GRAY WHALE RESEARCH IN MEXICO

Annual Research Report for the 2025 Gray Whale (*Eschrichtius robustus*) Winter Season in Laguna San Ignacio and the Bahía Magdalena Lagoon Complex, Baja California Sur, Mexico

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Introduction to 2025 Research Season:

Gray whales (*Eschrichtius robustus*) may be at a tipping point in their history as thousands have died throughout their North American range. Between 2019 and 2025 a minimum of 1,235 gray whales have stranded dead along the Pacific coast of North America from Baja California Sur in Mexico to Alaska, nearly 8-times the previous 10-year average stranding frequency. In response the United States National Oceanic and Atmospheric Administration (NOAA) declared in 2019 an Unusual Mortality Event (UME) for the Eastern North Pacific gray whale population and began to investigate the increased number of mortalities (NOAA 2024). NOAA has estimated the population declined from an estimated 26,960 whales in the 2015/2016 winter to 14,525 by the 2023/2024 winter as the result of multiple consecutive years of the increased mortality rate.

Beginning in 2018 Gray Whale Research in Mexico (GWRM) scientists working in Laguna San Ignacio and the Bahía Magdalena lagoon complex, in Baja California Sur, Mexico reported increasing percentages of "skinny" or "malnourished" whales in these lagoons, at a time when whales that supposedly had recently completed a summer of feeding in the Arctic portion of their range and should be healthy and in good condition. These increased sightings of emaciated whales have been accompanied by increased mortalities within these wintering areas and throughout the Pacific and Gulf of California coasts of the Baja California peninsula. Additionally counts of female whales with newborn calves that usually number in the hundreds during the winter months have continually declined each year since 2018 to less than 20 pairs counted annually in both the Laguna San Ignacio and Bahía Magdalena wintering areas combined. In total, these observations suggest a trend of declining viability of the Eastern North Pacific gray whale population. Here we report on the status of gray whales and trends in their body condition, declining calf counts, abundance, and strandings in Laguna San Ignacio and the Bahia Magdalena lagoon complex during the 2025 winter breeding season.

The gray whale monitoring and research program is undertaken as a collaboration between the Universidad Autónoma de Baja California Sur (UABCS) and the Gray Whale Research in Mexico program (GWRM), sponsored by The Ocean Foundation, based in Washington D.C., U.S.A.. This work took place in Laguna San Ignacio from January 15th to March 31st, 2025, and in the Bahía Magdalena lagoon complex (Bahía Magdalena, Bahía Almejas, and the Canal de López Mateos) from January 18th to March 24th, 2025. Activities included: photo-identification (Photo-ID) surveys, abundance surveys (weekly in Laguna San Ignacio and every 15 days in the Bahía Magdalena lagoon complex), photographic-identification and body condition evaluation using UAV-drones, documentation of underwater behavior from "Customized Animal Tracking Solutions" (CATS) digital tag placements, documentation of marine mammal strandings, outreach

talks to visiting eco-tourist groups and instruction and counseling of Marine Biology undergraduate students.

Photographic Identification:

The photographic-identification (Photo-ID) methodology allows the identification of individuals in a population. For gray whale's photographs are obtained of both the right and left flanks to capture the unique natural markings of each whale. Photographs were obtained with Digital Single Lens Reflex (DSLR) cameras (Nikon D7500), equipped with 28-300 mm zoom lenses, using a shutter speed of 1/1000 second and a light sensitivity of ISO 400 (Fig. 1).

Figure 1. *Photo-identification of the right flank of a gray whale.*

Whales were photographed from a 24 foot long boat (panga), that approached the whales at an approximate distance of 10 to 20 meters to obtain photographs with clear resolution and image size. Each photograph records the individually distinctive coloration and markings on each whale (*e.g.*, natural pigmentation and scars).

The research team in Laguna San Ignacio conducted Photo-ID surveys on 54 days, with a total effort of 225 hours, from which 316 gray whale sightings where documented. During the field season 7,677 photographs were taken and were compared between each other to creat the 2025 photo-ID catalogue. In total 723 different individual adult whales were photo-identified, of which 8 were females with calves and 715 were single individuals (males or females without calves).

An individual whale's minimum residence time was determined as the number of days between the first and the last time a whale was photographed during the season, and the average residence time was estimated from the average number of days from all of the

whales' individual residence times. The average residence time for females with calves was 29.4 days with a maximum residence time of 65 days. The average residence time for single adult whales was 8.8 days with a maximum residence time of 58 days.

The research team in the Bahía Magdalena lagoon complex conducted Photo-ID surveys on 47 days for a total of 372.5 total hours, from which 203 sightings were obtained (Fig. 2). During the field season a total of 11,468 photographs were taken and 1,090 individuals were documented; 55 in the Canal de López Mateos, 344 in Bahía Magdalena and 747 in Bahía Almejas. A total of 976 individuals were identified, of which only 6 were females with calves and 970 adult single whales. The average residence time for the females with calves was 16 days with a maximum of 43 days. For single whales the average residence time was 7 days, and the maximum was 35 days.

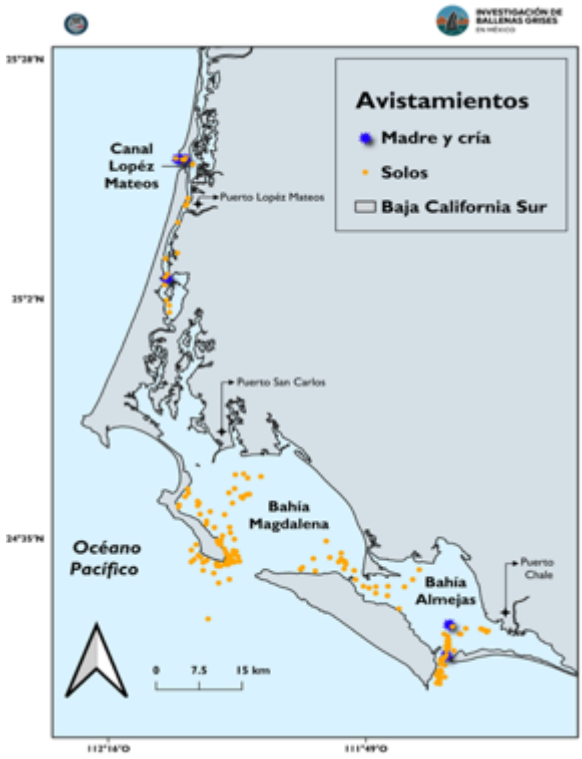

Figure 2. *The distribution of the gray whales' sightings in the lagoon complex Bahía Magdalena B.C.S. The orange points represent the sightings of single individuals and the blue the females with calves.*

The photo-identified individuals from both lagoon areas will be compared to determine the movements of whales between both areas during the 2025 winter.

Western North Pacific "Russian" Gray Whales:

All Photo-ID data obtained during the 2025 season in Laguna San Ignacio was compared against three Photo-ID catalogues from the feeding grounds of the Western North Pacific gray whale population (*i.e.,* Sakhalin Island and the Kamchatka Peninsula, Russia). Of the 381 individual gray whales in the Western North Pacific catalogues, six recaptures between both Western and Eastern North Pacific populations were discovered. It is noteworthy that of the 8 females with calves photo-identified in Laguna San Ignacio in 2025, two of the females corresponded to individuals in the Western population catalogs indicating an exchange of these whales between both populations (Table 1, Fig. 3).

Table 1. *Gray whale individuals photographed in Laguna San Ignacio in 2025 that were also photo-identified in the Western North Pacific population's feeding ground (Sakhalin or Kamchatka, Russia) in previous years (the catalogue numbers with the letter "M" correspond with females with calves.*

LSI, Mexico GWRM (PRIMMA-GWRM 2025)	Sakhalin, Russia (Burdin y Weller 1994-2016)	Sakhalin, Russia (Tyurneva y Yakovlev, 2002-2017)	Kamchatka, Russia (Tyurneva y Vertakin, 2004-2011)
25-0228-D-LSI	WGW-068	KOGW 043	Kam GW 118
25-0274-I-LSI	WGW-207	KOGW 212	---
25-0677-D-LSI	WGW-237	KOGW 215	---
25-0742-D-LSI	WGW-052	KOGW 026	---
25-0806-D-LSI-M	WGW-171	KOGW 161	Kam GW 111
25-0807-D-LSI-M	WGW-040	KOGW 093	---

Figure 3. *Gray whale females with calves from the Western North Pacific population photographed in Laguna San Ignacio, during 2025 (25-0806-D-LSI-M above and 25-0807-D-LSI-M below).*

All Photo-ID data from the 2025 catalogues for Baja California Sur will be compared with the historic photo-identifications from Laguna San Ignacio obtained during the period 1977 to 1982 to identify gray whales that are continuing to return with their calves to the winter breeding areas along the Baja California peninsula. The minimum age of these whales can be estimated from the number of years between the first year that they were photographed and the most recent photographic documentation of the whale's presence.

Surveys for Relative Abundance:

The minimum number of gray whales and their distribution in Laguna San Ignacio and the Bahía Magdalena lagoon complex during the winter was estimated from boat surveys conducted with standardized methodologies and following predetermined GPS (Global Position System) survey-lines (Figs. 4 and 5). Abundance surveys were conducted from 24 foot long boats, powered by 90 hp outboard motors, while navigating at a speed of 11

km/h to maximize the probability of sighting surfacing whales. A pair of observers (one primary and one secondary) noted each whale sightings on the left and right sides of the boat along the survey-line. A separate individual recorded for each sighting the number of whales, their apparent direction of movement, and whether any calves were present. Environmental conditions were also noted during each portion of the survey-line.

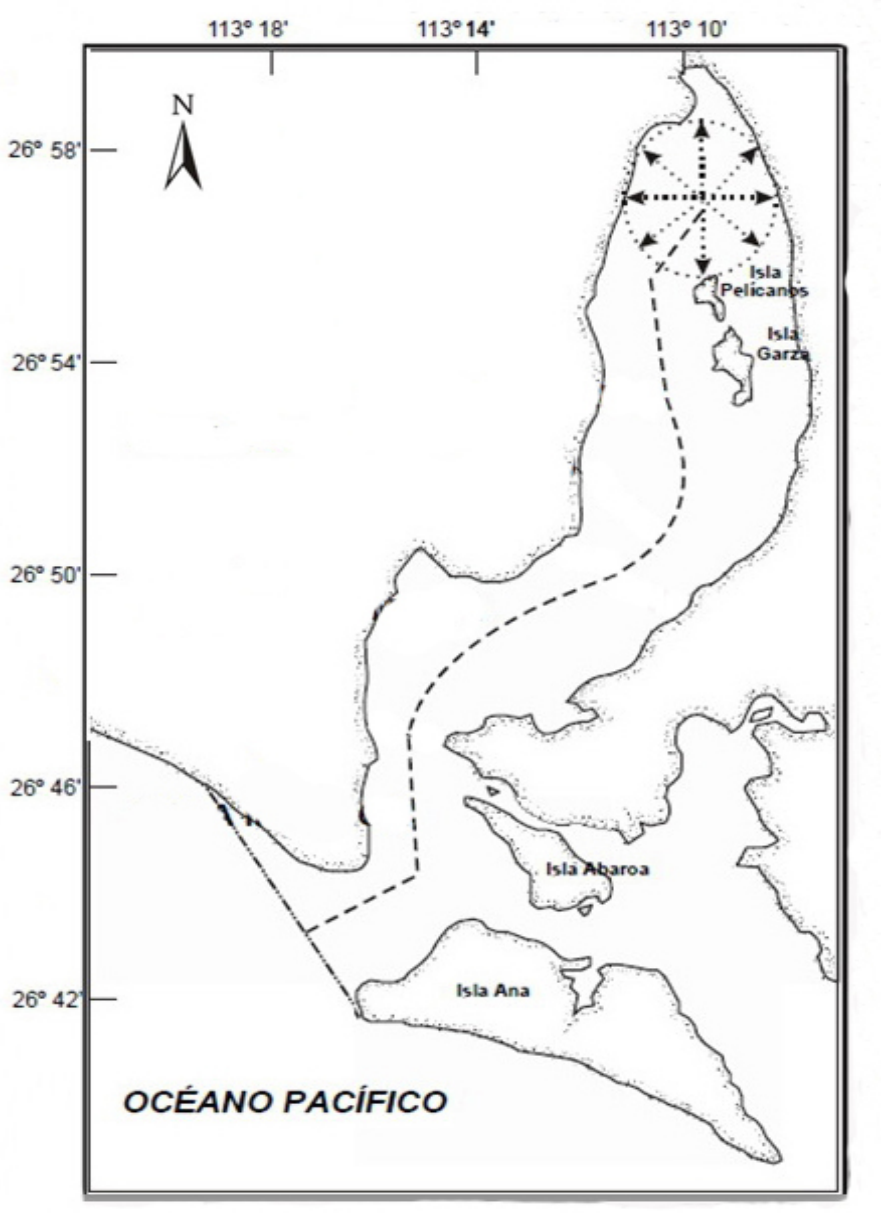

Figure 4. *Global Survey System (GPS) boat survey-line to document whale abundance and distribution in Laguna San Ignacio.*

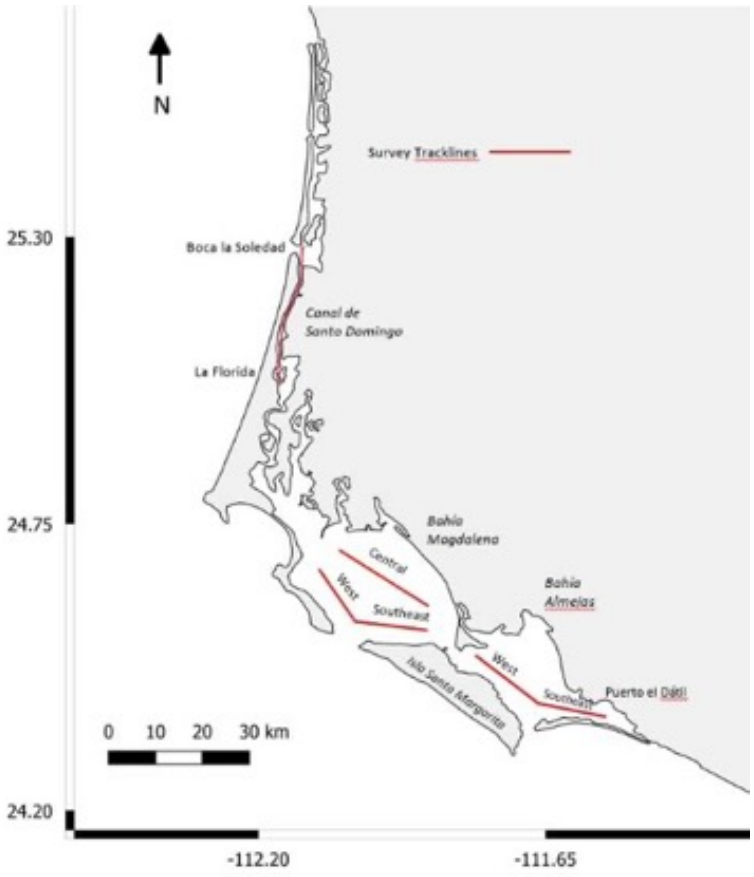

Figure 5. *Global Position System (GPS) boat survey-lines (red lines) to document abundance and distribution of whales for Bahía Magdalena, Bahía Almejas, and Canal de López Mateos.*

During the 2025 season the research team in Laguna San Ignacio conducted 11 abundance surveys with a separation of 5 to 8 days in between surveys depending on the weather conditions. The research team in the Bahía Magdalena lagoon complex conducted 5 abundance surveys in each of the three areas in this lagoon complex between January and March. The highest number of whales counted in Laguna San Ignacio was 112 individuals on March 7th (Table 2). In the Bahía Magdalena complex the highest whale counts were 296 whales in Bahía Almejas on February 17th , in Bahía Magdalena it was 126 individuals on March 11th, and in the Canal de López Mateos it was 9 individuals on March 9th (Fig. 6).

Table 2. *Summary of the 2025 abundance survey counts in Laguna San Ignacio (Singles are adult whales without calves, and Mc indicates females with calves).*

Census #	Date	Singles	Mc	Total
1	Jan-24-2025	5	2	9
2	Jan-29-2025	5	0	5
3	Feb-4-2025	15	1	17
4	Feb-9-2025	26	1	28
5	Feb-17-2025	46	2	50
6	Feb-24-2025	59	2	63
7	Mar-1-2025	95	2	99
8	Mar-7-2025	104	4	112
9	Mar-12-2025	83	2	87
10	Mar-17-2025	74	2	78
11	Mar-23-2025	43	5	53

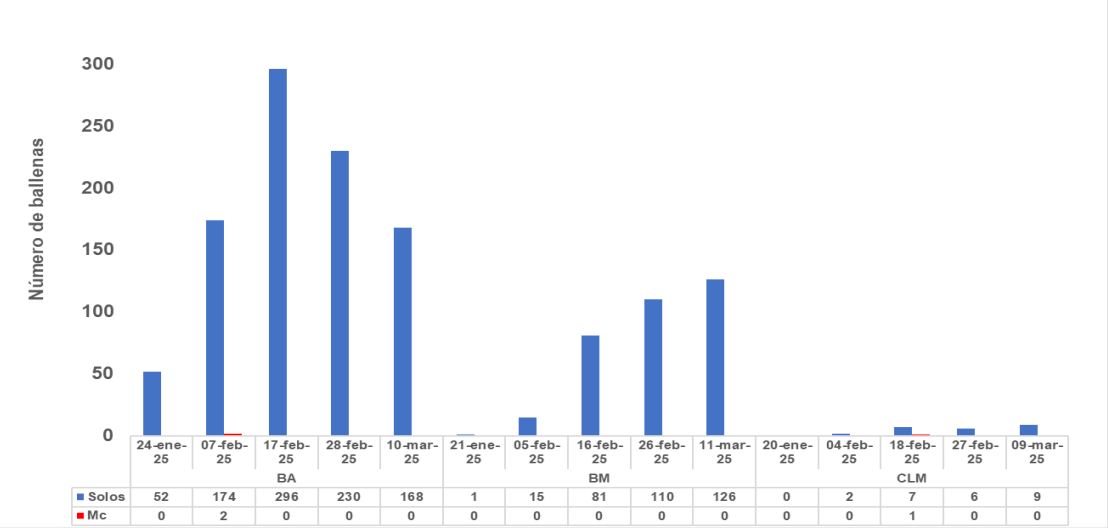

Figure 6. *Gray whale abundance survey counts in the Bahía Magdalena complex during the 2025 season. The blue bars represent single whales and the red bars indicate females with calves (Mc). The three survey areas within the complex are: BA is Bahía Almejas, BM is Bahía Magdalena and CLM is Canal de López Mateos.*

In Laguna San Ignacio, the March 7th peak count of single gray whales was the lowest and latest peak count of any season observed in this lagoon in the past 20 years (Fig. 7). This low abundance may be related to the “La Niña" climatological event that persisted during the 2025 winter. During “La Niña“ the sea surface temperatures (SST) are colder than average temperature and the distribution of the gray whales tend to be more southernly than in years with warmer water temperatures. For females with calves the abundance peak of 5 female-calf pairs was on March 23rd, and was the lowest female-calf pair count recorded during the previous 20 years (Fig. 8).

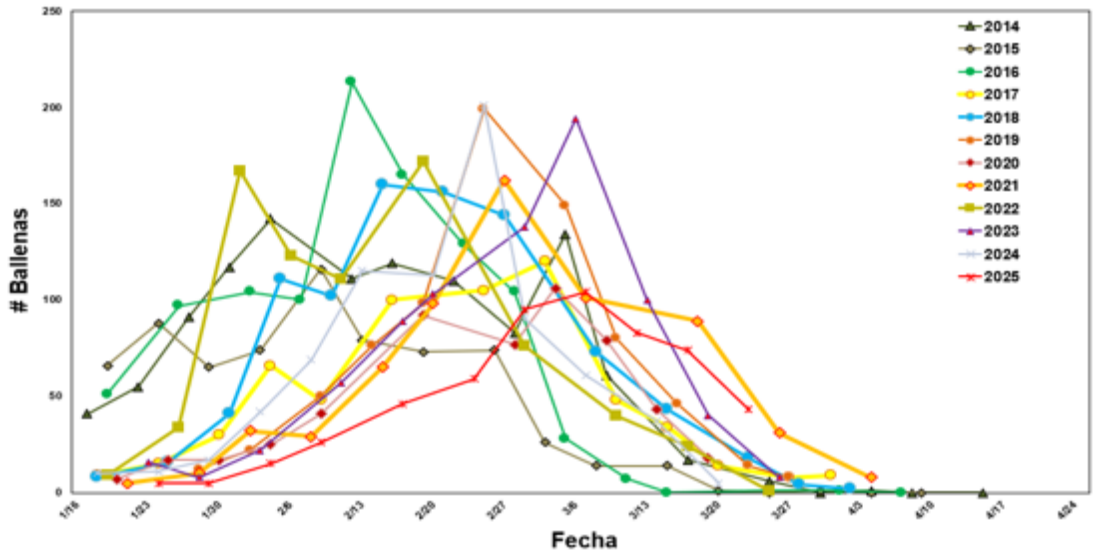

Figure 7. *Single whales' abundance counts comparison in Laguna San Ignacio, from 2014 to 2025. The red line indicates the counts obtained in 2025.*

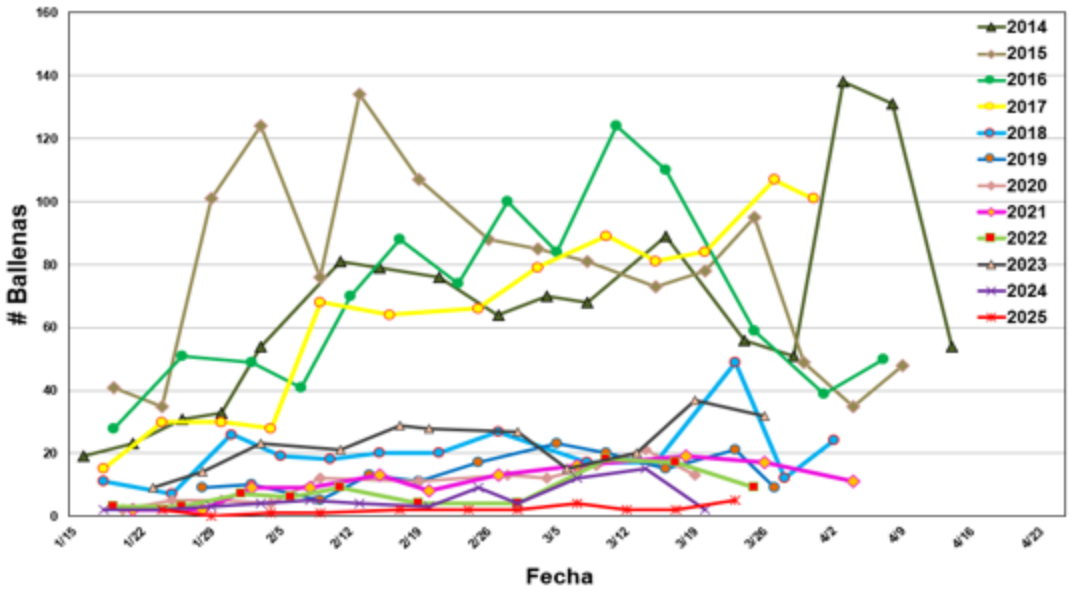

Figure 8. *Abundance counts of females with calves comparison in Laguna San Ignacio from 2014 to 2025. The red line indicates the values obtained in 2025. Note, counts of females with calves between 2018 and 2025 are the lowest ever recorded for this winter aggregation and breeding area.*

Comparison of the abundance survey counts of gray whales In the Bahía Magdalena lagoon complex obtained from 2016 to 2025 indicate there has been a reduction in the number of females with calves and single whales in the Canal de López Mateos during

this time period (Fig. 9). Counts of gray whales in Bahía Magdalena were also atypical in 2025; while the peak of abundance was the highest compared to previous years, the high counts occurred later in the season than in the previous years (Fig. 10). This delay could also be related to “La Niña” conditions of low winter water temperatures between 16- 18ºC recorded in this area in 2025. The lower-than-average water temperatures could also explain why several gray whales migrated to more southern areas in the Gulf of California and were sighted at Cabo Pulmo and Cabo San Lucas, were the water temperatures remained between 19 to 20ºC. Finally, Bahía Almejas had the highest peak of gray whale abundance compared to previous seasons, but occurred at similar times as seen in previous years (third week of February) (Fig. 11).

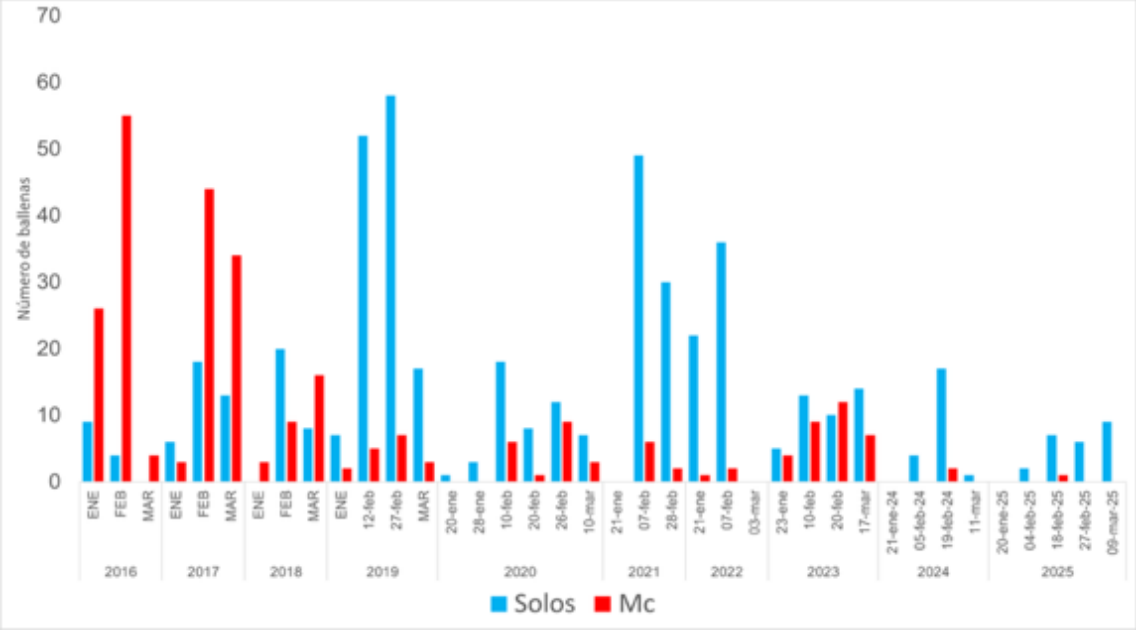

Figure 9. *Gray whales abundance survey results in the Canal de López Mateos from 2016 to 2025. The blue bars represent the single whales (Solos) and the red bars are the females with calves (Mc). Note the significant decline in the number of females with calves after the 2018 winter.*

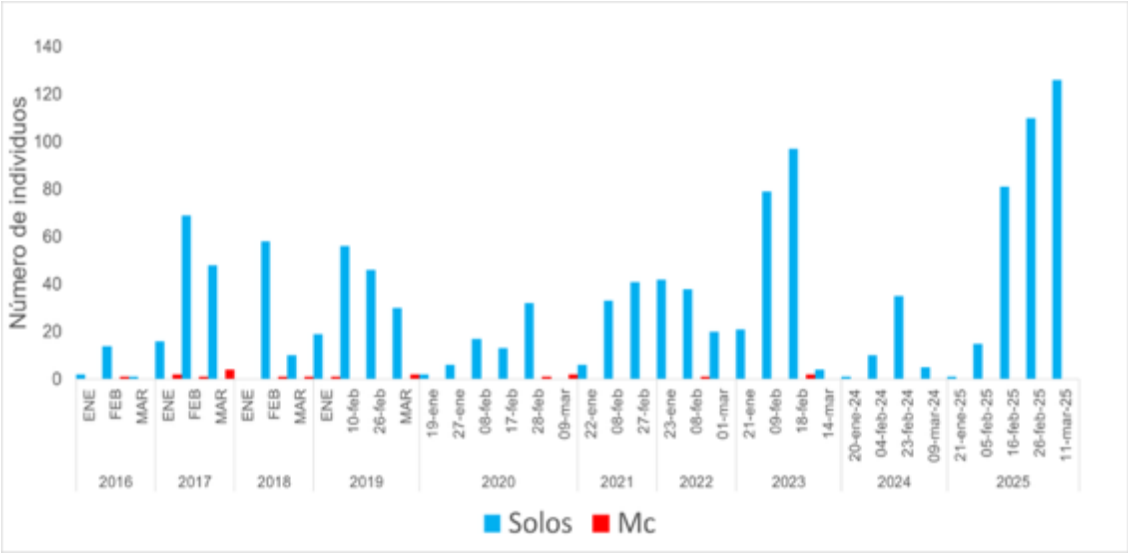

Figure 10. *Gray whales abundance survey results in Bahía Magdalena from 2016 to 2025. The blue bars represent the single whales (Solos) and the red bars the females with calves (Mc).*

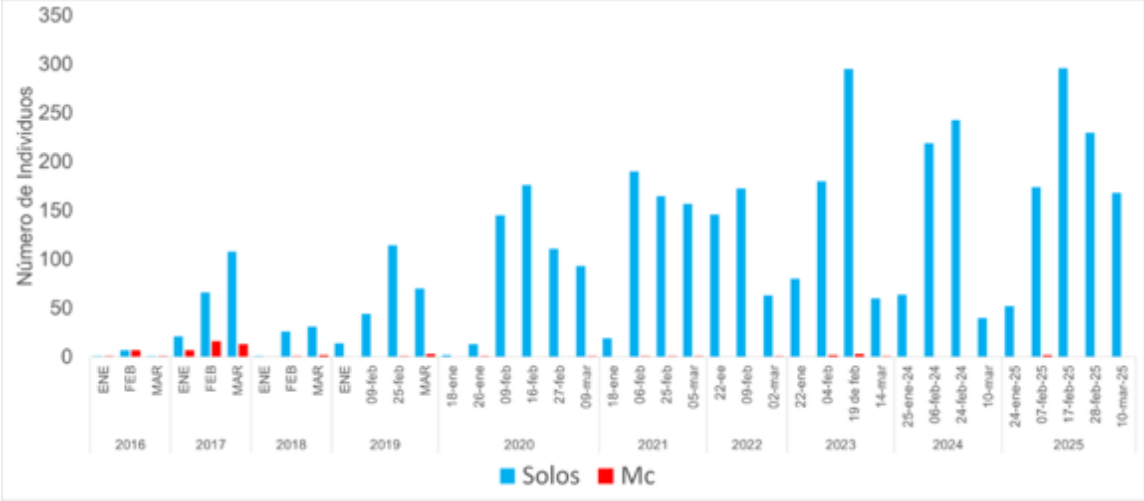

Figure 11. *Gray whales abundance survey results in Bahía Almejas from 2016 to 2025. The blue bars represent the single whales (Solos) and the red bars the females with calves (Mc).*

Body Condition:

Individual whale's body condition was evaluated from photographs of their head, scapula and flank regions. The proportion of whales that exhibited indications of poor condition or the “skinny whale syndrome” (nutritional stress) was determined by numerically scoring the reduction of their body fat and blubber layer compared to a healthy individual. For example, poor condition whales showed a post-cranial depression behind the blowholes and cranium where there is normally body fat in healthy animals. Similarly, the scapula anterior ridge and concave flanks are visible in whales that are in poor condition (Fig. 12).

Figure 12. *Picture showing the characteristics of a gray whale in poor body condition or the "skinny whale syndrome" (Note the post-cranial depression, visible scapular bone, and concave flank).*

Body condition was evaluated using the methodology and criteria proposed by Weller *et al.*, (2000) and Bradford *et al.,* (2012) where a numerical value from 1 to 3 is assigned to the head, and 1 to 2 to the scapula and the flank regions, depending on their condition. The greater the values the better the body condition is (Table 5).

Table 5. *Categorization scoring of gray whale body condition (Bradford 2012).*

Categories	**HSF**									
Good	322	321	32X	312	31X	3X2	3X1	3XX		
Fair	311	222	221	22X	212	21X	2X2	2X1	2XX	
Poor	211	122	121	12X	112	111	11X	1X2	1X1	1XX
Unknown	X22	X21	X2X	X12	X11	XX2	XX1	XXX		

In Laguna San Ignacio, a total of 720 single whales and 8 females with calves were photo-identified. Of these, the body condition of 559 single whales and 8 females with calves was evaluated. For single whales 48.84% (n= 273) presented a good or normal body condition, 38.28% (n= 214) presented a fair body condition and 12.88% (n= 72) presented a poor body condition (skinny whales). When compared to the values from previous years, the "fair" and "poor" body conditions showed increases compared to 2023 and 2024, while the "good" body condition declined, indicating that overall body condition in the whales was declining during these years (Fig. 13). All 8 females with calves were evaluated; 87.5% (n= 7) presented a good body condition and 12.5% (n= 1) was in fair body condition. Similar to 2024, there were no females with calves with a poor body condition, however 2025 presented the lowest numbers of calves observed since 2005 (Fig. 14).

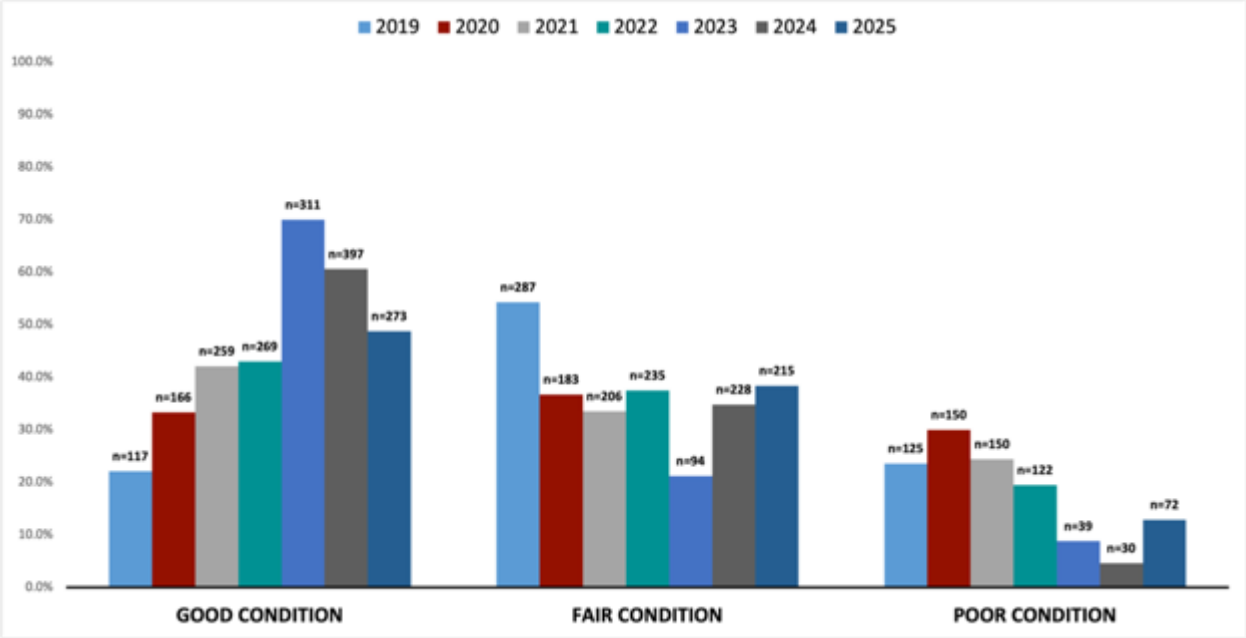

Figure 13. *Comparison of the percentages and number of single individual whales according to their body condition between 2019-2025.*

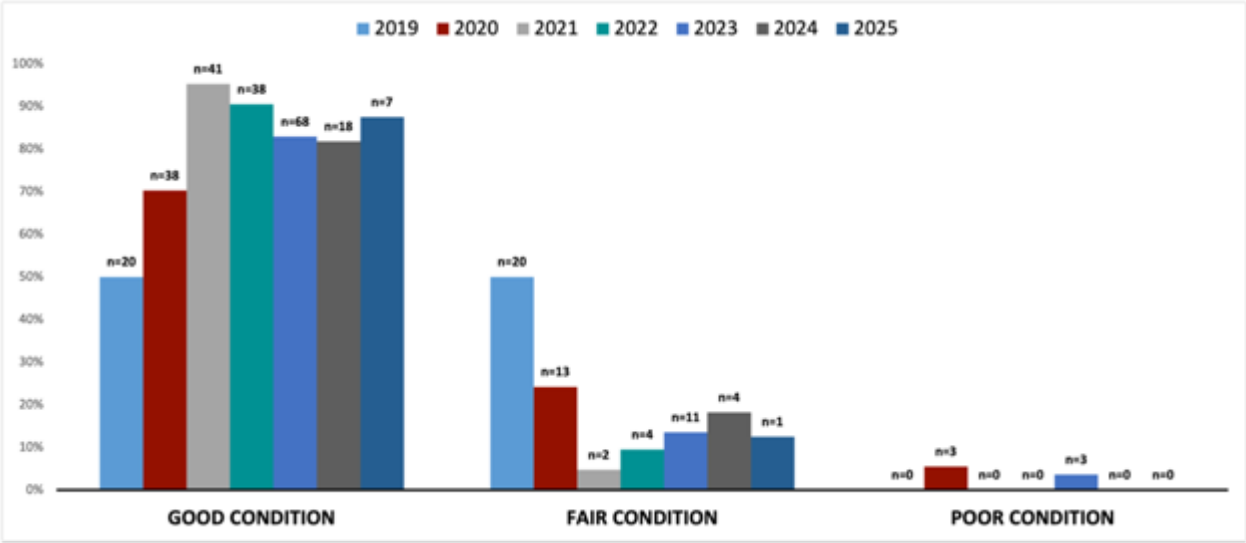

Figure 14. *Comparison of the percentages and number of females with calves according to their body condition between 2019-2025.*

In the Bahía Magdalena lagoon complex, of the 986 photo-identified individuals, body condition was evaluated for 678 whales, of which 6 were females with calves and the rest were single individuals. Out of all the single whales evaluated, 19.5% (n= 131) presented a good body condition, 44.2% (n= 297) a fair body condition and 36.3% (n= 244) a poor body condition (skinny whales). Compared to previous years, the number of skinny whales increased in 2025 as was documented in Laguna San Ignacio. Of the

females with calves evaluated, 33.3% (n= 2) exhibited a good body condition and 66.7% (n= 4) were in fair body condition. This is the first time in this area where the fair body condition is higher than the good body condition for females with calves suggesting a general reduction in their body condition.

Aerial Monitoring from UAV Drones:

Two DJI Mavic 3 Pro drones were used to collect photo-ID and body condition information of gray whales in Laguna San Ignacio. Each drone was equipped with a 20 Megapixel digital camera, a 24 mm f2.8-f11 lens with a polarizing filter, and laser range finders (LightWare SF11/C) that provided precise measurements of the altitude of the drone above water surface to measure each whale's length and girth accurately (Fig. 15). From January 17th to March 31st, 302 flights were made, for a total of 99 hours. A total of 398 individuals were identified that included 392 single whales and 6 females with calves. The estimated residence time was evaluated with the same methodology as used for the photo-identification surveys from boats; minimum residence time was estimated as the number of days between the first and the last sighting of an individual whale during the winter season (Table 5).

Table 5. Residence time of single adult whales and females with calves photographed during UA-drone surveys in Laguna San Ignacio during winter 2025.

Categories	# of whales	Average residence time (95% IC)
Females with calves	4	29 ± 10.37 (max = 59)
Singles	127	3.69 ± 0.40 (max = 56)

In addition to photographic identification, 407 images were obtained that were suitable for evaluation of body condition. Analysis of body condition from UAV-drone data is ongoing and these findings will be compared to previous years as an additional method for evaluating trends in whale body condition over time.

Figure 15. *DJI Mavic 3 Pro UAV Drone used to photo-ID individuals whales, determine body condition, and to track the CAT tagged gray whales in Laguna San Ignacio.*

CATS (Customized Animal Tracking Solutions) Digital Tagging:

From February 22nd to March 3rd GWRM scientists collaborated with Dr. William Gough and Cameron Nemeth from the Marine Mammals Research Program at the Hawaii Institute of Marine Biology, University of Hawaii, to place 11 digital CATS (Customized Animal Tracking Solutions) tags on gray whales in Laguna San Ignacio to collect bioenergetic data and video recordings of the whales' underwater behavior. These tags were placed on the whales from a 25-foot boat with the aid of an 8-meter-long pole and attached to the whale with four suction cups (Fig. 16).

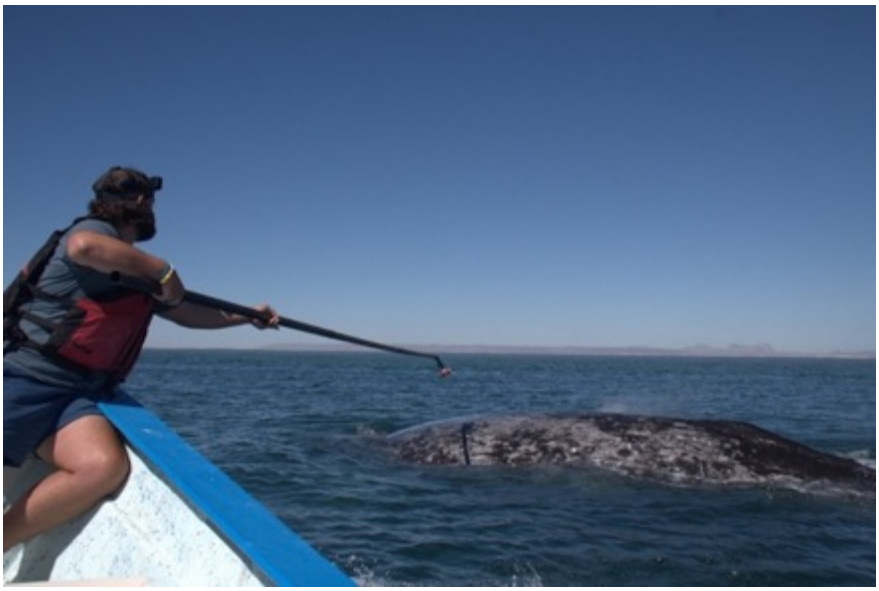

Figure 16. *Dr. William Gough placing a CATS tag on a gray whale.*

CAT tags were place on the dorsal region of both single whales and females with calves. The duration of the attachment of these devices ranged from an hour and forty-two minutes up to eleven hours and twenty-five minutes (Table 6). The information obtained from each tag included: surface-dive profile data, length of surface intervals and dives, depth, and video recordings. These data will be processed throughout the present year (Fig. 17).

Table 6. Number of Custom Animal Tracking Solutions (CATS) tags placed on gray whales during the 2025 season in Laguna San Ignacio, including the age/sex category of each individual tagged whale and the duration of the attachment of each tag on the whales.

Tag #	Category	Durantion (time)
1	Female with calf	02:31:01
2	Single	05:39:34
3	Single	02:36:18
4	Single	01:42:40
5	Single	03:19:19
6	Single	05:55:00
7	Single	03:27:18
8	Calf	11:25:35
9	Female with calf	02:45:22
10	Single	04:34:20
11	Single	02:59:47

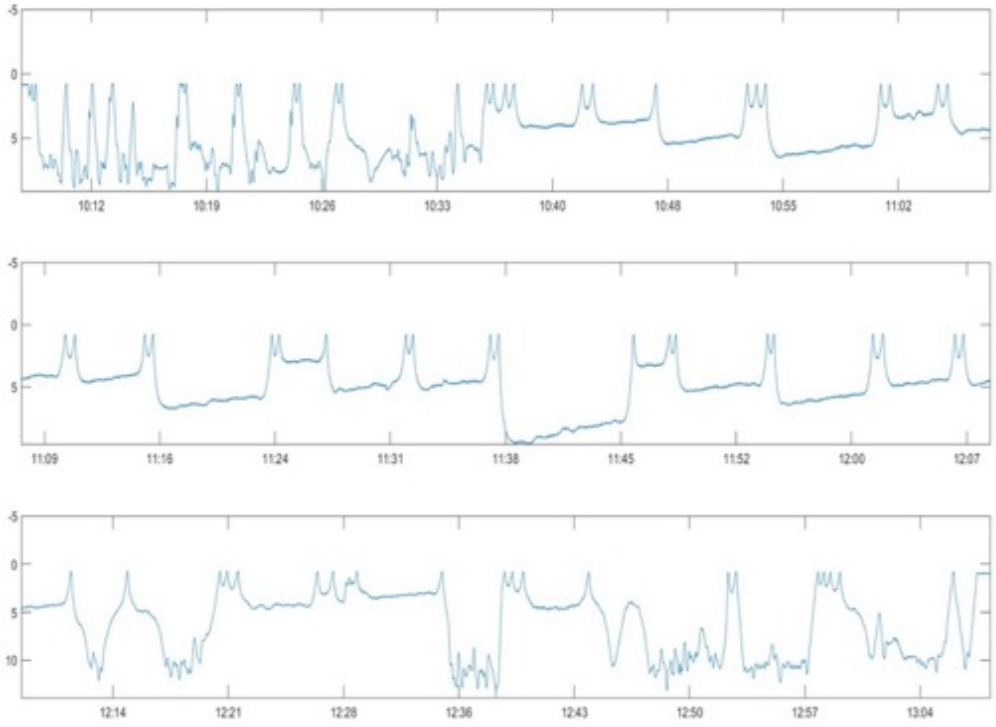

Figure 17. *Example of the surface-dive profile data obtained from a CAT digital tag attached to a gray whale in Laguna San Ignacio. Horizontal axis = GMT time; Vertical axis = Depth in meters.*

Stranded Whales and Dolphin:

During the 2025 field season a total of 26 stranded gray whales were documented in both areas: 3 in Laguna San Ignacio and 23 in Bahía Magdalena lagoon complex (Table 7). From these stranded individuals, 21 baleen samples and 2 skin and blubber samples were collected and will be analyzed to measure persistent organic pollutants, heavy metals and stable isotopes. In addition, three bottlenose dolphin strandings were

documented between both areas; 2 in the Bahía Magdalena's lagoon complex and one in Laguna San Ignacio.

Table 7. *Number and age categories of gray whales that stranded in Laguna San Ignacio and the Bahía Magdalena's lagoon complex during the 2025 winter.*

	Juveniles	Adults	Unknown	Total
Male	4	11	2	17
Females	2	6	1	9

Monitoring of the gray whales included the collection of information of all the gray whale stranding events in the Baja California Peninsula during the year. This information was obtained in collaboration with the state's stranding network, as well as the field monitoring collaboration with the enterprise Exportadora de Sal, and information from several sources (*e.g.,* personal communication, social media, news, etc.).

From December 19th 2024 to March 31st 2025, a total of 70 stranded gray whales were documented around the Baja California Peninsula (coastal Baja California, Baja California Sur, and in the Gulf of California along the Sonora and Sinaloa coasts). All of these whales were dead when examined. Out of these 70 animals, 53 were discovered on beaches and 17 were found floating in the ocean.

Most of the stranded individuals were adults (n=47), followed by the subadults (n=9) (Table 8). Due to the advanced decomposition of the stranded whales, poor body condition (skinny) was determined for only 7 individual whales.

Table 8. *Number of stranded gray whales discovered during the 2025 season, separated by age category and sex.*

Age category	**Males**	**Females**	**Unidentified**
Calf (4 to 7.9m)	2	0	0
Yearling (8 to 8.9m)	2	2	2
Subadult (9 a 11.1m in M and 11.7 m in F)	8	1	0
Adult (over 11.1 y 11.7 m)	20	19	7
Unknown	3	1	3

Other Species Monitored:

In Laguna San Ignacio the research team continues to monitor the Bottlenose Dolphin (*Tursiops truncatus*) present in the lagoon (Fig. 18). In the 2025 winter a total of 21 sightings were documented, with groups sizes ranging from 2 to 90 individuals, and an average groups size of 25 individuals. The photo-identifications obtained in 2025 will be compared with the individuals in the Bottlenose Dolphin catalogue from 2009-2024 to better understand their distribution, abundance and residency.

Figure 18. *Bottlenose dolphin (Tursiops truncatus) photo-identification in Laguna San Ignacio, BCS.*

In the Bahía Magdalena lagoon complex 37 opportunistic sightings of other cetacean species were documented. Of these 12 were Bottlenose Dolphin (*Tursiops truncatus*), 19 were Humpback whales (*Megaptera novaeangliae*), 3 were short-beaked Common Dolphin (*Delphinus delphis*), and 3 Pacific White Sided Dolphins (*Lagenorhynchus obliquidens*) (Fig. 19).

Figure 19. *Opportunistic sightings of other cetaceans in the Bahía Magdalena lagoon complex during the 2025 winter season.*

Outreach:

During the 2025 season in Laguna San Ignacio 27 environmental education presentations and lectures were made to visiting eco-tourist groups at the Kuyimá, Kuyimita Cabañas, Campo Cortez, and Baja Discovery eco-tour camps. Also, from February 19th to 23rd and from March 3rd to 7th the GWRM program hosted two groups of 22 and 36 undergraduate students enrolled in the "Marine Amniotes" course as part of the Marine Biology major at the Universidad Autónoma de Baja California Sur (UABCS) (Fig. 20).

Figure 20. *Undergraduate students groups of the "Marine Amniotes" course from the Universidad Autónoma de Baja California Sur (UABCS) hosted by the GWRM program in 2025.*

The research team working at the Bahía Magdalena's lagoon complex presented four workshops and lectures to eco-tourism service providers in in February and March 2025. The first was held in Cabo Pulmo, and the subject was "What is going on with the gray whales in Cabo Pulmo National Park?" This presentation was requested by the state's Natural Protected Areas department due to the unusual high number of gray whales in the area in 2025. The other three presentations were conducted in communities associated with the Bahía Magdalena lagoon complex, and the subject was "2025 gray whale monitoring results. Why were there skinny whales, dead whales and no calves?" The primary objective of these presentations was to inform the community about the gray whale research and monitoring program and explain what we understand about the atypical events of this season that are affecting the gray whales that winter in these areas.

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