A case report: Stomach foreign object in whaleshark (*Rhincodon typus*) stranded in Thailand

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ABSTRACT
A dead 5.5 m long female whale shark (*Rhincodon typus*) was brought to shore by fishermen in Samutprakarn, Thailand. A necropsy was subsequently performed. Several isolated hemorrhages with multiple ulcers were observed in the gastric mucosa, extending into the subserosal tissue of the stomach. An extremely hard and stiff plastic drinking straw was found in the gastric lumen. The hardening of the straw was due to the reaction of stomach enzyme to plastic, which became a sharp foreign object inside the stomach. Although putrefaction and autolysis was observed, all other organ systems displayed normal findings and no competing cause of death was in evidence. Cause of death was thus suspected to be attributed to the ingestion of the drinking straw, with subsequent irritation of the stomach mucosa causing wounds and infections and may be not possible to eliminate due to the floating nature of the plastic. Since this is a very rare case, due to the fact that shark could usually eliminate the stomach content, we should not overlook the danger of plastic pollution in the marine environment.

KEYWORDS: Whale shark, *Rhincodon typus*, death, foreign object, stomach, hemorrhage

INTRODUCTION

Whale sharks are the largest fish in the world and occur in circumtropical pelagic water (Pope, 1997). Plankton and small pelagic fish are its main food source, captured by filtration through its large mouth (Mojetta, 1997). The filtration apparatus consists of spongy tissue with a 2-3 mm wide mesh attached to the cartilaginous walls of the gill arch (Mojetta, 1997). Whale sharks can actively suck in food (Parker and Parker, 1999). They feed by swimming slowly near the surface (0.5 m/sec) with the top of their head clear of the surface and opening their large jaws wide as they swim and trap small organisms such as krill and small fish contained in the water that flows through the mouth and gills (Gunn et al., 1999; Tricas et al., 1997). They also make regular horizontal dives, foraging for food. They can grow to up to lengths of 18 meters (Mojetta, 1997).

CASE REPORT

On 17 October 2005, the carcass of a whale shark with a rope tied around its caudal fin was sighted in a fishing net offshore near Klongdan, Samutprakarn, Thailand (approximately 200 km from the abovementioned site). The shark was brought ashore by a small fishing boat and subsequently examined by the author 14 hours after the first sighting. It was initially assumed that the dead shark was the one that had been observed alive a few days earlier. However, upon comparison of photographs it was noted that the gill cover pattern of this shark differed from that of the live whale shark which had initially been observed, thus proving that it was a different shark.

The external examination revealed no apparent injuries. Length was 5.5 m, body mass was estimated at being 600 kg and sex was determined as female. Due to limited local facilities, post-mortem examination had to be performed in situ on the beach in a setting which allowed only partial necropsy. No equipment to facilitate hoisting was available.

Internal examination revealed a marked ammonia-like smell of all tissue and body liquids. Putrefaction had begun, with gaseous distension and oily decay of internal organs. However, the internal situs was intact and it was found that the liver appeared normal but autolysed, and did not display observable parasites. The spleen was slightly enlarged, probably congested but appeared to be normally homogenous. The intestine and other internal organs were of normal macroscopic appearance. Upon opening the stomach cavity, it was discovered that it contained about 3 kg of content (small fish and slimy liquid of reddish brown color) as well as a single plastic drinking straw such as can be found attached to commercially available rectangular paper soft drink packages. The straw had a length of 12 cm and a diameter of 3 mm. One end was cut at an angle of about 90° to its longitudinal

axis, while the other end was cut at an angle of about 45°, as can commonly be observed in these straws (Fig.1). It was remarkable that the material was much harder than the straws on drinking packages, being virtually inflexible and opaque white. The 45° end revealed sharp edges similar in shape to those of a hypodermic needle. The gastric mucosa revealed at least nine lacerations of about 2-3 mm in diameter. These did not penetrate all layers of the stomach wall and extended into the subserosa. Corresponding to these lesions, marked subserosal blue-black hemorrhages (up to about 15 cm in diameter) were visible on the external (serosa) side of the gastric surface (Fig. 2). It was noted that there were pockets of blood with a diameter of up to 10 cm which had separated the layers of the gastric wall horizontally in several loci. The stomach and entire intestine contained no blood or content suggestive of digested blood. No other foreign objects were found in the digestive tract. The digestive tract contained small amounts of liquefied digested food mixed with autolysed mucosal tissue. Heart, brain and kidneys could not be examined due to inaccessibility in the beach setting. Histology of all organs revealed marked putrefaction and autolysis. Histology of the lacerations of the stomach revealed autolysed red blood cells accumulated in large areas especially in the subserosa.

Furthermore, it was noted that members of the post-mortem team developed skin lacerations in areas in which they had been in extended contact with body fluids of the shark. These skin lesions persisted for 14 days and had the appearance of chemical burns similar to those observed in persons having skin contact with caustic agents such as concentrated ammonia.

DISCUSSION AND CONCLUSION

It could be shown that a dead whale shark found close onshore in Samutprakarn, Thailand, seemed essentially healthy and uninjured upon post-mortem examination except for a plastic drinking straw found in its stomach. There were several lacerations of the stomach wall reaching into the sub-serosal layers of the stomach. Marked hemorrhaging could be observed here. The size of the lacerations was compatible to being caused by the 45° angled end of the drinking straw. In addition, the plastic material of the drinking straw seemed unusually hard. The hardening and stiffening of the straw can possibly be attributed to its extended contact with an acid environment such as that found in the whale shark stomach. The digestive tract of the whale shark is relatively short compared to other vertebrates since digestion is assisted by powerful gastric juices containing concentrated hydrochloric acid and pepsin (Holmgren and Nilsson, 1999). Whale sharks ingest food by intermittent suction filter feeding with aperiodic pulses (Clark and Nelson, 1997; Compagno, 1990; Diamond, 1985; Martin and Neylor, 1997; Sanderson and Wassersug, 1993; Taylor et al., 1983).The straw was probably taken in with the flow of water and prey into the mouth (Budker, 1971; Colman, 1997; Gudger, 1941; Springer, 1967).

The straw thus caused the penetrating injuries to the stomach of the whale shark. The stomach is highly expandable and food remains in the stomach for many hours or even days (Holmgren and Nilsson, 1999). Although it seems speculative whether a shark can develop the equivalent of "stomach ache" due to several injuries of the stomach wall, this could have been one of the causes of the death of the animal. Furthermore, the hemorrhages of the stomach wall suggest a relevant amount of disturbance of gastric function and thus an impairment of uptake and digestion of food by the shark. This is supported by the fact that the intestine contained only small amounts of digestive products, suggesting a decreased food uptake prior to death. In the light of the fact that the whale shark is a surface feeder, it is to be expected that it will ingest floating foreign objects and swallow those that are below a certain size, like seemingly harmless pieces of floating trash such as a plastic drinking straw. There have been reports on unlikely objects found inside the shark stomach due to its scavenging and opportunistic feeding behavior (Parker and Parker, 1999). Some sharks regurgitate their gut contents under stress and as a defensive reaction (Parker and Parker, 1999). However, this mechanism has not been investigated exhaustively in whale sharks. In this case, the straw may have been contained in the stomach, with the impossibility of it being regurgitated once it had been swallowed. It is also noteworthy that the tissue and body fluids of whale sharks contain ammonia. This is the result of postmortal bacterial conversion of urea into ammonia. During lifetime, urea and trimethylamine in the blood and tissue of the whale shark aid in maintaining the osmotic balance, since whale sharks have no urinary tract in the usual sense. Instead, urea is concentrated in the blood and excreted through the skin (Vannuccini, 2002). The resulting ammonia is concentrated enough to cause chemical skin burns in humans. We therefore advise the use of protective gear upon post-mortem examination of whale sharks.

Fig. 1 A plastic drinking straw was found in stomach

Fig. 2 Subserosal blue-black hemorrhages on the external side of the gastric surface**.**

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