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FOREWORD

Marine mammal studies to address future challenges in conservation management

PETER G.H. EVANS[1,2], GRAHAM J. PIERCE[3] AND ANDREW J. WRIGHT[4,5]

[1]Sea Watch Foundation, Ewyn y Don, Bull Bay, Amlwch, Anglesey, LL68 9SD, UK, [2]School of Ocean Sciences, University of Bangor, Menai Bridge, Anglesey LL59 5AB, UK, [3]Oceanlab, University of Aberdeen, Main Street, Newburgh, Aberdeenshire, AB14 6AA, UK, [4]Department of Bioscience, Aarhus University, Frederiksborgvej 399, PO Box 358, DK-4000 Roskilde, Denmark, [5]George Mason University, MSN SF2, 4400 University Drive, Fairfax, VA 22030–4444, USA

During the 19th Century and much of the 20th Century, marine mammal studies, particularly of cetaceans, were based primarily upon dead animals—either the result of strandings or of catches as a direct product of human exploitation. The emphasis was on taxonomy and anatomy (see, for example, Cuvier, 1836; Rapp, 1837; Van Beneden & Gervais, 1880; Van Beneden, 1889; Beddard, 1900; True, 1904; Slijper, 1958). From around the 1950s, field studies of seal species were initiated in various parts of the world, particularly Europe, North America and Antarctica (for example, Laws, 1953, 1956a, b; Hewer, 1957; Bartholomew, 1959; Burns, 1965), but it was not until the 1970s that research on living cetaceans got underway (see, for example, projects reviewed in Winn & Olla, 1979; Payne, 1983; Pryor & Norris, 1991).

The cryptic nature of cetaceans at sea and perceived difficulties in species identification together contributed to the reluctance of biologists to turn their attention to studies at sea. Increasingly, however, technological advances have facilitated such research—examples include tags for telemetry and tracking studies; biopsy sampling for genetic, stable isotope, fatty acid and contaminant analyses; and both passive and active acoustic devices for recording and monitoring vocalizations (Boyd *et al.*, 2010). Units are becoming smaller and less invasive; and locations of animals more precise as GPS tags develop further. Marine mammal species that spend much of their lives in deep oceans far from land have long provided a major challenge, but even some of these, for example members of the little known beaked whale family Ziphiidae, are now being investigated using clever tags integrating tracking devices, acoustic sensors, magnetometers, accelerometers and depth recorders (Johnson & Tyack, 2003; Tyack *et al.*, 2011).

Much current monitoring and research on marine mammals aims to address conservation management issues, both those covered by existing law and directives, and emerging threats and pressures which remain to be addressed by policy-makers. At present the key policy drivers for conservation of marine mammals in Europe include the EU Habitats Directive and Marine Strategy Framework Directive, Regulation 812/2004 of the Common Fisheries Policy, OSPAR, and the Convention on Migratory Species (CMS). In some cases (e.g. CMS), agreements have led to the setting up of international organizations, such as ASCOBANS and ACCOBAMS, which work to implement policy, monitor its success and update it where necessary. Implementation of international and European agreements and directives is dependent on translation into national law, and effective delivery once this has taken place—and the extent to which this has been achieved varies widely across Europe. However, putting aside these issues of conservation governance, we may distinguish several reasons for monitoring, including:

(1) to determine status and spatio-temporal trends in status of populations of protected (and other) species;
(2) to measure the efficacy of existing conservation measures, including spatial instruments such as marine protected areas (MPAs), or mitigation measures for specific threats such as pinger deployment on gill nets;
(3) to determine impacts of specific threats; and
(4) to identify gaps and emerging issues which may require development of new conservation measures (i.e. a sentinel function).

Meeting these objectives in turn involves various types of data collection, using a range of methodologies:

(1) measuring abundance, distribution, movements and migrations, occupancy, habitat use and site fidelity. Relevant methodologies include dedicated and opportunistic sightings surveys, acoustic monitoring, photo-identification, strandings monitoring, and the various associated analytical and statistical tools;
(2) evaluating ecological (e.g. diet), life history (e.g. maturation, fecundity and mortality), health status (e.g. incidence of diseases, parasite loads, contaminant burdens and condition) and behavioural parameters; deriving population level parameters based on individual level studies. Such studies can involve strandings monitoring, biopsies, tagging, passive acoustic monitoring and visual observation;

(3) direct threat monitoring, e.g. using on-board observers or camera systems on fishing vessels, acoustic monitoring around wind-farms, etc; and
(4) environmental monitoring: surveillance of the structure, function and quality of supporting habitat of marine mammal species.

Similarly, conservation-related research has several functions and involves deployment of a wide range of techniques:

(1) identifying appropriate management units (for which it may be necessary to find ways to distinguish similar species or identify populations or 'stocks' based on genetic or ecological evidence);
(2) providing background knowledge on physiology, immune function, life history, ecology and behaviour—needed, for example, to help understand habitat requirements (ecological niches) and how threats and pressures may impact on individuals and populations (e.g. what are the likely behavioural and physiological consequences of exposure to underwater noise? how does bioaccumulation of persistent organic pollutants impact on immune function and reproduction?);
(3) developing methodologies and tools for data collection and analysis; and
(4) developing and testing specific threat mitigation measures.

The European Cetacean Society (ECS) held two recent conferences with themes that take a long-term view of marine mammal research and conservation. In March 2010, the ECS addressed the theme 'Marine mammal populations: challenges for conservation in the next decade' at its 24th Annual Conference in Stralsund, Germany; and in March 2011 at the 25th Annual Conference in Cadiz, Spain, its theme was "Long-term datasets on marine mammals: learning from the past to manage the future'.

Several of the papers in this special issue of the *Journal of the Marine Biological Association of the United Kingdom* provide examples of how marine mammal scientists are using different methods to monitor population size and demography, examine ecological relationships, and record responses to human activities. Some of these methods are novel, but tried and tested traditional approaches such as direct observation and stomach contents analysis continue to be used, along with refinements where appropriate. These provide useful ecological information and insights into effects of climate change, fisheries interactions and other stressors—and remain essential in poorly studied areas. The studies also illustrate how research on one topic can provide insights into another, as in the case of diet and habitat use.

Molecular genetics has been applied widely in recent years in attempts to reveal population structure and to develop management units (Evans & Teilmann, 2009) or to clarify taxonomic status (Perrin *et al.*, 2009). Despite this, morphometric studies still retain an important role. Genetic evidence has already indicated the critically endangered harbour porpoise (*Phocoena phocoena*) population in the Baltic to be distinct from porpoises occupying Danish Belt Sea and North Sea waters (Evans & Teilmann, 2009; Wiemann *et al.*, 2010). Its conservation status has thus been the subject of much concern. In the present volume, Galatius *et al.* (2012) have employed a 3-D geometric morphometric approach on porpoise skulls from the North Sea, the Belt Sea and the Baltic to test a number of hypotheses regarding population structure in the region. They suggest that foraging adaptations, and not merely geographical distance, may be responsible for the differences they observed, and note that their results support molecular indications of a distinct Baltic Sea porpoise population.

Barbato *et al.* (2012) used multivariate analysis of external morphological characteristics of franciscana (*Pontoporia blainvillei*) to investigate whether proposed management units were supported. While differences between three of four management units are suggested to reflect ecological divergence of the niches, the fourth management unit may represent a separate sub-species. Fetuccia *et al.* (2012) describe postcranial skeletal characteristics, which can be used to distinguish two species of the genus *Sotalia*.

Although originally used mainly to determine trophic position, stable isotope analyses are now increasingly used as a tool to make inferences on migrations and the existence of ecological stocks. Based on analyses of stable nitrogen and carbon isotopes, Meissner *et al.* (2012) found geographical differences in diet of striped dolphins *Stenella coeruleoalba* between the Atlantic and the Mediterranean but no clear differences were apparent between the five Mediterranean areas studied. In addition, results are interpreted as providing possible evidence of changes in maternal feeding behaviour as calves approach weaning, as well as confirming expected ontogenetic changes in the size (and trophic level) of prey consumed.

Whether to provide baseline information or to evaluate effects of specific threats and pressures, measuring abundance and detecting trends therein is a fundamental component of assessment of population status. De Oliveira *et al.* (2012) provided the first effective population size estimate for the South American sea lions (*Otaria flavescens*) living along the Peruvian coast. Following the strongest El Ninõ event in history, the effective population size was found to be still above widely accepted critical levels. However, higher abundance levels may be required for the population to withstand the more frequent and stronger El Ninõ events that climate models are predicting for the future. This will undoubtedly be a conservation challenge for the future as calls for culling, due to perceived fisheries interactions, intensify.

The most widespread tools for studies of distribution and abundance have been visual observations, mainly through dedicated effort-related surveys from land, sea or air. In north-west Ireland, Anderwald *et al.* (2012) have conducted land-based watches on nine cetacean and two seal species that occur regularly in Broadhaven Bay, County Mayo, in order to establish patterns of seasonal and spatial occurrence. They found some niche separation between species with bottlenose dolphins *Tursiops truncatus* using the innermost part of the bay whereas minke whales *Balaenoptera acutorostrata* and common dolphins *Delphinus delphis* showed spatial overlap.

Leeney *et al.* (2012) documented patterns of distribution and relative abundance of basking sharks *Cetorhinus maximus*, sunfish *Mola mola* and eight species of cetaceans around Cornwall and the Isles of Scilly, south-west England, from ferry trips and aerial surveys over a two year period.

Some useful information on distribution and distribution changes can also be gained from analysis of incidental sightings and strandings, as Pikesley *et al.* (2012) show using data collected between 1991 and 2008 from Cornwall in south-west England. They found significant decreases over this period in bottlenose dolphin sightings and pod size, but an increase in minke whale sightings and harbour porpoise sightings and strandings.

As we move towards a better understanding of future conservation challenges, new tools and techniques will be required. Autonomous acoustic data loggers, such as T-PODs, are among those undergoing a rapid growth in their applications at this time, for example to record species occurrence in the vicinity of potential threats such as wind farms. However, Elliott *et al.* (2012) offered a cautionary note, demonstrating that their use could benefit from further optimization. Specifically, they employed filters customized to match the click characteristics of bottlenose dolphins living in Doubtful Sound, New Zealand. In comparison with the manner in which T-PODs have been set in some other studies, the custom settings here led to between 8 and 33 times as many detections. This indicates clearly that studies using T-PODs and other such devices will benefit from similar optimization.

In order to detect range shifts it is important to have a good knowledge about migration patterns and the normal range of movements. Another way of looking at movements is to consider site fidelity, which is examined in two papers. Baracho-Neto *et al.* (2012) showed very low levels in humpback whales *Megaptera novaeangliae*, with 96% of 841 photo-identified animals in Bahia, Brazil, seen only once over a ten year period, the remainder being seen just twice, and mainly within the same season. Cribb *et al.* (2012), on the other hand, found that of 56 photo-identified spinner dolphins *Stenella longirostris* in Moon Reef, Fiji Islands, 70% were re-sighted on two or more occasions over a two-year period, suggesting that the studied reef area forms a regular resting habitat for the local population.

Photo-identification (photo ID) has also been used to investigate the social structure of a small (24 animals), declining resident bottlenose dolphin community in the Sado Estuary, Portugal. Augusto *et al.* (2012) found a fission–fusion society here but one that seemed to have more stability than in other bottlenose dolphin communities studied. Associations between individuals were in the form of a pattern of casual acquaintances, where individuals associate for a period of time, disassociate and then may reassociate again, though with no evidence for segregation by age-class or sex. The authors concluded that a combination of demographic characteristics and a stable and productive environment had led to a decrease in competition between individuals.

Male sperm whales *Physeter macrocephalus* are well known to undergo extensive migrations into high latitudes. Again, photo ID has proven to be a useful tool, in this case to establish links for individual whales travelling between tropical breeding grounds and temperate and polar regions. Steiner *et al.* (2012) in a review of several North Atlantic catalogues found six matches between the Azores and northern Norway, as well as more local matches within Norway (Andenes to Tromsø), and between Andenes and a stranding in western Ireland.

Whereas first population estimates are important, regular assessments over the longer term are invaluable, especially in areas designated as MPAs. Unfortunately, this has not been the case for the Golfo San José MPA in northern Patagonia, Argentina, where components of the local ecosystem except for the southern right whale (*Eubalaena australis*) for which it was created in 1975 have received little attention. In the first survey in 30 years, Coscarella *et al.* (2012) detected a potential shift in distribution as well as a likely decline in both abundance and group size in the bottlenose dolphins living in and around the MPA. This highlighted not only the population as a possible conservation concern, but also provides a challenge for appropriate MPA management in the future.

Otley *et al.* (2012) report on nearly one-and-a-half centuries of beaked whale strandings on the Falkland Islands and South Georgia in the South Atlantic Ocean. Although absolute numbers are limited to just 38 records across seven species, three species were found to appear in the record on at least three occasions only relatively recently: Arnoux's beaked whales (*Berardius arnuxii* Duvernoy, 1851) in 1965; Andrew's beaked whales (*M. bowdoini* Andrews, 1908) in 1981; and Gray's beaked whale (*M. grayi* van Haast, 1876) in 1987. This suggests that distributions of these species may be changing, perhaps in response to changes in water temperature and/or prey distributions.

Most studies on habitat use are based upon sightings data. Weir *et al.* (2012) used sightings and statistical modelling to investigate differences in habitat preferences of several cetacean species off West Africa in the eastern tropical Atlantic, demonstrating differences in the niches occupied. Habitat preferences of most species were primarily related to sea surface temperature, but water depth was the most important determinant of the presence of Risso's dolphin *Grampus griseus*, and seabed slope was the key variable for striped dolphin.

Two contributions show how studies on diet can provide insights into habitat preferences. Botta *et al.* (2012) describe interspecific differences in isotope ratios between several cetacean species in Brazil. Observed between-species differences in d13C values reflect different habitat preferences: d13C values were highest in coastal feeders such as bottlenose dolphin, and lowest in the offshore species, Fraser's dolphin *Lagenodelphis hosei*. Ponnampalam *et al.* (2012) describe stomach contents of several dolphin species in the Sea of Oman and Arabian Sea. Knowledge about the ecology of the prey species allows inferences to be made on the feeding habitats of the cetaceans. Thus, the Indo-Pacific humpback dolphin *Sousa chinensis* fed mainly in shallow coastal areas while spinner dolphins fed mainly on vertically migrating mesopelagic prey. Bottlenose dolphins, on the other hand, were seen to have foraged in a range of habitats.

Lopes *et al.* (2012) describe the feeding habits of Guiana dolphins, *Sotalia guianensis*, showing differences between the diet in estuarine waters and that elsewhere. Although dolphins mainly took locally abundant prey, the majority were not target species of fisheries.

A review by Brown *et al.* (2012) of dietary data on seals collected in the UK over twenty years revealed both temporal (e.g. seasonal) and regional differences in diet composition, as well as highlighting differences between grey seals *Halichoerus grypus* and harbour seals *Phoca vitulina*. The former species showed finer-scale spatial variation in diet as well as differences in the patterns of seasonal variation. The key conclusion is that future assessments of the impact of seal populations should not be based on past or localized estimates of diet.

Life history studies provide important information on population level responses. Osinga *et al.* (2012) showed that the pupping season in harbour seals advanced by approximately one month over 35 years. This change in phenology is likely to be an adaptive response to local environmental change, possibly related to global climate change.

With regard to long-term data sets on marine mammals, and especially cetaceans, few can match strandings records. Although there are well-known biases in studies based on strandings, they provide an essential record of causes of mortality and how they differ between species and vary over time, as well as access to a range of other life history data. Fruet *et al.* (2012) present an almost 40-year record of bottlenose dolphin mortality along part of the Brazilian coast. They noted that 43% of the 188 animals stranded during this period were determined to have been by-caught and that the overall mortality was seasonal and synchronous with fishing efforts. While juvenile males constituted the bulk of the predominantly male by-catch mortalities, adults represented 75% of all the by-caught females. When incorporated into a potential biological removal (PBR) analysis, these levels of fishing-related mortality were found to be unsustainable. Bornatowski *et al.* (2012) analysed more than 200 cetacean carcasses from the Abrolhos Bank in eastern Brazil and found that more than 20% of both humpback whales and other species, had evidence of shark bites suggesting they are important predators and scavengers. This was confirmed by photographic evidence from living animals.

Acoustics represents another means to investigate marine mammal ecology and behaviour. Gannier *et al.* (2012), for example, studied echolocation clicks and creaks of more than fifty sperm whales during 156 complete foraging dives in the north-west Mediterranean. They found that larger whales tended to dive longer at greater depths and emitted more creaks during a dive. Creak rates were highest earlier in the day then decreased, and were linked to shorter foraging phases and time spent at the surface.

As we move into the future, we can expect human use of the marine environment to only increase. One of the pressures marine mammals face is that of escalating vessel traffic. Papale *et al.* (2012) demonstrated this clearly with their reports of the effects of vessel traffic on bottlenose dolphin in southern Italy. Disruption of behaviours was found to be common, especially within 200 m. Moreover, original behaviours were seldom resumed following the departure of the boats, implying that long-term consequences may be present. However, it seems at least that leisure boats are not a threat to the hearing of bottlenose dolphins. David (2012) used a theoretical approach to determine the onset of hearing impairment, in terms of both temporary (TTS) and permanent threshold shifts (PTS) in this species. After extrapolating broadband boat noise levels, an equal-energy model predicted that exposure for eight hours at just 2.3 m would be needed to induce TTS, with PTS being even more unlikely.

Morteo *et al.* (2012) also assessed human–bottlenose dolphin interactions, although in their case they focused on fisheries interactions, in the western Gulf of Mexico. Through a spatial analysis based upon line transect data, they found non-random and mostly mutually exclusive distributions of dolphins and fisheries. The dolphins only interacted with gillnets (28.6% of vessels and 22.6% of fishing gear), with resident individuals ($N = 23$) generally trying to avoid humans, probably as a consequence of negative reinforcement caused by aggression from fishers. This combination indicates that artisanal fisheries in this area are influencing dolphin distribution and activities, while the risks of intentional interactions with gillnet fisheries are likely to be much higher in a relatively small number of individuals.

Pressures upon the marine environment throughout the world continue to escalate, including overfishing of many stocks of fish and shellfish, increased levels of vessel traffic, noise pollution from seismic exploration conducted in areas hitherto relatively untouched (such as West Greenland, Central and South America, the African sub-continent and parts of Asia), the introduction of new contaminants, and the often unclear consequences of climate change. And yet, even in regions like northern Europe where pressures are particularly intense (HELCOM, 2009; OSPAR, 2010), our knowledge of the status and trends of populations of most marine mammal species remains very poor (Evans, 2011). An important challenge for the coming decades is to find new ways to investigate especially the more inaccessible species.

REFERENCES

Anderwald P., Haberlin M.D., Coleman M., O'Cadhla O., Englund A., Visser F. and Cronin M. (2012) Seasonal trends and spatial differences in marine mammal occurrence in Broadhaven Bay, north-west Ireland. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Augusto J.F., Lopes P.R. and Dos Santos M.E. (2012) Social structure of the declining resident community of common bottlenose dolphins in the Sado Estuary, Portugal. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Baracho-Neto C.B., Santos-Neto E., Rossi-Santos M.R., Wedekin L.L., Neves M.C., Lima F. and Farua D. (2012) Site fidelity and residence times of humpback whales (*Megaptera novaeangliae*) on the Brazilian coast. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Barbato B.H.A., Secchi E.R., Di Beneditto A.P.M., Ramos R.M.A., Bertozzi C., Marigo J., Bordino P. and Kinas P.G. (2012) Geographical variation in franciscana (*Pontoporia blainvillei*) external morphology. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Bartholomew G.A. (1959) Mother–young relations and the maturation of pup behavior in the Alaska fur seal. *Animal Behaviour* 7, 163–171.

Beddard F.E. (1900) *A book of whales.* London; John Murray.

Bornatowski H., Wedekin L.L., Heithaus M.R., Marcondes M.C.C. and Rossi-Santos M.R. (2012) Shark scavenging and predation on cetaceans at Abrolhos Bank, eastern Brazil. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Botta S., Hohn A.A., Macko S.A. and Secchi E.R. (2012) Isotopic variation in delphinids from the subtropical western South Atlantic. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Boyd I.L., Bowen W.D. and Iverson S.J. (eds) (2010) *Marine mammal ecology and conservation: a handbook of techniques*. Oxford: Oxford University Press.

Brown S.L., Bearhop S., Harrod C. and McDonald R.A. (2012) A review of spatial and temporal variation in grey and common seal diet in the United Kingdom and Ireland. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Burns J.J. (1965) *The walrus in Alaska: its ecology and management.* Juneau, AK: Alaska Department of Fish and Game.

Coscarella M.A., Dans S.L., Degrati M., Garaffo G.V. and Crespo E.A. (2012) Bottlenose dolphins at the southern extreme of the south-western Atlantic: local population decline? *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Cribb N., Miller C. and Seuront L. (2012) Site fidelity and behaviour of spinner dolphins (*Stenella longirostris*) in Moon Reef, Fiji Islands: implications for conservation. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Cuvier F. (1836) *De l'histoire naturelle des cétacés*. Paris: Librairie Encyclopédie de Roret.

David J.A. (2012) Theoretical approach to estimating the induction of hearing impairment in bottlenose dolphins by radiated leisure boat noise. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

De Oliveira L.R., Fraga L.D. and Majluf P. (2012) Effective population size for South American sea lions along the Peruvian coast: the survivors of the strongest El Niño event in history. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Elliott R.G., Dawson S.M. and Rayment W.J. (2012) Optimizing T-Pod settings and testing range of detection for bottlenose dolphins of Doubtful Sound, New Zealand. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Evans P.G.H. (2011) *Review of trend analyses in the ASCOBANS area.* ASCOBANS AC18/Doc. 6-05 (S), 12 pp.

Evans P.G.H. and Teilmann J. (eds) (2009) *Report of ASCOBANS/HELCOM Small Cetacean Population Structure Workshop*. Bonn, Germany: ASCOBANS/UNEP Secretariat, 140 pp.

Fettuccia D.C., Da Silva V.M.F., Richa M.S. and Simões-Lopes P.C. (2012) Sternum and appendicular skeleton: morphometric differences between the species of genus *Sotalia* (Cetacea: Delphinidae). *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Fruet P.F., Kinas P.G., Da Silva K.G., Di Tullio J.C., Monteiro D.S., Dalla Rosa L., Estima S.C. and Secchi E.R. (2012) Temporal trends in mortality and effects of by-catch on common bottlenose dolphins, *Tursiops truncatus*, in southern Brazil. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Galatius A., Kinze C.C. and Teilmann J. (2012) Population structure of harbour porpoises in the greater Baltic region: evidence of separation based on geometric morphometric comparisons. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Gannier A., Petiau E., Dulau V. and Rendell L. (2012) Foraging dives of sperm whales in the north-western Mediterranean Sea. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

HELCOM (2009) *Biodiversity in the Baltic Sea—an integrated thematic assessment on biodiversity and nature conservation in the Baltic Sea.* Baltic Sea Environmental Proceedings No. 115B. Helsinki, Finland: HELCOM, 188 pp.

Hewer H.R. (1957) A Hebridean breeding colony of grey seals, *Halichoerus grypus* (Fab.) with comparative studies on the grey seals of Ramsey Island, Pembrokeshire. *Proceedings of the Zoological Society (London)* 128, 23–64.

Johnson M.P. and Tyack P.L. (2003) A digital acoustic recording tag for measuring the response of wild marine mammals to sound. *IEEE Journal of Oceanic Engineering* 28, 3–12.

Laws R.M. (1953) The elephant seal (*Mirounga leonine* Linn.), part 1: Growth and age. *Falklands Islands Dependencies Survey, London. Scientific Reports No. 8*, 1–62.

Laws R.M. (1956a) The elephant seal (*Mirounga leonine* Linn.), part 2: General, social and reproductive behaviour. *Falklands Islands Dependencies Survey, London. Scientific Reports No. 13*, 1–88.

Laws R.M. (1956b) The elephant seal (*Mirounga leonine* Linn.), part 3: The physiology of reproduction. *Falklands Islands Dependencies Survey, London. Scientific Reports No. 15*, 1–66.

Leeney R.H., Witt M.J., Broderick A.C., Buchanan J., Jarvis D.S., Richardson P.B. and Godley B.J. (2012) Marine megavertebrates of Cornwall and the Isles of Scilly: relative abundance and distribution. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Lopes X.M., Da Silva E., Bassoi M., Dos Santos R.A. and De Oliveira Santos M.C. (2012) Feeding habits of Guiana dolphins, *Sotalia guianensis*, from south-eastern Brazil: new items and a knowledge review. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Meissner A.M., Macleod C.D., Richard P., Ridoux V. and Pierce G. (2012) Feeding ecology of striped dolphins, *Stenella coeruleoalba*, in the north-western Mediterranean Sea based on stable isotope analyses. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Morteo E., Rodha-Olivares A., Arceo-Briseño P. and Abarca-Arenas L.G. (2012) Spatial analyses of bottlenose dolphin–fisheries interactions reveal human avoidance off a productive lagoon in the western Gulf of Mexico. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Osinga N., Pen I., Udo de Haes H.A. and Brakefield P.M. (2012) Evidence for a progressively earlier pupping season of the common seal (*Phoca vitulina*) in the Wadden Sea. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

OSPAR (2010) *Quality Status Report 2010*. London: OSPAR Commission, 176 pp.

Otley H., Smith J, and Dalebout M.L. (2012) Beaked whale strandings on the Falkland Islands and South Georgia, South Atlantic Ocean, between 1866 and 2008. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Papale E., Azzolin M. and Giacoma C. (2012) Vessel traffic affects bottlenose dolphin (*Tursiops truncatus*) behaviour in waters surrounding Lampedusa Island, south Italy. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Payne R. (ed.) (1983) *Communication and Behavior of Whales. AAAS Selected Symposium 76*. Boulder, CO: AAAS.

Perrin W.F., Mead J.G. and Brownell R.L. Jr (2009) *Review of the evidence used in the description of currently recognized cetacean subspecies*. NOAA Technical Memorandum NMFS NOAA_TM_NMFS-SWFSC-450, 38 pp. Obtainable online from the following website: https://swfsc.noaa.gov/publications/TM/SWFSC/NOAA-TM-NMFS-SWFSC-450.pdf

Pikesley S.K., Witt M.J., Hardy T., Loveridge J., Loveridge J., Williams R. and Godley B.J. (2012) Cetacean sightings and strandings: evidence for spatial and temporal trends? *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Ponnampalam L.S., Collins T.J.Q., Minton G., Schulz I., Gray H., Ormond R.F.G. and Baldwin R.M. (2012) Stomach contents of small cetaceans stranded along the Sea of Oman and Arabian Sea coasts of the Sultanate of Oman. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Pryor K. and Norris K.S. (eds) (1991) *Dolphin societies: discoveries and puzzles*. Berkeley and Los Angeles, CA: University of California Press.

Rapp W. (1837) *Die Cetaceen*. Stuttgart and Tübingen: Wilhelm Rapp.

Slijper E.J. (1958) *Walvissen*. Amsterdam, The Netherlands: D.B. Centen.

Steiner L., Lamoni L., Plata M.A., Jensen S.-K., Lettevall E. and Gordon J. (2012) A link between male sperm whales, *Physeter macrocephalus*, of the Azores and Norway. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

True F.W. (1904) *The whalebone whales of the western North Atlantic*. Washington, DC: Smithsonian Contributions to Knowledge. XXXIII.

Tyack P.L., Zimmer W.M.X., Moretti D., Southall B.L., Claridge D.E., Durban J.W., Clark C.W., D'Amico A., DiMarzio N., Jarvis S., McCarthy E., Morrissey R., Ward J. and Boyd I. (2011) Beaked whales respond to simulated and actual navy sonar. *PLOS One* 6, e17009. doi:10.1371/journal.pone.0017009.

Van Beneden P.J. (1889) *Histoire naturelle des Cétacés des mers d'Europe*. Brussels; F. Hayez.

Van Beneden P.J. and Gervais M. (1880) *Ostéographie des cétacés vivants et fossils*. Paris; A. Bertrand.

Weir C.R., Macleod C.D. and Pierce G.J. (2012) Habitat preferences and evidence for niche partitioning amongst cetaceans in the waters between Gabon and Angola, eastern tropical Atlantic. *Journal of the Marine Biological Association of the United Kingdom* 92, XX–XX.

Wiemann A., Andersen L.W., Berggren P., Siebert U., Benke H., Teilmann J., Lockyer C., Pawliczka I., Skora K., Roos A., Lyrholm T., Paulus K.B., Ketmaier V. and Tiedemann R. (2010) Mitochondrial Control Region and microsatellite analyses on harbour porpoise (*Phocoena phocoena*) unravel population differentiation in the Baltic Sea and adjacent waters. *Conservation Biology* 11, 195–211.

and

Winn H.E. and Olla B.L. (eds) (1979) *Behavior of marine animals. Current Perspectives in Research. Volume 3: Cetaceans*. New York and London: Plenum Press.