



ABSTRACTS
PLATFORM PRESENTATIONS

**Monday, 10 March 2008****A NEW MEDITERRANEAN FIN WHALE (BALAENOPTERA PHYSALUS)
DISPERSION PATH AND WINTER GROUND**

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The Ligurian-Corsican-Provençal Basin is a fin whale summer feeding ground but little is known about the seasonal movement patterns of this population. A decline in fin whale abundance in late summer and sightings peak in early spring and early autumn in both the Tyrrhenian sea and the Liguro-Provençal Basin strongly suggests seasonal migration. However no breeding or wintering grounds in southern Mediterranean regions are known to date, except for the recently documented presence of feeding whales during winter in the Sicily Channel. To further understand their movement patterns, we acoustically monitored two regions off Spain during summer-fall-winter 2006 using seafloor autonomous recording units. Two units were deployed in August-October 2006 North of the Gulf of Valencia (eastern Spain) and 2 units were deployed in October-January 2007 south of Almería (southern Spain). Mediterranean long patterned sequences of 20 Hz pulses were identified using acoustic features as indicators of population identity in both regions of study. Eastern area: fin whales were detected at very high rates (122 pulses/hour) and between 40-80 % of time per day. The detection pattern shows a unimodal distribution that can be explained by a gradual transiting behaviour through the acoustic recorder's detection area, suggesting that the area is probably used as a passage between summer and winter grounds. Southern area: detections from the same population were less abundant (21 pulses/hour) and between 10-35 % of time per day. The detection pattern shows a highly variable distribution with no clear trend, suggesting that Mediterranean fin whales continuously remained in and out

of the detection area of the recorder from November to January. These results show that this southern area is potentially used as a winter ground. This work documents a new dispersion path through French and Spanish waters towards the Alboran sea, a new potential winter ground.

PHOTO-ID FEATURES IN CUVIER'S BEAKED WHALES (ZIPHIUS CAVIROSTRIS) IN THE MEDITERRANEAN SEA

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Photo-id using natural markings has been used in a previous study on Cuvier's beaked whales (*Ziphius cavirostris*) in Hawaii. In particular, the presence/absence of white oval scars from cookie cutter sharks (genus *Isistius*) bites and paired linear scars was determined to identify different individuals, although no studies were carried out to assess mark types variability within the population. For instance, cookie cutter sharks are not uniformly world-wide distributed being found mainly in equatorial and tropical waters; they are absent in the Mediterranean sea. The goal of this work is to define a photo-id protocol suitable for Cuvier's beaked whales in the Mediterranean Sea. This study describes the mark types having sufficient stability and recognizability for re-identifying individuals through the time. During the nine-year study period, from 1998 to 2007, photographs of Cuvier's beaked whales were collected in the Ligurian Sea (4607 photographs with quality ≥ 4). The collected data were analyzed to evaluate the nature, temporal variability (gain/loss rates), frequency, relative abundance and recognizability of 10 different mark types found in Mediterranean specimens. Five reliable mark types were identified (persistent ones are notches, back indentation, scars, large stripes and medium scrapes) while the other five superficial marks were found not to be suitable for long-term photo-id studies. All mark types are correlated to the nature of mark type itself. Scrapes are found to be age and sex-dependent as well. Mature males show ten times more scrapes on average than immature individuals and five times more than mature females. Furthermore, scrape types seem to be statistically homogeneously distributed along the body in mature males while they are gathered in a posterior zone, below the dorsal fin, in adult females.

RESIDENCY PATTERNS OF BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) OFF PICO ISLAND, AZORES

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Though widely reported around the European Atlantic coast, details relating to the overall distribution, site fidelity and population structure of bottlenose dolphins (*Tursiops truncatus*) in the Azorean waters remains poorly documented. Existing studies have found evidence of seasonal, or year around, residency and social interactions amongst individuals. In this study, the area of Pico where bottlenose dolphins have been repeatedly sighted was examined. Since January to October 2007, 572 individual dolphins were identified, with 60 of those being re-sighted during the year. In total the catalogue for 2003-2007 now comprises 957 individuals. Comparison with previous data has allowed the recognition of 76 individuals re-sighted since 2003, enhancing the hypothesis of site fidelity and a possible resident subpopulation in this area. The associations between individuals were analysed using MDS analysis and clustering association based on Sorensen coefficient. The results show evidence of strong levels of similarity (alliances) between some pairs of individuals.

DELPHINUS SPP. FROM NORTHWEST AFRICA: PRELIMINARY EVIDENCE FOR TWO PUTATIVE POPULATIONS OR SPECIES?

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The common dolphin has a widespread distribution and is present in all oceans of the world, where it occupies from cold to temperate and subtropical waters. This wide distribution range has led to the differentiation of a number of morphotypes. Little information is available on this regard from the tropical and subtropical waters of the northeastern Atlantic Ocean. From 1993 to 2006, bone samples (n=68) and skulls (n=45) from stranded common dolphins (*Delphinus* spp.) were collected from the segment of

coastline extending from the Western Sahara to the Senegal River. Skull morphometrics and isotopic relative abundance of nitrogen and carbon were investigated to assess potential population structuring as well as position in the local trophic webs and preferred habitats. A high intraspecific variability was observed for both isotopes: nitrogen isotope ratios (δN) ranged between 10.8 and 14.3, a difference of about one trophic level, while carbon isotope ratios (δC) ranged between -14.4 and -10.9, indicating that the animals sampled display substantial differences in habitat use. Regression analysis between δN and δC revealed that individuals feeding at higher trophic levels were more pelagic and prone to feed over the continental slope, whereas those foraging at lower trophic levels were feeding over the continental shelf or around the shelf edge. Morphometric analysis (26 measures, including teeth number) also showed some intraspecific variability, but more importantly helped to conclude on habitat use by a joint analysis with the stable isotopes. Even though the data reveals a cline, the existence in the region of two putative populations or species is questioned until collection of further material. (Study funded by the Portuguese Foundation for Science and Technology).

BALAENA MYSTICETUS, THE RIGHT WHALE FOR A CHANGING CLIMATE? OBSERVATIONS FROM THE PAST, SPECULATIONS ABOUT TOMORROW

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The Greenland right or bowhead whale is often presented as a species that sticks very much to its old migratory paths. The speaker studied 40 whaling journals from the 18th century for the Davis Straits stock and will present his conclusions from these sources about this whale's old life cycle and migration to summer and winter grounds. From these and other historical sources he will give some reasoned speculations about this whale's chances to adapt itself to a changing climate. Is there sufficient evidence that the right whale changed its diet of plankton over time, is there evidence that the Davis Strait and Spitzbergen stock showed different ways of adaptation to their geographical environment and did they indeed change their migratory routes when climatic changes caused the plankton to be found elsewhere? After all, does it make sense to use written sources from several hundred years ago in a debate about issues of tomorrow?

A REVIEW OF NINE CENTURIES OF LAND BASED WHALING IN PORTUGAL

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The presence of whales in the coastal waters of Portugal is known since the 12th century as their products were already used in several fishing villages. However, it is not certain if whales were being hunted or their stranded remains only used in these early times. Later, during the 13th and 14th centuries whaling was a reality in several locations on the continental coast. Following the discovery of the archipelagos of Madeira and Azores in the 15th century whaling activities started to be conducted overseas in all the Atlantic colonies, mainly in Brazil. Sources indicate that the Portuguese land based whaling industry increased and decreased at certain times. After the 15th century whaling became again an important and economical viable industry only in the 19th century. The purpose of this study is to conduct a global review of nine centuries of Portuguese whaling sources and to obtain information on coastal catches by the Portuguese land based fleet during the 20th century. Commercial land based whaling occurred continuously through the 20th century in mainland and the archipelagos of Azores and Madeira. Different periods of whaling can be discriminated during the last century concerning the three Portuguese geographical localizations. Globally speaking, eighty nine years of land based whaling in Portugal resulted in a total capture of 29.180 great whales. Captures included mainly sperm whales, and also fin, humpback, sei, right and minke whales. After a peak during the mid-twentieth century, the decline on the land based whaling industry followed the decline of species in the exploited grounds.

BAIJI EXTINCTION - A LESSON TO BE LEARNT FOR THE FINLESS PORPOISE?

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The Yangtze river dolphin (*Lipotes vexillifer*), also known as the baiji, has lived in China's Yangtze river for 20 million years. Ongoing degradation of its habitat caused by ship traffic, pollution, human land uses, unsustainable

fishing and bycatch as well as lack of conservation measures, finally led to the declaration of becoming 'possibly extinct' by the IUCN (Smith et al. 2007). After a six week survey, organised by the Swiss baiji.org Foundation, no baiji specimen could be found any longer. During the expedition the population status of the likewise endemic Yangtze finless porpoise (*Neophocaena phocaenoides asiaeorientalis*) was also estimated. The Yangtze finless porpoise is today in a comparable population state to the baiji a decade ago and the population is rapidly declining from approximately 2,550 in 1990 to approximately 1,200 in 2006 (Wang et al. 2007) with a medium decline of about 85 per annum. Still, the habitat quality is decreasing, and ex situ conservation measures like translocation of specimens into a semi-natural reserve and to the Aquarium of the Institute of Hydrobiology of the Chinese Academy of Sciences in Wuhan has been successfully applied: The reserve's population is steadily growing whilst in 2005 the first finless porpoise, and first freshwater cetacean ever, was born successfully in captivity. The baiji.org Foundation continues to support the Institute of Hydrobiology on various conservation efforts, and its formerly aim to prevent the baiji from extinction by applying ex situ conservation measures focused on the conservation of the finless porpoise and its habitat as well as other freshwater dolphins. Another research expedition to the Yangtze river will be organised in 2008.

WHAT ARE WE DOING? : COPING WITH PAST, PRESENT AND FUTURE DATA IN LONG-TERM DEVELOPMENT IN OBSERVATIONAL SCIENTIFIC DATA

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For the last 30 years, long-term datasets on populations of marine mammals have accumulated and are considered invaluable. Longitudinal data has some clear advantages over short-term or cross-sectional data, but specific methodological and management problems are more likely to plague long-term data, especially in behavioral research. For example, inconsistent data recording procedures, measurement subjectivity, data entry errors, scattered data repositories, and variation in researcher data collection methodology create numerous quality concerns in these long-term data stores. Using the Shark Bay Bottlenose Dolphin Research Project dataset as a case study, we highlight some of the quality issues specific to observational data collection, including observer certainty, intra- and inter-observer reliability, and changing collection protocol standards. We will summarize the sustained

effort and iterative processes of data transformation and cleansing, with an emphasis on standardization and how to process data of varying quality and degrees of uncertainty. Combining all these processes it enables us to integrate all the data into a single repository, eliminating manual data merging from the data analysis procedure, but also to be used for sophisticated data analysis, such as social networks.

DETERMINATION OF CORTISOL IN BLOW OF BOTTLENOSE DOLPHIN AND CORRELATION WITH BEHAVIOURAL DISPLAYS DURING PREGNANCY

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Cortisol is useful to monitor physiological and pathological conditions in dolphins. This hormone is usually extracted through consolidate procedures from blood, saliva, urine and faeces. However, an innovative source may be found in blow, which can be collected non-invasively. Specific aims of this study were a) to set up and validate cortisol determination procedures from blowhole samplings and b) to assess the correlation between cortisol levels and behavioural displays expressed during pregnancy. As for a) three *Tursiops truncatus* (1,2) in Rimini Delfinario (Italy) were sampled from November 2002 to June 2007. The dolphins were trained to blow into polypropylene bottles and the samples were stored at -20°C. Hormone concentrations were determined by a validated radioimmunoassay. The Pearson's Correlation Test applied to cortisol levels, simultaneously measured in blow and blood, revealed the reliability of the concentrations in blow ($r=0,89$; $d.f.=13$; $p<0,0001$). Regarding b) a pregnant female was monitored from July 2006 during all the 52 weeks of her gestation. The behavioural observations were carried out twice a week with focal sessions lasting 1hr each (total 416hrs). A specific behavioural catalogue and Observer (Noldus) were applied to quantify frequency and duration of 64 behaviours a priori chosen for this study. The comparison between the behavioural trends and cortisol values, daily measured throughout the pregnancy, showed several cases of significant correlation. In particular, a positive relationship with stationary positions such as lie or rest at surface, the bending of the body or the emission of bubbles emerged. In conclusion, blow is safe, ready available and easy to store and transport. Blow sampling does not involve pain or infection and it is unaffected by the stress of animal handling. Moreover, the results underline the connection between cortisol

and animal activities, providing an opportunity for further studies in both physiology and behaviour.

ANTIDIURETIC HORMONE IN THE BOTTLENOSE DOLPHIN *TURSIOPS TRUNCATUS*.

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In this study we have investigated the endocrine role of the antidiuretic hormone (ADH) in the mechanism of water reabsorption in the bottlenose dolphin *Tursiops truncatus*. This species, like other marine mammals, must rely on the water content of the food to achieve water balance, since the metabolic cost of drinking sea water surpasses its advantages. To this effect, the kidneys of cetaceans show several specific morphological features including, increase of the cortex surface by a large number of renicula, higher medullary thickness and presence of a *sporta perimedullaris*. A series of seven captive bottlenose dolphins were sampled for blood and urine before and after meal. Blood and urine ADH concentration were determined by RIA, and urine electrolytes were measured by an automated biochemical analyser. Blood ADH levels (never before described in an experimental set of dolphins) were around 1.1 pg/ml. In urine, the hormone is more concentrated and, given the relation between plasmatic and urinary ADH, special attention was paid to urine ADH concentration in relation to food intake. A direct relationship was detected among food intake, ADH concentration and urinary Na⁺ levels. Our data indicate that a few hours after the meal, the ADH urinary values increase and correspond to a rise in Na⁺ urine levels, a clear sign of active urine concentration. In the bottlenose dolphin the direct effect of ADH on kidney tubular structures is thus aimed at curtailing the food-derived water content of urine.

BIG BANGS FROM A BIG NOSE: BIOMECHANICS OF AIR-DRIVEN SOUND PRODUCTION IN SPERM WHALES

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The sperm whale (*Physeter macrocephalus*) carries a large nasal complex that may take up 1/3 of the body length and reach a weight of more than 10 tons in old males. A number of theories have been advanced to account for the function and evolutionary driving forces behind this hypertrophied structure that is homologous with the much smaller sound producing nasal complex of delphinids. The bent horn model proposes that the sperm whale nose is a giant sound generator that produces powerful mono-pulsed sonar clicks for long range echolocation of prey and multi-pulsed coda clicks for communication. To test the bent horn model for sperm whale sound production we placed non-invasive Dtags on different, photo-documented parts of the nasal complexes of 6 free-ranging sperm whales. The Dtags sample sound at 96 kHz and 3-axis accelerometers at 50 Hz with 16 bit resolution, allowing for synchronized, high resolution measurements of tissue acceleration and sound propagation in the soft structures of the sperm whale nose. We demonstrate that sperm whale clicks are generated when the monkey lips are accelerated apart by pneumatic action. By analysing the reverberation patterns from tags placed between the reflective air sacs of the nose, we show that the sperm whale multi-pulsed clicks are generated by multiple reflections of a single sound pulse from the monkey lips. Recycled air from the right nasal passage is used to drive the sound generator at less than 0.1 liter of air per click, limiting the length of click trains, but not the output or properties of individual clicks with increasing hydrostatic pressure. These experimental data from free-ranging sperm whales confirm the bent horn model, and show that the sperm whale nasal complex is a giant sound generator producing sound by air driven acceleration of a single pair of phonic lips.

STRATIFICATION OF TRIACYLGLYCEROL AND PHOSPHOLIPID MOLECULAR SPECIES IN THE BLUBBER OF A MARINE MAMMAL

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Variations in the lipid composition in different vertical layers of marine mammal blubber provide information on the possible differentiation of the blubber into different functional layers (i.e. energy storage vs. thermoregulation) and may help to find out the underlying biochemical mechanisms. Blubber of the Saimaa ringed seal (*Pusa hispida saimensis*) was sampled at 3 mm intervals throughout the whole blubber column. Total lipids of the subsamples were extracted and the phosphatidylcholine (PC), sphingomyelin (SM), phosphatidylethanolamine and triacylglycerol molecular species were analyzed by electrospray ionization mass spectrometry. The molecular species composition (i.e. the fatty acid assembly) in both the structural and storage lipids varied in different blubber layers. In addition, the proportions of SM and PC phospholipid classes changed according to blubber depth. In the superficial blubber layers, the SM/PC ratio was significantly higher than in the deeper blubber layers. According to studies on human, elevated levels of adipocyte SM are associated with insulin resistance and obesity. This implies that the high proportion of SM in the adipocyte membranes of the superficial blubber could be one of the biochemical mechanisms that during negative energy balance enable the animal to maintain a blubber layer thick enough for proper insulation.

PORPOISE AND DOLPHIN ONTOGENIES COMPARED: PORPOISE PAEDOMORPHOSIS FORMALIZED

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Several skeletal traits in phocoenids have been described as pedomorphic relative to their delphinid relatives. These include skull shape and incomplete fusion of skull sutures and postcranial epiphyses. These traits have not been described in a comparative study, which would also be useful for evaluation

of the hypothesis of porpoise progenesis, i.e. precocious sexual maturity causing truncation of somatic development. In this study, museum samples of 66 white-beaked dolphins and 130 harbour porpoises were compared in terms of vertebral epiphyseal fusion, cranial suture development and skull shape ontogeny. Full fusion of all vertebral epiphyses was rare among porpoises. The youngest specimen to attain this was six years old. 65 of 79 specimens aged six and older showed incomplete fusion. In dolphins, the youngest mature specimen was ten, while 6 of 31 specimens aged ten and older were immature. Porpoises reached asymptotic levels of a cranial maturity score based on development of five sutures at ages 5-7. Dolphins reached asymptotic levels at 7-9 years, with more developed sutures. Skull shape was captured by 29 three-dimensional landmarks. These configurations were run through Procrustes superimposition, removing variation in location, size and orientation, leaving only size variation. A common allometric vector describing direction of shape development was computed by pooled regression of the mean species covariance matrix of shape on size. Specimen positions along this vector were plotted against size and age for comparison. Dissociation of size and shape was evident, porpoises showing more mature shapes than dolphins of similar sizes. This may be a partial compensation for truncation of shape development around age 4-5, leaving adult porpoises much more paedomorphic than dolphins which continue development until around age 10. In conclusion, these results corroborate the hypothesis of porpoise progenesis; in all investigated traits porpoises terminate ontogeny earlier than dolphins at more paedomorphic stages.

DETERMINATION OF BIOLOGICAL PARAMETERS BY SKELETAL REMAINS: STUDYING HARBOUR PORPOISES IN THE SEA OF AZOV

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Determining main biological characteristics of animals (first of all, age, sex and body size) by incomplete skeletal remains is a challenge both in examining museum collections and in population studies through strandings monitoring. Material for this study was obtained during the strandings monitoring performed since 1999. Individual age can be estimated not only by widespread technique of teeth sectioning, but also by counting growth layers in mandible, bulla tympani and basioccipital bone. The most reliable estimates are obtained from mandible; however, the readability of layers strongly depends on the sampled fragment. Age estimation from suture fusion is difficult because of individual variation. It is possible to distinguish calves (this-year-born animals) and yearlings (last-year-born animals) by

partial or complete fusion of nasal bones, squamosal bones (at least, one of them), vertebrae arches, sternum, epiphyses of humerus, proximal epiphysis of radius. Animals at the age of 1-3 years can be distinguished from those of 3 years and older by sutures in radius and ulna. Moreover, calves can be distinguished by size of ribs, vertebrae, metacarpals and first phalanges. Sex can be determined in animals of 1 year and older by length, curvature and mass of pelvic bones. Sexual dimorphism is seen in the skull size at the age of 3 years and more, so 90% of animals can be diagnosed based on main skull length and width measurements. However, the remaining 10% cannot be diagnosed from calvaria. Rough body length estimation is possible only for small (<100-110 cm) or extremely large animals; it is limited by bone size variation. For estimating body size, the 4th and 5th ribs are the best. Skull measurements can be used only for large animals. Thus, the more remains from an individual animal can be collected, the more reliable the estimates would be.

TROPHIC RELATIONSHIPS OF TEUTHOPHAGEOUS ODONTOCETES AND THEIR PREY INFERRED FROM STABLE ISOTOPE ANALYSIS, IN THE NORTHWESTERN MEDITERRANEAN SEA

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In the northwestern Mediterranean Sea, four cetacean species are exclusively or preferentially teuthophageous: Risso's dolphin (*Grampus griseus*), the long-finned pilot whale (*Globicephala melas*), Cuvier's beaked whale (*Ziphius cavirostris*) and the sperm whale (*Physeter macrocephalus*). Stomach content studies indicate that these species have very close diets and could be in competition for resources. In order to improve our knowledge on their relative trophic positions and relationships with their

prey, we measured $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ in muscle and skin samples from these cetaceans, as well as in the mantle of 15 species of bentopelagic cephalopods. For cephalopods, mean species' values of $\delta^{13}\text{C}$ ranged from -22.59 to -16.85 ‰ and $\delta^{15}\text{N}$ from 6.72 to 9.81 ‰. The cephalopods most frequently found in stomach contents of teuthophageous odontocetes presented mean $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ respectively of -19.51 and 9.81 ‰ for *Histioteuthis bonnellii* (n=1), -19.74±0.15 and 9.73±0.44 ‰ for *H. reversa* (n=4), and -18.63±0.1 and 7.80±0.40 ‰ for *Todarodes sagittatus* (n=4). For cetaceans, mean $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ were respectively -16.54±0.56 and 11.47±0.96 ‰ for Risso's dolphin (n=6), -16.90±0.49 and 9.93±0.22 ‰ for the pilot whale (n=4), -16.90 and 12.88 ‰ for Cuvier's beaked whale (n=1, juvenile) and -16.52±0.62 and 10.99±0.36 ‰ for the sperm whale (n=7). Cetacean skin and muscle samples did not show significant differences in their isotopic signatures. The average difference between $\delta^{15}\text{N}$ of cephalopods and cetaceans was of 2.78 ‰, confirming one relative step in the trophic web between them. Carbon isotopic signature of pilot whales was slightly lower than the $\delta^{13}\text{C}$ of sperm whales and Risso's dolphins, corresponding to their respective habitats. The former has an oceanic habitat, while sperm whales and Risso's dolphins have habitats respectively on the whole continental slope and in adjacent offshore waters, and on the upper part of the continental slope.

KILLERS IN THE DARK – NIGHT TIME PREDATION BY MAMMALEATING KILLER WHALES (ORCINUS ORCA) IN ALASKA

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North Pacific killer whales that specialize on hunting marine mammals do not typically emit cholocation clicks while searching for prey. This suggests that they detect prey either relying on visual cues or by listening for sounds generated by the prey animals. If vision is essential for prey detection, hunting should be limited to the daylight hours and documentation of predation at night provides evidence in support of a passive listening hypothesis of prey detection. We used digital recordings tags (DTAGs) attached to the animals with suction cups to study the behaviour of mammaleating killer whales in Southeast Alaska. These tags recorded the underwater movements of the tagged individual and any sound it generated or received. Predation events were documented unequivocally from distinctive sounds generated during prey capture and handling. We deployed 13 tags, of which 7 remained attached for at least part of the night. The majority of tags recorded a night time predation event, even though nights

were short (average of 4:18 hrs) during the study period. These findings show that mammal-eating killer whales have no difficulty detecting and capturing prey at night and thus suggest that passive listening forms an important part of their strategy to find prey.

ENERGY CONSUMPTION OF A MALE HARBOR PORPOISE (*Phocoena phocoena*) ESTIMATED BY THE LABELED BICARBONATE TECHNIQUE

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Indirect Calorimetric techniques can be adapted to estimate Field Metabolic Rate (FMR) of unrestrained, active subjects. FMR represents an animal's actual energy utilization in an unrestrained situation. An inexpensive indirect method to measure FMR is the ¹³C-Labeled Bicarbonate technique. In this study we adapted it for use on a trained, cetacean under human care. An intravenous dose of 450 mg ¹³C-bicarbonate was voluntarily administered to Eigil, a 40.5 kg, adult, male Harbor Porpoise (*Phocoena phocoena*) in steady state. During the following 24 hrs breath samples were collected voluntarily using a mask and breath bag apparatus. When not delivering breath samples Eigil was swimming freely. Breath was analyzed for ¹³C concentration using an InfraRed ISotope analyzer (IRIS) and the estimate of CO₂ production, if using a Respiratory Quotient of 0.85, resulted in an energy consumption of 22285 kJ/day. The value is close to Eigil's raw energy intake of approximately 20000 kJ/day. It also corresponds to 4.7 times its theoretical Basal Metabolic Rate according to Kleiber. For a comparison with other Marine Mammals of the same size this value matches the estimated of 23876 kJ/day calculated using Acquarone's revised equation for Pinniped FMR. It is also 1.3 times Nagy's estimated 16850 kJ/d for a 40.5 kg Carnivore. Both authors base their estimates on the Doubly Labeled Water technique. We have here demonstrated the feasibility of ¹³C-Bicarbonate measures on trained cetaceans in a controlled environment and the results obtained are plausible when compared to similar isotopic studies.

It is necessary for the future to refine this technique by improving the apparatus, comparing the results with other methods and using different activity levels and environmental parameters to investigate sensitivity to ecological challenges to the animal.



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**DIRECTIONALITY OF INDIVIDUAL HARBOUR PORPOISE
ECHOLOCATION CLICKS**

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The directionality of echolocation clicks from toothed whales has been measured for a few species, but the details in directionality have been poorly described. Here for the first time we simultaneously measured the directionality in the horizontal and vertical planes of single echolocation clicks from a harbour porpoise using a 16 hydrophone array. Measurements were made with an animal on station and free swimming animals catching fish in front of the array. The -3 dB beam width was in most cases similar to what has been previously measured by Au et al. (1999). Individual clicks however were sometimes broader or narrower than what has been previously reported. This may be caused by either voluntary control of the animal's beam width, or it may be a secondary effect of variations in intensity and air content within the sound production system.

**ABSOLUTE DENSITIES OF PORPOISES FROM STATIC ACOUSTIC
MONITORING WITH T-PODS**

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A central element in conservation and management of marine mammals is monitoring of population development. Only if reliable estimates of population sizes are available can the effectiveness of protective measures be evaluated. Line-transect surveys is the standard tool for small cetaceans. However, line-transect surveys are not realistic to conduct in low density areas such as the Baltic Proper. For low density areas static acoustic monitoring (SAM) of harbour porpoises, by means of T-PODs or other dataloggers, provides a viable alternative. SAM can be used to estimate densities within the framework of distance sampling. The radial detection functions derived from distance sampling theory were determined for two T-PODs (one version 1 and one version 3) by means of simultaneous acoustic detections and visual tracking of porpoises. 52% and 82% of the porpoises within 100 m from the T-PODs were detected by the V1 and V3 T-POD, respectively and 11% and 30% respectively, were detected between 100 and 200 m from the T-PODs. Effective detection area was 0.059 km² and 0.14 km² for the two T-PODs, respectively. Applying the "CetAll"-software filter to the V3 data reduced the effective area to 0.11 km². Assuming a total population of the Baltic Proper (250,000 km²) of 600 porpoises and average swimming speed of the animals of 17 km/day (from satellite telemetry data) an average detection rate of 2 positive detections/year/SAM-unit is predicted. Based on this figure and results from deployment of PCL-dataloggers (largely comparable to T-PODs) in the Swedish Baltic Proper to estimate among-station variance, it is predicted that one year of data from 300 SAM-units deployed at random locations within the Baltic Proper will provide an estimate of the total population size with a coefficient of variation below 0.2. Developing a SAM-based monitoring program for the Baltic Proper thus appears feasible.

WHAT CAN STATIC ACOUSTIC MONITORING (SAM) ACHIEVE FOR MARINE PROTECTED AREAS (MPA) MONITORING – RESULTS AND POWER ANALYSIS OF A FIVE-YEAR STUDY ON HARBOUR PORPOISES IN THE GERMAN BALTIC SEA

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Five marine protected areas (MPAs) in the German Baltic EEZ have been proposed by the German government as future Natura-2000 sites according to the EU-Habitat Directive. As MPAs can only be effective when protective legislation is translated into conservation measures, a monitoring needs to be commenced. The harbour porpoise (*Phocoena phocoena*), the only reproducing cetacean species in the German Baltic Sea, is protected under annex II and IV of the Habitat Directive. The German Oceanographic Museum has conducted a five-year passive acoustic monitoring to monitor this species with up to 42 measuring positions, where T-PODs, automatic cetacean click loggers, were deployed between 2002 and 2007. All T-PODs were calibrated and (from 2005 on) set to a standard sensitivity of 127 dB re 1 μ Pa. GAM-analyses of the results show significant yearly repeating seasonal patterns and geographical differences in the number of porpoise positive days (PPD), as being the percentage of days with porpoise registrations. The variation of PPD among five measuring positions in each of the proposed MPAs 'Kadet Trench' and 'Fehmarnbelt' was calculated. This allowed the conduction of a power analysis (paired t-test) to find the minimum number of measuring positions necessary to fulfill the EU requirements for a future monitoring programme. SAM shows tremendous potential for future monitoring in comparison to observer surveys, because short as well as long term variations in porpoise density can be detected and analysed. This is a key issue for evaluating the harbour porpoise population status. For future monitoring of harbour porpoises in the proper Baltic Sea and other low density areas, SAM appears to be the best practical solution, as with decreasing densities aerial and boat surveys become less cost-effective.

TIME-VARYING GAIN CONTROL IN THE TURSIOPS BIOSONAR ?

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Animal biosonar has been studied extensively in bats and captive toothed whales, but knowledge on echolocation in free-ranging toothed whales is very limited. Four species of toothed whales have been shown to decrease their source level when they approach a target as a hypothesized consequence of reducing their interclick interval to the two way travel time to the target. However, this does not match the acoustic behavior of other free-

ranging toothed whales echolocating for fish, and it is not clear if the observed range-dependent gain control can be generated as artefacts in the recording or analysis process. This study set out to investigate whether wild Bottlenose dolphins (*Tursiops* sp.) exhibit time-varying gain control of the sound source and whether the methods chosen to investigate this might influence the results. We recorded echolocation clicks of approaching Indopacific Bottlenose dolphins with a calibrated 4-hydrophone vertical array and analysed the relationship between apparent source level and range under a set of different on-axis criteria. We demonstrate that a rigorous on-axis criterion showed no time-varying gain in this delphinid species whereas more relaxed criteria would seemingly indicate some form of time-varying gain. In conclusion, the chosen on-axis criterion was found to be essential to the analysis and conclusions drawn and extra care must be given to make sure that analyses of echolocation signals in the wild are indeed on-axis.

PALAOA: TOOL FOR PERENNIAL BIOACOUSTIC RESEARCH

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Autonomous observatories collecting acoustic data in areas (periodically) inaccessible to humans are a promising tool to advance our knowledge concerning species inhabiting these remote regions. Here we introduce the PerenniAL Acoustic Observatory in the Antarctic Ocean (PALAOA) which was constructed to obtain real-time, year-round broadband underwater acoustic data from the Antarctic coastal ocean. The PALAOA-observatory is located at 70°31'S 8°13'W, on the Ekström ice shelf, at 1.5 to 3 km distance to the ice shelf edge, Eastern Weddell Sea. The observatory utilizes a hydrophone array deployed underneath the Antarctic ice shelf to autonomously and continuously record the underwater soundscape. The PALAOA-observatory has been operational since January 2006 and has collected a total of 8191 hours of data over 438 days (by November 2007). In this talk, we provide 1) information on the observatory's technical features, 2) an overview of (bio-) acoustic signatures recorded so far, 3) preliminary results concerning cetacean and pinniped species that have acoustically been identified in the PALAOA recordings and 4) an outlook of ongoing and future PALAOA based projects.

INTELLIGENCE WITHOUT HANDS

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We humans think of ourselves - and not without reason - as a very successful mammalian species. We attribute our success to our intelligence which allows us to control our world instrumentally in very many different ways. In looking for the evolutionary origins of this remarkable competence we look, of course, in the first place at our near relatives in the animal kingdom, the primates, in particular the hominoids. Our nearest relative, the chimpanzee, clearly excels in this respect as well. There is even evidence for the beginnings of self-awareness. Field research has moreover revealed that chimpanzees have an elementary culture, in which various forms of tool-making command attention. However, these discoveries have also sharpened our alertness for similar competences elsewhere. Consequently we have come to realize that certain bird species, such as the corvids, and certain marine mammals display levels of noteworthy intelligence as well, sometimes equalling and perhaps even surpassing primates. We are wondering, for example, whether not dolphins have a certain level of self-consciousness. This raises the question why such animals "without hands" should have developed these abilities. It has also forced us to think again about the evolutionary reasons for the development of intelligence in "our kind of animals".

SITE FIDELITY, GROUP CHARACTERISTICS AND STEREOTYPED BEHAVIOUR OF MELON-HEADED WHALES (*PEPONOCEPHALA ELECTRA*) AROUND AN OCEANIC ISLAND

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The melon-headed whale (*Peponocephala electra*) is a large and aggregative delphinid with a global tropical and subtropical distribution. It is generally considered as an oceanic species living in deeper off-shore waters. Around oceanic islands, melon-headed whales tend to occur closer

to coasts, as deep-water habitats can be found in close proximity to coastal environments. Very little is known on the behaviour and ecology of melon-headed whale, especially at the scale of social units. Around the island of Mayotte (45°10'E/12°50'S), in the Mozambique Channel, melon-headed whales have been regularly recorded throughout the year. A compilation of positional, behavioural and photographic data allowed us to describe some general aspects of this species's natural history. Between 2000 and 2006, 28 sightings were recorded around Mayotte (58% collected during dedicated surveys). Group size was large, especially in comparison to the other delphinid species observed in the area (mean=230; min=50; max=500; SD=124; mode=300). All groups including calves, subadults and adults. Groups were best described as a "super-groups", which was composed of subgroups containing around 40 individuals (mean; range=10-60). Melon-headed whales were predominately observed travelling parallel to the barrier reef at a mean depth of 80m. Along with this activity, regular breaks, considered as sleeping, were observed at various intervals but at a higher occurrence during the morning. Inter-specific associations were also observed with Fraser's dolphins (*Lagenodelphis hosei*), humpback whales (*Megaptera novaeangliae*) and pantropical spotted dolphins (*Stenella attenuata*). The collection of ~1500 photographs allowed the identification of 255 individual whales. A total of 16 individuals have been recaptured once or twice, suggesting some degrees of site fidelity. This study also suggests that this oceanic species makes use of near-shore insular habitat, especially during the day close to reef complexes.

OLD FEMALES SERVE AS SOCIAL BROKERS WITHIN A HIGHLY CONNECTED NETWORK OF ENDANGERED KILLER WHALES

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Killer whales are notable for their highly stable social structure, which is extreme even among social mammals. Long term studies of "resident" killer whales in the NE Pacific have documented matrilineal groupings that have remained stable for multiple generations, over more than 3 decades. One of these populations, the "southern residents", that use the coastal waters around southern Vancouver Island during summer months, has recently been listed as endangered in both the U.S. and Canada. Understanding

social structure is important for assessing population status and conservation threats, as social connectivity underpins key population processes. We analysed data on individual associations from almost 3000 hours of boat-based focal-follows from 1996 to 2003 and used social network analyses to quantify social connectivity. Despite strong matrilineal structuring, this social network was found to be highly connected, linking all individuals in this population, with no external associations. Associations were strongest within matrilines, but all individuals associated with individuals from other matrilines. Strong inter-matriline associations were significant with regard to matriline and age, reflecting preferred associations between specific matrilines comprising long-recognised “pods” and also strong associations involving older individuals, specifically females, in the 51-60 age class. This suggests that older animals are social “brokers”, responsible for the transmission of cultural traits and cultural diversity within the population, and likely play a key role in the viability and continuity of this endangered population.

RESEARCH OF THE BEHAVIOUR AND THE UNDERWATER ACOUSTIC ACTIVITY OF BELUGAS (*DELPHINAPTERUS LEUCAS*) IN THE MYAGOSTROV'S REPRODUCTIVE AGGREGATION (WHITE SEA)

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This work is the part of investigations, organized by Shirshov Institute of Oceanology on the White Sea. Its purpose was to collect data about the behavior and bioacoustic activity of belugas in the area of the Myagostrov and Roganka islands (Onezhsky gulf, White Sea). One of belugas reproductive aggregations lives there. The working period was June and July of 2005 and 2006. The place of observations was situated on the level of 40 meters above the sea. In the distance of 100 meters of the shore was put a hydroacoustic complex, allowed to listen and to record belugas underwater signals. The observers registered every 15 minutes: the number of belugas and their location; the size of different groups; the approximate age of animals; the time of their arrival and leaving; the character of the activity; frightening factors (vessels). We registered natural “marks” on the skin (scars, pigment spots). Besides the visually observations, the important part of the research was a video-shooting of the belugas behavior with a synchronic record of their underwater acoustic activity (the frequency range until 24 kHz) by using the digital camera Panasonic NV-GS400GC. The volume of the video-records – 36 hrs. During the observation was defined the size of population – about 30 adults. We observed complicated forms of

the behavior (individual and collective): parental, social, sexual, feeding, migration. The belugas underwater acoustic activity was characterized by the wealth and variety of signals. The using of the video-camera as a synchronic sound-recorder allowed very precisely connecting the certain types of signals and their sequences with a corresponding fragments of the behavior, and than to define the ethologic-acoustic correlations.

FLOW SIMULATION ALONG A GREY SEAL; THE IMPACT OF AN EXTERNAL DEVICE

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An increasing number of marine mammal studies on the behaviour, physiology and ecology rely on data collected from back-mounted devices, such as bio-logging tags and satellite transmitters. However, external devices may influence the animal's hydrodynamics, behaviour and energy expenditure and, therefore, impede the individual animal. In the Netherlands, weight loss and abnormal behaviour have been observed in grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*) with satellite transmitters attached. A grey seal was found dead nearly one year after the transmitter (an Argos Satellite Relay Data Logger) had been attached. Necropsy showed that the transmitter may have contributed to the death of this animal. To address how the transmitter influenced the seal, the water flow along a grey seal was simulated using Computational Fluid Dynamics calculations. The results reveal several changes in forces and moments and thus balance due to this device. The investigated satellite transmitter causes an average increase of the drag coefficient of 12%. Although the drag increase seems to be small, there are significant relative transmitter induced increases in the pitching moment (32%) and lift (240%). Furthermore, the simulation showed that the transmitter generates areas of decreased wall shear stress on the seal's back. These areas correspond with areas of untypical fouling found on the back of the seal and the transmitter. The results from this study demonstrate that external attached devices can change the hydrodynamics of the seal, which may have adverse effects on the animal's welfare and behaviour. It is important to take these effects into consideration, otherwise the value of the information obtained from the devices is poor. Therefore, interpretations and extrapolations regarding 'natural behaviour' of animals in their 'natural environment', such as estimated population size, rates of survival, diving and foraging behaviour will be the subject of debate.

NUMERICAL SIMULATIONS OF THE FLOW AROUND A HUMPBACK WHALE'S PECTORAL FIN

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This presentation is dedicated to the understanding of the flow around a humpback whale's pectoral fin. The humpback whale (*megaptera novaeangliae*) is known to be a very versatile swimmer despite of its size (average length: 13 meters, average weight: 30 tons). Biologists see the reason in the whale's unusually long pectoral fins (flippers), which can grow to 1/3 of the humpbacks overall body length. The flippers, aside from their length possess another peculiarity: Their leading edge is not smooth but covered with so called tubercles, which give the flipper a rather craggy look. The idea that these tubercles play an important role in the hydrodynamic properties of the flippers seems obvious, especially considering that humpbacks are born that way and do not acquire the tubercles later in life. In order to get some insights into the flow around the humpback's flippers, a virtual flipper was created for later use with CFD. As the whale operates a very wide range of different flow fields (e.g. hunting, long-distance swimming, cold and warm waters) chosen „operating points“ had to be specified for the numerical simulations. For comparison a second flipper was created without tubercles. Both flippers were examined numerically in water at different angles of attack and a typical swimming speed of the whale. The flipper with tubercles was then scaled via the Reynolds number and also simulated in air. Results show that the flipper with tubercles provides a much higher lift at high angles of attack, while losses remain the same compared to the smooth flipper. Apparently the tubercles generate a vortex pattern which re-energises and stabilises the boundary layer. This way stall is delayed and a higher lift achieved.

SENSITIVITY ANALYSIS OF THE EIGENFIN SOFTWARE

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The eigenfin process is a method for identifying dolphins via the shapes of their dorsal fins. It is based on Principal Components Analysis (PCA) of fin images. The crux of the eigenfin identification process is computing the coefficients that express the fin image as a linear combination of PCA

components. The dolphin's orientations in photographs vary and, to reduce the number of variables in the analysis, the images are rotated to make the angle of the leading edge of the fin equal to 45 degrees. The rotation angle is determined by finding a line tangent to the leading edge of the fin and computing the difference between the angle of that line and 45 degrees. Experimentally, determination of the rotation angle can have a variation of +/- 0.5 degrees or more because of the ambiguity of the definition of the tangent line. The purpose of this study is to determine the sensitivity of the coefficients to uncertainties in the angle. We take the computed fin angle of an extracted dolphin image and vary it by small increments and use the perturbed angle to rotate the image to the standard orientation and extract and scale the fin image. PCA coefficients are computed and compared graphically. A regression analysis of coefficient value versus angle change is done. Typically, the coefficients show a linear dependence and some sensitivity to uncertainties in the angle of the tangent line. This indicates the need for research on a more robust determination of the tangent line. Also, coupled with other variations in orientation, it indicates that the primary role of the PCA analysis should be to narrow a list of many possible candidates to just a few, with an exact match provided by the eigenfin post-processing software.

SEAL MITOCHONDRIAL CONTROL REGION USEFUL TO DISCRIMINATE BETWEEN SCATS FROM PHOCA VITULINA AND HALICHOERUS GRYPUS

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Identifying undigested hard prey remains in faecal samples is the most common method for studying the feeding ecology of seals. Scats, provide valuable information on e.g. prey selection and changes in the diet. In the Dutch Wadden Sea, grey (*Halichoerus grypus*) and harbour (*Phoca vitulina*) seals are found sharing their resting places. Scats can be retrieved from these haul out places. It is, however, not possible to visually distinguish between the scats of the two species. For this reason, we aimed to develop a molecular method to differentiate between scat samples of harbour and grey seals. DNA sequences of the mitochondrial control region of seals in GenBank showed profound variability between the two species and less variability within the species. Because sequences of seals from the Dutch

Wadden Sea were not yet available, we sequenced the control region of 25 tissue samples of known seal species from the western part of the Dutch Wadden Sea, in order to extend the database with seals from this area and to provide reference data for unknown scat samples. In parallel, we sequenced the control region from DNA extracts of small sub-samples (20-200mg) of 192 scats of unknown seal species of which prey contents have been determined. All DNA sequences were checked manually and a multiple alignment was produced, including sequences retrieved from GenBank. The output tree of the distance analysis showed a clear distinction between the two seal species, irrespective of the sample location, allowing the determination of species from unknown scats. It is now possible to separately analyse diets for harbour and grey seals in areas where both species occur. We are currently designing species-specific primers for grey and harbour seals. Using these primers in diagnostic PCR will allow routine and cost-effective species identification in scats.

WHERE HAVE ALL THE HARBOUR SEALS GONE?

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A previous study presented an analysis of changes in the regional abundance of harbour seals *Phoca vitulina* based on repeated aerial surveys of haulouts and demonstrated the use of sparse data to deliver advice about population status and management. Generalized linear models with negative binomial errors were used to represent the over-dispersed data. The shape parameter of the negative binomial distribution was directly estimated from the data where this was possible. Information from time-series counts where there were few gaps in the data was used to improve the estimation of this parameter in areas where fewer surveys had been carried out. Survey results from 2001 to 2006 showed that the number of harbour seals in eastern England has not increased since the end of the 2002 phocine distemper epidemic. There was also evidence of a general decline in most of the harbour seal colonies around Britain with the exception of populations in the Inner Hebrides where numbers appeared to be stable or possibly increasing. Between 2001 and 2006, the population in Orkney and Shetland declined by 40% (95% confidence interval: 30-50%), indicating harbour seals in these areas experienced substantially increased mortality or very low recruitment over this period. The widespread declines, ranging from Shetland to The Wash, suggested that the causes may have been operating over at least a large part of the North Sea. In August 2007, repeat surveys in most of Scotland and all areas where harbour seals are found in England,

will add further information on the state of harbour seal populations in Britain and will confirm whether the observed declines are genuine. Additional surveys determining the timing of the annual moult and the relative proportion of pups born within areas of decline will contribute to our understanding of the processes operating on harbour seals.

DESIGNING REPEATED MONITORING SURVEYS TO MEASURE THE ABUNDANCE OF BOTTLENOSE DOLPHINS USING A COASTAL MARINE PROTECTED AREA.

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Monitoring protected populations usually requires repeated measures of abundance. Increasingly, scientists are requested to plan and conduct surveys and provide reliable estimates of population size. Precise estimates with low cv values are essential in order to provide the precision necessary to detect long term population trends. Using photo-identification surveys of bottlenose dolphins using a Special Area of Conservation (SAC) in western Ireland we present a case study with which we develop a framework for planning repeated monitoring surveys of small populations of marked animals using protected areas. We used individual sightings histories of marked dolphins recorded during 14 surveys conducted during a seasonal peak in numbers during July to September 2003 to estimate abundance. Using a mark-recapture model tolerant of between-animal and between-survey heterogeneity we estimated 121 ± 14 (SE) 95 CI=103-163 dolphins to be using the SAC. We used a power analysis to examine the effect of estimate precision and reporting frequency on sensitivity to population change detection. Using a permutation procedure we then examined the effect of increasing sampling effort on resulting abundance estimates and their associated cv values. Increasing sampling effort from 3 to 14 surveys increased the mean sampling frequency of marked individuals from 1.17 to 2.17 and reduced the cv values from 0.58 to 0.14. Our analysis indicates that a minimum of 10 surveys with a mean individual sighting frequency of 1.8 and a cv below a threshold of 0.15 sufficient to provide a reliable and robust estimate of dolphins using this SAC. This procedure provides a useful tool for planning sampling strategies for future monitoring of this SAC and is applicable to survey efforts directed at mark-recapture monitoring of other species using protected areas.

EVALUATION OF PELAGIC TRAWL PINGERS AND THEIR EFFECT ON THE BEHAVIOUR OF COMMON DOLPHINS DELPHINUS DELPHIS

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Incidental capture in pelagic trawls is a serious threat facing small cetaceans in European waters. In an earlier study, Leeney et al. (2007) showed the behaviour of bottlenose dolphins was strongly affected by Continuous and Responsive Acoustic Deterrent Pingers. In the present study, boat-based trials were carried out to determine the effect of the same acoustic deterrents on the behaviour of common dolphins, the species most frequently caught in pelagic trawls. A total of 31 trials were carried out on a range of different groups over a wide geographical area off the south coast of Ireland and when engaged in a number of different behaviours. No evasive behaviour was recorded during the deployment of active Continuous Pingers (CP) or Responsive Pingers (RP) despite independent verification that the Responsive Pingers had been activated. Additional trials using a modified RP where the signal frequency, duration, length and interval could be modified between each trial also recorded no evasive behaviour. We conclude that the RP and CP acoustic deterrents tested here do not significantly affect the behaviour of common dolphins unlike the conclusions from similar trials carried out on bottlenose dolphins. Similarly, trials using CETASAVER and DDD acoustic deterrents also failed to solicit any evasive response from common dolphins in Ireland despite being affective in other studies elsewhere on this species suggesting there is considerable inter-species differences in the affect of pingers on dolphin behaviour.

APEX PREDATOR ABUNDANCE AND DISTRIBUTION IN THE FORMER SHELF ICE AREA LARSEN A AND B, ANTARCTICA

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In the last decades the Larsen A and B ice shelf at the eastern side of the Antarctic peninsula disintegrated due to global atmospheric warming. Aim of this study was to study the distribution, abundance and biomass of warm-blooded apex predators in this new habitat. In January 2007 a systematic line transect distance sampling survey was conducted over the Larsen A (6 726km²) and Larsen B (14 381km²) area. A helicopter based on the R/V Polarstern was used to cover a total of 2811 km on survey effort. 1514 km of this effort was conducted on parallel and equally spaced tracklines covering both sea ice and the coastal polynya in sea states less than 3 Beaufort. Three seal species, Crabeater (68%), Weddell (27%) and Leopard Seal (6%) were observed (on sea ice), as well as Emperor penguins and Antarctic Minke Whales. Using standard as well as multivariate analyses, detection functions were calculated and minimum densities for the Larsen A and B area estimated. Penguins were only sighted in the Larsen B area. Densities of pinnipeds and Minke Whales differed between Larsen A and B, but not significantly and were similar to other areas in the western Weddell Sea in early summer. Estimates of biomass showed that seal biomass was about 5x higher than that of Minke Whales. Red scat sightings of both seals and Antarctic Minke Whales show that the animals were feeding at least partially on krill. We conclude that the availability of sea ice (for haul out) as well as the apparent high production allowed top predators to invade this new habitat fairly fast. Albeit Penguins also depend on pelagic food sources, their low densities might signify that they did not yet benefit from these potential new feeding grounds.

USING A NETWORK OF FIXED-ROUTE TRANSECTS TO MONITOR THE CONSERVATION STATUS OF CETACEANS IN NORTHWEST EUROPE

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Monitoring the conservation status of cetaceans over a wide geographical area can be financially costly and logistically complex, especially in terms of providing adequate and consistent spatial coverage. One possible approach is to regularly sample a network of fixed transects, which in particular can increase the confidence in any changes that are detected. Ferries with set routes provide an opportunity to conduct fixed transects at low cost, especially when skilled volunteers are used as recorders. While not randomly placed by the researchers, these ferry routes are none-the-less randomly placed with respect to the distribution of cetaceans. In Northwest Europe, an extensive network of ferry surveys has developed since 1995 through the work of eight research groups that collaborate under the umbrella of the Atlantic Research Coalition (ARC). Collectively ARC partners currently conduct ~70,000km of survey effort each year along 17 ferry routes which have a combined length of 7550 km. Spatial coverage is extensive, with for example every UK ICES fishing area sampled. To demonstrate the value of such ferry survey networks for monitoring cetacean status, ARC annual survey data has been analysed to assess changes in cetaceans status across the sampled regions from 1996-2006. Trends from the ARC data are consistent with data from other sources, suggesting they are representative of the wider area. For example, ARC data show a significant increase in the occurrence of harbour porpoises and minke whales between 1996 and 2006 in the English Channel. This is consistent with results from the SCANS and SCANS II surveys. Trends in other species, indicative of changes in conservation status, are also seen in the ARC data. Therefore, the ARC network of ferry surveys provides an important source of data for the regular monitoring of the status of cetacean species around Northwest Europe.

**Wednesday, 12 March 2008****INTER-ANNUAL DIFFERENCES IN HARBOUR PORPOISE
DISTRIBUTION ON THE WEST COAST OF SCOTLAND**

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Effective conservation requires information on spatial and temporal aspects of a species distribution to identify important habitats and how they vary over time. There have been a number of studies on harbour porpoise (*Phocoena phocoena*) distribution on the west coast of Scotland in recent years. However, most analysis has focused on spatial variation and how the distribution of harbour porpoise varies at different temporal scales remains poorly known. We investigated inter-annual variations in harbour porpoise distribution and whether there were consistent high-use areas over time on the west coast of Scotland. Visual and acoustic line transect surveys were carried out between April and September 2003-2007 from the Hebridean Whale and Dolphin Trust's research vessel *Silurian*. Survey effort varied between years (range: 3,103 – 11,170 km) but consistent coverage of a core area was maintained through the study period. Distribution was compared between years by modeling detections per unit effort using a negative binomial generalized linear model (GLM) with a logit link function. Across each of the study years, significantly more porpoises were detected from acoustic surveys than from visual surveys (0.161 and 0.080 porpoises per kilometre, respectively; $p < 0.001$). There was a slight increase in both visual and acoustic detections over the five years, though this relationship was not significant. Results show that harbour porpoises were found at significant densities throughout the west coast of Scotland. However, there were areas of high use for harbour porpoises, which were consistent over time. For example, detection rates were high in the southeastern region, particularly the Firth of Lorn and Sound of Jura in every year of the study.

**DIVERGENT DIEL AND TIDAL PATTERNS OF USAGE SUGGEST
HABITAT PARTITIONING BETWEEN BOTTLENOSE DOLPHINS AND
HARBOUR PORPOISES IN WEST WALES.**

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In the UK, bottlenose dolphins and harbour porpoises are often sympatric in their distribution, with both species utilising coastal habitats. In Cardigan Bay, West Wales, the two species are present year-round, exploiting the same habitat for calving and feeding, and to some extent, the same prey stocks. However, within the last decade there has been a significant rise in the number of porpoise deaths resulting from attacks by bottlenose dolphins. Acoustic monitoring was used to compare spatial and temporal resource use of the two species. This method has the advantage that it records the presence of both species independent of sea state, weather and time of day over extensive periods. T-PODs were deployed at 10 locations within Cardigan Bay from March 2005 to January 2007. Acoustic detection rates were analysed to compare diel and tidal patterns of habitat use of the two species. Bottlenose dolphin and harbour porpoise detection rates over the tidal cycle were strongly negatively correlated, with up to 40% of the variation in the presence of one species explained by that in the other. This relationship was strongest during spring and summer when bottlenose dolphin abundance was highest. Patterns of occurrence over the diel cycle were also negatively correlated, and co-occurrence of both species at a site within the same hour was rare, with only 2.7% of hourly detections positive for both species. This suggests that fine-scale habitat partitioning is occurring between bottlenose dolphins and harbour porpoises via divergent patterns of habitat use in relation to the diel and tidal cycle. It is unclear what is driving this partitioning. Changes in the distribution or abundance of one or both species or increased competition for limited prey may all be factors, and further study is required to test these hypotheses.

LIFE HISTORY BUFFERING IN ANTARCTIC FUR SEALS AGAINST CHANGING PATTERNS OF CLIMATE AND ENVIRONMENTAL VARIATION

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The consequences of warming for Antarctic long-lived organisms depend on their ability to survive changing patterns of climate and environmental variation. We analysed 25 years of Antarctic fur seal mark-recapture data from South Georgia and used population dynamics models to assess the buffering of fur seal life history to increasing patterns of climate and environmental variation. We compared our results with the results of the analysis of other long-term data sets of birds and mammals from different Antarctic regions. In all the species we found strong support for selection of a low inter-annual variance in the survival and fecundity of adult females; these vital rates influence most the variability in mean population fitness. However, we also found that Antarctic fur seals have lived with a rapid increase in climate-related ecosystem fluctuation since 1990, which limits Antarctic krill, their main food supply, during critical phases of the breeding cycle. This increases the fitness costs of breeding for females, causing significant short-term changes in population structure through mortality and low breeding output. Ecosystem changes around South Georgia occur now with a frequency higher than the mean female fur seal generation time, and therefore are likely to limit adaptive responses. Fur seals are more likely to rely on phenotypic plasticity to maximise individual fitness and be able to cope with short-term environmental changes. With more frequent extreme climatic events driving more frequent ecosystem fluctuation, the repercussions for life histories in many Antarctic marine mammals and birds are likely to increase, particularly at regional scales. In species with life histories that are more constrained by fluctuation in their critical habitats, like sea-ice, this may cause demographic changes, population compensation, and changes in distribution, as already observed in species living in the Antarctic Peninsula and adjacent islands.

LOGIST REGRESSION MODELS TO PREDICT CETACEAN DISTRIBUTION AS FUNCTION OF THE HYDROGRAPHIC PARAMETERS IN THE PELAGOS SANCTUARY (SOLMAR-SIRENA '01, '02 AND '03 TRIALS).

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Ten research cruises have been conducted in the Ligurian Sea since 1999 within SOLMAR (Sound Ocean and Living Marine Resource), a project designed to study cetacean distribution as a function of environmental and hydrographic parameters. Sighting and hydrographic data were extracted from the 2001, 2002, and 2003 campaigns, to identify the environmental predictors for cetacean distribution in the Ligurian Sea. In a total of 210 stations, temperature, conductivity, dissolved oxygen, turbidity, salinity, density and sound velocity data were sampled. Concurrently, visual observations of cetaceans were conducted. Correlations between cetacean occurrence and environmental parameters were analysed for three species: the striped dolphin, *Stenella coeruleoalba*, the fin whale *Balaenoptera physalus* and the sperm whale *Physeter macrocephalus*. Factor analysis was used to reduce the redundancy and to define a subset of the environmental predictors to be used in the habitat modelling. Ten potential predictors were identified on the basis of seven extracted factors accounting for more than 95% of the total variance. A Stepwise Logistic Regression analysis was performed. Significant correlations were outlined ($P < 0.05$). Fin whales' presence was generally directly correlated with the mean values of sound velocity, density and turbidity (i.e. features related to temperature); sperm whales' occurrence was correlated with standard deviation of density, temperature and turbidity (i.e. associated with upwelling areas); striped dolphins' presence was closely related to standard deviation values of dissolved oxygen, proxy of high productivity areas. All the models showed good fit and good performances in their habitat predictions (higher than 65% up to a maximum of 87% of correct presence/absence classifications). These models allow a better understanding of cetacean distribution and provide further information for the management of the Pelagos Sanctuary.

**COMMUNITIES AS A "HOUSE OF CARDS": HOW PISCIVOROUS FISH
MAY HELP MARINE MAMMALS TO PERSIST**

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In marine communities piscivorous fish may forage on the same fish as fish-eating mammals. Whales, pinnipeds and large piscivores have therefore been argued to be potential competitors and negatively affect each other. However, these types of predators differ in their size selectivity, where piscivorous fish tend to forage primarily on small prey fish, whereas mammals tend to hunt for larger-sized individuals of these same prey species. Recently developed ecological theory has shown that the interaction between predators with different size selectivities is rather complex and not necessarily negative. Size-selective predation decreases total prey density, but also changes the prey size distribution if growth in body size of prey individuals is food- or density-dependent. The change in prey size distribution induced by piscivorous fish may translate into an increase in the density of large prey individuals and hence larger food densities for predators specializing on them. In this way piscivorous fish may exert an indirect, positive interaction on mammalian fish predators and even promote their persistence. Marine mammals may as a consequence suffer in an unexpected way from the world-wide depletion of marine fish stocks over the last decades, as this changes the marine food web in such a way that the quality and quantity of their food declines.

**PCB LEVELS ARE ASSOCIATED WITH THYMIC INVOLUTION AND
INFECTIOUS DISEASE MORTALITY IN UK-STRANDED HARBOUR
PORPOISES (1989-2006)**

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Time series data show several organochlorine pesticide levels declined markedly in UK-stranded harbour porpoises (*Phocoena phocoena*) (n=368-483) between 1990 and 2005, but summed blubber concentrations of 25 chlorobiphenyl congeners (Σ 25CBs) levels were significantly higher and more temporally stable (n=540). In a case-control study, levels of Σ 25CBs in healthy harbour porpoises that died of acute physical trauma (n=276) were compared with Σ 25CBs in animals that died due to infectious diseases (n=182). The infectious disease group had significantly greater Σ 25CBs concentrations (mean = 22.3 mg/kg lipid) than the physical trauma group (mean = 11.4 mg/kg lipid) ($p < 0.001$). This association occurred independently of other potentially confounding variables including age, sex, two indices of nutritional status, season, region and year found. Adult females (n=96) had the lowest Σ 25CBs but many had levels associated with reproductive impairment in other mammalian species. Total blubber PCBs levels (as *Aroclor 1254*) were also calculated enabling comparison with a proposed threshold for adverse health effects (including immunosuppression) in marine mammals of 17 mg/kg lipid. In porpoises with total PCBs levels exceeding 17 mg/kg lipid (n=244), total PCBs levels were significantly higher in the infectious disease group compared to the physical trauma group ($p < 0.001$). This association was no longer significant in porpoises with total PCBs levels below 17 mg/kg lipid (n=214) ($p > 0.90$). In another subset of porpoises (n=118), quantitative measures of thymic lymphoid tissue were independently and positively correlated with nutritional status and independently and negatively correlated with age and Σ 25CBs, but only in animals with total PCBs levels exceeding the proposed 17 mg/kg lipid threshold of toxicity (n=73). These findings are highly consistent with a causal relationship between PCB exposure and infectious disease mortality mediated via PCB-induced immunosuppression and show that PCB exposure in harbour porpoises in UK waters has declined only slightly over a 16 year period.

CAUSES OF DEATH OF HARBOR PORPOISES (PHOCOENA PHOCOENA) STRANDED ON THE DUTCH COAST

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The multidisciplinary research group MARIN (Marine Animals Research & Intervention Network) investigated the causes of death of marine mammals stranded on the continental coastline of the southern North Sea (Belgium, France, and Dutch coasts). Since the end of the 1990s, a significant rise of harbour porpoise (*Phocoena phocoena*) strandings occurred in the southern North Sea and different theories emerged to explain such increase. The aim of the present study is to present the main lesions and causes of death of porpoises stranded on the Dutch coast in 2006 and 2007. In 2006 and 2007, more than 800 animals were found dead on the Dutch coast, and 122 were kept frozen, necropsied and sampled following a standard procedure. Frequent observations included net marks on the skin, sub-cutaneous and muscular bruises, emaciation, pulmonary and gastric parasitism, acute pneumonia, and pulmonary congestion and edema. In fifty percents, the animals were too putrefied to identify lesions. For the others, two causes of death were significant: by caught in fishing nets and infectious diseases. By-catch in fishing nets was mainly observed in animals stranded in March and April while infectious diseases, mainly acute pneumonia, occurred throughout the year. External evidence of capture (net marks, penetration incision into body cavity) was observed in 57% of porpoises diagnosed as being by caught. In addition, only 43% of by-caught animals were healthy, others having evidence of slight to severe emaciation, acute pneumonia and mild to severe parasitosis. The main reason for the recent porpoises stranding rise on the Dutch coastline is linked with the southward shift of the population within the North Sea. The study showed that the diagnosis of

capture cannot be based only on external observations, and that by-caught porpoises are not always healthy.

POTENTIAL MARINE PROTECTED AREAS OFF OSA PENINSULA: SITES OF CONSERVATION RELEVANCE FOR CETACEANS.

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The region of highest biodiversity in Costa Rica is Osa Conservation Area. In terms of marine fauna this locations offers a great variety of complex coastal and marine ecosystem that support an equally impressive amount of marine species, among them, more than 11 species of cetaceans. Humpback whales (*Megaptera novaeangliae*) are one of the key species that together with *Stenella attenuata* dominate the neritic area. The transition area, along the shelf edge boasts the most important level of cetaceans' species richness. The aim of this investigation is to make a quantitative and qualitative assessment of the sites with potential as MPAs in terms of cetacean conservation. Three approaches are given: the quantification of alfa and beta diversity along three sites by means of the Simpson diversity index. The second approach is the determination of critical habitat for a potential flagship and umbrella species (humpback whale) by mean of physical attributes of nursing and breeding sites. The third analysis is a description of the oceanographic variables that might influence cetacean distribution and abundance (upwelling index and seasonal patterns). An important abundance and an increase in species diversity were observed in transitional areas between the coastal and oceanic waters, with greater occurrence of oceanic dolphins and overlap of indicator species such as *Delphinus delphis* (Upwelling Modified Waters) - *Stenella longirostris* (Warm Tropical Waters). Humpback whales (females and calves, singing males and roving individuals) mainly aggregate in two focal locations; around the east coast of Caño Island - Drake Bay, and around the west coast of Corcovado National Park. Recent studies show a fine scale preference for shallow topography and gentle slope, while at a basin scale, a particular range in values of sea surface temperature (24°C – 28°C), defined the realized breeding and nursing niche of *M. novaeangliae* in Osa Peninsula.

THE CAUSE OF BYCATCH OF ATLANTIC WHITE-SIDED DOLPHINS (LAGENORHYNCHUS ACUTUS) BY PELAGIC TRAWLERS

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Evidence is provided for possible causes of bycatch of Atlantic white-sided dolphins (*Lagenorhynchus acutus*) in the Dutch pelagic fishery, west of Ireland, in the 1990s. The hypothesis is put forward that dolphins are feeding on discards in the wake of the trawlers at night and thus become victim of bycatch during hauling or shooting of the gear. In this study, an extensive description is given of the way the catch is handled on board and how discards are released and become available for scavenging dolphins. Stomach contents of bycaught specimens are compared with discards and catch composition. Mackerel dominates the fresh remains of the stomach contents. Although the length distribution of the fresh mackerel in stomach contents is significantly different from the mackerel in the discards, dolphins may very well feed on discarded mackerel, rather than forage on the mackerel when these are caught in the net. Information gained by observers on board the trawlers and from other diet studies support this hypothesis. This conclusion suggests that controlling the discards flow may be an effective mitigation measure. This could be tested for example by implementing a discards "buffer-tank" on a trawler in which discards are stored during the fishing operations and released between fishing operations only.

SHIP STRIKES IN THE CANARY ISLANDS: THE NEED FOR URGENT ACTION TO MITIGATE COLLISION RISK

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The Canary Islands, known for an extraordinary high cetacean species diversity, have witnessed a rapid expansion of fast ferry traffic during the past few years. At the same time, ship strikes have been increasingly reported. A description of the quality and the quantity of the fast ferry traffic in the archipelago is presented. This is put in relation to ship strikes in the past. 556 cetacean carcasses, found ashore in the Canary Islands between 1991 and 2007, were examined. 59 strandings (11%) were found to be caused by vessel-whale collisions, many of them assumingly by large and

fast moving vessels, as indicated by severe injuries like huge slashes, cuts or animals separated into halves. Species most affected were sperm whales (*Physeter macrocephalus*, N=24, 41%), pygmy sperm whales (*Kogia breviceps*, N=10, 17%), Cuvier's beaked whales (*Ziphius cavirostris*, N=7, 12%), short-finned pilot whales (*Globicephala macrorhynchus*, N=6, 10%) and at least three baleen whale species (N=9, 15%). The temporal distribution of strandings indicate that lethal strikes have dramatically increased during the past few years. Given these numbers and the widely accepted fact that only a portion of ship strikes will be recorded due to lack of reporting and carcasses drifting away or sinking, ship strikes appear to be a major threat to at least some cetacean populations in the Canary Islands. Moreover, the issue is a matter of human safety, as crew and passengers are at risk of being harmed, too. In this situation, a number of measures to mitigate the risk of ship strikes are recommended as a matter of urgency. These include the assignment of dedicated observers on fast moving vessels, a speed limitation within a number of high-risk areas where cetacean abundance is noticeably high, and the introduction of an obligatory reporting system of vessel-whale collisions.

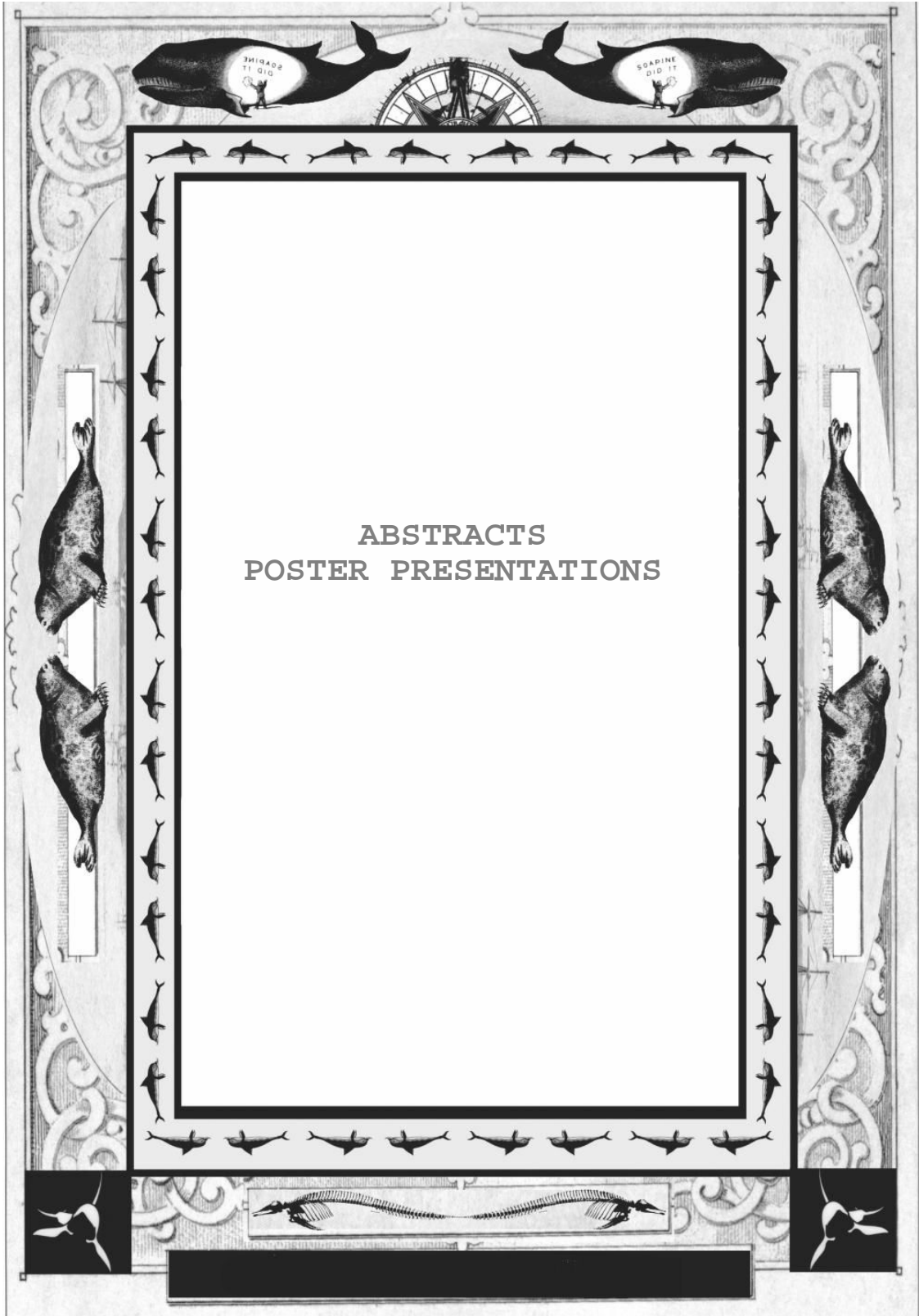
CETACEAN CONSERVATION AS PART OF AN ECO-TOURISM PROJECT IN THE NORTHERN RED SEA

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Cetacean data in the Northern Red Sea are mostly based on opportunistic sightings and beachings. The present research aimed to collect primary data and estimate economic feasibility of a long term, regional eco-tourism cetacean research. Data was collected between 1993-96 and 2004-06. Feasibility was assessed through 100 Willingness to Pay (WTP) questionnaires where tourists evaluated their WTP for an eco-tourism research oriented venture. Six cetacean species were encountered: Risso's dolphin (*Grampus griseus*), common bottlenose dolphin (*Tursiops truncatus*), Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), pantropical spotted dolphin (*Stenella attenuata*), spinner dolphin (*Stenella longirostris*) and false killer whale (*Pseudorca crassidens*). 80% of all surveys during the second period included at least one dolphin sighting with an overall sighting frequency of 0.48 individuals/Km. In the first attempted regional estimation of Risso's dolphin home range, 81% of the groups were sighted above waters 100-1000m deep and none in the shallow Gulf of Suez. Bottlenose dolphin mean group size was found smaller than in the higher-productive Indian

Ocean. Half of *Stenella* sp. sightings, some known to be nocturnal species, occurred after 17:00pm. They were sighted in several lagoons also used by diving boat operations, a fact that invites a managed zoning system. Supply and Demand curves were compared to the "Israeli 2005 tourism report". Tourists willing to pay higher rates were: non-Israeli, urbanites, with higher than average income and/or environmentally active. Economic analysis proved profitable in all population groups and all tour types. The year round comfortable weather combined with the very steep shelf, enabling near-shore sightings of open-water species, provides an ideal spot for cetacean eco-tourism. This project offers a strong base for (a) collating a marine mega-fauna list of the region; (b) an onboard educational program presenting the marine environment as a whole; and (c) use of data for marine conservation.



ABSTRACTS
POSTER PRESENTATIONS



ACOUSTICS

A01 MONITORING THE OCEAN NOISE INTERACTIONS

ANDRÉ, MICHEL (1), VALLEZ, SIMON (2), GERVAISE, CÉDRIC (2), SÁNCHEZ, ANTONIO (1), VAN DER SCHAAR, MIKE (1), MAS, ALEX (1) AND MORELL, MARIA (1)

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The sea environment is filled with natural and biological sounds, although increasingly many anthropogenic sources, e.g. shipping noise amongst others, have negatively contributed to the general noise budget of the oceans. The extent to which sound in the sea impacts and affects marine life is a topic of considerable current interest both to scientists and society. To address this issue, a necessary approach goes through the design and development of tools that allow a sustainable management of marine activities known to potentially and acoustically interact with biological sound sources, e.g. cetacean sonar. Here, we present a first version of an interactive simulator that computes the propagation and interaction of noise (natural, biological and anthropogenic) in a 3D environment. For low frequency components, a normal mode propagation code (ORCA) is used under the assumption of range independent propagation while a Gaussian beam model (Bellhop) is applied for higher frequencies which allows to consider the bathymetry effects in each 2D plane.

A02 ACOUSTIC IDENTIFICATION OF FIVE ODONTOCETE SPECIES IN THE MEDITERRANEAN SEA

AZZOLIN MARTA (1), GANNIER ALEXANDRE (2), CAÑADAS ANA (4), PEREZ-GIMENO NEUS (5), GAMBA MARCO (1), LAMMERS M. O.(5), GIACOMA CRISTINA (1)

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Acoustic observation can complement visual observation to provide more accurate estimates of marine mammal populations. For effective acoustic censuses, calibration methods must be determined by joint visual and acoustic studies. From 1994 to 2004, during visual-acoustic surveys, whistles of seven odontocetes species were recorded in different area of the Mediterranean Sea in order to determine how reliably these vocalizations can be classified to species using simple spectrographic measurements. Twelve variables were manually measured from each whistle using the program Cool Edit and seventeen parameters were extracted by using Matlab and a semi-automated algorithm named "TRIA". Thirtysix hours of recording were analyzed and 4600 whistles were extracted. Statistical analysis showed differences among whistles of different species for almost all the variables and parameters measured. Multivariate discriminant function analysis (DFA) allowed the correct classification of 70% of whistles to species using manual analysis, and 47% of the whistle using TRIA.

A03 ACOUSTIC BACKSCATTER FROM DIVING DOLPHINS: IN SITU TARGET STRENGTH MEASUREMENTS AND POSSIBLE FUTURE APPLICATIONS.

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Very few in situ measurements of acoustic target strength (TS) exist for free-swimming cetaceans. Many factors can influence the TS of this mammal Order, including size and depth distribution. Few investigations have been carried out to verify the impact of kinematic dynamics or physiological response effects to sound scattering by whales and dolphins. We present results from repeated TS measurements of dusky dolphins (*Lagenorhynchus obscurus*) in the wild, and elaborate upon possible future developments of the data collection method. During a fisheries survey off the coast of Namibia the presence of animals under the beam of the echosounder was

supported by simultaneous visual observations at the surface of a foraging group of dolphins. The average TS (N=300) for the diving dusky dolphins was -32,1 dB with a σ SD of $\pm 0,0008$. The dorso-ventral swimming behavior changed the TS values significantly with a maximum TS = -23,6 dB and a minimum TS = -41,9 dB. This substantial change in TS can be explained by the characteristic undulating swimming patterns of cetaceans and by the complete collapse of the animals' lungs at considerable depths (>50 m). The variance of TS measurements is behavior related, considering the various swimming postures adopted by this species. Maximum recorded depth was 162 m, while maximum swimming speed was 12 m/s. Combined with an opportunistic approach in extensive fisheries and ecosystem surveys, in situ measurements of cetaceans TS will increase the opportunity to perform detection for operational species identification. Furthermore, in the near future, the use of multi-frequency digital sonars, with capabilities to record real time TS data, should provide a powerful tool for the identification of cetaceans' echo-signatures, and contribute to the prevention of ship collisions worldwide and to the mitigation of the impact of seismic surveys on whales and dolphins.

A04 COMPARISONS OF LONG-FINNED PILOT WHALE (GLOBICEPHALA MELAS) AND NORWEGIAN KILLER WHALE (ORCINUS ORCA) ECHOLOCATION CLICKS

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The aim of this study was to compare source characteristics of biosonar signals from two sympatric species of toothed whales with different foraging behaviour. This study presents the first full bandwidth, multi channel array-recordings of long-finned pilot whale echolocation clicks. During November 2006 a total of 45 minutes of killer whale and long-finned pilot whale vocalisations (42 minutes and 3 minutes, respectively) were recorded. The study was carried out in Vestfjord, Norway, using a four-hydrophone vertical linear array. The array was deployed from a ship whenever weather and behaviour of the study animals permitted it. One hundred and thirty seven pilot whale echolocation clicks were recorded. Twenty of these were categorised as being on-axis and had a mean apparent source level (ASL_{pp}) of 196 dB re 1 μ Pa (SE: 0.8 dB). For killer whales, 28 out of 2000 recorded clicks were characterised as being on-axis and killer whales had a mean ASL of 203.2 dB re 1 μ Pa (SE: 2.1 dB). The -10 dB duration of pilot

whale echolocation clicks was significantly shorter (22.5 μ s; SE 1.4) than the -10 dB duration of killer whale clicks (41.6 μ s; SE 2.5). For pilot whale clicks the centre frequency (56.9 kHz; SE: 2.1) was significantly higher than the centre frequency of killer whale clicks (32.6 kHz; SE: 1.6). The significant difference in clicks may either be due to anatomical differences in the sound production system, or special adaptations related to the bisonar tasks faced by the two species, or both. The accumulation of energy over time for the clicks of the two species differed, with pilot whales having a more rapid increase in energy over time, than killer whale. This trait may make it possible to discern pilot and killer whales in automated acoustic detection routines and may, thus, have large practical implications.

A05 SNAPPING SHRIMP'S PULSES EFFECT IN THE BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) ACOUSTIC DETECTION IN THE COLUMBRETES ISLANDS MARINE RESERVE

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During a 1-year period, three T-PODs were deployed in the Columbretes Islands Marine Reserve (Castellón, Spain) to study the habitat use of bottlenose dolphins (*Tursiops truncatus*). Ambient noise measured in the study area showed a big amount of sound energy generated by snapping shrimp pulses from *Alpheus* and *Synalpheus* genera (order Decapoda), which have a wide geographical distribution. Acoustic analysis of their pulses (peak energy, frequency range, duration) revealed high similarities to echolocation clicks, being potentially logged by the T-POD as click events. Results of this study prove that most clicks logged (99,96 %) were not classified as dolphin click trains by the T-POD software, because most probably were generated by snapping shrimps. Total number of logged clicks for the study period was 164.554.311 from which 68.279 were classified as being part of a pulse train. From these, only 17,18 % were classified as dolphin click trains. This work shows that Snapping shrimps are a potential problem for the acoustic detection of bottlenose dolphin by T-POD due to three main reasons: 1- system saturation due to continuous click logging, 2- failed detections due to click and pulse temporal overlapping and 3- train misclassification by the software algorithms due to the presence of pulses in between the dolphins clicks form a train. To our knowledge, this is the first report of such a problem in the use of T-PODs as acoustic detectors.

A06 RELATION BETWEEN ECHO SOUNDER PINGS AND DOLPHIN WHISTLES IN LIGURIAN SEA

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During the Sirena 06 cruise, conducted in Ligurian sea, Italy, by NATO Undersea Research Center, two EARS (Environmental Acoustic Recording System) buoys were deployed off-shore of Capo Noli, at a depth of about 900 meters (location: N44.1404 E8.4899 and N44.11 E8.45). These two bottom recording systems remained on the sea floor roughly 15 days, from July 18 to August 1 2006. Ears buoys were set to sample at 192 kHz to record sounds up to 96 kHz. Recordings from one buoy were analyzed and classified using one minute time intervals. Almost all sounds were classified in one of three broad categories: either echolocation clicks or high frequency whistles by dolphins (both of them biological) or sonar pings. Most sonar detections were 12 kHz echo-sounder pings. For each category, we assigned a score ranging from 0 (no sound in the minute) to 3 (sound for approximately the entire minute) to indicate the presence of the respective sounds in each minute recorded. We found that those hours with highest rates of high frequency whistles are the same in which we have highest rates of ping activity. Very few exceptions are represented by those periods of time in which click series were not present, probably indicating that dolphins were not ranging in the area at those times. There is no evidence for changing oceanographic conditions during the time of recording, so there is no reason to suspect that differences in sounds spreading occurred between different days, preventing us from detecting whistling dolphins during some days. We suspect that high ping rates could induce a response in dolphins of increased whistling activity. However we cannot yet assess a cause-effect relationship between these events. Future studies are needed to more deeply investigate this aspect.

A07 SPERM WHALE TRACKING USING PARTICLE FILTERS

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A number of algorithms have been proposed in the literature for tracking Sperm Whales (*Physeter Macrocephalus*) using passive acoustics, typically based on estimation techniques. Tracking filters are a recursive form of maximum likelihood estimator which reduces computational load making them ideal for real-time implementation, often not possible with tracking techniques based on other estimation methods. Tracking filters have been successfully employed in radar, sonar and biomedical applications. A sequential importance resampling (SIR) particle filter is presented as a tracking filter solution for tracking Sperm Whales. Particle filters are not constrained to linear-Gaussian systems, so the complexity of the animal motion and sound propagation models, along with the filter parameters, can be set for an optimal compromise between tracking performance and available processing capacity. The sophistication of the system may be increased by exchanging a linear sound propagation model for a non-linear one that takes water temperature and salinity profiles into account. Likewise, simplified models can still provide good performance in situations where such data are not available or computational resources are limited. Application of a particle filter for tracking a single sperm whale is presented for two types of array configuration. Firstly tracking of an animal through a three dimensional Cartesian coordinate system using bottom mounted sensors is demonstrated and the results compared to those yielded by a cost function minimisation estimation technique. Secondly a bearings track from a two element towed array, as typically used on many research vessels, is presented.

A08 DETECTION OF WHALE CLICKS USING PHASE SPECTRUM

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Acoustic monitoring of the sound activities of whales helps to study their habitats. Many toothed whales produce short clicks of high directionality and source level for echolocation. Automatic detection and classification of their

clicks it is therefore necessary for their detection and continuous localization using passive acoustics. Some whales emit clicks in the range of human hearing (below 20 kHz) while others (like beaked whales) emit ultrasonic clicks with significant energy above 20 kHz. Since clicks are highly directional, they present different properties if they are recorded off or on the acoustic axis of the whale. Therefore the source level of the recorded clicks usually varies a lot within a short period of time. Many click detectors have been proposed in the literature which are mainly based on source level criteria (amplitude spectrum). Given the variability of the source level of clicks, however, these detectors need to dynamically adjust their detection threshold, increasing the complexity of the detection system without very satisfactory results. In this work we present a novel approach for the automatic detection of clicks from recordings of beaked and sperm whales, based on the slope of the phase spectrum. The slope is estimated through the group delay function. A click is detected simply by searching the positive zero crossings over time of the slope of the phase spectrum. A major advantage of the proposed approach is its robustness against additive noise while it doesn't require the definition of ad-hoc or adaptive thresholds for the detection of clicks. To evaluate the effectiveness of the proposed approach in detecting clicks, recordings of beaked and sperm whale clicks have been manually marked and compared to the automatically detected clicks. Results show that the proposed approach was able to detect 85% of the hand labeled clicks within an accuracy of 3ms.

A09 PALAOA: A STUDY ON THE ACOUSTIC REPERTOIRE AND BEHAVIOUR OF THE LEOPARD SEAL (HYDRURGA LEPTONYX).

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Long-term recordings from the PerenniAL Acoustic Observatory in the Antarctic Ocean (PALAOA) [1] located at the eastern Weddell Sea coast (70°31'S - 8°13'W) were used to investigate the acoustic repertoire and the behaviour of the leopard seal (*Hydrurga leptonyx*). This circumpolar distributed pack ice seal is difficult to observe due to its solitary occurrence and the limited accessibility of the Antarctic pack ice. With leopard seals being rather vocal underwater, at least during breeding season in polar summer, passive acoustic observations represent an effective research tool for enhancing the knowledge of this species. We analyzed the call repertoire, the acoustic characteristics of the most prominent call types and

the acoustic behaviour of leopard seals in the vicinity of PALAOA. Their seasonal and diurnal calling patterns were compiled over a long period using automated detection algorithms [2]. In addition, recordings from Drescher Inlet (72°52'S – 19°26'W) and Davis Sea (65°S - 90°E) were compared for geographical variation within the leopard seal vocalizations. First results show a high degree of similarity between the calls from PALAOA and Davis Sea, which are separated by a linear distance of 3600 km. In contrast to that observation the vocalizations from PALAOA differ significantly from those of the Drescher Inlet, being located only 500km away from PALAOA.

[1] Boebel, O., Kindermann, L., Klinck, H., Bornemann, H., Plötz, J., Steinhage, D., Riedel, S. and Burkhardt, E. (2006): Real-Time Underwater Sounds from the Southern Ocean. EOS, 87(36), pp. 361 and 366.

[2] Klinck, H., Kindermann, L. and Boebel, O. (2008): Detection of leopard seal (*Hydrurga leptonyx*) vocalizations using the Envelope-Spectrogram technique (tEST) in combination with a Hidden Markov Model. In: Canadian Acoustics, ISSN: 0711-6659 - in review.

A10 HOW MANY SPERM WHALES HAVE BEEN DETECTED BY NEMO?

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The INFN NEMO-ONDE (Ocean Noise Detection Experiment) station, deployed on the seafloor at 2000 m depth 25 km offshore Catania (Sicily, Italy) in year 2005, transmitted acoustic data from January to December 2005 and from July to November 2006. From April 2005 onward, 5 minutes of recording (4 hydrophones, 45 kHz bandwidth, 96 kHz sampling rate at 24 bits resolution, self-noise close to sea-state 0) were taken every hour. The recordings revealed a more frequent and consistent presence of sperm whales than was previously believed. Little literature and sighting information has previously been available for this area. However, with ONDE in year 2005 sperm whales were detected in 117 of the 231 recorded days and in 31 of the 83 days in year 2006. Clicks were the most common sperm whale vocalizations recorded. Chirrups and codas (dominated by the 3+1 pattern) were present frequently, but creaks, possibly indicating feeding actions,

were seldom heard. The whales were often detected for segments of only a few hours either as solitary individuals or in groups, which combined with the low rate of creaks, may mean they were just in transit. New algorithms have been developed to measure the Inter Pulse Interval. By combining all this information, we obtain a complete description of the clusters of transiting animals. This study shows that a fixed deep station is an optimal tool for long term monitoring of sperm whale populations, especially to validate the presence and assess the abundance and trends in areas where there are conservation concerns. Based on the success of ONDE, a new project (LIDO - Listening Into the Deep Ocean) has been funded by EEC; the new project is in partnership with INGV (National Institute of Geophysics and Vulcanology) to expand the network of underwater platforms with broadband acoustic sensors. The recordings revealed a more frequent and consistent presence of sperm whales than was previously believed. Only few sights are available for the previous years and little literature is available for the area. On the contrary, with ONDE, in year 2005 sperm whales were detected in 117 of the 231 recorded days and in 31 of the 83 days in year 2006. Clicks were the most common sperm whale vocalizations recorded. Chirrup and codas (dominated by the 3+1 pattern) were present frequently, but creaks, possibly indicating feeding actions, were seldom heard. The whales were often detected, solitary or in groups, for segments of only a few hours. This, with the low rate of creaks, may mean they were just in transit. New algorithms have been developed to measure the Inter Pulse Interval and to track movement of the whales whilst in the detection range. By combining all this information, we obtain a complete description of the clusters of transiting animals. This study shows that a fixed deep station is an optimal tool for long term monitoring of sperm whale populations, especially to validate the presence and assess the abundance and trends in areas where there are conservation concerns. Based on the success of ONDE, a new project (LIDO - Listening Into the Deep Ocean) has been submitted to ESONET, with INGV (National Institute of Geophysics and Vulcanology) to expand the network of underwater platforms with broadband acoustic sensors.

A11 SEARCHING FOR A LOST HUMPBACK WHALE

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Cetacean population surveys hold importance in population assessment of different species in marine ecology. In this context, acoustics techniques are appearing as prospective candidate because these are efficient, automatic, non-invasive and convenient for observation of vocally active species.

However, these contemporary techniques provide biased estimates in the sense that they fail to distinguish already counted re-appearing cetaceans, even if re-appearance occurs after a brief interval. Motivated by Signature Whistle Hypothesis (SWH) in some cetaceans, we propose development of an automatic recognition system for individual humpback whale (*Megaptera novaeangliae*) identification. The suggested system relies on development of individuals' database based on characteristics of their vocalizations. Such a methodology, when coupled with acoustics based tracking, localization and cetacean behaviour analysis, promises complete social picture of marine eco-system. In an earlier study, we analysed recognition performance of cepstrum based voice signature in individual humpback whales. The results were based on training and test data sampled from the same song. In this work, we test our hypothesis using data from different songs. i.e. training and test data sets are recorded in different timings. It gives some insights into the effects of temporal song evolution on accuracy of our system. We use cepstral coefficients and Support Vector Machine (SVM) for classification and signal band-crossing rate for segmenting song units. The results indicate classification accuracy of almost 100% for test set data recorded next day of training data. However, an old data of 1995 posed a challenging recognition problem with a maximum accuracy of 58%. This work discusses results, different aspects of datasets and our procedure. Figure.1 shows the system architecture.

A12 PULSED CALLS FROM LONG-FINNED PILOT WHALES (*GLOBICEPHALA MELAS*) OFF CAPE BRETON, NOVA SCOTIA

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Long-finned pilot whales use three call types: clicks, pulsed calls and tonal whistles. The clicks and whistles of *G. melas* have been described in the literature. However, pilot whale pulsed calls have received little study and their structure and function remain unclear. The goal of this study was to develop baseline information on the structural characteristics of this sound class. Pulsed calls are rapidly-produced sound pulses with distinct tonal properties caused by high pulse-repetition rates. Pilot whale vocalizations recorded off Cape Breton, Canada in 1998-2000 and 2005 were digitized at 44.1kHz, with a 16-bit sample size. In total, 129 high quality pulsed calls were extracted from the spectrograms (Hamming window 1024 bit, time resolution 3ms, frequency resolution 45Hz). We described the calls using between 6 to 30 measures, given the structure of each call. Pilot whale pulsed calls are between 0.086 and 1.72 seconds long and consist of several components varying in both time and frequency. All have a lower

frequency component (LFC) with the primary energy from 0.55 to 10.2kHz. The LFC may be divided into several temporal elements separated by a rapid shift in the pulse repetition rate (PRR). The PRR is reflected by the sideband interval, found to range from 45.1 to 5201Hz. Most measured pulsed calls appear to be simple with only one element (78.3%), whereas 21.7% have 2 elements or more (max = 4). Many (20.2%) also contain an upper frequency component (UFC). The fundamental frequency of the UFC ranges from 1.3 to 12kHz with multiple harmonics that can reach above 22kHz. This description of pilot whale pulsed calls is a fundamental step permitting further investigation of their role in information transmission. Future work will concentrate on identifying call types and exploring the relationship between call similarity and behaviour, social structure and vocal culture.

A13 MODELS FOR PREDICTING NITROGEN TENSIONS IN DIVING ODONTOCETES

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The modelling of nitrogen tensions in the tissues of diving marine mammals has been used to assess the probability of bubble growth by static diffusion in those tissues, and therefore the risk of the development of gas embolic diseases such as decompression sickness (DCS). These models are therefore of particular relevance to the cases in which whales, particularly beaked whales, are known to have developed symptoms consistent with DCS coincident with their exposure to mid-frequency active sonar. Several mathematical models of gas flux within marine mammals have been developed and used to predict nitrogen tensions within diving odontocetes. We present a model that shares the same basic structure as those previously proposed and discuss some of the general trends it predicts. This model has been developed as part of a larger programme to assess the probability of DCS occurring in diving odontocetes. This may in turn be used to further elucidate the link between the use of mid-frequency active sonar and the mass beaching of beaked whales. Given that beaked whales have been most severely affected by such events and are already thought to be endangered, this work is key to the development of effective mitigation measures against this phenomenon, which in turn could ensure the survival of these species into the future.

A14 AN ADAPTING NEURAL NETWORK FOR SPERM WHALE SEPARATION

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Female sperm whales tend to live in social groups together with their calves. During foraging they continuously produce a 'click' signal used for sonar. In recordings of these dives, generally made with only one or two hydrophones, it can be difficult to trace which click belonged to which animal. One approach that has been followed is the use of a trained radial basis function (RBF) network, using Gaussian kernels in its hidden layer. This allowed acoustic separation of a number of whales for a period of time. A problem is that the characteristics taken from the whales' clicks do not remain constant and often show trends. These changes are usually gradual and are assumed to be caused by the directional properties of a click. The authors demonstrate an adaptation to the RBF network that allows the network to follow the gradual changes in the features. The adaptation is first concentrated on adjusting the kernel centres of the hidden network layer. Then an assessment is made to see if the network is still capable of separating the animals adequately, or if the output layer weights need to be recalculated. The use of the adapting network allows to improve the correct classification compared to a static network, typically reaching percentages of correctly identified clicks of over 90%.

A15 PALAOA: ROSS SEAL PRESENCE AND CALLING PATTERNS

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The autonomous perennial acoustic observatory in the Antarctic Ocean (PALAOA) constitutes a powerful tool to monitor the acoustic presence of marine mammals at a pristine location in the Southern Ocean. For a limited period of time, these recordings are dominated by vocalizations of the Ross seal (*Ommatophoca rossii*) – a species considered to be the rarest and the least known of all Antarctic seals. PALAOA's acoustic data provides new information on the presence of Ross seals at the location of Atka Bay. Ross seal calls are shown to comprise of four distinct call types, which are explicitly described for the first time. Their seasonal as well as their diurnal

calling patterns are presented and placed into a behavioural context. The number of vocalizing seals is estimated by using time-delays between the two recorded channels of the hydrophone array. The results provide information required for the development of automated pattern recognition for acoustic censusing, particularly when faced with analysing the PALAOA multi-year recordings.

A16 COMPARATIVE QUANTITATIVE STUDY ON WHISTLE FROM STRIPED (STENELLA COERULEOALBA) AND COMMON (DELPHINUS DELPHIS) DOLPHINS FOR DISTINGUISHING THE SPECIES AT SEA

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Whistles of several groups of striped and common dolphins visually classified, were recorded from a sailing ship in 2004-05 around north-western coast of Ischia island, corresponding to the area of submarine canyon of Cuma. The whistles were recorded while dolphins were engaged in various behavioural activities. The recording equipment and hydrophones had a flat frequency response up to 20 kHz. All recording of each species were analysed with Adobe Audition 2.0, set between 0-25 kHz. Sonograms were inspected visually while simultaneously listening original recording. For each whistle with a suitable signal-to-noise level, ten variables were measured: five parameters regarding the frequency and duration of the signal and five the slope of the sonogram contour. Statistical analysis were made with SPSS 15.0 software package. The program calculated the difference between each pair of variables of the two species. Differences of some parameters between the two species were evident, though not statistically significant for the large standard deviation. The beginning frequency of striped dolphin was in average 22% lower and the ending frequency 14% higher than that of common dolphin. The total whistle length of striped dolphin was 26% longer than that common dolphin. The presence of harmonics in the whistle of striped dolphin was nine times more frequent than in those of common dolphin. Moreover at least a combination of the set variables used to compare the time/frequency content of striped and common dolphins whistles provided differences between two species statistically significant ($P < 0.04$) and with more emphasis than the single variables. In summary the differences between striped and common dolphins whistle seem evident, though statistical method for distinguishing significantly the two species at sea needs further research.

A17 WILL STATIC ACOUSTIC MONITORING WORK ON WHITE WHALES?

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White whales, *Delphinapterus leucas*, often spend prolonged periods underwater and can move distances of kilometers undetected from the surface. We tested the possibility of monitoring this species acoustically using the T-POD click-train-detection-system. A T-POD was deployed for 2 weeks in water 4-6m deep at the end of a disused steel pier in Ny-Ålesund, Kongsfjord, Svalbard, at 78°N, where white whales are often seen in spring/summer. Ambient noise levels in the water at frequencies above 10kHz were low. Visual watches were made for 44 hrs from an elevated platform approx 50 m from the shore and 300m from the pier. Digital recordings, sampling at 2MHz, were made of successive clicks in trains from white whales encountered in a neighboring fjord (Krossfjorden). White whales were seen on two occasions in Ny-Ålesund, but there were no simultaneous acoustic detections. One brief but clear acoustic detection, consisting of 2,300 clicks in trains, was made on May 11th at 3.08am, when the sun was still up, but no watch was in progress. These trains had a modal rate of 140clicks/s. This is higher than modal rates seen in a wide range of T-POD data from porpoises and dolphins, and such rates may indicate feeding. The spectra of many of the recorded clicks had a strongly bimodal frequency spectrum with peaks between 32-42kHz and 90-160kHz. Subsequent tests on captive white whales in L'Oceanografic, Valencia, have shown that the T-POD can be set to detect either spectral mode. These results suggest that white whales in this location might echo-locate mainly when feeding, and remain silent at other times, perhaps as an adaptation to the occasional presence of orcas, so that only feeding behaviour would be detectable for monitoring. We cannot yet exclude the possibility that lower frequency or broader-band clicks were made.

A18 TRIAL OF ACOUSTICS DETERRENTS (PINGERS) FOR PREVENTION OF BOTTLENOSE DOLPHIN DEPREDATION ON GILLNETS

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A trial of acoustics deterrents and a study of the interactions between bottlenose dolphin (*Tursiops truncatus*) and fishing activities were carried out during the Summer 2007 along the north-eastern coast of Sardinia. Bottlenose dolphin depredation on nets is well known in the Mediterranean Sea, this depredation causes an economic loss for the local fishermen and dolphins by-catch. The deployment trial was carried out on commercial fishing trips from Golfo Aranci (Sardinia) over the course of the summer. During the 73.5% of the days of boat-based observations bottlenose dolphins were present feeding around gillnets. In more of 90% of fishers interviews was annotated both directly and indirectly the presence of the dolphins through damages to nets and fishes. During the trial period, the gillnet armed with Pingers showed a lower number of damages caused by bottlenose dolphin depredation ($\chi^2_1 = 4.81$, $p > 0.05$). Our results show that the use of Pingers has an effective mitigation in the negative interaction between dolphins and fishing, but due to the short duration of the trial does not exist definitive proves that acoustic devices have a long term effectiveness. The factors of Dinner Bell and Habituation must be considered.

A19 CLICK COMMUNICATION IN HARBOUR PORPOISES, PHOCOENA PHOCOENA

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Acoustic communication is playing an important role for toothed whales in foraging and communication. However, little is known about acoustic communication in toothed whales that only produce clicks such as the harbour porpoise, *Phocoena phocoena*. To study the acoustic behaviour and to quantify the source parameters of communication clicks we recorded the acoustic and swimming behaviour of a porpoise mom-calf pair at the Fjord and Baelte Centre, Denmark. The sounds were recorded in a nursing/experimental pool (8*13m) using an array of four calibrated Reson

4014 hydrophones placed 1 meter apart and 1 meter below water surface. The behaviour was recorded on a video camera along with the output from a porpoise click detector (100 kHz to 160 kHz envelope detector) to link acoustic and live motion data. To test whether mother and calf porpoises communicate through acoustic signalling we analysed the clicks produced by the mother and the calf during defined social interactions consisting of aggressive display, grooming, protection of the calf and bottom grubbing. We analysed the source parameters of the clicks to estimate at which distances a mother and her calf can detect each other and the level of acoustic information conveyed in the signals. High repetition rate buzzes could be linked to aggressive behaviour and grooming. We thus found that a porpoise mother and calf do produce different click patterns during specific behaviours and that the communication sounds are made up of normal echolocation clicks produced in specific patterns with estimated source levels of 150-170 dB re 1 μ Pa (pp). We conclude that the porpoise mother-calf pair communicated acoustically using specific patterns of clicks with source properties comparable to normal echolocation clicks.

A20 MODEL PREDICTION OF A SIZE OF MONITORING-SAFETY ZONES FOR ENDANGERED WESTERN GRAY WHALES FEEDING AREA DURING FORTHCOMING 2008-2009 SEISMIC SURVEYS OFF SAKHALIN ISLAND

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In 2008-2009 oil companies plan Seismic Surveys in areas Astokh and Lebedinskoe off Sakhalin Island, located closely to shore feeding areas of endangered western gray whales (WGW). According to present day mitigation and monitoring practices for seismic surveys in other jurisdictions, two Monitoring- Safety Zones should be established to protect whales from physical injuries or an undue harm during their feeding. To reduce risks to receive acoustic injuries or impair hearing abilities of endangered WGW during the Seismic Surveys, "Injury Safety Radii" of about 1.5 km were evaluated taking into account sound levels of air guns and sound transition losses in the area. A radius around air gun arrays is defined as a size within which received pulse levels are ≥ 180 dB re 1 μ Pa rms. To avoid disturbance and displacement of WGW from feeding areas, a radius for "Disturbance Safety Zone" of 4 -5 km was calculated, within which the received pulse levels are ≥ 160 dB rms. The current report presents a new methodology to

forecast "Safety Zones» and gives an estimate for the model precision in the case of absence of a detailed description of acoustic parameters for bottom sediments. Unlike a standard technique, we are starting with a fine resolution geological profile of the seafloor obtained in previous geological studies and defined a detailed, multi-layer template of the sediment properties. The conversion from geological to acoustic parameters was made in accordance with a recent theory (Buckingham, 2005). It has been shown that across the WGW feeding area an expected modeling precision would not exceed 6 - 10 dB in the case of absence of a detailed description of the upper (up to 5-10 m) sediment layer parameters. This may lead to uncertainty of up to 2 km in forecasting the radius of the "Disturbance Safety Zone".

A21 FEASIBILITY OF STATIC ACOUSTIC MONITORING FOR DEEP DIVING WHALES

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The shelf slopes and deep water canyon systems lying off the west coast of Europe are thought to be preferred habitat for a number of deep diving cetacean species such as beaked whales and pilot whales. These habitats are, however, some of the most difficult to monitor in any meaningful way due to their distance from shore. 'Deep POD' is a modified version of the T-POD that is rated to 3500m water depth and records low frequency click trains emitted by species such as beaked whales and pilot whales. During the 2007 Canyons Survey a Deep POD was deployed from the RV Pelagia at 800m in 1,600m water depth within a branch of the Whittard Canyon System, some 200 miles southwest of Ireland. The POD was programmed to log tonal sounds in bands >26kHz, >31kHz, and <60kHz during successive 10second periods in each minute. 3 - 7 hours each day had multiple detections of click trains in very distinct encounters lasting up to 3 hours. The average inter-click interval in 1700 trains was 390microseconds, with a mean click rate of 13/s, but in one 12 hour period click rates averaged 5/s in 62 trains with a mean click duration of 580microseconds. Trains were logged at all the frequencies targeted. The inter-click interval and durations are much longer than those logged by this instrument from bottlenose dolphins (<100us). Long finned pilot whales and/or beaked whales appear to be the most likely source. This project has demonstrated that deep water

static acoustic monitoring is feasible and that an instrument providing more detailed acoustic information could be a robust and effective monitoring device for deep diving species in offshore habitats. Further deployments of static acoustic monitors, targeting beaked whales in deep water canyon systems are planned in 2008.

A22 SPERM WHALE CODAS RECORDED BY THE NEMO-ONDE PLATFORM. CHANGES IN THE MEDITERRANEAN CODAS TYPE?

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The INFN NEMO-ONDE (Ocean Noise Detection Experiment) station, deployed on the seafloor 25 km offshore Catania (Sicily, Italy) in year 2005, transmitted acoustic data from January to December 2005 and from July to November 2006. From April 2005, 4 hydrophones (45 kHz bandwidth, 96 kHz sampling, self-noise close to sea-state 0) made 5-minute recordings every hour. The recordings revealed a more frequent and consistent presence of sperm whales than was previously believed. Sperm whales were detected in 117 of the 231 recorded days in year 2005 and in 31 of the 83 days in year 2006. Codas were detected in 45 days during 2005 (38% of the days with sperm whales) and 24 days in 2006 (68%). Alternatively, of the five-minute recordings with detected sperm whales, codas were present in 9.95% of the files in 2005 and in 21% of the files in 2006. Several types of coda patterns were identified. Similar to previous investigations in the Mediterranean, the most common coda pattern was the 3+1. Within the coda-containing files, the 3+1 pattern was present in 82% of them in 2005 and 62% in 2006; the second most common pattern was the 2+1, with 24% and 50% presence; the third pattern, the 4+1, changed from 13% to 2.8%. Other patterns (2, 3, 5, 4, 5+1, and 7+1) were grouped into one category that varied in presence from 9% to 0.93%. A monthly distribution of these "other patterns" revealed peaks in July-August (2005) and July-October (2006); July showed the highest percentage of codas and the greatest variation of patterns in both years. Codas were present mainly when multiple whales were detected (78% of the files with codas in 2005 and 82 % in 2006), which is consistent with the current view that these sounds have a social function. In cases where only one animal emitting codas was recorded, it is plausible

that there were others outside the detection range of the hydrophones. We believe that this data could extend the vocal repertoire of Mediterranean sperm whale codas.



BEHAVIOUR

B01 SOCIAL ORGANIZATION OF HUMPBACK WHALES (MEGAPTERA NOVAEANGLIAE) FROM THE STRAIT OF MAGALLANES

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Sociality and cooperative social behaviour are thought to have evolved through kin selection or some form of altruism in response to ecological and social pressures that are critical for survival and reproduction. Among cetaceans, toothed whales have been described as highly social species, whereas baleen whales are generally believed to be largely solitary, beyond the short-term associations found between mothers and their calves. The humpback whale (*Megaptera novaeangliae*), a member of the latter group, appears to deviate from this general asocial pattern as there have been a number of reports describing the existence of some advanced social behaviours in this species. One of the aspects that need to be addressed is the nature and temporal stability of social groups, providing a window into their social structure and the possible proximate and ultimate factors that may have shaped them. The present work focuses on the analysis of the grouping patterns observed in a population of humpbacks located in the Magallanes Strait, Chilean southern Patagonia, which was studied on their feeding grounds over a period of five years (2003-2007). We used SOCPROG 2.3 (Whitehead 2007) to analyse this population's patterns of social organization and its stability over time. We found that groups tended to be small, typically consisting of dyadic units, probably mother-calf pairs. Some such groups appeared to coalesce and form larger aggregations but

then these tended to be unstable over time. These findings are consistent with observations from other populations of humpback whales in which the model of fusion-fission has been proposed to account for the characteristics reported. The question as to the mechanisms (kin-based cooperation versus altruism) that may be driving these associations beyond the dyad remains to be tackled. Current analysis of genetic relatedness between group members of the study population will probably shed light on this issue.

B02 ABNORMAL MATING BEHAVIOR OF STELLER SEA LION BULLS

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Steller sea lions display high dimorphism between sexes, as do all otariids. Steller sea lion males range from 300 to 350 cm in length, and 500 to 1000 kg in mass. Females are much smaller – maximum body length is 260 cm and the average weight is 350 kg. This difference in body size is closely related to social structure and life strategy, but it also has potential negative side effects. It is regularly observed that males kill females during mating, crushing them under their own weight. We observed 20 cases of death resulting abnormal copulation on Dolgaya Rock (Kuril Islands, Russia) during five breeding seasons (2003-2007). These events usually recur with the same bulls. The average male-killer causing death of 3 females during its stay on the rookery (min=1, max=5). Successful mating is also recorded for these males, but proportion of fatal copulations was about 29%. Copulation duration leading to death is longer (29.5 min), compare with duration of successful copulation which is similar to norm (20.8 min). Fatal copulations may be due to a combination of the greater body size of the bulls and the complicated topography of the rookery which reduces the mobility of females. All bulls-killers resided territories in difficult terrain surrounded by large boulders or lava flows and most of the dead females were trapped between the boulders during copulation. Furthermore, we observe one case when fatal copulation occurred in the same section of the rookery when a new male replaced the original male-killer. Apparently, number of fatal copulations decreases with experience of male, as the number of kills drops for a given male from year to year.

B03 OBSERVATIONS OF SHORT-FINNED PILOT WHALES AND ATLANTIC SPOTTED DOLPHINS TOWARDS DEAD CALVES: DISTINCT INTERSPECIFIC SOCIAL BEHAVIOUR?

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Epimeletic behaviour towards dead calves is well documented for several species of odontocetes, both in captivity and in the wild, and has also been described in some mysticetes. Nonetheless, apart from the present study, reports of epimeletic (nurturant) behaviour for wild short-finned pilot whales (*Globicephala macrorhynchus*) and Atlantic spotted dolphins (*Stenella frontalis*) are rare. Three observations of epimeletic behaviour on short-finned pilot whales, one in August 2003 in Azores and two in September 2007 in Madeira (archipelagos located in SE North Atlantic), showed that on each occasion it was always the same adult individual carrying the dead calf (either using the melon or mouth). In the three cases they were accompanied by other members of the group and the calves were in advanced state of decomposition, indicating that the carcasses were carried at least for some days. In contrast, the observations of four neonate fresh carcasses of Atlantic spotted dolphins abandoned by their groups in Madeiran waters between 2005-2007, suggests individuals of this species support dead calves only for a short-period of time (minutes to hours). Additionally, only a few individuals of the group are involved in this behaviour, as observed in two of these occasions. Based on the comparison of the reported observations we suggest distinct interspecific behaviour towards dead calves, both at a social level (number of animals in the group involved) as well as at an individual level (time and energy invested in supporting the dead calf).

B04 HIGH LEVELS OF INTERSPECIFIC INTERACTIONS IN THE STRAIT OF GIBRALTAR

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Several types of interspecific interactions involving cetaceans are described in the literature. Up to 7 species of cetaceans are present in the Strait of Gibraltar, of which 4 are present throughout the year and 3 are present only during some periods of the year. Our research took place from an opportunistic platform of whale watching in the Strait of Gibraltar from May to September 2003 through 2007. A total of 1968 sightings were recorded, of which 347 included some type of interspecific interaction. The most frequently observed interactions involved long-finned pilot whales (*Globicephala melas*) and bottlenose dolphins (*Tursiops truncatus*) (56.48%), and between short-beaked common dolphins (*Delphinus delphis*) and striped dolphins (*Stenella coeruleoalba*) (34%). In rarer occasions, we observed interactions with up to 3 species, e.g. 2 sightings involving common dolphins, striped dolphins and pilot whales. Two other sightings involved pilot whales, bottlenose dolphins and sperm whales (*Physeter macrocephalus*), and one sighting involved killer whales, one fin whale (*Balaenoptera physalus*) and pilot whales. Most observed interactions consisted of non-aggressive behaviours, like travelling, resting or milling. However, some aggressive interactions between pilot whales and bottlenose dolphins and /or pilot whales and killer whales were observed. We also observed clear interspecific mating attempts between pilot whales and bottlenose dolphins. This high level of interspecific interactions may be explained by the relatively high density of cetacean species in the area, the reduced space, and the high amount of food available. Many interactions may represent fortuitous associations, but in some cases intentional associations seem more probable explanations, e.g. bottlenose dolphins/pilot whales, and even intentional dissociations, e.g. the pilot whales/killer whales chase. No clear signs of competition have been observed but it cannot be completely ruled out.

B05 BEHAVIOURAL SYNDROMES OR WHEN DOLPHINS SHOW SOME INDIVIDUAL DIFFERENCES IN THEIR BEHAVIOURS: PRELIMINARY STUDY.

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In this study, we evaluated the individual differences in behaviours of bottlenose dolphins living in Panama City, Florida (30°08'N, 85°44' W). The dolphin population in Panama City, has been fed by human during several years. Despite of his prohibition by the Marine Mammal Protection Act, this practice is still observed in Panama City. Moreover, it is not rare to see some dolphins begging. Recent studies conducted by ethologist have documented 'animal personalities' in a broad range of organisms, including arthropods, birds and mammals. Therefore, to evaluate if dolphins have also some individual differences in their behaviours, we analysed the behavioural patterns of ten dolphins easily recognizable in the population. Among those; we are able to identify 4 males, 3 females but 3 individuals remained of unknown sex. Seven behavioural categories were observed: playing, social, sexual, spy hopping, begging, foraging and travelling. Our results show some differences in the behaviour frequencies between individuals, especially in the frequency of spy hopping and begging. Indeed, some dolphins seem to be 'regular beggars' while others dolphins never showed begging activities. We have also recorded the behavioural reactions of dolphins facing the presence of boats. Dolphins reactions were categorized as (i) get near the boat(s), (ii) have a neutral reaction or (iii) avoid the boat(s). Here again, analysis established that dolphins do not show the same behaviours: some of them avoid more often than others the presence of boats. Recent studies conducted by ethologist have documented 'animal personalities' in a broad range of organisms, including arthropods, birds and mammals. Therefore, to evaluate if dolphins have also some individual differences in their behaviours, we analysed the behavioural patterns of ten dolphins easily recognizable in the population, including 4 males, 3 females and 3 individuals of unknown sex. Seven behavioural states were noted: playing, social, sexual, spy hopping, begging, foraging and travelling. Our results show some differences in the frequency behaviours between individuals, especially in the frequency of spy hopping and begging activities. Indeed, some dolphins seem to be 'regular beggars' while others dolphins never showed begging activities. We have also recorded the behavioural reactions of dolphins facing the presence of boats. These reactions were categorized as (i) dolphins approach the boat(s), (ii) have a neutral reaction or (iii) avoid the boat(s). In this part, we can also establish that dolphins do not show the same reactions toward the presence of the boats. Some of them avoid boats more often than others.

B06 LOCAL FISHERIES INTERACTIONS WITH BOTTLENOSE DOLPHINS IN THE BALEARIC ISLANDS: A CASE OF DOLPHIN “CULTURAL” DIFFERENCES?

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Interactions between marine mammals and fisheries represent a serious and growing conservation issue. Around the Balearic Islands bottlenose dolphins regularly interact with coastal artisanal fisheries. In response, the DGP initiated in 2000 a series of multidisciplinary projects to study the problem and to design possible mitigation measures. We estimate that this interaction results in an economic cost of 6.5% of the total landed catch value (95% CI 1.6%-12.3%). The interaction also results in dolphin mortality (60 dolphins/year). However, there are clear differences in the extent of the interaction between areas. Furthermore in different areas, different fishing gears are affected despite all gears being used in all areas. For example, in 2002 the fishermen of Ciutadella (W of Minorca) first reported damage to bottom-set longlines caused by bottlenose dolphins. This problem is not reported in other sites around the Balearic Islands. Nowadays, this interaction is reported only in Ciutadella and the close harbours. We defined two study zones for photoidentification work (NE and SW of Majorca). Obtained data demonstrate that individuals have a strong geographical fidelity. There are no recaptures between areas, but there are differences in a same area between the population sizes in summer/winter, related to a seasonal pattern of distributional changes with respect to the coast. In addition the analysis of individual association patterns and temporal presence/absence indicates the existence of two groups: resident and transients. Only the resident interacts with the bottom gill and bottom trammel nets. This geographically varying pattern of interaction by different animals suggest this may be a case of “cultural” differences. The existence of “cultural” groups has important repercussions and must be valued to correctly manage the fishery interaction by different groups.

**B07 STUDY OF INTERACTION BETWEEN ARTISANAL FISHERY
AND TURSIOPS TRUNCATUS**

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Some feeding strategies (foraging behaviors) of *Tursiops truncatus* appear to be associated to various human activities. Often, the interaction of bottlenose dolphin with artisanal fisheries was a serious problem because of the depredation of the nets and the economic damages for fishermen. In this work we studied the interaction between bottlenose dolphin and artisanal fishery in Favignana Island, Archipelago of EGADI. The study was carried out between March and June 2006, with a local fishing boat using a 900 m long monofilament bottom set net. For each catch, fished (species, weigh), damages (number, position and dimensions of holes/tears), and dolphin presences were collected. Dolphin behavior, group composition, Photo-ID of exemplars and GPS tracks of dolphin movements were monitored simultaneously with inflatable boat surveys. A total of 29 catches were carried out with a mean fishing time of 2.5 hours. Bottlenose dolphins were encountered on 38% of cases and the data show that their movements were strictly linked to the positions of the nets (GPS tracks) and their feeding behavior confirms the active interaction with fishing gear. During the experiment, photo-ID allowed to recognize, in some cases, the same specimens in the fishing area. No by-catch events were signed. When dolphins are in the fishing area, there is an increase in damages of the net ($p < 0.01$, U-test Mann-Whitney) and in fished abundance ($p < 0.05$, U-test Mann-Whitney). The results of our study confirm that bottlenose dolphins modify their feeding strategies interacting with fishing activities, sacking and damaging the net in order to capture preys easily. Moreover is possible to assume that dolphins get near the fishing area when fish abundance increases.

**B08 THE DIURNAL BEHAVIOUR OF BOTTLENOSE DOLPHINS IN
CARDIGAN BAY, WEST WALES**

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The behaviour of common bottlenose dolphins (*Tursiops truncatus*) in Cardigan Bay, West Wales, was investigated to assess the daily behavioural budget and identify differences due to years, group size and seasonality. The kernel ranges were also estimated using the Animal Movement extension in ArcView 3.3, so as to identify the 50% (core areas) and 95% (home ranges) Utilization Distribution (UD), within Cardigan Bay, and then compared between behaviors. Boat-based visual surveys were conducted from 2001-2007, resulting in 1,210 sightings of bottlenose dolphins exhibiting particular behavioural states. Focal animal follows were conducted during line-transect and ad-libitum surveys. The following behaviors were considered: travelling, feeding, socializing, resting, and others- such as bow-riding or leaping. Groups were defined as an aggregation of dolphins within 100 metres, with the majority of the individuals engaged in similar activities. During the study period, traveling and feeding comprised over 90% of the dolphins' diurnal budget, followed by 'others,' resting and socializing. Groups consisting of 2-4 individuals spent more time feeding while groups greater than 11 individuals spent more time traveling and socializing, and the animals spent more time feeding at the end of the study season compared to the beginning of the season. Home ranges varied per year, and the dolphins used the space within their home range non-uniformly, with core areas varying with behaviour types. These findings provide important information concerning the spatial use of Cardigan Bay by this population of bottlenose dolphins.

**B09 LONG-TERM CONNECTION BETWEEN STELLER SEA LION
OFFSPRING AND MOTHER.**

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Observations on Dolgaya Rock in the Kuril Islands in Russia indicate that the number of reproductive females and pups has increased from 576 in 2003 to 693 in 2006. At the same time the number of juveniles on the rookery during the reproductive period is about 50 animals. During the reproductive period itself, the number of juveniles on a rookery does not fluctuate significantly. Only 5 % from known females (n =238) continue feed their offspring more than 1 year, and less than 1% of females also contributed milk to new born pups. Most of known yearlings (73%, n = 26) presented on the rookery retained a connection with mother. Number of two year old juveniles retained a long-term connection with the mother is only 8%, n known two years old = 26. Steller sea lions are one of the few pinnipeds that retain a close attachment to their offspring for more than one year. There may be a several reasons for this behavior. One is the general state of the population. If conditions are difficult for juveniles, one might expect greater maternal investment, and consequently longer term relations between mother and their young. We consider it significant that in a rookery with a stable or increased population, the proportion of yearlings that maintains a close connection with their mothers is low. Comparison our indices observed with the same on Medny Island, where population does not increase significantly and proportion of offspring related with mothers is higher. These allow us to conclude that the reproductive grouping of sea lions on the Dolgaya Rock rookery is in a favorable condition.

B11 VERTICAL AND SPATIAL MOVEMENTS OF SPERM WHALE (PHYSETER MACROCEPHALUS) IN MADEIRA AND AZORES ARCHIPELAGOS

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During Summer 2005 detailed dive data were obtained from suction-cup-attached time-depth recorder/VHF radio tags deployed on 2 sperm whales in the Madeira and 4 in the Azores Archipelagos. Pooling the data from the two archipelagos together, the tags provided a total track time of 20:43h, of which 6:35h (31%) were spent at surface, 3:33h (17%) on shallow dives (<200m), and 10:44h (52%) on deep dives (>200m). The average of each deployment was 3:27h (\pm 2:31h, n=6), and from a total of 18 deep dives, 15 were considered foraging dives. When analyzing the data by archipelago, the percentage of time spent foraging was clearly different between Madeira (33%) and Azores (83%). The average maximum depth was deeper in

Madeira ($957 \pm 124\text{m}$, $n=4$) than in Azores ($772 \pm 69\text{m}$, $n=9$). Generally, other dive parameters were found to be similar between Madeira and Azores, such as the duration ($44 \pm 9\text{min}$) and the bottom time ($22 \pm 9\text{min}$). Our results showed foraging activity both during day and dusk/night, consistent with information from other studies. Data suggest short-term spatial movements within a small geographic area on both zig-zagging and straight line, and always on a range of depths of 1200 to 2000m.

B12 SOCIAL STRUCTURE OF RISSO'S DOLPHIN (GRAMPUS GRISEUS) AT THE AZORES: A STRATIFIED COMMUNITY BASED ON HIGHLY ASSOCIATED SOCIAL UNITS.

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In this study, we present for the first time a model for the social structure of Risso's dolphin (*Grampus griseus* Cuvier 1812). Over the period 2004-2006, 1028 Risso's dolphins were identified at Pico Island, Azores. Individuals sighted on 10 or more occasions were included in analysis of social structure ($n = 183$). High resighting rates indicate strong site-fidelity of at least part of the population. We found that individuals form stable long-term bonds, organised in pairs, or in clusters of 3-12 individuals. Social structure is stratified based on age- and sex-classes, with strong associations between adult males and strong associations between adult females. We suggest that clusters form the basic units of Risso's dolphin society. 13 pods consisting solely of adults, likely males, and 3 pods consisting of mother-calf pairs were identified. Males are organised in stable, long-term associations of varying size, occurring throughout the complete range of behavioural states observed. For females, associations can be of similar strength, but the time-scale may vary depending on the presence of nursing calves. As sub-adults, associations also occur (pair-formation), albeit on lower stability than is observed for adults. We propose a new model for Risso's dolphin societies: a stratified social organisation, differing both from fission-fusion as well as matrilineal societies.

**B13 ASSOCIATION PATTERNS BETWEEN SOCIAL UNITS OF
RESIDENT KILLER WHALES (ORCINUS ORCA) IN AVACHA
GULF (KAMCHATKA, RUSSIA, NORTHWEST PACIFIC)**

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Previous studies show that associations between killer whale matriline within pods are not stable and vary from year to year. The influence of the composition of killer whale matriline on associations between matriline has been mentioned previously but not analyzed statistically. This study looked at (1) associations between stable units of killer whales at different spatial and temporal scales and (2) the influence of a unit's composition on associations between units. The data were collected from 2004-2006 when at least 44 units in 989 groups were recorded. A group was defined as killer whales within three body lengths of each other. Additional data from 1999-2003 were used to establish association patterns between units at the level of an aggregation. An aggregation ($n=149$) was defined as all killer whale groups within visual range. A simple ratio index (SRI) was used to analyze associations between units. Only 212 (21%) of all groups were formed by whales from different units. The associations between some units were strong during particular years but varied considerably year-to-year. All aggregation-level stable associations ($0.4 < \text{SRI} < 1.0$) were between units with the same vocal dialect. They rarely formed groups with each other but mostly were found in the same aggregations. Some units, however, formed no associations with other units, even with units of the same vocal dialect. One unit has never been seen in groups with other units. The significant negative correlation was between the number of mature males in the unit and (a) the frequency of the unit's occurrence in groups with other units ($R=0.574$, $p < 0.01$) and (b) the value of the unit's maximum SRI ($R=0.415$, $p < 0.05$). The differences in inter-unit association patterns of killer whales in Avacha Gulf may occur at different spatial and temporal scales. The stability and frequency of inter-unit associations depend on the unit's composition.

B14 DIVING BEHAVIOUR OF HARBOUR PORPOISES (PHOCOENA PHOCOENA) OFF ANGLESEY, WALES

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Of 105 recorded encounters with harbour porpoises off Carmel Head and Bull Bay, 55 were analysed and ventilation and dive profiles for each tidal state were created to get a preliminary view of the data. One ventilation profile was generated for a single animal from each encounter, while mean values for a number of dive-related parameters were used to create a typical dive profile for all the animals in each encounter for the different tidal states. Several parameters were considered to assess the diving patterns of harbour porpoises. Mean dive duration was 54 ± 17.42 s and three different diving types were outlined, when comparing the ventilation profiles. The first dive profile (single dive between two surfacings) is most common. Dive profiles two and three are mirror images of each other, both containing one short and one longer dive. They have been observed in the majority of encounters. Dive duration seems to be influenced by several factors, such as tidal currents and prey movement. In general, the number of surfacing rolls and dive types were dependent upon the situation (e.g. tidal state, etc.). Changes in dive time with tidal state were statistically significant, with longer mean diving durations during ebb and flood. Highly significant differences were also present in the proportion of time spent diving and surfacing between the tidal states, all leading to the assumption that harbour porpoises adapt their diving behaviour to the tidal state and the current situation. However, there was no significant difference of the diving behaviour during the day, although such differences did appear to be present in the collected data.

**B15 GROUP BEHAVIOR OF CALVES OF A BELUGA
(DELPHINAPTERUS LEUCAS), THE WHITE SEA, SOLOVETSKI
ISLAND**

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Observations were spent in summer gathering of belugas in the White Sea (Solovetski Island, cape Beluhzy) in 2001, 2003-2004. The group behavior of belugas calves was investigated. The age calves was defined on a combination of attributes: the size, painting, duration of a respiratory pause. In the first days of a life (about 4-5 days) newborns cooperate only with mother. Their mutual relations are visually shown in the form of short-term tactile contacts (3-5 seconds). The first independent contacts to other individuals of pod at newborns are observed in the age of from two weeks about one month. As a result of researches it has been shown, that it is the most typical groups of two individuals for all calves. To be grouped in pairs of calves monthly and bi-monthly age prefer with coevals. Possibly, it is caused by identical physiological and social development of calves. For calves two-three week age the groups only with coevals are opposite uncharacteristic. For formation of independent groups they, apparently, yet do not have social experience. Need in "The leader" pushes them to be united with more adult calves. Group contacts of calves of two-three week age, as a rule, are short-term and last from 7 up to 30 with. In process of growth at calves occurrence of groups of three both four individuals and their duration (up to 90 seconds) increases. Groups into which structure enters calves 1-3 years old at calves meet seldom or are short-term. Possibly, it speaks a different level of their social activity. The calves 1-3 years old form groups of five and six animals; especially often they are formed during pairing belugas. Possibly, in greater groups, older calves of belugas, simulating behavior of adult animals, acquire skills of sexual behavior easier and more quickly. Work was executed at support International Fund for Animal Welfare.

**B16 KILLER WHALE (ORCINUS ORCA) HUNTING BEHAVIOR IN
KAMCHATKA PENINSULA.**

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Much of the scientific study of cetacean behaviour relies on qualitative descriptions of causative factors, feeding techniques, communicative behaviours (Ex: vocalizations) and various types of social interactions (Ex: aggression). Many of scientists describe some general categories of activity during the all-animals continuous sampling techniques, for example "foraging", "resting", "socializing" etc. But doing these descriptions makes relatively little attention to quantitative data or statistical analysis. The purpose of our work was to define two different types of killer whale's hunting behaviour ("hunting on Atka mackerel" and "hunting on salmon"). Earlier we divided these two types of hunting behaviour using an acoustical data (mainly echolocation trains), but for behaviour measurements we used only all-animals continuous sampling techniques and no quantitative behavioural data were collected. For our purpose we used a focal-animal sampling and focal-group sampling techniques. The hunting behavior was broken down into six behavior acts (slow diving – "SD", deep diving – "DD", pursuit near the water surface – "P", jumping for a fish – "J", tail slapping – "TS" and diving at the end of which tail stands perpendicular the water surface – "T"). Our data was collected in July-August 2007 in the Central Avacha Gulf of Kamchatka Peninsula. During this period we had 14 hours of hunting behavior observations. For our study we took 163 encounters of hunting behavior, during this encounters 4001 acts were recorded. We recorded 623 "P", 2496 "SD", 723 "DD", 112 "J", 38 "TS" and only 9 "T". Using a cluster analysis we divided the hunting behavior into two clusters - "hunting on Atka mackerel" and "hunting on salmon". We made ethograms for these two clusters of hunting behavior. For these clusters we also analysed the echolocation trains. The results of this analysis mostly coincided with our earlier division of hunting behaviour based on the parameters of echolocation trains.

B17 HABITAT USE AND ACTIVITIES BUDGET OF STRIPED DOLPHINS IN NORTHWEST MEDITERRANEAN COASTAL WATERS

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Striped dolphin is known to be an oceanic species. In the Ligurian Sea, it is also present in the nearshore area. We wondered if these waters were used as a preferential habitat. Our study focused on the spatial and temporal habitat use. We covered 4200 km of survey track during 70 surveys (2003-2007) off Nice. Focal animal observations were used to study activity budgets and movement patterns. We observed schools during 270 hours (91 focal surveys). Activities were divided into feeding, travelling, socialising and resting. The activities budget varies significantly over the day. Travelling and feeding were the most widespread activities. When feeding (37 bouts, 22 hours of observation), dolphins used all bathymetric strata. Feeding before 10.00 h GMT and after 18.00 h was mainly observed in the nearshore area (< 600 m deep waters). Resting (22 bouts, 23 hours of observation mostly between 10.00 and 14.00 h) occurred over 600 m deep waters. A potential resting area above the canyon could be identified. Dolphins seemed to use small areas changing often their heading direction. Most observed travelling (38 bouts, 52 hours of observation all over the day) involved groups of animals heading to the canyon between 9.00 and 11.00 h, and travelling from since 11.00 h. Dolphins swam a direct track suggesting an area to be reached. Socialising (21 bouts, 16 hours of observation mainly between 12.00 and 16.00 h) was observed in the mouth of the canyon (> 1000 m), and could be related to travelling activity. However, no specific area has been identified as 75 % of area used for socialising was also used for others activities. These results suggest a clear temporal habitat use: resting succeeds to nocturnal feeding, and travelling leads dolphins to socialising. Only the feeding nearshore waters may be identified as a preferential area.

B18 DIFFERENCES IN AREA USAGE BETWEEN RESIDENT AND TRANSIENT KILLER WHALES (*ORCINUS ORCA*) AND BETWEEN RESIDENT CLANS IN AVACHA GULF, SOUTHEAST KAMCHATKA, RUSSIAN FAR EAST

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It is known that fish-eating (resident) and mammal-eating (transient) killer whales have clear differences in distribution and area usage. Some differences can also be found among pods of resident individuals within a given area. In this study we compared the distribution and area usage of several groups of resident and transient killer whales in Avacha Gulf, Southeast Kamchatka, in the Russian Far East. GPS data were taken to determine group position. We used a site fidelity test, kernel method and statistical comparison of coordinates of GPS registrations. We analyzed 664 registrations of resident killer whale groups from two acoustic clans and transient killer whale groups. Resident groups of "Avacha clan" were found to centre their activities around Cape Opasny. This significant fishing area has aggregations of spawning atka mackerel (*Pleurogrammus monopterygius*). The general activity of Avacha clan took place close to the shoreline, in areas where depths were less than 100 meters. Avacha clan seems to be familiar with the shoreline and underwater topography here, so we can suggest that Avacha Gulf centred on Cape Opasny is a key part of their home range. Killer whales from a second resident clan "K19 clan" and transient groups were found rarely in Avacha Gulf. K19 groups of whales traveled farther from shore where depths were more than 100 meters. The results of a site fidelity test demonstrated the random character of GPS registrations. We suggest that killer whales from K19 clan pass through Avacha Gulf only occasionally. Based on limited data, transient groups traveled along sea areas where the depths were between 50 and 100 meters. The traveling and acoustic behaviour of Avacha transient groups was similar to those of the Northeast Pacific transient killer whales, which use an "open water foraging" strategy. We did not see transient individuals and groups traveling close to the shore and visiting bays.

B19 LAND BASED SURVEY OF TURSIOPS TRUNCATUS INTERACTION WITH BOAT TRAFFIC IN LAMPEDUSA ISLAND

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Beginning in 2003, as part of the LIFE project "Del.Ta." (NAT/IT/000163), a bottlenose dolphin community has been studied in the Pelagie Archipelago (Sicily, Italy). During the summer 2006 land-based surveys were carried out at Lampedusa, one of the Archipelago's Islands, at fixed hours from 6 locations in typical weather condition. Continuous horizon scan and focal

group sampling methodology were adopted. Dolphin behaviour and dolphin-boat interaction were recorded for each sighting. A total of 236,08 hours were spent monitoring from a cliff. 35 sightings were recorded. Statistical analysis shows that sighting time decrease in the presence of vessels. More than 78% of sightings resulted in negative interaction (avoidance) between dolphins and vessels within 200m. Positive interactions (approaching a boat) were recorded just among dolphins and fishing vessels more than 200m away. Behavioural analysis shows that animals change their activity in the presence of vessels, increasing direction changes and decreasing normal swim. Markovian Chains show that animals simplify their behaviours near boats. Transit of fast ships that don't modify speed and direction lead the animals to break off activity and swimming away rapidly. This study demonstrates that dolphins can be disturbed by vessel traffic in the area. It is necessary to investigate the possible long-term negative impacts on the population of this disturbance. A comparison with other areas dealing with a similar phenomenon would be very useful.

B20 OBSERVATIONS OF BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) BEHAVIOURAL CHANGES IN RELATION TO BOAT PRESENCE IN CARDIGAN BAY, WALES.

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The bottlenose dolphins' habitat brings them in close contact with humans all over the world. There is growing concern over the effect of disturbance by boat traffic to dolphin behaviour and movement. This project investigated the changes in behaviour and movement patterns that took place when bottlenose dolphins came into close contact with various types of boats. The site was on a 60 meter high headland, in New Quay (Cardigan Bay SAC, Wales), to allow the best possible view point for observations of both the boat and dolphin behaviour. The study took place over a four weeks period in June/July, with 23 positive days for sighting. Behaviour of the dolphins in the absence of boats was recorded every 3 minutes after the first initial sighting until the dolphins disappeared. A similar process was followed during an encounter between a boat and dolphin(s). The behaviours of the dolphins and boats were categorised before the investigation started to allow easy recognition of behaviours. A theodolite was used to track and visually analyse any effect the boats may have had on the movement and behaviour of the dolphins and allow the data to be graphically represented, using a Pythagoras cetacean tracking program. The results showed obvious relationships between the dolphins' behaviours and the presence and behaviour of specific boats. Overall there were 57 dolphin sightings and 49

dolphin-boat encounters; 89% of the dolphin boat encounters showed a significant change in dolphin behaviour. Many of the encounters showed relationships that underline specific behaviours observed from the dolphins and how their behaviour changes depending on boat type and the manner at which they approach an individual. Observing the impact of how dolphins react to vessels will aid in the management of boats and the conservation of bottlenose dolphins within Cardigan Bay's designated SACs.



CONSERVATION MANAGEMENT

CM01 DEVELOPMENT OF THE RUSSIAN WHITE SEA AND BARENTS SEA HUNTING AND THEIR EFFECT ON WHITE WHALE AND HARP SEAL STOCKS IN THE 19 – BEGINNING OF 20 th CENTURIES

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We try to evaluate the main tendencies of the development of White sea harp seal (*Pagophilus groenlandicus*) and white whale (*Delphinapterus leucas*) hunting in the White Sea and east Barents Sea areas during 19-beginning of 20th centuries and evaluate the effect of hunting on sizes of their populations. We use the quantitative data such as the catch sizes, number of hunters, and number of gear and take the information on organization of marine hunting, and marine hunting methods. Until the 1870s the published sources and archives provide relatively few statistical data. The regular statistics for period 1872-1915 are available from publications of Statistical Committee of Arkhangelsk Province. For evaluation of the main tendencies of catch size and hunting effort in relation to time changes we have taken trendlines and analyzed R^2 values. Throughout 19th - 1920 harp seal catches ($R^2=0,52$), number of harp seal and white whale hunters were increasing. Probably, this increase resulted from growth of human population in the area. Catches of white whale didn't show tendency to change from late 18th century – 1920 ($R^2=0,05$). It might have been connected with strong fluctuations of white whale hunting due to social and economical reasons – white whale gears were most expensive on the Russian North and white whale hunting technique was most difficult. Moreover until 1920s marine hunting was influenced by weather conditions. In some years there were no harp seal and white whale catches in local hunting places because of storms or winds. The marine hunting have remained relatively low despite the increase in hunting effort: hunting techniques were quite primitive. Catches of marine mammals did not decline until 1920s. Thus, it appears that hunting did not influence negatively the White Sea harp seal and white whale stocks in the Russian North area until 1920s.

CM02 ILLEGAL HUNTING CAUSES DEPLETION OF AMAZON RIVER DOLPHINS (INIA GEOFFRENSIS) IN BRAZIL

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Mythological status had protected the boto or Amazon river dolphin from hunting throughout Brazil. Around the year 2000, evidence of hunting first emerged, and now it appears to be widespread. Dolphins are killed covertly at night and used as bait for Piracatinga, a scavenging catfish which is then sold to Colombia. A quantifiable impact of the hunt on the boto population was tested using standardised visual surveys within the Mamirauá sustainable development reserve, Brazil. Minimum-count surveys were executed from 1994 to 2007. No trend was apparent until the year 2000, but subsequently the mean number of dolphins fell by an average of 10% per annum ($R^2 = 0.15$, $p < 0.001$). Due to its nature, the scale of the boto hunt is difficult to judge. Direct evidence is scarce. It includes encounters with harpooned and rope-tied botos, and a greatly increased loss of recognisable botos in our study area since 2000. Interviews with fishermen demonstrated that the practice is widespread in the middle reaches of the Brazilian Amazon, and that tens or hundreds of animals were taken annually in many communities. However, fish landings are known and can be used to estimate the size of the dolphin hunt. Based on a bait:catch biomass ratio of 0.75, an estimated Piracatinga catch of 400 tonnes, and dolphins comprising 20% of the bait used, we estimate that 600 botos were taken annually around the nearest town to the Reserve (Tefé). Many towns process this fish, so the possible scale of the hunt is great. On current evidence it is also unsustainable. No attempts are being made to prevent this directed take of dolphins, and the expectation is that it will continue until either the target fish or the bait species are driven to such low levels that the fishery is no longer economically viable.

CM03 ENVIRONMENTAL & ANTHROPOGENIC VARIABLES INFLUENCING BOTTLENOSE DOLPHIN PRESENCE IN A MARINE FIN FISH FARM

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The aquaculture, in particular intensive fish farming, is an activity that has grown a lot in the Mediterranean over the last ten years. As consequence, new habitats have been created providing a contribution of nutrients that attract to numerous predators. During the spring of 2007, 293 samples were carried out in a marine fin fish farm on the north-eastern coast of Sardinia, Italy. The objective of this study was to recognize the possible variables that can be related with the presence of bottlenose dolphins and birds (gull, cormorants, shags and carrion crow) in the fish farm area. Based on the results obtained in this study, we can discriminate that the temperature of the water and the sea conditions (wind speed) are related with the presence of dolphins. In the case of most of species of birds, it is observed that their presence is related with the temperature of the water besides with anthropogenic variables (presence of recreational boats, fishing boats and fish farm boats). The results obtained in this study can help to the good administration of marine fin fish farm of similar characteristics in the presence of the predators.

CM04 MARITIME TRAFFIC AND CETACEANS IN THE NORTH-WESTERN MEDITERRANEAN: FIRST RESULTS OF IMPACT-CET®

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The problems of the threats generated by the maritime traffic on the cetaceans and their habitat are a priority of concerns for the Sanctuary PELAGOS and for ACCOBAMS. To enable bringing solutions to this, IMPACT-CET® aims at collecting in parallel data on maritime traffic and on cetaceans. It will lead to establish a first current stage and then the evolution of the threats generated by the human activities. The data-gathering is carried out in partnership with: 1) the French Navy all the year round from 8 "semaphores" on the continental and Corsican French coasts, 2) the Swiss Cetacean Society and Cybelle Planète: 63 weeks of campaigns at sea (June to September 2005-2007) and 3) écoOcéan Institut: 10 weeks of campaigns at sea (2006-2007). The first results show, in the Provence area, that the summer maritime traffic is very intense (76 ships/hour) and is composed primarily of pleasure boats (97.2% of the total traffic). They frequent mainly a strip of few NM along the coast and especially between 11h00AM and 5h00PM. Conversely, the maximum passage rate for the trading vessels and the ferries occurs in the beginning and end of the day, probably also during the night, and more offshore (> 10 NM from the coast). Concerning the distribution and relative abundances of large cetaceans, we show that the

sperm whale is located, in this sector, over the slope as well as offshore, while the fin whale is especially pelagic. Finally we show that the high risk areas of collision for large cetaceans and large vessels appear rather complementary for both species. Having highlighted that, it is then possible to find solutions suited in time and space to decrease collision (or accidental captures, potential disturbance,...). These results are intended to the managers, to decision makers and to professionals of the sea.

CM05 IDENTIFICATION OF HIGH EXTINCTION RISK AREAS FOR CETACEANS

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In the marine ecosystem, identification of areas where species have a high extinction risk has raised major challenges in conservation prioritization. Recent studies on terrestrial mammals have shown that intrinsic biological traits in combination with external threats are likely to increase species' extinction risk and the regions that will most probably suffer population declines in the future have been identified. However, perhaps because of the difficulty in investigating the marine environment, the degree to which multiple human pressures increase the risk of marine mammal species' collapse, individually or synergistically, has never been considered, and the areas with higher risks for species' extinction are not known. In this study, on the basis of the recent literature, I identify the Mediterranean Sea as being a hot-spot for human pressures. Of all the marine mammals threatened in this area, cetaceans are among the top predators, whose biology predisposes them to suffer extinction more than others when subjected to the locally high anthropogenic pressures. As discussed in this work, the emergence of a potential extinction risk might be attained in the presence of multiple independent factors that may not necessarily be the culprit of species decline when acting alone. Thus, given the important confluence of threats in the Mediterranean Sea, extinction of marine mammal species may emerge unexpectedly. I therefore stress the need for pluridisciplinary research and computer models aimed at cumulative risk assessment, with international preemptive regulation of all potential threats.

CM06 EMERGENCY RESPONSE FOR MEDITERRANEAN MONK SEALS (MONACHUS MONACHUS)

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The Seal Rehabilitation and Research Centre (SRRC) in Pieterburen started its operations in 1971; since 1987 the SRRC provides emergency response for orphaned or diseased monk seals throughout its range. In 1987 the first two orphaned monk seals, found in Greece, were treated in the Netherlands and released in the newly established marine reserve of the Northern Sporades; more were soon to follow. Since then 15 monk seals were released with the help of the SRRC in Greece (n=7), Mauritania (n=7) and Turkey (n=1). Advice was given on multiple other occasions in the mentioned countries as well as on Madeira, Portugal. Experience gained in the rehabilitation of more than 3000 common seals and 2000 grey seals provided the basis for the successful formula for the rehabilitation of monk seals. Protocols in use at the SRRC were adapted to the specific needs of the monk seal and facilities were directly provided by the SRRC or constructed locally in collaboration. During the treatment staff from the SRRC is continuously present to oversee the process. However it is the aim of the SRRC that local groups should finally become independent and be able to run the rehabilitation themselves. In 2007 the first monk seal rehabilitated in Turkey was released. "Badem" a young orphaned monk seal had washed ashore in Turkey. The rehabilitation process took place in the historic city of Foça, previously known as Phokaia, which both translate as seal. In a collaborative effort between the SRRC and the Turkish group SAD-AFAG with enormous support of the city of Foça; "Badem" could be released successfully and SAD-AFAG could make an additional step towards a completely independent future in monk seal rehabilitation. In the meantime, as long as help is needed, the monk seals can always rely on the support of the SRRC.

CM07 MANAGEMENT OPTIONS FOR COASTAL HARBOUR PORPOISES IN THE OUTER MORAY FIRTH, NE SCOTLAND

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Fine-scale coastal studies of harbour porpoises (*Phocoena phocoena*) in the outer southern Moray Firth in northeast Scotland have revealed that the inshore waters of this large, North Sea embayment may provide a significant habitat for the species during the summer and autumnal months. In recent years, however, alarming declines in porpoise abundance have been noted for this region, suggesting that conservation measures need to be implemented for the identification and subsequent mitigation of those activities negatively impacting upon these communities. In the present paper, the options available for management of these small cetaceans are discussed. The combined and potentially synergistic effects of disease, induced-stress and contaminant exposure resulting from issues such as coastal pollution (domestic, industrial and acoustic), disturbance (e.g. recreational, shipping, dredging and coastal development) and over-fishing (resulting in prey depletion and habitat change) are consequently reviewed. Incidental bycatch is recognised to be the single most significant anthropogenic threat to coastal porpoise populations in the Moray Firth. However, three years after the adoption of EC Regulation 812/2004, one of the main provisions aimed at reducing these bycatch levels, namely the compulsory use of pingers on specified set nets, remains difficult to enforce and somewhat impractical to regulate. Moreover, as the requirements are costly and unpopular within the Scottish fishing industry, and the industry in general, there appears to be little incentive for EU Member States to find a solution to this problem. Until such time as these issues are resolved, therefore, the conservation of ecologically important habitats for coastal harbour porpoise makes the continued monitoring of small inshore populations in UK waters a necessity.

CM08 ARE THE INTERACTIONS WITH TUNA FISHERIES A NEGATIVE ISSUE FOR THE KILLER WHALES IN THE STRAIT OF GIBRALTAR?

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Killer whales have been described in the Strait of Gibraltar associated with tuna fisheries for at least 2000 years. Killer whales exhibit two strategies to feed on them. One, exhausting the tunas, chasing them during around 30 minutes, which implicates high energetic investment, and another one

interacting with the long line fishery in the central waters of the Strait since the beginning of the 90s. A total of 7730 pictures of dorsal fins of killer whales, taken between 1998 and 2007 in 95 sightings, have been analysed showing the presence of 42 different individuals in the area. During the photo-id sessions, group structure was noted, and the catalogue was analysed with Socprog 3.2, resulting on a total of 5 pods. The temporal relationships were fitted calculating their lagged association rates resulting in a social system based on Rapid Dissociation and Constant Companions. All the pods were seen associated with the tuna exhaustion feeding strategies but 3 of them were also observed interacting with the long line fishery during summer months. Life history parameters (Population survival rate=0.989 (95% IC: 0.941-0.993), birth rate=0.066, mortality rate=0.013, new born survival rate=0.968 (95% IC: 0.811-0.995) of those 3 pods are similar to those observed for resident killer whales in the North Pacific. However the observed population growth rate ($\lambda=1.053$) and birth intervals (4.25 years) are respectively higher and lower compared to the North Pacific resident population. Raising the question of the possible demographic consequences of the interactions between the killer whales and the long line fishery. This interaction might allow them to increase their energetic gain and invest it in reproduction.

CM09 REHABILITATION OF LIVE STRANDED SMALL CETACEANS IN THE NETHERLANDS

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Since 1967 small cetaceans, mainly harbour porpoises, are being rehabilitated at the Dolfinarium in Harderwijk. In 1991 a separate isolated indoor facility was build for the rescue of stranded cetaceans. From 1994 onwards a continuous increase in live stranded harbour porpoises has been observed. This trend correlates with life animal sightings and stranding counts of dead animals. Experience has led to an increased success rate from 10% in the beginning to 50% at present. In 2005 an exhibit for non releasable animals was opened at the Dolfinarium exposing the visiting public to this endemic but generally little known species. Education and increase of conservation awareness is achieved by offering information during animal presentations, displays around the outdoor exhibit and the rehabilitation centre, guided tours and various available educational material. Research in the past and present focuses on acoustics, pathology and veterinary research. The Dolfinarium cooperates closely with the Erasmus University in Rotterdam and the Forschungs- und Technologiezentrum

Westküste in Büsum, Germany to realize this research. Since 2004 the charity foundation SOS Dolphin supports and supervises the rescue and rehabilitation efforts.

CM10 IMPACT ASSESSMENT OF WHALE-WATCHING BOATS ON CETACEANS IN MADEIRA ISLAND, PORTUGAL

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Whale-watching is a growing activity throughout the world, providing an important revenue in many regions and having an active role in environmental education. However, this form of tourism has short- and possibly long-term effects on cetaceans. In Madeira island, Portugal, whale-watching is conducted in an opportunistic manner and there is still no legislation to regulate the activity, only a voluntary code of conduct proposed by the Madeira Whale Museum. Observations were carried-out from land with the use of a theodolite and Pythagoras software as well as at sea from whale-watching boats to evaluate the effective compliance with the voluntary code of conduct and assess the short-term effects of the boats on cetaceans through behavior changes and reaction to the boats. Results have indicated that the code of conduct is complied in the majority of times, except for the rules of minimum distance between the boats and the animals and the simultaneous number of boats within 200 meters of the animals. For all the species of cetaceans that were analyzed the behavior before and after the encounters with boats was the same in 89% of the times. For delphinids, the medium speed during and after the encounters with boats was significantly higher ($p=0,000$) than before the encounters. Although incipient, whale-watching in Madeira island presents short-term effects on cetaceans, making of great importance the approval of a legislation in this region, in order to minimize the impacts of this activity on the target species.

CM11 FUNCTIONS OF MULTIPOD AGGREGATIONS IN KILLER WHALES

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There are three main reasons why animals gather in groups: (1) reduced predation risk; (2) increased foraging success; or (3) an extreme localization of some resource. In fish-eating North Pacific killer whales, large multi-pod aggregations of up to 100 animals often occur. These aggregations are traditionally thought to be reproductive gatherings where mating between members of different pods takes place. However, it is known that in fish-eating killer whales, mating usually occurs between acoustic clans rather than within a single clan. Yet multi-pod aggregations often include members of only one clan. No attempt has been made to describe multi-pod aggregations quantitatively and to reveal their real functional role. In this study we tried to analyze the functions of multigroup aggregations of killer whales in Kamchatka, Russia Far East. We examine three hypotheses about the functions of multi-pod aggregations: a) killer whales form multi-pod aggregations to mate; b) multi-pod aggregations play an important role in cooperative prey searching and foraging; c) multi-pod aggregations are "clubs" in which the whales gather to establish and maintain social bonds. We compared the frequencies of occurrence of different activity types in single-pod encounters and multi-pod intra-clan and inter-clan aggregations using the Chi-square test. Our results show that foraging is rare in multi-pod aggregations, whether inter-clan or intra-clan, and thus it is unlikely that they play an important role in cooperative prey searching and foraging. Socializing occurs more frequently in inter-clan aggregations rather than in intra-clan aggregations, which suggests the higher arousal level and possible mating during inter-clan aggregations. Intra-clan aggregations, on the other hand, are likely to be "clubs" in which the whales gather to establish and maintain social bonds rather than to undertake mating.

CM12 ACTION PLAN FOR THE CONSERVATION OF THE COMMON BOTTLENOSE DOLPHIN IN THE PELAGIE ISLANDS: A MANAGEMENT MODEL ON SMALL GEOGRAPHIC SCALE

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Biology Conservation is the applied science of maintaining the earth's biological diversity (Caughley and Gunn, 1996). It has been described as a crisis discipline, which proceeds on the basis of the best available information; where applying the precautionary principle and giving probabilistic, rather than prescriptive answers, is the norm. Natural resource management consists of two branches: socio-economic, which deals with legal and cultural aspects, and technical, where natural science's multidisciplinary approaches are the best. The Action Plan is one of the tools used in Conservation Biology: it is a technical document containing management indications for the conservation of a species (cf. Council of Europe, 1998). The species-specific approach is encouraged for populations at high risk or highly threatened by human activities and has positive outcomes on the entire ecosystem, despite its partiality. Documents concerning small populations and modest geographic scales can be helpful to achieve encouraging results in the short run. Moreover, they provide a management model for bigger and more complex ecological, economical and political systems. In this perspective, the elaboration process of the Action Plan for the common bottlenose dolphin in the Pelagie Islands consists of the following steps:

- 1) an analysis of the available information on population biology, distribution and abundance;
- 2) an investigation on ecosystem properties and human contest;
- 3) identification of the threats to the conservation of the species;
- 4) definition of the objectives for the safeguard of the population and related actions to meet such objectives;
- 5) elaboration of a monitoring plan to control management efficiency.

CM13 COLLISIONS IN THE STRAIT OF GIBRALTAR

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Collisions between ships and cetaceans are known to be widely underestimated, representing a major threat for some species, e.g. the North-Atlantic right whale (*Eubalaena glacialis*) population. The Strait of Gibraltar is a major cetacean hotspot, but also one of the world's major shipping routes. The incidence is underestimated mainly because strong surface currents wash the carcasses towards the Mediterranean Sea. This study was carried out from May to September 2003 through 2007, from opportunistic platforms of whale watching. Necropsies were also carried out on small cetaceans on behalf of the voluntary stranding network NERITA. Several small cetaceans were recaptured showing clear marks of encounters with propellers. Most of these involved fin mutilation or propeller scars on the animals' body. The species presenting most collisions signs was the long-finned pilot whale (*Globicephala melas*), followed by the bottlenose dolphin (*Tursiops truncatus*). One case involving a short-beaked common dolphin (*Delphinus delphis*) showed a large injury just in front of the dorsal fin which cut through the spine. Sperm whales (*Physeter macrocephalus*) also presented clear signs of ship strikes on their flukes and in some cases on their head. Fin whales are particularly at risk because they travel perpendicularly to the fast ferries' routes. We conclude that there are many more collisions in the Strait of Gibraltar than has been directly assessed in the past, and that these collisions probably involve smaller vessels which change direction frequently and target dolphin groups because of the frequent association of dolphins with targeted fish swarms. We recommend that regulations be put in place by the ACCOBAMS ranging states in order to reduce this increasing threat to the cetacean populations in the study area.

CM14 THE USE OF BEACHED WHALES BY SELKNAM, LAND HUNTERS OF THE TIERRA DEL FUEGO

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The selknam were terrestrial hunter-gatherers who lived in Tierra del Fuego Island, wandering in small territorial patrilocal bands, highly mobile and low density population. Their ancestors inhabited the Island when it was still connected to the mainland about 10,500 BP. It is supposed that at the time of the opening of the Straits of Magellan, two thousand years later, they were isolated in a very harsh and recently free of ice environment. That human isolation is unique in all the Americas. The selknam's highly mobile and territorial behaviour is partly contradicted by the ethnography that tell us that the scavenging of beached whales allowed the access to great amounts of fat and meat for immediate consumption and even for its storage, but also the opening of territories to guests from the neighbourhood. This attitude is mirrored by myths and rites of this society in which whales played a very important role in the masculine passage rites (Hain ceremony), for instance, favouring concentration of population into bigger and more lastly settlements. Not only that, the whales played a part in selknam's tales, body paintings and shaman's magic. In a recent archaeological survey by the north part of Tierra del Fuego we were able to locate remains of big, medium and small cetaceans in many late coastal archaeological sites (3000 to 500 BP). From Biology, data of registry throughout 30 years, in the different sectors from the Straits of Magellan, allow to conclude that the coasts inhabited by selknam present a greater number (16) of species of beached cetaceans.

CM15 DEVELOPING AN EMERGENCY PLAN FOR THE MANAGEMENT OF A MORBILIVIRUS OUTBREAK IN STRIPED DOLPHINS

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In 1990, a morbilivirus epidemic decimated part of the Mediterranean *Stenella coeruleoalba* population. Around 400 striped dolphins died along the Spanish coasts, 150 specimens in Catalonia. At that time there was no

organised stranding network in the region. Therefore, the chances or recovery of any dolphin stranding alive were minimal. The lack of a proper processing of stranded carcasses also caused the loss of very valuable information on the infection and the species. In summer 2007 a new outbreak of this epidemic was declared in the Spanish Mediterranean. Based on previous experience, an emergency plan was designed to see all the stranded animals on the Catalan coast. For three months - the estimated duration of the epidemic - 4 assistance points were set up along the Catalan coast. Each of them had: 1) a fully equipped vehicle for the transport of dolphins, 2) a swimming pool, 3) a stretcher, 4) a basic field hospital equipped for the medical care and monitoring of the animals, and 5) accommodation areas for the teams on duty (a veterinarian, a volunteer coordinator and a team of trained volunteers). The information cascade between the regional government, the stranding network team, and the volunteers, was essential for the total success of the action plan. In case of animals stranded in an advanced state of decomposition, fat and tooth samples were taken and, with the cooperation of the local authorities, the corpses were disposed of in controlled dumps. All fresh carcasses were transported to the Veterinary School of the Autonomous University of Barcelona (UAB), where necropsies, and subsequent histopathological, immunohistochemical and microbiological studies, were carried out. The experience was a total success thanks to the organisation and cooperation of 150 volunteers and 20 professionals. By the end of the epidemic 34 stranded animals were seen, recorded, photographed and sampled.

CM16 FISHERIES AND THE DECLINE OF SHORT-BEAKED COMMON DOLPHINS IN WESTERN GREECE

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Mediterranean short-beaked common dolphins *Delphinus delphis* have been classified as Endangered in the IUCN Red List of Threatened Animals in 2003. In the eastern Ionian Sea coastal waters surrounding the island of Kalamos, a former hotspot for this species, the local population declined steadily from about 120 dolphins in 1995 to 15 in 2007. Large tuna also showed a negative trend. The decline of high-order marine predators feeding on epipelagic schooling fish was consistent with the hypothesis of prey depletion, thought to have resulted from overfishing. Documenting fishing pressure in the study area has been difficult, due to poor reliability of landing data and the fact that local fishermen often misreport their catch. Therefore,

we started a regular monitoring of fishing effort and landings aimed to obtain first-hand information on the impact of fishing. The biomass removed annually by 308 fishing boats operating in the study area between November 2006 and October 2007 totalled 3570 tonnes. Biomass removed by common dolphins during this period was 17 tonnes, considering an average daily food consumption of 4.2 kg per animal. A Pianka's index of 0.5 reflected the degree of resource overlap between common dolphins and local fisheries. Both biomass removal and degree of overlap changed remarkably according to fishing gear, being higher for purse seiners and beach seiners, and lower for trawlers, trammel boats and longliners. Ten purse seine boats operating in the study area removed 1151 tonnes annually (32% of total fishery removal) and had the greatest impact on common dolphin prey. Enforcement of fishery management measures aimed to reduce overfishing and ban destructive fishing means is urgently needed to prevent the local eradication of common dolphins. Such action, advocated by international agreements such as ACCOBAMS, would likely result in ecosystem recovery as well as benefits for the larger fishermen community.

CM17 REVIEW OF SOCIABLE SOLITARY CETACEANS WITH RECOMMENDATIONS FOR MANAGEMENT

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In the last century solitary dolphins and whales have been documented across the world. Whilst most cases are of bottlenose dolphins (*Tursiops truncatus*), perhaps one of the first reports was of a risso's dolphin (*Grampus griseus*). There have also been cases of beluga whales (*Delphinapterus leucas*), a young male dusky dolphin (*Lagenorhynchus obscurus*), a juvenile spotted dolphin (*Stenella attenuata*), two cases of killer whale (*Orcinus orca*) and a tucuxi (*Sotalia fluviatilis*). Each have demonstrated a unique response to various stimuli including inanimate objects such as boats, logs, piers and buoys, through to people on marina pontoons, in boats and in the water. Whilst generalisations have been made into the behavioural ethogram displayed by "solitaries", each case and individual is unique. The question of whether they seek out contact or become habituated by those who seek contact with them has also been posed and deliberated by some. Many individual cetaceans have been studied scientifically, with the findings published in the literature. However, few studies have reviewed these sociable, solitary individuals worldwide, to date and considered the difficulties associated with management and providing protection for these cetaceans within the law. This review has examined all accounts of sociable, solitary cetaceans, considering the management action taken in each case

and identified where lessons can be learnt and where legislation can be improved to provide better protection within the UK and worldwide.

CM18 INTERACTIONS OF CETACEANS AND LONGLINE FISHERIES IN ATLANTIC WATERS

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In the Atlantic, economic losses have reported from shark, swordfish, and tuna long-line fisheries mainly due to depredation by false killer whale. To find a solution to this problem, a research project (PINGERS) is being carried out (Developing and Acoustic Prototype to Reduce Depredation by Marine Mammals in Swordfish Fisheries), and financed by the SECRETARIA GENERAL DE PESCA MARITIMA (Spain). In the frame of this project, the interaction of odontocete species with long- liners was investigated during two surveys on fisheries vessels operating North-East of Brazil and West-South West of the Azores, in addition to receiving data from several other vessels fishing in these areas. During the two surveys, fisheries and marine mammals observation data were collected registered during 86 days. T-PODs attached to the lines were used to collect acoustic data. The aim was to investigate the relationships between predation, sightings, and fishery catches. During the fishing trips for which captains supplied data, the incidence of depredation was low (around 1% of lines set) but the proportion of fish damaged was high when depredation occurred. 4217 fish were captured and 686 cetaceans were sighted. Predation on fish captured was low (0.17% and 0.67%), and mainly tuna and swordfish were predated. Acoustic detection was low when predation by false killer whales was

registered. Damage to fish was correlated with the presence of false killer whales. A high intensity of clicks were detected when sightings of delphinids were high and false killer whales were captured. Both cetacean presence and fish catch rates showed relationships with the phase of the moon.

CM19 TEODOLITE OBSERVATIONS OF THE GRAY WHALE IN THE REGION OF THE CONSTRUCTION GAS AND AND OIL EXTRACTION OF PLATFORM

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Teodolite observations on behaviour and movement patterns of gray whales were conducted during summer months at the Western gray whales (WGW) feeding grounds off North-East Sakhalin Island (Russia). The research was funded by WWF (2004) and IFAW (2005-2007). In 2005-2007s new marine oil and gas extraction platform was constructed some 6-7 km offshore the feeding ground Observations were done using digital teodolite Topcon DT-102 from the shore of Pil'tunskaya Spit (2004) and from the lighthouse (2005-07) 32 m high, which is situated opposite the entrance to the Pil'tun Bay. The data collected were entered into the database which also allowed preliminary analysis, using the program Pythagoras (Version 1.2.24 2000 Glenn Gailey and Joel Ortega), immediately in the field. We've recorded different aspects of behavior, geographic coordinates of every whale directly into program Pythagoras real-time. Synchronous behavior and whale track records 15 minutes long were taken for the analysis (total 79 whales). We have undertaken the analysis using Kolmogorov-Smirnov Test and Mann-Whitney U Test (nonparametric methods of the Statistica 6.0 program). The analyses of the following variables were conducted: linearity of whale movements, whale average speed and reorientation. We have found significant difference in whale reorientation (RR) which was generally higher during 2005 - 2006 if compared with 2004 ($p < 0,005$, $p = 0,000695$; $p < 0,001$, $p = 0,000969$), The noticeable RR increase was registered in response to oil platform construction activities on 30 of July 2005 ($p < 0,005$, $p = 0,0002778$), difference linearity movement of whales into months (June/July $p < 0,05$, $p = 0,022243$; July/September $p < 0,025$, $p = 0,002124$ – increase; August/September $p < 0,05$, $p = 0,025960$; June/September $p = 0,038052$ – decrease). Also we have analyzed average blow intervals duration (total 97 whales). Found significant difference in the duration of intervals between the 2004 and 2005 ($p < 0,001$, $p = 0,000000$)- decrease, 2004 and 2006 ($p < 0,05$)-decrease, 2005 and 2007 ($p < 0,025$, $p = 0,018144$)- increase, June and August ($p < 0,05$, $p = 0,017181$)- decrease, and before and after construction

of platform ($p < 0,005$, $p = 0,000870$)-decrease. Intensive ship traffic in vicinity to WGW feeding grounds and construction works at the sea platform had the influence on behavior of whales which caused changes in movement and respiration patterns.

CM20 LOCAL APPROACH TO REDUCE THE BYCATCH OF HARBOUR PORPOISE IN POLISH BALTIC WATERS

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Bycatch is one of the main threats for a vulnerable Baltic population of harbour porpoise and it should be given the highest priority to undertake the protection measures. As defined by ASCOBANS Recovery Plan for Baltic Porpoises the entire Baltic Sea is not a homogeneous system and Parties are required to take an area specific approach to reduce it. The highest level of bycatch in the Polish waters has been observed in the Puck Bay, a semi-closed shallow area covering ca. 1% of EEZ waters. This is a fishing ground for artisanal traditional fishery for which target species are flounder, cod, salmonides, eel and freshwater fish caught in gillnets, fyke nets and longlines in different seasonal numbers and distribution. In years 1990-2004 96% of harbour porpoises entangled in nets in this area was reported from anchored salmon gillnets (also locally called "semi-drift" nets). Following the ASCOBANS recommendation we have worked out a three-years- long project for years 2008-2010 aimed at mitigating this local problem of significant bycatch. The project assumes the consecutive stages of (1). deployment of static acoustic monitoring units covering the entrance to the Bay in two parallel settings to monitor the presence and movement of animals and (2). additional deployment of acoustic devices (pingers) in a barrier-like setting after one year time. Over the whole period the bycatch reports will be collected and the fishing effort will be monitored in situ by time and area. The effectiveness of the pinger barrier will be measured by bycatch scale and by registering of harbour porpoise presence in front and behind the barrier. The project assumes a wide education campaign to promote the urge need of a rare marine species protection and is aimed to create local fishery as an environmental friendly by being voluntarily cooperative without any financial engagement.

CM21 IMPLICATIONS OF THE MARINE STRATEGY AS FRAMEWORK FOR MARINE MAMMAL CONSERVATION IN THE BAY OF BISCAY: DEVELOPMENT OF ECOLOGICAL INDICATORS

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The main objective of the European Marine Strategy (EMS) is to project and restore the European seas, ensuring that human activities are carried out in a sustainable manner, providing safe, clean, healthy and productive marine waters; in summary, “to promote the sustainable use of the seas and conserve marine ecosystems”. Hence, the EMS establishes a framework for the development of marine strategies designed to achieve good environmental status in the marine environment by the year 2021. The first step is to lay down generic qualitative descriptors, criteria and standards for the recognition of good environmental status. This concept of environmental status takes into account the structure, function and processes of the marine ecosystems together with natural physiographic, geographic and climatic factors, as well as physical and chemical conditions including those resulting from human activities in the area concerned. In compliance with the EMS, our presentation will suggest the use of cetaceans as ecological indicators to assess the environmental quality of the waters of the Bay of Biscay. Such an indicator, based on an ecosystem-approach, may provide a simple and quantifiable measure of the environmental quality of the water, easily understandable by decision-makers and the general public, which is essential to implement and reinforce effective conservation measures towards cetaceans’ management. Our presentation will suggest some ideas based on an ecosystem approach and discuss implications for future management of cetaceans.

CM22 THE DEPENDENCE OF SHORE ACTIVITY OF AUTUMN COASTAL COLONIES OF PUSA HISPIDA LADOGENSIS FROM THE HYDROCLIMATIC CONDITIONS

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Pusa hispida ladogensis is a subspecies of *Pusa hispida*, an endemic of isolated area of Lake Ladoga. Starting from August and during the autumn period Lake Ladoga is characterized by high storm activity. During this season the direction and strength of wind and roughness of water can change every 20-30 minutes. As a result, on different sides of Sosnovy Island, where the observation was held, it is possible to observe different weather conditions – from calm to roughness of water (up to force 5 and more). Seals choose coastal colonies on shores with limited or no roughness of water. Groups of seals (up to 80 species) station themselves on rocky bars located 10-20 metres from the shore or on coastal rocks, where they rest. If water roughness increases, seals leave their coastal colonies as they cannot occupy rocks covered with water. In pairs or alone, they swim around the island, looking for a quieter place, or move away from the shore. Seals can change coastal colonies 2-3 times a day. If there is no silent water, they swim into open water areas.

CM23 WHITE-BEAKED DOLPHINS IN A WARMING WORLD: WHAT MAY THE FUTURE HOLD?

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The white-beaked dolphin is currently the most abundant delphinid in the North Sea and adjacent shelf waters, and this area contains globally-important aggregations of this species. However, the occurrence of white-beaked dolphins in this area has changed in recent years. In particular, while the west of Scotland once contained some of the highest abundances of this species in Europe, the occurrence of white-beaked dolphins in these waters has declined dramatically since the 1980s. The distribution of white-beaked dolphins is closely related to water temperature, with white-beaked dolphins become much rarer in areas where summer temperatures are above 13°C. These changes in white-beaked dolphin occurrence have occurred in conjunction with a 0.5°C per decade increase in water temperature. This suggests that the observed changes in occurrence could be linked to changes in water temperature. If this is the case, further temperature increases, caused by global climate change (GCC), is likely to lead to further changes in the occurrence of white-beaked dolphins. In particular, much, if not all, of the North Sea and adjacent shelf waters are predicted to warm to temperatures above 13°C in summer months within the next 25-50 years. As a result, we predict that the occurrence of white-beaked dolphins will decrease dramatically across this whole area over this time period. In the worst case scenario, white-beaked dolphins are predicted to be completely extirpated from this area by around 2050. Therefore, GCC

may pose an increasingly important conservation issue for white-beaked dolphins in European waters in the near future. However, surprisingly little is known about white-beaked dolphins in European waters, meaning that these predictions are based on an incomplete understanding of their ecology. Therefore, more research is urgently required to expand our knowledge of this species and improve the certainty of predictions of how white-beaked dolphins may be affected by GCC.

CM24 THE ROLE OF THE WHALE WATCHING STRATEGIES FOR THE CONSERVATION OF MARINE PROTECTED AREAS: THE EXAMPLE OF "TAVOLARA PUNTA CODA CAVALLO" SARDINIA, ITALY

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The primary role of Protected Areas is to reconcile with the human activities of conservation efforts. In particular, tourism activities must be compatible with a rational exploitation of natural resources. The Marine Protected Area Tavolara Punta Coda Cavallo has supported the birth of a Marine Mammals Research Center which has among its objectives research, awareness and ecotourism. A formula combining in a single action all these objectives was to make visitors to participate in monitoring activities at sea along with researchers. This formula has allowed whale watching to make known to the general public, not only dolphins, but also the high value in terms of biodiversity in the area. For the performance of whale watching in MPA was adopted a code of conduct, published and made available to the visitors and boat users. In this work are exposed data on the activity in 2007 that was attended by 260 whale watchers. Of this sample of visitors of MPA are analyzed parameters such as age, gender, geographical origin and composition of the groups. These initial results are the basis to guide future marketing strategies related to ecotourism and awareness. The whale watching is thus one of the best ways to reconcile human activities linked to the use of compatible MPA and research, contributing to the conservation of marine mammals in the area.

**CM26 SPERM WHALES AND CLIMATE CHANGE: UNUSUAL
TEMPORAL DISTRIBUTION IN THE STRAIT OF GIBRALTAR.**

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The sperm whale is the most frequently sighted non-resident species in the Strait of Gibraltar. The local population is composed of approximately 20 male individuals. Our study was conducted from May to September 2003 through 2007, from opportunistic platforms of whale watching. Most sightings took place in May and June every year, followed by a sudden drop and a near total absence of sperm whales in July and August of 2004, 2005 and 2006. This absence was not recorded in 2007 when most of the sightings took place in June, followed by high encounter rates throughout the summer. Unusual aggregations and interspecific interactions were also observed in 2007, including timely aggregations of up to 6 sperm whales at the surface for prolonged periods of time, often in association with long-finned pilot whales and/or bottlenose dolphins. There is no clear information about the diet or migration patterns of these sperm whales. Climate change is affecting several areas of the globe, and very small climatic changes can have considerable consequences on local ecosystems. The unusual sperm whale presence in 2007 is possibly related to an increase in food availability in the Strait of Gibraltar that could be due to climate change, but there is no evidence for lack of food in the previous years. It could also be a sign of a decrease of food availability in the area where they used to move to, or a possible habitat loss in the area they used to move to, be it due to anthropogenic or other reasons. Last but not least, the initial reason for leaving the Strait may have been to meet with female groups for mating purposes, and that these males represent young adults that will not return to the female groups until they have reached sexual and physical maturity.

CM27 ACOUSTIC MAP OF THE OCEANS: A TOOL FOR MANAGEMENT

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While anthropogenic sound sources are increasingly introduced in the oceans, management agencies lack objective data on the current noise status in specific areas and a representation of the noise dynamism associated to human activities. The Spanish Government will be one of the first European member states to implement sea motorways, i.e. an initiative aimed at reducing the emission of gas pollutants in the environment by transferring the terrestrial truck-transport of goods to the seacoasts. Here, we present the 2D reconstruction of the shipping noise load in the area of the Catalan coast where the first motorways are to be created. The noise interactive maps were built after recording and reconstructing the propagation of sound associated to shipping, taken into account the individual contribution of fishing, merchant, ferry and pleasure vessels. The maps allow a clear understanding of the local acoustic load and the geographic identification of noise level peaks. It therefore constitutes a useful management tool to anticipate the noise contribution of future human activities.

CM28 BOTTLENOSE DOLPHIN RESPONSE TO WHALE-WATCHING VESSELS IN THE STRAIT OF GIBRALTAR

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Four resident species of cetaceans coexist in the Strait of Gibraltar, among which the bottlenose dolphin (*Tursiops truncatus*) is the second most

frequently sighted. Our investigation took place in the Strait of Gibraltar, from an opportunistic platform of observation and was conducted during the past five years (2003-2007), from April to November. The amount of whale-watching operators, as well as the amount of whale-watching tours per boat has increased during the study period. We have recorded the response of the targeted species towards the whale-watching boat from which we collected our data. The response was categorised in 3 different types: approach, indifference and avoidance. The 3 types of response were statistically confronted (crosstabulation) against all the variables collected (e.g. wind strength, direction, tides,...). The avoidance response differed significantly (p -value < 0.05) according to the year. Most avoidance behaviour was found to be concentrated in the years 2005 to 2007, coinciding with a progressive increase in whale-watching vessels and with a time when no coordination efforts amongst whale-watching operators existed. We thus conclude that the response behaviour of bottlenose dolphin in the Strait of Gibraltar is linked to the amount of whale-watching vessels actively operating and their mutual collaboration. We recommend that the whale watching operators working in the waters of the Strait of Gibraltar continue and improve the collaboration in the future. It is also very important that the ACCOBAMS code of conduct be respected and enforced in the study area.

CM29 DISTURBANCE OF CETACEANS: ASSESSING THE RISK IN UK WATERS

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The 'strict protection' of animal species of Community interest as required by the Habitats Directive (HD) includes the prohibition of deliberate disturbance to all cetacean species occurring in European waters. In England, Wales and the UK offshore marine area this requirement has been implemented within Regulations for the conservation of species and habitats. It is an offence to deliberately disturb cetaceans in such a way as to be likely significantly to affect (i) the ability of any significant group of cetaceans to survive, breed, or rear or nurture their young; or (ii) the local distribution or abundance of a cetacean species. The terms 'significant group' and 'local' are interpreted by the UK in the context of the objectives of the HD, i.e. relative to maintaining and restoring populations of species at favourable conservation status in their natural range. Guidance has been developed on species- and activity-specific criteria to be considered when assessing the likelihood of committing an offence, so that both developers and regulatory authorities can focus mitigation measures where most needed. For each

species, the best population estimate and density available for the area affected by the potential cause of disturbance should be used to estimate the fraction of the population likely to become exposed. Additionally, assessment of the risk that a significant group of animals could become displaced from essential habitat should be made. Best available information should be used and reasonable caution applied when there is greater uncertainty about the species conservation status and the impact of the activity. The guidance will be reviewed as new information on cetacean populations and potential sources of disturbance are published so that risk assessments can be improved.

CM30 INTERFACING SCIENCE AND EDUCATION FOR A BETTER MANAGEMENT OF COASTAL AND OCEAN ACOUSTIC BUDGET

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Defining and controlling the impact of acoustic pollution, without impeding on the advances of human activities, constitutes a scientific challenge and carries an important responsibility to society. Ocean noise has always existed, both in natural and biological forms. Without any doubt, due to its recent and uncontrolled character, the massive introduction of artificial sound sources at a large scale has become a threat to its balance, more important than any other pollution found in the marine environment. Cetaceans, as top predators of the food chain, have evolved for millions of years on their acoustic perception of the environment and can be considered as bio-indicators of the acoustic balance in the oceans. While knowledge is necessary to take durable management decisions, the public concern on the effects of noise on cetaceans is very recent and still scarce. Here, we present an initiative that offers the general public an open access to scientific data, a new way to learn and listen to how noise has evolved in the last hundred of years in the oceans. Through an interactive application, the visitor can experience why underwater noise interactions must be addressed at society levels.

**CM31 PATTERNS AND MANAGEMENT ISSUES OF MARINE
MEGAFUNA BYCATCH IN THE WESTERN INDIAN OCEAN**

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Bycatch is defined by FAO as “part of a fishing unit taken incidentally, in addition to the target species towards which fishing effort is directed”. This is a major issue in many areas throughout the world, as many species have been severely depleted, especially taxa such as sharks, marine mammals and turtles. Catch of non-target species in fishing gears is known to occur throughout the Western Indian Ocean (WIO) region, both in coastal and pelagic ecosystems. However, few studies have been conducted on fisheries bycatch in any of the major fishing gears including long lines, purse seines, trawlers and gillnets and few mitigation measures are being implemented. This paper presents an overview of the bycatch problem in the western tropical Indian Ocean. It: 1- reviews the level of threat from fisheries, both coastal and pelagic; 2- discusses common issues relating to bycatch; and 3- discusses and resolves common issues relating to data collection and analysis. While turtles, dugongs, cetaceans and sharks are all impacted by fishing activities in the WIO region, the highest immediate priority is the dugong which is severely threatened from gillnetting. In view of heightened concern for the dugong from this fishery, a rapid regional assessment of the gillnet fishery is being launched. Recommendations include urgent fisheries-bycatch research and management measures, fund-raising and regional and international collaboration. In addition, practical ways to reduce bycatch are identified, including convincing decision-makers about the importance of reducing endangered species bycatch due to their economic value as tourist revenue earners.

**CM32 CHARACTERIZATION OF WHALE-WATCHING ACTIVITY IN
MADEIRA ARCHIPELAGO (SE NORTH ATLANTIC), PORTUGAL**

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Whale-watching is a form of ecotourism that has grown in recent years throughout the world, involving more than 1 billion American dollars and 9 million tourists annually. In Madeira archipelago there are no precise values of the number of tourists involved in whale-watching, but it is estimated that around 50 thousand people participate in this activity every year, which is mainly done in an opportunistic manner. Madeira is the only region of Portugal without a legislation to regulate whale-watching, existing only a voluntary code of conduct proposed by Madeira Whale Museum. For the characterization of this activity observations were carried-out from land and from whale-watching vessels from January to September 2007. The vessels' characteristics, their areas of operation and the number of people onboard were compiled and inquiries were conducted to evaluate the environmental conscience of tourists. Seasonal occurrences of cetaceans during the study period were described. There are 9 vessels operating in the south coast of the island with very variable characteristics, such as size, motor capacity and velocity. Estimates indicate that around 58 thousand tourists per year partake in this activity, involving 1.5 million euros. Most of the vessels displayed information onboard regarding cetaceans and complied with the code of conduct proposed. Tourists showed very little perception about the impacts of this activity on the animals, and thus turning the environmental education into a very important aspect that needs to be implemented. From the 28 cetacean species given for this archipelago, 8 were sighted during the study, being the short beaked common dolphin and Bryde's whale the most common. With the continued increase of whale-watching activity in this region, there is a dire need of research and management strategies in order to make this a sustainable industry.

CM33 'DÉJÀ VU', CAN PAST FISHERIES POLICIES AND NEW CONSERVATION TECHNIQUES INFORM THE IMMINENT CONFLICT BETWEEN FISHERMEN AND BOTTLENOSE DOLPHINS IN CROATIA

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Fishery interaction is recognized worldwide as a primary threat to cetacean populations. Historical data from the 19th and 20th centuries reveals that Adriatic dolphins were once slaughtered due to their competition with the pelagic fishery. It seems that the common dolphin (*Delphinus delphinus*) was most often the target of the culling which was one of the contributing factors for their gradual extinction in the Adriatic. The only remaining autochthonous cetacean species in the Croatian Adriatic today is the

bottlenose dolphin (*Tursiops truncatus*), which survived the culling campaign due to its preference for benthic fish species. In 1965 the culling campaign ended and by 1995 all cetaceans were protected under national law. Recent data collected on the behaviour and stomach contents of bottlenose dolphins in the North-eastern Adriatic Sea suggest that feeding habits of bottlenose dolphins have shifted from benthic fish to the recovered pelagic stocks. Surface feeding behaviour has increased in the behavioural budget of this population from 0.3% (1987-1994) to 3.0% recorded during 2006 and 2007. Stomach content analysis of 7 stranded animals has revealed that the most important prey is the pelagic species horse mackerel (*Trachurus* spp.) while the cause of death of 3 animals, due to barotraumas, was most likely related to illegal use of explosives in pelagic fisheries. In Addition, the Croatian Government has started to support development of the pelagic fishery with the planned construction of 30 new vessels by 2009. Once again state sponsored fishery development is leading to a position where the only remaining cetacean species in the Croatian Adriatic will be under direct threat. We argue that the development of the Lošinj Dolphin Reserve may provide the opportunity to mitigate fatal interactions at least in a small part of the Croatian Adriatic.

CM34 ACOUSTIC MONITORING OF SMALL CETACEANS ON THE WEST COAST OF IRELAND

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Visual and Acoustic monitoring has been ongoing in Galway and Clew Bays on the west coast of Ireland since 2005 as part of a Ph.D project, funded by the National Parks and Wildlife Service. Fieldwork in these two areas was aimed to assess the potential of both bays for future SAC designation for Annex II species, bottlenose dolphin and harbour porpoise. It was envisaged that the use of acoustics would greatly contribute to our knowledge on the presence of Annex II species in these areas, as the west coast of Ireland is an exposed area, and the amount of days that favours landbased observations are few. T-PODs were first deployed in Galway Bay in June 2006, while in Clew Bay they were first deployed in April 2006. Acoustic monitoring at both sites continued until September 2007. Acoustic data was analysed in order to explore the effect of seasonal changes, as well as the effect of tidal and diel cycles on the presence of cetaceans in these areas. Data was also extracted to generate a mean detection function per hour from each site, this was expressed as the mean detection positive minutes logged per hour (DPM/h-1). This acted as an acoustic index, which could be used to compare acoustic activity between sites. This was

especially useful when comparing acoustic indices from cSAC's with areas currently been assessed for future designation.

CM35 WILL THE MEDITERRANEAN MONK SEAL (MONACHUS MONACHUS HERMANN, 1779) IN THE NORTHEASTERN MEDITERRANEAN BECOME EXTINCT IN THE FUTURE?

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The northeastern Mediterranean coast of Turkey is one of the last remaining refuges where the critically endangered Mediterranean monk seal still survives and reproduces. The monk seal colony in this area has been closely monitored since 1994. In this study, the vital parameters of the monk seal colony, obtained since 1994, were evaluated using population viability analysis to estimate the risk of further decline of this species in the northeastern Mediterranean, and their expected chances of recovery. The three main questions to be answered were: i) what are the positive and negative implications of conservation measures applied in the area on the colony's demography? ii) What are the potential risks awaiting the colony in the future? iii) Is there a need to change or revise the existing conservation strategy? To answer these questions, demographic changes in the colony were evaluated by comparing the effect of Marine Protected Area established in 1999 as pre-conservation and post-conservation phases. Results indicated that existing conservation strategies certainly have a positive effect on the colony's demography. However, a considerable risk for the future of the colony remains. The fish stocks, which constitute the food resource of seals, were depleted as a consequence of heavy fishing pressure. It is known that limited food resource is directly related to mortality rate observed during the early life stages of the seals. As a result of limited food resources, the seals are attracted to fish trapped in nets thereby increasing the risk of entanglement in a fishing net. The analysis results showed that high mortality rates in the early life stages creates high risk for the presence and future survival of the colony. Therefore, efforts to reduce such early mortality must be the major priority of all conservation strategies aimed towards the monk seal population.

CM36 HARBOUR PORPOISES (PHOCOENA PHOCOENA) AND FISHERIES IN THE DUTCH NORTH SEA

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A study was carried out into the interaction between harbour porpoises (*Phocoena phocoena*) and fisheries in Dutch waters. The population biology of porpoises in the Dutch North Sea was investigated, stranding and necropsy data were analysed and a survey was sent to all professional fishermen. Estimates of the number of porpoises in the Dutch North Sea vary between ten thousand to over twenty thousand animals. There is a high seasonal variation in abundance with most porpoises being present in spring. The number of porpoises has increased over the last decade. This increase is thought to be due to a shift in abundance rather than a natural growth of the population. Stranding data for porpoises have been recorded since 1982 by the Seal Rehabilitation and Research Centre in Pieterburen. Necropsy reports of more than 225 porpoises were analysed and three main causes of death were identified. These were pneumonia, emaciation and by-catch. Animals classified as by-catch were found over the entire research period (1982-2006) and along the entire Dutch coast. However, by-catch was most often seen during the December-April period. On average 10-20% of the animals were deemed to be the victims of accidental by-catch. A survey was sent to all Dutch fishermen (n=721); one third of which responded. This survey supplied data on the fishing activities, observations of porpoises and interactions with porpoises. The total by-catch of the whole Dutch fleet was calculated to be 15 individuals per year. By-catch rates differed for each type of fishery and also depended on the fish species being targeted. The fishermen made useful suggestions on how to reduce the problem of by-catch. The scale of by-catch as determined by the survey was consistent with the results of the pathology and population studies.

CM37 IMPROVE THE REPRESENTATIVENESS OF MARINE MAMMALS STRANDINGS DATA: DETERMINE THE DRIFT AND DISCOVERY RATES OF THE DEAD SMALL CETACEANS ALONG THE FRENCH COAST

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Stranding of marine mammals is an important source of information on the state of conservation of cetacean populations. Nevertheless, sampling these data remains mostly opportunistic. A stranding is an event which starts with the death of an animal and includes its drift, its stranding and its discovery. The number of animals which die at sea and is likely to get stranded depends on two parameters: the abundance and mortality rate of the population. Drift rate was set as a ratio of the surface of ocean sampled by the drift compared to the total studied area. The number of animals discovered compared to the number of stranded animals was called the discovery rate. The aim of this study was to determine these rates in order to improve the representativeness of strandings data. The use of MOTHY model developed by Météo-France, made it possible to simulate the drift of marked dead animals, and thus to estimate their discovery rate at 11%, highlighting the fact that only a small proportion of dead animals is actually reported.. The analysis of drifts simulated on the whole French Atlantic coast allowed us to determine drift rate. It appears that drift rate variability only explains a small part of strandings variability. The biological component of stranding is therefore of greater importance than drift conditions. This suggests that the increased number of strandings observed in winter is mostly explained by an increase in the number of dead animals in the area (a combination of animal density in the area and mortality rate). Lastly, geographical variations in observed stranding locations related to changes in the distribution of the population and/or in the distribution of mortality. It appeared that modelling the drift of the carcasses is a very promising perspective in the improvement of the monitoring value of stranding data.

CM38 CETACEANS AND HUMAN MARITIME ACTIVITIES IN SAO TOME AND PRINCIPE ARCHIPELAGO, GULF OF GUINEA: HISTORICAL REVIEW, PRESENT STATUS AND FUTURE APPROACHES

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The Atlantic equatorial archipelago of Sao Tome and Principe seems to be an important area of cetaceans' concentration and has been reported as a possible breeding ground of humpback whales since the 19th/20th centuries whaling period. Our objective was to study cetacean's occurrence as well as to identify past and present human maritime activities that may conflict with whale and dolphin's conservation. We conduct a biological research simultaneously with an exhaustive historical bibliographic review. The results from our boat-based surveys, between 2002 and 2006, showed the occurrence of six cetacean species: *Globicephala* spp.; *Megaptera novaeangliae*; *Orcinus orca*; *Physeter macrocephalus*; *Stenella attenuata* and *Tursiops truncatus*. We mapped sighted species' occurrence in order to understand their geographical distribution and observed particular areas of cetaceans' concentration, particularly for the humpback whales occurring in the southern part of the Island and the pan-tropical spotted dolphins occurring mostly in the northeast part. We also documented five human activities with, direct or indirect, impacts on cetaceans occurring in the area: (1) whaling and by-catches; (2) fishing; (3) tourism; (4) debris and pollution; (5) oil exploration. Regarding the legislation of human activities on the marine environment we found several 20th century laws, especially in relation to whaling. From a total of eleven different laws, six were whaling related and the others associated to general environment protection. There is not any legislation regarding marine mammals' protection and is important to enhance that a significant nature tourism and whale watching industry is beginning. Also, an international influence is presently taking place so the local government assumes a new pro-whaling attitude. Scientific research, environmental education plans and whale watching programs should totally replace any whaling activity and is critical to move towards the creation of a

specific legal background to the conservation of cetaceans based on scientific results.

CM39 UK FAVOURABLE CONSERVATION STATUS REPORTS FOR MARINE MAMMALS

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In 2007, all Member States were required to report to the EC on the Favourable Conservation Status (FCS) of all species and habitats listed under the Habitats Directive. This was the first time FCS has been assessed since the inception of the Habitats Directive in 1992. The UK provided reports on 2 seal species and 11 cetaceans frequently occurring in its waters. The status of each species' natural range, population, habitat and future prospects was assessed against the baseline year of 1994 (year the directive came into force in the UK). Grey seals, harbour porpoises, bottlenose dolphin, white-beaked dolphin, minke whale and fin whale utilising UK waters were all considered to be in a favourable conservation status. There was insufficient information to make a judgement on the status of sperm whale, killer whale, long-finned pilot whale, Atlantic white-sided dolphin, short-beaked common dolphin, and Risso's dolphin. In contrast, the common seal was considered to be in an unfavourable (inadequate) status. There has been an apparent large decline in numbers in populations adjacent to the North Sea. At colonies around The Wash, this can be attributed to Phocine Distemper Virus (PDV) but other factors are involved at colonies in Scotland, where few seals were exposed to the virus. Range and habitat were found to be difficult parameters to define and assess for marine mammals since these are highly mobile species and their distribution can vary considerably in time and space and influenced by natural and anthropogenic factors. For most species a transboundary European-wide approach was adopted, an approach that should be encouraged for the next reporting round (in 2013) for all Member States.

CM41 STRANDINGS IN ALCOBAÇA BEACHES: FROM BIODIVERSITY TO RESEARCH

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The City Council of Alcobaça has an ancient background of standings, despite the non-existence of details. By the time the municipal veterinary and the municipal biologist initiated their work, they became aware that animals were collected from the municipal beaches straight into the intermunicipal embankment. In this context, in March 2004, a different procedure was implemented. Here the detailed biometry, the identification of species, sex, body condition registration, and necropsy (when the body condition made it possible) became compulsory practices in case of municipal standings. Thus, since March 2004, a database, is being elaborated. This work is developed with incredibly scarce material and means, and institutional and governmental supports are totally inexistent. The current database consists of 38 occurrences of 7 Cetacea species: considering the short 18 km of coast and taking into account that a large part of it is inaccessible and uninhabited, these figures might be underestimated. With the data collected in the last 3 years and a half, a training course entitled: "Cetacea: From Biodiversity to Research" has been submitted for accreditation to the Order of Biologists. The collected data justifies environmental education training in the municipal choices, especially for pupils who participate in the Coastwatch Europe program: the diffusion of this technical-scientific knowledge and the creation of resources, which disclose information, are quite important, since during the 3 years of contact with pupils from the 60 local schools it became clear that this topic was highly ignored.

CM42 ATTEMPT TO RESCUE A PYGMY SPERM WHALE (KOGIA BREVICEPS) STRANDED LIVE IN MADEIRA ISLAND

RIBEIRO, CLÁUDIA, ALVES, FILIPE, NICOLAU, CÁTIA AND FREITAS, LUÍS

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The biology, ecology and distribution of the pygmy sperm whale (*Kogia breviceps*) remain a mystery to scientists. Observations at sea are rare, as these animals do not approach vessels and are difficult to detect at the

surface. However, live strandings of pygmy sperm whales are common, providing an opportunity to collect information. Rescue and rehabilitation of pygmy sperm whales have been reported in the literature as an exceedingly difficult task. Here we report an attempt to rescue an adult female of pygmy sperm whale that stranded live on Madeira Island (SE North Atlantic). On August 3rd 2007, whale-watching operators reported the presence of a pygmy sperm whale with difficulties in diving and maintaining stability/buoyancy problems, 5.5 nm off the South coast. On the next day, the Madeira Whale Museum team was informed that a cetacean had stranded alive on a rocky shore near Funchal harbour, which was likely to be the same whale observed the day before given both events proximity. Several skin lesions were observed on the whale, which resulted from the injuries inflicted by the rocks. During the rescue attempt, behavioural aspects and breath cycles were registered and several times the animal was guided to avoid the shore. The animal did not react to human proximity/contact, displaying regular breathing pattern and normal posture in the water. While on land members of the team were preparing the facilities to accommodate animal, the others accompanied the animal (snorklers and from a boat at short distance) for seven hours. In the last one and half hours it started to get more active, moving slightly faster, intending to swim and attempting to dive. In an unexpected behaviour the whale dove and disappeared. For the next 40 minutes, the team continued to search the area but the whale was never seen again.

CM43 BEHAVIOURAL ANALYSIS OF THE WHALE WATCHING INDUSTRY IN THE STRAIT OF GIBRALTAR (SPAIN)

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The whale watching industry in the Iberian Peninsula (Spain) commenced during the end of the 90's in Tarifa, washed by the Strait of Gibraltar waters. This flourishing sector, which forms part of the so-called ecotourism, has increased for the last years peaking at 25000 tourists during the months of July and August 2007. At present, the regulation controlling approximation manoeuvres of vessels operating in Iberian Peninsula waters is non-existent, however a project has been developed which will shortly become operative. The objective of the following study is to determine whether the approximation manoeuvres of the whale watching vessels operating in the Strait of Gibraltar and the Bay of Algeciras are being carried out correctly, trying to minimise the negative impact towards the animals. In order to do this, good and bad approximation conduct indicators were defined based on

different international regulations, and 163 whale watching conducts for the four companies operating in the area were analysed during the summer months. From the analysis of these results we can conclude that the whale watching companies and organisations perform incorrect approximation manoeuvres 46% of the cases, emphasizing when vessels cut the animals way and during the approximation to the animals and when leaving the groups, where the manoeuvres were very brusque. In the same manner, the behavioural changes experimented by the cetaceans in direct relation to the vessel approximation manoeuvres were studied, observing an increase in behavioural change when incorrect approximation manoeuvres were fulfilled, specially when looking at behavioural changes of pilot whales, the species with the highest sighting percentage. The objective of the following study is to determine whether the approximation manoeuvres of the whale watching vessels operating in the Strait of Gibraltar and the Bay of Algeciras are being carried out correctly, trying to minimise the negative impact towards the animals. In order to do this, good and bad approximation conduct indicators were defined based on different international regulations, and 163 whale watching conducts for the four companies operating in the area were analysed during the summer months. From the analysis of these results we can conclude that the whale watching companies and organisations perform incorrect approximation manoeuvres 46% of the cases, emphasizing when vessels cut the animals way and during the approximation to the animals and when leaving the groups, where the manoeuvres were very brusque. In the same manner, the behavioural changes experimented by the cetaceans in direct relation to the vessel approximation manoeuvres were studied, observing an increase in behavioural change when incorrect approximation manoeuvres were fulfilled, specially when looking at behavioural changes of pilot whales, the species with the highest sighting percentage.

CM44 NEW INFORMATION ON DOLPHIN STUDIES IN WATERS OF THE PARQUE NACIONAL DEL ESTE, DOMINICAN REPUBLIC

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Populations of common bottlenose dolphins and Atlantic spotted dolphins exist in the coastal waters of the Parque Nacional del Este (Eastern National Park), in the southeastern waters of the Dominican Republic. Between February 2007 and November 2007, systematic surveys (7 surveys/month) were conducted, using random transect lines and stations within an area of

163.2 nm². Environmental parameters were also recorded, including measurements of surface current (from 15 to 35 cm/sec) and tidal state, to investigate their influence on the dolphin population. A total of 51 surveys were conducted over a period of 370h 52min, covering 1657.1 nm of transect lines. Data collected so far suggests: (a) that bottlenose dolphins travel along a predictable route, travelling southeasterly in the mornings and returning northwesterly in the afternoons; and (b) dolphin sighting density is especially high near in the western waters of Saona Island. In addition to these surveys, the current project has an educational and sustainable development component. To aid in the development of sustainable dolphin-watching 2 workshops, 2 training courses and a series of talks have been held in the area. Moreover, 38 students have received training courses on cetacean conservation and the importance of the Parque Nacional del Este as a natural resource. There is also strong community involvement with the project: local community members participate in surveys and events as volunteers, provide valuable logistical assistance, and there is also a network of volunteers that report whale and dolphin sightings to the project.

CM45 THE USE OF MOLECULAR MARKERS FOR DETECTING PRESSURE OF INCIDENTAL CAPTURES OF SMALL CETACEANS IN NORTHERN BRAZILIAN COAST

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Large numbers of small cetaceans are incidentally captured in gillnets set off northern Brazil. A recent monitoring program has been established for collecting data on cetacean and fisheries interaction in the coast of Pará. So far, only two genera were identified to interact with fisheries, *Sotalia* spp. and *Inia geoffrensis*. Data from six surveys showed only one *I. geoffrensis* specimen in contrast to 62 *Sotalia*. In view of the strict freshwater habitat of

Inia as well as the presence and the controversial distribution of two Sotalia species in the northern Brazilian coast, *S. guianensis* (marine ecotype) and *S. fluviatilis* (freshwater ecotype), we carried out a molecular identification of Sotalia specimens. Cytochrome b gene and the mitochondrial D-Loop region sequenced in 11 incidentally captured specimens of Sotalia indicated that they were *S. guianensis*. Our findings suggested that Inia is capable of occupying the estuarine environment, which were supported by regular observations in the northern coast of Brazil. Conversely, the freshwater ecotype of Sotalia, to the present, was not found in estuarine habitats. Further investigation for clarifying the origin of 31 dolphin souvenir samples on sale in Belém (Pará state) and Manaus (Amazon state) indicated that they also belonged to *S. guianensis*. This scenario characterized the extensive trade net associated to incidental captures of *S. guianensis* along the northern coast of Brazil. In conclusion, our data showed that *S. guianensis* is under a stronger capture pressure than *S. fluviatilis* and *I. geoffrensis*. A long term monitoring program is under consideration, for investigating the consequences of incidental captures in the genetic diversity of Sotalia populations in northern Brazil. This work was sponsored by Projeto Piatam Oceano – Petrobras.

CM46 THE LADOGA RINGED SEAL (*PUSA HISPIDA LADOGENSIS*) AS A SPECIES – INDICATOR OF THE INFLUENCE OF GLOBAL WARMING ON THE WILD POPULATIONS OF THE MARINE MAMMALS

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The Lake Ladoga ringed seal is a discrete population of ringed seal (*Phoca hispida ladogenic*), a seal species with a circumpolar distribution, that breeds on the ice of Lake Ladoga in the Karelia region of Russia. The ringed seal has been recently chosen as a bio-marker species for detection of climatic changes in the Arctic (Marine Mammal Commission, Valencia workshop proceedings, March 4-9 2007). Its relative abundance and circumpolar distribution make it possible to develop monitoring programs that utilize adequate numbers of animals to detect changes during life history and

health parameters. During the expedition of summer 2007 the islands of the Valaam archipelago have been surveyed. As a result of the conducted works bedding places frequently visited by the Ladoga seal during the ice-free period have been found. Also we received data on the approximate number of the seals in the rookeries in August. According to the general estimation in the vicinity of the Valaam Archipelago in August 2007 there were about 100 seals. A rather fresh corpse of the Ladoga seal was cast ashore. It was male. Its age was approximately 6 – 10 years (adult). The opening of the corpse of the Ladoga seal has been made. It was observed that full disintegration of all parenchymatous organs (a liver, a spleen, a pancreas, the nephros) occurred in the abdominal cavities. All parts of the intestine showed signs of hyperemia and were filled with gases, the stomach was empty. In addition to that the sternal cavity contained water (approximately 50 - 100 ml) with traces of blood, little isolated areas of the crupous pneumonias were noted in the right and left lungs, the heart was full of blood, it showed signs of hyperemia, the walls of the heart were thickened, the vessels of the heart were dilated. Moreover the sampling of the tissue pieces from six dead seals for the genetic analysis was made.

CM48 WHAT IS THE PRICE OF A PILOT WHALE IN THE STRAIT OF GIBRALTAR?

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A clan of approximately 216 pilot whale individuals inhabits the Strait of Gibraltar. Pilot whales are seen all the year around representing the main target of the whale watching activity in the area. They have a survival rate of 0.982, so their life span will be of approximately 56 years. Since 1996 whale watching activities have been developed around this species in the Strait with for 31% of the sightings, and 40% of the total vessel observation time. A total of 7 boats are running the activity between the months of March to November, generating a total of around 3 million Euro of direct income during the year 2006. In this poster we analyse the economic potential of the pilot whales of the Strait of Gibraltar. Approximately 5 550 Euro would be generated annually per individual. Hence, each pilot whale could generate a total of around 310 000 Euro during their life, giving an economic potential of around 67 000 000 Euro for the whole pilot whale population of the Strait of Gibraltar, if the activities direct economic income remains stable during the following years. This approach could be used to highlight the economic value of whales towards competent administrations. The resource (pilot whale) has a balanced equilibrium (high survival rate and continuous

respectful whale watching), and conservation measures have to be taken into account in order to protect the high economic value of the cetaceans inhabiting the Strait of Gibraltar.



ECOLOGY

E01 HABITAT PREFERENCES AND DISTRIBUTION OF BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) IN CARDIGAN BAY, WALES

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In 1992 the bottlenose dolphin (*Tursiops truncatus*) was afforded special protection under the Annex II of the EU's Habitats and Species Directive. As a result, two Special Areas of Conservation (SACs) were designated in Cardigan Bay, Wales, to contribute to maintaining favourable conservation status of the species: the Cardigan Bay SAC and the Pen Llyn a'r Sarnau SAC. Data were collected from line-transect and ad-libitum boat surveys for a total of 44.691 km travelled in good sighting conditions in Cardigan Bay during the 2001-07 period. The information on boat effort and bottlenose dolphin sightings was analysed on a vector format with the software ArcGIS 9.1. Raster spatial interpolations were also carried out to predict continued surfaces. The study area was divided into cells of 2'x2' in order to calculate the encounter rates and to relate the dolphin presence to environmental parameters such as water depth, bottom slope, distance from the coast and substrate type. The known range of dolphins was estimated according to the Kernel home range probabilistic technique. Bottlenose dolphins appeared to be non-randomly distributed, and to prefer particular areas within the bay. Generally, sandy substrate along with a mixture of pebbles and cobbles and slope less than 0.6% appeared to drive their distribution. Over the studied period the dolphins' home range and habitat preference has expanded beyond near shore areas (0-5km from coast and 5-10 meters depth) to deeper and farer areas (20-25 m depth and 15-20 km from coast). According to previous studies that reflect the same results, animals may need to search extensively for food in areas with scarce food supply. Therefore, it is recommended to complement this study with an analysis of the influence

that the movement and abundance of prey species may have on their distribution.

E02 THE IMPACT OF SEA ICE DYNAMICS ON MINKE AND HUMPBACK WHALE DENSITY DISTRIBUTIONS IN THE SOUTHERN OCEAN

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Baleen whales predominantly feed on krill in the Southern Ocean. Krill distribution and abundance is dependent on sea ice related variables, such as sea ice extent and duration, but the impact of sea ice dynamics on baleen whale distribution is poorly understood. This study explores the various relationships between distance from the sea ice edge and baleen whale density distribution by means of a circumpolar spatial analysis. For almost 30 years, the International Whaling Commission (IWC) has conducted whale surveys in the Southern Ocean during austral summer months under the IWC/IDCR-SOWER programme. This has resulted in three circumpolar sets of surveys, with over 21,000 and 2,000 sightings for Antarctic minke whales and humpback whales, respectively. We used these sightings in spatial models of line transect data based on generalised additive models (GAMs). The GAMs assumed an overdispersed Poisson error structure and log-link. Model selection was based on best model fit and maximisation of explained deviance. The GAMs were fitted independently by survey year. For example, GAMs were selected for a region within the Indian sector of the Southern Ocean based on 1984/85, 1988/89 and 1998/98 surveys. Selected GAMs for this part of the Southern Ocean included combinations of the following covariates: closest distance of sighting to sea ice edge, closest distance of sighting to the Southern Antarctic Circumpolar Current Front (SACCF), bathymetric depth, Optimally Interpolated Sea Surface Temperature (OISST) and latitude. Best models had explained deviances of 56.6-75.2% and 43.3-69.0% for humpback and Antarctic minke whales, respectively. The spatial models suggested that humpback whale densities are higher at small to moderate distances from the sea ice edge. However, Antarctic minke whale densities did not show a consistent relationship with distance from the sea ice edge over the years, suggesting heterogeneity in distribution for this region.

E04 HABITAT USE AND SELECTION BY BOTTLENOSE DOLPHIN IN FILICUDI ISLAND (ITALY)

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We examined environmental/behavioural determinants of the habitat use of bottlenose dolphin in Filicudi island (Italy). Data on 76 sightings were collected during 129 boat surveys over three summer periods (June-September, 2005-2007). Instantaneous, focal group and ad libitum sampling methods were used to assess dolphin behaviour. Location of fishing nets/boats, group size, and habitat submarine characteristics were recorded. Encounter rates were calculated for 98 monitored squares (1Km² each). Spatial differences in habitat use were identified by Principal Component Analysis (PCA) using the SAS software. Slope and bottom variability were found to be strongly correlated to encounter rate. We also evaluated if this distribution pattern was related to natural or fishing-related foraging. Mixed feed-travel activities were found to be correlated to slope and bottom variability. Feeding was observed in association with fishing nets/boats. To quantify habitat preferences, the area was divided in spatial classes. Using χ^2 statistics we found that habitat use in different classes was not homogeneous. A positive selection for the shallow-water of the "Banco" area was observed. Habitat selection in many classes was related to net abundance, but only in one class it was related to a decrease in group size, that seems to increase with distance from the coast. An increased group size was also associated to social/rest behaviour in off-shore water, by cluster analysis. These results quantitatively support the hypothesis that two distinctive distribution patterns are related to foraging: opportunities in coastal waters due to the presence of nets and optimal submarine habitat characteristics, and only in the second case over-exploitation may generate a group size reduction.

E05 ESTIMATING THE POTENTIAL IMPACT OF KILLER WHALE PREDATION ON SHETLAND HARBOUR SEALS

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Harbor seal *Phoca vitulina* populations around the UK have undergone widespread declines; these have been most dramatic in Orkney and Shetland. The causes of these declines are unknown, but one potential driver is an increase in predation. Killer whales *Orcinus orca* are frequently sighted around Shetland during the summer months and predate on harbor seals in nearshore waters. Here we use opportunistic sightings data to investigate the potential for killer whale predation on harbor seals to be a driver of declines around Shetland. There was a strong peak in sightings during June-July (1991-2006) coinciding with the harbor seal pupping season. Our median estimates of harbor seals consumed over the past decade (1997-2006) were 1,648 if killer whales show no preference in seal age/sex classes and 3,829 if killer whales specialized on predating naïve harbor seal pups. Killer whale predation could therefore be a potential factor in harbor seal declines around Shetland and deserves further investigation.

E06 DIFFERENCES IN BEHAVIOUR AND ABUNDANCE BETWEEN MINKE WHALES (*BALAENOPTERA ACUTOROSTRATA*) FORAGING ANTARCTIC KRILL (*E. SUPERBA*) AND ICE KRILL (*E. CRYSTALLOROPHIAS*) IN ROSS SEA, ANTARCTICA

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Studies on krill-eating predators (Minke whales, seals and penguins) were conducted during four expeditions (1994-95, 1997-98, 1999-2000, 2003-04) to evaluate their distribution, abundance and behaviour in relation to the two krill species that inhabit the Ross Sea: Antarctic krill and Ice krill. Isolated individuals of Minke whales were found in inshore regions, where Ice krill occurred much more frequently than Antarctic krill, but at low density (< 10 g/m²). These are the typical foraging areas of penguins. In contrast, herds of Minke whales (ranging from 2 to 5 individuals per km²), in cooperative behaviour, were found together with seals in offshore regions, where only Antarctic krill occurred, occasionally but in large (2-3 km) and dense (> 100 g/m²) aggregations. In the offshore Minke whale foraging areas Antarctic krill was large (> 42 mm) and close to surface (from 10 to 80 m). In the inshore foraging areas krill tended to be at deeper range (from 50 to 150 m) with occasional occurrences of juveniles of both species. Thus the abundance and behaviour of Minke whales and the type of associated krill-

eating predator foraging in Antarctic krill and Ice krill areas were totally different.

E07 THE ROLE OF BOTTLENOSE DOLPHINS IN A COSTAL ECOSYSTEM ASSESSED USING MASS-BALANCED MODELS

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Bottlenose dolphins are top predators in many marine ecosystems. However, so far their role is only poorly understood; it is thought that due to their body size and abundance they have an influence on the structure and function of the ecosystems. The complexity of ecosystems makes it difficult to assess process and events occurring within it difficult to assess based solely on observations. Ecosystem based modelling offers an alternative option by combining the information available for single species and combining them to form a food web representation of the ecosystem, which allows for analysis of processes and function of the ecosystem. This study used two of these ecosystem models to assess the role of bottlenose dolphins in a costal marine ecosystem, which is influenced by human activities (marine aquaculture), with the help of the Ecopath with Ecosim (EwE) software. The first model represents the study area in its present state and the second model represents the area in absence of bottlenose dolphins. The two models were analyzed and compared with each other to assess the structure of the ecosystem and the role of the bottlenose dolphins within it. The results of the study showed that the bottlenose dolphins are important in the structure and function of the ecosystem. The bottlenose dolphins were also found to be of importance in maintaining the ecosystem stability and reducing the impact that aquaculture has on the ecosystem. The models constructed in the study may be used for future studies to assess implications of management decisions and may aid the conservation of the bottlenose dolphin species.

E08 HAVE HARBOUR PORPOISE (PHOCOENA PHOCOENA) SHIFTED DISTRIBUTION AS A RESULT OF BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) RANGE EXPANSION?

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The harbour porpoise is the most frequently recorded cetacean in British waters with sightings along the east coast of Scotland being particularly common. The resident bottlenose dolphin population, originally thought to be restricted to within the Moray Firth, northeast Scotland, has been shown in recent years to have extended its range to include coastal waters further south, with regular sightings now being recorded from Aberdeen and St Andrews Bay. Given the violent interactions known to occur between the two species, the question was raised – has harbour porpoise distribution south of the Moray Firth changed as a result of the dolphin range expansion? Boat surveys were conducted between Stonehaven and Aberdeen during the period 2002 to 2005, to record the presence and distribution of both species in coastal waters. Data were input into ArcView 3.1, and mixed convex polygons (MCPs) and fixed kernels utilised to examine the distribution of both species within the survey area and to look for changes in distribution over time. Both species were found to have similar distributions, with the harbour porpoise distribution reaching slightly further offshore. A 40% kernel was used to define core areas of distribution. The location of the bottlenose dolphin core area varied slightly over time but was generally in the coastal areas around Stonehaven. The core area for the harbour porpoise was consistently found to be just south of Aberdeen for all years apart from the final year of the study, when it shifted further south. While the original distribution of harbour porpoise prior to the dolphin range expansion has not been established, a shift in harbour porpoise distribution, possibly as a result of increased bottlenose dolphin presence in the area, may be occurring. Continued research is required to see if the shift is real and becomes an established pattern.

E09 PRELIMINARY RESULTS OF RELATIONSHIPS OCCURRING BETWEEN HUMPBACK WHALE (MEGAPTERA NOVAEANGLIAE) DIVE TIME RATES AND ENVIRONMENTAL PARAMETERS IN NE ICELAND

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Respiration and diving patterns have been shown to provide useful information about whale behaviour and are considered essential in improving the effectiveness of abundance estimates. A sample of fifty sequences of humpback whales (*Megaptera novaeangliae*) dive time rates were collected during the 2006-2007 research season in Skjálfandi Bay, northeast Iceland. The aim of the study was to investigate significant correlations between these behavioural responses and important

environmental/habitat predictors such as bathymetry and dynamic oceanic features. The dive time rates of cetaceans were collected utilizing a digital recorder (Mikomi ET 812A) and stopwatch (Pro-Athlete). Samples were organized by species and duration classification including true dive times (TDT), e.g. dives lasting longer than one minute. Mean true dives (MTDT) were used for statistical analysis to determine the presence of significant correlations (Pearson's coefficient) and functional relationships (regression analysis) with environmental factors. Results showed a significant correlation between MTDT and depth (Pearson correlation, $p = < 0.0001$) and significant functional relationships (polynomial regression, $p = < 0.0001$) between MTDT and the variables aspect and sea surface temperature. These findings indicate how diving whales respond differently to different environmental conditions both in a linear relationship (depth) and with more complex associations involved. Plausibly the presence of river runoff and plumes may contribute to mechanical structuring of water masses and thus to stratification of the water column leading to an indirect correlation between sea surface temperature and time spent by diving whales. Additional data are needed to increase the sample size of humpback whale dive times as well as to extend the analysis to other species such as minke whales (*Balaenoptera acutorostrata*) and blue whales (*Balaenoptera musculus*). This is essential for more accurate results and for utilization within related research (population abundance estimates) and management (wildlife tourism).

E10 SPATIAL ANALYSES OF CETACEAN DISTRIBUTION OFF THE SOUTH COAST OF PICO (AZORES, PORTUGAL) IN RELATION TO WATER DEPTH AND SLOPE GRADIENT

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Many ecological factors are related to the complex habitat requirements of cetaceans, including presence of prey, water temperature, physiography, oceanography and bathymetry. At the Azores, despite of increasing cetacean research, much of the biology and ecology of 'local less interesting' species remains unexplored. This study examined the spatial distribution of cetaceans in the Bay of Ribeiras (Pico, Azores) between 2003-2006 in relation to the bathymetric variables water depth and slope gradient on a small scale. A minimum of 16 species were observed, of which Risso's

dolphin (*Grampus griseus*) was the most observed species. Short-beaked common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*) and sperm whale (*Physeter macrocephalus*) were also relatively common. Guilds differed in depth- and slope distributions; fish-eaters were found on shallowest depths (mean 862m, SD 189m), followed by Cephalopod-eaters (mean 1096m, SD 217m) and plankton-feeders (mean 1219m, SD 129m). With respect to slope, the reverse pattern was found (fish-eaters: mean 14.2°, SD 2.7°; Cephalopod-eaters: mean 10.6, SD 3.9; plankton-feeders: mean 8.8°, SD 2.7°). During foraging, guilds were not observed on different depths or slopes. Generally, obtained depth distributions at the Azores were in agreement with depth distributions worldwide, but obtained slope distributions were generally higher than reported elsewhere. This study indicated that local bathymetry played a significant role in the presence distribution of Azorean cetaceans. Depth and slope accounted for a substantial part in the explanation of observed variation in distribution. Depth significantly explained between 36.9-93.9% of the variation in distribution, whereas slope gradient explained between 25.4-81.5%. Responses varied between species, in time and between behaviour states. Additionally, the results indicate that the area appears to be an important area, used by many species including rare and threatened species.

E11 CETACEAN DIVERSITY IN NORTH WEST SCOTLAND: AN OCEANOGRAPHIC PERSPECTIVE

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The waters of the west coast of Scotland are oceanographically diverse. The two main influences are the Coastal Current arising from the Clyde and Irish Sea, and Atlantic water moving over the continental shelf north of Ireland. This leads to several distinct regions of oceanographic characteristics. It might be expected that this variation in oceanographic conditions in the area would be reflected in a non-uniformity of cetacean sightings, both in relation to abundance and diversity. Line transect surveys were conducted for five years from research vessel *Silurian* from April to September 2003 to 2007. A mean of 5,200 km survey effort was conducted per season (low 3,100 in 2004, high 8,200 in 2007). Sightings were dominated by eight species of coastal and pelagic cetacean, most of which were seen every year. Both cetacean abundance and species diversity were highest in areas where the

coastal and Atlantic waters are actively mixing, for example near the Small Isles (~25% Atlantic water). The Simpson's Diversity Index (SDI) for this area was 0.898. Diversity was lowest in areas exclusively dominated by the Coastal Current, chiefly in the region of Islay and Jura (SDI = 0.419). In fully mixed waters (>50% Atlantic water), for example around the Outer Hebrides, high species diversity remained (SDI = 0.856). The presence of Atlantic waters (at >25%) was a prerequisite for the occurrence of species such as white-beaked dolphins and common dolphins. Preliminary observations suggest that the degree of water mixing was a stronger indicator of cetacean abundance and diversity than sea surface temperature.

E12 THE INFLUENCE OF TIDAL CYCLE ON THE FINE-SCALE BEHAVIOUR AND GROUP SIZE OF BOTTLENOSE DOLPHINS USING THE OUTER SOUTHERN MORAY FIRTH COASTLINE

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Along the southern coastline of the outer Moray Firth in northeast Scotland (57°41'N, 2°00'W), bottlenose dolphins (*Tursiops truncatus*) exhibit a consistent spatial distribution throughout the summer and autumnal months. Whilst the occurrence of animals is relatively predictable along this coastline, however, their movements and behaviour seem to be highly flexible. Using data collected during dedicated boat surveys between May and October 2001 to 2007, in the present study, the influence of tidal cycle on the behaviour of coastal bottlenoses in this location was investigated. Group activities were classified as travelling, feeding, foraging and resting, accordingly. Travelling (defined as regular surfacing and movement in a uniform direction) was the most commonly observed activity during all encounters (n=146), whereas resting was the least common. The majority of encounters (approx. 75%), however, showed considerable overlap in their activities, and travelling was frequently accompanied by feeding and/or foraging behaviour. Group size (ranging from 1 to 44 animals) was found to be highest in feeding animals, which may reflect cooperative feeding effort, but also during ebb and flood tidal phases when animals engaged in travelling were most frequently recorded. Foraging and feeding activities were more often observed during low and flood water tides, whilst for resting animals slack water periods were most common, when tidal currents were weakest. Consequently, it appears that bottlenose groups in this area exploit local tidal currents, using the direction and velocity of the water flow to maximise their efficiency when travelling, resting, foraging or feeding respectively. Accordingly, this may be particularly significant considering the

high percentage of calves recorded in encountered groups along this coastline, and the evident importance of the southern outer firth region as a summer calving / nursery area for this northern population.

E13 PREDICTIVE HABITAT SUITABILITY MAPPING OF FIN WHALES (BALAENOPTERA PHYLSALUS) AND COMMON DOLPHINS (DELPHINUS DELPHIS) IN THE BAY OF BISCAY.

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Marine spatial planning (MSP) is becoming an important tool in the management of marine resources. To effectively implement MSP strategies managers require suitably detailed maps of the marine environment, including areas of biological importance. It is, however, practically unrealistic to survey large areas of the marine environment. Therefore, new methods are needed to predict and map areas that are 'potentially' important for marine biota. In this study two species of cetacean, the fin whale (*Balaenoptera physalus*) [n = 525] and common dolphin (*Delphinus delphis*) [n = 388], were chosen to test the possible applicability of habitat suitability mapping as a tool to identify biologically important areas. Data were collected during ORCA and Company of Whale surveys across the Bay of Biscay on-board the M.S. Pride of Bilbao between 1998 and 2004. Results of ENFA analysis for *B. physalus* indicate that suitable habitat should occur within the deep-water areas of Biscay from the continental slope margin. Importance of bathymetric parameters were ordered first by depth (Eigen Value = 3.822 Expl. = 0.551 Spec. = 0.551) then slope (Eigen Value = 2.460 Expl. = 0.355 Spec. = 0.906) then aspect (Eigen Value = 0.649 Expl. = 0.094 Spec. = 1.000). In contrast ENFA predicts the most suitable areas for *D. delphis* occur around shallower shelf areas from the continental margin back towards coastal zones. Importance of bathymetric parameters were ordered first by depth (Eigen Value = 2.246 Expl. = 0.415 Spec. = 0.415) then slope (Eigen Value = 1.710 Expl. = 0.316 Spec. = 0.731) then aspect (Eigen Value = 1.455 Expl. = 0.269 Spec. = 1.000). These predictions presented should be tested with other datasets and those areas that are identified as potentially important, being prioritised to receive future survey coverage.

E14 COMPETITION FOR THE RESOURCES BETWEEN PILOT WHALES, BOTTLENOSE DOLPHINS AND SPERM WHALES IN THE STRAIT OF GIBRALTAR

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The spatial distribution of 6 species: short-beaked common dolphins (*Delphinus delphis*), striped dolphins (*Stenella coeruleoalba*), long-finned pilot whales (*Globicephala melas*), bottlenose dolphins (*Tursiops truncatus*), sperm whales (*Physeter macrocephalus*), and killer whales (*Orcinus orca*) was examined with respect to the depth and the slope in the Strait of Gibraltar between 2001 and 2004 using GAMs. These analyses indicate that these species could be ordered into three groups. A first group, with a northward tendency is composed by common and striped dolphins. This group is likely to be feeding on mesopelagic fishes or squids associated with the surface Atlantic waters. The second group, constituted by bottlenose dolphins, long-finned pilot whales and sperm whales is mainly found over the deep waters of the central part of the Strait, and would share the same habitat. The third group, formed by killer whales (*Orcinus orca*) was associated with bluefin tuna (*Thunnus thynnus*) fisheries. Nitrogen (^{15}N) and carbon (^{13}C) stable isotopes were used, to denote the position of the species of the second group within the food web, to trace the origin of trophic resources exploited by them and then to look at possible competition for the resources. Bottlenose dolphins ($n=21$, $\delta^{15}\text{N}= 13.42$ SD= 0.89, $\delta^{13}\text{C}=-16.02$, SD=0.62) and sperm whales ($n=4$, $\delta^{15}\text{N} = 13.43$ SD= 0.41, $\delta^{13}\text{C} = -15.72$, SD= 0), showed significant same values between them, but different from the values of long-finned pilot whales ($n=54$, $\delta^{15}\text{N} = 11.27$ SD= 0.38, $\delta^{13}\text{C} = -16.35$, SD= 0.40). This suggests that the two first species share the same diet, but are segregated in depth. Although they share the same spatial distribution, they have a different diet from long-finned pilot whales, which eliminates a possible spatial competition for the resources between them.

E15 PHOTOGRAPHIC MATCH OF A HUMPBACK WHALE BETWEEN IRELAND AND THE NETHERLANDS

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Between 10-13 May 2007 a humpback whale *Megaptera novaeangliae* was photographed inshore, close to Texel Island in the Wadden Sea, Netherlands (52°59'N, 04° 45.5'E). On 28 September 2007 a small humpback whale (5-6m in length) was photographed by Conor Ryan during a commercial whalewatching trip with Colin Barnes off County Cork, Ireland (51° 2.5'N, 9°12'). Images were compared with those in the Irish Whale and Dolphin Group (IWDG) Humpback Whale catalogue which showed it was previously unrecorded in Irish waters. On 22 October Wouter-Jan Strietman, of the North Sea Foundation, having seen the images of the young humpback whale on the IWDG website www.iwdg.ie suggested that these two sightings were of the same animal. The match was confirmed by comparing images of barnacle scars on the whales left jaw. The match was also agreed by curators of the North Atlantic Humpback Whale catalogue at Allied Whale in the US who also noted that this whale was previously unrecorded from any other part of the North Atlantic. This was the first match of a humpback whale within Northeast European continental shelf waters and the first ever, international match of a humpback whale from either Ireland or the Netherlands. Between 16-20 November 2007, seven weeks after the Irish sighting, the same humpback whale was re-sighted off the Ijmuiden area of the Netherlands, (52° 29'N, 4° 33'E) some 60km south of where it was initially recorded in May. During the six months (May-November) this juvenile humpback whale has completed at least a 2500km round trip within European waters. The ecological significance of this record is difficult to determine. The whale was small, estimated at 5-8m, probably a yearling or juvenile. It was observed feeding suggesting it was able to sustain itself however whether its' movements are typical or aberrant are difficult to interpret.

E16 PREDICTIVE HABITAT SUITABILITY MAPPING OF BEAKED WHALES IN THE SOUTHERN ATLANTIC AND ANTARCTICA.

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The beaked whales represent the least known of the cetacean species occurring in the world's oceans. One aspect of this knowledge gap is this group's distribution and habitat selection within the waters of the Southern Atlantic and Antarctica. In recent years, sightings data for a range of species have slowly been compiled regarding Ziphiid distribution between South America and the Antarctic Peninsula. The aim of this study was to utilise Environmental Niche Factor Analysis (ENFA) to predict potential areas of high Ziphiid habitat suitability. Sixty three sightings of beaked whales (including southern bottlenose whale *Hyperoodon planifrons*, Gray's beaked whale *Mesoplodon grayii*, Cuvier's beak whale *Ziphius cavirostris*, Arnoux's beaked whale *Berardius arnuxii* and Strap-toothed beaked whale *Mesoplodon layardi*) were analysed with respect to distribution across depth, slope and aspect. Values of these bathymetric parameters were obtained from the GEBCO 2001 digital atlas and digital elevation models available with Arc 9.2. Results of the analysis show that for all species depth was the most important habitat predictor, followed by slope then aspect variables. Zones of potentially high habitat suitability are indicated to occur in deep-water zones around the edges of pronounced bathymetric variability associated with continental slope margins. Creation of individual species maps was possible for *H. planifrons* (n=42), *Z. cavirostris* (n=6) and *M. layardi* (n=6). ENFA analysis indicates that the habitat suitability of *H. planifrons* and *M. layardi* appear similar, the former having a more extensive distribution across deeper bathymetries, with *Z. cavirostris* appearing to favour contrasting shallower water zones within continental shelf areas. From the results of this study it is considered that ecological niche models are powerful tools for understanding and focusing future investigations into the distribution of beaked whales in the hard to survey waters of the Southern Ocean.



FEEDING

F01 PRELIMINARY ANALYSIS OF THE DIET OF THE STRIPED DOLPHIN, *STENELLA COERULEOALBA*, IN THE CENTRAL CANTABRIAN SEA

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The stomach contents of 22 striped dolphin *Stenella coeruleoalba* (Meyen, 1833) (10 males, 11 females and 1 undetermined sex) found stranded on the Asturian coast (04°30 N -07°01 W) were examined. Twenty-seven per cent (6 out of 22) of these dolphins were adults (3 males and 3 females). In 86% (19 out of 22) of the stomachs food remains were found. A total of 1507 prey remains belonging to 7 families of fish, 6 of cephalopods and 2 of crustaceans were found. The total reconstructed mass of examined food was 11750 g, which represented an average stomach content of 618.4 gr. In terms of number, fish were the most prevalent prey (97%), whereas cephalopods and crustaceans only represented 2.8 and 0.2% respectively. Among fish, the blue whiting *Micromesistius poutassou* was the most important prey (41.9% by mass of the fresh fraction). On the other hand, species belonging to the family *Gobidae* represented 43.6% in terms of number but only 11.2% by mass of the fresh fraction. *Myctophids* (lanternfish) accounted for 14.9% by number and 9.6% by mass of the fresh fraction being *Notoscopelus kroeyeri* the most significant species. The oceanic cephalopods *Gonatus steenstrupi* and *Todarodes sagittatus* were the most common cephalopod prey (16.4% and 3.5% by mass of the fresh fraction). The pasiphacic *Pasiphaea multidentata* was the only crustacean identified. Fish seems to constitute the bulk of the diet of the striped dolphin in the Asturian coastal waters. According to our results it is a general species with ichthyophagous preferences. Although most of the preys are neretic, the sporadic presence of mesopelagic species (*nyctophids*, *gonatids*, *histioteuthids* and *pasiphacids*) seems to indicate that *S. coeruleoalba* fed not only in the neritic but also in the oceanic habitats.

F02 VARIATIONS IN COASTAL MINKE WHALE OCCURRENCE WITH RESPECT TO FOOD AVAILABILITY IN NORTHEAST SCOTTISH WATERS

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The Moray Firth is a summer feeding ground for the northern minke whale (*Balaenoptera acutorostrata*). Between 2001 and 2007, we studied the summer occurrence of minke whales in the southern outer Moray Firth and examined how the use of this area varied both within and between years. Intra-annually, the occurrence of whales showed a typical increase from May to July and a subsequent decrease from July to September, representing an inshore-offshore movement. This behaviour may be in synchrony with the larval metamorphosis period of the lesser sandeel (*Ammodytes marinus*) prey, targeted by minkes in this region. While this pattern was consistent between years, the number of whales using the area varied greatly between years. The mean daily sighting rates were 0.1 whales per hour in 2001, 0.03 in 2002, 0.17 in 2003, 0 in 2004, 0.33 in 2005, 0.28 in 2006, 0.11 in 2007. There were also variations in observed feeding behaviours and spatial use of the study area, which was interpreted as a consequence of inter-annual variation between hatch-date distributions of sandeels. This inter-annual variation in occurrence is also found in data collected from other areas of the North Sea, and is the inverse of changes seen in western Scotland. This suggests that minke whales shift opportunistically between prey species and summer feeding grounds, according to prey availability. Therefore, our study of minke whale occurrence and behaviour in the coastal Moray Firth may provide information on the driving forces behind wider scale changes in minke whale occurrence in Scottish waters that are important to understand for conservation purposes.

F03 DIFFERENT BEHAVIOUR OF BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) RELATED WITH TRAWLERS IN THE EASTERN LIGURIAN SEA

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Due to its coastal habit, the bottlenose dolphin (*Tursiops truncatus*) experiences continuous interactions with human activities. The purpose of this study is to analyse the relationships between bottlenose dolphins and trawlers along the Eastern Ligurian coasts. 3 sub-areas were identified in relation to the bathymetry and the extension of the continental shelf; from the west to the east: zone A, B and C. Data were collected between April 2001 and September 2007 during 448 boat-based surveys. More than 1.100 hours were spent on effort. A GIS technique was applied to plot the effort. 82 groups of bottlenose dolphins were sighted and 102,9 hours were spent observing the animals. 220 trawlers were sighted. A strong association between dolphins and trawlers was observed only in zone C; in these cases the animals were following the trawlers while fishing. In the other zones, no associations between trawlers and dolphins were observed. Interviews with fishermen were performed to evaluate variations in catch. No big differences were referred in relation to the fishing area, with the only exception for hake (*Merluccius merluccius*) which seems to be more present in zone C. Furthermore, the association of dolphins and trawlers was studied in relation with distance from the land. Due to different bathymetric features, in zone B trawling activity occurs closer to the coastline and fully overlaps with pleasure boating, while in C there is only a minimum overlap. In any cases it seems that behavioural ecology of the bottlenose dolphin in the area is strongly influenced by human activities.

F04 COMPARING THE EPIPELAGIC DIET BETWEEN SHORT-BEAKED COMMON DOLPHIN AND ATLANTIC SPOTTED DOLPHIN IN TWO ATLANTIC OCEANIC ARCHIPELAGOS

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The short-beaked common dolphin, *Delphinus delphis*, and the Atlantic spotted dolphin, *Stenella frontalis*, are two of the most abundant cetacean species in the archipelagos of Azores and Madeira but seem to show some spatial-temporal segregation. In Azores *D. delphis* is present year-round, but its abundance is highest in spring with a decline during summer, while *S. frontalis* is present during summer months. In Madeira, the period of higher

occurrence of *D. delphis* is winter and spring, while the spotted dolphin can be encountered during summer and autumn. In addition, *D. delphis* is mostly sighted near the coast while *S. frontalis* is usually seen more offshore. To investigate this segregation, we identified and compared the prey consumed by these two dolphin species based on visual observations and specimens collection, while diurnal and surface feeding events occur. From 29 feeding events in Azores and 10 in Madeira, a total of 39 specimens were identified, corresponding to four species and one genus. For *D. delphis*, blue jack mackerel (*Trachurus picturatus*) was the most observed prey with 15 specimens, followed by chub mackerel (*Scomber japonicus*) with five and one observation of European pilchard (*Sardina pilchardus*). For *S. frontalis*, also blue jack mackerel was the most observed prey with 12 specimens, chub mackerel with five, Atlantic mackerel (*Scomber scombrus*) with one, and one specimen of the genus *Sardinella*. Although the sample size of feeding events in both archipelagos is small, it points out to similar diet for both species. As these two species are usually characterized as opportunistic feeders and are likely to compete for food in areas where they co-occur, we suggest that spatio-temporal segregation exists to avoid trophic competition. Other methodologies, like fatty acid composition and stable isotopes are being used by the authors for further study of the ecological implications of both species diets.

F05 DETERMINATION OF THE DIET OF THE HARBOUR SEAL (PHOCA VITULINA VITULINA) IN IRELAND

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In this study the diet of the harbour seal (*Phoca vitulina vitulina*) in the Republic of Ireland was determined using three methods. Data on diet was collected based on the analysis of the contents of digestive tracts, faecal samples and fatty-acid samples collected over a 17 month period from May 2006 to September 2007 from two main sites. The results indicate an opportunistic feeding strategy with a diet comprising a wide range of species, including pleuronectids, clupeids, salmonids, ammodytids, gadids, callyonymids, carangids and cephalopods. Seals on the western seaboard appear to have a more varied diet when compared to their more southerly counterparts with sandeel species, dragonet (*Callionymus lyra*) and gadoids being amongst the most important prey items consumed there whereas clupeoids and gadids were among the main constituents of the diet of seals in the south-west of the country, other important prey items include

Callyonimidae and Carangidae species. Salmonids seem to play only a minor role in the diet of the animals surveyed, however, their otoliths are inherently fragile and are less likely to survive the digestive process. Identification of bones and the application of digestive corrective factors were used to reduce any bias that may have been incurred as a result of this. Potential biases for each method of dietary analysis were also considered. This is one of the first studies on the diet of the Harbour seal in the Republic of Ireland and will provide a useful baseline for further studies and potentially to look at fisheries interactions.

F06 STILL A SEA OF PLENTY? SEALS AND SOLES IN THE SOUTHEASTERN NORTH SEA

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Many fish stocks in the North Sea are depleted and both the fisheries and several natural piscivorous predators suffer the consequences. Perhaps surprisingly in this situation, numbers of seals have largely been increasing over the last decades. In the eastern North Sea, numbers of harbour seals *Phoca vitulina* have increased from about 4,000 in 1975 to over 15,000 today, while numbers of grey seals *Halichoerus grypus* have increased from zero to over 2,000 in the same period. There is thus an apparent paradox of increasing numbers of predatory seals and a decreasing prey base. Diet studies on harbour seals in the eastern North Sea are dated however, while such studies on grey seals are non-existent. We studied the diet of grey seals from scats collected in March/April 2007 in the Dutch Voordelta, one of the sites of spectacular population growth of this species. Sole *Solea solea* was the main prey species, both in terms of relative occurrence and prey numbers as in terms of relative prey mass or energetic contribution to the diet. The grey seals were highly selective in their feeding, as sole made up about 70% to the diet in terms of relative prey mass. For the time being, there seems to be plenty of sole in the sea for the growing population of grey seals in the eastern North Sea.

F07 EATING THEMSELVES OUT OF HOUSE AND HOME: GREY WHALE ABUNDANCE IN A SUMMERTIME FEEDING AREA LINKED TO MYSID PREY AVAILABILITY

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The Eastern-Pacific population of grey whales (*Eschrichtius robustus*) are known to undertake an annual migration of 5000 miles from feeding grounds in the Bering/Chukchi Seas, to Baja California, where they spend the winter in and around calving lagoons. A subset of these animals, termed the "Southern Feeding Aggregation" has been documented as approximately 250 grey whales that do not complete the migration north and instead spend the summer feeding primarily on pelagic mysid shrimps in the shallow, coastal waters of British Columbia, Canada. Mysids are known to be associated with kelpbeds (*Nereocystis* and *Macrocystis* spp.) and previous surveys have found extremely large and dense swarms in the area. We report here on grey whale surveys that have been conducted annually since 1994 in the waters near Cape Caution, BC. Our data show that following the record number of grey whales recorded in 2004, the abundance of whales has dropped considerably, culminating in a record low of only five whales sighted in 2007. Initial cursory investigation of the mysid populations post-2004 indicated that mysids were not present in 2005-2006, therefore it was hypothesised that the extreme decline in grey whale numbers was linked to the lack of mysids. In 2007 we completed an extensive mysid survey of kelpbeds in our grey whale survey area using an underwater video camera and a new method for measuring mysid density. The survey also investigated the feasibility of using multibeam sonar to monitor the distribution of mysids in the survey area. Mysids were found to be present at 45% of the kelpbeds investigated, although not at densities seen in 1999-2001. Species composition had also changed, most notably with a different dominant mysid species identified. Suggested theories as to the decline in mysid numbers include over-predation by grey whales and climate change.

F08 DIET OF THE PYGMY SPERM WHALE (KOGIA BREVICEPS) IN THE CENTRAL CANTABRIAN SEA.

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The stomach contents of five pygmy sperm whales *Kogia breviceps* (Blainville, 1838) stranded along the Asturian coast (Northern Spain) were studied. A total of 1811 remains were found and the total reconstituted mass was 87,160 g (N=5; range 1,100-37,340). Twelve species of squids from nine different families and seven species of crustaceans from six families were identified. Simpson's diversity index and index of relative importance both showed a low diversity and a high degree of specialization of the diet, which is based almost exclusively in the pelagic deep-water squid, *Histioteuthis reversa*. All stomachs contained this species in a percentage above 90%. *Histioteuthis bonnellii* was the second most common prey (1.4% by number and 4.70% by mass of the fresh fraction). *Todarodes sagittatus* and *Gonatus streenstrupi* represented 4.57% and 2.21% by mass of the fresh fraction respectively. The rest of cephalopod prey appeared in very low percentages (<1%). The range of prey size was 8.6-359 mm estimated mantle length. However, 95% of prey consumed had less than 60 mm. The range of prey mass goes from less than 1g to 635 g (N=1774; average=48.5±2.0 g), with 95% of prey consumed weighing less than 90 gr. Crustaceans made up 1.99% by number and 0.19% mass of the fresh fraction. The deep-water pelagic shrimps *Pasiphaea multidentata* and *Systellapsis debilis* were the most frequent species followed by the bathypelagic mysidacea *Gnathophausia* zoea. Data from this study suggest that the diet of *K. breviceps* in the Cantabrian Sea seems to be mainly teuthophagous.

F09 TEMPORAL VARIATION IN DIET OF HARBOUR SEAL (PHOCA VITULINA) IN VESTERÅLEN, NORWAY

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Scat samples from harbour seal (*Phoca vitulina*) were collected in autumn 2007 in Vesterålen, Norway. Undigested hard remains (otoliths, etc.) in the faeces were analyzed in order to delineate the relative frequencies of preys in the diet of this resident population for that period. The data were then compared to the ones from a previous research in the same locality in 1990 and 1994-1995 (Berg et al. 2002) to check for potential temporal differences

in diet composition. Telemetric data of five tagged individuals were also sampled in autumn 2007 to provide information on distribution and habitat use. Preliminary results from a Canonical Correspondance Analysis suggest a significant influence of year on diet composition, whereas the seasonal variation in diet was not significant. Cod, saithe and haddock were by far the predominant preys and codfish constituted between 59% and 96% of the total biomass eaten per year.



GENETICS & EVOLUTION

GE01 PHYLOGENETIC HISTORY OF DELPHINIDAE (CETACEA:ODONTOCETI) DURING THE PLIOCENE OF THE GULF OF CALIFORNIA, MEXICO

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Despite the current diversity of delphinids, they are very rare in the fossil record, and are usually represented by comparatively fragmentary specimens. The Delphinidae include taxonomically and ecologically diverse small to large species with long or short rostra and narrow or broad rostra. Rostral shape as well as number and size of teeth are diet-related, with the various species ranging from generalists to predators to squid eaters. The Gulf of California is the semi-closed sea that separates the Baja California Peninsula from the Mexican mainland, It stretches over a northwest-southeast axis for 1070 km, varying in width from 100 to 200 km. The formation of the Gulf of California is relatively recent, being since Miocene Epoch. We have discovered two new genera and species of Pliocene dolphins that elucidate the phylogenetic relationships within the Delphinidae based on comparative morphological analysis of the crania and associated bones. We report another 20 more fragmentary fossil bones that includes all the formally known material of Pliocene Delphinidae from the Gulf of California. Since the majority of the Pliocene Delphinidae described previously are specimens found in Italy, the Mexican discoveries are a good opportunity to broaden our knowledge of the evolutionary history of the group. Apparently, the present abundance of delphinids is the result of an explosive evolution that probably occurred in the late part of the Pliocene,

resulting in the replacement of the earlier more diverse kentriodontids, phocoenids and monodontids. The rather abrupt appearance of Delphinidae, in relative abundance, in Pliocene time is a notable phenomenon in cetacean evolution.

GE02 MOLECULAR ANALYSIS OF MITOCHONDRIAL CONTROL REGION ON STRANDED STENELLA COERULEOALBA INDIVIDUALS

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The purpose of the present work was to perform a microevolutionary analysis on DNA extracted from tissues of four specimens of *Stenella coeruleoalba* stranded on Sicily coasts and found in different conditions of conservation. DNA analysis consisted on amplification and sequencing of the mitochondrial control region named D-loop. This region presents a high number of sequence variations, or polymorphisms, which allow the study of microevolutionary processes (Ross et al., 2003). Sequence variations are useful for phylogenetic analysis because they represent a number of divergent characters useful for analysing populations at the microevolutionary level. For each specimen we determined the most accurate nucleotide sequence by reading amplified fragments in both directions at least 6 times. Polymorphisms' analysis was carried out on a multialignment, which included all known D-loop *S. coeruleoalba* sequences, using the software MEGA 4. In this way a number of haplotypes were detected. Our specimens belong to haplotypes consistently present in the Mediterranean sea, but not outside. Our analysis suggests that genetically isolated *S.coeruleoalba* populations are solely present in the Mediterranean sea.

GE03 GENETIC DIVERSITY OF BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) FROM THE CROATIAN PART OF THE ADRIATIC SEA

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The bottlenose dolphin (*Tursiops truncatus*) is the only resident marine mammal species in the Croatian part of the Adriatic Sea with a total number of individuals estimated at around 250. This extremely low number and potential geographical isolation render this population prone to extinction. The bottlenose dolphin is considered an endangered species and is legally protected in Croatia. The maintenance of the genetic variation within populations is a general concern for the conservation of endangered species. Genetic variability is thought to be essential to the long-term persistence and adaptability of populations. We analysed microsatellite loci in 30 individuals found dead from 1994 until 2003 and a fragment of the mitochondrial DNA control region in 22 individuals. DNA was extracted from tissues of carcasses. Multiplex polymerase chain reactions were performed in which 12 polymorphic dinucleotide repeat cetacean microsatellite loci (EV1, EV14, EV37, EV94, TexVet3, TexVet5, TexVet7, D08, D14, D18, D22, D28) were amplified. PCR products were analysed on ABI PRISM 310 Genetic Analyzer. Genetic variation analysis was performed using the Genetix 4.05 program. Fragments of the mtDNA control region were sequenced using universal forward MTCRf primer and a newly-designed reverse primer named "DUPr". Sequence alignment was performed using ClustalW. MtDNA analysis was performed with the ARLEQUIN. The mean allelic diversity per microsatellite locus was 7.17, ranging from three to 15 alleles and the mean expected heterozygosity was 0.69, ranging from 0.34 to 0.89. The microsatellite results reveal relatively high genetic variability in the population of bottlenose dolphins in Croatia. Mt DNA sequence analysis identified only four unique haplotypes with 22 polymorphic sites in 22 individuals. Both haplotype diversity and nucleotide diversity of the Croatian bottlenose dolphin population were relatively low (0.403 and 0.008,

respectively). These genetic results should prove valuable for future molecular genetic investigations of the Adriatic bottlenose dolphins.

GE04 GENETIC ANALYSIS OF HARBOUR PORPOISE (PHOCOENA PHOCOENA) POPULATIONS LIVING ALONG BRITTANY COASTS

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Eight microsatellite loci previously cloned from the porpoise (*Phocoena phocoena*) genome have been analyzed on individuals stranded along brittany coasts of North-west France. Allelic variations are strong for the eight loci, and heterozygosity levels high. At the opposite, ISSR (Inter simple Sequence Repeats) analysis produced strongly homogeneous patterns, which are species specific. Investigation of ISSR on seven species, belonging to the Delphinidae and Phocoenidae families, allowed us to reconstruct a phylogenetic tree, strongly differentiating species and delphinidae-subfamilies. We are now comparing our results (ISSR analysis and single microsatellite length variations) with those of porpoises originating of north or celtic seas, and from south of France. This should allow us in near future to determine the geographical origin(s) of porpoises living along brittany french coasts, and to evaluate the genetic homogeneity of this population.

GE05 GENETIC STUDY OF COMMON DOLPHIN DELPHINUS DELPHIS IN THE CENTER/NORTH REGION OF PORTUGAL

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Despite of the occurrence of a large number of cetacean species in Portuguese waters there is a lack of information about their genetic and ecological characteristics, as well as the impact of human activities on these species. Therefore, the present study assessed the level of genetic population diversity and structure of short-beak common dolphin (*Delphinus delphis*) in the center/north region of Portugal, by analysing the mitochondrial control region of stranded animals, thus focusing on an essential subject to management and conservation strategies. In this population, the relations between haplotypes of the studied animals were investigated, aiming at assessing relationships between accidental captures of common dolphin and their social structure thus determining the impact of bycatch on the population in the study area. Furthermore, in a global analysis, samples from center/north of Portugal were compared with those from Azores, Galicia, Canary Islands, Black Sea and Pacific in order to investigate the genetic relation between different populations. The analysis of the molecular variance revealed the absence of population structure in *Delphinus delphis* occurring in the center/north of Portugal, suggesting a high genetic flow between individuals. Overall data lead to the hypothesis that the center/north Portuguese population is a part of a single population occurring in the Atlantic Ocean. In fact, there was no genetic differentiation between the Atlantic regions analysed, the only significantly divergent population being that from the Pacific. By integrating data on stranded animals with genetic data, parental relationships probably stronger than a maternal lineage, were suggested between some individuals and was also reinforced the hypothesised social organization of this species. The results obtained emphasised the need to define management and conservation strategies, as well as to implement mitigation measures to support the sustainability of cetacean populations.

GE06 BOTTLENOSE DOLPHIN POPULATION STRUCTURE ACROSS THE GIBRALTAR STRAIT

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The Strait of Gibraltar is the only connection between the Atlantic and the Mediterranean Sea. It is of high ecological interest for marine species and shows a variety of habitats from coastal to deep oceanic waters. Several studies have suggested that an ecological boundary exists near this region at the Almeria-Oran front, where the Atlantic and Mediterranean waters meet. For bottlenose dolphins, previous studies reported population structure across the Mediterranean Sea and eastern North Atlantic, however they did not identify the geographic location of the boundary between North Atlantic and Mediterranean waters. Here we assess bottlenose dolphin population structure across the Gibraltar Straits and the Alboran Sea. We analysed 68 samples from the area across the Strait (24 Alboran Sea, 22 Strait of Gibraltar, 22 Gulf of Cadiz) for 7 microsatellite loci and compared them with 145 samples from contiguous areas in the Mediterranean Sea, Eastern North Atlantic and the Black Sea. Using a Bayesian inference model we found that the Gibraltar sample was differentiated both from the Mediterranean and Atlantic populations, suggesting that this population has specialized and become isolated to some extent in this environment rather than representing a bridge between the Atlantic and Mediterranean populations. FST and RhoST analyses confirmed this result, with higher RhoST values compared to the FST values. Moreover, we found fine scale population structure among the locations across the strait (Alboran, Gibraltar and Cadiz), supported by highly significant FST values and reinforcing the hypothesis that adaptation to local habitats may be generally important in the structuring of populations of this species. Our findings are also relevant in the context of conservation and management plans for this area.

GE07 GENETIC STUDY OF MEDNYI NORTHERN FUR SEALS (CALLORHINUS URSINUS).

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The structure of Mednyi Island population of northern fur seals had been seriously changed since the island was discovered in 1741. South-Eastern

rookery (SE) originated in the beginning of last century. Karabelnoe rookery became extinct. Only Urilie (UR) remained from the complex of Glinka rookeries. It is considered that immigrants from other islands played role in demography of Mednyi rookeries last century (Chugunov, 1966; Chelnokov 1988; Boltnev and Nesterov, 1996). Also, it is known that females of northern fur seals come to breed to the same place where they have been born, what may be reflected in the mtDNA haplotype distribution. Section of the mtDNA control region (330bp) was sequenced from 43 samples collected at both rookeries on Mednyi Island. The mean number of pairwise differences between all Mednyi samples (SE and UR) was 11.06 (SD, 5.13), and nucleotide diversity π (Nei, 1987) in the total sample was 0.033 (SD, 0.017). We have found the indication of that population demographic expansion event ($F_s = -13.38$, $P = 0.004$) took place sometime in the history of the population (Fu, 1997). Such event usually occurs as a consequence of "bottleneck". Exact Test of population Differentiation (Non-differentiation exact P values) and the low F_{ST} values indicate current gene flow between the populations. The existence of the common haplotypes at both rookeries of Mednyi island reflect the history of rookeries development, whereas the indication of the gene flow supports that there is a high number of migrants between the Mednyi and Alaska islands.

GE08 CETACEANS PAST AND PRESENT: A COMPLETE SPECIES-LEVEL PHYLOGENY OF EXTINCT AND EXTANT WHALES AND DOLPHINS.

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We present the first comprehensive species-level phylogeny of crown (Neoceti) and stem-group (Archaeoceti) cetaceans, including all 85 living species. The past two decades have seen a great increase in the number of molecular and morphological attempts to establish the evolutionary relationships among cetaceans. Using a method known as supertree construction we combined these previously published cetacean phylogenies (ranging from 1968-2007) to build a complete phylogeny of Cetacea. The supertree approach allowed us to combine data from a wide variety of sources even when the actual data matrices were not available. From our literature searches we compiled 142 trees that were judged to represent independent datasets: 46 source trees were built from morphological data, 92 from molecular data and 4 from combined molecular and morphological

datasets. The trees were combined using a supertree method known as Matrix Representation with Parsimony (MRP). In order to ensure that poor quality data did not adversely affect our results we used two datasets, with the first including independent trees of any kind whilst the second was based on stricter criteria and only consisted of studies using rigorous tree building algorithms and clearly reproducible data. Based on these two datasets we built an updated tree of extant cetaceans, as well as a novel tree of all named fossil and living species available. Nodal support was generated using reduced Qualitative Support (rQS), a supertree specific method. The trees provide unique insights into cetacean relationships, whilst polytomies and low levels of support reveal clades such as the rorquals (Balaenoptera) whose phylogenetic relationships are still uncertain due to conflicting evidence. The comprehensive tree of fossil and extant cetaceans also reveals important evolutionary patterns: topological measures of diversification indicate that several clades represent significant shifts in diversification rate.

GE09 TAXONOMY AND POPULATION STRUCTURE OF THE NEW ZEALAND COMMON DOLPHIN (DELPHINUS SP.)

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This study is the first to assess the taxonomy and population structure of the New Zealand common dolphin. We analysed 92 samples for 577bp of the mtDNA control region (D-loop) and compared them with 177 published sequences from 11 different populations (Mediterranean, Celtic Sea, Galicia, Scotland, East Central Atlantic, Western North Atlantic, Mauritania, Argentina, short-beaked North Pacific, long-beaked North Pacific and long-beaked South Africa). The New Zealand population exhibited high genetic variability (gene diversity=0.991, nucleotide diversity=0.018) and comprised 65 different haplotypes. Three haplotypes were shared with other short-beaked populations (Scotland, Argentina and North Pacific) and a further two with long-beaked populations (North Pacific and South Africa). The New Zealand population showed significant genetic differentiation (FST analysis) when compared with all other populations except the short-beaked North

Pacific population. The Φ_{st} analysis confirmed these results but also indicated no significant differentiation when compared to the Western North Atlantic population. Phylogenetic analyses (Neighbour-Joining and Bayesian methods) did not show any cluster that reflects geographic origin of the different populations. Although not significant, the Tajima's D value was high ($D=-1.234$ $p\text{-value}=0.077$) and the Fu's F_s was highly significant ($f=-24.28$, $p\text{-value}=0$) indicating a population expansion. The mismatch distribution analysis and the median-joining network supported these results. Fine scale population structure was also examined within New Zealand by comparing putative offshore and inshore populations. Only four of the 65 haplotypes observed were shared between these two groups. Both F_{ST} and Φ_{st} analyses showed significant genetic differentiation between these putative populations suggesting that differences in habitat use may have a role in shaping population structure.



LIFE HISTORY

LH01 USING OF A REPRODUCTIVE CONGESTION OF BELUGAS OF SOLOVETSKI POD (THE WHITE SEA) AS A POPULATION MODEL

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The demographic condition of a population of belugas was usually estimated on biological sample (test) at a craft which has stopped 20 years ago. For finding-out of the modern status of pod of belugas the observations of a reproductive congestion (RC) near cape Beluzhi of Solovetski Island have been used as a population model. Results of dynamics of number, on age-sexual structure of groups, structure of congestion are analyzed. As base data were considered number of belugas on seasons, quantities of adult females, number of subadultus and number of juvenalis in RC in 1997-1999. The aggregate number was in 1997 - 88, in 1998 - 84 and in 1999 - 98 belugas. Surviveness $L(x_n)$ in n year was equaled accordingly 1.0, 0.954 and 1,167 (in 1997 1 (100%)). Specific surviveness $P(x_n)$ have made in 1997 $r.-1$, in 1998 - 0.953 and in 1999 - 1,223. Annual quantity of juvenalis was $B(x), (x+1)$ - 10, 11 and 13. Vectors of fruitfulness (all-the-year-round duplication) were equaled $m_{x1}=0,077$, $m_{x2} = 0.083$, $m_{x3} = 0.082$ (an average $m_x = 0.08067$). Number females - juvenalis on 1 female in RC was $m_x(0,1,2,3) = 0, 0.0568, 0.0655, 0.0663$. ($m_x = B_x / 2f_x$, where B_x - number of pregnant females. Observable growth rate RC $\langle r \rangle = 5$ belugas in a year or on the average $\langle r \rangle / N_2 = 0.059 \approx 6\%$ that coincides with an average on coefficient of growth, λ , $(\lambda_1 + \lambda_2) / 2 = 1,06 \approx 6\%$ and with exponent final growth rate $\langle er \rangle = 1,060$ in 1998-1999 (6 % from number of RC). Solving the equations of communication between parameters of kind $L_x \times e^{-rx} \times m_x = 1$, we shall receive exponent growth of number $r = - 1,13$ that is minimally admissible value of stability of a population (RC) for e^{-rx} . Analysis has shown that population is in stable state.

**LH02 WHALING AND THE SHIFT IN AGE AT SEXUAL MATURITY IN
THE ANTARCTIC MINKE WHALE BALAENOPTERA
BONAERENSIS: A REVIEW**

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The age at sexual maturity of the Antarctic minke whale (*Balaenoptera bonaerensis*) seems to have declined from the 1950s until the 1980s but has increased in the 1990s. One hypothesis for this trend is interspecific competition with other baleen whales. According to this hypothesis, overexploitation of other species of baleen whales since the 1940s has resulted in favorable feeding conditions for the Antarctic minke whale. This trend halted in the 1980s when the baleen whales allegedly recovered and started to compete again for krill. We review this hypothesis and propose other possibilities for the observed changes in age at sexual maturity of Antarctic minke whales. Interspecific competition between baleen whales in the Antarctic seems unlikely because there are strong indications of resource partitioning among species. Antarctic minke whales have been subjected to commercial exploitation and are still being taken annually. Exploitation of Antarctic minke whales may have resulted in reduced intraspecific competition. Size-selective hunting of Antarctic minke whales may also have affected life history parameters. We propose that a combination of reduced intraspecific competition and size selective hunting may have changed the age at sexual maturity. Furthermore, there are strong indications that the Antarctic marine environment is under stress due to climatic change. Reduced krill availability may have increased intraspecific competition and reversed the declining trend of age at sexual maturation. Reduced food availability due to climate change may have resulted in the reduced blubber layer observed in Antarctic minke whales. We conclude that the dynamics of the age at sexual maturity of the Antarctic minke whale cannot be solely explained by interspecific competition. started to compete again for krill. We review this hypothesis and propose other possibilities for the observed changes in age at sexual maturity of Antarctic minke whales. Interspecific competition between baleen whales in the Antarctic seems unlikely because there are strong indications of resource partitioning among species. Antarctic minke whales have been subjected to commercial exploitation and are still being taken annually. Exploitation of Antarctic minke whales may have resulted in reduced intraspecific competition. Size-

selective hunting of Antarctic minke whales may also have affected life history parameters. We propose that a combination of reduced intraspecific competition and size selective hunting may have changed the age at sexual maturity. Furthermore, there are strong indications that the Antarctic marine environment is under stress due to climatic change. Reduced krill availability may have increased intraspecific competition and reversed the declining trend of age at sexual maturation. Reduced food availability due to climate change may have resulted in the reduced blubber layer observed in Antarctic minke whales. We conclude that the dynamics of the age at sexual maturity of the Antarctic minke whale cannot be solely explained by interspecific competition.

LH04 AGE AND BODY LENGTH AT SEXUAL MATURITY OF HARBOUR SEALS IN THE NETHERLANDS

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Life history studies provide valuable information about the age structure, age at sexual maturity, and longevity of a population. For the East Atlantic harbour seal (*Phoca vitulina*) population, knowledge of the reproductive status is particularly important because of the large fluctuations in population size resulting from viral epidemics. Life history samples were collected from 489 harbour seals that died during the 2002 phocine distemper epidemic in the Netherlands. Females were considered sexually mature if the ovaries contained at least one corpus luteum or albicans. Histological analysis of the testes failed to show any presence of spermatozoa, probably due to a combination of postmortem autolysis and freezing artefact. Therefore, based on previous research, males with an average testis weight of 15 g were considered to be sexually mature. Age was determined from analysis of growth layer groups in the cementum. Age and length at maturity were predicted using Gompertz and von Bertalanffy growth curves. Total body length (TBL) and age ranged from 74-152 cm and 0-28 years in females and 74-178 cm and 0-21 years in males. The smallest mature female was 107 cm and the smallest mature male 124 cm. Asymptotic values obtained from growth curves were 136 cm and 144 cm for females and males respectively corresponding to an age of approximately 10 years for both sexes. These results indicate that harbour seals in the Netherlands are smaller than those in the Kattegat-Skagerrak area and Norway. Predicted sexual maturity from asymptotic length is obtained at 118 cm (females) and 124 cm (males). The present results suggest that female harbour seals in the Netherlands reach

sexual maturity smaller and younger than other studied European populations but no difference was found for the males. Additionally, very few old animals were found in the present study due to the 1988 viral epidemic.

LH05 CALF SURVIVABILITY AND FEMALE REPRODUCTIVE SUCCESS IN A NORTH SEA COASTAL BOTTLENOSE COMMUNITY

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Wild bottlenose dolphins (*Tursiops truncatus*) typically live in a complex hierarchical society in which lower ranking animals are often, and even forcefully, reminded of their place. In the Moray Firth in northeast Scotland, violent sexual interactions and infanticidal behaviour are remarkably common in the species, and here the rank and experience of females may be crucial to the very survival of offspring. In the present study, we examined reproductive success (RS) in 21 female bottlenoses from the Moray Firth community across a 10-year period, from 1997 to 2006 inclusive. Female RS was classified as 0, 1, 2 or 3 with respect to the number of calves who were seen to survive to age 3 across this period. From a total of 14 females with complete life histories, 3 were unsuccessful in raising any calves, 6 successfully raised one calf, 4 successfully raised two and a single female raised three calves. Accordingly, a mean inter-calving period of 4.09 years was established from this conservative dataset (n=16 inter-calf periods). The mortality data suggested survivability in first year calves was high in this population but the sample size was too small to determine whether or not the survivability of first-born calves was lower than that of later-born calves. The influence of social factors thought to affect calf survival in this location, such as mate choice, group size, maternal experience and food availability, for example, was consequently explored and discussed. In order to make the fullest, most complete analysis of RS and calf survivability for this population, however, an integrated effort involving all research groups currently working with the animals throughout their home range is proposed.



Medicine & Disease

MD01 PATHOLOGY AND CAUSES OF DEATH OF CETACEANS STRANDED IN CANARY ISLANDS (1999-2005)

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In the Canary Islands waters, 28 cetacean species have been identified of which 24 species have been found stranded. During a 6 year-period (1999-2005) 233 stranded whales and dolphins of 19 different species were recovered for scientific studies. Using a systematic standardized necropsy protocol, 138/233 stranded cetaceans were subjected to a complete or partial necropsy. Of these, 71/138 (51.45%) carcasses were in a very fresh or fresh status, 28/138 (20.29%) in moderate autolysis and 39/138 (28.22%) in advanced autolysis. Pathological studies were conducted by the Institute of Animal Health (University of Las Palmas de Gran Canaria) in order to identify lesions and to determine a morphological diagnosis, identify aetiological agents, and, ultimately, to reach an etiological diagnosis. As a result of these processes, cause(s) of death (defined as pathological entities) were identified wherever possible. From a total of 233 cetaceans stranded in the Canary Islands (1999-2005), in 59,23% of the cases a morphological diagnosis was done, in 56,22% an etiological diagnosis could be established and, finally, we were able to classify 51,07% within natural or anthropogenic pathological entities. Etio-pathologically, 62,32% of the 138 studied cetaceans were diagnosed as natural (i.e. non-anthropogenic) pathological entities that included infectious diseases, neonatal pathology, intra- and interspecific interactions and typical mass strandings. Another 33,33% of cases were diagnosed as anthropogenic entities including fishing interaction (by-catch), atypical mass-stranding linked to naval exercises, ship collisions, and other anthropogenic-related pathology. A cause of death could not be ascribed in only 4,35% of the 138 animals examined.

MD02 EXAMINATION OF THE IMMUNE STATUS OF MARINE MAMMALS AS A METHOD TO ESTIMATE THE INFLUENCE OF GLOBAL CHANGES OF CLIMATE ON THE WILD POPULATIONS

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It's well known that the immune system of mammals reacts very strongly to any changes in the environment. Therefore it is possible to estimate what influence global changes of climate have on marine mammals by studying hematological, immunological and microbiological parameters. These methods were employed to study several species of marine mammals. A research into immunological and microbiological parameters of both Steller sea lion pups (*Eumetopias jubatus*) and Black Sea bottlenose dolphin (*Tursiops truncatus*) was performed in condition of their natural habitat and in conditions of captivity. Twenty six Steller sea lion pups (age 3-4 weeks) from Medny Island and 14 pups from Cape Kozlov (Peninsula Kamchatka) were studied in 2004, 55 adult bottlenose dolphins were studied under conditions of captivity from 2001-2004 and 12 beluga whale (*Delphinapterus leucas*) in 2003. The following parameters showing the immune status were studied: in all animals—phagocyte activity of leucocytes; in beluga whales and bottlenose dolphins—absolute and relative number of lymphocytes and leucocytes, G/M-immunoglobulins, T/B-lymphocytes. The performed investigations showed a similar pattern of interconnected changes in immunological and microbiological indices in wild animals in their natural habitat and in captured animals during their adaptation to conditions of captivity. Species comprising microflora of upper airways (as unfavorable biotic factor) was determined and their percentage. In all cases visible effect of the environment on the state of health of animals was observed. Therefore these methods can be employed to estimate the influence of global changes of climate on populations of wild marine mammals.

MD03 POSSIBLE SEAL POX IN THE MONACHUS MONACHUS CYPRUS COLONY IS STRESS AND HUNGER A CONTRIBUTING FACTOR?

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In July 2006, an adult Mediterranean monk seal male was spotted in front of a cave on the island of Cyprus. The seal had remarkable scars and lesions on his body and rare flipper. As the bleeding skin lesions were possibly a symptom of infection by phocine distemper virus, the cave was monitored with infrared monitors and photos were taken automatically during the period between July 2006 and January 2007. These photographs enabled closer inspection of the lesions on his body. Cutaneous nodular lesions on the cranial region of the rear flipper however seem more like pox virus lesions, which has been identified morphologically in skin lesions of both captive and free-ranging pinnipeds and cetaceans. Seal pox is a proliferative lesion characterized by the formation of numerous 0,5 to 3 cm cutaneous nodules on the head, neck, and flippers of affected pinnipeds. These nodules eventually ulcerate and are slow to heal. The large scars around the nodules on his rear flipper and abdomen that developed over the healed areas may indicate that the lesions are recurring. Numerous small nodules on the head and neck are appropriate to the classical appearance of cutaneous poxvirus lesions although electron microscopy and/or PCR testing on tissue samples from lesion areas are needed to diagnose the possible agent. Poxvirus is rarely fatal; however, it is regarded as having an opportunistic nature, causing outbreaks with high morbidity when the immune status of the animals are low, when food availability is scarce or when the animals are stressed, as recently seen among reindeer in Finland and Norway. Poxviruses from seals are zoonotic, giving cutaneous infections on fingers and hands of people handling diseased animals, which should be noticed by persons involved in handling and care of seals.

**MD04 EVALUATION OF PERSISTENT CONTAMINANTS IN CUVIER'S
BEAKED WHALE STRANDED ALONG THE IONIC COAST OF
SICILY (ITALY)**

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The widespread use of synthetic chemicals by man has led to the accumulation of many persistent compounds in the marine environment. Pollutants absorbed in particulate and organic matter are then taken up by

plankton, crustaceans and fish and thus ultimately accumulated in top predators such as marine mammals. In this work we analyzed the concentration of heavy metal and polycyclic aromatic hydrocarbons (PAHs) in tissues of an adult female of *Ziphius cavirostris* stranded along Ionic Coast of Sicily in September 27, 2007. Heavy metal extraction (Cr, Ni, Pb, Zn, As, Cu, Sb and Hg) was carried out with acid digestion of the samples and measured at ICP-OES Optima 200 DV. Fingerprint of 16 PAH's was performed with sonication and measured with high performance liquid chromatography (HPLC UV). The results (ppm wet wt.) revealed a higher concentration of Cr (1,797), Ni (0,765), Pb (0,435), and Zn (139,994) in the skeleton. As (0,252), Cu (0,288) and Sb (0,158) concentrations were higher in the melon. Hg (0,496) was higher in the muscle and Cu (0,249) in the adipose tissue. Cd (Min. 0,028 –Max 0,079) distribution was uniform in the samples, while V was absent or below the detection limit of our assay. Total PAHs (ppm wet wt), were 0.047 and 5.47 in the muscle and adipose tissue respectively. Despite the lack of data about bioaccumulation of pollutants in *Ziphius cavirostris*, the metals concentrations measured appeared lower than in other exemplars of the same species retrieved near by the Mediterranean coast of France and in the Adriatic coast of Italy. In addition PAHs' values appear to be higher than in other odontocetes retrieved in the Mediterranean Sea.

MD06 THE CROSS-REACTIVITY OF THE BLOOD SERUM ALBUMENS FROM STELLER SEA LION PUPS (EUMETOPIAS JUBATUS)

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It is well known the population of Steller sea lion (Ssl) has been decreasing steadily in Far Eastern of Russia in recent decades. The analysis of the immune status of Ssl pups were conducted as a part of some multi-disciplinary investigations of the cause of this phenomenon. For this purpose it was necessary to produce reagents for the immune reactions. The fraction of γ -globulins was obtained from 101 pup's blood serum samples by method of protein sedimentation with ammonium sulphate (SAS). Ssl sera were

precipitated twice with 35% and 50% SAS, resuspending with 0,85% NaCl. The final precipitates were dialyzed against PBS. The isolated γ -fraction was subjected to nonreducing SDS-PAGE (Laemmli-PhastSystem) on a linear 10 to 15% gradient gel and stained with Coomassie blue. There are three stripes of the proteins situated in albumen's zone (45-67kD) and one - in the zone of γ -globulins (150-160 kD). The analysis by immunoelectrophoresis confirmed the predominant content albumins in the isolated fraction (alb+ γ). The cross-reactivity of pup's blood proteins was investigated by reaction of the dual radial immunodiffusion (Ouchterlony) with sera to blood proteins of cattle, horse, pig, rabbit, dog and mouse. We showed that the alb+ γ -fraction of pups Ssl precipitated with proteins of horse, pig and dog. By method of the simple radial immunodiffusion (Mancini) it was established that alb+ γ -fraction and blood serums of Steller sea lion is forming precipitation rings with antiserum to pig's γ - globulins. The pool from 101 pup's blood serum was used as standard. The diameter of the alb+ γ -fraction precipitate was two times smaller than the precipitate of pup's native blood serum. The diameter of the precipitation rings of samples Ssl has been found to differ from each other. Therefore this method will be able to be used for determining the protein level in blood of Ssl during immunological monitoring. These data will help to further understand our knowledge regarding the evolution of the marine mammal's immune system.

MD07 EVIDENCE OF MORBILLIVIRUS INFECTION IN STRIPED DOLPHINS (STENELLA COERULEOALBA) FOUND STRANDED ON THE LIGURIAN SEA COAST OF ITALY

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Since the last months of 2007, an unusual high rate of cetaceans strandings was observed along a short coastline tract of the Western Ligurian Sea (North-Western Italy), in an area contiguous to the French borderline. Within 3 months, 8 cetaceans were found stranded lifeless (mean annual value for the same area within the last 10 years was 4 specimens/year). All concerned animals were striped dolphins (*Stenella coeruleoalba*), namely 1 newborn male, 1 subadult female and 6 adults (5 females and 1 male). Detailed post-mortem examinations were carried out on all 8 dolphins, followed by in-depth parasitological, microbiological, histopathological, immunohistochemical, immunofluorescence, biomolecular and serological investigations. More in detail, an anti-Canine Distemper Virus (CDV) nucleoprotein (N) antigen monoclonal antibody was utilized for both immunohistochemistry and immunofluorescence and an RT-PCR technique detecting specific Morbillivirus genomic sequences was applied on brain tissue extracts obtained from 4 out of the 8 cetaceans under study (1 newborn, 1 subadult and 2 adult females). On the blood serum from these 4 animals a virus neutralization assay to detect anti-Morbillivirus antibodies was performed using the Onderstepoort CDV strain. Macroscopically, evidence of (broncho)-pneumonia was found in 6 dolphins, with large numbers of parasitic bodies being detected in both pulmonary and extra-pulmonary locations. Histologically, a multifocal, subacute-to-chronic, non-purulent meningo-encephalitis occurred in some of the investigated animals, with detailed immunohistochemical, immunofluorescence and biomolecular investigations being currently underway from them as well as from the remaining dolphins. Serological investigations yielded presence of Morbillivirus (CDV) neutralizing antibodies in the blood serum from all 4 investigated dolphins, with positive titres respectively of 1:10 (1 newborn), 1:20 (1 subadult and 1 adult female) and 1:40 (1 adult female). These data strongly support the assumption that the current Mediterranean Sea morbilliviral epidemic has now involved striped dolphins living along the Italian coastline.

MD08 IMMUNOHISTOCHEMISTRY STUDY OF CYTOCHROME P450 IN LIVERS OF STRANDED CETACEANS

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Marine pollution is a world wide problem of the high industrial, agriculture and coastal urbanism and is directly linked to human activities on the coastal and marine areas. This problem is directly affecting marine mammals all over the world and requires more long term research and funding investment from both scientists and administrators in order to get better conclusions about the impact of pollutants on the marine animal health and mitigation. The cytochrome P450 is an enzyme system which participates in phase I of biotransformation process of lipophilic xenobiotics like polycyclic aromatic hydrocarbons (PAHs) which are natural constituents of oil and planar halogenated aromatic hydrocarbons (PHAHs) such as non-ortho polychlorinated biphenyls (PCBs) used in transformers and other electrical equipment. The cytochrome P450 (CYP1A1) has been identified in some species of cetaceans including beluga whales (*Delphinapterus leucas*), minke whales (*Balaenoptera acutorostrata*) and bottlenose dolphins (*Tursiops truncatus*), and in different tissues such as liver, blubber or vascular endothelial cells in multiple organs. In the present study, fixed liver samples from stranded cetaceans will be used to demonstrate immunohistochemically the expression of CYP1A1 using a monoclonal antibody against cytochrome P4501A. The results of this investigation will be presented together with a corresponding histopathological study of the liver and with the pathological details of each animal included in this study.

MD10 INFLUENCES OF METHYL-, PHENYL-, ETHYLMERCURY AND MERCURYCHLORIDE ON LYMPHOCYTE PROLIFERATION AND CYTOKINE EXPRESSION IN HARBOUR SEALS

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Mercury is one of the most immunotoxic metals that may be present in the marine environment, but its effects on the immune system depend on its chemical form and concentration. In this study, the effects on adult and juvenile harbour seal lymphocytes after in vitro exposure to different

concentrations of four different mercury compounds were evaluated. The cells were cultured with methyl- (MeHg), ethyl- (EtHg), phenylmercury (PhHg, only adult seals) and mercurychloride (HgCl₂), and the subsequent lymphocyte proliferation was measured using a lymphocyte transformation test (LTT). Furthermore, mRNA cytokine expression of interleukin-2, -4 and -6 of MeHg-incubated cells was analyzed using RT-qPCR. For juvenile seals, a decreased proliferation was found for MeHg- and EtHg-incubated cells for both concentrations, but not for HgCl₂. In adult seals, the lymphocyte proliferation was not suppressed by mercury compounds. The lymphocytes' mRNA expression of IL-2 was suppressed by both concentrations of MeHg, IL-4, and -6 only by the higher concentration. This study showed an age-dependent immunosuppressive influence of mercury compounds. The cellular immunity of young animals in particular appears to be susceptible to the immunotoxic effect of mercury. Furthermore, in respect to immunotoxicity, the chemical form of mercury was important and increased in the following order: HgCl < (PhHg) < EtHg < MeHg.

MD11 NORTH SEA VS BALTIC SEA- COMPARISON OF IMMUNESYSTEM PARAMETERS IN HARBOUR SEALS

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The increasing commercial use of the North and Baltic Sea results in accumulation of stressors influencing the ecosystem. The cumulative effects of these stressors could affect the immune system of marine mammals. Impairment of the immune function might be responsible for the increasing incidence of infectious diseases in marine mammals of the North and Baltic Sea. To recognize possible changes in the immune system, a profile of pro- and anti-inflammatory cytokines, the acute phase proteins haptoglobin (Hp) and heat shock protein (HSP) 70 were investigated in blood samples of harbour seals from the North and Baltic Sea. Blood samples were taken from free-ranging harbour seals at the Islands Helgoland in the North Sea and Anholt in the Baltic Sea. After RNA isolation expression of pro-inflammatory [Interleukin (IL)-1, IL-8, IL-12, Tumour necrosis factor α (TNF),

interferon (IFN) γ], and anti-inflammatory cytokines [IL-4, IL-10, transforming growth factor (TGF)- β] as well as Hp and HSP 70 were analyzed using real time RT-PCR. Highest mRNA expression was found for the pro-inflammatory cytokine IL-2, followed by IL-8, IL-1 and TGF- β . Interestingly, the cytokine profiles showed widely accordance in their expression profiles and only discreet differences between animals of the North and Baltic Sea. For most cytokines slightly higher mRNA expression levels were detected in samples from the North Sea. However, IL-8 and haptoglobin mRNA were found in higher amounts in animals from the Baltic Sea. This study reveals interesting findings of the immune-profiles of North and Baltic Sea harbour seals. In summary, only little differences in cytokine expression patterns of animals from Helgoland and Anholt were found.

MD12 ULTRASOUND DIAGNOSIS OF GASTRITIS AND PARASITE (Anisakis sp.) GASTRIC INFESTATIONS IN DOLPHINS.

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Gastric lesions, mainly parasitations due to *Anisakis* sp., have been described in a moderate to high frequency, in most of dolphin species from Galician waters. Heavy infestations have been observed producing gastritis and gastric ulcers. The aim of this presentation is to demonstrate the utility of ultrasound examination of the dolphin's stomach chambers to diagnosticate gastric parasitations and associated gastritis. With this purpose, 60 death (very fresh) and 6 alive dolphins were ultrasound examined, belonging to four species: Common (*Delphinus delphis*), Striped (*Stenella coeruleoalba*), Bottlenose (*Tursiops truncatus*) and Harbour porpoise (*Phocoena phocoena*). Among them, 16 individuals presented clear increases in the wide of first stomach wall, diagnosticated as gastritis. In 9 animals, the presence of parasitic structures was identified as a very brightness and irregular images into the first chamber of the stomach. Finally, in 4 animals, the brightness structures (parasites) presented a maintained movement during the exploration. In death animals, the ultrasonically diagnosticated infestation could be demonstrated during the necropsy, corresponding all the parasitations to *Anisakis* sp. The "positive" ultrasound individuals presented heavy infestations (more than 50 *Anisakis*). By the other hand, the necropsies showed 18 "false negative" for parasitation, because of the presence of ultrasonically non-detected low number of parasites (1-10). We can conclude that ultrasound examination of

the gastric region can be very useful to visualize heavy infestations of stomach parasites. Although these parasites can be diagnosed with other imaging techniques such as endoscopy, the ultrasound examination appears as a good choice into the clinical protocol with alive animals, being a non-stressful technique. However, the detection of "false negative" animals make us to recommend the use of ultrasound in combination with other diagnostic methods, such as endoscopy or coprological analysis.

MD13 PARASITOLOGICAL FINDINGS IN TWO RISSO'S DOLPHINS (*GRAMPUS GRISEUS*) STRANDED ON THE ITALIAN ADRIATIC COAST

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Two specimens of Risso's dolphins have been stranded along the coasts of the Central Adriatic Sea during the last two years. In June 2005 an adult female of *Grampus griseus* was rescued in the Ancona harbour, and in June 2007 a male of the same species was found alive outside the town of Cattolica. Both animals showed signs of severe distress. Despite medical care and assistance provided by the Fondazione Cetacea (Riccione, Italy) and Acquario di Cattolica with hospitalization in a special pool, both animals died a few days after stranding. Complete postmortem examinations were carried out at the Faculty of Veterinary Medicine of the University of Padova. In this report we detail the morphological features of the parasites identified on these two dolphins, their topographical distribution in the body, and the relative histopathological lesions. A moderate infestation by the spirurid nematode (*Crassicauda grampicola*) was identified in both specimens. The parasites were localized in the pterigoideus and temporal sinuses. We also detected a few adult cestodes belonging to Tetrabothriidae family in the intestine. Interestingly, we observed also rare tetraphyllidean larvae (merocercoids referred to *Monorygma grimaldii*) in the peritoneum and skeletal muscles of the female Risso's dolphin. In the male, two types of tetraphyllidean larvae were found in the liver, mesenteric lymph nodes and in the testicles; the skin of this animal was also severely affected by crustacean copepods (*Pennella* sp.). The degree of the infestation and the location of

the parasites are indicative of the poor health status of the two dolphins at the time of the stranding.

MD14 FIN WHALE COLLISION IN THE CANARY ISLANDS: A PATHOLOGICAL STUDY.

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Collisions between large vessels and cetaceans have only recently been fully recognized as a source of anthropogenic mortality and injury, and they need to be assessed and quantified. A pathological diagnosis of the primary cause of death is not always easy, as most of the carcasses are found in a very advanced process of decomposition. Floating carcasses can be stroken by vessels, making difficult to determine whether the collision had occurred pre- or post-mortem. Since some years ago, we have made efforts for the development of histochemical techniques that could help to differentiate those situations, allowing us to get a final diagnosis. A histochemical technique based on detecting fat emboli in the lung blood vessels has been set up, and it has been applied to whales suspected to be killed by ship collision. An example of a collision of fin whale (*Balaenoptera physalus*) and a cargo-ship is presented in this poster. This animal appeared draping over the bow bulb of a big vessel at the commercial port of Las Palmas de Gran Canaria. Necropsy was carried out, showing severe damaging in several parts of the body and internal organs. Numerous fat emboli were demonstrated within mid size vessels and capillaries using osmium tetroxide and Oil Red O histochemical techniques. The present results reestate that both histochemical techniques could be a valid forensic tool to demonstrate severe traumas occurred "in vivo" (especially in ship-collision cases), allowing us to rule out "postmortem" changes found during the necropsy.

MD15 MOLECULAR IDENTIFICATION AND PHYLOGENETIC RELATIONSHIPS IN POXVIRUSES FROM CETACEAN SKIN LESIONS

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Cetacean poxviruses (CPV) cause tattoo skin disease characterised by typical, irregular, grey, black or yellowish, stippled lesions. CPV belong to a new genus of the subfamily Chordopoxvirinae (family Poxviridae) with a most immediate ancestor in common with terrestrial poxviruses of the genus Orthopoxvirus. The present study identified poxviruses in skin lesions from UK cetaceans and described phylogenetic relationships between poxviruses amplified in cetaceans from different ocean provinces. Frozen skin samples from suspected tattoos were obtained from eight harbour porpoises (*Phocoena phocoena*) and one striped dolphin (*Stenella coeruleoalba*) stranded around the UK between 1998 and 2007. Polymerase chain reactions (PCRs) targeting the CPV DNA polymerase and topoisomerase genes were positive for all lesions identified as tattoos whereas PCRs targeting orthopoxvirus hemagglutinin and parapoxvirus major envelope gene were negative. DNA sequencing of purified PCR products followed by generation of neighbour-joining phylogenetic trees showed that the UK dolphin and porpoise poxviruses grouped most closely with the poxviruses amplified in free-ranging striped dolphins (*Stenella coeruleoalba*), rough-toothed dolphins (*Steno bredanensis*) and bottlenose dolphins (*Tursiops truncatus*) from Florida and in captive Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) from Hong Kong to form a unique branch of poxviruses. The poxvirus infecting the UK striped dolphin was most closely related to the CPV branch that includes viruses from US Delphinidae. The harbour porpoise poxvirus was on a different phylogenetic branch indicating that a different species of cetacean poxvirus infects Phocoenidae. This suggests that a common ancestor of the Delphinidae and Phocoenidae was infected by an ancestral cetacean poxvirus that evolved with its separate hosts. The present study is the first to report a Phocoenidae- poxvirus.

MD16 THE POSTMORTEM FINDINGS OF THE "THAMES WHALE" JANUARY 2006

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On 19th January 2006 a northern bottlenose whale (*Hyperoodon ampullatus*) was spotted in the River Thames in central London. The animal died on 20th January during an unprecedented rescue attempt. A necropsy was conducted on 21st January. Gross findings showed the juvenile female animal was not severely underweight. There was evidence of marked pulmonary congestion and oedema, along with generalised visceral congestion. There were no significant findings from microbiological analysis (lung, liver, kidney, blood, lymph node, brain) to suggest any underlying infection. Results from the blood tests taken pre-mortem indicated moderate-severe dehydration, renal failure, muscle damage and possibly a mild anaemia. Histopathology confirmed severe pulmonary congestion and oedema, intra-alveolar haemorrhage and interstitial emphysema. A lack of polymorphs or foreign materials within the alveolar spaces indicated that the pulmonary oedema was probably caused by cardiovascular collapse alone. Immunohistochemistry (antifibrinogen) confirmed severe rhabdomyolysis of skeletal muscle and myocardial damage. Sections of renal tissue demonstrated scattered foci of positive staining for heat shock protein and positive staining for myoglobin within some renal tubules. A combination of pre-existing dehydration and cardiovascular/respiratory collapse and possibly myoglobinaemia/myoglobinuria (stranding myopathy) most probably induced the renal failure detected haematologically. Death of the animal could therefore be attributed to a combination of factors including pre-existing dehydration complicated by physiological stress and the effects of bodyweight induced by stranding/the rescue attempt. This may have led to cardiovascular collapse, respiratory impairment, multi-organ ischemia, skeletal and myocardial muscle damage and renal failure. The pre-existing dehydration was probably linked to the period the whale spent in the North Sea unable to feed on her normal deep-water prey and thus limiting the uptake of water through her diet. The reason that the "Thames whale" strayed into the relatively shallow North Sea from her normal deep-water/shelf-edge habitat ultimately remains unknown.

MD17 EPIDERMAL LESIONS OCCURRENCE ON TURSIOPS TRUNCATUS (Montagu, 1821) IN THE NORTHERN TYRRHENIAN SEA

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A scarcely studied population of bottlenose dolphins (*Tursiops truncatus*) inhabits the coastal waters of the Northern Tyrrhenian Sea. This population, as other populations of coastal marine mammals, is strongly exposed to different and intensive human activities. Although different studies have shown that no significant relationships were found between epidermal disease and contaminant level, having an idea of the epidermal health condition may lead to a preliminary idea of the general wellbeing of a population, and thus its response to human activities. The skin is the most visible part of the dolphin's body, and it is also the easiest to study non invasively using photo-id. In this study we used photographic techniques to obtain the prevalence and severity of skin lesions dissimilar to the dolphin's natural pigmentation. The photographs were taken over a three year period with year-round surveys. Only high quality pictures were selected from the database and used for examination. Epidermal lesions, physical deformities, and injuries were identified and classified. We then compared our results with earlier studies of worldwide bottlenose dolphin populations. The population we studied presented a low prevalence (<20%) and a rather high severity for the four types of skin lesions identified. The comparison of our results with that of the other populations of bottlenose dolphins highlighted the significantly lower occurrence of skin lesions in the population we studied as opposed to the other areas investigated. This study therefore gives us an optimistic general idea of the north Tyrrhenian population as far as epidermal diseases are considered.

MD18 TOXOPLASMOSIS IN THREE STRANDED ATLANTIC SPOTTED DOLPHIN (Stenella frontalis) IN CANARY ISLANDS

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Toxoplasma gondii has been reported to cause mortalities in marine mammals, including many cetaceans' species. From 2001 to 2006, 36 Atlantic spotted dolphins (*Stenella frontalis*) stranded in Canary Islands have been necropsied. Tissue samples were fixed in 10% buffered formalin and embedded in paraffin, sectioned and stained with Haematoxylin and Eosin for a routine light microscopical study. Three of these animals showed nonsuppurative necrotizing encephalitis associated to the presence of PAS positive toxoplasma-like organism structures. Other organic lesions were identified in adrenal glands, skeletal muscle, heart or stomach where those organisms were also observed. Immunohistochemistry for detection of *Toxoplasma gondii* antigens was performed on the brain, adrenal gland, heart and lymphoid tissues. A disseminated toxoplasmosis was histopathological and immunohistochemically diagnosed. The presence of toxoplasmosis in marine mammals has been described in many species. In the present poster we contribute with 3 pathological cases of toxoplasmosis in Atlantic spotted dolphins, a protozoal disease not previously documented in this specie.

MD19 HEAVY METALS AND ORGANOCHLORINE COMPOUNDS IN BLOOD OF A STRANDED RISSO'S DOLPHIN FROM NORTHERN ADRIATIC SEA, ITALY

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Pollutants play an important role in the crisis populations in dolphins. This long living mammals tend to accumulate contaminants because of the high lipidic composition of their tissues, their rank in the food chain and food preferences. Assessing pollutants concentrations can help to investigate the possible effect on the immune system and on the reproductive cycles of endangered species. Risso's dolphin *Grampus griseus* is rarely present in shallow waters like Adriatic sea, where represents about 4% of strandings (Mazzariol et al. 2007). Present work reports about the heavy metals and organochlorine compounds (organochlorine pesticides and PCBs) content in blood of a Risso's dolphin stranded in summer 2007 in Northern Adriatic Sea. Samples were collected during rehabilitation cares and analysed with ICP-AOS and GC/MS techniques. Metals concentration found are close to those observed in a stranded Risso's dolphin from Israel by Shohan et al. (2002) and are equal to 7.31 µg/ml for Hg, 0.05 µg/ml for Cd, 0.13 µg/ml for

Pb and 0,40 for µg/ml for As. Interestingly Cu and Zn are below the limit of detection of the method. For organochlorine compounds, only some of the investigated organohalogen were detected: HCB (0.77 ng/ml), ΣHCH (1.45 ng/ml), ΣDDT (4.32 ng/ml). Concerning PCBs, congeners 118, 128, 157, 158, 167, 177, 180, 183, 192 and 201 were detected, always at the ng/ml level. Low levels of organochlorine compounds observed can be due to the poor conditions of the animal, who was starved and didn't eat. This caused a loss of adipose tissue, a certain mobilisation of contaminants and their rapid excretion. The same consideration is valid for heavy metals. Actually there is a lack of comparing data and their interpretation can be speculative. Anyway, the combination of blood and tissues analysis will give more information and make these evaluation more easy.



Natural History

NH01 SYSTEMATIC AND TYPOLOGICAL ACCOUNT OF THE CETACEAN COLLECTIONS HOUSED IN THE ITALIAN MUSEUMS OF NATURAL HISTORY

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This study provides synthetic data on the composition of the cetacean collections kept in the Italian Museums of Natural History. More than 850 specimens (including mounted specimens, skeletons, skulls and other body parts) belonging to 39 species are preserved in 40 museums. Such collections consist mostly of Mediterranean species and are based on the recovery of specimens stranded along the Italian coastline. The collections include many individuals or body parts belonging to *Stenella coeruleoalba*, *Tursiops truncatus*, *Grampus griseus*, *Delphinus delphis*, *Balaenoptera physalus* and *Physeter macrocephalus*, which are the commonest species in the Italian waters. Rarer Mediterranean species are also present in the Museums, and, moreover, the collections contain also 53 specimens belonging to 26 extra-Mediterranean species. Two *Kogia sima* and one *Mesoplodon europaeus* are the only individuals of the species ever reported stranded along the entire Mediterranean coasts and maintained in a museum. Some collections possess a high historical value and represent a unique patrimony for biometric studies relative to the cetacean populations of the Italian seas, and may be important to ascertain recent trends in marine ecology. A brief historical note outlines cetological studies in Italy. A significant increase in cetacean collections is observed starting in the 1980s, when numerous and specific research studies were launched. In the past 25 years the consistency of cetacean collections in Italian museums nearly doubled.

NH02 SEXUAL DIMORPHISM OF HARBOUR PORPOISE SKELETONS

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The determination of sex is an important precondition to reconstruct the natural history of cetaceans and studies in cetacean biology rely heavily on stranded specimens although the condition of carcasses is often poor due to tissue decomposition. With regards to sexual dimorphism of harbour porpoises (*Phocoena phocoena*) it is known that males are smaller in total length but the structure of their pelvic bones is more massive. To provide further data for sex determination, we studied the growth of 83 harbour porpoises by using 66 different metric measurements of the skull and the postcranial skeleton. The sex of adult (but not subadult) animals can be distinguished by the relative width of the skull and the width of the humerus, respectively. Thus, besides the structure of the pelvic bones, morphometrics of the skull and the humerus can be used to determine the sex of adult harbour porpoises when only partial skeletal material is available. These results provide further data for the analyses of strandings, the handling of museum collections and for zooarchaeological studies.

NH03 SPERM WHALES PRESERVED IN THE ITALIAN MUSEUMS OF NATURAL HISTORY

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The authors report the results of a survey study based on the specimens of sperm whale (*Physeter macrocephalus*) kept in the collections of the Italian museums of natural history. The report includes a detailed list with the description of the samples (skulls, mandibles, skeletons, mounted specimens or single parts) and all the relative information (stranding and biological data). A thorough research was performed on historical files and

unpublished documents to obtain more information about stranding data from the past. As a result, a database has been established with all the information referred to sperm whale strandings along the Italian coasts dating back to the 16th century up to the present years, with a total of 242 stranded specimens. Presently, 38 sperm whale specimens are kept in 22 museums of natural history or similar institutions. An osteometrical study was performed to try to assess eventual morphological features specific of this population. Finally, the complete skeleton preserved at the Natural History Museum of Milan was studied in detail before exhibit, and more than 100 drawings were realized. The resulting accurate and illustrated description of the osteological characteristics of the specimen is presented here with some examples extracted from the whole catalogue of drawings.

NH04 MARINE MAMMALS AND ORAL HISTORY: A VIABLE MARRIAGE?

RAPPÉ, GUIDO

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In an oral history project on the historical ecology of the southern North Sea, Flemish retired fishermen have been interrogated in 2007 on the period 1930-1980. The goal was to try to retrieve valuable information of ecological significance extracted from the memories of former professional fishermen (ideally aged 75+), based on their lifelong field experience. Marine mammals were only one of the topics queried. The questions were very basic and clear. Where and when have you seen which species in what numbers and what were they doing? Pictures were used to support the communication. What are the chances and caveats of this method? The interviewer should master the subjects treated, be aware of the ways the human memory works (especially that of the elderly) and speak the same language (local dialects!). Oral history workers furthermore should be aware that they are creating a new historical source and act accordingly. The interviews were registered and stored in an archival facility, for future use in scientific, educational and/or socio-cultural contexts. The project yielded interesting anecdotes on distribution, ethology and ethnozoology. Every oral history project in the biosphere has its own context in time, space, biodiversity and experience of the people involved, the interviewer included. To draw a general conclusion on the methodology therefor is impossible. The conclusion in this particular study, as far as marine mammals is concerned, is that oral history certainly can add to the general picture by collating anecdotal data. 'Great expectations' however are not realistic: as a tool to retrieve scientifically sound data on non-commercial marine species oral history should not be overestimated.



NEW TECHNIQUES

NT01 GOOGLE EARTH APPLICATION TO MONITOR CETACEAN ON COAST

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Anthropogenic issues for cetacean protection especially along the Ligurian coast where fishing or maritime traffic are intense lead to propose mitigation alternatives. In 2007, numerous fin whales have been sighted in shallow waters in the North-western Mediterranean and at least two juveniles died entangled (6.5 m-long and 8 m-long) due to lack of management of these animals. This work presents our free application using Google earth©. It is dedicated to inform local authorities about whales presence on coast in order to minimize risks to hit them. The interactive tool gives the geographic positions with a 2-hours delay determined by field monitoring. This application zooms automatically on the most recent positions and includes as well previous day movements. More information as diving pattern, average speed or eventual behaviour near boats are also indicated. An estimation of positions trend for next hour are also indicated referring to its velocity and its index of linearity. Every two hours, information are updated and transfer to the Coast Guards to manage the maritime traffic in this area. It is friendly-use application that can be shared easily via internet. This tool was applied successfully for three different occasions: 1) in May 2007, from the 20th to the 30th, along the Ligurian Coast, with the 10 m-long fin whale that entered few times in Genoa's ports; 2) in June 2007, the 8th along the Ligurian Coast with a group of 4 fin whales travelling at a constant speed westwards. Along their entire trajectory, pleasure boats were slow down by Coast Guards; 3) in October 2007, the 28th to November, the 9th with an ill Cuvier's beaked whale. Its presence at Genoa-Voltri lead to stop a nautical

competition. This tool proved to be useful to protect cetacean where maritime traffic or fisheries activities and to limit unnatural mortality.

NT02 TWO TYPES OF "TIME" – NEW CETACEAN COMMUNICATIONS

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Introduction: The hypothesis tested is that cetaceans have a novel "temporal form," and use such for low stress communications, not previously recognized, studied or used in most known human endeavours.

Materials and methods: 1) acoustic, rhythmic transmissions to Megaptera and other large cetacean species, 2) synchronization of rhythms, 3) rhythmic message mimicry to initiate 4) "Rhythm Based Communication, RBC," 5) computerized data to analyze patterns of rhythmic durations, 6) development of an "RBC vocabulary," 7) identification of universal rhythmic concepts, both marine and terrestrial.

Results: "RBC" requires and produces low biological stress enhancing subsequent "Rhythmic Communications." Such "requirement" is for "rhythmic synchronization." "RBC" produces low stress (now involving many species) because this novel communication system depends less on what each organism does and more on "WHEN" such signals are received. The "WHEN," however, is Einstein's "RELATIVE Time T," and NOT "Conventional (space/speed) time t." "Time T" is defined as "the mental perception of 'rhythmic lateness,' RELATIVE to a pre-established rhythmic synchronization." Using "Time T," 1200 "rhythmic reciprocal greetings" with cetaceans have been achieved in the past three years with > 95% leading to extended "Rhythm Based Communications," and marked low stress encounters. Such seems a potential solution to advanced low stress "human-animal communications," including future human-whale encounters.

Conclusions: Humans use mainly information encoded in signals, signs and symbols, now known as "Signal Based Communication, SBC." Low stressed animals, including, to a large extent, the baleen whales, use mainly information encoded in "Rhythm Based Time T" or "RBC." All living organisms appear to often switch their communication systems from "evolutionary-type SBC," to "altruistic-type RBC," when, and only when, under low stress biological conditions.

References: 1) *Dancing With Whales*, Creative Book Publishing, ISBN 1-895387-28-0, 175p; 2) "TIME" beyond "conventional time," Rodway's Book Publishing ISBN 0-9689955-2-7 136p; 3) <http://www.animalcontact.com/research>

NT03 USING LASER METRICS TO MEASURE WILD BOTTLENOSE DOLPHINS

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Photo-identification is a powerful tool for estimating key population parameters. However there is often a lack of information on individual covariates that constrains assessments of many important life history traits. In this study we adapted a new laser metric technique, recently used to measure killer whale dorsal fin height, to remotely measure individuals from the resident bottlenose dolphin population on the east coast of Scotland. Long-term research on this population has discovered much about individual ranging patterns, associations and reproductive rates. Here, our aim was to develop techniques to explore variation in these patterns in relation to estimates of body size (that might provide correlates of age or sex) and information on body condition and growth. A simple portable apparatus was designed with two Beamshot 4mW laser sights fixed at 10cm apart and attached to the tripod mount of a Canon EF 70-200 f/2.8L USM lens. During photo-ID surveys the laser dots were projected onto the dorsal fin or body of the dolphin and photographs were taken, providing digital images with a known scale. Our aim was to determine the distance from blowhole to dorsal fin which previous studies indicate can be used to estimate total length, and to measure dorsal fin size as a potential indicator of sex. Laser dots were visible between 5 and 20m. Calibration of known length objects resulted in accurate estimates with average errors of 0.6% at 5m and 3% at 20m. Of 65 individuals recorded on 4 photo-ID trips in 2007 we used Image Tool 3.0 to estimate the total length of 11 individuals (ranging from 260cm to 323cm). We describe the development and use of this technique for bottlenose dolphins and suggest it can be incorporated into standard photo-ID surveys to provide important additional information on the characteristics of recognisable individuals.

NT04 INTER-ANNUAL VARIATION IN THE TIMING OF PUPPING OF INDIVIDUAL FEMALE HARBOUR SEALS (PHOCA VITULINA)

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Climate change and changes in food availability have raised concerns over the state of many pinniped populations, requiring a better understanding of

the ways in which individuals cope with environmental change. Studies suggest that variation in environmental conditions may cause inter-annual changes in the timing of pupping, but further work is required to confirm that such changes are not the result of difference in age-structure. This study was undertaken to determine the timing of pupping of individual harbour seals in Loch Fleet, Scotland. Pupping dates were obtained by sightings and re-sightings of individual females using photographic identification of the head and neck pelage patterns during the breeding season. These were compared with similar data from the same site collected during 2006. Data were also collected on site fidelity, lactation durations, maternal length using digital photogrammetry and pup sex. This group of harbour seals showed high levels of site fidelity both within (10 to 100%) and between (86.5%) seasons, and individual females were consistent in their relative timing of pupping between years ($p < 0.05$). Overall the timing of pupping occurred significantly earlier in 2007 compared to 2006 both for the group (2006, $n=31$, June 19th; 2007, $n=25$, June 15th; $p < 0.05$) and for individual (2006, $n=17$, June 17th; 2007, $n=17$, June 14th; $p < 0.05$) females. This may be explained by reduced food availability in 2006. Females who pupped earlier weaned their pups at an older age than females who pupped late in the season ($p < 0.05$), and female pups were born significantly earlier than male pups ($n=19$, $p < 0.05$). These results suggest that individual-based studies of inter-annual variation in the timing of pupping provide potential for exploring the impacts of environmental variability on harbour seals.

NT05 HOW TO DETECT “TOXICOLOGICAL STRESS SYNDROME” IN MEDITERRANEAN CETACEANS USING INTEGUMENT BIOPSIES

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In the last 20 years there has been growing concern about potential hazard to Mediterranean cetaceans occasioned by bioaccumulation of POPs such as organochlorine compounds (OCs) and emerging contaminants, such as polybrominated diphenyl ethers (PBDEs). While levels of organochlorine compounds are decreasing, concentrations of PBDEs seem to be increasing in the environment, including the Mediterranean sea. Several international

institutions (IWC, ACCOBAMS, etc.) have encouraged research and development of suites of sensitive non-lethal biomarkers in biopsies of free-ranging animals, to define the toxicological status of cetaceans. The main objective of our research group was to develop a non-lethal “multi-trial biomarker tool” applied to cetacean integument biopsies to detect “toxicological stress syndrome”. Here we propose a multidisciplinary approach, combining molecular biomarkers (western blot of CYP1A1, CYP2B, ER), gene expression (RT-PCR), a genotoxicity biomarker (comet assay) and proteomic studies with analysis of POPs (OCs), PAHs and emerging contaminants (PBDEs), for a complete assessment of the toxicological health status of the Mediterranean cetaceans. In order to validate this “multi-trial biomarker tool”, a three phase experimental protocol was followed. In a first phase (in vitro experiments) we explored the sensitivity of the “multi-trial biomarker tool” in cultured fibroblasts of *Stenella coeruleoalba* and *Tursiops truncatus* experimentally exposed to OCs, PBDEs and PAHs. In a second phase (biopsy/liver slice experiment) we validated this multidisciplinary approach in slices of biopsies and liver of stranded and free-ranging (biopsy) *Stenella coeruleoalba* and *Tursiops truncatus* treated with different mixtures of OCs, PBDEs and PAHs. Finally, in a third phase (field applications) we applied the multidisciplinary diagnostic methodology to explore differences in exposure to OCs, PBDEs and PAHs of three Mediterranean sub-populations of *Stenella coeruleoalba*. Future development and validation of this diagnostic methodology, embedded in a statistical “Expert System”, will provide more complete information about “toxicological stress syndrome” in Mediterranean cetaceans.

NT06 SEDRA: A NEW AUTOMATIC AND AUTONOMOUS UNDERWATER ACOUSTIC MONITORING SYSTEM

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The SEDRA system is an autonomous underwater equipment developed specially for digital submarine acoustic data recording. The principal characteristics are its capacity of storage of digital audio (20Gb), its autonomy (170h.), and that it can be used until a depth of 30 meters. It can be deployed for a week. At present, similar products exist but they need a superficial buoy where the audio recording and power system are located. The SEDRA system consists of a compact submersible device that integrates one hydrophone, electronic board to process the acoustic signals,

digital storage module and lithium polymer battery. This configuration has several advantages as the use is simplified, it cannot be detected at the surface, so the risk of theft and damage can be diminished. The SEDRA outside container is manufactured in a high resistance copolymer (Delrin by Dunlop) formulated with special additives, obtaining a good UV, and chemical resistance, appropriate for marine environments conditions. The system can be used repeatedly, as it's fitted with LiPo battery cells, supporting over 500 charges. For data transfer the SEDRA system is equipped with an USB port, permitting compatibility with standard PC's running windows. The SEDRA system has been tested successfully in marine conditions in Rias Baixas, Galicia, for a period of 30 days, the digital audio obtained was transferred to a PC every 5 days. This new equipment allowed us to record underwater sounds for long time without assistance, simplifying the digital recording of submarine acoustic data.

NT07 NEW TOOLS FOR MEASURING ACUTE-PHASE PROTEINS IN BLOOD AND LIVER SAMPLES OF HARBOUR SEALS (PHOCA VITULINA)

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The body's protective response to infection, wounding, trauma and malignancy include the acute-phase reaction. During an acute-phase reaction, levels of specific proteins synthesized by the liver e.g. C-reactive protein, serum amyloid A, haptoglobin, transferrin and ceruloplasmin change within the plasma. The quantification of the concentration of acute-phase proteins (APP) can provide valuable diagnostic information. This contribution focuses on the investigation of the APP transferrin and ceruloplasmin extracted from blood serum and liver from harbour seals (*Phoca vitulina*) of the North Sea. In a first attempt to determine transferrin in these biological matrices an immunoassay based on a canine antibody was tested. Despite of the near phylogenetic relationship between dogs and seals the antibody showed no cross reactivity. To overcome these problem a new method for the determination of transferrin and ceruloplasmin based on liquid chromatography and inductively coupled plasma mass spectrometry (ICP-MS) has been developed, which utilizes the characteristic metal content of both APPs for their sensitive and selective detection.

NT08 USING PERSONAL DIGITAL ASSISTANTS (PDA) IN CETACEAN RESEARCH FROM FIELD TO PAPER

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Coastal cetacean surveys have been performed in Israel since 1998. Pencil, paper pad and handheld GPS were the main tools for recording the field data. The research was done from small crafts and the amount of data collected was low. When digital hand-held technology that incorporated GPS became widely distributed, we decided to switch to such a system and adapt it for our needs. The developed software allows the collection of standard navigational (Sea state, Swell height, etc.) and observational data (Group size, Behavior categories, etc.) together with geographic coordinates. This data can be transformed to the laboratory data base either offline or online via internet connection (i.e. WiFi, GPRS, etc.) We have developed a versatile generic platform, suitable for diverse requirements. The technology used is based on the Microsoft infrastructure C#(.NET), using Windows operating systems, Windows Mobile 5 (WM5), MS SQL Express/7/2000/2005 and SQL Mobile MS for the Mobile devices. The database is queried and reports are produced with Microsoft reporting system. The reports are transformed to an excel sheet which can be transferred to any statistical software.

NT10 ESTIMATING FLUKE SPAN FOR SPERM WHALES WITH MISSING FLUKE TIPS

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Measurements of fluke tip-to-tip distance, or fluke span, made from photographs taken at known range, can be used to calculate sperm whale (*Physeter macrocephalus*) body length. Body lengths provide useful data for management including population length and age structures. However, this method is difficult to apply when one or both fluke tips are missing. In the Gulf of Mexico 24% of individuals identified from 2002 to 2005 had two

missing fluke tips. We explored several methods for estimating the location of missing fluke tips by measuring distances between geometrically derived fluke landmarks. The most consistent geometric relationships resulted from drawing a straight line tangent to the highest points of the trailing edge, a line perpendicular to this line through the notch, and a line along each lateral edge. We marked each fluke tip and intersection of the edge lines. Two researchers independently processed and measured images of 58 individuals from the Gulf of Mexico with intact flukes. We plotted distance to fluke tip versus distance to intersection and used linear regression to define this relationship. We tested the regression line's predictive accuracy by artificially obscuring the fluke tips. The predicted values of fluke span were in good agreement with the true values (mean difference = 0.3%) and results were consistent between the two researchers. This method seems most useful for flukes with more of the tip missing, while guessing the location of the missing tip seems most accurate when only a very small portion of the tip is missing. We believe that this technique allows reliable measures of fluke span and body size to be derived from whales with missing flukes but further research should be conducted, including comparisons of length estimates derived from fluke span with estimates derived using other methods.

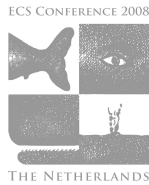
NT11 THE EIGENFIN METHOD FOR DOLPHIN IDENTIFICATION

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Many researchers believe that the combination of shape, markings, nicks and scars of a dolphin's dorsal fin are sufficiently distinctive to uniquely identify a particular dolphin. Visual identification offers an easier and less invasive method of identification than tagging. In the absence of distinctive marks, nicks and scars, visual identification is based almost entirely on the fin shape and can be time consuming and uncertain. Several researchers have used various techniques to automate the shape classification process. This paper introduces the eigenfin method of fin shape analysis, which is based on Principal Components Analysis (PCA) and is similar to the classical eigenfaces biometric identification technique for facial recognition. A set of training images is selected that has variations in fin shape. For each image, the dolphin is segmented from the image (dolphin pixels are separated from sea pixels) and put into a standard orientation. The fin subimage is extracted and scaled to a standard size. The training subimages are used to create a PCA basis that is used for identification. A new dolphin image to be identified is put through the same preprocessing steps as the training image to extract the fin subimage, which is expressed as a linear

combination of the PCA basis images, and the coefficients are compared to those of known dolphins. This process yields a sorted list of candidates for identification. The identification process is completed by post-processing software that transforms each image to partially compensate for the effects of roll, pitch and yaw and presents the overlaid images for a final visual comparison. The method permits the unambiguous detection of small fin shape differences. The eigenfin method is a useful complement to existing methods, particularly for dolphins that are difficult to distinguish visually.



PHYSIOLOGY & ANATOMY

PA01 "IN SITU" MAGNETIC RESONANCE IMAGING OF THE BRAIN OF COMMON (DELPHINUS DELPHIS) AND STRIPED DOLPHINS (STENELLA COERULEOALBA)

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The magnetic resonance imaging (MRI) are increasingly being used for neuroanatomical descriptions of the dolphin brain. Most of the previously reported MRI cetacean brain descriptions were done with images obtained from extracted brains examined by MRI. This is the first description of the adult common (*Delphinus delphis*) and striped (*Stenella coeruleoalba*) dolphins neuroanatomy from brains located "in situ", into the head of the individuals. During the study, MRI and Computerized Tomography (CT) examinations of the whole body of three common and two striped dolphins were carried out. We also made anatomical cross sections, in the three body planes, of five common and three striped dolphins. We have compared the anatomical sections that include the brain with their corresponding MRI and CT images. The images of the brain into the head presented has been successfully achieved the identification of the anatomic structures and determined their MRI image patterns, in order to set up the baseline to identify lesions. The CT scans produced a good definition of skull bones, allowing 3D reconstructions of it, but we could not achieve the identification of brain structures. The description of grey and white matter structures as

well as some cranial nerves and sinuses allows to consider MRI as a very useful tool for the pathological evaluation of this organ, presenting a complicated visualization access "in vivo" or a complex "post-mortem" dissection. We conclude that the MRI is a very interesting choice to study the internal anatomy of the brain of death dolphins that cannot be dissected, as well as for pathological diagnostic purposes in living animals.

**PA02 ANATOMICAL ORGANIZATION OF THE AMYGDALOID
COMPLEX OF THE BOTTLENOSE DOLPHIN (TURSIOPS
TRUNCATUS)**

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The anatomical organization of the amygdaloid complex (a part of the brain involved in emotional and motivational behaviour) of the bottlenose dolphin was studied using thionin and myelin-revealing methods and by immunohistochemical mapping of the calcium-binding protein parvalbumin. Three brains from autopsied animals were fixed by 4% paraformaldehyde. The anteromedial portions of the temporal lobes, including the amygdala, were isolated, cryoprotected and cut on sliding freezing microtome in serial coronal sections of 50 µm thickness. Adjacent series of sections were then stained with thionin and myelin-revealing techniques, while another series was used for parvalbumin immunohistochemistry. The amygdaloid complex of bottlenose dolphin can be divided in deep, superficial, and other nuclei. The deep nuclei include the lateral, basal, accessory basal, and paralaminar nuclei. The superficial nuclei consist of the anterior cortical nucleus, the nucleus of the lateral olfactory tract (small or absent), the medial nucleus, the periamygdaloid cortex, and the posterior cortical nucleus. The other nuclei include the anterior amygdaloid area, the central nucleus, the amygdalohippocampal area, and the intercalated nuclei. The deep nuclei (and primarily the lateral nucleus) represent the greater part of the amygdaloid complex. The virtual absence of the nucleus of the lateral olfactory tract is, probably, correlated to the absence of the olfactory bulbs. Parvalbumin-immunoreactive neurons were observed in most of amygdaloid nuclei, with the highest density in the lateral, basal, and accessory basal nuclei. Parvalbumin-immunoreactive neurons showed a non-pyramidal morphology and could represent an inhibitory circuitry that controls the activity of pyramidal neurons. The subdivision of the amygdaloid complex,

the prominent volume of the deep nuclei, and the features of the parvalbumin immunoreactivity suggest that the amygdaloid complex of the bottlenose dolphin is very similar to that of Primates.

PA03 GROWTH OF THE BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) FROM THE ADRIATIC SEA

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The bottlenose dolphin is the only marine mammal resident in the Adriatic Sea and there are still gaps in the knowledge on its biology. Growth of the Adriatic bottlenose dolphin was estimated from 75 dead specimen (39 females, 34 males, 2 unknown sex) found in the Croatian part of the Adriatic Sea during 1990-2004. Body mass, body length and age were determined as part of post mortal examination. The greatest measured length in females was 288 cm and body mass 261 kg, while in males they were 312 cm and 324 kg. Growth curves were fitted to mass-at-age and length-at-age data. In both males and females, most growth occurs during the first nine years. In females, length reaches a plateau during the 10th and 12th year of life, while in males the length increases continuously during this age. In females, the body mass increases continuously, whereas in males mass increases rapidly during the 10th and 17th year of life. The asymptotic length and mass are in females 277.88 cm and 223.39 kg, and in males 301.12 cm and 243.03 kg. According to its length and mass the Adriatic bottlenose dolphin is intermediate in size within world's bottlenose dolphins populations.

PA04 VARIATIONS IN NUTRITIVE CONDITION RELATED TO REPRODUCTIVE STATUS IN WESTERN MEDITERRANEAN STRIPED DOLPHINS

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In organisms, as cetaceans, that are down-top regulated, nutritive condition is the main factor determining resilience and demographic fitness. The accurate measurement of nutritive status is therefore critical to assess the ability of populations to overcome environmental change, either natural or human-related. Condition indices currently in use in cetaceans depart from the assumption that blubber thickness or blubber mass conform directly proportional to changes in body energy stores. However, cetaceans have a compounding pressure to conserve the blubber layer, which is the primary thermal barrier in the aquatic environment; it is thus relevant to investigate in these mammals the actual energetic role of protein. Through 3 independent condition indices we investigated variation in nutritive condition in relation to reproductive state in western Mediterranean striped dolphins (*Stenella coeruleoalba*). The study was conducted on a sample of 120 stranded individuals that were found in a gradient of nutritional status. Total body weight, muscle weight, as well as the weight and lipid content of the blubber and liver were determined and related to the weight of the heart, which was considered a reference value for body size. The results indicate that blubber mass and blubber lipid content, are sensibly varying with reproductive status (Study funded by MEC project CGL2005-00922/BOS).

PA05 INNERVATION OF THE VIBRISAL FOLLICLE SINUS COMPLEX IN YOUNG BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*)

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Dolphins are hairless except for the early postnatal phase of their life. Newborn bottlenose dolphins exhibit small vibrissae of about 10 mm in length on their upper lip, and maintain them until 3-5 months of age. We decided to verify immunohistochemically the innervation of this dermal sensory system, and obtained small samples of upper lip skin of three newborn *Tursiops truncatus* from the Mediterranean Marine Mammal Tissue Bank. Specimens were fixed in 4% paraformaldehyde, washed in buffer, cryoprotected, frozen and sectioned on a freezing microtome; 30 µm thick sections were then processed with an antiserum to Protein Gene Product 9.5 (PGP 9.5), a general neural marker. We observed that the vibrissal follicles show a very well developed innervation, as in most land mammals. Our results show that nerve bundles reach deep into the follicular bulb and

break into an interlacing plexus of nerve fibers within the cavernous sinus. The remaining part of the vibrissal follicle is enwrapped by axons of different thickness, positioned along the major axis of the vibrissae. Some of these nerve fibers give off a terminal arborisation with small globular expansions located especially around the upper region of the bulb. The rich innervation of the vibrissal follicle sinus complex suggests that, in newborn dolphin, the vibrissae, despite their poor number and small dimensions, could be the source of mechanical information coming from the surrounding liquid environment.

PA06 ASPECTS OF THE EPICRANIAL AIRWAYS IN THE HARBOUR PORPOISE (PHOCOENA PHOCOENA)

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The nasal complex in the order Cetacea is a structure that went through considerable evolutionary modification. This study analysed the epicranial nasal structures of *Phocoena phocoena*, the harbour porpoise, by means of anatomical microscopy, histology and electron microscopy with respect to the accessory nasal air sacs. Findings of this study confirm a stratified squamous epithelium for the epicranial respiratory tract. No sensory epithelium or sensory cells were found. The nasal complex of the harbour porpoise contains a distinctive and surrounding capsule of connective tissue, the 'porpoise capsule', in which the epicranial respiratory tract and nasal air sacs are embedded and that is to be interpreted as a stiffening element. Functional implications for the 'porpoise capsule' can be seen as an antagonist for the facialis musculature of which contractions manage possibly a sort of "fine tuning" of those elements responsible for the generation of sound in this area. The epithelial characteristics of the phonic lips are described here for the first time. Various layers of extremely flattened, incompletely keratinised epithelial cells lay directly on top of compact collagenous connective tissue. This can be interpreted as an adaptation to the strong mechanical stress of the epithelium of the phonic lips. The presence of mechanoreceptors in the immediate vicinity of the phonic lips and fat bodies here is described for the first time. They may be linked functionally in that way that mechanoreceptors give feedback regarding incidences such as vibrations or pressure changes in the fat tissue and phonic lips. This finding supports the current theory of the sound generation mechanism by Cranford et al. (1996). Further features, such as ovoid bursal cartilages behind the caudal fat bodies and a paired nasal elastin body located dorsocaudally of the caudal fat bodies are new findings and will be discussed in terms of functional implications.

**PA07 CRANIOMETRICAL VARIABILITY IN A SAMPLE OF ITALIAN
TURSIOPS TRUNCATUS**

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The bottlenose dolphins *Tursiops truncatus* is very variable in morphological and morphometrics traits all around its distribution. A craniometrical analysis was performed in order to identify possible variation of the Adriatic population of *Tursiops truncatus* with respect to the one present in others Italian waters. Thanks to the collections of Fondazione Cetacea (Riccione), natural history museums of Genova and Firenze, Accademia dei Fisiocritici di Siena, and Corpo Forestale dello Stato, a total of 34 specimens were measured. 39 morphometrics traits were measured with calipers of 1 mm precision and correlated with provenience, total length and sex providing a dataset of 1326 information. All the specimens selected were adults with a condylobasal length between 500 and 580 mm. Descriptive statistics are provided for all the direct measurements. Normalisation of the traits were performed on total lengths of individuals. Bivariate analysis concentrate on linear correlation between selected variables and condylobasal length, as well as the principal component analysis was performed in order to describe the fundamental axis of variation. The measurement obtained show a general variation within the range of the literature data for the Mediterranean. No significant difference was found related to sex in the whole sample. Only the wide nostrum measurement at 60mm from the base was greater in males. Related to geographical differences, 11 parameters show significant differences, as the Adriatic samples are larger than the others, underlining a previously supposed trait of this close population in decline.

PA08 MOBILISATION AND TRANSFER OF VITAMIN A IN GREY SEALS: RELATIONSHIPS WITH ORGANOCHLORINES

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Grey seal (*Halichoerus grypus*) females fast throughout their short lactation period. During that time, large amounts of essential nutrients, such as vitamin A, are mobilised into the milk to satisfy the demand of the newborn. However, fat-soluble pollutants such as PCBs and DDTs are also transferred to pups during that period. This study investigated the dynamics of vitamin A and organochlorines (PCBs and DDTs) in 29 mother-pup pairs from the islands of North Rona (NR) and May (IOM) in Scotland during the 2006 breeding season. Vitamin A concentrations in maternal outer blubber remained constant between early and late lactation (from 50.3 ± 22.1 mg/kg to 54.6 ± 21.1 mg/kg (NR) and from 46.1 ± 7.2 mg/kg to 45.5 ± 16.9 mg/kg (IOM)) whereas the levels significantly increased in inner blubber (from 37.9 ± 13.2 mg/kg to 111.8 ± 72.8 mg/kg (NR) and from 23.0 ± 4.7 mg/kg to 93.5 ± 66.9 mg/kg (IOM)). Blubber PCB and DDT levels followed the same pattern. Unlike terrestrial mammals, milk from late lactation was more concentrated in vitamin A than colostrum (from 6.0 ± 1.6 mg/kg to 18.5 ± 15.5 mg/kg (NR) and from 5.4 ± 1.3 mg/kg to 9.7 ± 5.4 mg/kg (IOM)). A significant increase in PCBs and DDTs was also observed. As a result, we observed a rise of vitamin A and organochlorine levels in the serum of suckling pups. The similarity in the dynamics of those compounds in milk and inner blubber suggests a potential common mechanism of mobilisation from maternal body stores and transfer into the milk.

PA09 THE LANGUAGE OF BONES: MORPHOMETRICAL ANALYSES OF ZIPHIID-SKULLS

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During 1999 and 2001 some studies were carried out on morphometry of ziphiid-skulls with special emphasis on the species *Hyperoodon ampullatus*

and *Mesoplodon bidens*. Data was derived from measurements of 13 skulls of *Hyperoodon ampullatus* and 3 skulls of *Mesoplodon bidens* from different German and Dutch museum collections. The first goal of the studies was the development and construction of instruments for morphometric analyses of these large skulls. A morphometrical measuring was conducted to analyse the relationship of the ziphiid-genera *Hyperoodon* and *Mesoplodon*. Furthermore, the measuring points, which were cited in literature for skull analyses, were critically discussed concerning their suitability and comparability of genera. The morphological and morphometrical analysis and their results showed, that this classical work in museums collections is, even today, an important basic work for further scientific work. Also, it is an essential work for the presentation of whales in public museums exhibitions.



SURVEYS, ABUNDANCE, STOCK ID, DISTRIBUTION

S01 ABUNDANCE TREND OF SHORT-BEAKED COMMON DOLPHINS IN THE EASTERN IONIAN SEA: ONE OF THE LAST CENTRAL MEDITERRANEAN STOCKS IS VANISHING

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Short-beaked common dolphins *Delphinus delphis* were studied for 13 years (1995-2007) in an area of about 1,000 km² surrounding the island of Kalamos, Greece. We present evidence of decline based on population estimates obtained through mark-recapture techniques. Pollock's robust design with Huggins estimator has been the preferred model. Previous work in the Kalamos area showed that this population of common dolphins could be regarded as open among years and closed within each annual sampling interval of 3-5 months, based on individual movement patterns, a high degree of site fidelity, and low rates of immigration. The proportion of unmarked individuals was estimated based on the number of photographs of marked and unmarked dorsal fins. No mark-recapture estimates could be done in 2006-2007 because of insufficient recaptures events. However, encounters in these years were so few and groups so small (mean size 5.7, SD=2.37, range 2-9) that all the individuals present could be identified. Estimated abundance of common dolphins around Kalamos declined steadily from 127 animals (95% C.I. 115-149) in 1995 to 15 in 2007. Large-scale cetacean surveys conducted by us and by other research groups since 1991, totalling tens of thousands km of dedicated effort and covering large portions of the Ionian Sea, suggest that common dolphins have been rare or absent in waters adjacent the study area. The hypothesis that common dolphin decline around Kalamos was the result of a gradually-shifting home range is presently unsupported. The Kalamos stock is one of the last in this part of the central Mediterranean, with the only exception of the inner Gulf of Corinth, Greece. Based on the observed trend, common dolphins around Kalamos may be eradicated from this portion of the Mediterranean Sea in

the near future if urgent management measures are not taken and enforced immediately.

**S02 USE OF NON-DEDICATED FERRY AS A PLATFORM TO
MONITOR CETACEAN POPULATIONS OVER 15 YEARS IN
CENTRAL TYRRHENIAN SEA**

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Monitoring cetacean presence, distribution and migration timing is an effective indicator to detect environmental changes and habitat degradation. The geographical and ecological characteristics of the Central Tyrrhenian Sea makes it strategic for monitoring the presence of animals, also because intercepts the marine corridor that connects the Northern-Pelagos Sanctuary to the Southern-Mediterranean Sea. From 1989 to 1991 weekly observation on cetacean were undertaken from non-dedicated ferries along the “transect” from Civitavecchia (Rome district) to G.Aranci (Sardinia). In 2007 research restarted with same protocol. We compared summer data of the three years in the 1990’s (87 ferry runs-590 hours of observations) with the study conducted from May to September 2007 (31 runs-160h). Each transect was considered as an independent statistical unit and we primarily analysed frequency of occurrence (f.o.), mean group size (g.s.) and distribution. Results showed that in 2007 f.o. of *Balaenoptera* sp. was $0,18h-1\pm 0,06$ with g.s. of $1,3\pm 0,11$ while, for *Stenella coeruleoalba*, was $0,51h-1\pm 0,08$ with $5,4\pm 0,57$ g.s. There was a significant difference of monthly f.o. of *Balaenoptera* sp. ($P<0.05$), with higher values at beginning of summer, strengthening the migratory behaviour trend recorded for the first time in the 1990’s. Monthly f.o. of *S.coeruleoalba*, instead, was similar during the summer period in 2007 ($P=0.36$) as it was in the 1990’ study. Compared with 1990’s there was an increase of f.o. of *Balaenoptera* sp. (78%) and of *S.striata* (29%), for the latter g.s. decreased (18%). Most of the sightings occurred towards the Sardinian coast. No ferry-whale collision was recorded in the investigated periods ($n=139$). Re-surveying confirmed how effective and cost efficient is such a programme for monitoring cetacean distribution and consequently environment quality. Increase abundance of animals and strengthening of migration pattern could be related to the Pelagos Cetacean Sanctuary supporting the need of the proposed new Sanctuary in the Southern-Mediterranean.

**S03 COASTAL HABITAT USE BY CUVIER'S AND BLAINVILLE'S
BEAKED WHALES OFF EL HIERRO, CANARY ISLANDS**

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This paper investigates the habitat use by two broadly distributed and little known species of the family Ziphiidae: Cuvier's and Blainville's beaked whales (hereon Zc and Md respectively). Cryptic behaviour and distribution over deep waters usually far from the coast complicate the study of Ziphiidae species. However, year-round populations of Zc and Md have been found near the coast off El Hierro, a volcanic island reaching water depths of up to 1000 m less than 1 nm from the shore, offering an optimal scenario to investigate these species. A long term study is on-going since 2003 using a combination of land and boat research platforms. In addition, sound and orientation recording DTAG's were attached to seven animals to study their foraging behaviour. A total of 1458 sightings of beaked whale groups have been recorded since 2003 in 116 effective survey days (753 hours of land-based effort), an average of 1.9 beaked whale group sightings/hour. Of these, 258 were identified to species level from the boat resulting in 135 confirmed sightings of Md and 123 of Zc. Visual data was combined with sub-surface data recorded from seven tagged Md providing information on the spatial location of their foraging dives. The distribution of the sightings and the movements of the whales while foraging were analyzed here in relation to bathymetric contours, topographic features and distance from the coast. Acoustic data on the distribution of prey capture attempts performed by the whales in the water column showed that Md forage both in mesopelagic and deep benthopelagic niches. This integrative analysis of a large data base of beaked whale sightings and a small set of detailed sub-surface data provides a unique window into the use of the habitat to forage by these mysterious deep diving beaked whales.

**S04 COMPOSITION AND GROUP STRUCTURE OF A SMALL
ENDANGERED RESIDENT POPULATION OF BOTTLENOSE
DOLPHINS (TURSIOPS TRUNCATUS)**

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The Sado estuary accommodates the only resident bottlenose dolphin resident population in mainland Portugal (and one of the few in Europe) which is small enough for monitoring using complete censuses. Its numbers have declined in the past decades, reaching a current number of 26 individuals, the minimum on record. The majority of dolphins in the population (76%) are adults, with half of the animals estimated as older than 27 years old. Average group size was 10.06 (sd 7.61). The most common groups observed in this study contained adults, subadults and calves, while groups with only subadults were not recorded. The average size of groups varied with age class: groups with adults, subadults and calves were larger () than groups with subadults and calves (2.0, N = 1). The coefficient of association (CoA) between dyads was calculated using the HWI and tested for non-randomness with SOCPROG 2.3. The CoA's ranged from 0.33 to 0.87 with an average of 0.61. Most dolphin locations recorded (n = 86) occurred in coastal waters adjacent to the river's mouth and in the south channel of the estuary, while only one position was recorded in the industrialized north channel. Feeding occurred mostly in the less polluted south channel. Group size was similar in all behavioral states, but it differed according to area. Groups in coastal waters and at the river mouth were larger (17.75 and 15.78, respectively) and groups in the north channel were the smallest (5.63). The continuing use of this estuary by resident bottlenose dolphins, indeed the survival of this population, will require stringent conservation measures, including habitat protection and rehabilitation, and enforcement of existing anti-harassment laws.

**S05 ANALYSING LOCATION AND MORPHOLOGY OF MINKE
WHALE (BALAENOPTERA ACUTOROSTRATA) AND WHITE-
BEAKED DOLPHIN (LAGENORHYNCHUS ALBIROSTRIS)
DORSAL FIN MARKS OFF FAXAFLÓI, ICELAND**

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Photo-identification studies depend on the ability to correctly identify naturally marked individuals. This study aims to photo-identify, through observations from May to September 2007, the different individuals of minke whales and white-beaked dolphins sighted during the whale-watching tours off Faxaflói, Iceland (May and September from 9.00-16.00, June-August from 9.00-20.00), using a Nikon D80 digital camera fitted with 70-300 mm zoom lenses, $f=4.0-5.6$. In particular marks occurring along the edge of the dorsal fin (DEMs) have proved useful in discriminating between individual whales. Shape and positions of marks have been considered. Of the total of 207 tours and 621 hours, minke whale were sighted on 143 (69%) and white-beaked dolphins on 64 (31%). A total of 66 individuals of minke whales were recognized (N=21 marked, mean group size=2.7, SD=1.63) and 60 white-beaked dolphins (N=25 marked, mean group size=5.0, SD=2.49) from close-up pictures. The DEMs showed marks mainly on the trailing edge of the dorsal fin (TE=99%; LE=01%), and a majority of rounded notches (minke, N=12; dolphin, N=09), indentations (dolphin, N=07; minke, N=02), top missing (dolphin, N=06; minke, N=00), triangular (dolphin, N=04; minke, N=04) and squared notches (dolphin, N=02; minke, N=02). Processes that could cause DEMs include inter (predation), intra (competition) specific interaction events, parasitic attachment and collision with vessels or debris. However, little is understood of the processes which lead to the formation of these marks. This first study underlines that using a whale-watching vessel as a research platform is a good way to collect photo-ID although a number of restrictions have to be accepted and results must be dealt with carefully. Carrying on such research might in the long term lead to a better consideration of the life history and status among cetaceans in Faxaflói. Of the total of 207 tours and 621 hours, minke whale were sighted on 143 (69%) and white-beaked dolphins on 64 (31%). A total of 66 individuals of minke whales were recognized (N=20 marked, mean group size=2.7, SD=1.63) and 60 white-beaked dolphins (N=25 marked, mean group size=5.0, SD=2.49) from close-up pictures. The DEMs showed marks mainly on the trailing edge of the dorsal fin (TE=99%; LE=01%), and a majority of rounded notches (minke, N=12; dolphin, N=09), indentations (dolphin, N=07; minke, N=02), top missing (dolphin, N=06; minke, N=00), triangular (dolphin, N=04; minke, N=04) and squared notches (dolphin, N=02; minke, N=02). Processes that could cause DEMs include inter (predation), intra (competition) specific interaction events, parasitic attachment and collision with vessels or debris. However, little is understood of the processes which lead to the formation of these marks. This first of this studies underline that using a whale-watching vessel as a research platform is a good way to collect photo-ID although a number of restrictions have to be accepted and results must be dealt with care. Carrying on such research might in the long term give a better consideration of the life history and status among cetaceans in Faxaflói.

**S06 WINTER DISTRIBUTION AND DENSITY OF SMALL CETACEANS
IN THE INSHORE FISHING GROUNDS OFF SOUTHWEST
ENGLAND**

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The objective of this research was to complement previous offshore surveys off Southwest England. The aims were to enlarge our understanding of winter inshore distribution of small cetaceans, compare inshore/offshore densities and to contribute data to the UK Strandings Database by recording and interpreting findings on stranded cetacean carcasses. The studies took place during the winters of 2006 and 2007 and provided density indices from line-transect boat-based surveys for harbour porpoise (*Phocoena phocoena*) and the short-beaked common dolphin (*Delphinus delphis*) in the inshore fishing grounds. The relative density index for porpoises was 13.2 sightings per 100km (n/L) which is comparable to data obtained off Pembrokeshire during Autumn. Common dolphin density (n/L) inshore was 5.2 (95%CI=2.8-9.2) whilst this ranged between 5.9 and 17.5 offshore. Group sizes of common dolphins ranged between 1-60 individuals with a mean of 10.22 (SE 2.84). This is higher than offshore (5.2-7.1) and may relate to differences in foraging behaviour or in group compositions. The majority of stranded cetacean carcasses showed lesions indicative of entanglement in fishing gear. The detailed analysis of digital photography proved to be a valuable tool in identifying lacerations on stranded carcasses. The condition of one carcass deteriorated to such a degree within 24 hours that upon reaching the Laboratory the cause of death (bycatch) could only be determined by the analysis of digital images. Systematic coastal surveys, targeting remote sites with little human visitation, also revealed that a percentage of cetacean strandings are not reported to the UK Strandings Database. The results highlighted that the inshore fishing grounds off Southwest England form an important winter habitat for porpoises and common dolphins, although further research is needed to increase sample size and coverage.

**S07 SIGHTING RATES FROM CETACEAN SURVEYS IN THE
MEDITERRANEAN BETWEEN 2003 AND 2007**BOISSEAU, OLIVER, LACEY, CLAIRE, LEWIS, TIM, MATTHEWS, JUSTIN, MOSCROP,
ANNA, DANBOLT, MAGNUS AND MCLANAGHAN, RICHARD

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A series of visual-acoustic surveys were carried out in the Mediterranean Sea between 2003 and 2007 from research vessel Song of the Whale. The primary aim of these surveys was to develop and test methodology for a basin-wide survey of sperm whales under the auspices of ACCOBAMS. Over 18,000 km of trackline were surveyed between the longitudes of 6°W and 36°E with an emphasis on regions with low survey effort. Survey tracklines were designed to provide even coverage probability and random start points. When light and sea state conditions were suitable, two visual observers were positioned on a platform 5m above sea level to record any sightings. Apart from sperm whales, nine other cetacean species were identified (fin whale, Cuvier's beaked whale, false killer whale, long-finned pilot whale, Risso's dolphin, bottlenose dolphin, rough-toothed dolphin, striped dolphin and common dolphin). Several of these species (plus sei whale) were also encountered during survey work in the Atlantic contiguous area (the entrance waters of the Mediterranean between the Iberian Peninsula and northwest Morocco). Visual encounter rates and pertinent results from all these surveys are briefly presented. Substantial information is now available from studies presented here and by other researchers for the planning of a basin-wide Mediterranean sperm whale survey.

S08 SITE FIDELITY AND RESIDENCE TIME IN FORAGING HUMPBACK WHALES IN NUUK FJORD, WEST GREENLAND

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Humpback whales (*Megaptera novaeangliae*) migrate annually from low latitude breeding grounds to high latitude feeding grounds, but little is known about the habitat use of Atlantic humpback whales on their summer feeding grounds in Greenland. Here we use photo-identification to study residence time and site fidelity in foraging humpback whales in Nuuk fjord, West Greenland. The study was carried out from mid-May to mid-October 2007. With an effort 89 days of visual survey and 45 days on the water, a total of 54 id-photos were taken leading to the identification of 20 individuals. To test for possible site fidelity, the id-photos were compared with a catalogue of earlier id-photos ranging from 1988 to present date. Most whales were present during June (31%) whereas May and September had the lowest number of individuals (4%). On average the whales stayed in the fjord for 2 weeks (SD=1.8). However, a single individual remained in the fjord throughout the entire season. One individual was present in July and

returned to the fjord in mid-October around the time where the humpback whales start their southward migration. Year to year site fidelity was verified in 20% of the identified individuals. Two individuals were matched to id-photos dating back to 1991 and 1992 in the same fjord. Two individuals were matched to id-photos taken in 2006. Positive id-matches of different years were also seen amongst photos in the catalogue. The humpback whales in Nuuk fjord are part of an open population as seen by the variable residence time. The open fjord allows the whales to migrate in and out throughout the season. Despite this, some individuals return to this specific fjord system strongly indicating year to year site fidelity in the West Greenlandic humpback whales foraging in Nuuk fjord.

S09 HARBOUR PORPOISE (PHOCOENA PHOCOENA) POPULATION STRUCTURE FROM UK STRANDING TOXICOLOGICAL RECORDS.

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With in excess of 700 entries, spanning nearly two decades, the UK cetacean strandings database is fast becoming a major resource, aiding our understanding of cetacean ecology, disease and conservation management. Strandings data include not only basic information on the condition and location of animals but also a comprehensive toxicological profile, including PCB and heavy metal accumulation. We used data from 564 stranded harbour porpoises (*Phocoena phocoena*) to investigate the spatial population structure of this species in UK waters. Principal components analysis of 25 chlorinated biphenyl congeners and 12 heavy metals provided an integrated toxicological profile for 284 animals, found to have stranded due to physical trauma (as opposed to infectious disease or other causes). This cause of death class provides the best approximation to the natural population. Hierarchical cluster analysis of principle components allowed a blind test, not subject to comparison between pre-conceived (for example, geographic) groups, of porpoise population structure. We found evidence for two, distinct geographical populations, based on toxicological data. These populations are broadly located on the North Sea coast of Scotland vs.

elsewhere in the UK. The Scottish stranded porpoises were associated with lower overall toxicological levels. This toxicological population structure is compared to population structure, obtained from population genetic (microsatellite) data. Further, we interpret PCB and heavy metal principle components to identify the key pollutants, associated with the greatest variance in overall toxicology, and show temporal trends in the most influential pollutants. Identifying differences in spatiotemporal patterns of ecological (toxicological) and evolutionary timescale (genetic) population structure is essential to understand dynamic responses to disease and, therefore, for effective conservation management.

S10 PRELIMINARY DATA ON SOUTHERN RIGHT WHALES (EUBALAENA AUSTRALIS) IN BAHÍA DE SAN ANTONIO, PATAGONIA, ARGENTINA

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A preliminary study was conducted in 2007 on the presence of southern right whales (*Eubalaena australis*) in Bahía San Antonio (BSA). Land based observations covered a total of 265h spread consistently over the months March-December. First whales were sighted inside BSA as early as April but no steady build up was seen until early August. A clear peak in sighting frequency (SF) was found in September (SF=0.3) after which it declined again rapidly. In total, 43 right whale groups were observed of which 48.8% consisted out of a solitary animal. Other group compositions were non-surface active groups (non-SAG's; 25.6%) consisting on average out of 2.3 individuals (SD=0.47), mothers and calves (M&C; 20.9%) and SAG's (4.7%) consisting out of 5 individuals (SD=1.4) on average. In total, 70% of the observed whale groups (n=33) were present at more than 1km from the coast. Whales present in BSA were mainly resting or in a slow traveling behaviour (63.4%). 22% of the whales were seen to be socializing with each other (non-SAG) whereas only few groups were believed to be engaged in a real courtship behaviour (4.9%). Other behavioural states were medium travel (7.3%), and other (2.4%). Data, although preliminary, indicate a clear presence of whales in BSA and suggest that it is not a main breeding area. The lack of information and the recent legalization of a "swim with whales" activity in the area point to the urgent need of continuous effort and research.

S11 USE OF T-PODS TO EVALUATE HOW BOTTLENOSE DOLPHINS USE CRITICAL AREAS WITHIN A SPECIAL AREA OF CONSERVATION

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Conservation plans for cetaceans and the designation of MPAs usually require the definition of critical areas, or hotspots, and rely mostly on sightings data. Such data are normally gathered during relatively infrequent visual surveys that are restricted to daytime, and depend heavily on weather conditions. The use of T-PODs, Timing Porpoise Detectors, can overcome some of the constraints presented by other survey methods, since they can be deployed continuously for long periods of time and work in all weather conditions. The T-POD is an automated passive acoustic device that detects and records cetaceans' echolocation clicks. In this study T-PODs were used to analyse seasonal and diurnal patterns in use of space by bottlenose dolphins in the Moray Firth Special Area of Conservation, Scotland, and to test the hypothesis that knowledge about these patterns will affect the definition of critical areas. Three areas of intensive use were originally identified from sightings data (1991-1997). T-POD data collected at these sites between 2005 and 2007 showed clear seasonal patterns, with the highest number of detections occurring between May and August. Contrary to previous findings the higher resolution T-POD data showed that the number of detections increased towards the inner Moray Firth as summer progressed. For the two most intensively used areas there were significant differences in the number of detections during night and day (Wilcoxon Sum of Ranks (Mann-Whitney) test, $p < 0.05$), but the pattern differed between sites. The use of T-PODs can help to expand the range of conditions under which data can be collected, giving additional insight into cetaceans' use of space, and providing a more robust framework for conservation strategies.

S12 SPATIAL AND SEASONAL DISTRIBUTION OF THE COMMON DOLPHIN (DELPHINUS DELPHIS) AND BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) IN THE SOUTHERN BLACK SEA

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The Middle East Technical University Institute of Marine Sciences routinely performs oceanographic surveys in the southern Black Sea covering the Turkish EEZ. During such surveys dolphins observed around the research vessel are recorded. In addition to these visual observations, sounds propagated by the dolphins are recorded by the multi-frequency scientific echo sounders of the vessel. These recordings can easily be isolated and used to assess the distribution of the dolphins along the surveyed area. In this study both visual observations and acoustical recordings were used to map seasonal differences in the distribution of dolphins (mainly *Delphinus delphis*) in the southern Black Sea. As the breeding season of Black Sea dolphins reaches its peak between June and July, it is assumed that the locations where dolphins are grouped during these months may indicate their breeding sites. Based on this assumption it can be postulated that the main breeding site of the common dolphins in the Black Sea is in the eastern region of the central gyres where they were aggregated in June and July.

S13 CETACEANS FROM THE SPANISH NORTH COAST. COASTAL SHIP SURVEYS AND LAND BASED MONITORING

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From July 2006 to June 2007, a coordinated project on cetacean populations distribution and ecology was carried out at north and northwest Spanish waters. This project, supported by "Fundación Biodiversidad" (Spain), joined for first time the conservation and scientific programs of four different organizations working at the Atlantic and Cantabrian waters. Here we

present the results obtained from land based sighting points and from the specific ship surveys in coastal waters. 25 monthly-sampled sighting points through the coastline were monitored by a working net of observers. In 21 of the sampled points, a total of 60 sightings of four species were registered: bottlenose dolphin (*Tursiops truncatus*, 46,7%), common dolphin (*Delphinus delphis*, 36,7%), harbour porpoise (*Phocoena phocoena*, 3,3%) and killer whale (*Orcinus orca*, 1,7%) , and also of unidentified individuals (11,7%). Most cetaceans were observed on the Atlantic and west Cantabrian coast. The average Rp was 3,9 hours/sighting. The relative density (individuals/25km²) for main species was: 2,9 for bottlenose dolphin and 2,4 for common dolphin. A total of 28 standardized shipboard surveys were made at coastal waters (13 at the Atlantic and 15 at the Cantabrian Sea), following line transects, that were designed trying to cover the maximum surface and with a similar effort in each one. A total of 2.490 km were surveyed, and 61 sightings were registered of seven species: bottlenose dolphin (31,1%), common dolphin (27,9%), pilot whale (*Globicephala melas*, 13,1%), minke whale (*Balenoptera acutorostrata*, 4,9%), fin whale (*Balaenoptera physalus*, 4,9%), striped dolphin (*Stenella coeruleoalba*, 3,3%) and Risso's dolphin (*Grampus griseus*, 1,6%). The average Rp was 4,6, but there were big differences among the areas (2,8 for Atlantic waters, 4,9 for the east Cantabrian Sea, and 6,2 for the west Cantabrian waters). The obtained data allow us to estimate the size population for common dolphin (8.400±2.600) and bottlenose dolphin (2.000±350).

S14 CETACEAN SURVEYS IN THE ISTANBUL (BOSPHORUS) STRAIT IN 2006

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The Turkish Straits System, namely the Istanbul (Bosphorus) Strait, Marmara Sea, and Canakkale Strait, is known as an important pathway for marine organisms, including cetaceans, between the Aegean and Black Sea. There found three cetacean species: bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*) and harbour porpoise (*Phocoena phocoena*). Due to anthropogenic stress, such as pollution, high human population, and sea traffic, there has been a great concern about these cetaceans. This study aimed to understand the seasonal and spatial distribution of three cetacean species in the Istanbul Strait. Regular surveys were made in March-November (except August) 2006 with a 12m commuter boat, covering the Black Sea exit to the Marmara Sea exit of the Strait

(approximately 16.3 nautical miles in length). Sixty surveys were made, totalling 257 hours and 1800 nautical miles (nmiles) of survey effort. Totally 387 sightings (3527 individuals) were recorded and the harbour porpoise was the most often observed species comprising 42%, followed by the bottlenose dolphin 39% and the common dolphin 19%. In terms of the number of individuals sighted, bottlenose dolphins were most abundant (41%), while harbour porpoises 30% and common dolphins 29%, because harbour porpoises formed smaller groups than other two species. The overall encounter rate was 0.215 sightings/nmiles. When the Strait was divided into three parts: North, Middle, and South, all three species were most often sighted (71%) in North, near the Black Sea exit, where less traffic and human population create less disturbance for cetaceans. In North and Middle, the sightings of harbour porpoises were most frequent, while in South, where sea traffic is heavy, bottlenose dolphins were most frequent. Both number of sightings and encounter rate peaked in June (129 and 0.403, respectively) and decreased during fall months (September – November) in spite of the constant effort.

S15 FROM THE BARENTS SEA TO THE ST. LAWRENCE: A TRANS NORTH ATLANTIC SIGHTINGS SURVEY (T-NASS)

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TNASS, planned under the auspices of NAMMCO Scientific Committee, will estimate the abundance of cetacean populations in the Northern North Atlantic from survey data collected during summer 2007 from 11 vessels and 5 aircrafts. It adds to the series of NASS surveys conducted in 1987, 89, 95 and 2001, thus forming a 20-year time series, providing an opportunity to detect temporal changes in abundance. Line transect methods, with when

possible double platform methodology, were used to collect visual data. Passive acoustic data were also collected from 5 vessels, with a focus on sperm whales. TNASS was coordinated in time, spatial contiguity and methodology with the European CODA and the American SNESSA surveys. The 12 main platforms covered 62.121 nm in effort in an area of c. 1,6 mill. nm², extending from the Eastern Barents Sea to the East coast of Canada and from 78° N to 52°N in the east and 42 °N to 61° N in the west. 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 over the Mid Atlantic Ridge. Cetacean encounters numbered over 4000 from 22 identified species, with fin whales and white beaked dolphin as the most common whale and dolphin species. With the participation of Greenland and Canada and observers on fishery surveys, a trans North Atlantic survey was achieved for the first time, adding to the NASS area with coverage to the west of Greenland and the eastern coast of Canada. Abundance estimates will be calculated from these data, followed by spatial modelling. Assessment of trends will be done by comparison with the earlier NASS surveys. Estimates will be incorporated into the management framework of NAMMCO and the IWC, as well as national plans.

S16 2007: A PARTICULAR YEAR OR THE SYMPTOM OF A GLOBAL CHANGE IN THE DISTRIBUTION OF LARGE CETACEANS IN THE NORTHWESTERN MEDITERRANEAN SEA ?

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The distribution and the behaviour of finwhales and spermwhales in 2007 were unusual in the Liguro-Provençal Sea, as stated by the results of the programme Objectif Cétacés (WWF / FNH / IOPR). The finwhales were rare, dispersed and generally shy, points that are not so usual. On the other hand, the visual encounters with spermwhales were comparatively numerous (11 in 2007 against 20 over 1994-2006), and generally with big groups (4.7 ind/group in 2007 against 1.01 over 1994-2006). Moreover the majority of the great groups were social units (females with young and even new-born), usually observed south of the 41°th parallel, in particular around the Balearic Islands. In the same way, these animals usually located on the lower slope (1426 m) and not far from the coast (22 MN) were seen in 2007 further from the coasts (31 MN and 2384 m of depth). The distribution of the cetaceans is generally the reflection of the distribution of their respective preys. Thus, it is probable that the climatological conditions of this year (mild winter, stormy summer) result in sparse and low phyto- and zoo-plancton production. This

has to be studied precisely, but it is an interesting assumption to explain the scattered distribution of the planctonophageous finwhales. But what to say about the arrival of these social units of spermwhales in this northern part of the Mediterranean Sea? Which were the attractive elements leading them to come here or the repulsive or limiting elements leading them to leave their more southerly districts? In order to seek answer to these questions, a discussion is in hand with teams of all the Mediterranean Sea. Do we face an atypical year or are we witnesses of a progressive adaptation of predatory to the evolutions of the marine environment following the global climatic change?

S17 MONITORING ABUNDANCE TRENDS OF BAHAMIAN ODONTOCETES

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Effective conservation requires knowledge of abundance trends. We report on an ongoing study to monitor the abundance of odontocetes in the northern Bahamas to support the newly established Bahamian Marine Mammal Protection Act, and to provide trend data for deep-divers following a mass stranding event concurrent with navy sonar (Balcomb and Claridge, 2001). Sea state influenced estimates of dwarf sperm whales, *Kogia sima* and Blainville's beaked whales, *Mesoplodon densirostris*, whilst the number of scientific observers influenced estimates of sperm whales, *Physeter macrocephalus*. Julian day (1 – 365 d) influenced dwarf sperm whale and sperm whale estimates, suggesting a seasonal effect. Estimated annual dwarf sperm whale and Blainville's beaked whale abundance decreased after 2000, whilst estimated sperm whale numbers in the study area were consistently low (Figure 2). These analyses provide the first abundance trends in this region, representing an important baseline data. Observed declines in dwarf sperm whales and Blainville's beaked whales after 2000 may be due to reductions in prey availability or the delayed impact of anthropogenic noise pollution.

**S18 THE DECLINE OF INSHORE BOTTLENOSE DOLPHINS
(TURSIOPS TRUNCATUS) IN SOUTHWEST ENGLAND**

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Historically the bottlenose dolphin (*Tursiops truncatus*) was a common sight off the Southwest of England, however, over the last 17 years there has been an alarming decline in both sightings and average group sizes. This study presents an examination of the Cornwall and Devon Wildlife Trusts Seaquest and Marine Strandings Network databases, utilising verified records since 1990. Sightings of bottlenose dolphins were found to be uniformly distributed though sites of particular note include Falmouth, St Ives, Torbay, Teignmouth, Plymouth and Bideford where sightings were more frequent. A significant decrease in sighting numbers since 1992 was recorded, with a concurrent decrease in average group sizes. Given the likelihood of an increase in sightings due to increased awareness and observation by the public, this decrease is substantial and extremely disturbing. In the last three years, there has been an increase in the reported numbers of stranded bottlenose dolphins. All stranded individuals were examined and recorded. In a small number of cases, suitable carcasses were retrieved for post-mortem analysis. During 2007, the results of one post-mortem concluded that the bottlenose dolphin died as a result of entanglement in fishing gear. Anonymous reports indicate that the fishing gear in questions was an inshore static net. The seas off the Southwest of England are one of the most heavily fished in the UK and there are concerns that the inshore static net fishery may pose a substantial threat to bottlenose dolphins. Until further research can be conducted, the precautionary principle should be applied to the conservation and management of inshore bottlenose dolphins in the region to prevent the continuing decline in their numbers.

**S19 NOTES ON THE ECOLOGY OF SOTALIA GUIANENSIS IN THE
SOUTHERN AREA OF THE GULF OF MORROSQUILLO,
COLOMBIA**

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Sotalia guianensis was designated in 2005 as a vulnerable species in Colombia, due to fast habitat changes caused mainly by anthropogenic pressure. The main threats for the Colombian populations in the Gulf of Morrosquillo are: regional changes in prey abundance and distribution, progressive loss of habitat, direct capture for illegal marketing and display, and incidental catches in fishing gear. The relative abundance, spatial distribution, habitat use and selection, group size and foraging behavior of this species were investigated in the study area from November 2002 through June 2006. Data collection consisted of boat-based surveys of dolphins and habitat that covered 8226.52 Km over 194 survey days, photo-identification of individual dolphins, behavioral data and carcass. Some of the results are: (1) The total number of dolphins/Km over all survey transects was 0.2, (2) 56.4% of the sightings (n = 75) were in Cispatá Bay, (3) Cispatá Bay was also the zone that presented the highest density of dolphins/km (62.6%, n =526), (4) Cispatá Bay had as well the highest level 0,1 calves/adult dolphin, (5) the average group size was 8.4 individuals, (6) the average depth of sightings was 9.9 m, and the average salinity was 28.6 ppm. Comparing this data with previous reports of this species in the same area of study, we noticed that the number of sightings were less than before. It was perceptible as well a shift in the habitat use, even there is a strong tendency for site fidelity and long-term residency specially for the foraging areas. These results highlight the need for conservation parameters for this species and its habitats in the Gulf of Morrosquillo.

S20 VISUAL AND ACOUSTIC MONITORING OF CETACEANS ON BERINGA ISLAND, RUSSIA FAR EAST: COMPARISON OF APPROACHES

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The main purpose of our research was to compare the effectiveness of two different methods of cetacean monitoring – visual and acoustic monitoring – in the Commander Reserve on Beringa Island, Russia Far East. During visual observations we performed two 15min scans of the area during each hour. To define the distance and direction to cetaceans we used the binocular “Bushnell 7X50” with internal rangefinder and compass. This allowed us to calculate the geographical coordinates of observed cetaceans

and put them on the map. For the acoustic monitoring we used a stationary radio-hydrophone situated in 700m from the shore. The bandwidth of our recording system was up to 24 kHz. During the study we have visually registered 7 cetacean species: sperm whale (*Physeter macrocephalus*), killer whale (*Orcinus orca*), Baird's beaked whale (*Berardius bairdii*), harbour porpoise (*Phocoena phocoena*), Dall's porpoise (*Phocoenoides dalli*), minke whale (*Balaenoptera acutorostrata*) and sei whale (*Balaenoptera borealis*). Acoustically we have registered the sounds of sperm whales and killer whales. We noted the presence or absence of sperm whale clicks each 15 minutes and compared these data with the visual observations. In good visibility the amount of clicks correlated with the number of visually observed sperm whales (Spearman correlation coefficient, $r_s = 0,898$, $p < 0,01$), but if the visibility was less than 10-12km correlation was non-significant. Thus, acoustic monitoring is more reliable indicator of sperm whale presence, than visual. For killer whales, acoustic and visual monitoring should supplement each other, because sometimes they are visible but silent, and sometimes vocal but invisible. For other species in this area, visual monitoring is more reliable, either because they are less vocal or because their sounds are beyond the bandwidth of our recording system.

S21 CONTRIBUTION TO SPERM WHALE (PHYSETER MACROEPHALUS) STUDIES IN THE AZORES USING PHOTO-ID TECHNIQUE

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Photo-identification data of sperm whales, (*Physeter macrocephalus*), was taken within the Azores archipelago, in the South of Pico island, between the 10th of May and the 30th of August 2003. This study was possible with the directions given by "land look-outs" and boats from a Whale Watching company (Espaço Talassa). Estimates indicate that approximately 300 sperm whales visited the study area within this study period. 129 of these 300 sperm whales have been photo-identified and 76% of these individuals were sighted only once. The interaction between a male and a group of female and immature sperm whales has also been noted. From the 129 photo-identified individuals, data from the most frequently sighted ones (group of 17 individuals denominated G1) was selected, and the frequency of their occurrence within the area of study was analysed. It was concluded that at least two family units, G1a and G1b, used this area with different timings

during the period of July-August and that feeding is the main activity is this area. Together with the research of Lisa Steiner in the North Atlantic and Mediterranean Sperm Whale Catalogue (NAMSC), it was possible to conclude that individuals from both units, G1a and G1b, (possibly incomplete) have been using the study area since 1989 and 1988 respectively, suggesting the return of these units to this place as a behaviour pattern of the sperm whales.

S22 SUMMER DISTRIBUTION AND ABUNDANCE OF CETACEANS IN NORTHERN / CENTRAL PORTUGAL

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Information about the distribution and density of cetacean species occurring in Continental Portuguese waters is still lacking. The present study, reports the results obtained during boat surveys aiming at the evaluation of the importance to cetacean populations of Northern and central Portuguese coastal waters. These surveys were conducted during summer 2007 along a coastal area presenting a high level of cetacean strandings and a documented importance to the harbour porpoise. The survey consisted in linear transects covering ca. 500 km and amounting to an effort of 30 hours. This allowed registering 29 sightings of 4 cetacean species: common-dolphin (n=21), harbour porpoise (n=2), bottlenose dolphin (n=2) and minke whale (n=4), yielding a frequency of 0.96 sightings/hour of effort. Concerning individual observations, a total number of 329 animals were recorded: 317 common-dolphins, 4 harbour porpoises, 2 bottlenose dolphins and 5 minke whales. This summer survey covered an area between Porto (northern Portugal) and S. Pedro de Moel (Central Portugal) emphasizing the importance of the Portuguese coast to cetacean populations, with particular reference to common dolphins. Comparing this census with those performed since 2002, it is possible to confirm a clear decrease in the number of harbour porpoise sightings. On the other hand, the highest number of total sightings of common dolphins was registered during 2007. Active feeding was the most observed behaviour in this species. Furthermore, the presence

of calves was confirmed in a large number of groups. For the first time, it was possible to detect minke whales in areas near the coast. Data emphasizes the need to implement a large dedicated survey to evaluate the distribution and abundance of cetacean populations that occur in Northern and Central Portuguese waters in order to implement effective strategies of conservation and management of small cetaceans. The survey consisted in linear transects covering a total of ca. 500 km and amounting to an effort of 30 hours. This allowed to register 29 sightings of 4 cetacean species: common-dolphin (n=21), harbour porpoise (n=2), bottlenose dolphin (n=2) and minke whale (n=4), yielding a frequency of 0.96 sightings/hour of effort. In what concerns individual observations, a total number of 329 animals were recorded: 317 common-dolphins, 4 harbour porpoises, 2 bottlenose dolphins and 5 minke whales. This summer survey covered an area between Porto (northern Portugal) and S. Pedro de Muel (Central Portugal) emphasizing the importance of the Portuguese coast for cetacean populations and to common dolphins in particular. Comparing this census with those performed since 2002 it is possible to confirm a clear decrease in the number of harbour porpoise sightings. Inversely, 2007 presented the highest number of total sightings and of common dolphins. The dominant observed behaviour for this species was active feeding and, in a large number of groups, it was possible to confirm the presence of calves. For the first time, it was possible to detect minke whales in areas near the coast. Data emphasizes the need to implement a large dedicated survey to evaluate the distribution and abundance of cetacean populations that occur in Northern and Central Portuguese waters in order to implement effective strategies of conservation and management of small cetaceans.

S23 ESTIMATES OF MOVEMENT AND SITE FIDELITY OF NORTH ATLANTIC KILLER WHALES USING OPPORTUNISTIC INDIVIDUAL IDENTIFICATIONS

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Dispersal can be driven by competition with kin, temporal and spatial variation in habitat quality and prey abundance, and in-breeding avoidance. The role of dispersal in determining levels of gene flow makes it of great

importance to the study of behavioural, conservation, evolutionary, and population ecology. A direct method for measuring spatial dispersal is by resighting naturally marked individuals. Marine mammals suffer a low cost of locomotion and are known to travel large distances. Multi-site mark-recapture techniques can therefore be a useful method for analysing individual movement and identifying long-range dispersal in marine mammals. Here we estimate transition probabilities of naturally marked individual killer whales between areas of high sighting density across the eastern North Atlantic and their inter-annual site fidelity within each site. Photo-identification data was collected through a mixture of dedicated surveys and opportunistic encounters between 1981-2007 from Iceland, Norway and Scotland. We find a higher probability than expected from random movement of resighting individuals between years within each study area, but limited or no probability of long-range movement of individuals between areas. We suggest that this pattern of site fidelity and low long-range emigration could be linked to the exploitation of predictable prey resources.

S24 CETACEANS HOT SPOTS IN ADRIATIC SEA: THE MONTE CONERO AREA

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Adriatic sea is a semiclosed gulf in the northern Mediterranean Sea characterized by shallow waters and high biomass production. Low salinity, important fishery and harbor activity too are distinctive for this high human pressure area. The presence of cetaceans is underestimated and although some hot spot were previously know in the Istria peninsula, Kvarneric archipelago, Greek coasts and islands, few information are available for the central area. Numerous strandings and sightings also witness for a stronger presences of sea mammals in the zone. The Monte Conero area is particular for the presence of one of the few high cliff along the Italian Adriatic coasts and for the conjunction of circulation and high productivity, related to different bottom characteristics, which create an important feeding ground for different species. A great collection effort of information from different sources and, from 2007, specific transect surveys have been improved thanks to logistic assistance of the Numana Commune group for civil protection. In 20 nautical miles around Monte Conero cliff it's actually possible to confirm the presence of *Tursiops truncatus*, *Stenella*

coeruleoalba, Grampus griseus, Delphinus delphis, Ziphius cavirostris, Balenoptera physalus, Megaptera novaeangliae. The only local population is of bottlenose dolphins that are present all year long with newborn concentrated between May and July. Recent stranding of a fin whale is the last confirmation of the use of the area also by large species. Delphinus delphis sights also were of great importance as very rarely present in Central north Adriatic. Problems with local fisheries are mainly related with few cases of bycatch and asportation of fish from nets. The importance for local ecotourism is also discussed. The Monte Conero area is particular for the present of one of the few high cliff along the Italian Adriatic coast and for the conjunction of circulation and high productivity, related to different bottom characteristics, create an important feeding ground for different species. A great effort of collection of information from different sources and, from 2007, specific transect surveys are improved thanks to logistic assistance of the Numana Commune group for civil protection. In 20 nautical miles around Monte Conero cliff it's actually possible to confirm the presence of Tusiops truncatus, Stenella coeruleoalba, Grampus griseus, Delphinus delphis, Ziphius cavirostris, Balenoptera physalus, Megaptera novaeangliae. The only local population is of bottlenose dolphins that are present all year long with newborn concentrated between May and July. Recent stranding of a fin whale is the last confirmation of the utilization of the area also from large species. Delphinus delphis sights also was of great importance as very rarely present in Central north Adriatic. Problems with local fisheries are mainly related with few cases of bycatch and asportation of fish from nets. The importance for local ecotourism is also discussed.

S25 DORSAL EDGE MARKS CATEGORIES: AN INDIRECT METHOD TO INVESTIGATE SOCIAL STRUCTURE OF BOTTLENOSE DOLPHIN (TUSIOPS TRUNCATUS) IN THE EASTERN LIGURIAN SEA.

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Group sizes and composition of free-ranging bottlenose dolphins living in the coastal waters of the Eastern Ligurian Sea (Santuario Pelagos), were studied using data collected during boat-based surveys carried out from August 2005 to October 2007. The aim of this study is to determine whether

presence/absence of calves produces significant differences in terms of size and structure of groups. Photo-identification and mark-recapture techniques were applied. Over the study period 33 encounters provided data that could be used in the group composition analysis, 220 dolphins were identified and catalogued. Group sizes ranged from 2 to 39 animals, calf presence ranged from 0 to 5. Schools containing calves (excluding calves from the analysis) were significantly larger (mean = 19.8) than groups in which calves were absent (mean = 8.5) ($p < 0.001$, Tukey-HSD test). In order to assess group composition, 5 categories were defined according to body size and type/extent of nicks on the dorsal fin edge: (1) calf, (2) juvenile, (3) adult/sub-adult without nicks, (4) adult/sub-adult with few and little nicks, dorsal fin edge still recognizable, (5) adult/sub-adult with a lot of and/or deep nicks, dorsal fin edge difficult to recognize. Schools with calves presented a significantly higher number of categories (3) and (4) and a significantly lower number of (2), compared to schools in which calves were absent ($\chi^2 = 14.11$, $p < 0.01$). Assuming that categories (3) and (4) are composed mainly by females, our results suggest that natal attraction phenomena could take place during the first period of calves' life, producing herds of mothers, calves and non-mothers (immature females and mature females without calves). These herds do not include mothers with juveniles, which seem to prefer smaller groups with a lower number of (3) and (4).

S26 GROUP SIZE VARIATION AND DISTRIBUTION OF RISSO'S AND STRIPED DOLPHINS IN THE NORTHWEST MEDITERRANEAN SEA

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Two ecologically and biologically diverse, sympatric species were compared in order to investigate how similar environmental conditions may generate different strategies and evolutionary responses. Group size variation and the distribution of Risso's (*Grampus griseus*) and Striped dolphins (*Stenella coeruleoalba*) in the North-west Mediterranean Sea was investigated to evaluate how seasonal and daily variations may influence distribution and group dynamics. Surveys were carried out for 17 years (1990-2006; May-October), with a total effort of about 255,000 Km and 25,500 hours. Risso's dolphins were sighted 151 times and were most frequently encountered on

the continental slope, with a mean group size of 15. Striped dolphins were sighted 1,894 times, they occurred preferentially in pelagic waters, and their average group size was 20. In general, Risso's dolphins were less influenced by seasonal variations than striped dolphins.

S27 COMMON DOLPHINS DECREASE IN THE STRAIT OF GIBRALTAR

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Common dolphin populations have declined dramatically in the Mediterranean Sea over the last 30-50 years. Although they were still very common in the Strait of Gibraltar over the past decade, a recent decrease in their encounter rate has occurred. Since 1999, CIRCE has sailed over 10 000km on effort in the area and realised over 465 sightings of common dolphins. Although the group size has not shown any clear trend over the years with a mean number of individual per sighting of 35 (95% CI: 15-56), the encounter rate has decreased dramatically from over 100 sighting per year until 2001 and down to less than 25 between 2003 and 2005 (Pearson adjusted $R^2=0.67$, Fisher test, $p<0.05$). Causes of this decrease are not known however many human impacts are taking place such as pollution, high maritime traffic, whale watching activities, recent morbillivirus epidemic that hit mainly striped dolphins but may have contaminated common dolphins as well.

S28 COMPARISON BETWEEN LAND AND BOAT BASED SURVEYS OF TURSIOPS TRUNCATUS IN LAMPEDUSA ISLAND

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One of the main goals of the LIFE project "Del.Ta." (NAT/IT/000163) is the preparation and implementation of the Action Plan to study and protect the bottlenose dolphin community in the Pelagie Archipelago (Sicily, Italy). The Action Plan stresses the relevance of regular monitoring of the presence, spatial and temporal distribution of dolphins in order to evaluate the impact of local activities (mainly fishing, tourist boat traffic and dolphin watching). Because vessel monitoring can be an expensive activity, this study evaluates the possibility that land-based surveys could be an effective

alternative survey method by comparing land and vessel-based survey data typology, together with their efficiency, repeatability, precision, time and cost required. During the summer of 2006, land and vessel-based surveys were carried out at Lampedusa, one of the Archipelago's Islands. 35 sightings were recorded from land, using continuous horizon scan, and 31 from the boat. Statistical analysis shows that observers from land have different sighting abilities. Comparing data between the two methods we saw that both methodologies are efficient, repeatable and precise, but there are differences in costs, sighting time and in what information is possible to collect from animals. Vessel-based surveys are expensive but a short time is sufficient to photo-identify animals and to observe social interaction and morphology. From land it is easier to analyse movements, interactions with anthropogenic elements and group dynamics.

S29 CETACEANS IN PINTUYAN, SOUTHERN LEYTE PHILIPPINES WATER SEPTEMBER 2007

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To our knowledge there is hardly any data on the list of species frequenting this area. The first two authors made two days dolphin surveys in front of Pintuyan Sogod bay, Southern Leyte Philippines water. During the surveys four dolphin species were encountered Melon-Headed Whale (*Peponocephala electra*), Spinner dolphin (*Stenella longirostris*), Fraser's dolphin (*Lagenodelphis hosei*) & Irrawaddy dolphin (*Orcaella brevirostris*). These species are known from the literature to be regularly sighted at the Philippines sea: The first three species were documented by Minolta Z3 camera photos & video. A pod of five Irrawaddy dolphins were observed for less than two minutes & were not photographed. On 24th of September a survey of 4 hours and 20 minutes was performed from a Motor Kayak 16HP. The average speed of the boat along the survey was 5 knots. Three observations of a total 39 minutes were made on three pods of dolphin from North Sonok, Pintuyan to San Ricardo, Southern Leyte: a pod of 5 Irrawaddy dolphins, 2 pods of 8 individuals and 25 individuals of Melon Headed Whale. On the second day on the 25th of September a survey of 3 hours and 30 minutes was done between Cogon, Pintuyan & San Ricardo, Southern Leyte. The average speed of the boat was 3 knots. Two observations were made totaling two hours & 18 minutes. A mix pod of 60 dolphins of Spinner dolphin, Fraser's dolphin & Melon Headed Whale were

observed and later on a pod of 8 individuals of Melon Headed Whale. The behaviors categories which were displayed by the animals were: Melon-Headed Whale-Travelling, Bow Riding, and Resting. Spinner dolphin-Travelling & Aerial Behavior includes spinning. Fraser's dolphin-Travelling. Irrawaddy dolphin - Travelling & Avoiding Boat.

S30 THE MEDITERRANEAN MONK SEAL , MONACHUS MONACHUS (HERMANN, 1779) ON THE NORTHERN CYPRUS

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The critically endangered status of the Mediterranean monk seal (*Monachus monachus*), of which only a few hundreds seals survive today in the Mediterranean, emphasizes the need to safeguard the small and scattered remaining colonies which are important for the vitality of the species. The Cyprus is one of the areas possibly holding one of these small colonies in the Mediterranean. The presently outlined work involved a comprehensive survey which was conducted along the North Cyprus during the course of summer 2006 and two complementary surveys conducted during the autumn and winter 2006-2007. The priority was given to the identification of the coastal caves that are suitable for monk seal use. Once the caves were identified infrared monitors were deployed to monitor seal movements in the caves. The collected data allowed photoing-identifying the recorded individuals and thus estimating the minimum colony size of the study area. A total of 5 seals were identified, one of them being a member of the Anatolian seal colony identified in other studies, while the remaining are 2 young adult females, 1 juvenile female (1 year old as of January 2007), and a sub-adult of undetermined sex. It is assumed that the juvenile must have been born on the island since it is too young to be able to travel the distance between the mainland and the island at the time she was first observed. The health of the coastal ecosystem was evaluated all using 5 indices; number of macro algae; number of fish species, number of species with conservation value, number of large fishes, in a unit area and sea urchin righting time. The types of human activities on the coast were classified and quantified. The indices were implemented into a GIS and outputs were compared with seal distribution. The results indicated that the seals prefer sites with less human activity and with high ecosystem values.

S31 SUMMARY OF REPORTED CETACEAN SIGHTINGS ALONG THE ISRAELI MEDITERRANEAN COAST (1993-2005)

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Background: Due to the low dedicated survey effort that it can launch, IMMRAC supplements its own sightings with those of reporting bodies with continuous at-sea or coastal annual presence. Expertise is traded for vast cumulated time at sea and good size judgment and detail perception. Methods: We present information from 2000 sightings reported by fishermen (49%), yachtsmen (26%), other vessels (14%), IMMRAC surveys (4%) and coast-based (7%), from a ~13km wide sea strip along the entire coastline. Species ID from non-experts relied on photographs, close (often real-time) interrogation and pictorial guides. Results: Estimated animal size breakage is: <5m 1939, 5m><10m 43 and >10m 18. Species breakage is: *Tursiops truncatus* 1534, *Stenella coeruleoalba* 22, *Delphinus delphis* 9, either Sc or Dd 160, *Grampus griseus* 11, *Balaenoptera physalus* 8, *Physeter macrocephalus* 8, *Balaenoptera acutorostrata* 6, *Pseudorca crassidens* 5, *Steno bredanensis* 1, *Ziphius cavirostris* 1 and 235 unknowns. Spatial density is homogenous. Mean annual sighting frequency/trawler day at sea is ~0.01, slightly higher in spring. For Tt, mean \pm SD sighted group size is 4.8 ± 11.1 , practically independent on time of day, geographical location and trawler-association, but doubles in winter and halves at shallow depths. Calves are reported in 1 out of 4 sightings in winter and spring and 1 out of 6 in summer and fall. Sighting frequency of large groups (>10) is 5% and doubles in winter. Mean \pm SD group size for Sc+Dd is 8 ± 13 , significantly higher than Tt ($p < 0.0001$), independent of depth, geography, season and time of day. Conclusions: Common bottlenose dolphin is by far the most likely species to be sighted near-shore, comprising 87% of identified sightings. General agreement with dedicated survey results puts some credence on this source of information, yet obvious discrepancies (i.e. 20 versus 50% Tt calves sighting frequency) point to limitations.

S32 VARIATIONS IN CETACEAN COMMUNITY COMPOSITION AND STRUCTURE WITHIN THE NORTHERN NORTH SEA, UK.

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Whilst both structure and composition are often examined within cetacean communities, the driving forces behind them remain largely unclear. One approach for identifying such forces is to undertake comparative studies of different cetacean communities. This study compared the structure and composition of cetacean communities in four areas of the northern North Sea: (i) the Aberdeenshire coast, (ii) the coastal outer Moray Firth, (iii) the non-coastal waters beyond the outer Moray Firth boundary and (iv) the inshore waters around the Northern Isles. These areas differ from each other in a number of ways, including average water depth, distance from the coast, proximity to the shelf edge and the influence of Atlantic Water entering the North Sea. Significant variations in species composition and rankings were observed between the four areas suggesting that a number of different cetacean communities exist, even within this relatively small North Sea region. The Northern Isles was seen to have the most diverse cetacean community with a total of nine species recorded, whilst the non-coastal waters of the outer Moray Firth had the least diverse community with only five species recorded. Although the structuring of cetacean communities probably relates primarily to differences in available habitat between areas, differences relating to competitive interactions between species were also noted. For example, white-beaked dolphins were only recorded, and held a higher position within the community rankings, in areas where bottlenose dolphins were not commonly present year-round. Within the northern North Sea, this fine-scale variation in community structure is probably driven by a combination of both differences in habitat between neighbouring areas and differences in competitive interactions between members within these communities. Similar factors may also be responsible for variations in cetacean community composition and structure in other geographic areas, and this may have implications for current management directives.

**S33 GEOGRAPHICAL, TEMPORAL AND BEHAVIOURAL
DISTRIBUTION OF SMALL CETACEANS AROUND THE COAST
OF DEVON: SIGHTINGS DATA AND T-POD PASSIVE ACOUSTIC
MONITORING.**

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The number of sightings of small cetaceans (Harbour porpoise *Phocoena phocoena* and Bottlenose dolphin *Tursiops truncatus*) has reduced dramatically in the past 20 years. Localised research in the south west of the

UK in limited in particular in the county of Devon, where this study is based. Using a public network of observers and T-POD acoustic data, this study sets out to address the geographical, temporal and behavioural distribution of the harbour porpoise and the bottlenose dolphin. These cetacean species are seen all year round, with highest numbers during the summer months which the studies shows to be June-August. Harbour porpoise and bottlenose dolphins show a non random geographical distribution between the north and south coast, and a non random temporal distribution both monthly and per hour. Identified hotspots for harbour porpoise along the north coast, in areas such as Lundy Island, Morte Point and Welcombe Mouth, shows it to be an important area for the species. These findings depicting the geographical and temporal distribution have implications for the conservation of bottlenose dolphins and harbour porpoise in Devon.

S34 COMPARISON OF PASSIVE ACOUSTIC AND VISUAL SURVEY TECHNIQUES ON BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) IN CARDIGAN BAY SAC, WALES

HICKEY, RONAN, BARBA, LAURA, BINSTEAD, MONICA, GARDINER, JANE, HRUKOVA NIKOL, NUUTILLA, HANNA, PESANTE, GIONVANNA, RUSTON, NICOLA, SCULLION, ANDREW, VENERUSO GEMMA, WILDIN, CLARE.

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The results of visual and acoustic detections of bottlenose dolphins (*Tursiops truncatus*), during line transect surveys in Cardigan Bay SAC were compared between different weather conditions, effort types and animal behaviours. A single element hydrophone was towed 120 metres behind the vessel during visual surveys on eight days in July, August and September 2007. Of the 26 dolphin encounters during the study period, 8 were detected by the hydrophone before being seen by observers, 7 were seen before any acoustic detection, 10 encounters were only detected acoustically, and one encounter of two travelling adults 200m directly ahead of the boat was seen by observers without being heard through the hydrophone. During the day of worst weather, sea state 3-4, there were two acoustic detections without any visual recordings of dolphins. On the calmest day, sea state 0, a group of 4 feeding animals was seen 950m ahead of the vessel. This group was not heard until 13 minutes after the initial sighting. Group size also had an impact on the detection rates. Groups of 5 individuals or more were more likely to be detected visually before being heard, while encounters with smaller groups were more likely to be detected acoustically. The results show that during visual line transect scans of Cardigan Bay SAC, a substantial proportion of dolphins remain unseen and unrecorded. While acoustic techniques cannot provide estimates of group numbers, it seems likely from encounters that were recorded both visually and acoustically that

these unseen dolphins were most likely in smaller groups or lone individuals. Visual scans in combination with passive acoustic monitoring could provide a higher detection rate of dolphins occurring in smaller groups, resulting in a more accurate representation of group size and composition of bottlenose dolphins in Cardigan Bay.

S35 ABUNDANCE AND HABITAT PREFERENCES OF STRIPED DOLPHINS (*STENELLA COERULEOALBA*) IN THE NORTHERN ALBORÁN SEA, SPAIN

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The Mediterranean sub-population of striped dolphins has been proposed as “Vulnerable” during the recent IUCN Red List assessment of Mediterranean cetacean subpopulations, especially due to its susceptibility to morbillivirus epizootics. Abundance has been estimated only for the whole western Mediterranean for 1991-92 and for the central-eastern coast of Spain for 2000 -2002. There are currently no data available to assess trends in abundance of this population. We used a large dataset collected over 15 years (1992-2006) to estimate absolute abundance and model habitat preferences of striped dolphins in the highly productive Alborán Sea (south-western Mediterranean). Shipboard line transect sampling was conducted along non-systematically designed transects which aimed to provide good overall coverage of the study area. A total of 1,127 sightings of striped dolphins were made during more than 57,000 km surveyed on effort. Mean observed group size was 55, ranging from 1 to 800 animals. A detection function was obtained using Multiple Covariate Distance Sampling. Various sources provided data on environmental covariates. Generalised Additive Models were used to model the abundance of groups and group size in two different steps, using those covariates. The results of the best models were combined to predict density across the whole study area. The overall density was one dolphin per sq km. The highest densities occurred towards deeper waters, with relatively low densities observed in shallow waters where striped dolphins often formed mixed groups with common dolphins. No trends in abundance have been found during the 15 year study period. This study contributes to the assessment of the present situation of striped dolphin in the Western Mediterranean and helps to guide conservation actions for this species in the Mediterranean.

S36 PRELIMINARY RESULTS ON THE DISTRIBUTION AND ABUNDANCE OF CETACEANS IN THE CROATIAN SOUTHERN ADRIATIC SEA

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The Adriatic Sea, is a small, semi-enclosed sea, connected to the Mediterranean through the narrow, but deep Strait of Otranto. The Palagruža sill separates the shallow northern and central sub-basins from the much deeper southern basin. Research in the Croatian Northern and Central Adriatic Sea indicates that the bottlenose dolphin (*Tursiops truncatus*) is the only regularly sighted cetacean species. However, information gathered in the deeper open waters of the Croatian Southern Adriatic points at a regular occurrence of a number of other cetacean species. Such difference in cetacean species occurrence is likely to be due to strong latitudinal and longitudinal asymmetries in bathymetry and associated habitat types. This work provides the first preliminary encounter data around the island of Vis. Between June and August 2007 a total of 14 boat surveys were conducted spending 624.41 km on-effort and in good conditions. Bottlenose dolphins (*Tursiops truncatus*) were encountered 19 times and a fin whale (*Balaenoptera physalus*) was sighted once. The mean group size of bottlenose dolphins groups was estimated 5.2, ranging from 1 to 14 individuals. Dolphin encounter rate was 0.113 dolphins/km, with a sighting frequency of 0.025 sightings/km in good conditions, twice that found in the north-eastern Adriatic. A photo catalogue was initiated using standard photo-identification procedures with a total of 89 mature and 26 immature dolphins identified. No matches were found with two other catalogues, from the north and central parts of the Croatian Adriatic. In addition, information gathered from stranding and opportunistic sightings indicates the presence of fin whales (*Balaenoptera physalus*), striped dolphins (*Stenella coeruleoalba*), Risso's dolphins (*Grampus griseus*) and Cuvier's beaked whales (*Ziphius cavirostris*). This would indicate that the continuation and expansion of this study is likely to provide valuable information on the real occurrence and habitat use by cetaceans of the Croatian waters.

S37 DO SPERM WHALES REGULARLY PASS FROM THE GULF OF CATANIA? EVIDENCE FROM 2 YEARS OF DATA COLLECTED WITHIN THE NEMO PROJECT

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The INFN NEMO-OnDE (Ocean noise Detection Experiment) station, deployed on the seafloor at 2000 m depth 25 km offshore Catania (Sicily, Italy) in year 2005, transmitted acoustic data from January to December 2005 and from July to November 2006. From April 2005, 5 minutes of recording (4 hydrophones, 45 kHz bandwidth, 96 kHz sampling rate at 24 bits resolution, self-noise is about 30 dB re 1 μ Pa²/Hz, close to sea-state 0) were taken every hour. In the initial phase, the recording was continuous; the analysis of continuous recording versus the 5 minute slots confirmed the statistic validity of the slots. The recordings revealed a more frequent and consistent presence of sperm whales than was previously believed. Only few sightings are available for the previous years and little literature is available for the area. On the contrary, with ONDE, in year 2005 sperm whales were detected in 117 of the 231 recorded days and in 31 of the 83 days in year 2006. Clicks were the most common sperm whale vocalizations recorded. Chirrup and codas (dominated by the 3+1 pattern) were present frequently, but creaks, possibly indicating feeding actions, were seldom heard. The whales were often detected, solitary or in groups, for segments of only a few hours. This, with the low rate of creaks, may mean they were just in transit. A comparison of 2005 and 2006 MASF (monthly acoustic sighting frequency) data puts in evidence a correspondence in the "peaks of presence" of sperm whales within the study area. In year 2005, May and August were the months with the most consistent presence. In year 2006 (from July to the half of November) the months with the highest detection rates were July and October, with no detections in August and September and few detections in November. In order to better understand the dynamics of sperm whale's presence within the area we tried to approach the analysis on a daily presence, on the 5 minutes slots, and also by aggregating the detections into clusters. We consider a cluster a group of slots with detections separated by other groups by at least 6 hours of silence (no detections). Further analysis carried on by the INFN NEMO-OnDE researchers, showed that average background noise is almost constant, with a monthly behaviour superimposable between the two year of recordings. Monthly variations in

level of mean background noise seem to be correlated to the presence of sperm whales within the detection area. Monthly maxima of the recorded background noise are clearly correlated with the presence of sperm whales. Based on the success of ONDE, a new project (LIDO - Listening Into the Deep Ocean) has been funded by EEC; the new project is in partnership with INGV (National Institute of Geophysics and Vulcanology) to expand its network of underwater platforms with broadband acoustic sensors. The recordings revealed a more frequent and consistent presence of sperm whales than was previously believed. Only few sights are available for the previous years and little literature is available for the area. On the contrary, with ONDE, in year 2005 sperm whales were detected in 117 of the 231 recorded days and in 31 of the 83 days in year 2006. Clicks were the most common sperm whale vocalizations recorded. Chirrup and codas (dominated by the 3+1 pattern) were present frequently, but creaks, possibly indicating feeding actions, were seldom heard. The whales were often detected, solitary or in groups, for segments of only a few hours. This, with the low rate of creaks, may mean they were just in transit. A comparison of 2005 and 2006 MASF (monthly acoustic sighting frequency) data puts in evidence a correspondence in the "peaks of presence" of sperm whales within the study area. In year 2005, May and August were the months with the most consistent presence. In year 2006 (from July to the half of November) the months with the highest detection rates were July and October, with no detections in August and September and few detections in November. In order to better understand the dynamics of sperm whale's presence within the area we tried to approach the analysis on a daily presence, on the 5 minutes slots, and also by aggregating the detections into clusters. We consider a cluster a group of slots with detections separated by other groups by at least 6 hours of silence (no detections). Further analysis carried on by the INFN NEMO-OnDE researchers, showed that average background noise is almost constant, with a monthly behaviour superimposable between the two year of recordings. Monthly variations in level of mean background noise seem to be correlated to the presence of sperm whales within the detection area. Monthly maxima of the recorded background noise are clearly correlated with the presence of sperm whales.

S38 CALCULATION OF CORRECTION FACTORS FOR MARK RECAPTURE POPULATION ESTIMATE.

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Mark recapture methods estimate only marked individuals in a population. To calculate the total number of individuals, a correction factor is used,

which is the ratio of the number of well marked individual pictures by the total number of pictures of all individuals. Since we could identify the unmarked individuals in a pilot whale population in the Strait of Gibraltar, we were able to compare real to calculated values from different methodologies. All results were very similar although the methods averaging correction factors between sightings had very large confidence intervals. Differences were found between real correction factors and calculated one however no trend allowed a constant conversion over the years. Therefore, it is recommended to use the percentage over the entire dataset to estimate the correction factor but reminding that some variance from true values may occur. This last method combines both precision and efficiency.

S39 CAPE VERDE ISLAND HUMPBACK WHALES: PAST, PRESENT AND FUTURE RESEARCH CONCERNS FOR THIS EASTERN NORTH ATLANTIC POPULATION

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Over the last 10 years, winter/spring cetacean surveys were completed around the Cape Verde Island archipelago using both inflatable boats and sailing vessels, with main target species the humpback whale (*Megaptera novaeangliae*). We obtained over 80 individual fluke photographs from this region. These fluke photographs are catalogued at the College of the Atlantic, Bar Harbor, Maine, USA and have been compared to over 6,000 individuals which are maintained in the North Atlantic Humpback Whale Catalogue. Based on fluke photographs, the Cape Verde Islands has a high inter annual resight rate (>20%), suggesting strong site fidelity for these humpbacks to this breeding ground. Two individuals had been photographically matched to northern feeding grounds of Bear Island, Norway and Iceland. Annually, humpback whale songs were recorded from

these waters for inter annual comparisons. Song comparisons were made using Raven software: from 1999 to 2007 show constant evolution with single cases of discontinuity. Song comparisons with recordings obtained in the Caribbean (2000, 2006, 2007) show parallel evolution of the song, indicating the existence of an exchange of information and therefore a contact between the two breeding populations. Future studies are required based on photo identification, acoustics and genetics for all portions of the Eastern North Atlantic. Additional international collaboration among scientists and naturalists to share humpback whale fluke photographs would provide important insight into the migratory patterns of this Eastern North Atlantic population. Cape Verde's tourism is increasing at an alarming rate. A balance is needed whereby conservation, whale watching guidelines, habitat preservation and CITES protection and enforcement will be very important components to gain knowledge and provide protection to this small population.

S40 ECOLOGY OF BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS) IN THE KORNATI NATIONAL PARK, CROATIA: POPULATION ESTIMATION, GROUP COMPOSITION AND DISTRIBUTION

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The ecology of bottlenose dolphins in the Kornati National Park (Croatia) was investigated regarding their population size and group composition as well as their distribution in two different years. In total 50 bottlenose dolphins (42 adult animals, 8 calves) could be distinguished by the standard photo-identification method. For the time period between the end of May to the middle of October, the dolphin population size was estimated to be 28 ± 4.88 individuals. Considering all 32 sightings, the groups ranged from 1 to 14 individuals (median = 4.4 ± 3.24). To describe and quantify the level of association between two different dolphins, the half weight index was calculated. Bottlenose dolphins with few strong relationships to a small number of individuals were found. In contrast, other dolphins exhibited many weak associations with many individuals. By defining a social cluster as having an association value of ≥ 0.4 , we received four subgroups of three to

eight individuals. In summary, the group compositions did not appear to be very stable. In 104 survey trips, covering a study area of 363 km², we had 27 dolphin sightings with a sighting frequency of 2.6% (sighting moments/driving moments). The dolphins showed different patterns in their spatial distribution. We found strong differences in sighting moments in the study area within and outside the main tourist season (in the core zone as well as in the 'offshore region'). In addition 9 dolphins were re-sighted from other study areas. Consequently, the home range of these 9 individuals is larger than the region of our study area. The re-sighting of two dolphins in the south of the Lošinj study area (Northern Adriatic) indicates that several individuals are travelling over approximately 90 km between the two areas. The results of this study provide a basis for further surveys.

S41 POPULATION DYNAMICS OF KILLER WHALES (ORCINUS ORCA) OFF NORTHERN NORWAY

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Killer whales (*Orcinus orca*) have been concentrating in northern Norwegian fjords during October-January for 20 years, where their main prey Norwegian spring spawning herring (*Clupea harengus*) has been overwintering. This has provided a unique possibility to study killer whale behavior and conduct long-term photo-identification work. We estimated the size and survival rates of identifiable animals in this population using photo-identification and mark-recapture techniques. Population size was estimated using simple two-sample estimators on pairs of years and using closed capture models in program MARK within years. In the latter analyses, the best models were selected using AIC; how well the models fit the data was explored using Goodness of Fit tests in programs RELEASE and MARK. The highest annual estimate of the number of identifiable animals was in 2003: 398 individuals (95% CI = 314-531). The proportion of identifiable individuals was estimated to be 0.556 (SE = 0.052) for 1992-1995 and 0.656 (SE = 0.041) for 2000-2003. Total population size for 2003 was estimated to be 606 individuals (95% CI = 460-800). Survival was estimated for stage/sex specific groups: adult males, adult females, sub-adults, juveniles and calves with Cormack-Jolly-Seber (CJS) open recapture models in program MARK. Adult male and adult female survival were estimated as 0.958 (SE = 0.0096, 95% CI = 0.935-0.973) and 0.959 (SE = 0.0142, 95% CI = 0.929-0.980), respectively. Lowest survival was estimated for calves, 0.816 (SE = 0.167, 95% CI = 0.335-0.975). Calving intervals were examined using photo-

identification data of total 14 years (1989-2002). Calving intervals ranged from 3-14 years (mean = 5.93, SE = 3.087).

S42 USING POD AND LAND-BASED OBSERVATIONS FOR MONITORING BOTTLENOSE DOLPHIN (TURSIOPS TRUNCATUS) AND HARBOUR PORPOISE (PHOCOENA PHOCOENA) POPULATIONS IN GALICIAN COASTAL WATERS

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From July 2005 to December 2006, CEMMA developed the project "Os Sons do Mar" funded by the Foundation Pedro Barrie de la Maza. The main objectives of the project were monitoring of bottlenose dolphin and harbour porpoise coastal populations in Galician waters, comparing the results from land-based observations with POD data, as well as to know the influence of coastal state on the presence of these cetacean species. From September 2005 to December 2006, five PODs were deployed on mussel rafts in Ría de Vigo and Ria de Pontevedra to detect the presence of bottlenose dolphin and harbour porpoise. At the same time, land-based observations were carried out from different sites of the coast, just in front where PODs were situated. The analysis of coast state was developed with the aim of knowing if there was some relation between the presence of cetaceans and coast degradation. A total of 194 hours of land-based observation were carried out and 25 hours of sighting were registered, being the bottlenose dolphin the most observed species. POD data also showed that Tursiops was mainly recorded inside the rías, specially on the north margin of them. By other side, PODs detected porpoises only outside rías. Data of land-based observations agreed with POD recordings, and we could observe that in areas most frequented by bottlenose dolphins, harbour porpoises weren't detected. Coastal analysis showed that the south side of the rías are worse conserved than the north, and the best conserved zones corresponded with areas where cetaceans were mainly sighted. The main conclusions of the projet were: POD are an useful tool for monitoring cetaceans inside the rías, there is a clear relation between coastal state and the presence of cetaceans, and there is a spatial segregation between bottlenose dolphins and harbour porpoises in galician coastal waters.

**S43 BEYOND THE SHELF: SHIPBOARD SURVEYS FOR
CETACEANS IN EUROPEAN ATLANTIC OFFSHORE WATERS**

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Since 1994 there have been two major surveys (SCANS and SCANS-II) of the European continental shelf to generate estimates of cetacean abundance and to contribute to an assessment of the impact of bycatch. In contrast, European offshore waters have only been partially surveyed and the abundance estimates generated suffer from several sources of bias. Offshore surveys to generate unbiased abundance estimates are especially important to complement on-shelf surveys for species that are distributed in both habitats. The CODA project will generate new information on the distribution, abundance and habitat preferences of cetaceans in the offshore European Atlantic; these data will contribute to bycatch assessment for common dolphin and to our understanding of the effects of military and industrial activities on deep divers. The survey area included offshore waters of the European Fishing Zone west of the UK, Ireland, France and Spain. Shipboard surveys were carried out during July 2007. Line transect methods were used to collect double platform visual survey data to allow analyses to account for the probability of detection on the transect line to be less than one and for responsive movement of animals to the ship. Passive acoustic data were also collected on survey ships for all species. Five ships covered 10 000 km of transects in an area of 880 000 km². Sightings amounted to just over 1 500 encounters of seventeen species. Fin whale encounters were greatest and centred in the Bay of Biscay and further West. Common dolphins occurred mainly in the southern part of the survey area. Sperm whales and three Ziphiid species were recorded throughout the area. Abundance estimates will be calculated where data allow. Estimates for the

common dolphin will be incorporated into a management framework that was developed during SCANS-II to allow safe bycatch limits to be determined.

S44 CETACEAN ECOLOGY AND BEHAVIOUR IN THE WATERS OF UTILA, BAY ISLANDS, HONDURAS: PRELIMINARY OBSERVATIONS

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The study of cetaceans in Honduras has a very recent history, and only a few efforts have been made in assessing coastal populations based on field research in Utila, Bay Islands. The purpose of this study was to generate baseline information for the long-term monitoring on the diversity of dolphin and whale species in these waters. Regular boat-based surveys and photo-identification techniques were used to study the occurrence, distribution and behaviour of cetaceans in the waters off Utila. Between May and December 2007, 41 survey trips were conducted and total effective effort of 143 h and 1648 km of cetacean survey were logged in the waters around the island. A total of 25 sightings were made of five identified species including long-snouted spinner dolphins (*Stenella longirostris*), common bottlenose dolphins (*Tursiops truncatus*), rough-toothed dolphins (*Steno bredanensis*), long-finned pilot whales (*Globicephala melas*) and orcas (*Orcinus orca*). Spinner dolphins were the most commonly sighted of the five delphinid species with 44% of all sightings and were predominantly recorded on the south side of the island. 26 groups of cetaceans were observed from which 76 individuals were identified and catalogued. Minimum group size observed was one individual for pilot whales, and maximum group size was 100, recorded for spinner dolphins. Animals used the study area for different activities with travel comprising 42% of all behaviours observed while feeding only 4%. In addition, sightings reported by the local dive shops and individuals expanded the knowledge of cetacean occurrence in these waters. Moreover, such involvement facilitates the development of positive relationships between scientists and local community. Further research in Utila will improve our understanding of the population structure and ecology of these species and will allow us to evaluate anthropogenic threats from the increasing tourism, fisheries and coastal development in Utilian waters.

**S45 OPTIONS FOR GREY SEAL PHOTO-ID MONITORING IN WALES,
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There have been various projects to capture images of Grey Seal pelage around Wales and Ireland from 1993 to the present by the Countryside Council for Wales (CCW) and others. This was to investigate seal movements, site fidelity and range and the possibility of abundance estimates using mark-recapture statistics. Understanding linkage between sites is an important backdrop to assessing condition of seals. Furthermore, using mark-recapture techniques, the approach can also give an estimate of total numbers. Between 1996 and 1998 images and capture histories formed an Irish and Celtic Sea Database for grey seals, termed EIRPHOT, where images were digitised into a desktop computer. Dedicated image processing and computer software identified matches for similar images, and generated a sightings history for each seal. This work was undertaken and the database maintained under contract by Conservation Research. In North Wales from 2001 to the present images have been incorporated into the CYMRUPHOT catalogue and MORLO database. This project will investigate the options for identifying matches using image processing and computer software and discuss their strengths and weaknesses for meeting monitoring requirements. Option 1:

1. The EIRPHOT catalogue and computer based matching system developed by Conservation Research (Hiby & Lovell, 1990). The matching system involves fitting a 3D surface model to the image and the program captures a pattern that is unaffected by camera angle or posture. This software catalogue is maintained by Conservation Research and requires a high level of skill and continuity; 2. Adapting an automated Photo-ID system for Common Seals developed by Conservation Research so that it can be used for Grey Seals; 3. Further development of the Identifier Patch method described in a 2005 ECS poster and in (Beaumont & Goold, 2007).

**S46 CHARTING UNDISCOVERED WATERS: CETACEANS AROUND
THE COAST OF MANN**

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The Isle of Man is an ideal location to survey and monitor cetaceans due to its central Irish Sea position combined with its rich and varied coastal habitat and unique bathymetry. Nevertheless, its unusual system of governance, being neither part of the UK or EU, and its lack of links with research institutions, has resulted in Manx waters remaining largely unstudied. The Manx Whale and Dolphin Watch (MWDW) was set up in 1995 to provide a permanent record of opportunistic cetacean sightings around the island. The large number of sightings reported suggested that Manx waters were a key area for several marine mammal species and in 2007 a team was set up to carry out formal scientific surveys. The surveys followed standard Distance Sampling protocol and covered territorial waters divided into 8 survey boxes. The surveys comprised 1793.7 km of effort and there were 117 sightings of 4 marine mammal species. An abundance estimate of 814 (501-1322; CV 24.5%) was derived for Harbour Porpoise (*Phocoena phocoena*). Additionally, a photo identification catalogue of Risso's Dolphins (*Grampus griseus*) was created, thus far consisting of 20 well-marked individuals. Furthermore, there were 461 opportunistic sightings, reported by members of the public, of 9 cetacean species. Sightings from both sources show that the predominant species using Manx waters are the Harbour Porpoise, Risso's Dolphin, Minke Whale (*Balaenoptera acutorostrata*) and Grey Seal (*Halichoerus grypus*). The high frequency and diversity of sightings suggests that Manx waters provide a marine habitat of international importance. A hugely successful first year, in the face of adversity, leaves us confident of determining in greater detail the diversity, abundance and temporal and spatial variations of species within this habitat. It is hoped that highlighting the importance of Manx waters to marine mammals will lead to the eventual creation of marine protected areas.

S47 METHODS FOR THE TREATMENT OF MARINE MAMMAL SIGHTINGS DATA AND PRODUCTION OF PHOTOGRAPHIC CATALOGUES

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Introduction: In cetacean studies an important phase of the research is represented by the use of specific technologies to gather and analyse data. This work show a new method and a new software to collect and data analyses.

Material/methods: For photographic analyses a digital camera connected to a Gps is used. This allows to incorporate geographical coordinates in the

exif data of the release while a plotter records the course of the boat. Subsequently, with a specific software, data are filed and statistically analysed. **Results:** "Dolphin Manager" represents our approach to the marine mammal analysis. The software, developed in VisualBasic, use Access-format files and it can be especially applied to species such as the Bottlenose dolphin (*Tursiops truncatus*), Risso's dolphin (*Grampus griseus*), Fin whale (*Balaenoptera physalus*), Sperm whale (*Physeter catodon*). The software has been projected to automatize as much as possible the analyses, allowing quick insertion and treatment of great quantities of images and data coming from the research campaigns. In brief is possible the following operations: sighting data collection; the automatic importation of the sighting photos in specific files; the separate or joint treatment of different areas and/or groups; the treatment of photos with more than one target individual without file duplication; the definition of the target individual in the photo through "marks" of the dorsal fin and body; the georeferencing of photos through date/hour on the GPS trace; the building of registry from the identified individual; the "matching" with the identification mark filter joint to the zoom and pan functions. Other results are possible analyzing the Access files. **Conclusions:** Dolphin Manager, through the software Acces, allows to extract from files many different types of information on the target population, such as for instance the printed photographic catalogue, the representation of the positions of single sightings through GIS, the statistical output of the correlations among individuals within a given group, the individual movements, the reconstruction of familiar relationships, the distribution and abundance.

S48 ABUNDANCE ESTIMATE OF THE RIVER DOLPHINS INIA GEOFFRENSIS AND SOTALIA FLUVIATILIS IN THE ORINOCO BASIN (VENEZUELA – COLOMBIA)

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This research estimated the abundance and density of *Inia geoffrensis* and *Sotalia fluviatilis* along 380 linear km in the Orinoco river (Venezuela) and the *Inia* along 800 linear km in the Meta river. Surveys were conducted respectively in the rising water period and high water period. Abundance estimate was based on a combination of strip and line transects, stratifying the area in different types of habitat (main river, tributaries, islands and channels). Vessels used in this survey were similar in both cases and consisted of two platforms of observation located at four meters above the

river level. Five observers were located on these platforms, three to cover bow and two to cover stern. Both platforms were in permanent communication. Estimates of strip transects were calculated within a strip width of 100 m. Preliminary evaluation of the data using DISTANCE 5.1 showed that frequency distribution was almost uniform. A total of 46 sightings was obtained, 27 of *Inia* and 19 of *Sotalia* in the Orinoco river, and 14 of *Inia* in the Meta river. Density of *Inia* in the Orinoco river was highest around islands (1.26 ind/km²), and for *Sotalia* these was highest in the main river (1.16 ind/ km²); on the other hand density was highest in channels (1.53 Ind/km²) in the Meta river. Despite a large area was sampled in the Meta river, the abundance of dolphins was lower (292) than in the Orinoco river (*Inia* 1184 and *Sotalia* 1159). The Average group size was highest in confluences for both species. These results demonstrate that *Inia* and *Sotalia* were very selective about which available habitat to use. This research represents the first contribution about the size of dolphin populations in the Orinoco basin.

S50 RESIDENCE PATTERNS, SITE FIDELITY AND POPULATION STRUCTURE OF BOTTLENOSE DOLPHINS IN CARDIGAN BAY, WALES

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Cardigan Bay in West Wales is known since at least the early 1920s as home to a population of bottlenose dolphins (*Tursiops truncatus*). However, the level of residency and site fidelity of this population and the exchange of individuals with adjacent waters have yet to be fully elucidated. Photo-identification data collected by Sea Watch Foundation over the period 2001-07 from 681 photographic boat surveys have been analyzed to shed light on this. 198 well-marked dolphins were identified, with individuals seen up to 48 times, and sighting frequencies ranging from 1 to 26 (mean=4.13, SD=6.23). However, 11% of the dolphins were seen only once and 58% from 2 to 9 times; 28% were seen in only one year, and 10% during all the years. 28% were defined as common (seen ≥ 12 times), 11% frequent (seen 8-11 times), 26% occasional (4-7), and 35% rare (1-3). An attempt was made to divide the dolphins into residents, temporary migrants and transients, but different classifications taking into account either the re-sighting frequency or the presence in consecutive seasons and years, or both, gave different results, suggesting that the residency level of this population might be better

described in an alternative way. The best fitting model that resulted from the mark-recapture analysis for the 01-07 pooled data revealed that the emigration rate between years was 10%, and the likelihood that emigrated animals stayed out of the bay the next year was as high as 80%. These data suggest that we are dealing with a meta-population showing some level of residency and site fidelity but also a consistent number of transients and infrequent individuals. This population is better described by an open model, and is probably drawn from a much larger one, encompassing part if not all of the Irish Sea. This has important implications for management.

S51 SEASONAL OCCURRENCE AND GROUP SIZE OF HARBOUR PORPOISES (PHOCOENA PHOCOENA) FROM THE FRENCH SOUTHERN NORTH SEA

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The harbour porpoise (*Phocoena phocoena*) is the most abundant cetacean in European coastal waters. Recently, changes of its distribution have been observed on various locations in the southern North Sea, including the Netherlands, Belgium and France. Their presence has been regularly recorded during sea watch surveys undertaken on Cap Gris Nez (the limit between the Channel and the North Sea) and on the Digue du Clipon (further east, French coast of the southern North Sea, 51°N/2°E). From January 2004 to September 2007, more than 3,628 hours of effort have been dedicated to record seabirds and marine mammals in this area. A total of 115 sightings of harbour porpoises have been collected (301 individuals). Group size was variable (mean=2.6; SD=4; range=1-36), with solitary individuals being the commonest group type encountered (n=42). Groups were mainly constituted by adults, but larger groups also included young individuals. The largest group sizes were observed in March. The seasonal occurrence of harbour porpoises showed significant variations, with relative abundance being the highest in winter and spring (especially March: mean=0.4 ind./h) and the lowest in summer (no sightings in June). Activities of porpoises were recorded on several occasions, and feeding was the most frequently recorded activity, followed by travelling. These data provide the first assessment of the year-round occurrence of harbour porpoises along the southern bight of the North Sea based on effort-related information. It underlines the high seasonal variation of abundance of this species in this

area, and quantitatively documents the occurrence and recent come-back of harbour porpoises along the French coast.

S52 PRESENCE OF SOCIALIZING SPERM WHALES IN THE LIGURIAN SEA ASSESSED THROUGH ACOUSTIC, BEHAVIORAL AND PHOTO-IDENTIFICATION DATA

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Sperm whales are widely distributed across the Mediterranean Sea. The north-western basin is described as an area with high relative abundance, where sperm whales are generally encountered as isolated males or in small groups of two to three animals, mostly engaged in feeding activity. Socializing units have been reported only sporadically. This work discusses the presence of sperm whale social herds in the Ligurian Sea, assessed through acoustic, behavioral and photo-identification data. During summer 2007 cetacean dedicated surveys have been conducted in the Ligurian Sea covering a total of 7420.15 km, as part of a long-term study on the ecology of cetaceans in this area. 79 sperm whale acoustical detections were made; 40 animals, after being tracked using a two-element towed array, were individually photo-identified, together with concurrent sampling of the respiration patterns and monitoring of visual surface movements. Moreover, 29 hours and 13 minutes of recordings were performed, both during sperm whale acoustic tracking and right after the animals' fluking. Analysis of behavioral and photo-identification data, together with the examination of the vocal repertoire - consisting mostly of clicks and creaks - demonstrate that in 72% of the instances the animals were engaged in feeding activities. In addition, two socializing groups of 5 and 10 individuals respectively, with no calves associated, were observed. The smaller pod was prevalently composed by adults, while the other was principally composed by young individuals. Surface social activities like head-outs, side-flukes, lobtailing and coordinated swimming, associated with the production of social recognized vocalizations like codas and chirrup, support the hypothesis that the animals were engaged in socializing activities. These results outline the importance of the north-western Mediterranean area both for feeding and for socializing herds of sperm whales, underlining the need for comprehensive management and conservation measures in the Pelagos Sanctuary area.

S53 TRENDS IN CETACEAN SIGHTINGS ALONG THE GALICIAN COAST, NW SPAIN, 2003-2007, AND ANALYSIS OF CETACEAN HABITAT PREFERENCES

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Since mid-2003, systematic monthly sightings surveys for cetaceans have been carried out in Galicia (NW Spain) from observation points around the coastline, with the aim of providing baseline data on cetacean distribution. Here we summarize results for September 2003 to October 2007. The most frequently recorded species was the bottlenose dolphin (*Tursiops truncatus*), seen during 10.7% of observation periods, followed by common dolphin (*Delphinus delphis*, 3.7%), harbour porpoise (*Phocoena phocoena*, 1.6%), Risso's dolphin (*Grampus griseus*, 0.4%) and short-finned pilot whale (*Globicephala melas*, 0.2%). Generalized additive modeling was used to (a) summarize spatial and temporal trends, taking into account differences in survey effort and conditions and (b) quantify relationships with environmental variables. Preliminary analysis revealed that duration of observation, area observed, number of observers and wind strength all had significant effects in at least some models. Bottlenose dolphins were seen most frequently in the area around Riveira. Common dolphins were most frequently seen in three areas, around Cabo Ortegal, Laxe and La Guardia. There was a weak trend for porpoise sightings to be more frequent in the North than in the south. The sightings rate of bottlenose dolphins has increased since 2003 while no consistent temporal pattern was evident in the other species. It is expected that distribution patterns relate in part to the distribution of prey and their habitat presences. We examine relationships with seabed slope, sea depth, substrate type, SST and chlorophyll-a concentrations in the vicinity of the observations. Satellite images were processed to extract data on SST and Chl-a and averages calculated for a temporal and spatial buffer zone around each observation point (within 2-3 days and 5 km from each observation time and location). The analysis will also explore whether patterns are more clearly revealed using a coarser spatiotemporal scale.

S54 FIRST REPORT ON BOTTLLENOSE DOLPHINS (TURSIOPS TRUNCATUS) NEAR THE PROMONTORY OF THE ISTRIAN PENINSULA, CROATIA

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Little is known about the presence of bottlenose dolphins (*Tursiops truncatus*) near Kamenjak, the tip of Istria, Croatia. Therefore Vivamar Society carried out dedicated boat surveys and land-based observations between 2003 and 2007. Habitat use and site fidelity studies of the species are going on in Slovenia as well as around the island of Lošinj, whereas not much has been reported so far about it near Kamenjak. It is situated between Lošinj (27 Nm NW) and the Slovenian sea (about 45 Nm S). The question arises whether these dolphins are a part of any of the populations from the other above mentioned geographical areas. Some data were recorded about dolphins crossing the Bay of Kvarner, indicating, that animals might pass over to Kamenjak from Lošinj. More observations were recorded about animals travelling along the West coast of Istria, heading north and vice versa. There might be some interchange with at least few individuals, which may have an important gene fluctuation role. The area near Kamenjak seems to be an important feeding ground for the dolphins. Bioproductivity around the peninsula is higher than in other nearby areas due to the mixing of currents. This was evident also by the presence of other top predators, such as tunas. They were observed in over 10% of encounters with dolphins. In the summer, calves were regularly present. Some photo ID data were collected. Interactions with fisheries were sometimes observed, showing that dolphins might also be opportunistic feeders. In order to find out more about the ranges of populations and the abundance of the animals, comparative studies of both other areas are necessary. Present data could help in defining important habitat areas for these top-level predators and bring us closer in making proper conservation measures for their protection in this area of the Northern Adriatic Sea.

S55 A FIRST APPROACH TO COMMON DOLPHINS (DELPHINUS DELPHIS) OCCURRENCE OFF THE WEST CENTRAL COAST OF PORTUGAL

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Historical sources showed that common dolphins (*Delphinus delphis*), locally known as toninhas, existed and were captured in large numbers off Portugal mainland during late 19th and 20th centuries. Their existence is also referred to by fishermen, ecotourism operators, tourists, as well as in results of some scientific campaigns. Nevertheless, a continuous scientific methodology is still missing for this region and the present work intends to be a first approach to the presence of common dolphins off the west central coast of Portugal. A total of 20 boat-based visual surveys with an effort of 2650 minutes at sea were conducted during 2007 from three different geographic locations: Nazaré, Peniche and Sesimbra. Our objective was to detect groups of common dolphins, even though bottlenose and striped dolphins were also sighted, and determine their existence. When sighted records of GPS positions, depth data, distance to shore, group sizes, presence of calves, behavior observed at surface and photo-id data were obtained. Records were analyzed and Sea Surface Temperature (SST) information was added in order to address their preferential distribution within the study area. We obtained 15 independent sightings of common dolphins, in groups ranging from 1 to 100 individuals, with the presence of calves. Most of the sightings occurred in depths between 30m to 150m bathymetry, reflecting common dolphins' preference for deep areas than shallow ones, and at SST of 18/19°C. These are the first year results of an on-going effort that will take place in the following years in order to obtain knowledge for the conservation of common dolphins, especially in the Marine Reserve Prof. Luiz Saldanha (Sesimbra) included in our study area.

S56 SPATIAL ANALYSIS OF THE BREEDING BEHAVIOUR OF THE BOTTLENOSE DOLPHIN ALONG THE EASTERN LIGURIAN COAST: PRELIMINARY RESULTS.

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Bottlenose dolphin (*Tursiops truncatus*) is present along the Eastern Ligurian coasts where breeding activity is also reported. The aim of this work is to locate and describe possible breeding areas. The study area includes coastal waters between Punta Chiappa (Genoa) and Punta Bianca (La Spezia) and was divided in to two zones: B and C. Data were collected from February 2005 to October 2007 with boat-based surveys. A GIS method was used in order to visualize the research effort and sightings. Minimum Convex Polygon method was used to display the area of groups with and without calves. Pictures were taken to confirm the presence of calves. 132 boat-based surveys were carried out and 508 hours were spent on effort. 59 groups of bottlenose dolphins were sighted, but only those with better photographic data were considered (37). Calves were observed 10 times out of 15 sightings in B and 9 times out of 22 in C. In both B and C, calf areas are significantly smaller than non-calf areas and present a higher level of sighting aggregation in comparison with non-calf sightings. B calf area presents a partial overlap with the non-calf area. In C the calf area is completely contained inside the non-calf area. Further analyses are needed in order to understand which habitat variables may influence the choice of breeding areas in bottlenose dolphins.

S57 ABUNDANCE MONITORING AND PHOTO IDENTIFICATION AT A SEASONALLY CHANGING GREY SEAL (*HALICHOERUS GRYPUS*) SITE IN CORNWALL, UK.

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Cornwall Seal Group, a voluntary group of interested individuals, students and conservationists, have monitored one Grey Seal site on the north Cornwall coast since 2000. Previous results led to the formulation of two hypotheses for the study period April 2005 to March 2006. 1: Most seals are present during the moulting and breeding seasons. 2: This is a static colony of 30 - 40 seals. Observers recorded seal numbers, gender, environmental factors and took digital photos of the seals hauled out, which were compared to the photo identification database built up for this site since 2000. 384 observations were made on 261 days (72% of days in the year). The number of seals ranged from 1 to 149, with an average of 35 seals per observation. Results showed average monthly seal numbers peaked three times, the

smallest during October - November 2005, coinciding with the breeding season. The larger peaks occurred in April 2005 and March 2006, the main moulting period. Seal numbers decreased significantly during the Summer, coinciding with the seals' relocation from the mainland to the smaller offshore island haul out. This relocation may link to increased air temperatures, direct sunlight and the sheltered morphology, making the mainland haul out uncomfortable for seals in the Summer. This data proves the first hypothesis. Some of the 227 photo identified seals (recapture rate 61%) spent more time than others at this north coast site. Seal visits were classified as 'Semi resident' (19 seals, 8%, seen more than 20 times); 'Regulars' (79 seals, 35%, were seen between 5 and 19 times) and 'Migrants' (129 seals, 57%, were seen less than 5 times.) As the most frequently identified seal, DP122 was only seen on 23% of observations, no seals were classed as 'Resident'. This data disproves the second hypothesis.

S58 CAN CUVIER'S BEAKED WHALE, ZIPHIUS CAVIROSTRIS, ACT AS A PREDICTOR FOR CLIMATE CHANGE

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The impacts of climate change on cetaceans are expected to show the range in distribution moving to stay within optimal habitat and this movement will likely be reflected mainly in responses to changes in prey distribution and abundance as a result of warmer sea temperatures. The Bay of Biscay is the most northerly range of the Cuvier's beaked whale and with year round observations within the bay it could be suggested the population may be resident. This study focuses on dedicated and non-dedicated sightings gathered from 1996 to 2006 by the Biscay Dolphin Research Programme (BDRP). Two regions have been selected based upon areas of frequent encounters. The first area is over the CapBreton canyon (44N, -3W) and the second area is over the northern continental shelf (46N -5W). Water depth in both areas ranges 1000-2000m. In the southeastern corner of Biscay Sea

Surface Temperature (SST) has remained stable from 1995-2006, with the exception of positive peaks in temperature in 1998 and 2003. A seasonal warming trend is also a regular event. Dedicated and non-dedicated sightings show encounters are more frequent over the CapBreton Canyon; however non-dedicated sightings show an increase in encounters over northern slopes from 2002. The movement to the northern slopes is a seasonal event where observations are made in spring and summer, whereas in autumn and winter the distribution is mainly in the south over the CapBreton canyon. Water temperatures are warmer in the south during autumn/winter compared to cooler waters over the northern slopes, with an average difference of 1.55/0.70 °C. The results from the statistical analysis found the distribution of Cuvier's Beaked Whale to be significantly correlated with SST ($t = 4.265$, $P = <0.001$). This raises the question, could Cuvier's beaked whale act as a predictor of increasing water temperatures as a result of climate change by shifting their distribution to the northern slopes of Biscay and possibly even further north if water temperatures rise, because they are confined to sea temperatures above 10°C? Will there be a permanent shift to northern slopes if water temperatures rise? This study focuses on dedicated and non-dedicated sightings gathered from 1996 to 2006 by the Biscay Dolphin Research Programme (BDRP). Two regions have been selected based upon areas of frequent encounters. The first area is over the CapBreton canyon (44N, -3W) and the second area is over the northern continental shelf (46N -5W). Water depth in both areas ranges 1000-2000m. In the southeastern corner of Biscay Sea Surface Temperature (SST) previous research shows water temperatures warming since 1992 to 2003. A seasonal warming trend is also a regular event. Dedicated and non-dedicated sightings show encounters are more frequent over the CapBreton Canyon; however non-dedicated sightings show an increase in encounters over northern slopes from 2002. The movement to the northern slopes is a seasonal event where observations are made in spring and summer, whereas in autumn and winter the distribution is mainly in the south over the CapBreton canyon. Water temperatures are warmer in the south during autumn/winter compared to cooler waters over the northern slopes, with an average difference of 1.55/0.70 °C. The results from the statistical analysis found the distribution of Cuvier's Beaked Whale to be significantly correlated with SST ($t = 4.265$, $P = <0.001$). As a final picture, Cuvier's Beaked Whale could act as a good predictor of increasing water temperatures as a result of climate change.

S59 ABNORMAL PRESENCE OF FIN WHALES IN COASTAL WATERS OF THE NORTHWESTERN MEDITERRANEAN SEA DURING 2007.

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This work reports the unusual distribution of fin whales and its correlated high mortality along the coast of northwestern Mediterranean, in particular in the Pelagos Sanctuary in 2007. Of the 20 sightings occurred along the shore, 6 were juveniles unpaired with their mothers and 4 of them died. First, we detail their unusual behaviour. All individuals were static, undernourished and covered with a high quantity of parasites (*Penella* sp.). Most of them entered ports: for instance from 20th to 30th May 2007 we monitored a juvenile fin whale, less than 10m-long, which remained in shallow waters in front of Ligurian coast and entered repeatedly the port of Genova-Voltri, or the whale named "Desirée" that stayed on the French Riviera, from 14th to 24th July 2007. We include videos showing the 10-m long juvenile rustling in *Posidonia* beds, a behaviour never described yet. The second part of this work deals with general distribution of fin whales in 2007. We estimate the encounter rate of fin whale sightings according to the distance from the coast comparing data from 2004 to 2007, using 121 scientific and 565 whale-watching one-day surveys. Results indicate a significant decline of abundance throughout all 2007. Encounter rate decreases from 1.50 sightings/50 mn in May 2005 to 0.25 sightings/50 mn in May 2007. The last part of this work provides some indications about possible reasons concerning this unusual coastal distribution. We correlate 2007 species distribution with oceanographic parameters such as surface temperature and concentration of chlorophyll, known to be predictive of fin whale distribution. Anomalies of these parameters are mapped showing SST values higher than usual since February (seasonal average = +1°C to +6°C) and an unusual concentration of phytoplankton occurring earlier than previous years. This study may point out some direct global warming impacts influencing top-predator distribution.

S60 THE PREDICTIVE HABITAT SUITABILITY MAPPING OF MINKE WHALES, HUMPBACK WHALES AND WHITE-BEAKED DOLPHINS IN NORTH EAST ICELAND

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Marine spatial planning is a key way in which marine resources are managed and protected from a range of deleterious impacts, e.g. fisheries by-catch, chemical pollution. However, to be able to effectively designate protected areas (i.e. marine reserves) detailed maps describing the marine environment, in particular important habitats, are required. Cetacean species can act as bio-indicators of important marine habitats due to their apex position in marine ecosystems and communities. Therefore this study aimed to gain an appreciation of the habitat selection by cetaceans off the North East of Iceland, in particular Skjálfandi Bay, and then to predict other potential areas of cetacean habitat suitability which may require further research or increased management effort. Data was collected using whale watching vessels as platforms of opportunity, between the years 2004 and 2007, during the months of May to September. Findings ascertained that the three most common species encountered (minke whale *Balaenoptera acutorostrata*, humpback whale *Megaptera novaeangliae* & white-beaked dolphin *Lagenorhynchus albirostris*) were found to be associated with particular bathymetric (depth, slope and aspect) and oceanographic (sea surface temperature and chlorophyll biomass) variables. These associations were then used to predict and explain potential high habitat suitability areas using the ecological niche modelling technique Environmental Niche Factor Analysis (ENFA). Results of the ENFA analysis showed areas of potentially high levels of whale habitat suitability including the adjacent inlets of Eyjafjörður and Öxarfjörður, as well as areas beyond the Island of Grímsey in the Arctic Circle. In particular it was considered that oceanographic features, such as the cold Icelandic Current and local warm nutrient-laden glacial river plumes in the area, may be crucial to the spatio-temporal distribution of these three cetacean species within the waters of North East Iceland.

S61 CETACEAN STRANDINGS IN THE TURKISH WESTERN BLACK SEA COAST DURING SPRING MONTHS IN 2003-2005

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There are three cetacean species in the Black Sea, namely the common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*) and harbour porpoise (*Phocoena phocoena*). These cetaceans are under the threat of pollution and fishing activities in the Black Sea. Every year several hundreds of dolphins are entangled in bottom gillnets then strand ashore between early April and June. Many harbour porpoises and bottlenose dolphins also die as the result of incidental catch by the sole and turbot fishery. A total of 211 stranded cetaceans were found on the 45km sandy beaches, during the coastal stranding surveys in April, May and June, 2003 – 2005. Among them, 175 were harbour porpoises (83%), 22 common dolphins (10%), 10 bottlenose dolphins (5%), and 4 unidentified specimens. The sex ratio of stranded harbour porpoises was 48 females to 39 males, although the genital areas of some individuals were eaten by scavengers and some specimens were at the advanced stage of decomposition which made it impossible to determine sex (50.3% unidentified in harbour porpoises), to measure body length (24% unmeasured in harbour porpoises) and to find any net mark. Tail flukes and flippers of some individuals were partially missing, which was a characteristic of bycatch. Our survey period overlapped the turbot fishing season (April-June). Therefore, we assumed most, if not all, strandings were related to the interaction with the turbot fishery. Minimum body length class of the harbour porpoise was 61-70 cm (9 individuals), and maximum 131-140cm (10 individuals) in the study area. The minimum neonate length was 63cm in female and 66cm in male. All neonates were found in late May-June. Most frequency was 121-130cm intervals with 39 individuals for 133 specimens. The mean body length for all the harbour porpoises was 111.46cm (n=133, SD:16.87).

S63 CHARACTERISATION OF BOTTLENOSE AND COMMON DOLPHINS HABITAT IN THE BAY OF BISCAY: EVIDENCE OF A STRONG SPATIAL SEGREGATION

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

S64 BASELINE INFORMATION FOR THE CONSERVATION AND MANAGEMENT OF CETACEAN POPULATIONS IN OFFSHORE AREAS OF ATLANTIC SPANISH WATERS.

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Although the terrestrial Natura 2000 network is well represented in Spain, there is a huge lack of implementation in marine network, mainly in offshore waters. In 2006-2007 CEMMA carried out an interregional research project in collaboration with several northern NGOs of Spain to identify offshore areas of special interest for cetaceans. In September 2006 coordinated ship surveys were carried out in the north Spanish offshore waters using the same methodology covering from west to east; Galicia bank, Aviles canyon, Cachucho sea mountain, Torrelavega canyon and Cap Breton canyon. In May 2007 one additional 5 days survey was carried out in Galicia Bank. During the 10 days of survey in Galicia Bank, a total of 1540.2 Km were covered and 60 sightings of 7 different species were recorded. During the 7 days of survey in the rest of areas a total of 956.5 km were covered and 39 sightings of 5 species were recorded. Truncation distances for fin whales and small cetaceans were estimated in 2000 and 1500m respectively. Density estimates (individuals per 25 Km²) were calculated for each area: Galicia bank, 9.93, Aviles canyon, 26.82, Cachucho sea mountain, 50.14, Torrelavega canyon, 42.76, and Cap Breton canyon, 9.08. Abundance estimates for the most frequent sighted species were obtained. Abundances of small dolphins were estimated in 2065 (919-3305) for striped dolphins, 1339 (542-2137) for common dolphins, 1038 (766-1310) for bottlenose dolphins, and 163 (135-191) fin whales.

S65 SIGHTING FREQUENCY AND PHOTO-IDENTIFICATION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) ALONG THE COAST OF BAHÍA SAN ANTONIO, PATAGONIA, ARGENTINA

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The sighting frequency (SF), site fidelity, home-range and group composition of bottlenose dolphins (*Tursiops truncatus*) were assessed during a photo-identification study in 2006 and 2007. This study aims to provide first data on this unknown austral bottlenose dolphin population to answer to their increasing conservation needs. Data and pictures were collected during 132 surveys with an average observation effort of 2.8h (SD=1.6) per survey. All clear pictures were analysed using the automatic identification systems FinEx and FinMatch (EuroPhlukes Initiative). The SF was obtained dividing the number of sightings by the amount of effort. Site-fidelity was estimated using the Capture Mark Recapture method and the degree of residency by the re-identification frequency following Culloch (2004). In total, 377.4h were spent searching for bottlenose dolphins of which 57.3h was spent in the presence of 126 dolphin groups divided in 105 sightings. The SF was 0.28/h with an average duration of 43.2min/sighting (SD=0.76). A total of 43 dolphins were classified into an identification catalogue. These recognizable dolphins were re-identified up to 10 days with 44% (n=43) showing a degree of residency (resighting frequency (RF)≥4). The average group size was 6.1 (SD=7.9) ranging from one to fifty animals. Group size increased significantly with the presence of calves and with the distance from the coast. Nevertheless, all dolphins were seen in inshore waters ≤20m deep. The most frequent group formation was loose (34.5%), variable (29.8%), disperse (20.2%) and tight (15.5%). At least 6 identified dolphins, including one mother with her calf, were photographed in the mouth of the Río Negro 250km from the study area indicating that their home-range is far from limited to Bahía San Antonio. Data indicate that it concerns a resident but yet unknown population of bottlenose dolphins with a high commercial potential and an urgent need of conservation measurements. (Culloch, R.M. 2004. Mark recapture abundance estimates and distribution of bottlenose dolphins (*Tursiops truncatus*) using the coastline of the outer Moray Firth, NE Scotland, MS dissertation, University of Whales, Bangor. 95pp.)

**S66 A REVIEW OF CETACEANS' PRESENCE IN PORTUGAL
MAINLAND FROM WHALING DATA AND "OBSERVATIONS OF
OPPORTUNITY"**

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In Portugal, along the years, few researchers have drawn their attention to the study of cetaceans' existence off the continental coasts. Nevertheless, a bibliographic research shows that at least since the beginning of the 19th century sparse information on cetacean off Portuguese mainland was published. During the 20th century there were even a couple oceanographic campaigns that included observations and data collection on cetaceans. Rather than scientific research, we consider that exists a lot of "forgotten science" that is extremely relevant to approach this issue. Our first goal was to gather data from land based on whaling campaigns (1925 to 1927 and 1944 to 1951) which provided information to quantify species sighting off Portugal mainland. Our second objective was to conduct a search to obtain more updated information, since 2004 to 2007, on the presence and distribution of coastal (non resident) populations of cetaceans. As an "observation of opportunity" we have considered the reports of whale and dolphins observers, which included a positive identification from photographs and an approximate geographic localization. These reports were obtained from anecdotic sightings made by fishermen, photographers, scuba divers and from the public in general. From whaling data were mentioned 1308 sightings off the west central coast, where most of the captures (80%) were fin whales. The records from the observations of opportunity, resulted in 29 sea sightings (not considering stranding' information) and 63% of common dolphins occurrence. Compiled information shows the presence of five different species of mysticetes and six species of odontocetes in the central

region of Portugal mainland. These cetaceans seem to live mostly along main ocean topographic features.

S67 NEW RECORDS OF BOTTLENOSE DOLPHINS IN THE SEA OF AZOV AND ADJOINING AREA

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Bottlenose dolphins inhabit the Black Sea and the Black Sea part of the Kerch Strait (to the south of Fonar Cape) but usually do not spread to the north, to the Sea of Azov. Only 3 strandings were reported from that area in 1980-2000. However, we observed some more evidence of bottlenose dolphins in the Sea of Azov based on coastal monitoring since 1999. A calf 140 cm long was found on August 20, 2001, to the north-west of Fonar Cape, in the Azov part of the Kerch Strait. An adult animal was reported to have stranded in October 2003 near Barzovka (Varzovka) Cape, in the same region. A vertebra was found in the same locality on October 1, 2005. A stranded animal (probably, male) 238 cm long and 16 years old was found on May 27, 2007, at Tarkhan Cape, at the southern coast of the Sea of Azov. A male 244 cm long and 12 years old was found on October 15, 2007 (and stranded 10 days before), near Barzovka Cape. So in 2007 bottlenose dolphins took 8% in cetacean strandings at the monitored coast of southern Sea of Azov and adjoining area. In addition, local respondents reported several sightings and strandings of cetaceans resembling a bottlenose dolphin, although their descriptions were too obscure and incomplete to determine the species surely. Thus, the bottlenose dolphin appears to enter the Sea of Azov rarely but regularly. The region of its most frequent occurrence is the Azov part of the Kerch Strait where it takes 7% in all strandings. However, bottlenose dolphins seem to occur throughout all the Sea of Azov.

S68 STEPPING-STONE AZORES: BALEEN WHALE FEEDING GROUND DURING MIGRATION OVER NORTH ATLANTIC OCEAN

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Although information exists on the destinations of baleen whale migrations, their migratory routes over the North Atlantic Ocean are still largely unknown. Historical whaling records have named the presence of baleen whales at the Azores. Today, six species of baleen whales still use the waters. In this study, we aim to determine the functionality of the Azorean waters for baleen whales, in respect to their migration over the North Atlantic. From 2003-2007, baleen whale abundance and behaviour, and individual presence were determined from year-round land- and ocean-based observations off the coast of Pico Island Azores. Five species of baleen whales were recorded: blue whale (*Balaenoptera musculus*; nobs_land=79, nID=30), fin whale (*Balaenoptera physalus*; nobs_land=78, nID=29), sei whale (*Balaenoptera borealis* ; nobs_land=56, nID=28), humpback whale (*Megaptera novaeangliae*; ; nobs_land=16, nID=5) and minke whale (*Balaenoptera acutorostrata*; nobs_land=3). Although sightings were made year-round, baleen whale presence was highly seasonal, peaking in the spring months (April-June). Synchronised, stable patterns of spring arrival of blue, fin and sei whales were observed. Group size ranged from solitary individuals to congregations of >10 animals in one area. Interestingly, feeding made up for a large part of their behavioural budget (20-45%), complemented by travelling (55-75%). Some resting, but no socialising was observed. Resightings of identified individuals suggest that individuals remain in the area for at least several days, possibly depending on foraging conditions. The observed pattern is strongly consistent with the presence of a feeding ground for baleen whales at the Azores: it seems that the area functions as a stepping-stone on their extensive migration towards the summer feeding grounds. We therefore suggest that the area forms a critical habitat for baleen whales in the North Atlantic. Also, our findings support the theory of offshore migratory routes for these species. Additionally, we would like to stress that this research clearly shows the functionality of non-invasive techniques in the study of baleen whales.

S69 THE COMMON SEAL (*PHOCA VITULINA*) IN THE DOLLARD (WADDEN SEA)

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During the pupping season of the common seal in the summer of 2007, the distribution and abundance of common seals were studied. Special attention was given to the level of disturbance and the bond between mothers and pups. The seals had been observed in the Eems-Dollard estuary (Wadden Sea) during low tide. Seals give birth in this area on sandbanks near the

dike. For this study, five sandbanks were identified. Every 15 minutes, the banks were scanned and the distribution and abundance of seals were recorded. Disturbance and the interactions between mother and pup were recorded continuously. The average number of seals, recorded in the area, was around 140, including pups. The seals mainly hauled out on the sandbank which had the greatest distance to the coast. The average distance between mother and pup was also larger on the banks further away from the coast. Preference is thought to be related to the submersion time of the sandbanks. Preference also exists for sandbanks where the seals can stay close to the waterline during the whole low tide period. Disturbance of seals was often caused by persons recreating in the area. This concerned mainly people who walk or cycle on the dike. Agricultural vehicles, airplanes, boats and cars also caused disturbance, but less frequent. A very strong bond had been observed between mothers and pups. This bond was carefully maintained by regular physical contact and focal display by the pup. Usually mother seals will follow their pups in and out of the water. However, in case of disturbance pups follow their mothers. On several occasions pups were found without their mothers. None of these pups reunited with their mother. These orphaned pups were therefore admitted to the SRRC for rehabilitation.

S70 COMPARATIVE ANALYSIS OF WHITE-BEAKED DOLPHIN DORSAL FIN EDGE MARKS BETWEEN TWO DISTINCT STUDIES IN ICELANDIC WATERS

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Photo-identification is considered to be a powerful tool in the investigation and analysis of cetacean life history and behavioural traits. The white-beaked dolphin (*Lagenorhynchus albirostris*) has been proven to be a suitable candidate for the use of photo-identification techniques. However, little is currently known about the occurrence and frequency of marking patterns for this species making any detailed investigation and comparative analysis difficult. The aim of the following study was to compare and catalogue the position and morphology of *L. albirostris* dorsal fin edge marking occurring between two distinct study locations in Iceland. These included the areas of Faxaflói in the south east and Skjálfandi Bay in the north east of Iceland. Data collection was performed utilising whale watching vessels as a platform of opportunity and conducted primarily during the summer months, May to September, between the years 2001 to 2007. In total 73 individuals were compared [marks n = 98] with 25 individuals from

Faxaflói [marks $n = 30$] and 48 individuals from Skjálfandi Bay [marks = 68]. Results of chi-square tests for proportional variance in marking categories between Faxaflói and Skjálfandi Bay showed no significant difference in either the position ($X^2 = 6.185$ $df = 4$ $p = 0.186$) or morphology ($X^2 = 14.825$ $df = 4$ $p = 0.061$) of marks occurring between the two study locations. Therefore it is interpreted from the results that either the marking processes forming dorsal edge marks between these two areas may be the same or that these may potentially be individuals of the same population as indicated by other contemporary studies. It is therefore considered important that future comparative research on *L. albirostris* between southern and northern Iceland be conducted with respects to identifying possible population dynamics within Icelandic waters.

S71 WHITE-BEAKED DOLPHIN (LAGENORHYNCHUS ALBIROSTRIS) OCCURRENCE IN THE MINCH (SCOTLAND, UK) DURING AUGUST 2007

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The Minch, located off North-west Scotland (UK), has historically been an area of high white-beaked dolphin occurrence, but recent studies have suggested that the species may have declined in this region. During August 2007, a dedicated survey was conducted using a 16m yacht to investigate the current status of white-beaked dolphins in these waters. A total of 738 km of survey coverage was acquired in Beaufort sea states ≤ 4 , including coverage across ten $\frac{1}{4}$ ICES rectangles. Data are presented on the following aspects of white-beaked dolphin occurrence: (1) spatial distribution; (2) relative abundance; (3) habitat preferences; (4) group composition; and (5) photo-identification. A total of 10 sightings comprising a minimum of 70 animals were recorded in a relatively small spatial area north of $58^{\circ}15'N$, encompassing two $\frac{1}{4}$ ICES rectangles. Relative abundance in this region was high at 0.4–0.5 animals/km. The encounters

were recorded mid-way across the Minch at a mean distance of 26 km from shore, indicating a preference for open water habitat. Sightings had a mean water depth of 123 m and a mean sea surface temperature of 13.4°C. Most animals were observed in the ≥ 100 m depth category and in the 13.0–13.9°C temperature category. The mean group size was seven animals, with the two smallest groups comprising adult animals only. Five sightings included calf proportions of 25–50%, indicating that some groups consisted entirely of adult-calf pairs. Only three individuals were photo-identified from permanent markings on the dorsal fin, with a further five individuals identified from temporary markings or poor-quality images of permanent features. None of these individuals were re-sighted over the duration of the study. The distribution, habitat preferences and group compositions are discussed in relation to previous studies on white-beaked dolphins in the Minch.

S72 PHOTO-IDENTIFICATION OF FIN AND HUMPBACK WHALES OFF THE SOUTH COAST OF IRELAND

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In June 2004 the Irish Whale and Dolphin Group (IWDG) commenced photo-identification of fin whales *Balaenoptera physalus* and humpback whales *Megaptera novaeangliae* in the inshore waters off County Cork, Ireland. Most (95%) of this fieldwork was conducted from a commercial whalewatching vessel skippered by Colin Barnes. Between 2005–2007 we accompanied 36 trips, most of which concentrated on a 45km stretch of coastline between Toe Head (51°28'N, 09°13'W) and Seven Heads (51°34'N, 08°41'W) and within 25km of the coast. Most effort (80%) was between August and December, when land-based observations showed high relative abundance of fin whales, peaking in November. Humpback whale encounters were less frequent compared to fin whales. In 2005 we observed fin whales on 54% of boat trips, 63% in 2006 and 83% in 2007. Images of fin whales suitable for photo-identification, including notches in dorsal fins, chevrons and lesions were obtained on 53% of trips. To date, we have 35 recognisable fin whales and seven humpback whales from the south coast. Of the fin whales analysed to date, nine (32%) have been resighted at least once and four (14%) were re-sighted over a minimum of 2 years. Individual whales were resighted between September and January along the 125 km length of the Cork coast. 86% of humpback whales have been resighted at least once and 57% of these between years. One individual has been resighted on 24 occasions in six of the past 7 years. This high resighting rate may indicate low numbers of fin and humpback whales

are visiting these waters, but they show high site fidelity and longevity, suggesting it is an important foraging area for these whales. We plan to broaden the scope of this field work to see if the same whales are using others areas along the southern Irish coast.

S73 OCCURRENCE OF CETACEANS IN THE NORTH SEA BETWEEN HOOK OF HOLLAND (NL) AND HARWICH (UK).

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In 2005 a project was launched under the name of Project Rugvin in order to investigate the occurrence of cetaceans in the Dutch North Sea. For the first time, ferry surveys are carried out in the southern North Sea. Researchers make use of the Stena Line ships Stena Britannica and Stena Hollandica, operating between Hook of Holland (NL) and Harwich (UK). The surveys are carried out on a monthly basis with an effort of 13 hours (two days) per survey. The harbour porpoise (*Phocoena phocoena*) is the most numerous species in the southern North Sea, also the whitebeaked dolphin (*Lagenorhynchus albirostris*) is observed regularly. The abundance of both species strongly fluctuates with season, with the highest densities in spring (March-May). These seasonal variations are in line with those found in aerial surveys carried out by the Dutch National Institute for Coastal and Marine Management (Osinga, 2005). In 29 survey days, 137 sightings of cetaceans were recorded with in total 228 individuals. Monitoring cetaceans in the southern by means of ferry surveys proved to be successful, therefore the work is continued and a new foundation was established. Rugvin foundation is part of the Atlantic Research Coalition (ARC). ARC was established in 2001 as a pan-European collaborative approach to the monitoring of cetacean status using platforms of opportunity.

S74 LONG-TERM DYNAMICS OF OCCURRENCE AND DISTRIBUTION OF CETACEANS IN THE WATERS OF CRIMEA AND ADJOINING AREAS

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Retrospective monitoring proved to be the most effective approach in cetacean research in Ukraine when studying a large area. 1847 respondents were polled since 2002; 1401 of them reported 1647 sightings and 638 reported 709 strandings of cetaceans, mainly in Crimea but also in the north-western Black Sea, northern Sea of Azov, Caucasus. Bottlenose dolphins dominated in sightings and harbour porpoises in strandings. Both sightings and strandings demonstrate strong annual fluctuations. The highest rates of occurrence were observed in 2003 and 2006, the lowest ones in 2007. It is partly explained by the fact that bottlenose dolphins approach the coast, and is probably connected with fish migrations. In 2003, the sightings were most frequently observed in Sevastopol, Yalta, Sudak and Feodosia regions; in 2006, in Yalta, Alushta and Sudak regions. In particular, it suggests the lability of distribution of dolphin resident schools, at least in coastal waters of southern Crimea. Long-term tendency in the occurrence of bottlenose dolphins is generally stable, although in 2006 the occurrence rate was extremely high. Strandings of harbour porpoises do not demonstrate a one-way tendency but 3-year cycle is suggested, with peaks in 1998, 2001 and 2004. Cetacean mortality events were reported in Kalamita Gulf (1998), Sevastopol region (2000) and south-western coast of the Sea of Azov (1998-2000). Ratio of sightings and strandings demonstrates regional variation and demands different approaches for more special monitoring research.

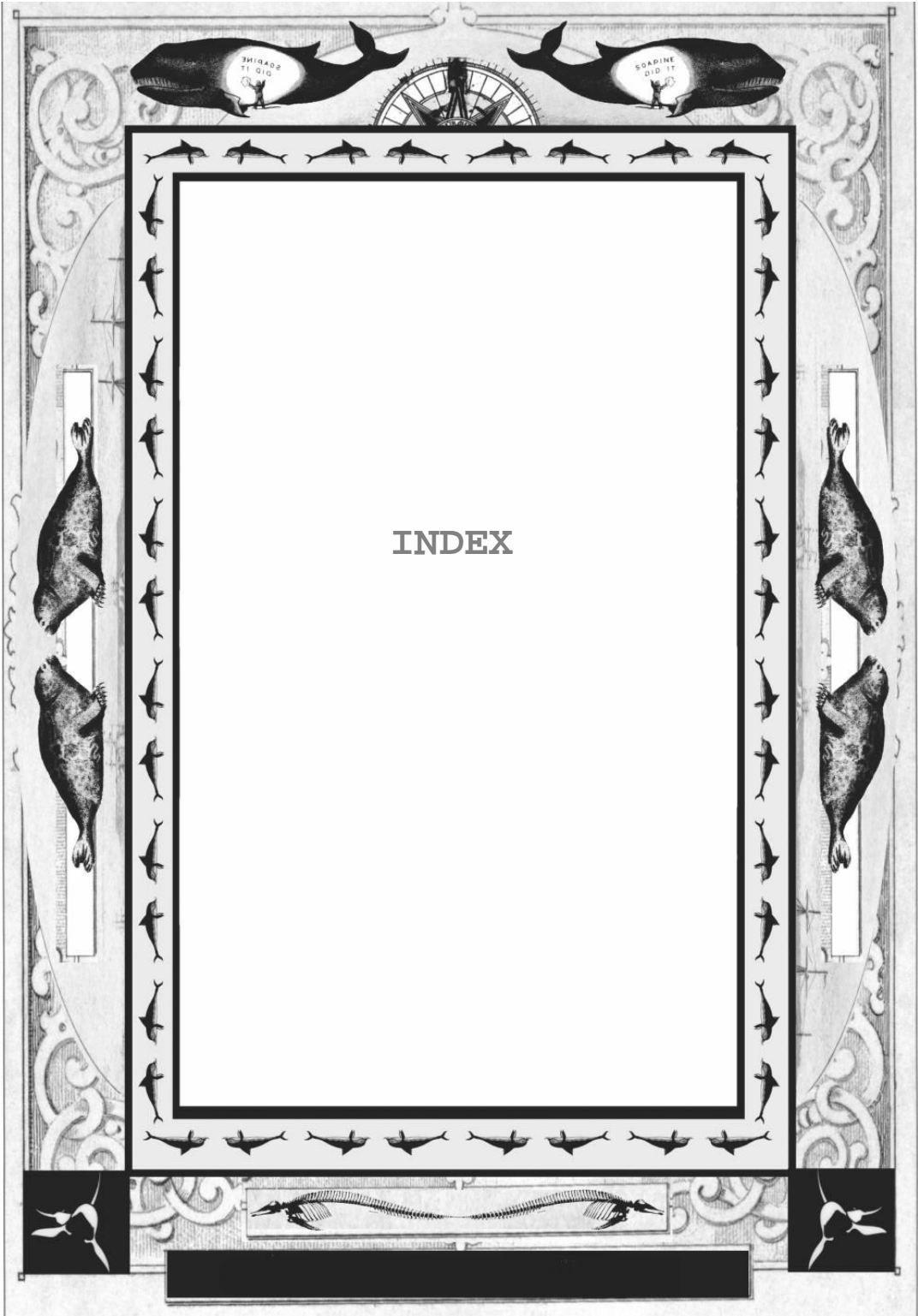
S75 CETACEANS IN THE WATERS OF SOUTH-EASTERN CRIMEA: OCCURRENCE AND IMPLICATIONS FOR CONSERVATION

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Waters of the south-eastern Crimea are one of the critical habitats for cetaceans of the northern Black Sea where bottlenose dolphins and harbour porpoises are observed in mass during the parturition season. However, there is lack of information on cetacean distribution and abundance in this region; it is only known that three species, the harbour porpoise, the bottlenose dolphin and the common dolphin, occur in this area. This study is based on our observations in the area between Alchak Cape and Primorsky settlement in 2005-2007. 47 sightings and 6 strandings were registered; in addition, 41 sightings and 12 strandings were reported by students and local respondents during the non-stop student poll program, and general observations in the sea area of Karadag natural sanctuary were taken into consideration. Bottlenose dolphins dominated in sightings (75% in authors' observations, 60% in respondents' reports, and near 100% in Karadag area) throughout all the studied area during the warm season; they were observed in Karadag area daily since April to October/November. Also, dolphins were observed near St. Ilyi Cape in October and February. Average group size was 2-3 animals. Also groupings of 10-15 and 20-25 animals were observed. The existence of one or several resident schools is hypothesized. Harbour porpoises were observed only in the spring. However, harbour porpoises dominated in strandings (near 100% in observations, about 45% in reports) and by-catches; they were found all-year-round. Common dolphins were observed rarely. It is necessary to enlarge protected sea area in this region and improve the conservation of existing areas. Karadag sanctuary, an important area for nature conservation, located in this coastal region, can be the core of the new marine protected area.



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