



**FIELDWORK  
AND ANNUAL  
SUMMARY  
REPORT 2022**

**GALAPAGOS  
WHALE SHARK  
PROJECT**

[WWW.GALAPAGOSWHALESHARK.ORG](http://WWW.GALAPAGOSWHALESHARK.ORG)

PHOTO ©JONATHAN R GREEN



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**Project Partners:** MigraMar, Galapagos Science Center/ USFQ, Georgia Aquarium, Marine Megafauna Foundation

**Supporting Institutions:** Galapagos Conservation Trust, Galapagos Science Center, Galapagos Conservancy, Save Our Seas Foundation, World Wildlife Fund, Galapagos Shark Diving, Galapagos Shark Sky Travel and Conservation, Chronos Cinema

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Figure 1: Whale Shark with school of big eyed jacks in the background (Photo ©Jenny Y Waack)

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## INTRODUCTION

The Galapagos Whale Shark Project has been leading expeditions for whale shark conservation in the Galapagos Marine Reserve (GMR) for the past decade, tagging over 100 whale sharks during this time frame. The whale shark, categorized as endangered by the IUCN red list (IUCN, 2016), is highly important for ocean health, serves as an ocean ambassador for other marine species, and is essential for certain coastal communities economy, thus deserves special attention for conservation efforts.

This filter feeding, migratory shark, which spends most of its lifetime in shallow waters (<50m) is vastly exposed to anthropogenic impacts such as vessel strikes,

falling prey as bycatch in areas of high industrial fishing pressure, plastics pollution, and climate change.

Hence it is the GWSPs goal to understand this species movement patterns and behaviours, which ocean areas are most important for their survival, and where they may be suffering the highest risk of anthropogenic activities in order to protect this endangered shark. The data collated by the project is being used directly in the development of conservation management strategies and the development of marine protected areas by local stakeholders and policy makers.

**Figure 2: Adult whale shark next to a Zodiac**  
(Photo: Simon J Pierce)

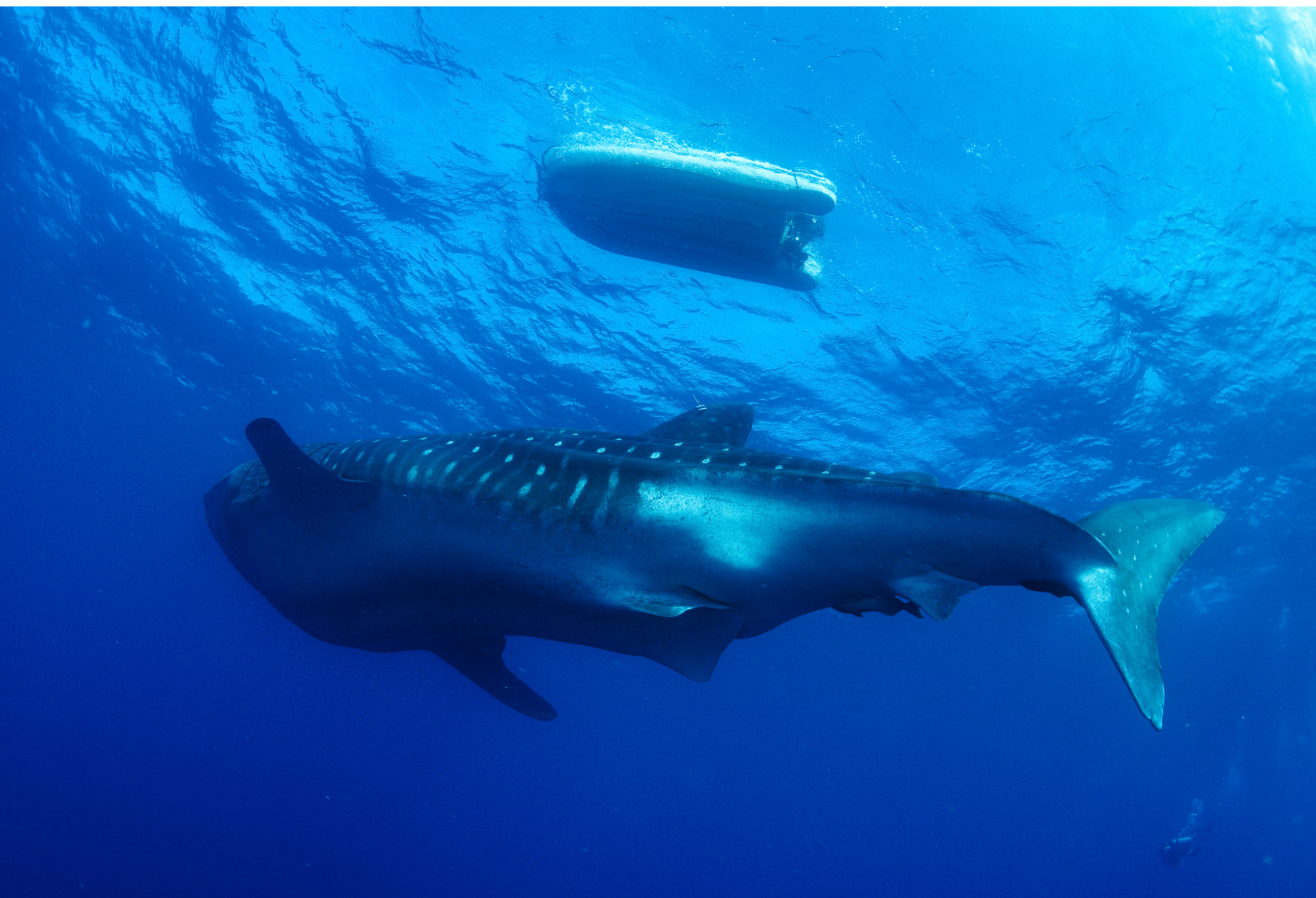




Figure 3: Scientist tagging a whale shark (Photo: Simon J Pierce)

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## FIELD EXPEDITIONS 2022

Two field trips were undertaken in 2022. One in March 2022, during the warm season which focused on studying a new whale shark constellation in the central and southern areas of the archipelago adding a new component to the study of whale sharks in the region and worldwide.

The other expedition was undertaken in July 2022, during the cold season, as part of a continued long-term study on whale sharks sighted seasonally at Darwin's Arch dive site in the far northern region of the archipelago.

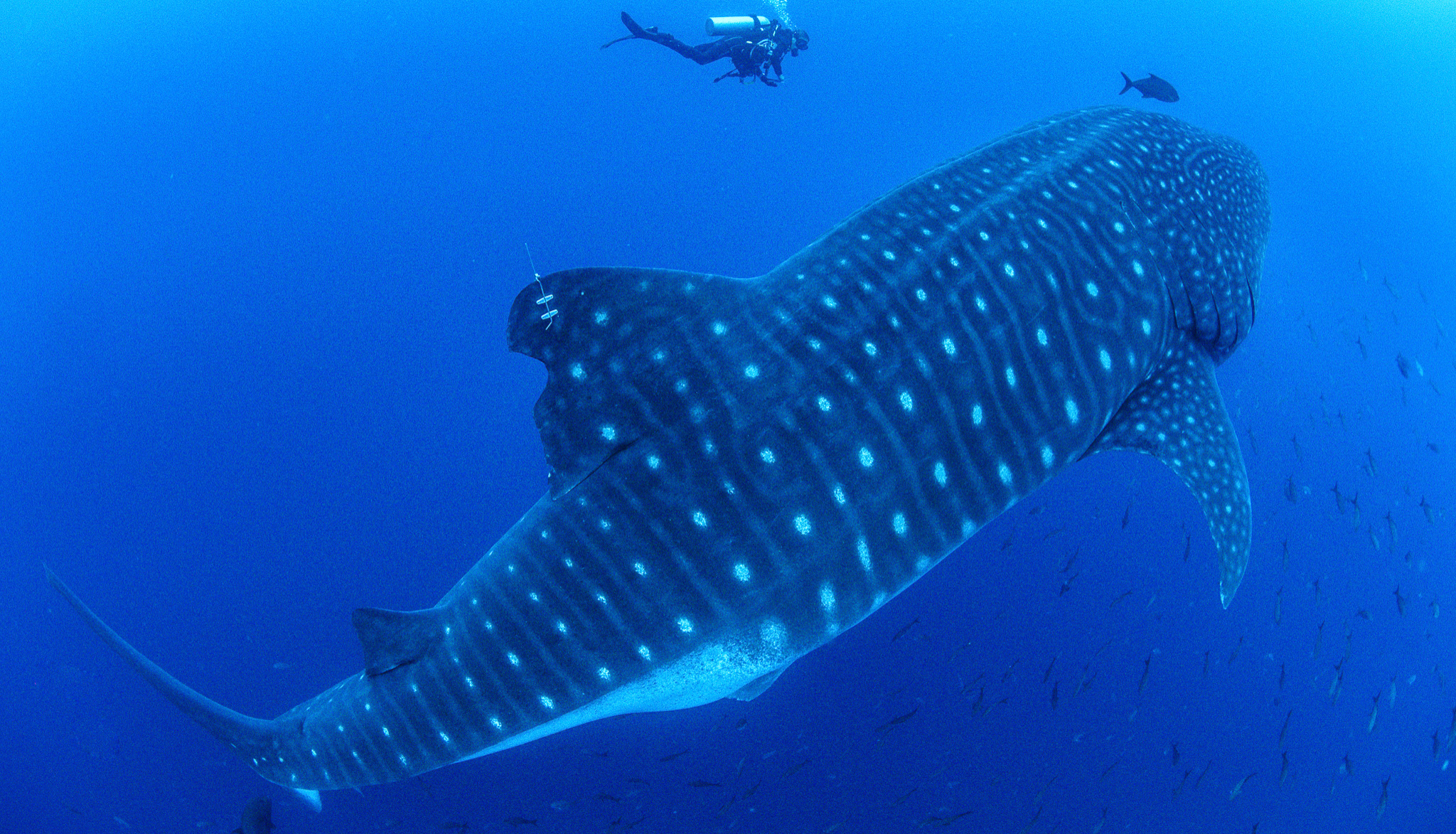


Figure 4: Successfully tagged whale shark swims by. (©Simon J. Pierce)

## **MARCH 2022 - SOUTHERN EXPEDITION FOR A NEW WHALE SHARK STUDY**

Since the late 1980's – early 1990's observations from naturalist guides and fishermen indicated the presence of whale sharks in the areas south and west of Espanola, Floreana and south of Isabela and Fernandina, (JR Green, pers.obs).

These sightings were subsequently confirmed as aggregations following overflights by the Galapagos National Park Directorate in 2016 by small aircraft. One aggregation was reported with over 30 individuals just south of Tortuga Island, off southern Isabela Island.

For the past few years, it has been a goal of the project to study this aggregation and piece together the whale sharks sighted during the different season

in the Galapagos and different sighting locations (north-Darwin & Wolf, and South/Central Islands). Due to funding and logistics difficulties and delays with COVID-19 an attempt to investigate this area was not possible until March of this year.

Using a small ultralight aircraft, the team were able to locate and tag five adult female whale sharks by free-diving. During the expedition four SPLASH 10 and one SPOT 6 fin mounted tags were deployed on adult female whale sharks in the southern region of the archipelago (Tables 1 and 2).

**Figure 5: Scientist tagging an adult whale shark free diving**  
(Photo: ©Cameron Perry)





WS #	Sharkbook	Alt ID	Year	Location	Latitude	Longitude	TL (m)	TL	Sex	Life
	ID							Method		Stage
1	G-167	G 220301-1	2022	Banco Ruso	-1,125323	-89,90832	13	Estimated	F	Adult
2	G-195	G 220313-1	2022	Española	-1,391101	-89,60909	11	Estimated	F	Adult
3	G-196	G 220313-2	2022	Española	-1,399518	-89,61246	11,5	Estimated	F	Adult
4	G-197	G 220313-3	2022	Española	-1,40493	-89,61549	11	Estimated	F	Adult
5	NA	G 220313-4	2022	Española	-1,400954	-89,61897	13	Estimated	F	Adult
6	G-198	G 220314-1	2022	Española	-1,399876	-89,60848	12,5	Estimated	F	Adult

Table 1. Whale Shark Encounters- March 2022

WS #	Deploy Date	Deploy Time	Tag Type	Tag PTT	Platform Sighted	Tagger ID	Swab type	Swab #	Current	SST
1	01-03-22	14:24	SPLASH10-346B	220365	Fishing Boat	SMG	Dorsal/ Cloacal	01-Feb	1	27
2		10:40			Ultralight					
3	13-03-22	10:49	SPLASH10-346B	220358	Ultralight	SMG			1	
4	13-03-22	11:20	SPLASH10-346B	220360	Ultralight	SMG			1	
5	13-03-22	11:43	SPLASH10-346B	220366	Ultralight	AH			1	
6	14-03-22	11:54	SPOT 6	195789	Fishing Boat	AH			1	

Table 2. Whale Shark Encounters-Information on Samples and Tagging- March 2022

These first tracks serve as a baseline to understand this new constellation of whale sharks being studied and will begin to shed light on a missing puzzle piece of where these adult female whale sharks are located during this

time of the year. Due to average retention rates, whale sharks tagged in the far northern region during the cold season have transmitted locations for an average of 57 days with the longest track ranging between the months of September and May.

Considering adult female whale sharks are elusive and not commonly found in sighting aggregations around the world it is of importance to understand where they are during different times of the years and how habitat use may differ during each month and location.

The tracks of whale sharks tagged in march of 2022 showed varied movements with three heading out the west, travelling beyond the East Pacific Rise plate margin and two heading towards the Chile / Peru Trench. Whilst not unusual when compared with tracks from whale sharks tagged at Darwin Arch, this data does not confirm the reasons for this southerly movement which we believed to be associated with the shifting of the Equatorial Front and Sea Surface Temperatures, (SSTs), in relation to primary productivity and therefore food availability. However, when taking into consideration the persistent Niña conditions it is possible that both areas provided the necessary conditions for foraging.

Further studies will be carried out in the coming years on this southern aggregation to form a clear picture of where these individuals navigate, where they may be foraging, which environmental variables influence their movements, and what they may be doing in the Galapagos Marine Reserve during the warm season.

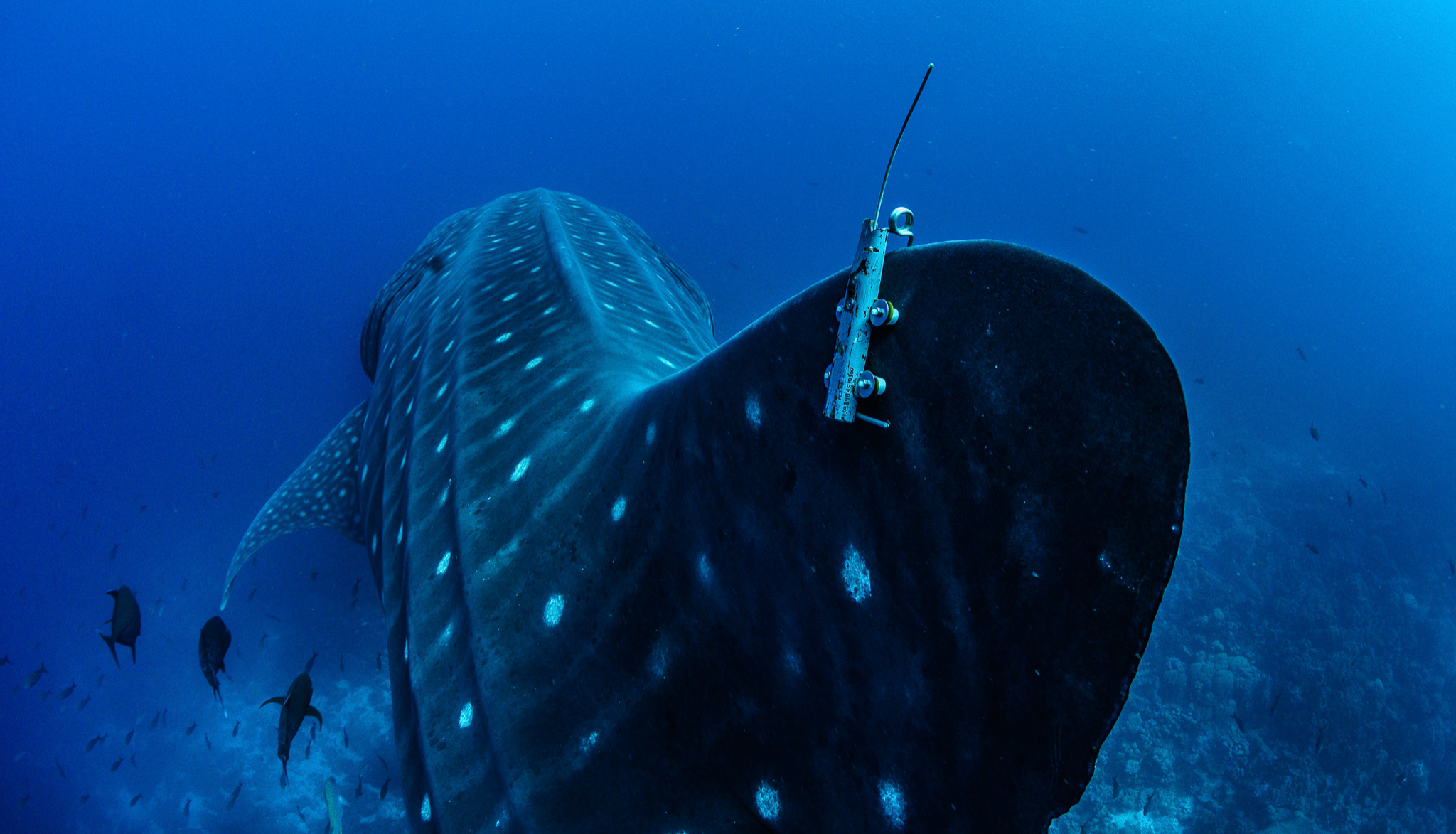


Figure 6: SPLASH10 346 fin mount tag deployed on a whale shark's dorsal fin this season 2022 (Photo ©Simon J Pierce)

## JULY 2022 - LONG-TERM WHALE SHARK TRACKING

The July field expedition continues the projects long-term tracking of whale sharks sighted at Darwin Islands seasonally between June-December.

This expedition focused on passive and active tracking of whale sharks along with blood draws to delve in deeper into their reproductive ecology and general health.

The active tracking was realized through tagging with satellite linked transmitters, again using SPLASH10 346 with fin mount tags. A total of eight whale sharks were tagged although due to tag loss, nine tags were deployed with 1 whale shark double tagged on different days (Table 3).

# R typus	Sex	Date	# Dive of the Day	Time of Day	Tag PTT SPLASH	Tagger ID	Blood Sample	Blood Sampler ID	Photo ID	Alternate ID	WB ID	Total Length (m)	Scars
1	F	05/07/2022	2,3	10:54	220363	SMG/JRG	0					10	Abrasions all along left side on dorsal and peduncle. Abrasions (maybe bite marks from another WS) on right pectoral.
		10/07/2022	2	11:45	"					GD-220705-1	G-226		
2	F	05/07/2022	3	14:57	234735	SMG	0					13	Clipped Top Caudal, stretch marks over right gill slits, bite marks on tail, whole that looks like a bullet hole over her left side pectoral fins, close to the head.
		07/07/2022	3	15:10	"		0						
		08/07/2022	1,3	07:20	234742	JRG	0	JRG					
		09/07/2022	2,3	11:30, 15:35	"		1	JRG		GD-220705-2	G-230		
		11/07/2022	1,2	07:40, 11:20	"		0						
3	U	08/07/2022	1	07:15	NA		0			GD-220708-1	G-235	5	None
4	F	08/07/2022	2	11:02	234737	SMG	0			GD-220708-2	G-237	11	Deformed left 5th gill slit, full of remoras.
		11/07/2022	2	11:25	234739	JRG	0						
5	M	08/07/2022	2	11:20	NA		0			GD-220708-3	G-236	5	None
6	F	08/07/2022	2	11:39	234740	SMG	0			GD-220708-4	G-239	12	Tail was "deformed". Maybe from natural causes, bites, or anthropogenic causes. Top of caudal missing, both pectorals were clipped.
7	F	08/07/2022	3	15:30	234741	SMG	0					10	Big bite out of back caudal. Abrasions on pectoral fins.
		09/07/2022	1,3	07:10	"	JRG	1	JRG					
		10/07/2022	3	15:20	"		0			GD-220708-5	G-255		
		11/07/2022	2	11:20	"		0						
		12/07/2022	2	11:50	"		0						

8	F	09/07/2022	2	11:50	234736	SMG	0			GD-220709-1	G-258	11	Big recent looking bite from her dorsal.
9	U	09/07/2022	3	15:00			0					13	
10	U	10/07/2022	1	07:15			0						
12	F	11/07/2022	3	14:53			0			GD-220711-2	no left	10	
13	F	11/07/2022	3	15:00	234739	JYW/SMG	0			GD-220711-3	G-213	11	
14	F	12/07/2022 13/07/2022	2 1	11:25			0			GD-220712-1	G-259		Scarring along right side peduncle
15	F	12/07/2022	2	11:40			0			GD-220712-2	G-264		Rope scarring on left side over pectoral and head. Clips off dorsal fin.
16	F	15/07/2022	1	06:37			0	JRG		GD-220715-1	G-265	12	Missing most of caudal tail. Scars on the right side.
17	F	15/07/2022	2	10:30						GD-220715-2	G-269	9	Back of dorsal is zig-zag shaped. Has a white dot in front of her dorsal and has some faded out marks along her body and her tail. She had remoras inside her spiracle and cloaca.
18	F	15/07/2022	2,3	14:55						GD-220715-3	G-273	10.5	No scars.

Table 3. Whale shark encounters and work performed in the field - July 2022

For details on Methodology please refer to our past field reports:

<https://www.galapagoswhaleshark.org/news/research-trip/>

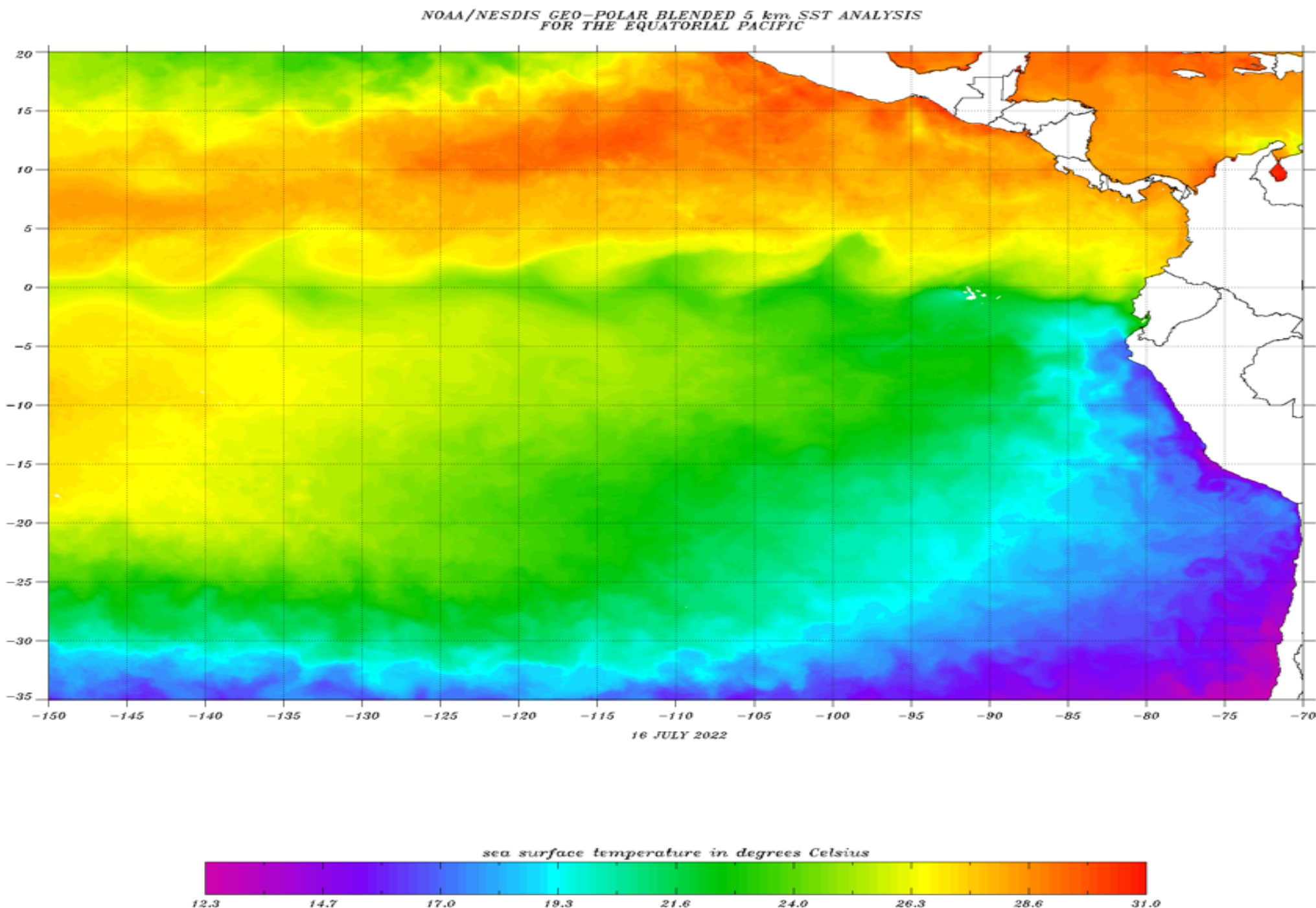
Passive tracking of whale sharks is realized through photo identification of each individual and the posterior upload of the images and spot pattern mapping on the global catalogue “Wildbook for Whale Sharks” at

[www.sharkbook.ai](http://www.sharkbook.ai).

During this field expedition we encountered 17 whale sharks underwater and were able to identify 15 of them through photo imagery for posterior analysis.

Environmental – climatic conditions were a marked and continuing La Niña event with lower than average Sea Surface Temperatures, (SSTs) for the Tropical Eastern Pacific, (ETP). A rapid decrease in SSTs and southerly movement of the Equatorial Front brought a spate of early, (end May) season whale shark sightings around the northern islands.

Figure 7: Sea Surface Temperatures (SSTs) for the 16th July, 2022 during the field trip. A defined Equatorial Front was close to but just south of the northern islands during this period. (©NOAA)



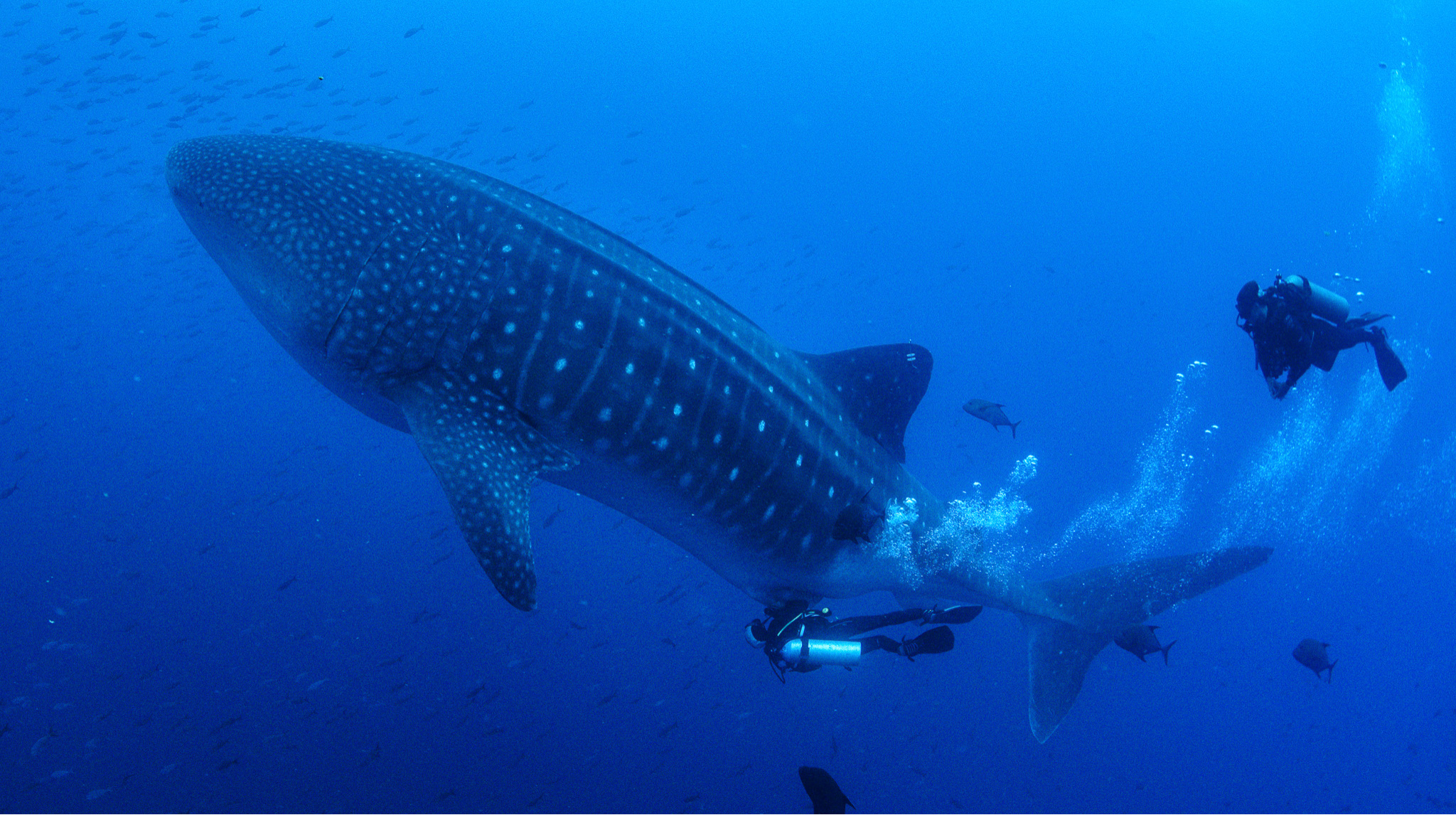


Figure 8: Blood draw attempt on a free swimming whale shark. (Photo © Simon J Pierce)

According to NOAA this tendency will continue into 2023, (<https://www.climate.gov/enso>) for which reason we have decided to undertake a very early season field trip, in June, together with the Okinawa Churaumi Institute team in order to focus on Ultrasound and Blood Draw.



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# PROJECT UPDATES





Figure 9: Adult female whale shark swimming by. (Photo © Jenny Y Waack)

## A DECADE OF TRACKING WHALE SHARKS

A decade of tagging with satellite tags, SPOT and SPLASH, towed tags and subsequently fin mounted have given us an insight into local and regional movements, both on the horizontal and vertical axis. Although much remains to be done and neither the available technology nor the methodology are yet to meet the challenges when tagging the world's biggest fish and shark species, we now have a clear insight into certain aspects of habitat use and seasonal movements (see Figure 10 - Whale Shark tracks 2011 – 2021).

The team is currently working on a study summarizing a decade of data, tracking over 100 sharks, to highlight what we have found and hope to have it available to the public in the form of a published scientific manuscript in the coming year (2023).

The figure above clearly shows the range of movements outside the Marine Protected Area (MPA) of the Galapagos Marine Reserve, highlighting the risks of interaction or effects of anthropogenic activities, which are being analyzed as part of the same study.

Figure 10: All Whale Shark Tracks from 2011 – 2021 showing horizontal movements by surface transmission, corrected for probable biological locations. (©GWSP 2022)

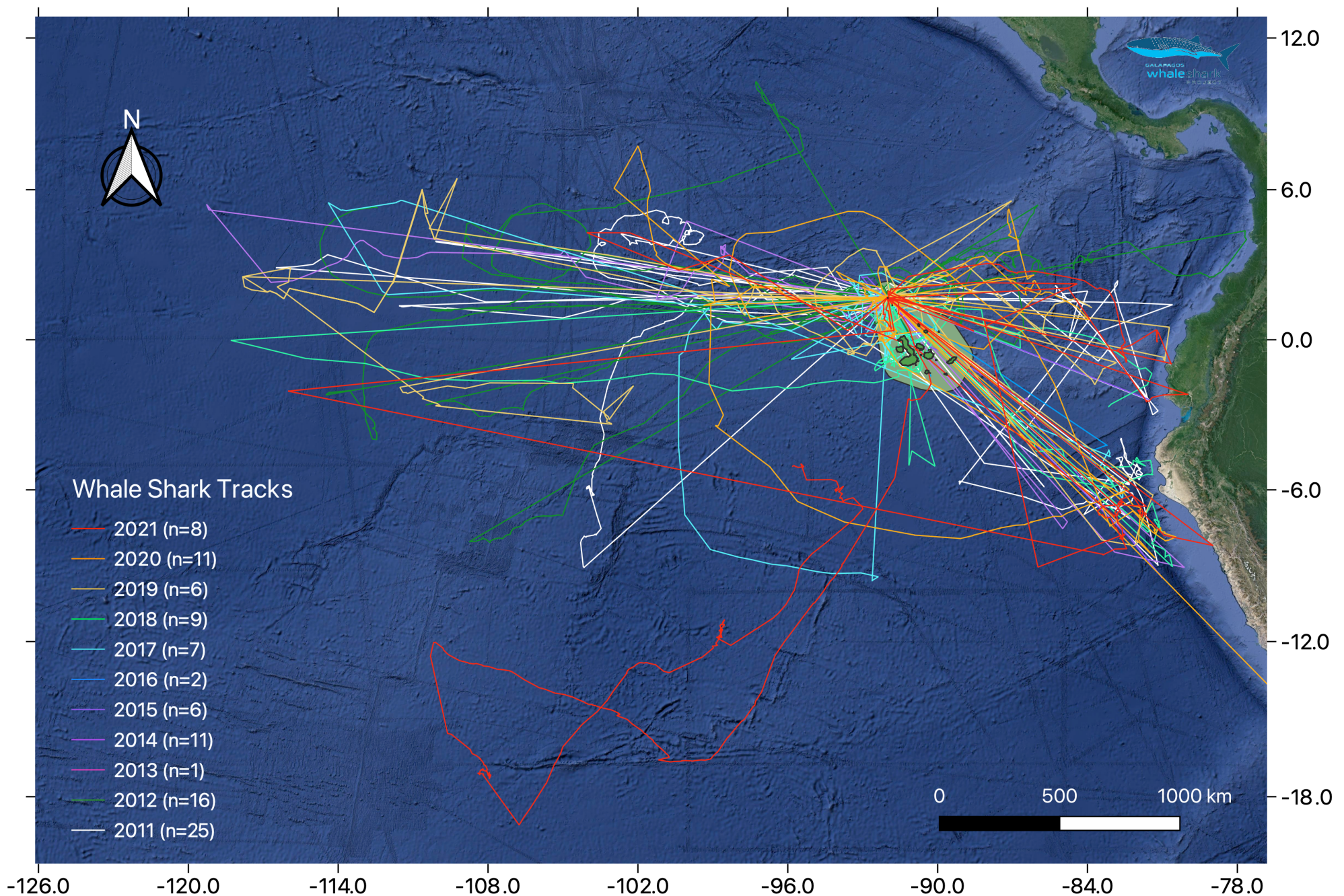




Figure 11: Whale shark tagged with SPLASH10 tag. (©Simon J Pierce)

## ANTHROPOGENIC IMPACTS

Four of the 13 tags deployed during a single year of work (August field expedition 2021 and March, 2022) subsequently reported from land, 2 from Ecuadorean fishing ports and 2 from ports in Peru (Figure 12).

Two of these tags were later recovered, by colleagues from the WWF (Ecuador) and Pro-Delphinus NGO (Peru) and provided a unique opportunity to download fine scale data that would otherwise be lost if the tag simply detaches and is not recovered.

The data retrieved from both tags gives a far better insight and understanding of vertical movements and diving behaviour as indicators of habitat use,

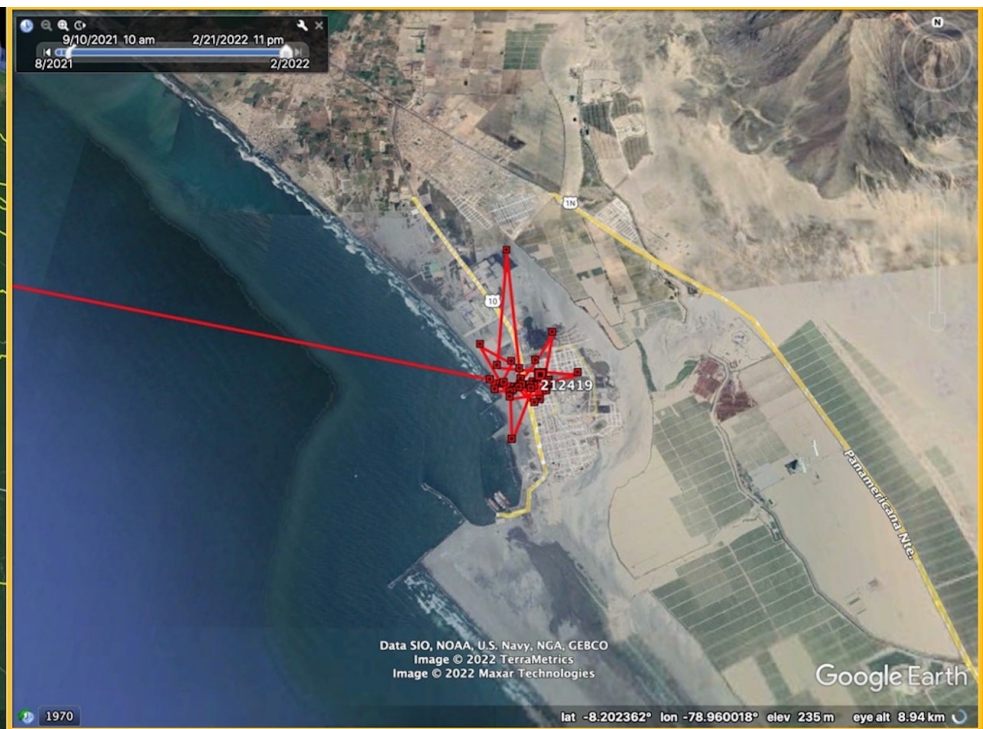
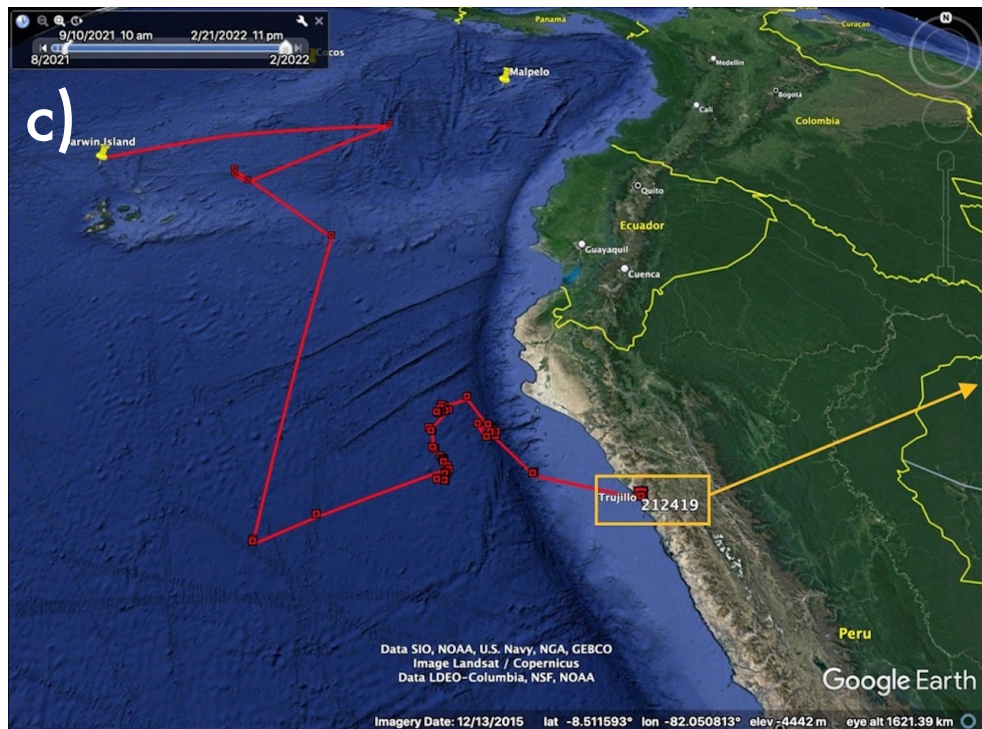
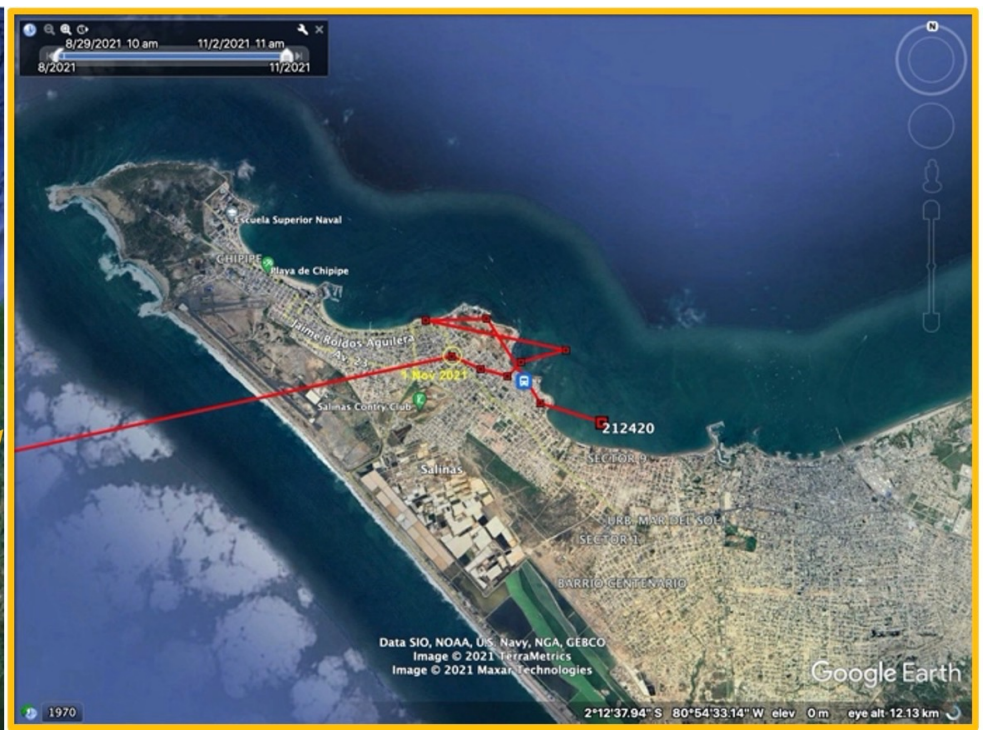
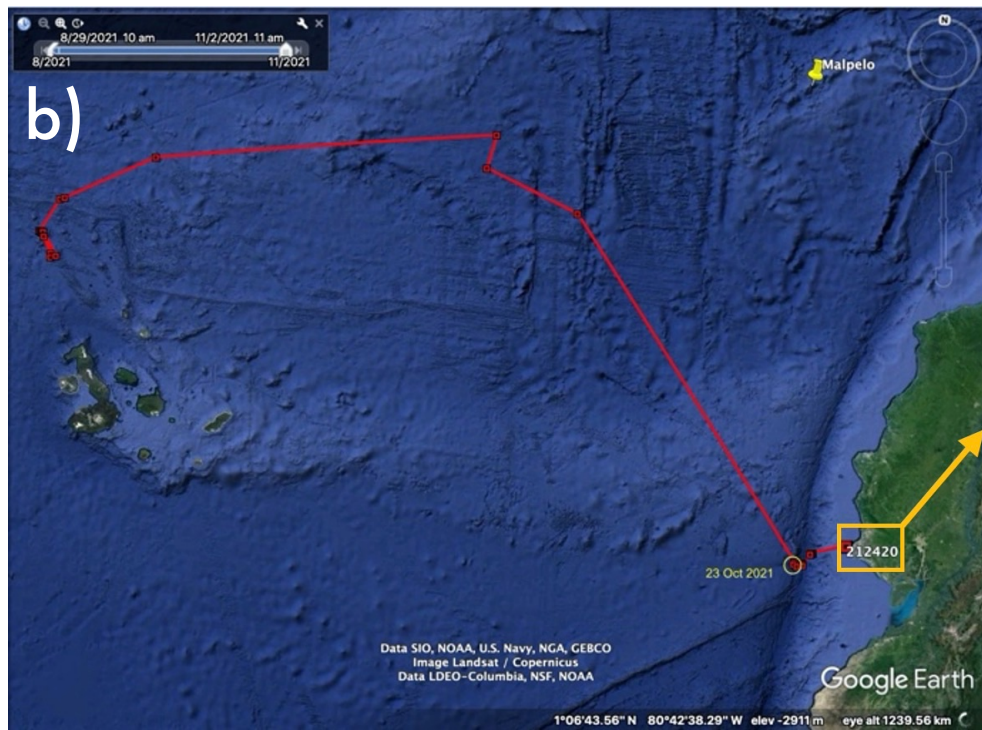
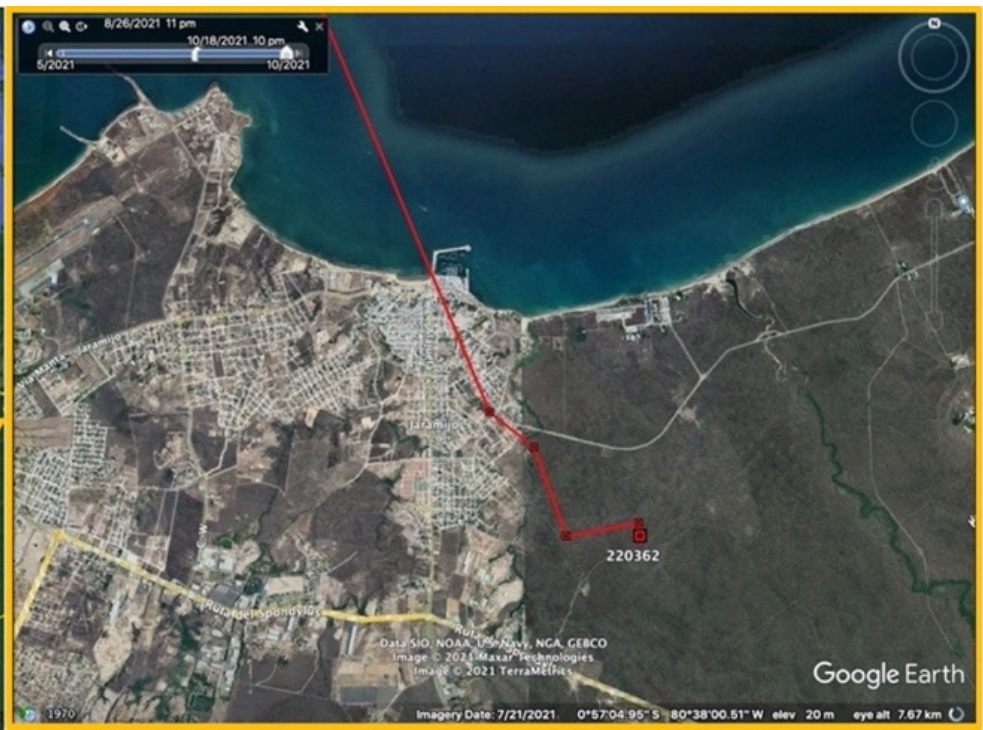
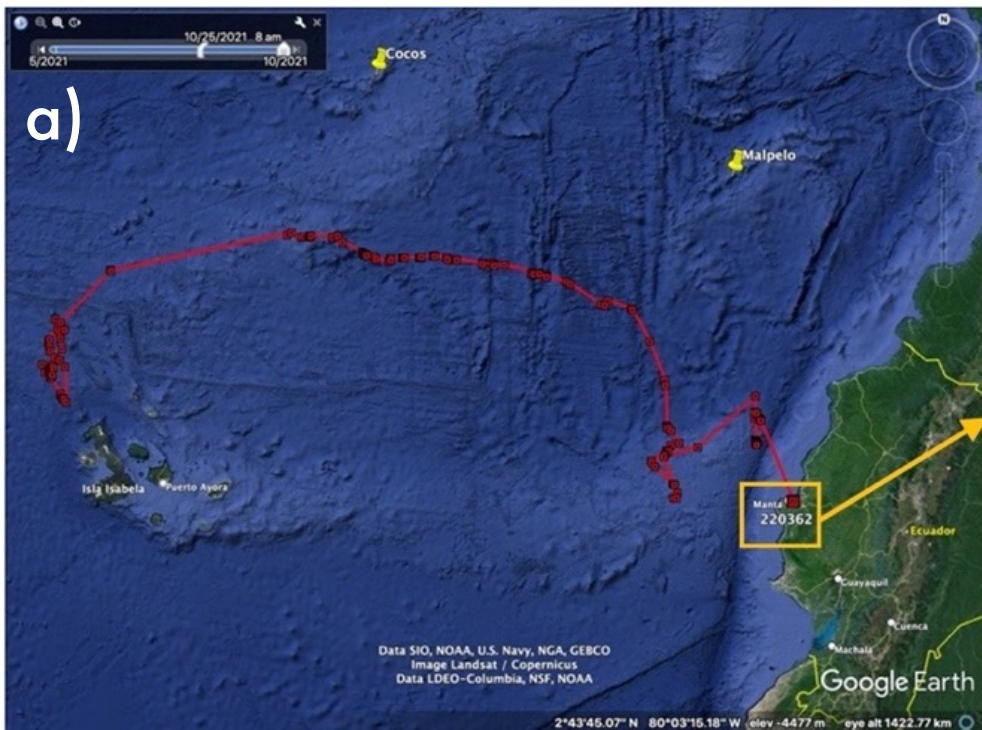


Figure 12: Tags from the 2021 field expeditions reporting from land. a) Oct.19, 2021 in Jaramiyo, Ecuador b) Nov. 1st, 2021 in Salinas, Ecuador, c) 24th of January, 2022 in Salaverry, Peru (©GWSP-2022)

which leads to a better understanding of requirements for conservation and the development of management policy.

The data also provided some surprising new details of deep diving which are reported in a separate work on the vertical movements of adult female whale sharks currently being prepared by the GWSP team.

However the clear and underlying ramifications of so many tags transmitting from land, specifically fishing ports that are known centers for fishing operations of all magnitude, including industrial vessels, indicates a critical and

**Figure 13: Scientists taking photo identification of whale shark tagged with SPLASH10 tag.**  
(©Simon J Pierce)



extremely alarming level of interaction between fisheries and whale sharks.

The immediate consequences, or even long term are hard to define given that the fishermen who returned the tags could possibly omit details about events surrounding the encounter when the animal is harmed, injured, killed or harvested, (partially or entirely).

From the two encounters where we successfully retrieved the tags, the version of the facts shared with the scientists in Ecuador, was that a whale shark was specifically targeted by a tuna fishing operation due to its association with the target fishery. It was stated that the whale shark was released “unharmful” and the tag snagged on the net. In Peru the tag was in the hands of artisanal fishermen who declared that upon returning to the area where nets had been set the previous day they found the net partially destroyed, with big holes and the tag also snagged in the netting but no signs of the whale shark.

As a result of these transmissions and in order to ascertain possible threat levels and percentage of encounters we undertook a revision of historical data from the last decade. For this study fishing hotspots are being defined in the Eastern Pacific and correlated with the movements of the whale sharks tracked. The preliminary results found are cause for deep concern as high number of all tracks ended transmission in areas within medium-very high fishing thresholds. The study also highlighted the area where the four tags became “entangled”, (clearly indicated by abrupt change in direction and speed), as an area of high risk for fishing pressure. Full results of the study will be disclosed in the full scientific publication.

Whilst we cannot determine the reasons of ceasing of transmission and the sheer numbers of tags that have stopped transmitting, (or become floating drogues in the case of the early SPOT5/6 tags), the probability that these may be resulting from anthropogenic impacts has certainly been highlighted. As part of the same study, further analysis is being carried out on other potential anthropogenic impacts that could explain end of transmission such as vessel traffic which could result in vessel strikes. Early data already suggest that the level of risk is much higher than previously understood.

**Figure 14: Scientists approach a whale shark (©Simon J Pierce)**





Figure 15. Screen capture of a blood draw on pectoral fin of free-swimming whale shark (©Sofía Green-GWSP)

## BLOOD WORK

Two successful blood draws were carried out, both from adult female whale sharks. The whole blood was analysed immediately back on board using a portable i-STAT blood analyzer with CG4+ cartridges. Using previously obtained data the blood gas levels and lactate were all within parameters considered “normal” for baseline health and stress.

Link for blood draw video:

<https://www.dropbox.com/s/cjbzc6c21hbvw83/Blood%20draw%20GWSP.mp4?dl=0>

Part of the remaining whole blood was then centrifuged and samples of whole blood, red blood cells and plasma were then frozen for posterior





Figure 16: Blood draw on pelvic fin of free-swimming whale shark (©Sofía Green)

analysis for micro plastics and chemical hormonal levels as indicators of baseline health and reproductive state.

The micro plastic analysis will be carried out by the University of the Sunshine Coast, Australia and the chemical hormonal testing is planned for July 2023, following the Ultrasound / Blood draw field work with the team from the Okinawa Churaumi Research Institute, either in the laboratory of Universidad San Francisco de Quito in Cumbaya, or at the Institute in Okinawa, together with samples from the last two field seasons.

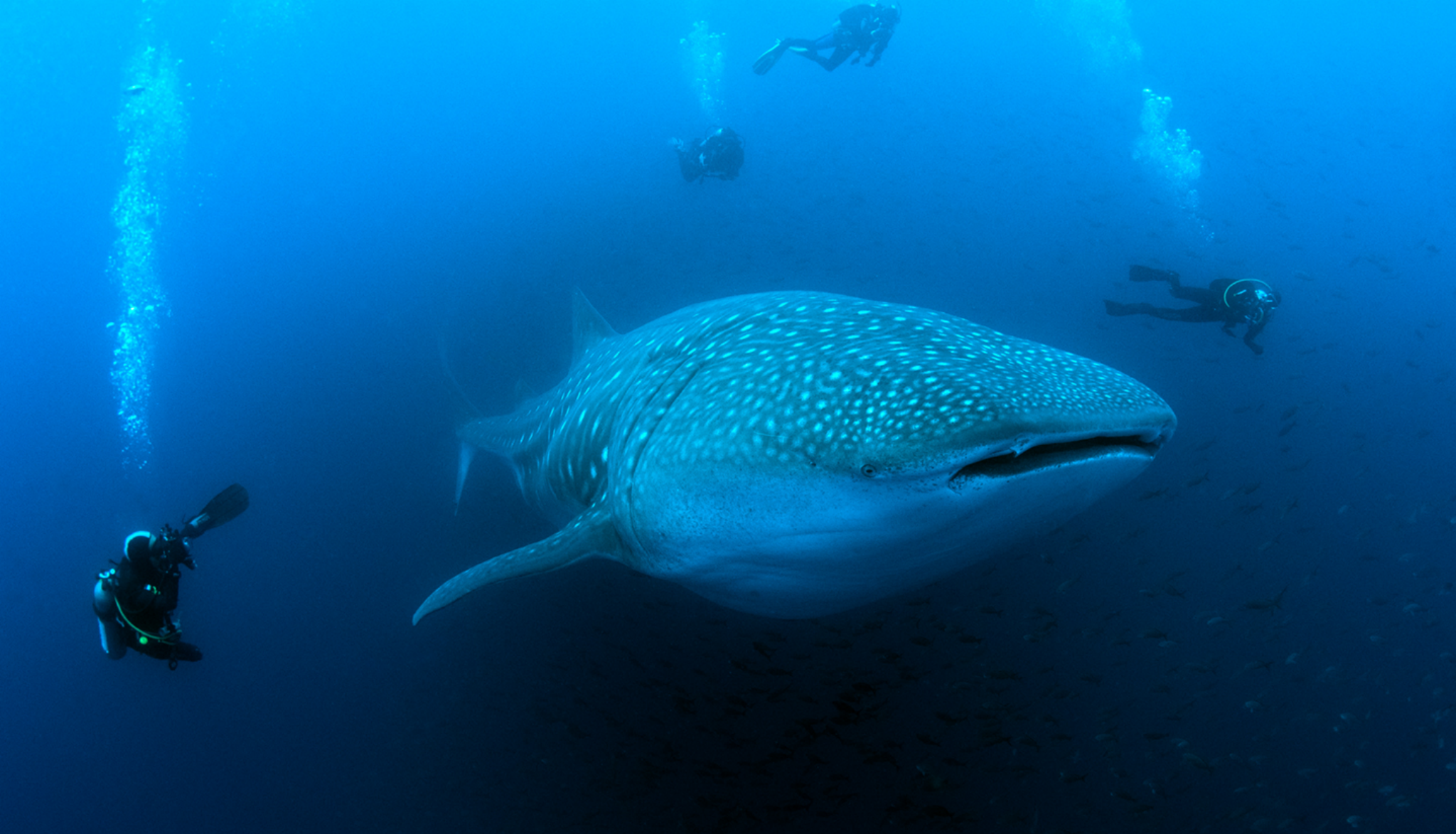
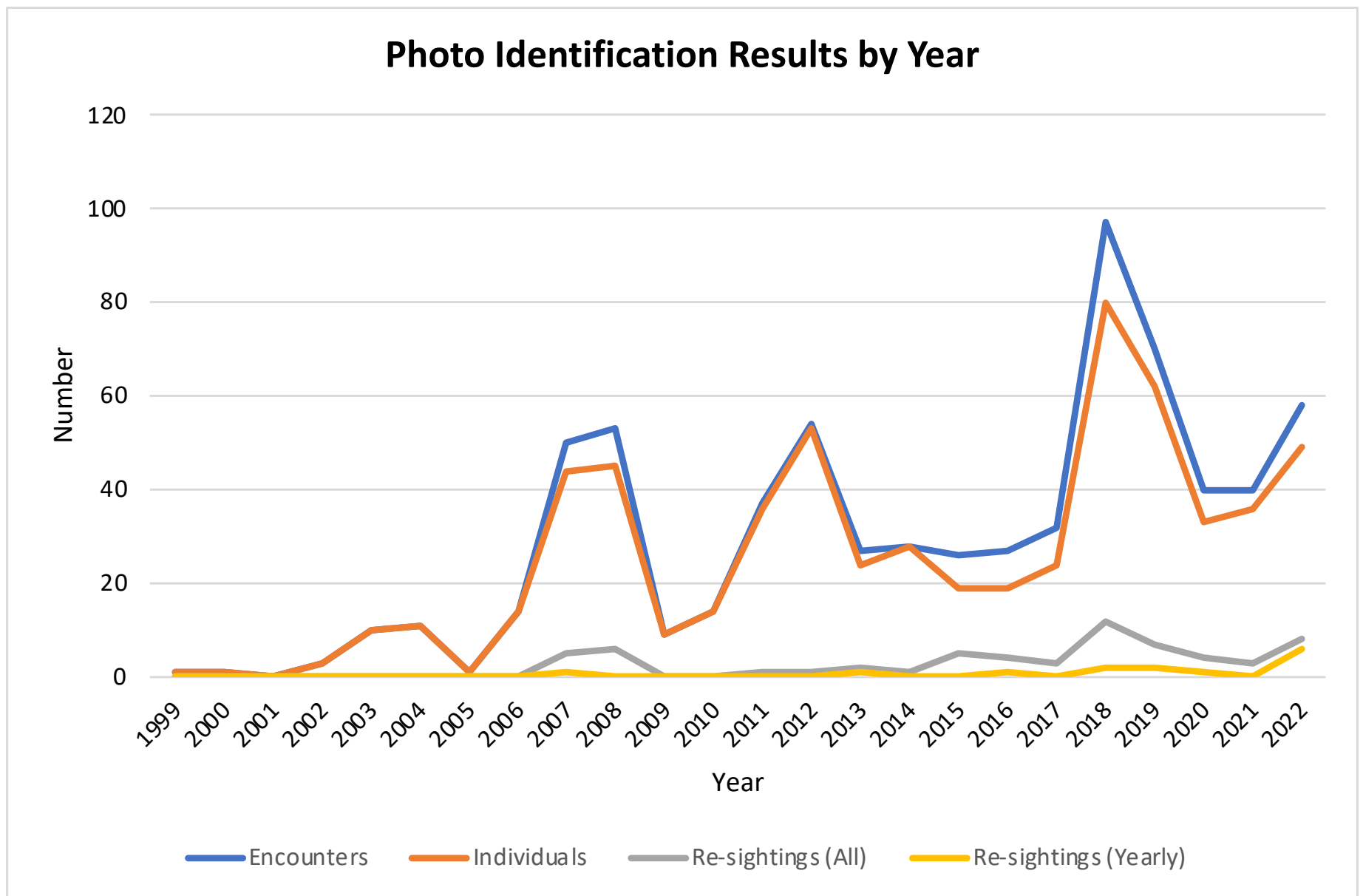


Figure 18: Diver taking photo ID of a whale shark. (Photo ©Jonathan R Green)

## PHOTO IDENTIFICATION

Sightings from whale sharks in the Galapagos began at the end of the 20th century, yet from 2011 when the project began, the team has been working on growing the local catalogue of whale sharks sighted in the Galapagos.

This component of the project is increasingly bearing fruit thanks to outreach within the local dive community and increasingly with tourists that are visiting the Islands. As part of the “passive” science it is both highly cost effective and far reaching. This element of the research will bring important data about frequency and fidelity of whale sharks around Darwin Arch but also regional and eventually possibly even global movements on the surface.

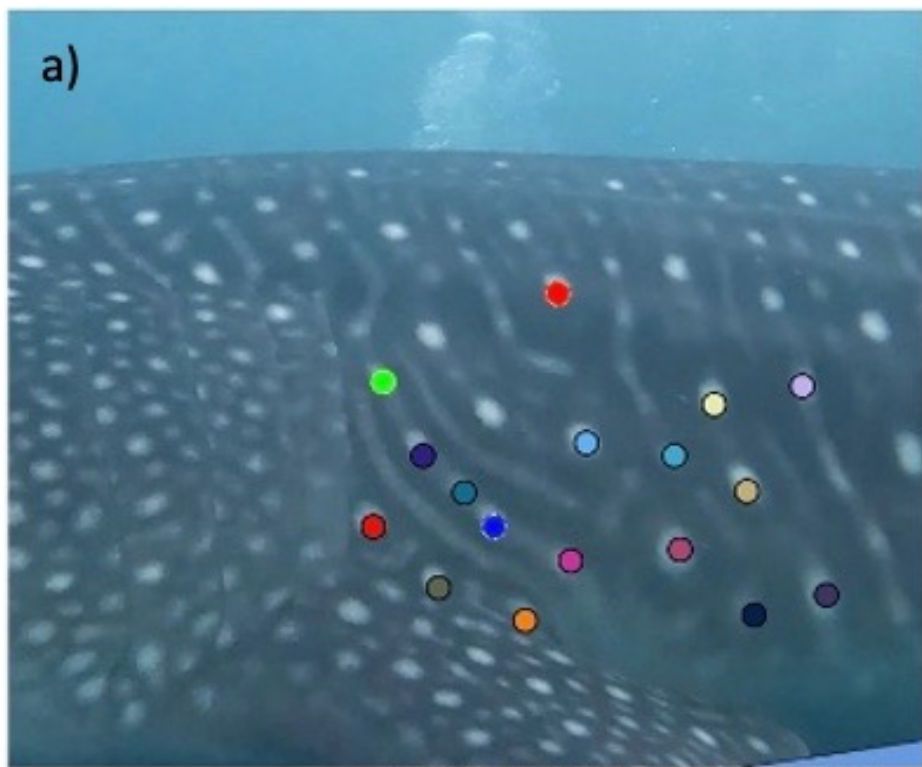


**Figure 19: Photo identification results by effort of sampling (©GWSP)**

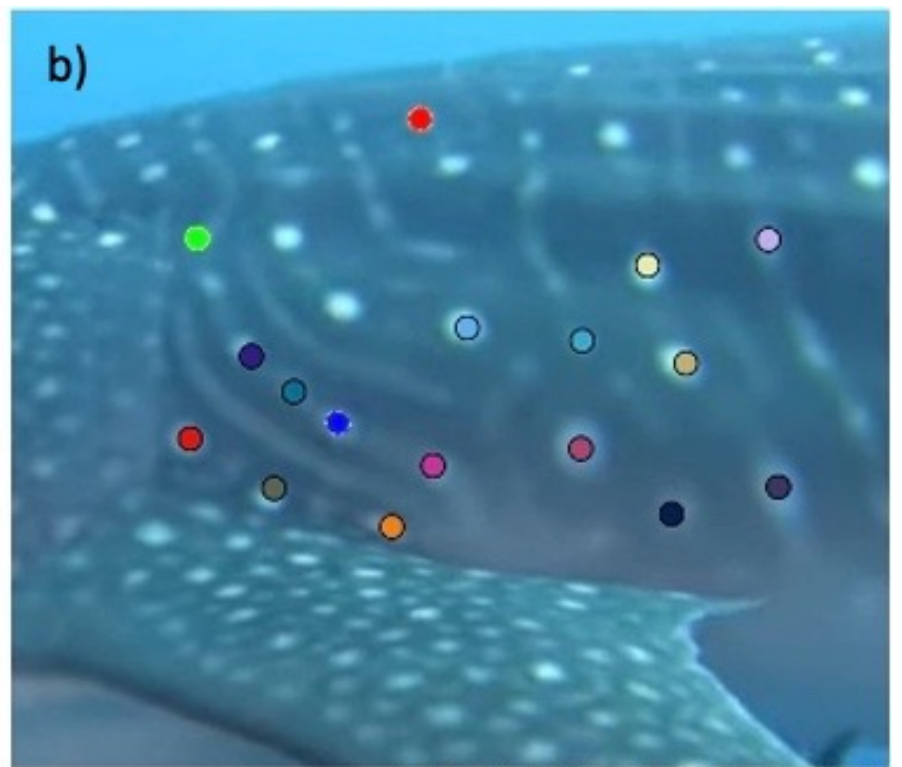
Our team is able to be out in the field for only a small portion of the year, meanwhile citizens are diving and snorkeling in sighting locations every day of the year; reason for which we have involved dive guides from the GMR and their national and international passengers.

Since 1999 we have been able to collect 987 sighting uploads, from which we have been able to identify 616 unique individuals identified with at least a left-side photograph (Figure 19).

With a growing Photo ID catalogue, we are now seeing an increasing number of re-sightings. Moreover, for the first time ever we have recorded remarkable and previously unknown connectivity between Mexico and Ecuador. This year we had a match with the modified Groth-Algorithm (Figure 19) of a whale shark sighted at Socorro Island,



**Enc ID** 640dfd9f-bf9a-4bf3-aaf5-52a73a7b3292  
**Date** 2022-04-09  
**Sex** unknown  
**Assigned to**  
**Size** unknown  
**Location** Galapagos  
**Location ID** 7a



**Enc ID** 61fa45b7-6129-47b8-be97-df3a238d0b73  
**Date** 2021-05  
**Sex** unknown  
**Assigned to** e1112eca-d450-4d9e-9de6-3d13447b8e15  
**Size** undefined  
**Location** Cabo Pearce, Socorro Island  
**Location ID** Mexico-Revillagigedo

Figure 20: Match with Modified Groth Algorithm in Sharkbook.ai a) Whale shark photographed on the 4th of April, 2022 in Galapagos, Ecuador b) Whale Shark photographed on the 14th of May, 2021 in Revillagigedo, Mexico (©GWSP- [www.sharkbook.ai](http://www.sharkbook.ai))

Figure 21: Traced connectivity of the two sighting locations, Revillagigedo-Mexico and Galapagos-Ecuador (©GWSP)



Revillagigedo, Mexico in May of 2021 and sighted, almost a year after, at Roca Blanca, Galápagos in May of 2022 (Figure 20). Worth noting, is the fact that both photo IDs were submitted by natural or non-scientist citizens, corroborating the power and importance of citizen science.

Figure 22: Divers take photo ID on a citizen science dive liveaboard in the Galapagos Islands. (Photo ©Jenny Y Waack)





Figure 23: Whale shark surrounded by creole fish (Photo ©Jenny Y Waack)

## 4

# OUTREACH EFFORTS

Part of the project's mission, is to work on the education of the local community to promote the amplification of marine protected areas and raise global awareness of whale sharks as charismatic ambassadors for marine conservation. As a team we highly believe that education is the base for long term conservation.

To achieve this goal as a project we have been working on varied outreach projects with the local community of the three populated islands of the Galapagos and with the international community that visits the islands.



Figure 24: Group photo of the Mola Mola Eco-Club (©EPI)

## INTERACTIVE ACTIVITIES WITH THE LOCAL ECO- CLUBS

In Santa Cruz Island, we participated in talks and interactive learning activities with the two eco clubs, the “Mola Mola” club, led by Ecology Project International and the “Tibuembajadores” or shark ambassador club led by the Charles Darwin



Foundation, both conformed of local teenagers (ages 12-18).

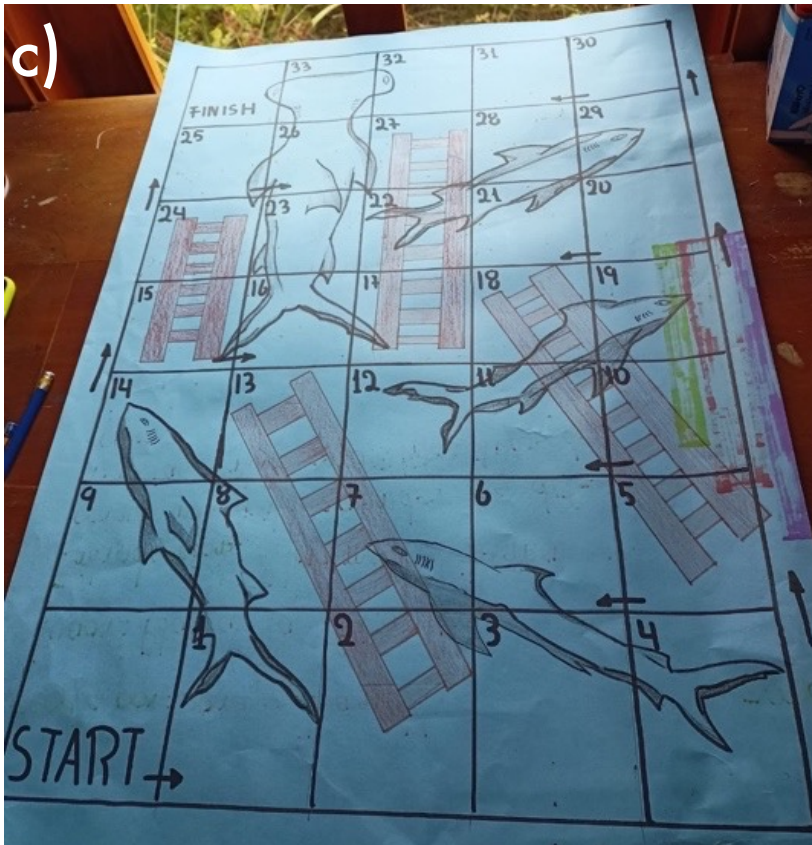


Figure 25 (a, b, c & d):  
Interactive learning  
activities with the  
“Tibuembajadores”  
(sharkambassadors)  
from the Charles  
Darwin Foundation.  
(©CDF)



Figure 26: Talks and field  
work demonstrations with  
the Mola Mola Eco-Club  
(©EPI)





Figure 27: Whale shark with deformed dorsal fin. (Photo ©Jenny Y Waack)

## TALKS AND PHOTO-ID WORKSHOPS DIRECTED TO THE LOCAL COMMUNITY

On the other hand, to reach the local adult population, talks on whale sharks and the work being done in the Galapagos to protect this endangered species were given in the three populated islands throughout the year. During each talk a small workshop on the photo identification of whale sharks for passive tracking was included.

The main goals of these talks are to create awareness of the importance of marine conservation and bridge the gap between the local community and the scientists by involving the local citizens in the scientific work occurring in the archipelago.



Figure 28: Talks and photo-ID workshops given in the three main populated islands of the Galapagos. (©GWSP)





Figure 29: Juvenile whale shark with diver. (Photo ©Simon J Pierce)

## TEACHER TRAINING FOR A CONTEXTUALIZED EDUCATION

Since March 2021, the province of Galapagos, through Ministerial Agreement 016 of the Ministry of Education, has implemented the Contextualized Curriculum with a Sustainability approach (CCSG by its Spanish acronym) that is mandatory for the entire educational system.

The CCSG facilitates the connection of student learning with the themes of sustainable development in Galapagos. Every month, the province's schools address a theme of sustainability contextualized to the reality of the islands, which allows students to acquire the knowledge and skills necessary for the conservation and sustainable development of their province. Fourteen essential topics were selected to make it into the new curriculum on culture, the economy and the environment.

Ecology Project International Ecuador (EPI Ecuador), together with the Ministry of Education (MinEduc) through the Galapagos District Directorate of Education, coordinate the formation of groups of experts for each topic of the CCSG.

For this process the GWSP team contributed, through collaborative work between teachers, technicians and educational experts, coordinated by EPI Ecuador and MinEduc with the support of the Galapagos Conservancy and the Scalesia Foundation on the subjects of biodiversity and sustainable fisheries. Our team, together with other experts from Galapagos institutions prepared lectures for the teachers, revised and collaborated with development of teaching resources and participated in the class planning sessions. This process has a high potential impact for societal change considering we are able to reach 100% of the teachers of the Galapagos Islands.

**Figure 30: Juvenile whale shark swimming by.** (Photo ©Simon J Pierce)





Figure 31: Whale shark close to the surface surrounded by sunlight. (Photo ©Simon J Pierce)

## REACHING AN INTERNATIONAL COMMUNITY

Throughout the year members of the project have been giving both in person, live and recorded talks to members of the international community to create awareness on a global level. These talks have taken place at hotels and on board ships in the Galapagos Islands, at international conferences such as Sharks International, and on online platforms such as Facebook and YouTube.

Our project also keeps active on social media platform in order to keep people engaged and informed about the work being done to achieve the conservation of whale sharks and the marine environment.



Figure 32 above: Giving talks to international travelers visiting the islands (©GWSP)

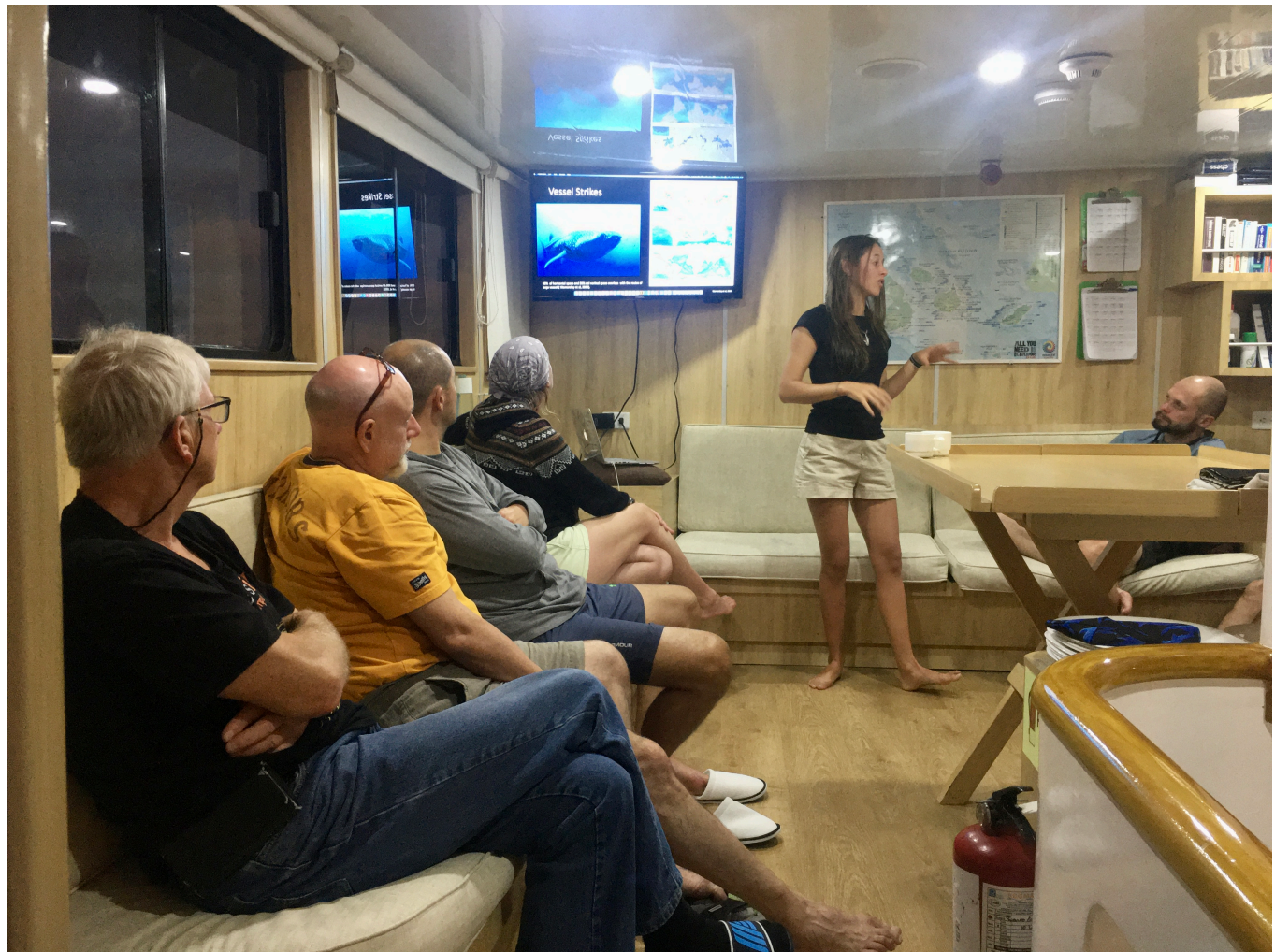


Figure 33 right: Giving talks to international travelers visiting the islands on board vessels (©GWSP)



Figure 34: Whale shark followed by Galapagos sharks (Photo ©Simon J Pierce)

## DEVELOPMENT OF WILDLIFE TRACKER

The project has been working with geoinformatics specialist, Bryan Vallejo, in the development of a new tool for data visualization, analysis and communication, Wildlife Tracker (<https://www.gis4-wildlife.com/>).

Wildlife Tracker is a cloud processing tool dedicated to create web map animations of wildlife movements overlaid with ocean monitoring data. On the platform we can observe the movement of our tracked individuals over the ecological variables that influence their movements and also the movements around human activities such as fisheries and marine traffic which have been identified as major threats for whale sharks.

The tool serves for great visualizations when communicating to the public and also allows us to work on data analysis in a more efficient manner.

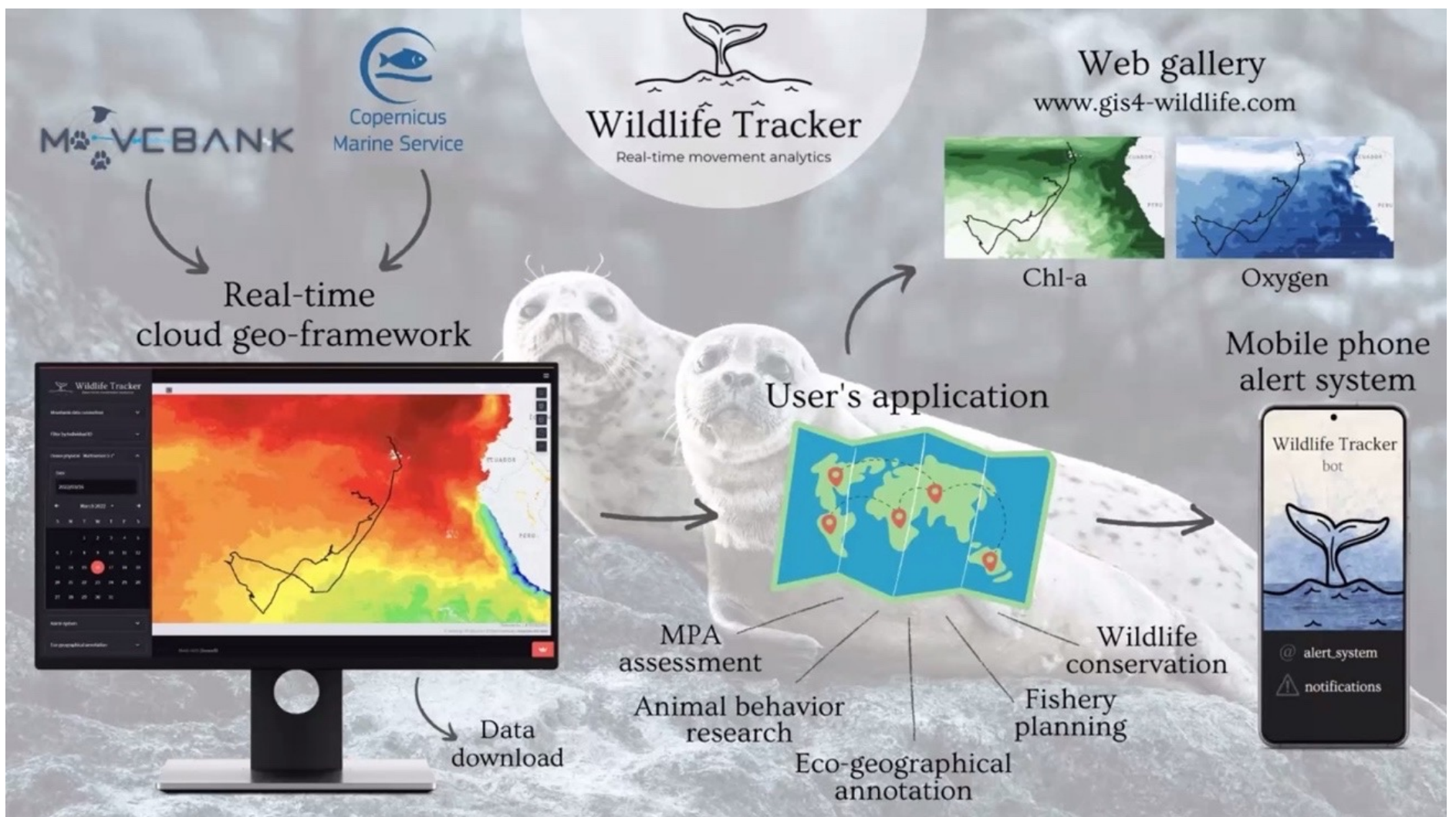


Figure 35: Use of Wildlife tracker for real-time tracking over ecological variables and anthropogenic impacts (©GIS4Wildlife)

Our team has served as advisors for the needs of scientists in the development of this new tool and we have served as the first use case.

To read further on how we have been using this tool so far you can check out our blogs here:

1. "The influence of eco-geographical variables on Whale Shark Movements"  
<https://medium.com/gis4-wildlife-tracking/the-influence-of-eco-geographical-variables-on-whale-shark-movements-5068accf43a6>
2. "Application of the Wildlife Tracker to Conservation Efforts"  
<https://medium.com/gis4-wildlife-tracking/application-of-the-wildlife-tracker-to-conservation-efforts-1d3cc572e4cd>
3. "Integration of Blue Cloud services on the 'Wildlife Tracker for Oceans'"



(<https://medium.com/gis4-wildlife-tracking/integration-of-blue-cloud-services-on-the-wildlife-tracker-for-oceans-22ba4ddb9ae>)

Checkout the demo video:

<https://www.youtube.com/watch?v=reDiZzusU7Y>

Figure 36: Scientists taking photo ID and video of a whale shark swimming by. (Photo © Simon J Pierce)





Figure 37: Diver taking blood from the pelvic fin of a free swimming whale shark  
(Photo: Simon J Pierce)

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## FUTURE STEPS - 2023

1. Reproductive studies - Ultrasounds and blood work- reproductive studies. June 2023
2. Environmental Education Activities with the local community - Continued into 2023
3. Connectivity between mainland Ecuador whale shark sightings and insular sightings - 2023
4. Continued study on “New” whale shark aggregation in Galapagos - March 2023
5. Microplastic Analysis - 2023



Figure 38: Whale shark passing by the diver. (Photo: Simon J Pierce)

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## SCIENTIFIC MANUSCRIPTS PUBLISHED 2022

Andrzejaczek, S et al. (2022). Diving into the vertical dimension of elasmobranch movement ecology. *Sci. Adv.* 8, eabo1754 (2022) doi: 10.1126/sciadv.abo1754

Araujo G, et al. (2022). Improving sightings derived residency estimation for whale shark aggregations: A novel metric applied to a global data set. *Front. Mar. Sci.* 9:775691. doi: 10.3389/fmars.2022.775691



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# ACKNOWLEDGMENTS

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As always we would like to thank our funding partners and collaborating institutes and colleagues without whom none of this work would take place.



This July we partnered for the first time with the fishing vessel “Yualka II” and her Captain Yuri Revelo and crew gave us fantastic support, showing how both the fishing and science sectors of Galapagos and perhaps the Oceans as a whole can work together for mutual benefit and for the future of our Planet.



Photos by Simon J. Pierce,  
Jonathan R. Green, Sofia M.  
Green, Jenny Waack

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