FINAL RESEARCH REPORT

2022/2023 season

A novel technique to reveal population structure and dynamics of humpback whales of the Mexican Pacific.

SOCIETY FOR MARINE MAMMALOGY

Small Grants In Aid of Research

Recipient:

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El Salvador

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EXECUTIVE SUMMARY

Three Population Units (PUs) of humpback whales (Offshore, Coastal and Central American) congregate in the Mexican Pacific, which use different feeding areas in the North Pacific. The proportion of individuals of each PU in the different regions in Mexico, as well as the movements and interactions between them is unknown. Therefore, in areas where all three PUs congregate, such as in the Mexican Pacific states of Baja California Sur (BCS) and Nayarit-Jalisco, it is difficult to know to which whales are most being affected by threats such as entanglement and vessel strike, making it difficult to identify and protect the PUs at greatest risk. The present study aims to determine the proportion, dynamics and interaction of whales from these three PUs throughout the breeding season, to clarify the arrival and departure times of each of them, as well as their movements between the different regions of the Mexican Pacific. The sampling effort will be carried out during the 2022/2023 and 2023/2024 breeding seasons between December and April at five locations in Mexico and Central America: Revillagigedo Archipelago (Colima, Mexico), Magdalena Bay and Los Cabos (BCS, Mexico), Nayarit-Jalisco (Mexico) and Los Cóbanos (Sonsonate, El Salvador). The techniques and tools that will support the work will be 1) photo-identification, through the collation of photographic catalogues of identified whales and the use of the Happywhale platform; 2) genetic analysis through the collection of biopsies and analysis of mitochondrial DNA haplotypic frequencies; and 3) carbon-13 (δ13C) and nitrogen-15 (δ15N) isotope analysis. All this will help to understand the peculiarities of each population, allowing to know the anthropogenic impact on each one and thus to adopt effective and targeted conservation actions.

This project is an original idea from Dr. Jorge Urbán ot the *Programa de Investigación de Mamíferos Marinos (PRIMMA) Universidad Autónoma de Baja California Sur*), whose laboratory has been in charge of surveying the Mexican areas of study with the collaboration of *La Orca de Sayulita* and *Oregon State University's Whale Habitat, Ecology & Telemetry Lab*, and of *Proyecto Megaptera El Salvador* in El Salvador. In this report, we present specifically the results of the 2022/23 humpback whale field season in El Salvador:

Between November 2022 and March 2023, 69 marine surveys were conducted in Los Cóbanos Natural Protected Area (NPA), covering 2956.5 km during 258 hours (83 hours of whale-watching and 174 hours of navigation/searching). A total of 179 individuals (142 adults, 5 subadults, 3 juveniles, 24 calves and 5 individuals of unknown age) were recorded in 81 groups (29 solitary individuals, 11 pairs, 2 trios, 4 quartets, 9 competitive groups, 12 mothers with calf, 11 mothers with calf and escort, 1 mother with calf and two escorts, and 2 groups of unknown category). The most common behaviour was *Travelling slow* (36%), followed by *Surface Activity* (i.e. jumping, pec slapping, tail lobbing) (21 %), *Travelling fast* (12%), *Resting* (8%), *Singing* (7%) and *Aggressive* (6%). During December and January, the predominant direction of movement of individuals was southwards (57.14% and 65.71%, respectively), while in February and March it was northwards (46.88% and 60%, respectively). Seventy-five individuals were photo-

identified thanks to *Happywhale* (6 new individuals recorded for breeding areas; 28 new for Central America; 16 new for El Salvador; and 25 recaptures). In addition, 14 underwater recordings of humpback whale sounds were collected, of which 8 are of good quality for analysis. Lastly, 38 skin biopsies were collected throughout the season (5 in December, 14 in January and 19 in February).

Although this is a medium-term study (4 years) in collaboration with different entities and different sites, the objectives of the present proposal for the 2022/2023 season in El Salvador have been successfully achieved. We plan to conduct one more season (2023/2024) simultaneously in the five study areas between Mexico and El Salvador. After this, genetic samples from both seasons will be processed and analysed in the laboratory.

Overall timetable

Activities/Years	**2023**	**2024**	**2025**	**2026**
Samplings	X	x		
Sample processing		x	x	
Data analysis	X	x	x	x
Participation in conferences		x	x	x
Final report				x

PARTICIPANTS DURING THE 2022/2023 SEASON

- Melvin G. Castaneda - Coordinator and Principal Researcher – El Salvador
- Paula Cabanilles Benito – PhD student UABCS – Researcher - Spain
- Nicola L. Ransome – Advisor and Researcher - England
- Urszula Leavitt – Volunteer student – United States

ACKNOWLEDGEMENTS

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1. Introduction

The humpback whale (*Megaptera novaeangliae*) is a cosmopolitan mysticete species that undertakes long seasonal migrations between summer feeding grounds at high latitudes and winter breeding and calving grounds at low latitudes, for which they have a high degree of fidelity (philopatry) (Palacios et al., 2019). The Mexican Pacific represents one of the main breeding grounds of North Pacific humpback whales (Calambokidis et al. 2008). Three Population Units (PUs) from different feeding grounds gather in the region, and which also use different breeding and nursery grounds within Mexican waters: 1) the **Central American PU**, which winters off the coasts of Central America and the south-eastern Mexican Pacific and feeds during the summer on the west coast of the United States, mainly in California and Oregon and to a lesser extent in Washington; 2) the **Coastal Mexican PU**, which corresponds to whales that winter in mainland Mexico (central Mexican Pacific) and feed off the west coast of the United States (California, Oregon and Washington); and 3) the **Offshore Mexican PU**, which is made up of whales that spend the winter both off the coasts of mainland Mexico and the Revillagigedo Archipelago and the summer in more northerly Pacific waters, mainly Alaska and to a lesser extent in Russia (González-Peral, 2011; Martien et al. , 2021; Taylor et al., 2021) (Fig. 1). Furthermore, although there is both movement and genetic evidence suggesting the existence of several demographically independent populations within the latter PU, the data and analyses to date are insufficient to resolve this question.

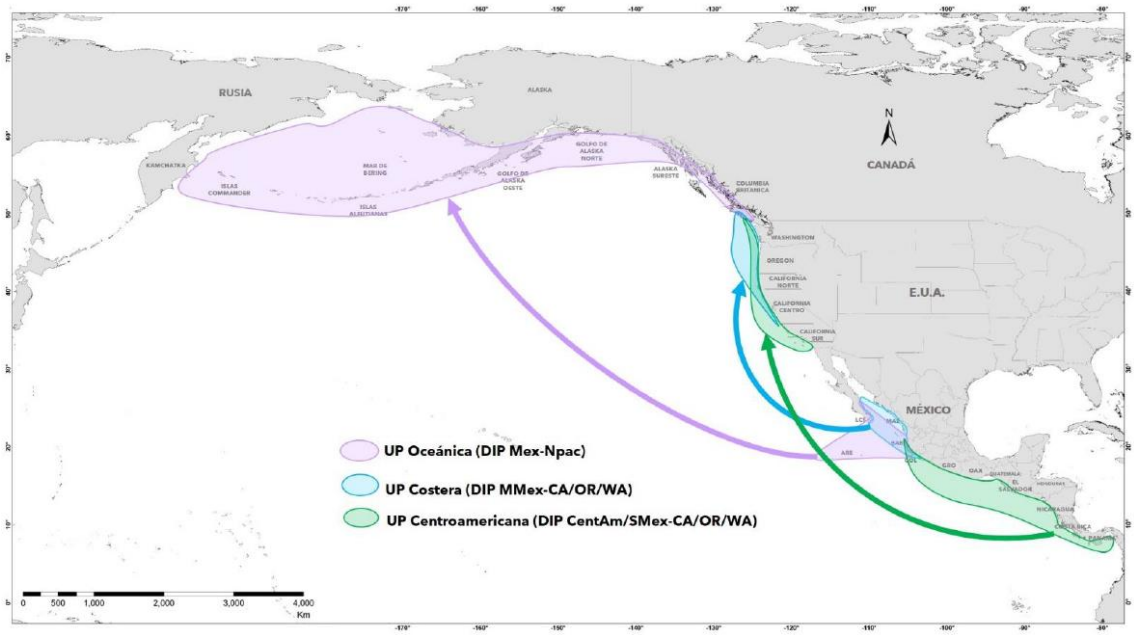

Figure. 1. Spatial distribution of the three Mexican Pacific PUs (Central American, Coastal Mexican and Offshore Mexican) and their migratory connection with feeding areas. Source: Martínez-Loustalot, 2022.

We plan to use a novel technique of identifying combinations of haplotypic frequencies and isotopic values, to determine to which population unit each individual humpback whale corresponds. This is without the need for recapture of individual whales in the feeding areas, and will be extremely beneficial for whales from the more poorly surveyed feeding regions (eg. the remote Aleutian Islands). This new technique will allow us to

know with greater precision the degree of movement and interaction of whales from these three PUs (Central American, Coastal Mexico and Offshore Mexico) that occur and converge in the Mexican Pacific. Questions such as how frequently they breed with each other, whether there is a distinct spatio-temporal distribution pattern for the three units, and if so, what their boundaries are, remain unanswered. To try to resolve these questions, some areas of distribution of the different PUs were selected: Socorro Island, in the Revillagigedo Archipelago; Los Cabos, in Baja California Sur; Sayulita, in Nayarit; and Los Cóbanos, in El Salvador. The study techniques on which the work will be based are photo-identification, genetic (mtDNA) and isotopic (carbon-13 (δ13C) and nitrogen-15 (δ15N)) analysis.

2. Background

Between 2004 and 2006, a large-scale basin-wide survey of the North Pacific known as SPLASH (Structure, Population Levels, And Status of Humpbacks) (Calambokidis et al. 2008) was conducted, the largest collaborative study of large cetaceans, to date. More than 400 researchers collected photographic and genetic material from feeding, breeding and calving grounds, estimating an abundance of over 20,000 non-calf individuals in the North Pacific and presenting a first approximation of the population structure of the species in the North Pacific basin (Calambokidis et al. 2008).

Using data from SPLASH, González-Peral et al. (2011) studied in more detail migratory destinations of humpback whales from the Mexican Pacific and concluded that there are two main PUs, using different breeding and feeding areas: 1) the Coastal PU, and 2) the Offshore PU (Fig.2).

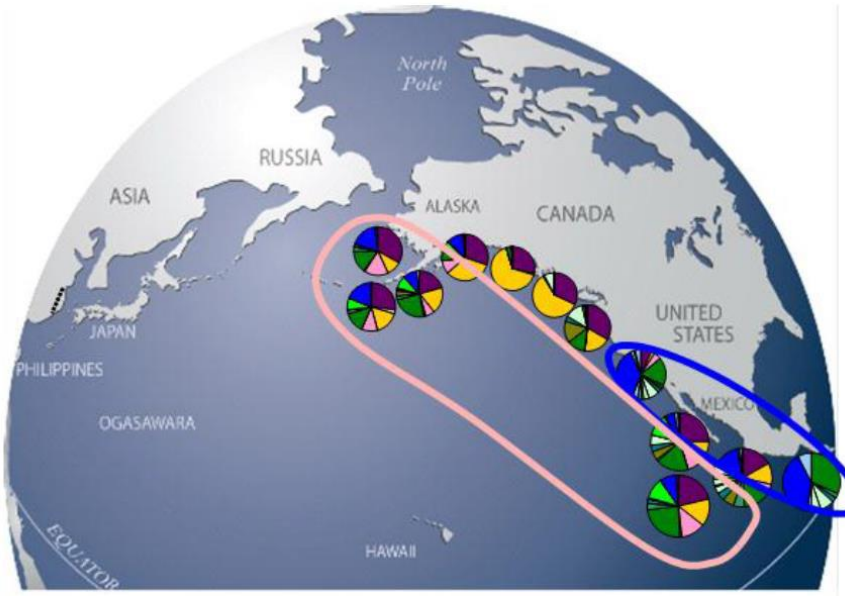

Figure 2. Main connections of Mexican Pacific humpback whales with feeding grounds according to the different Mixed Stocks Analyses. In blue=Coastal Population Unit; in pink= Offshore Population Unit. Source: González-Peral, 2011.

Regarding individuals from the Central American PU, genetic and satellite tagging data suggest that they migrate directly through the Mexican Pacific (Mate et al., 2018) and that reproductive interactions with the Coastal Mexico PU are limited (Baker et al., 2013). Recently, based on movement and exchange rates, Martínez-Loustalot et al., (2022) determined that the range of the Central American PU extends beyond its primary breeding range between Panama and Guatemala. This PU would use the coasts of Chiapas to Nayarit-Jalisco as a secondary breeding area (Fig.3).

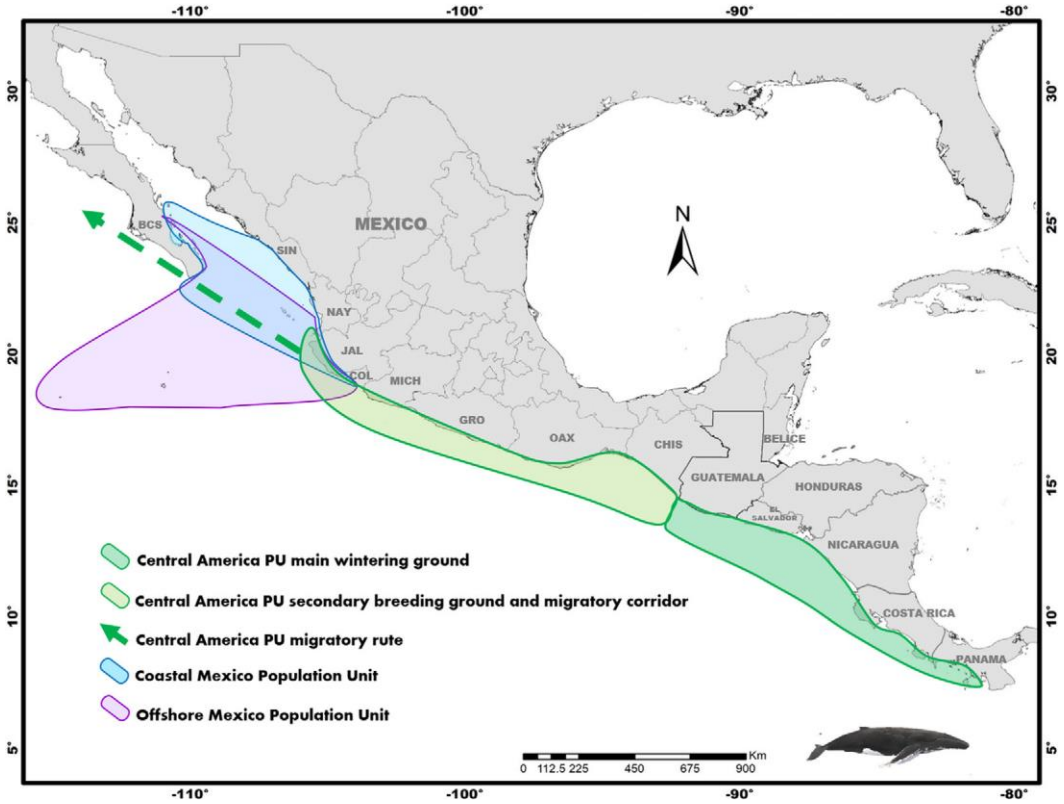

Figure 3. Central American Population Unit (PU) corridor and main wintering area for humpback whales. The main (dark green) and secondary (light green) wintering grounds of the Central American PU, the wintering grounds of the Coastal Mexico PU (blue) and the wintering grounds of the Oceanic Mexico PU (purple) are shown. Source: Martínez-Loustalot et al., 2022.

Based on breeding grounds, in 2016 the NOAA identified 14 Distinct Population Segments (DPSs) of humpback whales worldwide. In the case of the North Pacific, 4 DPSs were described, the "Western North Pacific DPS ", the "Hawaii DPS", the "Mexico DPS" and the "Central America DPS", of which the Mexico DPS is listed as "threatened" and the Central America DPS as "endangered" (Fig. 4).

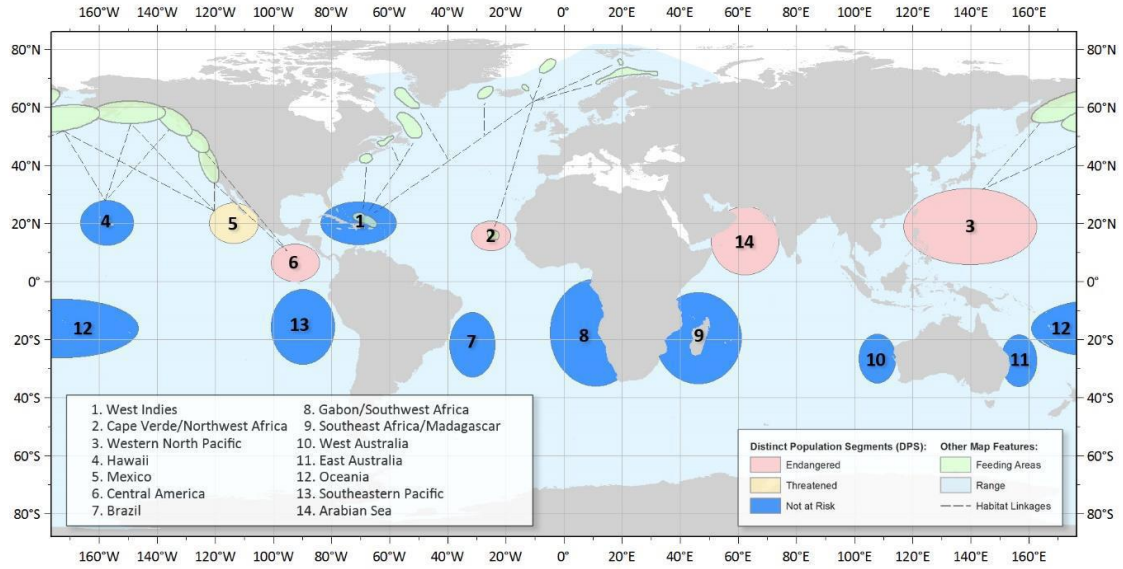

Figure 4. Location of the 14 distinct population segments (DPSs) of humpback whales around the world. The Mexican DPS (5) is listed as threatened and the Central American (6) as endangered. Source: NOAA (https://www.fisheries.noaa.gov/species/humpback-whale).

Recently, the NOAA itself has considered the need to determine and establish demographically independent populations (DIPs) that connect breeding and feeding grounds and allow effective conservation decisions to be made (NMFS, 2016). This analysis of stock status and subsequent assessment, management and conservation requires prior delimitation of DIPs, usually by placing geographic boundaries (Martien et al., 2021).

Currently, there is a need to establish the boundaries and distribution limits of the different PUs that occur in Mexico and Central America (Central America, Coastal Mexico and Offshore Mexico), as well as to clarify their movements and how they interact with each other (Martien et al., 2021; SC/68b/IA WP/05). The purpose of locating these geographical boundaries is to apply better management of the PUs so that more accurate abundance estimates can be made, to determine the anthropogenic impact on population mortality, and for more effective conservation actions (Martien et al., 2021).

3. Justification

The proportion of individuals of each PU in the different regions of the Mexican Pacific, as well as the movements between them, are unknown. This is why, in mixed congregation sites such as Baja California Sur and Nayarit-Jalisco, it is complex to know to which PU each whale belongs, making it difficult to identify and protect the populations that are most at risk. The present study aims to determine the proportion, dynamics and interaction of the different PUs throughout the season, to clarify the arrival and departure times of each of them, as well as their movements between the different regions of the Mexican Pacific. All of this will help to understand the peculiarities of each population, which in turn will allow for the adaptation of management plans and effective and targeted conservation actions.

4. Objetives

General

The aim of this study is to investigate and identify combinations of haplotypic frequencies and isotopic values as a new technique to determine population unit origin of individual humpback whales.

Specific

In this report, we specifically present the results of the 2022/23 humpback whale field season in El Salvador by *Proyecto Megaptera El Salvador*. The present funds were requested to achieve the following objectives:

- Photo-identification of humpback whale flukes.

- Collection of biopsies for molecular analysis and genetic studies.

5. Methods

5.1 Marine surveys

Marine surveys were conducted between November 2022 and March 2023 aboard 6-8 m long fibreglass fishing boats with 40 and 60 hp outboard engines, departing from the community Los Cóbanos (Sonsonate, El Salvador). Sampling was targeted, i.e. areas were chosen based on the experience of local fishermen to increase the probability of sightings and to record as much information as possible (Rasmussen et al. 2012). The approach to humpback whales was conducted following the guidelines of the research permit MARN-DEB-GVS-AIMA-041-2020 and the recommendations of the *Manual de Avistamiento Responsable de Cetáceos de El Salvador* (MARN, 2019).

General data for each sighting was recorded on field sheets (Rasmussen et al. 2012): date, time, geographical position (latitude and longitude) using a GPS, weather conditions (waves, cloud cover and wind) and water surface temperature. Group size and composition (solitary, pair, more than two adults, mother/calf or mother/calf/offspring), as well as behavioural data (travelling slow, travelling fast, feeding, singing, aggressive and acrobatic behaviour such as jumping, flapping or tailing) were also recorded.

5.2 Photo-identification

Using digital SLR cameras with 80-300 mm telephoto lenses, photographs of the ventral part of the flukes of humpback whales were taken (Katona et al., 1979). Afterwards, photographs were compared with our fluke catalogue of El Salvador and uploaded to *Happywhale* for individual's identification.

5.3 Collection of biopsies

Skin and attached fat tissue samples were collected by biopsy using a recurve crossbow with special darts at a distance of approximately 40 metres (Baker et al., 1998; Clark et al., 2016). Samples were approximately two centimetres in size. Each biopsy was processed immediately after collection. First, using a scalpel and a Petri dish, the skin and

fat portions were separated. A small amount of skin was left attached to the fat portion to identify the site of lipid insertion. The fat sample was stored in aluminium foil and inside an Eppendorf tube for future contaminant analysis. The skin portion was divided into two portions by vertical cuts: one for haplotyping and sex determination, which was stored in an Eppendorf tube with absolute ethyl alcohol; and another for future isotopic analysis stored in an empty Eppendorf tube (Fig. 5). All samples were stored in a cooler during fieldwork and subsequently refrigerated in a freezer (Martinez-Loustalot, 2022).

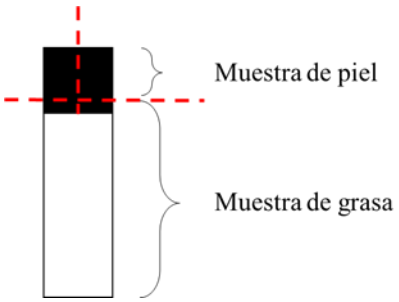

Figure. 5. Schematization of the cuts and subdivisions made in the biopsies for the different a posteriori analyses.

6. Results

Sampling effort

Between 22nd November 2022 and 21st March 2023, 69 research trips were conducted in the NPA of Los Cóbanos in the department of Sonsonate in El Salvador. A total of 2956,5 km were covered during 258 hours (83 hours of cetacean observation and 174 hours of navigation/searching (Table 1, Fig. 6).

Table 1. Research trips per month and sampling effort in hours and km.

Month	Nº of marine surveys
November 2022	2
December 2022	10
January 2023	23
February 2023	26
March 2023	8
Total marine surveys	69 surveys
Km covered	2956,5 km
Hours	258 hours

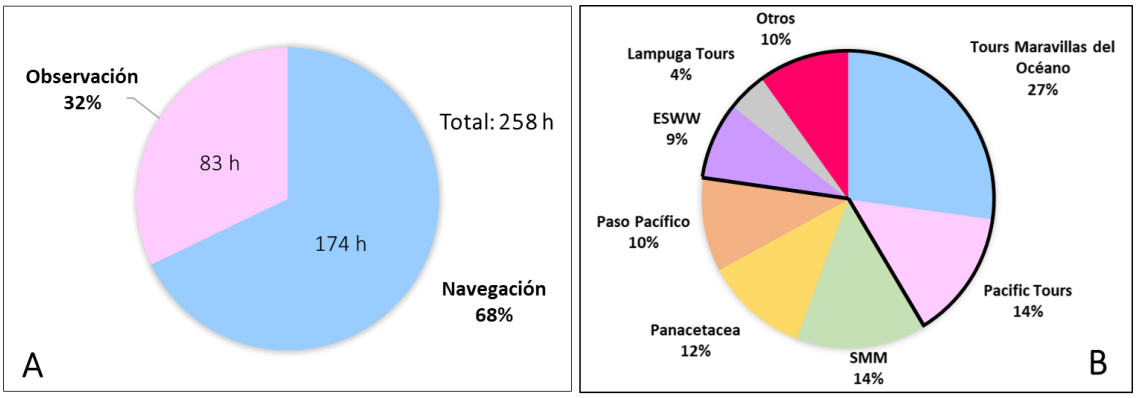

Figure 6. (A) Percentage of hours of cetacean observation (83 hours corresponding to 32% of the total time) and navigation/searching for cetaceans (174 hours corresponding to 68% of the total time) during the 69 marine surveys conducted in the 2022/2023 season. (B) Percentage of the 69 monitoring trips funded by each institution during the 2022/2023 season. The total percentage of trips financed by the tourist fleet (64% of the total number of trips made) are grouped together in black.

Species and sightings

A total of five cetacean species were recorded in 96 sightings: 81 of humpback whale (*Megaptera novaeangliae*), 10 of spotted dolphin (*Stenella attenuata*), 2 of bottlenose dolphin (*Tursiops truncatus*), 2 of bryde's whale (*Balaenoptera edeni*) and 1 of false killer whale (*Pseudorca crassidens*) (Table 2, Fig. 7).

Table 2. Temporal distribution of encounters with other cetacean species.

Species/ Month	Nov 2022	Dic 2022	Ene 2023	Feb 2023	Mar 2023	Total
Balaeonoptera edeni	0	2	0	0	0	2
Stenella attenuate	0	0	1	6	3	10
Tursiops truncates	0	2	0	0	0	2
Pseudorca crassident	0	0	1	0	0	1
TOTAL						**15**

Figure 7. Number of total and species-specific sightings of cetaceans recorded during the 2022/2023 season.

Individuals, Type of groups and Distribution

A total of 179 individuals (142 adults, 5 subadults, 3 juveniles, 24 calves and 5 individuals of unknown age) were recorded in 81 different groups (29 solitary individuals, 11 pairs, 2 trios, 4 quartets, 9 competitive groups, 12 mothers with calf, 11 mothers with calf and escort, 1 mother with calf and two escorts, and 2 groups of unknown category) (Fig. 8). G1 and MC/MCE groups were the most abundant in all months. The acoustic activity of singers was almost exclusive to the months of January and February (Fig. 9). Figure 10 shows the distribution of the different groups differentiated between groups with and without a calf, and competitive groups.

Figure 8. Number of total humpback whale groups by category during the 2022/2023 season. A total of 81 groups were recorded. G1: single, G2: pair, G3: trio, G4: quartet, CG: competitive group, MC: mother-calf, MCE/MCEE: mother-calf-escort, ND: no data.

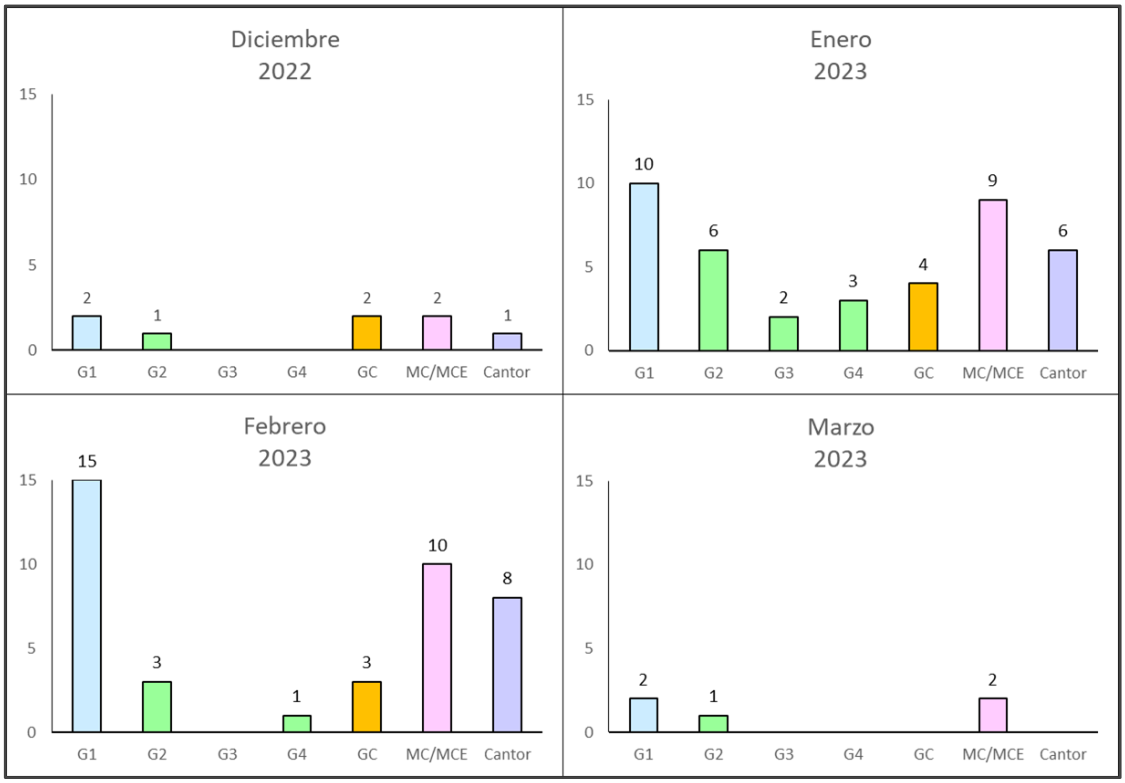

Figure 9. Number of groups per category and month during the 2022/2023 season. A total of 81 groups were recorded in the four months of the study. G1: solo, G2: pair, G3: trio, G4: quartet, CG: competitive group, MC/MCE: mother-calf/ mother-calf-escort. The number of singers recorded per month is also shown.

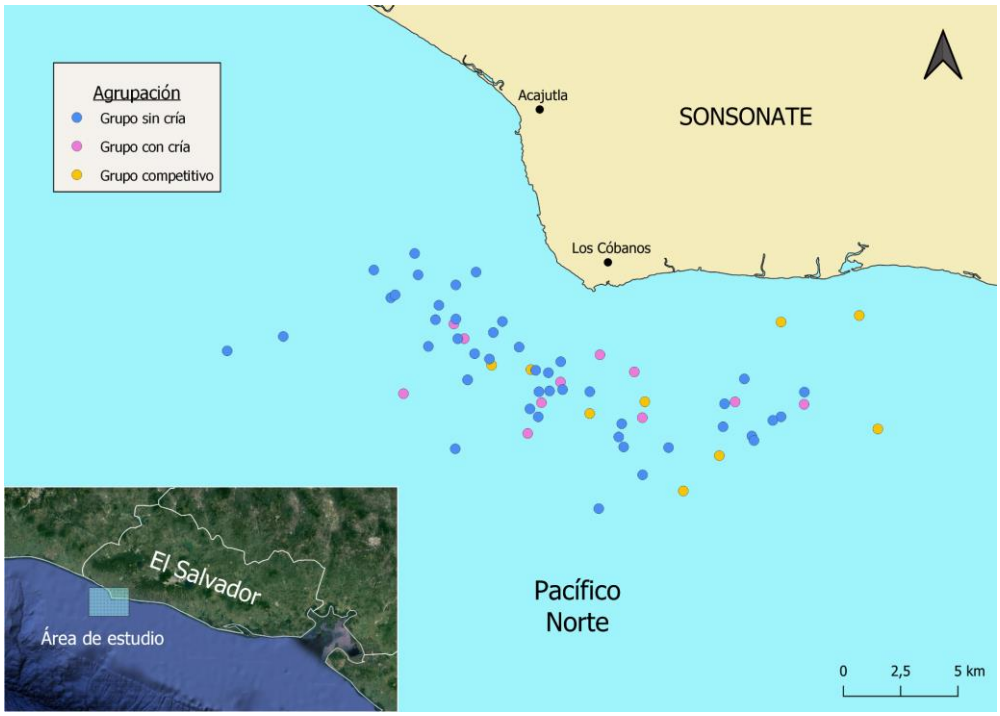

Figure 10. Study area within Los Cóbanos Natural Protected Area, in the department of Sonsonate (El Salvador). The location of the 81 groups registered with (pink) and without (blue) a calf is shown.

Behaviour and Direction

The most common behaviour was *Travelling slow* (36%), followed by *Surface Activity Travelling fast* (12%), *Erratic* (10%), *Resting* (8%), *Singing* (7%) and *Aggressive* (6%) (Fig. 11A).

In December and January, the predominant direction of movement of individuals was southwards (57.14% and 65.71%, respectively), while in February and March it was northwards (46.88% and 60%, respectively) (Fig. 11B).

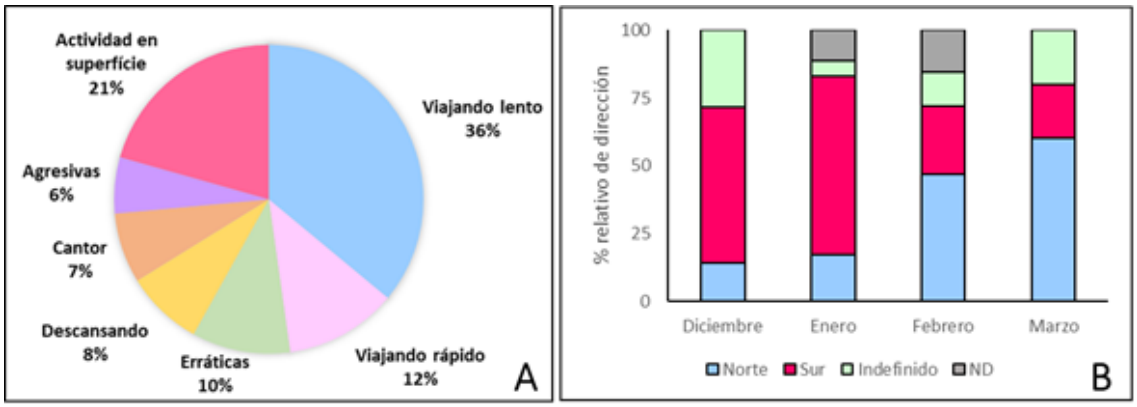

Figure 11. (A) Percentage of each behaviour recorded for the 81 humpback whale groups sighted in the 2022/2023 season. The *Surface Activity* category assembles the categories *Jumping*, *Flippering*, *Surface Active* and *Pectoral*. **(B)** Relative percentage of direction of travel (South, North, Indefinite (no clear direction: erratic, static or resting), and No data (ND)) by month during the 2022/2023 season.

Photo-identification: New individuals and Recaptures

In total, 75 individuals were photo-identified using Happywhale (6 new individuals recorded for breeding areas, 28 new for Central America, 16 new for El Salvador, and 25 recaptures). Finally, 38 biopsies were collected throughout the season (5 in December, 14 in January and 19 in February). One individual was biopsied twice. For three other biopsied individuals, no photograph of the fluke is available (Fig. 12).

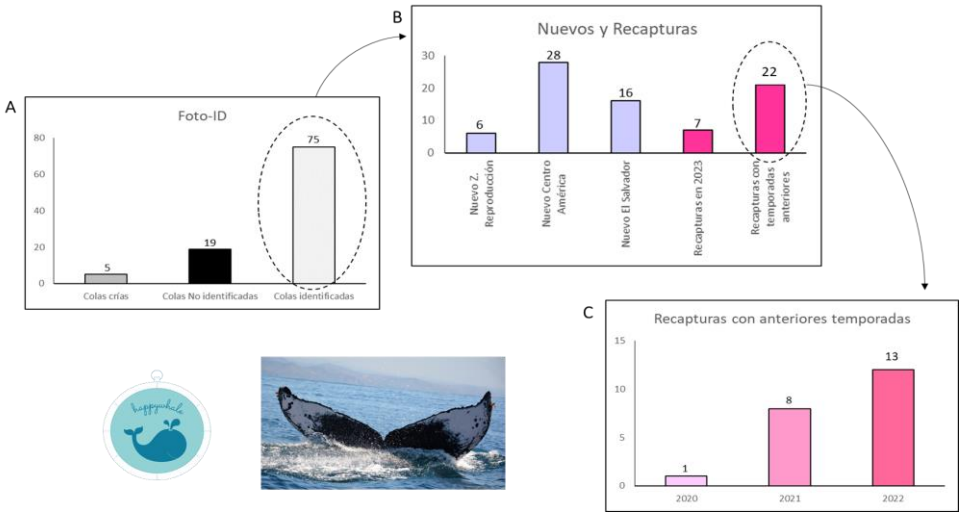

Figure 12. (A) Number of calves' flukes photographed; flukes identified and unidentified by Happywhale for the 2022/2023 season. **(B)** Number of new individuals recorded in Happywhale for breeding areas, Central America and El Salvador; as well as individuals recaptured during the same (2023) and previous (2020, 2021 and 2022) seasons in El Salvador. **(C)** Number of recaptures with previous seasons (2020, 2021 and 2022) of individuals photographed in 2023.

- *Recaptures during the 2022/2023 season: Residence times*

Seven individuals were recaptured on different days within the same 2022/2023 season. Five individuals were sighted on two occasions, while two others were sighted on three different occasions. The minimum number of days between the first and last sighting of each individual was two days, while the maximum number of days was 45 (Table 3).

Table 3. Individuals recaptured during the same season (2022/2023).

ID	1ª fecha	Última fecha	Nº Avistamientos	Días entre 1er y último avist.
CRC-12125	04/01/2023	06/01/2023	2	2
CRC-15363	06/01/2023	13/01/2023	2	7
CRC-15056	01/02/2023	04/02/2023	3	3
CRC-11606	04/02/2023	05/02/2023	2	1
CRC-12452	08/02/2023	11/02/2023	2	3
CRC-10704	16/01/2023	02/03/2023	2	45
CRC-11667	21/12/2022	19/01/2023	3	29

- *Recaptures with previous seasons: Site fidelity*

On the other hand, 22 individuals recaptured in previous seasons were recorded this season: one individual photographed for the first time in 2020, eight individuals photographed in 2021, and 13 individuals in 2022 (Table 4).

2020	2021	2022
CRC-11743	CRC-11838	CRC-11743
	CRC-10025	CRC-11343
	CRC-10617	CRC-15774
	CRC-16603	CRC-17826
	CRC-10527	CRC-12576
	CRC-12180	CRC-15275
	CRC-11667	CRC-12113
	CRC-11343	CRC-30058
		CRC-12058
		CRC-10601
		CRC-10863
		CRC-11352
		CRC-15085

Table 4. Codes (used on Happywhale) of recaptured individuals from the breeding season 2022/2023 with previous seasons (2020, 2021 and 2022).

Recordings of songs and whistles and Skin samples

A total of 15 recordings of cetaceans were obtained between 22 November 2022 and 21 March 2023. Fourteen of these belonged to humpback whales (*M. novaeangliae*) and one to false killer whales (*Pseudorca crassidens*). Of the 14 humpback whale recordings, eight are of good quality for analysis, three are of fair quality and one is of poor quality (Fig. 8). In total, 36 biopsies (skin and blubber) and 4 sloughed skin samples were collected throughout the present season. For comparison, between 2020 and 2022, only 28 samples of sloughed skin were collected (Fig. 13).

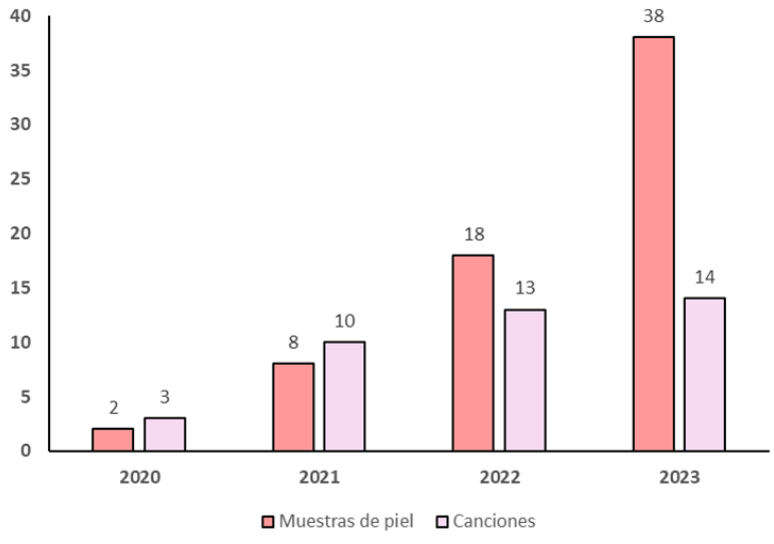

Figure 13. Total number of skin samples collected and underwater recordings of humpback whale sounds between 2020 and 2023 in El Salvador.

Anthropogenic impacts: Propeller strikes and entanglement in fishing nets.

One calf was documented with propeller marks on the left region of its dorsum (Fig. 14A). The scars were pale red in colour, so the accident had probably occurred recently (Fig. 14B). The whale calf was observed to be very active, jumping and fluking vigorously (Fig. 14C), and was in apparent good health.

Additionally, tourists and fishermen reported seeing whales entangled in fishing nets. However, no photographic evidence of such an event was obtained. So far, there are three documented cases of whales entangled in fishing gear in recent years in the study area (Castaneda et al., 2022).

Finally, the geographic locations of 16 floating long-line fishing nets found in the area were recorded. On one occasion, an Olive Ridley turtle (*Lepidochelys oliavacea*) was successfully released from one of these nets (Fig. 15). On a second occasion another Olive Ridley turtle was found entangled in these nets but unfortunately it was deceased.

Figure 15. Olive Ridley turtle (*Lepidochelys oliavacea*) entangled in a simbra net found on 8/02/2023 in Los Cóbanos PNA.

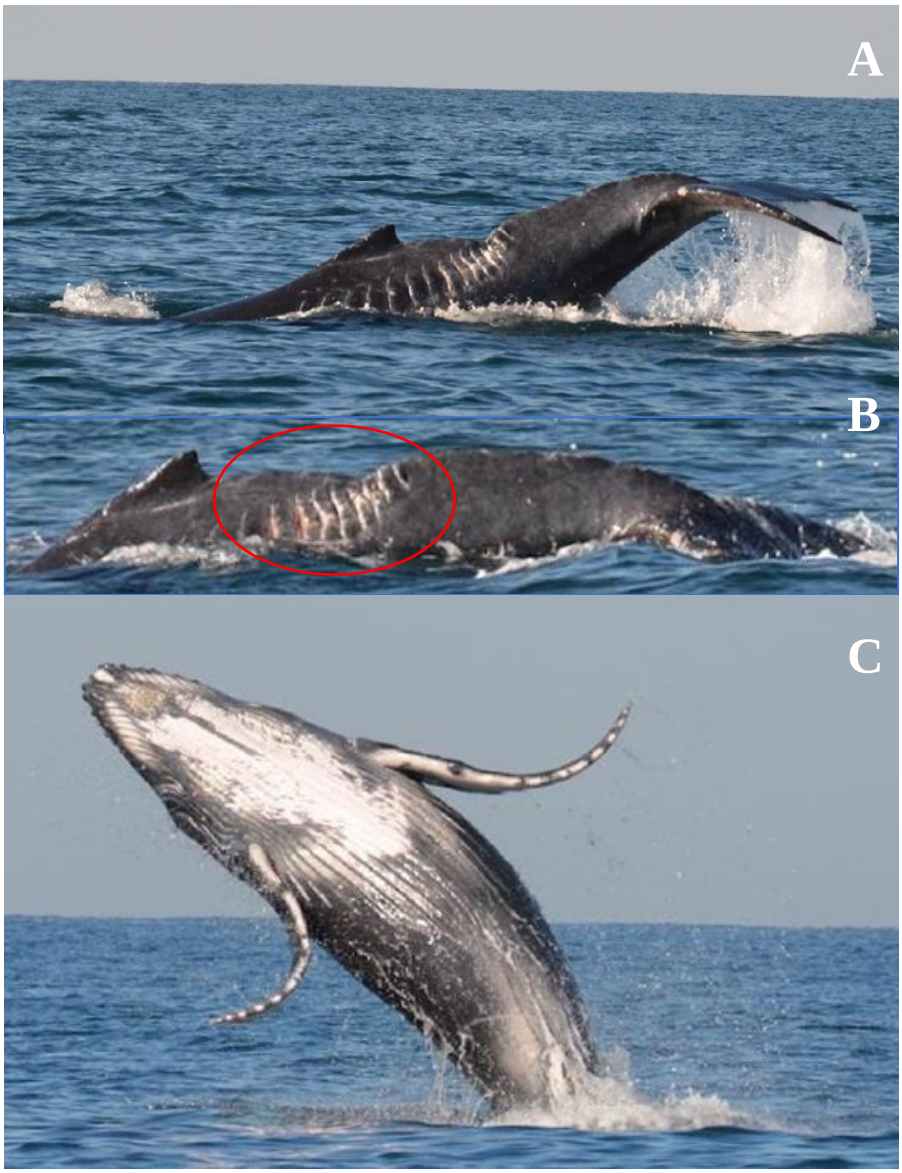

Figure 14. (A) Humpback whale calf with probable propeller marks on its left dorsum. (B) Recent wound. (C) Surface activity of the injured calf.

Socio-economic benefits for the community

It was estimated that between December 2022 and March 2023, around 2,200 tourists and 406 boats participated in whale-watching excursions in Los Cóbanos, generating $90,000 USD in direct economic income to the community. Each year more and more tourists are coming to do this activity in the PNA (PMES, unpublished data). During the 2014/2015 season the number of tourists was only 391 (Castaneda et al., 2021).

Another great benefit that the presence of these cetaceans brings to the community is the strengthening of local capacities. In the case of artisanal fishermen, due to the economic

inequality they face, they have been forced to work from an early age. Consequently, many of them abandon their studies at an early age, or even attempt to travel to other countries for work, often without legal permission. However, since the beginning of the whale tourism in Los Cóbanos, some of them have been trained as tour guides, touristic boat captains and as research assistants (Fig. 16A). US AID (a United States Non-Governmental Organization) have commended us for our work in helping to reduce illegal immigration from the region. Fisherman have learned to operate professional cameras, drones, GPSs and other scientific research equipment, as well as citizen science platforms and methodologies for data collection and processing (Fig. 16B). Between 2020 and 2023, *Proyecto Megaptera el Salvador* has organised three workshops with the community, has supported the creation of the Sustainable Tourism Committee and the Group of Responsible Cetacean Observers, as well as the creation of the *Grupo de Atención de Ballenas Enmalladas de El Salvador* (GABES) of which we are part of (Fig. 16C).

Figure 16. (A) Fishermen benefiting from whale watching tourism. **(B)** Knowledge exchange: fishers train the biologist to drive the boat while he trains them in cetacean research methods. **(C)** Training of the group of Salvadorans (fishermen, rangers and biologists) in the rescue of entangled whales during the workshop organised in December 2022 by the International Whaling Commission and RABEN (Photo: MARN).

7. Budget implementation

Thanks to SMM's Small Grant, we were able to conduct 10 marine surveys on the following dates: 11th, 16th, 18th, 20th and 31st of January 2023; and on the 1st (morning), 1st (afternoon), 2nd, 8th and 10th of February 2023 (Table 5). On these dates, we encountered 16 groups of humpback whales, totalling 44 individuals. Of these, 23 individuals were identified thanks to *Happywhale* (5 individuals were recaptures, 2 individuals were new records for breeding areas, 10 individuals were new records for

Central America and 6 individuals were new records for El Salvador). In addition, 27 biopsies were collected and 2 songs were recorded.

Table 5. Dates and costs (USD) of the ten SMM-funded research trips.

Activity	Date	Cost USD
1º marine survey	11th January	$200
2º marine survey	16th January	$200
3º marine survey	18th January	$200
4º marine survey	20th January	$200
5º marine survey	31st January	$200
6º marine survey	1st February AM	$200
7º marine survey	1st February PM	$200
8º marine survey	2nd February	$200
9º marine survey	8th February	$200
10º marine survey	10th February	$200
TOTAL		**$2,000**

8. Conclusions and Recommendations

In the current season, fewer groups and almost half the number of humpback whales were observed in Los Cóbanos NPA compared to the previous season 2021/2022, with similar sampling effort in both seasons (Table 6). Similarly, the number of calves counted has decreased from 61 in 2021/2022 to 24 in 2022/2023. Both years occurred under La Niña climatic event, characterised by cooler than usual water surface temperature. It is essential to carry out continued population monitoring to assess population trends and fluctuations such as these over the long-term, and therefore general population health and recovery. Such monitoring will allow us to continue to aid in the conservation and management of this endangered population segment of humpback whales. Funding for research marine surveys such as the small grants offered by *The Society for Marine Mammalogy* are essential for small organisations such as *Proyecto Megaptera El Salvador*. For this we thank you, and for allowing us to continue our work in EL Salvador, as without support such as yours, none of this would be possible.

Table 6. Comparison of sampling effort and number of groups, individuals and calves recorded during the 2021/2022 and 2022/2023 seasons in Los Cóbanos NPA.

	2021/2022	**2022/2023**
Sampling effort (hours)	268	258
Groups	125	81
Individuals	238	179
Calves	61	24

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