

**Feeding ecology and diet shift of long-beaked common dolphins (*Delphinus capensis*) incidentally caught in anti-shark nets off KwaZulu-Natal, South Africa**

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Unpredictable inter-annual variations in the timing, spatial extent and intensity of the Sardine Run (*Sardinops sagax*) have been documented in recent years off the coastline of KwaZulu-Natal, Southern Africa. Although a number of apex predators in the Sardine Run have been studied in detail, little is known about the diet of long-beaked common dolphins (*Delphinus capensis*). The objective of this study was to determine if variations in the availability of sardine are reflected in the condition and diet of the dolphins over the past three decades. Blubber thickness was assessed as an indicator of animal condition. No significant change in blubber total weight ( $R^2 = 0.0016$ ,  $N = 185$ ), nor dorsal, lateral or ventral blubber thickness ( $R^2 = 0.0044$ ,  $R^2 = 0.0003$ , and  $R^2 = 0.0003$  respectively,  $N = 74$ ) was seen over the last 30 years (1970 to 2007). Stomach contents from 97 common dolphins (57 females, 40 males) caught between 2000 and 2009 were analysed, and compared to historical data between 1972 and 1992. The results suggest some resource partitioning between adult males and females. Mesopelagic fish and squid dominated the diet, with 23 fish and 5 squid species represented in adult dolphins. A shift in the principal prey species consumed by the dolphins was observed. Prior to 1992, sardine comprised up to 48% of the total stomach contents, while mackerel (*Scomber japonicus*), was the dominant prey recorded in the stomach contents between 2000 and 2009. As common dolphins feed opportunistically, this dietary shift appears to

indicate changes in the shoaling characteristics of the most abundant fish prey. Given the "Data Deficient" status of the long-beaked common dolphin on the IUCN Red Data List, and the strong climatic forcing of the Sardine Run, such dietary data have important implications in the light of expanding fisheries and climate change.

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**Biology, ecology and anthropogenic threats of Indo-Pacific bottlenose dolphins in east Africa**

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This presentation examines the biology, ecology and anthropogenic threats of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) off Zanzibar, Tanzania, based on research conducted and samples collected between 2000 and 2008. Distribution and occurrence are described based on incidental catches (bycatch) in gillnet fisheries. Biology and ecology are examined by ageing and studying the reproductive biology and stomach contents of collected specimens. The composition of organohalogen compounds is determined in blubber samples, and assessment and mitigation of bycatch are conducted using observers onboard fishing vessels. Fisheries bycatch data showed that Indo-Pacific bottlenose dolphins occur year round in all areas around Zanzibar. Sexual maturity was attained between 7 and 8 years and body length 190-200 cm in females and at 16 years and body length 213 cm in males. The gestation period was estimated to be 12.3 months, with calving occurring throughout the year, peaking November-March and with an interval of 2.7 years. The estimated pregnancy rate was between 0.10 and 0.58 depending on methods used. Stomach contents revealed a relatively large number of prey species, but that only a few small- and medium-sized neritic fish and cephalopods contribute substantially to the

diet. Estimates of total annual bycatch were >9% which is not considered sustainable. An experiment showed that pingers can be a short term mitigation measure to reduce bycatch of dolphins in both drift- and bottom set gillnets. Methoxylated polybrominated diphenyl ethers (Meo-BDEs) were found at higher concentrations than anthropogenic organic pesticides (OCPs), with only traces of polychlorinated biphenyls (PCBs) detected. This study reveals the magnitude and apparent susceptibility of Indo-Pacific bottlenose dolphins off Zanzibar to anthropogenic threats, especially fisheries bycatch, and it is clear that immediate conservation and management measures are needed to reduce bycatch.

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**The seasonal movements and dynamics of migrating humpback whales (*Megaptera novaeangliae*) off the east coast of Africa, between Plettenberg Bay, South Africa and the south west Indian Ocean breeding grounds.**

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The partitioning of the Southwest Indian Ocean humpback whale breeding grounds (area C), recommended by the IWC, into three sub-regions (C1, C2 and C3) is linked to the assumption of three different migration routes conveying whales to and from area C. This raises important questions about which sub-region(s) are associated with the humpback whales seen in transit past Plettenberg bay in South Africa. The current assumption is that these whales are C1 (Mozambique) animals. Sighting data, tail fluke and dorsal fin images and biopsy samples were collected in Plettenberg Bay, South Africa during 2005 to 2008; Bazaruto

Archipelago, Mozambique 2007 and Ponta Mamoli, Mozambique in 2009. 708 hours of sea time resulted in 324 humpback whale sightings were made. 330 tail flukes, 570 left dorsal fin and 569 right dorsal fin were collected including 47 skin samples. Using tail flukes, eight individuals from Plettenberg Bay have been re-sighted. Of these, five were between year matches in Plettenberg Bay, one within year match in Plettenberg Bay and two between year matches between Plettenberg Bay and Ponta Mamoli, Mozambique. Images will also be matched to catalogues from Tanzania (C1), South West Africa (B2) and the IWC Antarctic catalogue to determine any interchange with and between breeding grounds and to determine links to feeding grounds. Genetic analysis will be used to determine the genetic identity and variation with the population of humpback whales observed between South Africa and Mozambique.

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**We'll be back... Photo identification of humpback whales *Megaptera novaeangliae* off the west coast of South Africa**

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An electronic image database was compiled for humpback whales photographed off the west coast of South Africa. The database incorporates all known sightings where photographs date back as far as 1983, up the end of February 2008. The final catalogue contains 510 pictures of tail flukes (TF), 616 of left dorsal fins (LDF), and 694 of right dorsal fins (RDF). Within and between-year matching was first carried out for each identification feature separately. Excluding images deemed 'not useable', this resulted in 154 different individuals being identified by

TF, 230 by LDF, and 237 by RDF. Using combined features (TF, LDF, RDF, and microsatellite matches, based on 216 skin biopsies) a total of 289 individual whales were identified. Sixty-seven whales were seen more than once, including re-sightings on the same day or in the same year. Of these 44 were re-sighted in different years. The largest number of re-sightings for one individual was 11 times, seen in six different years. The longest interval recorded between the first and last events of identification was ca. 18 years for a whale first seen in 1989 and again in four subsequent years, the last being 2007. The re-sighting rate of 15.22% (based on combined identification features) at intervals of a year or more, appears to indicate a high level of fidelity to the region. More than 11% of whales were also seen on different days in the same year. The relatively low number of individuals identified by tail flukes, compared to dorsal fins, suggests that inconsistent fluking behaviour may introduce heterogeneity in sighting probabilities. Resightings between six different time-periods (spring and summer months in 2001-2007) were used to calculate preliminary abundance estimates for this sub-population, using both closed and open population models.

are endemic to the west coast of southern Africa. The present study represents an initial phase of a larger multi-year research project and investigates selected aspects of dolphin daily occurrence and behaviour observed across a short temporal scale in coastal waters of Table Bay. Groups of Heaviside's dolphin varied in size from two to 26 animals ( $\bar{x} = 7$ ; SD = 6) with generally both sexes present. Although diverse behaviours were seen, foraging was not observed in areas close to shore, which supports earlier studies suggesting that these dolphins forage primarily offshore. For the array of behaviours observed, there was no obvious site preference and kernel density estimates indicate extensive overlap of areas used for milling, socialising, resting and travelling. Group structure across a short temporal scale (one year) appears highly dynamic, with great lability in group sizes and membership, suggesting a fluid social system with weak inter-individual bonds. Whether this short-term pattern holds across longer temporal scales remains a topic of an ongoing research. Even though conclusions based on one-year data need to be viewed cautiously, this study provides a valuable framework for a continuous ecological research that is currently underway.

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**Occurrence and group dynamics of Heaviside's dolphins (*Cephalorhynchus heavisidii*) in Table Bay, Western Cape, South Africa.**

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Heaviside's dolphins, *Cephalorhynchus heavisidii*, are among the least known cetaceans. They are coastal dolphins which

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**Aerial photo-identification of South African right whales, 1979-2009**

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Annual aerial surveys of right whales in South African waters began in 1971 and since 1979 have included annual photo-identification surveys by helicopter between Cape Town and Plettenberg Bay in mid October. Photography has concentrated on cow-calf pairs, of which 2,918 were photo-identified up to and including 2006. The number of calves photographed annually has increased at an exponential rate of 7% a year

throughout the time series, resulting in an approximate eight-fold increase in calf production. The coastal distribution of both cow-calf pairs and unaccompanied animals has remained fairly consistent over time but with a shift in emphasis towards the west. A computer-assisted matching programme (Hiby and Lovell, 2001) introduced in 2004 has proved highly effective, with the eventual match being presented as the number one candidate 95% (and in the first ten 99%) of the time, with the worst ranking being 40. The catalogue of identified cows at the end of the 2006 survey stood at 958 and the intervals between successive calves had been recorded 1,959 times, with most (77.9%) being at 2-4 years and smaller peaks at 5-7 years (16.8%) and 8-10 years (4%) and the longest recorded interval being 23 years. A maximum likelihood model has been used to produce estimates of adult female survival and population increase rate from these data (Best *et al.*, 2005). Resightings of 80 partially albinistic calves as mothers 5-19 years later can be used with the same likelihood model to estimate the mean age at first parturition and immature female survival rate, and re-sightings of 17 albinistic calves since 2005 indicate the potential for obtaining demographic information for males. Temporal variations in calf production are being investigated as a possible indicator of the effect of oceanographic anomalies on right whale feeding success.

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### The Marion Island Marine Mammal Programme

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The Marion Island Marine Mammal Programme (MIMMP) conducts research on pinnipeds and killer whales at Marion Island, Prince Edward Islands, under the auspices of the Mammal Research Institute, University of Pretoria. A long-term mark-resight study of

southern elephant seals *Mirounga leonina* was implemented in 1983. This population is the only well-studied elephant seal population within the southern Indian Ocean and the uninterrupted, ongoing mark-resight programme is of global significance. The Marion Island elephant seal population declined by 87% from 1951 to 2004, but experienced a change in growth rate in 1997 and is currently increasing. Insights into many aspects of elephant seal biology, including life-history, demography, foraging movements and behaviour have been gained. Current research addresses population dynamics in an ecosystem context, i.e. to relate survival, fecundity and foraging success to environmental conditions. Sympatric populations of Subantarctic fur seals *Arctocephalus tropicalis* and Antarctic fur seals *A. gazella* breed at Marion Island and the recovery (following cessation of commercial sealing) and subsequent rapid increase of these populations were documented. Presently, the response of the populations to increased abundance is gauged and investigations into the foraging ecology, maternal provisioning and diet of both fur seal populations reflect changes in the environment. Opportunistic, land-based photographic identification of killer whales (*Orcinus orca*) has provided baseline population size, seasonal abundance and sociality data for the Marion Island population. Recently, dedicated observations are used to quantify observer effort, improve sighting rates and to further our understanding of the potential impact of the killer whale population on resident pinniped populations. The MIMMP benefits from collaboration with leading national and international researchers. Furthermore, the programme has a long track record of training postgraduate students, and their endeavors in the field and completion of postgraduate studies make them ideal candidates to contribute to marine mammal science in South Africa.

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## **Mauritius Marine Conservation Society- Past and Future Actions**

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The Mauritius Marine Conservation Society (MMCS) is a non-governmental organisation which has worked for the past 30 years on education and conservation programs designed to protect the marine environment around Mauritius. These programs include education, marine archeology, the creation of marine parks, whale and dolphin monitoring and reef monitoring and creation. MMCS teaches children, skippers, guides, tourists and the general public about our marine ecosystems, the threats to their survival and how to protect them. Educational games, slide shows and talks, booklets and a DVD have been published to assist with this program. Through the Archeomar programme several historically important wrecks have been discovered and extensive collections of conserved artifacts are in the national collection. An awareness campaign to Mauritians, visitors and the government assisted in the proclamation of the first two marine parks in Mauritius. The MMCS has assisted in the creation of new habitats – old ships - to compensate for damaged areas of reef and has also installed permanent mooring buoys at various popular diving and snorkeling sites. Efforts continue today to raise awareness and identify possible marine protected areas and ultimately the creation of marine parks and their appropriate management. Scientific research has become increasingly important to the work of the MMCS. Since 2006, the MMCS has been conducting dedicated research into the impact and sustainability of the whale and dolphin watching activity along the west coast and the application of legal regulations in Mauritius. As this project concluded in March 2010, MMCS is now looking at the best means of continuing its research, education

and awareness activities. New projects include the production of a Field Guide to cetaceans, extending the research area to include the north of the island, MPA project for the west coast and ultimately the creation of a research, education and exhibition centre.

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## **Welcome and Introduction to the Mammal Research Institute**

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I introduce the research activities of the Mammal Research Institute, including the history of research. I then focus on the development of a concentration of marine mammal research in the Mammal Research Institute, the current research concentrations, and our vision for the future. I also outline synergies that we hope to continue to develop with other research groups. Finally, I extend a warm welcome to all attendees.

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## **Cetacean diversity, distribution and conservation status off Anakao, southwest coast of Madagascar**

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Diversity, distribution and status of cetaceans along the coasts of Madagascar are poorly documented. Between 2004 and 2009, boat-based surveys were conducted to establish status of cetacean populations in the southwest region of Madagascar, off the village of Anakao, 40km south of Toliara. Data were collected along a 75km stretch of

coast on 120 boat days during 5 years between June and November, for over 660 boat hours and 7300km of track line. Two species of mysticetes and eleven species of odontocetes were observed in 305 sightings, highlighting the diversity and ecological importance of the region. Humpback whales were the most frequently sighted cetacean, with 193 sightings. All pod categories associated with reproductive behaviour were documented, including mothers with newborn calves, and sighting rate and travel direction across the winter season were indicative of an active breeding ground as opposed to migratory corridor. A single sighting of a southern right whale constituted the other mysticete. At least eight deep-water odontocete species were documented, including 23 sightings of Risso's dolphins, 14 sightings of spotted dolphins, seven sightings of short-finned pilot whales, and single sightings of common bottlenose dolphins, false killer whales, melon-headed whales and a dwarf sperm whale. Sperm whales were detected acoustically on two occasions. Three near-shore species of odontocetes included 25 sightings Indo-Pacific humpback dolphins, 12 sightings of Indo-Pacific bottlenose dolphins and 14 sightings of spinner dolphins. Depth preferences were evident among species, and there was preliminary suggestion of temporal/seasonal variation in sighting rates and possible temporal habitat partitioning. Hunting of the three inshore dolphin species was reported through interviews of artisanal fishers, and a drive hunt of 100-200 spinner dolphins was documented in October 2005. Data suggested potential depletion of inshore dolphin populations with decreasing trends in sighting rate and group size across the six year period.

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## Conservation and Research through Tourism

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Operating from Kleinbaai and based at the Great White House, Dyer Island Cruises (DIC), a boat based whale watching company; and Marine Dynamics Tours (MD), a shark cage diving operation promote conservation and research and educate clients on the Marine Big 5 - whales, sharks, seals, dolphins and penguins - that inhabit the area. The business motto is 'Discover and Protect' as it is through knowledge that we can better understand and protect our marine environment. Both businesses have received Fair Trade in Tourism certification awarded for fair wages and working conditions, fair purchasing, fair operations, equitable distribution of benefits and respect for human rights, culture and environment. DIC has been used as a case study on sustainable eco-tourism (New Tourism Ventures - An Entrepreneurial and Managerial Approach (Juta-2008). Together 100 national and international agents, 40 national and international journalists, 6 film crews and 600 people on education trips are accommodated each year free of charge. DIC has been involved in aspects of conservation for over a decade but it was with the Faces of Need penguin housing project in 2006 that the Dyer Island Conservation Trust was established to manage this and other conservation initiatives. Since then, and through the direct contribution of a captive market of 12 000 people per annum who support the businesses, the Trust has raised over R1million towards research and conservation. Projects include penguin research and penguin homes, great white shark research, whale research, whale disentanglement, dolphin research, assisting MCM with seal tagging, the care of injured/oiled seabirds, education and awareness, and the clean marine project which includes recycling and beach clean ups with local schools. The Trust now has the added value of a dedicated research boat and three marine biologists employed through the companies who will bring increased awareness to the area through their research.

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## Dugong conservation off Mozambique, where to now?

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Two decades of surveys, community questionnaires and anecdotal data suggest that fewer than 1000 dugongs still inhabit the Western Indian Ocean – East Africa and the Mascarene Islands. Dugongs are scattered throughout the region, occurring in small, relict populations, isolated one from the other. The exception appears to be a small population, some 250 dugongs, occurring around the Bazaruto Archipelago, central Mozambique. Unfortunately, this area is a prime artisanal gill-net fishing area, a prime tourist area and has hydrocarbon deposits, which may be commercially exploitable. These, especially the ongoing capture in gill-nets, will almost certainly lead to their extirpation. To counteract these threats, we have formulated a three phased conservation and action programme. Phase one is to undertake a Rapid Assessment of the fishing communities of the area, to establish the gear used, catches and attitudes to dugongs. Concurrently, to undertake questionnaire surveys of the tourist facilities, tourist activities and tourists in the archipelago, to establish the possibility of establishing community based marine eco-tourism. Phase two is to use the results from phase one to explore sustainable 'alternative livelihoods' for the communities, such as dugong, dolphin or whale watching,; fishing using FADS rather than gill-nets etc. Phase three is to promote an awareness of dugongs and marine resources, both locally and nationally, to scholars and laymen, in an effort to enhance dugong conservation.

## The development of whale and dolphin eco-tourism as an alternative livelihood for fishers in Rodrigues.

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Throughout the Western Indian Ocean coastal zones are increasingly degraded. Uncontrolled development, poor agricultural practices and overexploitation of resources, amongst a myriad of pressures, all lead to resource depletion and diversity decline. Rodrigues, an island (18 km x 6 km) 600 km ENE of Mauritius is no exception and artisanal fishers lack the skills and education to pursue alternative livelihoods. A new ReCoMap funded programme is designed to attempt to solve these problems for Rodrigues' artisanal fishers, through a programme to try to substitute fishing with eco-tourism. Firstly, a series of questionnaire surveys is designed to establish cetacean distribution and relative abundance around the Island; the willingness of fishers to participate in finding alternative livelihoods; the attitudes of those involved in the tourism industry to community based eco-tourism and the attitudes of tourists with regard to the desirability for and expectations of community based eco-tourism on Rodrigues. Additionally, educational and awareness programs will be undertaken throughout the Island, sensitising local adults and children to the need for coastal conservation. Given overall positive outcomes to these enquiries, community guides and boatmen will be trained, in tourism and business, and a pilot community run and owned whale and dolphin watch operation will be established. A long term programme to establish basic natural history parameters for the cetaceans watched and any impacts on them will be initiated.

**Bryde's whale (*Balaenoptera brydei*) activity in Algoa Bay, South Africa.**

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Our current knowledge of cetaceans is still very limited, mainly due to the logistical challenges of studies in the marine environment. The sea conditions are often unpredictable and dangerous, and marine mammals often elusive. This is especially true for the inshore form of Bryde's whales (*Balaenoptera brydei*), along the south east coast of South Africa. Data on the distribution and abundance of all cetaceans (and associated animals) has been collected in Algoa Bay during marine eco-cruises from 1997 until present. This important dataset was collected on a regular basis during a set route from the Port Elizabeth harbour to St Croix Island (25km), then inshore to Jahleel Island and following a 5 metre depth contour past Bluewater Bay and back to port. From May 1999 until July 2007, a total of 546 Bryde's whales were observed. Photos of their dorsal fins were taken wherever possible for identification and GPS locations were recorded. This dataset is unique over this period in Algoa Bay. On occasional cruises undertaken to Bird Island during this period, similar data on any cetaceans were also collected. Finally, these data are still being recorded since 2007. This project aims to give the first population estimate for Bryde's whales in Algoa Bay, as well as their seasonality and distribution. By comparing with similar data collected from Plettenberg Bay between August 2003 and May 2007, we will determine their potential movements between the two bays.

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**Conservation & Ecology of Coastal Delphinids in Namibia**

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The coastal delphinids of Namibia have been poorly studied to date and little data exist on the movements, abundance and general ecological relationships of Heaviside's, dusky and bottlenose dolphins in Namibian waters. Of immediate conservation concern is coastal development (port expansion, mariculture) and a very large marine ecotourism industry (>25 boats) in the Walvis Bay area. The core focus of this project is assessing the health and conservation status of bottlenose and Heaviside's dolphins in Walvis Bay through estimating population abundance, residency, habitat use and distribution patterns using a variety of techniques including photo-ID, moored acoustics and visual surveys. Exposure to human impacts varies considerably between the two species due to differences in habitat use, population size and behaviour. The Heaviside's dolphin population has been estimated at 505 (95%CI: 335-764), with high turnover of individuals over days, but clear residency over at least 2 years. The bottlenose dolphin population is much smaller (77, 95%CI: 71 – 122) and exposure of individuals to human impacts such as tour boats is high. Heaviside's dolphins show highly predictable use of one small concentration areas roughly 1nm<sup>2</sup> in size. Bottlenose dolphins use the majority of the shallow bay area (where interactions with oyster farms and harbour activity is high) and the open coast. Behaviourally specific habitat use by bottlenose dolphins may allow for the implementation of protected status for an area of coast used frequently for resting by mother-calf pairs. At a broader scale, the project is using moored acoustics, and stable isotope and fatty acid analysis to investigate variation in diet and habitat use between seasons and across study sites. Variation in the density of competitor (dolphins and seals)

and prey species will allow for investigation of factors affecting the behaviour and density of Heaviside's dolphins in a variety of ecological conditions.

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### **Dugong (*Dugong dugon*) abundance and distribution in the Bazaruto Archipelago, Mozambique**

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Despite a distribution range across nearshore waters of the tropical and subtropical regions of the Indian Ocean and Western Pacific Ocean (approximately 26 degrees north and south of the equator), the distribution of dugongs in the Western Indian Ocean is highly fragmented and appears to be declining. The population of the Bazaruto Archipelago is believed to comprise the only viable population in the region. A total of 27 surveys were flown over the Bazaruto Bay region to define the distribution and estimate the abundance of the species in the area. A total of 9052 nautical miles of survey effort was flown during the 27 surveys, during which 355 sightings of an estimated 760 dugongs were made. Two core areas of distribution were apparent within the surveyed area; a northern core region of distribution was spread across the inshore and offshore region to approximately the 10 m isobath between the Save River Mouth and 21°24' S, while the southern core region was found within Bazaruto Bay and inshore of Bazaruto, Benguerra and Magaruque Islands, and appeared aligned with the shallow sandbanks to the north and south of Santa Carolina Island. Group sizes recorded in the Bazaruto Archipelago were comparable to group sizes recorded in other regions of dugong abundance, although few very large groups of dugongs were seen in the Bazaruto

Archipelago. Standard line transect analyses of each survey carried out with Distance software showed dugong densities to be considerably lower than densities recorded during surveys in Australia or in the Arabian Gulf. The mean of survey abundance estimates suggested a population within the Bazaruto Archipelago in the order of the low hundreds, although a significant correlation between abundance estimate and survey conditions was noted.

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### **Cetacean research in Kisite-Mpunguti Marine Protected Area, Southern Kenya**

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Global Vision International (GVI) is a non-governmental organisation, working in partnership with Kenya Wildlife Service (KWS), non-governmental and community-based organisations. Since January 2006 we have been conducting research in and around the Kisite-Mpunguti Marine Protected Area (MPA) to investigate the status of cetacean populations and dolphin-watching tourism. Kisite Mpunguti MPA is situated on Kenya's south-coast incorporating Kisite Marine Park, Kenya's largest at 28 km<sup>2</sup> and the adjacent 11 km<sup>2</sup> Mpunguti Marine Reserve. It represents Kenya's primary location for dolphin-watching which over the last 15 years has generated significant revenue for KWS and surrounding communities. However, little scientific research has been conducted on the cetaceans of East Africa and little information is available on the baseline ecology of species that utilise Kisite Mpunguti MPA. Mark-recapture analysis with closed population models have been used to calculate absolute abundance of Indo-Pacific bottlenose dolphins on a quarterly basis. The models estimate a population size of 119 (95% CI 108-146) individuals between January and March 2006, and 122 (95% CI 110-143) individuals

between October and December 2008. To date, more than 15000 photographs have been taken for the photo-identification catalogue, with over 120 Indo-Pacific bottlenose dolphins and 20 Indo-Pacific humpback dolphins identified individually. This research programme aims to provide data on the ecology of dolphin species and seasonal movements of humpback whales in addition to the occurrence of mega-fauna such as sea turtles, whale sharks and dugongs, to facilitate a scientific basis for reviewing management of the MPA and long-term sustainability of cetacean-based tourism and other anthropogenic activities. In 2007 GVI supported KWS in the introduction of a dolphin-watching code of conduct providing awareness and education to tour boat operators and are currently collecting data on tour boat encounters with dolphins.

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### **Molecular ecology of southern African inshore delphinids**

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Of the three dolphin species that inhabit the southern African seas year-round, the Heaviside's dolphin (*Cephalorhynchus heavisidii*) is restricted to the cold-water system off the west coast; Indo-Pacific bottlenose (*Tursiops aduncus*) and Indo-Pacific humpback (*Sousa chinensis*) dolphins occur in warm and temperate waters off the east and south coast. Although a number of previous studies have addressed the population ecology and behaviour of these animals, their population structure and

connectivity on a larger geographic scale remain generally unknown; primarily a result of limited means for conducting sufficiently detailed studies. This project implements a broader ecological and molecular approach to investigate population genetics and socio-genetics of these three understudied dolphin species in the southern African coastal region. The molecular ecology component is being addressed by a combination of intensive sea-based surveys and fine-scale genetic analyses that include both mitochondrial and nuclear DNA sequencing and analyses of microsatellite loci to investigate population connectivity and genetic structure, population history, migration, and rate of gene flow between groups and across the species' range. Where sufficient detailed photo-ID data is available, our study will also investigate the socio-genetic dynamics of dolphin groups. The results of this study will contribute to the understanding of the molecular mechanisms that shape the population structure and geographic dynamics of coastal dolphins in a diverse yet understudied coastal ecosystem of southern Africa.

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### **Marine Mammal Tourism Ponta do Ouro, Mozambique**

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Human-cetacean interactions are gaining in popularity as alternatives to whaling and marine exploitation. Apparently contradictory needs of social and economic development are in tension with environmental conservation. Our work confronted the challenges to developing tourism that arise when human-dolphin encounters are inevitable in a given habitat. Research shows that human activities have serious negative

impacts on cetacean habitats and populations. This is exacerbated by underdevelopment in countries of the Southern Hemisphere. In Ponta do 'Oura Mozambique tourists arrive seasonally to enjoy the beaches, dive the reefs, fish and engage in related leisure activities. This brings temporary and transient transformation to an isolated rural area. In the marine environment noise levels increase as a wide range of motorised watercraft are deployed up and down the coastline. Within this context a growing provision of swim-with-dolphin programmes threatens the resident and transient cetacean populations, particularly the numerous in-shore bottlenose dolphin (*Tursiops aduncus*). In this context Dolphin EnCOuntours in support of Dolphin Care Africa, a small resident organisation has gathered multiple strands of information from long-term behavioural studies of dolphins since the mid 1990's.

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## Research & conservation of Marine mammals in Mozambique

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Marine mammal research and conservation in Mozambique has emerged recently, despite the long coastline and the past importance of marine mammals during the whaling era. Research has focused on the distribution and abundance of a few coastal species (bottlenose dolphins, humpback dolphins and humpback whales), but there is very little on biology, bycatch and sustainable utilization of nearshore species. The first long shore survey was carried out in 1977, but subsequent cruises in 1991 and 2003 provided more information on species diversity, photo-identification of whales and genetic samples. In Maputo and Bazaruto Bays research was carried out for Indo-Pacific bottlenose dolphins, humpback dolphins and dugongs. The research at Ponta do Ouro area was started in 1997 due to its high potential for

dolphin tourism, and high frequency of strandings. Recent concession of marine areas for oil exploration contributed to increased knowledge of species distribution through aerial surveys and marine mammal observation crews during seismic surveys at inaccessible areas. Research should be directed to mitigate human impacts and sustainable management of dolphin habitats including evaluation of acoustic impacts, pollution on marine mammals, but also look into their growing socio-economic value. However, the limited human and financial resources can be a major difficulty. Marine mammal conservation is also incipient because of the need of awareness of marine mammals. So far, nominal protection is given to marine mammals in the fisheries law. Bazaruto National Park is the only conservation areas declared to protect dugongs, despite that they range outside this area. Mozambique is a signatory of a CMS (Convention for Migratory Species). Bycatch is the main threat to marine mammals in Mozambique, but it is not monitored, apart from some initiatives in Maputo Bay. Recent establishment of Fisheries Communities Councils (CCP) in the country for managing the artisanal fisheries may be a platform to improve awareness among fishers and establish self-monitoring of protected species. The role of NGOs, Research Institutions and Tourism Industry are relevant to the protection of marine mammals.

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## Cape fur seals of the Agulhas Current

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The Cape and Australian fur seal *Arctocephalus pusillus* inhabits three very different environments: the waters of the Bass Straits, and the Benguela and the Agulhas Currents of Southern Africa. The smallest and least studied of these three populations is that of the relatively unproductive Agulhas Current. Little is known

of how animals of this population cope with possibly suboptimal environmental conditions, and what part they play in this ecosystem. Suggestions have also been made that future environmental change might impact this population. There are indications that the waters of the Benguela Current will decline in productivity with global climate change, with consequent changes in the populations of prey species in this and the neighbouring Agulhas Current ecosystems. Should this happen, we can expect changes in the populations of their predators, including Cape fur seals. I intend to examine the demographics, diet and foraging behaviour of Agulhas Current seals together with a number of collaborators. Preliminary work, on the marking of pups and the monitoring of their survival, has begun.

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### What can acoustic studies tell us?

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The use of sound is central to the lives of whales and dolphins; acoustic studies can enhance our understanding of cetacean communication systems so that we avoid further damaging their habitat through human-induced ocean noise. Recent investigations into acoustic communication of southern right whales in South African waters confirmed a similarity to the reported repertoire of other right whale populations, and identified several context-related call types with call-specific calling rates, occurring in bouts. This suggested the purposeful use of signals. The individual calling rate per whale was found to drop as the number of whales present increased; this could be due to a number of factors, including female harassment avoidance, information sharing, predator avoidance and a reduced need for communication when in close proximity of other whales; whatever the cause, it indicates

that whales are aware of their collective numbers as whales enter and leave an area. Up to half of whale groups sighted from the boat were silent, suggesting that a passively listening whale could glean important information. Close to one third of the calls recorded came from whales not sighted from the boat; this underlined the deficiencies in relying on visual census alone. There was preliminary evidence for individually distinctive calls, and the use of frequencies below 20 Hz. In subsequent studies we could expand on these results. Recording whale vocalisations at close range may uncover other signals which are used only at low energy. Calls unequivocally from distinct whales (for instance, the calls from the focal animal in surface active groups) will greatly advance the study of vocal individuality; calls unequivocally from distinct populations will provide new tools for understanding the movements and mixing of populations. The deeper our understanding of whale acoustics, at individual, social and population levels, the less harm we will cause them.

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### Population status and diet of Cape fur seals at Robberg Nature Reserve – preliminary findings

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A colony of 5000 to 6000 Cape fur seal was resident in Plettenberg Bay until the late 1800s, suggesting that food in the area must have been abundant. However, by 1908 this colony was eliminated by harvesting. From 1990, seals again started to haul out along the northern shore of the Robberg peninsula, where there is little human disturbance. The increase in seal numbers resulted in conflict with the local fishing industry. The objectives of this study are (i) to investigate trends in

Cape fur seal numbers and pup production on Robberg over time and (ii) to determine the diet of the seal colony on Robberg in terms of prey species composition, abundance and size and (iii) to explore annual and seasonal variation in seal diet. The seal colony was monitored fortnightly from 2000 to 2008. Scat samples were collected and otoliths and squid beaks extracted to determine seal diet. Preliminary results show that the seal colony increased in number between 2000 and 2008 but fluctuated widely. During this period few pups were born per season and the survival rate was low. The re-established colony is thought to largely comprise of non-breeding males and thus considered a "non-breeding colony". Pilchard and anchovy are the most important prey species, followed by maasbanker and tonguesole. This study is the first diet analysis of predominantly male Cape fur seals. Further analysis of the diet and count data will explore potential competition with the fishing industry.

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### **Spatial modelling of cetacean abundance and distribution: a case study of long-finned pilot whales in the Mediterranean Sea**

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Spatial modelling of line transect data is a combination of distance sampling and spatial modelling methods that accounts for variation in the probability of detecting animals and estimates the abundance of a species based on its relationship with environmental covariates (Hedley *et al.*, 1999). Potential explanatory covariates include biological factors, oceanographic data, geophysical information and anthropogenic factors. This method does not require that transects have random or systematic placement. Little is known about pilot whales in the

Mediterranean Sea, a species which has been proposed as "Data deficient" in the recent IUCN Red List assessment of Mediterranean cetacean subpopulations. Since 1992, Alnitak, a research organisation in the north-western Mediterranean, has collected data on the distribution and abundance of cetaceans, primarily in Spanish waters but also in the waters of Morocco, Tunisia and Algeria in 2009. Shipboard line transect sampling was conducted along non-systematically placed line transects that were nevertheless designed to cover the range of covariates used in the modelling, covering >56,000km on effort and resulting in >400 sightings of pilot whales. The abundance of groups and group size were modelled independently using Generalised Additive Models, and the results of the best-fitting models combined to predict density across the study area. Abundance of groups was significantly influenced by depth and distance from a sea mount, while depth, longitude, year and sea floor topography were the covariates that best explained variation in group size. The abundance of pilot whales within the study area was estimated to be 1,890 individuals (95% CI= 1,483 - 1,915, CV=0.07) and areas of high use habitat were identified. These results will be useful in informing conservation actions for pilot whales in the Mediterranean.

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### **Effects of sex, birthmass and age on survival and capture probability of Cape fur seal pups**

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Of the life stages of seals, the pup stage is most vulnerable to mortality, with rates that can be highly variable between years. Pup mortality is therefore a critical parameter to measure for seal population growth models.

However, despite that the Cape fur seal population has been the subject of several population modeling studies, no robust measures of pup survival beyond the first month of life have been documented. We conducted a capture-mark-recapture (cmr) study of Cape fur seal *Arctocephalus pusillus pusillus* pups at a mainland colony in Namibia, in two separate years. The birth date, mass and sex were obtained for pups born within demarcated study sites. The pups were double-tagged and their survival was monitored longitudinally for several months after the birth season. The cmr data was analysed using the software programme MARK. We report on the modeled (apparent) pup survival rates and effects of co-variables including sex and birth mass, on survival and capture probabilities of pups.

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### **Introducing draft National Policy for cetacean strandings, with response plan**

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The mass stranding of false killer whales *Pseudorca crassidens* at Kommetjie in 2009 underscored the need for an appropriate coordinated national management strategy, including response plans, for the rescue and management of stranded and entangled marine animals. Subsequently, recommendations towards a National Policy for Marine Animal Disentanglement and Stranding Response were drafted, and expert workshops were held to inform the assimilation of a Response Plan. The Response Plan has been designed as a reference guide for use by South African Stranding Network (SASN) personnel and other stakeholders, prior to and during responses to incidents. It outlines legislative responsibilities, response strategies, key roles

and responsibilities of SASN and external stakeholders, emergency contact details, procedures, protocols, resource lists and relevant data collection forms, and is in line with the draft Policy. In this presentation, the objectives of the draft policy and how they are to be implemented is introduced, and a brief overview of the draft response Plan is provided.

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### **Developing science- tourism relationships to the benefit of both. Investigating bottlenose dolphins (*Tursiops aduncus*) in Durban Bay, KZN**

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South Africa has strict protocols governing marine tourism, particularly the boat-based whale watching industry. Marine research is expensive and has a poor dollar:data ratio. Even for high profile groups of animals like cetaceans, funding is hard to come by and there is a potential for a mutually beneficial relationship between the marine tourism industry and scientists if managed correctly. Tour boats are likely to be at sea year round, a feat not easily achieved by researchers, and are effectively self funding. They provide platforms of opportunity for the collection of photographic, behavioural and spatial data, within the constraints of limited trip times and license restrictions. Further, profits from tourism may be fed back into directed research trips which benefit the business through increasing knowledge about local cetacean populations and improving the skills and knowledge of staff through interaction with researchers. We highlight the potential value of tourism-science collaborations by presenting some preliminary analyses estimating the abundance of bottlenose dolphins in Durban Bay, calculated using mark-recapture techniques applied to opportunistically collected ID photographs.

Data were collected on 28 occasions during a four year study period. Mark-recapture analyses were performed only on the data from a limited period between 2008 and 2009 due to selective criteria on photographic quality. Using a photographic data set of over 4,608 images, 302 individuals were identified of which 136 dolphins were only seen once. A total population of approximately 635 animals (CV= 0.09, 95% CI 519-751) was estimated (corrected for the proportion of distinctive individuals in the population). This study showed that by using the data obtained from a mixture of opportunistic (tourism) and dedicated (research) trips, we might be able to assess the population structure of the bottlenose dolphins along the KZN coast given a longer, more complete dataset.

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### Zoogeography of the cetaceans in Algoa Bay, South Africa

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Algoa Bay is a large, south-east facing bay in the Eastern Cape Province, South Africa. To date there has been no survey of the cetaceans in Algoa Bay. A number of developments in recent years such as a deep-water port, a proposed oil refinery, two potential wind power plants, increased recreational boating and fishing (commercial and recreational) as well as a proposed large Marine Protected Area (MPA), and increased interest in whale watching, highlight the need for a baseline study on cetaceans. The present study will determine the spatial and temporal distribution, and habitat preference of cetaceans in Algoa Bay. Boat-based surveys are being carried out monthly between June 2008 and May 2011. At each sighting the GPS location, species, number,

composition, and behaviour are recorded. To date 345 hours of search effort have been completed over 70 surveys, with a total of 318 sightings. Species observed are: the southern right whale (*Eubalaena australis*), humpback whale (*Megaptera novaeangliae*), Bryde's whale (*Balaenoptera brydei*), Indian Ocean bottlenose dolphin (*Tursiops aduncus*), Indo-Pacific humpback dolphin (*Sousa plumbea*), and long-beaked common dolphin (*Delphinus capensis*). 64% of all mysticete mother/calf pair sightings occurred in the proposed MPA, compared to 36% in the rest of the bay. There was no significant difference in the depths among humpback dolphins, bottlenose dolphins and southern right whales ( $p > 0.01$ ), and similarly between Bryde's whales and humpback whales ( $p > 0.01$ ). However, there was a significant difference between the inshore and offshore species in all cases (one-way ANOVA;  $p < 0.01$ ). These results indicate how cetaceans utilise the bay in significantly different ways, with key areas of high use differing between species, and results of a more detailed GIS analysis will illustrate that. Such data will aid in determining preferred habitats that need to be defined for future management strategies in the bay.

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### Coastal Cetaceans and Aquaculture – Developing a baseline data set on movements, behaviour and habitat use to assess a growing impact in South Africa.

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Aquaculture is seen in many quarters as the saviour of over-utilised wild fish populations but has many potentially serious environmental impacts of its own if not managed responsibly. For instance, release of medication into the wild, increased parasites from high density farming and excessive

nutrification from faeces and excess food which can result in harmful algal blooms or changes to the benthic fauna. There is very little research on the direct interactions between top predators such as cetaceans and aquaculture installations, and no data available from South Africa. Top predators may be killed in predator exclusion nets or shot by operators, but the majority of impacts are likely to be subtle and harder to quantify, such as exclusion from prime feeding, resting or breeding habitat within the sheltered bays that are typically occupied by farms. The development of open-water aquaculture is getting strong governmental support and is likely to be a rapidly growing industry locally. Mossel Bay has been identified as the site of the first fin-fish farm to be built in 2011. The goal of this study is to generate baseline data on the movements, habitat use and interactions of cetacean species in Mossel Bay prior to the installation of the fish farm. Of highest concern are the southern right whale (*Eubalaena australis*) which calves seasonally along the Cape south coast, and the humpback dolphin (*Sousa plumbea*), which is known to have small local populations and be vulnerable to human threats such as pollutants and bycatch. Preliminary results have already highlighted differential use of the nearshore area by humpback dolphins including possible feeding and resting sites.

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### **An Assessment of Large Whale Entanglement and Disentanglement in South Africa**

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Historically, whale entanglement within South African waters was low in comparison to

internationally reported levels. Since 1999, however, incidents of entanglement have increased substantially. The majority of whale entanglements recorded in South Africa have been attributed to fishing gear from the rock lobster industry and the shark nets off the KwaZulu-Natal (KZN) coastline. The KZN Sharks Board, which is responsible for maintaining shark nets, attempts to disentangle all whales entrapped in the nets and has kept records since 1981. With regard to other entanglement, the South African Whale Disentanglement Network (SAWDN) became operational in 2006. This study reports on all known records of large whale entanglement in South Africa up to 2009, including entanglement in shark nets and fishing gear. The assessment includes descriptions of the geographical and temporal distributions of entanglement events, the whale species and entangling materials involved, and the outcomes of release attempts.

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### **The Biology of South African Bryde's whales**

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The biology of South African Bryde's whales (*Balaenoptera brydei/edeni*), with a focus on the inshore form, was investigated through estimates of abundance and survival rate, seasonality of occurrence and variation in mitochondrial and nuclear DNA. Photographs, sightings data and biopsy samples were collected in Plettenberg Bay, on the southeast coast of South Africa. Additional genetic material was obtained from the Iziko South African Museum, Marine and Coastal Management, and the Port Elizabeth Museum. Mark-recapture methods applied to photo-identification data were used to estimate abundance and survival rate. Estimates of abundance ranged from 130 to 250 (CV =

0.07 - 0.38) and the estimated annual survival rate was 0.934 (CV = 0.047, 95% CI = 0.852 - 1.0). Seasonal increases in the encounter rate and number of individual whales were observed during summer and autumn, with a peak in April, which corresponded to increased feeding activity and larger average aggregation sizes. Chlorophyll-a, sea surface temperature and wind speed were all significant factors in explaining the variability in the occurrence of whales. No seasonality in the occurrence of calves was detected. Mitochondrial DNA control region sequences (685bp) were compared to published sequences. This confirmed the offshore form as *Balaenoptera brydei* and the inshore form as closely related to *B. brydei*, possibly at the sub-specific level, but excluded it as *B. edeni*. Genetic differentiation between the two forms was high ( $F_{ST} > 0.95$ ) indicating low gene flow between them. The use of 10 polymorphic microsatellite loci revealed no population structure among the inshore samples ( $F_{ST} = 0.006$ ). Pairwise estimates of relatedness found most individuals to be unrelated, with only a few distant relatives detected.

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### The southern right whale on a feeding ground on the west coast of South Africa

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Southern right whales (*Eubalaena australis*) are believed to migrate from lower latitude calving/breeding grounds in coastal waters to pelagic feeding grounds in higher latitudes in summer. Whaling records off the west coast of South Africa dispute this view as right whales were taken in St Helena Bay in summer and autumn months indicating that the area was not used as a breeding ground but a possible feeding ground. Data from

satellite-tagged whales support the existence of this summer feeding ground and its use. Between 2003 and 2007 boat-based photo-identification surveys were conducted to establish the abundance and distribution of southern right whales in the St Helena Bay area. Of the 484 right whales that have been identified from the area, 14% had been seen in more than one season. A Cormack-Jolly-Seber model allowing for distinctiveness of individuals was used to calculate the Horvitz-Thompson population estimates at 1641 (SE=411.76) for 2004 and 1342 (SE=338.93) for 2005. The composition of the community seen in the study area differs from that of the predominantly cow-calf community encountered on the south coast nursery ground as only 25 individuals were encountered with a calf. Throughout the study right whales were most commonly encountered feeding (30% of all encounters) or in surface active groups (26%). A further 32% is attributed to resting and travelling (16% respectively). Notably in 2004 37% of encounters were thought to be of feeding whales with 21% of the encounters noted as that of surface active groups. Preliminary analyses of oceanographic stations taken when feeding right whales were encountered indicate that the copepods *Calanoides carinatus* and *Centropages brachiatus* are the dominant species in plankton assemblages that the whales are feeding on. At present southern right whale faecal samples are being analysed for the presence of these and other potentially important prey species.

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### Observations of the occurrence and movement patterns of bottlenose dolphins, *Tursiops aduncus*, and other delphinids, on the north coast of KwaZulu-Natal from incidental sightings.

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Five species of dolphin were sighted incidentally during a shore-based humpback whale migration survey, carried out at Cape Vidal, KwaZulu/Natal between June and October, 1988 to 1991. Indian Ocean bottlenose dolphins (*Tursiops aduncus*) were sighted most frequently during the study, followed by humpback dolphins (*Sousa chinensis*), spinner dolphins (*Stenella longirostris*), spotted dolphins (*Stenella attenuata*), and common dolphins (*Delphinus spp.*). The aim of this study was to investigate the occurrence and movement patterns of dolphins sighted incidentally on the north coast of KwaZulu-Natal, where, until recently, few dolphin-directed studies have been carried out. There were only enough data for bottlenose dolphins, for further analyses to be carried out. This analysis showed that ninety percent of bottlenose dolphin sightings were made within 1km from shore, equivalent to the 30m isobath. The dominant movement trend was northward travel, representing the majority of observations. Bottlenose dolphins moved in a consistent northerly/north-easterly direction along the coast throughout most of the daily observation period, and very few animals were ever observed travelling south. It is not possible to interpret or indeed verify the observed movement patterns without further data. A conservative speculation would be that, if we are indeed seeing a cyclic movement pattern, it may form part of a movement cycle which takes place on a small to medium spatial scale, with potential links to a diurnal pattern, possibly driven by foraging, or environmental factors.

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### Population ecology of southern elephant seals at Marion Island (1983-2000)

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In terms of demographics, southern elephant seals at Marion Island are globally among the most intensively studied marine mammals. A consistent mark-recapture program was initiated on this population in 1983. This has been maintained ever since with annual marking of weaned pups and regular resighting effort around the island. We here highlight some of the research that has been published over the past decade based on this mark resight data collected between 1983-2000. Some of the conclusions that have emanated are that survival in this species is sex-dependent. Survival is age-dependent during the first few years of life but plateaus once sexual maturity is reached. A comparison of survival during three population trajectories (declining, stable, increasing) demonstrated that adult rather than juvenile survival was the most instrumental parameter in governing population growth. Furthermore, limited support for density dependence in fecundity has been found. This was, however, confirmed in adult female survival, with a number of studies pointing to food limitation as the ultimate reason for a long-term decline in this population. In terms of reproductive costs, adult females primiparous at the different ages all had similar future fitness probabilities, yet a seasonal investigation of reproductive costs suggested that post-breeding survival of primiparous females was relatively low. Understanding the large scale mechanisms governing food resources of southern elephant seals remains a major challenge.

## Organ weights of three dolphin species from South Africa

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Data on organ weights are available for a number of baleen whale species from examinations carried out on whaling stations. In contrast, there is a lack of information on organ weights in small odontocetes. Such data can contribute significantly to the knowledge on the ecology of a species, and are increasingly important as baseline information to monitor disease related and other pathological changes. In the present study we examined organ weights from 724 common dolphins *Delphinus capensis*, 624 bottlenose dolphins *Tursiops aduncus*, and 145 humpback dolphins *Sousa plumbea* from the Port Elizabeth Museum marine mammal collection. These data originate from animals incidentally caught and drowned in the anti-shark nets off KwaZulu-Natal between January 1974 and August 2007. In common dolphins the heart was heavier in relation to body weight (females: 0.62%±0.09; males: 0.62%±0.11) than in bottlenose dolphins (females: 0.60%±0.11; males: 0.60%±0.17), while it was the lightest in humpback dolphins (females: 0.52%±0.06; males: 0.52%±0.09). Common dolphins also had the largest testes, making up 2.21% (±0.73) of the total body weight in adult males, while adult bottlenose dolphins showed a mean combined testis weight of 0.61% (±0.24). Humpback dolphins had the smallest testes in relation to body weight with 0.43% (±0.13). Heart weights in relation to body size may reflect the ability of the different species to travel long distances at high speed, while testis size in relation to group size is taken as an indicator of the

mating system of a species. Subsequently the above results reflect the different ecologies of the three dolphin species: common dolphins being oceanic, travelling long distances at high speeds in large groups of up to 500-1000 animals. Bottlenose dolphins form medium-sized groups, travelling considerable distances along the coastline, while humpback dolphins occur inshore in small groups and have a more localized homerange.

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## Killer whales at Subantarctic Marion Island

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Killer whales (*Orcinus orca*) have been opportunistically investigated at Subantarctic Marion Island since 1973 but systematic data collection was not initiated until 2006. Since 2008 dedicated shore-based observations have been conducted, collecting mainly photographic identification data. These data have shown that killer whales at Marion Island prey on elephant seals, fur seals and penguins (although other prey may be included in their diet) and that the inshore abundance of killer whales peaks in September to December and April to May, linked to the reproductive timing of seals and penguins. From nearly 10,000 photographs 37 individuals have been identified of which 7 have been classified as adult males, 22 as adult females, 5 as unknown age-sex class and 3 as calves. Mark-recapture analyses in the software program MARK indicate a population size of 42 (95% CI = 35-50) individuals. The advantages of dedicated versus opportunistic observation effort are hereby further highlighted. The prey, temporal occurrence and population size of the Marion Island population seem comparable to these aspects in killer whale populations at Subantarctic Îles Crozet and

Northern Patagonia, Argentina. These findings provide fundamental information necessary for the elucidation of killer whales' top-predator role in the Marion Island marine ecosystem and provide context for planned future studies at the Island.

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### Marine mammal research at the Department of Environmental Affairs

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The sub-directorate: Marine Biodiversity and Conservation of the Department of Environmental Affairs (DEA) conducts research on marine mammals that is important to the objectives of government. Most research is currently directed towards the Cape fur seal (*Arctocephalus pusillus pusillus*) but research and monitoring is also being conducted on cetacean species, including through collaborative projects. Broadly, research and monitoring effort can be broken down into the following areas of relevance: (1) population dynamics (including distribution and abundance), (2) feeding ecology and trophic interactions, (3) management of inter-specific interactions (seal-seabirds), (4) ecotourism, (5) stranding and disentangling. There is an emphasis on long term projects that have relevance to assessing effects of environmental changes on animal populations and ecosystems, and the use of biological measures to provide indicators of such changes or information otherwise useful for ecosystem-based management.

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### Individual variation in bottlenose dolphin ranges in Walvis Bay, Namibia. Implications for managing restricted areas.

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The population of bottlenose dolphins (*Tursiops truncatus*) in Walvis Bay, Namibia, is estimated to be between 71 and 122 individuals inhabiting a shallow 100km<sup>2</sup> bay. This small population lives in a restricted area and is potentially vulnerable to many threats, most of which are human-induced. Even relatively benign activities such as marine tourism are not without potential costs. The tourism industry in Namibia is large with approximately 25 tour boats operating around the bay and boat related harassment and resultant stress to the dolphins is a concern. Varied use of the Walvis Bay habitat by bottlenose dolphins includes some areas being used more for feeding and other areas more for resting. It has been proposed that an area used regularly for resting by bottlenose dolphins can potentially become an area protected from marine tourism. However, due to variation in individual ranging patterns and behaviour, the consistent use of the particular area may not apply to all individuals. This study therefore aims to determine the ranges of individual bottlenose dolphins within Walvis Bay and whether there is potential for demarcating a conservation area in which boat traffic could be restricted. A restricted area would be most beneficial if it protects areas in which the most impact-sensitive behaviours (e.g. resting) are performed. This work will extend previous research, but focuses on determining the proportion of individuals making use of the proposed resting area as well as identifying any other common areas of use by the animals. Boat based mark-resight surveys and photo-identification techniques used in conjunction with GPS locations will allow range plots for each individual using various methods for defining animal ranges and ArcGIS 9.3 software.

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### Cetacean Research at the Mammal Research Institute: An overview of past and current research

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Cetacean research has been undertaken at the Mammal Research Institute (MRI), of the University of Pretoria, since the 1970's, when opportunistic work on killer whales at Marion Island began. In 1984 the MRI Whale Unit was established in Cape Town, and is currently based at the Iziko South African Museum. More recently the MRI's cetacean research has branched out into Namibia, KwaZulu-Natal and Mossel Bay. Research is primarily on the ecology, population dynamics and behaviour of cetaceans, mostly in the waters of southern Africa, with the principal objective of providing information that will assist in their management and conservation, including investigating human threats such as tourism, aquaculture and coastal development. Cetacean research at the MRI has produced over 100 scientific papers, numerous popular articles, books, reviews, etc. and 15 post-graduate degrees. There are several ongoing programmes and international collaborations. Many projects run concurrently, using techniques such as photo identification of individuals (aerial and boat-based surveys), theodolite tracking, collection of skin and blubber (for DNA, toxicology, fatty acid, stable isotope and fungal analysis), prey analysis (faeces and zooplankton sampling), age determination, collection of oceanographic data, behavioural sampling, acoustics and dissections of stranded animals. An overview of past and current research projects will be presented.

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**Megaptera, an experience on cetaceans watching in Madagascar and Comoros archipelago since 1998**

**Michel Vély**<sup>1</sup>, M.Perri<sup>1</sup>, J.J. Bastid<sup>1</sup>

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MEGAPTERA ([www.megaptera.org](http://www.megaptera.org)) is a French nonprofit association, for the knowledge, observation and the conservation of marine mammals and the whale shark created in 1998 in Mayotte (Comoro archipelago, Mozambique channel). All MEGAPTERA members are voluntary. Our association has been operating on the east coast of Madagascar, in the Isle Sainte Marie channel and in the Comoro archipelago (Mayotte, Mohéli, Anjouan and Ngazidja). Our association develops mainly monitoring programs of humpback whales populations and marine mammals inventories in those areas based principally on whale watching cruises, support project for sustainable and equitable whale watching with fishers and in Comoros and with touristic operators in Mayotte and Madagascar and develop training, education and sensitizations programs targeting tourists, local authorities and local communities on marine mammals conservation. We now have a photo ID catalogue of more than 500 flukes and succeeded to demonstrate the matching of individuals within C3 (Isle Sainte Marie) substock and C2 (Mayotte and Mohéli) substock during the same year and different years and between C3 (Isle Sainte Marie) substock and C2 (Mayotte) substock on different years. Now Megaptera aims to operate on cruise ships and in other areas of the Western Indian Ocean, like Aldabra in Seychelles, the Madagascar West coast, and the Mascareignes islands. We develop off Mauritius a Sperm whale monitoring program based on Photo ID in and out water and on acoustics. We currently develop a program on the Development of Whale and Dolphin Ecotourism as Alternative Livelihood for Fishers in Rodrigues, in partnership with Shoals Rodrigues ([www.shoalsrodrigues.net](http://www.shoalsrodrigues.net)) and the Center for Dolphin Studies ([www.dolphinstudies.co.za](http://www.dolphinstudies.co.za)). MEGAPTERA is also providing some theoretical and practical training for Whale watching operators outside the western Indian Ocean as we did in Nouvelle Calédonie in 2009. Our chairman is a French delegation member of the

International Whaling Commission scientific committee.

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**I am interested in pursuing a Ph.D. or joining a long term project in Africa**

**Katja Vinding Petersen<sup>1</sup>**

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My name is Katja Vinding Petersen and I am interested in pursuing a Ph.D. or joining a long term project concerning marine mammals in Africa. I am originally from Denmark where I obtained my biology degree at University of Copenhagen, December 2007. In my presentation I will outline a suggested Ph.D-project as well as a brief overview of my competences and work experience through out my 10 years in the field of Marine Mammalogy. The aim of the suggested Ph.D-project is to obtain "A baseline study of the distribution of whales in the area from Danger point to Quoin Point, prior to the establishment of a Nuclear power station at Pearly Beach". ESKOM holdings, the main power suppliers in South Africa, are considering building a Nuclear power station at Bantamsklip, west of Cape Agulhas (Pearly Beach). The potential impact on the whales in the area is unknown and it is therefore important to monitor the behaviour of the whales prior to an establishment of a nuclear power station. Suggested methods: EAR, Hydrophone-array, D-tags and ID-catalogue. My main competence is sound recording and analysis. I have worked with killer whales (*Orcinus orca*), in Iceland, various fish species and harbour porpoises (*Phocoena phocoena*) in captivity, at the Fjord&Bælt Center, Denmark. Additional competences are photo-ID work, necropsies of stranded animals (from seals to baleen whales, countless harbour porpoises and dolphins), tracking D-tagged whales, diet analysis and producing film documentaries. I have extended experience as an educator and guide, e.g. through "Danmarks Akvarium" and as the leader of the educational department at Zoological Garden and at the Natural History

Museum of Denmark. I have been associated with Dyer Island Cruises since 2006.

I am very open towards feed-back of the suggested Ph.D-project as well as alternative projects -and I am looking forward to share.

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**Ecology of Fear: Marine Mammals and Great White sharks of Southern Africa**

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Fear can play a pivotal role for both predator and prey. For prey, fear can determine habitat selection, impact feeding rates, and modify group behavior. For predators, fear can reduce the catchability of prey, increase time devoted to foraging, and deplete prey availability. One of the most dominant predators associated with South African waters is the Great white shark (*Carcharodon carcharias*) and this pilot study aims to understand how fear may impact the behaviour of Great white sharks and their prey; Cape fur seals (*Arctocephalus pusillus*) and Indo-Pacific humpback dolphins (*Sousa chinensis*) in Gansbaai, South Africa.

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**Cetaceans and Dolphin Watching in Mauritius**

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In May 2007, MMCS launched a major scientific research project to assess the impacts of eco-tourism on the marine environment. The objective of this project was to achieve a sustainable cetacean watch and swim programme, which benefits the Mauritian economy, the tourist and the

environment. Concern that the Dolphin Watching Activity (DWA) was developing in an uncontrolled and unregulated environment prompted MMCS to look at the economics of the activity as well as the animals it relies on. While we have recordings of 11 cetacean species along the west coast the bottlenose and spinner dolphins (*Tursiops aduncus* and *Stenella longirostris*) are the focus of the dolphin watching activity. Each year some 77000 tourists participate in dolphin watching in Mauritius. On average 35 boats and 217 clients per day visit the dolphins, with each encounter lasting an average of 39 minutes. Almost 600 hours were spent at sea studying the population dynamics and behaviour of the dolphins with and without the boats. Initial analysis gives a bottlenose population of less than 70 animals and less than 500 spinner dolphins for this area of coast. While the bottlenose dolphins tend to be more opportunistic, the spinners prefer certain areas for specific activities. Group composition changes frequently between the bottlenose while the spinners have more stable groups. Although both species display some changes in behaviour and even avoidance of boats and swimmers under certain circumstances, whether the behavioural changes observed indicate disturbance and at what level remains unknown. There is not enough data yet to confirm negative impacts or reduced resource sustainability. Once statistical analyses of the data have been completed, the indications will be clearer. Future research should also help provide the information necessary to determine whether the DWA use of the dolphins can be sustainable and not negatively influence Mauritian cetacean biodiversity.

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### **Ethics as a way forward for dolphin-swim-with programs in the Indian Ocean**

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Dolphin EnCOuntours initiated Africa's first wild dolphin interaction facility in Ponta do Ouro (PDO) during the mid-90's, after regular visits to the area confirmed the residency of the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*). Following the global trend of 'swim with dolphin' programs, Ponta do Ouro was earmarked as a prime location to establish relations with this specific species. An initial baseline pilot study was undertaken to assess the frequency of cetaceans in the area and the sustainability of marine mammal based tourism opportunities. By the late 90's Dolphin EnCOuntours, under the guidance of various institutes and marine mammal experts, had developed an interactive marine mammal experience that balanced both humanity's need to interact with dolphins with the collection of baseline data on the various species encountered in the area. A combination of attitudinal and methodological elements to produce human behaviour that is consistent and predictable is advocated and taught. This brings benefits to both eco-tourism and research. Due to the 'reliability' of certain species in specific areas, many regions are gaining reputation for interactive marine megafauna encounters, with a focus on swimming with dolphins, whales, whale sharks and manta rays. Unregulated and unethical tourism practices have a negative effect on these special species and it is necessary that regulations be reviewed to cater for the inevitable encounters. Over the last 15 years an exponential growth in 'ocean safaris' and 'dolphin swims' is being noted within the Indian Ocean. Currently South Africa has a no swim policy however due to lack of policing it is happening regardless in those areas that are accessible. Kenya, Mozambique, Zanzibar, Seychelles and Mauritius partake in marine mammal tourism activities. Working within a framework of strict fieldwork ethics a way forward has emerged for swim-with dolphin-programs.

**Ocean Research Conservation Africa (ORCA) Foundation based in Plettenberg Bay, South Africa.**

Tracy E Meintjes  
ORCA Foundation PO Box 1812 Plettenberg Bay  
6600

The ORCA (Ocean Research Conservation Africa) Foundation is a Non-Government organization situated in Plettenberg Bay. ORCA was established to assess and monitor the condition of the bay for all marine species. Since 2007, sightings data of all encountered marine mammal species have been collected opportunistically. These include humpback dolphins (*Sousa chinensis*), humpback whales (megaptera novaeangliae), inshore bottlenose dolphins (*Tursiops aduncus*), common dolphin (*Delphinus sp*), Bryde's whale (*Balaenoptera edeni*), southern right whales (*Eubaleana australis*), and other seldom seen species. Data includes dates and times, photos for individual identification, GPS coordinates, species sighted, group sizes, and environmental data. Through collaborations with other scientific organisations, we aim to assist in collecting data that can be used to produce relevant findings regarding the marine mammals in our area. Data will continue to be collected through our volunteer program and with our affiliation with a permitted boat-based whale watching (BBWW) company (Ocean Blue Adventures).

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**Preliminary ideas towards an M.Sc. on the impacts of fishing on Marine Mammals in Southern Mozambique**

J. Newenham [jenny@biovista.co.za](mailto:jenny@biovista.co.za)

This serves as the first step towards investigating a M.Sc. on Marine Mammals in Mozambique. The initial idea is to focus on the possible impacts that the artisanal fishing activities have on the target species.

It is proposed that the study area be parts of the Ponta do Ouro Partial Marine Reserve (PPMR) and sections of Maputo Bay, located in Southern Mozambique. The PPMR is an

extension of the Maputoland Marine Protected Area in South Africa, (part of the Lubombo Transfrontier Conservation Initiative).

It is important that the study be of an applied nature; provide valuable support information to other initiatives in the region and help to conserve the target species and their associated ecosystems.

Possible target species include: Dugongs (although potentially too marginal a population); Indo-pacific Bottlenose dolphins and Indo-pacific Humpback dolphins.

The initial questions arising include: Are fishing activities having an impact on the target species? If so, how are they impacting? E.g.: are drag-netting actions compromising the sea grass beds (foraging areas of Dugongs)? Or are there direct impacts such as deaths or injuries to the target species? And assuming that there are impacts of some kind, how can they be mitigated or reduced?

The methodologies to be employed still require more detailed research before progressing to the next step.

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**Sperm Whale Underwater Monitoring Programme – Mascareignes Islands**

Fabrice SCHNOLLER Abyss Chairman  
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Abyss NGO Indian Ocean Sanctuary Sperm Whale Monitoring Program is an open source etho-acoustic data base. We use high definition cameras (60 pictures of 2 millions pixels by second) and professional hydrophones to collect observations.

They are stored and classified through three dimensions : visual obs, acoustic obs, individual identifications. The aim is to link these observations with multivariate statistical tools.

For example: does vertical posture of Sperm Whale correlates with overlapping codas?