Cetacean research in the southern African subregion: a review of previous studies and current knowledge

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Abstract

Cetacean research, in terms of the number of papers, research groups and areas for which data are available has expanded considerably in the Southern African Subregion (SAS) in the last decade, especially in the South West Indian Ocean (SWIO). Here we review cetacean research in the SAS from the 1800s to the present to provide an overview of findings, investigate trends and identify knowledge gaps. Data are presented separately for large whales (those subject to commercial whaling) and smaller cetaceans and are separated by era and ocean basin. Over 550 peer-reviewed papers and books were identified relating to research on cetaceans within the subregion. More than half (284) have been produced since 1990 and 193 relate specifically to South African waters. The most studied species are those that are most accessible due to their coastal distributions (southern right whale *Eubalena australis*: 45 papers, humpback whale *Megaptera novaeangliae*: 31 papers, killer whales *Orcinus orca*: 27 papers, Indo-Pacific bottlenose dolphin *Tursiops aduncus*: 30 papers, Indo-Pacific humpback dolphin *Sousa chinensis* (*plumbea* form): 25 papers) or were hunted commercially (sperm whale *Physeter macrocephalus*: 25 papers). Identified conservation concerns vary by region but include bycatch and directed hunts, oil and gas development, eco-tourism activities, shifts in prey resources and noise and chemical pollution. The inshore stock of Bryde's whales and both species of humpback dolphin were identified as the populations of highest conservation concern, although there are considerable knowledge gaps relating to deep water species and almost no data (even on species occurrence) are available for several areas and countries.

Keywords: Cetacean, dolphin, whale, research, review, Southern African subregion, whaling, Southern Ocean, Indian Ocean, Atlantic Ocean.

Introduction

Cetacean research in the southern African subregion (defined here as extending between the equator and the Antarctic ice edge, and from the central Atlantic at 20˚W to the central Indian Ocean at 80˚E) is a relatively small but active field which has produced key insights into several aspects of cetacean research, including the description of several species. Research in the subregion has increased steadily since the 1960s, although different areas of the subregion have experienced different timing and considerably different levels of research output. The majority of work prior to 2000 occurred in South African waters, but in the last decade both the output and geographic spread of research has peaked throughout the subregion.

The environmental and oceanographic conditions within the subregion are diverse (Ansorge and Lutjeharms, 2007) and well suited to investigate globally important questions such as speciation (Perrin 2007) and adaptation to climate change. The waters of the subregion (Figure 1) encompass tropical, temperate and polar systems, including nutrient-rich upwelling systems (particularly the Benguela ecosystem), strong flowing western boundary currents, subtropical, subantarctic and polar fronts and mixed coastal waters (Ansorge and Lutjeharms, 2007). The high diversity of marine life occurring in the region can be attributed, at least partially, to the wide variety and specific features of the oceanic conditions and marine habitats available (Ansorge and Lutjeharms, 2007; Findlay et al., 1992; Perrin, 2007).

Estimating the exact number of cetacean species present in the subregion is complicated by taxonomic uncertainties and the lack of information on the exact range of many species. Best (2007) listed 51 species or subspecies, or 63% of the approximately 80 recognised species of cetacean worldwide to occur in the subregion. The International Whaling Commission provide a more recent global species list and recognise a minimum of 86 cetacean species worldwide (www.iwcoffice.org/conservation/cetacea.htm updated on 2009/01/09). A full list of common and scientific names of species considered in this manuscript is provided in Table 1, and only common names are used in the text from

hereon. A regional breakdown suggests that the waters around South Africa are the most diverse, although this may reflect a paucity of observer effort in the more poorly studied waters further north. In their extensive review of strandings, scientific surveys and opportunistic sightings, Findlay et al. (1992) listed 28 species of small odontocete within South African and Namibian waters. To this number can be added the sperm whale, and at least seven species of balaenopterid (i.e. a total of 36 species) known to occur in South African or Namibian waters (Best, 2007). Weir (2010c) compiled data from strandings, whaling records and sightings data and listed at least 28 species of cetacean (seven balaeonopterids and 21 odontocetes) using the waters between Angola and the Gulf of Guinea (which extends northwards of the geographic limits set in this review). Kiszka and colleagues (Kiszka et al., 2006; Kiszka et al., 2010a; Kiszka et al., 2010c) listed 22 and 12 cetacean species using the waters of Mayotte and the Comoros Islands (Mozambique Channel) respectively, based on recent survey data.

Multiple conservation threats exist within the subregion including directed and accidental capture in fisheries and anti-shark nets, over fishing of prey species, habitat loss (e.g. coastal development, pollution and dredging) and disturbance from commercial marine tourism activities, shipping and seismic exploration. Both human capacity and available financial resources to monitor threats within the region are low and some degree of coordination and understanding of existing knowledge is needed in order to optimize research and conservation efforts within the region.

In line with current initiatives to improve communication and coordinate research efforts within marine science within the region (e.g. the African Marine Mammal Colloquium, Elwen & Thornton, this volume) we have compiled a review of past and existing cetacean-focused research within the subregion. This manuscript has several objectives: (1) to present a brief historical review of cetacean research in the southern African subregion as a background to assessing its current status; (2) outline the major trends and developments in cetacean research; and (3) identify conservation-related gaps in

knowledge and priorities for future cetacean research; and (4) to provide a resource of relevant publications to future researchers.

Data Sources and Methods

Cetacean research in the subregion can be broadly broken down into successive periods, distinguished by different approaches and motivations for research on large whales and smaller cetaceans. We consequently review research on these groups separately rather than following strict taxonomical groupings.

In the case of large whales (those that were the targets of the whaling data, comprising most of the baleen whales and the sperm whale) research is separated into: (1) a historical era (prior to 1975), marked primarily by data collected during or associated with commercial whaling operations; and (2) a modern era (1975-present) marked largely by the cessation of commercial whaling and the onset of independent field research. In the case of the smaller cetaceans (including the beaked whales, kogid whales, delphinids and the single phocoenid), research is divided into: (1) early opportunistic data collection (prior to 1960); and (2) the beginning of dedicated research up until the current era, including ongoing studies (1960 to 2010). The split at 1960 for smaller cetaceans was chosen to reflect the rapid increase of research output associated with the appointment of full time cetologists based in South Africa who carried out much of the pioneering work in the region. Research outside of South Africa, especially in the Southwest Indian Ocean Islands expanded markedly since the late 1990s, and we have presented some of the tabulated summaries with 2000-2010 listed separately to reflect this.

The information presented is purposefully restricted to the primary peer-reviewed research on cetaceans, and does not include grey literature (i.e. theses or unpublished reports), except where deemed to be particularly ground-breaking in terms of subsequent research in a region. Several of the older publications, such as the Discovery Reports, may not have been peer reviewed in the current sense, but include much of the data

available from this era. Data have been compiled from literature searches of available databases, reviews and the publication records of several key scientists working in the region. To investigate trends in research, we have conducted a meta-analysis type break down of the literature by area (region, country or coast), time period (as above) and by species or group of species (if a particular publication is directed at more than one species). The categorisation of publications by areas is presented in Table 2, while the definition of species groupings used in the meta-analysis is presented in Table 3. The text of this manuscript is intended as an overview of the main research and trends and thus does not include all qualifying publications. A full list of these papers (no grey literature) is provided as Appendix 1 with codes designating species and area break downs. Numbers of identified papers in text refer to this full list.

For both large whales and small cetaceans, we present information on research activities in the subregion in chronological order, and have divided the subregion into research performed in South Africa, the Eastern Tropical Atlantic (north of Namibia), South West Indian Ocean (excluding the South African coast) and the Southern Ocean (regarded here as south of 40°S and including the subantarctic islands). However it should be noted that there is some overlap of research approaches across the era periods, for example research arising from data collected during the whaling era continues to be published in recent years.

While effort has been made to consider research in all coastal countries within the southern African subregion, the volume of work is biased towards the waters of South Africa where the clear majority of research activity has occurred to date. Furthermore we have focused this review on research that is primarily aimed at describing cetacean distribution, biology and ecology, and have not included literature pertaining to methodological studies (such as sighting survey methodologies), although these are not an insignificant component of research originating in the subregion.

Large whales and the whaling era (pre 1975)

The majority of early information on mysticetes and sperm whales in the southern African subregion originated from whaling activities during both the historic or 'open-boat' (from around 1770 to 1929) and 'modern' whaling eras (steam driven ships using explosive harpoons from 1908 to 1975). The vast majority of catches within the sub-region during the open-boat whaling period were made by British, Dutch, French or American 'Yankee' pelagic fleets operating in extensive whaling expeditions across broad oceanic areas. The bulk of the data available from vessel log books during this period was for southern right and sperm whales with some data for humpback whales. Catches from shore based stations by 'open-boat' whalers were considerably fewer and predominantly of southern right whales (Best and Ross, 1989).

The scientific value of much of the data gathered during this era was only fully appreciated and analysed much later and only 13 papers could be identified arising from historical whaling data for the region. Townsend (1935) summarized catch data from a sample of whaling logbooks for the period 1761-1920 and provided the first published information on the distribution and seasonality of southern right, humpback and sperm whales in the region. Catch data from open-boat coastal whaling has provided information on the exploitation, recovery, distribution and seasonality of southern right whales (Best, 1970a; Best, 2006; Best and Ross, 1986; Richards and Du Pasquier, 1989). A more complete review of the history of shore-based open-boat whaling is provided by Best and Ross (1989).

Modern shore-based whaling started in Durban, South Africa in 1908 and stations were opened all around the coast of the subregion from Cap Lopez in Gabon to Angoche in Mozambique, targeting mainly humpback whales. Catch statistics from this industry are available from several sources (Best, 1994; Best and Ross, 1986; Best and Ross, 1989; Findlay, 2001; Tønnessen and Johnsen, 1982). Modern shore-based whaling in the

Antarctic fell outside of the study region (Kellogg, 1929; Morch, 1911; Risting, 1912), apart from a brief interlude carried out at Kerguelen between 1911 and 1913 (Tønnessen and Johnsen, 1982). Antarctic pelagic whaling in the study region began with the advent of pelagic whaling operations in the late 1920's and early 1930's and continued in a series of species dominated waves as the populations of different large whale species were decimated. International protection was afforded to different species at different times from 1935 for southern right whales to 1963 for humpback whales, although Soviet fleets operated outside of regulation between 1946/47 and 1972/73 (Tormosov et al., 1998; Zemsky et al., 1995). A number of pelagic whaling operations took place in the low-latitudes of the study region, including whaling by South African companies and foreign countries *en route* to and from the Antarctic. Two cruises to the Mozambique Channel and the Madagascar coast to target humpback whales occurred either side of World War Two. These were made by a South African fleet from 1937-1939 (Bermond, 1950) and Norwegian-American fleet from 1949-1950 (Angot, 1951). The pirate whaling vessel Run/Sierra and its associated vessels operated outside of regulations in the southeast Atlantic from 1967 until 1979 (Best, 1996; Best, 2001; Best and Ross, 1989) while Soviet whaling fleets operated north of 40ºS (often illegally) between 1946/47 and 1972/73 (Mikhalev et al., 1981a; Tormosov et al., 1998; Zemsky et al., 1995). Lastly, several whale marking and sightings cruises and flights occurred between 1968 and 1975 (Findlay et al., 1992; Gambell et al., 1975).

Research arising from modern whaling activities on the African sub-continent can be divided into two approaches, namely: (1) biological research carried out at stations or on-deck during flensing operations and largely relating to feeding, reproductive, morphometric and anatomical studies; and (2) research carried out in the searching and catching phases of the operation, relating to catch distribution, abundance and migration seasonality as well as whale marking programmes.

Whaling research in the subregion was episodic prior to the 1960s and resulted mainly from independent visits to whaling stations by European researchers. In 1912, the

Norwegian Ørjan Olsen was sponsored by the whaling entrepreneur Johan Bryde to visit the Donkergat and Durban whaling stations in South Africa in a year long trip (Best and Ross, 1989). Olsen produced several important findings including the first description of the external appearance of the Bryde's whale and observations of the life history and migration patterns of humpback whales up both the east and west coasts of Africa (Olsen, 1913; Olsen, 1914). It should be noted that whalers operating in African waters often could not distinguish between sei and Bryde's whales and the catches recorded for these species, particularly in the Atlantic should be viewed with caution (Olsen, 1913; Harmer, 1928; Ruud, 1952; Best, 1994; Best, 1996; Best, 2001). Some early descriptions of the anatomy of sperm whales were made from the investigation of foetuses

Discovery Investigation scientists (N.A. Mackintosh and J.F.G. Wheeler) were based at the Donkergat whaling station in South Africa for a year in 1926 and the material they collected there contributed greatly to their classic work on the migration patterns and life history of blue and fin whales (Mackintosh & Wheeler 1929, Best and Ross 1989). A 4 month visit by Discovery scientists A.H. Laurie and F.D. Ommaney to the Union Whaling Company's factory at Durban in 1930 provided information on humpback whales (Matthews, 1938a), sei whales (Matthews, 1938b) as well as the large number of sperm whales being taken there (Matthews, 1938c). The deployment and recovery of Discovery tags (numbered darts fired into a whales body during deployment trips and recovered during flensing operations) resulted in many of the first, and in some cases only, observations on the movement patterns and seasonality of sei, humpback, fin, blue and sperm whales (Best and Ross, 1989; Branch et al., 2007; Brown, 1962; Rayner, 1940) in the region.

Scientists in the Eastern Tropical Atlantic (ETA), analysed catch data providing information on the species identification of whales occurring in the region (Budker, 1950; Budker, 1953; Ruud, 1952; Mikhalev *et al.*, 1981a), their seasonality (Budker and Roux, 1968; Best, 1996; Best, 2001), and aspects of their biology such as size distribution (Budker and Collignon, 1952; Budker, 1953; Budker and Roux, 1968), age determination

from baleen plates (Ruud, 1952), stomach contents (Budker, 1950; Budker, 1953; Best, 1996; Best, 2001), parasites and scarring (Budker, 1950; Best, 2001) sex ratios (Budker and Collignon, 1952; Budker, 1953), and the presence of foetuses and other reproductive data (Budker and Collignon, 1952; Budker, 1953; Budker and Roux, 1968; Best, 1996; Best, 2001). Information from Gabon also highlighted a growing awareness of overexploitation of whales, particularly humpback whales, with several scientists expressing concern over the unsustainability of whaling activities in the region (Budker, 1952; Budker, 1953; Budker and Collignon, 1952; Budker and Roux, 1968).

South African and British scientists worked at the main South African whaling stations at Donkergat and Durban from 1962 onwards and collected large amounts of data, some of which are still being analysed. The high number of catches of sperm whales at both stations allowed for significant early insights into their external characteristics (Best and Gambell, 1968b), the reproductive characteristics of both females (Best, 1967b; Best, 1968a; Best, 1968b; Gambell, 1966; Gambell, 1972) and males (Best, 1969a; Gambell, 1972), distribution and migration patterns (Best, 1969b; Gambell, 1967), life history (Best, 1970b; Gambell, 1972), feeding (Best, 1999; Clarke, 1980) and social system (Best, 1979; Best et al., 1984b). Other key findings during this period include the description of an inshore and offshore form of the Bryde's whale (Best, 1977; Best, 2001) at the same station at which the species was originally described by Olsen (1913), and the first description of the dwarf minke whale (Best, 1985). The feeding and seasonal appearance of baleen whales (Bannister and Baker, 1967; Bannister and Gambell, 1965; Best, 1967a), growth and reproduction of sei whales (Best and Gambell, 1968a; Best and Lockyer, 2002) , and the seasonal abundance, feeding, reproduction, age and growth of Antarctic minke whales (Best, 1982) were described from animals captured during this period. Material collected at Durban was also invaluable in studies that clarified the rate of lamina formation in the ear plugs of fin (Roe, 1967) and sei whales (Lockyer, 1974).

Large whale research in the Southern Ocean sector during the whaling era largely comprised extensive distributional studies from whaling catch records (Ichihara, 1966;

1981; Mackintosh, 1942; Mackintosh et al., 1929; Omura, 1973), discovery marks (Brown, 1959a) and associated search effort (for example Kasuyo and Wada, 1991). A total of 16 papers could be identified as arising from data collected during these 'modern whaling' operations in the Southern Ocean within the region.

While there was relatively little in the way of non-whaling associated research during this early period, the recording of sightings of all cetaceans in the region was recognized as valuable by many scientists. For example, large whale sightings from merchant vessels working in the Atlantic Ocean prior to 1956 were collated to provide information on their distribution (Brown, 1959b). Records of small cetaceans made during whaling operations are discussed below.

Large whale research in the post whaling era (post 1975)

The majority of research on large whales since 1975 has taken place in South African waters and in the Southern Ocean. The three most comprehensively studied large whale species are the southern right whale (41 papers since 1975, of which 21 are published since 2000 and several are based on historic data), humpback whale (29 papers since 1975, of which 17 have been published since 2000) and Antarctic minke whale (14 papers since 1975, although only 2 since 2000). The vast majority of southern right whale research has been in South African waters reflecting the species current range within the region. Humpback whales have been studied throughout the region. Antarctic minke whales have been studied almost exclusively in the Southern Ocean through International Whaling Commission (IWC) survey initiatives. It is noticeable that research on several of the species that comprised major components of the commercial catch (notably sperm, blue, fin and sei whales) has been negligible over this period, largely reflecting the loss of access to these offshore populations. The majority of publications on large whales prior to 2000 resulted from data collected during whaling operations (Fig 2), and this data

continues to be published reflecting both its shear volume and value to cetology in general.

The South African region

Between 1975 and 1986, the South African government ran a series of annual marine mammal cruises to monitor cetaceans within the 200nm Exclusive Economic Zone of South Africa and Namibia, during which dedicated observations of cetaceans were made (Findlay et al., 1992). The sighting frequencies of large baleen whales were relatively low during these cruises, perhaps reflecting the recently decimated populations of these species.

A dedicated ship-based survey in January/February 1983 carried out to assess the inshore stock of Bryde's whales which inhabits the shelf waters off South Africa, provided the only population estimate to date at 582 ± 182 animals (Best et al., 1984a). Analysis of catch records, and several scientific and whaling related cruises (pre and post the end of whaling) has shown that Bryde's whales in the subregion form at least three stocks ranging between Gabon and Madagascar (Best, 2001). A recently completed study using photo-identification methods in Plettenberg Bay, South Africa has provided some data on the seasonality of the inshore stock in coastal waters (Penry et al., this volume).

Closer to shore, the South African government began to monitor the stocks of southern right whales along the south coast of the country in 1969. Aerial sightings surveys and photographic surveys for right whales have been carried out annually during October since 1969 and 1979 respectively, and the photographic survey series remains unbroken up to 2010 (P.B. Best pers. comm.). This survey series has provided data on many aspects of the ecology and biology of the species, for example the applicability of photographic identification for monitoring the species (Best, 1990a), environmental (Elwen and Best, 2004b; Elwen and Best, 2004c) and social (Elwen and Best, 2004a) influences on distribution and long range movement patterns including the Tristan da Cunha ground

(Best, 1988), abundance (Best, 1990b), demographic parameters and population trend (Best et al., 2001a), healing and long term responses to biopsy and satellite tagging (Best and Mate, 2007; Best et al., 2005) and the rate of entanglement in fishing gear (Best et al., 2001b).

Several boat based and other studies of southern right whales have taken place in South African waters since 1995. Collection of tissue samples has allowed for the investigation of social behaviour (Best et al., 2003b), feeding, growth and seasonal movements using stable isotopes (Best and Schell, 1996), inheritance of dorsal pigmentation patterns (Schaeff et al., 1999), disease (Mouton et al., 2009), development and structure of the integument (Reeb et al., 2007; Reeb et al., 2005) and genetic relationships both locally and internationally (Kaliszewska et al., 2005; Patenaude et al., 2007). Satellite telemetry and photo-identification studies have uncovered broad scale movement patterns, migration routes and unexpected long term residencies and feeding areas (Best et al., 1993; Mate et al., in press), while ultrasound studies of blubber thickness provided an interesting comparison with North Atlantic right whales (Miller et al., in press). The increasing numbers and expanding range of southern right whales has been investigated in Namibian waters by Roux et al. (2001). The occurrence of a low-latitude summer feeding ground in St Helena Bay, South Africa has been confirmed by satellite telemetry (Best and Mate, 2007; Mate et al., in press) and analysis of historical catch records (Best, 2006) and provides a rare opportunity to investigate diet and feeding of this species outside of Antarctic waters.

Humpback whales have been studied on both the Indian and Atlantic Ocean coasts of South Africa. Initial shore based monitoring of humpback whales on the west coast of South Africa described a temporary summer residence of whales in what appeared to be a suspended migration (Best et al., 1995; Findlay and Best, 1995). Following this, a study at Saldanha Bay confirmed the existence of a summer feeding ground used by both humpback and southern right whales (Barendse et al., this volume; Barendse et al., 2010; Best and Mate, 2007). Shore-based monitoring on the east coasts at Cape Vidal, South

Africa from 1988 to 1991 and in 2002 (Findlay et al., this volume) was carried out to assess the relative abundance and migration patterns (Findlay and Best, 1996b) and also provided useful data on survey techniques (Findlay and Best, 1996a). These surveys laid the groundwork for multiple broader scale vessel-based surveys in Mozambican and Madagascan waters.

The Eastern Tropical Atlantic Region

Political instability in some countries bordering the ETA (Angola and the Democratic Republic of the Congo) in the latter part of the 20th century limited the opportunities for research in this part of the Southern African subregion. During the late 1990s two short studies investigated the population structure and abundance of humpback whales. Best et al. (1999) carried out brief photo-identification, acoustic and biopsy studies of humpback whales off northern Angola during September 1998. Walsh et al. (2000) flew two days of aerial survey transects for humpback whales in the vicinity of Point Gentil in Gabon during August 1998, and carried out eight days of boat work during 1997, 1998 and 1999, collecting data on distribution, group composition, acoustics and biopsy samples. A longer-term study of humpback whales in coastal Gabon was initiated by the Wildlife Conservation Society to investigate the status, distribution and population structure of humpback whales in the region using photo-identification, acoustic and genetic methods (Pomilla and Rosenbaum, 2006; Rosenbaum and Collins, 2006). A further study analysed the song structure produced by humpback whales off Gabon and Brazil and found similarities suggesting interaction between whales from different Atlantic breeding populations (Darling and Sousa-Lima, 2005).

Between 2004 and 2009, information on the distribution and seasonal occurrence of cetaceans in oceanic waters between Angola and Gabon was collected from platforms of opportunity (geophysical survey vessels), providing the first year-round and multi-year dataset on the occurrence of oceanic large whales, particularly sperm and humpback whales in the ETA (Weir, 2007; Weir, In press). While the nature of these surveys prohibits calculations of absolute abundance or in-depth studies on behaviour or biology,

they have provided information on spatial distribution, seasonality and group sizes in poorly-studied oceanic waters. A dedicated cetacean survey off southern Angola also produced information on the distribution and behaviour of Bryde's whales in coastal areas (Weir, 2010a).

Southwest Indian Ocean

Subsequent to the last whaling marking cruise in the southwest Indian Ocean (Gambell et al., 1975), there was a lull in broad scale survey effort in the Indian Ocean. Following the development of the Indian Ocean Sanctuary (IOS) by the IWC in October 1979, there have been several broad scale (100s of km) opportunistic surveys undertaken to describe cetacean distribution and relative abundance within the Sanctuary (e.g. Keller et al., 1982), although the majority has only occurred since 1990 (Ballance et al., 2001; Ballance and Pitman, 1998; Eyre, 1995; Eyre, 1997; Eyre, 2000; Kasuya and Wada, 1991; Kasuyo and Wada, 1991; Tynan, 1997). In 1995, the IWC SOWER (Southern Ocean Whale and Ecosystem Research) programme conducted a blue whale cruise to the south of Madagascar (see Best et al., 2003a). Other sources of information have also been considered to assess distribution and seasonality of large balaenopterids in the region, notably logbooks of French tuna-seiners fishing vessels operating from the Seychelles from 1982 to 1986 (Robineau, 1991).

Following earlier work on the east coast of South Africa at Cape Vidal, multiple broad-scale surveys were carried out using a variety of vessels to assess the absolute abundance and distribution of humpback whales in Mozambique and Madagascar waters (Best et al., 1998; Best et al., 1996; Findlay et al., 1994; Findlay et al., in press). The majority of large whale work in the SWIO region has been directed towards humpback whales, probably due to their accessibility to researchers. Localised studies (using small boats in inshore waters) have been carried out in Antongil Bay, Madagascar between 1996 and 2007, off the island of Mayotte and surrounding reef banks (eastern Comoros archipelago) to investigate density, group composition, habitat preferences and seasonality (Ersts et al., in press; Ersts and Rosenbaum, 2003; Kiszka et al., 2010c).

Biopsy samples collected during these surveys have been analysed along with those from the east and west coast of southern Africa and Gabon to investigate stock structure, relatedness and migration characteristics of humpback whales in the region (Rosenbaum et al., 2009), including individual movements between ocean basins (Pomilla and Rosenbaum, 2005).

Research on other species of large whales has included a dedicated survey for sperm whales undertaken off the Amirante Islands (Seychelles), to assess their density and behaviour (Kahn et al., 1993), while Corbett (1994) provided opportunistic records of sperm, fin, blue and humpback whales off Mauritius, during the austral winter. Recently, the French government has recognised a need for more dedicated research and protection of its overseas EEZ. Therefore, a large scale aerial survey programme has been undertaken in the SW Indian Ocean (covering more than 1,500 000 km²). Preliminary results are already available from the REMMOA surveys (REcensements des Mammifères marins et autre Mégafaune pélagique par Observation Aérienne / Census of marine mammals and other pelagic megafauna by aerial survey) set up to run from 2008 onwards, working in collaboration with locally based researchers and using a standardised line-transect methodology to increase comparability between areas and survey periods (Ridoux et al., 2010). These results have already provided new information on the distribution, species composition and abundance of cetaceans in the southwest Indian Ocean, including in the Seychelles EEZ, Mozambique Channel (including Mayotte, Comoros, north-western Madagascar, Juan de Nova, Europa, Bassas da India and southwestern Madagascar), Mauritius and La Réunion, and north-eastern Madagascar, including Tromelin (Ridoux et al., 2010). An exploratory survey aboard the French research vessel Marion Dufresne in 2009 documented the presence of sperm whales and fin whales off southern Madagascar and in the southern Mozambique Channel (Doremus et al., 2009).

Southern Ocean

Most large whale research in the Southern Ocean within the study region has been run under the auspices of the IWC. A series of summer ship-based surveys, the IWC/IDCR (International Decade of Cetacean Research) and IWC/SOWER (Southern Ocean Whale Ecosystem Research) surveys have taken place in Antarctic waters (south of 60˚S and across different longitudinal bands of the entire Southern Ocean) between 1978/79 and 2009/2010. The three full circumpolar surveys, termed CPI, CPII and CPIII, cover the periods of 1978/79-1983/84, 1985/86-1990/91 and 1991/92-2003/04 respectively. Area III (the 0-70 E longitudinal band to the south of Africa) was surveyed in 1979/80, 1987/88, 1992/93, 1994/95, and 2008/09. These surveys have provided considerable information on the abundance and distribution of the more southerly migrating baleen whale species (particularly Antarctic minke, blue, and humpback whales) and sperm whales within the Southern Ocean waters south of 60˚S (Branch and Butterworth, 2001a; Branch and Butterworth, 2001b; Kasamatsu et al., 1988; Kasamatsu et al., 1996; Kasamatsu et al., 1990; Kasamatsu et al., 2000) and have included the first evidence of the recovery of Antarctic blue whales (Branch et al., 2004). The considerable volume of data from these cruises provides the opportunity for further studies, particularly of the distributional data in relation to oceanographic and topographic features.

The creation of the Southern Ocean Sanctuary (mostly south of 40ºS, except east of 20ºE where it changes to south of 55ºS and borders on the IOS to the north) by the IWC in 1994 has seen a minor increase in the extent of cetacean directed research in the global Southern Ocean, although the majority of this research to date has been outside of the study area. The Southern Ocean Cetacean Ecosystem Program (SOCEP) surveys of the Australian government have covered a minor portion of the defined study area (south of 60ºS and east of 60ºE). However, little published research from this small sector could be identified. Gedamke and Robinson (2010) recently reported on acoustic surveys of cetaceans south of 60ºS and east of 30ºE.

Smaller cetaceans – research prior to 1960

Early research on small cetaceans in the subregion was largely opportunistic and associated with particular voyages or events where work consisted largely of collecting and describing specimens and trying to disentangle the various duplicate descriptions made by different taxonomists (Gray, 1850; True, 1889), a task complicated and slowed by the modes of travel and communication available at the time. A total of 16 papers relating small cetaceans or mixed-species could be identified prior to 1960.

From the waters around South Africa specimens of the Layard's beaked whale (Gray, 1865), Heaviside's and dusky dolphin (Gray, 1828) were collected and described for the first time by European-based biologists. Many other specimens collected during this era were housed in European museums and played a role in the developing taxonomy of the Cetacea (Flower, 1884; Flower, 1885; Gray, 1850; True, 1889). Several species originally identified elsewhere during this era were only fully described based on animals collected or stranded in the subregion during more recent decades, for example Fraser's dolphin: (Perrin et al., 1973) and Longman's beaked whales (Dalebout et al., 2003). A mass stranding of false killer whales was documented in when (Smithers, 1938) and the first marine mammal specific guidebook for the region was published in Cape Town in 1954 (Barnard, 1954). Observations by biologists along the east coast of South Africa highlighted early indications of bycatch and interactions with fishermen (Barnard, 1954; Davies, 1963).

In the ETA, there are almost no published data available on small cetaceans between Gabon and Angola prior to 1960. The capture and scientific description of a pantropical spotted dolphin off Gabon (at 0º15'N, just north of the study area) during 1946 (Fraser, 1950) is one of few records. This is in marked contrast to the increase in published information on small cetaceans to the north off Côte d'Ivoire and Senegal during the 1950s (e.g., Cadenat, 1959).

Measurements of dolphin swimming speed made in the Indian Ocean were used by Gray in his seminal paper on the locomotion of dolphins (Gray, 1936). Stranding (including mass strandings) and catch records of several odontocete species (e.g. killer whales, false killer whales and Risso's dolphins) were reported from the late 19th century in the southwest Indian Ocean in Zanzibar and along the South African coast (for review see Kruse et al., 1991; Leatherwood and Donovan, 1991).

A recent review of odontocetes in the Southern Ocean (van Waerebeek et al., in press) has noted that in contrast to the larger commercially hunted baleen whale species, research on the smaller cetaceans of the Southern Ocean has historically been very limited. Little or no published work arose from the Southern Ocean sector of the study area *per se* prior to 1960, although species records have been analysed to provide distribution patterns of species across the entire Southern Ocean region (for example Brownell Jr, 1974). Cetacean (and pinniped) sightings around Kerguelen and Amsterdam Islands were summarised by Flower (1879), Angot (1954) and Paulian (1953).

Small Cetacean Research 1960 – Current

Dedicated research on delphinids in southern Africa began at the Port Elizabeth Museum and Oceanarium during the 1960s, following the opening of a captive dolphin facility in 1961. Much of the pioneering work done here is discussed in more detail in the Indian Ocean section below and in Best (2007). The majority of small cetacean research after 1960 took place in South African waters but, as with large whale research, has expanded throughout the subregion in the last decade. The vast majority of studies on small cetaceans have been in coastal waters. We could identify a total of 220 papers produced during this period relating to small cetaceans of which 134 have been published since 1990.

The valuable contribution of museums to cetacean research (through their role in the collection and study of stranded specimens) became more obvious during this period.

The attendance of strandings and collection of specimens rapidly increased the number of species known to occur in South African waters. Species records and samples collected by South African museums during this period have been included in several broad scale studies spanning South African and Namibian waters (i.e. both Atlantic and Indian Oceans). Findlay et al. (1992) summarised the spatial and seasonal distribution patterns of all small odontocete cetaceans in this region using a collated data set of strandings, sightings, and multiple surveys from a wide range of historic sources up until the end of 1986. Sekiguchi et al. (1992b) described the diet of 20 odontocete species based on stomach content analysis from animals stranded, bycaught or collected in South African and Namibian waters between 1966 and 1990. Stranded animals from both the Atlantic and Indian coasts of South Africa have also been used to examine the morphology and diet of several species. For example the baleen morphology and the anatomy of the laryngeal apparatus of the pygmy right whale (Reeb and Best, 1999; Sekiguchi et al., 1992a) and the diet of strap-toothed and southern bottlenose whales (Sekiguchi et al., 1996; Sekiguchi et al., 1993).

South Africa has the only two facilities holding captive dolphins in the subregion at Port Elizabeth (1961 - recently closed) and Durban (captive dolphins since 1976). Although a great potential resource of information, only 10 papers could be identified originating from work on captive dolphins.

Atlantic Ocean

We could identify only 9 papers published prior to 1990 relating to delphinids or small cetaceans in the Atlantic Ocean specifically, with a further 20 relevant papers with a more regional scope (mainly referring to records from South Africa as a whole). Within South African waters, occasional observations were made of inshore species such as Heaviside's dolphins and dusky dolphins. These included the establishment of the rate of growth layer deposition in dusky dolphin teeth through tetracycline marking (Best, 1976), the first acoustic recording (Watkins et al., 1977), first comprehensive description of the external appearance and observations of the movements and behaviour of Heaviside's

dolphins (Rice and Saayman, 1984), and inclusion of both species in broader scale studies of exploitation and live capture fisheries (Best and Ross, 1977; Best and Ross, 1984).

More recent ecological studies of Heaviside's dolphin since 1999 have provided an initial population estimate at the southern limit of their range (Elwen et al., 2009) and insights into genetic population structure (Van Vuuren et al., 2002), ranging patterns using photographic mark-recapture and satellite telemetry (Elwen et al., 2006) and fine scale habitat use (Elwen et al., 2010). The echolocation signals of the species have recently been described (Morisaka et al., 2011) and long term monitoring using moored acoustic click detectors is being developed in Namibian waters (Leeney et al., 2011)

The dusky dolphin remains poorly studied in the subregion (Best and Meÿer, 2010), although data and samples from local animals have been included in broad scale morphological, taxonomic and genetic studies (Cassens et al., 2003; Cassens et al., 2005; Harlin-Cognato et al., 2007; Van Waerenbeek et al., 1995). Best and Meÿer (2010) summarised data on opportunistic sightings, diet and life history parameters from stranded and bycaught animals. Grahl-Nielsen et al. (2010) compared the fatty acid composition of blubber and prey and Bernasconi et al. (in press) described acoustic observations of underwater feeding behaviour in the region.

Very little dedicated field research on small cetaceans has taken place in Namibian waters, although Findlay et al. (1992) provide distribution records based on sightings and strandings and Griffin and Coetzee (2005) provide a species list of small cetaceans ecorded from Namibian waters. Opportunistic sightings include killer whales observed to predating on and playing with seabirds at Mercury Island (Williams et al., 1990), and southern right whale dolphins have been recorded offshore (Rose and Payne, 1991). An incomplete PhD study in Namibia provided baseline data on the population of common bottlenose dolphins known to occur in the vicinity of Walvis Bay (Praetsch, see Best, 2007). High levels of coastal development and marine eco-tourism have motivated a

(Rose and Payne, 1991)use of the small (< ~100 animals) population has identified a potential protected area in which threats (mainly boat-based tourism) could be reduced (Snyman et al., this volume).

Published information on the smaller cetaceans occurring between Angola and the equator first became available during the 1980s and 1990s. However, it remained sparse, and mostly related to opportunistic records rather than dedicated research surveys, for example, at-sea sightings of cetaceans in the ETA region between 1976 and 1978 (Tormosov et al., 1980), killer whales observed by whaling fleets between 1961 and 1979 (Mikhalev et al., 1981b), and striped dolphins sighted off Angola during 1974 (Wilson et al., 1987). Occasional stranding records from this period have also appeared in the literature as extensions to the known distribution range of a species within the southern African subregion, for example an Antarctic minke whale in southern Angola (Best, 2007; Weir, 2010c). A paper by van Bree and Purves (1972) that included skulls from Angola and Gabon discussed common dolphin taxonomy and proposed sympatric short- and long-beaked species in Gabonese waters. Opportunistic notes on the distribution and group sizes of common dolphins off Gabon were recorded during the humpback whale surveys carried out by Walsh et al. (2000). The only dedicated small cetacean survey during this period appears to be a study of the pantropical spotted dolphin around St Helena between April and June 1983, during which data on the taxonomy and historical catches of the species, and notes on their distribution, seasonality and behaviour were collected (Perrin, 1985; Perrin and Perrin, 1986).

Towards the end of this period, the paucity of information for the ETA region was becoming a source of concern to conservation bodies such as the IUCN, resulting in a published review of existing subtropical/tropical dolphin and porpoise records off the west coast of Africa by Jefferson et al. (1997). Very few of these records originated south of the equator, emphasizing the lack of research activities in the region.

The last decade has seen increasing research focus on smaller cetacean species in the waters between Angola and Gabon, with the publication of an updated review of cetacean occurrence in the waters between Côte d'Ivoire and Angola (Weir, 2010c) and some new information presented at the 2010 meeting of the IWC's Sub-Committee on Small Cetaceans, which focused on North-western African and eastern tropical Atlantic waters (IWC, 2010).

A short dedicated survey was carried out around the island of St Helena during the winter of 2003, examining the distribution and behaviour of the odontocete community (MacLeod and Bennett, 2007). The increased number of studies from platforms of opportunity in oceanic waters have provided new records of occurrence of some odontocete species in Angolan and Gabonese waters (de Boer, 2010; Weir, 2006a; Weir, 2006b; Weir, 2006c; Weir, 2010c; Weir et al., 2008), information on cetacean community composition, distribution and seasonality in oceanic regions of the ETA (de Boer, 2010; Weir, 2007; Weir, In press), and examined the behaviour of some species in relation to airgun sounds (Weir, 2008a; Weir, 2008b).

In a review of the status of the Atlantic humpback dolphin, a species endemic to the nearshore tropical and subtropical waters along the Atlantic seaboard of Africa, Van Waerebeek et al. (2004) found only a handful of stranding and opportunistic sighting records for its occurrence between Gabon and Angola. Since then, dedicated surveys by boat and along the beach have been carried out for the species in Gabon and the Republic of the Congo, producing preliminary data on their distribution and threats within the region (Collins et al., 2010b; Collins et al., 2004). A dedicated survey for Atlantic humpback dolphins was carried out at the southern limit of their range off southern Angola during 2008, representing the first attempt to gather fine-scale, systematic information on the abundance, distribution and behaviour of the species using photo-identification methods (Weir, 2009). The study also provided the first description of the whistles of this species (Weir, 2010b), as well as provided information on coastal occurrence of common bottlenose dolphins (Weir, 2010c).

Southwest Indian Ocean

Researchers based at the Port Elizabeth Museum and Aquarium in South Africa led much of the early work in the Indian Ocean during the 1960s and beyond. The combination of field researchers, a museum with an active collection of stranded specimens and an aquarium in which various dolphin species (mainly Indo-Pacific bottlenose) were kept, proved highly productive. Also noteworthy is the pioneering approaches used by Graham Saayman and Colin Tayler to study dolphins, particularly the feasibility of studying wild cetaceans by observation alone (Saayman and Tayler, 1973; Saayman and Tayler, 1979), including comparisons of the social systems of cetaceans and primates (Tayler and Saayman, 1972) and the recording of signature whistles from Indo-Pacific bottlenose dolphins (Tietz and Tayler, 1964). Further research by members of this institution included novel species records for South Africa for True's (Ross, 1969), Hector's (Ross, 1970) and Cuvier's beaked whales (Ross and Tietz, 1972), and for several other species summarised in Ross et al. (1985). Taxonomical research included early work on the differentiation of bottlenose dolphins into the two separate species recognized today (Ross and Cockcroft, 1990; Ross, 1977). The movements and distribution of Heaviside's dolphins (Rice and Saayman, 1984), killer whales (Rice and Saayman, 1987) and bottlenose dolphins (Ross et al., 1987; 1989) in South African waters were described. Ecological observations of humpback and bottlenose dolphins (Saayman and Tayler, 1973; 1979) and various oceanic species (Saayman et al., 1972) in the region were documented, and bottlenose dolphin behavioural patterns at sea and in captivity were published (Cockcroft and Ross, 1990; Saayman et al., 1973; Tietz and Tayler, 1964).

In 1952, protective "anti-shark" gill nets (shark nets) were first deployed along the Durban coastline in KwaZulu Natal to protect bathers and the summer tourism industry by reducing the number of sharks in the environment. The nets are responsible for considerable bycatch of shark and cetacean species (Cockcroft, 1990; Dudley and Cliff, 2010). Data on dolphin mortality in these nets became available from 1964 (Best and Ross, 1977; Peddemors, 1993a). Growing concern over the high level of the bycatch motivated the next period of dedicated research on small cetaceans in South Africa and

considerable information has been gained from the animals by-caught in the shark nets. Scientists from the Port Elizabeth Museum and the Kwazulu-Natal Sharks Board (formerly Natal Sharks Board) published data from captured delphinids including a comparison of milk composition between bottlenose, common and humpback dolphins (Peddemors et al., 1989) and analyses of diet of common dolphins (Young and Cockcroft, 1994), Risso's dolphins (Cockcroft et al., 1993) and Indo-Pacific humpback dolphins (Barros and Cockcroft, 1991). Several studies during the late 1980s and early 1990s investigated pollutant levels of all stranded and bycaught cetaceans along the east coast (Cockcroft and Ross, 1991b) as well as bottlenose and common dolphins specifically (Cockcroft et al., 1989b; Cockcroft et al., 1990). Indo-Pacific humpback dolphins have been shown to have the highest pollutant levels of any marine mammal in South Africa (Cockcroft, 1999; de Kock et al., 1994).

The Indo-Pacific bottlenose dolphin is the most frequently entangled species in the shark nets (Cockcroft, 1990; Cockcroft and Ross, 1991a) and research on this species in South Africa has included investigations into the reasons for entanglement (Cockcroft, 1992; 1994), distribution patterns (Cockcroft, 1990; Cockcroft and Ross, 1991a; Ross et al., 1987) abundance (Ross et al., 1989), alongshore genetic variation (Goodwin et al., 1996) natural predation (Cockcroft et al., 1989a) and appropriate survey techniques for monitoring the population (Cockcroft et al., 1992; Peddemors, 1993b). A more in-depth review of delphinid research in South Africa up to this time is provided by Peddemors (1993a; 1999).

At least two stocks of Indo-Pacific bottlenose dolphins are thought to occur along the South African coast (Goodwin et al., 1996; Natoli et al., 2007); a small resident stock along the KZN coastline (described above) and a much larger population along the south east coast. Photo-identification data collected in the region of Port Elizabeth in the early 1990s have recently been used to generate an estimate of the number of animals in this larger population (Reisinger and Karczmarski, 2010). Shore based tracking of bottlenose dolphins which were recorded as part of a humpback whale study at Cape Vidal in the

early 1990s has recently been published (Photopoulos et al., this volume). Some recent data on the distribution of bottlenose dolphins along the east coast of South Africa are available as part of several broad ecological studies investigating the 'sardine run' and its associated predators (O'Donoghue et al., 2010a; O'Donoghue et al., 2010b).

The population(s) of common bottlenose dolphins (*T. truncatus*) which occur on the shelf and offshore throughout the subregion (Best, 2007; Findlay et al., 1992; Ross, 1984) have not been the focus of any directed field studies and there are no data available on population size or movements. Some samples from animals stranded and caught between Walvis Bay and Durban animals have been included in a global comparison of inshore and offshore forms of bottlenose dolphins (Hoelzel et al., 1998).

The Indo-Pacific humpback dolphin has been studied in several parts of the subregion since 1990. A four year study of Indo-Pacific humpback dolphins in Algoa Bay, South Africa in the early 1990s produced data on daily movements and ranging behaviour, abundance, habitat use and group dynamics (Karczmarski and Cockcroft, 1999; Karczmarski et al., 1999a; Karczmarski et al., 2000a; Karczmarski et al., 1998; Karczmarski et al., 2000b). Building on these earlier studies in South Africa, research on this species has expanded considerably throughout the subregion in the last 10-15 years. Population level data including ranging behaviours, abundance, habitat use and group dynamics are available from several locations: Richards Bay, South Africa (Atkins et al., 2004; Keith et al., 2002), Maputo Bay, Mozambique (Guissamulo and Cockcroft, 2004) and Zanzibar, Tanzania (Stensland et al., 2006).

Much of the research carried out in the SW Indian Ocean (outside of South Africa) prior to 2000 was conducted by scientists based in Europe or the USA and largely consisted of summaries of opportunistic sightings (Kruse et al., 1991; Leatherwood and Donovan, 1990; Leatherwood et al., 1982) and species lists for particular islands or areas including Mauritius (Corbett, 1994) and the Seychelles (Racey and Nicoll, 1984). Dedicated field

studies in the SWIO are still very recent and there is little background information available for many areas. Species lists for many areas in the SWIO have only been produced in the last decade. These are available for East Africa (Berggren, 2009), Madagascar (Rosenbaum, 2003), Zanzibar (Amir et al., 2005b; Berggren et al., 2001), the Comoros (Kiszka et al., 2010c) including the French island of Mayotte (Kiszka et al., 2007; Kiszka et al., 2010a) and the island of Reunion (Dulau et al., 2007). We could identify 38 and 12 papers referring to small cetaceans or mixed species research on the Indian Ocean coast of South Africa (ZAE) and the SWIO outside of South Africa between 1991 and 2000. Since 2001 trends have reversed with only 14 papers from ZAE and 38 from the SWIO indicating the rapidly increasing research in this area.

A growing recognition of bycatch and directed catch of dolphins in artisanal fisheries throughout the southwest Indian Ocean (Cockcroft and Krohn, 1994; Guissamulo and Cockcroft, 1997; Rakotonarina et al., 1994) raised conservation concerns particularly for inshore species. In Mozambique, data are available from monitoring of coastal dolphins and dugongs (Dugong dugon) in Maputo and Bazaruto Bays (Guissamulo and Cockcroft, 2004; Guissamulo and Cockcroft, 1997). In 1998, a reconnaissance trip was conducted off Zanzibar to assess the presence and occurrence of cetaceans, particularly Indo-Pacific humpback and bottlenose dolphins, in relation to high levels of bycatch (Stensland et al., 1998). This dedicated research and capacity building program has focused on assessments of conservation status of delphinids and in particular Indo-Pacific bottlenose dolphin (Amir, 2010; Berggren et al., 2007). Data are available on levels of bycatch (Amir et al., 2002), feeding ecology of bycaught animals (Amir et al., 2005a), growth and reproduction (Amir, 2010), the occurrence and distribution of species around the island (Amir et al., 2005b), population size and behaviour (Stensland et al., 2006), behavioural changes in response to tourism vessels (Christiansen et al., 2010; Englund and Berggren, 2002; Stensland and Berggren, 2010), phylogenetic placement and population structure and pollutants in the blubber of Indo-Pacific bottlenose and spinner dolphins (Mwevuraa et al., 2010).

Recent summaries on the level of bycatch in artisanal fisheries are available for several areas: Zanzibar, Tanzania (Amir et al., 2002), southwestern Madagascar (Razafindrakoto et al., 2004) and Mayotte (Kiszka et al., 2008a; Pusineri and Quillard, 2009). Bycatch in fishing gear has been recognised as the most serious threat to small cetaceans worldwide (Read et al., 2006) and in the SWIO region specifically (Kiszka et al., 2008b).

Around Mayotte, a dedicated research program on delphinids has been developed in the last decade, focusing on habitat preferences, community and genetic population structure, social behaviour, mixed-species associations and ecological niche segregation (Gross et al., 2009; Kiszka, 2010; Kiszka et al., 2010a). A study to evaluate the behavioural reactions of small dolphins to remote biopsy sampling was undertaken (Kiszka et al., 2010bb). The health status of small cetaceans and the presence of lobomycosis-like disease was described for the first time in the Indian Ocean, especially around Mayotte (Kiszka et al., 2009). Pollutant levels were investigated across a wide range of sites in the SWIO (Jauniaux et al., submitted; Mwevuraa et al., 2010). Around other islands, such as Juan de Nova, Europa and Glorieuses, the occurrence of odontocetes has been investigated during an exploratory survey (Doremus et al., 2009).

Southern Ocean

The presence of biologists based full time on subantarctic islands generated opportunistic studies on cetaceans, especially in the Kerguelen and Crozet Islands (Fr) and Marion Island (SA) since the 1980s.

The population of Commerson's dolphin which occurs at the Kerguelen Islands has recently been described as a subspecies by Robineau and colleagues (2007). This population has been relatively well studied, especially during a productive period during the 1980's. Information is available on external anatomy and pigmentation (Robineau, 1984), several aspects of the skeletal structure and growth (de Buffrénil and Robineau, 1984; Robineau and De Buffrénil, 1985), genital tract (Collet and Robineau, 1988),

reproductive habits (de Buffrénil et al., 1989), distribution patterns (Robineau, 1985), organochloride pollutant levels (Abarnou et al., 1986) and the adaptive significance of morphological characteristics (Robineau, 1986). The acoustic signals produced by Commerson's dolphin have also been studied (Dziedic and De Buffrenil, 1989). A vagrant sighting has been reported on the Agulhas Bank in South African waters (De Bruyn et al., 2006).

Killer whales have been studied at the Possession Islands in the Crozet archipelago including descriptions of social behaviour and foraging strategies (Guinet, 1991b; 1992) such as the intentional stranding technique used to catch hauled-out seals and the teaching of this behaviour to their young (Guinet, 1991a; Guinet et al., 2000; Guinet and Bouvier, 1995). The initiation of photo-identification studies and biopsy sampling in the Crozet archipelago has generated data on population dynamics (Poncelet et al., 2010; Tixier et al., 2010b) and the level of persistent organic pollutants in their blubber (Noel et al., 2009). Further to the west, on Marion Island (South Africa), opportunistic observations of killer whales have generated data on the distribution, movements, seasonal abundance (Condy et al., 1978), diet and abundance of the population visiting the island (Pistorius et al., 2002; Reisinger et al., in press) as well as its social structure (Tosh et al., 2008). Data are also available on the seasonality of killer whale occurrence at Amsterdam Island (Roux, 1986) and of interactions with longline operations in open waters (Roche et al., 2007; Tixier et al., 2010a).

Due to the inaccessibility of the region and a possible lack of top predator research on South African vessels en route to and from the Antarctic, small cetaceans are far less well studied in the open waters of the Southern Ocean, and this is reflected by a scarcity of publications. Van Waerebeek *et al.* (in press) note that circumpolar abundance estimates of small odontocetes have been calculated from the IDCR/SOWER datasets from south of 60 S (Branch and Butterworth, 2001a; Kasamatsu et al., 1996), although these are generally for broader Southern Ocean areas than the subregion specifically. Papers that

have arisen are largely global Southern Ocean reviews that include records from the study area (such as (Sekiguchi et al., 2006; van Waerebeek et al., in press).

Synthesis of cetacean research in the southern African subregion

The southern African subregion has a long history of productive and internationally relevant cetacean research conducted by both locally based and visiting scientists. We identified over 550 papers, books or book chapters in total pertaining to research in the subregion, of which over half (284) have been published since 1990 (Fig 2). Notably, the number of published studies on large whales has remained approximately stable since 1980, although with the major source of data shifting away from whaling in recent years (Fig 2), while the number of manuscripts focusing on small cetaceans has increased continually and has outnumbered the latter since the 1980s.

This review indicates that the high number of cetacean species in the subregion provides considerable potential for research, which is slowly being realised. However, even such basic information as the occurrence and distribution of many species in the region remain poorly documented and there are clear biases in the species focus of the research activities carried out to date. Such biases largely reflect the low number of scientists working in the field as well as accessibility to study animals, the relative cost of studying cetaceans, the extent of available resources and political-stability in some countries. This review identified that almost nothing is known of the conservation status of many species, with only limited population abundance studies having been carried out in the region.

The vast majority of low- and mid-latitude research prior to 2000 has occurred in South African waters (Table 6, Fig 3 and 4). Trends in the last three decades indicate that the number of research papers produced in South Africa per decade on large whales has stabilized (Fig 4) while work on small cetaceans has decreased on the east coast and

increased on the west coast and in Namibia (Fig 3). This latter pattern reflects the highly productive period during the 1980s and early 1990s when considerable effort was expended investigating issues of bycatch surrounding the anti-shark nets on the KwaZulu-Natal coast.

Research output in the Southern Ocean has remained approximately steady in the last three decades. A considerable amount of research on large whales in the Southern Ocean originates from IWC initiates and is available in documents associated with meetings of the scientific committee thereof, and is not available in the peer reviewed literature. The majority of the small cetacean research in the Southern Ocean originates from the subantarctic islands, especially the Crozet-Kerguelen group (FRA) in the 1980s and the Prince Edward Islands group (SA) in the 1990s and pertains mostly to Commerson's dolphins and killer whales. Due to the inaccessibility of the Southern Ocean and its islands, the majority of research is associated with government sponsored or supported expeditions.

The number of publications and research projects in the SWIO and ETA has increased markedly since 2000 (Table 1, Fig 3 and 4). Research is being undertaken on many of the islands in the SWIO region, although the continental waters, especially northern Mozambique and Kenya, remain poorly studied (Table 4). The Atlantic coast north of South Africa, remains poorly studied, especially with regard to large whales (Fig. 3 and 4). Consequently, while expanding markedly during the last decade, cetacean research in Namibia and the ETA remains relatively scarce and is driven by a small number of interested individuals rather than by government resources. Similar is true throughout much of the southern African subregion, highlighting the importance of individual efforts in resource-limited regions.

A further consequence of the individual / small research group aspect of many local researchers is that much of the data collected subsequent to the end of commercial

whaling is extremely irregular both temporally and spatially, with few studies of more than 10 years duration. Long term studies of keystone species are of great value to ecological research and allow for the investigation of environmental changes and adaptations at a variety of temporal scales. Longer term studies include: (1) annual southern right whale photo-identification surveys which have been carried out in South Africa since 1979; (2) the annual IDCR/SOWER series of Southern Ocean minke whale assessment cruises which have intermittently surveyed the area south of 60°S across the study region; (3) long term photo-identification and genetic data on humpback whales are available from a series of separate projects run throughout the subregion since the late 1980's (Barendse et al., 2010; Findlay and Best, 1996b; Findlay et al., 1994; Findlay et al., in press; Pomilla and Rosenbaum, 2005; Rosenbaum et al., 2009); (4) long term data series (from 1964) are available for several dolphin species (predominantly Indo-Pacific bottlenose, common and Indo-Pacific humpback dolphins) bycaught in the shark nets of eastern South Africa, including necropsies since 1982 (Peddemors, 1993a; Peddemors, 1999); and (5) long-term stranding records from the entire South African (and Namibian prior to ~1992) coast of all species are kept by the Iziko: South African Museum in Cape Town (roughly Mossel Bay to Namibia) and the Bayworld Port Elizabeth Museum (roughly Mossel Bay to Mozambique). To be really valuable, however, such data sets should be associated with known or constant effort, and few of the above (apart from the first two) meet this criterion.

Across a spatial scale, some areas and species are very well-studied and others almost not at all. In particular, the limited accessibility to offshore species reflects a strong bias towards research on coastal species (Table 1), with most recent effort focused on Indo-Pacific bottlenose and humpback dolphins, killer whales, southern right whales and humpback whales. Most of these species are also easily distinguished individually (for photo-identification), widespread and comparatively easy to work with (accessible and approachable). In contrast, research on cetaceans inhabiting offshore, deep water areas is far scarcer. Access to the deep water cetacean fauna off South Africa, Namibia and Mozambique has been severely limited since the end of whaling operations and dedicated government run marine mammal cruises. Oceanic cetacean communities have received

some attention in other areas. The steep volcanic islands of the Indian Ocean provide access to deep water species (e.g. Kiszka et al., 2010a), and the use of platforms of opportunity (geophysical and other scientific survey vessels) in the Atlantic Ocean has provided information on the tropical, deep-water cetacean communities in the ETA (e.g. de Boer, 2010; Weir, 2007). The recent REMMOA surveys (Ridoux et al., 2010) described above, are an indication of a change to the positive.

Suggested priorities for future cetacean research

Assessing research (and conservation) priorities in such a large area is a considerable challenge, especially given the lack of basic knowledge about so many species and areas. Knowledge about many species in the region comes almost exclusively from stranded specimens. Oceanic species are particularly poorly known. No papers could be identified from Kenya or northern Mozambique. The majority of conservation concerns throughout the region reflect global trends and are human induced, being far higher in coastal and shelf waters. Identified threats include bycatch in artisanal and commercial nets, directed fisheries (Kiszka et al., 2008a), oil and gas development (Rosenbaum and Collins, 2006), tourism activities (Christiansen et al., 2010; Snyman et al., this volume), noise pollution, chemical pollution (Cockcroft, 1999; Jauniaux et al., submitted), shifts in prey resources (Roy et al., 2007), entanglement and ship strikes (Best et al., 2001b) and the overarching impact of climate change. Below we present more area-specific conservation and research priorities:

South African Region

Although the waters around South Africa are the best studied to date, much of the research has been focused on very few species, particularly right whales, humpback whales, Indo-Pacific bottlenose and Indo-Pacific humpback dolphins. Humpback dolphins remain a conservation priority due to their low population sizes (Karczmarski et al., 1999b), extreme nearshore habitat, high pollution loads and unknown trends in their abundance (Karczmarski et al., 1998). Little is known about the current abundance or

population status of species living predominantly on the continental shelf. These species, including the dusky dolphin, common dolphin and Bryde's whale, are potentially competing with human fisheries, and levels of bycatch are unknown. Further, several major fish stocks in the region have undergone considerable changes in size and distribution in recent years (e.g. Heymans et al., 2004; Roy et al., 2007) with unknown consequences on cetaceans. The inshore stock of Bryde's whale is small (Best et al., 1984a) and non-migratory and may thus be particularly vulnerable to changes in local fisheries. No published estimates of abundance or trends are available for this population since 1982 (Best et al., 1984a)and urgent work is required. The degree of recovery of several previously hunted large whale stocks in South African waters remains unknown, particularly blue, fin and sei whales. Access to the majority of the species mentioned above requires working in shelf and offshore waters. Access to vessel time and development of broad scale (100s of km), repeated surveys to investigate distribution, seasonality and abundance trends of these species should be prioritised. Static acoustic monitoring, provides another method with which to investigate patterns of relative abundance, distribution and seasonality (Leeney et al., 2011; Marques et al., 2009; Van Parijs et al., 2002) and techniques to estimate absolute abundance are rapidly developing (Marques et al., 2010).

South West Indian Ocean

Many gaps have been identified in the southwest Indian Ocean region, including identifying diversity and abundance of oceanic species. The REMMOA project, conducted in late 2009 and early 2010, will provide new information on distribution, absolute abundance, habitat preferences and community structure of cetaceans over a wide area (Ridoux et al., 2010).

For management purposes, information on population and demographic structure, abundance and trends of all cetaceans is clearly needed, especially on species affected by bycatch and direct hunting, including Indo-Pacific bottlenose, humpback and spinner dolphin. An assessment of the level of bycatch particularly in gillnets, is needed

throughout the region. This may be achieved with Rapid Bycatch Assessments that have been successfully developed in other countries, including in the Comoros archipelago and Tanzanian mainland (Moore et al., 2010). Almost nothing is known about the feeding ecology of cetaceans in the region (except on Indo-Pacific bottlenose dolphins in Zanzibar; Amir et al., 2005). This information is critical, particularly for small cetaceans that potentially compete with coastal fisheries.

Basic, current information including on migration patterns, seasonal abundance and population structure is still lacking for most large whale species, especially Bryde's, fin and blue whales.

A few locations in the southwest Indian Ocean (for example Mayotte and La Réunion) allow an easy access to deep water species which are poorly studied both globally and regionally, such as beaked whales and oceanic delphinids (e.g. melon-headed, false killer whales; Dulau et al., 2008; Kiszka et al., 2010). More dedicated research on those species that also directly interact with fisheries (e.g. depredation by false killer whales in the pelagic longline fishery) would be highly useful. Capacity-building and the training of local scientists is required, especially to ensure the establishment of longer-term research.

Eastern Tropical Atlantic

Cetacean research in the ETA is still at a very early stage and baseline data on the distribution, abundance and seasonality of almost all cetacean species is lacking. Therefore there is considerable scope for future development of research activities in this area. Priorities for research include establishing year-round bycatch, stranding and sighting monitoring programmes for both coastal and offshore cetaceans. The latter are required particularly for evaluating the importance of the region to breeding populations of sperm and humpback whales which occur in high numbers (Rosenbaum and Collins, 2006; Weir, 2007; Weir, In press). The Atlantic humpback dolphin, which is endemic to the ETA, is perhaps the greatest research priority in the region. Low population size,

restricted geographic range, exclusive occurrence in developing countries and occupancy of a strictly coastal habitat are factors which combine to make the Atlantic humpback dolphin extremely vulnerable to human activities (van Waerebeek et al., 2004; van Waerebeek and Perrin, 2007; Weir, 2009; Weir et al., In press). Although currently listed as 'Vulnerable' on the IUCN Red data List, it has been recommended that this status be reassessed and the species potentially reassigned to a more threatened category in light of serious concerns over its conservation status (IWC, 2010; Weir et al., In press). Efforts to identify the distribution, abundance and status of this species are needed. The ETA region remains a problematic locality for cetacean research, given the logistical, political and socio-economic factors prevailing in many countries. Capacity-building and the training of local scientists is required.

The Southern Ocean

The future of cetacean research in the African sector of the Southern Ocean remains uncertain at this stage with the termination of the SOWER series of cruises by the IWC in 2010. There are considerable opportunities in evaluating current trends in Antarctic large cetacean populations in relation to protection from whaling, and climate change. We consequently believe that the continuation of long-term monitoring of these species is imperative. The migratory nature of many of these species means that not only can significant components of this work be carried out in low-latitude waters, but also that there is a dedicated body of African research with direct Antarctic interests. Furthermore we suggest that further analyses of considerable amount of distributional data from recent IWC SOWER cruises could provide interesting distributional information on both large and small cetacean species within the Southern ocean region of the Study Area.

Concluding remarks

In this review we have attempted to provide an overview of all research output meeting our criteria of peer review, in the southern African subregion to date, although we are aware that we may have missed early "grey" publications and records that are published outside of the direct academic literature.

As will all reviews of this nature, this manuscript will become out of date as soon as it is published. By including authors working across the subregion, we have aimed to be as current as possible in our review, and consequently have included many 'in press' papers. However, there is a considerable amount of information available from research and conservation projects which we have not been able to include (for instance reports to the IWC, IUCN and funding bodies). Finally, many research and conservation projects are relatively new or ongoing and published reports are still to arise, this is a positive sign of the increased number of research projects occurring in the subregion.

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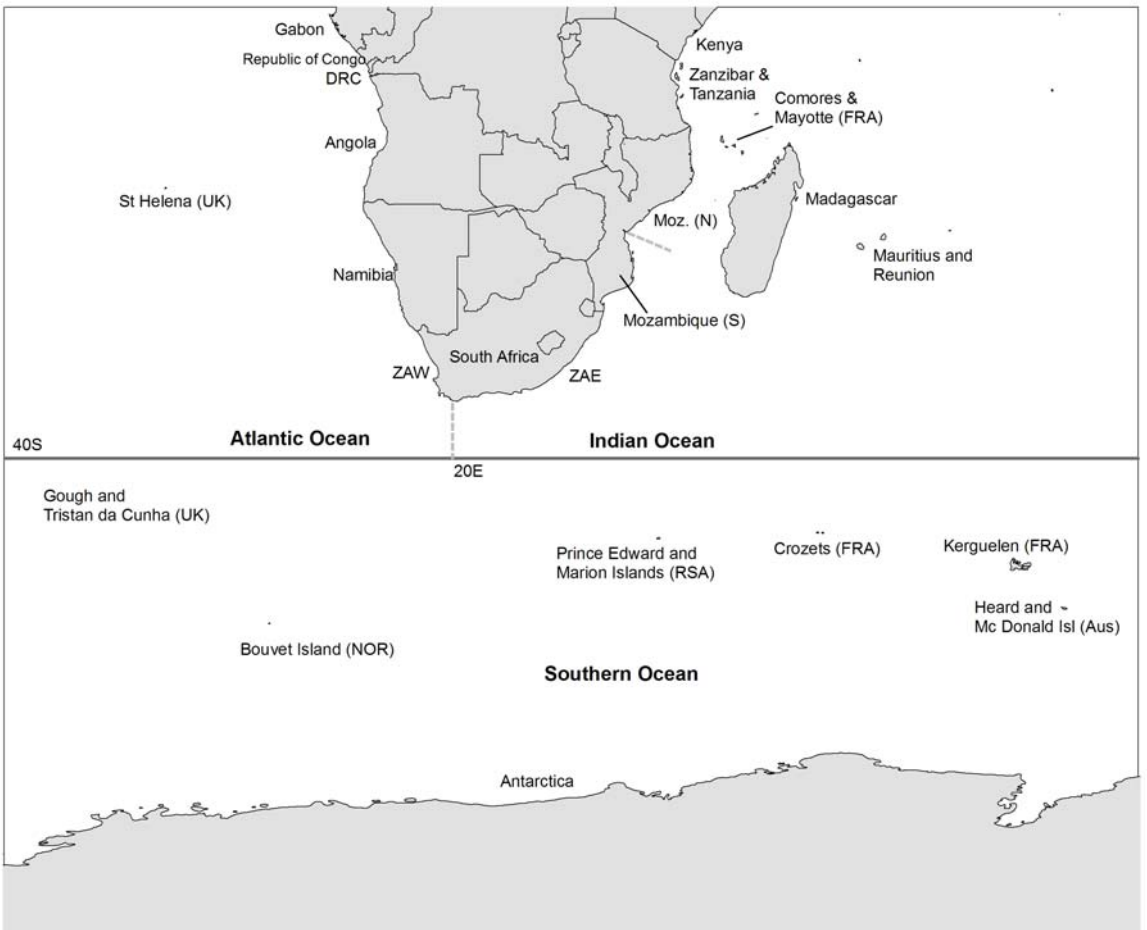

Figure 1. The southern African subregion as considered in text, ranging from the equator to the ice edge from 20°W to 80°E. Horizontal dark grey line shows 40°S. Dashed light grey lines show separation of the west (ZAW) and east (ZAE) coast of South Africa at 20°E) and north and south coasts of Mozambique at Beira (20°S)

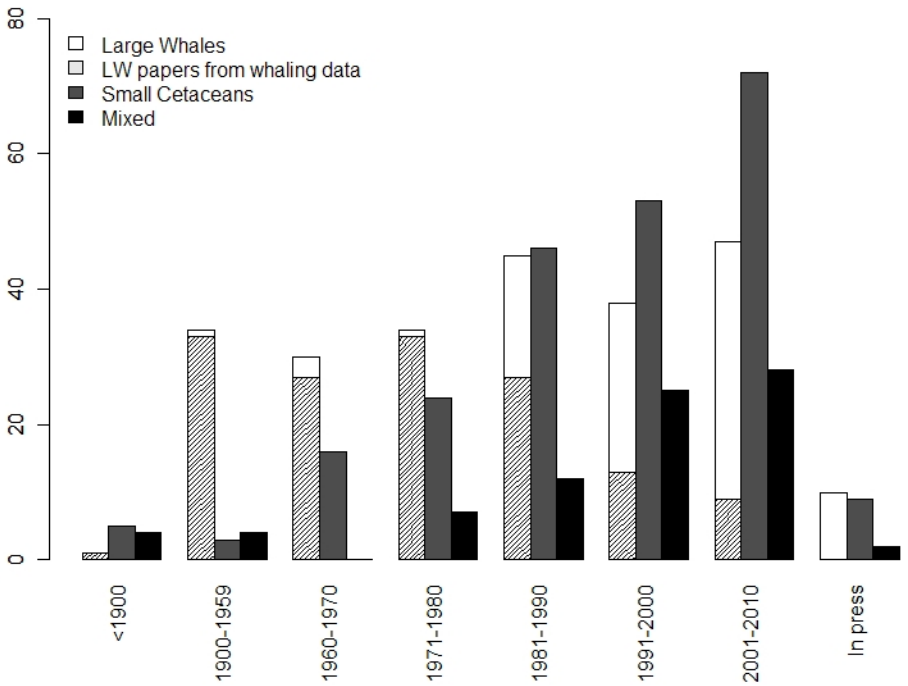

Figure 2. Number of identified papers, books, or book chapters relating to research in the Southern African subregion between 1800 and 2011. Manuscripts are divided into those focusing on large whales (grey portion of bars represents papers resulting directly from whaling data), small cetaceans or papers referring to all or mixed groups of cetaceans (see text for definitions).

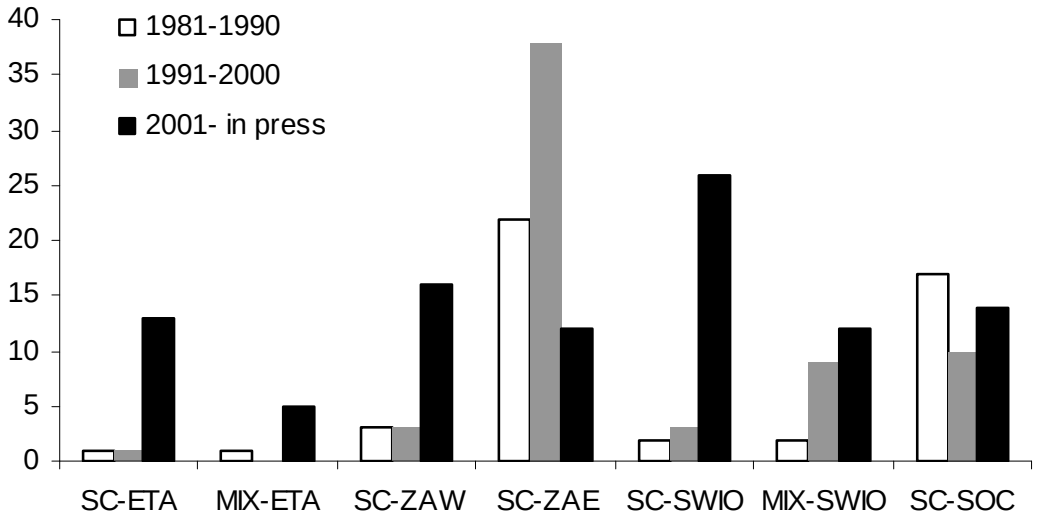

Figure 3. Number of identified papers, books or book chapters focusing on small cetaceans (SC) or mixed species (e.g. 'cetacean sightings'), between 1981 and 2011. Numbers of manuscripts are divided by area into: Eastern Tropical Atlantic, South African west coast (including Namibia), South African East Coast, South West Indian Ocean and Islands (outside South Africa) and Southern Ocean (including subantarctic islands).

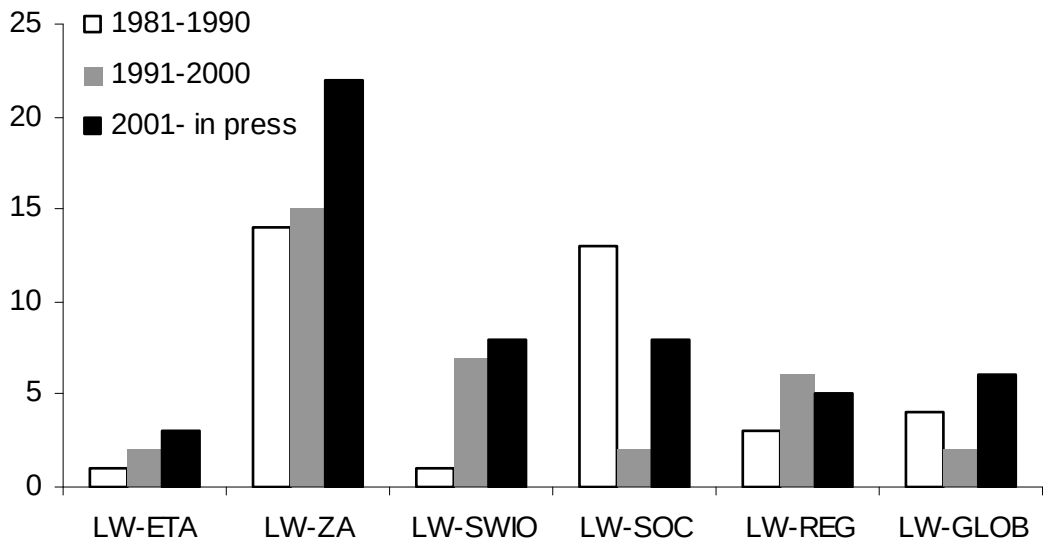

Figure 4. Number of identified papers books or book chapters published focusing on large whales only, between 1981 and 2011. Numbers of manuscripts are divided by area into: Eastern Tropical Atlantic, South Africa (both coasts), South West Indian Ocean and Islands (outside South Africa), Southern Ocean (including subantarctic islands) and regional or global studies.

Tables

Table 1. Nomenclature of the cetacean species occurring within the southern African subregion (from Best 2007; Weir 2010a) and the number of papers referring to those species or groups of species. Species groupings are explained in Table 2 and 3. List differs from Best 2007 in that we have listed the pygmy blue whale separately to the Antarctic blue whale, only list one species of common dolphin and have a separate row for papers referring to both species of humpback dolphin.

(1) The taxonomic status of Bryde's whale is confused; recent molecular analysis conclusively separated Bryde's whale into two species (*Balaenoptera edeni* and *B. brydei*) (Wada et al., 2003). Following Best (2007) and Weir (2010a), *B. brydei* is used for this species within the study area based on the lack of records in the region of a small form referable to *edeni*.

(2) The taxonomic status of the genus *Sousa* is unresolved. Many biologists consider Indo-Pacific humpback dolphins to consist of at least two species: *S. plumbea* (western Indo-Pacific) and *S. chinensis* (eastern Indo-Pacific). *S. chinensis* (*plumbea* form) is used here following Reeves et al. (2008).

(3) The taxonomy of *Delphinus* dolphins is unresolved (IWC, 2009). The IWC Scientific Committee concluded that until further genetic information becomes available, the various geographical populations should be denoted in less committal terms such as short-beaked and long-beaked forms rather than as short-beaked (*Delphinus delphis*) and long-beaked (*D. capensis*) species (IWC, 2009). Consequently, they are referred to simply as common dolphin (*Delphinus* sp.) here.

Common name	**Scientific name**	**<1900**	**1900-1959**	**1960-1970**	**1971-1980**	**1981-1990**	**1991-2000**	**2001-2010**	**In press**	**Total**
Southern right whale	*Eubalaena australis*	0	0	3	2	9	10	20	1	**45**
Pygmy right whale	*Caperea marginata*	0	0	0	1	0	2	0	1	**4**
Blue whale	*Balaenoptera musculus*	0	3	2	1	2	0	7	2	**17**
Pygmy blue whale	*Balaenoptera musculus brevicauda*	0	0	3	0	1	1	0	0	**5**
Fin whale	*Balaenoptera*	0	0	2	1	1	1	0	0	**5**

Common name	Scientific name	<1900	1900-1959	1960-1970	1971-1980	1981-1990	1991-2000	2001-2010	In press	Total
	physalus									
Sei whale	*Balaenoptera borealis*	0	2	2	2	1	0	2	0	**9**
Bryde's whale	*Balaenoptera brydei*[1]	0	2	1	2	2	1	1	0	**9**
Dwarf minke whale	*B. acutorostrata subsp.*	0	0	0	0	0	0	0	0	**0**
Antarctic minke whale	*Balaenoptera bonaerensis*	0	0	0	2	9	3	2	0	**16**
Humpback whale	*Megaptera novaeangliae*	0	2	0	2	1	9	11	5	**30**
Sperm whale	*Physeter macrocephalus*	0	1	13	7	5	1	0	0	**27**
Dwarf sperm whale	*Kogia sima*	0	0	0	1	0	0	0	0	**1**
Pygmy sperm whale	*Kogia breviceps*	0	0	0	0	0	0	0	0	**0**
Cuvier's beaked whale	*Ziphius cavirostris*	0	0	1	2	0	0	1	0	**4**
Arnoux's beaked whale	*Berardius arnuxii*	0	0	1	0	0	0	0	0	**1**
Shepherd's beaked whale	*Tasmacetus shepherdi*	0	0	0	0	0	0	1	0	**1**
Longman's beaked whale	*Indopacetus pacificus*	0	0	0	0	0	0	2	0	**2**
Southern bottlenose whale	*Hyperoodon planifrons*	0	0	1	0	0	1	0	0	**2**
Hector's beaked whale	*Mesoplodon hectori*	0	0	2	0	0	0	0	0	**2**

Common name	Scientific name	<1900	1900-1959	1960-1970	1971-1980	1981-1990	1991-2000	2001-2010	In press	Total
True's beaked whale	*Mesoplodon mirus*	0	0	3	0	5	0	3	0	**11**
Gervais' beaked whale	*Mesoplodon europaeus*	0	0	0	0	0	0	0	0	**0**
Gray's beaked whale	*Mesoplodon grayi*	0	0	1	0	0	0	1	1	**3**
Andrew's beaked whale	*Mesoplodon bowdoini*	0	0	0	0	0	0	0	0	**0**
Layard's beaked whale	*Mesoplodon layardii*	0	0	0	0	0	1	0	0	**1**
Blainville's beaked whale	*Mesoplodon densirostris*	0	0	0	1	0	0	0	0	**1**
Ginkgo-toothed beaked whale	*Mesoplodon ginkgodens*	0	0	0	0	0	0	0	0	**0**
Killer whale	*Orcinus orca*	0	0	0	2	9	4	13	0	**28**
Long-finned pilot whale	*Globicephala melas*	0	0	0	1	0	0	0	1	**2**
Short-finned pilot whale	*Globicephala macrorhynchus*	0	0	0	0	0	0	1	0	**1**
False killer whale	*Pseudorca crassidens*	0	1	0	0	1	0	0	0	**2**
Melon-headed whale	*Peponocephala electra*	0	0	0	0	2	0	0	0	**2**
Pygmy killer whale	*Feresa attenuata*	0	0	2	1	0	1	2	0	**6**
Humpback dolphin (both)	*Sousa spp.*	0	0	1	0	0	0	0	0	**1**
Atlantic humpback	*Sousa teuszii*	0	0	0	0	0	0	4	1	**5**

Common name	Scientific name	<1900	1900-1959	1960-1970	1971-1980	1981-1990	1991-2000	2001-2010	In press	Total
dolphin										
Indo-Pacific humpback dolphin	*Sousa chinensis*[2]	0	0	1	3	1	11	8	0	**24**
Rough-toothed dolphin	*Steno bredanensis*	0	0	0	0	0	0	1	0	**1**
Dusky dolphin	*Lagenorhynchus obscurus*	0	0	0	1	0	1	6	0	**8**
Hourglass dolphin	*Lagenorhynchus cruciger*	0	0	0	0	0	2	0	0	**2**
Southern rightwhale dolphin	*Lissodelphis peronii*	0	0	0	1	2	1	0	0	**4**
Risso's dolphin	*Grampus griseus*	0	0	0	0	0	2	0	0	**2**
Common bottlenose dolphin	*Tursiops truncatus*	0	0	0	2	1	1	1	0	**5**
Indo-Pacific bottlenose dolphin	*Tursiops aduncus*	0	0	1	2	11	8	10	0	**33**
Pantropical spotted dolphin	*Stenella attenuata*	0	0	1	0	2	0	1	0	**4**
Atlantic spotted dolphin	*Stenella frontalis*	0	0	0	0	0	0	0	0	**0**
Spinner dolphin	*Stenella longirostris*	0	0	0	0	0	0	0	0	**0**
Clymene dolphin	*Stenella clymene*	0	0	0	0	0	0	1	0	**1**
Striped	*Stenella*	0	0	0	1	1	1	0	0	**3**

Common name	Scientific name	<1900	1900-1959	1960-1970	1971-1980	1981-1990	1991-2000	2001-2010	In press	Total
dolphin	*coeruleoalba*									
Common dolphin	*Delphinus spp.*[3]	0	0	0	1	2	2	1	0	**6**
Fraser's dolphin	*Lagenodelphis hosei*	0	0	0	1	0	0	1	0	**2**
Commerson's dolphin	*Cephalorhynchus commersonii*	0	0	0	0	5	0	1	0	**6**
Heaviside's dolphin	*Cephalorhynchus heavisidii*	0	0	0	1	2	1	5	1	**10**
Spectacled porpoise	*Phocoena dioptrica*	0	0	0	0	1	1	1	0	**3**
Large cetacean		0	16	4	17	9	5	1	1	**53**
Small Cetaceans		0	0	0	3	3	3	2	0	**11**
Dolphins		1	1	1	1	2	6	7	2	**21**
Balaenopterids		0	0	0	0	0	0	0	0	**0**
Guide/Review		1	1	0	1	1	1	2	0	**7**
All or Mixed species		9	3	0	2	5	18	21	2	**59**

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Table 2. Description of spatial association of publications considered in meta-analysis of cetacean research in the southern African subregion. Those publication clearly originating from a single country were assigned to that country (total list not shown here, see Fig 1).

Area	**Description**
South Africa (both coasts)	Both coasts of continental South Africa
South Africa (W)	Atlantic coast of South Africa (west of 20°E)
South Africa (E)	Indian Ocean coast of South Africa (east of 20°E)
Mozambique (all)	Whole coast or shelf waters of Mozambique
Mozambique (S)	Coast south of Beira (20°S)
Mozambique (N)	Coast north of Beira (20°S)
Atlantic Ocean	Open Atlantic Ocean beyond the continental shelf
Indian Ocean	Open Indian Ocean beyond the continental shelf
Southern Ocean	Open water not associated with any particular island
Indian & Atantic	Study takes place in both ocean basins beyond the continental shelf
Global Review	Paper is a review or comparative study involving data from multiple continents or oceans and including data from the region, includes international guide books. For example Pitman and Ensor (2003), Heinrich et al. (2009), Ross et al. (1994), Wilson et al. (1987)
Regional Review	Papers studying one or more species within all or part of the subregion (at least two countries). For example: Best (2007), Weir (2010a), van Waerebeek et al. (2004), Findlay et al. (1992).
Species Review	Species specific with no regional focus such as papers on, taxonomy, histology, reproductive biology, sexual maturity, growth rates, parasites etc.
Captive	Study of behaviour, ontogeny (etc) of captive animals
Technical	Paper about technical or analytical procedures with not specific area focus. For example Best (1975), Best & Kato (1996), Butterworth & Best (1994), Kiszka et al. (2010).

Table 3. Definitions of species groupings used in meta-analysis of cetacean research in the southern African subregion. Those publication clearly originating from a single species were assigned to that species

Code	**Definition**
Mixed	Paper which investigates 'cetaceans' or 'marine mammals', regardless of which species were encountered
Large cetacean	As defined in text - any paper referring to 'whaling' (species unspecified) which could include sperm whales and baleen whales.
Small Cetaceans	Papers refer to ‘small cetaceans’ and may include smaller baleen whales, beaked whales and *Kogids*
Delphinids	Paper studies one or more species of delphinid
Guide/Review	Paper or book explicitly providing a review of all cetaceans, usually guide books

Table 4. Break down of number of identified publications (journal articles, book chapters, books) by country or region. Codes explained in Tables 3 and 4.

Meta-Analysis: Please see attached excel sheet – easier to insert new references in there and then sort alphabetically.

Continental Africa	**Number**
Gabon	13
Democratic Republic of Congo	2
Angola	9
Namibia	14
South Africa (whole)	64
South Africa (W)	31
South Africa (E)	99
Mozambique (all)	3
Mozambique (S)	2
Mozambique (N)	0
Tanzania	14
Kenya	0
Indian Ocean Islands	
Comoros (incl Mayotte)	10
Madagascar	11
Mauritius, Rodrigues, Reunion	3
Seychelles	2
Other IO Islands.	0
Bouvet	0
Prince Edwards	4
Crozet	11
Kerguelen	21
Atlantic Islands	
Ascension & St Helena	4
Gough & Tristan	3
Region	
Atlantic Ocean	0
Indian Ocean	17
Southern Ocean - open water	58
Global Review	49
Regional Review	66
Species Review	48
Captive	7
Technical	25
Ocean	
Atlantic Ocean	95
Indian Ocean	177
Southern Ocean	98

Literature Cited

Abarnou A, Robineau D, Michel P. 1986. Contamination par les organochlores des dauphins de Commerson des iles Kerguelen. (Organochlorine contamination of Commerson's dolphin from the Kerguelen Islands). . Oceanologica Acta 9(1):19-30.

Amir OA. 2010. Biology, ecology and anthropogenic threats of Indo-Pacific bottlenose dolphins in east Africa: Stockholm University, Sweden.

Amir OA, Berggren P, Jiddawi NS. 2002. The Incidental Catch of Dolphins in Gillnet Fisheries in Zanzibar, Tanzania. Western Indian Ocean Journal of Marine Science 1(2):155-162.

Amir OA, Berggren P, Ndaro SGM, Jiddawi NS. 2005a. Feeding ecology of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) incidentally caught in the gillnet fisheries off Zanzibar, Tanzania. Estuarine Coastal And Shelf Science 63(3):429-437.

Amir OA, Jiddawi NS, Berggren P. 2005b. The occurence and distribution of dolphins in Zanzibar, Tanzania, with comments on differences cetween the two Species of *Tursiops*. Western Indian Ocean Journal of Marine Science 4(1):85-93.

Angot M. 1951. Rapport Scientifique Sur Le Expeditions Baleineres Autour de Madagascar. (Saisons 1949 et 1959) Memoires Institute Science Madagascar VI(2):439 - 486.

Angot M. 1954. Observations sur les mammifères marins de l'Archipiel de Kerguélen, avec une étude detaillée de l'Elephant de mer Mirounga leonina L. . Mammalia 18:1-11.

Ansorge IJ, Lutjeharms JRE. 2007. The Cetaceans Environment off Southern Africa. In: Best PB, editor. Whales and Dolphins of the Southern African Subregion. Cape Town: Cambridge University Press.

Atkins S, Pillay N, Peddemors VM. 2004. Spatial Distribution of Indo-Pacific Humpback Dolphins (Sousa chinensis) at Richards Bay, South Africa: Environmental Influences and Behavioural Patterns. Aquatic Mammals 30(1):84-93.

Ballance LT, Anderson RC, Pitman RL, Stafford K, Shaan A, Waheed Z, Brownell JRL. 2001. Cetacean sightings around the Republic of the Maldives, April 1998. Journal of Cetacean Research and Management 3(2):213-218.

Ballance LT, Pitman RL. 1998. Cetaceans of the western tropical Indian Ocean: distribution, relative abundance, and comparisons with cetacean communities of two other tropical ecosystems. Marine Mammal Science 14(3):429-459.

Bannister JL, Baker AdC. 1967. Observations on food and feeding of baleen whales at Durban. Norsk Hvalfangsttid 4:78-82.

Bannister JL, Gambell R. 1965. The succession and abundance of fin, sei and other whales off Durban. Norsk Hvalfangsttidende 54(3):45-60.

Barendse J, Best PB, Thornton M, Elwen SH, Rosenbaum HC, Carvalho I, Pomilla C, Collins TJQ, Meyer M. this volume. Transit station or destination? Attendance patterns, regional movement, and population estimate of humpback whales Megaptera novaeangliae off West South Africa based on photographic and genotypic matching.

Barendse J, Best PB, Thornton M, Pomilla C, Carvalho I, Rosenbaum HC. 2010. Migration redefined? Seasonality, movements and group composition of humpback whales *Megaptera novaeangliae* off the west coast of South Africa. African Journal of Marine Science 32(1):1-22.

Barnard KH. 1954. A guide book to South African whales and dolphins. S Afr Mus Guide 4.

Barros NB, Cockcroft VG. 1991. Prey of humpback dolphins (Sousa plumbea) stranded in Eastern Cape Province, South Africa. Aquatic Mammals 17:134-136.

Berggren P. 2009. Whales and dolphins; a field guide to marine mammals of East Africa. Norwich: East Publishing Limited.

Berggren P, Amir OA, Guissamulo A, Jiddawi NS, Ngazy Z, Stensland E, Sarnblad A, Cockcroft VG. 2007. Sustainable Dolphin Tourism in East Africa.

. MASMA Technical Report WIOMSA Book Series No 7, ix+72pp.

Berggren P, Amir OA, Stensland E, Jiddawi NS. 2001. Marine Mammals in Zanzibar: A Resource in Need of Conservation and Management. Paper Presented at the Wiomsa Second Scientific Symposium, 22nd – 25th October 2001, Karimjee Hall, Dar es Salaam, Tanzania.

Bermond M. 1950. Campagne Baleinière dans les eaux de Madagascar (saison 1949). Cybium 5:31-47.

Bernasconi M, Nottestad L, Axelsen BE, Krakstad J-O. in press. Acoustic observations of Dusky dolphins *Lagenorhynchus obscurus* hunting Cape horse mackerel *Trachurus trachurus capensis* off Namibia. Marine Ecology Progress Series DOI: 10.3354/meps09071.

Best PB. 1967a. Distribution and feeding habits of baleen whales off the Cape Province. South African Sea Fisheries Research Institute Investigational Report 57.

Best PB. 1967b. The sperm whale (*Physeter catodon*) off the west coast of South Africa: 1. Ovarian changes and their significance. South African Sea Fisheries Research Institute Investigational Report 61.

Best PB. 1968a. The polarity of sperm whale ovaries. Norsk Hvalfangst-tidende 57(2):43-45.

Best PB. 1968b. The sperm whale (*Physeter catodon*) off the west coast of South Africa: 2. Reproduction in the female. South African Sea Fisheries Research Institute Investigational Report 72:1-20.

Best PB. 1969a. The sperm whale (*Physeter catodon*) off the west coast of South Africa: 3. Reproduction in the male. South African Sea Fisheries Research Institute Investigational Report 72:20.

Best PB. 1969b. The sperm whale (*Physeter catodon*) off the west coast of South Africa: 4. Distribution and movements. South African Sea Fisheries Research Institute Investigational Report 78:12.

Best PB. 1970a. Exploitation and recovery of right whales *Eubalaena australis* off the Cape Province. South African Sea Fisheries Research Institute Investigational Report 80:1-20.

Best PB. 1970b. The sperm whale (*Physeter catodon*) off the west coast of South Africa: 5. Age, growth and mortality. South African Sea Fisheries Research Institute Investigational Report 79:27.

Best PB. 1976. Tetracycline marking and the rate of growth layer formation in the teeth of a dolphin (*Lagenorhynchus obscurus*). South African Journal of Science 72:216-218.

Best PB. 1977. Two allopatric forms of Bryde's whale off Sourth Africa. Reports of the International Whaling Commission (Special Issue 1):10-38.

Best PB. 1979. Social organization in sperm whales, *Physeter macrocephalus*. In: Winn HE, Olla BL, editors. Behaviour of Marine Animals. New York, USA and London, UK.: Plenum Press. p 227-289.

Best PB. 1982. Seasonal abundance, feeding, reproduction, age and growth in minke whales off Durban (with incidental observations from the Antarctic). Reports of the International Whaling Commission 32:759-786.

Best PB. 1985. External characteristics of southern minke whales and the existence of a diminutive form. Scientific reports of the Whales Research Institute, Tokyo 36:1-33.

Best PB. 1988. Right whales (*Eubalaena australis*) at Tristan da Cunha, a clue to the 'non recovery' of depleted stocks? Biological Conservation 46:23-51.

Best PB. 1990a. Natural markings and their use in determining calving intervals in right whales off South Africa. SAfr J Zool 25(2):114-123.

Best PB. 1990b. Trends in the inshore right whale population off South Africa, 1969-1987. Marine Mammal Science 6(2):93-108.

Best PB. 1994. A review of the catch statistics for modern whaling in Southern Africa, 1908-1930. Reports of the International Whaling Commission 44:467-485.

Best PB. 1996. Evidence of migration by Bryde's whales from the offshore population in the southeast Atlantic. Reports of the International Whaling Commission 46:315-322.

Best PB. 1999. Food and feeding of sperm whales *Physeter macrocephalus* off the west coast of South Africa. South African Journal of Marine Science 21:393-413.

Best PB. 2001. Distribution and population separation of Bryde's whale *Balaenoptera edeni* off southern Africa. Marine Ecology Progress Series 220:277-289.

Best PB. 2006. The presence of right whales in summer on the west coast of South Africa: the evidence from historical records. African Journal of Marine Science 28(1):159-166.

Best PB. 2007. Whales & Dolphins of the Southern African Subregion. Cape Town: Cambridge University Press.

Best PB, Brandão A, Butterworth DS. 2001a. Demographic parameters of southern right whales off South Africa. . Journal of Cetacean Research and Management Special Issue 2:61–169.

Best PB, Butterworth DS, Rickett LH. 1984a. An assessment cruise for the South African inshore stock of Bryde's whale (*Balaenoptera edeni*). Reports of the International Whaling Commission 34:403-423.

Best PB, Canham PAS, Macleod N. 1984b. Patterns of reproduction in sperm whales, *Physeter macrocephalus*. Reports of the International Whaling Commission (Special Issue 6):51-79.

Best PB, Findlay KP, Sekiguchi K, Peddemors VM, Rakotonirina B, Rossouw A, Gove D. 1998. Winter distribution and possible migration routes of humpback whales *Megaptera novaeangliae* in the southwest Indian Ocean. Marine Ecology Progress Series 1.

Best PB, Gambell R. 1968a. The abundance of sei whales off South Africa. Norsk Hvalfangsttid 57:168-174.

Best PB, Gambell R. 1968b. A comparison of the external characters of sperm whales off South Africa. Norsk Hvalfangsttid 57:146-164.

Best PB, Lockyer CH. 2002. Reproduction, growth and migrations of sei whales *Balaeonoptera borealis* off the west coast of South Africa in the 1960s. South African Journal of Marine Science 24:111-133.

Best PB, Mate BR. 2007. Sighting history and observations of southern right whales following satellite tagging off South Africa. Journal of Cetacean Research and Management 9(2):111-114.

Best PB, Meÿer MA. 2010. Neglected but not forgotten: southern Africa's dusky dolphins. In: Würsig B, Würsig M, editors. The dusky dolphin Master acrobat off different shores Academic Press. p 291-311.

Best PB, Payne R, Rowntree V, Palazzo JT, Both MC. 1993. Long range movements of South Atlantic right whales *Eubalaena australis*. Marine Mammal Science 9(3):227-234.

Best PB, Peddemors VM, Cockcroft VG, Rice N. 2001b. Mortalities of right whales and related anthropogenic factors in South African waters, 1963-1998. Journal of Cetacean Research and Management (Special Issue 2): 171–176.

Best PB, Rademeyer RA, Burton C, Ljungblad D, Sekiguchi K, Shimada H, Thiele D, Reeb D, Butterworth DS. 2003a. The abundance of blue whales on the Madagascar Plateau, December 1996. Journal of Cetacean Research and Management 5(3):253-260.

Best PB, Reeb D, Morais M, Baird A. 1999. A preliminary investigation of humpback whales off northern Angola. Paper SC51/CAWS33 submitted to the Scientific Committee of the International Whaling Commission Grenada, May 1999.

Best PB, Reeb D, Rew MB, Palsboll PJ, Schaeff C, Brandão A. 2005. Biopsying southern right whales: Their reactions and effects on reproduction. Journal of Wildlife Management 69(3):1171-1180.

Best PB, Ross GJB. 1977. Exploitation of small cetaceans off southern Africa. Paper 1.17. Reports of the International Whaling Commission 27:494-497.

Best PB, Ross GJB. 1984. Live-capture fishery for small cetaceans in South Africa waters. Reports of the International Whaling Commission 34:615-618.

Best PB, Ross GJB. 1986. Catches of Right Whales from Shore-based Establishments in Southern Africa, 1792-1975. Report of the international Whaling Commission (Special Issue 10):275-289.

Best PB, Ross GJB. 1989. Whales and Whaling. In: Payne AIL, Crawford RJM, editors. The Oceans of Life off Southern Africa. Halfway House,South Africa: Vlaeberg Publishers.

Best PB, Schaeff CM, Reeb D, Palsbøll P. 2003b. Composition and possible function of social groupings of southern right whales in South African waters. Behaviour 140(11-12):1469-1494.

Best PB, Schell DM. 1996. Stable isotopes in southern right whale (*Eubalaena australis*) baleen as indicators of seasonal movements, feeding and growth. Marine Biology 124:483-494.

Best PB, Sekiguchi K, Findlay KP. 1995. A suspended migration of humpback whales, *Megaptera novaeangliae* on the west coast of South Africa. Marine Ecology Progress Series 118:1-3:1-12.

Best PB, Sekiguchi K, Rakotonirina B, Rossouw A. 1996. The distribution and abundance of humpback whales off Southern Madagascar, August – September 1994. Reports of the International Whaling Commission 46:323-331.

Branch TA, Butterworth DS. 2001a. Estimates of abundance south of 60S for cetaceans species sighted frequently on the 1978/79 to 1997/98 IWC/IDC-SOWER sighting surveys. Journal of Cetacean Research and Management 3(3):252-270.

Branch TA, Butterworth DS. 2001b. Southern hemisphere minke whales: standardized abundance estimates from the 1978/79 to 1997/98 IWC/IDC-SOWER sighting surveys. Journal of Cetacean Research and Management 3(3):143-174.

Branch TA, Matsuoka K, Miyashita T. 2004. Evidence for increases in Antarctic blue whales based on Bayesian modelling. Marine Mammal Science 20:726-754.

Branch TA, Stafford KM, Palacios DM, Allison C, Bannister JL, Burton CLK, Cabrera E, Carlson CA, Galletti Vernazzani B, Gill PC, Hucke-Gaete R, Jenner KCS, Jenner M-NM, Matsuoka K, Mikhalev YA, Miyashita T, Morrice MG, Nishiwaki S, Sturrock VJ, Tormosov D, Anderson RC, Baker AN, Best PB, Borsa P, Brownell Jr RL, Childerhouse S, Findlay KP, Gerrodette T, Ilangakoon AD, Joergensen M, Kahn B, Ljungblad DK, Maughan B, McCauley RD, McKay S, Norris TF, Oman Whale and Dolphin Research Group, Rankin S, Samaran F, Thiele D, Van Waerebeek K, Warneke RM. 2007. Past and present distribution, densities and movements of blue whales in the Southern Hemisphere and northern Indian Ocean. Mammal Review 37(2):116-175.

Brown SG. 1959a. Whale marks recovered in the Antarctic seasons 1955/56, 1958/59, and in South Africa 1958 and 1959. Norsk Hvalfangst-Tidende 48:610-616.

Brown SG. 1959b. Whales observed in the Atlantic Ocean. Notes on their distribution. Norsk Hvalfangst-Tidende 48:289-308.

Brown SG. 1962. The movements of fin and blue whales within the Antarctic zone. Discovery Reports 33:1-54.

Brownell Jr RL. 1974. Small odontocetes of the Antarctic. In: Bushnell VC, editor. Antarctic Map Folio Series Folio 18 New York: American Geographic Society. p 13-19.

Cadenat J. 1959. Rapport sur les petits cétacés ouest-africaines. Résultats des recherches enterprises sur ces animaux jusqu'au mois de mars. Bulletin de l'Institut Français d'Afrique Noire 21(A):1367-1440.

Cassens I, Van Waerebeek K, Best P, Crespo E, Reyes J, Milinkovitch M. 2003. The phylogeography of dusky dolphins *(Lagenorhynchus obscurus)*: A critical examination of network methods and rooting procedures. Molecular Ecology 12(7):1781-1792.

Cassens I, Van Warebeek K, Best PB, Tzika A, Van Helden AL, Crespo EA, Milinkovitch M. 2005. Evidence for male dispersal along the coasts but no migration in pelagic waters in dusky dolphins (*Lagenorhynchus obscurus*). Molecular Ecology 14:107-121.

Christiansen F, Lusseau D, Stensland E, Berggren P. 2010. Effects of tourist boats on the behaviour of Indo-Pacific bottlenose dolphins off the south coast of Zanzibar. Endangered Species Research 11(1):91-99.

Clarke MR. 1980. Cephalopoda in the diet of sperm whales of the Southern Hemisphere and their bearing on sperm whale biology. Discovery Reports 37:1-324.

Cockcroft VG. 1990. Dolphin catches in the Natal shark nets, 1980-1988. South African Journal of Wildlife Research 20(2):44-51.

Cockcroft VG. 1992. Incidental capture of bottlenose dolphins (*Tursiops truncatus*) in shark nets: an assessment of some possible causes. Journal of Zoology, London (A) 226:123-134.

Cockcroft VG. 1994. Is there common cause for dolphin capture in gillnets? A review of dolphin catches in shark nets off Natal, South Africa. Reports of the International Whaling Commission Special Issue 15:541-547.

Cockcroft VG. 1999. Organochlorine levels in cetaceans from South Africa: a review. In: Reijnders PJH, Aguilar A, Donovan GP, editors. Chemical Pollutants and Cetaceans: Journal of Cetacean Research and Management (Special Issue 1).

Cockcroft VG, Cliff G, Ross GJB. 1989a. Shark predation on Indian Ocean bottlenose dolphins, *Tursiops truncatus*, of Natal, South Africa. SAfr J Zool 24(4):305-309.

Cockcroft VG, de Kock AC, Lord DA, Ross GJB. 1989b. Organochlorines in bottlenose dolphins *Tursiops truncatus* from the east coast of South Africa. South African Journal of Marine Science 8:207-217.

Cockcroft VG, de Kock AC, Ross GJB, Lord DA. 1990. Organochlorines in common dolphins caught in shark nets during the Natal "sardine run". SAfr J Zool 25(2):144-148.

Cockcroft VG, Haschik SL, Klages NTW. 1993. The diet of Risso's dolphin, *Grampus griseus* (Cuvier, 1812), from the east coast of South Africa. Z Saugetierkunde 58:286-293.

Cockcroft VG, Krohn R. 1994. Passive gear fisheries of the southwestern Indian and southeastern Atlantic oceans: an assessment of their possible impact on cetaceans. Report of the international Whaling Commission (Special Issue 15):317-328.

Cockcroft VG, Ross GJB. 1990. The growth and behavioral development of a captive bottlenosed dolphin calf. In: Leatherwood S, Reeves R, editors. The Bottlenose Dolphin New York: Academic Press. p 461-478.

Cockcroft VG, Ross GJB. 1991a. Bottlenose dolphins in the Natal shark nets, 1980 to 1987: Catch rates and associated contributing factors. In: Leatherwood S, Donovan GP, editors. Cetaceans and Cetacean Research in the Indian Ocean Sanctuary. Nairobi: United Nations Environment Programme, Marine Mammal Technical Report No. 3. p 115-128.

Cockcroft VG, Ross GJB. 1991b. Occurrence of organochlorines in stranded cetaceans and seals from the east coast of Southern Africa. In: Leatherwood S, Donovan GP, editors. Cetaceans and Cetacean Research in the Indian Ocean Sanctuary. Nairobi: United Nations Environment Programme. p 271-276.

Cockcroft VG, Ross GJB, Peddemors VM, Borchers DL. 1992. Estimates of abundance and undercounting of bottlenose dolphins off northern Natal, South Africa. South African Journal of Wildlife Research 22(4):102-109.

Collet A, Robineau D. 1988. Data on the genital tract and reproduction of Commerson's dolphin, *Cephalorhynchus commersonii* from the Kerguelen islands. In: Brownell RLJ, Donovan GP, editors. Biology of the genus *Cephalorhynchus*: Reports of the Intrnational whaling commission, . p 119.

Collins T, Boumba R, Thonio J, Parnell R, Vanleeuwe H, Ngouessono S, Rosenbaum HC. 2010. The Atlantic humpback dolphin (*Sousa teuszii*) in Gabon and Congo:

cause for optimism or concern? . Paper SC/62/SM9 presented to the Scientific Committee of the International Whaling Commission, Agadir, June 2010 19.

Collins T, Ngouessono S, Rosenbaum HC. 2004. A note on recent surveys for Atlantic humpback dolphins, *Sousa teuszii* (Kükenthal, 1892) in the coastal waters of Gabon. . Paper SC/56/SM23 presented to the 56th Annual Meeting of the IWC Scientific Committee, July 2004, Italy

Condy PR, Van Aarde RJ, Bester MN. 1978. The seasonal occurrence and behaviour of killer whales *Orcinus orca* at Marion Island. Journal of Zoology London 184:449-464.

Corbett HD. 1994. The occurrence of cetaceans of Mauritius and adjacent waters. Report of the international Whaling Commission 44:393-397.

Dalebout ML, Ross GJB, Baker CS, Anderson RC, Best PB, Cockcroft VG, Hinsz HL, Peddemors VP, Pitman Rl. 2003. Appearance, distribution, and genetic distinctiveness of Longman's beaked whale, *Indopacetus pacificus*. Marine Mammal Science 19(3):421-461.

Davies DH. 1963. Notes on dolphins. SAAMBR Bull 4:36-37.

de Boer MN. 2010. Cetacean distribution and relative abundance in offshore Gabonese waters. Journal of the Marine Biological Association of the UK 90:1613-1621.

De Bruyn PJN, Hofmeyer GJG, de Villiers MS. 2006. First record of a vagrant Commerson's dolphin, *Cephalorhynchus commersonii*, at the southern African continental shelf. African Zoology 41(1):131-133.

de Buffrénil V, Dziedzic A, Robineau D. 1989. Répartion et déplacements des dauphins de Commerson *Cephalorhynchus commersonii* (Lacépède, 1804) dans un golfe des îles Kerguelen; données du marquage individuel. Canadian Journal of Zoology 67:516-521.

de Buffrénil V, Robineau D. 1984. Report on maturation of post-cranial skeleton in Commersons dolphin (*Cephalorhynchus commersonii*) of Kerguelen Islands [Indian Ocean]. Annales Des Sciences Naturelles Zoologie Et Biologie Animale 6(2):125-132.

de Kock AC, Best PB, Cockcroft VG, Bosma C. 1994. Persistent organochlorine residues in cetaceans from the east and west coasts of southern Africa. Science of the Total Environment 154:153-162.

Doremus G, van Canneyt O, Pusineri C, Samaran F, Le Corre M. 2009. Doremus, G. van Canneyt, O. Pusineri, C, Samaran, F and Le Corre, M. 2009. Distribution et abondance des oiseaux et mammiferes mains tropicaux (NAOMI). Marine Mammal Research Center, La Rochelle, France. 26pp p.

Dudley SFJ, Cliff G. 2010. Influence of the annual sardine run on catches of large sharks in the protective gillnets off KwaZulu-Natal, South Africa, and the occurrence of sardine in shark diets. African Journal of Marine Science 32(2):383-397.

Dulau V, Boucaud V, Rota B. 2007. Cetacean diversity off La Réunion Island and interactions with human activities. In: Kiszka J, Muir C, editors. Incidental

catches of non-targeted marine species in the western Indian Ocean: problems and mitigation measures Mayotte, France: Workshop proceeding. 13-15th November 2006. p 100-103.

Dziedic A, De Buffrenil V. 1989. Acoustic signals of the Commerson's dolphin, *Cephalorhynchus commersonii,* at the Kerguelen Islands. Journal of Mammalogy 70(2):449-452.

Elwen SH, Best PB. 2004a. Are there reproductive benefits to southern right whale females (*Eubalaena australis*) associated with their coastal distribution off South Africa? Marine Ecology Progress Series 269:289-295.

Elwen SH, Best PB. 2004b. Environmental factors influencing the distribution of southern right whales (*Eubalaena australis*) on the South Coast of South Africa I: Broad scale patterns. Marine Mammal Science 20(3):567-582.

Elwen SH, Best PB. 2004c. Environmental factors influencing the distribution of southern right whales (*Eubalaena australis*) on the South Coast of South Africa II: Within bay distribution. Marine Mammal Science 20(3):583-601.

Elwen SH, Meÿer MAM, Best PB, Kotze PGH, Thornton M, Swanson S. 2006. Range and movements of a nearshore delphinid, Heaviside's dolphin *Cephalorhynchus heavisidii* a determined from satellite telemetry. Journal of Mammalogy 87(5):866-877.

Elwen SH, Reeb D, Thornton M, Best PB. 2009. A population estimate of Heaviside's dolphins *Cephalorhynchus heavisidii* in the southern end of their range. Marine Mammal Science 25(1):107-124.

Elwen SH, Thornton M, Reeb D, Best PB. 2010. Near-shore distribution of Heaviside's (*Cephalorhynchus heavisidii*) and dusky dolphins (*Lagenorhynchus obscurus*) at the southern limit of their range in South Africa. African Journal of Zoology 45(1):78-91.

Englund A, Berggren P. 2002. The impact of tourism on Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) in Menai Bay, Zanzibar. Paper SC/54/WW1 Presented to the Scientific Committee of the International Whaling Commission, Shimonoseki, Japan, May 2002.

Ersts PJ, Kiszka J, Vely M, Rosenbaum HC. in press. Density, group composition, and encounter rates of humpback whales (*Megaptera novaeangliae*) on three banks in the north-eastern Mozambique Channel. Journal of Cetacean Research and Management.

Ersts PJ, Rosenbaum HCR. 2003. Habitat preference reflects social organization of humpback whales (*Megaptera novaeangliae*) on a wintering ground. Journal of Zoology, London 260:337-345.

Eyre EJ. 1995. Observation of cetaceans in the Indian Ocean whale Sanctuary, May-July 1993. Report of the international Whaling Commission 45:419-426.

Eyre EJ. 1997. Preliminary composite cetacean survey in the Indian Ocean Sanctuary, April 1995. . Paper SC/49/O28 submitted to the Scientific Committee of the International Whaling Commission.

Eyre EJ. 2000. Observations of cetaceans in the Indian Ocean Sanctuary, Mauritius to Singapore, April 2000. Paper SC/52/O16 submitted to the Scientific Committee of the International Whaling Commission.

Findlay KP. 2001. A review of humpback whale catches by modern whaling operations in the Southern Hemisphere. Memoirs of the Queensland Museum 47(2):411-420.

Findlay KP, Best PB. 1995. Summer incidence of humpback whales on the west coast of South Africa. South African Journal of Marine Sciences 15:279-282.

Findlay KP, Best PB. 1996a. Assessment of heterogeneity in sighting probabilities of humpback whales within viewing range of Cape Vidal, South Africa. Marine Mammal Science 12(3):335-353.

Findlay KP, Best PB. 1996b. Estimates of the numbers of humpback whales observed migrating past Cape Vidal, South Africa, 1988-1991. Marine Mammal Science 12/3:354-370.

Findlay KP, Best PB, Peddemors VM, Gove D. 1994. The distribution and abundance of humpback whales on their Mozambique winter grounds. Report of the international Whaling Commission 44:311-320.

Findlay KP, Best PB, Ross GJB, Cockcroft VG. 1992. The distribution of small odontocete cetaceans off the coasts of South Africa and Namibia. South African Journal of Marine Science 12:237-270.

Findlay KP, Meÿer MA, Elwen SH, Kotze D, Johnson R, Truter P, Uamusse C, Sitoe S, Wilke C, Kerwath S, Swanson S, Staverees L, van der Westhuizen J. in press. Distribution and abundance of humpback whales, *Megaptera novaeangliae*, off the coast of Mozambique. Journal of Cetacean Research and Management Special Issue on humpback whales.

Findlay KP, P.B. B, Meÿer MA. this volume. Migrations of humpback whales past Cape Vidal, South Africa, and an esimate of the population increase rate (1988-2002). African Journal of Marine Science.

Flower WH. 1879. An Account of the Petrological, Botanical, and Zoological Collections Made in Kerguelen's Land and Rodriguez during the Transit of Venus Expeditions, Carried out by Order of Her Majesty's Government in the Years 1874-75. 95-100 p.

Flower WH. 1884. On the characters and divisions of the family *Delphinidae*. Proceedings of the Zoological Society of London 1883:466-513.

Flower WH. 1885. List of the specimens of Cetacea in the zoological department of the British Museum. British Museum (Natural History). 36 p.

Fraser FC. 1950. Description of a dolphin Stenella frontalis (Cuvier) from the coast of French Equatorial Africa. Atlantidae Reports 1:61-84.

Gambell R. 1966. Foetal growth and the breeding season of sperm whales. Norsk Hvalfangsttid 6:113-118.

Gambell R. 1967. Seasonal movements of sperm whales. Symposia of the Zoological Society of London 19:237-254.

Gambell R. 1972. Sperm whales off Durban. Discovery Reports 35:199-358.

Gambell R, Best PB, Rice DW. 1975. Report on the international Indian Ocean whale marking cruise 24 November 1973- 3 February 1974. Report of the international Whaling Commission 25:240-252.

Gedamke J, Robinson SM. 2010. Acoustic survey for marine mammal occurrence and distribution off East Antarctica (30-80°E) in January-February 2006. Deep-Sea Research II 57:968-981.

Goodwin JA, Durham BD, Peddemors VM, Cockcroft VG. 1996. Genetic variation in the bottlenose dolphin *Tursiops truncatus* along the Kwazulu/Natal coast, South Africa. South African Journal of Marine Science 17:225-232.

Grahl-Nielsen O, Krakstad J-O, Nottestad L, Axelsen BE. 2010. Dusky dolphins *Lagenorhynchus obscurus* and Cape fur seals *Arctocephalus pusillus pusillus*: fatty acid composition of their blubber and prey species. African Journal of Marine Science 32(2):187-196.

Gray J. 1936. Studies in Animal Locomotion VI: The propulsive powers of the dolphin. Journal of Experimental Biolog 13:192-199.

Gray JE. 1828. Original figures and short systematic descriptions of new and unfigured animals. Spicilegia Zoologica Part 1.

Gray JE. 1850. Catalogue of the Specimens of Mammalia in the Collection of the British Museum. London: British Museum. 153 p.

Gray JE. 1865. Notices of a new genus of delphinoid whales from the Cape of Good Hope, and of other cetaceans from the same area. Proceedings of the Zoological Society of London 1865:522-529.

Griffin M, Coetzee CG. 2005. Annotated checklist and provisional national conservation status of Namibian mammals. Technical Reports of Scientific Services Directorate of Scientific Services, Ministry of Environment and Tourism, Windhoek, Namibia 4:207.

Gross A, Kiszka J, Van Canneyt O, Richard P, Ridoux V. 2009. A preliminary study of habitat and resource partitioning among co-occurring tropical dolphins around Mayotte, south-west Indian Ocean. Estuarine, Coastal and Shelf Science 84:367-374.

Guinet C. 1991a. Intentional stranding apprenticeship and social play in killer whales (*Orcinus orca*). Canadian Journal of Zoology 69(11):2712-2716.

Guinet C. 1991b. L'Orque (*Orcinus orca*) autour de L'archipel Crozet comparaison avec d'autres localit,s. Rev Ecol Terre Vie 46:321-337.

Guinet C. 1992. Comportement de chasse des orques (*Orcinus orca*) dans l'archipel Crozet. Canadian Journal of Zoology 70:1656-1667.

Guinet C, Barrett-Lennard L, Loyer B. 2000. Co-ordinated attack behaviour and prey sharing by killer whales at Crozet Archipelago: Strategies for feeding on negatively-buoyant prey. Marine Mammal Science 16(4):829-834.

Guinet C, Bouvier J. 1995. Development of intentional stranding hunting techniques in Killer whale (*Orcinus orca*) calves at Crozet Archipelago. Canadian Journal of Zoology 73:27-33.

Guissamulo A, Cockcroft VG. 2004. Ecology and population estimates of Indo-Pacific humpback dolphins (*Sousa chinensis*) in Maputo Bay, Mozambique. Aquatic Mammals 30(1):94-102.

Guissamulo AT, Cockcroft VG. 1997. Dolphin and dugong occurrence and distribution and fisheries interactions in Maputo and Bazaruto Bays, Mozambique. Paper SC/49/SM24 presented at the 49th meeting of the International Whaling Commission, London, September 1998.

Harlin-Cognato HD, Markowitz T, Würsig B, Honeycutt RL. 2007. Multi-locus phylogeography of the dusky dolphin (*Lagenorhynchus obscurus*): passive dispersal via the west-wind drift or response to prey species and climate change? . BMC Evolutionary Biology 7:131.

Heymans JJ, Shannon LJ, Jarre A. 2004. Changes in the northern Benguela ecosystem over three decades: 1970s, 1980s and 1990s. Ecological Modelling 172:175-195.

Hoelzel AR, Potter CW, Best PB. 1998. Genetic differentiation between parapatric 'nearshore' and 'offshore' populations of the bottlenose dolphins. Proceedings of the Royal Society of London B 265:1177-1183.

Ichihara T. 1966. The pygmy blue whale, *Balenoptera musculus brevicauda*, a new subspecies from the Antarctic. In: Norris KS, editor. Whales, Dolphins and Porpoises Berkeley and LA,: Uni Cal. p 79-113.

Ichihara T. 1981. Review of pygmy blue whale stock in the Antarctic. Mammals in the seas. Rome, Italy: Food and Agricultural Organization of the United Nations. p 211-218.

IWC. 2010. International Whaling Commission Annex L: Report of the sub-committee on small cetaceans. http://iwcoffice.org/_documents/sci_com/SCRepFiles2010/Annex%20L%20FINAL-sq.pdf [downloaded 26 December 2010].

Jauniaux T, Fontaine M, Farnir F, Kiszka J, Coignoul F. submitted. Pollutant exposure of cetaceans from the western Indian Ocean: evidence from cytochrome P4501A induction from biopsy samples. . Marine Pollution Bulletin.

Jefferson TA, Curry BE, Leatherwood S, Powell JA. 1997. Dolphins and porpoises of West Africa: a review of records (Cetacea: *Delphinidae, Phocoenidae*). Mammalia 61(1):87-108.

Kahn B, Whitehead H, Dillon M. 1993. Indications of density-dependent effects from comparions of sperm whale populations. Marine Ecology Progress Series 93:1-7.

Kaliszewska ZA, Seger J, Rowntree VJ, Barco SG, Benegas R, Best. PB, Brown MW, Brownell RLJ, Carribero A, Harcourt R, Knowlton AR, Marshall-Tilas K, Patenaude NJ, Rivarola M, Schaeff CM, Sironi M, Smith WA, Yamada TK. 2005. Population histories of right whales (Cetacea: *Eubalaena*) inferred from mitochondrial sequence diversities and divergences of their whale lice (Amphipoda: *Cyamus*). Molecular Ecology 14:3439-3456.

Karczmarski L, Cockcroft VG. 1999. Daylight behaviour of humpback dolphins *Sousa chinensis* in Algoa Bay, South Africa. Zeitschrift fur Saugetierkunde (International Journal of Mammalian Biology) 64(1):19-29.

Karczmarski L, Cockcroft VG, McLachlan A. 1999a. Group size and seasonal pattern of occurrence of humpback dolphins *Sousa chinensis* in Algoa Bay, South Africa. South African Journal of Marine Science 21:89-97.

Karczmarski L, Cockcroft VG, McLachlan A. 2000a. Habitat use and preferences of Indo-Pacific humpback dolphins *Sousa chinensis* in Algoa Bay, South Africa. Marine Mammal Science 16(1):65-79.

Karczmarski L, Cockcroft VG, McLachlan A, Winter PED. 1998. Recommendations for the conservation and management of humpback dolphins *Sousa chinensis* in the Algoa Bay region, South Africa. Koedoe 41(2):121-129.

Karczmarski L, Thornton M, Cockcroft VG. 2000b. Daylight occurrence of humpback dolphins *Sousa chinensis* in Algoa Bay, South Africa. African Journal of Ecology 38(1):86-90.

Karczmarski L, Winter PED, Cockcroft VG, McLachlan A. 1999b. Population analyses of Indo-Pacific humpback dolphins *Sousa chinensis* in Algoa Bay, Eastern Cape, South Africa. Marine Mammal Science 15(4):1115-1123.

Kasamatsu F, Hembree D, Joyce GG, Tsunoda L, Rowlett R, Nakano T. 1988. Distribution of cetacean sightings in the Antarctic: results obtained from the IWC/IDCR minke whale assessment cruises, 1978/79 to 1983/84. Reports of the International Whaling Commission 38:449-485.

Kasamatsu F, Joyce GC, Ensor P, Mermoz J. 1996. Current occurrence of baleen whales in Antarctic waters. Reports of the International Whaling Commission 46(293 - 304).

Kasamatsu F, Joyce GG, Ensor P, Mermoz J. 1990. Current occurrence of cetacea in the southern hemisphere; results from the IWC/IDCR Southern Hemisphere minke whale assessment cruises, 1978/79-1987/88. Paper SC/42/0 15 presented to the IWC Scientific Committee, June 1990.

Kasamatsu F, Matsuoka K, Hakamada T. 2000. Interspecific relationships in density among the whale community in the Antarctic. Polar Biology 23:466-473.

Kasuya T, Wada S. 1991. Distribution of large cetaceans in the Indian Ocean: data from Japanese sighting records, November-March. In: Leatherwood S, Donovan GP,

editors. Cetaceans and cetacean research in the Indian Ocean sanctuary Marine Mammal Technical Report No 3. Nairobi, Kenya.: UNEP. p 139-170.

Kasuyo T, Wada S. 1991. Distribution of large cetaceans in the Indian Ocean: data from Japanese sighting records, November-March. In: Leatherwood S, Donovan GP, editors. Cetaceans and cetacean research in the Indian Ocean sanctuary Marine Mammal Technical Report No 3. Nairobi, Kenya.: UNEP. p 139-170.

Keith M, Peddemors VM, Bester MN, Ferguson JWH. 2002. Population characteristics of Indo-Pacific humpback dolphins at Richards Bay, South Africa: implications for incidental capture in shark nets. South African Journal of Wildlife Research 32(2):153-162.

Keller RW, Leatherwood S, Holt SJ. 1982. Indian Ocean Cetacean Survey, Seychelles' islands, April through June 1980. Reports of the International Whaling Commission 32(503-513).

Kellogg R. 1929. What is known of the migrations of some of the whalebone whales. Reports of the Smithsonian Institution 1928:467 - 494.

Kiszka J. 2010. Ecological segregation within a community of tropical delphinids: habitat, resource use and social structure. La Rochelle, France: University of La Rochelle. 220 p.

Kiszka J, Breysse O, Boinali K, Vely M. 2006. Marine mammals around the Union of the Comoros (Mozambique Channel): recent records and review of available information. Report SC/58/O6 submitted to the Scientific Committee of the International Whaling Commission:5.

Kiszka J, Ersts PJ, Ridoux V. 2007. Cetacean diversity around the Mozambique Channel island of Mayotte (Comoros archipelago). Journal of Cetacean Research and Management 9(2):105-109.

Kiszka J, Ersts PJ, Ridoux V. 2010a. Structure of a toothed cetacean community around a tropical island (Mayotte, Mozambique Channel). African Journal of Marine Science 32(3):543-551.

Kiszka J, Muir C, Poonian C, Cox TM, Amir OA, Bourjea J, Razafindrakoto Y, Wambiji N, Bristol N. 2008a. Marine Mammal Bycatch in the Southwest Indian Ocean: Review and Need for a Comprehensive Status Assessment. Western Indian Ocean Journal of Marine Science 7(2):119-136.

Kiszka J, Muir CE, Amir OA, Cox TM, Bourjea J, Poonian C, Razafindrakoto Y, Wambiji N, Bristol N. 2008b. Marine mammal bycatch in the southwest Indian Ocean: review and need for a comprehensive status assessment. Western Indian Ocean Journal of Marine Science 7(2):119-136.

Kiszka J, Simon-Bouhet B, Charlier F, Ridoux V. 2010b. Individual and group behavioral reactions of dolphins to remote biopsy sampling. Animal Welfare 19:411-417.

Kiszka J, Van Bressem MF, Pusineri C. 2009. Lobomycosis-like disease and other skin conditions in Indo- Pacific bottlenose dolphin (*Tursiops aduncus*) from the Indian Ocean. Diseases of Aquatic Organisms 84(2):151-157.

Kiszka J, Vely M, Breysse O. 2010c. A preliminary account of cetacean diversity and humpback whale (*Megaptera novaeangliae*) group characteristics around the Union of the Comoros (Mozambique Channel). Mammalia 74:51-56.

Kruse S, Leatherwood S, Prematunga W, Mendes C, Gamage A. 1991. Records of Risso's Dolphins, *Grampus griseus*, in the Indian Ocean, 1891-1986. In: Leatherwood S, Donovan GP, editors. Cetaceans and cetacean research in the Indian Ocean sanctuary Marine Mammal Technical Report No 3. Nairobi, Kenya: UNEP. p 67-77.

Leatherwood JS, Donovan GP. 1991. Cetaceans and Cetacean Research in the Indian Ocean Sanctuary. Marine Mammal Technical Report 3 United Nations Environment Programme, Nairobi, Kenya.

Leatherwood S, Donovan GP. 1990. Cetaceans and Cetacean Research in the Indian Ocean Sanctuary. Nairobi, Kenya: United Nations Environment Programme. 287 p.

Leatherwood S, Todd S, Thomas JA. 1982. Incidental records of cetaceans in southern seas, January and February 1981. Reports of the International Whaling Commission 32:515-520.

Leeney RH, Carslake D, Elwen SH. 2011. Using Static Acoustic Monitoring to describe Echolocation Behaviour of Heaviside's Dolphins in Namibia. Aquatic Mammals 37(2):151-160.

Lockyer CH. 1974. Investigation of the ear plug of the southern sei whale, *Balaenoptera borealis*, as a valid means of determining age. Journal du Conseil International pour l'Exploration de la Mer 36(1):71-81.

Mackintosh NA. 1942. The southern stocks of whalebone whales. Discovery Reports 22(197-300).

Mackintosh NA, Wheeler JFG, Clowes AJ. 1929. Southern blue and fin whales. Discovery Reports 1:257-540.

MacLeod CD, Bennett E. 2007. Pan-tropical spotted dolphins (*Stenella attenuata)* and other cetaceans around St Helena. Journal of the Marine Biological Association of the UK 87:339-344.

Marques TA, Thomas L, Martin SW, Mellinger DK, Jarvis S, Morrissey RP, Ciminello C-A, DiMarzio N. 2010. Spatially explicit capture–recapture methods to estimate minke whale density from data collected at bottom-mounted hydrophones. Journal of Ornithology in press.

Marques TA, Thomas L, Ward J, DiMar., Tyack PL. 2009. Estimating cetacean population density using fixed passive acoustic sensors: an example with Blainville's beaked whales. Journal of the Acoustical Society of America 125:1982-1994.

Mate BR, Best PB, Lagerquist BA, Winsor MH. in press. Coastal, offshore and migratory movements of South African right whales revealed by satellite telemetry. Marine Mammal Science.

Matthews LH. 1938a. The humpback whale, *Megaptera nodosa.* Discovery Reports 17:7-92.

Matthews LH. 1938b. The sei whale, *Balaenoptera borealis*. Discovery Reports 17:183-290.

Matthews LH. 1938c. The sperm whale *Physeter catodon*. Discovery Reports 17:93-168.

Mikhalev JA, Savusin VP, Kishiyan NA, Ivashin MV. 1981a. To the problem of the feeding of sperm whales from the Southern Hemisphere. Reports of the International Whaling Commission 31:737-745.

Mikhalev YA, Ivashin MV, Savusin VP, Zelenaya FE. 1981b. The distribution and biology of killer whales in the Southern Hemisphere. . Reports of the International Whaling Commission 31(551-566).

Miller CA, Reeb D, Best PB, Knowlton AR, Brown MW, Moore MJ. in press. Blubber thickness and its relationship with reproduction, life history status and possibly prey abundance in right whales *Eubalaena glacialis* and *Eubalaena australis*. Marine Ecology Progress Series.

Morch JA. 1911. On the history of whale-bone whales. Proceedings of the Royal Society of London 1911:661-667.

Morisaka T, Karczmarski L, Akamatsu T, Sakai M, Dawson S, Thornton M. 2011. Echolocation signals of Heaviside's dolphins (*Cephanlorhynchus heavisidii*). The Journal of the Acoustical Society of America 129(1):449-457.

Mouton M, Reeb D, Botha A, Best PB. 2009. Yeast infection in a beached southern right whale (*Eubalaena australis*) neonate. Journal of Wildlife Diseases 45(3):692-699.

Mwevuraa H, Amir OA, Kishimbaa M, Berggren P, Kylin H. 2010. Organohalogen compounds in blubber of Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) and spinner dolphin (*Stenella longirostris*) from Zanzibar, Tanzania. Environmental Pollution 158(6):2200-2207.

Natoli A, Peddemors VM, Hoelzel AR. 2007. Population structure of bottlenose dolphins (*Tursiops aduncus*) impacted by bycatch along the east coast of South Africa. Conservation Genetics 9(3):627-636.

Noel M, Barrett-Lennard L, Guinet C, Dangerfield N, Ross PS. 2009. Persistent organic pollutants (POPs) in killer whales (*Orcinus orca*) from the Crozet Archipelago, southern Indian Ocean. Marine Environmental Research 68(4):196-202.

O'Donoghue SH, Drapeau L, Peddemors VM. 2010a. Broad-scale distribution patterns of sardine and their predators in relation to remotely sensed environmental conditions during the KwaZulu-Natal sardine run. African Journal of Marine Science 32(2):279-291.

O'Donoghue SH, Whittington PA, Dyer BM, Peddemors VM. 2010b. Abundance and distribution of avian and marine mammal predators of sardine observed during the 2005 KwaZulu-Natal sardine run survey. African Journal of Marine Science 32(2):361-374.

Olsen Ø. 1913. On the external characters and biology of Bryde's whale (*Balaenoptera brydei*), a new rorqual from the coast of South Africa. Proceedings of the Zoological Society of London 1913:1073-1090.

Olsen Ø. 1914. Hvaler og hvalfangst I Sydafrica. BergensMuseums Arbok 1914-1915(5):3-56.

Omura H. 1973. A review of pelagic whaling operations in the Antarctic based on the effort and catch data in 10° squares of latitude and longitude. Scientific Reports of the Whales Research Institute of Japan 25:105-203.

Patenaude NJ, Portway VA, Schaeff CM, Bannister JL, Best PB, Payne RS, Rowntree VJ, Rivarola M, Baker CS. 2007. Mitochondrial DNA diversity and population structure among southern right whales (*Eubalaena australis*). Journal of Heredity 98(2):147-157.

Paulian P. 1953. Pinnipèdes, cétacés et oiseaux des îles Kerguelen et Amsterdam. Mémoires de l'Institut Scientifique de Madagascar Série A 8:111-234.

Peddemors V, de Muelenaere H, Devchand K. 1989. Comparative milk composition of the bottlenosed dolphin (*Tursiops truncatus*), humpback dolphin (*Sousa plumbea*) and common dolphin (*Delphinus delphis*) from southern African waters. Comparative Biochemistry and Physiology 94A(4):639-642.

Peddemors VM. 1993a. Bottlenose dolphins *Tursiops truncatus* research in Natal, South Africa: A review. Lammergeyer 42(1):24-34.

Peddemors VM. 1993b. Use of commercial flights to census inshore marine mammals off Natal, South Africa. Lammergeyer 42:43-47.

Peddemors VM. 1999. Delphinids of southern africa. A review of their distribution, status and life history. Journal of Cetacean Research and Management 1(2):157-166.

Penry GS, Cockcroft VG, Hammond PS. this volume. Seasonal fluctuations in the occurrence of South African Bryde's whales.

Perrin WF. 1985. The former dolphin fishery at St Helena. Report of the international Whaling Commission 35:423-428.

Perrin WF. 2007. The South African Species Gate. In: Best PB, editor. Whales and Dolphins of the Southern African Subregion. Cape Town, South Africa: Cambridge University Press.

Perrin WF, Best PB, Dawbin WH, Balcomb KC, Gambell R, Ross GJB. 1973. Rediscovery of Fraser's dolphin *Lagenodelphis hosei*. Nature, Lond 241(5388):345-350.

Perrin WF, Perrin MJ. 1986. Investigation of the cetacean fauna and former dolphin fishery of St Helena. . National Geographic Research Reports 21:355-360.

Photopoulos T, Best PB, Hammond PS, Findlay KP. this volume. Movement patterns of coastal dolphins in the presence of a strong current: shore-based observations at Cape Vidal, South Africa. African Journal of Marine Science xxx(xxx):xxx.

Pistorius PA, Taylor FE, Louw C, Hanise B, Bester MN, Dewet C, Du Plooy A, Green N, Klasen S, Podile S, Schoeman J. 2002. Distribution, movement, and estimated population size of killer whales at Marion Island, December 2000. South African Journal of Wildlife Research 32:86-92.

Pomilla C, Rosenbaum HC. 2005. Against the current: an inter-oceanic whale migration event. Biol Lett 1:476-479.

Pomilla C, Rosenbaum HC. 2006. Estimates of relatedness in groups of humpback whales (*Megaptera novaeangliae*) on two wintering grounds of the Southern Hemisphere. Molecular Ecology 15(2541-2555).

Poncelet E, Barbraud C, Guinet C. 2010. Population dynamics of killer whales in Crozet Archipelago, southern Indian Ocean: exploiting opportunistic and protocol-based photographs in a mark-recapture study. Journal of Cetacean Research and Management 11:41-48.

Pusineri C, Quillard M. 2009. Bycatch and direct captures of protected megafauna by the artisanal coastal fishery of Mayotte. Western Indian Ocean Journal of Marine Science 7(2):195-206.

Racey PA, Nicoll ME. 1984. Mammals of the Seychelles. In: Stoddart DR, editor. Biogeography and ecology of the Seychelles Islands. Lancaster: Junk Publishers. p 607-626.

Rakotonarina B, Cockcroft VG, Kroese M, Vely M. 1994. Status and exploitation of Madagascar's coastal resources. Sirenews 22:6-10.

Rayner GW. 1940. Whale marking: progress and results to December 1939. Discovery Reports 19(245-284).

Razafindrakoto Y, Andrianarivelo N, Rosenbaum HC. 2004. Sightings, catches, and other records of Indo-Pacific humpback dolphins in the coastal waters of Madagascar. Aquatic Mammals 30(1):103-110.

Read AJ, Drinker P, Northridge S. 2006. Bycatch of marine mammals in U.S. and global fisheries. Conservation Biology 20:163-169.

Reeb D, Best PB. 1999. Anatomy of the laryngeal apparatus of the pygmy right whale, *Caperea marginata (G*ray, 1846). Journal of Morphology 242(1):67-81.

Reeb D, Best PB, Kidson S. 2007. Structure of the integument of southern right whales, *Eubalaena australis*. Anat Rec 290:596-613.

Reeb D, Duffield M, Best PB. 2005. Evidence of post-natal ecdysis in southern right whales, *Eubalaena australis*. J Mammal 86(1):131-138.

Reeves RR, Dalebout ML, Jefferson TA, Karczmarski L, Laidre K, O'Corry-Crowe G, Rojas-Bracho L, Secchi ER, Slooten E, Smith BD, Wang JY, Zhou K. 2008. *Sousa chinensis*

Reisinger RR, de Bruyn PJN, Bester MN. in press. Prey and seasonal abundance of killer whales at subantarctic Marion Island. African Journal of Marine Science.

Reisinger RR, Karczmarski L. 2010. Population size estimate of Indo-Pacific bottlenose dolphins in the Algoa Bay region, South Africa. Marine Mammal Science 26(1):86-97.

Rice EH, Saayman GS. 1984. Movements and behaviour of Heaviside's dolphins (*Cephalorhynchus heavisidii*) off the western coasts of southern Africa. Investigations of Cetacea 16:4-63.

Rice EH, Saayman GS. 1987. Distribution and behaviour of killer whales (*Orcinus orca*) off the coasts of southern Africa. Investigations of Cetacea 20:231-250.

Richards R, Du Pasquier T. 1989. Bay whaling of southern Africa *c*. 1785-1805. South African Journal of Marine Science 8:231-250.

Ridoux V, Certain G, Doremus G, Laran S, van Canneyt O, Watremez P. 2010. Mapping diversity and relative density of cetaceans and other pelagic megafauna across the tropics: general design and progress of the REMMOA aerial surveys conducted in the French EEZ and adjacent waters. Paper SC/62/E14 Submitted to the 62nd Annual Meeting of the IWC Scientific Committee.

Risting S. 1912. Knolhvalen (Translation in Hinton, M.A.C. 1925. Report on the papers left by the late Major Barrett-Hamilton, relating to the whales of South Georgia. Crown Agents for the Colonies, London : 57 - 209). Norsk FiskTid 31:437-449.

Robineau D. 1984. Morphologie externe et pigmentation du dauphin de Commerson, *Cephalorhynchus commersonii* (Lacepede, 1804), en particulier celui des iles Kerguelen (External morphology and pigmentation of Commerson's dolphin, *Cephalorhynchus commersonii*). Canadian Journal of Zoology 62(12):2465-2475.

Robineau D. 1985. Données Préliminaires sur la répartition du dauphin de commerson *Cephalorhynchus commersonii* aux îles Kerguelen, en Particulier dans le Golfe du Morbihan. (Preliminary information on the distribution of Commersons dolphin, *Cephalorhynchus commersonii* from the Kerguelen Islands, especially the Gulf of Morbihan). Biological Conservation 31(1):85-93.

Robineau D. 1986. Valeur adaptative des caracteres morphologiques distinctifs (taille et pigmentation) d'une population isolee d'un dauphin subantarctique, *Cephalorhynchus commersonii* (Lacepede, 1804). (Adaptive significance of population-specific morphological characters of an isolated population of subantarctic dolphin, *Cephalorhynchus commersonii*. Mammalia 50(3):357-368.

Robineau D. 1991. Balaenopterid sightings in the Western Tropical Indian Ocean (Seychelles area), 1982-1986. In: Leatherwood JS, Donovan GP, editors. Cetaceans and Cetacean Research in the Indian Ocean Sanctuary Marine Mammal Technical Report 3. Nairobi, Kenya.: United Nations Environment Programme.

Robineau D, De Buffrénil V. 1985. Données ostéologiques et ostéométriques sur le dauphin de Commerson, *Cephalorhynchus commersonii* (Lacépède, 1804), en paticulier celui des îles Kerguelen. Mammalia 49(1):109-123.

Robineau D, Goodall RNP, Pichler F, Baker CS. 2007. Description of a new subspecies of Commerson's dolphin, *Cephalorhynchus commersonii* (Lacépède, 1804), inhabiting the coastal waters of the Kerguelen Islands. Mammalia 71(4):172-180.

Roche C, Gasco N, Duhamel G, Guinet C. 2007. Marine mammals and demersal long line fishery interactions in Crozet and Kerguelen Exclusive Economic Zones: an assessment of the depredation level. CCAMLR Science 14:67-82.

Roe HSJ. 1967. The rate of lamina formation in the ear plug of the fin whale. Norsk Hvalfangst-Tidende 56(2):41-43.

Rose B, Payne AI. 1991. Occurrence and behavior of the southern right whale dolphin, *Lissodelphis peronii*, off Namibia. Marine Mammal Science 7(1):25-34.

Rosenbaum HC. 2003. Marine mammals of Madagascar. In: Goodman S, Bengston J, editors. The Natural History of Madagascar. Chicago, Illinois: University of Chicago Press. p 213-216.

Rosenbaum HC, Collins T. 2006. The ecology, population characteristics and conservation efforts for humpback whales (*Megaptera novaeangliae*) on their wintering grounds in the coastal waters of Gabon. Bulletin of the Biological Society of Washington 12:425-433.

Rosenbaum HC, Pomilla C, Mendez M, Leslie MS, Best PB, Findlay KP, Minton G, Ersts PJ, Collins T, Engel MH, Bonatto SL, Kotze DPGH, Meÿer M, Barendse J, Thornton M, Razafindrakoto Y, Ngouessono S, Vely M, Kiska J. 2009. Population structure of humpback whales from their breeding grounds in the South Atlantic and Indian Oceans. PLoS ONE 4:e7318. .

Ross G, Cockcroft V. 1990. Comments on Australian Bottlenose dolphins and the taxanomic status of *Tursiops aduncus* (Ehrenberg, 1832). In: Leatherwood S, Reeves R, editors. The Bottlenose Dolphin. London: Academic Press, Inc. p 101-128.

Ross G, Cockcroft V, Butterworth D. 1987. Offshore distribution of bottlenosed dolphins in Natal coastal waters and Algoa Bay, eastern Cape. SAfr J Zool 22(1):50-56.

Ross GJB. 1969. Evidence for a southern breeding population of True's beaked whale. Nature, Lond 222:585.

Ross GJB. 1970. The occurrence of Hector's beaked whale *Mesoplodon hectori* (Gray) in South African waters. Ann Cape Provo Mus (nat Hist) 8(13):195-204.

Ross GJB. 1977. The taxonomy of bottlenose dolphins, *Tursiops* species in South African waters, with notes on their biology. Annals of the Cape Province Museum (Nat Hist) 11(9):135-194.

Ross GJB. 1984. The smaller cetaceans of the south east coast of southern Africa. . Ann Cape Prov Mus (nat Hist) 15:173-410.

Ross GJB, Cockcroft VG, Cliff G. 1985. Additions to the marine mammal faunas of South Africa and Natal. Lammergeyer 35:36-40.

Ross GJB, Cockcroft VG, Melton DA, Butterworth DS. 1989. Population estimates for bottlenose dolphins *Tursiops truncatus* in Natal and Transkei waters. South African Journal of Marine Science 8:119-130.

Ross GJB, Tietz RM. 1972. Records of Cuvier's beaked whales from South Africa. Annals of the Cape Provincial Museum (Natural History) 7:1-10.

Roux J-P, Best PB, Stander PE. 2001. Sightings of southern right whales (*Eubalaena australis*) in Namibian waters, 1971-1999. Journal of Cetacean Research and Management(Special Issue 2):181-185.

Roux JP. 1986. Le cycle annuel dábundance des orques, *Orcinus orca*, aux îles Saint-Paul et Amsterdam. Mammalia 50(1):5-8.

Roy C, can der Lingen CD, Coetzee JC, Lutjeharms JRE. 2007. Abrupt environmental shift associated with changes in the distribution of Cape anchovy *Engraulis encrasicolus* spawners in the southern Benguela. African Journal of Marine Science 29(3):309-319.

Saayman G, Tayler C. 1973. Social organisation of inshore dolphins (*Tursiops aduncus and sousa*) in the Indian Ocean. Journal of Mammalogy 54(4):993-996.

Saayman GS, Bower D, Tayler CK. 1972. Observations on inshore and pelagic dolphins on the South-Eastern Cape Coast of South Africa. Koedoe 15:1-24.

Saayman GS, Tayler CK. 1979. The socioecology of humpback dolphins (*Sousa* spp.). In: Winn HE, Olla BL, editors. Behaviour of Marine Animals New York: Plenum Press.

Saayman GS, Tayler CK, Bower D. 1973. Duirnal activity cycles in captive and free-ranging Indian Ocean bottlenose dolphins (*Tursiops aduncus*, Ehrenburg). Behaviour 44:212-233.

Schaeff CM, Best PB, Rowntree VJ, Payne R, Jarvis C, Portway VA, Rivarola M. 1999. Dorsal skin color patterns among southern right whales (*Eubalaena australis*): genetic basis and evolutionary significance. Journal of Heredity 90(4):564-471.

Sekiguchi I, Olavarria C, Morse L, Olson P, Ensor P, Matsuoka K, Pitman RL, Findlay K, Gorter U. 2006. The spectacled porpoise (*Phocoena dioptrica*) in Antarctic waters. Journal of Cetacean Research and Management 8:265-271.

Sekiguchi K, Best PB, Kaczmaruk BZ. 1992a. New information on the feeding habits and baleen morphology of the pygmy right whale, *Capera marginata*. Marine Mammal Science 8(3):288-293.

Sekiguchi K, Klages NTW, Best PB. 1992b. Comparative analysis of the diets of smaller odontocete cetaceans along the coast of southern Africa. In: Payne AIL, Brink KH, Mann KH, Hillborn R, editors. Benguela trophic functioning: South African Journal of Marine Science p843-861.

Sekiguchi K, Klages NTW, Best PB. 1996. The diet of strap-toothed whales (*Mesoplodon layardii*). Journal of Zoology, London 239:453-463.

Sekiguchi K, Klages NTW, Findlay KP, Best PB. 1993. Feeding habits and possible movements of southern bottlenose whales (*Hyperoodon planifrons*). Proceedings of the National Institute of Polar Research Symposium on Polar Biology 6:84-97.

Smithers RHN. 1938. Notes on the stranding of a school of *Pseudorca crassidens* at Berg River mouth, December 27, 1936. . Trans R Soc S Afr 25(4):403-411.

Snyman L, Elwen SH, Bester MN, Gridley T, Meyer T, Leeney RH. this volume. Individual variation in bottlenose dolphin ranges in Walsvis Bay, Namibia. Implications for managing restricted areas. African Journal of Marine Science.

Stensland E, Berggren P. 2010. Behavioural changes of nursing female Indo-Pacific bottlenose dolphins in response to boat based tourism. Marine Ecology Progress Series 332:225-234.

Stensland E, Berggren P, Johnstone R, Jiddawi N. 1998. Marine mammals in Tanzanian waters: urgent need for status assessment. Ambio 27:771-774.

Stensland E, Carlen I, Sarnblad A, Bignert A, Berggren P. 2006. Population size, distribution, and behavior of Indo-Pacific bottlenose (*Tursiops aduncus*) and humpback (*Sousa chinensis*) dolphins off the south coast of Zanzibar. Marine Mammal Science 22(3):667-682.

Tayler CK, Saayman GS. 1972. The social organisation and behaviour of dolphins (*Tursiops truncatus*) and baboons (*Papio ursinus*): Some comparisons and assessments. Annals of the Cape Province Museum (Nat Hist) 9(2):11-49.

Tietz RM, Tayler CK. 1964. Dolphin Talk. Scientific South Africa(August 1964):385-390.

Tixier P, Gasco N, Duhamel G, Viviant M, Authier M, Guinet C. 2010a. Interactions of Patagonian toothfish fisheries with killer and sperm whales in the Crozet islands Exclusive Economic Zone: an assessment of depredation levels and insights on possible mitigation strategies. CCAMLR Science 17:179-195.

Tixier P, Gasco N, Roche C, Guinet C. 2010b. Killer whales of the Crozet Islands. Photo-Identification Catalogue 2010.

Tønnessen JN, Johnsen A. 1982. The history of modern whaling (Transl. from Norwegian by RI Christophersen). Berkley and Los Angeles: University of California Press.

Tormosov DD, Budylenko GA, Sazhinov EG. 1980. Biocenological aspects in the investigations of sea mammals. Paper SC/32/02 presented to the Scientific Committee of the International Whaling Commission, Cambridge, July 1980:9.

Tormosov DD, Ikhaliev YAM, Best PB, Zemsky VA, Sekiguchi K, Brownell RLJ. 1998. Soviet catches of southern right whales *Eubalaena australis*, 1951 -1971. Biological data and conservation implication. Biological Conservation 86( ):185-197.

Tosh CA, de Bruyn PJN, Bester MN. 2008. Preliminary analysis of the social structure of killer whales, *Orcinus orca*, at subantarctic Marion Island. Marine Mammal Science 24(4):929-940.

Townsend CH. 1935. The distribution of certain whales as shown by logbook records of American whaleships. Zoologica 19:1-50 + 56 maps.

True FW. 1889. Contributions to the natural history of the cetaceans: a review of the family *Delphinidae*. Bulletin of the United States National Museum 36:285pp.

Tynan CT. 1997. Cetacean distribution and oceanographic features near the Kerguelen Plateau. Geophysical Research Letters 24(22):2793-2796.

Van Bree PJH, Purves PE. 1972. Remarks on the validity of *Delphinus bairdii* (Cetacea, Delphinidae). Journal of Mammalogy 53:372-374.

Van Parijs SM, Smith J, Corkeron PJ. 2002. Using calls to estimate the abundance of inshore dolphins: a case study with Pacific humpback dolphins *Sousa chinensis*. Journal of Applied Ecology 39:853-864.

Van Vuuren B, Best P, Roux J, Robinson T. 2002. Phylogeographic population structure in the Heaviside's dolphin *(Cephalorhynchus heavisidii)*: Conservation implications. Animal Conservation 5(4):303-307.

van Waerebeek K, Barnett L, Camara A, Cham A, Diallo M, Djiba A, Jallow AO, Ndiaye E, Samba Ould Bilal AO, Bamy IL. 2004. Distribution, status, and biology of the Atlantic humpback dolphin, *Sousa teuszii* (Kükenthal, 1892). Aquatic Mammals 30:56-83.

van Waerebeek K, Papastavrou V, Thiele D, Findlay KP, Donovan G, Ensor P. in press. Odontocetes of the Southern Ocean Sanctuary. Journal of Cetacean Research and Management.

van Waerebeek K, Perrin WF. 2007. Conservation status of the Atlantic humpback dolphin, a compromised future? Paper CMS/SC14/Doc6 presented to the 14th Meeting of the CMS Scientific Council, March 2007, Bonn, Germany:10.

Van Waerenbeek K, van Bree PJH, Best PB. 1995. On the identity of Prodelphinus petersii Lutken, 1889 and records of dusky dolphins *Lagenorhynchus obscurus* (Gray, 1828) from the southern Indian and Atlantic Oceans. . South African Journal of Marine Sciences 16:25-35.

Walsh PDF, J.M., Gulick S, Sounguet GP. 2000. Humpback whale activity near Cap Lopez, Gabon. Journal of Cetacean Research and Management 2:63-67.

Watkins WA, Schevill WE, Best PB. 1977. Underwater sounds of *Cephalorhynchus heavisidii* (Mammalia: Cetacea). Journal of Mammalogy 58(3).

Weir CR. 2006a. First confirmed records of Clymene dolphin, *Stenella clymene* (Gray, 1850), from Angola and Congo, South-east Atlantic Ocean. African Zoology 41:297-300.

Weir CR. 2006b. Sightings of beaked whales (Cetacea: Ziphiidae) including first confirmed Cuvier's beaked whales *Ziphius cavirostris* from Angola. African Journal of Marine Science 28:173-175.

Weir CR. Sightings of rough-toothed dolphins (*Steno bredanensis*) off Angola and Gabon, South-east Atlantic Ocean.; 2006c 2–7 April 2006.; Gdynia, Poland. European Cetacean Society.

Weir CR. 2007. Occurrence and distribution of cetaceans off northern Angola, 2004/05. Journal of Cetacean Research and Management 9:225-239.

Weir CR. 2008a. Overt responses of humpback whales (*Megaptera novaeangliae*), sperm whales (*Physeter macrocephalus*), and Atlantic spotted dolphins (*Stenella frontalis*) to seismic exploration off Angola. Aquatic Mammals 34:71-83.

Weir CR. 2008b. Short-finned pilot whales (*Globicephala macrorhynchus*) respond to an airgun ramp-up procedure off Gabon. Aquatic Mammals 34:349-354.

Weir CR. 2009. Distribution, behaviour and photo-identification of Atlantic humpback dolphins *Sousa teuszii* off Flamingos, Angola. African Journal of Marine Science 31:319-331.

Weir CR. 2010a. Cetaceans observed in the coastal waters of Namibe Province, Angola, during summer and winter 2008. Marine Biodiversity Records. p e27.

Weir CR. 2010b. First description of Atlantic humpback dolphin (*Sousa teuszii*) whistles, recorded off Angola. Bioacoustics 19:211-224.

Weir CR. 2010c. A review of cetacean occurrence in West African waters from the Gulf of Guinea to Angola. Mammal Review 40 2-39.

Weir CR. In press. Distribution and seasonality of cetaceans in tropical waters between Angola and the Gulf of Guinea. African Journal of Marine Science.

Weir CR, Debrah J, Ofori-Danson PK, Pierpoint C, Van Waerebeek K. 2008. Records of Fraser's dolphin *Lagenodelphis hosei* Fraser 1956 from the Gulf of Guinea and Angola. African Journal of Marine Science 30:241-246.

Weir CR, Van Waerebeek K, Jefferson TA, Collins T. In press. West Africa's Atlantic humpback dolphin (*Sousa teuszii*): endemic, enigmatic and soon endangered? African Zoology.

Williams AJ, Dyer BM, Randall RM, Komen J. 1990. Killer whales *Orcinus orca* and seabirds: "Play", predation and association. Marine Ornithology 18(37-41).

Wilson CE, Perrin WF, Gilpatrick JWJ, Leatherwood S. 1987. Summary of worldwide locality records of the striped dolphin, *Stenella coeruleoalba*. NOAA Technical Memorandum NOAA-TM-NMFS-SWFC 90:69.

Young DD, Cockcroft VG. 1994. Diet of common dolphins (*Delphinus delphis*) off the south-east coast of southern Africa: Opportunism or specialization? Journal of Zoology 234(1):41-53.

Zemsky VAB, A.A., Mikhalev YA, Tormosov DD. 1995. Soviet Antarctic pelagic whaling after WWII: review of actual catch data. Reports of the International Whaling Commission 45:131-135.