Photographic Identification and Status of Eastern North Pacific Gray Whales (*Eschrichtius robustus*) In Laguna San Ignacio, Baja California Sur, Mexico During the 2005-2006 Winter Breeding Season

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5 September 2006

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Field studies of breeding gray whales in Laguna San Ignacio, Baja California Sur, México, were conducted during February 2006. Participants were Dr. Jorge Urbán Ramírez, M en C. Alejandro Gómez Gallardo, Biol. Mar. Sergio González Carrillo, Biol. Mar. Benjamín Troyo Vega and Biol. Mar. Mauricio Nájera Caballero from Autonomous University of Baja California Sur (UABCS), and Dr. Steven L. Swartz from Maryland, U.S.A.

OBJECTIVES

The overall objective of this season's research was to continue gray whale scientific monitoring in San Ignacio Lagoon to detect and assess trends in the whales' use of this breeding habitat, to evaluate the status and apparent condition of whales that are observed in the lagoon, and to provide this information as a basis for advice to resource mangers for monitoring and directing ongoing human activities in the San Ignacio lagoon wetlands complex.

Specific objectives included:

1. Documenting the relative abundance and distribution of gray whales within San Ignacio Lagoon during the period of study;
2. Estimating the relative number of Cows with calves and single whales in San Ignacio Lagoon during the 2006 winter breeding season;
3. Initiate a third time series of photographic identification data for ENP gray whales in their breeding lagoons of Baja California Mexico;
4. Combining photographs from 2005 -2006 with the existing historical gray whale digital photographic database;
5. Analyzing photographic data for evidence of changes in physiological condition (e.g., physical evidence of skinny, malnourished, scarred, or otherwise stressed individuals) by comparing photographs of known whales from all three time periods (i.e., 1977-1985, 1996-2002, and 2005-2006);
6. Searching and comparing photographs in the database to identify individuals animals, especially females, that are re-sighted in the breeding lagoons and other areas of the gray whales' range to determine: (a) frequency of occurrence and movements within and among specific areas and breeding lagoons, (b) calving intervals for known females, (c) estimates of adult and calf survivorship; (d) determine associations between known individuals; and (e) other life history parameters relevant to the health and condition of the ENP gray whale population.

STUDY AREA.

San Ignacio Lagoon:

San Ignacio Lagoon (Fig. 1) is in the middle of the Baja California Peninsula (26º 43' and 26º 58' north; 113º 08' and 113º 16' west). It is a coastal lagoon within the Vizcaíno Biosphere Reserve. Its entrance is protected from the Pacific Ocean by the barrier sand island, Isla Ana. The shoreline of the lagoon is composed of sandy shores and rocky shell limestone, with some areas of red mangroves and mud flats (Urbán *et al.* 1996). It has relatively warm weather and temperature between 18-22º C. The lagoon length is 30 km, and its interior is composed of a system of channels separated by sand bars and mud flats, some of which support dense growths of eel grass. The bathymetry of the lagoon describes 3 different parts: (1) Upper lagoon with an average depth of 5 m. is the area from the northern most point (El Remate) to the location of La Freidera; (2) the Middle lagoon with a series of wide channels approximately 6 m deep and separated by san bars; and (3) the Lower lagoon, the deepest part of the lagoon (10-20 m) from Punta Piedra to the lagoon entrance. The sea level change with the tides runs between 0.9-2.4 m depending on the stage of the tide (Winant and Gutierrez de Velasco, 1999). The total surface of the lagoon is 152 km^2

but only the 57% of this area is of sufficient depth to be used by the gray whales (Jones and Swartz, 1984).

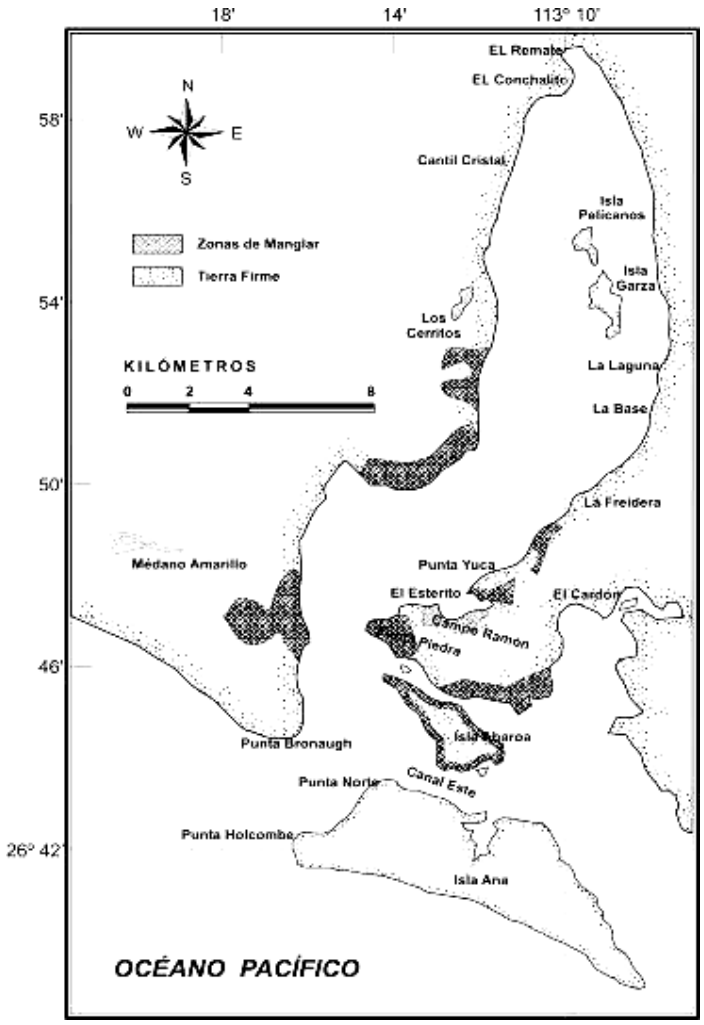

Figure 1. San Ignacio lagoon.

METHODOLOGY

Abundance and Distribution.

To estimate the number and distribution of whales in the lagoon during the season, boat-based surveys were conducted on four dates within the month of February (February 5th, 10th, 15th and 21st). We attempted to conduct additional surveys, but poor weather and high winds prevented the completion of those additional surveys.

The census survey methodology follows a single transect line that runs down the middle of the lagoon along its entire length from the northernmost point (El Remate) to the entrance (near Punta Halcombe). The survey is conducted in a 22 ft long fiberglass boat called a “panga”, powered by a 90 HP outboard motor, at speed of 10 km/hr. According to Jones and Swartz (1984) this speed is preferred for such surveys because it is slow enough to observe whales yet faster than the gray whale travels (i.e., 3-5 km/hr) thus minimizing the likelihood of counting the same whales twice.

Each survey began I the northern part of the lagoon with a 20 minutes 360° sweep of this area to estimate the number of whales in the northern portion. The survey then began southward along the transect line to the lagoon entrance.

The survey crew included a driver, two observers (each one on each side of the boat) and a fourth person who recorded all whale observations and other information related to the census survey (e.g., change in wind and visibility, other species encountered, boats, etc.). Observed whales were recorded when they passed an imaginary line perpendicular to the boat, not when they were first seen. This way, the relative distribution of whale sightings along the transect line can be determined. We distinguish between Cows with calves of the year and single whales without calves. Recorded data included: the zone of the lagoon, start and stop time, time of each sighting and time recorded, the number of whales in each group, weather conditions, other species observed (e.g., dolphins, sealions, birds, sharks, etc.) and boats.

Duration of Stay (Residence time) and number of whales in San Ignacio Lagoon
To estimate the duration of stay or residence time of whales that visited the San Ignacio Lagoon in 2006 winter season, separate boat surveys were conducted to obtain photographs of whales and these compared across survey days and the entire season. Photo-identification surveys generally were a full day or approximately 8-hrs. In addition to obtaining photographs, other observations included the date, time each photograph was take, weather conditions, number of animals and category (cow/calf or single), etc..

Minimum length of time a whale was in the lagoon was estimated from the number of days from the first day it was photographed to the last day it was photographed.

Photographic Database
Following the field season, a laboratory analysis was conducted with all the photographs obtained in San Ignacio Lagoon in 2006. This analysis consisted of sorting and comparing all of the photographs, and matching those photographs of the same individual whales. From these, the total number of distinct individuals photographed in the lagoon, and the number of times each individual was photographed could be determined.

Each photograph was then assigned an identification number, and coded according to the prominent distinguishing markings on that whale (e.g., white marks, scars, patterns, etc.), including the body portion photographed (i.e., left and/or right side). All of these identified and coded photographs were then entered into the ENP Gray whale photographic identification database where they could be archived and compared with other photographs from previous seasons.

RESULTS.

Abundance and Distribution.
In all census surveys, single whales were more abundant that cows with calves (Table I), and the counts of single whales increased between survey dates(Fig. 2). The largest number of single whales counted was 108 during the February 21st survey (the last census conducted this season). Counts of cows with calves increased to a high count of 45 during the February 15th survey, and then decreased slightly to 43 in the last surveys on February 21st.

Table I. Census counts of gay whales in San Ignacio lagoon across the 2006 season.

	Cow / calf	Singles
February 5th	25	29
February 10th	26	43
February 15th	45	97
February 21st	43	108

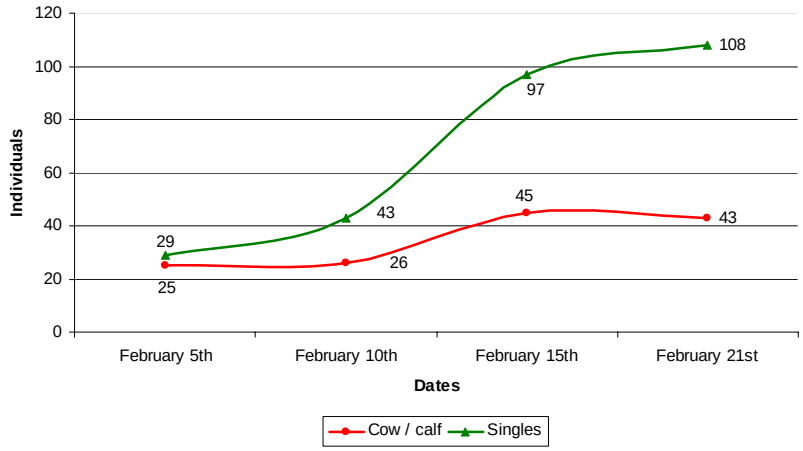

Figure 2. Number of gray whale Cows with calves and Single whales counted along the census survey conducted during the 2006 season.

The distribution of gray whales inside the lagoon did not vary much across the season and the census counts suggested a typical pattern of lagoon occupation. The Table II and Fig. 3, 4, 5 and 6 shows the distribution and abundance in each date of the census. We get as a result that the distribution and abundance was almost the same and we identify two zones with huge difference, one is the North end, this area presents the lower numbers and the other area is the Middle and Lower lagoon, this zone is important because is where we had the highest numbers of whales for both categories.

Table II. Number of gray whales for each category (Cows and Singles) during the four censuses done in San Ignacio lagoon on 2006 season, for each zone of the lagoon.

February 5th 2006	**1st census**					
Category	**North**	**Upper lagoon**	**Middle lagoon**	**Lower lagoon**	**Total**	**Total with calves**
Mother with calf (Mc)	0	2	9	14	25	50
Single (S)	0	1	12	16	29	29
Total					***54***	***79***

February 10th 2006	**2nd census**					
Category	**North**	**Upper lagoon**	**Middle lagoon**	**Lower lagoon**	**Total**	**Total with calves**
Mother with calf (Mc)	0	4	9	13	26	52
Single (S)	0	12	15	16	43	43
Total					***69***	***95***

February 15th 2006	**3rd census**					
Category	**North**	**Upper lagoon**	**Middle lagoon**	**Lower lagoon**	**Total**	**Total with calves**
Mother with calf	4	14	19	8	45	90

(Mc)						
Single (S)	1	16	41	39	97	97
Total					***142***	***187***

February 21th 2006 4th census

Category	**North**	**Upper lagoon**	**Middle lagoon**	**Lower lagoon**	**Total**	**Total with calves**
Mother with calf (Mc)	0	8	22	13	43	86
Single (S)	0	12	48	48	108	108
Total					***151***	***194***

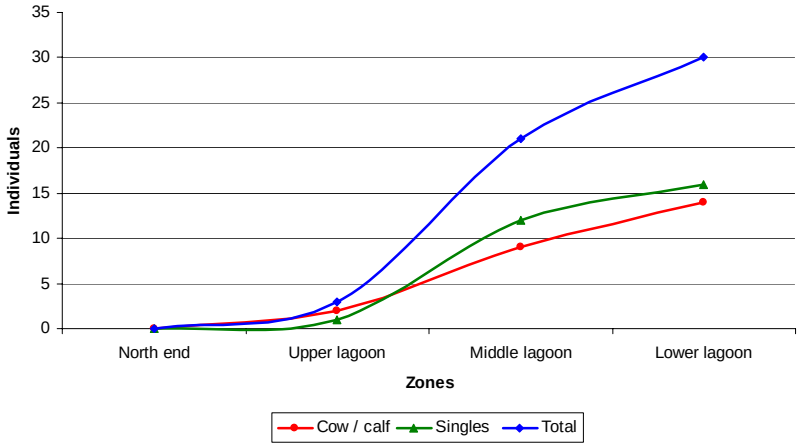

Figure 3. Number of gray whales during the first census in San Ignacio lagoon.

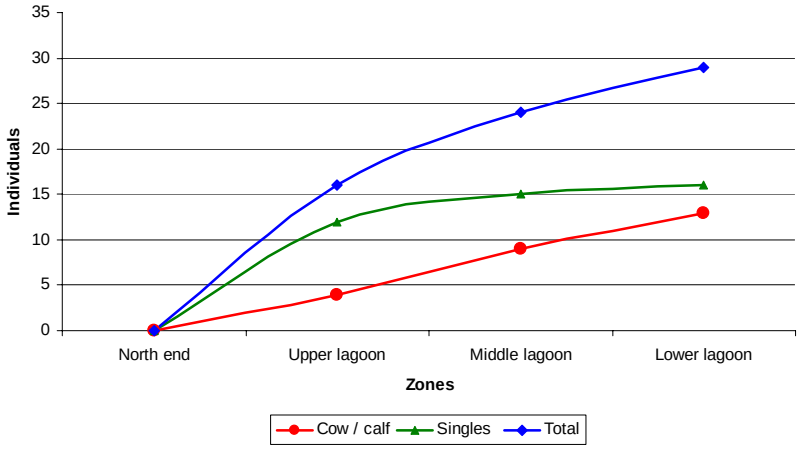

Figure 4. Number of gray whales during the second census in San Ignacio lagoon.

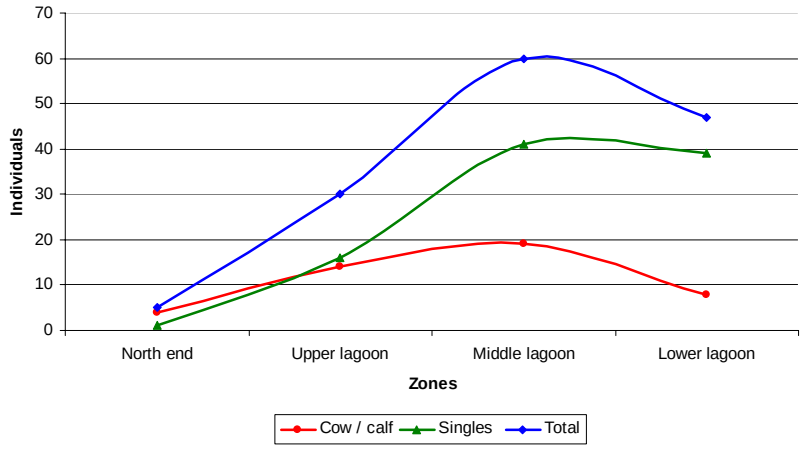

Figure 5. Number of gray whales during the third census in San Ignacio lagoon.

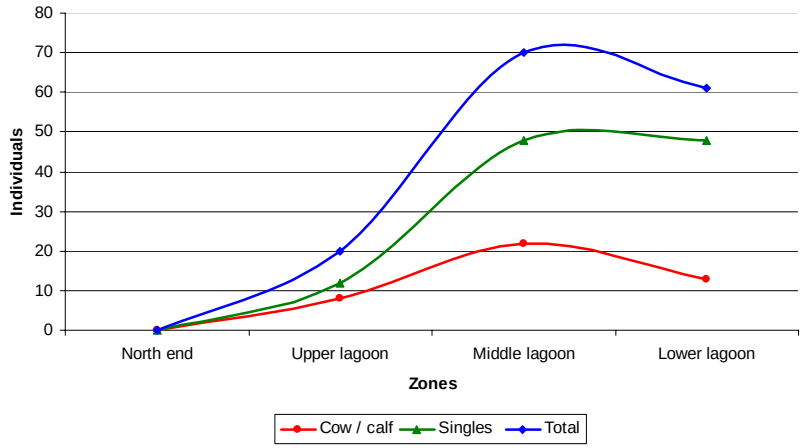

Figure 6. Number of gray whales during the fourth census in San Ignacio lagoon.

Permanence and number of whales in San Ignacio Lagoon.

On this season we took almost like 500 pictures, we could identify 327 whales. We compared each one against each one and we get 257 individuals, 67 cows, 189 singles and one male. All the data of each individual is in the database.

We matched 19 individuals, 13 cows and 6 singles. We only took matched whales of different days.

The Table III shows us the relation between recaptures, how many times did we saw the whale and the date. The Whale ID # LSI-2220 had 3 recaptures along the season; this is the highest number of recaptures in this year; while the Whale ID # LSI-2216 had the highest number of days in the lagoon with 21 because that is the time between the first and second record do we have. Both whales are females.

Table III. Recaptures found in San Ignacio lagoon during this winter season.

Whale ID #	Recaptures	Dates (February days)	
		Original	Recapture
LSI-2183	2	3	6 y 13
LSI-2196	1	4	8
LSI-2197	1	4	18
LSI-2198	2	4	6 y 9
LSI-2203	1	6	6 y 7
LSI-2211	1	6	13
LSI-2213	1	6	13
LSI-2214	1	6	13
LSI-2216	**1**	**6**	**27**
LSI-2218	1	7	8
LSI-2219	1	7	20
LSI-2220	**3**	**7**	**8, 9 y 26**
LSI-2233	1	8	24
LSI-2241	1	9	27
LSI-2266	1	14	20
LSI-2283	1	20	21
LSI-2285	1	20	21
LSI-2306	1	21	26
LSI-2394	1	26	27

Input on database.

Once we finished the match progress of this season, that means how many whales do we have and recaptures, we input on database all the individuals with the information recorded of each whale. The total of records of gray whales for this season are 281; so the grand total of gray whales for San Ignacio lagoon across all the years (1996 to 2006) is 3264 pictures and 2527 individuals.

Whale Condition

We did not observe any whales that appeared to be in poor or unhealthy condition during the 2006 field studies in Laguna San Ignacio. Photographs from 2006 were analyzed for evidence of changes in physiological condition (e.g., physical evidence of skinny, malnourished, scarred, or otherwise stressed individuals). We also compared photographs of presumed “healthy” whales taken during previous field studies and time periods in Laguna San Ignacio (i.e., 1977-1985, 1996-2002). This review and analysis is ongoing and, if any suggestions of poor physiological condition are discovered in the future, these will be reported to the NOAA Fisheries Office of Protected Species**,** Marine Mammal Health and Stranding Rsponse Program (F/PR2).

Acknowledgements

The authors wish to acknowledge the support of the NOAA Fisheries, Office of Protected Resources, Marine Mammal Health and Stranding Response Program (F/PR2) without which the 2005-2006 field season would have not been possible..

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