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The Philippine Marine Mammal Strandings from 1998 to 2009: Animals in the Philippines in Peril?

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Abstract

A well-maintained marine mammal stranding database can be an invaluable tool in understanding not only strandings but also changes in the marine environment. This study aimed to examine the following aspects of marine mammal strandings in the Philippines: species composition, temporal (i.e., frequency of stranding per year and seasonality) and spatial (i.e., frequency of stranding per region and province) variation, proportions of alive or dead specimens, and stranding hotspots. In 2008, a systematic collection of data on strandings, including out-of-habitat incidents, resulted in an initial 12-year database—from 1998 to 2009. A total of 178 stranding events were recorded: 163 single, 10 mass, and 5 out-of-habitat strandings, with an average of 15 observed stranding events annually. Twenty-three of the 28 confirmed species of marine mammals in the Philippines were recorded to strand, including first-recorded specimens for the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*), pygmy sperm whale (*Kogia breviceps*), and Longman's beaked whale (*Indopacetus pacificus*). The top five most frequent species to strand included spinner dolphin (*Stenella longirostris*) (n = 26), short-finned pilot whale (*Globicephala macrorhynchus*) (n = 14), melon-headed whale (*Peponocephala electra*) (n = 13), Risso's dolphin (*Grampus griseus*) (n = 11), and common bottlenose dolphin (*T. truncatus*) (n = 10). Dugongs (*Dugong dugon*) stranded seven times since 2001. Strandings occurred throughout the year with frequency significantly peaking during the northeast (NE) monsoon (November to March) season. Overall, Regions III (Central Luzon) and VII (Central Visayas) had the highest number of strandings (both n = 27) followed by Regions I (Ilocos) (n = 22) and V (Bicol) (n = 18). The following provinces or local government units were considered hotspots based on high number of strandings observed at each area: Zambales, Cagayan, Zamboanga City, Negros Oriental, Bohol, Pangasinan, and Bataan. Sixty-five percent of all documented stranding events involved live (n = 116) animals. This high percentage might be linked to dynamite fishing (causing acoustic trauma), fisheries interactions, or biotoxins from harmful algal blooms coupled to their foodweb. These strandings in general validate the diverse marine mammal assemblage in the Philippines and reveal the various environmental threats with which they deal.

Key Words: marine mammals, stranding, stranding database, stranding network, dolphins, whales, dugongs, Philippines

Introduction

A marine mammal stranding is an event in which an individual or group of marine mammals washes ashore after death or is found on the beach or shore in a helpless situation unable to return to the water on its own ability (Geraci & Lounsbury, 2005). A stranding is categorized either as dead or alive, depending on the state of the animal when it was initially observed, and as single or mass. A mother/calf pair that strand together is considered a single stranding, while a mass stranding pertains to a simultaneous stranding of two or more animals. Marine mammals are said to be out-of-habitat when these animals, usually pelagic species (e.g., pilot whales, common dolphins), are found close to shallow waters and likely at risk of becoming stranded (National Oceanographic and Atmospheric Administration/National Marine Fisheries Service [NOAA/NMFS], 2009). Since these species are often in a large group, others (Brownell et al., 2009) refer to out-of-habitat as near mass stranding.

A database detailing the records of marine mammal strandings is a valuable resource for information regarding species occurrence, distribution, potential abundance, and ocean and human health since marine mammals are considered sentinel species (Bossart, 2009). Furthermore, a decomposing carcass on a beach is still considered important in certain cases because it can yield valuable information regarding an individual's life history, genetics, predators, contaminants, and feeding ecology. Live strandings of a rare species can inform us about that species physiology and behavior. Every stranding event presents a scientific opportunity to add knowledge and understanding regarding a certain aspect of a species (Perrin & Geraci, 2002).

Strandings occur worldwide. Although global statistics of these events are lacking, several countries have established formal stranding response programs and well-established national databases (e.g., United States, Australia, United Kingdom, and Canada). In the United States, a National Stranding Alert Network for six regional centers with a central database file was established after passage of the Marine Mammal Protection Act in 1972, which led to the establishment of the Marine Mammal Health and Stranding Response Program (MMHSRP). In Southeast Asia, Vietnam and Thailand have established their respective national stranding programs (Perrin & Geraci, 2002). The oldest stranding program, although not scientifically based (i.e., not systematically catalogued), could be in Vietnam where cetacean specimens that washed ashore were collected and preserved in the Buddhist temples for centuries (Smith et al., 1997). In general, however, a national stranding response program and a stranding database are often nonexistent in many developing countries, which often harbor an unknown assemblage of marine mammal populations.

In the Philippines, it is not surprising to encounter stranded marine mammals because the country represents an archipelago of more than 7,100 islands with a total coastline of 36,289 km (Fajardo, 2001; The Official Government Portal of the Republic of the Philippines, 2010). Aragones (2008) reported that 27 species of marine mammals (i.e., 26 cetaceans and one sirenian) were recorded in Philippine waters, and several accounts indicated that they strand in various parts of the country. However, most reporting of marine mammal strandings in the Philippines has been sporadic and opportunistic. As such, the information regarding these events has not been intentionally or systematically collected nationwide.

The Bureau of Fisheries and Aquatic Resources (BFAR) of the Department of Agriculture has mandate over marine mammals in the Philippines, except for the dugong, which is under the Department of Environment and Natural Resources (DENR). In October 2005, BFAR, in collaboration with Ocean Adventure (OA), a marine park located in Subic Bay, established the Philippine Marine Mammal Stranding Network (PMMSN) (Aragones et al., 2008).

The main purpose of this study is to examine the various aspects of marine mammal strandings from the Philippines. Investigation of the data that were collected was aimed mainly at the following questions: (1) species composition of the marine mammals that stranded, (2) temporal variation (i.e., seasonality), (3) spatial variation (i.e., frequency of stranding per year and by region), (4) proportions of alive or dead specimens, and (5) potentially identified stranding hotspots. A stranding hotspot is an area of concern as strandings in this place are often unusually higher than in other regions (after Bradshaw et al., 2006) and/or involve endangered or rare species. This information could be vital to the identification of locations for marine mammal rescue centers that might be established in strategic stranding hotspot areas. Also, such details could be valuable information to a conservation plan for the marine mammals in the Philippines.

This paper highlights some important results from collation of the details surrounding documented strandings of marine mammals in the Philippines from 1998 to 2009. A comprehensive and systematic stranding database could shed light on many aspects of marine mammal science and contribute to information for monitoring the changes in our marine environment.

Materials and Methods

All available data on marine mammal strandings, including out-of-habitat events, was collated from government offices (BFAR, DENR) and selected local government (LGUs) offices; from nongovernment offices (OA and its nonprofit arm, Wildlife In Need [WIN]); from the media in the form of newspaper or online reports (particularly those in archives); and from the Museum of Natural History at the University of the Philippines, Los Baños. Also, data records from actual strandings that the authors responded to or assisted with were included in this paper.

Collection of data from BFAR was conducted primarily by visiting 12 of the 17 regional offices nationwide (Appendix 1). The Philippines, due to its archipelagic nature, is divided into 17 regions for administrative purposes. The 17th is its Central Office (in the National Capital Region [NCR], Figure 1). The two other regional offices sent a compilation of their incident reports. The stranding data from Region III were collected mainly by OA and WIN. Since OA and WIN are located in Region III and have responded to most stranding events in that region, they were the main data source for this region. Most of the strandings that occurred from 2006 to 2009 were directly reported during the actual stranding events by various personnel from regional offices and LGUs.

A standard stranding report form for the PMMSN was completed for each stranding or out-of-habitat incident (see Appendix 2; after Aragones & Laule, 2008). The main variables gathered included, but were not limited to, species identification, location, date and time, age class (calf, subadult, and adult), alive or dead, rehabilitated or immediately released, or restranding. A stranded marine mammal is considered for rehabilitation when it is brought to a facility for medical attention. Often an animal is stabilized—that is, it is given supportive care to prevent further injury and kept in an upright position protecting the blowhole from water and debris (Geraci & Lounsbury, 2005). This is performed in the area where it stranded before it is considered for release (usually after at least a couple of hours). Other relevant information, including possible cause of stranding (e.g., signs of fisheries interaction), manner of carcass disposal, morphometrics, if tissues or bones were collected and preserved, and if a necropsy was performed, was also collated.

Very limited data were collected from years prior to 1998. The regularity of collection of yearly stranding records began only in 1998. Thus, it was decided to limit the presented analyses to datasets

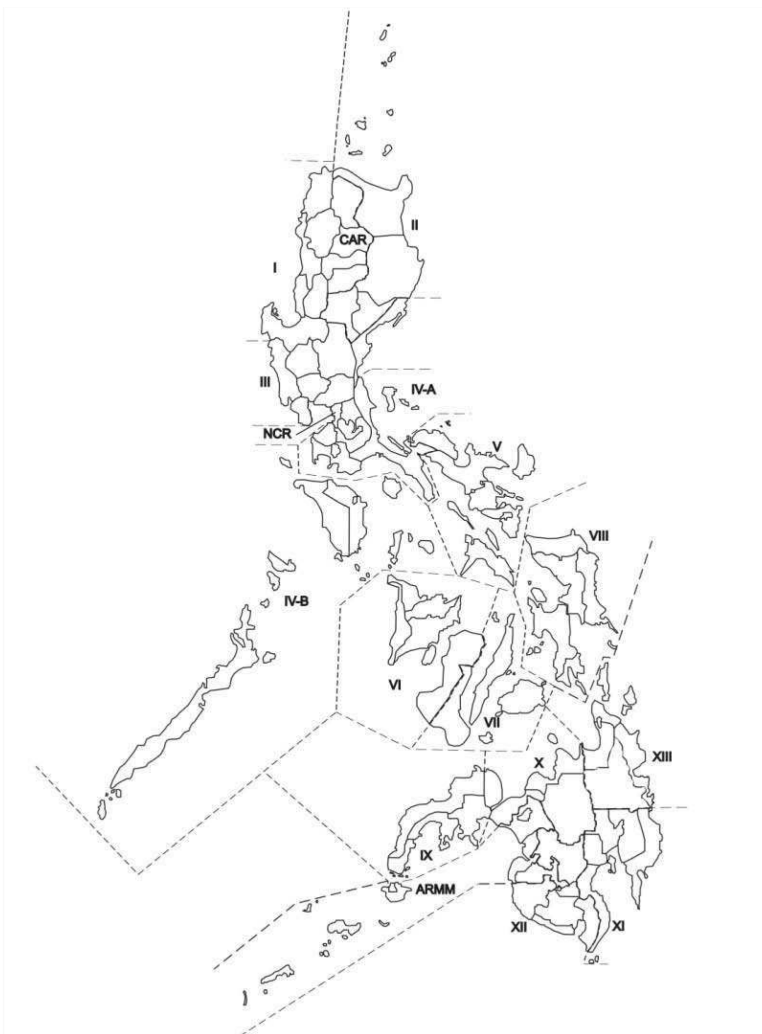

Figure 1. The 17 regions of the Philippines (see Appendix 1 for list of corresponding names of various regions)

from 1998 to 2009. Stranding events reported between these years were investigated for differences in stranding frequency by year, region, season, species, sex, age class, dead or alive, and rehabilitation success.

An ANOVA was used to examine potential significant differences in the frequency of stranding events between seasons across the years. The seasonal scheme was based on the prevailing winds at certain months of the years: northeast (NE) monsoon – from November to March, southwest (SW) monsoon – from June to September, lull (or transition) period before SW monsoon – from April to May, and lull period before NE monsoon in October (Wang, 2006).

Results

A total of 178 stranding events were recorded from 1998 to 2009, which were comprised of 163 single and 10 mass stranding events, and five out-of-habitat incidents (Table 1). The annual frequency of strandings ranged from two (in 1999 and 2000) to 48 (in 2009) with an average of 15 events per year (Figure 2). A total of 222 individuals were involved in all documented strandings. Single stranding events involved 163 individuals, including three events of mother/calf pairs, while 34 individuals represented the 10 mass stranding events. An estimated 370 individuals were involved in the five out-of-habitat events (including 350 individuals for two out-of-habitat events of melon-headed whales [*Peponecephala electra*]). Seven species were observed to mass strand, with three species mass stranding more than once (Table 1). The oldest recorded stranding was from 1967, where 12 sperm whales (*Physeter macrocephalus*) stranded at Cadiz City, Negros Occidental.

Species Composition and Species Which Strand Most Frequently

Twenty-three of the 28 confirmed species of marine mammals found in Philippine waters (Aragones, 2008; Aragones et al., unpub. data) were recorded to strand, including first-recorded specimens for Indo-Pacific bottlenose dolphin

Table 1. Frequency of stranding events and total number of individuals per species

		Stranding/out-of-habitat frequency (no. of individuals)			Total stranding/out-of-habitat frequency (no. of individuals**)
	Species	Single	Mass	Out-of-habitat	
1	*Stenella longirostris*	26			26 (26)
2	*Stenella attenuata*	5	1 (3)		6 (8)
3	*Stenella coeruloealba*	2	1 (2)		3 (4)
4	*Lagenodelphis hosei*	8			8 (8)
5	*Tursiops aduncus*	7			7 (7)
6	*Tursiops truncatus*	7	2 (5)	1 (6)	10 (18)
7	*Steno bredanensis*	7			7 (7)
8	*Grampus griseus*	9	2 (4)		11 (13)
9	*Orcaella brevirostris*	1			1 (1)
10	*Peponocephala electra*	10	1 (3)	2 (350)	13 (13)
11	*Globicephala macrorhynchus*	14*			14 (15)
12	*Pseudorca crassidens*	2			2 (2)
13	*Feresa attenuata*	5	2 (14)		7 (19)
14	*Kogia sima*	8*			8 (9)
15	*Kogia breviceps*	2			2 (2)
16	*Physeter macrocephalus*	6	1 (5)		7 (11)
17	*Mesoplodon densirostris*	2			2 (2)
18	*Indopacetus pacificus*	1			1 (1)
19	*Megaptera novaeangliae*	3			3 (3)
20	*Balaenoptera edeni*	4			4 (4)
21	*Balaenoptera omurai*	2			2 (2)
22	*Balaenoptera* spp.	1			1 (1)
23	*Dugong dugon*	7			7 (7)
	Unknown	24*		2 (14*)	26 (39)
	Total	163 (166)	10 (36)	5 (370)	178 (222)

*Involved a mother/calf pair

**Excluding out-of-habitat

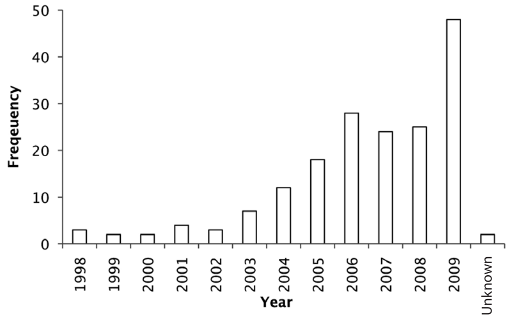

Figure 2. Annual frequency of strandings from the Philippines

(*Tursiops aduncus*), pygmy sperm whale (*Kogia breviceps*) (Aragones et al., unpub. data), and the Longman's beaked whale (*Indopacetus pacificus*) (Acebes et al., 2005). From these 23 species, 18 were odontocetes, four were mysticetes, and one sirenian—the dugong (*Dugong dugon*). The humpback (*Megaptera novaeangliae*) and the Omura's (*Balaenoptera omurai*) were some of the large species of whales (mysticetes) to have stranded in the Philippines. The dugong, the only sirenian among the recorded stranded marine mammals in the Philippines, stranded seven times since 2001. The top five most frequently observed species to strand include the spinner dolphin (n = 26), short-finned pilot whale (*Globicephala macrorhynchus*) (n = 14), melon-headed whale (n = 13), Risso's dolphin (*Grampus griseus*) (n = 11), and common bottlenose dolphin (*T. truncatus*) (n = 10). Most of the species stranded singly.

Species that were recorded to mass strand at least twice included the pygmy killer whale (*Feresa attenuata*), Risso's dolphin, and common bottlenose dolphin. Two out-of-habitat or near mass strandings of melon-headed whales in February and March 2009 consisted of at least 150 to 250 individuals for each event (Table 1) (Aragones et al., unpub. data). There were three species that stranded only once (n = 1): Irrawaddy dolphin (*Orcaella brevirostris*), Longman's beaked whale, and an unidentified *Balaenoptera* sp. whale. The species identification of 25 stranding events remains unknown. These reports were from the years 2003 to 2009 and included too little detail to identify the species.

Seasonality of Strandings

Strandings occurred throughout the year, with frequency of events peaking during the NE monsoon (November to March) (N = 61; 34%) and dipping during the lull period before the NE monsoon (October) (N = 5; 5%) (Figure 3). A significant difference in seasonality for strandings across years (p = 0.041) was identified.

Spatial Variation of Strandings and Stranding Hotspots

Two spatial scales, both based on geopolitical boundaries—regional and provincial—were used for management purposes as these are the relevant political units that will implement respective programs to address issues, such as stranding, within their respective boundaries. On a regional basis, Regions III (Central Luzon) and VII (Central Visayas) had the highest number of stranding incidents (both n = 27) followed by Regions I (Ilocos Region) (n = 22) and V (Bicol Region) (n = 18) (Figure 4). On a provincial or LGU basis, strandings were most frequent in the provinces of Zambales (n = 14), followed by Cagayan (n = 10), Zamboanga City (n = 10), Bohol (n = 10), Negros Oriental (n = 10), Pangasinan (n = 9), and Bataan (n = 9) (see Figure 4). Of the three large island groups in this country, Luzon presented more strandings (n = 101) than Visayas (n = 43) and Mindanao (n = 33) combined.

Some locations might be considered hotspots by virtue of being a site of unusual stranding events. In one case, Davao City (Region XI) is a hotspot since this was where the Longman's beaked whale stranded in 2004. Similarly, the shoreline of Bulacan (Region III) in Manila Bay is a hotspot because this was where the first recorded specimen of the pygmy sperm whale in the Philippines stranded. Similarly, Batangas is a hotspot because it had the highest number (n = 4) of stranding of baleen whales (Bryde's).

Age Class and Gender

Age class was undetermined for about 29% (n = 64) of all the stranded individuals that were documented. For individuals for which age class was determined (n = 158), 61% were adults (n = 96), 25% were subadults (n = 39), 9% were calves (n = 15), and 5% were strandings of mother/calf pairs (n = 8). Gender was not determined for a large proportion (76%, n = 169) of stranded individuals. When gender was determined, there was an almost 1:1 ratio (females, n = 23; males, n = 30).

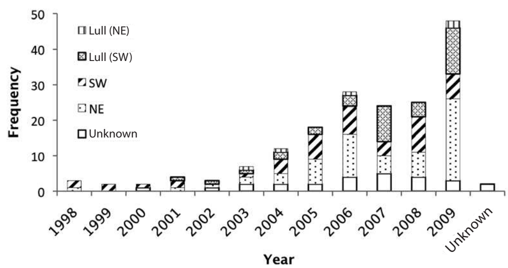

Figure 3. Yearly frequency of strandings during different monsoon periods in the Philippines

Live Stranding

More than half (65%) of the stranding events (n = 116) involved live animals. Of these 116 live events, 103 involved single individuals, eight represented mass strandings, and five were out-of-habitat. As for their disposition, 40% (n = 46) of the live stranding incidents resulted in death on site. Of the remaining incidents, 32% (n = 37) of the events involved individuals that were released immediately, 4% (n = 5) swam back to the open sea, 1% (n = 1) resulted in death of one and release of the other individual (from the same mass stranding), and 23% (n = 27) required rehabilitation (Figure 5). The overall survival rate for rehabilitated individuals was 11% (3 out of 27) (Figure 6): one was released and the other two were considered nonreleasable individuals that are still alive at OA. An adult female short-finned pilot whale was euthanized.

Discussion

Diverse Marine Mammal Assemblage of Strandings in the Philippines

This 12-year stranding dataset revealed many interesting results regarding marine mammals in the Philippines. First, it supports the suggested diverse assemblage of marine mammals in the Philippines. In one of the earliest works regarding Philippine marine mammals, Leatherwood

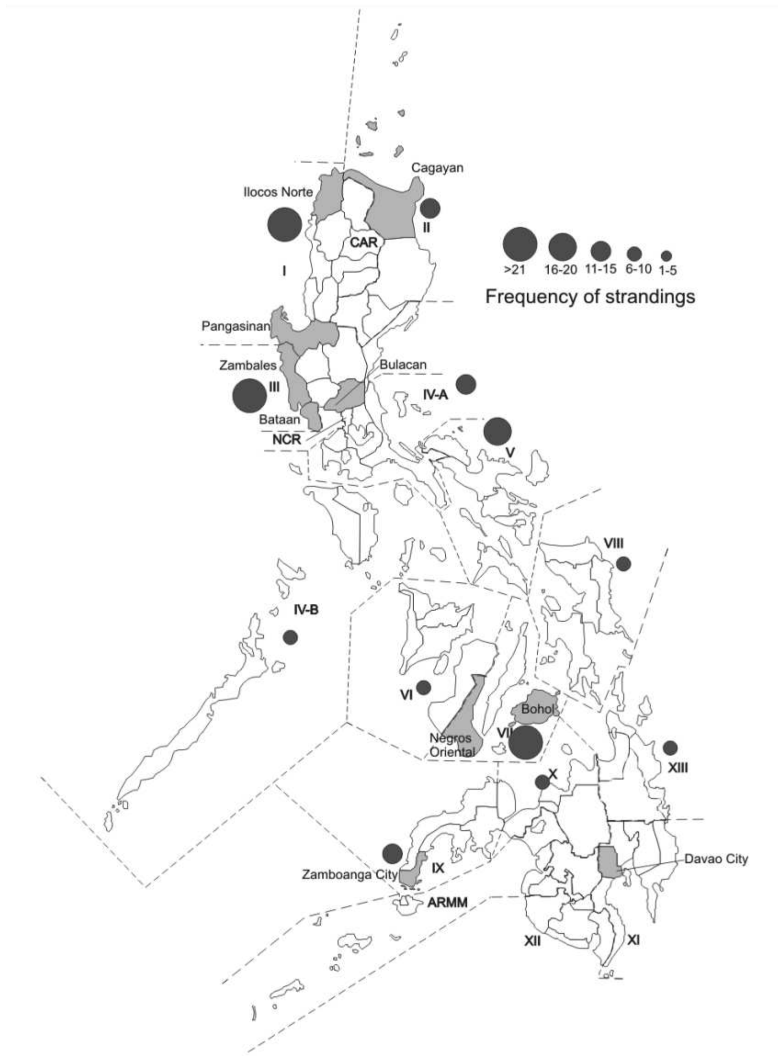

Figure 4. Strandings from 1998 to 2009 identified by region; solid circles represent frequency of strandings in each region. Hotspot provinces and LGUs are represented by shaded areas on the map.

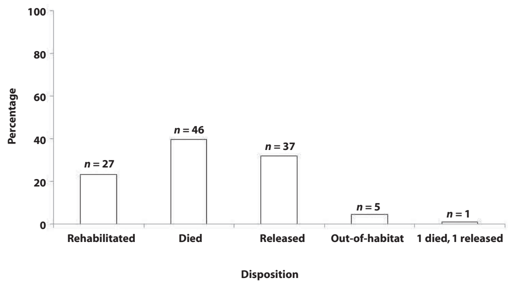

Figure 5. Disposition of the initially live-stranded individuals

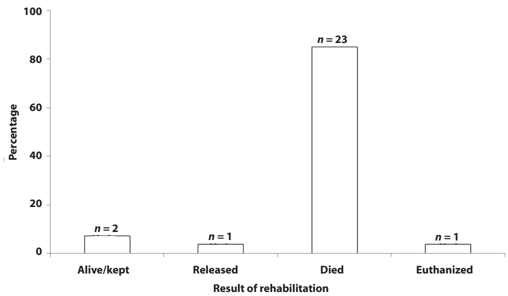

Figure 6. Condition of the animal after rehabilitation

et al. (1992) reported 17 species found around the Philippines; three years later, Tan (1995) reported 20 species. Ten years later, Perrin et al. (2005) removed two species (finless porpoise and pygmy sperm whale) from Tan's list because there were no recently confirmed records of these species. In 2008, 27 species were reported within Philippine territorial waters (Aragones, 2008). Of these, 23 have been recorded to strand. Recently, the first-recorded specimen to confirm the presence of the pygmy sperm whale in the Philippines came from a stranding in Bulakan, Bulacan area of Manila Bay (Aragones et al., unpub. data), increasing the estimated total number of marine mammal species in the Philippines from 27 to 28. The second specimen for this species actually stranded in the northwestern Luzon (Pasuquin, Ilocos Norte) less than a month later.* Likewise, the first confirmed specimen of the Indo-Pacific bottlenose dolphin in the Philippine waters came from a stranding in Bagac, Bataan, in 2003 (Aragones, 2008). One of the rarest cetacean species to strand in the Philippines to date is the Longman's beaked whale. A subadult stranded in Davao City (Region XI) in January 2004 (Acebes et al., 2005).

* For a complete list of strandings in the Philippines from 1998 to 2009, check out www.pmmsndatabase.upd.edu.ph/RPStrandings98_09.pdf.

Temporal Variation in Strandings

Examination of temporal variation in strandings from the Philippines indicated that these events do vary temporally. Annual increases in stranding events from 1998 to 2009 might be attributed to a growing awareness of the general public regarding the plight of marine mammals in the Philippines, and the recognition of the need to address and record stranding events. The first considerable documented increase in stranding events occurred in 2005-2006 (Figure 3). This was most likely an artifact of an increase in people's awareness since 2005 was the year the PMMSN was initially formed. The formation of the PMMSN and the training of key BFAR personnel regarding marine mammal stranding response spurred the development of local response teams and networks in various regional offices and greatly contributed to an increased effort for recording and responding to these events. The second major spike in stranding events was observed in 2009 (Figure 3); however, this was most likely an extraordinary year for strandings (n = 48). This elevated number of events may have been a result of the increased media hype (both national and international) regarding the unusual near mass stranding (300 to 350 individuals) of melon-headed whales in Bataan on February 10, 2009 (Aragones et al., unpub. data). The weeklong media coverage (and Internet blogging) for this event resulted in an increased awareness regarding dolphins and whales nationwide. Whether educated or captivated by such an unusual event, coastal residents seemed more willing to report stranding events than in the past. It is also possible that some illegal fishing practice(s) or environmental changes contributed to such an unusually high incidence of strandings (see below). Further, it might be likely that the annual average number of strandings of 15 from 1998 to 2009 represents an underestimate in events because past incidents might have been unreported. As systematic collection of data on strandings continues nationwide, a more accurate picture of the situation, including unusual interannual variations (or oscillations, such as in 2009), might be seen.

As for seasonality, an emerging pattern was that more stranding events occurred during the NE monsoons (Figure 3). One possible explanation is that strong upwellings occur or that most upwellings in the Philippines are at their maximum during the NE monsoons as observed in the northwestern Luzon and eastern Mindanao (Udarbe-Walker & Villanoy, 2001). More strandings were recorded in the western section of Luzon than anywhere else in the entire Philippine archipelago during the NE monsoons. The NE monsoon winds produce strong alongshore currents which flow along the shelf with sharp bends and steep slope areas producing upwellings (Udarbe-Walker & Villanoy, 2001; Amedo et al., 2002). This is an interesting phenomenon that requires more comprehensive studies. In the island state of Tasmania in Australia, increases in zonal and meridional winds resulting in colder and presumably nutrient-rich waters running along the southern Australian land masses served as good predictors of increases in stranding frequency (Evans et al., 2005).

Spatial Variation of Strandings and Stranding Hotspots

The spatial variation in stranding events, which lead to the identification of hotspots, can be attributed to several factors. The entire NW (Regions I and III), northern (Region II), and SW (Batangas) sections of Luzon; the Bicol peninsula; Central Visayas (Region VII); southern Zamboanga peninsula (Region IX); and the Davao area (Region XI) seem to be major stranding hotspots (Figure 7). Differences in the frequency of stranding events in space (i.e., the regional and provincial levels) could be an artifact of (1) actual marine mammal distribution, (2) prey availability, (3) intensity of fishing efforts and propensity of illegal fishing practice(s), and (4) variation in regional awareness of folks in the coastal communities.

In the initial assessment for marine mammals in the Philippines, western Luzon, Tañon Strait, Bohol Sea, Sulu Sea, and Mindanao Sea, which were some of the identified stranding hotspots, were also areas of concern for cetaceans. These waters had more species and high relative

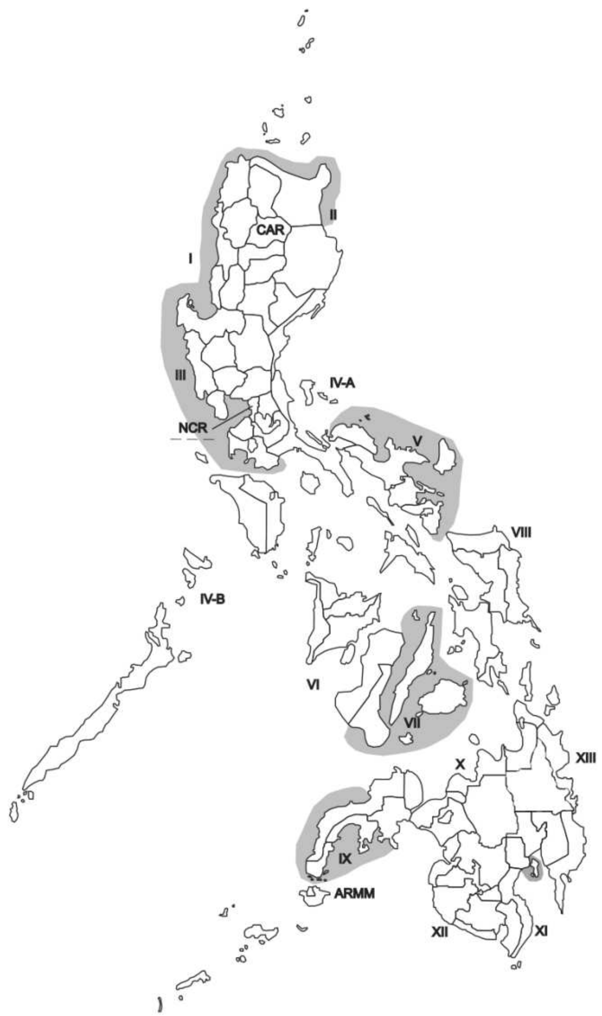

Figure 7. Stranding hotspots in the Philippines

abundance (Aragones, 2001). Moreover, Tañon Strait and Sulu Sea, the only bodies of water that have had comprehensive surveys for cetaceans, exhibit high densities of several dolphins and toothed whale species (Dolar et al., 2006).

The results were also consistent with the known distribution for some species that have been recorded and studied in the Philippines. For instance, spinner dolphins were the most frequent species recorded to strand (Table 2), particularly along the Tañon Strait (between the islands of Negros and Cebu) and the Bohol Sea, both in Central Visayas (Region VII), and were also frequently encountered in these waters during surveys (Leatherwood et al., 1992; Abrenica & Calumpong, 2002; Dolar et al., 2003, 2006; Aragones, 2008; Aragones et al., unpub. data). All recorded strandings of the humpback whale (n = 3) were in Northern Luzon where sightings have been reported since 1964 (Slijper et al., 1964). A stranding of an Irrawaddy dolphin in Dumangas, Iloilo, in 2006 provided the first evidence that such species was not restricted to Malampaya Sound, Palawan. This has significant implications with respect to the context of how to conserve and manage this supposedly most endangered cetacean species in the Philippines (Perrin et al., 2005). Furthermore, the results validated the wide distributional range of many marine mammal species in the Philippines and suggest the possibility of multiple populations of some species. The spinner, Fraser's, Risso's, and common bottlenose dolphins; short-finned pilot whale; and dugong all stranded at least once in Luzon, Visayas, and Mindanao.*

The intensity of fishing efforts and propensity of illegal fishing practices could also help explain the spatial variation of strandings in the Philippines. Most of the identified provincial hotspots, such as Zambales, Bataan, Pangasinan, Negros Oriental, and Bohol, with the exception of Zamboanga City (heavily exploited, > 2 to 70 fishers/km), were all included in the very heavily exploited fishing grounds (> 70 fishers/km) in the Philippines (Tandog-Edralin et al., 1987; Green et al., 2003). These areas are presumably fisheries productive waters that can also serve as marine mammal habitats, particularly for cetaceans. The areas of concern for cetaceans identified by Aragones (2001), with more species and high relative abundance, were also reported to have intensive fishing efforts, resulting in complex marine mammal-fisheries interactions (e.g., entanglements). It would not be surprising to know that many illegal fishing operations occur within these waters.

Prey availability might have contributed to the observed spatial variation of stranding events. Prey availability is known to be enhanced by upwellings. As mentioned earlier, seasonal upwellings have been recorded in the NW section of Luzon (Udarbe-Walker & Villanoy, 2001). Most of the marine mammal hotspot provinces (Zambales, Bataan, Pangasinan, and Ilocos Norte) are located in this section (Figure 4). Similarly, strong indicators of upwelling in the northern Bicol shelf were identified (Amedo et al., 2002); the Bicol region is also considered a stranding hotspot.

Regional variation in stranding events could also be attributed to differences in marine mammal awareness. In Region III, the presence of OA in Subic, Zambales, and the public education messages regarding marine mammals that OA has imparted could be contributing factors on why this region has one of the highest number of reported stranding events. The locals, particularly those from Zambales and Bataan provinces, often informed OA of stranding incidents, not only involving marine mammals, but also other large marine vertebrates, including sea turtles and sharks. In fact, 24 of the 26 stranding events in Region III were responded to by OA. In Region V, the high records could be attributed to the region's commitment to responding to stranding events by creating its own BFAR Region V Stranding Response Team in 2007.

Live Strandings

The most intriguing result of this study is the high proportion of live stranded individuals; 65% of total strandings were live. This appears to be higher than in other countries that maintain national databases with at least a ten-year dataset. In Thailand, about 9% of stranded individuals were live (K. Adulyanukusol, pers. comm., 1 January 2010). In Taiwan, 40% of cases from 1990 to 1997 were live strandings (L. S. Chou, pers. comm., 1 January 2010). In South Australia, only 11% of the recorded events from 1881 to 2000 were live (Kemper et al., 2005). On the eastern coast of the United States, only 17% involved live strandings (Mead, 1979).

The seemingly high percentage of live strandings observed could be attributed to several reasons; three hypotheses are discussed. First, acoustic trauma from dynamite blasts in the waters where these animals strand is very plausible in the Philippines. Some fishers use timer-detonated dynamite to stun pelagic fishes in deep waters during their fishing trips. Allegedly, fishers were using this illegal technique to capture pelagic fishes found in fish aggregating devices (FADs). A credible informant, L. Artagame (pers. comm., 9 November 2009), who happens to be the Fisherfolk Representative to the National Fisheries and Aquatic Resources Management Council

(NFARMC) and Chairman of the Integrated Fisheries and Aquatic Resources Management Council for Region III confirmed that several fishing operators allegedly employed dynamite fishing offshore Zambales and Bataan provinces the night before the near mass stranding (out-of-habitat) event of melon-headed whales in Pilar, Bataan, in February 2009. In Cagayan, most stranding events occurred in 2005 to 2007 (Figure 4) when there had been several reports of dynamite blasting in the area. These blastings were associated with fishing and treasure hunting for underwater artifacts from old shipwrecks. After dynamite fishing was successfully halted by the BFAR Regional office (Region II) and the Philippine Coast Guard, no additional cases of strandings have been reported in that area since 2008. Dynamite fishing in the Philippines is now known as the infamous scourge of Philippine seas (Green et al., 2003).

Second, interactions of marine mammals with fisheries are very possible and might result in entanglement. Entanglement could weaken the animals, especially if they have to struggle before being released. In Peru, high bycatch of small cetaceans from artisanal fisheries has been reported recently (Mangel et al., 2010). In the UK, 253 of 415 (61%) cetaceans subjected to full veterinary necropsy from strandings between 1990 and 2006 were determined to have been victims of fisheries bycatch (Leeney et al., 2008). The Philippines is one of the world's largest fish-producing nations, but its waters are also among the most overfished as the fishery resource is only 10% of what it used to be 50 years ago (Green et al., 2003). In 2001, marine fisheries accounted for 57% of the Philippines' total fisheries production (Green et al., 2003). However, as population increases (88.56 million Filipinos as of August 2007; National Statistics Office [NSO], 2008), fishing efforts increase as well, resulting in Malthusian fisheries. Unfortunately, the Philippine archipelago, which is supposed to be the center of the center of marine shore fish biodiversity (Carpenter & Springer, 2005), are heavily negatively impacted by all of these (Green et al., 2003).

The third possible factor for the many live marine mammal strandings may be associated with increasing frequency and intensity of harmful algal blooms in the Philippines. Since the first recorded occurrence of a harmful algal bloom (HAB) (*Pyrodinium bahamense* var. *compressum*) in Manila Bay in 1983 (Bajarias & Relox, 1996; Azanza et al., 2004), many more similar HAB species (e.g., *Cochlodinium polykrikoides*, *Noctiluca scintillans*, *Alexandrium* sp.) have been reported throughout the Philippines (e.g., Masinloc, Zambales [Bajarias, 1995]; Western Palawan [Azanza et al., 2008]; and Cancabato Bay, Leyte [Marasigan et al., 1995]). In fact, from 1983 to 2002, the Philippines had 40 outbreaks of HABs in at least 22 coastal areas with subsequent fish kill and shellfish poisoning episodes (Relox & Bajarias, 2003). Although detection of algal toxins in stranded marine mammals has yet to occur in the Philippines, it is likely that cetaceans are exposed to biotoxins from HABs through their prey items. Recently, Leandro et al. (2010) suggested that exposure of the critically endangered North Atlantic right whales (*Eubalaena glacialis*) to marine biotoxins such as domoic acid is another possible reason for its failed recovery. Since marine mammals are long-lived and travel significant distances, they could serve as proxies to detect changes in our marine environment (Bossart, 2009). Obviously, a combination of biotoxins, fisheries interactions, and acoustic trauma could worsen the situation for these marine mammals.

Special Considerations for the Irrawaddy Dolphin, the Dugong, and Calves

Stranded animals listed as endangered or rare species should be given special considerations during rescues if for no other reason than their decreased numbers and the often limited information about them. In the Philippines, the Irrawaddy dolphin and the dugong are probably the two most endangered marine mammals (Aragones, 2008); the former by virtue of a very limited distributional range (Dolar et al., 2002; Smith et al., 2004; Perrin et al., 2005), and the latter because of its affiliation to the coastal areas, particularly seagrass beds, which is the same zone where human populations are migrating into, records of direct and indirect takes occur, and overexploitation is encountered (Hines et al., in press).

In the case of stranded marine mammal calves, they require highly specialized, resource intensive, long-term care. In the event that these animals are nonreleasable, they still have conservation value as ambassadors to showcase the plight of their cousins in the wild when they are exhibited in an oceanarium, which raises the issue of the availability of appropriate facilities for the long-term care of nonreleaseable stranded marine mammals in the Philippines. Presently, there is only Ocean Adventure in Subic Bay that has the facilities and capability to properly care for and maintain rehabilitated marine mammals in the Philippines.

Recommendations

Although it has been a remarkable step to collate stranding data on a national level, more effort and involvement is needed to record as much data as possible on every stranding event and develop a more comprehensive picture of the Philippine scenario. Through time, we expect the quality, accuracy, and completeness of data to improve. The large proportions of unknown species identification, age class, and gender in our dataset will eventually be reduced once people become more familiar with marine mammals and stranding protocols. Collections of comprehensive data will likely lead to greater accuracy in determining the possible causes of strandings, and the influence of human activities on these events than our present dataset. An examination of the possible impacts of dynamite fishing and other similar underwater noises resulting in acoustic trauma, marine mammal-fisheries interactions such as bycatch and entanglements, and possible exposure to biotoxins for the Philippine marine mammals should be more thoroughly investigated.

Marine mammal stranding response capability and related facilities should be developed and improved. The development of regional stranding rescue teams and rehabilitation centers, especially in the identified hotspots in the Philippines (see relevant discussion above), could increase the efficiency of the recording of and success in responding to strandings. In addition, survival rate of live-stranded individuals can be increased further through a quick response and a well-planned rehabilitation program. In addition, the need for an enabling law in the Philippines (with fund allocation), similar to the U.S. Marine Mammal Protection Act, providing for National Stranding Alert Networks and the Marine Mammal Health and Stranding Response Program (MMHSRP) is imperative.

Finally, local and national awareness regarding marine mammals and strandings must continue to grow. This can be enhanced by the website of the PMMSN database, which is now online (www.pmmsndatabase.upd.edu.ph). It is likely that the majority of strandings still go unreported, but the more strandings to which we can respond and systematically collect data, the more we learn about these individuals, the species, and the status of marine mammals in the Philippine waters overall.

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Literature Cited

Abrenica, B., & Calumpong, H. P. (2002). Whale watching in Bais City, Negros Oriental, Philippines: An ecotourism enterprise. *University of the Philippines – Visayas Journal of Natural Sciences*, *7*(1&2), 158-168.

Acebes, J. V., Bautista, A., Yamada, T., Dolar, M. L. L., & Perrin, W. F. (2005, December). Stranding of *Indopacetus pacificus* in Davao, Philippines. *16th Biennial Conference on the Biology of Marine Mammals*, San Diego, CA. [Abstract] (Available at www.marinemammalogy.org).

Amedo, C. L. A., Villanoy, C. L., & Udarbe-Walker, M. J. (2002). Indicators of upwelling at the Northern Bicol Shelf. *University of the Philippines – Visayas Journal of Natural Sciences*, *7*(1&2), 42-52.

Aragones, L.V. (2001). *Status and conservation of marine mammals in the Philippines*. Unpublished manuscript. Final Report submitted to the University of the Philippines – Los Baños. 78 pp.

Aragones, L. V. (2008). Overview of Philippine marine mammals. In L. V. Aragones & G. E. Laule (Eds.), *Marine mammal stranding response manual: A guide for the rescue, rehabilitation, and release of stranded cetaceans and dugongs in the Philippines* (pp. 7-30). Subic Bay Freeport, Philippines: A Wildlife In Need (WIN) and Ocean Adventure publication.

Aragones, L. V., & Laule, G. l. (Eds.). (2008). *Marine mammal stranding response manual: A guide for the rescue, rehabilitation, and release of stranded cetaceans and dugongs in the Philippines.* Subic Bay Freeport, Philippines: A Wildlife In Need (WIN) and Ocean Adventure publication.

Aragones, L. V., Alesna, E. B., & Follosco, N. G. (2008). An introduction to the Philippine Marine Mammal Stranding Network. In L.V. Aragones & G.E. Laule (Eds.), *Marine mammal stranding response manual: A guide for the rescue, rehabilitation, and release of stranded cetaceans and dugongs in the Philippines* (pp. 1-2). Subic Bay Freeport, Philippines: A Wildlife In Need (WIN) and Ocean Adventure publication.

Aragones, L. V., Encomienda, R. P., Flores, M. B., & Roque, M. A. (2010). [The first and second-recorded specimens for the pygmy sperm whale (*Kogia breviceps*) in the Philippines]. Unpublished raw data.

Aragones, L. V., Roque, M. A., Flores, M. B., Encomienda. R. P., & Desmond, T. (2009). [Unusual near mass strandings or out of habitat of melon-headed whales (*Peponocephala electra*) in Bataan and Romblon]. Unpublished raw data.

Azanza, R. V., David, L. T., Borja, R. T., Baula, I. U., & Fukuyo, Y. (2008). An extensive *Cochlodinium* bloom along the western coast of Palawan, Philippines. *Harmful Algae*, *7*, 324-330.

Azanza, R. V., Siringan, F. P., San Diego-Mcglone, M. L., Yñiquez, A. T., Macalalad, N. H., Zamora, P. B., et al. (2004). Horizontal dinoflagellate cyst distribution, sediment characteristics and benthic flux in Manila Bay, Philippines. *Phycological Research*, *52*, 376-386.

Bajarias, F. F. A. (1995). Dynamics of *Pyrodinium* red tide in the coastal waters of Masinloc, Zambales, Philippines. In P. Wuthisiu & N. Otawa (Eds.), *International Seminar on Marine Fisheries Environment* (pp. 139-147). Rayong, Thailand: EMDEC & JICA.

Bajarias, F. F. A., & Relox, J. R., Jr. (1996). Hydrological and climatological parameter associated with the *Pyrodinium* bloom in Manila Bay, Philippines. In T. Yasumoto, Y. Oshima, & Y. Fukuyo (Eds.), *Harmful and toxic algal blooms* (pp. 49-52). Paris: IOC of UNESCO.

Bossart, G. D. (2009). Marine mammals as sentinels for oceans and human health. *One Health Newsletter*, *2*(4), 3-6.

Bradshaw, C. J. A., Evans, K., & Hindell, M. A. (2006). Mass cetacean strandings: A plea for empiricism. *Conservation Biology*, *20*(2), 584-586. doi: 10.1111/j.1523-1739.2006.00329.x

Brownell, R. L., Jr., Ralls, K., Baumann-Pickering, S., & Poole, M. M. (2009). Behavior of melon-headed whales, *Peponocephala electra*, near oceanic islands. *Marine Mammal Science*, *25*(3), 639-658. doi: 10.1111/j.1748-7692.2009.00281.x

Carpenter, K. E., & Springer, V. G. (2005). The center of the center of marine shore fish biodiversity: The Philippine Islands. *Environmental Biology of Fishes*, *72*, 467-480.

Dolar, M. L. L., Walker, W. A., Kooyman, G. L., & Perrin, W. F. (2003). Comparative feeding ecology of spinner dolphins (*Stenella longirostris*) and Fraser's dolphins (*Lagenodelphis hosei*) in the Sulu Sea. *Marine Mammal Science*, *19*(1), 1-19.

Dolar, M. L. L., Perrin, W. F., Gaudiano, J. P., Yaptinchay, A. A. S. P., & Tan, J. M. L. (2002). Preliminary report on a small estuarine population of Irrawaddy dolphins *Orcaella brevirostris* in the Philippines. *The Raffles Bulletin of Zoology*, *10*(Supp.), 155-160.

Dolar, M. L. L., Perrin, W. F., Taylor, B. L., Kooyman, G. L., & Alava, M. N. R. (2006). Abundance and distributional ecology of cetaceans in the central Philippines. *Journal of Cetacean Research and Management*, *8*(1), 93-111.

Evans, K., Thresher, R., Warneke, R. M., Bradshaw, C. J. A., Pook, M., Thiele, D., et al. (2005). Periodic variability in cetacean strandings: Links to large-scale climatic events. *Biology Letters*, *1*, 147-150.

Fajardo, I. S. (2001, August). Surveying and mapping in the Philippines. *Proceedings of the Twentieth International Cartographic Conference,* Beijing, China.

Geraci, J. R., & Lounsbury, V. J. (Eds.). (2005). *Marine mammals ashore: A field guide for strandings* (2nd ed.). College Station: Texas A&M University Sea Grant College Program.

Green, S. J., White, A. T., Flores, J. O., Carreon III, M. F., & Sia, A. E. (2003). *Philippine fisheries in crisis: A framework for management* (CRMP Document No. 03-CRM, 2003). Project of the Department of Environment and Natural Resources, Cebu City, Philippines.

Hines, E., Aragones, L. V., Adulyanukosol, K., Poochaviranon, S., Somany, P., Ath, L. E., Cox, N., et al. (In press). Asian dugong. In E. Hines (Ed.), *International strategies for manatee and dugong conservation*. Gainesville: University Press of Florida.

Kemper, C. M., Flaherty, A., Gibbs, S. E., Hill, M., Long, M., & Byard, R. W. (2005). Cetacean captures, strandings and mortalities in South Australia 1881-2000, with special reference to human interactions. *Australian Mammalogy*, *27*(1), 37-47.

Leandro, L. F., Rolland, R. M., Roth, P. B., Lundholm, N., Wang, Z., & Doucette, G. J. (2010). Exposure of the North Atlantic right whale *Eubalaena glacialis* to the marine algal biotoxin, domoic acid. *Marine Ecological Progress Series*, *398*, 287-303. doi: 10.3354/meps08321

Leatherwood, S., Dolar, L., Wood, C., Aragones, L. V., & Hill, C. (1992). Marine mammal species confirmed from Philippines waters. *Silliman Journal*, *36*, 65-86.

Leeney, R. H., Amles, R., Broderick, A. C., Witt, M. J., Loveridge, J., Doyle, J., et al. (2008). Spatio-temporal analysis of cetacean strandings and bycatch in a UK fisheries hotspot. *Biodiversity Conservation*, *17*, 2323-2338. doi 10.1007/s10531-008-9377-5

Mangel, J. C., Alfaro-Shigueto, J., Waerebeek, K. V., Caceres, C., Bearhop, S., Witt, M. J., et al. (2010). Small cetacean captures in Peruvian artisanal fisheries: High despite protective legislation. *Biological Conservation*, *143*, 136-143.

Marasigan, A. N., Ingles, J., & Babaran, R. (1995). Distribution of resting cysts of *Pyrodinium bahamense* var. *compressum*, Cancabato Bay, Leyte, Philippines. In P. Wuthisiu & N. Otawa (Eds.), *International Seminar on Marine Fisheries Environment* (pp. 149-156). Rayong, Thailand: EMDEC and JICA.

Mead, J. G. (1979). An analysis of cetacean strandings along the eastern coast of the United States. In J. R. Geraci & D. J. St Aubin (Eds.), *Biology of marine mammals: Insights through strandings* (pp. 54-68). Washington, DC: U.S. Marine Mammal Commission.

National Oceanographic and Atmospheric Administration/ National Marine Fisheries Services (NOAA/NMFS) (2009). *NMFS decision process for responding to live marine mammals that are stranded or otherwise in distress.* Silver Spring, MD: Marine Mammal Health and Stranding

Response Program. Retrieved 28 June 2010 from www.nmfs.noaa.gov/pr/pdfs/health/decision_process.pdf.

National Statistics Office (NSO). (2008). *2007 census of population of the Philippines.* Retrieved 28 June 2010 from www.census.gov.ph/data/census2007/index.html.

Perrin, W. F., & Geraci, J. R. (2002). Strandings. In W. F. Perrin, B. Würsig, & J. G. M. Thewissen (Eds.), *Encyclopedia of marine mammals* (pp. 1192-1194). San Diego: Academic Press.

Perrin, W. F., Reeves, R. R., Dolar, M. L., Jefferson, T. A., Marsh, H., Wang, J. Y., et al. (Eds.). (2005). *Report of the Second Workshop on the Biology and Conservation of Small Cetaceans and Dugongs of Southeast Asia* (CMS Technical Publication No. 9).

Relox, J. R., Jr., & Bajarias, F. F. A. (2003, March). Harmful algal blooms (HABs) in the Philippines. In *Proceedings of the Workshop on Red Tide Monitoring in Asian Coastal Waters*. Tokyo, Japan: The University of Tokyo. (Available at http://fol.fs.a.u-tokyo.ac.jp/rtw/TOP/EXabst/019JuanRReloxJr.pdf).

Slijper, E. J., Van Utrecht, W. L., & Naaktgeboren, C. (1964). Remarks on the distribution and migration of whales, based on observation from Netherlands ships. *Bijbragen Tot de Djerkunde XXXIV*, *34*, 3-93.

Smith, B. O., Jefferson, T. A., Leatherwood, S., Ho, D. T., Thuoc, C. V., & Quang, L. H. (1997). Investigations of marine mammals in Vietnam. *Asian Marine Biology*, *14*, 111-143.

Smith, B. O., Beasley, I., Buccat, M., Calderon, V., Evina, R., del Valle, J. L., et al. (2004). Status, ecology and conservation of the Irrawaddy dolphins, *Orcaella brevirostris* in Malampaya Sound, Palawan. *Journal for Cetacean Research and Conservation Management*, *6*, 41-52.

Tan, J. L. (1995). *A field guide to whales and dolphins in the Philippines.* Makati, Philippines: Bookmark, Inc.

Tandog-Edralin, D. D., Corez-Zaragoza, E. C., Dalzell, P., & Pauly, D. (1987). Some aspects of the biology and population dynamics of skipjacks (*Katsuwonus pelamis*) in Philippine waters. *Interactions of Pacific Tuna Fisheries General Report*, *12*, 100-111.

The Official Government Portal of the Republic of the Philippines. (2010). *General information*. Retrieved 28 June 2010 from www.gov.ph/index.php.

Udarbe-Walker, M. J. B., & Villanoy, C. L. (2001). Structure of potential upwelling areas in the Philippines. *Deep-Sea Research Part I*, *48*, 1499-1518.

Wang, B. (Ed.). (2006). *The Asian monsoon*. Chichester, UK: Springer-Verlag.

Appendix 1. Date of visit to different BFAR regional offices and corresponding names per region

Region	Name of region	Location of regional office	Date of visit
I	Ilocos Region	San Fernando City, La Union	5 October 2009
II	Cagayan Valley	Tuguegarao City, Cagayan	21-23 October 2008
III	Central Luzon	Pampanga and Bulacan	Not visited (via telephone)
IVA	CALABARZON (Southern Tagalog A)	Quezon City, Metro Manila	14-15 July 2009
IVB	MIMAROPA (Southern Tagalog B)	Calapan City, Oriental Mindoro	Through correspondence
V	Bicol Region	Pili, Camarines Sur	10-14 October 2008
VI	Western Visayas	Iloilo City	Through correspondence
VII	Central Visayas	Cebu City, Cebu	24-25 August 2009
VIII	Eastern Visayas	Tacloban City, Leyte	6-8 March 2009
IX	Zamboanga Peninsula	Zamboanga City	31 July to 1 August 2009
X	Northern Mindanao	Cagayan de Oro City, Misamis Oriental	4-5 September 2009
XI	Davao Region	Davao City	21-23 November 2009
XII	SOCCSKSARGEN	General Santos City, South Cotabato	16-17 November 2009
XIII	Caraga	Butuan City, Agusan del Norte	8-9 September 2009
CAR	Cordillera Autonomous Region (landlocked)	Baguio City, Benguet	Not visited
ARMM	Autonomous Region of Muslim Mindanao	Cotabato City, Maguindanao	10-11 November 2009

Appendix 2. Stranding response report form (after Aragones & Laule, 2008)

STRANDING RESPONSE REPORT FORM

CODE NUMBER ____

COMMON NAME: ____ GENUS: ____ SPECIES: ____

CALL RECEIVED BY: ____ Affiliation: ____

TEAM LEADER ____ Contact nos: ____

A.Local Contact Info

Date of Stranding: ____ Time of stranding: ____

Name of Local Contact: ____ Tel. Number: ____

Adress: ____

Observations of local contact:

Approximate size of animal: ____ meters

First observed: ☐ Beach/Land ☐ Floating ☐ Swimming

Animal condition ☐ Live ☐ Fresh dead ☐ Decomposing

B. Stranding Site Address and Description

Region ____ Province ____ City/Municipality ____

Brgy. ____ Address ____

Ttype of beach: ☐ Sand ☐ Silt ☐ Mangrove ☐ Rock

Weather condition ____ Road Access ____

Animal Location:

Sun ☐ Direct sunlight ☐ Shade

Surf ☐ In the surf ☐ Above the surf

Beach ☐ On sand ☐ On rock

C. Type of Stranding

☐ Single stranding ☐ cow and calf

☐ Mass Stranding How many? ____

D.Stranding Result of Human Activity?

(1) ☐ Yes ☐ No ☐ Not determined

If Yes, Check one or more

(2) ☐ Boat collision ☐ Shot ☐ Fishery interaction

(3) Other: ____

E. Condition of Animal Upon Exam by Stranding Team Arrival date and time of Stranding Team: ____

☐ 1. Alive ☐ 2. Fresh dead ☐ 3. Moderate decomposition ☐ 4. Advance decomposition ☐ 5. Mummified/Skelatal

Comments: ____

F. Live Animal Disposition *(check one or more)*

☐ 1. Left at Site
☐ 2. Released at Site
☐ 3. Relocated
☐ 4. Disentangled
☐ 5. Died
☐ 6. Euthanized
☐ 7. Transferred for Rehabilitation
Date: ____
Facility: ____
☐ 8. Other: ____

Condition/Determination *(check one or more)*

☐ 1. Sick
☐ 2. Injured
☐ 3. Deemed Healthy
☐ 4. Abandoned/Orphaned
☐ 5. Unknown
☐ 6. Other: ____

Comments: ____

G. Morphological Data

Sex *(check one)*

☐ 1. Male
☐ 2. Female
☐ 3. Unknown

Age class *(check one)*

☐ 1. Adult
☐ 2. Subadult
☐ 3. Pup/Calf
☐ 4. Unknown

Size & Weight

Straight Length: ____ ☐ cm ☐ in ☐ actual ☐ estimated

Weight: ____ ☐ kgs ☐ lbs ☐ actual ☐ estimated

Photos/Videos taken ☐ Yes ☐ No

Disposition ____

H. Wole Carcass Status *(check one or more)*

☐ 1. Left at Site ☐ 2. Buried (location:) ____ ☐ 3. Towed/Sunk at: ____ ☐ 4.Frozen for Later Exam

☐ 5. Scientific collection (where?) ____ ☐ 6. Educational collection (where?) ☐ 7. Other: ____

Necropsied?

☐ Yes ☐ No

if yes Date: ____ Place: ____ Necropsied By: ____

For results see Necropsy Form