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

2012 FIELD RESEARCH REPORT

Gray Whale Abundance Increases for Second Year

The 2012 Laguna San Ignacio Ecosystem Science Program's (LSIESP) winter field research began on 18th of January and continued until the 15th of April. For the second consecutive winter the winter abundance of gray whales increased in Laguna San Ignacio, with female-calf pairs reaching their highest numbers at the end of the season in April. Overall the whales appeared to be healthy with few sightings of skinny whales. Photographs of individuals and mother-calf pairs were obtained in Laguna San Ignacio and from the Bahia Magdalena region for identification of whales that may visit both winter aggregation areas during the same year.

Gray Whale Monitoring and Assessment:

The 2012 gray whale research team at Laguna San Ignacio included Sergio Martínez A., Diana López A., Tabata Olavarrieta G., Laura Rodriguez J., Mauricio Rodríguez A., from the Autonomous University of Baja California Sur (UABCS) in La Paz, B.C.S., Mexico, and LSIESP co-director Dr. Steven Swartz. Also assisting the team were Susana Tobar H., Flor Vázquez, Claudia Díaz, and Erandi Calderón Y. A second

team of researchers traveled to Bahia Magdalena to obtain photographic identification information on the whales in this aggregation area located south of Laguna San Ignacio. The Bahia Magdalena team was Dr. Hiram Rosales Nanduca, and included Jessica Robles M., and Lilia Alonso L

The number of gray whales visiting Laguna San Ignacio increased for a second year. The abundance and distribution of gray whales in Laguna San Ignacio was monitored during census surveys conducted every four to five days. These surveys began on January 20th 2012 and continued until April 15, 2012. The overall number of gray whales utilizing the lagoon was greater this winter than was observed between 2007 and 2010, but the whale abundance was similar to that seen in 2011. The greatest number of adult whales was counted on February 22nd in included 205 single adults and 63 female-calf pairs (Fig. 1).

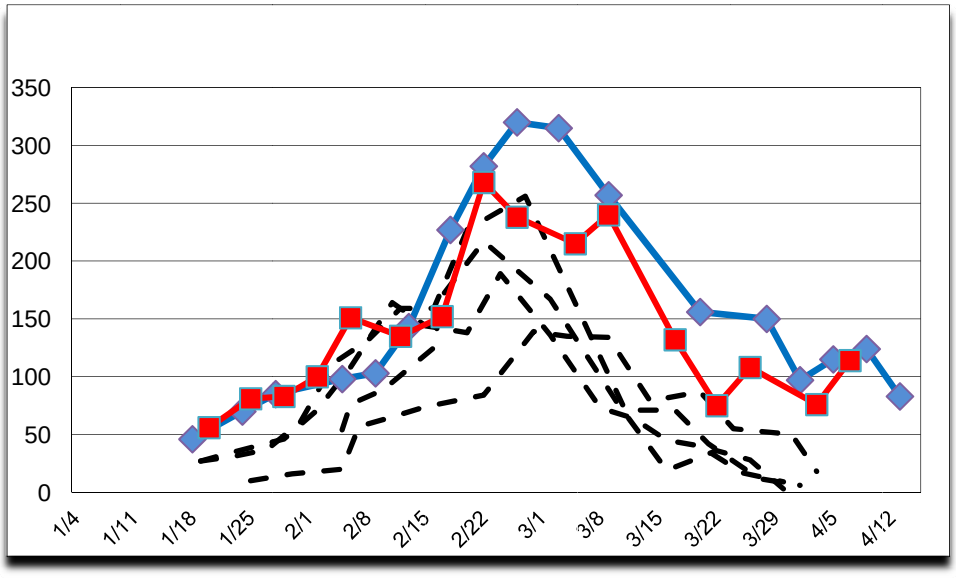


Figure 1. Counts of adult gray whales in Laguna San Ignacio: Red = 2012; Blue = 2011; Dashed = 2007-2010.

There was an increase in the number of female-calf pairs late in the winter of 2012, and this was also seen in 2011. The highest counts of these whales were 86 pairs on March 9th and a second high count of 110-pairs on April 7th (Fig. 2). The age of these calves was 1-2 month as estimated from their size, and the increase in their numbers occurred after the end of the normal birthing period in February. This late season increase suggests that females with calves born earlier in the season were entering Laguna San Ignacio from other calving areas in Baja California. This gathering of females with their calves was originally documented during the 1978-1982 winters, but it was not seen in Laguna San Ignacio until 2011. The comparison of photographs from Bahia Magdalena and Laguna San Ignacio will confirm if there is an exchange of gray whales between these two winter aggregation areas.

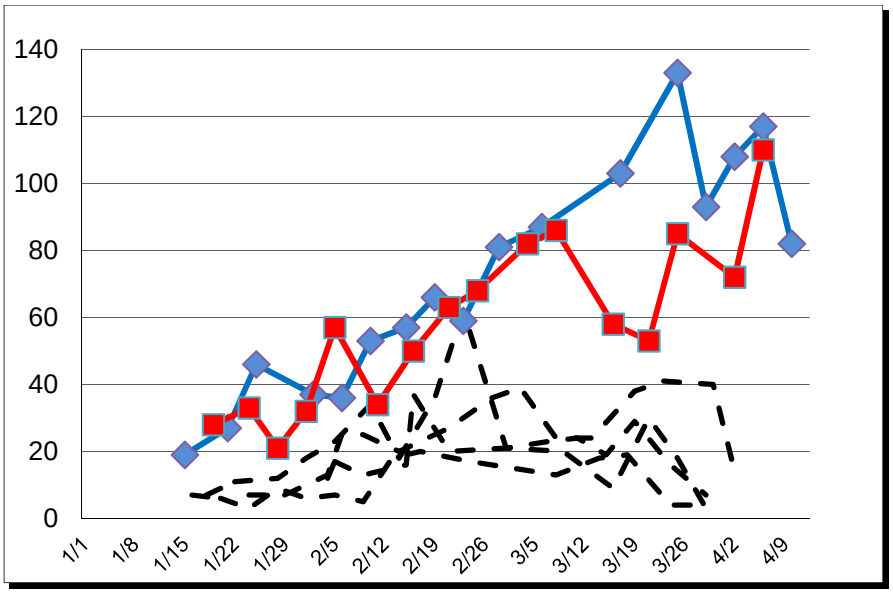


Figure 2. Counts of gray whale mother-calf pairs in Laguna San Ignacio: Red = 2012; Blue = 2011; Dashed = 2007-2010.

Counts of single whales reached a maximum of 205 whales on February 22nd (Fig. 3). In recent years (2007-2010) most gray whales were distributed in the areas nearest to the lagoon's entrance and in the middle lagoon area, with few whales occupying the innermost northern areas of the lagoon furthest from the sea. However, in 2011 and again in 2012 gray whales were distributed throughout the entire lagoon, resembling 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 healthy, and very few "skinny" whales were observed in 2012. This suggesting that gray whales are continuing to recover from the nutritional stress and reduced birth rate that was observed following the range-wide die-off the 1998-2000. It is also possible that more females are reaching maturity and beginning to reproduce, and these whales are replacing mature females that died during the 1998-2000 mortality event.

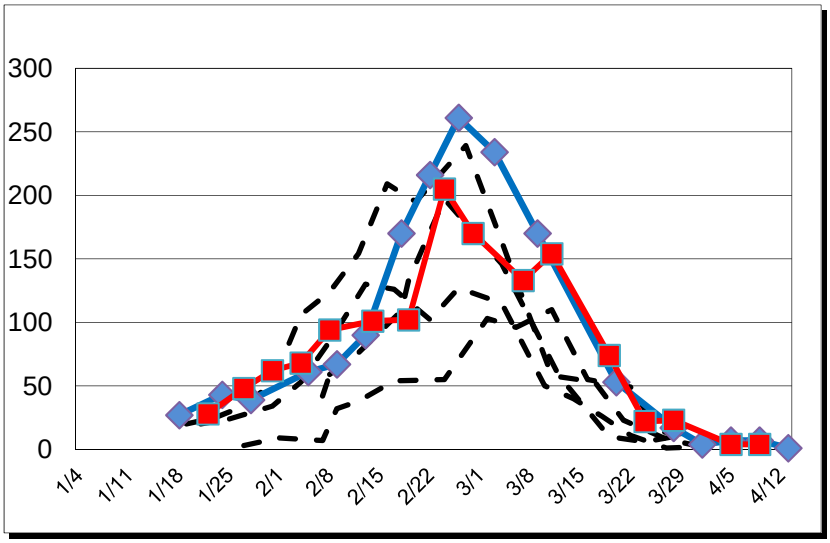


Figure 3. Counts of single gray whales in Laguna San Ignacio: Red = 2012; Blue = 2011; Dashed = 2007-2010.

Photo-Identification Results and the Photograph Archiving and Management:

Sixty-four days totaling 360 hours of effort were devoted to photographic identification in Laguna San Ignacio in 2012. A total of 9,508 digital images from 863 sightings produced the identification of 671 individual gray whales. These included 432 single whales and 239 mother-calf pairs. The minimum residence time (i.e., the time between the first and last photograph of an individual whale) in the lagoon for single whales averaged 2.1 days with the longest being 67 days. The minimum residence for mother-calf pairs averaged 21.6 days and the longest stay was 81 days.

These 2012 photographs will be organized in a digital catalog, compared with the catalogs from 2006-2011, 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.).

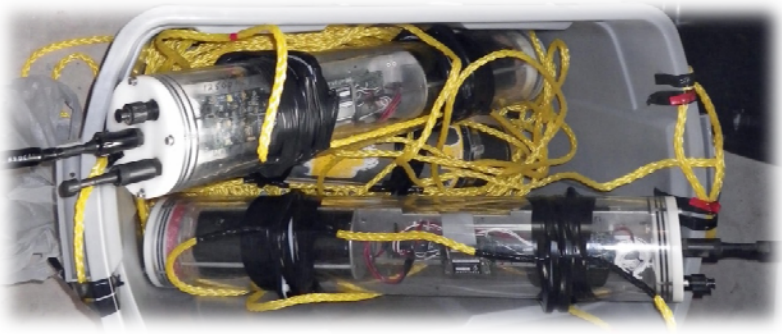
Diana López and Tabata Olavarrieta obtaining photographs of individual gray whales.

Catalogs for females and their calves returning to the lagoon were analyzed for the period 2005-2011 by UABCS student Jessica Robles for her thesis. The estimation of calving-interval illustrates how frequently a female gray whale can reproduce, and it is a key indicator of the reproductive health of the population. Jessica estimated the calving interval during this period at 2.33 yrs (95% CI = 0.15) compared to 2.1 yrs (95% CI = 0.09) for the period 1977-1082, and 2.24 yrs (95% CI = 0.15) for the period 1996-2002, suggesting that the birth interval has increased following the period of nutritional stress and range-wide mortality event on the late 1990s. The data obtained during the 2012 winter will be added to this analysis to better illustrate the current trend in female gray whale calving success.

In 2012 LSIESP researchers conducted photographic identification surveys in the Bahía Magdalena lagoon complex in Baja California Sur, México. Hiram Rosales-Nanduca and his team photographically identified 272 individual whales from 3,270 digital images, of which 231 were Single whales and 41 were Mother-calf pairs. Of these, 83% of the Mother-calf pairs were sighted in waters around the López Mateos area, while the majority of Singles were sighted in waters near to mouth of Bahía Magdalena (89%), suggesting that females with newborn calves are segregating from single whales. Of the total number of whale's photographically identified, 91% of Single and 63% of Mother-calf pair's, were sighted only one time, indicating only brief stays in this area and a high turn-over or exchange rate of individuals. The whales with longest residence time (duration of stay) inside the lagoon complex were Mother-calf pairs, with the longest residence time of 27 days and an average residence time for 3.9 days. The longest residence time of a Single whale was seven days and an average residence time of 1.2 days. The shorter residence times of whales visiting the Bahía Magdalena lagoon complex compared with the other gray whale winter calving-breeding areas indicates that gray whales spend less time in the lagoon complex of Bahía Magdalena, and the aggregation of breeding whales is highly dynamic.

Acoustic Research:

The Acoustic Team included Aaron Thode (Scripps Institution of Oceanography), Melania Guerrera (Cornell University), Sheyna Wisdom (Fairweather Science), Shane Walker and Kerri Fullam (SCRIPPS Institution of Oceanography). Digital recording arrays have been in use in Laguna San Ignacio since 2005 to establish a baseline of noise levels in the lagoon. In 2012 recorders were placed on the lagoon bottom at two locations within the lagoon to gather baseline ambient noise measurements: one was within the lower lagoon whale-watching zone, and the second in a deep channel in the interior "closed" zone (no whale-watching).



Digital acoustic recorders placed on the bottom of Laguna San Ignacio.

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. Analysis of recordings indicates that gray whale vocal activity increases during the early morning and early evening hours. The passive acoustic monitoring program is also demonstrating that whale group size is not measured directly; rather it monitors the number of vocal connections in the whales' social network which increases exponentially with group size.

Ecological Function of Seagrasses in Laguna San Ignacio:

Rafael Riosmena-Rodríguez and his graduate students continued their surveys to monitor and evaluate the seasonal and annual variation in the distribution and status of sea-grass meadows (*Zostera marina* and *Gracilaria vermicullophyla*) that occur in the lagoon.

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. Their monitoring program is demonstrating the seasonal increases and decreases in the density of sea-grass, and the seed production and distribution within the lagoon. They are also noting the increased amount of other algae that compete with sea-grass, but do not provide food

for marine organisms in the lagoon. The sea-grass in Laguna San Ignacio has been declining in recent years, and Dr. Riosmena's group is hoping to identify the factors that may be causing the decline of this very important resource.

Local School Outreach and Classroom Presentations:

LSIESP researchers make annual visits to the primary and secondary school classes in the Ejido Luis Echeverria 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 the primary students learned basic "Origami", the Japanese art of paper-folding, to learn gray whale anatomy and behavior. Each student constructed their own paper gray whale complete with flippers, flukes, blowholes, and paper "spouts". The students also viewed power-point presentations by LSIESP researchers on the species of marine life and birds that live at Laguna San Ignacio.

Students at the Ejido Luis Echeverria primary school and their Origami gray whales

LSIESP researchers collaborated with Ecology Project International (EPI) in March 2012 to host two high school groups from the town of San Ignacio. Each of these groups of students spent 3-days at the lagoon where they learned from LSIESP about how to use photography as a scientific research tool to study whales. 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

2012 Community Reunion at Laguna San Ignacio:

On 4 March LSIESP researchers hosted the 6th Annual Community Reunion at the Kuyimita 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. This year's science presentations included: "Evolution of Gray Whales" by Steven Swartz; "Analysis of Gray Whale Photo-Identification Data" by Sergio Martinez; "Abundance and Dymanics of Gray Whales in Laguna San Ignacio" by Mauricio Rodriguez; "Update on Sealion Monitoring on Isla Pelicano" by Ranulfo Mayoral. This year's reunion also included presentations on the various "Community Development Projects in Ejido Luis Echeverria Alvarez" by Raul Lopez and other community leaders. Approximately 60 attendees included members of the Eco-Tourism Operator's Association, Philanthropiece, the Vizcaino Biosphere Reserve, Pronatura-Noroeste, University of Siena-Italy, local school teachers and interested public.

Mauricio Rodríguez presents information on gray whale abundance at 2012 Reunion.

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.

Leigh Henry of World Wildife Fund-US and other WWF program managers visiting the lagoon met with LSIESP researchers to discuss conservation of this marine protected area and the larger Vizcaino Biosphere Reserve. WWF Media Relations Director Monica Echeverria produced a video about the LSIESP's gray whale research (see link below). ABC News Nightline staff Celia Vega and Alex Waterfield produced a news article and video that featured the friendly whales of Laguna San Ignacio and LSIESP gray whale research and monitoring (see link below).

Blue Ocean Institute's president Carl Safina and David Moore-Huntley of the United States Public Broadcast System (PBS) visited the lagoon and interviewed LSIEPS researchers as part of a documentary film series they are producing on marine protected areas and sustainable development. Additional public outreach included interviews and discussion with Mexican and other international media groups including Fundacion de Transforma de Tijuana, Mexico, a new NGO that promotes sustainable development in Mexico; Manuel Rueda of Univision News for a feature story on gray whales and eco-tourism in Baja California; and Mike Schaadt of the Cabrillo Marine Aquarium, San Pedro as part of their ongoing lecture series on marine wildlife and protected areas. LSIESP researchers made presentations on their research and gray whales to 7 eco-tour groups visiting the lagoon.

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 19th Conference on the Biology of Marine Mammals of the Society for Marine Mammalogy held from November 27 to December 2, 2011 in Tampa, Florida, the 33rd meeting of the Sociedad Mexicana de Mastozoologia Marina A.C. from May 6-9, 2012 in Melaque, Jalisco, Mexico, and at the California Coalition's Gray Whale Workshop from March 31 to April 1, 2012 in San Francisco, California.

LSIESP researchers authored or co-authored scientific publication 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. (In Press) Movements of gray whales between the western and eastern North Pacific. Endangered Species Research.

Urbán J. R. , Weller, D., Tyurneva, O., Swartz, S.,Bradford, A., Yakovlev, Y. Sychenko, O., Rosales H.N., Martínez, S. A., Burdin, A. and Gómez-Gallardo, A U. 2012. Report on the photographic comparison of the Western and Mexican gray whale catalogues. Rep. Intl. Whaling Comn. Scientific Committee. SC/64/BRG13.

Swartz, S.L., Urbán, J. R., Gómez-Gallardo, A. U., Martínez, S., Olavarrieta, T. G., Lopez, D. A., Rodríguez, L.J.[2], Rodríguez, M. and Rojas-Bracho, L. 2012. Numbers of gray whales

(*Eschrichtius robustus*) utilizing Laguna San Ignacio, Baja California Sur, Mexico during the winter breeding seasons: 2007-2012 Rep. Intl. Whaling Comn. Scientific Committee. SC/64/BRG14.

Nanduca, H.R., Urbán, J.R., Swartz, S.L.[2], Robles-Mercado, J., Alonso-Lozano, L., and Gómez-Gallardo, A.U. 2012. Gray whales at Bahia Magdalena Lagoon complex, Mexico, during winter 2012. Rep. Intl. Whaling Comn. Scientific Committee. SC/64/BRGXX.

Ponce, D., Thode, A.M., Guerra, M., Urban, J.R., and Swartz, S.L. 2012. Relationship between visual counts and call detection rates of gray whales (*Eschrichtius robustus*) in Laguna San Ignacio, Mexico. Journal Acoustical Society of America, 131(4):2700-2713.

LSIESP Supported Students and Graduates:

Ana Liria Del Monte M. continues research for her Bachelor's thesis at UABCS on the history and evaluation of the development of whale-watching in Laguna San Ignacio.

Jessica Robles M. completed her analysis of female gray whale calving intervals by analyzing the extensive photographic data catalogs from 2005-2011 for her Bachelor's Thesis at UABCS in June 2012.

Tabata Olavarrieta G. will complete her Bachelor's Thesis and degree at UABCS in June 2012. Her research involves the use of stable isotopes to investigate the feeding biology and behavior of Bryde's whales in the Gulf of California.

Sergio Martinez A. completed his Master's Thesis at UABCS during summer of 2011 and is now enrolled in the Ph.D. program. His research investigates the use photographic identification methods to study the dynamics, natural history and behavior of gray whales.

Mauricio Rodríguez Á. is completing his Bachelor's thesis research at UABCS on the analysis of changes in the distribution of gray whales for three time periods: 1978-82, 1996-2000 and 2007-2011. He will receive his degree in June 2012.

Erandi Alcira Calderón Y. continues her Bachleor's thesis research at UABCS on the analysis of body condition (skinny whales) of gray whales that visit Lagoon between 2008 and 2011.

UNAM Ph.D. graduate Hiram Rosales Nanduca lead the research team conducting the pilot population assessment of gray whales in Bahia Magdalena.

Lilia Alonso L worked with the Bahai Magdelena photographic identification team and will complete her Bachelor's degree at UABCS in June 2012.

Laura Rodriguez J. completed her Master's degree at UABCS in 2011 and worked with the gray whale research team in Laguna San Ignacio in 2012. She intends to pursue her doctorate and continue her research on the use of stable isotope analyses to detect and monitor anthropogenic contaminants in marine food chains.

Diana Carina López A. joined the gray whale research team in Laguna San Ignacio in 2012, and is beginning studies and research for her Master's degree at UABCS.