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Acoustic and visual observations of Sperm Whales, *Physeter macrocephalus*, off the Southeast Coast of Sri Lanka, April 2013

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Abstract An opportunistic study was carried out from a 113' motor-sailing vessel along the southeast coast of Sri Lanka from April 11 to 19, 2013. Passive acoustic monitoring allowed pods of sperm whales (*Physeter macrocephalus*) to be detected and tracked before being sighted. Key observations included sightings of whales along the 1000 m drop-off, repeated breaching of whales on two separate occasions within 50 m of a driftnet, and the presence of a single bull male with mating-related behaviour and jaw-clapping. These observations and other visual observations during the ship's voyages indicate that sperm whales are located in Sri Lanka waters for feeding, breeding and calving.

Keywords: Bull, Calves, Clang, Driftnet, Jaw Clap

1 Introduction

From 1982 to 1984, a dedicated study was carried out in Sri Lankan waters to study the distribution and behaviour of sperm whales using benign techniques (Gordon 1987, Whitehead 1990). The methods pioneered then were further developed and applied successfully by scientists around the world, but further research of this type was not carried out in Sri Lanka due to many reasons including the civil war (1983 to 1990). Nevertheless, the studies conducted before and after the civil war confirmed that sperm whales, *Physeter macrocephalus*, have been sighted around Sri Lanka feeding and with calves during the NE and SW monsoon (Gordon 1987, Whitehead 1990, de Vos *et al.* 2012, Ilangakoon 2012a, Priyadarshana 2016).

The Indian Ocean Sanctuary (Figure 1) was established in 1979 by the International Whaling Commission to prohibit whaling and to allow long-term studies of marine mammals. Although the sanctuary remains in effect, threats to marine mammals off Sri Lanka include entanglement in drift nets, ship strikes and underwater noise such as seismic surveys for oil and gas exploration (Alling 1988, Broker and Ilangakoon 2008, NARA 2009, Ilangakoon 2012a, Ilangakoon 2012b). While current data is inadequate

to assess the impact of these activities on marine mammal populations, a combination of past data and current scientific efforts suggest that these threats are cause for great concern (de Vos *et al.* 2013, Randage *et al.* 2014, Priyadarshana *et al.* 2016).

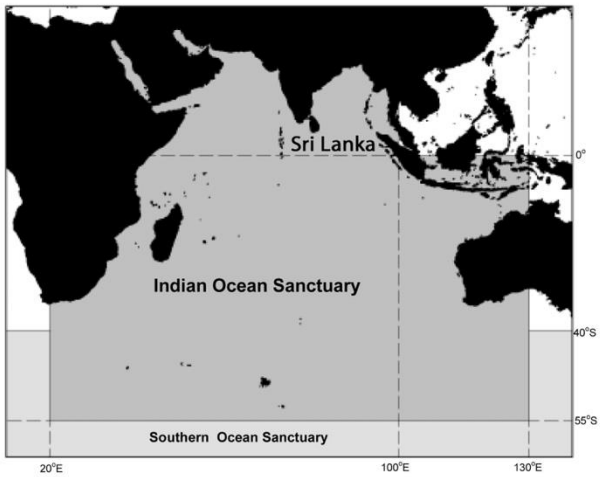

Fig. 1: Map of the Indian Ocean Sanctuary (IFAW 2002)

Globally, hundreds of thousands of marine mammals are caught by accident annually in fishing equipment (Read *et al.* 2006). An IUCN (2012) report considers the top threat to Mediterranean cetaceans as driftnet by-catch. It was estimated that over 30,000 cetaceans were caught as by-catch in gill or leila nets in Sri Lankan waters in the early 1980's (Alling 1988). This prompted the National Aquatic Resources Agency to declare the by-catch of marine mammals illegal in 1996, but, unfortunately, it did not stop the unintended entanglement, which resulted in clandestine catches that fishermen would not declare for fear of legal action. Additionally, some fishermen developed a palate for cetacean meat and found it good for shark bait as well, which then resulted in a directed fishery for dolphins using harpoon and dynamite (Ilangakoon 2002, Mohan 2013). While smaller cetaceans are most heavily impacted by by-catch, large whales can also become entangled in nets. There also appears to be a growing awareness that ambergris, unique to sperm whales, is a valuable substance. For example, on May 20, 2014, a dead 16m female blue whale floated into Midigama Bay and was cut open by a fisherman looking for ambergris (Randage *et al.* 2014).

Ship strikes are a global problem and a significant threat to whales worldwide, particularly to small or isolated populations (Laist *et al.* 2001). One of the busiest shipping lanes in the world is located off the southern coast of Sri Lanka (Leaper 2011, Priyadarshana *et al.* 2015). The passage of these ships is usually between the 200m to 3,000m depth contours, which marks the continental drop-off where sperm whales have been observed moving parallel to the coast (Gordon 1987). Sperm whales were seen off the Southern coast of Sri Lanka during a 2013-2015 study to assess the distribution of marine mammals in the Southern shipping lane (Priyadarshana *et al.* 2016). During the final year of this study, and as *Mir* was departing Mirissa Harbor for

Singapore on April 22, 2015, the crew of *Mir* encountered a pod of sperm whales moving from east to west along the shipping lane spanning an area greater than our sight at deck level, or about 3 miles (Alling 2015). They were clustered in small groups, some with calves, and all were moving consistently as a single large group. Our visual assessment, as we motored east, and away from the shipping lanes was that this may have been a super pod of more than 100 individuals because the numbers of whales kept appearing on the horizon as we moved away.

At the time of the study, seismic activity for oil and gas exploration had commenced in the Gulf of Mannar, and was earmarked for development in Sri Lanka which was noted to be harmful to sperm whales and marine mammals, in general (NARA 2009). All of these activities were underway with little or no assessment of the impact on the sperm whale population, nor is there adequate information about the population size, distribution and behaviour of the Sri Lanka sperm whale population.

This paper reports on several key sperm whale observations made in 2013 with the aim of encouraging further studies of this endangered species and addressing these numerous conservation issues.

2 Material and Methods

An opportunistic study was undertaken on a 113' motor-sailing vessel, named '*Mir,*' to search for sperm whales along the southeastern coast of Sri Lanka from April 11-19, 2013 (Figure 2).

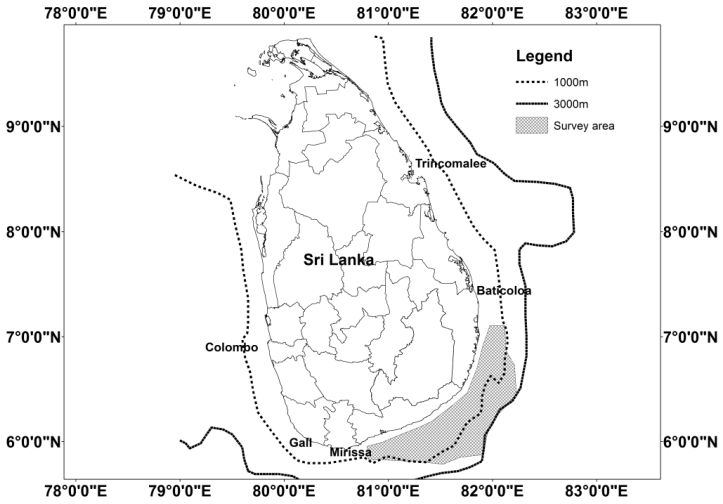

Fig. 2: Survey Area during the sailing ship *Mir's* voyage, April 11 to April 19, 2013

The vessel left Galle Harbor on 11 April and headed along the Southeast coast until the ship had to return back to port on the evening of 16 April due to rough seas and high winds, arriving safely back to Mirissa Harbor on 19 April 2013. A crew of six operated the vessel and carried out a visual and acoustic survey daily from 0800 to sunset 1800.

2.1 Passive Acoustic Monitoring (PAM)

A Vanishing Point Marine towed hydrophone with a 200m cable length was used for passive acoustic monitoring (PAM). The hydrophone streamer consisted of four hydrophones (two Benthos AQ4 for low frequency and two Magrec HP03 for mid frequency) and Magrec HP02 preamplifiers. Output from the hydrophone was amplified and filtered using a Magrec HP27 amplifier before being sampled with a "Fireface 400" sound card. "PAMguard" software was used to visualize and record the data.

Every 30 minutes, the hydrophones were monitored for 5 minutes and recordings were made when clear cetacean vocalizations were heard. The PAMguard software calculated the location of the source of the sounds by comparing the inputs from the different hydrophones spaced along the streamer and together with a GPS input gave a bearing and distance to the source, the sperm whales. These bearings were followed to locate the whales for visual confirmation. In rough weather, and when approached by other vessels, the hydrophone was brought out of the water.

2.2 Visual Observation

A helmsman, positioned just off-center on the port side of the vessel aft of mid-ship was on the ship deck at all times and scanning ahead of the beam. When cetaceans were audible by the PAM system, a second observer was stationed on the bow and or on a 3m ladder to look for blows. A third person was called to monitor the PAM system to provide direction for the helmsman to steer. For each sighting, a fourth person recorded the time, latitude and longitude, species, number of individuals, and behavioural observations were noted. A fifth person was stationed on the bow with a camera to photograph the whales for positive identification and to illustrate notable behaviour.

3 Results and Discussion

3.1 Passive Acoustic Monitoring (PAM)

The percentage of monitoring stations at which cetaceans were heard during daylight hours is shown in Figure 3. Sperm whales were heard 33% of the time, dolphins were heard (both clearly and faintly) 24.7% of the time, other ship engines were heard 3.7%

of the time, and 40.4% of the time nothing was heard. These acoustic findings represent what we could hear while searching or following sperm whales and are included as an index for marine mammal or ship abundance.

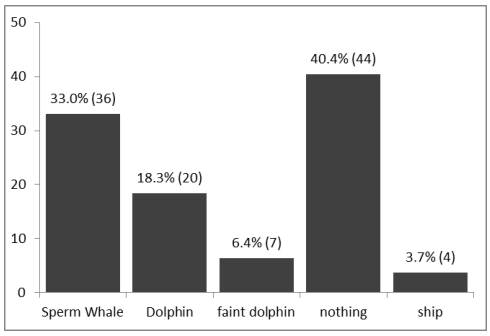

Fig. 3. Chart of the percentage of time different cetaceans were heard during the acoustic survey

PAM enabled the survey team to track sperm whale pods during dives and identify the specific call of a large bull sperm whale before the male was sighted visually. This method is an effective way to track sperm whales to carryout behavioural studies, arrive at population estimates (Gordon 1987, Whitehead 2003, Lewis *et al.* 2007), and understand their distribution (Leaper *et al.* 2000).

3.2 Visual Observations

Figure 4 shows the locations of visual (marked by a circle) and acoustic detections (marked by a cross) of sperm whales.

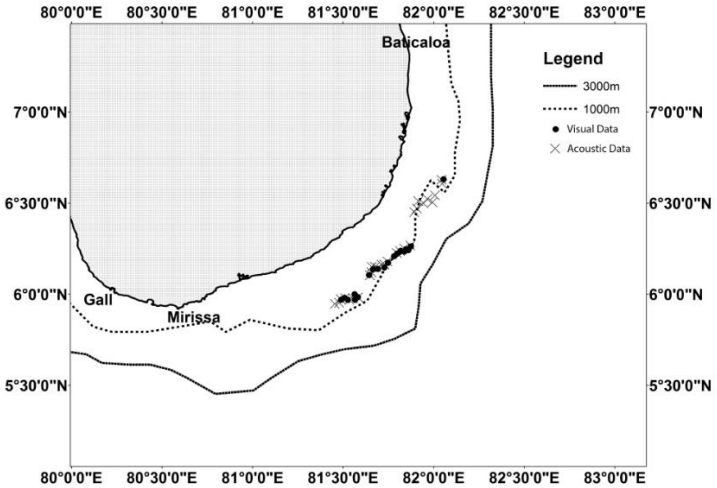

Fig. 4. Map of acoustic and visual data locations off the Southeast coast of Sri Lanka

On both April 12th and April 15th, the whales were tracked acoustically heading Northeast (NE) before being sighted. On April 14th passive acoustic monitoring (PAM) and visual observations were used to follow the sperm whales for 11 hours heading NE. On April 16th, a pod was followed Southwest (SW) using the PAM system even though no whales were sighted. All whale detections were close to the 1000m depth contour.

3.3 Behavioural Observations

Figure 5 illustrates locations and photographs of behavioural observations.

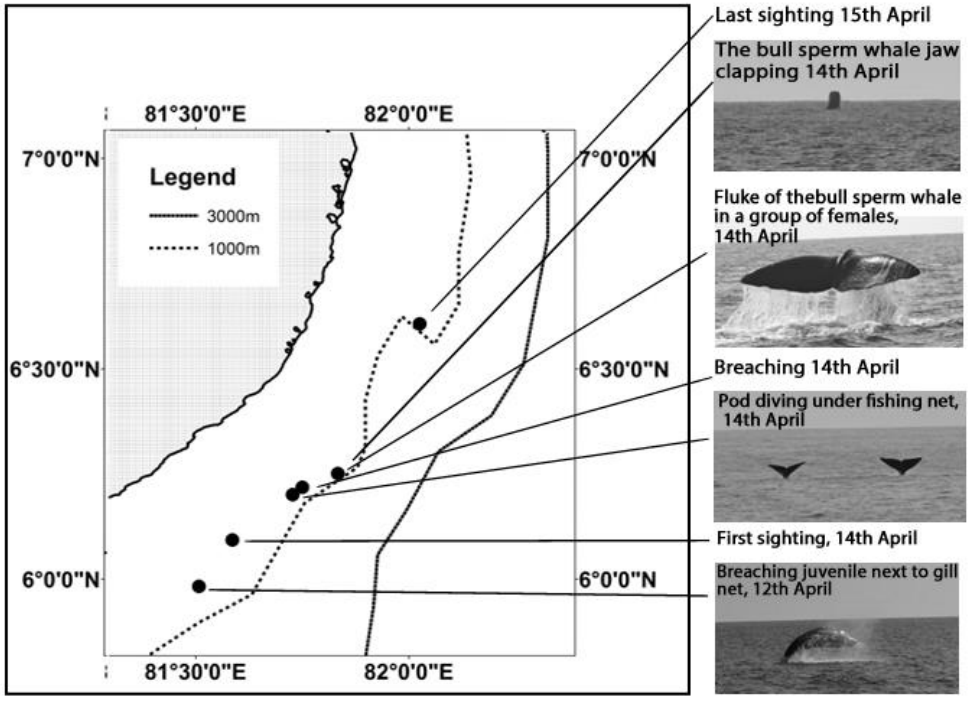

Fig. 5: Location of behavioural observation notes of sperm whales on April 12 and 14, 2013

Following observations were made in April, 2013 (Figure 5):

April 12th. A group of sperm whales, estimated at 35 individuals, was first heard and sighted at 09:16 and followed through the whole day. At 16:26 two juveniles were observed breaching repeatedly on either side of a drift net, while the rest of the pod dove under and resurfaced on the other side.

April 14th. Sperm whales were sighted, heard and tracked starting at 06:29. At 07:45 distinctive slow "clang" click trains were heard and a pod of sperm whales were seen in the distance. At 11:50 a group of four individuals fluked and dove in unison just

before reaching a long (approximately 2 km) driftnet and were seen surfacing on the other side. At 12:44 a breach was observed in that area.

Clangs became louder through the day and at 15:31 a large male was sighted with a group of smaller whales. Whales were observed rubbing, swimming on sides, lob tailing and breaching. The interaction lasted around one hour before the smaller whales (probable females although we were not able to verify the sex) fluked and dove, traveling west. The large male dove last and was observed one more time at 16:03 rising out of the water while jaw-clapping about 800m to the south. *Mir* remained with the group of about 7 females that moved slowly at the surface until 17:15 when the survey stopped at dusk.

April 15th. At 12:45 sperm whales were heard, but they were travelling quickly making visual observations difficult until contact was lost 16:46 just before dusk.

April 16th. Sperm whales were heard between 15:45 to 16:45 however, the wind increased to a force 5 and the sea state made visual observations difficult. On April 12th and April 14th, sperm whales were observed repeatedly breaching on two separate occasions. Each time, the breaching whale was close to a net (within 50 m). From our viewpoint, it appeared as if the whale breached because it was near a diftnet. The study was too limited to know if this was significant, but detailed studies of sperm whales elsewhere (Whitehead 2003) suggest that breaching probably has several functions including the removal of parasites or play by young whales. As well, when a whale repeatedly breaches, it may convey a message to accentuate other vocal signals.

Additionally, the audible clang and slow click trains are interesting because they are characteristic of males in breeding grounds (Weilgart and Whitehead 1988, Whitehead 1993). Side fluking, spy hopping and rubbing side by side has been described elsewhere as mating behaviour (Gordon *et al.* 1998) and females have been documented as having a tendency to dive first in such female/bull interactions (Whitehead 1993). Gordon (1987) also identified a large bull sperm whale off the coast of Sri Lanka, as well as observations of sperm whales feeding and in association with calves.

4 Conclusions

Passive acoustic monitoring allowed us to locate and track sperm whale groups throughout the day, which led to four interesting observations: (a) sperm whales were repeatedly seen around the 1000m depth contour and thus concentrated in feeding areas; (b) breaching behaviour was seen twice and each time in close vicinity to driftnets; (c) mating-related behaviour was observed in a pod of whales with one bull male; and (d) the bull male was seen jaw clapping. These observations suggest that the southeastern coast of Sri Lanka may be a sperm whale feeding, breeding and calving area. To address the threats to this population by ship-strikes and driftnet entanglement specifically, there is an urgent and pressing need to estimate the abundance, seasonality, distribution and behaviour of sperm whales off the coast of Sri Lanka.

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References

Alling A. 2015. Blue Whales Endangered by Ship Strikes: Dangers and Fatalities to whales in the shipping lanes. *Nautique Magazine* Sept/Oct Issue.

Alling A. 1988. A preliminary report of the incidental entrapment of Odontocetes by Sri Lanka's coastal drift net fishery. *Journal of Bombay Natural History Society* 85(3): 537–550.

Broker KCA, Ilangakoon A. 2008. Occurrence and conservation needs of cetaceans in and around the Bar Reef Marine Sanctuary, Sri Lanka. *Oryx – International Journal of Conservation* 42(2): 286–291.

De Vos A, Clark R, Johnson C, Johnson G, Kerr I, Payne R, Madsen P. 2012. Cetacean sightings and acoustic detections in the offshore waters of Sri Lanka: March - June 2003. *Journal of Cetacean Research and Management* 12(2):185-193.

De Vos A, Wu T, Brownell RL. 2013. Recent blue whale deaths due to ship strikes around Sri Lanka. *Paper SC/65a/HIM03 presented to the IWC Scientific Committee*, June 2013, Jeju Island, Republic of Korea. (unpublished). 8pp.

Gordon J.1987. Sperm whale groups and social behaviour observed off Sri Lanka. *Report of the International Whaling Commission* 37: 205–217.

Gordon J, Moscrop A, Carlson C, Ingram S, Leaper R, Matthews J, Young K. 1998. Distribution, movements and residency of sperm whales off the Commonwealth of Dominica, eastern Caribbean: Implications for the development and regulation of the local whalewatching industry. *Report to the International Whaling Commission* 48: 551-557.

IFAW. 2002. "IFAW Summary Briefing: Indian Ocean Whale Sanctuary", [http://www.ifaw.org/united-states/node/1142.]

Ilangakoon AD. 2002. *Whales and Dolphins of Sri Lanka*. WHT Publications, Sri Lanka. 99pp.

Ilangakoon AD. 2012a. A review of cetacean research and conservation in Sri Lanka. *Journal of Cetacean Research and Management* 12(2):177–183.

Ilangakoon AD. 2012b. Exploring anthropogenic activities that threaten endangered blue whales (Balaenoptera musculus) off Sri Lanka. *Journal of Marine Animals and Their Ecology* 5(1): 3–7.

IUCN. 2012. Marine Mammals and Sea Turtles of the Mediterranean and Black Seas. Gland, Switzerland and Malaga, Spain: IUCN. 32 pages.

Laist DW, Knowlton AR, Mead JG, Collet AS, Podesta M. 2001. Collisions between ships and whales. *Marine Mammal Science* 17(1): 35-75.

Leaper R, Gillespie D, Papastavrou V. 2000. Results of passive acoustic surveys for odontocetes in the Southern Ocean. *Journal of Cetacean Research and Management* 2(3): 187-196.

Leaper R. 2011. Ship strike risk to whales off Sri Lanka. Preliminary briefing note for the *International Fund for Animal Welfare*. 6-9 pp.

Lewis T, Gillespie D, Lacey C, Matthews J, Danbolt M, Leaper R, Mclanaghan R, Moscrop A. 2007. Sperm whale abundance estimates from acoustic surveys of the Ionian Sea and Straits of Sicily in 2003. *Journal of the Marine Biological Association of United Kingdon* 87: 353-357.

Mohan SR. 2013. Butchery in the deep blue sea. *Ceylon Today*, February 1, 2013 (Newspaper article, by Sulochana Ramiah Mohan, available at https://ceylontoday.lk/author/sulochana/).

NARA. 2009. Three dimensional seismic survey for oil exploration in Block-SL-2007-01-001 in Gulf of Mannar, Sri Lanka. *National Aquatic Resources Research and Development Agency Initial Environment Examination Report, Cairn Lanka PVT. LTD*. 156 pp. http://www.prds-srilanka.com/pdfs/Sri_Lanka_Seismic_EIA_Final_Report.pdf

Priyadarshana T, Randage SM, Alling A, Calderan S, Gordon J, Leaper R, Porter L. 2016. Distribution patterns of blue whale (*Balaenoptera musculus*) and shipping off Southern Sri Lanka. 2015. *Regional Studies in Marine Science* 3:181-188.

Priyadarshana T, Randage SM, Alling A, Calderan S, Gordon J, Leaper R, Porter L. 2015. An update on work related to ship strike risk to blue whales off southern Sri Lanka. *Paper SC66aHIM presented to the IWC Annual Meeting June, 2015*. 13pp.

Randage SM, Alling A, Currier K, Heywood E. 2014. Review of the Sri Lanka blue whale, *Balaenoptera musculus*, with observations on its distribution in the shipping lane. *Journal Cetacean Resource and Management* 14: 43-49.

Read AJ, Drinker P, Northridge S. 2006. Bycatch of marine mammals in U.S. and global fisheries. *Conservation Biology* 20(1):163-169.

Weilgart LS, Whitehead H. 1988. Distinctive vocalizations from mature male sperm whales (Physeter macrocephalus). *Canadian Journal of Zoology* 66(9): 1931-1937.

Whitehead H. 1990. *Voyage to the Whales*. Chelsea Green Publishing Company.

Whitehead H. 1993. The behaviour of mature male sperm whales on the Galápagos Islands breeding grounds. *Canadian Journal of Zoology* 71: 689-699.

Whitehead H. 2003. *Sperm Whales: Social Evolution in the Ocean*. University of Chicago Press, London. 195pp.