Final Evaluation Report

We ask all grant recipients to complete a project evaluation that helps us to gauge the success of your project. This must be sent in **MS Word and not PDF format**. We understand that projects often do not follow the predicted course but knowledge of your experiences is valuable to us and others who may be undertaking similar work – remember that negative experiences are just as valuable as positive ones if they help others to learn from them.

Please DO NOT fill in and submit this form until the project has been completed.

Complete the form in English. Note that the information may be edited before posting on our website.

Please email this report to jane@rufford.org.

Your Details	
Full Name	Ana Eguiguren
Project Title	Sperm whale clans around the Galápagos Islands and beyond
Application ID	39234-2
Date of this Report	December 7, 2025

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
Ascertain the population status of sperm whales in the Galápagos Islands in 2023.			x	Photo-ID and demographic data were collected. Demographic metrics were calculated based on group composition annotations in the field.
Determine the identity of sperm whale clans in and around the GMR in 2023			x	Acoustic recordings collected in 2023 were analysed to determine clan identity. This was done as part of an honours thesis and is being processed for submission to a scientific journal.
Diagnose the health of sperm whales in and around the GMR through body condition and scar-rate analyses.		x		We have developed a method to determine sperm whale sex and age class using drone photogrammetry which is currently under review. This is an important prerequisite for evaluating body condition while accounting for developmental and sex differences.
Strengthen ties within the "Cachalotes del Pacífico" Network			x	Through continued contact with members of the network, we have been involved in updating and reporting on the status of Eastern Tropical Pacific sperm whale clans to the UN's CMS secretariat, recommending the renewal of the concerted action on ETP sperm whale clans. There are currently 14 people from 7 countries involved in the network.

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

a). Key data collected to inform evaluations of sperm whale clan identity, population status, and individual health

We spent 80 days at sea on 2023, 16 of which were spent tracking sperm whales within and around the Galápagos Marine Reserve (GMR). During this time, we collected **752 hours of acoustic data**, **40,000 photographs for photo identification**, and obtained **>72 hrs of drone footage** on sperm whales. This adds to the **346 hours of acoustic data** and over **15,000 photographs** for photo-identification we had collected in 2022 (Figure 1).

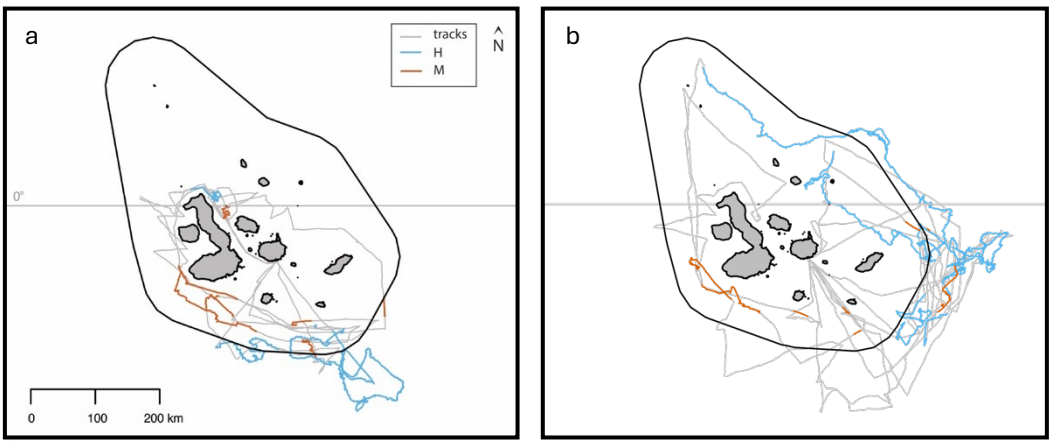

Figure 1. Study area covered in 2022 (a) and 2023 (b). Vessel tracks while searching for whales are shown in grey, tracks conducted while following males are shown in orange, and following females are shown in blue. The Galapagos Marine Reserve boundary is shown for reference.

<u>Summary of findings:</u>

1. *Updated assessment of clan identity:* Using a recently developed AI-assisted acoustic detector (Gubnitsky et al. 2024), we completed the analysis of acoustic data collected in 2022 and 2023. We found that the cultural turnover documented after the 2010s persists, with no evidence of the clans that were originally sighted in the 1980s and 1990s returning to the region (**Figure 2**). Clans present in 2022 and 2023 were also detected in 2013 and 2014, which is consistent with the presence of re-identified individuals between the two time periods (Sliwa in prep. & Sidhu 2023).

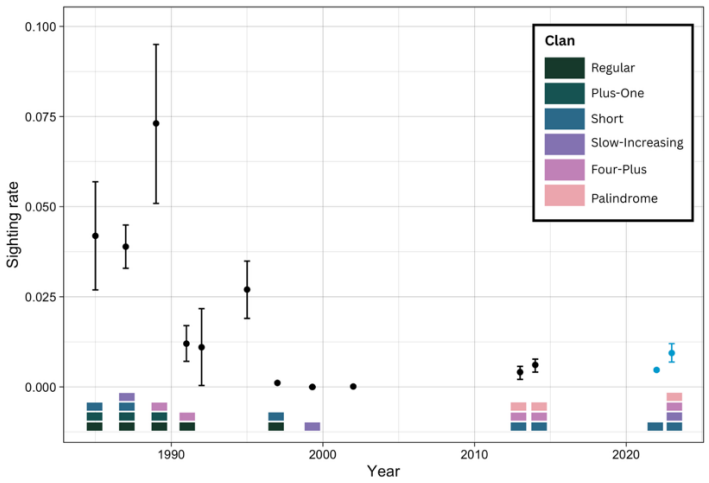

Figure 2. Encounter rates for female/juvenile sperm whales (estimated as the number of encounters/hours spent searching for whales) in surveys off the Galapagos Islands. With rates obtained from the 2022 and 2023 field seasons highlighted in blue. Clans detected each year are indicated by the coloured boxes. Figure modified from Cantor et al. (2016).

2. *Population status:* Preliminary analysis of sperm whale sighting rates in 2022 and 2023 shows slightly higher sighting rates than in 2013 and 2014, but these remain considerably lower than those documented in the late 80s and early 1990s (**Figure 2**). Daily defecation rates which have been used as an indicator of foraging success, were like those documented in the 1990s, but considerably higher than the late 80s (**Figure 3-a**). The proportion of calves in a cluster, which we consider as an indicator of the reproductive capacity in a year, had comparable numbers to those recorded in 2013 and 2014, suggesting a slight recovery when compared to the earlier decades.

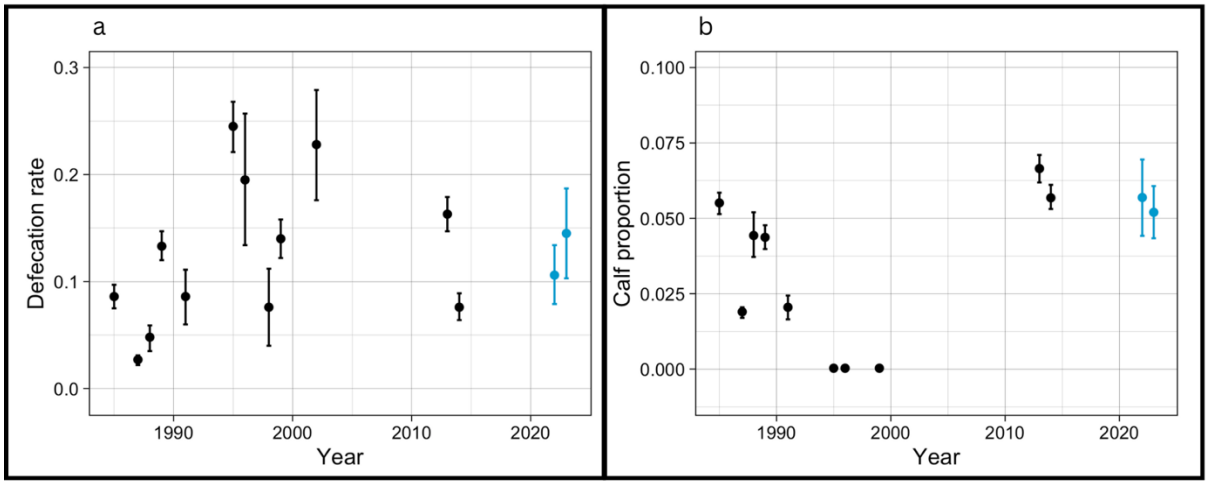

Figure 3. (a) Defecation rate measured as the proportion of fluke prints inspected in a day where defecation was detected +/- standard error. (b) Average daily proportion of calves in a cluster of female and immature individuals. Figure adapted from Cantor et al. 2017

3. *Movements and distribution*: A comparison of our data with Llong-term movement analysis shows significant shifts: compared to historical data collected in the 19th Century, the 1980s and 1990s, when whales were often found west of the archipelago, individuals more recently are found in the south, east and north of the islands, often outside the GMR boundaries. Our findings also show that individuals spend less time near and around the Galapagos Islands, suggesting that site fidelity has also shifted considerably across decades (Sidhu, 2022).

b). Establishment and strengthening of the 'Cachalotes del Pacífico' network –

After conducting the '*Cachalotes del Pacifico'* workshop (Nov 2022), we established an ongoing regional network dedicated to advancing research and conservation of sperm whales throughout the Eastern Tropical Pacific (ETP). Over the past three years, this collaboration has strengthened significantly and produced several key outcomes:

- *Contribution to international conservation agreements:*
  We lead the drafting and reporting of the Concerted Action for ETP sperm whales under the UN Convention on Migratory Species (CMS). Our team provided updated information on the state of knowledge of sperm whales throughout the region, highlighting critical gaps in our knowledge of the distribution, movement patterns, and threats faced by sperm whales in the region. Most recently, we submitted a **renewal request for the Concerted Action for the sperm whales of the ETP** to the CMS secretariat for 15th COP meeting to be held in Brazil (2026). Here,

we identified actionable future steps to ensure the conservation of eastern tropical pacific sperm whales in the region (summarized in **Section 7**).

- *Peer-reviewed publication on culture and conservation:*
  We published a review on the **relationship between sperm whale culture and their conservation in the region** (Eguiguren et al., 2025a). This work illustrates how knowledge of animal culture can help inform conservation efforts and outlines practical steps to tackle some of the associated challenges.
- *Progress toward a regional integrated photo-ID catalogue:*
  We **advanced efforts to build a unified ETP-wide sperm whale photo-ID catalogue to enable matching across regions**. We have successfully uploaded entire Whitehead Lab catalogue (spanning from 1985 -2023; >5,000 individuals)– to Flukebook which supports AI-assisted matching across study areas. We continue to coordinate collaborates as they upload their catalogues. This work will allow for monitoring sperm whale movements at the appropriate ecological scale, helping identify long-range movements, habitat use, and the whereabouts and status of clans that haven't been seen since the 2000s.

c). Development of a minimally invasive tool to infer sperm whale age-class and sex using aerial photogrammetry.

We developed a novel approach to determine the whale age-class and sex of sperm whales based on aerial photogrammetry (preprint – Eguiguren et al. 2025b, submitted for publication). By combining drone measurements with established growth curves for males and females, our tool infers whether individuals are newborns, calves, juveniles, adult, or mature, and whether they are male or female at a scale that was not possible through visual inspections. This method provides a minimally invasive, and cost-effective way of assessing the demographic makeup of sperm whale groups. Understanding the proportions of adult females, males, juveniles, and young calves is essential for evaluating the health and recovery of the ETP population. Our method can also be easily adapted to track changes in the population structure in other regions and identify areas where the viability of sperm whales may be threatened.

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

During the 2023 field season, we experienced mechanical difficulties in the research vessel, which caused the loss of several planned days at sea. Initially, accessing replacement parts hindered our ability to resume fieldwork. However, this was resolved by the ingenuity of the mechanics at the Galapagos Islands (particularly Luis Vela), who was able to resolve the issue and enabled fieldwork to resume.

Following two successful field seasons, a significant challenge has been posed by the sheer volume of acoustic and photographic data collected. We have addressed this in part by integrating newly developed AI-assisted technologies, including an

automated coda detector and photo-ID matching algorithms, which considerably accelerated our data processing workflow. This, in turn, created an opportunity for a direct collaboration with the developers of the automated coda detector, as we the efficiency of their methods beyond their original system.

Despite these, substantial human effort has still been required for developing relevant methodologies and validating our results. For example, we recently finished our evaluation of the measurement accuracy of our drone system and developed a method for inferring sperm whale age-class and sex based on aerial photogrammetry. This work is a pre-requisite to characterizing individual body condition as an indicator of health, given the expected variation across developmental stages and sexes. The time required to complete these preliminary steps have meant that some analyses are still in process, although we expect they will be completed within the following year (2026).

6. **Describe the involvement of local communities and how they have benefitted 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. Their movements span thousands of kilometres, with individuals re-sighted throughout the Eastern Tropical Pacific, making the notion of a 'local community' for this species inherently broad. Nevertheless, our research activities contributed significantly at the local scale by strengthening ongoing monitoring efforts and building regional capacity.

First, our fieldwork directly supported the Galápagos National Park's long-term cetacean monitoring project, which seeks to map the spatial and temporal distribution of cetaceans off the Galápagos Islands. This is especially valuable as we surveyed distant waters that fall outside the reach of tourist and Park monitoring routes.

Additionally, the participation of Ecuadorian and Latin American volunteers contributed to the capacity building of emerging biologists who will be key in preserving marine species off the Galápagos and beyond. Several team members have since taken important steps in their conservation and research careers. For example, María Virginia Gabela (field volunteer in 2022) is now the Communications Coordinator and Research consultant for MigraMar, an NGO dedicated to the conservation of highly migratory marine megafauna (including sperm whales) in the Eastern Tropical Pacific. María Antonia Izurieta (field volunteer in 2022) recently began an M.Sc. in Texas A&M University in Marine Biology. Constanza Cerda-Rojas (field volunteer in 2023) started her PhD at the Universidad Católica de Chile, where part of her project aims at assessing the seasonal acoustic presence of sperm whales off Chile, where research on their distribution has not been conducted since 2004.

6. Are there any plans to continue this work?

Sperm whales live for decades and move thousands of kilometres in the ETP. This means that long-term monitoring, coupled with trans-national collaboration, is essential for uncovering the status and threats sperm whales face. Currently, we plan to conduct two more field seasons in the region in 2026 and 2027. The goal of this fieldwork will be documenting the distribution, continue to monitor the demographic 8arameters, and generate data on individual health through scarring and body condition analysis.

Through our collaboration network, we hope to expand field efforts to other regions where sperm whales have not been the focus of dedicated studies. Particularly, we are interested in collaborating to conduct passive acoustic monitoring throughout the ETP (PAM), which contributes towards a year-round understanding of sperm whale distribution. A wide-spread passive acoustic monitoring system will enable us to identify key habitats and areas of potential negative anthropogenic interactions (especially vessel collisions/entanglement with fishing gear).

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

- Peer-reviewed publications

- Published:
    - Eguiguren et al. (2025) Integrating cultural dimensions in sperm whale (*Physeter macrocephalus*) conservation: threats, challenges and solutions. Phil Trans Roy Soc B. https://doi.org/10.1098/rstb.2024.0142
- Submitted:
    - Eguiguren et al. (preprint & under review). Inferring sperm whale (*Physeter macrocephalus*) sex and developmental stage using aerial photogrammetry. https://doi.org/10.1101/2025.10.17.683129
- In preparation:
    - Oliver et al. (in prep). Sperm whale clans off the Galápagos Islands – a long term report of movement and change.

- Other publications:

- Eguiguren A, Avila I, Rosero P, Toro F, Hersh T, Rojas C, Mesnick S, Alava J. (2023). Report on the implementation of the concerted action for sperm whales (Physeter macrocephalus) of the Eastern Tropical Pacific. 14th Meeting of the Conference of the Parties, Uzbekistan. Convention on the Conservation of Migratory Species of Wild Animals – UN Environment Programme. UNEP/CMS/COP14/Doc.32.2.4. [Technical Report]

- Oral presentations:
    - Planned workshop on the role of culture for conservation to be held in the Ecuadorian Conference for Mammalogy in October, 2026.
    - Colloquia at local universities (e.g., Universidad San Francisco de Quito, Universidad de Santa Elena)

-Social media
- Bluesky – Shared Preprint: bsky.app/profile/did:plc:cnbndrcvxva2hoyyzt4zgdjs/post/3m3pp54sv4227
- Facebook: facebook.com/photo/?fbid=10161735075818897&set=a.10151119609093897
- For future posts:
    - Personal Bluesky: bsky.app/profile/anaeg.bsky.social
    - Lab Bluesky: bsky.app/profile/whiteheadlab.bsky.social

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

In the short term (next 1 – 2 years), we will complete the assessment of individual sperm whale health based on body-condition measurements extracted using drone imagery. Moreover, we have taken the first steps to establish collaboration with Dr. Cesar Peñaherrera, specialized in Quantitative Marine Sciences, to model the overlap between sperm whale habitat and human threats, with particular attention to the jumbo squid fisheries off the west coast of South America.

At a medium to long- term (2 – 10 years), as outlined in our **Proposal for A Concerted Action for the sperm whales (*Physeter macrocephalus*) of the Eastern Tropical Pacific**, our priorities in the future are to:

1. Determine the degree to which anthropogenic threats affect sperm whale populations in the region and identify areas where these may be prevalent. To this end, we plan to:
    a. Continue our long-term monitoring program of sperm whale distribution and population off the Galápagos Islands in 2026 and 2027
    b. Implementing reverse-drift modelling to stranding events in the region to infer at-sea mortality hotspots and overlap with anthropogenic activities
    c. Identify sites and collaborators for establishing passive acoustic recording stations throughout the ETP to identify key sperm whale areas for conservation.
    d. Identify key actors and support local stranding networks to gather important data on causes of mortality across the region.

2. Extend our circle of influence to other researchers in the region, NGOs, academic institution, and the public.

a. Identify and contact potential partner organizations involved in research and conservation of other highly mobile marine species for collaboration towards broad-scale monitoring.
b. Conducting a workshop on etP research tools in upcoming relevant meetings (e.g., SOLAMAC, SOMEMMA, and Cachalote Coonsortium).
c. Developing an action plan for raising awareness of sperm whale conservation and influencing policy makers.

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 have included the Rufford Foundation logo in oral presentations and posters relating to our project. These include oral presentations and posters presented at the following locations:

- European Cetacean Society – ACCOBAMS Workshop, Azores, 2025
- 36th Conference of the European Cetacean Society, Azores, 2025
- Conference of Dalhousie Oceanography Graduate Students, Dalhousie University, Canada, 2025
- Patrick Lett Symposium, Dalhousie University, 2025
- Cachalote Consortium, virtual workshop (2024)
- Annual Conference of the Canadian Society for Ecology and Evolution (2024)
- Charles Darwin Foundation community – science talks, Galápagos, Ecuador (2022 & 2023),
- Cameron Conference for undergraduate honours students, Dalhousie University, Canada (2022 – 2024)

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

Core Research Team
- Ana Eguiguren (Principal Investigator – Ph.D. student): organized fieldwork, drone pilot, 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: Skippered 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.

- Dr. Hansen Jhonson: Skippered research vessel.

- Michael Keen: Skippered research vessel.

- Mateo Valencia: Field technician

- Dr. Elizabeth Zwamborn: drone operations advisor and field assistant

- Dr. Éadin O'Mahney: drone operations advisor and field assistant

Cachalotes del Pacífico Network:
-Dr. Isabel Ávila (Col)
-Dr. Patricia Rosero (Ecu)
-Héctor Pérez-Puig (Mex)
-Fredrick Toro (Chil)
-Dr. Taylor Hersh (USA)
-Constanza Rojas-Cerda (Chil)
-Dr. Sarah Mesnick (USA)
-Christine Clarke (Can)
-Dr. Luke Rendell (UK)
-Dr. Maurício Cantor (Bra)
-Dr. Juan José Alava (Ecu)

Field volunteers:
- Collette Robertson
- Maria Virginia Gabela
- Dr. Laura J. Feyrer
- M.Sc. Christine Konrad
- Maria Antonia Izurieta
- Dr. Patricia Rosero
- Constanza Rojas-Cerda
- Franco Cruz

10. Any other comments?

I would like to express my sincere gratitude to the foundation and staff, particularly Jane Raymond, for their support with this project. The financial contribution from the foundation was essential to our success, which in turn allowed us to collect valuable data, generate long-lasting collaborative relations, and contribute to the scientific and research capacity of the students that have been involved in our project. The

feedback provided during the application process motivated me to find ways of extending the impacts of our research far beyond pure science and across nations. This resulted in a research network that I see as essential towards understanding and protecting sperm whales in the decades to come. My own career, which I hope contributes towards ensuring a future for marine biodiversity, has been dramatically influenced by this process.

ANNEX – Financial Report

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