Whale sharks of northern Mindanao: hunters to spotters?

Large Marine Vertebrates Research Institute Philippines

Progress Report II

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This report presents our final update for our 2017 whale shark research and conservation work in Northern Mindanao, Philippines. After completion of our leg of the work in Talisayan, Misamis Oriental, we moved west to Salay on the eastern side of Macajalar Bay, south Bohol Sea. We completed a total of 27 surveys along the municipality of Salay, extending from Balingasag to the south and towards Talisayan to the northeast, covering 96 hours and 1,021 km of effort. During our surveys we didn't encounter any whale sharks, however the locals did confirm their presence in the area. The municipality of Salay has 725 fishermen registered with the Local Government Unit in 8 coastal barangays (villages). We aimed to interview 40% of them (290) to keep consistency with our previous work in Talisayan and with other similar studies, to understand their experiences and interactions with whale sharks, and other megafauna catches. Here, we present preliminary results from fisherfolk questionnaires in Salay and Talisayan.

Background

The whale shark *Rhincodon typus* is the world's largest fish, and it inhabits the tropical and warm temperate waters of the world (Rowat & Brooks, 2012). Whale sharks create seasonal aggregations in certain areas, normally linked to primary productivity (e.g. Robinson *et al*., 2013; Motta *et al*., 2010; Rohner *et al*., 2015). This predictability makes them targets to hunters and tourists alike. In the Philippines, targeted fisheries for whale sharks operated in the Bohol Sea area into the late 1990s, with over 100 whale sharks landed seasonally at just two sites (Pamilacan Island, Bohol, and Talisayan in Misamis Oriental; Alava *et al*., 2002). Continued exploitation in the Indo-Pacific region led to the uplisting of the species to 'Endangered' under the IUCN Red List in 2016 given their >50% population decline in the last three generations (Pierce & Norman, 2016).

The northern Mindanao bays present high primary productivity between December and June (Cabrera *et al*., 2011). This was corroborated by semi-structured interviews with local fishermen who confirmed the bloom of sergestid shrimps (spp. unknown) during these months, a whale shark favourite (e.g. Rohner *et al*., 2015; Araujo *et al*., 2016a). The bays are in close proximity to deep waters close to shore, providing unique areas of upwelling, and where pelagic species are seen in relative proximity to the coast. Hunters from Guiwanon, Talisayan, used to travel far and wide across the Bohol Sea in search of whale sharks (Alava *et al*., 2002). Whale sharks were caught in Talisayan, south of Camiguin, and in the Salay area on the west side of the peninsula, though catch per unit effort decreased there over time. Eckert *et al*. (2002) deployed a satellite tag on a whale shark in Salay, and recent tag data revealed movement between Talisayan, Camiguin and Salay by some individuals (Araujo *et al*., *in prep*.). These results highlight the importance of the area for this endangered species, on at least a seasonal basis.

Little is known about the general marine biodiversity in northern Mindanao. Magsaysay, between Gingoog and Butuan Bays, reportedly hosts whale sharks during the sergestid shrimp season and satellite tag data also shows whale sharks moving through this area (Araujo *et al*., *in prep*.). Malimono in Surigao del Norte is a long straight coastline with occasional small bays adjacent to steep slopes. Whale sharks were sighted along a 25 km stretch of coastline during exploratory surveys in 2016 (Araujo, unpub. data). Similarly, Talisayan and Salay have seasonal black skipjack tuna fisheries, fisherfolk of which all reported the occurrence of whale sharks in close proximity to the tuna, even sometimes ending entangled in their nets. A close relationship with the fishermen can help identify whale shark hotspots and seasonality.

This report presents our preliminary results from our second leg of the project in Salay. Meetings were held during April and early May and a Prior Informed Consent (PIC) was signed with the municipal Mayor of Salay. We started surveys in Salay in March, at the same time as we were in Talisayan, and continued so until mid-May when we moved the whole team to Salay. The data clean up from Talisayan and Salay fisherfolk questionnaires are complete and we present preliminary results herein.

Project Update 2: Salay

Whale Shark surveys

In collaboration with the Local Government Unit of Salay, surveys were conducted along the coastline of Salay, Misamis Oriental, in search for whale sharks (Fig. 1).

Figure 1. Map of the study area.

Similar to that reported in Talisayan, whale sharks are commonly sighted in association with other fauna. To help find the whale sharks, we look for fish boils on the surface. In Talisayan we encountered whale sharks occurring with *Euthynnus affinis* (black skipjack or mackerel tuna), *Katsuwonus pelamis* (skipjack tuna), *Auxis* spp. (likely *A. rochei* and *A. thazard*; bullet mackerel/tuna), and the juvenile version of these species. When sighting a boil of fish, the pumpboat slowly approaches whilst looking for fins breaking the surface. Fisherfolk are normally already at the scene, and they drive with their pumpboats over the boil, trailing a 30 m line with a single or multiple silvery hooks over it. It is unsafe for researchers to get in the water to observe if whale sharks are under the tuna boil and not breaking the surface. We collect a GPS waypoint only when a researcher visually confirms a whale shark sighting.

We completed a total of 27 surveys in Salay, spanning 1,021 km over 96 hours of survey effort. Surveys were conducted as far south as Balingasag and northeast towards Talisayan. We did not encounter any whale sharks whilst on survey in the area. The locals did report their presence in the area, mostly between January and April. Even though we did survey in March and April, most of the effort was in May and June. Whale sharks are elusive and reports of whale sharks close to shore were predominately at night time this year.

Other megafauna

Whilst on survey, we also recorded encounters with other species. We had a total of 37 encounters with other marine megafauna, namely spinner dolphins (*Stenella longirostris*), Risso's dolphins (*Grampus griseus),* melon-headed whales (*Peponocephala electra*), Fraser's dolphins (*Lagenodelphis hosei*), green turtles (*Chelonia mydas*) and mobulid rays (*Mobula* spp.). They were mostly encountered 3-7 km from shore, all along the municipalities of Salay, Sugbongcogon and Binuangan. These data were shared with the Local Government Unit of Salay.

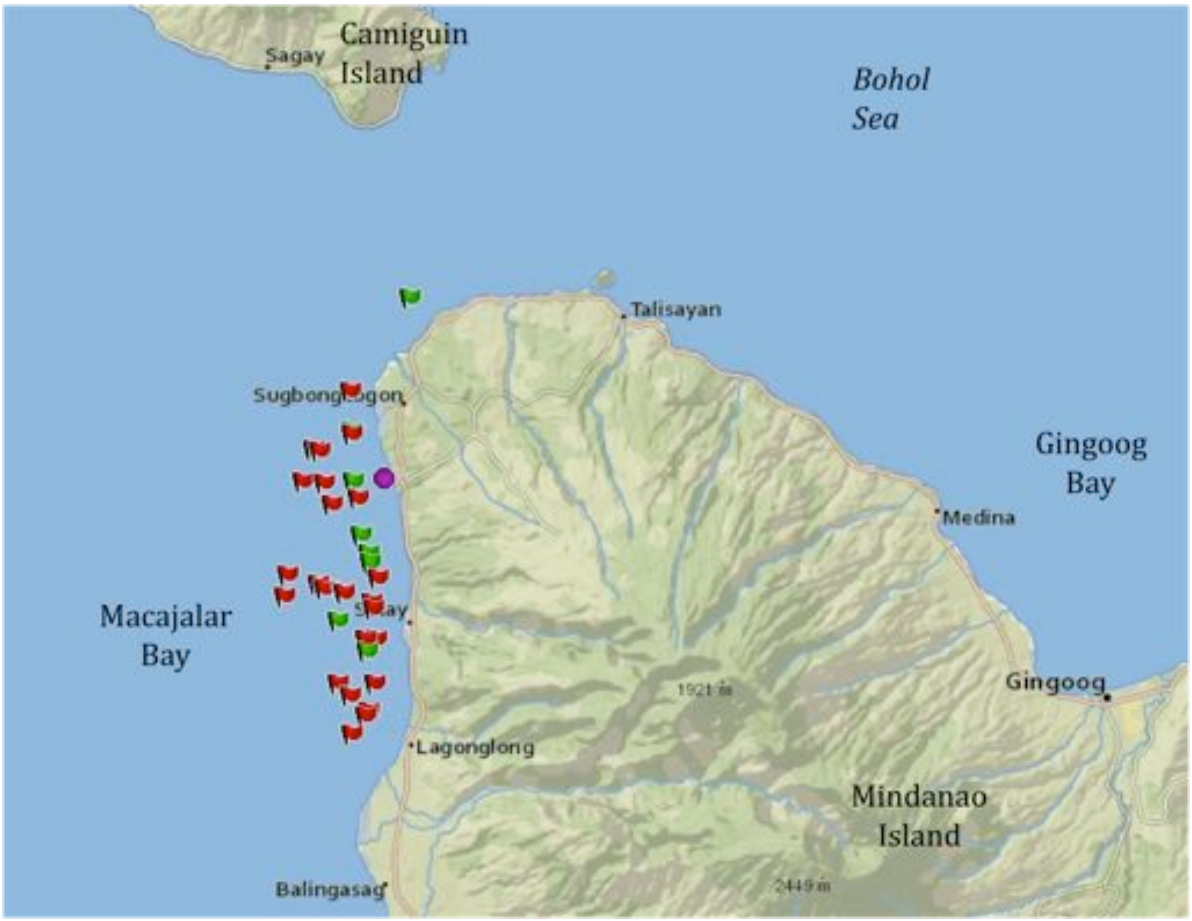

Figure 2. Marine megafauna recorded on surveys from Salay. Red flags = cetaceans; green flags = mobulid rays; purple circles = turtles.

Fisherfolk questionnaires: Salay & Talisayan

Salay: whale sharks

Between May 22nd and June 28th we conducted 259 interviews with the fisherfolk of Salay, throughout 8 coastal barangays. This represented 36% of the registered fishermen on the official ledger, a 2015 initiative by the Bureau of Fisheries and Aquatic Resources (BFAR, FishR). We fell short of the 40% target due to a lack of available fisherfolk. Semi-structured interviews were based on methods adapted from Whitty (2016) and Moore at al. (2010). Interviews lasted 20 min on average ± 9 min S.D. Ninety-nine percent of respondents knew the whale shark was a protected species, with only 3 fisherfolk being unaware of it. Of the 259 respondents, 91 (35%) of them had had their gear damaged by a whale shark, with one fisherfolk having had gear damaged on 30 different occasions. On 79% of occasions the gear

involved was a net (drift or gill net), and on 18% of occasions with lines. Eighty-nine respondents said they had had a whale shark entangled in their gear or someone else's gear. Most entanglements (57%) happened during net setting around small fish (anchovies, sardines). On 85 occasions the whale sharks were released, presumably alive, whilst on another 4 they didn't know. Only 5 incidents were ever reported to the local authorities for record keeping.

As part of the interview we wanted to know how fisherfolk thought entanglements with whale sharks could be avoided. Sixty percent of respondents said it was unavoidable, whilst 36% said they could avoid entanglements with whale sharks if they actively manoeuvred around them or didn't set nets/lines when the whale sharks were in the vicinity. A further 3% suggested swapping gears altogether, whilst a further 1% suggested lifting the ban on whale shark hunting, and hence, keep the animal. When asked how they could release the whale shark safely whilst avoiding catch loss, 81% suggested leaving the whale shark alone and they'd find a way out of the net, whilst 13% suggested actively lowering the net or cutting lines to avoid whale shark entanglement. The remaining 6% either didn't know or didn't answer.

Barangay	# of fisherfolk	# of interviewees (36%)
Dinagsaan	25	10
Ampinican	45	18
Inobulan	179	70
Salay Riverside I	42	17
Salay Riverside II	76	24
Poblacion	21	8
Casulog	149	59
Looc	188	53
Total	**725**	**259**

Table 1. Coastal Barangays of Salay and interviewee numbers.

Salay: other megafauna

We asked fisherfolk if they were aware of turtles, sharks or rays being protected by law in the Philippines. Ninety-six percent were aware of species being protected, whilst 4% were unaware or didn't know. Seventy-seven percent were aware of turtles being protected, 53% were aware of manta rays being protected, 11% was aware of at least one species of shark being protected, and 5% believed mobula rays were protected. The most species of sharks caught were thresher sharks (*Alopias* spp., 13% of respondents), dogfish, nurse shark (*Nebrius ferrugineus*), hammerhead shark (*Sphyrna* spp.), and silky shark (*Carcharhinus falciformis*). It is not possible to ascertain the species with accuracy as most are morphologically similar to other species, and at least 200 species have been confirmed in Philippines (Alava et al., 2014). The most commonly caught species of ray was the manta ray (now *Mobula* spp.) by 10% of respondents, followed by blue-spotted ribbontail or maskray (9%), stingray (general, 9%), and lesser devil rays (5%, *Mobula* spp.).

Eleven percent (29) of respondents admitted to have had a turtle entangled in their gear (hook and lie, and net on all occasions). The most commonly caught species was the green turtle on 59% of cases, followed by the critically endangered hawksbill turtle *Eretmochelys imbricata* (31%) and leatherback turtle *Dermochelys coriacea* (7%). On all occasions the turtles were released presumably alive. Only 3 cases were reported to the local authorities.

Talisayan: whale sharks

Between March 23rd and May 8th 2017 we conducted 162 semi-structured interviews with fisherfolk across 11 coastal Barangays in Talisayan, Misamis Oriental. Interviews lasted 24 min on average ± 8 min S.D. Out of 162 interviewees, 96% knew that the whale shark is a protected species, 2% didn't and 2% didn't know. Only 2% of interviewees had never seen a whale shark, and those who have, had seen them within the last calendar year. 34% of interviewees had had their fishing gear damaged by a whale shark, with one individual having had interactions with whale sharks on 20 different occasions. Most interactions happened with nets (17%) and lines (15%). Fifty-nine (36%) of interviewees responded that they had had a collision with a whale shark at least once.

Barangay	# of fisherfolk	# of interviewees (41%)
Luyong Baybayon	20	8
Poblacion	60	24
San Jose	65	26
Calamcam	20	8
Tagbucbuc	28	11
Putting Balas	38	19
Pampangon	24	10
Pook	25	10
Sta.Ines	45	18
Punta Santiago	38	15
Mandahilag	32	13
Total	**395**	**162**

Table 2. Coastal Barangays of Talisayan and interviewee numbers.

Twenty-three (14%) interviewees said whale sharks had been entangled in their own gear, whilst 32 (20%) had seen it or experienced in someone else's gear. Of these entanglements, 34 were released presumably alive, 1 admitted releasing the animal as presumably dead, and 1 did not know of the condition of the animal. Only 3 incidents were ever reported to the local authorities. Entanglements happened more frequently with nets (89%) and lines (11%).

The fisherfolk who'd had entanglements in their gear, or someone else's gear, were asked how these entanglements could be avoided. Fifty-one percent (n=37) responded that these entanglements were unavoidable, whereas 38% suggested actively avoiding setting lines or nets where whale sharks were sighted, 3% suggested having law enforcement involved, 3% luring them away with bait (provisioning), 3% suggested removing the ban on whale shark hunting, and 2% suggested driving the shark away by knocking on the pumpboat. The interviewees were subsequently asked how they would release the whale sharks whilst avoiding catch loss. Forty percent suggested to actively move the gear to avoid the whale shark, 35% didn't know how, 22% suggested to leave the gear in place and the whale shark will find its way out/through, and 3% suggested to lure the shark away by provisioning.

Figure 3. Researchers Jessa Baldesanso and Sue Ong conducting one-on-one interviews with fisherfolk.

Talisayan: other megafauna

We asked fisherfolk if they were aware of turtles, sharks or rays being protected by law in the Philippines. Eighty-one percent (n=162) of interviewees said they were aware of some species being protected, namely turtles (50% of respondents), manta rays (28%, both species of mantas are present in the Bohol Sea), mobula rays (8%, at least 3 species confirmed in the Bohol Sea) and thresher sharks *Alopias* spp. (7%, all 3 species present in Philippines). The most commonly caught species identified by fisherfolk were threshers (species hard to confirm as close look-alikes). The most commonly caught species of rays were identified as either blue-spotted ribbontail ray (*Taeniura lymma*) or look-alike blue-spotted maskray (*Neotrygon* spp.). These two rays are commonly found throughout the Philippines with the former inhabiting shallow-reef systems, and the latter muck substrate habitats. Interestingly, these are also the most commonly found rays in markets throughout the country (Utzurrum, pers. comm.). *Mobula* spp. were also confirmed as commonly caught, as well eagle rays and manta rays, the latter being highlighted as distinctly different from the lesser devil rays. *Manta birostris*, or more recently known as *Mobula birostris* (White et al., 2017), was protected nationally under the same Fisheries Administrative Order 193 (FAO 193, Department of Agriculture) that protected the whale shark in 1998. Other *Mobula* spp. and thresher sharks have come under protection in the country following their listing into CITES in 2016. Other elasmobranchs remain unprotected nationally, unless more regionally managed for. In the northern Mindanao provinces, there are no legislations protecting sharks and rays. Turtles were also caught in fisherfolk's gear (7% of respondents), lines and nets being the most common gear, all of which were admittedly released alive. When asked if they had further comments regarding megafauna interactions, 24% of respondents had negative perceptions of sharks stating that sharks should be caught because they are a threat to humans.

Local Education

On June 2nd 2017 we hosted a community event in Talisayan that was centred on marine ecosystems, the different large sea animals found in the area, and plastic pollution. The event was called 'Tawikids' to resemble the local name for the whale shark, *tawiki*. Students aged 9 to 12 year old were invited to participate in art activities, storytelling, games, and a beach clean-up, and were treated to a short skit and a film. In the first and the last exercises of the day, they were asked to draw their dream environment. At the start of the event, they were drawing animals, trees, and land or a church, buildings and a road in the beginning of the event. And at the end of the day, the kids incorporated trash bins in a park and people cleaning or people, houses and boats alongside seas full of fishes and corals, and mountains

full of trees and flowers in their work. A change in their perception of how they want their surroundings to be was apparent and they became more resolute about what they wanted to see in their environment. They learned that people can live in harmony with their environment, and they showed a lot of hope for the future if we put in the work required. Following the success of 'Tawikids' in Talisayan, we organized 'Talokids' in Salay on June 17th 2017. The whale shark in the eastern side of Macajalar Bay is known as *taloki* and hence the newly adapted name for the event. We hosted 24 students for the day, between 15 to 17 years old. We conducted similar activities as in Talisayan and held more discussions with the teenagers on the topics at hand. Each participant was given a pre- and post-assessment test on basic knowledge about the marine environment and its threats. The post evaluation showed high knowledge retention from the lectures and activities, such as correctly identifying fishes from marine mammals, biodegradable items from non-biodegradable ones, and threats to the environment. More importantly, right after the event, a few of the kids took to social media on their own accord and shared what they picked up from the event and how it impacted them.

Figure 4. Photo of researcher Bryan with kids during tawikids/talokids.

Results dissemination and workshops

Following completion of data collection, data cleaning, and preliminary analyses of the whale shark part of the interviews, we returned to Salay and Talisayan in September 2017. In each municipality, we hosted a workshop with heads of fisherfolk from the municipality, fisheries officers and technicians, and members of the mayor's office. In both municipalities there was great reception and were very appreciative of the work we'd done and for having worked closely throughout the project with members of their community.

It was agreed that the municipalities would hold a record of whale shark sightings and interactions throughout the year. Heads of fisherfolk from the various barangays would communicate with the municipal fisheries officers to ensure records are kept up to date. There was an understanding that net and line setting would be first avoided if a whale shark was sighted in the vicinity, and in the case of an entanglement the shark's safety would be prioritised over the catch. Should a whale shark be presumed dead on the net, authorities would be contacted, in which case, the fisherfolk would not be held responsible.

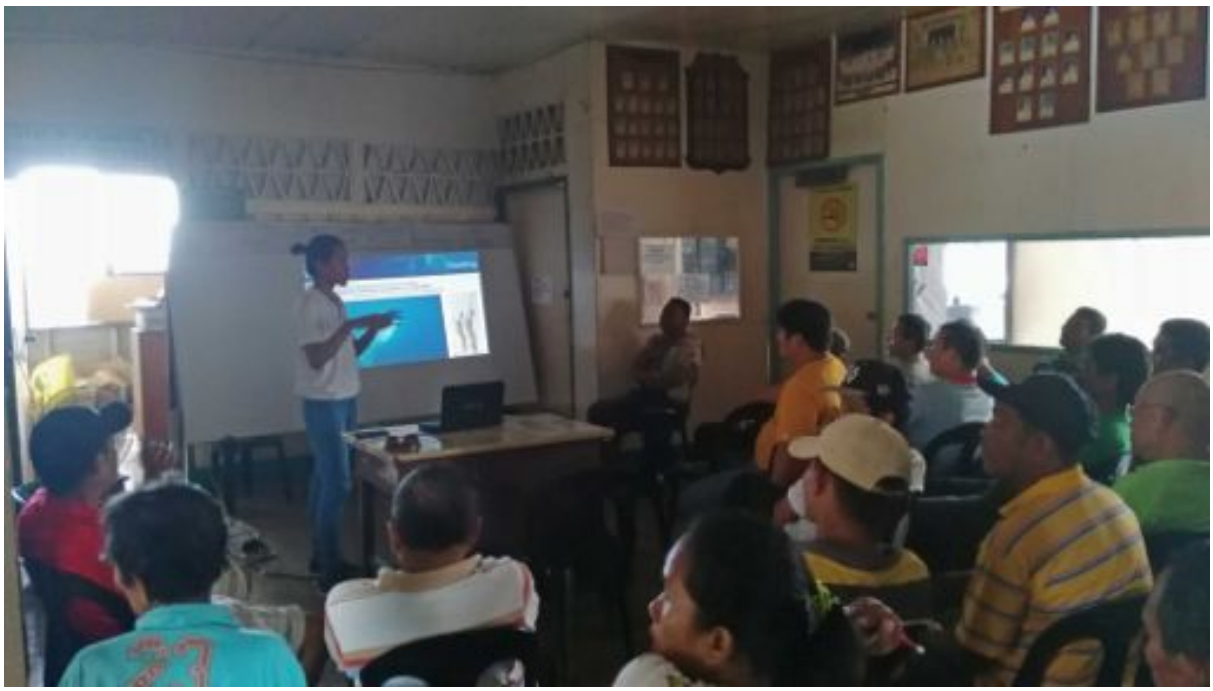

Figure 5. Researcher Jessica presenting whale shark biology and ecology with heads of fisherfolk in Talisayan.

One of the main outputs of the interviews in regards to other megafauna was the general lack of awareness on the status of endangered and protected species. The fisheries officers, under whose management these species fall, will create educational materials to disseminate and educate local fisherfolk on protected species. We will coordinate and help them in the development of such materials. In the event of a rare or endangered species (e.g. thresher or megamouth shark) being caught in the vicinity, we will be contacted to collect morphometric data and samples where possible. The megamouth shark *Megachasma pelagios* (IUCN Red List Data Deficient) in particular has been found in the general area on various occasions (Ponzo et al., 2017) with the most recently occurring whilst we were in Talisayan on May 1st 2017.

Discussion

This project represents the first systematic study on whale sharks in northern Mindanao. Following preliminary data collected in 2016, we completed 57 surveys in western Gingoog Bay and eastern Macajalar Bay in search for whale sharks between March and June 2017. No whale sharks were encountered in Salay or the vicinity; however whale sharks were encountered in Talisayan. Whale sharks were found in association with other fauna, primarily small tuna and mackerel species. This information was corroborated by local fisherfolk, as was their seasonality with whale sharks being sighted in the area anytime between November and June. This is interesting as it coincides with the seasonality for whale sharks in Southern Leyte as reported by Araujo et al. (2016; 2017). Seasonality there is highly variable, and it is therefore possible that northern Mindanao is a similar case. If whale sharks occur in the area during to forage on specific prey, identified as sergestid shrimp in both Southern Leyte and Mindanao, it is possible that when food blooms don't take place, or they don't take place near the surface, whale sharks are not observed to be present in the area. Whale shark sightings in Southern Leyte were poor this 2017 season (Araujo, unpub. data), and it could be the same for northern Mindanao. Survey effort was high and reliability of sightings was very low. Two of

the whale sharks encountered in Talisayan this year had previously been identified in southern Cebu through photo-identification.

Through interviews with fisherfolk in both Salay and Talisayan, it was clear that whale sharks are still part of the local culture. Before there was a ban on their hunting, whale shark meat and skin were dried, and would be locally consumed by frying them, cooking them in coconut milk, or dipping them in vinegar and chili. Locals still remember eating this as a delicacy and expressed a liking to it. It supported the time-honoured barter method of goods between the people that grow crops and fruit in the mountains and the fishermen. The hunting out of Guiwanon, Talisayan, also provided an income to many people, from the hunters to the processors, to the salesmen. To this day, the hunting of the whale shark is remembered as a time of prosperity in the community. What was also clear during our time in Talisayan was the lack of information dissemination during the entire banning process. The locals were never properly explained why their livelihood was taken away, and why they weren't allowed to hunt whale sharks anymore. There was no support given to them after the ban took effect either. On our first presentation in February we invited some of the hunters to participate, where we explained our work, and what we'd be doing in the area. Their knowledge of the whale shark's biology was uncanny, as was their confirmation that whale sharks do target sergestids in the region, and that every whale shark stomach they opened was always full of sergestids.

Sea turtle conservation efforts started with Executive Order No. 542 in 1979 and the creation of the Task Force Pawikan, and are now fully protected under the Wildlife Resources Conservation and Protection Act of 2001 (RA-9417). Through our 421 fisherfolk interviews across 19 coastal Barangays, we learnt that awareness of turtle protection is high, as is that for whale sharks under Fisheries Administrative Order 193. However, awareness of other protected species in the country is low. We have therefore partnered with the local government units to produce materials to raise awareness on protected and endangered species. Fishing effort increased over time with more fishermen competing for fishing grounds, and gear allowing for larger areas to fish in. Non-surprisingly, the number of sharks and rays caught has decreased over time, and pelagic species caught are now memories.

Results were presented to local stakeholders in both Salay and Talisayan, and there is general interest to continue raising awareness and conserving their marine resources. For whale sharks, both municipalities agreed to create a reporting system coordinated between fisheries officers and heads of fisherfolk in each barangay, year-round. We will call them on a regular basis for an update on sightings, and when reports are consistently high we might visit the area to opportunistically collect photo-ID and genetic samples where possible. The development of a better information sharing system will benefit not only whale sharks, but also other megafauna species.

Future steps

This project enabled the understanding of what whale sharks might be doing in the waters of Talisayan. The mayor of Talisayan has support from the province to develop a tourism endeavour in his municipality. Although whale shark sightings were unreliable, cetacean encounters were very reliable >3 km from shore. The data collected during this project was shared with them and we advised on the development of a marine wildlife watching ecotourism endeavour, rather than purely a whale shark one. The condition we asked for the development of such activities was to first prioritize the hunters from Guiwanon and their children through the development of a People's Organisation that would lead the tourism. The Department of Tourism from the province would provide training in wildlife spotting, boat

handling, emergency first response and hospitality. The close relationship established with the municipalities of Salay and Talisayan are exceptional, and further research into the whale sharks that visit the area would continue to be a source of pride for the locals for hosting the world's largest fish.

Acknowledgements

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