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Review Article

On The Mass Stranding Event of Melon-Headed Whale, *Peponocephala Electra* in April, 2021 at Axim, Ghana: Possible Causes and Data Needs.

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Summary

Dolphins and whales are collectively referred to as cetaceans which have until recently remained unstudied in Ghana and within the Gulf of Guinea. In recent times, the growing increase in the landings and stranding of cetaceans have raised concern to environmentalists and the general public even though Ghana has enacted several legislations intended to foster the conservation of biodiversity and protection of the environment. Some of these include United Nations Convention on Migratory Species (UN/CMS) and United Nations Convention on Biodiversity (UN/CBD). The concernshave been heightened since March 2021 by the mass stranding of melon-headed whales (*Peponocephala Electra*), along the beaches of Axim on the western coast of Ghana. Although it is not immediately clear as to the plausible causes of the stranding, some postulations have been made based on sequential observations over time in this paper to help guide mitigating measures and aid in raising public awareness. Among the potential multifactorial causes postulated include the joint naval exercises taking place in and around Ghana's offshore deep-water areas in response to the escalating piracy along the Gulf of Guinea in recent times; the presence of biotoxins and chemical pollutants and poisons arising from '*red tides*'; and the increased maritime vessel traffic along West African waters due to the closure of the Suez Canal compelling vessels to traverse the Cape of Good Hope around South African. These thus are rife with plausible increased ship strikes of the animals, and the possibility of a pandemic, resulting from dolphin morbillivirus (DMV). Suggestions and recommendations have been provided to guide the collection of needed data to facilitate the process of policy, ocean governance and development of management strategies.

Introduction

Ghana's marine and coastal aquatic resources remain an essential component of her economic growth –thus driving the coastal economy, with the provision of essential nutrition, as well as income generation while serving asa livelihood to many coastal communities (Ofori-Danson *et al*., 2019) [17]. Consequently, as observed by the EPA between 2009 and 2013, the remarkable increase in marine mammal beaching incidences (EPA, 2014, 2016; Lartey, 2018) [8, 15], and the recent mass stranding of melon-headed whales (*Peponocephala Electra*) at Axim on the coast of Ghana, have raised national concerns about the possible causes of these events. They also highlight the urgent need to obtain data on these aquatic animals while placing a premium on the collection of basic biological and diagnostic data on the populations of these aquatic animals impacted particularly, by fisheries and other anthropogenic activities in the Ghanaian coastal waters.

Most writers use the term marine mammals to include five (5) members of different mammalian groups, namely: whales, dolphins and porpoises referred to as cetaceans; Sirenians which are the manatees and dugongs, Pinnipedes which includes the sea lions, walruses and seals; freshwater and sea otters and polar bears. Among others, they differ from fishes typically with horizontal tail (fluke)

compared with the vertical tail of fishes and like their counterpart, humans suckle their young with milk, bring forth live young (calves) and have constant body temperature. The most common marine mammals in Ghana are members of the cetacean group represented bydolphins, whales and the Sirenian group represented by a single species, the West African manatee, (*Trichechus senegalensis*).

The increasing awareness of the integral relevance of marine mammals to healthy marine ecosystems, cannot be overemphasised, amidst growing anthropogenic threats posited by activities-anthropogenic to these animals and their environments (Umana, 2002) [22]. Furthermore, Ghana has enacted several legislation aimed at fostering the culture of conservation of biodiversity and protection of the environment (Ofori-Danson *et al*., 2019) [17]. Some of these include United Nations Convention on Migratory Species (UN/CMS) and United Nations Convention on Biodiversity (UN/CBD). The Fisheries Act 2002, (Act 625) Section 90 prohibits targeted fishing for marine mammals, and where caught in nets, the fishers are required to release them into the water. These pieces of legislation also provide for the protection of dolphins. Subsequently, these legislations also help meet national obligations required under the conventions and treaties to which the country is a party.

The exploitation of dolphins and whales

The captures of dolphins are a regular report by field scientists in many coastal nations in West Africa (Bamy *et al*., 2010; Collins *et al*., 2019; Segniagbeto *et al*., 2019) [1, 3, 20]. A phenomenon easily associated with the pressures from rapid population growth and declining fish catches. It does turn marine mammals into a response to immediate food needs. Ghana's Western Region has gained notoriety for the dubious distinction of hosting the highest documented dolphin exploitation in western Africa (Ofori-Danson *et al*., 2003) [16]. Nigeria, however, is suspected of potentially coming close to second in intakes though there are few firm survey data in the issue and with conflicting conclusions (Uwagbae and Van Waerebeek, 2010) [23, 26]. In Ghana, at least 16 dolphin species are affected. It includes three of (i) Clymene dolphins, *Stenella* Clymene; (ii) pantropical spotted dolphin, *S. attenuata*; and (iii) common bottlenose dolphin, *Tursiops truncatus* - in such appreciable numbers that landings raise serious conservation concerns (Ofori-Danson *et al*., 2003) [16]. While no quantifiable data exist to aid in evaluating the extent to which the dolphins converted into bait in the shark fishery industry, it has been suggested that most captured animals are landed, butchered and sold for human consumption (Ofori-Danson *et al*., 2019) [17]. Others are salted, smoked or dried, with processed dolphin products being 'exported' mainly to the hinterland. It has been noted that currently, prices for dolphins are as high as those for similarly-sized billfishes such as sailfish and marlin (Debrah, Ofori-Danson and Van Waerebeek, 2010) [6, 16, 26]. In contrast with the situation observed in neighbouring Togo, where the overt landing of dolphins is not permitted (Segniagbeto *et al*., 2019) [20], within the Ghanaian ports, these animals are landed and sold without impediment.

Sightings and Stranding Of Melon-Headed Whales

Until recent times, most people rarely saw large whales and dolphins die on the beach. This situation was through an event called stranding. A stranded whale or dolphin (especially in mass) always attracts a crowd. Usually, the whale or dolphin has died at sea and has washed up on the shore. Unfortunately, within a few days in the month of April 2021, there were several reports of observed stranding of "dolphins estimated between 80-100" along the beach of Axim. A close identification shows that they all belong to one species, named, the melon-headed whale, *Peponocephala Electra* (seen in Figure 1).

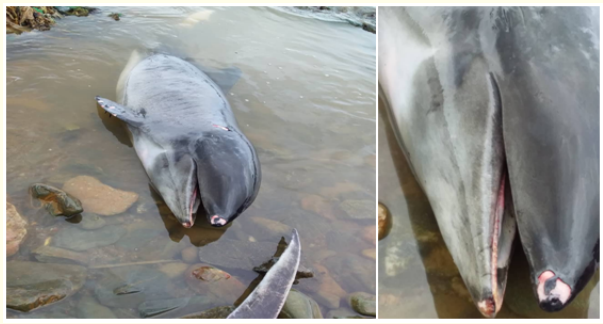

Figure 1: An observed stranding of melon-headed whale found along the Axim Beach, Ghana. Photo Credit: Eric Quayson (March 2021).

The situation as observed relates to the unique characteristics associated with melon-headed whales, described as highly social and more likely to be seen in large pods of 100 to 500 (with a known maximum of 2,000 individuals) (CMS, 2011) at water depths between 1300 to 2,300 metres worldwide (Perryman *et al*., 1994) [19]. This behavior also tends to make them vulnerable where mass stranding is of concern. Thus, the observed numbers suggest an impact on a school of animals. Subsequently, the challenge associated with washing ashore in mass at the Axim beach suggests more likely that an adverse event leading to stress might have occurred in deep waters offshore than inshore waters. Thus investigation into the causes of these 'strange mass landings' may have to focus more on offshore waters while working gradually to waters inshore, in line with water quality analysis and a search for an algal bloom.

While mass stranding among some mammalian species and fishes is not a new phenomenon (as in Figure 2 below), several theories espoused points to plausible causes following the nature of the sequence of events observed.

Figure 2: Stranding of a shot fin pilot whale among some fish species sighted along the Axim Beach few days after the mass stranding of the melon-headed whale. Photo credit: Eric Quayson (April, 2021).

Mass stranding of melon-headed whales reportedly, have come from various coastal waters such as the Moreton Island and Crowdy Heads, Australia. Others include Seychelles; Aoshima, Japan; Piranga Beach, Brazil and Costa Rica (CMS, 2011) [2]. It was noted amongst the several mass stranding that the ratio of females to males was about 2:1, which may reflect behavioural segregation (Perryman *et al*., 1994) [19]. Unfortunately, the rush for the stranded animals (seen in Figure 1 as well as in Figure 2) by local fishers as food could not afford the opportunity to either aid in collecting data on sex ratio and size-frequency from the strand animals at Axim.

The earliest record of this species in the Gulf of Guinea was within 1994 when a specimen landed at Shama, Ghana. Subsequently, several mammal specimens have been captured incidentally and landed with some regularity at Ghana ports (Van Waerebeek *et al*., 2009) [26]. There have been recent sighting reports of the occurrence of the species offshore of Ghana and Cote d'Ivoire (de Boer *et al*., 2016), Gabon (Findlay *et al*., 2006) and Angola (Weir, 2008) [5, 10, 27].

Potential causes of the mass stranding of melon-headed whales

Although it is not immediately clear as to the causes of the current event of stranding in Ghana's waters, some postulations can easily be drawn as a guide to the investigations. Firstly, is the threat from noise pollution? In this regard, one would have to ensure that there are or were no naval exercises taking place in or close to Ghana's offshore deep waters which has a high propensity for underwater noise radiation. This assertion is because the stranding are observed to have occurred only along the Axim beaches (as in Figure 3).

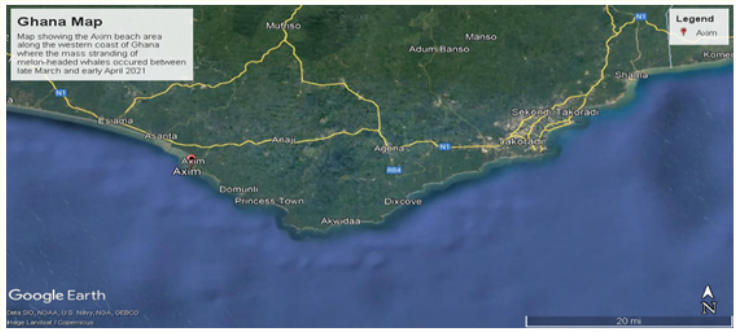

Figure 3: Map showing offshore area from the Axim beach area along the Western Coast of Ghana. Image Courtesy, Google Satellite (2021).

Thus, over a relatively narrow stretch of the shore than over a wider area (many kilometres). And hence could have arisen from a'point source' or definite location offshore possibly, from submarine exercise offshore–that deployed high-frequency active sonar or underwater explosion. Indeed, evidence suggest the Ghanaian Navy in effort towards regional cooperation, maritime domain awareness (MDA), information-sharing practices, and developing tactical interdiction expertise is spearheading new efforts in the Gulf of Guinea through a range of international naval exercises (GM Events, 2021) [11]. For instance, March 2021 saw Ghana host *Obangame Express 2021* (OE21) the largest maritime exercise in Western Africa (GM Events, 2021) [11]. This is because 2020 represented a year of worrying escalation of piracy for coastal West Africa, mainly around the Gulf of Guinea region calling for emerging counter-piracy plans and related military operations by stakeholder countries.

There have been several instances of links between naval military exercises and the mass stranding of melon-headed whales. A case in point is the record of 15-200 melon-headed whales that occupied the shallow waters of Hawaii Bay for over 28 hours in 2004. These largely pelagic animals remained in the shallow, confined bay until human assistance aided their returned to deeper waters. These event as recorded coincidently coincided with military training exercises in the Hawaii islands, thus suggesting that military sonar might have been the cause of distraction (South all *et al*., 2006, Taylor *et al*., 2008) [21]. The melon-headed whale is very sensitive to sound apparent. Thus, there is the likelihood of huge navy exercises off Ghanaian offshore waters which could plausibly become a causal factor even though difficult to prove. A possible physical impact on the school of melon-headed whales would be severe injuries to the inner ear. The ear bones (*periotic* and *bulla tympanica*) may be damaged or shattered, leading to internal bleedings and loss of hearing and echolocation capacity. Thus samples of the head of the animals (as seen in Figure 1 above) may need (or should have been collected) for future study of the ear bones by experts. A mass stranding of melon-headed whales has been documented in theCape

Verde Islands and it was found to be spatially and temporally associated with the presence of a nuclear submarine in Cape Verde (Van Waerebeek *et al*., 2008) [25].

A second possibility of the causes of stranding is throughbio toxins and chemical pollution poisoning through poisonous algae, so-called "red tide' through the food chain, which both fish and dolphins (indirectly via fish fed on by the dolphins). Following the food chain, this could be another plausible explanation given the mass mortalities of fish along the beach of the Accra-Osu area on the Ghanaian coastline about the same period. A reliable source from Mauritius indicates that a similar incident occurred there some time back with the same melon-headed whales. In this connection, water quality and plankton data would need to be collected from areas offshore towards the shore. In addition, it was also reported that the concentrations of polychlorinated biphenyls (PCBs) and hexachlorobenzene (HCB) in melon-headed whales that got stranded on Japanese coasts were slightly lower after the year 2000 relative to stranded specimens recorded in 1982 (Kajiwara *et al*., 2008) [13]. Stranded specimens on these shores also did show the presence of substantial concentrations of mercury and cadmium (Endo *et al*., 2008) [7]. Thus, data from chemical analysis of the tissues including the blubber of the animals would be needed at such incidences. Samples of blood and skin (for genetic studies), blubber, liver, kidneys - (for assessment of contaminants) should also be taken by staff of the Fisheries Commission or Environmental Protection Agency (EPA) of Ghana to provide relevant information for the future. Furthermore, serum samples could have been taken for examination for the presence of dolphin morbillivirus (DMV) which have been found to cause serious, potentially lethal diseases in dolphins and could be vulnerable to new epidemics (Van Bressem *et al*., 2001) [24].

A third possible cause could arise from a non-military source due to increased maritime vessel traffic in West African waters due to the closure of the Suez Canal compelling vessels to use the South African route through the Cape of Good Hope. Although most of these marine vessels were not necessarily en route to port in West Africa, the article on the "right of innocent passage" under the United Nations Convention Law of the Sea (UNCLOS 1982) grants the usage of sea areas for transit beyond the 200nm high seas into the 12nm territorial waters provided such transit voyage are continuous. In this regard, authorities of the coastal state are not to impede such transit unless otherwise, there are grounds to do so under the convention (Lamptey and Sackey, 2017) [14]. These detour voyages occasioned by the Suez Canal blockage in March to marine navigators encompass ship route through the Gulf of Guinea, an area with the heightened alert for pirate attacks. The implication meant vessels exercising the right of innocent passage at the same time had ramped up security measures including but not limited to use of all available engines for speed, possibly raising concerns of vibration noises for animals' near-surface such as melon-headed whales, noted to be sensitive to noise pollution. In other words, this could increase the risk of ship strikes and/or noise pollution which could have been checked from the morphological structure of stranded animals.

Other possible sources of noise pollution, such as from geophysical seismic surveys would need to be verified with national maritime authority registers, however is considered less likely because of the targeted or species specificity mass stranding. While extreme distress and potential death of a single animal has been attributed to the proximity of firing seismic air guns (Gray and Van Waerebeek, 2011), such a link has not been established with mass stranding.

Conclusion

In conclusion, the potential causes of the mass stranding may be multifactorial requiring urgent scientific investigation into the incident to enable preparedness for future occurrences. Unfortunately, it is apparent from the April 2021 event that most of these animals might end up butchered and/or used as bait for catching sharks or processed for consumption and hence too late to rescue live ones for their release back to the waters which would have been possible if the stranded animals had been critically examined by experts for vital data. For instance, an attempt should have been made to count, determine the sex and measured body lengths and appropriately photograph all specimens. These should be accompanied by necropsies made by competent local biologists and veterinarians or at the invitation of the International Whaling Commission (IWC) small cetacean and stranding group and the Panel on stranding for Africa

and the Indian Ocean under IUCN/SSC (species survival committee) Cetacean Specialist Group to compose a technical team to undertake necropsy in collaboration with local marine mammal experts. Meanwhile, the efforts by locals either through ignorance, poverty or greed to collect the animals for consumption or sale, some of who claim that the event is "an omen of blessings from the gods' raise health issues. This is because of possible biotoxins from these animals, even though there has been no indication of red tides. Thus, it is recommended that the law enforcement agencies such as the Ghana Police Force and District/Municipal Authorities as a matter of urgency prevent the locals from gathering the animals and confiscate the carcasses for freezing and the excess amount for mass burial at designated locations (GPS locations) for later necropsies and associated studies. It is also imperative that the larger society, particularly industry and academia lead the process of policy on ocean governance and probably develop implementation strategies.

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