

Final Evaluation Report

Your Details	
Full Name	Ana Eguiguren
Project Title	Sperm whale clans around the Galapagos Islands and Beyond
Application ID	32419-1
Date of this Report	June 10, 2022

1. Indicate the level of achievement of the project's original objectives and include any relevant comments on factors affecting this.

Objective	Not achieved	Partially achieved	Fully achieved	Comments
Determine the identity of sperm whale clans off the Galápagos Islands in 2022.				Acoustic recordings were collected, and a subsample has been analysed to determine clan identity.
Evaluate the population status of sperm whale clans off the Galápagos Islands.				Photo-ID and demographic data were collected. Demographic metrics were calculated based on group composition annotations in the field. Photo-ID data will be used in the future to produce population estimates and re-sighting rates.
Ascertain the degree to which sperm whale habitat use in 2022 overlap with anthropogenic threats.				Geographic positions of sperm whale presence and absence were collected. These, along with satellite-derived fishing effort data, will be used to determine habitat overlap with human activities.
Organize the "Cachalotes del Pacífico" Workshop.				The workshop project was shared with colleagues during the "Cachalote Consortium" at the Biennial Marine Mammal Conference. The syllabus is currently being developed and the workshop will take place in November 2022.

2. Describe the three most important outcomes of your project.

a). Key data collected: We spent 41 days at sea, of which 16 were spent following groups of sperm whales within and outside the Galapagos Marine Reserve (GMR) (Figure 1). During this time, we collected 346 h of recordings, over 15,000 photographs for photo-identification, as well as demographic and behavioural data. With these data, we were able to determine: a) the identity sperm whale clans present off the Galápagos Islands, b) their population status, and c) their distribution, as per our research objectives.

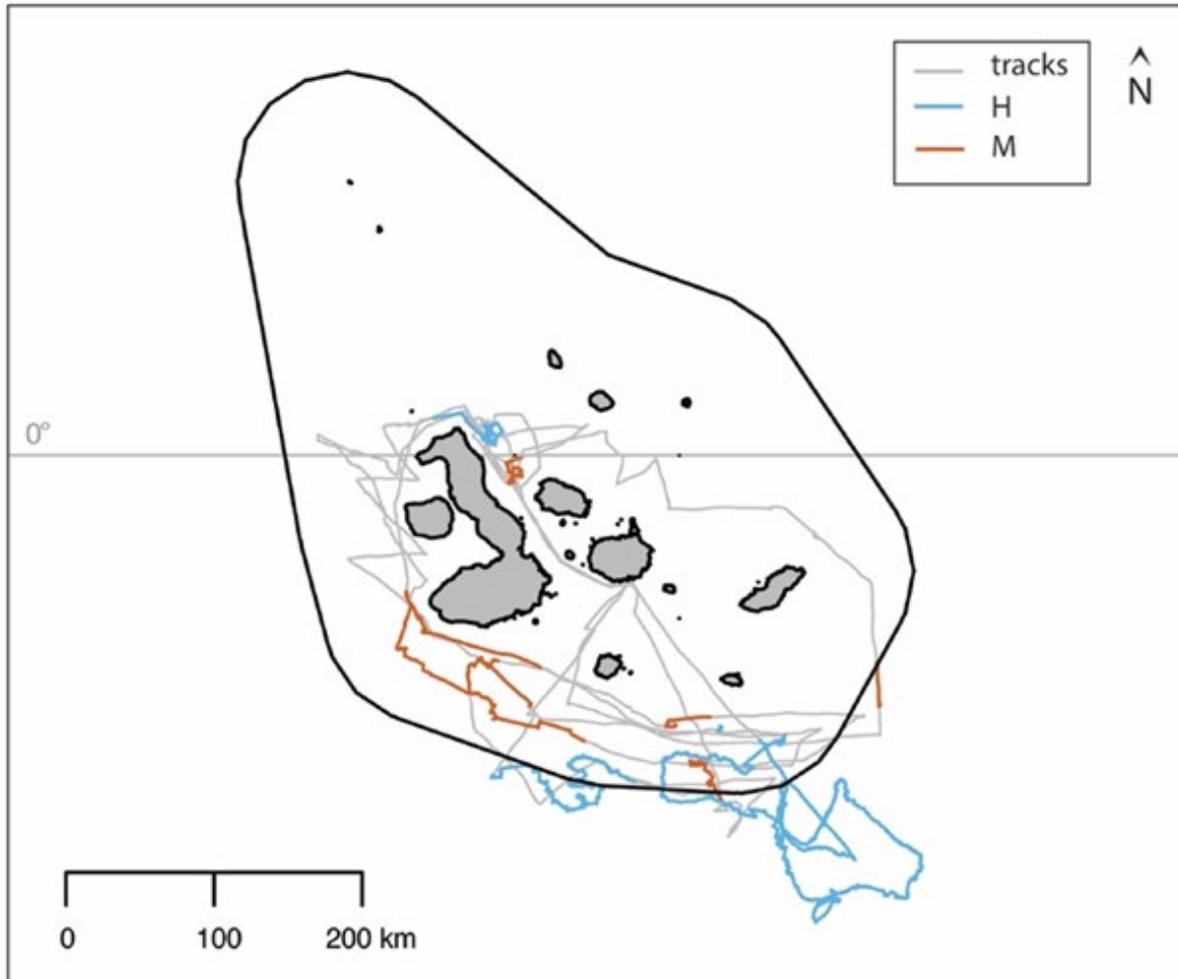


Figure 1. Study area covered during the 2022 field season (March – May). Surveyed areas (grey) and encounters (blue = females; orange = males) are shown. The Galapagos Marine Reserve boundary is marked in black.

b). Clan Identity: The sperm whales we followed most likely belong to the short clan, which was also documented in 2013 & 2014 (Figure 2).

c). Population Status: We found sighting rates slightly higher than those documented in 2013 & 2014, but still lower than those documented in the late 80s and early 90s (Figure 2).

Likewise, feeding rate was like that documented in 2014, but much lower than that documented in 2013 (Figure 3-a). The feeding rate we documented was comparable to normal conditions (i.e., not strong El Niño or La Niña events) recorded during the 1980s and 1990s. While males were found among groups of females and juveniles, breeding male proportion was less than half of that documented in the previous decade (Figure 3-b). Conversely, we found the highest proportion of calves documented in this region in 2022 (Figure 3-c).

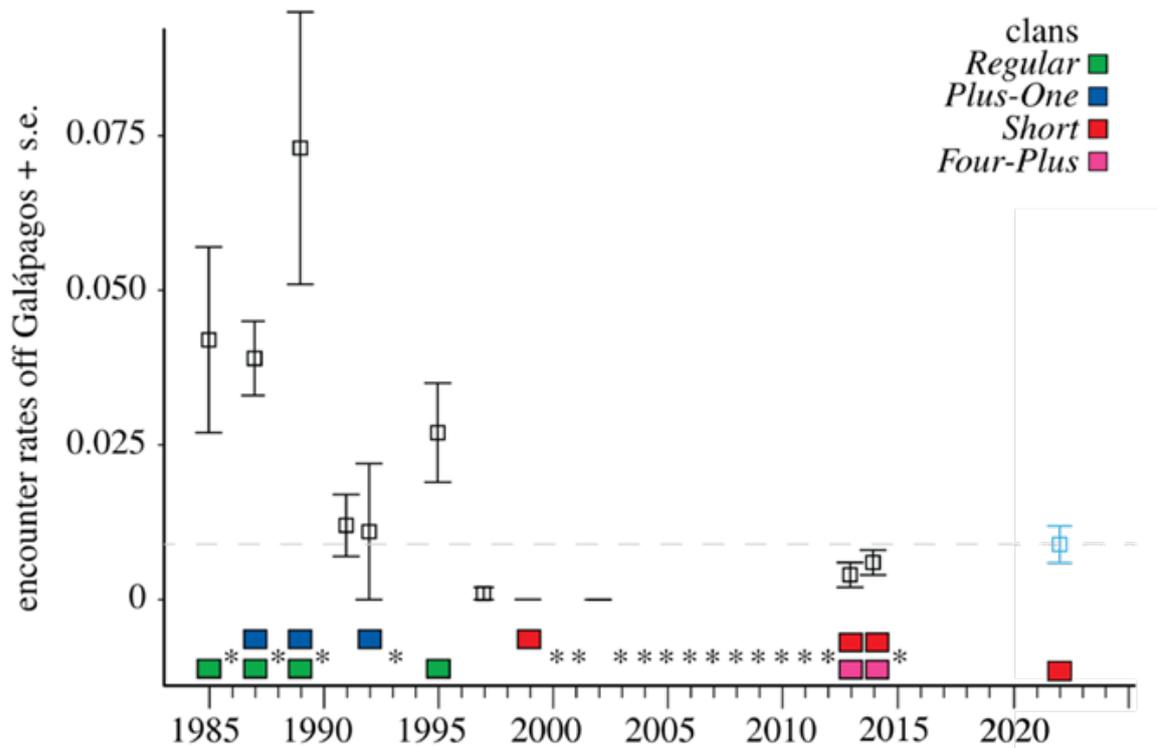


Figure 2. Encounter rates for female/juvenile sperm whales (number of encounters hours searching) in surveys off the Galapagos Islands, with rates obtained from the 2022 field season highlighted in blue. Clans present each year are indicated by the coloured boxes. Figure taken and adapted from Cantor et al. (2016).

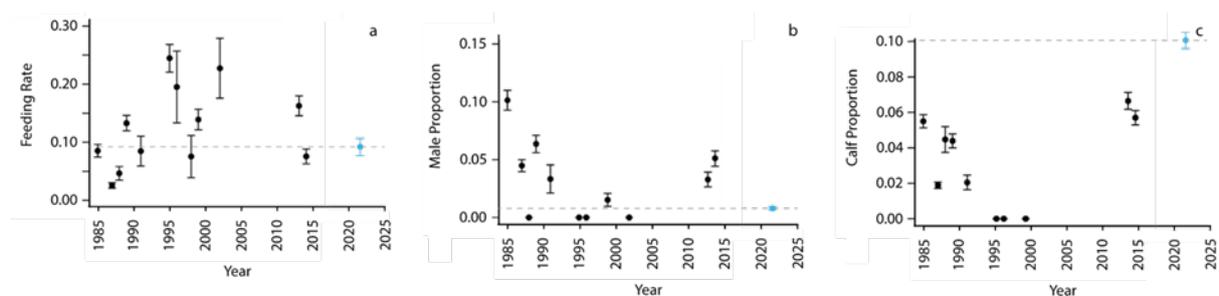


Figure 3. Population metrics for sperm whales encountered off the Galapagos Islands, with rates obtained from the 2022 field season highlighted in blue: a) feeding rate measured as the number of fluke prints inspected where defecation was detected, b) male proportion measured as the number of adult males encountered in clusters of females and juveniles, and c) calf proportion measured as the number of calves encountered in clusters of females and juveniles. Figure taken and adapted from Cantor et al. (2017).

Distribution and potential overlap with anthropogenic activities:

We found that 45.1% of the time we spent following female and juvenile sperm whales was spent outside the boundaries of the GMR. This is a higher proportion than recorded in the 2010s (30.1%) and much higher than in the 1990s and 1980s (< 3%). Female and juvenile sperm whales were predominantly found south of the archipelago, much like in the 2010s. However, this distribution is distinct from what was found in the 1980s – 1990s, as well as in the 19th Century whaling years, during which whales were most frequently found west of the islands.

Our findings indicate a possible shift in sperm whale habitat use off the islands in recent decades that may be driven by different clans being present and/or changes in oceanographic conditions. Unfortunately, this shift may make sperm whales vulnerable to anthropogenic threats – particularly interactions with fisheries – which are abundant outside the boundaries of the GMR. However, the degree to which this overlap results in a threat to sperm whales remains unclear and hard to assess given the logistical constraints of monitoring the distant waters off the Galapagos Islands.

Participation in the 2022 Cachalote Consortium: The Cachalote Consortium was started in 2005 and it provides a space for researchers to share their findings on sperm whale biology and conservation. I presented our results in this year's meeting, held during the 24th Biennial Conference on the Biology of Marine Mammals. During my participation, I was able to connect with other researchers around the world and identify collaborators that work with sperm whales across the Eastern Tropical Pacific. I was able to gain the support of a Dr Sarah Mesnick, sperm whale researcher for the National Oceanographic and Atmospheric Administration (NOAA), for the development of our workshop in the autumn and for strengthening the outreach of our work to the public and decision-makers.

Local Involvement/Outreach: Throughout our project, we worked in close contact with the Charles Darwin Foundation (CDF) and the Galapagos National Park (GNP), which are key institutions for marine conservation around the Galapagos Islands. We collaborated with the GNP to provide cetacean sightings information to contribute to their cetacean monitoring programme. This is especially valuable as we surveyed distant waters that are outside the reach of tourist and park monitoring routes.

We shared preliminary findings at the Charles Darwin Research Station to an audience of c. 15 attendees, including CDF staff, volunteers, and GNP authorities. During this talk, we highlighted the importance of surveillance in deep waters and established possible collaborations with local researchers in the future.

Ecuadorian student participation: Four Ecuadorian volunteers (one from the Galápagos Islands) participated in our research surveys. Through their involvement, volunteers were trained in marine mammal visual and acoustic monitoring protocols. Through the support of the Rufford Grant, we were able to cover travel costs for some of these volunteers who might otherwise not have been able to participate. Most of our volunteers are interested in pursuing a research career, and this experience is likely to increase their access to graduate programs and funding in the future.

3. Explain any unforeseen difficulties that arose during the project and how these were tackled.

The primary difficulty in conducting our project was the onset and later re-emergence of the Covid-19 pandemic. This impacted our original timeline so that it started later and was cut short with respect to our original plan (see pt. 7 for further details). Additionally, we incorporated additional safety protocols to our fieldwork (i.e., testing and quarantine requirements) which resulted in additional costs (see pt. 8). Finally, the Omicron wave in the first quarter of 2022 limited our opportunities for outreach in local universities.

Nevertheless, through these adjustments we were able to run a successful field season and collect data needed to fulfil our objectives. We plan to conduct outreach activities once data has been fully processed and in-person gatherings are safe under Covid-19 conditions.

4. Describe the involvement of local communities and how they have benefited from the project.

The sperm whales off the Galapagos Islands are found in deep and distant waters which most of the local population never visits. However, our research activities contributed to the Galápagos National Park ongoing cetacean monitoring project, which seeks to map the spatial and temporal distribution of cetaceans off the Galápagos Islands. Additionally, the participation of Ecuadorian volunteers contributed to the capacity building of emerging biologists who will be key in preserving marine species off the Galápagos and Ecuadorian waters in the future.

5. Are there any plans to continue this work?

This field season revealed to us that sperm whales off the Galapagos may be predominantly using waters south of the archipelago and outside the boundaries of the GMR. We therefore plan to conduct a follow-up field season next year (January – May 2023), during which we will concentrate our efforts in the waters south of the archipelago and outside the borders of the reserve. Our goal with this second field season is to determine whether this shift in habitat use persists, and to incorporate the use of drones to detect possible anthropogenic threats that sperm whales face outside the GMR (entanglement, etc.). This will be a valuable opportunity for us to monitor waters that fall outside the reach of the Galapagos National Park authorities and to document the status of a sperm whale population that exists most often outside of the reach of national surveillance and/or jurisdiction.

Once fieldwork is completed, we will prioritise outreach to local government authorities, as well as to the broader public. Specifically, we intend to build social media presence regarding the importance of oceanic species that are unprotected by EEZs.

6. How do you plan to share the results of your work with others?

- Peer-reviewed publications.
- Colloquia at local universities – Universidad de Santa Elena, Galapagos Science Centre.
- Social media outreach.

7. Looking ahead, what do you feel are the important next steps?

- Outreach: Share our findings at local universities (e.g., Universidad de Santa Elena, Galapagos Science Center).
- General public: Social media outreach – I am currently a member of the Seascovery team (<https://seascovery.org>) which is dedicated to social media outreach for ocean conservation. We will use this connection to share the unique drone footage captured through our fieldwork, with hopes of introducing sperm whales to the public in Ecuador.
- Establish a means to maintain research on sperm whale off the Galapagos Islands in the long term: we have been meeting with Galapagos National Park (GNP) authorities and colleagues in Canada to study the feasibility of setting up a passive acoustic monitoring array in the deep waters off the Galapagos Archipelago. Doing so would allow us to monitor not only sperm whale presence, abundance, and clan identity year-round, but also provide acoustic data on the presence of other cetaceans as well as on the presence of ships in waters that are beyond the GNP's surveillance reach. This project is in early development phase, but we are optimistic it would provide an extremely valuable tool for research, conservation, and enforcement.

8. Did you use The Rufford Foundation logo in any materials produced in relation to this project? Did the Foundation receive any publicity during the course of your work?

We included the Rufford Foundation logo in our talk at the Charles Darwin Foundation, to which ~15 people (including staff from the CDF and the Galapagos National Park) attended. I also included the Rufford Foundation logo during my presentation at the Cachalote Consortium, which had ~50 attendants represented by sperm whale researchers from around the world.

9. Provide a full list of all the members of your team and their role in the project.

Ana Eguiguren (Principal Investigator – Ph.D. student): Organized fieldwork, responsible for data analysis and outreach.

Dr. Hal Whitehead (Principal Investigator – Supervisor): Organized fieldwork, research vessel captain, involved in data analysis and publication.

Dr. Luke Rendell: Skipped research vessel, assisted with setup of hydrophone and recording software, as well as with the overall research design for fieldwork.

Dr. Mauricio Cantor: Participated in the development of the project, helped with field activities, and will be involved in photo-id analysis.

Dr. Taylor Hersh: Participated in the development of the project, helped with field activities, and will be involved in acoustic analysis.

Michael Kean: Skippered research vessel.

Collette Robertson: Field volunteer

Maria Virginia Gabela: Field volunteer

Dr. Laura J. Feyrer: Field volunteer

M.Sc. Christine Konrad: Field volunteer

Mateo Valencia: Field volunteer

Maria Antonia Izurieta: Field volunteer

10. Any other comments?

I would like to reiterate my appreciation for the support we received from The Rufford Foundation during these extremely uncertain couple of years. Not knowing when and if we were going to be able to conduct our work was challenging for our team, and it was a relief to count on the foundation's flexibility while we figured out next steps. I am also personally thankful for the trust given by the foundation to start my research career and am hopeful that we'll be able to build a dedicated team to protect these and other oceanic nomads in the future.