. A variety of possible factors have been proposed to explain live strandings of otherwise apparently healthy animals, including following prey inshore, adverse weather conditions, geomagnetic disturbances/errors in navigation while following geomagnetic contours, disturbance of echolocation in shallow water and more recently, sources of anthropogenic noise in the marine environment, including the use of high-intensity sonars.



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## DICTIONARY

brewery  
Ozeaneum  
German Oceanographic Museum

die Brauerei  
das Ozeaneum  
das Meeresmuseum

## Fundamentals / Grundlagen

ENGLISH	DEUTSCH
Yes	Ja
No	Nein
All right	In Ordnung! Alles Klar
Thank you	Danke
I'm sorry / Excuse me	Entschuldigung
Good morning	Guten Morgen
Good afternoon	Guten Abend
Good night	Gute Nacht
See you, goodbye	Auf Wiedersehen, Tschüss.
How are you?	Wie geht es Ihnen?
Very well, thank you.	Sehr gut, danke.
My name is ...	Ich heiße ...
Where is...? / I am looking for ...	Wo ist ... ? / Ich suche ...
How far is it ...?	Wie weit ist es ...?
Is the best way to ...?	Komme ich am besten ...?
...by bus	...mit dem Bus
...by foot	...zu Fuß
...by bicycle	...mit dem Fahrrad
Which direction should I take?	Welche Richtung muss ich gehen?
...to the left	...nach links
...to the right	...nach rechts
...straight ahead	...gerade aus
...back there	...hier zurück
Could you please show me on the map	Zeigen Sie mir bitte auf der Karte...
...	
Could you please help me?	Könnten Sie mir bitte helfen?
the brewery	die Brauerei
the Ozeaneum	das Ozeaneum
Welcome	Willkommen
Hello	Hallo
How are you?	Wie geht es dir?
I am fine, thank you	Mir geht es gut, danke
What is your name?	Wie heißt du?
My name is...	Ich heiße...
Where are you from?	Woher kommst du?
I am from ...	Ich komme aus...
Nice to meet you	Schön Sie zu sehen / kennenzulernen
Good luck	Viel Glück
Have a nice day	Ich wünsche Ihnen einen schönen Tag
I don't understand you	Ich verstehe Sie nicht
Please	Bitte
How much is it?	Wie teuer ist das?
Excuse me?	Entschuldigung?

Could you please write it down for me?

Könnten Sie das bitte für mich  
aufschreiben?

Thank you / Thank you very much

Danke / Vielen Dank

My address is...

Meine Adresse ist...

My phone number is...

Meine Telefonnummer lautet...

### **SIGN / SCHILD**

Entrance

Eingang

Exit

Ausgang

Pull

Ziehen

Push

Drücken

No Smoking

Rauchverbot

No Admission

Zutritt verboten

Emergency exit

Notausgang

Elevator

Aufzug / Fahrstuhl / Lift

Up

Hoch

Down

Runter

Stairs

Treppe / Stufen

## Numbers / Zahlen

### NUMBERS / ZAHLEN

0	Null
1	Eins
2	Zwei
3	Drei
4	Vier
5	Fünf
6	Sechs
7	Sieben
8	Acht
9	Neun
10	Zehn
11	Elf
12	Zwölf
13	Dreizehn
14	Vierzehn
15	Fünfzehn
16	Sechzehn
17	Siebzehn
18	Achtzehn
19	Neunzehn
20	Zwanzig
30	Dreißig
40	Vierzig
50	Fünfzig
60	Sechzig
70	Siebzig
80	Achtzig
90	Neunzig
100	Hundert
200	Zweihundert
300	Dreihundert
400	Vierhundert
500	Fünfhundert
600	Sechshundert
700	Siebenhundert
800	Achthundert
900	Neunhundert
1000	Tausend
2000	Zweitausend
5000	Fünftausend
10000	Zehntausend
100000	Hunderttausend
1000000	Eine Million

### CARDINAL NUMBERS / GRUNDZAHLEN

1.	Erstens
2.	Zweitens
3.	Drittens
4.	Viertens
5.	Fünftens
6.	Sechstens
7.	Siebtens
8.	Achtens
9.	Neuntens
10.	Zehntens
11.	Elftens
12.	Zwölftens
13.	Dreizehtens
14.	Vierzehntens
15.	Fünfzehntens
16.	Sechzehntens
17.	Siebzehntens
18.	Achtzehntens
19.	Neunzehntens
20.	Zwanzigstens

## Transportation / Transport

### TRAIN / ZUG

Station	Bahnhof
Central station	Hauptbahnhof
Tourist information	Information
Ticket office	Fahrkartenschalter
Ticket	Fahrkarte
Reduced ticket	Ermäßigte Fahrkarte
Platform / track	Bahnsteig
Timetable	Fahrplan
Departure	Abfahrt
Arrival	Ankunft
Waiting room	Wartehalle
Delay	Verspätung
Direct train	Direkte Verbindung
Express train	ICE (Inter City Express)
Fast train	IC / EC (Inter City / Euro City)
Slow train	RE / RB (Regional Express / Regional Bahn)
Compartment	Abteil
First / second class	Erste / Zweite Klasse
Conductor	Schaffner, Zugbegleiter
Reserved seat	Reservierter Sitz
Luggage rack	Gepäckablage
Restroom	Toiletten, Bad
Where is the railway station?	Wo ist der Bahnhof?
How can I get there?	Wie komme ich dorthin?
Where are the ticket offices?	Wo befinden sich die Fahrkartenschalter?
A reserved seat, please.	Ich würde gerne einen Sitz reservieren.
A single ticket to ..., please.	Eine einfache Fahrt nach ... bitte.
A return ticket to ..., please.	Eine Rückfahrkarte nach .... bitte.
How much is a single ticket to ...?	Wie teuer ist eine einfache Fahrkarte nach...?
How long is the ticket valid?	Wie lange ist das Ticket gültig?
Where is the tourist information center?	Wo befindet sich die Touristen Information?
Where is the restroom?	Wo befindet sich die Toilette?
What is the best connection to...?	Was ist die beste Verbindung nach...?
Is this a direct connection?	Ist dies eine direkte Verbindung?
Do I need to change the train?	Muss ich umsteigen?
At which track does the train to ... leave?	Von welchem Gleis fährt der Zug nach ...?
Where is the train to...?	Wo steht der Zug nach ...?
When will the train from ... arrive?	Wann kommt der Zug von ... an?
Does the train have delay?	Hat der Zug Verspätung?
Where is the dining-car?	Wo befindet sich der Speisewagen?
sleeping-car?	Schlafwagen?
couchette-car?	Liegewagen?
Excuse me, is this seat occupied?	Entschuldigung, ist dieser Sitz besetzt?

May I put my suitcase here?  
May I open the window?

Kann ich mein Gepäck hier abstellen?  
Könnte ich das Fenster öffnen?

### COACH / BUS

Where is the bus station?  
How can I get there?  
Is there a bus to the ...  
    Brewery  
    Ozeaneum  
    Oceanographic Museum  
At which time does the bus to ... leave?  
At which time will we arrive at...?  
  
Where will we stop on the way?

Wo ist die nächste Bushaltestelle?  
Wie komme ich dahin?  
Gibt es einen Bus zum...  
    zur Brauerei  
    zum Ozeaneum  
    zum Meeresmuseum  
Wann fährt der Bus nach...ab?  
Wann werden wir bei dem / der ...  
ankommen?  
Wo werden wir unterwegs halten?

### Accommodation / Unterkunft

Hotel  
Guest house  
Youth hostel  
Reception desk  
Bathroom  
Showers  
Where is the tourist information?  
  
I have booked a room on the name...  
  
I would like a room  
    a single room  
    a double room  
    a three-bed room  
  
Could I have a room with a  
bathroom?  
Ash-tray  
Bottle  
Coat rack  
Cup  
Fork  
Knife  
Spoon  
Teaspoon  
Glass  
Glass / tumbler  
Breakfast  
Lunch  
Dinner / supper  
Menu  
Table

Hotel  
Pension  
Jugendherberge  
Rezeption  
Bad  
Duschen  
Wo befindet sich die Touristen  
Information?  
Ich habe ein Zimmer auf den Namen ...  
gebucht  
Ich hätte gern ein Zimmer.  
    Einbettzimmer  
    Zweibettzimmer  
    Dreibettzimmer  
Könnte ich ein Zimmer mit Bad haben?  
  
Aschenbecher  
Flasche  
Garderobe  
Tasse  
Gabel  
Messer  
Löffel  
Teelöffel  
Glas  
Becher  
Frühstück  
Mittag(essen)  
Abendessen  
Menü  
Tisch



Napkin  
Plate  
Salt cellar  
Saucer  
Sugar bowl  
Matches  
Toothpick  
Tip  
Self service

Serviette  
Teller  
Salzstreuer  
Untertasse  
Zuckerdose  
Streichhölzer  
Zahnstocher  
Trinkgeld  
Selbstbedienung

## **Meal / Essen**

Tea  
Beer  
Wine  
Ice cream  
Pepper  
Salt  
Bread  
Butter  
Yogurt  
Cheese  
Appetizer  
Meat  
Fish  
Salad  
Vegetable  
Vegetarian  
Sandwich

Tee  
Bier  
Wein  
Eis  
Pfeffer  
Salz  
Brot  
Butter  
Joghurt  
Käse  
Aperitif  
Fleisch  
Fisch  
Salat  
Gemüse  
Vegetarisch  
Sandwich

## Time / Zeit

Hour	Stunde
Minute	Minute
Second	Sekunde
What time is it?	Wie spät ist es?
It is ... o'clock	Es ist ...Uhr
At what time?	Wann? Zu welcher Zeit?
How long will it take?	Wie lange wird es dauern?
In the morning	Am Morgen
Before noon	Vormittags
At noon	Mittags
In the afternoon	Nachmittags
Evening	Abends
Night	Nacht
Day	Tag
Week	Woche
This week	Diese Woche
Today	Heute
Tomorrow	Morgen
Monday	Montag
Tuesday	Dienstag
Wednesday	Mittwoch
Thursday	Donnerstag
Friday	Freitag
Saturday	Samstag
Sunday	Sonntag















## ADDENDUM

### POSTER

#### MISSING ABSTRACTS

**B21**

**THE PECULIARITIES OF THE BEHAVIOR AND THE UNDERWATER ACOUSTIC ACTIVITY OF CAPTURED BELUGAS (*DELPHINAPTERUS LEUCAS*)**

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It was observed repeatedly that belugas displayed the stress and changes in their behavioral activity after their capture. However there is a little data in how the capture and the condition in a limited space influence change in acoustic activity. Material for the present work was gathered in the summer of 1992 in the estuary of the Amur River. The belugas were caught for the dolphinarium and temporarily secluded in a small lagoon (73 to 32 meters). There were 6 animals from different herds including 2 adults, 2 sub adults and 2 calves. Belugas were sheltered for 4 months and then released back into the sea. Feedings included live fish regularly placed in the lagoon. The research of behavior and underwater acoustic activity was conducted from August 10 to 25, 1992 (3 months after capture), but only now acoustic records were processed using contemporary computer methods. The belugas separated into 3 age pairs. The pair of adults dominated over the pairs of the younger animals. A reduction of this behavior occurred during feeding, calm moving and sleep only. Attempts of "contacts" with observers were also registered. The analysis of acoustic records shows considerable impoverishment of the acoustic repertoire in comparison to the normal repertoire of wild belugas found in the investigations in 1980 and 1983 in the same region of the Amur's estuary. Although the level of the acoustic activity was high (4 - 16 sign/min), only 11 types of sounds were observed (in the nature more than 50 types). Besides, the signals of captured belugas were very stereotype in comparison with signals of wild belugas. Thus the seclusion of belugas in a reserved space (even in relative roomy one) has very negative consequences for their normal behavior and acoustic activity.



**D29**

**SEASONAL CHANGES IN ABUNDANCE STELLER SEA LION (*EUMETOPIAS JUBATUS*) ON TULENY ISLAND ROOKERY, 2006-2009**

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Breeding rookery of Tuleny island is increasing against the reduction of population of steller sea lions (*Eumetopias jubatus* (Schreber, 1776)) in Russian Far East. Large breeding grouping of animals were formed on the island in a short space of time in 1970-80ss. Our investigations have showed that abundance of Steller sea lions growth up till now. Increase of animal population on rookery occurred in 2006: the maximal number of animals made up 1082 steller sea lions, but 1646 animals in 2007 ( $p=0.005$ ). Number of animals of all the age and sex classes increased: territorial and harem males, semi-bulls, young animals and females. But quantity of females that gave birth increased insignificantly so the number of pups didn't change ( $p=0.081732$ ). But in 2008-2009 the number of all animals elder than 1 year were at grade (max 2008 - 1373, 2009 -1365 animals). And the number of pups increase till 678. Observations over branded animals showed that both young and sexually mature animals especially females migrated to the Tuleny Island. These fact lead us to the conclusion, that increase of the animal population had two combined causes: increasing of quantity of 'local' animals and migration of steller sea lions from another islands ).



**M18**

**CULTURED MICROORGANISMS FROM HINDGUT OF STELLER SEA LION  
(*EUMETOPIAS JUBATUS*)**

**Karina Tarasyan (1), Andrey Letarov (1), Evgeniy Kulikov (1), Vladimir Burkanov (2)**

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The data on studies of pathogenic microflora causing infectious diseases in pinnipeds is relatively abundant, while there is but a few mentions of normal gut microflora of pinnipeds. The species composition of normal intestinal microbial ecosystem of Steller sea lion (*Eumetopias jubatus* Shreb) was also not studied yet. We analyzed a microbiological composition of faeces taken from 4 free-living females of Steller sea lion and their newborn pups. Samples were collected manually per anus from the anesthetized females and by the sterile swab from the pups. Samples were frozen in liquid nitrogen and thus transported. Microbe-containing inoculates were plated on different rich and selective cultivation media: LB, 5% blood agar, potato-dextrose agar, Endo medium with lactose, *Staphylococcus* and *Saburo agar*. Cultivation was done at 37°C for 72-120 hours. Identification of microorganisms was performed using both conventional methods for the assessment of cultural, morphological and biochemical bacterial properties, and also MALDI-TOF MS profiling method. Also, we analyzed 16S rDNA and some conservative bacterial protein DNA sequences. In total, we identified 640 bacterial clones. Among the found bacteria we observed Enterobacteriaceae family members (Gen. *Escherichia*, *Enterobacter*, *Citrobacter*, *Salmonella*), Micrococcaceae (Gen. *Micrococcus*, *Kocuria*, *Staphylococcus*), Streptococcaceae, Pseudomonadaceae and Bacillaceae. *Escherichia coli* was the most frequent species. We used PCR genomic fingerprints based on IS1 insertion elements for determination a high genetic homogeneity of the isolated individual clones. Each animal had 1-2 individual predominant *E. coli* strains independently on an initial medium for cultivation. According to available literature data, this is a common evidence for Carnivorae, having fish-based diet and living on a considerable distance from potential *E. coli*-rich sources like human. These results can be applied as an additional reference in conducting medical veterinary studies and selection of drugs for correcting dysbiotic conditions of the digestive tract of the pinnipeds in captivity.



**B16**

**THE ROLE OF PLAY IN FEEDING BEHAVIOR SHAPING IN CALVES OF BOTTLENOSE DOLPHINS AND SEA LIONS IN OCEANARIUM**

**Olga Chechina**



**G05**

**REPRODUCTION OF BLACK SEA BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN OCEANARIUM CONDITIONS**

**Lyudmila Bogdanova**



**HA04**

**HABITAT USE AND THE EFFECTS OF BOAT TRAFFIC ON BOTTLENOSE DOLPHINS AT NEW QUAY HARBOUR, CARDIGAN BAY**

**Gemma Veneruso, Helen Bates, Lucy Buckingham, Edita Magileviciute, Peter G. H. Evans**



**D10**

**SPERM WHALE SIGHTINGS IN THE TURKISH PART OF THE AEGEAN AND MEDITERRANEAN SEA**

**Ayaka Amaha Öztürk (1,2), Ayhan Dede (1,2), Arda M. Tonay (1,2), Bayram Öztürk (1,2)**

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**F09**

**ATLANTIC WHITE-SIDED AND BOTTLENOSE DOLPHINS: THE UNKNOWN FORAGING ECOLOGY IN THE WATRES AROUND IRELAND**

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**HA10**

**DISTRIBUTION AND ECOLOGY OF RISSO'S DOLPHIN, *GRAMPUS GRISEUS* (CUVIER, 1812), IN THE WESTERN LIGURIAN SEA IN RELATION TO PHYSIOGRAPHIC, OCEANOGRAPHIC AND INTRINSIC BIOLOGICAL PARAMETERS**

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**S10**

**UNUSUAL MASS MORTALITY OF CETACEANS ON THE COAST OF THE TURKISH WESTERN BLACK SEA IN SUMMER 2009**

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## TALK

### ABSTRACTS MODIFIED (LIST OF AUTHORS AND/OR AFFILIATIONS)

**23<sup>rd</sup> March, 08:30**

#### **TRENDS IN ABUNDANCE OF A SMALL RESIDENT POPULATION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) INHABITING PATOS LAGOON ESTUARY, SOUTHERN BRAZIL**

**Pedro Fruet (1), Juliana Di Tullio (1), Eduardo Secchi (2)**

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**24<sup>th</sup> March, 11:40**

#### **CHARACTERISTICS OF HUMPACK WHALE HABITAT IN THE SCOTIA SEA AND THE ANTARCTIC PENINSULA**

**Carole Durussel (1), Sue Moore (2), Nancy Friday (2), Alexandre Zerbini (2), Sharon Hedley (3)**

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