Laguna San Ignacio
ecosystem science program
a project of The Ocean Foundation

2013 FIELD RESEARCH REPORT

Key Findings in 2013 Include:
Gray Whale Abundance Increases for Third Year
Eel Grass and other Algae Declining
Female-Calf Pairs Move between LSI and Bahia Magdalena
5-Year Acoustic Baseline Report in Preparation

The 2013 winter season marked the eighth winter field season and year for the Laguna San Ignacio Ecosystem Science Program (LSIESP). Since its beginning in 2006, LSIESP continues to provide information on the biological status of the lagoon and its wildlife, especially the gray whales, to the local community, eco-tourism operators, and government officials. We have been fortunate to work with many university student researchers and their professors, many of which have gone on to pursue additional academic training and to careers in marine wildlife science, management, and conservation.

Gray Whale Monitoring and Assessment:

Paulette Durazo R., Jessica Robles M., Steven Swartz, Kerri Seger, Aaron Thode, and Constanza Torres V.

The 2013 gray whale research Team in Laguna San Ignacio was led by Steven Swartz, and Jorge Urbán from the Universidad Autónoma de Baja California Sur, La Paz, B.C.S. Mexico (UABCS), with Alejandro Gómez Gallardo U. (UABCS) as Research Coordinator, and Sergio Martinez A. (UABCS) as the senior field chief scientist. The Team included 5 university researchers: Sergio Martínez A., Jessica Robles M., and Carlos A. López M (UABCS), Constanza Torres V. (UNAM), and Paulette Duranzo R. (CECSE). The 2013 Bahía Magdalena gray whale photographic identification Team was led by Hiram Rosales Nanduca, and included university researchers Erandi Calderón-Yañéz, Lilia Alonso-Lozano, and Adriana del Aguila Vázquez all from UABCS. The Acoustic Research and Monitoring Team was let by Aaron Thode from Scripps Institution of Oceanography, and included Kerri Seger (Scripps Institution of Oceanography), and Melania Guerrera (Cornell University).

Gray whale abundance monitoring

Seventeen bi-weekly census surveys of gray whales were conducted in the lagoon to monitor abundance, distribution, habitat use. Surveys began on January 19th 2013 and continued until April 8, 2013. The overall number of gray whales was similar to that seen in 2011 and 2012, and greater numbers of gray whale were observed in the lagoon compared to the low numbers observed between 2007 to 2010. The greatest number of adult whales was counted on 16 February 2013 (214 adults and 58 mother-calf pairs) (Fig. 1).

For the third consecutive winter since 2010, we observed a late season increase in the number of female-calf pairs entering Laguna San Ignacio. This was again a significant increase compared to the low numbers observed1996-2010. Female-calf counts reached a high count of 86 pairs on 2 March and after that averaged 66-pairs until the last survey on 8 April (Fig. 2). This late season increase and photo-id records indicate that mother-calf pairs are entering Laguna San Ignacio from calving areas in Bahia Magdalena to the south, and perhaps from other winter aggregation areas as well.

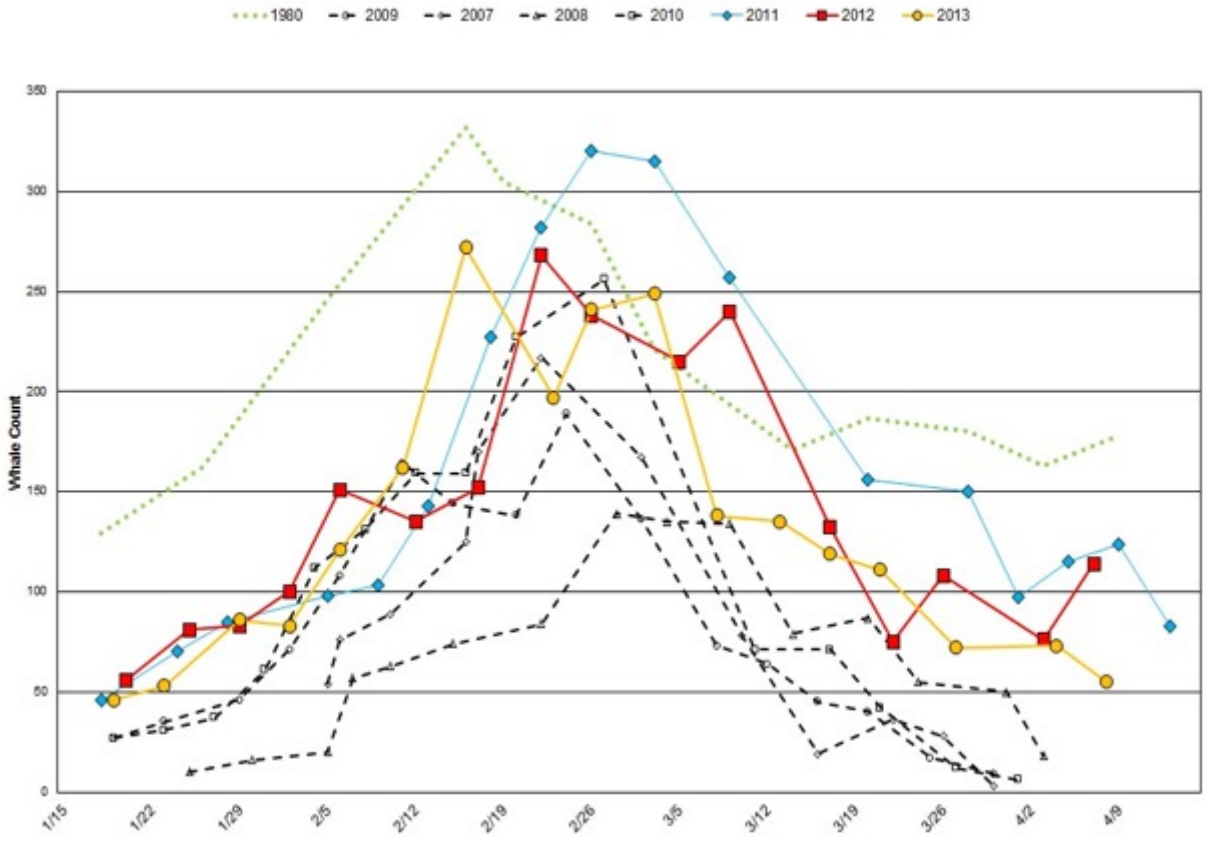


Figure 1. Adult gray whales count inside Laguna San Ignacio from January 19 to April 8, 2013. Yellow = 2013 counts; Red = 2-12; Blue = 2011; Black broken lines = 2007-2010. Dotted green line = 1980 counts for comparison.

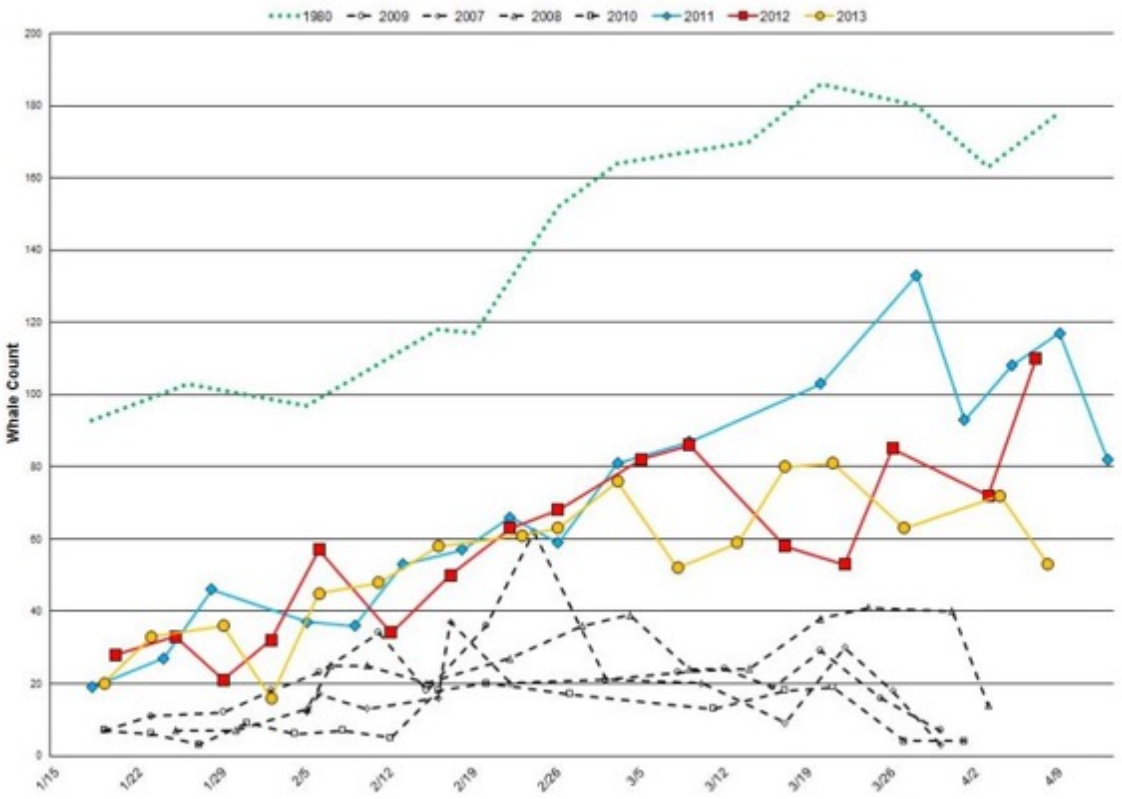


Figure 2. Counts of female-calf pairs counted inside Laguna San Ignacio from January 19 to April 8, 2013. Yellow = 2013 counts; Red = 2-12; Blue = 2011; Black broken lines = 2007-2010. Dotted green line = 1980 counts for comparison.

Single breeding whales (adult females without calves and adult males) arrived at the lagoon during January and their counts reached their highest values during the last two weeks of February in 2013, which was similar to the previous years from 2007 to 2012 (Fig. 3). Counts of single whales reached a maximum of 214 whales on 18 February. Counts of single whales declined throughout March and by early April there were very few singles whales detected in the surveys.

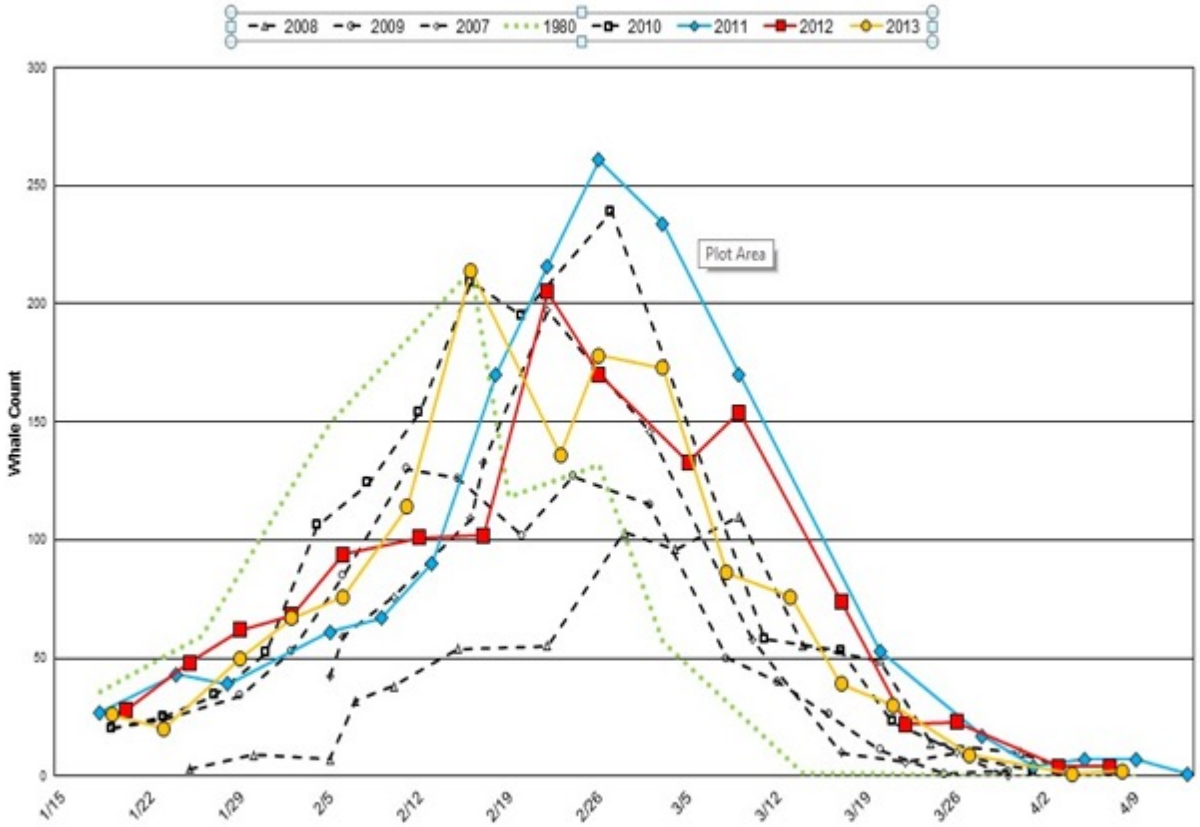


Figure 3. Counts of single whales (non-female-calves) counted inside Laguna San Ignacio from January 19 to April 8, 2013. Yellow = 2013 counts; Red = 2-12; Blue = 2011; Black broken lines = 2007-2010. Dotted green line = 1980 counts for comparison.

Gray whales utilized the entire lagoon, but were distributed in a gradient with the highest densities nearest the entrance to the ocean, and the whale density becoming less in the more northerly areas of the lagoon. This distribution resembled the distribution patterns observed during the 1978-1982 time period. It is not clear why more gray whales are now utilizing more of Laguna San Ignacio than during the previous decade. Researchers also noted that the condition of the newborn calves looked very "fat", with few "skinny" whales observed in 2013, suggesting that gray whales are finding sufficient food during the summer months, and continuing to recover from the nutritional stress that was observed following the range-wide die-off the 1998-2000.

Trends in gray whale survey counts from 2007 to 2013 in Laguna San Ignacio were compared with survey counts for the same time period in Laguna Ojo De Liebre. The dates and magnitude of the highest gray whale counts in both Laguna San Ignacio and Laguna Ojo de Liebre were compared to evaluate the numbers of whales utilizing each lagoon, and seasonal timing of the occupation of both lagoons by gray whales. The 2013 survey counts for Laguna Ojo de Liebre did not suggest a late season increase in female-calf pairs as was documented in Laguna San

Ignacio. This suggests that once their calves are of sufficient age, females and their calves leave Laguna Ojo de Liebre and begin their northward spring migration, or as the photographic-identification data suggests (see below), they visit Laguna San Ignacio or other winter aggregation areas in Baja California before continuing with their northward spring migration.

Photo-Identification Research

Constanza Torres and Paulette Duranzo taking digital photographs of individual gray whales.

Naturally occurring markings on the skin of gray whales and photographic identification and analysis methods are used to document individual whales that visited Laguna San Ignacio and Bahia Magdalena, and that traveled between their breeding and calving lagoons and aggregation areas along the west coast of Baja California Peninsula, in Mexico.

Approximate 10,000 digital images of individual gray whales that visited Laguna San Ignacio were obtained during the 2013 season, representing approximately 375 single whales and 175 mother-calf pairs (Final numbers to be determined during post-field season analysis). An additional 3,512 digital images of individual gray whales were obtained from Bahia Magdalena during the 2013 season, representing 287 single whales and 45 mother-calf pairs. All of the 2013 photographs were archived in a digital catalogs of photographs, compared with the catalogs from 2006-2012, and posted on the LSIESP website to allow other researchers to review and search for matches with photographs of gray whales from other portions of the species range (e.g., Arctic, Western Pacific, etc.).

Analysis and comparison of 1,942 individual whales photographed during the 2012 and 2013 winters revealed that 56 photographic matches or recaptures during the same year were found between the three primary winter aggregation areas of Bahía Magdalena, Laguna San Ignacio and Laguna Ojo de Liebre (also known as Scammon's lagoon). These recaptures included 40 female-calf pairs and 16 single whales (i.e., adult whales without calves). Of these recaptures, 80.4% were between Bahia Magdalena and Laguna San Ignacio, 16% were between Laguna Ojo

de Liebre and Laguna San Ignacio, and 3.6% were between Bahía Magdalena and Laguna Ojo de Liebre.

LSIESP researchers participate in, and contribute their gray whale photographs from Baja California to, the "Pacific Wide Study on Population Structure and Movement Patterns of North Pacific Gray Whales" initiated and coordinated by the International Whaling Commission. The 2013 analysis of gray whale photographs from across the North Pacific included comparison of 382 identified gray whales obtained from summer feeding grounds off Russia (232 from Sakhalin Island 1994-2012; and 150 from Kamchatka Peninsula 2004-2011). These were compared with 4,352 photo-identified individuals from winter calving lagoons off the Baja California Peninsula, Mexico between 2006 and 2012.

The Sakhalin, Kamchatka and Mexico catalogs comparison resulted in a total of 9 confirmed matches of individuals, including 1 male, three females and five of unknown sex. Two whales were observed in the three places, three in Sakhalin and Mexico and four in Kamchatka and Mexico. Eight of the 9 whales in Mexico were sighted in Laguna San Ignacio and one in Bahía Magdalena. Seven of the 9 whales were photographed in Mexico only in one year, one in two years and one in three years. Five whales were sighted in consecutive seasons. These results offer the first complete migratory information for some individual gray whales that summer off Russia and provide new information important to the evolving understanding of gray whale population structure in the North Pacific.

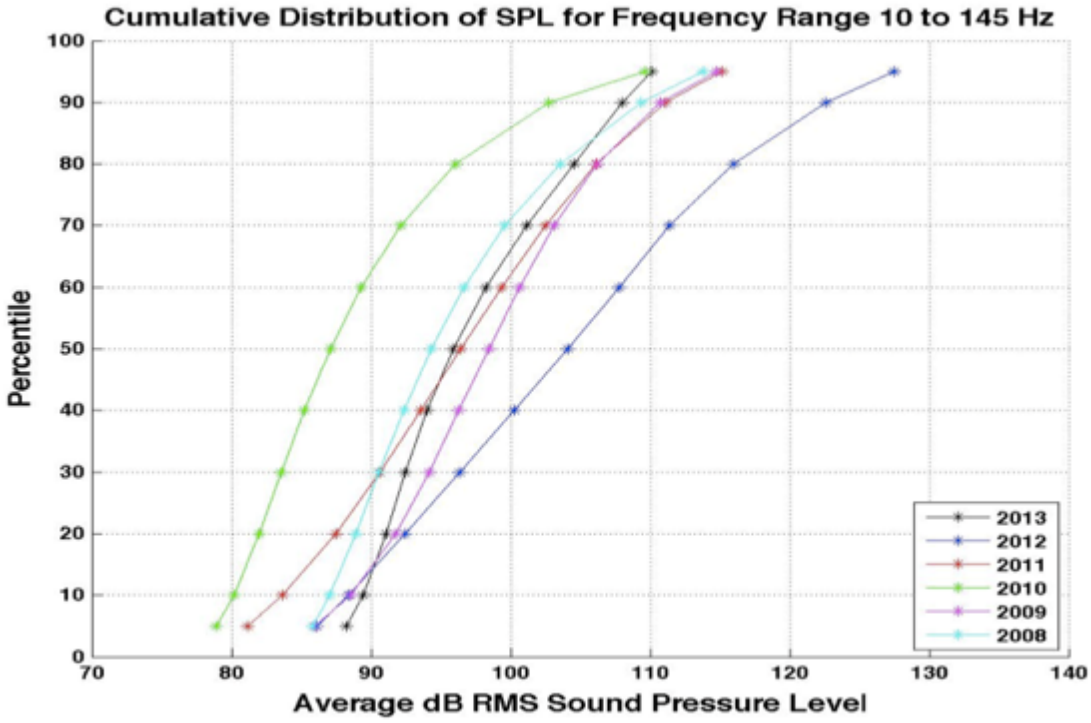
Acoustic Research:

Underwater noise in Laguna San Ignacio has many sources including natural sounds from wind, rain, the tides, biological sounds from invertebrates, fish and whales, and human sounds from boats that operate in the lagoon. Overall, the "acoustic environment" in the lagoon can be very noisy depending on the contribution of all of the sources of noise. The LSIESP Acoustic investigation led by Dr. Aaron Thode of Scripps Institution of Oceanography (SIO) has recorded underwater noise in the lagoon since 2008.

Dr. Thode and his researchers are analyzing these recordings and are producing sound "profiles" or graphs that show the frequencies of the noise, their intensity, and how these vary from year to year. This analysis is ongoing, but examples of the sound analyses are provided in their field report for 2013.

In 2013 digital recording arrays were placed at three locations within the lagoon to gather baseline ambient noise measurements: one within the lower lagoon whale-watching zone, the second in a deep channel in the interior "closed" zone (no whale-watching), and a third outside the lagoon in the southern entry channel where whales aggregate before entering the lagoon. Recordings documented gray whale calls and naturally occurring biological and non-biological noise (e.g., tides, snapping shrimp, & fish), and noise resulting from the operation of whale-watching and fishing boats in the lagoon.

SIO graduate student Kerri Seger conducted the preliminary analysis of the data from the Punta Piedra recordings to investigate the overall noise budget across four different frequency bands. The bands were purposefully selected to approximately match various known sound sources. They include 5-25 Hz (related to tidal noise and fish sounds), 10-145 Hz (mainly dominated by gray whale calls), 200-1000 Hz (due to boat engines and some gray whale calls), and 1000-3125 Hz (caused by near-by boat engines, wind, and snapping shrimp). A comparative analysis was performed between this year's noise budget and past years (2008-2012) at both the Punta Piedra location and at another location close to the Kuyima Ecoturismo campground on the southern shore of the lagoon's interior.



Ecological Function of Seagrasses in Laguna San Ignacio:

As primary producers, these sea-grass meadows provide food for a wide range of invertebrates and vertebrates (e.g., sea turtles, Brant geese) in the lagoon. These LSIESP researchers began monitoring the sea-grass meadows in Laguna San Ignacio in 2006 and have continued to build a database on the status of sea-grass in this lagoon and for comparison with sea-grass in other coastal lagoon along the Pacific coast of Baja California.

Nestor Ruíz Robinson Tania Cecilia Cita L.

Rafael Riosmena-Rodríguez, Ph.D. of the Programa de Investigación en Botánica Marina at UABCS and his students, Tania Cecilia Cita L. and Nestor Ruíz Robinson, visited the lagoon in the fall of 2012 and again during the 2013 winter to obtain samples of algae and sea grass to monitor and evaluate the decline of eel grass meadows (*Zostera marina)* that has occurred in the lagoon in the past decade. At this time it is uncertain what factors are contributing to the eel grass decline, but opportunistic brown algae (*Gracilaria vermicullophyla*) and another unknown and possibly invasive species are displacing eel grass in areas where it used to thrive.

Dr. Rafael Riosmena-Rodríguez

Eel grass and the related invertebrate fauna associated with the sea-grass meadows provide food for a wide range of invertebrates and vertebrates (e.g., sea turtles, Brant geese, marine fish, etc.) in the lagoon, and the loss of eel grass is expected to change the tropic structure of the lagoon significantly.

Local School Outreach and Classroom Presentations:

LSIESP researchers visit the primary and secondary school classes in the Ejido Luis Echeverria each year to talk with the students and to teach them about Laguna San Ignacio's marine life, marine mammals, and the importance of conserving the lagoon habitat for gray whales and other wildlife. This year another group of students and teachers from Punta Abreojos visited the lagoon in 2013 where they toured the LSIESP Field laboratory and chartered whale-watching pangas to see the whales in the lagoon. Project director Steven Swartz presented an overview of the lagoon research program and the natural history of the gray whales to a group of directors of the copper mining companies from the town of Santa Rosalia on the Gulf of California that visited the lagoon to see and learn about the whales.

For the third winter LSIESP researchers collaborated with Ecology Project International (EPI) in April 2013 to host high school groups from the town of San Ignacio; the students spent 3-days at the lagoon learning to conduct photographic-identification studies on gray whales and methods for analysis of these data. Each group then went out on the water to conduct their own photographic-identification surveys and observe the gray whales. The students then returned to the LSIESP field laboratory to conduct analyses of their photographs, and to write their reports on the number of photographic matches they obtained. On the final day of their visit the students composed posters and made presentations on the findings of their photographic identification research projects.

High School students from San Ignacio participated in EPI-LSIESP photo-ID project

2013 Community Reunion at Laguna San Ignacio:

On March 1st LSIESP researchers hosted the 7th Annual Community Reunion at the Kuyimeta Campground Palapa to present brief talks on the research underway at the lagoon and to discuss local concerns and issues relating to the conservation of the lagoon. . These meetings provide an opportunity for the local residents of Laguna San Ignacio to meet and discuss with the scientists the research that is conduced each winter in the lagoon. LSIESP researchers make presentations on their research and discuss new information about gray whales and other topics related to the conservation of the lagoon ecosystem.

Sergio Martinez discusses the development of a photo-identification catalog for Bottlenose dolphins that reside in Laguna San Ignacio at the 2013 Community Reunion.

This year's science presentations included: "Abundance Trends of Gray Whales in Laguna San Ignacio" by Steven Swartz; "Preliminary Analysis of Bottlenose Dolphin Photo-Identification Data" by Sergio Martinez; "Sealion Monitoring on Isla Pelicano: Third Year Observations" by Ranulfo Mayoral; "Gray Whale Calving Interval for 2005-20011" by Jessica Robles M., and "Community Development Projects in Ejido Luis Echeverria Alvarez" by Raul Lopez and other community leaders.

Approximately 45 people attended the Reunion including members of the Eco-Tourism Operator's Association, Panga Operators, local fishermen, Philanthropiece, Pronatura-Noroeste, local school teachers, students, and interested public.

Jessica Robles discusses lagoon ecology with students and teachers from Punta Abreojos.

Media Outreach:

Several different television and news groups visited Laguna San Ignacio to see the whales, and to interview the local fishermen, the Eco-Tour operators, and LSIESP researchers.

LSIESP researchers met in 2013 with World Wildife Fund-MX & the Telcel Alliance managers and directors that visited the lagoon to produce a video for television in Mexico. Additional public outreach included interviews and discussion with Mexican and other international media groups including: KNSJ (KNSJ.org) San Diego Community Radio, a newly launched activist public radio station that features environmental issues. LSIESP researchers made presentations on the lagoon's ecosystem and and gray whales to 7 eco-tour groups visiting the lagoon, including a school group from Punta Abrejos, and a group of managers from the copper mining company in Santa Rosalia

Link to World Wildlife Fund video: http://lsiecosystem.org/research/our-researchers/

Link to ABC Nightline video: http://abcnews.go.com/blogs/technology/2012/05/gray-whales-protected-off-mexico-may-face-new-threat-in-arctic

Professional meetings and Publications:

Academic presentations on gray whales were made by LSIESP researchers at the 2012 Mexican Marine Mammal Society (SOMEMMA) meeting (4), and three papers on gray whales and Western Gray Whales in Baja California were submitted to the International Whaling Commission's Scientific Committee meeting in May of 2013. LSIESP researchers co-authored a 2013 publication with Russian, NOAA NMFS, and Cascadia researchers on the matching of photographs of Western gray whales with Eastern North Pacific gray whales photographed in Laguna San Ignacio, that documents the migrations of endangered Western gray whales to North American for the winter breeding season, and raises the question that they may inter-breed with Eastern gray whales

LSIESP researchers authored or co-authored the following scientific publications for international scientific meetings and academic journals. These include:

Weller, D.W., Klimek, A., Bradford, A.L., Calambokidis, J., Lang, A.R.,Gisborne, B., Burdin, A.M., Szaniszlo, W., Urbán, J.R., Gómez-Gallardo, A.U., Swartz, S., Brownell,Jr., R.L. 2012. Movements of gray whales between the western and eastern North Pacific. Endangered Species Research.

Urbán R.J., Weller, D., Tyurneva, O., Swartz, S.,Bradford, A., Yakovlev, A., Sychenko, A., Rosales N., H., Martínez S. A., Burdin, A., Gómez-Gallardo U.A. 2013. Report on the photographic comparison of the Sakhalin Island and Kamchatka Peninsula with the Mexican gray whales catalogues. Report. International Whaling Commission, Scientific Committee, SC/65/BRG4.

Martinez, S., Rosales, N.H., Swartz, S.L., Gómez-Gallardo U. A., Urbán, R.J. 2013. Movements of gray whales among the calving and breeding lagoons in the Baja California península. Report. International Whaling Commission, Scientific Committee, SC/65/BRG5.

Swartz, S.L., Urbán R. J., Gómez-Gallardo U.A., Martínez, S., Robles M.J. Gonzàles López, I., and Rojas-Bracho, L.. 2013. Number of gray whales (*Eschrichtius robustus*) utilizing Laguna San Ignacio and Laguna Ojo de Liebre, Baja California Sur, Mexico, during the winter breeding seasons: 2007-2013. Report. International Whaling Commission, Scientific Committee, SC/65/BRG 6.

LSIESP Supported Students and Graduates:

Jessica Robles M. (UABCS) completed her analysis of female gray whale calving intervals by analyzing the photographic data catalogs from 2005-2011 for her thesis at UABCS; she will now undertake a re-analysis incorporating 2012 and 2013 mother-calf photo-id data. Sergio Martinez completed his Master's Thesis at UABCS during summer of 2011 and is now enrolled in the

Ph.D. program at UABCS. Mauricio Rodríguez Álvarez completed his thesis research on the analysis of changes in the distribution of gray whales for three time periods: 1978-82, 1996-2000 and 2007-2011. Alejandro Gomez-Gallardo U. completed his Ph.D. at UABCS and is now the Director of the Marine Science Program at the university. For the second winter UNAM Ph.D. graduate Hiram Rosales Nanduca lead the research team conducting a photo-id based population assessment of gray whales in Bahia Magdalena, a gray whale aggregation area south of Laguna San Ignacio. Participating in the LSIESP were two new student researchers: Pauleta Durazo Rodríguez and Constanza Torres Valdez.

Learn more about the Laguna San Ignacio Ecosystem Science Program by visiting our website at www.lsiecosystem.org