



UNIVERSITY OF THE PHILIPPINES

EMERGING PATHOGENS AND HUMAN INTERACTIONS
OF STRANDED CETACEANS IN THE PHILIPPINES:
SENTINEL SPECIES PROVIDING CLUES
ON OCEAN AND HUMAN HEALTH

by

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ABSTRACT

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The recognition of “one health” view brings together the interdisciplinary approaches to explore the interconnections among the health of humans, animals, and environments. It is in this viewpoint that this effort was undertaken – investigating marine mammals in the Philippines as sentinels of pathogen pollution and emerging diseases as well as resource exploitation through fishing pressure. In the work of finding the links between ocean and human health, one of the challenges for the Philippines is the lack of scientific information on waterborne emerging diseases that are not only potentially infectious, but are also zoonotic. The present study fills in this knowledge gap by detecting the occurrence of bacteria, Microsporidia, *Giardia*, and *Toxoplasma gondii* in locally found cetacean species. Cetaceans (n=30) that stranded from January 2012-March 2013 were appropriately responded to and biological materials were taken whenever applicable. These cetaceans were confirmed to the following species: *Globicephala macrorhynchus*, *Kogia sima*, *Kogia breviceps*, *Lagenodelphis hosei*, *Mesoplodon* sp., *Physeter macrocephalus*, *Stenella attenuata*, *Stenella longirostris*, *Steno bredanensis*, *Tursiops aduncus*, and *Tursiops truncatus*. A total of 25 bacteria were isolated from nine stranders. Phenotypic and genotypic methods of isolate identification yielded 12 consensus genera: *Acinetobacter*, *Aeromonas*, *Burkholderia*, *Enterococcus*, *Moraxella*, *Proteus*, *Providencia*, *Rhizobium*, *Serratia*, *Sphingomonas*, *Staphylococcus*, and *Vibrio*. More than half of the bacteria isolates (67%) showed either single (24%) or multiple resistances (43%) to 90% of the

following antibiotics tested (arranged according to determined degree of effectiveness): Ciprofloxacin> Meropenem> Amoxicillin> Amikacin> Trimethoprim/Sulfamethoxazole and Tetracycline>Nitrofurantoin and Chloramphenicol> Cefazoline> Erythromycin. No screened strander was positive for *Giardia*. Microsporidia were detected in fecal samples of four individuals through amplification of SSU/LSU rRNA gene. Specifically, *Enterocytozoon bieneusi*, *Encephalitozoon intestinalis*, and presumptive microsporidian parasites phylogenetically related to *Nosema* species *bombycis* and *sporodopterae* were identified. Serological assay detected antibodies for *Toxoplasma gondii* in five stranders while nested polymerase chain reaction positively amplified the B1 gene of the parasite in two stranders. This study provides the first report on bacteria (and their antimicrobial resistance profiles), Microsporidia, and *T. gondii* in cetaceans found in the country. Since the detected microorganisms include species recognized to cause new infections in marine mammals worldwide, the findings of the study underscore the potential of stranded cetaceans to serve as sentinels for studying the movement of emerging pathogens in marine habitats, provide clues on the health status of their free-ranging populations, and present the health risks available to humans who share the same water resource with them.

Apart from pathogen infection and diseases, human interactions continue to affect cetacean populations worldwide. In particular, fisheries are some of the serious threats which can take the form of direct fishery interactions (e.g., mortalities or injuries from fishing gears) or indirect fishery interactions (e.g., prey availability). In this study, cetacean stranding events (n=354) that occurred in the Philippines from July 1998-March 2013 were analyzed for different forms of human interaction (HI), including an attempt to find spatial associations between fishing pressure (in terms of fishing efforts) and stranding sites nationwide. A subset of these strandings (i.e., 27 events with 28 individuals) was responded from January 2012 to March 2013 using a protocol on examining stranded

cetaceans for signs of HI. Based on the involvement of HI, all stranding events considered in the study were classified as: (1) *Non-HI Strandings* or strandings not resulting from HI (n=21); (2) *HI-Strandings* or strandings caused by HI (n=47); and (3) *CBD (Could not Be Determined)* or strandings in which the contribution of HI was neither assessed nor confirmed (n=286). Most stranding events had northeast monsoon seasonality, with many *HI-Strandings* reported to occur also during this season. The findings on the use of a protocol for investigating HI in the representative subset demonstrated what could have been possibly missed in the larger dataset that included all other documented stranding events in the country from July 1998. Consequently, the 33% *HI-Strandings* recorded in the subset suggested the possibility of at least 92 cetacean stranding events of the *CBD* component that was not assessed at all (n=278). In general, HI negatively affected stranded cetaceans by inflicting physical injuries and resulting to mortalities, eventually increasing their likelihood to strand. The regions with higher proportion of *HI-Strandings* were those previously identified as regional stranding hotspots: Region III (Central Luzon), Region VII (Central Visayas), Region V (Bicol Region), and Region I (Ilocos Region). Generated spatial models showed these regions had relatively higher share of municipal fishing efforts (*GT days*). The implicated forms of HI in the case of direct fishery interactions include entanglement in fishing nets, entrapment in fish cages, collision with fishing vessels, and fishing gear-associated injuries while those of direct human interactions include physical attack, intentional capture, and collision with navigation vessel. The present findings showed that stranding events if closely monitored, could provide alternative opportunities to investigate the impacts of human interactions in cetaceans, and offer the chance to trace the links to fisheries even in live animals that strand for any other reason. Future efforts should consider employing the protocols provided here in assessing local cetacean stranding events for signs of HI as well as associating findings on this to other parameters

of fishing pressure. Likewise, the extent of marine debris ingestion and entanglement in “ghost nets” among cetaceans in the Philippines should also be investigated.

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