



# Laguna San Ignacio ecosystem science program

a project of The Ocean Foundation

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## **2017 RESEARCH REPORT FOR LAGUNA SAN IGNACIO & BAHÍA MAGDALENA, BAJA CALIFORNIA SUR, MÉXICO**



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## PROGRESS ON GOALS AND OBJECTIVES

The 2017 winter at Laguna San Ignacio and Bahía Magdalena was unusually cold, rainy, and windy, conditions that significantly reduced the number of work days on the water. Despite the weather, LSIESP researchers were able to complete the annual surveys for gray whale (*Eschrichtius robustus*) abundance, photo-graphic identification of individual whales in both locations. Dedicated photographic-identification surveys of bottlenose dolphin (*Tursiops truncatus*) continued for a second winter in Laguna San Ignacio to determine the number of dolphin resident in the lagoon, and to identify those that are transient to this region. The Bahía Magdalena team surveyed gray whales in the southern aggregation areas of Lopez Mateos, Bahía Magdalena, and Bahía Almejas.

The information database developed during the past 12 winters by the Laguna San Ignacio Ecosystem Science Program (LSIESP) for Laguna San Ignacio and Bahía Magdalena is sufficient to detect, describe, and understand trends in the use of winter aggregation areas by gray whales during their winter breeding season. The 2017 winter is a good example, when the average water temperature was 2-3 degrees C° cooler than in 2016, known as the “La Niña” condition. The 2017 counts of gray whales in both areas were consistent with previous winters with cooler sea surface temperature with fewer whales utilizing the northern aggregation areas and more whale migrating further south to utilize the more southerly aggregations areas. Some whales entered the Gulf of California as far north as Bahía de La Paz, and three gray whales were reported to have crossed the Gulf of California to visit the mainland coast at Mazatlan. Such long-term databases are powerful tools for the interpretation of gray whale migrations, movements within and occupation of winter breeding and aggregation areas.



LSIESP researchers continue to strengthen their collaboration with colleagues in Mexico’s Vizcaño Biosphere Reserve (which includes Laguna San Ignacio), and assumed the

responsibility of reporting to the Reserve the weekly number of gray whales that are utilizing Laguna San Ignacio during the winter, their distribution within the lagoon, documenting any stranded whales, and incidents of whale entanglement in fishing gear.

We've been fortunate to work with many talented and motivated university students and their professors, and our sponsors have provided the means to share the findings of our research with the local community of Laguna San Ignacio, the students at schools and universities of Baja California Sur, and the employees of Eco-Tourism companies and the thousands of visitors they bring to the lagoon each winter. We are especially grateful for the generous donation that made it possible to purchase a new Honda 75 HP outboard engine and to completely refurbish our research "panga" in 2017. With essentially a new, dependable, and safe research vessel, we look forward to continuing the ecosystem science program in the years to come.

### **Leadership and Research Staff**



The 2017 research was directed by Drs. Jorge Urban R., Steven Swartz, Alejandro Gómez Gallardo, Sergio Martínez Aguilar (Laguna San Ignacio), and Hiram Rosales Nanduca (Bahía Magdalena). Collaborating researchers include: Dr. Aaron Thode and Ludovic Tenorio (Scripps Institute acoustic investigations); and Sr. Ranulfo Mayoral (sealion colonies in Laguna San Ignacio). At Laguna San Ignacio we welcomed returning researchers Eder Antonio Belmont Sánchez, Fabian Misael, Carlos Alberto López Montalvo (UABCS), and new researchers Allyson Richins and Mauriel Rodriguez from the University of New Mexico. Student researchers in Bahía Magdalena included: Rocío González Ruelas, Omar Castañeda, Miwako Yokoo Guerrero, Vinnie Caicero García, Mariana Hidalgo Reza, and Lorena Viloría Gómora (UABCS). Dr. Daniel Galindo Espinosa (UABCS) will assume the leadership of the avian research project, and a former student of the late Dr. Rafael Riosmena Rodriguez, Dr. Juan Manuel Lopez Vivas will continue the research program on marine seagrass meadows

in Laguna San Ignacio. Visiting researchers in 2017 included Dr. Fredrik Christiansen and Dr. Lars Bejder from Murdoch University, Murdoch, Western Australia, and Dr. Celine Godard-Codding, Mary Hayden, and Kia Hayes from Texas Tech University, Lubbock, Texas.

LSIESP's research was conducted under scientific research permits No. SGPA/DGVS/01822/17 and No. SGPA/DGVS/02011/17 issued by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), Subsecretaría de Gestión Para La Protección Ambiental.

## Gray Whale Abundance Monitoring



**Laguna San Ignacio:** Systematic boat surveys for gray whales have been conducted in Laguna San Ignacio during three time periods beginning in 1977 to 1982 (Jones and Swartz 1984), 2000 to 2003 (Swartz et al. 2008), and from 2006 to the present by LSIESP researchers ([www.sanignaciograywhales.org](http://www.sanignaciograywhales.org)). These surveys follow a standardized methodology that allows inter-annual comparisons, and they provide an index of the abundance of whales, their distribution, and duration of stay within the lagoons (Fig. 1).

In Laguna San Ignacio 13 surveys of gray whales were completed to monitor seasonal abundance and habitat use in 2017. Surveys began on 19 January and continued until 31 March. The overall number of gray whales and their seasonal occupation of the lagoon was slightly lower than seen in previous years, presumably due to the cooler sea temperature, when more gray whales migrate further south to find warmer water (Table 1). Higher counts of gray whales in the Bahía Magdalena complex to the south of Laguna San Ignacio support this conclusion (see below).

**Figure 1. Standardized gray whale boat survey track line in Laguna San Ignacio. Counts in the northern portion of the lagoon are obtained from a 360° scan of the area. The survey track line continues south over the deepest portions of the lagoon from the northern area to the entrance of the lagoon: these are the Upper Zone, the Middle Zone, and the Lower Zone .**

**Table 1. Survey counts of gray whales (Female-calf pairs, Singles (whales without calves), and total Adults) in Laguna San Ignacio during the 2017 winter breeding and calving season. Number of female-calf pairs equals the number of calves observed.**



| Survey | Date      | Female-calf Pairs | Singles | Total Adults |
|--------|-----------|-------------------|---------|--------------|
| 1      | 19-Jan-17 | 15                | 9       | 24           |
| 2      | 23-Jan-17 | 30                | 15      | 45           |
| 3      | 30-Jan-17 | 30                | 30      | 60           |
| 4      | 4-Feb-17  | 28                | 66      | 94           |
| 5      | 9-Feb-17  | 68                | 48      | 116          |
| 6      | 16-Feb-17 | 63                | 100     | 163          |
| 7      | 25-Feb-17 | 66                | 105     | 171          |
| 8      | 3-Mar-17  | 79                | 120     | 199          |
| 9      | 10-Mar-17 | 89                | 47      | 136          |
| 10     | 15-Mar-17 | 81                | 34      | 125          |
| 11     | 20-Mar-17 | 84                | 14      | 98           |
| 12     | 27-Mar-17 | 107               | 8       | 115          |
| 13     | 31-Mar-17 | 101               | 9       | 110          |

The counts of single adult whales (breeding males and females without calves) reached a maximum of 120 whales on 3 March (Fig. 2, Table 1). The highest count of females with calves of 107 occurred on 27 March (Fig. 3, Table 1). As in previous winters, female-calf pairs occupied all areas within the lagoon, particularly the northern upper lagoon area, but shifted their distribution to the lower lagoon nearest the entrance once the single adults had left the lagoon by mid-March.

**Figure. 2. Numbers of single whales (adult males and females without calves) counted in Laguna San Ignacio during the winter seasons: 2010-2017.**

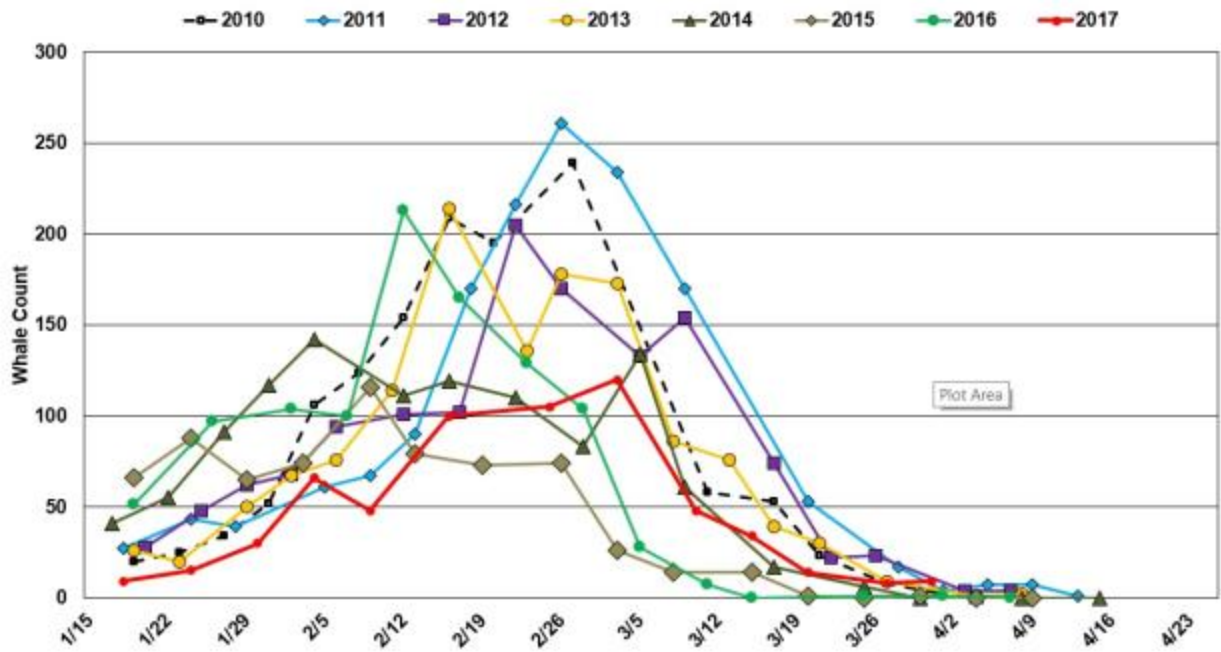
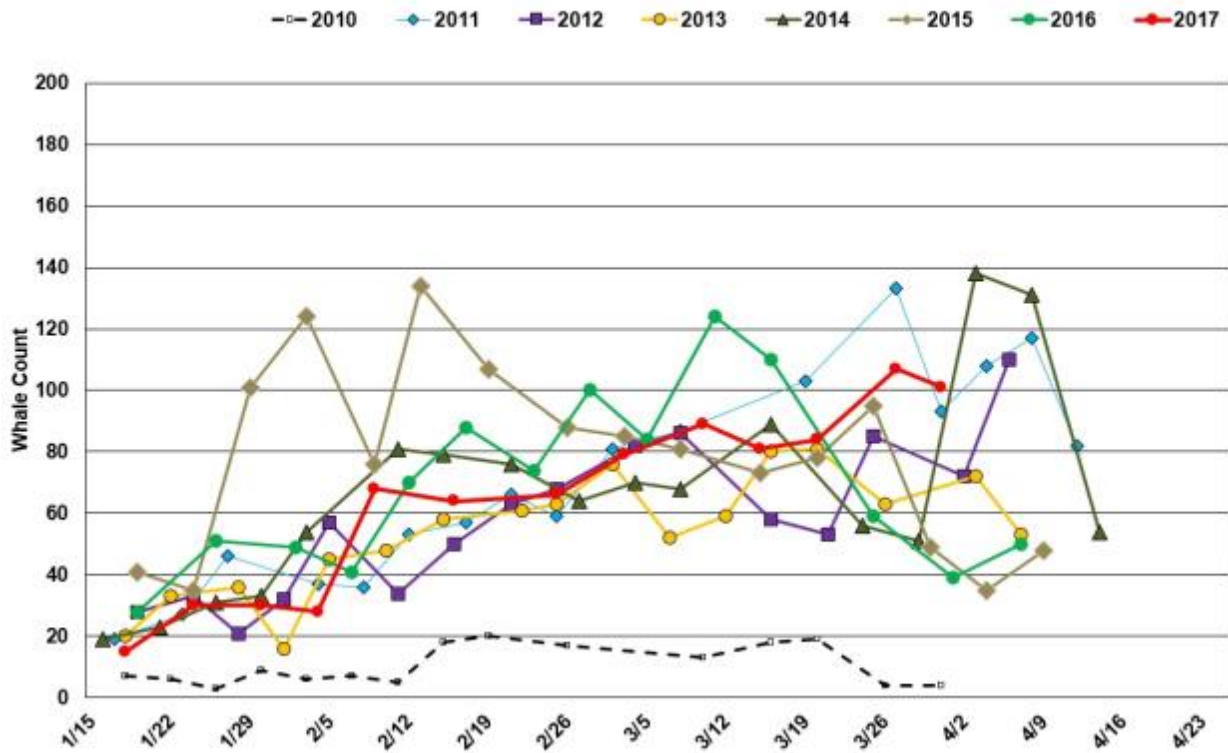


Figure. 3. Numbers of female-calf pairs (females with young of the year) counted in Laguna San Ignacio during the winter seasons: 2010-2017.



**Bahía Magdalena Lagoon Complex:** The 2017 census surveys of gray whales in the Bahía Magdalena lagoon complex were conducted in three different areas (Bahía Almejas in the south, Bahía Magdalena, and Lopez Mateos in the north) during three different time periods: 17-26 January, 8-16 February, and from 27 February to 3 March (nine surveys in all) (Table 2; Figs. 4 and 5). The highest count of gray whales was obtained on March 1 in Bahía Almejas, and was of 121 individuals (13 mother-calf pairs and 108 single whales), while the lowest count was 9 adult whales in Lopez Mateos in January, 6 singles and 3 mother-calf pairs. Mother-calf pairs were seen in all census surveys. The numbers of single animals observed in surveys of all three areas were notably higher in 2017 in comparison with 2016, when the highest count was of 14 single whales in February in Bahía Magdalena.

**Table 2. Number of Single gray whales (whales without calves), Female-calf pairs, and Adults) counted during surveys in the Bahía Magdalena complex and surrounding areas during the 2017 winter.**

| Survey Dates in 2017        | Bahía Almejas | Bahía Magdalena | Lopez Mateos | Totals |
|-----------------------------|---------------|-----------------|--------------|--------|
| <b><u>Single Whales</u></b> |               |                 |              |        |
| January 17-26               | 21            | 16              | 6            | 43     |
| February 8-16               | 66            | 69              | 18           | 153    |
| Feb 27-March 3              | 108           | 48              | 13           | 169    |

|                                 |    |   |    |    |
|---------------------------------|----|---|----|----|
| <b><u>Female-calf pairs</u></b> |    |   |    |    |
| January 17-26                   | 7  | 2 | 3  | 12 |
| February 8-16                   | 16 | 1 | 44 | 61 |
| Feb 27-March 3                  | 13 | 4 | 34 | 51 |

|                            |     |    |    |     |
|----------------------------|-----|----|----|-----|
| <b><u>Adult Whales</u></b> |     |    |    |     |
| January 17-26              | 28  | 18 | 9  | 55  |
| February 8-16              | 82  | 70 | 62 | 214 |
| Feb 27-March 3             | 121 | 52 | 47 | 220 |

Figure 4. Gray whale boat survey track lines (red lines) in the Bahía Magdalena lagoon complex in the 2017 winter: Bahía Almejas (BA), Bahía Magdalena (BM) and Lopez Mateos (LM).

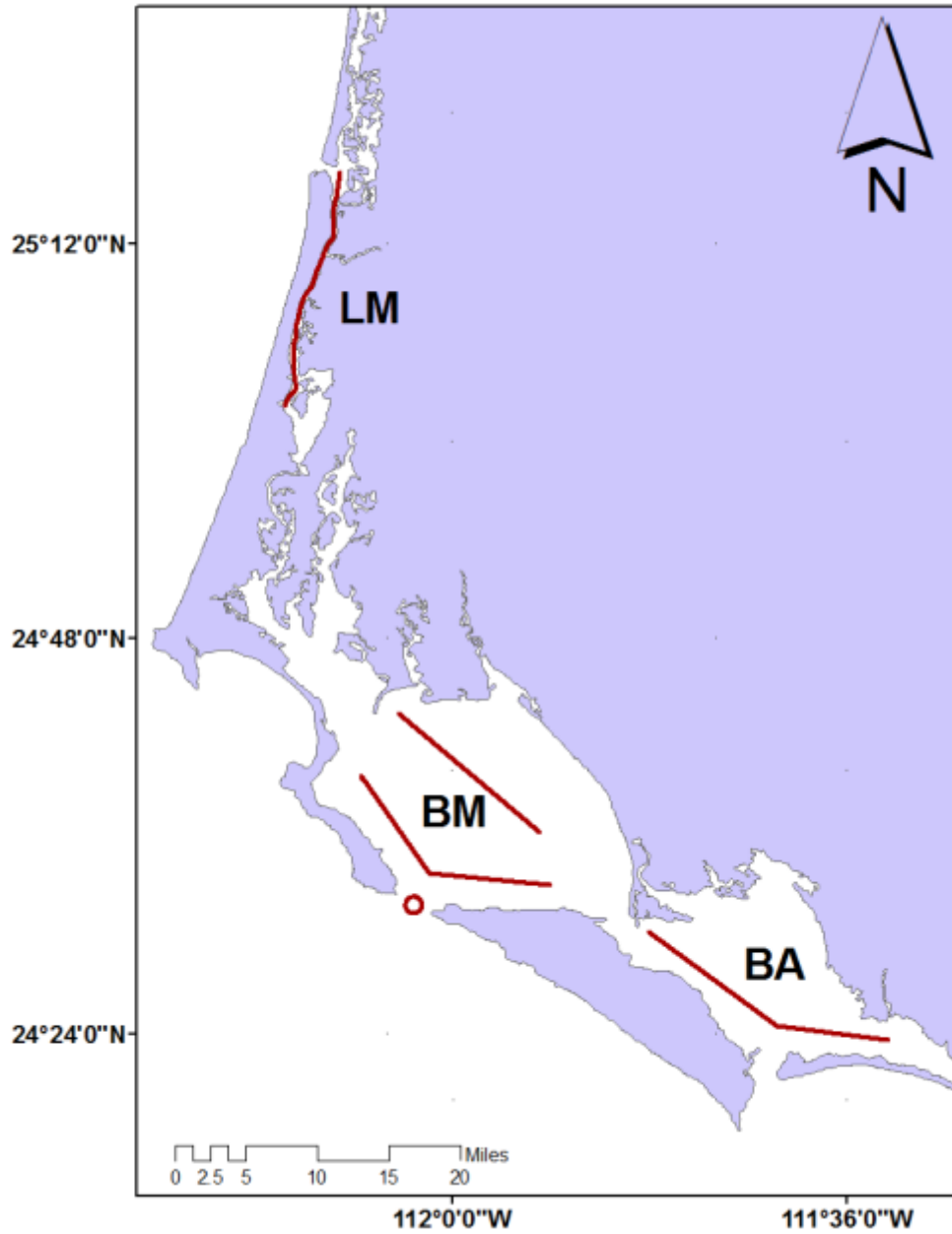
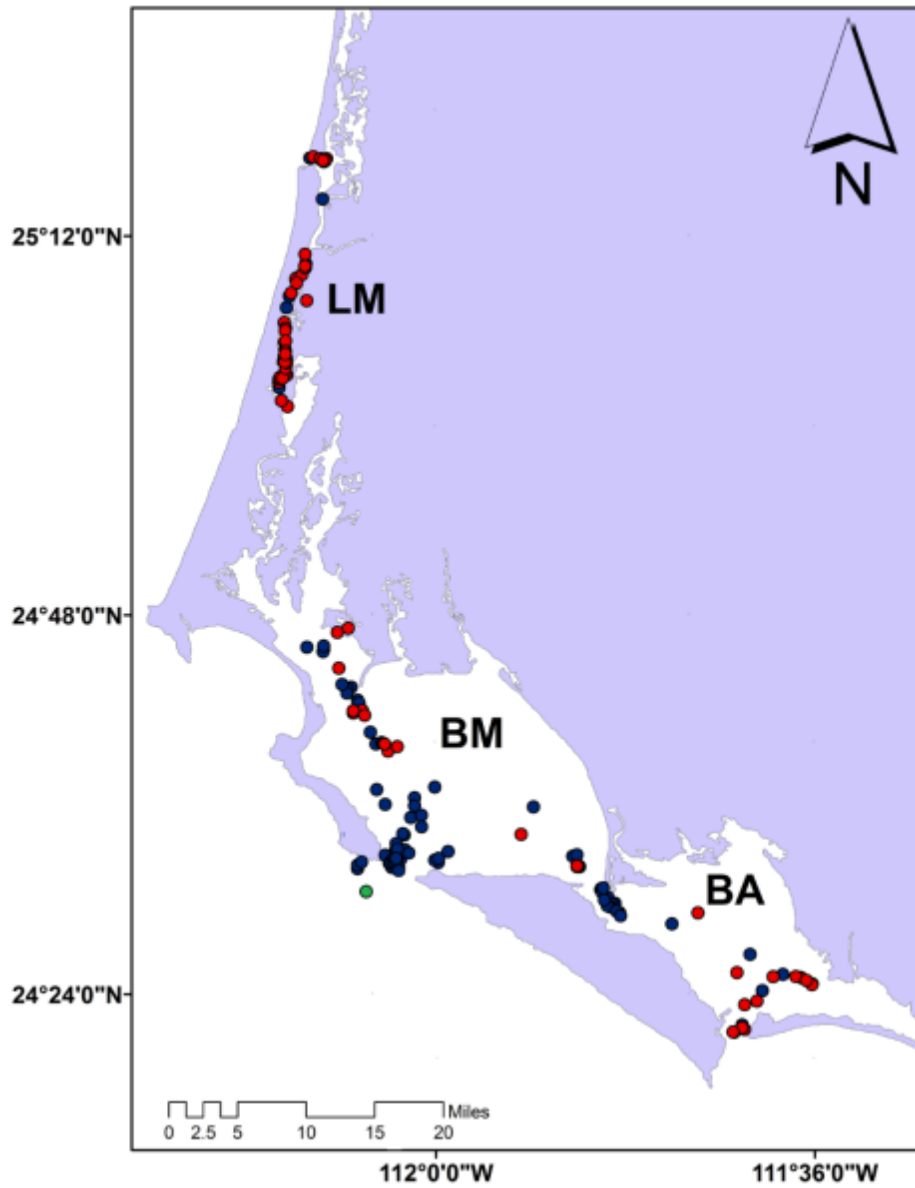




Figure 5. Whale sightings in the Bahía Magdalena lagoon complex and surrounded waters in the 2017 winter: Bahía Almejas (BA), Bahía Magdalena (BM) and Lopez Mateos (LM). blue circles = gray whale single animals; red circles = gray whale female-calf pairs; and green circles = humpback whales.



In addition, during the winter of 2017 gray whales were observed around Cabo San Lucas at the southern end of Baja California, in the Gulf of California around Bahía de La Paz, and three individuals were observed off Mazatlan on the mainland coast of Mexico (pers. Com. Jorge Urbán). Trends of gray whale abundance along the Pacific coast of Baja California are influenced by sea surface temperatures in the winter, and it is reasonable to conclude the warm El Niño conditions that prevailed during the 2016 winter contributed to a more northerly distribution and the early departure of gray whales from Laguna San Ignacio, and that the cooler La Niña conditions contributed to a more southerly distribution and the extended stay of females with calves observed in the cooler 2017 winter.

### **Photo-Identification, Photo Archiving and Management**



**Laguna San Ignacio:** Photographic identification (Photo-ID) effort in Laguna San Ignacio included 265 hours over 56 days photographing gray whales in 2017. A total of 11,893 digital images were obtained from 489 gray whale sightings that yielded 646 individual whales. These included 428 single whales that averaged 11.4 days in the lagoon (range 1 to 68 days), and 218 females with calves that averaged 32.4-days in the lagoon (range 1 to 74 days) (Table 3).

**Bahía Magdalena:** Researchers working in the Bahía Magdalena region obtained 4,119 digital images from 203 sightings of gray whales during the 2017 season. From these images, 374 individual whales were identified (319 single whales and 55 female-calf pairs), representing significantly more single whales in this region in 2017 compared to the previous winter when only 74 single whales were counted. Of these 374 whales, 13 single whales and 23 mother-calf pairs were re-sighted two or more times in Bahía Magdalena lagoon complex during the 2017 season. Final numbers including the minimum time spent in the Bahía Magdalena region (estimated as the time between the first and last time a whale was photographed) will be determined during post-field season analysis (Table 3).

Table 3. Photographic identification effort and preliminary results for Laguna San Ignacio and the Bahía Magdalena complex and surrounding areas. NA = not available; TBD = to be determined.

| AREA                                 | Laguna San Ignacio | Bahia Magdalena Complex |
|--------------------------------------|--------------------|-------------------------|
| No. Survey Days                      | 56                 | 18                      |
| No. Effort Hours                     | 265                | 181                     |
| No. Images                           | 11893              | 4119                    |
| No. Sightings                        | 646                | 203                     |
| No. Individual Whales                | 688                | 374                     |
| No. Single whales                    | 428                | 319                     |
| Single whales' mean days in area     | 11.4 (1-68)        | 6.3 (1-18)              |
| No. Female-calf pairs                | 218                | 55                      |
| Female-calf pairs' mean days in area | 32.4 (1-74)        | 19.4 (1-41)             |

**Calving Interval Estimation:** The estimated gray whale calving was  $2.11 \pm SD = 0.40$  years during the 1977-1982 time period (Jones 1990). Photographs of known breeding females obtained from 2005-2016 were used to develop an estimate of female calving-interval of  $2.46 \pm SD = 0.58$ . This sample of 307 females produced 736 calves between 2005 and 2016, and of these 20% of the calves were born between 2005 and 2010, while 80% of the calves were born between 2011 and 2016 (S. Martinez, unpublished data). This suggests that female gray whales are breeding more frequently in the years following the range-wide mortality event of 1998-2000 (LeBoeuf et al. 2000).

**Individual Age Estimation:** The minimum ages of breeding female gray whales were determined from photographs obtained during the 1977-1982 (Jones and Swartz), the 1996-2000 (Urban et al.), and the 2005-2016 (LSIESP) time periods. Seventeen females from the earliest time period (1977-1982) were recaptured in recent years, and their minimum age was estimated to range from 26 to 46 years (Martinez et al. 2016). In 2017 five of these females were recaptured (photographically matched) and their estimated minimum ages from the time of the earliest photograph to the most recent photograph were updated, confirming minimum ages ranging from 35 to 47 years, and that these females are continuing to reproduce and visit Laguna San Ignacio with their new calves each winter. These are the oldest photographic identification data for any living gray whales, and clearly demonstrate the fidelity of breeding female gray whales to Laguna San Ignacio.

HEMBRA / FEMALE

2017 sighting

SI780121-0001CCL-46  
SI8301-0001L-46

| 1978 | 1983 | 2008 | 2012 | 2013 | 2014 | 2016 | 2017 |
|------|------|------|------|------|------|------|------|
| Mc   | S    | Mc   | Mc   | S    | Mc   | Mc   | S    |

39 años/ years + (6 – 8)

45-47

08-0075-I-LSI-M  
12-0040-D-LSI-M  
13-0111-I-LSI  
14-0691-D-LSI-M  
IMG\_8523  
14/MAR/2016  
1-FEB-2017

Digital photographs of bottlenose dolphin (*Tursiops truncatus*) dorsal fins obtained in 2017 included 111 sightings and a maximum group size of 20 individuals, and an average group size of 5 individuals including female-calf pairs. This catalogue is being analyzed by UABCS researcher Fabian Misael Rodriguez do estimate the size and distribution of the bottlenose dolphin population in Laguna San Ignacio. These photographs will be compared with bottlenose dolphin photographs contained in the NOAA Tursiops Photo-ID Catalog to estimate the range of the animals observed in Laguna San Ignacio.



As in previous years, all photographs from 2017 are archived, placed into digital catalogs, compared with the catalogs from 2006-2016, and compared with photo ID catalogues of Laguna Ojo de Liebre, Bahía Magdalena, and the Western North Pacific gray whale population to determine the number and movements of gray whales that are utilizing these lagoon areas. All photo-ID catalogs are posted on the LSIESP website ([www.sanignaciograywhales.org](http://www.sanignaciograywhales.org)) and are available to researchers for review and to search for matches with photographs of gray whales from other portions of the species range (e.g., Arctic, Western Pacific, etc.).

## Whale Dis-Entanglement

**Whale Dis-Entanglement:** In 2017 two dis-entanglements of gray whale calves were attempted in Laguna San Ignacio. The first on March 4<sup>th</sup> was un-successful as the whale broke free of the dis-entanglement gear; however, this calf and its mother were re-sighted between 13 and 23 March and there was no gear on the calf. The second attempt on March 8<sup>th</sup> successfully removed approximately 26 m of float line and floats from a gray whale calf.



## Developing Projects

**Gray whale behavioral acoustics:** Ph.D. candidate Ludovic Tenorio, his major professor Dr. Aaron Thode of Scripps Institution of Oceanography, and LSIESP researchers are collaborating to develop a project to compare specific gray whale vocalizations with the whales' behavior and interactions during the winter months in Laguna San Ignacio. This project would involve simultaneous recordings of gray whale calls and observations of gray whale behavior from a tower placed along the shore of the lagoon, and it will represent the first investigation to address the context and meaning of various gray whale vocal calls.



**Estimating gray whale body condition, growth, and energetic cost of reproduction:** LSIESP is exploring methods to expand research on detecting and evaluating changes in body condition and evidence of stress and disturbance for gray whales. In 2017 the LSIESP team hosted visiting researchers Dr. Fredrik Christiansen and Dr. Lars Bejder from Murdoch University, Murdoch, Western Australia who demonstrated the utility of using drones equipped with high resolution digital video cameras to provide estimates of humpback whale (*Megaptera novaeangliae*) calf growth, the decrease in girth of lactating



females over the winter, and obtained estimates of resting, traveling, and nursing times for these whales.



The drones were used to obtain digital images of gray whale female and calf pairs in Laguna San Ignacio over a 3-day period, and clearly demonstrated that the high quality, precise digital imagery required to accurately measure the growth and girth could be obtained from boats and from shore in Laguna San Ignacio. These data provide the baseline data to establish values of normal, undisturbed behavior and growth of female gray whales and their calves, which if gathered over time could detect changes in “normal” trends that might be indications of stress, disturbance, and poor health resulting from environmental climate related changes, and exposure to human activities (e.g., eco-tourism whale watching, fishing).

LSEISP also hosted visiting researchers from Texas Tech University, Lubbock, Texas. Dr. Celine Godard-Codding and her students Mary Hayden, and Kia Hayes are exploring the use of exhaled respirations from whale “blows” to obtain samples of organic steroid hormones from the whales to evaluate gray whale health, reproductive condition, and identify biochemical indicators of stress (e.g., cortisol).

Augmenting boat based surveys for gray whale abundance, distribution and photo-identification research with new methods for gathering information on gray whale body condition, reproductive health, levels of contaminants, and indicators of stress for gray whales will provide a solid baseline for evaluating future changes, and support the conservation, and protection of the gray whales and their winter aggregation areas.



## Public and Professional Outreach and Education

Our public outreach activities in 2107 included interviews and discussion with Mexican and other international media groups that visited the lagoon. Field Chief Sergio Martinez and Co-Director Steven Swartz made 14 presentations on gray whales and the lagoon to visiting eco-tour groups including "Andiamo" Eco-Tours, Nature Adventures Inc., Natural Habitats, and the Natural Resources Defense Council.

**University Students:** LSIESP researchers hosted two classes of 30 university students from the Autonomous University of Baja California Sur (UABCS) and their instructor LSIESP's Dr. Alejandro Gómez Gallardo from 25 February to 1 March, and again from 7 to 10 March. These field trips are part of a comparative vertebrate zoology course "Marine Amniontas" offered by UABCS. Each group of students were divided into 3-teams, and each day they participated in field exercises including: obtaining photographic identification data from gray whales in Laguna San Ignacio; processing, analyzing, and comparing digital photographs of gray whales; and conducting avian surveys to estimate bird abundance and diversity. Their field trips concluded with a visit to the commercial oyster culture facility in the nearby community of El Cardón.



**2017 Community Reunion at Laguna San Ignacio:** The 11<sup>th</sup> annual "Community Reunion" and science symposium was held at the Kuyimita Eco-Tourism Campground on February 25th, 2017. Presentations included: an update on trends in gray whale abundance in LSI from 2010 to 2017; the influence of sea surface temperature on gray whale movements and distributions; the bottlenose dolphin photographic identification program and evaluation of the lagoon's dolphin population; the determination of female gray whale ages from historical photographic identification re-captures between 1977 and 2017; an update on the occupation of the lagoon's islands by California sealions (*Zalophus californianus*); and an artistic video by Sergio Martinez featuring his photographs of the lagoon and its wildlife. Approximately 100 guests attended the reunion including UABCS students, Eco-Tour Operator Staff and naturalists, local residents, and eco-tourists visiting the lagoon.

## Professional Meetings, Training and Publications

LSIESP researchers participated in a one-day media event sponsored by WWF-Mexico and Telcel Alliance for approximately 25 radio, newspaper, and television reporters. LSIESP staff and researchers were interviewed and photographed throughout the day, and demonstrations of our photographic identification program were made in the “Pachico Mayoral” field station and laboratory. LSIESP researchers presented papers documenting the findings of gray whale research for the May 2017 meeting of the Scientific Committee of the International Whaling Commission in Bled, Slovenia.



## LSIESP Supported Students and Graduates

The following LSIESP students and researchers completed or will complete their academic degrees in 2016-2017:

**Fabian M. Rodríguez González** (2017). Undergraduate thesis on Turisops “Patrones de residencia de los tursiones Trusiops truncates en la Laguna San Ignacio, B.C.S., México.” UABCS.

**Liliana Paredes Lozano**. 2017. Análisis integral del uso de la ballena gris confines tirísticos en Puerto Adolfo López Mateos, B.C.S., México. CIMACO-UABCS.

**Daniele Coppola**. 2015. Indagini ecotossicologiche nelle subpopolazioni orientali del Nord Pacifico de megattera (*Megaptera novaeangliae*) a di belena grigia (*Eschrichtius robustus*): valutazione de contaminanti organici persistenti e dek citocroo P450. Università de Siena, Italy.

## REFERENCES CITED

- Jones, M.L. and Swartz, S.L. 1984. Demography and phenology of gray whales and evaluation of whale-watching activities in Laguna San Ignacio, Baja California Sur, Mexico. In: Jones, M.L., Swartz, S.L. and Leatherwood, S. (eds.) *The gray whale, Eschrichtius robustus*. Academic Press, Inc., Orlando, Florida, pp. 309-374
- Jones, M.L. 1990. The reproductive cycle in gray whales based on photographic resightings of females on the breeding grounds from 1977-82. Rep. Intl. Whal. Commn. (Special Issue 12) SC/A88/ID 38. 6 pp.
- LeBoeuf, B.J., Pérez-Cortés, M., Urbán R., J., Mate, B.R., and Ollervides U., F. 2000. High gray whale mortality and low recruitment in 1999: potential causes and implications. J. Cetacean Res. Manage. 2(2):85-99.
- Salvadeo, C.J., Gómez-Gallardo, González S. A., Nájera-Cabellero, M., Urbán , J.R., and Lluch-Belda, D. 2015. The effect of climate variability on gray whales (*Eschrichtius robustus*) within their wintering areas. PLoS ONE, 10(8); e.0134655, doi;10.1371/journal.pone0134655. 17 pp.
- Swartz, S.L., Urbán J., Gómez-Gallardo, González S., A., Troyo, B., Nájera, M., and Rojas-Bracho, L. 2008. Preliminary Comparison of winter counts of gray whales in Laguna San Ignacio, B.C.S., Mexico: 1978 to 2008. Rep. Intl. Whal. Comn. SC/60/BRG30, 19 pp.
- Swartz, S.L. 1986. Gray whale migratory, social and breeding behavior. pp. 207-229 In: Donovan, G.P. (ed.) Cetacean Behavior Relative to Management Issues. Rep. Int. Whal. Commn., Special Issue 8, Cambridge,U.K.
- Urbán , J.R., Gómez-Gallardo A., Flores de Sahagún, V., Palmeros M. R. and Ludwig, S. 1999. Changes in the abundance and distribution of gray whales at Laguna San Ignacio, México during the 1997-98 El Niño and the 1998-99 La Niña. SC/51/AS22, 8pp.
- Urbán, J. R., Swartz, S.L., Gómez-Gallardo U., A., and Rojas-Bracho, L. 2011. Report of the gray whales censuses in San Ignacio and Ojo de Liebre breeding lagoons, Mexico. Rep. Intl. Whaling Commission, Scientific Committee, SC/63/BRG15.
- Urbán J.R., Swartz, S., A. Gómez-Gallardo U, S. Martínez A., and H. Rosales N. 2015. Report of the 2015 gray whale research in Laguna San Ignacio and Bahía Magdalena, Mexico. Rep. Intl. Whal. Commn. SC/66a/BRG21, 12 pp.
- Urbán J.R., Swartz, S., A. Gómez-Gallardo U, S. Martínez A., and H. Rosales N. 2016. 2016 gray whale research in Laguna San Ignacio and Bahía Magdalena, Mexico. Rep. Intl. Whal. Commn. SC/67a/BRG19, 15 pp.