DAVAO RESEARCH JOURNAL

P-ISSN 2244-4432
E-ISSN 2984-7125

A survey of cetaceans found in Mayo Bay, Davao Oriental, Philippines

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ABSTRACT. Cetaceans play an important role in marine ecosystems through the regulation of their prey population. Data on these organisms is scarce because of the difficulties in studying them in the wild. In the Philippines, there is a large gap in knowledge in cetacean research. Short-term studies, including those on strandings, play an important role in addressing the gaps in cetacean research. Boat-based surveys of cetaceans were designed and conducted to create a database of cetaceans in Mayo Bay, Davao Oriental, Philippines. *Globicephala macrorhyncus, Peponocephala electra, Stenella attenuata, Stenella longirostris, Tursiops truncatus,* and *Lagenodelphis hosei* cetacean species were encountered during the short-term survey, with *Stenella longirostris* being the most common cetacean species. Moreover, cetacean strandings within Mayo Bay recorded at least three species that were not observed in the wild during the boat-based survey. This study provided additional information on at least six data-deficient cetacean species of the Philippines and perhaps new information on a species belonging to the genus Mesoplodon in the Philippines, highlighting the importance of Mayo Bay for cetacean research and the need for further investigations in the region.

OPEN ACCESS

Submitted: 08 August 2019
Revised: 11 September 2019
Accepted: 15 October 2019
Published: 16 December 2019

https://davaoresearchjournal.ph

Keywords: *Biodiversity, cetacean, Davao Oriental, marine mammals, Mayo Bay, Philippines*

How to cite: Jimenez, L. A., Inabiogan, M. K. D. (2019). A survey of cetaceans found in Mayo Bay, Davao Oriental, Philippines. Davao Research Journal (DRJ), 12(2), 30-39. https://doi.org/10.59120/drj.v12i2.122

INTRODUCTION

The Philippines is part of the coral triangle, which hosts very high marine biodiversity (Veron et al., 2009). The study by Carpenter and Springer (2005) stated that the Philippine archipelago is the center of marine shore fish diversity owing to the higher concentration of species per unit area when compared to other countries belonging to the Coral Triangle. The country is also known to host charismatic marine vertebrates such as five marine turtle species, 27 cetacean species, and one sirenian species (Bagarnao, 2011; Alava et al., 2012). Unfortunately, the Philippines is also considered a marine biodiversity "hotspot," with species loss occurring mainly due to anthropogenic activities (Nanola et al., 2011; Lavides et al., 2010). This is a major concern since biodiversity influences ecosystem services or the benefits that humans acquire from the environment (Worm et al., 2006).

Cetaceans play an important role in the marine environment. Being top predators, cetaceans exert a "top-down" control on marine ecosystems, influencing population of their prey and overall ecosystem dynamics (Myers et al., 2007). Moreover, Roman et al., (2014) has also showed that cetaceans act as ecosystem engineers by enhancing primary productivity in coastal basins through thevertical transport of nutrients from deeper areas of oceans where cetaceans forage and release it near the surface as fecal matter (Roman et al., 2010). Cetaceans also serve as important nutrient source for deep sea ecosystems (Jones et al., 1998). However, populations of cetaceans are still dwindling, with some species becoming extinct (e.g. Baiji) or on the brink of extinction (e.g. Vaquitas) (Turvey et al., 2007; Rojas-Bracho et al., 2006). The loss of cetacean species has implications in ecosystem services provided by the marine environment and impact human societies (Worm et al, 2006).

In many parts of the world, data on cetacean is scarce (MacLeod et al., 2006). This could be the result of the difficulties entailed in conducting cetacean survey (e.g. source of funding, logistics, lack of experts, among others) (Kiszka et al., 2007; Schick et al., 2011). In the Philippines, efforts to address the knowledge gap in cetacean research in the country have come a long way since the 1990's (Alava et al, 2012). Although this is the case, there is still a need to conduct more studies (Santos 2009). Studies on marine mammal strandings and short-term surveys, as limited as they are, can produce data that can be useful as a baseline for more comprehensive studies (Obusan et al., 2016; Ender et al., 2014). For example, Aragones et al (2010) utilized stranding data to create a species list of cetaceans found in the Philippines. Further, the first record of Deraniyagala's beaked whale (*Mesoplodon hotaula*) in the Philippines and the first case of plastic ingestion of this species was also known through stranding (Abreo et al., 2016: Lacsamana et al., 2015).

The island of Mindanao, which is situated in the southern part of the Philippines, also harbors high marine biodiversity and the marine environment is also in various states of degradation (Alcala et al., 2008). This makes studying marine biodiversity and the marine environment on the island imperative. Mayo Bay, which is in the eastern part of Mindanao, in the province of Davao Oriental, is said to cater to different species of marine mammals, such as dugongs (*Dugong dugon*) and cetaceans. Contrariwise, data on these organisms in the area are not readily available or easily accessible due to lack of publications in both national and international scientific journals. This study aimed to provide the species list of Mayo Bay to underscore the importance of this region for cetaceans. The data generated by this study will be important in crafting sound conservation methodologies and management policies for cetaceans in Mayo Bay, Mati City, Davao Oriental.

METHODOLOGY

Study site

Mayo Bay is geographically located at the southeastern tip of the Philippines (Figure 1). It is an embayment that is commonly used for tourism and commercial fishing activities by municipal and commercial fishers in Mati City (Macusi et al., 2017). Common target species of fishers include pelagic fishes like species like sardines, bigeye scad, roundscad, dolphinfish, swordfish, skipjack tuna, and yellowfin tuna. Mayo Bay together with Pujada Bayare the only embayment in Davao Oriental that harbors dugong and marine turtles. Catch of marine turtles is strictly prohibited by law (Philippine Fisheries Code of 1998, RA 8550). It is situated on the opposite side of Pujada Bay where dugongs are known to be present (Katsunori et al., 2017).

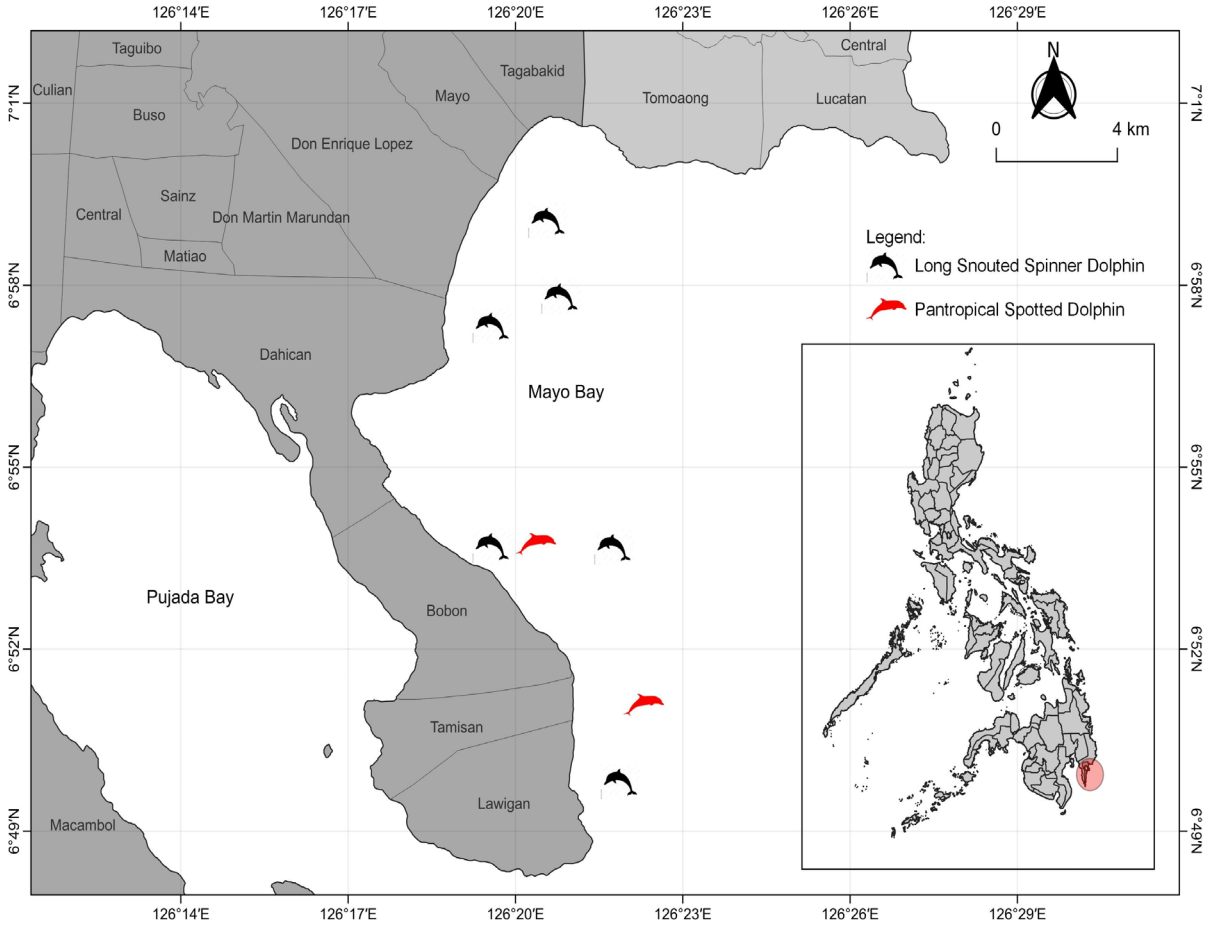

Figure 1. Map of spatial distribution of cetacean sightings in Mayo Bay for the month of June and July 2016.

Cetacean species inventory

A boat-based survey was carried out on 14 June 2016 to 29 July 2016 with average of 3 hours and 28 minutes per day, with a total of 86 hours and 50 minutes for the duration of the study. Boat used in the survey was 5 meters in length powered by two in-board engines with 7.5 horsepower each. Since thisstudy was designed to be exploratory, the survey design was not systematic. Survey started from Amihan sa Dahican beach area as take-off point encompassing Sitios Cadanlaan, Panombon, and Brgy. Mayo on the eastern side and Sitios Bobon, Bangunay and Lawigan on the western part of the bay. All survey tracks and cetacean encounters were recorded using a hand-held GPS unit (Figure 1). Cetaceans were photographed using Canon™ EOS 1100D 75-300 mm lens and

DOI: https://doi.org/10.59120/drj.v12i2.122

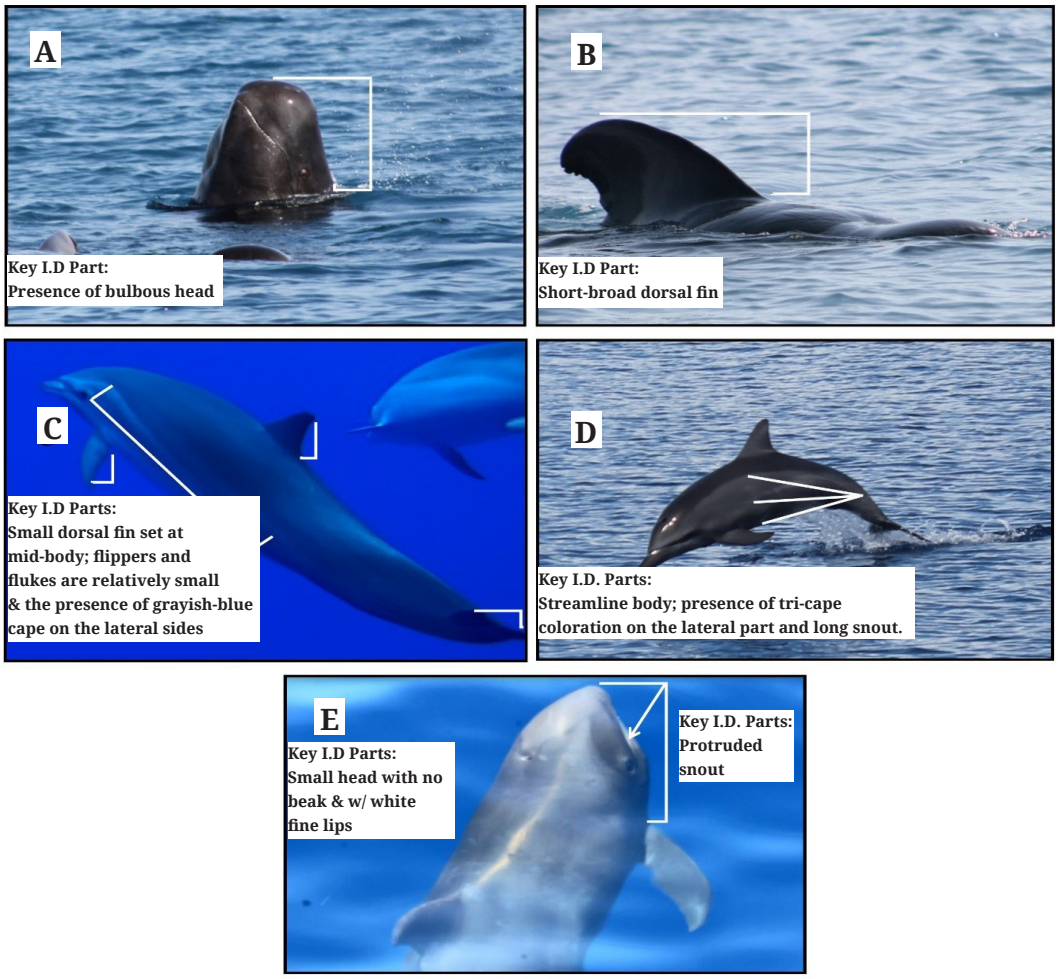

Figure 2. Some of the key identification features of whales documented in Mayo Bay: Short-finned pilot whale *Globicephala macrorhyncus* doing a spy hop, estimated length 4 to 4.5 meters (A); pilot whale's broad dorsal fin (B) photos taken at Brgy. Mayo, date: 7/9/2016; Frasers dolphin *Lagenodelphis hosei* estimated length 2 to 2.5 meters (C); Spinner dolphin *Stenella attenuata* breaching (D), photo taken at Barangay. Bobon date: 7/12/2016; Melon headed whale *Peponocephala electra* estimated length 2 to 2.5 (E), photo taken at Sitio Tagubon, Municipality of Tarragona date: 7/13/2016, photo credit to RIC XI-DOSCST

underwater videos were taken using Olympus™ Tough TG1 for identification (Figure 2). Species were identified using Jefferson, Webberand Pitman (2008) and were confirmed by other cetacean researchers in the country.

Cetacean strandings

The researchers are commonly consulted for reports of cetacean strandings in Mayo Bay. When this happened, body measurements, coloration, stage of decomposition and various tissue samples of carcasses are taken for further histo-pathological studies and species identification confirmatory tests.

RESULTS

Boat-based survey

A total of 24 encounters were recorded with six species of cetaceans identified during the duration of the survey (Table 1; Figure 2). The locations of the sightings were presented in Figure 1. Overall, the most common cetacean species encountered was *Stenella longirostris* (62.5 % of all sightings)

with pods estimated from a minimum of 10 individuals to a maximumof 300 individuals (see Figures 2 and 3).

Cetacean strandings

Five cetacean strandings were recorded in Mayo Bay from 2014 to 2016 (Table 2). Of the species that stranded, only *Stenella longirostris* has been recorded alive in the boat-based survey conducted in Mayo Bay, although other species stranded includes the Philippines in their geographic distribution. It is also important to note that majority of the stranded species are listed as "data deficient" in the country.

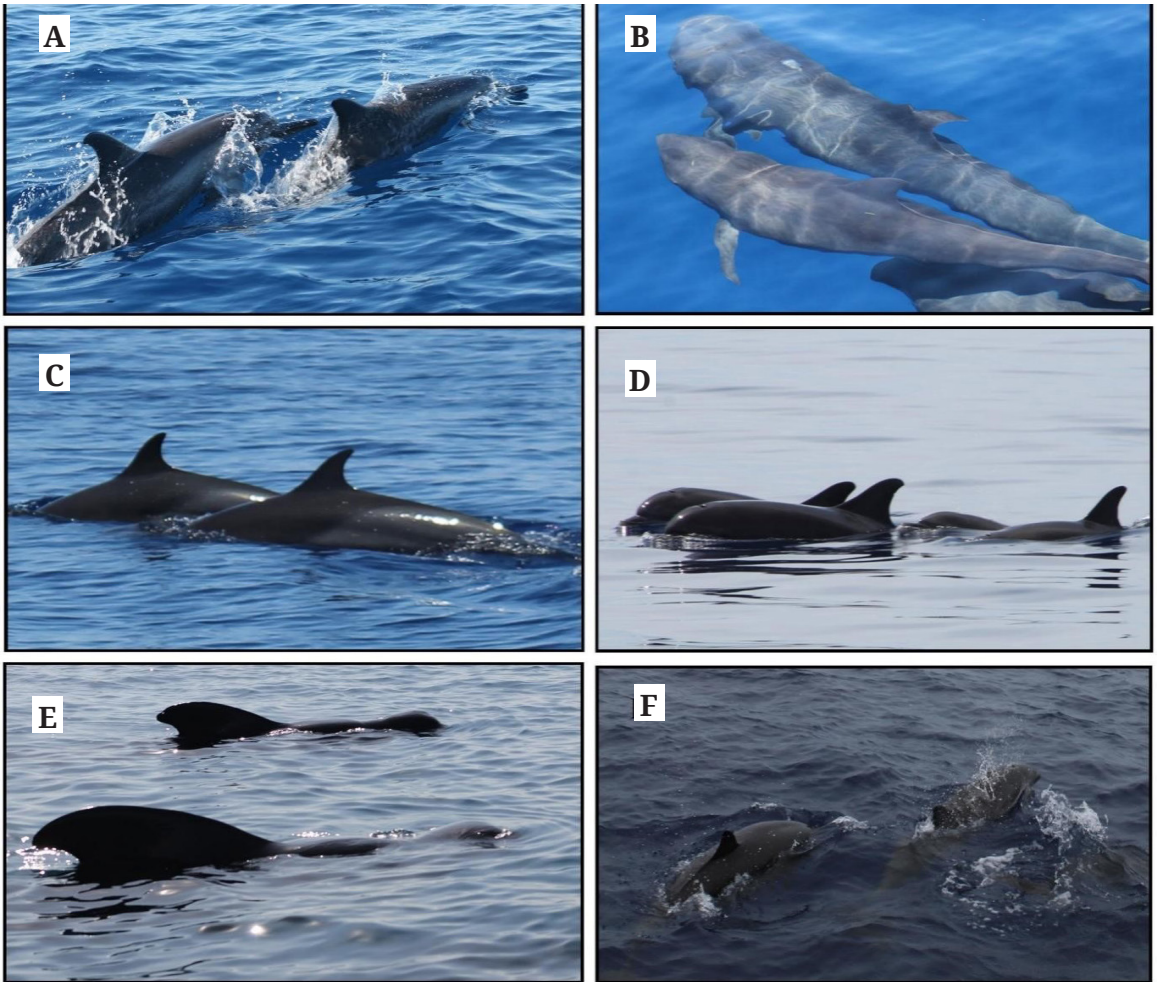

Figure 3. Photographs of the various sightings of cetaceans in Mayo Bay, Dahican, Mati City, Davao Oriental, Philippines.

Table 1. Cetacean species sighted in Mayo Bay, Davao Oriental, Philippines during boat-based survey. (DD – Data Deficient; VU - Vulnerable).

Common name	Scientific name	Sightings	%	Status*
Short-finned Pilot Whale	*Globicephala macrorhyncus*	4	16.6	DD
Melon-headed Whale	*Peponocephala electra*	2	8.3	DD
Pantropical spotted dolphin	*Stenella attenuata*	1	4.2	DD
Spinner dolphin	*Stenella longirostris*	15	62.5	VU
Common bottlenose dolphin	*Tursiops truncatus*	1	4.2	DD
Fraser's dolphin	*Lagenodelphis hosei*	1	4.2	VU
Total no. of Sightings		24	100	

* Alava et al., (2012)

DOI: https://doi.org/10.59120/drj.v12i2.122

DISCUSSION

Cetacean species distribution is influenced by oceanographic features, presence of preferred prey and productivity of the area (Ponnampalam 2012; Dolar et al., 2006). At present, information on oceanographic features of Mayo Bay is limited, but the presence of different cetacean species in the area with different ecology and behaviour shows diversity in available habitats that these organisms can utilize. Further, the difference in foraging strategies and prey preference of these cetaceans (e.g. Dolar et al., 2003) also shows that Mayo Bay and its adjacent waters harbour high marine biodiversity. Further investigations on the importance of Mayo Bay on cetacean research and marine biodiversity are highlighted by this study.

Table 2. Recorded cetacean stranding in Mayo Bay. (DD – Data Deficient; VU -Vulnerable).

Common name	Scientific name	Date of stranding	Status*
Spinner dolphin	*Stenella longirostris*	Sep. 9, 2014	VU
False Killer Whale	*Pseudorca crassidens*	Mar. 30, 2015	DD
---	*Kogia* sp.	Nov. 5, 2015	DD
---	*Mesoplodon hotaula*	Dec 28, 2015	--
---	*Kogia* sp.	Jun. 16, 2016	DD

*Alava et al., (2012)

The results of this study were similar to the results of the study of Dolar et al., (2006) where *Stenella longirostris* appears to be common in Philippine waters. Although this study did not follow the same methodology as Dolar et al., (2006), therefore caution should be taken in comparing results. *S. longirostris* was also observed to be the most common cetacean observed in other countries within the Coral Triangle (Ender et al 2014; Ponnampalan 2012; Borsa and Nugroho 2010). The capacity of *S. longirostris* to utilize deep waters and extend its foraging range to include shallow waters could be a reason to the high number of sightings for these species in cetacean surveys (Dolar et al., 2006). The *Stenella longirostris* were observed near fish schools suggesting that these organisms are feeding in the area in several encounters. Different cetacean species are shown to utilize bays as resing areas and this study provided evidence of such activities by *Globicephala macrorhynchus* inside Mayo Bay (Tyne et al., 2015). Like other mammals, rest is important to cetaceans to recuperate from strenuous activities during foraging (Johnston 2014). Lack of sleep or rest results to cognitive impairment and could also lead to the organism becoming less vigilant and vulnerable to predators (Cirelli and Tononi 2008; Dukas and Clark 1995). Moreover, cetaceans are known to exhibit site fidelity such as *Stenella longirostris* and *Globicephala macrorhynchus*

The result of this study could add valuable information for cetaceans in the Philippines. Moreover, information on species under the genus *Mesoplodon* are very limited due to the difficulties in observing individuals in the wild (McSweeney et al., 2007; MacLeod et al., 2006). The close morphological characteristics of different *Mesoplodon*species adds to the difficulties in studying these organisms in the wild (Dalebout et al., 2014; 2002). Majority of the information on most of *Mesoplodon* species are dependent on few stranded specimen e.g. *Mesoplodon hotaula* (Lacsamana et al., 2015; Dalebout et al., 2014) and *Mesoplodon perrini* (Dalebout et al., 2002). According to the latest list on Philippine marine mammals, only Blainville's beaked whale (*Mesoplodon densirostris*) is known to be found in the country (Alava et al., 2012).

This list is expected to change due to additional species of *Mesoplodon* confirmed in the country e.g. Deraniyagala's beaked whale *Mesoplodon hotaula* (Lacsamana et al., 2015). Initial morphological observations on the stranded *Mesoplodon* specimen in Mayo Bay suggested that the specimen is not *Mesoplodon densirostris*. Further genetic studies are recommended to confirm the identity of the *Mesoplodon* specimen, possibly adding information to these rare marine mammals in the Philippines (Dalebout et al., 2014; 2002).

Although there is a possibility that strandings may reflect the abundance of live cetacean species in Mayo Bay (Prado et al., 2016), caution should be taken in formulating such conclusions (Norman et al., 2004). Nevertheless, the paucity in the availability of cetacean data in the country and the opportunities presented by stranding events for gathering data could provide valuable insights on the biology of these organisms and its interaction with the environment, especially those species, or events (e.g. plastic ingestion) that are relatively rare and difficult to observe in the wild (Abreo et al., 2016; Obusan et al., 2016). Moreover, cetacean strandings have also led to the discovery of previously unknown species (Dalebout et al., 2014; 2002), making thorough investigations of stranding events a great tool for cetacean research.

CONCLUSION

Sightings and stranding records of cetaceans suggest that Mayo Bay in Davao Oriental is an important area for cetacean species in the Philippines and the presence of these organisms may indicate that the coastal habitats of Mayo Bay are in good condition. This study provided information on at least 6 data deficient (DD) cetacean species and perhaps new information on a species belonging to the genus Mesoplodon in the Philippines once a confirmatory study is conducted. Furthermore, studies on cetacean populations, species richness, ecology and behavior is recommended for this area. Oceanographic studies will also be needed to possibly explain the presence of these organisms in Mayo Bay. Threat identification and risk assessment studies are further recommended to aid in crafting protection and conservation policies for cetaceans and the marine environment.

ACKNOWLEDGEMENT

The authors would like to thank Elson Q. Aca of Balyena.org, Dr. Ma. Theresa Aquino of the Marine Wildlife Watch of the Philippines and Remie M. Aurelio Jr of the University of the Philippines for their contribution to this manuscript. This project is funded by the Department of Environment and Natural Resources - Foreign Assisted Special Project Office (DENR-FASPO).

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