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2016 GRAY WHALE RESEARCH IN LAGUNA SAN IGNACIO AND BAHIA MAGDALENA, MÉXICO

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ABSTRACT

Overall the numbers of gray whales residing in LSI during the 2016 winter were similar to those seen during the past five winters (2011-2015), except for an unexpected early departure of single adult whales (breeding males and females) and lower numbers of female-calf pairs at the end of the season in Late-March and early-April. For the second year the lowest numbers of gray whales since 2012 were counted in Bahia Magdalena suggesting a decline in the use of that area by gray whales in 2015 and 2016, coincident with warmest SST, which was 2-3.5 °C, warmer than the previous years of 2012 and 2013. Photographic identification effort in Laguna San Ignacio included 320 hours over 56 days photographing gray whales in 2016. A total of 11,882 digital images were obtained from 830 gray whale sightings that yielded 688 individual whales. These included 439 single whales what averaged 7.9 days in the lagoon (range 1 to 31 days), and 249 females with calves that averaged 32.8-days in the lagoon (range 1 to 80 days). Researchers working in the Bahia Magdalena region obtained 3,546 digital images from 143 sightings of gray whales during 184.5 hours of effort over 18 days during the 2016 season. From these images, 151 individual whales were identified (75 single whales and 76 female-calf pairs). Of these, five single whales averaged 1.48 days in the lagoon complex (range 1 to 15 days), and 34 female-calf pairs that were re-sighted two or more times in Bahía Magdalena lagoon complex averaged 7.2 days in the lagoon complex (range 1 to 50days).

INTRODUCTION

"El Niño" conditions prevailed during the 2016 winter along the Baja California Coast, resulting in warmer than average water temperatures in Laguna San Ignacio (LSI). The sea surface water temperature (SST) inside the lagoon ranged from 14°C to 17°C during late January but warmed to 19°C to 21°C in during March and April, while in Bahía Magdalena SST began at 19°C in January and by march reached 24°C. Unlike the previous winter, there was little rainfall and only a few days with significant fog. The normal prevailing North and West winds were more frequent and more severe than in 2015 (Urban *et al*. 2015), with some wind storms lasting 4-5 days. Unlike 2015, schools of sardines and other bait fish were not frequently observed, and the general abundance of marine birds was lower throughout the winter. For the second consecutive winter humpback whales were observed near and west of the mouth of Bahía Magdalena, including one female-calf pair of humpback whales inside of Bahía Magdalena.

SST influences the numbers, distribution, and durations of stay of gray whales within the winter aggregation areas and breeding lagoons of Baja California, with whales spending less time in the southern most winter aggregation areas in warm water years (El Niño conditions), and spending more time and migrating further south and entering the Gulf of California in cooler water or "La Niña" years (Urban *et al*. 1999, Salvadeo *et al.* 2015). Overall the numbers of gray whales residing in LSI during the 2016 winter were similar to those seen during the past five winters (2011-2015), except for an unexpected early departure of single adult whales (breeding males and females) and lower numbers of female-calf pairs at the end of the season in late-March and early-April. For the second year the lowest numbers of gray whales since 2012 were counted in Bahia Magdalena suggesting a decline in the use of that area by gray whales in 2015 and 2016, coincident with warmest SST, which was 2-3.5 °C, warmer than the previous years of 2012 and 2013.

GRAY WHALE ABUNDANCE MONITORING

Systematic boat surveys for gray whales have been conducted in LSI during three time periods beginning in 1977 to 1982 (Jones and Swartz 1984), 2000 to 2006 (Swartz *et al.* 2008), and 2007 to the present (Laguna San Ignacio Ecosystem Science Program, www.sanignaciograywhales,org) (Fig. 1). 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.

In Laguna San Ignacio 14 surveys of gray whales were completed in 2016 to monitor seasonal abundance and habitat use. Surveys began on January 19 and continued until April 7. In general, the overall number of gray whales and their seasonal occupation of the lagoon was consistent with that seen in previous years, however the decline in gray whales' numbers occurred 1-2 weeks earlier than expected in 2016 (Fig. 2). During this time female-calf pairs occupied the entire lagoon particularly the northern basin north of the Islands and farthest from the ocean entrance of the lagoon, and counts of these whales reached their highest count of 124 pairs on 11 March. The number of female-calf pairs then decreased through March, with only 50 pairs observed in the last survey on 7 April (Fig 3, Table 1). The abundance of single adult gray whales (breeding males and females without calves) reached a high count of 213 whales on 12 February, after which their abundance declined with few singles whales observed after mid-March (Fig.4, Table 1).

Trends of gray whale abundance along the Pacific coast of Baja California are influenced by SST in the winter, and it reasonable to conclude the warm El Niño conditions that prevailed during the 2016 winter contributed to the early departure of gray whales from Laguna San Ignacio. The numbers of female-calf pairs observed in Laguna San Ignacio in recent years continues to be less than the numbers counted during the 1980's, while the numbers of single breeding adults has increased slightly, and these whale remain longer in the lagoon in some years (Figs. 2-4).

The 2016 surveys of gray whales in the Bahía Magdalena lagoon complex were conducted in three different areas during three different time periods: 16-18 January, 5-7 February, and 4-6 March (nine surveys in all) (Table 2). Overall the 2016 distribution of gray whales

was concentrated in these three areas: (1.) the Florida area near of Puerto Lopez Mateos in the Canal La Soledad and Boca La Soledad; (2.) in La Bocana of Bahía Magdalena (the passage between Punta Redonda on the north end of Isla Santa Margarita and Punta Estrada); and (3.) the area along the north shore of Isla Creciente and the passage that connect Bahia Magdalena and Bahía Almejas (Fig. 5). The highest counts of gray whales were consistently observed in the Canal La Soledad near Lopez Mateos, which is the area with highest number of female-calf pairs of all Bahía Magdalena lagoon complex areas. Combined counts of whales in all three areas were: in January, 39 adults (27 female-calf pairs and 12 single whales); in February, 88 adults (63 female-calf pairs and 25 single whales), and in March, 7 adults (five female-calf pairs and 2 single whales). The highest counts of gray whales were obtained in on 6 February in the Canal La Soledad, and was of 59 individuals (55 female-calf pairs and four single whales), while the lowest count was one single whale in Bahía Magdalena in March 4 (Fig. 6, Table 2).

As was observed in Laguna San Ignacio, few whales remained in the Bahía Magdalena complex by mid-March when SST reached 23-24 °C, so surveys there were discontinued. While female-calf pairs were seen in seven of the nine surveys, no female-calf pairs were seen in Bahía Magdalena in January and March. Previously, the highest counts in Bahía Magdalena were 50 single whales in March 2012 and 74 single whales that occurred in February 2013; however, the number of whales observed in this area has been 15 single whales in February of 2015 and 2016, suggesting the decline in the use of Bahía Magdalena by gray whales is probably related to increased SST. Other species sighted included humpback whales near and west of the mouth of Bahía Magdalena, including one mother-calf pair of humpback whales inside of Bahía Magdalena (Fig. 6).

PHOTOGRAPHIC IDENTIFICATION

Photographic identification (Photo-ID) effort in Laguna San Ignacio included 320 hours over 56 days photographing gray whales in 2016. A total of 11,882 digital images were obtained from 830 gray whale sightings that yielded 688 individual whales. These included 439 single whales what averaged 7.9 days in the lagoon (range 1 to 31 days), and 249 females with calves that averaged 32.8-days in the lagoon (range 1 to 80 days) (Table 3).

Researchers working in the Bahia Magdalena region obtained 3,546 digital images from 143 sightings of gray whales during 184.5 hours of effort over 18 days during the 2016 season. From these images, 151 individual whales were identified (75 single whales and 76 female-calf pairs). Of these, five single whales averaged 1.48 days in the lagoon complex (range 1 to 15 days), and 34 female-calf pairs that were re-sighted two or more times in Bahía Magdalena lagoon complex averaged 7.2 days in the lagoon complex (range 1 to 50 days) (Table 3).

Photographs of known breeding females obtained from 2006-2015 were compared to calculate an estimate of female calving-interval of 2.52 $\pm$ SD = 0.57 yrs, which is any indicator of the reproductive health of the population. This estimate compared to an interval of 2.11 $\pm$ SD = 0.40 years during the 1977-1982-time period (Jones 1990) suggests that female gray whales are not reproducing as frequently as in the previous decades, and explains the low counts of female-calf pairs observed in recent years compared to the higher numbers of these whales observed in this lagoon during the 1980's.

As in previous years, all photographs from 2016 will be archived, placed into digital catalogs, compared with the catalogs from 2006-2015, 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) 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.).

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gray whales that reside within in Laguna San Ignacio and Bahia Magdalena during the winter months. The 2016 gray whale research was directed by Drs. Jorge Urbán R., Steven Swartz, Alejandro Gómez Gallardo, Sergio Martínez Aguilar (Laguna San Ignacio), and Hiram Rosales Nanduca (Bahía Magdalena). Collaborating researchers include: Natalia Serna Urrea, Carlos Alberto López Montalvo, Vinnie Caicero García, Gabriela Noemi Salazar Sánchez, Eder Antonio Belmont Sánchez, Liliana Paredes, Miwako Yokoo Guerrero, and Omar Castañeda. This research was supported by grants from The Ocean Foundation, with in-kind support for logistics provided by Searcher Natural History Expeditions, and Kuyima Eco-Tourismo, Inc. Field research was conducted under Scientific Research permits issued by the Secretaría de Medio Ambiente y Recoursos Naturales (SEMARNAT) of Mexico.

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.

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 from1978 to 2008. Rep. Intl. Whal. Commn. SC/60/BRG30, 19 pp.

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., A. Gómez-Gallardo U, S. Martínez A., and H. Rosales N. 2015. Report of the 2015 gray whale research in Laguna San Ignacio and Bahia Magdalena, Mexico. Rep. Intl. Whal. Commn. SC/66a/BRG21, 12 pp.

TABLES

Table 1. Survey counts of gray whales (Female-calf pairs, Singles, and total Adults) in Laguna San Ignacio during the 2016 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-16	28	51	79
2	26-Jan-16	51	97	148
3	02-Feb-16	49	104	153
4	07-Feb-16	41	100	141
5	12-Feb-16	70	213	283
6	17-Feb-16	88	165	253
7	23-Feb-16	74	129	203
8	28-Feb-16	100	104	204
9	05-Mar-16	84	28	112
10	11-Mar-16	135	7	142
11	16-Mar-16	110	0	110
12	25-Mar-16	59	1	60
13	01-Apr-16	39	1	40
14	07-Apr-16	50	0	50

Table 2. Number of gray whales (Singles, Female-calf pairs, and Adults) counted during surveys in the Bahía Magdalena complex and surrounding areas during the 2016 winter.

Survey Dates in 2016	Bahía Almejas	Bahía Magdalena	Lopez Mateos	Totals
Single Whales				
January 16-18	1	2	9	12
February 5-7	7	14	4	25
March 4-6	1	1	0	2
Female-calf pairs				
January 16-18	1	0	26	27
February 5-7	7	1	55	63
March 4-6	1	0	4	5
Adult Whales				
January 16-18	2	2	35	39
February 5-7	14	15	59	88
March 4-6	2	1	4	7

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	320	184.5
No. Images	11882	3546
No. Sightings	830	134
No. Individual Whales	688	151
No. Single whales	439	75
Single whales' mean days in area	7.9 (1-31)	1.48 (1-15)
No. Female-calf pairs	249	76
Female-calf pairs' mean days in area	32.8 (1-80)	7.2 (1-50)

FIGURES

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 360^0 scan of the northern basin. 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.

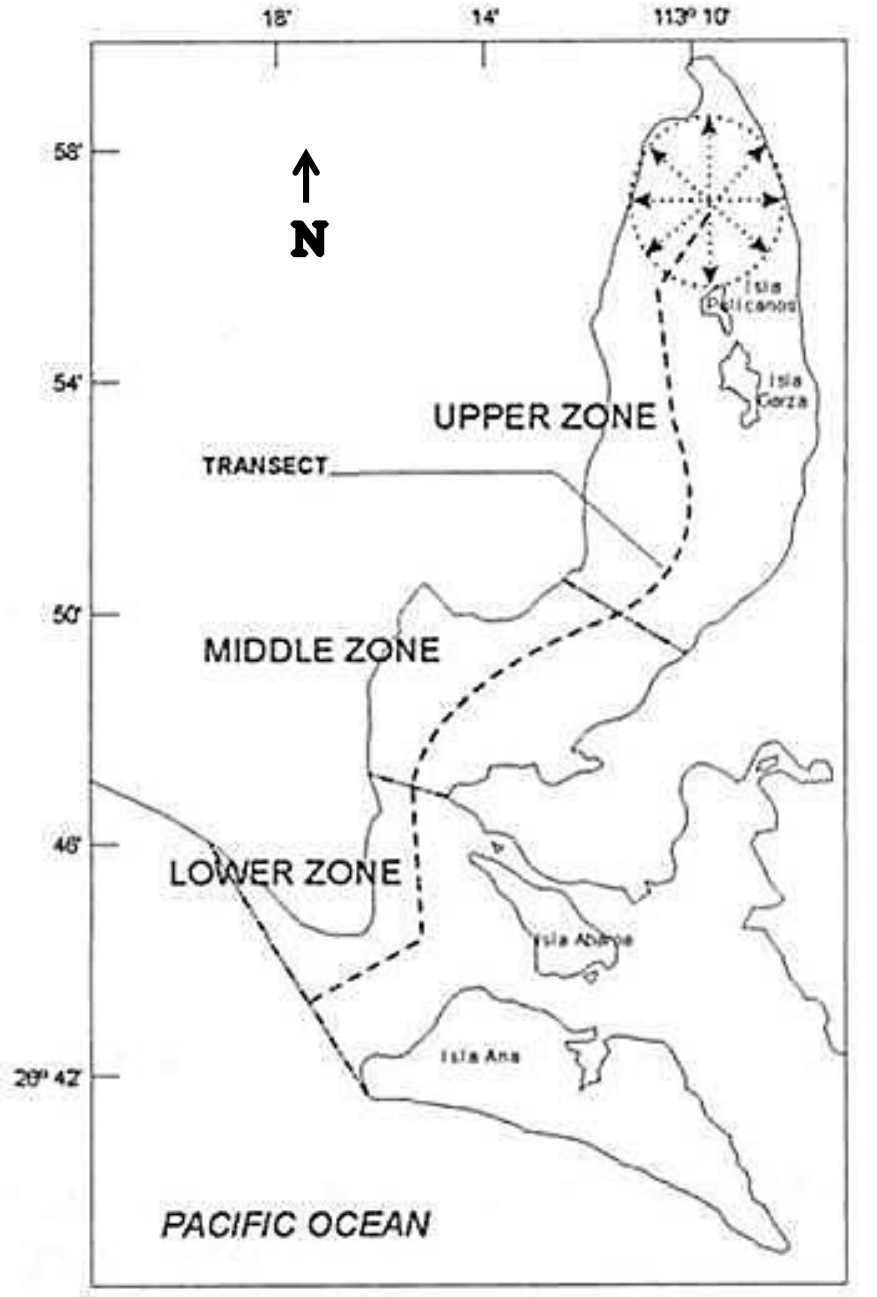

Figure. 2. Numbers of total adult whales (Adult males, females, and females with calves) counted in Laguna San Ignacio during the winter seasons: 1980, and 2011-2016.

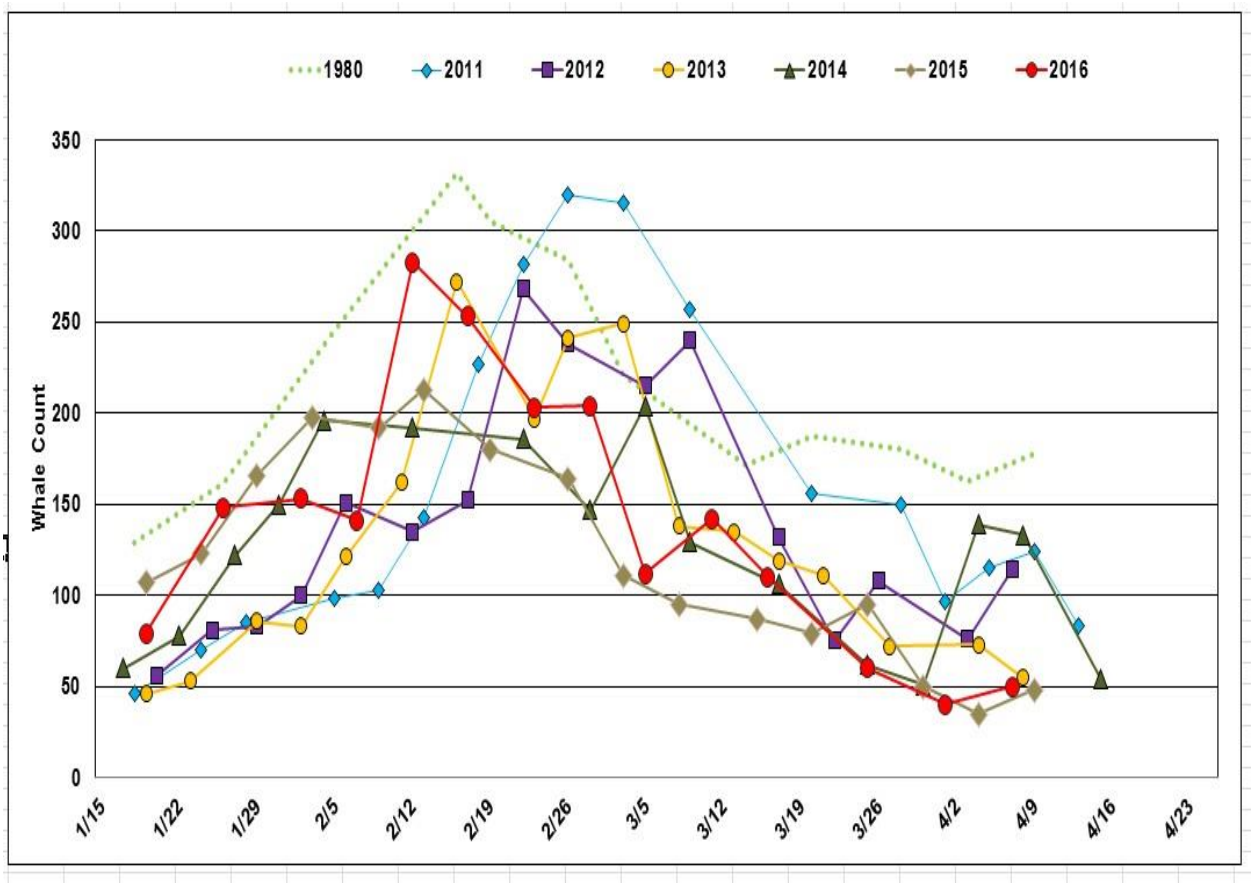

Figure. 3. Numbers of female-calf pairs (females with young of the year) counted in Laguna San Ignacio during the winter seasons: 1980, and 2011-2016.

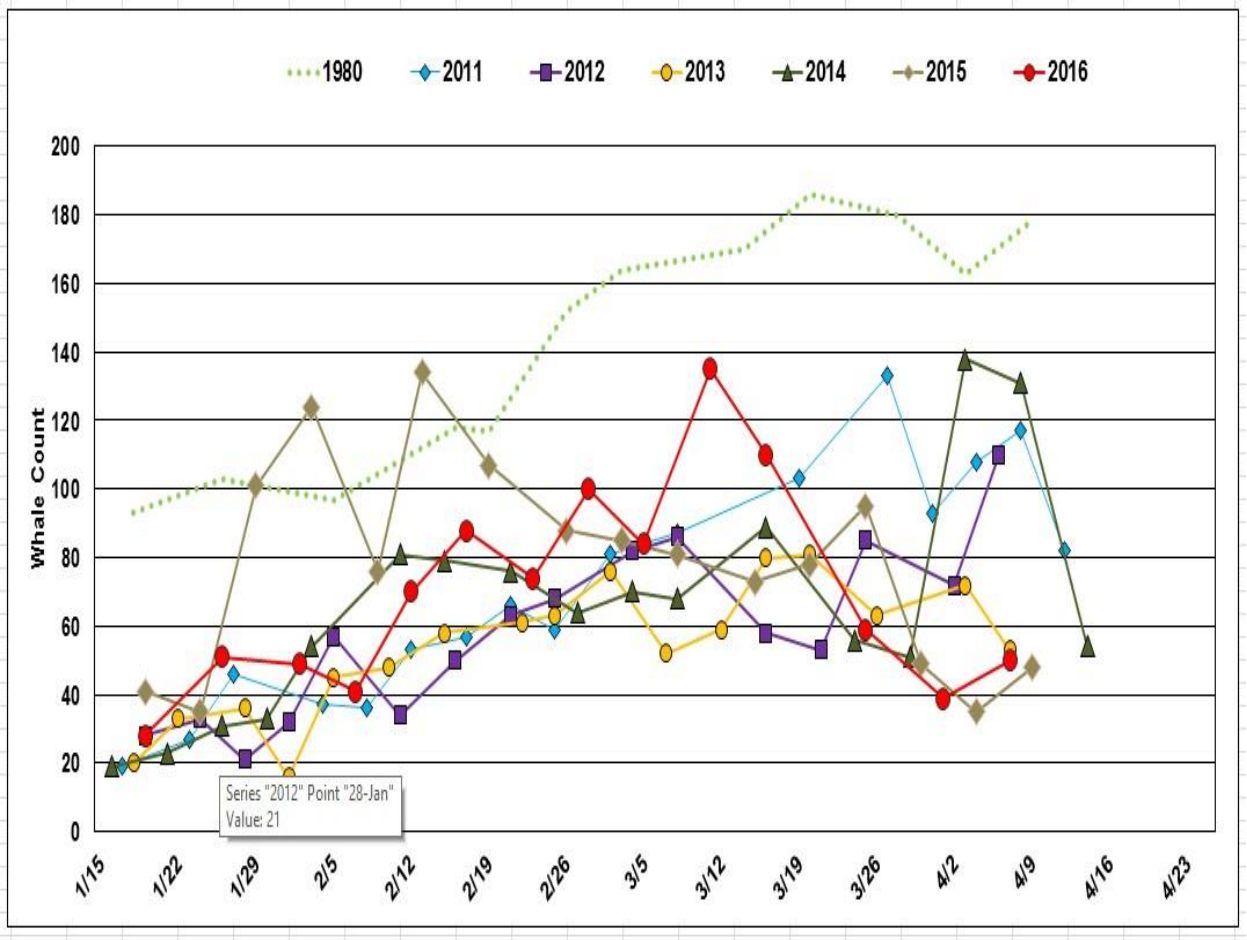

Figure. 4. Numbers of single whales (adult males and females without calves) counted in Laguna San Ignacio during the winter seasons: 1980, and 2011-2016.

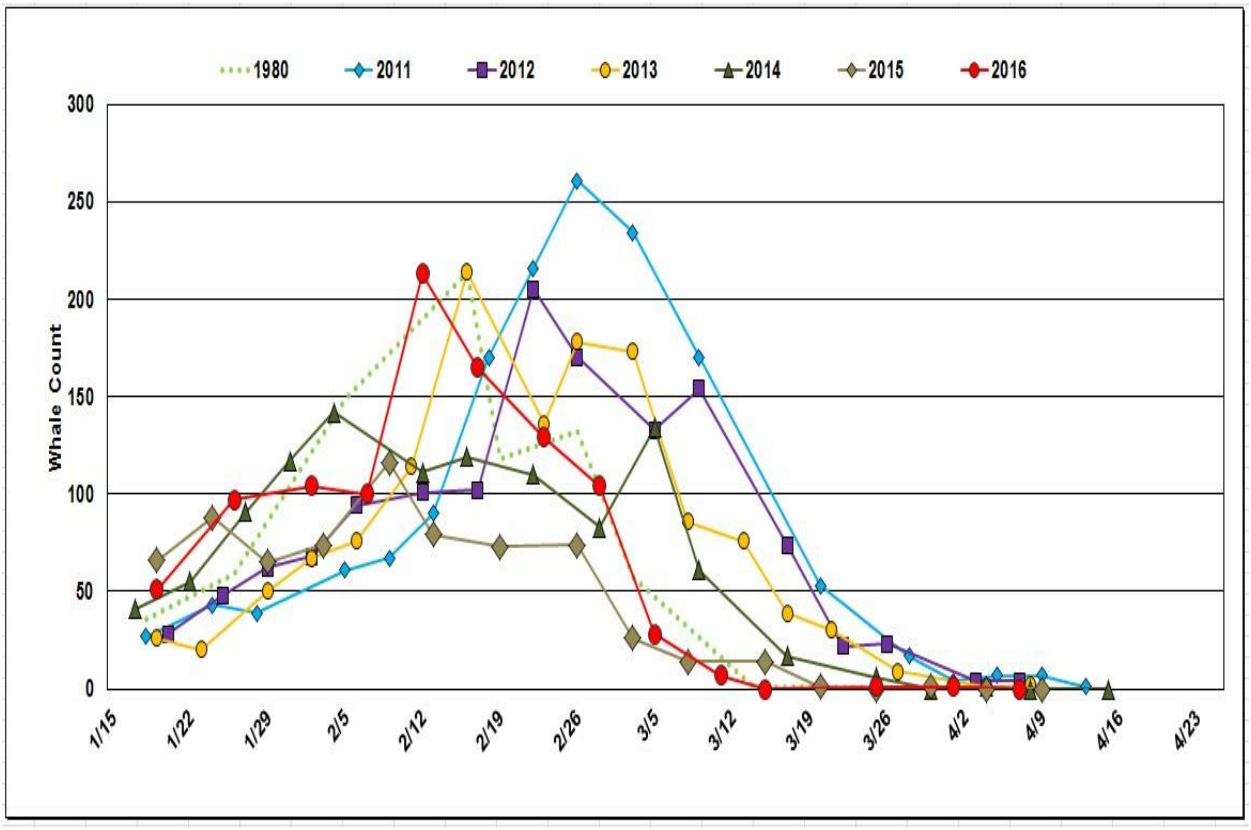

Figure 5. Gray whale boat survey track lines (red lines) in the Bahía Magdalena lagoon complex: Bahía Almejas (BA), Bahía Magdalena (BM) and Lopez Mateos (LM).

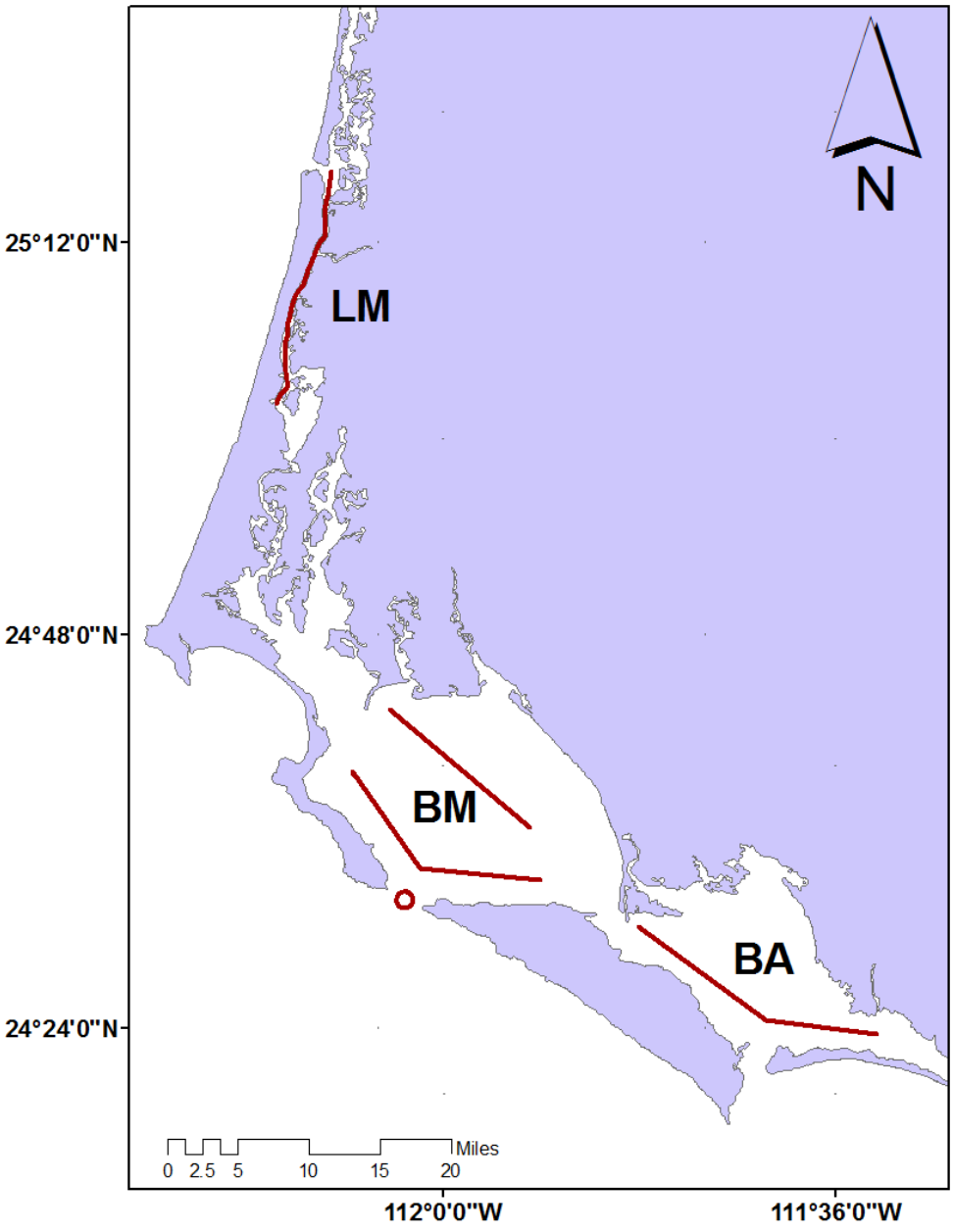

Figure 6. Whale sightings in the Bahía Magdalena lagoon complex and surrounded waters: Bahía Almejas (BA), Bahía Magdalena (BM) and Lopez Mateos (LM). blue circles = gray whale single animals; red circles = gray whale female-calf pairs; and green circles = humpback whales.