

Short Note

Marine Mammals of Coastal Penang Island, Malaysia

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Twenty-seven species of marine mammals have been confirmed from the waters of Malaysia (Jaaman, 2006; Ponnampalam, 2012). These records were derived from observations and archived specimens, newspaper reports, strandings, and, more recently, dedicated research studies, with information dating back to the early 1900s (e.g., Lydekker, 1901; Gibson-Hill, 1949; Nadarajah, 2000; Jaaman, 2006; Minton et al., 2011). Much of this information and recent research data has been collected from only a few areas (Jaaman, 2006; Hoffman et al., 2015; Minton et al., 2016), and there are many gaps in the knowledge of species occurrence and distribution throughout Malaysian waters. Very little attention had been focused on the marine mammals of the Penang Island, which is located in northwest peninsular Malaysia. The northwest and western parts of the island are rural areas where fishing is one of the main activities, although tourism activities are growing, especially in the north (Ismail et al., 2002). Penang Island is a rapidly growing zone of economic importance, with massive infrastructure expansion and extensive coastal zone development already underway.

Coastal habitats are being lost, and the integrity of the marine ecosystem is being altered before wild-life can be documented (Chee et al., 2017). Interest in the marine mammals of Penang Island is driven largely by the importance of assessing species distribution (Rajamani, 2014; Rajamani et al., 2014) in an area that is rapidly urbanising and where development processes may have severe impacts (Chee et al., 2017). In 2010, a dedicated research team was established in Penang at the Centre for Marine and Coastal Studies (CEMACS), in a field station affiliated with Universiti Sains Malaysia (USM). A thorough review of media reports and strandings data, as well as key informant information and

boat-based surveys, then commenced; the results of these endeavours provide the basis for confirming the occurrence and distribution of marine mammals around the island of Penang (see Appendix 1). This short note aims to (1) document information on cetaceans derived from interviews and reports from knowledgeable community members and the Department of Fisheries, Malaysia, between 2008 and 2015, and (2) present the findings of occasional boat trips conducted between 2012 and 2014.

Penang Island is located on the eastern seaboard of peninsular Malaysia (5° 8' N to 5° 35' N and 100° 8' E to 100° 32' E), and it covers an area of 293 km² (Figure 1). The northwest and west of the island are rural areas where fishing is one of the main activities, although tourism is growing, especially in the north (Ismail et al., 2002). Results from previous research involving local knowledge of marine mammals (Rajamani et al., 2014) identified the fishing villages of Teluk Bahang, Sungai Pinang, and Sungai Burung as potential hotspots for the animals. Western Penang has some residual mangroves skirting Sungai Pinang down to Sungai Burung. This area corresponds to Balik Pulau Estuary, a microtidal system (i.e., ~2 m deep) with an input from six different rivers along approximately 14 km of coastline that is covered with mangrove forest. The depth gradient from the shore to approximately 2 km seawards is shallow (Horton et al., 2008; Rosli & Yahya, 2013).

To gain some insights on the presence and absence of dolphins in Penang, 30 informal interviews were conducted with local fishers, tour operators, and staff at the CEMACS field station in 2010. Two pertinent questions were asked: (1) Have you seen dolphins? and (2) Where did you see them? In all cases, the informants provided affirmative information about the presence of dolphins and that they were seen in northwest

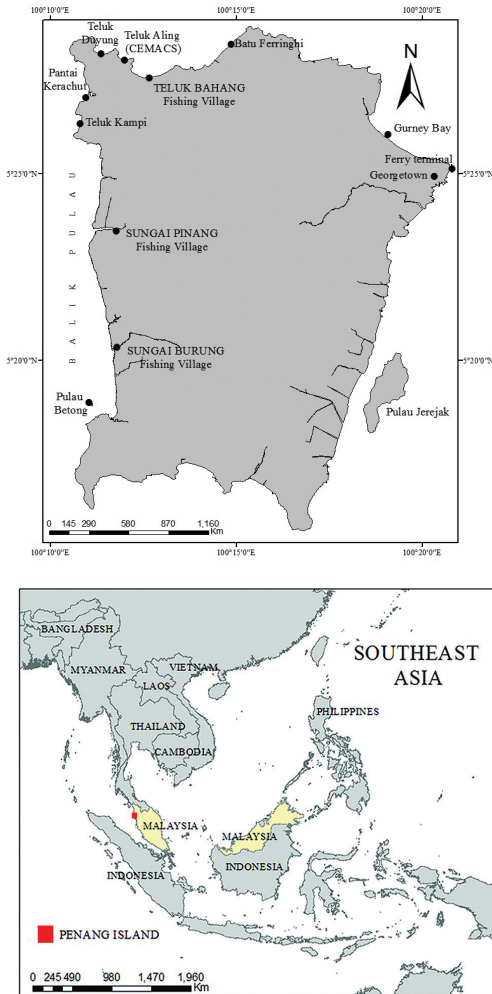


Figure 1. Location of Penang, Malaysia, within the Southeast Asian region

Penang (Teluk Bahang, Teluk Aling, and Sungai Penang). Not only did this provide baseline information, but this process also fostered interest in the marine mammals of the area. This interest led to the establishment of a key informant group that began to consistently report all marine mammal-related incidences to the research team. Information on the date, time, location, number of individuals, activity of the observer, general comments, observer name and contact, photos, and a description of the animal were recorded; often, informants would notify the research group so that nearby members could document the marine mammal(s) themselves. Between 2012 and 2014, four boat surveys were conducted either as part of training workshops or as reconnaissance surveys

(see Appendix 1). A total of ~200 km of survey effort was completed which focused in the waters of North and West Penang. Oceanographic parameters such as salinity, water depth, sea surface temperature, and turbidity were recorded every half an hour and at locations of sightings of dolphins. As these boat trips were for line-transect survey protocol training (Buckland et al., 2001) and photo-identification skills development, the actual data collected was limited. However, these trips have played a useful role in capacity building and better planning of future surveys so that research in the future can be systematically and appropriately conducted. The images collected not only provided a record for species confirmation but also the basis for a photo-identification catalogue of two species that were regularly encountered: (1) the Indo-Pacific humpback dolphin (*Sousa chinensis*) and (2) the Irrawaddy dolphin (*Orcaella brevirostris*).

Indo-Pacific humpback dolphins were positively identified from images during interview surveys and were observed 12 times by the key informants (Table 1). The groups were located in northern Penang coastal waters and were, on occasion, observed for hours over many kilometres (Figure 2A). Group size ranged between two to 30 individuals (mean = 12). Four strandings of this species were also reported (Table 2; Figure 2B). The skeleton of a previous stranding is housed at CEMACS, although it remains unknown in what year it stranded. During boat surveys, Indo-Pacific humpback dolphins were observed in southwest and northwest Penang (Figure 3). These encounters provide sufficient image data to identify at least 44 individuals: 28 individuals were identified from the left side dorsal fin, and 30 individuals were identified from the right side dorsal fin. No attempts to pair left side and right side matches were made. A video was also submitted to the research group which showed Indo-Pacific humpback dolphins at the Penang Second Bridge (a distinctive landmark) located to the east of the island. Media reports also indicate sightings of the humpback dolphin three times from 2012 to 2015 at Tanjung Bungah and Penang Second Bridge (Yeoh & Jalleh, 2012; Tan, 2014; Hilmy, 2015). Thus, it appears that Indo-Pacific humpback dolphins occur throughout Penang coastal waters.

Indo-Pacific finless porpoises were positively identified from images and were observed within western Penang waters on 20 occasions (Table 1; Figure 2A). Group size ranged between one to seven individuals (mean = 3.7). Sixteen strandings were also documented in western as well as northern waters (Table 2; Figure 2B). Several of these strandings documented missing tail flukes, indicating that entanglement may have been a factor in their deaths. During boat surveys, three

Table 1. Key informant sighting records from Penang, Malaysia

Date (d/mo/y)	Species	Location	Group size (No. of individuals)	Observer/Source	Photo (Yes/No)
2011	<i>T. aduncus</i>	Teluk Duyung	1	Fisheries Department, Malaysia	Yes
11/12/2011	<i>N. phocaenoides</i>	Pantai Kerachut	1	Pak Atan	No
5/10/2012	<i>S. chinensis</i>	Teluk Aling	2	Luz Helena	Yes
15/10/2012	<i>S. chinensis</i>	Penang Bridge (Batu Kawan)	20	Yeoh & Jalleh, 2012	Yes
10/1/2013	<i>S. chinensis</i>	Teluk Aling	30	Luz Helena	No
30/1/2013	<i>S. chinensis</i>	Teluk Aling	20	Luz Helena	No
8/2/2013	<i>S. chinensis</i>	Teluk Bahang	20	Luz Helena	Yes
3/5/2013	<i>S. chinensis</i>	Teluk Aling	2	Luz Helena	No
30/7/2013	<i>S. chinensis</i>	Teluk Aling	20	Luz Helena	Yes
15/8/2013	<i>S. chinensis</i>	Teluk Bahang	6	Luz Helena	No
23/8/2013	<i>S. chinensis</i>	Teluk Aling	3	Luz Helena	No
25/9/2013	<i>N. phocaenoides</i>	West Region Penang	7	Luz Helena	Yes
25/9/2013	<i>N. phocaenoides</i>	West Region Penang	2	Luz Helena	No
25/9/2013	<i>N. phocaenoides</i>	West Region Penang	4	Luz Helena	Yes
30/9/2013	<i>N. phocaenoides</i>	West Region Penang	1	Luz Helena	No
30/9/2013	<i>N. phocaenoides</i>	West Region Penang	4	Luz Helena	Yes
30/9/2013	<i>N. phocaenoides</i>	West Region Penang	4	Luz Helena	Yes
30/9/2013	<i>N. phocaenoides</i>	West Region Penang	4	Luz Helena	Yes
10/2013	<i>T. aduncus</i>	Penang	1	Luz Helena	Yes
13/11/2013	<i>N. phocaenoides</i>	West Region Penang	6	Luz Helena	Yes
14/11/2013	<i>N. phocaenoides</i>	West Region Penang	1	Luz Helena, Pak Rahman	No
14/11/2013	<i>N. phocaenoides</i>	West Region Penang	6	Pak Rahman	Yes
14/11/2013	<i>N. phocaenoides</i>	West Region Penang	6	Pak Rahman	No
15/11/2013	<i>N. phocaenoides</i>	Sungai Pinang	6	Luz Helena, Pak Rahman	Yes
15/11/2013	<i>N. phocaenoides</i>	West Region Penang	2	Pak Rahman	Yes
15/11/2013	<i>N. phocaenoides</i>	West Region Penang	4	Pak Rahman	Yes
15/11/2013	<i>N. phocaenoides</i>	West Region Penang	3	Pak Rahman	Yes
15/11/2013	<i>N. phocaenoides</i>	West Region Penang	5	Pak Rahman	Yes
15/11/2013	<i>N. phocaenoides</i>	West Region Penang	1	Pak Rahman	Yes
16/11/2013	<i>N. phocaenoides</i>	West Region Penang	5	Pak Rahman	Yes
16/11/2013	<i>N. phocaenoides</i>	West Region Penang	2	Luz Helena, Pak Rahman	Yes
14/4/2014	<i>S. chinensis</i>	Tanjung Tokong	1	Tan, 2012	Yes
15/3/2015	<i>T. aduncus</i>	Teluk Bahang Jetty	1	Luz Helena	No
25/5/2015	<i>S. chinensis</i>	Teluk Bahang	20-30	Leela Rajamani	Yes
22/10/2015	<i>S. chinensis</i>	Penang Bridge	4	Hilmy, 2015	Yes

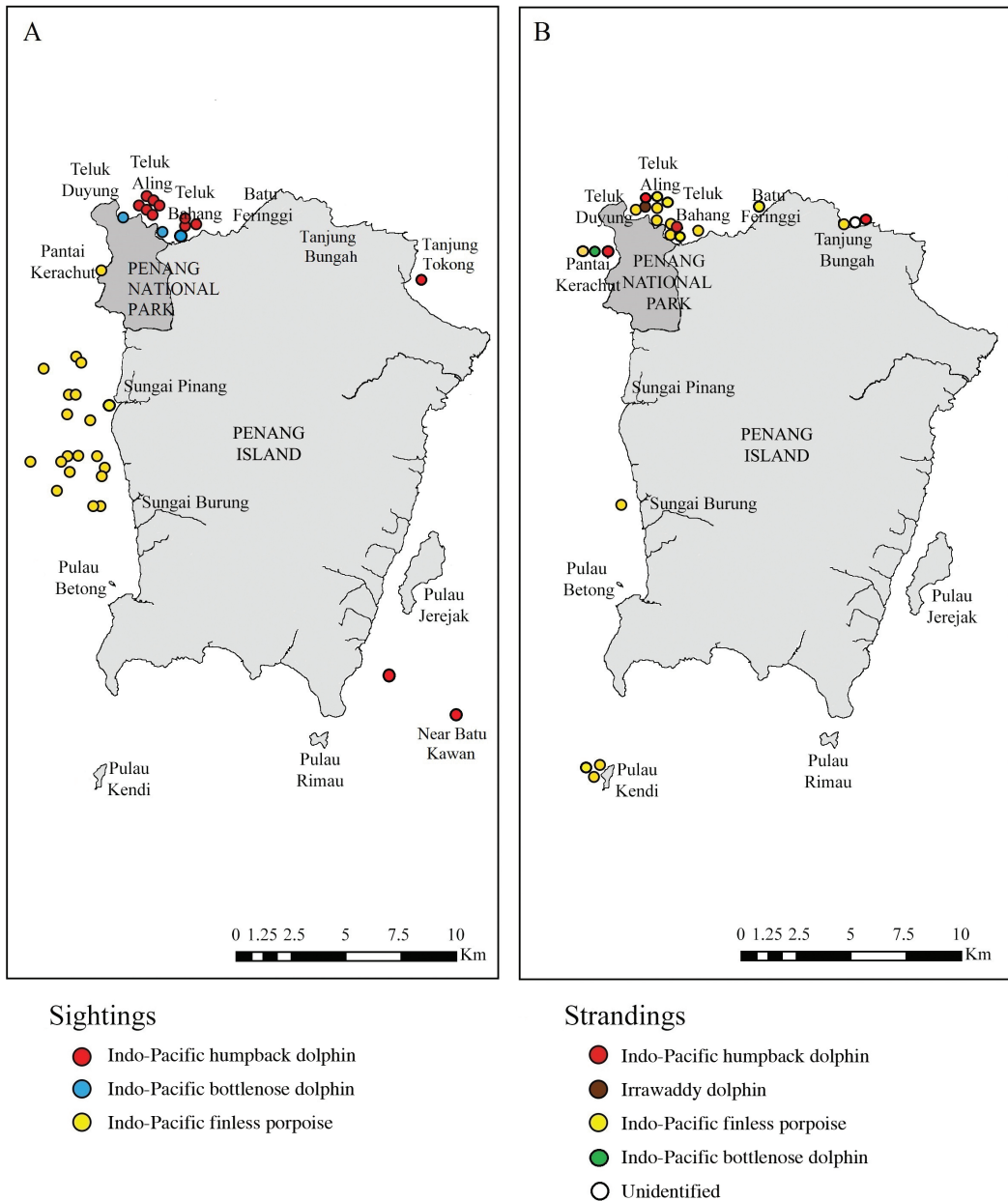


Figure 2. (A) Sightings reported by the key informant group, and (B) stranding locations provided by the key informant group and the Fisheries Department, Malaysia

finless porpoise sightings were recorded—one in western waters and two in the deeper waters of northern Penang (Figure 3). It appears that finless porpoises occur mainly in western Penang waters and, perhaps occasionally, to the north and south.

Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) were positively identified from images

provided by the Fisheries Department and others on two occasions in northern Penang waters (Table 1; Figure 2A). One stranding is reported from Penang western waters (Table 2; Figure 2B). Data on this species is limited; however, thus far, two sightings and a single stranding have occurred only in north-western waters.

Table 2. Cetacean mortalities in West and North Penang, Malaysia

Date (d/mo/y)	Species	Location	No. of individuals	Type of death	Observer/ Source	Sex/ Length (m)
22/7/2008	<i>S. chinensis</i>	Pantai Kerachut	1	Stranded	FDM	2.12
2011	<i>T. aduncus</i>	Pantai Kerachut	1	Stranded	FDM	N/A
14/1/2011	<i>N. phocaenoides</i>	Teluk Duyung	1	Stranded	FDM	Calf
10/12/2011	<i>N. phocaenoides</i>	Teluk Aling	1	Stranded	FDM	Calf
11/12/2011	<i>N. phocaenoides</i>	Pantai Kerachut	1	Stranded	FDM	Adult
2/1/2012	<i>Not identified</i>	Tanjung Bungah	1	Found floating	Yee, 2012	Adult
12/2/2012	<i>N. phocaenoides</i>	Kuala Sungai Burung	1	Stranded	FDM	Adult
28/3/2012	<i>N. phocaenoides</i>	Pulau Kendi	1	Stranded	FDM	Adult
7/12/2012	<i>N. phocaenoides</i>	Pulau Kendi	1	Stranded	FDM	Adult
21/12/2012	<i>O. brevirostris</i>	Teluk Duyung	1	Entangled	LH	~1.40
8/2/2013	<i>N. phocaenoides</i>	Teluk Bahang	1	Entangled	LH	N/A
23/2/2013	<i>N. phocaenoides</i>	Teluk Aling (CEMACS)	1	Entangled in drift net	A	1.24
7/3/2013	<i>N. phocaenoides</i>	Teluk Aling (CEMACS)	1	Entangled in drift net	A	0.76
8/3/2013	<i>S. chinensis</i>	Teluk Aling	1	Unknown	LH	N/A
14/5/2013	<i>N. phocaenoides</i>	Kendi Island	1	Entangled in drift net	WM	N/A
19/7/2013	<i>N. phocaenoides</i>	Green Hall – Batu Ferringhi	1	Entangled in drift net	Anonymous	N/A
27/12/2013	<i>N. phocaenoides</i>	Teluk Bahang	1	Entangled	LH	<100
1/1/2014	<i>N. phocaenoides</i>	Teluk Aling	1	Unknown	LH	Male/ 0.97
9/1/2014	<i>N. phocaenoides</i>	Teluk Bahang	1	Entangled	LH	Male/ 0.99
10/1/2015	<i>N. phocaenoides</i>	Teluk Bahang (near police station)	1	Stranded	TF	N/A
28/1/2015	<i>N. phocaenoides</i>	Tanjung Bungah (behind Flamingo hotel)	1	Stranded	TF	N/A
28/5/2015	<i>S. chinensis</i>	Teluk Bahang	1	Found floating	SK	N/A
4/10/2015	<i>S. chinensis</i>	Tanjung Bungah	1	Stranded	Mohd Ali, 2015	Adult

Note: FDM – Fisheries Department, Malaysia, LH – Luz Helena, TF – Teviot Fairsevis, SK– Sugendra Kumar, A – Anip, and WM – W. Mohizan

Irrawaddy dolphins (*Orcaella brevirostris*) were only reported during reconnaissance and line-transect surveys. During the three reconnaissance surveys in 2012, one Irrawaddy dolphin was sighted once in the first two surveys (see Appendix 1), and two Irrawaddy dolphins in the last survey in October. During the line-transect survey in 2014, there were four sightings of Irrawaddy dolphins of between one to four animals (Figure 3). They were all observed in the vicinity of Sungai Pinang Estuary. One stranding was also reported from northern Penang waters (Table 2; Figure 2B). The flukes from this stranding had been removed, and it appeared that the dolphin had been entangled in a net.

The environmental data that were recorded during boat surveys led to some observations on

habitat use. The Irrawaddy dolphin and Indo-Pacific humpback dolphins were found in shallow coastal waters (3 to 25 m), whereas finless porpoises occurred in relatively deeper waters (20 to 35 m) (Table 3). Both the finless porpoise and Indo-Pacific humpback dolphin were sighted in waters with a turbidity of 5 to 6 Nephelometric Turbidity Units (NTU), whereas the single Irrawaddy dolphin sighting was recorded in the more turbid waters of the river (16.1 NTU) (Table 3). All species were located in waters that were influenced by the freshwater outflow of Penang rivers (Table 3). The sea surface temperature recorded during the Irrawaddy dolphin sighting was lower than those recorded for all other sightings: 28.8 to 29.8°C vs 30.7 to 38.0°C (Table 3).

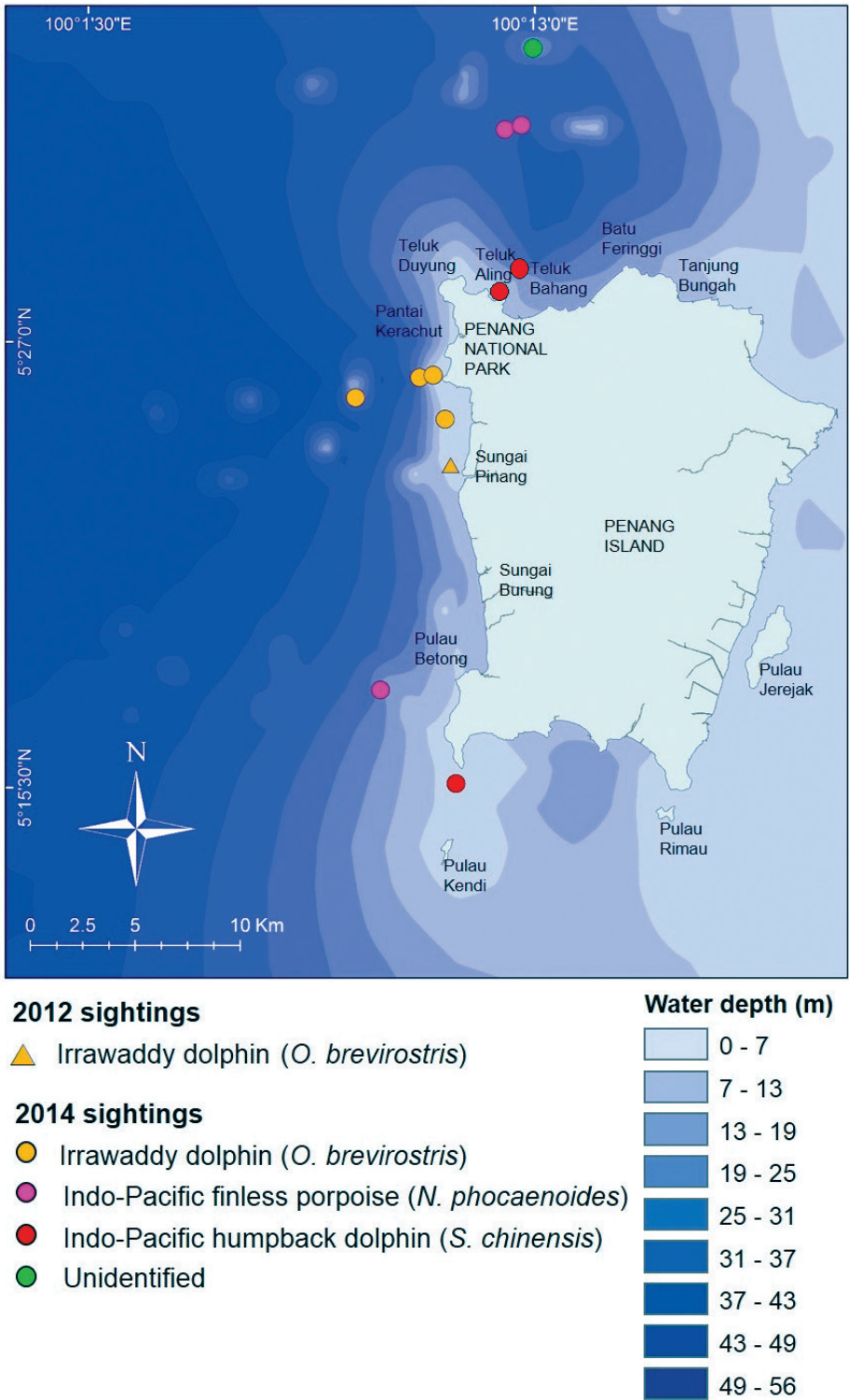


Figure 3. Sightings recorded during boat surveys of western Penang waters, 2012 to 2014

Table 3. Environmental data collected during boat survey sighting events

	Species:	Indo-Pacific humpback dolphin	Indo-Pacific finless porpoise	Irrawaddy dolphin
Depth (m)	Mean	13.1	30.3	13.7
	Range	5-25	20.2-35.4	2.6-26.9
Salinity (PPT)	Mean	29.4	29.5	29.5
	Range	29.4-29.5	29.4-29.5	29.4-29.6
Turbidity (NTU)	Mean	5.7	5.3	16.1
	Range	2.3-9.6	5.1-5.5	3.2-30.3
Sea surface temperature (SST) (°C)	Mean	34.4	31.2	29.5
	Range	30.7-38.0	30.9-31.0	28.8-29.8

In addition to the findings presented herein, this study also increased awareness of the marine mammals in the area, led to a Universiti Sains Malaysia (USM) sponsorship for the dedicated study of the Irrawaddy dolphins of Penang, and established a photo-identification catalogue for this species (Rodriguez-Vargas, 2015). This work also initiated a citizen sighting programme and created greater awareness of the island's natural resources. This enabled the research team to gain accurate and real time information on sightings and strandings. On a few occasions, we were able to conduct on-the-spot photo-identification studies close to CEMACS after notification by a boat operator who later took us to the site.

It should be noted that current coastal development and reclamation in Penang has extended to most of the east and northeast of the island, while western waters remain in a relatively pristine condition. All four species of dolphin and porpoise that regularly occur within Penang coastal waters utilise the western waters; however, the ever-present desire to develop more coastal residencies is putting considerable pressure on all of Penang's coastal areas (Nadzir et al., 2014). It would be timely to propose a marine management plan with the involvement of local stakeholders and fishers, particularly since the dolphins are located in areas adjacent to the Penang National Park. This would provide the opportunity to establish an integrated management zone which would better protect the integrity of the land, coastal, and offshore areas. Hence, it would also assist in securing the livelihoods of the fishing communities which share fish resources with the marine mammals. Concern has already been raised with regards to the effect of polluted river runoff and the effect this has had on macroinvertebrate communities, such as *Thiara* sp., *Macrobrachium* sp., and *Tanytarsus formosanus*, which have declined in some areas (Al-Shami et al., 2011). Further work is required on the health of the coastal habitat of Penang and, where possible, steps need to be taken

to decontaminate polluted areas. Although marine mammal research is relatively new in Penang, it has made significant progress in a few years.

Given the rapidity with which development has occurred in other areas of Penang, there is little time to collect comprehensive data before recommending management actions to local authorities. Here we propose that current conservation measures should include continued public awareness programmes and community involvement in the monitoring of the dolphin species in the area. Since incidental entanglement in nets has been indicated in some stranding events of cetaceans, attempts should also be made to minimise these incidents by fishing gear changes or cessation of the fishery in areas where high mortality has been recorded. The comparatively higher mortality rate of the finless porpoise needs further investigation as to the causes of death and vulnerability of the population. Research programmes aimed at documenting the distribution of populations within the area should be continued. Finally, the establishment of a marine mammal management plan in western Penang waters should be a priority conservation action.

Acknowledgments

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