

Short Communication

Apreliminary study of population size of Irrawaddy Dolphins (*Orcaella brevirostris*) in Cowie Bay, Sabah, Malaysia

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ABSTRACT. A population of Irrawaddy dolphins (*Orcaella brevirostris*) occurs in Cowie Bay, southwest of Sabah. Boat-based photo-identification surveys were conducted over a period of 12 months, from October 2009 to September 2010. Photographs were first sorted according to quality and according to physical appearance of Irrawaddy dolphins' dorsal fin. They were then assigned a unique code. A total of 27 Irrawaddy dolphins were identified and all were adults. The data obtained from this survey was used to estimate the population size via mark-recapture method. The total population size was estimated to be 31 individuals (SE = 1.8508).

Keywords: Irrawaddy dolphin, *Orcaella brevirostris*, Cowie Bay, Sabah, Malaysia.

INTRODUCTION

The Irrawaddy Dolphin (*Orcaella brevirostris*) was first described by Sir Richard Owen in 1866, based on a specimen found in 1852, in the harbour of Visakhapatnam on the east coast of India (Sinha, 2004). These dolphins have been described as 'facultative' river cetaceans due to their species' flexibility to inhabit marine and freshwater environments (Leatherwood & Reeves, 1994) and are classified as *Vulnerable* on the International Union for Conservation of Nature (IUCN) Red List. Five freshwater populations in Southeast

Asia are listed as *Critically Endangered*. Irrawaddy dolphins are found in shallow, near-shore tropical and sub-tropical marine waters of the Indo-west Pacific. There are records from Vishakpatnam to deltas of Brahmaputra and Ganges Rivers in India (James *et al.*, 1989). They are also recorded in coastal waters of Bangladesh, Myanmar, Malaysia, Singapore, Thailand, Cambodia and Brunei, where population sizes are unknown (Pilleri & Gihl, 1974; Haque, 1982; Perrin *et al.*, 1996; Dolar *et al.*, 1997; Smith *et al.*, 1997; Stacey and Leatherwood 1997). In Malaysian waters, there are confirmed records of Irrawaddy dolphin sightings in the Sulu Sea, Celebes Sea, South China Sea and Peninsular Malaysia (Jaaman, 2010; Ponnampalam, 2012).

Although marine mammal research in Malaysia started in 1996, the status of marine mammals in Malaysian waters are not sufficiently documented (Jaaman, 2004). Occurrence of Irrawaddy dolphins in Cowie Bay, Tawau, on the east coast of Sabah (Figure 1) were first recorded on a nine-day marine fauna survey in July 1999 (Jaaman, 2010). Subsequent surveys in February 2000 and October 2002 saw the sighting of Irrawaddy dolphins in the inner part of Cowie Bay, which includes Kalabakan and Marumar estuaries and Wallace Bay (Jaaman, 2010). Threats from fisheries by-catch, disturbances from heavy vessel traffic, and urban as well as industrial

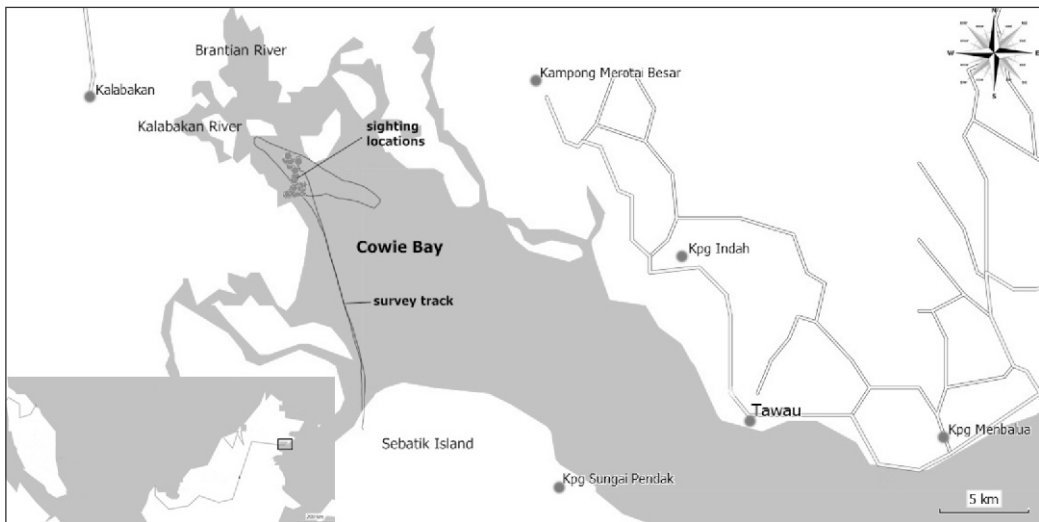


Figure 1. Map of the study location. Survey tracks from Sebatik Island to Cowie Bay. Small dots indicate sighting locations of Irrawaddy dolphins. The Irrawaddy dolphins are always sighted in the inner part of Cowie Bay. Inset: Map of Malaysia indicating the location of Cowie Bay off Tawau, east coast Sabah.

development are rendering them vulnerable (Jaaman, 2010). This study aims to estimate the population size of Irrawaddy dolphins in Cowie Bay through the photo-identification mark-recapture method.

MATERIALS AND METHODS

Study area

Sabah, situated in North Borneo, constitutes Malaysia along with Sarawak and Peninsular Malaysia. Cowie Bay is located north of Sebatik Island ($4^{\circ} 10' N - 4^{\circ} 28' N$ $117^{\circ} 30' E - 117^{\circ} 53' E$), and has a coastline of 90 km (Chew *et al.*, 2005). The northern part of Sebatik Island belongs to Malaysia, while the southern part of the island belongs to Indonesia. Tawau sits to the north of Cowie Bay. Major rivers that discharge into Cowie Bay are Brantian River, Kalabakan River and their tributaries. The bay extends 45 km along its southwest-northeast axis from its opening at Tawau port limited to the mouth of Kalabakan Estuary, and its width is between 8 and 13 km. The surface area of Cowie Bay is approximately 500 km² and the depth of the bay

ranges from 35 m near the opening of the bay to 0.5 m on the sandbanks near the mouth of the Kalabakan Estuary (Jaaman, 2010). Figure 1 shows survey tracks, with dots indicating sighting locations.

Data collection

Boat-based surveys were carried out during neap tide in the inner part (Sector II) of Cowie Bay (refer Jaaman 2010) from January 2010 until September 2010. Surveys were conducted along a standardised route, approximately 2 km from the coastline, one to three days a month. Upon encountering a group of dolphins, information on group size, group formation, and behaviour were recorded at five minute intervals onto an Encounter Sheet. The location of the survey vessel was marked with a hand-held Garmin GPS. A separate observer takes photographs of all individuals that constituted the group using a Nikon D90 SLR with 70mm-300mm zoom lens. An encounter lasted until contact with the group had been lost, or when weather conditions were not permissible.

Data analysis

Following Dove *et al.* (2008), photographs were sorted by date and were allocated into three categories - poor, good and excellent. The edges of the dorsal fins were scrutinized for nicks and scars as these provided the most information in discerning between individual dolphins within a population. Individuals were sorted accordingly and were assigned a unique code, adapted from Trujillo (2007). Capture histories from January 2010, April 2010, May 2010 and June 2010 were analysed using estimators available in the CAPTURE application, which is available within the programme MARK 6.1 (White, 2004). The abundance estimate obtained via CAPTURE only includes marked dolphins. The proportion of identifiable dolphins was estimated by determining the proportion of total number of excellent and good photographs to the number of identifiable fins.

RESULTS AND DISCUSSION

A total of 943 identifications of 27 Irrawaddy dolphins were obtained across the sampling periods. All identifications obtained were of adult dolphins, as juveniles have no permanent marks. One individual, NR001 was identified by its dorsal fin as well as the absence of both its flippers. The M_{th} Chao model in CAPTURE estimated the population size of identifiable Irrawaddy dolphins, \hat{N} to be 28 dolphins (SE = 1.4563, 95% CI = 28-34). This result was then scaled according to the photograph ratios (Table 1) and the formula $\hat{N}_{total} = \hat{N} / \hat{\theta}$ (Wilson *et al.* 1999) to obtain the total population size of Irrawaddy dolphins in Cowie Bay (Table 2). The total population size, \hat{N}_{total} , is 31 Irrawaddy dolphins (SE = 1.8508)

A comparison of Irrawaddy dolphin population size estimates acquired using photo-identification field methods and closed-population mark-recapture analysis methods (Table 3) shows that the Cowie Bay population is very small.

The population size estimate of Irrawaddy dolphins in the Mekong River, Cambodia, was downwardly biased as the discovery curve of identified individuals did not plateau towards the end of the sampling period (Beasley, 2007). Underestimation also occurred with population size estimates of the Mahakam River, Indonesia as eight out of 31 sightings had no photographs (Kreb, 2008). The discovery curve of identified individuals in this study did plateau towards the end of the sampling period and photographs were obtained during all sightings. Hence, the population size estimate in this study is not downwardly biased. Sutaria's (2009) study confirms that a small population of Irrawaddy dolphins used Chilika Lagoon in India. The Irrawaddy population in Cowie Bay does not appear to be fragmented and no by-catch was observed while field work was conducted. However, Jaaman *et al.* (2009) stated that the Irrawaddy dolphin was the most frequently reported cetacean caught by boats using gillnets in Sabah. There is a presence of motorised vessels and large ferries in the bay. This might be a threat to Irrawaddy dolphins in Cowie Bay. Nevertheless, it is known that the smaller the population, the more susceptible it is to extinction from various causes (Shaffer, 1981). Regular surveys to estimate population size, together with trend monitoring should be conducted. Assessment of the Cowie Bay Irrawaddy dolphin population based on the IUCN Red List guidelines is recommended.

Table 1. Proportion of dolphins with identifiable marks obtained from the number of photographs.

Number of photographs used in analysis	Number of identifications	Proportion of dolphins with identifiable marks
1047	942	0.8997

Table 2. Total population size (\hat{N}_{total}) of Irrawaddy dolphins in Cowie Bay, estimated from CAPTURE within programme MARK 6.1 and scaled according the photograph ratio.

Model	n	\hat{N}	SE	95% CI	$\hat{\theta}$	\hat{N}_{total}	SE	CV
M_{th} Chao	27	28	1.4563	28 - 34	0.8997	31	1.8508	0.06

Table 3. A comparison of population size estimates, which were obtained using similar field and analytical methods.

Location	Area / Length	Population Size
Chilika Lake, India	≈ 768 km ²	95-140 (Sutaria, 2009)
Mekong River, Cambodia	190 km	127 (108-146) (Beasley, 2007) 71 (66-88) (Dove <i>et al.</i> , 2008)
Mahakam River, Indonesia	510 km	87 (81-106) (Kreb and Susanti, 2011)
Balikpapan Bay, Indonesia	≈ 120 km ²	67 (59-74) (Kreb, 2008)
Sundarban, Bangladesh	1756 km ²	397 (290-505) (Smith <i>et al.</i> , 2006)
Cowie Bay, Malaysia	≈ 500 km ²	31 (28-34)

ACKNOWLEDGEMENTS

This study was supported financially by the Ministry of Science, Technology and Innovation (Science Fund No. 04-01-10-SF0111). We would like to extend our gratitude to our skipper Nosar Isid, who kept us safe and sound throughout surveys; and to our colleagues for the assistance given on and off the field.

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