



## Earthwatch 2019 Annual Field Report

### Protecting Peru's Giant Manta Rays

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Period covered by this report: January 2019 – December 2019

## Letter to Volunteers

Dear Earthwatch volunteers,

Thank you so much for joining us this year in northern Peru! This 2019 was our first year running an Earthwatch project and we could not have achieved it if it were not for your support.

The giant manta ray is a majestic yet vulnerable species. Although it is now legally protected in Peru, incidental interactions with fisheries still occur, threatening this population. The research you have contributed with is fundamental to understand the behavior of mantas in northern Peru, in order to help guide conservation measures and management action for this species. We have greatly enjoyed carrying out a series of activities together with you during this project, including manta ray boat surveys, plankton sampling, lab work and community engagement activities.

We were able to conduct 5 Earthwatch expeditions this year. The data collected by Earthwatch volunteers helped map manta sightings and is contributing to understand seasonal, and potentially interannual patterns, exhibited by giant mantas in the area. Additionally, this year you helped us collect 192 seawater samples to understand zooplankton composition and its relationship with mantas. With this, we have been able to identify 57 zooplankton species to date and you have been able to support the development of an undergraduate thesis of a young female Peruvian biologist. You have also helped us process 15 genetic samples of mantas which will help understand genetic variability, as well as engage with over 300 local community members.

During our expeditions, some volunteers had greater encounter opportunities with giant mantas, however all data collected during expeditions are equally important for our research purpose. In July 2019, Planeta Océano carried out a multi-sectorial workshop to discuss management actions to reduce manta ray bycatch in northern Peru. Workshop participants highlighted the need to enhance understanding on manta ray behavior in the area, an information gap which we hope will be filled through Earthwatch expeditions.

Based on what we have achieved this year, we look forward to our next Earthwatch Expeditions to further scientific knowledge on this species in Peru. We look forward to keeping you updated on our progress with our upcoming expeditions; as well as updating you on how any new information will relate to and support that collected in 2019. We have enjoyed learning from you this year and look forward to implementing this learning in future expeditions as well.

It was an honor to collaborate with every single one of you and we are humbled to receive so many volunteers with different backgrounds at the coastal community of Zorritos. We greatly appreciate the energy, commitment, interest and enthusiasm that you brought every day to our project. We hope that you also cherished the experience in meeting and interacting with the local community members, including local fishermen, artisans and students.

Thank you once again for your participation. We look forward to being in contact soon!

Sincerely,

Kerstin Forsberg  
Raquel Siccha  
Patricia Ayón

## Summary

During 2019 we conducted 5 Earthwatch expeditions. Project outcomes for this first year of Earthwatch expeditions included the following:

- Manta sightings for 2019 were mapped, as well as survey effort calculated. This information aims to build upon data collected from manta surveys in northern Peru from 2014-2017 to understand seasonal, and potential interannual patterns, exhibited by giant mantas in the area. Manta sightings were predominantly noticed in June.
- Zooplankton was studied and 192 seawater samples were collected to assess zooplankton composition and its relationship with manta presence. To date, 57 zooplankton species have been identified, a study which is also supporting the development of an undergraduate thesis of a young female Peruvian biologist.
- 15 genetic samples of mantas have been processed to extract DNA. Further study with these samples will help understand genetic variability of manta rays.
- Community engagement is a core component of our project. Over 300 local community members were engaged during Earthwatch expeditions. Livelihoods of local artisans, local fishermen and other community members were supported. Outreach was carried out by restoring 4 murals in the community and education activities were carried out in local schools, providing the opportunity for students to benefit from cultural exchange and become stewards for manta conservation.



Photo 1. Earthwatch volunteers and project staff monitor environmental conditions in Tumbes

## Goals, Objectives, and Results

This project aims to contribute to conservation of giant manta rays (*Mobula birostris*) in northern Peru by defining seasonal visitation patterns of giant mantas, identifying critical visitation sites and determining any site fidelity exhibited by mantas. We also aim to understand environmental factors that may be influencing manta ray occurrence presence, and document any anthropogenic threats related to artisanal fisheries. Furthermore, by understanding the genetic structure and variability of *M. birostris* in northern Peru, we aim to document the connectivity with the manta population in Ecuador, as well as enhance understanding on the size of this population.

Our specific project objectives are as follows:

(OBJ. 1) Estimate relative density, habitat use and seasonality for manta rays in northern Peru

(OBJ. 2) Identify potential migratory behavior and site fidelity, as well as natural or fishery-induced threats to manta rays

(OBJ. 3) Assess genetic variability among manta rays in northern Peru, and in relation to manta rays encountered in Ecuador, through mitochondrial molecular markers.

(OBJ. 4) Assess zooplankton composition and oceanographic variables (sea surface temperature, salinity, pH and Oxygen) in manta ray aggregation sites, along a three year time period

We expect to collect this information during our 3-year Earthwatch project. During this first year, together with Earthwatch volunteers, we have made the following progress in each of these objectives:

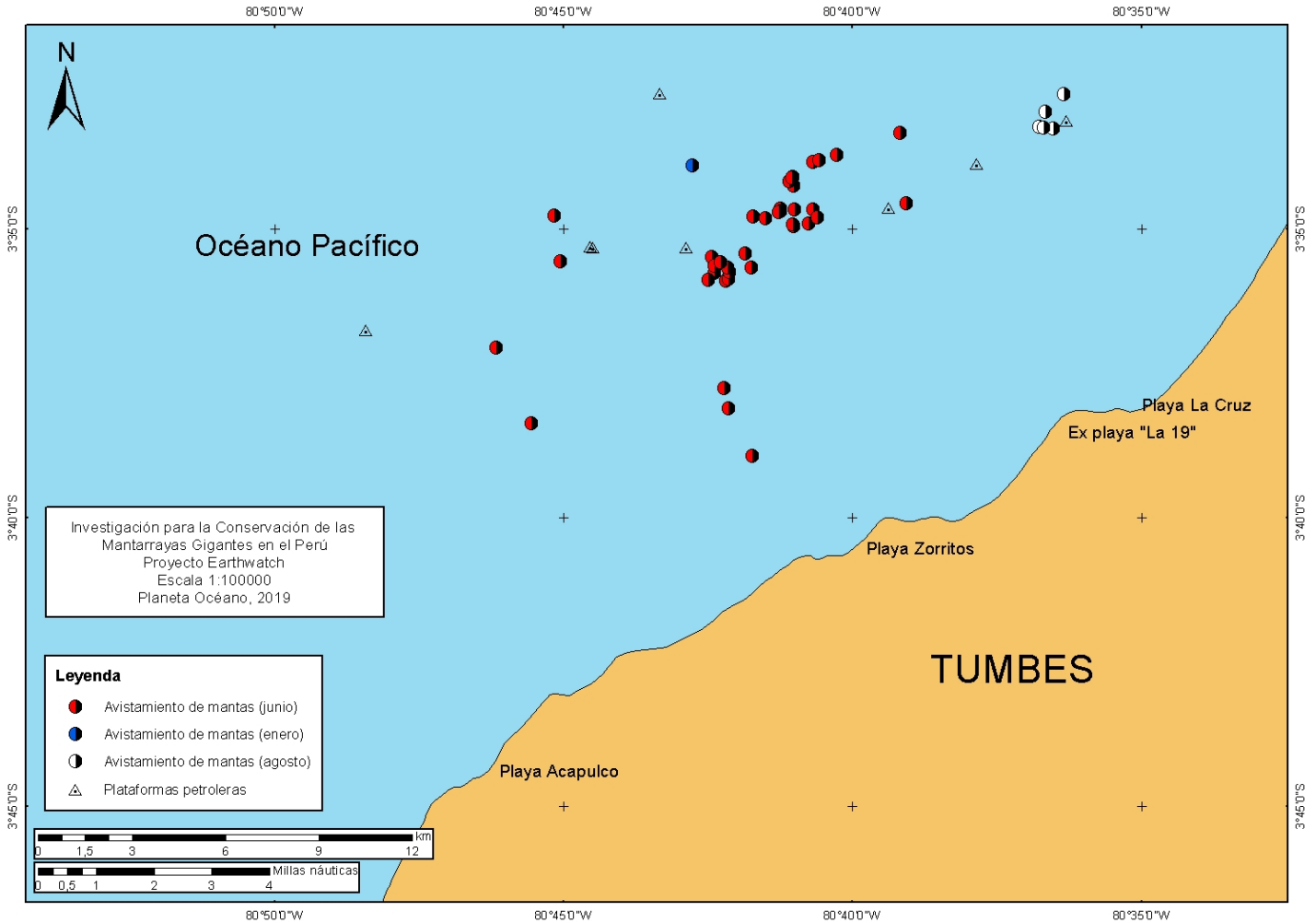
### **(OBJECTIVE 1) Estimate relative density, habitat use and seasonality for manta rays in northern Peru**

Earthwatch Expeditions were conducted in January, June, August, September and November 2019. During each of these Expeditions, 2 half-day boat trips (surveys) were conducted to search for mantas in the main manta sites identified in the Tumbes region. GPS positions and times were recorded during the boat surveys to calculate survey effort, as well as for any manta ray sightings observed.

Manta sightings were recorded in January, June and August 2019 (Map 1). From these months, the highest number of sightings were significantly recorded in June. In June, several giant manta rays were observed breaching out of the water, as well as swimming on the surface (Photo 2). No mantas were observed in September and November.

Map 1 below presents a general overview of the manta sightings recorded by volunteers in accordance to the study site. It is important to note that each 'sighting' does not necessarily imply a different 'individual', as individuals could have been repeatedly counted from the boat. On most occasions, manta rays were elusive or seen from a distance and did not permit recording of photo IDs. Behavior (e.g. swimming, breaching, feeding) and direction that the manta ray was swimming in was also recorded, together with environmental conditions.

**Map 1. Manta ray sightings during 2019 Earthwatch Expeditions**



It is also important to note that lack of recordings does not necessarily imply the absence of this species, as animals could be submerged, and therefore, outside the scope of volunteers and researchers of the project. Further complimentary research, such using satellite telemetry to understand manta behavior, is currently being conducted by Planeta Océano and Stanford University.

In collaboration with a wide range of partners, Planeta Océano has been mapping the occurrence of giant manta rays in northern Peru since 2014. The data collected during these 2019 Earthwatch Expeditions aims to be contrasted with this dataset of manta sightings from 2014-2017, in order to further understand the manta population in northern Peru. Although this analysis is still in process, data collected on this 2019 Earthwatch season might help suggest the existence of potential interannual patterns (in addition to seasonal patterns) for this manta population.



**Photo 2.** Swimming with a giant manta ray during an Earthwatch Expedition (June 2019). © John McCarty

In addition to recording giant mantas, GPS locations and time were collected for encounters with marine fauna during the project. Fauna recorded included mobula rays (Jan, Aug), whale shark (Jan), whales (Jun, Aug, Sep), sailfish (Nov), sea turtles (Jan, Aug, Sep, Nov) and seabirds. These opportunistic sightings will contribute to a wider ecosystem-based approach to support marine conservation in the area (Photos 3-6).





Photos 3-4. Whale shark observed in northern Peru (January 2019) © Stephen Hart





Photo 5. Humpback whale breaching (August 2019) © Noel Rowe



Photo 6. Sea Lions (June 2019) © John McCarty

**(OBJECTIVE 2) Identify potential migratory behavior and site fidelity, as well as natural or fishery-induced threats to manta rays**

Given that manta rays were elusive or seen from a distance, we were not able to collect photo-IDs during the expeditions in 2019. Collecting photo-IDs is fundamental for this objective and hence we expect to obtain these images in the upcoming Earthwatch expeditions.

**(OBJECTIVE 3) Assess genetic variability among manta rays in northern Peru, and in relation to manta rays encountered in Ecuador, through mitochondrial molecular markers.**

The size of the manta population in Peru and its connectivity with Ecuador is still little understood. Through genetics, we hope to document this connectivity, as well as enhance understanding on the size of this manta population. This will be vital to help guide national and international management actions for the conservation of giant manta rays in northern Peru and the East Pacific.

Our team has been collecting mucus and tissue samples from giant mantas in northern Peru since 2018, with the goal to analyze genetic variability in mantas. Mucus and tissue samples were also collected in the Earthwatch Expeditions in January and June 2019. Table 1 below presents the manta ray mucus and tissue samples that have been processed in the laboratory in collaboration with Earthwatch volunteers:

**Table 1.** Manta ray tissue and Mucus samples processed by Earthwatch volunteers

| <b>No.</b> | <b>Type of sample</b> | <b>COLLECTION DATE</b> |
|------------|-----------------------|------------------------|
| 1          | Mucus                 | 07/20/2018             |
| 2          | Mucus                 | 13/11/2018             |
| 3          | Mucus                 | 13/11/2018             |
| 4          | Mucus                 | 14/11/2018             |
| 5          | Mucus                 | 14/11/2018             |
| 6          | Mucus                 | 01/16/2019             |
| 7          | Mucus                 |                        |
| 8          | Mucus                 |                        |
| 9          | Mucus                 | 06/07/2019             |
| 10         | Mucus                 | 06/07/2019             |
| 11         | Tissue                | 07/20/2018             |
| 12         | Tissue                | 13/11/2018             |
| 13         | Tissue                | 14/11/2018             |
| 14         | Tissue                | 14/11/2018             |
| 15         | Tissue                | 06/07/2019             |

For each of the above samples, DNA was extracted by Earthwatch volunteers at the IMARPE laboratory. With further collection from the following Earthwatch expeditions (with the goal of reaching 30 samples), extracted DNA will be then sequenced and analyzed to determine the population structure, genetic variability, haplotype networks, among others (Photos 6-9).

For expeditions in which manta ray samples were not available in the laboratory, Earthwatch volunteers contributed with DNA extraction for other shark and ray species, thus collaborating with genetics and elasmobranch research at the IMARPE laboratory.



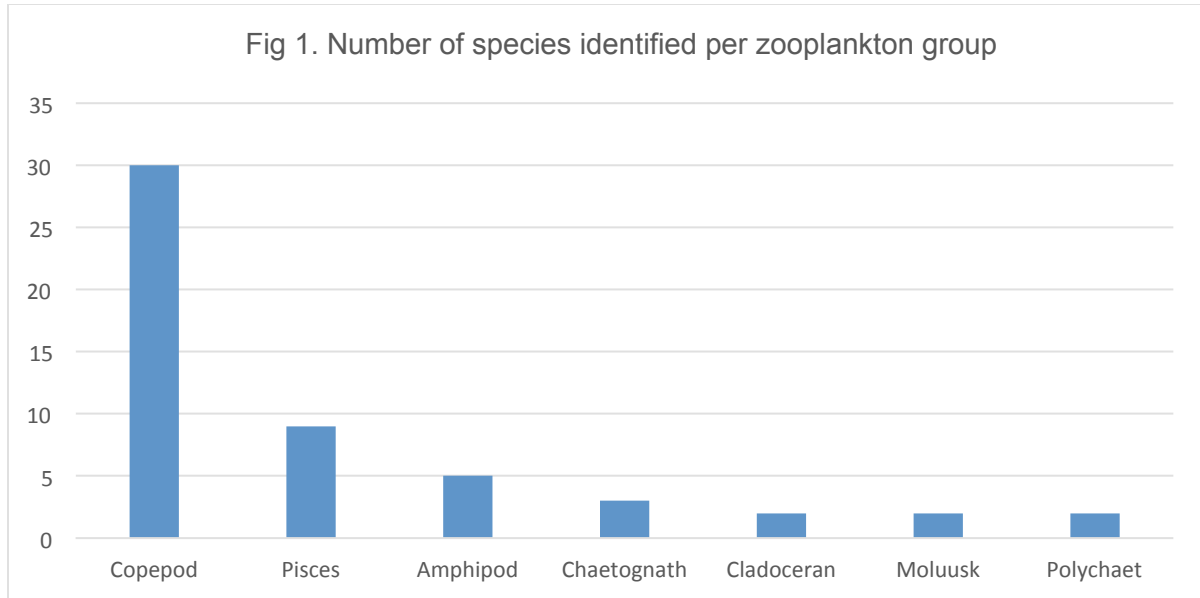
**Photos 6-9.** Lab work carried out to extract DNA from manta ray tissue and mucus samples

(OBJECTIVE 4) Assess zooplankton composition and oceanographic variables (sea surface temperature, salinity, pH and Oxygen) in manta ray aggregation sites, along a three year time period

Manta rays are plankton feeders and it is likely that food source is the overriding factor influencing manta's presence in this region. To understand manta feeding patterns, we aim to analyze which plankton taxa are present/absent during the time of manta presence.

Together with Earthwatch volunteers, we collected zooplankton samples from 96 stations, totaling 192 samples (Photos 10-11). The samples were collected with a Baby-bongo net (150 and 300 micron mesh) provided by a flowmeter to identify the final water volume filtered and present the results in abundance per volume. The samples were fixed and preserved with ethanol 96%. The samples are currently being analyzed with a stereomicroscope NIKON model SMZ 1270 and a compound microscope NIKON model Eclipse 600.

Zooplankton composition is compound mainly by copepods, amphipods, cladocerans, polychaets, chaetognaths among others. From the samples studied so far, copepods have been seen to be mainly predominant regarding the number species and abundance (Fig. 1). Until now, we determined at least 57 zooplankton species (Table 1). In the copepods we have determined 30 species. Given that some species are very difficult to identify, we are measuring, taking pictures (Photo 12) and analyzing with DNA code in order to register as evidence of the identification.



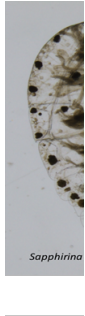
Zooplankton composition during Earthwatch expeditions will be analyzed and presented as the undergraduate Biology thesis of Ms. Arelliss Choque. Based on this analysis, we then plan to compare zooplankton composition and abundance to data on giant manta ray sightings and Sightings per Unit Effort (SPUE). Furthermore, through further understanding of zooplankton in northern Peru, we expect this information will support ecosystem and fisheries management in the future.





Photos 10-11. Volunteers and Field staff prepare plankton nets and collect samples





Photo

Table 1. Species composition of zooplankton.

| Class/Order   | Family            | Species               | Group       | Class/Order    | Family            | Species                  |
|---------------|-------------------|-----------------------|-------------|----------------|-------------------|--------------------------|
| Calanoida     | Eucalanidae       | Rhincalanus nasutus   | Copepod     | Harpacticoida  | Clytemnestriidae  | Goniopsillus             |
| Calanoida     | Eucalanidae       | Subeucalanus pileatus | Copepod     | Calanoida      | Calanidae         | Mesocalanus tenuicornis  |
| Calanoida     | Eucalanidae       | Eucalanus inermis     | Copepod     | Cyclopoida     | Corycaeidae       | Corycaeus                |
| Calanoida     | Centropagidae     | Centropages furcatus  | Amphipod    | Amphipoda      | Lestrigonidae     | Hyperoides sibagines     |
| Calanoida     | Pontellidae       | Labidocera acuta      | Amphipod    | Amphipoda      | Lycaeidae         | Symorhynchotus           |
| Calanoida     | Euchaetidae       | Euchaeta longicornis  | Amphipod    | Amphipoda      | Lestrigonidae     | Lestrigonus bengalensis  |
| Calanoida     | Pontellidae       | Calanopia minor       | Amphipod    | Amphipoda      | Lestrigonidae     | Hyperietta               |
| Calanoida     | Temoridae         | Temora stylifera      | Amphipod    | Amphipoda      |                   |                          |
| Calanoida     | Temoridae         | Temora discaudata     | Chaetognath | Aphragmophora  | Sagittidae        | Sagitta pacifica         |
| Calanoida     | Candaciidae       | Candacia curta        | Chaetognath | Aphragmophora  | Sagittidae        | Sagitta peruviana        |
| Calanoida     | Candaciidae       | Candacia catula       | Chaetognath | Aphragmophora  | Sagittidae        | Sagitta enflata          |
| Calanoida     | Calanidae         | Nanocalanus minor     | Chordata    | Clupeiformes   | Engraulidae       |                          |
| Cyclopoida    | Sapphirinidae     | Sapphirina sp.        | Chordata    | Perciformes    | Labrisomidae      |                          |
| Cyclopoida    | Sapphirinidae     | Sapphirina metallina  | Chordata    |                | Dactiloscopidae   |                          |
| Calanoida     | Clausocalanidae   | Clausocalanus jobei   | Chordata    | Myctophiformes | Benthoosema       |                          |
| Calanoida     | Paracalanidae     | Acrocalanus gibber    | Chordata    | Gadiformes     | Bregmacerotidae   | Bregmaceros bathymaster  |
| Calanoida     | Paracalanidae     | Paracalanus parvus    | Chordata    | Myctophiformes | Myctophidae       | Diogenichtbys laternatus |
| Calanoida     | Scolecitrichidae  | Scolecitrix           | Chordata    | Perciformes    | Carangidae        | Chlosocmbrus orqueta     |
| Calanoida     | Acartiidae        | Acartia sp.           | Chordata    | Perciformes    | Scianidae         |                          |
| Calanoida     | Acartiidae        | Acartia sp.1.         | Chordata    | Perciformes    | Trigidae          | Prionotus stephanophrys  |
| Calanoida     | Calanidae         | Calanus chilensis     | Decapods    | Decapoda       | Brachyuridae      |                          |
| Cyclopoida    | Oncaeidae         | Oncaea 2              | Euphausiid  | Euphausiacea   | Euphausiidae      |                          |
| Cyclopoida    | Oncaeidae         | Oncaea 3              | Polychaet   | Polychaeta     | Lopadorrhynchidae | Pelagobia longicerrata   |
| Calanoida     | Pseudodiaptomidae | Pseudodiaptomus       | Polychaet   | Polychaeta     | Aliciopidae       |                          |
| Cyclopoida    | Sapphirinidae     | Copilia               | Cladoceran  | Branchiopoda   | Podonidae         | Evadne spinifera         |
| Harpacticoida | Ectinosomatidae   | Microsetella          | Cladoceran  | Branchiopoda   | Podonidae         | Pleopis polyphemoides    |
| Harpacticoida | Euterpinidae      | Euterpina             | Mollusk     | Bivalvia       |                   |                          |
| Cyclopoida    | Oithonidae        | Oithona               | Mollusk     | Gastropoda     |                   |                          |

12. Zooplankton pictures © IMARPE.

## Project Impacts

### 1. Increasing Scientific Knowledge

#### A) TOTAL CITIZEN SCIENCE RESEARCH HOURS

The following table provides an estimate for the number of hours per day that volunteers spent collecting data, being trained to collect data in the field, and performing data entry.

| Description  | Time (hours)                       |
|--|------------------------------------|
| Training   | 8                                  |
| Data collection<br>Manta surveys: 14 hours<br>Plankton sampling: 7 hours<br>Genetics Laboratory: 6 hours | 27                                 |
| Data entry   | 4                                  |
| Other activities (community outreach, meeting local partners, organizing and preparing materials)        | 12                                 |
| Total per Volunteer  | 51                                 |
| Total (in 2019)  | 51 x 30 volunteers<br>= 1530 hours |

#### B) NON-PEER REVIEWED PUBLICATIONS:

Reports on this project, highlighting Earthwatch, were featured on the following media outlets:

- The Guardian: <https://www.theguardian.com/environment/2019/jun/25/peru-sea-giant-worth-far-more-alive-than-dead-giant-manta-ray>
- GCTN: <https://america.cgtn.com/2019/07/08/a-biologist-protecting-perus-giant-manta-rays-from-being-at-risk>

#### C) PRESENTATIONS:

During 2019, co-PI Kerstin Forsberg participated in a series of events in which this project was highlighted, together with the work carried out by Planeta Océano. These events include the following:

- OceanObs' (Hawaii, September 2019)
- Marine Conservation Fellows Summit, New England Aquarium (Boston, October 2019)
- III Congress of Latin America Protected Areas (Lima, October 2019)
- Planeta Océano and Peru's Ministry of Environment's intersectorial workshop on manta bycatch reduction (Tumbes, July 2019)
- UNESCO Forum on Education for Sustainable Development and Global Citizenship Education (Hanoi, July 2019)
- UNESCO Ocean Science Day (Paris, June 2019)





Photo 13. Earthwatch volunteers, Earthwatch staff and co-PI Kerstin Forsberg reunite at Marine Conservation Fellows Summit Symposium (Boston, October 2019)

## 2. Outreach and Mentoring

### a) Graduate students

| Student Name   | Graduate Degree                          | Project Title  | Anticipated Year of Completion |
|----------------|--|--|--------------------------------|
| Areliss Choque | Bachelor's Degree (undergraduate thesis) | Composition of zooplankton in the Tumbes region, northern Peru | 2020                           |

### b) Community outreach

| Name of school, organization, or group           | Education level | Participants local or non-local | Estimated number of participants* | Details on contributions/ activities   |
|--|-----------------|---------------------------------|-----------------------------------|--|
| I.E 052 Sigfredo Zúñiga Quintos**                | Primary school  | Local                           | 8 students                        | Restore and enhance 3 murals showcasing manta ray conservation on school walls   |
|  | Primary school  | Local                           | 120 students                      | 5 workshops on manta ray conservation aimed at children between 10 and 13 years old. Students then posted signs made by them outside and inside their school, showcasing elasmobranch conservation in their community. |
| I.E José Carlos Mariátegui**                     | Primary school  | Local                           | 20                                | 1 workshop on manta ray conservation aimed at children between 10 and 13 years old. Students then posted signs made by them outside and inside their school, showcasing elasmobranch conservation in their community.  |
| Zorritos Fishing Terminal                        |                 | Local                           |                                   | Restore and enhance 1 mural showcasing manta ray conservation on fishing terminal wall   |
|  |                 | Local                           |                                   | Post signs initiative for fishermen to report and share real-time sightings of manta rays and avoid fisheries interaction  |
| Provincial Municipality of Contralmirante Villar |                 | Local                           | 20 adults + 10 youth              | Beach clean-up was carried out with personnel from the Municipality as well as local youth at Caleta Grau  |

\* The table above represents the number of direct beneficiaries for outreach activities. Indirect beneficiaries include the wider fishing community (e.g. fishermen observing murals everyday), student family members, etc. Outreach activities were centered on developing a genuine, two-way learning and collaboration exchange between local community members and Earthwatch volunteers.

\*\*As a follow-up activity, and after Earthwatch expeditions took place, school students were later connected online with other classrooms from the region (e.g. Costa Rica), as part of Planeta Océano's 'Connecting Schools Initiative'. During these online exchanges, students shared their experience learning about manta rays with students from another other country.



Photo 14. Volunteers participate in school workshops and assist students in developing a mini campaign to showcase manta ray and elasmobranch conservation



Photo 15. Posting signs for fishermen to report and share real-time sightings of manta rays © Noel Rowe



Photo 16. Manta ray mural restored on school wall thanks to Earthwatch volunteers



Photo 17. Beach clean-up at Caleta Grau (January 2019) © Claudia Ampuero



Photo 18. School workshop in Zorritos, Tumbes

### 3. Partnerships

| Partner   | Support Type(s) <sup>1</sup>           | Years of Association (e.g. 2006-present) |
|---|--|--|
| Instituto del Mar del Perú (IMARPE) – Tumbes Laboratory | Collaboration (Genetics Laboratory)    | 2018-present                             |
| Instituto del Mar del Perú (IMARPE)                     | Collaboration (Zooplankton Laboratory) | 2018-present                             |

### 4. Contributions to management plans or policies

| Plan/Policy Name   | Type <sup>2</sup> | Level of Impact <sup>3</sup> | New or Existing? | Primary goal of plan/policy <sup>4</sup> | Stage of plan/policy <sup>5</sup> | Description of Contribution   |
|--|-------------------|------------------------------|------------------|--|-----------------------------------|---|
| RESOLUCIÓN MINISTERIAL N° 441-2015-PRODUCE   | Policy            | National                     | Existing         | Species conservation                     | Adopted                           | We contributed with further investigation on the giant manta ray in Peru to help guide conservation and management actions for this species |
| National Action Plan for Conservation and Management of Sharks, Rays and Related Species of Peru | Management Plan   | Local                        | Existing         | Species conservation                     | Adopted                           |   |



Photo 19. Data entry by Earthwatch volunteers



## 5. Conserving natural and sociocultural capital

### a) Conservation of taxa

- *In the past year, has your project helped conserve or restore populations of species of conservation significance? If so, please describe below.*

| Species                 | IUCN Red List category | Local/regional conservation status | Local/regional conservation status source | Description of contribution   | Resulting effect <sup>6</sup>                                     |
|-------------------------|------------------------|------------------------------------|---|---|---|
| <i>Mobula birsotris</i> | Vulnerable             | Vulnerable                         | IUCN                                      | Scientific knowledge, community ownership in manta ray conservation | Contribution to mitigating bycatch, protection by local community |

### b) Conservation of ecosystems

- *In the past year, has your project helped conserve or restore habitats? If so, please describe below.*

| Habitat type               | Habitat significance <sup>7</sup> | Description of contribution                              | Resulting effect <sup>8</sup> |
|----------------------------|-----------------------------------|--|-------------------------------|
| Marine ecosystem of Tumbes | High biodiversity area            | Research, engagement of community in marine conservation | Enhanced resilience           |



Photo 20. Earthwatch volunteers exchange information with artisanal fishermen from boat-to-boat on the waters of Tumbes, northern Peru

**c) Ecosystem services**

**Provisioning Services**

- Fisheries (Fresh & Marine)
- Energy (Fuelwood/hydropower)
- Livestock grazing
- Material extraction (e.g. resin, grass)
- Timber
- Water supply
- Other food (crops, wild foods, spices)
- Pharmaceuticals

**Regulating & Support Services**

- Carbon sequestration/storage/"blue"
- Coastal protection
- Erosion control
- Flood regulation/protection
- Pest and disease control
- Pollination
- Seed dispersal
- Water purification/quality
- Nutrient cycling

**Cultural Services**

- Cultural/historical values
- Health (mental & physical)
- Research & knowledge
- Recreational
- Spiritual/aesthetic values

**Other Services**

- Biodiversity
- Employment/Livelihoods

Details:

This project is generating valuable information on giant manta rays as well as information for marine biodiversity in northern Peru. This in turn hopes to contribute with sustainable fisheries as well as local livelihoods such as manta ecotourism.



Photo 21. Local fishermen at Zorritos, Tumbes © John McCay

#### d) Conservation of cultural heritage

Provide details on intangible or tangible cultural heritage components that your project has conserved or restored in the past year.

| Cultural heritage component <sup>9</sup> | Description of contribution   | Resulting effect                    |
|--|---|-------------------------------------|
| Traditional Ecological Knowledge         | This project is showcasing the importance of conserving manta rays, once greatly valued by pre-inca cultures. We are also working alongside local fishermen to value Traditional Ecological Knowledge regarding this species. | Community ownership in conservation |

#### e) Impacting local livelihoods

Provide details on how livelihoods were impacted by your project. This includes persons hired to assist Earthwatch teams (field assistants, guides, cooks, drivers, etc.) and any economically applicable training provided to local community stakeholders.

| Local livelihood impact(s)               | Description of contribution   | Number of people impacted |
|--|---|---------------------------|
| Artisanal fishermen                      | Local fishermen from the 'Asociación Ecoturística Manta Pacífico Tropical', a local association that seeks to promote community-based manta ecotourism, received economic income through expeditions. They have also been benefited by training (e.g. safety, first aid). Local fisherman that operate rowboats have also received income as they assist volunteers in embarking and landing in Zorritos. | 15                        |
| MUTUMBI (Women artisans from Tumbes)     | Volunteers support livelihoods of artisan women in purchasing their art crafts, as well as provide valuable feedback on their sustainable products and services   | 15                        |
| Miguel Quispe (local artisan) and family | Volunteers had dinner at the Quispe's family local restaurant, as well as make their own accessories including eco-friendly items such as cloth bags and jewelry. This activity supports livelihoods for Miguel and his family, while engaging the family as local artisan ambassadors in our manta project.  | 10                        |
| Local divers                             | Local young divers have received economic income for supporting sightings of manta rays and serving as water safety personnel. Divers come from local fishing families. Additionally, one of the divers is a biologist and through these expeditions he has been able to enrich his knowledge about field techniques.   | 4                         |
| Local drivers                            | We have worked with 6 local drivers who have obtained economic income for their service. Although they have lived for a long time in coastal areas, they were not aware about the manta rays in the region. By engaging in our project, they are becoming aware of this species and the activities we carry out for its conservation.   | 6                         |
| Local cook                               | María Pereda is a housewife who works with us in this project cooking food for the team, and thus generating an income for her family   | 1                         |
| Early Career Researchers                 | Three members of our field team, Claudia, Mariano and Areliss are young Peruvian Early Career Researchers. By participating in this project, they have been able to learn more about giant manta ray sample collection techniques, laboratory processing, as well as leadership skills, team coordination and group management.   | 2                         |
| Volunteers                               | Expeditions have involved Peruvian students from different careers. For example, a tourism student from Tumbes who through the project gained university credits, a recently graduated high-school student and 3 recently graduated undergraduate biology students.   | 8                         |



Photos 22-23. Earthwatch volunteers collaborate with artisans from MUTUMBI and the Quispe family

## Research Plan Updates

Report any changes in your research since your last proposal/annual report. For any 'yes' answers, provide details on the change in the 'Details' box. This section will not be published online.

- 1) Have you added a new research site or has your research site location changed?  Yes  No
- 2) Has the protected area status of your research site changed?  Yes  No
- 3) Has the conservation status of a species you study changed?  Yes  No
- 4) Have there been any changes in project scientists or field crew?  Yes  No

Details – provide more information for any 'yes' answers

Mariano Cabanillas, one of field staff, was offered a scholarship to study a Master's degree in Brazil and moved to Brazil in March 2020. He will remain as an associate researcher for Planeta Océano, although he will no longer be able to assist field crews.

Raquel Siccha is on temporal leave at IMARPE and will remain associated with the project, although she will no longer be able to assist in laboratory work during expeditions.

## Acknowledgements

We would like to thank all Earthwatch volunteers for their support during this project. Thank you to all Planeta Océano and IMARPE staff, interns, students, volunteers, colleagues, partners and friends who have supported our team throughout the year. We greatly appreciate the contributions of local community members and project participants, including local fishermen, divers, teachers, artisans and youth.