

Final report

Project name:

Banderas Bay, Mexico, as an important habitat for cetaceans.



Name of leader: Iyari Janethzy Espinoza Rodríguez

Project number: 36091-1

Period of operation: November 2021 - November 2023

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Summary

The research project enabled the compilation of an up-to-date list of cetaceans in Banderas Bay, including their distribution and abundance. This is a crucial area of research, particularly in regions where the rapid expansion of tourism is leading to an increase in the supply and demand for marine activities. The activities in question entail sailing in a variety of vessels, encompassing the majority of the bay. During the sampling process, direct and indirect interactions with cetaceans were observed. Given the oceanographic characteristics of the bay, it is possible that several species of cetaceans converge in the area, where human activities also take place. Consequently, training is of significance to both tourism service providers and coastal communities, with particular attention paid to the younger generation and those who utilize resources. Over the course of the two-year period, more than 500 tour operators were trained. Various environmental fairs were attended in coastal communities. Last spring, educational workshops for primary school children were initiated, which will continue in this and the coming years. The objective is to foster an understanding of the importance of cetacean conservation and the environment among children. We would be gratified to continue contributing to the conservation of these cetacean species, which are of great importance.

Project results

Fieldwork

The project "Bahía de Banderas, important habitat for cetaceans" commenced operations in November 2021, with the support of a grant from the Eagle Wings Foundation. This grant was used to cover the operational expenses for the sampling of marine mammals from November 2021 to February 2022. The Rufford Foundation provided the necessary resources to cover the operational expenses for the months of March and April 2022 and from November 2022 to April 2023. This resulted in the completion of two sampling seasons, each comprising six months. The sampling methodology involved dividing the bay into 8 transects (Figure 1). Each day, two transects were covered to complete the 8 transects in four monthly field trips. In total, during the two sampling seasons, 48 days of marine monitoring were conducted, with approximately 53 km covered per day in 8 to 9 hours.

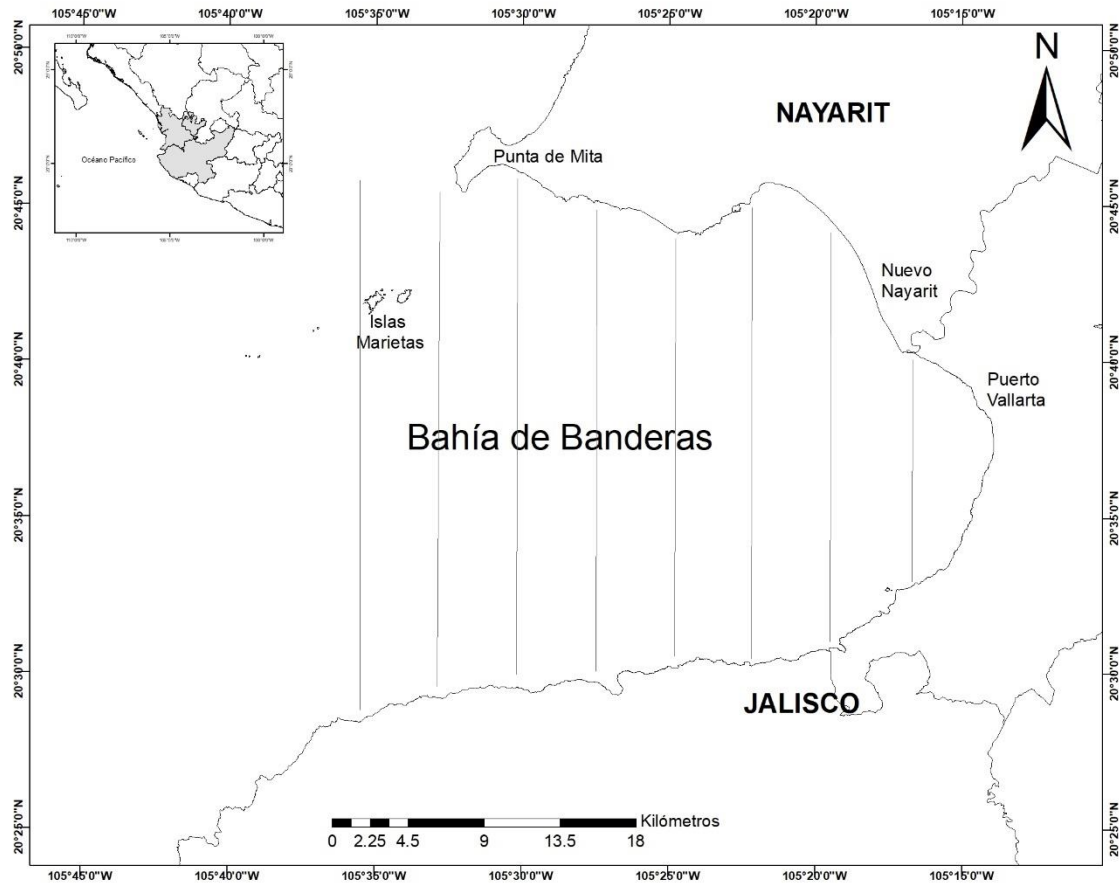


Figure 1. Study area. The lines indicate the eight sampling transects.

Marine mammals

The marine mammal species present in the bay were documented using the distance sampling method. A total of 713 cetacean groups were observed, with 369 observed during the first season and 344 during the second season. The cetaceans were classified into four families, nine identified species, and two unidentified species (Table 1). A total of 38 volunteers participated in the fieldwork, comprising 33 biology students and 5 professionals from other fields. Furthermore, four national and two foreign internship students participated in the monitoring. Photographs taken of the cetaceans are being edited and individualized for photo-identification; in the case of the humpback whale, the photographs were shared on the Happy Whale platform (<https://happywhale.com/user/9341>) where the vast majority have already been identified (Figure 2). Analysis of the data will continue and will be published in peer-reviewed journals.

Tabla 1. Cetáceos identificados en Bahía de Banderas entre noviembre y abril de 2021 a 2023.

FAMILIA	ESPECIE	TEMPORADA 2021-2022 (369 GRUPOS)	TEMPORADA 2022-2023 (344 GRUPOS)
DELPHINIDAE	<i>Tursiops truncatus</i>	X	X
	<i>Stenella attenuata</i>	X	X
	<i>Steno bredanensis</i>	X	X
	<i>Pseudorca crassidens</i>	X	X
	<i>Orcinus orca</i>		X
	<i>Sin identificar</i>		
KOGIIDAE	<i>Kogia sima</i>	X	X
	<i>Kogia sp</i>		X
ZIPHIIDAE	<i>Ziphius cavirostris</i>	X	
BALAENOPTERIDAE	<i>Megaptera novaeangliae</i>	X	X
	<i>Balaenoptera edeni</i>	X	

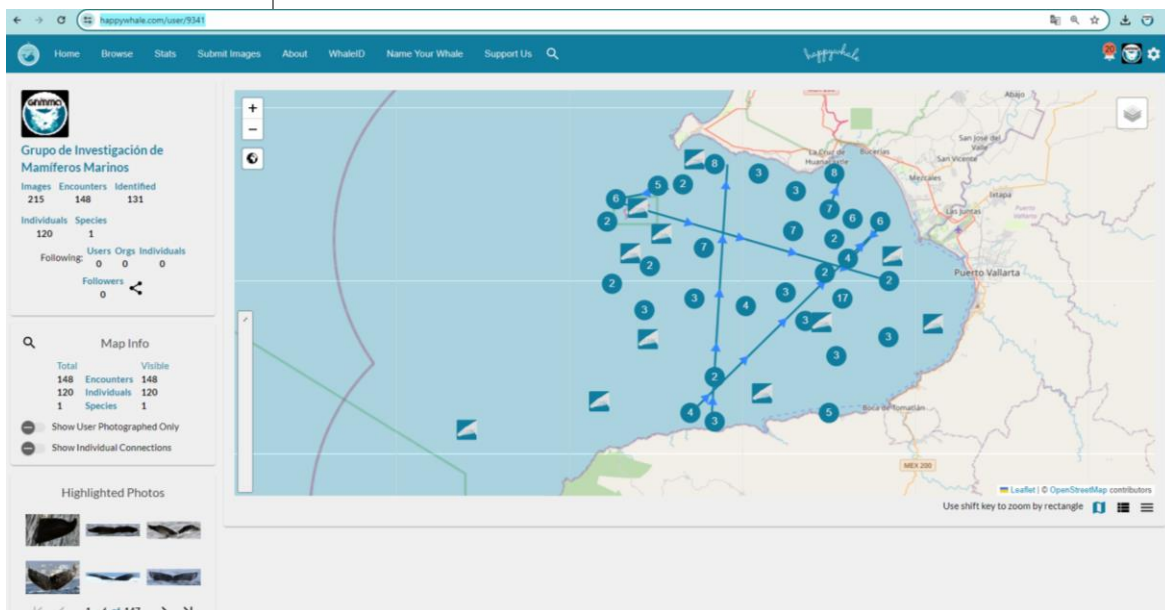


Figure 2. Contribution to the photo-identification of the North Pacific humpback whale population. This screenshot was obtained from the Happy Whale platform.

Vessel traffic

Two distinct methodologies were employed to ascertain the extent of marine traffic in the study area. The first involved a survey of boat captains in seven coastal communities of Banderas Bay. The second entailed a count of vessels observed within a radius of three kilometers during marine sampling. This enabled the identification of the navigation routes, the number of vessels departing from the principal ports or boarding areas of the bay, and the activities they engage in. The method

implemented proved to be useful in the circumstances of the bay, with a variety of vessel sizes being recorded, including those without satellite identification systems. These included panga-type boats under 10 meters in length belonging to coastal fishing cooperatives or small companies, as well as medium and large vessels engaged in tourist or transport activities. The data were analyzed by two students of professional practices of the biology degree at the Centro Universitario de la Costa of the University of Guadalajara (Figure 3 and 4). The study yielded several noteworthy findings, including the identification of established boat traffic routes (Figure 3, left) and the delineation of months with the highest concentration of boats and their annual fluctuations (Figure 3, right). Furthermore, during the surveys, the captains indicated that the primary threats to marine mammals are the result of a lack of environmental awareness and the inadequate enforcement of environmental legislation. A detailed analysis of the data will be published in a peer-reviewed journal.

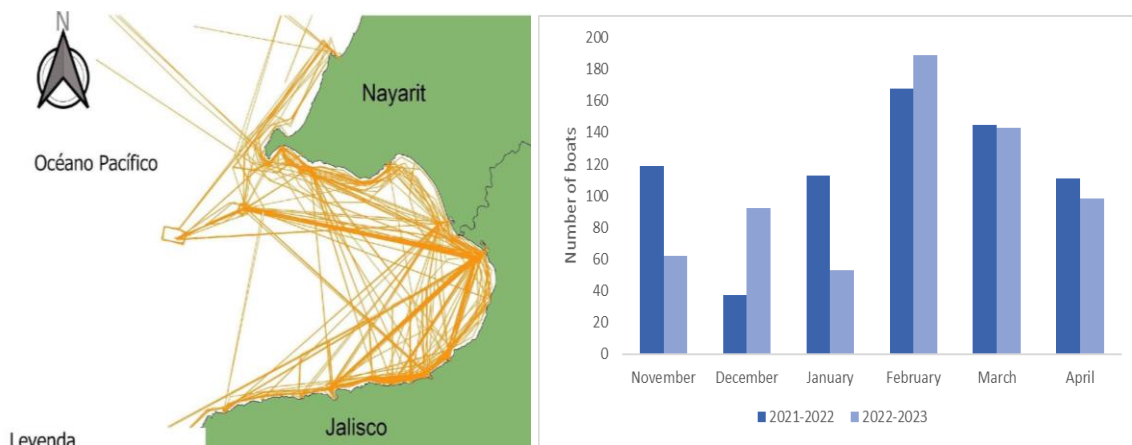


Figure 3. The subject of this study is the boating industry in Banderas Bay. The left-hand image depicts the shipping lanes in Banderas Bay, while the right-hand image presents number of vessels observed by month and year in Banderas Bay.

UNIVERSIDAD DE GUADALAJARA CENTRO UNIVERSITARIO DE LA COSTA
LICENCIATURA EN BIOLOGÍA



Tráfico marino asociado a los mamíferos marinos de Bahía de Banderas durante un ciclo anual de muestreo.

INFORME EJECUTIVO DEL PROYECTO DE PRÁCTICAS PROFESIONALES

Grupo de Investigación de Mamíferos Marinos

GRIMMA, AC

PRESENTA:

ELSA NICOL PÉREZ MEZA

UNIVERSIDAD DE GUADALAJARA
CENTRO UNIVERSITARIO DE LA COSTA
LICENCIATURA EN BIOLOGÍA



INFORME EJECUTIVO DEL PROYECTO DE PRÁCTICAS PROFESIONALES

TEMA

Los mamíferos marinos y el tráfico marino en Bahía de Banderas, México, durante dos periodos invernales.

NOMBRE DE LA ORGANIZACIÓN DONDE FUERON REALIZADAS

GRIMMA, Grupo de Investigación de Mamíferos Marinos A.C

PRESENTA

Gabriela Estefanía González Tabares

Figure 4. Professional practice work of two biology students.

The temperature of the water column

With the assistance of Dr. Adan Mejía from the Autonomous University of Baja California, it was possible to gather data on the temperature of the water column in Banderas Bay. In order to achieve this objective, 31 CTD (Conductivity, Temperature, and Depth instrument) sets were carried out during the 2021-2022 season. The data were collected from the water column at 30-cm intervals for the following parameters: temperature, salinity, conductivity, and sound velocity. The majority of this data is currently undergoing analysis. The water column temperature data were presented at the Union de Geofísica Mexicana conference, held from 30 October to 4 November 2022 in Puerto Vallarta, Jalisco (Figure 5).

Reunión Anual 2022

Unión Geofísica Mexicana, A. C.

Martes, 1 de Noviembre, 2022

Adán Mejía-Trejo, Iyari Espinoza-Rodríguez,, David Aguirre-Ayala, Roberto Moncada-Cooley
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Estimado colega:

Su resumen, con número de identificación 0706, intitulado *VARIACIÓN ANUAL DE LAS CONDICIONES HIDROGRÁFICAS EN BAHÍA BANDERAS* ha sido **ACEPTADO** para su presentación en modalidad **ORAL** en la sesión regular **OCC OCEANOGRAFÍA COSTERA** de la Reunión Anual 2022 de la Unión Geofísica Mexicana, que se efectuará del 30 de octubre al 4 de noviembre en Puerto Vallarta, Jalisco, México.

El programa general, donde podrá consultar el día y la hora de su presentación, estará disponible en la página de la Reunión Anual 2022 (<https://raugm.org.mx>) a partir del mes de septiembre.

El comité organizador agradece su interés por participar y esperamos verlo en Puerto Vallarta.

Atentamente

Dr. Arturo Iglesias Mendoza
Presidente
Unión Geofísica Mexicana, A. C.

Reunión Anual UGM 2022
30 de Octubre al 4 de Noviembre
Puerto Vallarta, Jalisco, México

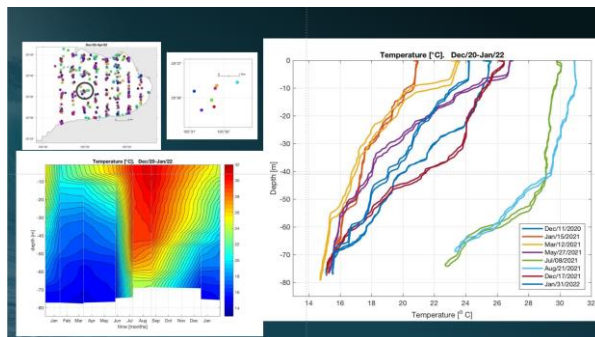


Figure 5. Participation in the Conference of the Unión de Geofísica Mexicana. Left: document displays an acceptance letter. Right: example of data analysis.

Marine sound

During the marine surveys conducted during the 2022-2023 season, we recorded marine sound data from the bay. The objective of this study was to record cetacean species that we possibly did not observe during the survey, as well as the noise pollution emitted by vessels. An intriguing aspect of this acoustic sampling was the detection of boats in locations where they were not visible. It became evident that noise pollution at sea has an impact on areas where there are no vessels in sight. The data from the acoustic sampling are still pending detailed analysis. To date, only the locations where noise pollution was detected have been included in the diptych (see session: visual material). In the near term, the objective is to engage undergraduate and postgraduate students in the analysis of the audio data, with the aim of identifying the presence of cetacean and boat sounds. The results will be presented at conferences.



Figure 6. Acoustic sampling.

Campaign: Whales to the sea, rubbish to the sack.

During the initial sampling season, all litter observed floating in the water was collected. The entire sampling season was conducted by approaching the boat to the rubbish and collecting it by hand. The rubbish was also geo-positioned and classified according to the type of waste found: plastic (types), metal and glass. The mark of each waste was also recorded. In order to facilitate the collection of litter during the second sampling season, a crowdfunding campaign was launched on the Donadora website to purchase nets and bags. These items were intended to enhance the ease with which the rubbish could be collected and placed. The results were striking. In the 2021-2022 season alone, we stopped the vessel 340 times to collect waste, a figure almost identical to the number of occasions we observed a group of cetaceans that season. The principal items collected included: styrofoam cups and plates, plastic bottles of water and soft drinks, packaging from snacks and biscuits, fragments of styrofoam from construction activities on land, and on occasion, bags of waste and even buckets of burnt car oil, as well as bottles of motor oil from boats (Figure 7). The data was subsequently transformed into infographics, which were presented during a training workshop for tourism service providers and disseminated via social media.



Figure 7. Collecting rubbish.

Training

Students and volunteers

We were extremely fortunate to have undergraduate students in biology and zoology from national and international universities participating in our research project. The students have participated in the project as volunteers, fulfilling their social service obligations or as interns. We are gratified to have young students who are just beginning their professional careers. They are in their first semesters and are dedicated to the project and to the conservation of natural resources. Thanks to their dedication, we were able to complete the field sampling equipment, ensure constant replacements that allowed us to train them in data collection, carry out environmental education activities, support the training workshops and even develop field and environmental education material. Everyone always joins us with great pleasure and commitment. Furthermore, a Canadian volunteer authored a newsletter about her experience as a volunteer with GRIMMA. She has been supporting GRIMMA for four years, during which time she has spent each winter in the bay, undertaking the role of observer and photographer during marine monitoring. The newsletter that was shared at the NGO Group for Research and Education on Marine Mammals (GREMM) in Canada can be found in the following link:

RÉCIT DE MIGRATION AU MEXIQUE:

https://baleinesendirect.org/recit-de-migration-au-mexique/?fbclid=IwZXh0bgNhZW0CMTEAAR2lydwZRhYtrfRm7UOCfi6vEA3kCULdnXnZHVGFz6CLOc5oZ0_QLSbjy6w_aem_AZxIHMp12QxTOXODWOilpUanYgfkWus0ezDEXcUtRv7W373waFpTwonee16Xv4jSootAXt253yNyXD8bbKNFRG9Z

The composition of the team is as follows: 29 women and 10 men (Figure 8).





Figure 8. Team of volunteers

Boat captains

During the marine sampling we received the support of a tourist services cooperative, renting us the boat at an affordable price and allowing us to train the boat captains. During the sampling we told them about the objectives of the project, the marine mammals sampling method, for those who go out on dolphin or whale tours, it was easy to say "let's go to this area of the bay, there are always some there". We explained to them the reason and importance of doing systematic and random sampling, at certain speed and people. We also showed them the correct way to approach marine mammals, the correct manoeuvres, as well as the different species of cetaceans we saw. Some thought, for example, that the species of the Kogiidae family were dolphins with a different behavior. The captains were young people under 25 years old and even adults over 50 years old

Training workshops for tourism service providers

Over the course of two years, whale-watching tourism service providers have not received any training from the federal authority. This began with the pandemic in 2020 and continued without any training until 2021, for reasons that remain unknown. The training sessions were traditionally held in locations that could accommodate 400 attendees. Lectures were delivered simultaneously to both tourism service providers and boat crew members from Nayarit and Jalisco. During our field trips, we became acutely aware of the necessity to resume training. Consequently, in the year 2022, we set about the arduous task of seeking resources to fulfill this objective in coordination with the federal authorities. The commitment of 11 members of different communities in the bay to support the training courses led to a request for assistance from the National Commission of Natural Protected Areas, which resulted in the organization and implementation of five training courses. This approach aimed to divide the providers by community, thereby enhancing the effectiveness of the training and ensuring that the information would be retained by the attendees. In November 2023, we provided assistance to the federal government in the organization and delivery of selected training topics. In this instance, two face-to-face courses and one online course were conducted. In both seasons, lectures were delivered on a range of topics related to environmental regulations, fines and sanctions, marine mammal biology, marine mammal diversity, the threats faced by marine mammals, floating marine litter and strategies to improve tourist services. During the lecture on floating marine debris, we presented the various types of waste found in the bay, the locations with

the highest concentration, and the "Whales to the Sea, Rubbish to the Sack" campaign. For this initiative, we provided participants with pool nets to collect the marine debris they encountered during their tours (Figure 9). The topics were presented by representatives of federal government agencies, biologists from other NGOs, and GRIMMA staff. At the conclusion of the event, we received positive feedback from a number of attendees. The attendees expressed satisfaction with the format and the information provided.



Figure 9. Training workshops in Jalisco and Nayarit, Mexico.

Outreach activities

Environmental education

Over the course of the two-year project, we participated in 12 environmental fairs in five communities located within the bay. At these events, we disseminated information to attendees, primarily children, about marine mammals, cetaceans, the distinction between whales and dolphins, the photo-identification of whales and dolphins, and whale anatomy. This was achieved through a combination of interactive talks, exhibitions and playful activities. Furthermore, as a result of our collaboration with the Ocean Connectors, an American non-profit organization dedicated to environmental education initiatives concerning migratory species between Mexico and the United States, we participated in 10 workshops designed for 5th grade students from coastal communities within the Compostela, Nayarit, municipality. During these sessions, we discussed cetacean biology, as well as the current threats to marine mammals. Finally, the students decorated a whale tail made of cardboard and committed to an activity in their daily lives to help marine mammals. The implementation of these activities was made possible by the invaluable assistance of the volunteer team. While environmental education was not a specific objective of the project, the dissemination of information regarding the project's outcomes was a crucial element of its execution. Moreover, the opportunity to impart knowledge to young learners is a highly valued aspect of the project's activities (Figure 10).





Figure 10. Environmental fairs in Banderas bay.

Participation in local radio and television

Another form of outreach was to engage with media outlets, such as television and radio. Television coverage was secured through participation in the program "Aquí en el 10" on a local television station. Four local radio stations were also approached, with the intention of sharing information about the aforementioned cetacean monitoring and floating marine litter projects, as well as the importance of environmental education. The following links provide access to some of the participations:

<https://fb.watch/rN4yIN2zjQ/>

<https://www.facebook.com/photo?fbid=792990736195103&set=pcb.792993422861501>

<https://fb.watch/rN4HBkX1Hh/>

<https://fb.watch/rN7RHlk-43/>

Cycle of conferences

Annually, in August, GRIMMA commemorates its anniversary with an online lecture series. This event invites participation from local, national, and international researchers, who deliver lectures intended for the benefit of the organization's followers. In August 2023, I delivered a lecture (<https://fb.watch/rN6Ydn6vPs/>) in which I presented the findings of the project funded by the Rufford Foundation (Figure 11).

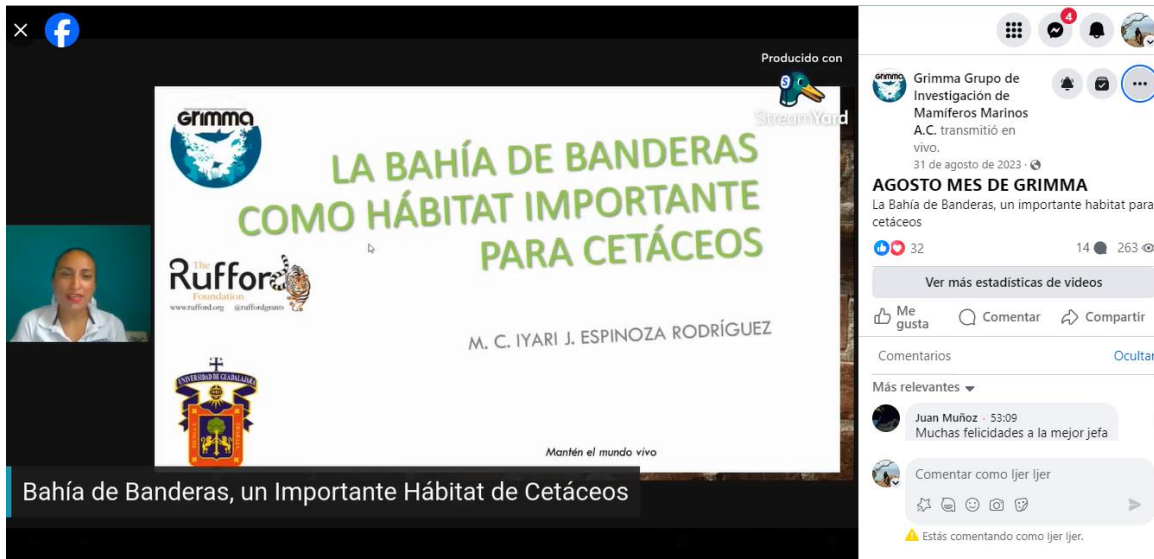


Figure 11. Participation in the cycle of conferences.

Dissemination on social networks and website

During the project's development and subsequent completion, the visual material produced was disseminated on social media platforms such as Facebook and Instagram. Additionally, posts on marine monitoring and cetacean issues were shared on these platforms. The following links provide access to some of the social media and website:

<https://www.facebook.com/GRIMMA.ORG>

<https://grimma-ac.org/>

https://www.instagram.com/grimma_ac/

Public policy participation

Large whale protection program

The favorable relationship between the CONANP and the federal authorities, coupled with the research conducted, has facilitated our participation in the "Planning Workshop for the Development of the Large Whale Protection Program for the Western and Central Pacific Region." This initiative aims to establish a cetacean protection area along the Mexican Pacific coast in the states of Nayarit, Jalisco, and Colima. The workshop was attended by a number of federal environmental authorities, including SEMARNAT and PROFEPA, SEMAR, Harbor Master, other NGOs, tourism service providers and educational institutions in the region (Figure 12). The workshop was held in July 2023, at which the information generated by the project was shared with the authorities. This proved to be a useful contribution to the achievement of the workshop objectives.



Figure 12. Participation in the Planning Workshop for the Development of the Large Whale Protection Program for the Western and Central Pacific Region.

Visual material

In order to facilitate the dissemination of the results, the following visual material was produced:

- Infographics of the cetaceans present in Banderas Bay
- Diptych “Navigate safely in the presence of whales and dolphins in Banderas bay”
- Infographics and reels of the Mexican regulations for whale-watching
- Infographics on the presence of floating marine debris in the bay

All the material generated was presented to the communities in the training courses for tourism service providers held during the month of November 2022 and 2023. It was also shared on social networks and on our website. In the attached files you will find all the visual material.

Collaborations

This summary of the project serves to remind us that we are highly satisfied with the results obtained. We are gratified by our work at sea, but we also believe that it is our duty to share the

knowledge generated. Involving students was a valuable experience, training tourism service providers was a necessary undertaking, and generating information was and continues to be an indispensable activity for maintaining global awareness. This effort would not have been possible without the invaluable help of the Marine Mammal Research Group (GRIMMA), of which I am a member, and the support of educational institutions such as the Tecnológico Nacional de México Campus Bahía de Banderas and the Centro Universitario de la Costa of the University of Guadalajara. The surveys were carried out in collaboration with various organizations, including tourism and fishing companies and cooperatives. We would also like to thank the federal government agencies, such as the National Commission for Protected Areas (CONANP), the Ministry of Environment and Natural Resources (SEMARNAT) and the Federal Prosecutor's Office for Environmental Protection (PROFEPA), for their support and participation in the training workshops. We would also like to express our deep gratitude to the project volunteers and NGOs such as the Eagle Wings Foundation and especially the Rufford Foundation for their invaluable support. This is just the first phase of a major research project that will continue to evolve.

We created a video to thank our sponsors: <https://fb.watch/rOkZMFFnEF/>





