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Marine Mammals in the Waters of East Coast Johor, Malaysia

S.A. Jaaman[1]* and C.A.R. Mohamed[2]

Marine mammal searches were opportunistically conducted during the East Coast Johor Scientific Expedition (ECJSE) on 21-30 May 2012, on a live-on-board (LOB) diving vessel, MV BLACK PEARL. The expedition was designed mainly to survey coral reef ecosystems and water quality. Daylight visual observations of the sea were undertaken during sailing and stopping/anchored from the most upper open-deck of the vessel. The survey resulted in two sightings of long-beaked common dolphins (*Delphinus capensis*), each at Pulau Aur and Pulau Tinggi. Both observations were brief (< 5 minutes) and were made when the vessel was anchored. Based on anecdotal evidences, skeletal remains and previous surveys, the vulnerable dugong, Indo-Pacific bottlenose, Indo-Pacific humpback, Irrawaddy and long-beaked common dolphins, the false killer and pygmy killer whales, and the baleen whales are known to occur in the East Coast Johor waters, at least occasionally. The low sighting rate with marine mammals during this survey is highly likely caused by the survey design and also may be due to the environmental conditions and ecological factors. Dedicated and periodical boat and aerial surveys for marine mammals need to be conducted to determine species diversity and to understand the seasonality, habitat use, and social interactions of the marine mammal populations in the area. The findings will be most useful for marine park and fisheries authorities to plan conservation management strategies for marine mammals and promote their conservation through eco-tourism activities.

Key words: Cetacean; dugong; distribution; diversity; marine park; Johor; South China Sea

Historically, the Malaysian (East and Peninsular) waters possessed rich marine mammal population (Jaaman 2010). Despite modern environmental pressures, it is still possible nowadays to encounter a number of species. In 1949-1950, C.A. Gibson-Hill published "two popular accounts of whales, porpoises and dolphins recorded from Malayan and Sarawak waters…in the hope of arousing local interest in the group, and so leading to further records." Since then, little has been achieved, especially on determining the status of marine mammals in the waters of Peninsular Malaysia.

Interest on marine mammals has grown high in recent years. However, difficulty in getting funding for monitoring and studying the animals remains one of the major limitations in establishing a marine mammal research programme in the country. Recently, the Institute of Oceanography and Environment (INOS) of Universiti Malaysia Terengganu (UMT) Higher Institution Centre of Excellence (HICoE) Programme became active in conducting research on marine endangered species. Namely, one of its focus research is on the population ecology of dugongs and cetaceans in the South China Sea, particularly in the Bay of Brunei.

According to Ponnampalam (2012), Peninsular Malaysia harbours 17 of the total 27 marine mammal species confirmed in Malaysian waters. Around Tioman Island and East Coast Johor waters, nine marine mammal species have been recorded (Gibson-Hill 1949; Mansor *et al*. 2000; Nadarajah 2000; Affendi *et al*. 2007; Jamal-Hisne & Ponnampalam 2011). The majority of the large nearshore islands in Endau-Mersing waters, which include Pulau Tioman, Pulau Aur, Pulau Pemanggil, Pulau Tinggi, Pulau Sibu and Pulau Besar, are gazetted as marine parks.

These are Marine Protected Areas (MPA) that have management regimes on human/tourism activities and developments, and biodiversity and habitat conservation. The geography, environment and management of the area seem suitable for marine mammals to inhabit, which warrant for their renowned status. The East Coast Johor Scientific

[1]MOE-HICoE Marine Endangered Species Programme, Institute of Oceanography & Environment (INOS), Universiti Malaysia Terengganu (UMT), 21030 Kuala Terengganu, Terengganu, Malaysia
[2]Faculty of Science & Technology (FST), National University of Malaysia (UKM), 43600 Bangi, Selangor, Malaysia
*Corresponding author (e-mail: saifullahaj@umt.edu.my)

Expedition (ECJSE) 2012 provided an opportunity to collect data on the diversity and distribution of marine mammals in the area. The following questions are asked: What is the species composition of marine mammals in the area? What is the sighting rate of marine mammals in the area? Are marine mammals equally likely to be found in all regions of the study area?

MATERIALS AND METHOD

The East Coast Johor Scientific Expedition (ECJSE) 2012, which was designed mainly to survey coral reef ecosystems and water quality, was conducted between 21-30 May 2012, on a live-on-board (LOB) diving vessel, MV BLACK PEARL. The expedition covered Pulau Aur, Pulau Pemanggil, Pulau Tinggi, Pulau Sibu and Pulau Besar and their adjacent waters (Figure 1).

Searches for marine mammals were conducted during sailing and stopping/anchored from the most upper open-deck of the vessel, about three metres above sea level that provided 360º unobstructed views of the surrounding sea. Throughout the survey, searches for marine mammals were made only during daytime, particularly three hours after sunrise and before sunset, and in relatively calm sea conditions (sea states Beaufort 0-3). Effort data recorded during the survey were time, position (using a GARMIN 60CSx handheld Global Positioning System [GPS] receiver), weather and Beaufort sea state for every one hour and during sightings. The maximum speed of the vessel during sailing was 18 km/hr.

During the survey, one dedicated observer used the naked eye to scan the area continuously from the vessel to the horizon, but occasionally used a handheld 7 × 50 magnifier FUJINON marine binocular. When a group of marine mammals was spotted, the dedicated observer blew a whistle to alert all expedition team members and crews to the location of the sighting. Time and position of the boat were immediately saved in the GPS unit. Marine mammals were identified to the most precise taxonomic level possible based on their body appearance, size, shape, colouration, and the animals' distinctive behaviour, described in several field guides (Tan 1997; Jefferson *et al*. 2008). The best estimate of the maximum and minimum numbers of individuals in the group was based on a consensus of the observer, expedition team members, and crews on watch. All data were recorded in a standardised UMT Cetacean Sighting Form (Appendix 1).

RESULTS

Initiative

In total, nine days were spent conducting marine mammal searches during the expedition (Table 1). Distance surveyed per day varied from 12.2 km to 68.3 km (mean = 32.0; SD = 16.07). The total distance surveyed was 288.4 km. Time surveyed per day varied from 4.6 hours to 8.6 hours (mean = 6.6; SD = 1.20). Hence, the total time surveyed was 59.4 hours. The total daily effort (the product of survey time and distance for each survey day summed over all survey days) was 2017.2 km.hrs and the mean effort per survey day was 224.1 km.hrs (SD = 151.63).

Species Sighted

A total of two sightings of long-beaked common dolphins (Delphinus capensis) were made with a sighting rate of 0.1 per 100 km.hrs (Table 1).

The first sighting was made on Monday, 21 May 2012 at 8.30 am. The vessel was anchored at the position of N2º 27.693' E104º 29.302' and the dolphin sighting occurred about 50 m to the north of the vessel, between Pulau Aur

TABLE 1. SUMMARY OF MARINE MAMMAL SURVEY EFFORT AND SIGHTING RATE DURING THE EAST COAST JOHOR SCIENTIFIC EXPEDITION (ECJSE), 21-30 MAY 2012.

Date	Distance surveyed (km)	Time surveyed (hrs)	Survey effort (km.hrs)	Number of sighting	Sighting rate (per 100 km.hrs)
21/5/2012	21.5	7.4	159.1	1	0.63
22/5/2012	32.1	5.5	176.6	0	0.00
23/5/2012	23.4	6.7	156.8	0	0.00
24/5/2012	40.2	6.6	265.3	0	0.00
25/5/2012	23.7	5.6	132.7	0	0.00
26/5/2012	37.5	7.3	273.8	0	0.00
28/5/2012	12.2	4.6	56.1	1	1.78
29/5/2012	29.5	7.1	209.5	0	0.00
30/5/2012	68.3	8.6	587.4	0	0.00
TOTAL	288.4	59.4	2017.2	2	0.10

and Pulau Lang (Figure 1). Using the naked eye, two adult long-beaked common dolphins were observed swimming fast in variable directions. The animals could be chasing their prey in the channel and appeared to be wary, before they disappeared to the open sea.

The second sighting was made on Monday, 28 May 2012 at 9.15 am, when the vessel was anchored at the position of N2º 19.039' E104º 06.915' off Pulau Tinggi near Tanjung Gua Hujan (Figure 1). Using binoculars, six adult long-beaked common dolphins were spotted about 1.5–2 km northeast of the vessel. The group of dolphins was observed travelling in north direction. The group of dolphins was observed swimming fast close to each other in a northward direction.

DISCUSSION

Both long-beaked common dolphin observations lasted for less than five minutes, and no photos were taken. Although the individuals sighted between Pulau Aur and Pulau Lang appeared to be wary, it could not be certain if the animals were avoiding the research vessel. During Jamal-Hisne and Ponnampalam (2011) survey in Pulau Tioman, they found that a great number of dolphins appeared to shy away from the research vessel, which is quite untypical of gregarious species such as *T. aduncus* and *D. capensis*.

Nevertheless, the characteristics of D. capensis sighted during this survey were obvious. All individuals observed have a slender body and narrow long beak with an hourglass pattern on the side. Their body length were estimated to be more than 2 m long. These differentiate them from the Gray's spinner dolphin (*Stenella longirostris longirostris*) or the dwarf spinner dolphins (*S. l. roseiventris*), which have a tripartite (three-part) colour pattern and relatively shorter body length (Jefferson *et al*. 2008). The dolphins observed during this survey were most likely the *D.c. tropicalis* form of common dolphins that apparently occur in the Indian and far western Pacific oceans (Jefferson et al. 2008).

The long-beaked common dolphin has been previously recorded in Pulau Tioman (Jamal-Hisne & Ponnampalam, 2011) and Pulau Pemanggil (Gibson-Hill, 1949), but this study provides the first recorded sightings in Pulau Aur and Pulau Tinggi waters. Based on anecdotal evidences, skeletal remains and previous surveys, the vulnerable dugong, Indo-Pacific bottlenose, Indo-Pacific humpback and Irrawaddy dolphins, the false killer and pygmy killer whales, and the baleen whales are also known to occur in the Endau-Mersing islands and coastal waters, at least occasionally (Table 2).

Recently, actively swimming melon-headed whales were video recorded near Pulau Tioman by a group of recreational SCUBA divers, and this is the first confirmed record of the species in the area (Dr Lee Jennie, pers. comm.). Nadarajah (2000) and Jamal-Hisne and Ponnampalam (2011) also noted that cetaceans are quite common and have been seen by boat operators, fishermen, and dive operators in Pulau Tioman while they were out at sea. These suggest that there may be higher marine mammal diversity in the survey area than what was observed during this study and the low species diversity recorded during this survey is possibly caused by the survey design and the timing of the expedition. The dugong, which is also known to inhabit and feed in the area (Mansor *et al*. 2000; Affendi *et al*. 2007), is difficult to spot during a boat survey and conducting a

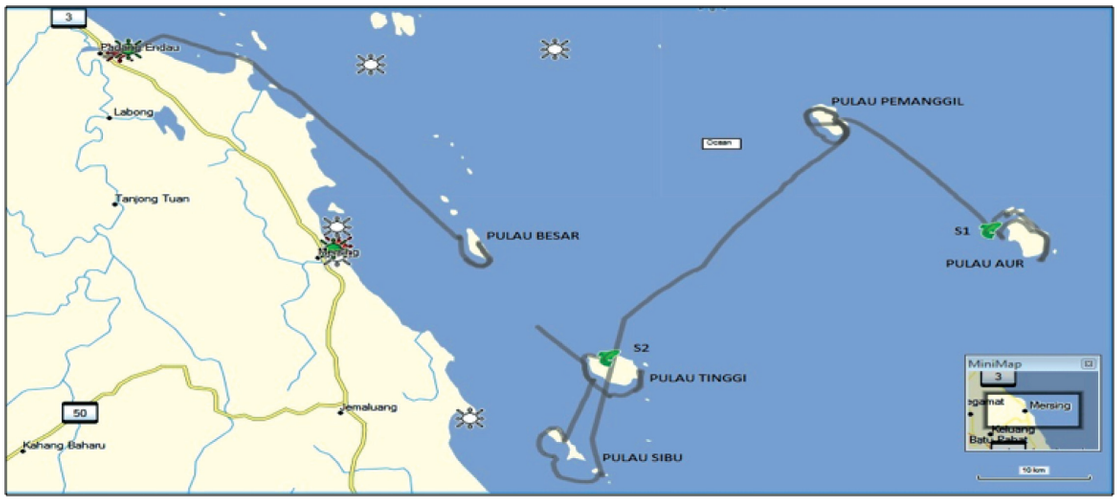

Figure 1. Map of study area, with survey track lines and locations of long-beaked common dolphin sightings (S1 = first sighting, S2 = second sighting).

TABLE 2. SUMMARY OF MARINE MAMMAL SPECIES KNOWN TO OCCUR IN THE ENDAU-MERSING ISLANDS AND COASTAL WATERS.

Common Name (Species)	Pulau Tioman	Pulau Pemanggil	Pulau Aur	Pulau Sibu	Pulau Tinggi	Pulau Besar	Endau-Mersing mainland	Sources
Dugong (Dugong dugon)				1, 2, 3	1, 2, 3		1, 2	Mansor *et al*. (2000) Nadarajah (2000) Affendi *et al*. (2007)
Spinner dolphin (Stenella longirostris)	1							Nadarajah (2000)
Long-beaked common dolphin (Delphinus capensis)	1	1	1		1			Gibson-Hill (1949), Jamal-Hisne and Ponnampalam (2011), this survey.
Indo-Pacific bottlenose dolphin (Tursiops aduncus)	1, 2							Jamal-Hisne and Ponnampalam (2011)
Indo-Pacific humpback dolphin (Sousa chinensis)							2	Jamal-Hisne and Ponnampalam (2011)
Irrawaddy dolphin (Orcaella brevirostris)							2	Nadarajah (2000)
False killer whale (Pseudorca crassidens)	2							Jamal-Hisne and Ponnampalam (2011)
Pygmy killer whale (Feresa attenuata)	2							Jamal-Hisne and Ponnampalam (2011)
Baleen whales (Balaenoptera sp.)	1							Jamal-Hisne and Ponnampalam (2011)

Note: 1 (sighting), 2 (stranding), and 3 (incidental catch in fisheries)

well-planned aerial and land-based surveys should prove to be useful in determining its population ecology (Jaaman & Lah-Anyi 2003; Jaaman & Bali 2011).

Cetacean sighting rate of 0.10 per 100 km.hrs made during this survey is relatively lower than any sighting rates for cetacean surveys conducted in the South China Sea of East Malaysia, which is between 0.17 and 0.31 per 100 km.hrs (Jaaman *et al*. 2008; Bali *et al*. 2010; Jaaman, 2010; Lim & Kamaruzzan 2012). To compare sighting rate between categories (*i.e*. surveys, areas, seasons or species), the survey effort should be constant and the data need to be standardised to both survey distance and time used (km. hrs).

Nonetheless, standardisation to time alone may not accurately represent the amount of area surveyed if much time was spent observing animals or searching at different boat speeds. Standardisation to solely survey distance would not represent the amount of effort allocated per unit of distance. This correction for differences in effort is the same principle as catch per unit effort or CPUE used frequently in fisheries science (see Gulland 1983). If the cetacean sighting rate made during this survey is recalculated according to time and distance separately, the sighting rate is 0.02 per hour or 0.35 per 100 km distance surveyed. The sighting rates are also relatively lower than the sighting rates made during a cetacean survey in Tioman (Jamal-Hisne & Ponnampalam 2011).

The low number of marine mammal sighting and low sighting rate are highly likely caused by the survey design, which was to survey coral reef ecosystems and water quality. The vessel had to stop/anchor at many stations to allow research diving and water sampling to be conducted. This limited the work scope for marine mammal searches. In addition, due to limited time and funds to conduct the expedition, it was not possible for the vessel to sail following a line transect survey method to increase the search coverage and the chance to spot marine mammals. A dedicated pre-determined transect lines survey covering the whole area may yield a higher sighting rate.

The low sighting rate with marine mammals during this survey may also be due to the environmental conditions. During the expedition, marine mammal searches were mainly conducted three hours after sunrise and before sunset, and in sea states Beaufort 0-3. According to Jamal-Hisne and Ponnampalam (2011), some marine mammal species in Tioman waters, such as the false killer whale, Indo-Pacific bottlenose dolphin and long-beaked common dolphin, have a time preference on when they come close

to shore. The *P.crassidens* is commonly seen in the early parts of the morning, while *T.aduncus* and *D.capensis* are commonly seen in the later parts of the day. Although marine mammal searches were conducted three hours after sunrise and before sunset, mostly were conducted when the vessel was anchored to survey coral reefs and this has limited the area covered.

During the expedition, these species may have occurred during off-effort period, which may also contribute to the low sighting rate. Furthermore, the low sighting rate may also be due to the ecology of the survey area. One important factor is the oceanography affecting the distribution of prey in the area that should be taken into consideration, but is not currently available. Furthermore, Jaaman (2010) found that the occurrence of dolphins in Cowie Bay, Sabah was not significantly affected by the survey initiative nor environmental parameters (season, daylight and tidal periods, depth, SST, salinity and turbidity), but the pattern of distribution is more likely to be influenced by the abundance of prey and the presence of many estuaries and mangroves in the area.

Based on observations made during the expedition, the existence of numerous nearshore islands, coral reefs, seagrass meadows, mudflats and mangrove estuaries in the Endau-Mersing coastal waters provide feeding, breeding and nursery grounds for many marine fishes and invertebrates, particularly within the marine park boundaries. This high productivity and vast fisheries resources resulted in the presences of extensive commercial, traditional and recreational fishing activities in the area. Predator species, like the cetaceans, sharks and turtles, may also frequent the area for feeding. The *Balaenoptera* sp. sighted by Jamal-Hisne and Ponnampalam (2011) in the area, could be tropical species such as the Omura's or Bryde's whales that may be using the islands' calm waters for resting and/or socialising. Due to those reasons and with nine of the total 17 marine mammal species confirmed in Peninsular Malaysian waters (Ponnampalam, 2012) had been recorded from this water (Table 2), there is a high possibility that conducting dedicated and periodical marine mammal surveys during fishing season could yield a high sighting rate and may prove that this area is a 'hot-spot' with high species diversity.

According to Jamal-Hisne and Ponnampalam (2011), the low sighting rate and low diversity of cetaceans observed during surveys may be partially attributed to a bias in sighting ability resulting from the limited number of dedicated observers who have limited or no opportunity to rest and rotate duties. During this survey, only one dedicated observer was available to search and record data on marine mammals. Similar limitations have been encountered and reported in other marine mammal surveys in Malaysia (e.g. Lim & Kamaruzzan 2012; Ponnampalam 2012).

CONCLUSION AND RECOMMENDATION

Although opportunistic in nature, this expedition provided this study with useful information on the occurrence and distribution of cetaceans in the east coast Johor waters. This is important in adding to the knowledge base of marine mammals in Malaysia, where their present status remains unknown. During this survey, only the long-beaked common dolphin was observed near Pulau Aur and Pulau Tinggi. The number of sightings, sighting rate and cetacean diversity are low; however, this is highly likely caused by the survey design and may not represent the actual status. The Endau-Mersing islands and its coastal waters are believed to harbour a high diversity and viable populations of marine mammals, which need to be studied and conserved. On the other hand, healthy marine mammal populations represent a valuable resource; therefore, the animals could be used through non-consumptive means (*i.e.* eco-tourism) and their conservation promoted through such activities (*i.e.* dolphin watching) that is prominent in the area.

Nevertheless, dedicated and periodical surveys for marine mammals using boat, acoustic and aerial survey methods are much needed in the area to determine species diversity and to understand the seasonality, habitat use, and social interactions of the marine mammal populations. It is also important to estimate the size of marine mammal populations in the area and identify their residency patterns. Findings from these surveys will be useful to marine park and fisheries authorities to plan achievable conservation management strategies and if they are to promote marine mammal conservation through eco-tourism activities. However, minimal disturbance to the populations have to be assured and the development of activities does not cause the degradation of the environment in the area.

Aside from the long-term research and monitoring of marine mammals and its habitats, marine park and fisheries authorities need to increase patrols to enforce marine park/fisheries protection and conservation laws to errant fishermen, boat operators and tourists that threaten marine endangered species and their habitats. Apparently, these patrols could also be conducted as part of the boat and aerial surveys for marine mammals. In addition, local communities and fishermen have to be educated to comply with conservation regulations as an alternative to enforcement, and to encourage their involvement in marine mammal monitoring.

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Historically, the Malaysian (East and Peninsular) waters possessed rich marine mammal population (Jaaman 2010). Despite modern environmental pressures, it is still possible nowadays to encounter a number of species. In 1949-1950,

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Appendix 1

CETACEAN SIGHTING FORM

Cruise no.	**Ship/ platform name**	**Sighting number no.**	**Acoustic detection no.**
Date/day		**Time at start of encounter**	**Time at end of encounter**

Were animals detected visually and/ or acoustically?	**How were the animals first detected?**
☐ visual ☐ acoustic ☐ both	☐ visually detected by observer keeping a continuous watch ☐ visually spotted incidentally by observer or someone else ☐ acoustically detected by PAM ☐ both visually and acoustically before operators/ observers informed each other

1st. GPS Position	**2nd. GPS Position**	**Course (COG)**	**Speed (SOG)**	**Beaufort Scale**

Depth (m)	**Temperature (°C)**	**Description** (include features such as overall size; shape of head; colour and pattern; size, shape and position of dorsal fin; height, direction and shape of blow)
Salinity	**Turbidity**	
Bearing to animal	**Range to animal (m)**	

Species/ species group	**Number of adults**	**Number of calves**	**Associated animals**
	Max - Best - Min -	Max - Best - Min -	

Behaviour (visual sightings only)

Direction of travel (relative to ship)		**Photograph (Yes/No)**
☐ towards ship	☐ variable	
☐ away from ship	☐ milling	
☐ parallel to ship in same direction as ship	☐ stationary	**Video (Yes/No)**
☐ parallel to opposite direction to ship	☐ other	
☐ crossing perpendicular ahead of ship	☐ unknown	