



# Whale Shark Conservation and Ecotourism at Panaon Island, Southern Leyte

Large Marine Vertebrates Project Philippines: 2016 Seasonal Report

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This report presents an update for the 2016 whale shark season from the LAMAVE research and conservation work in Pintuyan, Southern Leyte. A total of 95 individual whale sharks (Rhincodon typus) were identified in Pintuyan and San Ricardo between October 14 2015 and January 31 2016. Whale sharks ranged from 3 to 8 m, with a mean estimated size of 5.5 m (± 1.1 m SD). There was a significantly male bias with 64 males, 8 females and 23 of undetermined sex ( $\chi^2 = 23.9, P < 0.001$ ). We conducted a total of 51 surveys aboard tourist and survey boats, with a mean duration of 3:00 hrs ( $\pm$  39 min SD). There was a mean encounter rate of 3.1 ( $\pm$  2.2 SD) whale sharks per trip. We recorded a total of 81 tourist-whale shark interactions with a minimum of 42 different whale sharks, ranging from 0 to 26 min (mean 4 min  $\pm$  5 min SD). Two temperature-depth-recorder (TDR) tags were retrieved from last season's deployment and were unfortunately corroded and the data lost. A further 3 TDR tags were deployed, and in collaboration with the Marine Megafauna Foundation, a further 5 SPOT satellite tags. Preliminary data from the satellite tags revealed a high level of residency to the west and south of Panaon Island, with occasional trips to Mindanao and Bohol by one particular 5.5 m male individual.

## Background

Panaon Island is home to a large aggregation of whale sharks (*Rhincodon typus*) between October and June on most years (Araujo *et al.*, 2016). The Large Marine Vertebrates Project Philippines (henceforth 'LAMAVE') has been studying this aggregation since preliminary work was conducted in May 2012. This aggregation sustains a locally run ecotourism endeavour that operates out of Barangay Son-Ok, Pintuyan. This endeavour sustains two alternative livelihood programmes of People's Organisations: KASAKA and Sea Breeze Women's Association, the latter being a Sew Mates Conservation initiative by which women of Barangay Son-Ok create stuffed whale sharks toys to sell to tourists. KASAKA is involved with the whale shark tourism and the maintenance of the Son-Ok Fish Sanctuary.

During the 2015 whale shark season, a total of 49 individual animals were identified through the use of photographic identification (see Marshall & Pierce, 2012), supplemental educational sessions were conducted at local schools, workshops were held with KASAKA and the tour operators that visit the area, tissue samples were collected, and tags were deployed (see Araujo & Labaja, 2015). During the 2016 season, the focus of the LAMAVE project is to continue the assessment of the whale sharks at Panaon Island, more specifically in Pintuvan and San Ricardo. This again involves the collection of tissue samples for genetics, stable isotope, and fatty acid analyses, as well as the deployment of temperature-depth-recorder (TDR) and satellite tags as part of a collaboration with the Marine Megafauna Foundation (www.marinemegafauna.org). These methodologies will give us a further understanding of the whale sharks' ecology, movement patterns and habitat use. To complement these methods, we will start a feeding ecology study, by which we aim to understand what drives the presence and absence of whale sharks at the site in collaboration with the University of the Philippines-Tacloban. We will also continue to focus on supplementing the Philippine school curriculum focusing on marine ecology and pollution. Here, we present an update on some of these objectives (methods described in detail in Araujo & Labaja, 2015).

### **Preliminary Results 2016**

### Whale Shark Population Structure

Through the use of photo-identification (henceforth 'photo-ID') a total of 95 individual whale sharks were identified between Pintuyan and San Ricardo, from October 14<sup>th</sup> 2015 to January 31<sup>st</sup> 2016. Individuals identified were significantly male biased, with 64 males, 8 females and 23 whose sex could not be determined ( $\chi^2 = 23.9, P < 0.001$ ). Individual whale sharks ranged from 3 to 8 m estimated total length, with an overall mean  $\pm$  SD of 5.5  $\pm$  1.1 m. There was no difference in the sizes of sexdetermined and undetermined individuals. Five male individuals (8% of males) were considered mature based on clasper morphology (Rohner *et al.*, 2015).

### Survey effort and tourism

Between November 14<sup>th</sup> 2015 and January 30<sup>th</sup> 2016, we conducted a total of 51 surveys on two different survey platforms: small pumpboats and tourist boats.

Surveys lasted between 01:10 and 4:48 (mean  $\pm$  SD = 03:00  $\pm$  0:39). Results are summarised on Table 1. We spent a total of 152 hrs and 30 min on survey. There was an average of 3.1 ( $\pm$  2.2 SD) whale sharks per trip, ranging from 0 to 10 individuals as confirmed by photo-ID (Fig. 1). No whale sharks were encountered on 5 surveys. Moon irradiance was used to test for this absence for the preliminary 2016 season and for the 2015 season, but yielded no correlation ( $R^2 = 0.0012$ , P = 0.2831). There was a total of 156 whale shark encounters whilst on survey (Fig. 7).

We recorded a total of 81 tourist-whale shark interactions in water. The mean interaction duration was 4 min ( $\pm$  5 min SD), ranging from 0 to 26 min. Interactions were recorded with a minimum of 42 different individuals. Mean interaction duration with certain individuals was longer than with others (e.g. LSR-59 15 min, n = 3; LSR-172 2 min, n = 9). There was a total of 295 tourists recorded between October 1<sup>st</sup> 2015 and January 23<sup>rd</sup> 2016 (Pintuyan Official Tourist Logbook).



Fig. 1. Number of whale sharks encountered on survey at the study site between 14-Nov-15 and 30-Jan-16.

Operator	Number of trips	Mean Duration	SD
Coral Cay Conservation	1	2:06	0:00
Sogod Bay Scuba Resort	5	3:42	0:35
Leyte Divers	1	2:21	0:00
Southern Leyte Divers	5	2:53	0:31
Padre Burgos Castle Resort	6	2:45	0:48
Peter's Dive Resort	3	2:54	0:28
Sea Doors - Liveaboard	4	2:11	1:04
Survey Pumpboat*	20	3:09	0:26
Tourist Pumpboat	4	3:20	0:16
Whale Shark Divers	2	2:42	0:03
Total	51	3:00	0:39

Table 1. Survey effort between November 14<sup>th</sup> 2015 and January 30<sup>th</sup> 2016. \*Note: these were dedicated whale shark surveys, not tourism tours.

# Resightings and site visitation

Of the 95 individuals identified through photo-ID, 39 (41%) had been previously identified at the site. The remaining 56 (59%) individuals were newly added to the site's database and to the online worldwide whale shark database Wildbook for Whale Sharks (www.whaleshark.org). Of these newly identified whale sharks, two had previously been identified at Oslob, Cebu, one off Pamilacan Island, Bohol, and a fourth one in Donsol, Sorsogon.

Between October 14<sup>th</sup> 2015 and January 30<sup>th</sup> 2016, there were a total of 232 whale sharks encounters recorded, defined as a successfully identified individual whale shark at a specific time and place. These came from a range of sources including citizen science, dive operators, researchers, and from Ery Cordova, a local tour guide, whom LAMAVE trained to opportunistically collect photo-ID data at the site. Individual whale sharks were sighted on average  $2.4 \pm 2.2$  SD different days. Fifty-one (54%) individuals were only sighted once, and 11 individuals were sighted at least on 5 different days.

## Telemetry: TDR and satellite tags

During this early stage of the season, we managed to retrieve two TDR tags deployed on April 2<sup>nd</sup> and 3<sup>rd</sup> 2015 (see Araujo & Labaja, 2015). The tags were corroded upon manual retrieval, and were therefore sent off to the manufacturer in the UK for data download. One tag was unfortunately ruined and no data was recovered, and the second one is currently in-transit back to the UK. Due to this unprecedented failure of the tags, a further 3 were deployed on sharks that had been previously identified at the site. The tags were deployed on 5, 5.5 and 7 m males (P-765, P-495 and P-762 respectively). All three sharks were resignted immediately or soon after tags were deployed. They will be opportunistically retrieved during the 2016 season to have a better understanding of their local habitat use.

As part of a collaboration with Marine Megafauna Foundation, we deployed five Wildlife Computers SPOT satellite tags on five different whale sharks. These tags were opportunistically deployed whilst on survey. A summary is presented on Table 2. These tags use the ARGOS satellite system to estimate the location of the tag when it comes in contact with air. Four individuals were immediately resighted following tag deployment, and the fifth one (P-909) was deployed in very limited visibility (~1 m) and rainy weather therefore not possible to continue survey. Figures 2-6 present the preliminary results from these five deployments.

Tag Number	Deployment Date	Location	Shark ID	Sex	Size (m)
142237	16-Nov-15	Pintuyan, So. Leyte	P-532	F	6.0
142218	17-Nov-15	Pintuyan, So. Leyte	P-904	М	4.5
142220	18-Nov-15	Pintuyan, So. Leyte	P-905	М	5.0
142229	18-Nov-15	Pintuyan, So. Leyte	P-909	UK	5.5
142236	24-Nov-15	Pintuyan, So. Leyte	P-491	М	6.0

Table 2. Summary of SPOT Satellite Tags deployed in Southern Leyte.



Fig. 2. Tag #142237 deployed on P-532 on 16-Nov-15.



Fig. 3. Tag #142218 deployed on P-904 on 17-Nov-15.



Fig. 4. Tag #142220 deployed on P-905 on 18-Nov-15.



Fig. 5. Tag #142229 deployed on P-909 on 18-Nov-15.



Fig. 6. Tag #142236 deployed on P-491 on 24-Nov-15.

# School Education

During January 2016, the LAMAVE team resumed the educational modules in local schools. We built on last season's efforts and this season we will be focusing on more basic ecological processes. So far we have visited Pintuyan National High School and delivered modules to Grades 7 to 10 students, with a total of 163 attendees. We have also delivered modules in Son-ok Elementary School to Grades 5 and 6 students, tallying 30 participants. Other schools in the municipality will be targeted through the month of February, concluding with a coastal community clean up on the 27<sup>th</sup> of February.

School	Grade Level	Number of Students		
Son-ok Elementary School	Grade 5	15		
Son-ok Elementary School	Grade 6	15		
Pintuyan National High School	Grade 7	52		
Pintuyan National High School	Grade 8	31		
Pintuyan National High School	Grade 9	38		
Pintuyan National High School	Grade 10	42		



Fig. 7. Map of A: Philippines; B: Bohol Sea; and C: the study site with whale shark encounter locations between Pintuyan and San Ricardo, Panaon Island, Southern Leyte.

# **Preliminary Discussion 2016**

These preliminary results suggest the 2016 whale shark season at Panaon Island will be a fruitful one, with 95 individual whale sharks identified thus far, more than the LAMAVE team identified during the recent peak season in 2013 when 93 individual whale sharks were identified between February and July. The population structure appears consistent with previous seasons, with significant male bias and a mean estimated size of 5.5 m (Snow, 2013; Araujo & Labaja, 2015; Araujo *et al.*, 2016). This is also consistent with other coastal whale shark aggregations across the globe where whale sharks are primarily juvenile males (Rowat & Brooks, 2012). Interestingly, 5 individual males were considered mature and were identified at the site between mid-November and mid-December.

Given the early stages of the season, we managed to complete 51 surveys with an average of 3 sharks per trip, and a total of 81 tourist-whale shark interactions. There have been at least 295 tourists, highlighting that the season is still in its early stages and tourism remains low in Sogod Bay (compared to the 2013 tourist season when over 1,800 tourists were recorded between October and June; see Snow, 2013). Sharks were encountered between Pintuyan and San Ricardo, with a particularly high density of encounters off Pintuyan Poblacion and Cogon. These two sites coincide with the steepest slopes in the area and might be associated with productivity. A current study by LAMAVE will aim to address this hypothesis.

Forty-one percent of individuals had been previously identified at the study site. This is an interesting find as it highlights the importance of this site for the species. During the 2015 season, we pointed out that most of the recurring individuals were observed feeding at the site. This season however, a lot of individuals were only sighted once, possibly highlighting that the area isn't just a foraging ground, but also a migratory corridor for whale sharks. This being the case, conservation efforts should focus on the protection of this critical habitat.

TDR tags can provide valuable information about the sharks' habitat use. By understanding how they use depth, we can infer their foraging and diving preferences in response to environmental cues. Unfortunately the two tags retrieved so far were corroded and no data are yet available. In contrast, during the second half of November 2015, we successfully deployed 5 satellite tags in Pintuyan. One individual was not resignted following the tagging event, however, the tag revealed this individual stayed in the area at least a month. The tags yielded two interesting finds: whale sharks stay in the area for a longer period than previously thought as measured through survey effort and encounter rate; and whale sharks might leave the area for a few days and travel very long distances and still return to the study site. These findings suggest whale sharks might use the waters off Pintuyan and San Ricardo to opportunistically forage on a selected prey, yet they might still move out of the site for hundreds of kilometres and yet return within a few days. This has dire implications for the management of the species, as it appears they have a very large range, and therefore any species-specific initiatives would need to include several provinces.

Education still remains a key component of our conservation efforts in the area. We will continue to complement the Philippine school curriculum, and are currently in the process of developing a summer activity camp called 'Pawikan Snorkel Club', targeted to children between the ages of 6 and 11. Ideally, these children would have

attended our education modules in schools, and this activity would bridge the theory with a hands-on experience. The snorkel club will aim to run every Saturday during the school summer break, and conclude with a community activity in which we'll engage with participants' friends and families as well.

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### References

Araujo G, Labaja J. 2015. Whale Shark conservation and ecotourism at Panaon Island, Southern Leyte: LAMAVE 2015 Seasonal Report. Available on www.lamave.org/publications

Araujo G, Lucey A, Labaja J, So CL, Snow S, Ponzo A. 2014. Population structure and residency patterns of whale sharks, Rhincodon typus, at a provisioning site in Cebu, Philippines. *PeerJ* 2:e543

Araujo G, Snow S, So CL, Labaja J, Murray R, Colucci A, Ponzo A. Accepted. Population structure, residency patterns and movements of whale sharks in Southern Leyte, Philippines: results from dedicated photo-ID and citizen science. Aquatic Conservation: Marine and Freshwater Ecosystems, 2016.

Marshall AD, Pierce SJ. (2012). The use and abuse of photographic identification in sharks and rays. *Journal of fish biology*, 80(5):1361-1379.

Rohner CA, Richardson AJ, Prebble CE, Marshall AD, Bennett MB, Weeks SJ, Pierce SJ. 2015. Laser photogrammetry improves size and demographic estimates for whale sharks. *PeerJ* 3:e886.

Rowat D, Brooks KS, March A, McCarten C, Jouannet D, Riley L, Jeffreys G, Perri M, Vely M, Pardigo B. 2011. Long-term membership of whale sharks (*Rhincodon typus*) in coastal aggregations in Seychelles and Djibouti. *Marine and Freshwater Research* 62:621-627.

Snow S. 2013. Whale Sharks in Southern Leyte, Philippines: Population assessment and tourism evaluation. Physalus, Large Marine Vertebrate Project, Philippines. 2013 Seasonal Report.