Agenda Item 5.4

Implementation of the ASCOBANS Triennial Work Plan (2007-2009)

Review of New Information on Population Distribution, Sizes and Structures

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Report on the symposium « Strategies for Monitoring Marine Mammal Populations »

Action Requested

- Take note of the information submitted
- Comment

Submitted by

France

NOTE:
IN THE INTERESTS OF ECONOMY, DELEGATES ARE KINDLY REMINDED TO BRING THEIR OWN COPIES OF DOCUMENTS TO THE MEETING

Report on the symposium

« Strategies for Monitoring Marine Mammal Populations »

La Rochelle, 2008 November 21st-23rd

1. Introduction

In most European countries, marine mammals are protected under national, European and international legal mechanisms (national environmental laws, EU Habitats Directive, Common Fishery Policy, regional agreements under CMS such as ASCOBANS and ACCOBAMS). However, indicators proposed to assess the state of marine mammal populations are only defined in very general terms, with essentially two criteria that are fairly easy to express but difficult to document: abundance and distribution. Approaches used by European countries to describe abundance and distribution include dedicated surveys, acoustic monitoring, use of platforms of opportunity and stranding schemes. Each of these approaches has a different role to play in monitoring, but their values have rarely been assessed. As a consequence, in order to develop strategies for monitoring marine mammal populations in Europe, it is necessary to compare available methodologies and assess the performance of the many possible indicators both in terms of their capacity to detect changes in marine mammal populations sufficiently early, and in terms of their cost-effectiveness.

The "state of a marine mammal population" covers a number of concepts and is often used without a clear definition. Concepts include conservation status, demographic status and health status. Conservation status is usually based upon comparisons of current abundance and distribution data with a supposedly undisturbed initial situation where populations were thought to be in equilibrium with their habitats and resources. This initial undisturbed situation is generally difficult to obtain in areas where there is a long history of interaction between anthropogenic activities and marine mammal populations. Assessing the demographic status aims to describe changes in vital rates, *i.e.* fecundity and mortality, which may lead to future changes in abundance and distribution. In addition, these vital rates are essential to conduct modelling exercises of population trajectories under various management options. Health status describes the main pathologies and causes of death, including nutritional state and contamination by pollutants. These processes determine reproduction and survival of individuals, and their proper understanding helps in identifying relevant mitigation or management actions.

Conservation status is the ultimate criterion allowing one to state that a population has changed. On the other hand, demographic and health status of a population are also both very relevant to management as they permit on-going processes to be identified before they have fully expressed their effects on population abundance and distribution. This allows relevant management decisions to be taken earlier than if we had to demonstrate that population size or distribution had significantly changed prior to taking any decision. Early decision-making is particularly crucial for marine mammals since, because of their low fecundity, they recover slowly from adverse conditions.

Participants to this symposium included officers responsible for monitoring and conservation policies for marine mammal populations and habitats at national, European and international levels, research

scientists in biology and conservation of marine mammals, and field biologists who collect, compile or synthesize relevant monitoring data. Facilitating contacts between these different spheres was an integral part of the goals of the symposium. The symposium was organised in four distinct sessions and comprised a total of 35 oral presentations, 21 poster presentations and two workshops. The societal demand for monitoring marine mammal populations was examined through its expression in laws and regulations at national, EU and international levels (Session 1). Then, the variety of current practices used to assess population status or for detecting changes was explored (Session 2). Various attempts made to assess the performance of several monitoring practices were then presented and discussed (Session 3). Finally, two workshops concluded the symposium; one focused upon management and quality control in field observer networks, and the other concentrated upon general guidelines for establishing a strategy for monitoring marine mammal populations (Session 4).

The symposium was hosted by *Université de La Rochelle* and co-hosted by *Agence des Aires Marines Protégées* and *Ministère de l'Ecologie, l'Energie, le Développement Durable et l'Aménagement du Territoire*. It was sponsored by *Région Poitou-Charentes, Centre National de la Recherche Scientifique, Ministère de la Culture et de la Communication, Ville de La Rochelle, Conseil Général de la Charente Maritime*. It was supported by ASCOBANS and ACCOBAMS, the two regional Agreements of the Convention on Migratory Species (CMS) dealing with European cetaceans. Simultaneous translation was offered throughout the meeting to facilitate communication by all participants.

2. Societal demand in monitoring marine mammal populations (Session 1)

Notarbartolo-di-Sciara was invited to open this first session. He pointed out that societal demands concerning the conservation of the marine environment have emerged during the recent decades. In parallel there has also been a substantive evolution of the correspondent legislative framework. In spite of such clear societal demands and a wealth of legal instruments, serious conservation problems remain to be addressed (military sonars, driftnets, regional declines of common dolphins, difficulty in ensuring the conservation of monk seals, *Monachus monachus*). It is difficult to address conflicts for several reasons: problems derive from human activities, involving economic production and social pressures; concern for nature has always mattered less, also within governments (e.g., fisheries vs. environment); environmental values remain outside of the equation: an immediate gain to limited interest groups usually matters more than a greater loss for society as a whole; lack of scientific certainties are still used as an excuse for inaction. Science is capable of supporting the maintenance of marine biodiversity by monitoring its changes, so that the appropriate management decisions can be taken early enough. Monitoring marine mammals is important because of the intrinsic difficulty to restore depleted populations, since marine mammals can act as umbrella or flagship species and because, in offshore habitats, the abundance and diversity of air-breathing top predators are among the few measurable elements of biodiversity. Nevertheless, monitoring data become important (only) at the point when they are used to make sound management decisions and decisions are not made by scientists, but by politicians.

In a second part, Notarbartolo-di-Sciara presented the work prepared by Grillo on marine mammal monitoring in ACCOBAMS. This Agreement not only concerns cetaceans but turtles and seabirds as well. There are three stages for effective conservation: first, we need an understanding of distribution, abundance and status; second, we have to address key threats; and third, it is necessary to monitor

trends in order to evaluate attempts to manage threats. Actual and potential threats concern direct death (bycatches and vessel collisions) and habitat degradation (chemical and noise pollution, over-industrialisation, over-fishing and uncontrolled tourism and whale-watching). Synoptic surveys and monitoring are essential tools for conservation and management.

Bräger presented monitoring efforts in the ASCOBANS context, as for example SCANS II and SAMBAH in the German Baltic Sea. The Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas has been extended westward recently, now covering an area that reaches the Strait of Gibraltar in the south. The objective of the Agreement is to achieve and maintain a Favorable Conservation Status for small cetaceans. A Conservation and Management Plan has been established with several obligations such as survey and research, and annual reports. One of the main future projects is SAMBAH (Static Acoustic Monitoring of the BAltic sea Harbour porpoise, *Phocoena phocoena*, see Amundin *et al.* in session 3, 3.2, Identifying Spatial Patterns) using stationary underwater devices. Tentative future objectives for a strategic monitoring of cetaceans include quantitative monitoring, ecological aspects (such as habitat use), and aspects of population health. It is also planned to attempt the use of Unmanned Aerial Vehicles (UAV) with an integrated color digital camera.

Bigan presented marine mammal monitoring under different EU regulations, aiming to reach a Favorable Conservation Status for species and habitats. Several parameters have to be taken into account in order to assess the conservation status of a species: distribution area, population size, habitat size, and future conservation perspectives. Thus, the EU Marine Strategy Directive asks Member States to take the necessary actions that will permit one to maintain or reach a good environmental status by 2020.

Laroussinie presented the objectives of the French agency for Marine Protected Areas: supporting public policies in the field of marine protected areas, managing the human and financial resources dedicated to marine nature parks, co-ordinate and help managers of marine protected areas. He also mentioned the role of the national stranding network and existing OSPAR ecological quality objectives in assessing species' conservation status and marine ecosystem health respectively.

As shown above, cetaceans are protected by a number of international conventions and agreements which require the development of a strategic and systematic approach to monitor population density and assess trends. Pinn and Tasker presented the draft UK proposal to meet monitoring needs, which has been developed by JNCC through collaboration with the other Countryside Agencies and the Sea Mammal Research Unit (University of St Andrews). The Strategy has five key actions:

- ✓ continuation of the UK Cetacean Stranding Investigation Programme (CSIP)
- ✓ continuation of the UK Bycatch Monitoring Scheme
- ✓ continuation of the decadal SCANS/CODA type surveys
- ✓ introduction of systematic annual surveys
- ✓ implementation of the Joint Cetacean Protocol (JCP)

Where appropriate, the proposal advocates continued international collaboration in the monitoring of these wide ranging species. Only by consideration of the abundance and distribution at an appropriate geographic and temporal scale can trends in these species realistically be detected.

Evans closed this first session by explaining how the societal demand for monitoring marine mammal populations has to be converted into measurable indicators. Monitoring is an important tool for

investigating spatial patterns of usage of an area, as well as identifying changes in abundance, life history parameters and health status. Monitoring helps in obtaining a better knowledge of a population across its range, a population inhabiting a particular area and the usage of that area. Detection can be visual with various dedicated or opportunistic platform types (headland, installations, vessels, aircraft) or acoustic (static and towed devices), each type presenting different advantages and limitations. For particular species, taking photos is useful for the identification of individuals that can be distinguished due to natural marks on their body. Other research tools for monitoring include VHF radio telemetry, satellite tracking, DNA studies, fatty acid or stable isotope analysis and biomarkers. Depending on the species, the most appropriate monitoring approach has to be chosen, and one should not consider one single solution but instead a mix of complementary approaches.

3. Existing practices (Session 2)

Existing practices in monitoring marine mammal populations are often derived from empirical approaches whose performances have not been fully assessed. Nonetheless, important baseline data on distribution, patterns of occupancy and indicators of relative abundance are produced by using a broad variety of approaches.

As an introduction to session 2, Ridoux proposed a typology of existing monitoring practices. The main variables to be monitored include abundance and distribution, vital rates, health conditions and risks. The ultimate assessment of conservation status depends on the determination of the former whilst the appropriate management decisions depend on the understanding of the latter. All levels are subject to being monitored by a vast array of possible methodologies. The characteristics of monitoring methodologies allow the recognition of several general types of approaches: static monitoring (visual, acoustic), mobile monitoring (platform of opportunity, dedicated surveys; either visual or acoustic), site-based monitoring (in critical habitats, in MPAs,…) individual-based monitoring (photo-ID, telemetry,...), risk-based monitoring (observer programs on fisheries, seismic surveys, …), and biological and health monitoring that generally require access to samples other than only biopsies (material derived from by-caught or stranded animals). A broad variety of examples was illustrated in session 2.

3.1. Acquisition of baseline information

Several presentations reported on initial attempts to establish baseline knowledge for poorly known areas and/or species. They used historical catch or by-catch data, opportunistic sightings, dedicated boat or aerial surveys, photo-identification and passive acoustics.

Vieira, Brito, Sá and Carvalho (Oral) compiled data from whaling, observations of opportunity and boat-based surveys, to establish base-line knowledge of cetacean occurrence off central Portugal. Among small delphinids, the most frequent species was the common dolphin, *Delphinus delphis*, whereas, regarding large whales, it was the fin whale, *Balaenoptera physalus*.

Rinaldi and Rinaldi (Oral) used photo-identification to explore patterns of residency of sperm whales, *Physeter macrocephalus*, and other cetaceans in Guadeloupe and neighbouring waters. Of a total of 207 photo-identified sperm whales, eight groups showed a high level of site fidelity and inter-individual association. In addition, movements of individuals or groups between Guadeloupe,

Dominica and Martinique have been revealed. Other species, including the humpback whale, *Megaptera novaeangliae*, and several delphinids were not sufficiently documented to infer clear patterns. The authors stressed the importance of information on residency *versus* movement for cetacean conservation in the area.

Samaran, Adam, Ruzié, Royer and Guinet (Oral) revealed large whale seasonal patterns of occurrence around the sub-Antarctic Crozet Islands, SW Indian Ocean, from the analysis of one year of acoustic recordings obtained from the permanent autonomous hydrophones of the International Monitoring System (IMS). An automated call detection method showed that Antarctic blue whale, *Balaenoptera musculus*, calls were very abundant and occurred year round with a peak in fall and winter whereas calls of the Madagascar type pygmy blue whale, *Balaenoptera musculus brevicauda*, were detected only in the summer to fall period. Using long-term acoustic monitoring from opportunistic structures such as the IMS provides unique data sets to obtain information on large whales in remote areas.

Dorémus, Certain, Van Canneyt, Rinaldi, Jeremie, Bolaños, Watremez and Ridoux (Poster) conducted aerial surveys in order to map top predators' preferred habitats and assess minimum abundance in the EEZ off French Caribbean (123 000 km²) and Guiana (138 000 km²). The most commonly encountered cetacean species were humpback and sperm whales in the Caribbean and bottlenose dolphins, *Tursiops truncatus*, and Guiana dolphins, *Sotalia guyanensis*, in Guiana. Spatial modelling, using bathymetry, surface temperature, surface Chlorophyll *a*, wind strength and divergence, sea surface height anomaly and associated gradients as covariates, identified peri-insular slopes and the continental shelf as critical habitats in the Caribbean and Guiana respectively. Minimum abundance estimates were obtained for *Tursiops* (45 960, CV= 0.24) and *Sotalia* (2 280, CV= 0.3) in Guiana waters. These surveys constituted the first record of top predators in these areas and provided baseline data for management and conservation purposes.

3.2. Identifying spatial patterns

Large scale spatio-temporal patterns considered here include general distributions of populations whereas small scale patterns comprise habitat usage. The proper understanding of these structures allows critical areas to be identified. Methods employed included opportunistic surveys, platform of opportunity, photo-identification and passive acoustics.

Castège, Hémery, D'Amico, Lalanne, Mouchès, d'Elbée and Pautrizel (Oral) monitored seabird and marine mammal relative abundance and distribution in coastal waters of the Bay of Biscay from ships of the French customs used as platforms of opportunity, from 1976 onwards, following a line transect methodology. Top predator distributions present an important spatio-temporal variability, but several areas consistently host high densities of several species.

Cotté, Guinet, Taupier-Letage, Mate and Petiau (Oral) used ferries from France to Algeria to investigate cetacean seasonal distribution and relative abundance in the western Mediterranean (WM) from early September 2006 to late July 2007. The focus was on fin whale and also striped dolphin, *Stenella coerulaeoalba*. Fin whales exhibited fidelity to the northern WM with a summer-aggregated and winter-dispersed pattern. This pattern was confirmed by Argos tracking of eight fin whales. Most striped dolphins were also observed in the northern WM without seasonal variation in distribution. At a finer scale, models revealed that both species were associated with steep frontal zones. By taking into account relationships both at larger and finer scales, modeling allowed the distribution and

abundance of cetaceans to be estimated. Applying this method, 38 600 (95%-CI: 25 900-53 900) striped dolphins were estimated to live in WM between 3 and 6°E.

Dhermain, Gnone, Eynaudi and Cesarini explored site fidelity and long-distance movements in bottlenose dolphins around Corsica. Photo-identification has been used to assess site fidelity and movement patterns of bottlenose dolphins. The Corsican catalogue, including *c.* 200 identifiable individuals, was compared to those of Hyeres islands, Genoa gulf and Tuscany archipelago. Group composition varied on a daily basis. Reported movements were of up to 80 km in two days around Corsica, including mother-calf pairs. Positive matches were found between Corsica and various regions from Tuscany to the Rhone estuary. This large-scale use of north-west Mediterranean coastal waters underlines the fact that individual SACs are not sufficient for management and bottlenose dolphin conservation purposes.

Amundin, Carlén and Carlström (Poster) presented the project SAMBAH (Static Acoustic Monitoring of the BAltic sea Harbour porpoise). In SAMBAH, 300 static acoustic monitoring devices (SAMs; see Tregenza in session 3, 4.2, Comparing indicators) will be used to record porpoise echolocation sounds. Given the low density of harbour porpoises in the Baltic Sea, SAMs are considered to be the most cost-effective method for population monitoring. SAMBAH will provide information on the distribution, population density, possible hotspots, important habitats, and areas with higher risk of anthropogenic conflicts for harbour porpoises in the Baltic Sea. SAMBAH involves partners in Sweden, Denmark, Germany, Poland, Finland, Estonia, Latvia and Lithuania, and the UK.

3.3. Monitoring stranded animals

Stranding networks in many different European countries record stranding events and necropsy reports, and collect tissue or organ samples allowing long-term monitoring of the number of stranded individuals, main causes of death, as well as major biological data that include vital rates, diet and health condition.

Van Canneyt, Certain, Peltier, Dabin, Dorémus, Spitz, Duguy and Ridoux (Oral) presented a synthesis of trends revealed by 35 years of stranding records along the French coasts (14 367 entries in data base). Most small cetaceans and seals (common, bottlenose and striped dolphins, harbour porpoise, grey, *Halichoerus grypus*, and common, *Phoca vitulina*, seals) were found to have increased. Deep diving species showed no trend, whilst fin and minke, *Balaenoptera acutorostrata*, whales increased significantly in stranding records. When available, ground-truth data, such as seal counts at haul-out sites and harbour porpoise distribution and densities revealed by the EU surveys SCANS-I and SCANS-II, validated trends observed in strandings. Stranded individuals were also examined for causes of death (not synthesised), and provided abundant material allowing vital parameters to be determined for the most common species (see Ployart *et al.* in session 2, 3.4, Monitoring interactions with fisheries).

Jepson, Deaville, Law, Allchin, Baker, Patterson, Reid, Northridge, Learmonth, Davison, Penrose, Perkins and Bennett (Oral) examined trends in PCB levels in UK-stranded harbour porpoises and conducted a case-control study of Σ25CBs levels in porpoises that died from acute trauma *versus* infectious diseases. Although several organochlorine pesticide levels declined markedly between 1990 and 2005, summed blubber concentrations of 25 chlorobiphenyl congeners (Σ25CBs) levels were significantly higher and more temporally stable. The infectious disease group had significantly greater

Σ25CBs concentrations than the physical trauma group. Quantitative measures of thymic lymphoid tissue were independently and positively correlated with nutritional status and independently and negatively correlated with age and Σ25CBs, but only in animals with total PCBs levels exceeding a proposed 17 mg/kg lipid threshold of toxicity. 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 has declined only slightly over a 16-year period.

3.4. Monitoring interactions with fisheries

The proper management of interactions with fisheries requires the assessment of this additional mortality and a prospective analysis of its effects in the long-term. Presentations were given of the large scale cetacean bycatch monitoring program implemented under EU fishery regulation 812/2004 and of two modeling exercises of the effect of fishery-induced additional mortality assessed from demographic data obtained by photo-identification and from stranding material, in killer whale, *Orcinus orca*, and common dolphin respectively.

Morizur, Bonhomme, Van Canneyt, Delamare and Ridoux (Oral) presented a progress report of the implementation of EU regulation 812/2004 in France. The observation program includes 1800 days *per* year. Observations were made on gill and trammel net fisheries in the Bay of Biscay and on single and pair pelagic trawl and high vertical opening otter trawl fisheries in the Atlantic, English Channel and Mediterranean. In 2007, the total estimate of harbour porpoises by-caught in set nets in the Bay of Biscay amounted to *c.* 600 individuals. In the sea-bass pelagic trawl fishery, 150-220 common dolphins were estimated to be caught compared to 580 individuals *per* year in 2004-5. The CETASAVER prototype deployed on pair trawl pelagic fisheries has led to an estimated 50-70% decrease in common dolphin bycatch.

Tixier, Guinet, Gasco and Duhamel (Oral) examined the demography of killer whales in the Crozet archipelago, in response to interactions with Patagonian toothfish, *Dissostichus eleginoides*, fisheries. Killer whales have been killed by illegal long-liners operating in this area from 1996-2000. Photo-identification data analysed by Capture-Mark-Recapture modeling showed a continuous decline in survival rate from 1977 (0.94) to 2007 (0.91), with a sharp decrease over the years 1996-2000 that was particularly clear for groups known to interact with long-liners. Abundance of the coastal groups varied from 102 in 1988-89 to 28 individuals in 2007, which raises a major conservation concern. This study suggests the worsening effect of poaching on a population that was already decreasing because of other factors.

Ployart, Augeraud-Véron, Dabin and Ridoux obtained age, reproductive and cause of death data from stranded common dolphins in the Bay of Biscay and built a demographic model to test the sustainability of current bycatch levels. Mortality and fertility functions were obtained by fitting Siler's and Hadwiger's equations respectively. The model provided basic vital parameters consistent with current knowledge for the species (*e.g.* life-time calf production per female: 4.8; survival at onset of maturity: 0.61). The resulting dynamic model, discretized by age class, was used to test the influence of bycatch levels on population size. It appeared that current removal rates applied to an initial population of 40 000 individuals (for a management unit confined to animals living over the continental shelf) would result in a 96% decline over 100 years.

4. Indicators and their performance (Session 3)

As an introduction to the session, Pierce, Mendes, Santos, Hall, MacLeod, Ridoux and Learmonth gave a general presentation of a definition of indicators and their expected performance. Ecological indicators are used to communicate information about ecosystems and the impact of human activities to the public or government policy makers. Ecosystems are complex and ecological indicators can help describe them in simpler terms that can be understood and used by non-scientists to make management decisions. Desirable properties of indicators include specificity, sensitivity, responsiveness and representativeness. Indicators should also have a clear theoretical basis, be subject to validation, be easy to understand, be relevant to policy and have a link to management, as well as a high public profile. The usefulness of indicators depends on data availability, data quality, logistics, statistical properties and limits beyond which they do not apply.

During this session, several papers compared methods of monitoring for their capacity to detect patterns or changes and for their cost-effectiveness.

4.1. Testing monitoring methodologies

Peltier, Certain, Daniel, Van Canneyt and Ridoux (Oral) estimated drift and discovery rates of dead dolphins in the aim of improving the monitoring value of stranding data time series. Stranding of marine mammals results from several processes: the death of an animal, its drift, stranding and discovery. Discovery rate was estimated at 16.2% from data on tagged carcasses left drifting immediately after incidental death in fisheries. Drift was calculated by using the Météo-France model MOTHY and validated by comparing stranding with at-sea sighting data. Stranding and sighting data were strongly correlated in bottlenose dolphins (C=0.221, P= 0.0002, r^2=0.67) but not in common dolphins (C=0.001, P= 0.923). In the future, modelling carcass drift would allow stranding data series to be spatialized and may provide the necessary information on geographical origin, and hence putative population, of biological samples collected on stranded marine mammals.

Hastie, Murray, Snowball and Janik (Oral) tested active sonar as an environmental and mitigation tool around renewable devices. Active sonar is a potentially powerful tool that could allow underwater observation of marine mammals when visibility is low. Furthermore, as there is the potential that the acoustic signals of the sonar could cause a range of negative impacts, we carried out a series of behavioural response tests with captive grey seals and captive harbour porpoises to assess reactions to the acoustic signals of a high frequency imaging sonar (375 kHz, but significant components of the signal down to 6 kHz). Our study suggests that sonar activity can influence marine mammal behaviour with potential ecological or energetic consequences, and using sonar in the wild should be carried out with caution.

Schaeff (Oral) examined the use of fluctuating asymmetry as an indicator of marine mammal population health. Fluctuating asymmetry (FA) is an indirect measure of developmental instability (DI). DI occurs primarily as a consequence of stresses – genetic and environmental – experienced during development. Individuals with elevated DI typically experience lower reproductive success and survivability and hence are considered to be less fit. As the proportion of individuals in a population exhibiting elevated levels of FA increases, the overall health of the population typically declines. FA

estimates can be used to answer two main questions concerning population health: whether the health of one population is significantly different from that of another (i.e., impact of stresses acting on the test population) and whether the health of a population has changed over time. Our studies investigating the usefulness of FA for monitoring the health of marine mammal populations indicated that FA is a valuable tool for assessing a variety of species (e.g., Florida manatees, *Trichechus manatus*, California sea lions, *Zalophus californianus*, bottlenose dolphins, and Atlantic harbour porpoises). Methodological advances included the identification of factors that influence the accuracy of FA estimates.

Vincent, McConnell, Hassani, Elder and Ridoux (Poster) presented telemetry and censuses as complementary approaches for calibrating seasonal monitoring of seal abundance. Total abundance of seal populations is usually assessed from pup counts or censuses during the moult. Regular censuses of seals hauled out are, however, conducted at many sites, over all seasons: they can provide indices of seasonal and inter-annual trends in relative abundance and sex/age composition of seal groups. The proportion of individuals hauled out was estimated during regular censuses conducted outside the breeding and moulting seasons, from individual telemetry. Sixteen grey seals from the Archipel de Molène were tracked with Argos tags from 1999 to 2003 (mainly in summer/autumn), and fifteen harbour seals, *Phoca vitulina*, from the Baie du Mont-Saint-Michel and Baie des Veys were tracked with Fastloc GPS / GSM tags in 2006-2007 (mainly during winter/spring). Grey and harbour seals spent on average 18.6 and 18.0% of their tracking time hauled out, respectively. Grey seals were only present on haul-out sites and during 25% of their tracking time, against 62% of harbour seals' tracking time. Grey seals sometimes moved away from the catching site and hauled out on other sites (included in the UK), or made foraging trips lasting more than a day, while harbour seals made shorter movements, coming back more frequently on the haul-out sites where they were caught.

4.2. Comparing indicators

Comparing two or more monitoring methodologies conducted concurrently in the same conditions allows the assessment of their relative cost-effectiveness and capacity to detect changes.

Tregenza (Oral) proposed static acoustic monitoring as an alternative to line transect surveys. Line transect surveys are costly and suffer significantly from responsive movement by small cetaceans, and the volumes of data collected are often too low to separate various factors that may significantly alter the chance of detection of an animal on the track-line. Static acoustic monitoring (SAM) uses instruments deployed continuously and serviced every 3 to 6 months to collect data on acoustic detections of small cetacean sonar. The cost per detection is a small fraction of that in mobile surveys and the problems of responsive movement are not present. The instruments can already distinguish porpoises from dolphins and distinctions between dolphin species are the next target. SAM has been shown to work in the most difficult situation of monitoring populations that are too sparse for any other method to give useful results. Progress has been made in determining the 'detection function' that is required to estimate absolute density from SAM data.

Pavan, Podestà, Lanfredi, Portunato, Cividini, Azzellino and Zimmer (Oral) compared visual and acoustic data in dedicated at-sea surveys conducted to estimate the diversity, abundance and distribution of marine mammals in the Alboran Sea (Mediterranean Sea). Passive acoustic equipment was used 24h/day; by contrast, visual observations were conducted during daylight hours only and were severely limited by weather conditions. 18 days of survey allowed 390 hours of acoustic

monitoring and only *c.* 50 hours of visual survey in positive conditions to be undertaken. Beaked whales, which are critical cetaceans for passive acoustics and one of the target species of the survey, were detected acoustically nearly 100 times but sighted only 16 times. Among the aims of the survey, the mapping of the presence of Cuvier's beaked whales, *Ziphius cavirostris*, was particularly successful, demonstrating the value of passive acoustic surveys conducted with a quiet dedicated platform.

4.3. Power analyses of monitoring methods

Limited information was presented regarding a proper assessment of a method's capacity to detect changes in marine mammal populations. A global analysis of published at-sea surveys aimed at determining cetacean abundance was undertaken.

Quick, Kaschner, Jewell, Thomas, Wiff, Harris and Hammond (Oral) conducted a global analysis of cetacean abundance surveys for which trends in abundance can be detected. The analysis, based on 1035 abundance estimates for 34 species, investigated whether variation in estimates of cetacean density can be explained by temporal, taxonomic, spatial and survey-related covariates. Generalised additive models (GAMs) were used to model cetacean density, which was weighted for survey area and precision. Cetacean density was mostly explained by the taxonomic covariate, suggesting that to reveal trends, species should be considered individually. The density estimates of the seven most data rich species (minke, fin, sperm, humpback and long-finned pilot whale, *Globicephala melas*, striped dolphin and harbour porpoise) were therefore modeled separately on a regional level. Power analysis showed that the probability of detecting anything but the largest trends in density was low. Knowledge of population trends is vital for informing management decisions; recommendations will be made as to how best to ensure that future data collection and analytic methods increase our ability to assess population trends.

4.4. Monitoring in non-scientific contexts

Monitoring marine mammals is by nature an activity that must be maintained over extended areas and long periods. For the sake of cost efficiency, monitoring marine mammal populations often relies on networks of volunteers or on contributions from non-specialists. This difficulty is more acute in the case of rare and elusive species, for which the cost of any single data is higher. Finally, this is still exacerbated in overseas territories and developing countries where availability of experts in sufficient number may be a challenge, and where cultural and economic contexts may result in conservation and monitoring marine mammals being of low priority. Hence, more robust methodologies, often based on interviews and platforms of opportunity, have to be developed in place of the standard approaches.

David and Di-Meglio (Oral) analysed the advantages and limits of monitoring practices by ecovolunteers. Monitoring marine mammals implies large spatial and temporal coverage; hence networks of volunteers collecting data under protocols validated by scientists can be a response to improving cost-efficiency of marine mammal monitoring programmes. It proves to be complementary to expensive scientific surveys. Additionally, projects run with volunteers are also of great interest for the development of public awareness in conservation of marine environments and biodiversity.

Pusineri, Kiszka, Dulau, Caceres and Garrigue (Oral) examined marine mammal monitoring practices in the French Indo-Pacific Islands (New Caledonia, Réunion, Mayotte). Regarding the societal demand, institutions are often easy to mobilize as insularity facilitates contacts with authorities and the management of the coastal zone is a priority. By contrast, the demand from the local population is

generally weak, except when a species is of cultural importance like dugongs, *Dugong dugon*, in New Caledonia. Therefore developing public awareness is a priority and regional collaborations must be developed. Regarding monitoring practices, small study areas and high density of animals in coastal habitats make some practices, such as biopsy and focal follow sampling or photo-identification surveys, more accessible. By contrast, stranding events are rare and difficult to monitor. Capacities, resources and knowledge are limited; programs largely rely on volunteers, and low-cost practices should be favoured. Original practices, such as interviews, have to be developed. Monitoring strategies should also consider specificities of local threats (*e.g.* poaching, whale-watching development, habitat degradation…). As human activities grow rapidly in these overseas territories, changes in marine mammal populations have to be detected as early as possible.

Kiszka, Muir and Pusineri analysed the difficulty to monitor dugongs, a critically endangered species, threatened by hunting and bycatch, in Tanzania and Mayotte. In Tanzania, the NGO SeaSense collected 35 opportunistic data (including sighting, stranding and bycatch), 272 records (incidental catches or sightings) from interview surveys from local fishermen, and 0 sightings from systematic aerial surveys. Around Mayotte, several institutions collected 73 opportunistic sightings, 138 records from interview surveys of local fishermen, and 5 sightings from systematic aerial surveys. Interview surveys provided the highest number of data, both for the extent of bycatch and on dugong occurrence. Opportunistic records provided qualitative information on the occurrence of bycatch and documented reproduction (cow-calf pairs). It underlines that monitoring of this rare and elusive species should be undertaken through multiple approaches: an observer network, interview surveys and, capacity permitting, quantitative aerial surveys.

5. Data quality and management of volunteer networks (Session 4)

The theme of data quality in networks of volunteers was dealt with in one of the two workshops that closed the symposium. Ridoux introduced this workshop by an analysis of the need for data quality in monitoring marine mammals and the challenge that it represents in the context of data providers acting on their own initiative and resources.

Quality is understood as the continuous process by which an activity is carried out for the ever improved satisfaction of the users. This is immensely important in activities relating to human (and domestic animal) health, food and safety, which are domains where norms are increasingly prevailing and legal actions frequent. In the field of monitoring biodiversity, the application of the concept of quality is comparatively at its infancy, possibly because users are weakly defined and perceived immediate risks for humans low.

The aim of monitoring is to detect changes (trends, fluctuations and events) in the abundance, distribution, demographic variables, health status and causes of death across populations. Consistency and quality of data acquisition protocols are central to ensure credibility of the data. Strong monitoring data are needed because they contribute to decisions regarding human activities at sea (fisheries, naval exercises, exploration, transport, tourism,…) and on land (pollution, climate change,…). In a management context, you must have convincing monitoring data if economically or socially costly decisions are to be taken.

There is a need for higher quality and more demonstrable quality in monitoring data. Central to the achievement of this aim is the use of methodologies that are standardized and controlled over time and space, particularly in long lasting and geographically extended networks of correspondents or

data providers. Monitoring network contributors have diversified origins, motivations and capacities to collect samples and data. They provide data and samples on a voluntary basis, during their free time, within their commitment in an NGO or during working time; most often within a local organization.
With the increasing involvement of voluntary contributors, one can observe an increasing willingness not to be confined to just providing data and samples, and hence the need to develop a more participative network management. However, because volunteers act on their own resources, the technical level that can be achieved varies from place to place. Technical heterogeneity is a challenge for data quality and contributing on a voluntary basis is a challenge for network management. How can we ask more in the name of quality to people acting on their own initiative and resources? A Voluntary Code of Conduct and initial ideas about quality control were proposed in the subsequent workshop chaired by Laurence Micout.

France's National Stranding Network (RNE = *Réseau National d'Echouages*) comprises about 250 contributors belonging to 50 different organisations. They work throughout the entire national territory under the coordination of the Center of Research on Marine Mammals (CRMM = *Centre de Recherche sur les Mammifères Marins*). Such an important number of different actors is difficult to manage. For this reason, appropriate measures and tools had to be developed and applied. A code of conduct presented by Van Canneyt was submitted to, and amended by, participants with the aim of obtaining a final version in late 2009. Gonzales and Dabin explained the importance of a quality control system. There is a need for harmonization of working methods by standardizing protocols. Data and tissue or organ samples collected on stranding events must be traceable. Therefore a quality system that aims to obtain a "quality label" has to be created. This is a long-term interactive project, and the participation of every RNE member is essential. Finally, Dorémus presented the new RNE logo.

6. Monitoring strategies (Session 4)

Hohn and Scott presented examples from the US for integrated monitoring strategies. Subjects for monitoring are populations, demographics, distribution, associated species and habitat. Monitoring aims to obtain time series of data in sufficient quantity to determine if there are trends in the data. In the US, case studies on grey whales, *Eschrichtius robustus*, Hawaiian monk seals, *Monachus schauinslandi*, and bottlenose dolphins have been conducted. Grey whale populations were monitored during migration by shore-based counts and stranding data. The combination of these two different monitoring strategies highlighted a decline in grey whale population and calf abundance. The potential causes (starvation, derelict gear, predation, habitat loss, fishery mortality, human disturbance and male aggression) of the endangered Hawaiian monk seal's decline have been monitored. For every potential cause, different appropriate monitoring tools have been applied. Monitoring many factors has been critical for reducing the rate of decline, since many of the factors affecting mortality can be managed to reduce population decline. Another case study is the monitoring of coastal bottlenose dolphins. This species is distributed along the east coast of the US and suffered a 50 percent decline in the late 1980s. Recovery and actual abundance are unknown. The main threat identified in the northern part of the species' distribution area is fishery bycatch. According to US Marine Mammal Management laws, a fishery must be modified to reduce takes if the Potential Biological Removement (PBR) level (depending on estimated abundance) of a population is

exceeded. Fishery Management Plans seem to reduce bycatch mortality because stranding rates decreased after implementation. Strandings can be used to monitor fishery interactions. Integrated monitoring may include many factors simultaneously or sequentially but must be re-evaluated on a regular basis to incorporate new factors, and requires a long-term commitment because parameters change over time.

The workshop chaired by Hohn and co-chaired by Tasker started with a presentation made by Tasker on cetacean surveillance/marine mammal monitoring. Two documents were previously distributed to all participants: an overview of the marine mammal monitoring actions carried out in French waters prepared by Ridoux, and the draft UK cetacean surveillance strategy prepared by the Joint Nature Conservation Committee (JNCC), presented by Pinn.

The objectives of the workshop can be summarized in the following four questions:

What is a strategy for the monitoring of marine mammal populations?
A strategy is a plan of actions to be undertaken in the long term in order to monitor the status and trends of marine mammal populations. Habitats are exposed to many threats and therefore should be monitored in addition to populations. This necessity should be taken into account explicitly in proposals and projects. Missing data on habitat needs for several species are highlighted here. A difference must be made between scientific purposes and the aims expressed by the EC. We should be aware that funds will be allocated for the actions that member states are asking for!

What should we include in a strategy for the monitoring of marine mammal populations?
The strategy should cover the range of the population. Information about the population structure and the habitat is a prerequisite. Although the Habitats Directive refers to “species”, it is acknowledged here that “populations” constitute in most cases the unit on which management should be be based. The strategy must be designed in the long term. Pertinent delays between successive assessments must be estimated. When large monitoring programs cannot be scheduled on a regular basis (*i.e.* high cost and/or heavy logistics), proxies for monitoring parameters must be determined and monitored on a more frequent basis.

The strategy must be relevant for management purposes. Qualitative or quantitative indicators obtained from the monitoring of marine mammal populations must be useful for management decisions. It is highlighted, however, that new information might be needed in the future for management purposes that are not asked for at present. The scientific community also has the important role to drive and anticipate future studies on marine mammal conservation status.

The following parameters have been identified as key information to be monitored:

Abundance and trends. Absolute abundance is usually difficult to assess but the strategy should include a plan for its estimation. Relative abundance must be monitored when/if absolute abundance cannot be estimated, at a frequency that allows rapid detection of trends, so that management actions can be planned in time to reduce the variations in abundance (when needed).

Demography. Vital rates should be estimated and monitored in addition to abundance, as it also constitutes a proxy for future changes in abundance.

Health status of marine mammal populations. Methods and parameters must be relevant for species.

Occupancy and residency or movement patterns. Although occupancy is usually hard to monitor on a short-term basis, local monitoring of population occupancy could provide indicators of changes in circumstances.

Biotic and abiotic factors. Factors influencing the distribution and abundance of marine mammal populations should be monitored (prey distribution and abundance, environmental parameters…).

Risks. Environmental or human-induced factors, with a potential negative effect on marine mammal populations, should be monitored (e.g. fishing effort & bycatch, ship traffic, PCB levels, noise…).

All these parameters must be:
- monitored at an appropriate interval (to be defined according to parameters and species),
- quantifiable, with known variance, bias, etc…, (a major issue previously identified in several studies and highlighted by WGMME is that the statistical power of many monitoring schemes is too low to meet targets for detection of trends),
- appropriate for the species,
- monitored at a large and a sufficiently fine spatial scale (the latter being necessary for most Marine Protected Area designations),
- comparable with reference points to allow status to be evaluated (there has to be a mechanism to determine whether something measured is good or bad).

In conclusion, it was highlighted that all these recommendations need international collaboration to be fulfilled.

Shall we have priorities and if so, what are the priorities?
If priorities are to be set, they should follow legal requirements. Monitoring must be management based, and therefore area based (since current management plans, at least in Europe, are based on habitats). A summary of knowledge and gaps should be made, from which priorities can be determined. A discussion emerged, however, whether or not there is a need to set priorities: pros are linked to realism and need to focus on main risks, cons are based on the difficulty to monitor rare species. There is a trade-off to make between “easy” studies and remaining realistic by taking the cost/benefit into account. For instance, a monitoring strategy might be designed for a target species, but remain open for data on other species to be collected in the meantime. A priority action was suggested: make an inventory of available data, gaps in data, institutions or people already or potentially involved in monitoring programs. This inventory will necessarily imply international collaboration and the use of GIS.

What actions should we plan from here?
A steering committee could be set up in order to work further on the strategy for marine mammal population monitoring. It is suggested that its members could come from existing committees (like ACCOBAMS, ASCOBANS, etc…). Members from countries outside Europe bordering common areas of investigation (like the Mediterranean) should be encouraged. The inventory of available data, gaps in data, and institutions/people already/potentially involved in monitoring programs, is suggested to be the next step in setting up such a strategy. Funding for establishing this inventory could be sought in a COST proposal.

Tasker was invited to close the whole symposium by an overall talk summing up all three days of presentations and discussion. In this difficult exercise, he particularly stressed several conclusions or suggestions:

- there are many good studies, but they need to be published;
- a useful product would be an agreed publication on advantages and disadvantages of techniques and circumstances when use would be appropriate;
- study proposals should be explicit on the degree of ability to detect change, and on potential sources of bias/ assumptions;
- international populations require international study;
- responses to legislative needs are most relevant (there can be a contradiction here as the EC requests national responses on conservation status, yet the populations assessed are clearly international; the recent Marine Strategy Framework Directive on the conservation of marine habitats should clarify this apparent contraction as it requires that Member States collaborate in order to ensure a good environmental status to ecologically meaningful marine regions);
- comparisons between independent studies in same area can be instructive *e.g.* Bay of Biscay;
- integration (*i.e.* use of multiple studies) is helpful as it can provide explanation and better interpretation; it is often necessary to solve the problem.

7. Acknowledgements

The success of the symposium was largely due to many institutional and individual contributions. The symposium was hosted by *Université de La Rochelle* and co-hosted by *Agence des Aires Marines Protégées* and *Ministère de l'Ecologie, l'Energie, le Développement Durable et l'Aménagement du Territoire*. It was sponsored by *Région Poitou-Charentes, Centre National de la Recherche Scientifique, Ministère de la Culture et de la Communication, Ville de La Rochelle, Conseil Général de la Charente Maritime*. It was supported by ASCOBANS and ACCOBAMS, the two regional agreements of the Convention on Migratory Species relevant to cetacean conservation in European waters. In kind and financial contributions were also offered by *Parc Zoologique de La Flêche, Léa Nature* and *MAAF Assurance*. The invited participants, Peter Evans, Aleta Hohn, Giuseppe Notarbartolo di Sciara, Graham Pierce and Mark Tasker offered their time and vast expertise to improve the scientific content of the meeting and the quality of the debates. All participants and contributors are finally warmly welcome for making this symposium fruitful in a friendly atmosphere.

APPENDIX 1: LIST OF PRESENTATIONS

ORAL PRESENTATIONS

NOTARBARTOLO DI SCIARA G.: Societal demands leading to the need for marine mammal monitoring

GRILLO M.C.: Marine mammal monitoring in ACCOBAMS

BRÄGER S.: Monitoring efforts in the ASCOBANS context

BIGAN M.: Marine mammal monitoring under EU regulations

LAROUSSINIE O.: Society demand in monitoring marine mammals populations: French national framework

EVANS P.: Converting the societal demand into measurable parameters

PINN E. & TASKER M.: Meeting monitoring requirements: the proposed UK approach

RIDOUX V.: Existing practices in marine mammal monitoring

VIEIRA N., BRITO C., SÁ E. & CARVALHO I.: Cetaceans' occurrence off the west central Portugal coast: a compilation of data from whaling, observations of opportunity and boat-based surveys

RINALDI C. & RINALDI R.: Sperm whales and other cetaceans: results of photo ID in Guadeloupe FWI and neighbouring waters

TIXIER P., GUINET C., GASCO N. & DUHAMEL G.: Demography of killer whales *Orcinus orca* in the Crozet archipelago in response to interactions with illegal Patagonian toothfish longliners

MORIZUR Y., BONHOMME C., VAN CANNEYT O., DELAMARE A. & RIDOUX V.: Assessment of impact of cetacean by-catch in fisheries and mitigation: the contribution of France in the application of the 812/2004 EU regulation

PLOYART S., AUGERAUD-VÉRON E., DABIN W. & RIDOUX V.: Operating stranding's data for the production of biological indicators for the bay of Biscay common dolphin (*Delphinus delphis*): a contribution to assessing the fisheries impact

SAMARAN F., ADAM O., RUZIÉ G., ROYER J.-Y. & GUINET C.: Long-term acoustic monitoring in the southwestern Indian Ocean reveals

VAN CANNEYT O., CERTAIN G., PELTIER H., DABIN W., DOREMUS G., SPITZ J., DUGUY R. & RIDOUX V.: 35 years of stranding records reveal trends in marine mammal populations

JEPSON P.D., DEAVILLE R., LAW R.J., ALLCHIN C.R., BAKER J.R., PATTERSON I.A.P., REID R.J., NORTHRIDGE S., LEARMONTH J.A., DAVISON N., PENROSE R., PERKINS M. W. & BENNETT P.M.: PCB levels are associated with thymic involution and infectious disease mortality in UK-stranded harbour porpoises (1989-2006)

PUSINERI C., KISZKA J., DULAU V., CACERES S. & GARRIGUE C.: Marine mammal monitoring in overseas territories: the example of French Indo-pacific tropical islands

DAVID L. & DI-MEGLIO N.: Existing practices of monitoring by ecovolonteers: advantages and limits

DHERMAIN F., GNONE G., EYNAUDI A. & CESARINI C.: Long-term monitoring, site fidelity and long distance movements of bottlenose dolphins *Tursiops truncatus* around Corsica: implications for conservation

CASTÈGE I., HÉMERY G., D'AMICO F., LALANNE Y., MOUCHÈS C., D'ELBÉE J. & PAUTRIZEL F.: Long-term trends in abundance and distribution patterns of cetaceans in coastal waters of the bay of Biscay

COTTÉ C., GUINET C., TAUPIER-LETAGE I., MATE B. & PETIAU E.: Using platform of opportunity to study and monitor cetacean populations in western Mediterranean Sea

PIERCE G., MENDES S., SANTOS B., HALL K., MACLEOD C., RIDOUX V. & LEARMONTH J.: Indicators and their performance

KISZKA, J., MUIR, C.E. & PUSINERI, C.: Monitoring rare and elusive marine mammals: a case study for east African dugong (*Dugong dugon*)

TREGENZA N.: Static acoustic monitoring of cetacean sonar: an alternative to line transect surveys

PAVAN G., PODESTÀ M., LANFREDI C., PORTUNATO N., CIVIDINI F., AZZELLINO A. & ZIMMER W.M.X.: Combined acoustic and visual survey in the Alboran Sea

QUICK N., KASCHNER K., JEWELL R., THOMAS L., WIFF R., HARRIS C. & HAMMOND P.: A global analysis of cetacean abundance surveys

PELTIER H., CERTAIN G., DANIEL P., VAN CANNEYT O. & RIDOUX V.: How strandings records can inform on cetacean at sea: an attempt to model and validate drift and discovery rates

HASTIE G., MURRAY A., SNOWBALL J. & JANIK V.: Active sonar as an environmental monitoring and mitigation tool around marine renewable devices

SCHAEFF C.: Fluctuating asymmetry: a useful indicator of marine mammal population health

HOHN A.A. & SCOTT M.D.: Integrated Monitoring Strategies: Examples from the U.S.

RIDOUX V.: The need for quality in monitoring data Networks of volunteers: a challenge for data quality?

TASKER M.: Cetacean surveillance/ marine mammal monitoring

POSTER PRESENTATIONS

CUCKNELL A.C., NICHOL A.J. & ROBINSON N.E.: A comparison of mitigation monitoring versus research monitoring

AMUNDIN M., CARLÉN I. & CARLSTRÖM J.: SAMBAH – static acoustic monitoring of the Baltic harbour porpoise

FOSSATI C., PAVAN G., DYMOND R., TROIANO L. & PINZANI D.: Towed digital array for marine mammals survey

DORÉMUS G., CERTAIN G., VAN CANNEYT O., RINALDI R., JEREMIE S., BOLAÑOS J., WATREMEZ P. & RIDOUX V.: Aerial surveys in Caribbean and Guiana: top predator abundance, distribution and diversity in French overseas territories

STEPHAN E.: Small cetaceans distribution and abundance in the Iroise Sea. Preliminary results of action n°3 of the PINGIROISE program.

KECK N., KWIATEK O., DHERMAIN F., DUPRAZ F., BOULET H., LAPRIE C., THIAUCOURT F., PERRIN A., GODENIR J. & LIBEAU G.: Morbillivirus on striped dolphins (*Stenella coeruleoalba*) in Mediterranean Sea: synthesis of the 2007/2008 epizootic

BUDZINSKI H., PELUHET L., TAPIE N., LÉA D., DI-MÉGLIO N. & LEGAVRE T.: PCBS and POPS contaminations: an indicator of the contamination of fin whale in Mediterranean Sea

LARAN S., CASTELLOTE M., GLOTIN H., CAUDAL F. & LAMMERS M.: Programme GIS3M: cetaceans monitoring in the Pelagos sanctuary. I- passive acoustic monitoring in the Ligurian Sea

DAVID L., LARAN S., ODY D., EYNAUDI A., MAYOL P., CAUDAL F., MAURT P., CAPOULADE F., DUPRAZ F. & DI-MÉGLIO N.: Follow-up and conservation, interest to collaborate: case of the fin whale and the GIS3M in the Mediterranean Sea

DI-MEGLIO N., ODY D., EYNAUDI A. & DAVID L.: Programme GIS3M: cetaceans monitoring in the Pelagos sanctuary. II- aerial and boat based monitoring of the populations of cetaceans in the Liguro-Provencal Sea

PAVAN G., PODESTA' M., LANFREDI C., PORTUNATO N., CIVIDINI F., AZZELLINO A. & ZIMMER W.M.X.: The Italian cetacean stranding network online database

QUARESMA S. & ANTÓNIO C.: Monitoring strandings in Alcobaça beaches

MÉNDEZ P., MARTÍNEZ-CEDEIRA J., FERNÁNDEZ R., CALDAS M., COVELO P., LLARENA M., LLAVONA A. & LÓPEZ A.: Monitoring cetaceans in Galicia: diagnostic and conservation

JAUNIAUX T., BERGUERIE H., CAMPHUYSEN K., DAOUST P-Y., DROUGUET O., GHISBAIN T., GARCIA-HARTMANN M., GRONDIN A., HAELTERS J., JACQUES T., KISZKA J., LEOPOLD M., PEZERIL S., SCHNITZLER J. & COIGNOUL F.: Mortality of harbour porpoises in the North Sea: evaluation tool for the population

PÉZERIL S. & KISZKA J.: Seasonal occurrence and group size of harbour porpoises (*Phocoena phocoena*) from the French southern North Sea

VAN CANNEYT O., MASSÉ J., CERTAIN G., GAUTIER G., SPITZ J. & RIDOUX V.: Characterization of bottlenose and common dolphins habitat in the bay of Biscay: evidence of a strong spatial segregation

DUPUIS L., DELCOURT R., HOSTEN C. & ROUSSEL M.: Grey seal (*Halichoerus grypus*) population in the Somme bay estuary: past, present and future

ELDER J.-F., VINCENT C., MC CONNELL B., SPITZ J., MARIOTTI L., GAUTIER G. & CAILLOT E.: Monitoring of harbour seal (*Phoca vitulina*) in Baie de Veys

GAUTIER G., CAILLOT E. & ELDER J.-F.: Aerial surveys from ULM for the monitoring of harbour seal in Normandy

GAUTIER G., CAILLOT E., ELDER J.-F. & AULBERT C.: Aerial censuses (ULM) on future Marine Protected Areas

VINCENT C., MCCONNELL B.J., HASSANI S., ELDER J.-F. & RIDOUX V.: Telemetry and censuses: complementary approaches for calibrating seasonal monitoring of seal abundance