

STATE OF THE CETACEAN ENVIRONMENT REPORT (SOCER) 2012

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INTRODUCTION

Several resolutions of the International Whaling Commission, including Resolutions 1997-7 and 1998-5, directed the Scientific Committee (SC) to provide regular updates on environmental matters that affect cetaceans. Resolution 2000-7 welcomed the concept of the State of the Cetacean Environment Report (SOCER) at the 52nd Annual Meeting in Australia and “request[ed] the annual submission of this report to the Commission”. The first full SOCER (SC/55/E7) was submitted in 2003 and subsequent editions continued a cycle of regional focuses encompassing the Mediterranean and Black Seas, the Atlantic, Pacific and Indian Oceans, and the Arctic and Antarctic Seas. Each SOCER also includes a Global section addressing the newest information that applies generally to the cetacean environment. **SC/64/E2** (SOCER 2012) focuses exclusively on the Indian Ocean (no Global section), summarising key papers and articles published from ca. 2010 through 2012 to date.

INDIAN OCEAN

General

Distribution modelling used to predict important areas for Oman cetaceans

Oman has one of the highest population growth rates in the world, with increasing anthropogenic activities in the coastal zone, including fishing activity, but little is known about the distribution of cetacean species throughout Omani waters. Therefore, a distribution modelling exercise for the coast of Oman, extrapolating sightings data coincident with oceanographic and topographic parameters, was undertaken to predict habitat use. There was a clustering of humpback whales along part of the Dhofar coast, which may warrant protection. This was a useful effort in a data-poor region.

(SOURCE: Corkeron, P.J., Minton, G., Collins, T., Findlay, K., Willson, A. and Baldwin, R. 2011. Spatial models of sparse data to inform cetacean conservation planning: an example from Oman. *Endang. Spec. Res.* 15:39-52)

Historical overview of the establishment of the Indian Ocean Sanctuary

The establishment of the International Whaling Commission’s Indian Ocean Sanctuary in 1979 is outlined by the author, who actively participated in the process. The problems that led to the consideration of establishing a sanctuary in these waters are discussed, as is the role of the Seychelles as a range state in taking the initiative. Also presented is the concept of an Indian Ocean Alliance for Conservation, considered at that time but ultimately abandoned. The author concludes that “[t]o this day there is, unfortunately, no comprehensive plan or authority for the conservation and the management of use of the marine life of the region as a whole”.

(SOURCE: Holt, S. 2012. Negotiating the Indian Ocean Whale Sanctuary. *J. Cetacean Res. Manage.* 12 (2))

International cetacean symposium on the Maldives issues declaration

The Indian Ocean Cetacean Symposium (IOCS) was held in July 2009 and issued the Lankanfinolhu (Maldives) declaration. The declaration, adopted by 60 delegates from 22 countries: calls for maintaining the Indian Ocean Sanctuary in perpetuity; urges efforts to protect all cetaceans and their habitats within the Exclusive Economic Zones of the respective countries; suggests that Indian Ocean coastal states promote implementation of the Convention on the Conservation of Migratory Species of Wild Animals (CMS); reminds parties to the Convention on Biological Diversity of commitments to protect at least 10% of all ecosystems, including marine and coastal waters; supports the wider adoption of responsible whale and dolphin watching guidelines; and encourages Indian Ocean states, in collaboration with the IWC and other relevant organizations, to develop an action plan to improve conservation outcomes for cetaceans in the IOC.

(SOURCE: http://ww.mrc.gov.mv/index.php/news_events/iocs_closing/)

New agreement on improving environmental management in the Western Indian Ocean

Ten East and Southern African nations have signed the “Protocol for the Protection of the Coast and Marine Environment of the Western Indian Ocean from Land-based Sources and Activities”. This includes the shorelines of Tanzania, Kenya, Mozambique, South Africa and Somalia, as well as the Seychelles, Comoros,

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Mauritius, Madagascar and Reunion-France. The amended convention, ratified on 31 March 2010 in Nairobi, Kenya, covers pollution from ship-based sources, dumping, land-based activities, transboundary movement of hazardous wastes and airborne sources. This is only the third marine area in the world to achieve a multilateral agreement on land-based impacts on the marine environment (after the Mediterranean and Wider Caribbean). It pledges to “conserve biological diversity and protect and preserve rare or fragile ecosystems, as well as rare, endangered or threatened species of fauna and flora”.

(SOURCE: News. 2010. *Mar. Pollut. Bull.* 60: 1150; News. 2010. *Mar. Pollut. Bull.* 60: 639; <http://www.unep.org/NairobiConvention/Publications/index.asp>)

Three areas in Bangladesh to be declared dolphin sanctuaries

The UNESCO-listed Sundarbans mangrove forest is home to large populations of Ganges River and Irrawaddy dolphins. Dozens of dolphins have died after entanglement in the fishing nets of tens of thousands of fishermen. Bangladesh will designate three river areas in its southwest as dolphin sanctuaries to protect the country’s endangered population of freshwater cetaceans.

(SOURCE: News. 2011. *Mar. Pollut. Bull.* 62: 2587; <http://www.iucn-csg.org/index.php/2012/03/01/three-new-wildlife-sanctuaries-for-ganges-river-and-irrawaddy-dolphins-declared-by-the-government-of-bangladesh/>)

Dolphin watching industry in Oman lacking current industry standards

Apart from a Ministerial decision (4/94) protecting cetaceans from consumptive use, there are no official guidelines in place for dolphin watching in Oman. Based on tourist questionnaires, the authors determined that the awareness levels of visitors were low and that they were largely unable to recognize poor boat handling techniques and inappropriate cetacean watching practices. Based on the potential for the dolphin watching industry to expand considerably in Oman, the author suggests introducing codes of conduct and/or accreditation or certification schemes for tour companies.

(SOURCE: Ponnampalam, L.S. 2010. Dolphin watching in Muscat, Sultanate of Oman: tourist perceptions and actual current practice. *Tour. Mar. Environ.* 7(1): doi: 10.3727/154427311X13038402065866)

Major new Marine Protected Area in the Indian Ocean

The Chagos Marine Protected Area (half-a-million-square kilometres) has been created in the middle of the Indian Ocean. Beyond protection for coral reefs, this initiative bans pelagic fisheries, including tuna fisheries. This area, 450 nautical miles in diameter, is considered to be the most important marine wilderness area in the Indian Ocean and doubles the no-take pelagic area in the world’s oceans. It is part of an initiative to also make MPAs no-take zones and marks a trend to consider ecosystem-scale protection as the best approach to ensuring the survival of all components of the ocean environment.

(SOURCE: Sheppard, C. 2010. Marine protected areas and pelagic fishing: The case of the Chagos Archipelago. *Mar. Pollut. Bull.* 60: 1899-1901; Nelson, J. and Bradner, H. 2010. The case for establishing ecosystem-scale marine reserves. *Mar. Pollut. Bull.* 60: 535-637)

International conventions identified as a strategy to protect marine ecosystem health in the Indian Ocean

Management and conservation efforts for small cetaceans in the Indian Ocean are “sorely lacking at the local, national and international levels”. The author calls for stronger incorporation of those international conventions whose overall goal is to “maintain the health and stability of the marine ecosystem”, specifically the Convention on Migratory Species and the Convention on Biological Diversity. They are “well placed to address issues of marine mammal by-catch and depredation in the Indian Ocean region”.

(SOURCE: Thomas, P.O. 2009. Assessing international priorities for marine mammal conservation. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Chemical pollution

Organic tins measured along the coast of India

The organotin compound tributyltin (TBT), used in antifouling paints, was analyzed near various ports along the coast of India. Many of the areas had contamination levels high enough to pose a risk to aquatic and benthic organisms. Although the International Maritime Organization (IMO) has totally prohibited the use of these compounds in antifouling paints, India currently has no water quality guidelines with respect to TBT or any legislation prohibiting the use of TBT-based paints on ship hulls. TBT can suppress the normal functioning of the immune system of mammals and has been implicated in health problems in cetaceans ranging from cytotoxic effects to increased susceptibility to infectious diseases.

(SOURCE: Garg, A., Meena, R.M., Jadhav, S. and Bhosle, N.B. 2011. Distribution of butyltins in the waters and sediments along the coast of India. *Mar. Pollut. Bull.* 62: 423-431)

Contaminated killer whales in the Indian Ocean

Despite the remoteness of Possession Island, Crozet Archipelago, contaminant levels from biopsy samples collected from killer whales inhabiting its waters in the southern Indian Ocean were high. “Over 70% of our study animals had PCB concentrations which exceeded a 1.3 mg/kg PCB threshold established for endocrine disruption and immunotoxicity in [pinnipeds],” according to the researchers (p. 196). The high levels of pollutants in the whale tissues led the authors to conclude that “contaminants cannot be excluded as a possible risk factor in the decline of this population” (p. 201).

Total TEQ: 76.45 ± 5.00 (juvenile female); 44.24 ± 8.37 (adult female); 109.02 (male)

Maximum contaminant levels (lipid weight): PCB: 20.5 mg.kg⁻¹; PCDD: 77.1 ng.kg⁻¹; PCDF: 36.1 ng.kg⁻¹

(SOURCE: Noël, M., Barrett-Lennard, L., Guinet, C., Dangerfield, N. & Ross, P.S. 2009. Persistent organic pollutants (POPs) in killer whales (*Orcinus orca*) from the Crozet Archipelago, southern Indian Ocean. *Mar. Environ. Res.* 68: 196-202)

Habitat degradation

General

Ganges River dolphin distribution and river flow rates

A survey and analysis of Ganges River dolphin distribution found that changes in river flow rate caused by dams and barrages could impact the species. The survey was conducted along 332 km of the flow-regulated Gandak River, India (in the Ganges River basin). Dolphins were sighted in 40% of the river segments surveyed, with an estimated population of 257 (range 250-267) animals. Dolphin distribution was affected by river depth and presence of meanders in the river. Moreover, distribution corresponded closely with gillnet fishing and there may be conflict for diminishing fish resources. Minimum channel depth at which dolphins were found ranged from just over 2 m (for females with calves) to just over 5 m. As river flow was reduced, dolphins were more often clustered in pools and were absent in sections of the river that had low flow rates/shallow depth. Females and calves may be particularly vulnerable when river flow is reduced by dam systems, as they tend to inhabit shallower channels. The researchers concluded that “these results suggest that local and landscape-level alteration of river flows in the Gangetic basin can have serious impacts on river dolphins, and support the need for [river flow rate management] for their conservation” (p. 23).

(SOURCE: Choudhary, S., Dey, S., Sagar, V., Nair, T and Kelkar, N. 2012. River dolphin distribution in regulated river systems: Implications for dry-season flow regimes in the Gangetic basin. *Aq. Conser.* 22: 11-25)

Cetaceans in Pakistan

Twelve species of cetaceans are reported from Pakistani waters. Close work with fishers helped identify entanglement in fishing gear (in light of major recent increases in fish exports by Pakistan) and opportunistic exploitation for use as food, bait or medicine as two major threats to local cetaceans. Additional issues along Pakistan’s 1,050 km of coastline include very high levels of chemical pollution near Karachi and the ship-breaking area of Gadani. The paper outlines a comprehensive project incorporating policy development, the preparation of a marine cetacean biodiversity action plan, the designation of a Marine Protected Area in Balochistan, the establishment of a national whale and dolphin conservation society, and trials of whale and dolphin watching.

(SOURCE: Gore, M.A., Kiani, M.S., Ahmad, E., Hussain, B. Ormond, R.F., Siddiqui, J. Waqas, U. and Culloch, R. 2012. Occurrence of whales and dolphins in Pakistan with reference to fishers’ knowledge and impacts. *J. Cetacean Res. Manage.* 12 (2))

Potential environmental threats to whales in the Savu Sea, Indonesia

The Savu Sea in eastern Indonesia is the crossroads between two oceans and thus an important habitat for cetaceans. Efforts are being made to protect such migratory bottlenecks/marine corridors in the framework of MPAs. For example, the Dampier Strait MPA (Raja Ampat, Papua Barat, Indonesia) has recently been expanded from ca. 46,000 to 302,00 hectares. The Savu Sea study area is also traversed by two major shipping channels. The author identified this as an “unknown but possibly significant threat to large cetaceans”, as is the common practice of reef bombing. A multi-year visual and acoustic survey and research program in the Savu Sea followed a tagged blue whale; the high proportion of time this animal spent on the surface at night implied increased vulnerability to offshore gillnets and long-lines. There is also intensive whaling pressure for sperm and baleen whales by traditional whaling communities in Lamalera, Lambala Island.

(SOURCE: Kahn, B. 2009. Blue whales of the Savu Sea, Indonesia AND Kahn, B. 2009. Deep-sea yet nearshore cetacean habitats within the Marine Protected Area networks of Indonesia: Managing critical habitats for migratory and oceanic whale species. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Indus delta Indo-Pacific humpback dolphin population in Pakistan faces several threats

A 4-year survey (2005-2009) showed that the Indus delta was a very important habitat for Indo-Pacific humpback dolphins. The threats identified were “increasing competition for food resources, by-catch, boat strikes, deforestation, pollution and increasing marine traffic”. The authors call for “a sound conservation and management strategy which will also help fulfil the national conservation strategy of Pakistan”.

(SOURCE: Kiani, M.S., Gore, M. and Siddiqui, P.J.A. 2009. Photo-identification mark-recapture studies on Indus delta Indo-pacific humpback dolphins of Pakistan. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Cetaceans in India

Twenty-five cetacean species have been recorded to date from Indian waters. The main threats to their survival are identified as fisheries interactions, domestic consumption (*e.g.*, a lower estimate of 2000 cetaceans caught per year in Malpe) and pollution. The authors identify a failure to develop a professional approach to cetacean research and conclude that the above threats are compounded by the lack of quality information to inform management. A first step is taken by summarizing over 2000 records to propose an inventory by state and identifying the level of data available (in five categories) for the respective species and/or areas.

(SOURCE: Kumarran, R.P. 2012. Cetaceans and cetacean research in India. *J. Cetacean Res. Manage.* 12 (2))

Ganges River dolphin under threat

The Ganges River dolphin is highly threatened in the Brahmaputra River system due to fisheries bycatch, poaching for their oil, habitat degradation and proposed seismic surveys related to oil prospecting. Approximately 240-300 of the total population of this species (2000 individuals) inhabits the Brahmaputra system. Research conducted by the IUCN identified eight river sections as potential protected areas to save the dolphins.

(SOURCE: News. 2011. *Mar. Pollut. Bull.* 58: 1424; Wakid, A. and Braulik, G. 2009. Protection of endangered Ganges River dolphin in Brahmaputra River, Assam, India. Final technical report to Sir Peter Scott Fund, IUCN, 44 pp.)

Cetaceans in Sri Lanka

Twenty-seven species of cetaceans have been recorded in Sri Lankan waters. Small cetaceans, however, are increasingly threatened due to the developing fishing industry, with bycatch being the key concern. Direct takes of small cetaceans by hand-held harpoons is also on the increase. The author identifies increasing shipping traffic and unregulated marine tourism as additional threats. Several large whales have been killed by ship strikes in recent years, and no specific regulations are in place to control or monitor whalewatching. Despite national legislation that protects cetaceans, implementation of the relevant laws and conservation efforts are hampered by resource constraints.

(SOURCE: Ilangakoon, A. D. 2012. A review of cetacean research and conservation in Sri Lanka. *J. Cetacean Res. Manage.* 12 (2))

Threats to cetaceans along coast of Balochistan, Pakistan

A large proportion of stranded dolphins along the coast of Balochistan show signs that cause of death was interaction with fisheries. The author identifies two other main threats: shark fishing because fishermen use cetaceans as bait, and biotoxins from plankton blooms associated with the upwelling of nutrient-rich waters.

(SOURCE: Rahim, A. 2009. Stranding status and threats to cetaceans at coast of Balochistan. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Poor prognosis for the Arabian Gulf

The Arabian or Persian Gulf has experienced substantial changes to its marine habitats, leading to a poor prognosis for the Gulf to continue to provide abundant natural resources. The combination of anthropogenic disturbances (*e.g.*, coastal development, overfishing), outside disturbances (*e.g.*, seawater warming) and poor cross-border and intra-country collaboration have severely impacted numerous benthic habitats, ecosystems and species groups. This has implications for many coastal cetaceans, which have distinct home ranges restricting their ability to move to alternative habitats. The status of cetaceans is poorly known in the Gulf, but marked

declines have been reported for dolphins in the United Arab Emirates, for example. One explanation advanced for mass die-offs of dolphins is a reduction of prey species and changes associated with anthropogenic alteration of habitats.

(SOURCE: Sheppard, C. *et al.* (24 co-authors). 2010. The Gulf: A young sea in decline. *Mar. Pollut. Bull.* 60: 13-38)

Fisheries

High proportion of bycatch in 10-year survey in Tanzania

In a report by the marine mammal research group established in Zanzibar, Tanzania, in 1999, 235 bycaught and stranded animals (whales, dolphins, and dugongs) were examined in a 10-year period. Of these, 210 (91%) animals were bycaught. The authors identify the bycaught animals as stemming from drift and bottom-set gillnets, suggesting fisheries are a threat to cetaceans here.

(SOURCE: Amir, O.A., Berggren, P. and Jiddawi, N.S. 2009. Records of marine mammal species in Tanzania after 10 years of research. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Fishing techniques with no bycatch cited as one reason for cetacean abundance in the Maldives

Most forms of fishing with nets, including gill-netting and purse seining, are banned in the Maldives to protect traditional pole and line tuna fishing. The authors attribute the rich cetacean community here (23 species and considerably higher acoustic detection and sightings rates than in the eastern Indian Ocean) to the favourable habitat and to the no-bycatch fishing techniques practiced in these waters.

(SOURCE: Clark, R.A., Johnson, C.M., Johnson, G., Anderson, R.C., Payne, R., Kerr, I., Godard, C.A.J. and Madsen, P.T. 2009. Cetacean sightings and acoustic detections in the offshore waters of the Maldives during January-March of 2003 and 2004 AND Anderson, R.C., Sattar, S.H. and Adam, M.S. 2009. Cetaceans in the Maldives – A review. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Seychelles takes an active approach to southwest Indian Ocean regional cooperation on cetacean research

The Seychelles has made human-cetacean interactions a national priority. This involves hosting an international workshop on shark and cetacean depredation of long-lines in 2007 under the umbrella of the IOTC (www.iotc.org). Research on cetacean depredation of long-lines is ongoing, pointing to the significance of cetacean interactions with fisheries here, with potential negative repercussions to both cetaceans and the industry.

(SOURCE: Gendron, G., Rowat, D., Lucas, V., Vely, M. and Giroux, F. 2009. Cetacean studies and conservation in Seychelles: Country report. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

High levels of depredation in the Seychelles

The overall depredation rate of the semi-industrial swordfish and tuna fishery in the Seychelles was estimated to be 21%, one of the highest loss rates in the world. Sharks and several species of cetaceans were identified as potential culprits. This depredation entails considerable economic losses. Worldwide, such losses prompt actions by fishers against cetaceans. In order to avoid this, an action plan was drawn up, including the testing of two different types of mitigating devices. Neither proved successful, prompting future testing of an improved model.

(SOURCE: Lucas, V., Rabearisoa, N., Giroux, F., Vely, M., Rowat, D., Gendron, D., Tixier, D., SAdam, O. and Guinet, C. 2009. Mitigating depredation in the Seychelles' semi-industrial longline fishery. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Scarring from fishing gear on endangered Arabian Sea population of humpback whales

The IUCN Red List has recently classified the Arabian Sea subpopulation of humpback whales as Endangered. A survey off the coast of Oman yielded estimates here of less than 100 individuals. Based on the analysis of scarring on the caudal peduncle region, 30%-40% of these animals "are likely to have been involved in entanglements with fishing gear". Although this value is lower than reported elsewhere (Gulf of Maine humpbacks or North Atlantic right whales), the authors conclude that, when viewed in relation to the stock's isolated status and low population estimates, "this entanglement rate may represent a significant threat". Considering Oman's rapidly developing economy and infrastructure, much of it focused on coastal and marine areas, the authors reiterate calls for research, management and conservation efforts to protect this stock.

(SOURCE: Minton, G., Collins, T., Findlay, K., Ersts, P., Rosenbaum, H., Berggren, P. and Baldwin, R. 2011. Seasonal distribution, abundance, habitat use and population identity of humpback whales in Oman. *J. Cetacean Res. Manage. (special issue)* 3: 185-198)

Stomach contents reveal potential fisheries interactions with dolphins

The examination of three species of stranded dolphins along the Oman coastline – 11 bottlenose dolphins, 5 Indo-Pacific humpback dolphins and 2 spinner dolphins – revealed that all three were feeding in areas where artisanal and/or commercial fishing occurs. Although only a small percentage of the prey items in the stomachs were of commercial interest (pointing to little or no direct competition between fisheries and these cetaceans), the authors concluded that “a number of animals examined in this study showed signs of mortality due to fisheries interaction, indicating that these dolphins still face significant risk of incidental capture from feeding in the same highly productive areas where fishing occurs”.

(SOURCE: Ponnampalam, L.S., Collins, T.J.Q., Minton, G., Schulz, I., Gray, H., Ormond, R.F.G. and Baldwin, R. M. 2012. Stomach contents of small cetaceans stranded along the Sea of Oman and Arabian Sea coasts of the Sultanate of Oman. *J. Mar. Biol. Assoc. U.K.* doi: 10.1017/S0025315411002104)

Directed takes

High levels of dolphin hunting in Madagascar

In southwest Madagascar, traditional fishermen hunt coastal dolphins for local consumption and sale of meat. An interview survey indicated that about 6,000 dolphins (mostly spinner, Indo-Pacific bottlenose and Indo-Pacific humpback dolphins) were killed from 1985-2000; in addition, a drive hunt of 100-200 spinner dolphins was observed in 2005. A similar survey in an area where no hunts take place showed a dramatic difference in group sizes and encounter rates of humpback dolphins. In response, the authors initiated an education and awareness-raising program along with a series of stakeholder workshops, resulting in a stakeholder association explicitly devoted to cetacean conservation. MPAs are being considered as a further strategy.

(SOURCE: Cerchio, S., Andrianarivelo, N., Mendez, M., Razafindrakoto, Y. and Rosenbaum, H.C. 2009. Coastal dolphin hunting in Madagascar: Status of populations, human impacts and conservation actions. Indian Ocean Cetacean Symposium, Maldivian Marine Research Centre website: www.mrc.gov.mv)

Disease and mortality events

Dolphin mass strandings in Iran

Two mass mortality events involving at least 152 small cetaceans occurred in southern Iran in 2007. The first event involved 79 spinner dolphins, which drifted ashore along 13 km of coastline within about 24 hours. This led the authors to interpret this mortality to have been caused by a single acute event at sea. This event was “spatially and temporally coincident with an active fishing ground, and other potentially bycaught and discarded species were found on the beach”. The authors also found traumatic injuries. Since they were able to exclude a Harmful Algal Bloom (HAB) and found no evidence of chemical or oil pollution, as well as no indications of seismic surveys or military exercises, they hypothesize that it was caused by fishing operations.

(SOURCE: Braulik, G., Savadkouhi, O.S., Fadakar, S., Mohammadi, H., Brownell Jr., R.L., Reeves, R.R., Nabavi, M.B. and Fernandez, A. 2010. A retrospective investigation of two dolphin mass mortality events in Iran, autumn 2007. *Zoology in the Middle East* 49: 13-26)

Unusual mass stranding of spotted dolphins on the coast of Pakistan – a military exercise link?

A mass stranding of pan-tropical spotted dolphins (200–250) occurred on 6 March 2009 on Gaddani Beach (25°09.024'N 66°44.298'E) on the Balochistan coast of Pakistan, approximately 50 km northwest of Karachi. Animals began to strand at about 1000 hours and continued until 1400 hours, although some animals stranded on the following day (7 March). This is the first record of this species from the coast of Pakistan, and the largest mass stranding recorded of this species by an order of magnitude (three strandings of 3-11 animals have been reported from Florida and one of 13 animals occurred in Western Australia). A multi-national naval exercise (20+ warships from the US, UK, France and Australia; AMAN 09) was conducted in Pakistan waters between 5 March and 14 March, and its commencement in Karachi coincided with the onset of the mass stranding. Therefore, data on warship location and sonar use/noise production must be analysed before military exercises can be ruled out as the cause of this unusual mass stranding.

(SOURCE: Kiani, M.S., Iqbal, P. & Siddiqui, J.A. 2011. First confirmation of occurrence of the pan-tropical spotted dolphin, *Stenella attenuata*, in Pakistani waters through a mass stranding event. *Mar. Biodivers. Rec.* 4(e60): 1-3 (doi:10.1017/S1755267211000601)

Antibiotic-resistant pathogens indicate heavy pollution with sewage

Bacterial samples taken from the water and sediment in three coastal areas in southern India show a high frequency of resistance to antibiotics. This indicates that the coastal environment is highly exposed to antibiotic sources, apparently through sewage. This widespread occurrence of pathogenic pollution indicators and antibiotic-resistant microorganisms would lead to a water quality classification of E (= very poor) according to the World Health Organization. The bacteria examined (*E. coli*, *Salmonella*, *Vibrio*, *Enterococcus*) can have a pathogenic effect on humans and include forms that are known to impact cetaceans.

(SOURCE: Vignesh, S., Muthukumar, K. and James, R.A. 2012. Antibiotic resistant pathogens versus human impacts: A study from three eco-regions of the Chennai coast, southern India. *Mar. Pollut. Bull.* 64: 790-800)

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Appendix 1

GLOSSARY

Species glossary

Bottlenose dolphin	<i>Tursiops</i> spp.
Ganges River dolphin	<i>Platanista gangetica gangetica</i>
Humpback whale	<i>Megaptera novaeangliae</i>
Indo-Pacific humpback dolphin	<i>Sousa chinensis</i>
Indo-Pacific bottlenose dolphin	<i>Tursiops aduncus</i>
Irrawaddy dolphin	<i>Orcaella brevirostris</i>
Killer whale	<i>Orcinus orca</i>
Pan-tropical spotted dolphin	<i>Stenella attenuata</i>
Spinner dolphin	<i>Stenella longirostris</i>
Tuna	<i>Thunnus</i> spp.

Glossary of terms

Benthic: Of or related to the bottom, particularly the bottom of the ocean.

Butyltin: A toxic chemical commonly used in anti-fouling paints on ship hulls (as tributyltin or dibutyltin, a break-down product of tributyltin).

Cytotoxic: Toxic to cells.

Depredation: A predatory act; in the context of fisheries, the taking of fish from fishing gear by predators such as cetaceans.

***E. coli* (*Escherichia coli*):** A bacterium present in the human digestive tract that, when found in a water body, indicates human fecal contamination and can cause infections such as gastroenteritis and other illnesses.

Endocrine system: A system of ductless glands producing hormones that control and moderate metabolic processes in the body.

Endocrine disrupter: Any outside substance (chemical) that interferes with an organism's endocrine system.

***Enterococcus*:** A bacterium present in the human digestive tract that, when found in a water body, indicates human fecal contamination and can cause urinary tract infections, bacteremia, bacterial endocarditis, diverticulitis and meningitis.

Immunotoxic (immunotoxicity): Toxic to the immune system, caused by exposure to a chemical.

IOTC: Indian Ocean Tuna Commission

IUCN: International Union for Conservation of Nature.

Lipid weight: A basis of measurement whereby concentrations of a substance are compared to the lipid (fat) content of a material.

Mitigating device: A means of alleviating or reducing a concern or threat

MPA: Marine Protected Area.

Organotin: Organic chemicals containing tin.

Pathogenic: Capable of causing disease.

PCB: Polychlorinated biphenyls (209 different forms containing differing numbers of chlorine atoms arranged in various positions on the aromatic rings) are industrial organochlorines manufactured for use in electrical transformers and other applications. These man-made chemicals do not occur naturally and all traces reflect pollution. PCB (CB-154) is 2,2',4,4',5,5' - hexachlorobiphenyl, one of the most prevalent PCB congeners.

PCDD: Polychlorinated dibenzodioxins (also simply dioxins) are a group of organic polyhalogenated compounds that are significant environmental pollutants.

PCDF: Polychlorinated dibenzofurans are a group of halogenated organic compounds that are significant environmental pollutants.

Salmonella: A pathogenic genus of bacteria responsible, for example, for typhoid fever, paratyphoid and foodborne illness.

TBT: Tributyltin, a form of butyltin.

TEQ: Toxicity equivalent

Vibrio: A pathogenic genus of bacteria responsible, for example, for cholera (*V. cholerae*) and other illnesses.