

## FOREWORD

# Marine mammals in time: past, present and future

JAN WILLEM BROEKEMA<sup>1</sup>, JOOST C.A. SCHOKKENBROEK<sup>2</sup>, GRAHAM J. PIERCE<sup>3,4</sup>  
AND PETER G.H. EVANS<sup>5,6</sup>

<sup>1</sup>Brikkenwal 20, 2317 GT Leiden, The Netherlands, <sup>2</sup>Nederlands Scheepvaartmuseum Amsterdam, Kattenburgerstraat 7, Amsterdam, The Netherlands, <sup>3</sup>Instituto Español de Oceanografía, Centro Oceanográfico de Vigo, PO Box 1552, 36200, Vigo, Spain, <sup>4</sup>Oceanlab, University of Aberdeen, Main Street, Newburgh, Aberdeenshire, AB41 6AA, UK, <sup>5</sup>Sea Watch Foundation, Cynifryn, Llanfaglan, Caernarfon, Gwynedd LL54 5RA, UK, <sup>6</sup>School of Ocean Sciences, Bangor University, Menai Bridge, Anglesey LL59 5AB, UK

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In the history of whale research and whaling (Slijper, 1962; Tønnessen & Johnsen, 1982), as in the history of the European Cetacean Society (ECS) (Evans *et al.*, 2007), the Dutch have played a prominent role, alongside countries like the UK, Norway, Denmark and Spain. However, it was only during the 2006 annual ECS conference in Gdynia (Poland) that the idea of organizing the Society's 2008 conference in The Netherlands came to fruition. The theme selected by the organizers was 'Marine mammals in time: past, present and future'.

Nowadays the popular perception of cetacean research centres upon ocean-based research—looking for and observing the animals in their natural habitat. What tends to be forgotten is that much research can, and indeed has to be, conducted back on dry land: in the laboratory, the office and the library. This is important basic research, which provides the necessary foundation for further science in the field and elsewhere. In the past, even in classical times, marine mammals were important not only as animals for the study of nature, but also as objects of wonder and folklore. In Northern Europe, records of whale strandings go back many centuries, e.g. sperm whale *Physeter macrocephalus* strandings in The Netherlands have been documented from the 17th Century (Smeenk, 1997). In the Mediterranean Sea, the coast of western Liguria (Italy) was even called in Roman times *Costa Ballaenae*, the 'Coast of Whales' (Orsi Relini *et al.*, 1992), indicating that large whales regularly stranded along those coasts. That the beluga *Monodon monoceros* was the origin of the description of the fabled unicorn (Gesner, 1551) was a 17th Century discovery by I. Ionston (1660), a doctor from Leiden University. Both historical studies (conducted *in* the past) and history studies (studies *about* the past) are of equal importance to meaningful understanding of present day research. At the 2008 ECS conference, a truly multidisciplinary approach to the study of cetaceans was strongly advocated. This resulted in a workshop entitled 'Marine mammals in the arts, social sciences and other

disciplines', an initiative that was generally welcomed wholeheartedly.

In 2007 (at San Sebastián, Spain) and also in 2008 (at Egmond aan Zee, The Netherlands), ECS workshops were also held on cultural aspects (Brito & Evans, 2009), since we can also learn from both art and literature about our natural habitat. The petroglyphs from Norway (Clark, 1947; Schäfer, 1956) and Minoan frescoes in the palace of Knossos, Crete, are excellent examples of the importance of culture for the study of marine mammals in the past, in the same way as the many Mediterranean fables of Ancient Greece (e.g. Arion's rescue by a dolphin) have been recounted by successions of literary scholars from Aristotle and Pliny (the Elder) onwards, and tell us something of the species inhabiting the Mediterranean more than two thousand years ago. Likewise, chronicles of the development of early whaling for right whales *Eubalaena glacialis* by the Basques of northern Spain have provided insights to aspects of the biology and conservation management of this now endangered species (Aguilar, 1986).

In the present, to have access to studies and publications in the multicultural world that is Europe, implies being able to read and understand many languages. The ECS has been very conscious of this, even if Anglo-Saxon is its *lingua franca*. We must all pay special attention to disseminating research findings both from and to, those regions where English is not the primary or even the second language.

As always, the range of topics covered by the oral and poster presentations of this conference extended well beyond its main theme, as reflected in the papers contained in this Special Issue, which also includes several papers submitted after the 2008 conference.

Three papers describe different aspects of competition and interactions between cetacean species. Weir *et al.* (2009) examine the distribution and behaviour of white-beaked dolphins *Lagenorhynchus albirostris* and common dolphins *Delphinus delphis*, two species which co-occur on the west

coast of Scotland. The authors showed that *L. albirostris* occurred in waters significantly deeper and further from shore than *D. delphis*, furthermore that *L. albirostris* was foraging sub-surface while *D. delphis* exhibited surface-feeding with associated gannets *Morus bassanus*, suggesting inter-specific differences in preferred habitat and foraging strategies. Di Benedetto *et al.* (2009) compared the diets of the franciscana *Pontoporia blainvillei* and the boto-cinza *Inia geoffrensis* from south-eastern Brazil, showing that fish are more important in the diet of the boto-cinza, and squids are consumed mostly by the franciscana. The authors showed that the squids eaten tend to have higher gross energy content than the fish prey, suggesting that teuthophagy could convey a competitive advantage. Rossi-Santos *et al.* (2009) point out that, while interactions between different odontocete species are commonly documented, mysticete cetaceans also co-occur and interact with various odontocete and other mysticete cetaceans, as the authors describe for north-eastern Brazil.

Gannier (2009) compared cetacean abundance around two island groups in French Polynesia. Higher cetacean abundance in the Marquesas, as compared to the Society Islands, may relate to higher primary productivity in the former area.

Insights into individual ecology and life history can be obtained from so-called recording structures, notably the teeth and baleen of odontocete and mysticete cetaceans respectively, with various recent studies having attempted to interpret trends in isotope ratios across a recording structure, in terms of feeding ecology and movements. Luque *et al.* (2009) analysed the possible interpretation of mineralization anomalies in the teeth, showing that the appearance of some types of anomaly (e.g. dentinal resorption and cemental disturbance) appear to be related to the maturation process.

Researchers themselves may affect the behaviour and stress levels of their marine mammal subjects, but studies to examine such effects are rare. Eskesen *et al.* (2009) measured heat rate, respiration rate and cortisol levels in harbour porpoises during handling and radio tagging procedures. They found an overall significant decrease of 31.5% in respiration rate, with immatures respiring less than mature animals. Some individuals increased their heart rates significantly more than others, although no general trend was detected and no relationship was found between cortisol levels and either respiration or heat rate. Pouring water over the animal and lowering it into the water appeared to be effective at stabilizing a stressed animal.

Several papers address important conservation issues, notably fishery interactions. Jaaman *et al.* (2009) obtained information on marine mammal by-catch in Malaysian fisheries using an interview survey. As in many countries with large fishing fleets (in this case around 15,000 boats), adequate on-board monitoring of interactions with marine mammals is logistically difficult. Results indicated that highest by-catches occurred in gill nets, and that by-catch rates of both cetaceans and dugongs are probably unsustainably high, especially in Sabah. Similarly, Danilewicz *et al.* (2009) note the unsustainably high rate of by-catch of franciscana in southern Brazil; whilst Lauriano *et al.* (2009) illustrate the other side of marine mammal–fishery interactions, namely the economic damage to fisheries caused by cetacean depredation on fish in the nets. It is worth pointing out that not all cetaceans prey on commercially important fish and squid. Most prey of the 12 cetacean species studied in the Canary Islands was

non-commercial fish and cephalopod species (Fernández *et al.*, 2009). However, even in these cases, there was evidence of interactions, with one sperm whale (a species known for depredation on longlines) having a fish hook in its stomach.

In terms of providing solutions to conservation problems, there is evidence that in some cases an area-based approach might be successful. Lauriano *et al.* (2009) showed that it is possible to identify regions where a greater amount of cetacean depredation occurs. Conservation issues may be particularly pressing for coastal and estuarine species, due to small population sizes and the high likelihood of interactions with human activities. In some cases, as for Guiana dolphin *Sotalia guianensis*, areas of particular importance to the animals, which could provide the focus for conservation efforts, can be identified (Aichinger Dias *et al.*, 2009). However, in the case of the franciscana in southern Brazil there were no clear patterns in distribution and it was not possible to identify specific areas that could usefully be protected (Danilewicz *et al.*, 2009).

Studies of cetacean social structure nowadays rely heavily upon photo-identification techniques. One species often studied in this way is the sperm whale. Jaquet & Gendron (2009) investigated the social organization of sperm whales in the Gulf of California from long-term photo-identification data coupled with behavioural observations, and then compared these to other populations. They found that mean group sizes in the region were similar to those in the Galapagos, Chile and Seychelles, but significantly larger than in the Sargasso Sea, Caribbean and northern Gulf of Mexico. The groups in the Gulf of California were more stable than those in the South Pacific, generally remaining together for ~80 days in contrast to Galapagos and Chile where groups persisted for only around 10 days. They speculated that differences between study areas in the Pacific and Atlantic were due to differences in predation pressure (e.g. killer whale densities) and/or food resources.

For some species, however, our knowledge of social structure is more rudimentary. Guiana dolphins in southern Brazil, for example, have been relatively little studied. They appear to live in small family groups of 2–3 individuals, which may come together to form larger aggregations, the age composition of which varies from place to place (Fila & Monteiro-Filho, 2009).

Modern developments in molecular biology have permitted us to examine aspects of ecology and evolution that were never previously tractable. Biopsies can be taken to determine gender, and thence sex-ratios (as for southern right whales *Eubalaena australis* in Brazil—Oliveira *et al.*, 2009). Genetic studies can be combined with photo-identification to investigate movement patterns, revealing hitherto unknown overlap of breeding grounds in low latitude areas between northern and southern hemisphere humpbacks *Megaptera novaeangliae* (Rizzo & Schulte, 2009). And new approaches to genetic studies are being developed. One such makes use of the major histocompatibility complex (MHC), a multigene family which has recently been found to be highly polymorphic at sites that specify the amino acids of the peptide binding region, the region responsible for peptide collection and presentation. There is now growing evidence for its functional role in the immune system of a range of taxa including cetaceans, the MHC gene being at least partly under balancing selection, probably when populations change habitats and environmental conditions, and thus

acquire new pathogens. The results of a Brazilian study, using skin biopsies from both the franciscana and southern right whale, lends further support for this (Heinzelmann *et al.*, 2009).

Survey techniques have also come a long way in the last two or three decades. Indeed before then, there was scarcely any monitoring of cetacean populations except from whaling records. This is a burgeoning area of study, as reflected in the number of papers on this subject. A variety of techniques are commonly employed, often in conjunction with one another. An interesting approach adopted by Vieira & Brito (2009) has been to calculate sperm whale sighting rates from whaling log books (1947–1973) in the Azores, and then compare these to the sighting rates obtained by whale watching operations in the same area between 1997 and 2008. Although various additional factors need to be taken into account, they found significantly higher rates during the whaling period, and as a consequence suggest that the sperm whale population in that region remains depleted. Whaling records (in this case, catch statistics) are used also to supplement sightings and strandings information to provide a review of the cetacean fauna of the remote archipelago of Tristan da Cunha (Best *et al.*, 2009). Amongst the fifteen species recorded, of particular interest is the apparent importance of the area for the little known Shepherd's beaked whale *Tasmacetus shepherdi*, and records indicating significant extensions to the previous known ranges of two other ziphiids—True's beaked whale *Mesoplodon mirus* and Andrew's beaked whale *M. bowdoini*, these results represent significant extensions to their previous known range. New information for another remote archipelago—the islands of São Tomé and Príncipe in the Gulf of Guinea—is presented by Picanço *et al.* (2009). Six cetacean species were recorded during boat-based surveys between 2002 and 2005, with some ecological differences in the distribution of particular species observed following patterns found elsewhere in the world: humpback whales favouring shallower inshore waters, bottlenose dolphins *Tursiops truncatus* along the shelf at similar depths, but pantropical spotted dolphins *Stenella attenuata* occurring in deep slope waters.

Vessel surveys are also used to derive estimates of both density and absolute abundance. Along the north coast of Anglesey, UK, regular line transect surveys for harbour porpoise *Phocoena phocoena*, between 2002 and 2005, revealed a comparatively high density (0.63 individuals/km<sup>2</sup>), leading to an abundance estimate of 309 animals in this small area (Shucksmith *et al.*, 2009).

Two papers test the application of relatively new survey techniques: Lodi *et al.* (2009) describe and evaluate the use of digital video in photo-identification of individual bottlenose dolphins in Brazil, whilst Rayment *et al.* (2009) trial the T-POD (a passive acoustic click detector used primarily on porpoises) on an endangered dolphin species, the Hector's dolphin *Cephalorhynchus hectori*. Both applications showed promise, the latter in particular detecting all individuals observed visually within a radius of ~200 m.

Long-term monitoring of cetacean populations has also used a variety of approaches, ranging from systematic land-based watches targeting coastal species like the bottlenose dolphin (Pierpoint *et al.*, 2009), use of platforms of opportunity such as ferries (Macleod *et al.*, 2009), strandings records (Meirelles *et al.*, 2009), or a mix of strandings, opportunistic sightings and systematic aerial surveys (Jung *et al.*, 2009). Although

strandings alone may not enable one unambiguously to identify trends in population status, when combined with post-mortem examinations they can indicate trends in health status. Thus, Meirelles *et al.* (2009) were able to show that 25% of strandings (mainly of dolphins) in north-eastern Brazil were human-related, mostly fisheries by-catch. Two papers (Jung *et al.*, 2009; Macleod *et al.*, 2009), using different approaches, provided corresponding evidence for increases in occurrence of harbour porpoises in the area of the English Channel and coasts of Brittany between the late 1990s and late 2000s. Pierpoint *et al.* (2009) also found increases in bottlenose dolphin site use and occupancy between 1994 and 2007, which supported other evidence from vessel-based line transect survey and photo-identification.

With respect to the future, we find that conservation has increasingly become an important topic for research, as pressures upon the marine environment accelerate, particularly in relation to climate. Marine mammals may either suffer from, or take advantage of, climate (and other environmental) change, but they might also be considered as indicator species for such changes. We need to learn a lot more about these options. Such themes have since been taken up in the 2009 ECS Conference, material from which will feature in the next Special Issue, due for 2010.

In conclusion, we stress the importance not only of undertaking studies with regard to the present but should also consider drawing information from the past and making predictions about the future, for presentation in the scientific literature of marine mammal research.

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