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

2014 RESEARCH REPORT

Key Findings in 2014 include:

Record numbers of gray whale mother-calf pairs enter the lagoon at end of season
Dis-Entanglement Workshop pays off and saves a gray whale calf
Photo-ID matches confirm movements between all three Baja lagoons and Russia
Collaboration with ESSA researchers yields new data from Laguna Ojo de Liebre
Acoustics Team reports on noise trends in the lagoon from 2006-2013
LSIESP Researchers present papers at SOMEMMA and IWC-SC meetings
"Lagoon Time" gray whale and lagoon guide published

PROGRESS ON GOALS AND OBJECTIVES:

2014 marks the 9th winter of ecosystem monitoring and research for the Laguna San Ignacio Ecosystem Science Program (LSIESP). Thanks to continuing support from our sponsors, the LSIESP continues to report on the biological status of the lagoon and its wildlife, especially the gray whales, to the local community, eco-tourism operators, government officials, and outdoor wildlife enthusiasts and visitors to the lagoon. The program continues to provide a hands-on training experience for university students studying wildlife science and management, and opportunities to complete their individual research on various aspects of the lagoon and its wildlife. Ongoing abundance and distribution surveys, and photographic identification research (Photo-ID) continues to document the numbers, movements and exchange of gray whales within Laguna San Ignacio each winter, and between the three gray whale major winter aggregation and breeding areas of Lagua Ojo de Liebre (OLO), Laguna San Ignacio (LSI), and Bahia Magdalena (BM). In collaboration with international scientists under the sponsorship of the International Whaling Commission's Scientific Committee (IWC-SC), LSIESP researchers have identified endangered "Western Gray Whales" that visited the aggregation areas and lagoon of Baja California during the winter, including mature females that may interbreed with the "Eastern Gray Whale" population. LSIESP have begun a collaboration with researchers from Exportadora de Sal's (ESSA) Department of Ecology, and staff from the Vizcaíno Biosphere Reserve (SEMARNAT) to obtain Photo-ID and biopsy data on gray whales in LOL for comparison with other areas in Baja California and throughout the gray whales' range. This collaboration encourages a closer relationship between our research team and those also working in Baja California, and increases the overall contribution of information on gray whales to the IWC-SC's North Pacific basin-wide research effort on gray whales. The 2014 winter included visits to the local schools in the Ejido Luis Echeverria Alvarez for presentations about Laguna San Ignacio's marine life, the importance of conserving the lagoon habitat, and the natural history of gray whales. LSIESP researchers hosted high school and university groups from La Paz, Punta Abreojos, and San Ignacio. Following the winter at the lagoon, LSIESP researchers actively participated in the Mexican Society for Marine Mammalogy (SOMEMMA), and the Scientific Committee of the International Whaling Commission.

Gray whale monitoring and assessment:

The 2014 Gray Whale Research Team was led by Steven Swartz from Darnestown Maryland, U.S.A., Jorge Urbán R. and Alejandro Gómez Gallardo from the Autonomous University of Baja California Sur, in La Paz, B.C.S., Mexico (UABCS). Senior field researcher Sergio Martinez A. (UABCS) served as Field Chief at the lagoon. Additional researchers included: Carlos Alberto López Montalvo (UABCS), Marina Hidalgo Reza (UNAM), Lizbeth Sanchez Eliseo (UABCS), and Ludovic Tenorio Hallé (Scripps Institution of Oceanography). The Acoustic Team included Aaron Thode and Kerri Seger (Scripps Institution of Oceanography).

Gray whale abundance monitoring involved 17 abundance surveys of gray whales in the lagoon to monitor seasonal abundance and habitat use. Counts began on January 17, 2014 and continued until April 15, 2014. In general the overall number of gray whales and their seasonal occupation of the lagoon was consistent with that seen in 2011 to 2013, but there were a few unexpected differences in 2014. First, the abundance of single adult gray whales in January was unusually greater than in recent years, then it declined in February, only to increase to numbers similar to previous years in March and April. As gray whale calves were being born, counts of mother-calf pairs increased during January and early February, after which they remained stable at around 75-80 pairs, and then declined slightly in March. Following the annual birth period, the counts of mother-calf pairs increased rapidly in April to over 138-pairs, and remained around 100 pairs as females with older moved into Laguna San Ignacio from other areas. Fifty-four mother-calf pairs were counted in the lagoon during the final survey on April 15, 2014. The sudden increases, decreases, and then increase in the numbers of individuals was not expected. Also, this winter was characterized by warmer than average water temperatures that hovered between 18-20^{o}C, compared to 14-16^{o}C in previous winters.

The greatest number of adult whales was 204 adults counted on 5 March 2014 (134 single whales and 70 mother-calf pairs). Again this winter, the late season increase of mother-calf pairs compared to the low numbers observed1996-2010 was significant; mother-calf counts reached a high count of 138 pairs on 4 April and remained high through the last survey on April 15th when 54 mother-calf pairs remained in the lagoon. This late season increase and photo-id records indicate that mother-calf pairs are entering Laguna San Ignacio from calving areas in BM to the south, and from OLO to the north. Counts of single whales reached a maximum of 132 whales on February 4th. Gray whales were distributed throughout the entire lagoon, resembling the distribution patterns observed during the 1978-1982 time period.

Figures: Counts of gray whales in Laguna San Ignacio between January 17 and April 15, 2014. TOP: Survey counts of adult whales (males + mother-calf pairs); MIDDLE: Survey counts of Breeding Adult s (no mother-calf pairs); BOTTOM: Survey counts of mother-calf pairs.

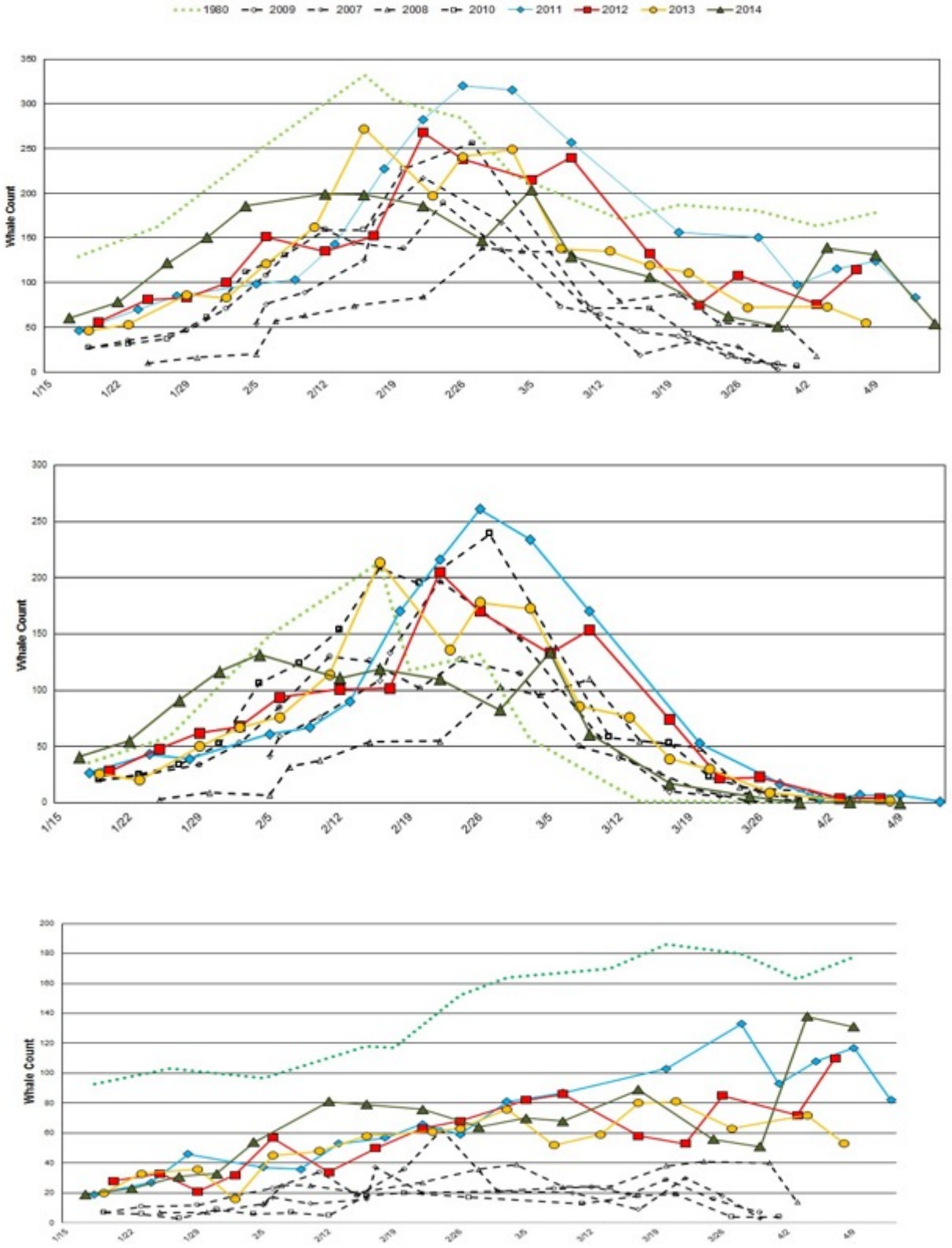

Photo-Identification, Photo Archiving and Management:

LSIESP researchers conducted 3.5-months of Photographic-Identification (Photo-ID) surveys to monitor individual whale's duration of stay in the lagoon, the number of individuals returning to the lagoon, their movements within the lagoon and among the three major lagoon-aggregation areas of Laguna San Ignacio, Laguna Ojo de Liebre, and Bahia Magdalena. Photo-ID surveys yielded photographs of approximately 450 individual single whales, and 190 mother-calf pairs (final numbers will be determined during post-season analyses). These 2014 photographs are archived, placed into digital catalogs, compared with the catalogs from 2006-2013, 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.).

More than 51,000 photographs of females with calves obtained from 2006-2013 were compared by Sergio Martinez A. to estimate female gray whale calving-interval, which is a key indicator of the reproductive health of the population. From these photographs, 4,051 different individuals were identified, and of those 119 females reproduced two or more times during the study period, which represents a total of 248 reproductions (i.e., calves). Of the 129 calving intervals 49 (38%) represented births at every 2 years, 24 (19%) at 3 years, 33 (26%) at 4 years, 13 (10%) at 5 years, 8 (6%) at 6 years and 2 (2%) at 7 years. Some females were not photographed every year, and is not known if these females reproduced during these missing years. For the 79 calving intervals from 75 females with complete reproductive histories (i.e., no missing years), the average birth interval was 2.44 years, S.D. ± 0.61, slightly greater than the interval of 2.11 years, S.D. ± 0.40 calculated by Jones (1990) for gray whales during the period between 1977 and 1982, but similar to the interval of 2.4 years, S.D. ± 0.49 calculated by Díaz (2004) for the period 1996 to 2002 , and less than the 2.81 years, S.D. ± 0.46 calculated by Robles (2012) for the period following the range-wide die-off during 1998-2000. The majority of calving intervals (38%) estimated from the 2006-2013 data corresponds to the two-year interval, which is the normal calving interval for this species reported by other investigators (Jones 1990, Díaz 2004, Robles 2012). Intervals approaching 2-years suggest that the breeding females are obtaining sufficient nutrition to successfully reproduce each year. [Click here to see Sergio's presentation]

At the request of the International Whaling Commission's Scientific Committee (IWC-SC), we continued collaboration with other researchers to identify endangered Western gray whales that visit the gray whale breeding lagoons of Laguna San Ignacio, Laguna Ojo de Liebre, and Bahia Magdalena: to date the comparison of photographs from the breeding lagoons in Baja California have identified 23 "Western" gray whales, including breeding females, that have visited Baja california during the winter months. In 2014 LSIESP researchers made four 5-day visits to Laguna Ojo de Liebre at the invitation of Exportadora de Sal (ESSA) and the Vizcaíno Biosphere Reserve (Reserva) to collaborate on the collection of Photo-ID and biopsy data on gray whales in Laguna Ojo de Liebre. The analysis of these data is ongoing, and is conducted as part of Carlos Alberto López Montalvo's research for his Ph.D. Thesis at UABCS, in La Paz, B.C.S. Mexico. The results of his research will constitute a major contribution to the overall understanding of gray whales that winter in Baja California, and to the IWC-SC's North Pacific basin-wide research effort on gray whales. [Click here to see Jorge Urban R's presentation]

Acoustic Research:

In 2014 winter the acoustics team of Dr. Aaron Thode and Kerri Seger of Scripps Institution of Oceanography collected three-months of digital recordings of underwater ambient noise, noise from whale-watching boats, and gray whale vocalizations to document and understand trends in naturally occurring noise in the lagoon, the vocal behavior of gray whales and their response to human and natural noise in Laguna San Ignacio. Digital recording arrays were placed at

Punta Piedra (Rocky Point) in the commercial whale-watching zone to gather baseline measurements of ambient noise and whale vocal behavior. 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. The acoustic team is developing a report that summarizes natural, whale, and human sound in the lagoon during the period 2006 to 2013, that clearly demonstrates trends in the various sources of noise in the lagoon, and establishes a quantitative baseline for noise in the lagoon during this period and for monitoring underwater noise in the future. Kerri Seger presented a paper based on this research at the December 2013 meeting of the American Acoustical Society. [Click here to view Kerri's presentation] The acoustics tea's report will be posted on the LSIESP website later this summer.

Whale Dis-Entanglement Training Workshop:

On January 18-29, 2014 an IWC-SC endorsed workshop on building capacity to respond to whales entangled in fishing gear was held at the Kuyima Eco-Tourismo facility at Laguna San Ignacio. This training workshop was funded by the Natural Resources Defense Council (NRDC) and coordinated by UABCS-LSIESP staff. This workshop focused on methods and techniques for responding to whales entangled with fishing gear which are seen in the lagoon each winter, and specific methods developed to safely remove the fishing gear from the whales. The IWC and NOAA provided two expert trainers, David Mattila and Ed Lyman, that instructed 34 participants during a day of class room instruction and background, and one day of practical simulation on the water. Trainees included 12 local fishermen and eco-tour panga operators, 6 staff from the Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT), and 4 LSIESP researchers. A complete set of specialized tools and equipment was provided and will be kept at the lagoon to aid in a rapid response. This training and tools will allow fishermen, whale-watching panga operators and guides, and LSIESP researchers to respond to and safely remove fishing nets, lines and other gear from gray whales in the lagoon. [Click here to read the report of the workshop]

On 22 March 2014 the LSIESP researchers responded to a sighting of a gray whale calf that had several lines and buoys wrapped around its flippers and through its mouth. Using their workshop training and the special tools, the LSIESP researchers successfully removed the fishing gear from the calf. [Photo credit: Shane Keena; Click here to read the report of this disentanglement]

Sealions on Isla Garzas and Isla Plicano:

Lagoon resident and naturalist Ranulfo Mayoral reported on his fourth year of monitoring the sea lion colony present on the lagoon's islands during the summer months.

Ranulfo has monitored the movement of California sealions (Zalophus californianus) from the outer barrier islands in front of Laguna San Ignacio during the winter into the lagoon and onto the islands during the summer months. He notes that these summer groups of sealions are predominantly males with only a few females, and no pups have ever been observed. Some of the males appear to be very old and heavily scarred from long lives of fighting, presumably for mating opportunities during the sealion's breeding season. Ranulfo hopes to begin some focal animal investigations by using photographs to identify specific individuals that return to the lagoon's islands each summer.

VISITAS A LA ISLA

LOBOS ISLA PELICANOS 2013

O1	03 JUNIO – JUNIO 09	1	---	1
02	10 JUNIO – JUNIO 16	1	---	1
03	17 JUNIO – JUNIO23	1	---	1
04	24 JUNIO – JUNIO 30	3	---	3
05	01 JULIO –JULIO 07	1	---	1
06	08 JULIO – JULIO 14	1	---	1
07	15 JULIO – JULIO 21	1	---	1
08	22 JULIO – JULIO 28	1	---	1
09 *	29 JULIO – AGOSTO04	2	---	2
10**	05 AGOSTO –AGOSTO 11	2	---	2
11	12 AGOSTO – AGOSTO 18	27	---	27
12	19 AGOSTO – AGOSTO 25	57	---	57
13	26 AGOSTO – SEPTIEMBRE 01	---	---	---
14	02 SEPTIEMBRE – SEPTIEMBRE 08	---	---	---
25	09 SEPTIEMBRE – SEPTIEMBRE 15	77	---	77
26	16 SEPTIEMBRE – SEPTIEMBRE 22	82	---	---
17	23 SEPTIEMRE – SEPTIEMBRE 29	---	---	---
18	30 SEPTIEMBRE –OCTUBRE 06	98	---	---
19	07 OCTUBRE – OC TUBRE 13	--	---	---
20	14 OCTUBRE – OCTOBRE 20	114	---	114
21	21 OCTUBRE –OCTUBRE 27	93	---	93
22	28 OCTUBRE – NOVIEMBRE 03	76	---	76*
23	04 NOVIEMBRE – NOVIEMBRE 10	69	---	69
24	11 NOVIEMBERE – NOVIEMBRE 17	43	---	43
25	18 NOVIUEMB RE –NOVIEMBRE 24	28	---	28
26	25 NOVIEMBRE – DICIEMBRE 01	7	---	7
27	02 DICIEMBRE – DICIEMBRE 08	---	---	---
28	09 DICIEMBRE – DICIEMBRE 15	---	---	---

*JULIO 30, SE ENCONTRO UN LOBO MUERTO EN EL MISMO SITIO DONDE SE SITUA LA COLONIA EN LA ISLA. NO SE LE ENCONTRARON LAS CAUSAS DE MUERTE.

**, SE ENCONTRARON CINCO LOBOS MACHOS NADANDO DESDE LA ISLA HACIA EL SUR, A MEDIAN MILLA APROXIMADAMENTE DEL SITIO DE DESCANSO.

Ecological Function of Seagrasses in Laguna San Ignacio:

Rafael Riosmena-Rodríguez, Ph.D. of the Programa de Investigación en Botánica Marina at UABCS and his students continue to visit the lagoon at different times during the year to monitor and evaluate the status of eel grass meadows (*Zostera marina)* and other marine plants in the lagoon. It is believed that overall warming of the interior of the lagoon continues to contribute to the decline of eel grass, and the growth of opportunistic brown algae (*Gracilaria vermicullophyla*) and another unknown and possibly invasive species that are displacing eel grass in areas where it used to thrive. The Marine Botany Team led by Dr. Rafael Risomena made three trips to Laguna San Ignacio in 2013 and 2014 to continue the monitoring of the "Seagrass Meadows in Laguna San Ignacio," to document seasonal and annual variation in the growth and productivity of marine plants, and the increase of invasive plants and algae in the lagoon.

Their current report presents the results 2013 to 2014 surveys of marine flora in the San Ignacio Lagoon, which represents 50% of the surveys planned for the year. They were able to identifying 19 species of macroalgae to the area plus 2 Seagrass which are traditionally found in the lagoon. Rafael and his students are comparing the number of species / distribution of macroalgae and seagrass, and conducting an extensive review of the literature for these species which will include the information from their final field trip to the lagoon in May-June 2014. During the last two years they have not been able to find large abundances of species of microalgae as were described since 2006, and included in the floristic lists of marine plants developed in the 1990's. This decline in the traditional plant and algae species along with the presence and increase coverage and biomass of invasive species is a real cause of concern and a real threat to the flora of the lagoon. New information on these new species and range extensions found in the area of Laguna San Ignacio is presented in their 2014 report.

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) in the lagoon, and the continuing decline of eel grass is expected to affect the tropic structure of the lagoon significantly. [Click here to read their complete report].

Public and Professional Outreach:

Local School Outreach and Classroom Presentations:

LSIESP researchers made educational presentations to the primary and secondary school classes at the Ejido Luis Echeverria Alvarez on lagoon ecology, wildlife conservation, and gray whales. Additional presentations were made to school groups visiting the lagoon from Punta Abreojos and the town of San Ignacio. Our public Outreach included interviews and discussions with Mexican and other international media groups including the BBC World News. LSIESP Co-Director Jorge Urban R. was interviewed by WWF-MX and Al Jazeera World News. Jessica and Chris Newley produced

a video about the conservation program at Laguna San Ignacio featuring LSIESP Co-Director Steven Swartz [Click here svsilentsun.com]

LSIESP researchers also gave after dinner and lunch-time presentations on gray whales and the lagoon to several eco-tour groups visiting the lagoon including the "Andiamo" group from the Autonomous University of Baja California Sur (UABCS UABCS in La Paz, the Natural Resources Defense Council at the Baja Discovery camp on Punta Piedras, to Searcher Natural History Tours from San Diego, Natural Habitat Adventures at the Kuyima Cabanias, Ocean Conservation research at La Freidera, and Colegio de Estudios Cientificos y Techologicos de Mulege.

2013 Community Reunion at Laguna San Ignacio:

On March 1st LSIESP researchers hosted the 8th 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. Science presentations included: "Abundance Trends of Gray Whales in Laguna San Ignacio" by Mariana Hidalgo Reza; "Preliminary Analysis of Female Gray Whale Calving Interval: 2006-2013" by Sergio Martinez; "Sealion Monitoring on Isla Pelicano: Year Four Observations" by Ranulfo Mayoral; "History of the LSIESP" by Steven Swartz, "Western Gray Whales in Baja California" by Jorge Urban R., and "Community Development Projects in Ejido Luis Echeverria Alvarez" by Raul Lopez. Approximately 60 attendees included members of the Eco-Tourism Operator's Association, Panga Operators, local fishermen, Pronatura-Noroeste, local school teachers, students, and interested public.

Professional meetings and Publications: Academic presentations on gray whales will be made by LSIESP researchers at the 2014 Mexican Marine Mammal Society (SOMEMMA) meeting in May 2014. These included: "Areas for whale conservation in the Gulf of California, Mexico: An ecological approach" by Alejandro Gomez-Gallardo U. and Jorge Urban R.; "Gray whale birth interval in San Ignacio Lagoon, BCS, Mexico" by Sergio Martinez A. *et al.*; "Gray whale habitat use in the lagoon system of Bahia Magdalena" by Hiram Rosales Nanduca, *et. al.*; "Conservation and education outcomes of a local whale science program in Mexico" by Jorge Urban R. *et al.*; and "Effect of climate variability on the distribution of gray whales within their winter breeding areas" by Maurico Nájera-Caballero *et al*.

Co-Director Jorge Urban R. attended a special IWC-SC workshop on Western Gray whales held April 8-11, 2014 at the U.S. NOAA, Southwest Fisheries Science Center in La Jolla, CA.

Additional papers on gray whales in Laguna San Ignacio, on Western Gray Whales in Baja California, on gray whale calving intervals were presented at the 2014 meeting of the International Whaling Commission's Scientific Committee meeting in May of 2014. LSIESP Co-Director Steven Swartz published "Lagoon Time: a Guide to Gray Whales and Natural History of San Ignacio Lagoon", as a special project of The Ocean Foundation. This historical guide to the Gray Whales, the human and natural history of Laguna San Ignacio will raise funds for the LSIESP. "Lagoon Time" is available from Sunbelt

Books in El Cajon, California http: [http://www.sunbeltbook.com/book-details?id=543] , on Amazon.com, and from all major book retailers.

LSIESP Supported Students and Graduates:

Ph.D. candidate Sergio Martinez Aguilar continues to serve as the winter "Field Chief" and photographic identification catalog manager for LSIESP after completing his Master's degree in 2011. UABCS Ph.D. candidate Carlos Alberto Lopez Montalvo is continuing his thesis research on "Migratory origin, reproductive and energetic status of gray whales during the winter breeding season." This summer Lizbeth Sanchez Eliseo will begin studies for her thesis on the seasonal distribution of gray whales in Laguna San Ignacio over the past 36 winter breeding seasons (1978 - 2014) as a researcher for the Programa de Investigación de Mamíferos Marinos, UABCS. LSIESP researcher Constanza Torres Valdez (2013) will begin her thesis research on the genetics of Fin whales (*Balenoptera physalus*) under Jorge Urban R. at UABCS later in 2014.

In December 2013 LSIESP researcher Erandi Alcira Calderón Yáñez (2011-2013) completed her thesis on "Análysis de la condición corporal de las ballenas grises (*Eschrichtius robustus*) que visitaron Laguna San Ignacio durante las temporadas: 2008-2011," and received her Marine Biology degree from la Universidad Autónoma de Baja California Sur, in La Paz, B.C.S., Mexico. Sergio Martinez A. completed his Master's Thesis at UABCS during summer of 2011 and is now enrolled in the Ph.D. program at the Universidad Autónoma de Baja California Sur, in La Paz, B.C.S., Mexico . UNAM Ph.D. graduate Hiram Rosales Nanduca lead the LSIESP research team conducting a photo-id based population assessment of gray whales in Bahia Magdalena in 2012 and 2013, and is now working with Eocolgical Projects International as a marine biology instructor, and holds a Post-Doctoral teaching position at the Universidad Autónoma de Baja California Sur, in La Paz, B.C.S., Mexico. while he continues his involvement with LSIESP. Ludovic Tenorio Hallé will begin his Ph.D. studies at Scripps Institute of Oceanography in the fall of 2014. Following her participation in LSIESP in 2014 Mariana Hidalgo Reza will continue her graduate program at university. Benjamin Vega Troyo (LSIESP 2006-2008) is teaching research methods and "Sociocultural Development" (e.g. globalization, economy, sustainability) at the new Universidad Tecnológica de La Paz in Baja California Sur, Mexico.

We express our thanks for support from our sponsors, including: The Ocean Foundation, World Wildlife Fund-Mexico / Telcel Alliance, The Searcher Natural History Tours, Spirit of Adventure Sportfishing, Baja Discovery, Kuyima Eco-Tourismo, Pachico Whale-Watching Tours, the residents of Ejido Luis Echeverra Alverez, the Laguna Baja Asociación Rural de Interés Colectivo, and the naturalists and boat operators of the eco-tourism companies in Laguna San Ignacio. The LSIESP collective research program in 2014 was conducted in Laguna San Ignacio under scientific research permit No. 00100/14 from the Secreteria de Medio Ambiente y Recursos Naturales, Subsecretería de Gestión Para La Protección Ambiental, Dirección General de Vida Silvestre, de Mexico.