

HISTORICAL CHANGES OF GRAY WHALES ABUNDANCE IN SAN IGNACIO AND OJO DE LIEBRE BREEDING LAGOONS, MEXICO.

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ABSTRACT

Boat surveys at Laguna Ojo de Liebre (1980-1983, 1985, 1987-1989, and 1996-2010) and Laguna San Ignacio (1978-1982, 1996-2000, and 2006-2010) show changes in the abundance of gray whales in the lagoons. In Laguna Ojo de Liebre the year with more whales in the peak of the season was 2004 with 1122 (889 cow-calf pairs and 233 single whales). In Laguna San Ignacio the year with more whales in the peak of the season was 1982 with 407 (137 cow-calf pairs and 270 single whales). In both lagoons there were a decrease in the numbers of cow-calf pairs during the seasons of 2007 to 2009, similar to the results from shore-based surveys at Piedras Blancas during the northbound migration. In 2010 there were the lowest counts of cow-calf pairs in both lagoons in the last 15 years.

INTRODUCTION

Laguna Ojo de Liebre (Scammon's Lagoon), and Laguna San Ignacio (LSI) are two of the of the three calving-breeding lagoons of the Eastern Pacific gray whale (*Eschrichtius robustus*) that remains mostly undeveloped (Urbán *et al.*, 2003a). The lagoons are located in the west coast of the Baja California Peninsula in Mexico (Fig 1). These lagoons are part of El Vizcaino Biosphere Reserve

METHODS

Boat Surveys (census)

By convention, we considered "cow-calf pairs" (*i.e.*, female whales with calves of the year) as a single unit and counts of these pairs are equivalent to calf counts. "Single whales" refer to non-parturient females, adult males, and immature animals.

Laguna Ojo de Liebre (Scammon's Lagoon)

Until 2000 surveys were made following procedure described in Sánchez (1991), Since 2001 survey procedure was a modification of that used before. We follow the same transects and division of the lagoon but using two boats instead one in order to cover better the lagoon and to avoid to count the same whale twice. Similar to Jones and Swartz (1984) and Urbán *et al.* (1997), transects were conducted from a 7m boats powered by an outboard motors, traveling at an estimated speed of 11 km/hr. This speed insures that whales (which typically travel at 2 to 4 knots) do not move ahead of the survey boat and thus be counted more than once. During the whale surveys the coastal areas searched in order to locate stranded whales. Census from 1980 to 1983 were made by Luis Fleischer (Fleischer and Beddington, 1985), from 1987 to 2000 by Jose Sánchez

(Sánchez, 1981), from 2001 to 2002 by Jorge Urbán R. (Urbán *et al.*, 2003a), and 2003 to 2010 by personnel of the El Vizcaino Biosphere Reserve and Compañía Exportadora de Sal S.A..

Laguna San Ignacio

Boat surveys utilizing standardized methodology have been used to monitor the number of gray whale residing within LSI during the winter began in 1978-1982 (Jones and Swartz 1984). A second series of surveys were conducted from 1996-2000 (Urbán *et al.*, 2003a). A third survey series began as part of the Laguna San Ignacio Ecosystem Science Program (LSIESP) in 2007 and these surveys continue to the present (Swartz *et al.* 2007, 2008, and 2009). Counts from the 2007 to 2010 surveys were compared to establish the current timing and pattern of the winter occupation, and to monitor the number gray whales that currently utilize this lagoon during the winter breeding season.

RESULTS

Laguna Ojo de Liebre (Scammon's Lagoon)

Historical surveys indicate that Laguna Ojo de Liebre is the most important breeding and calving lagoon in terms of the number of whales that occupy it during the winter breeding season. The maximum counts since the early 1980s are relatively constant with the exception of three drastic declines (Fig. 2). During 1988, there was an extreme decline in the counts of mother-calf pairs from 503 in 1987 to 84 in 1988. The cause of this decline remains uncertain, however, apparently it was not related to Sea Surface Temperature (SST) anomalies observed during this period; the SST in the lagoon was the same (17.2°C) as the year before (Sánchez P, 1991). In 1989, low numbers of mothers with calves were observed again, along with lower than expected counts of single whales. The SST in the lagoon that year was 15.5°C (Sánchez P, 1991) and the general winter distribution of gray whales along the Pacific coast of Baja California appeared to have shifted further south, with some whales moving into the Gulf of California and up to Bahía de Banderas along the mainland coast. Unfortunately, there were no surveys during the next five years to monitor trends of gray whale occupancy in the lagoons. Surveys resumed in 1996, when winter counts of gray whales had returned to expected levels. A similar decline in counts occurred in 1999, when the number of mother-calf pairs decreased from 530 in 1998 to 213. Again, the SST was lower than the average and the general whale distribution appeared to have shifted to the south (Urbán *et al.*, 2003b). Counts during the 2000 and 2001 winter seasons indicated a slight increase in mothers with calves, but a decrease in single whales. The highest numbers recorded in the lagoon were in the seasons 2004, 2005 and 2006 with more than 800 mother-calf pairs in the peak of the season each year. Finally during 2010 a strong decline in the mother-calf pairs was noted again with only 183, the lowest number in the last 15 years (Figs. 2,3 and 4).

Laguna San Ignacio

Historical records of census in Laguna San Ignacio were presented to this subcommittee by Swartz *et al* (2008) and Swartz *et al* (2009). During the season 2010, similar than Laguna Ojo de Liebre, there was the lowest cow-calf pairs present in the peak of the season with only 20. In the figures 5, 6 and 7 compare the three series of surveys in Laguna San Ignacio (1978-1982, 1996-2000, and 2007-2010) and we can observe an historical decline in the numbers of cow-pairs present in the Laguna San Ignacio.

DISCUSSION

Results from the season 2010 are preliminary. We do not know the reason of the reduction of cow-calf pairs in the lagoons. For the moment we can add that there were no special high mortality of gray whales in the lagoons,

the presence of “skinny” whales were on average similar than previous seasons, about 5%, and no important SST changes were detected in the lagoons.

Perryman *et al* (2002) have suggested that there is a link between the timing of the melt of seasonal ice in the Arctic and calf production in this population the following winter.

The fluctuations of the numbers of cow-calf in the lagoons is similar to changes in the estimates of northbound gray whale calves based on shore-based surveys conducted from the Piedras Blancas Light Station in California (Perryman *et al.* 2010), which indicates that the changes in the abundance in the lagoons are an reflect of what happened in the population.

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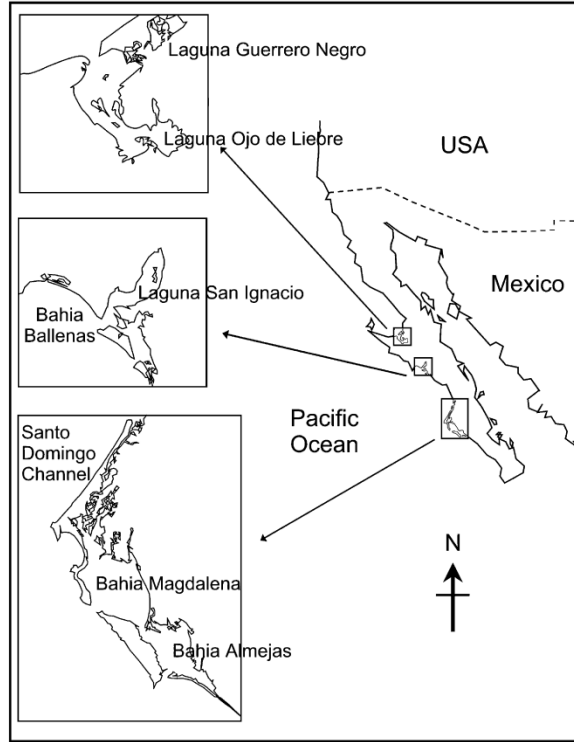


Figure 1. The three calving and breeding coastal lagoons in the west coast of the Baja California Peninsula

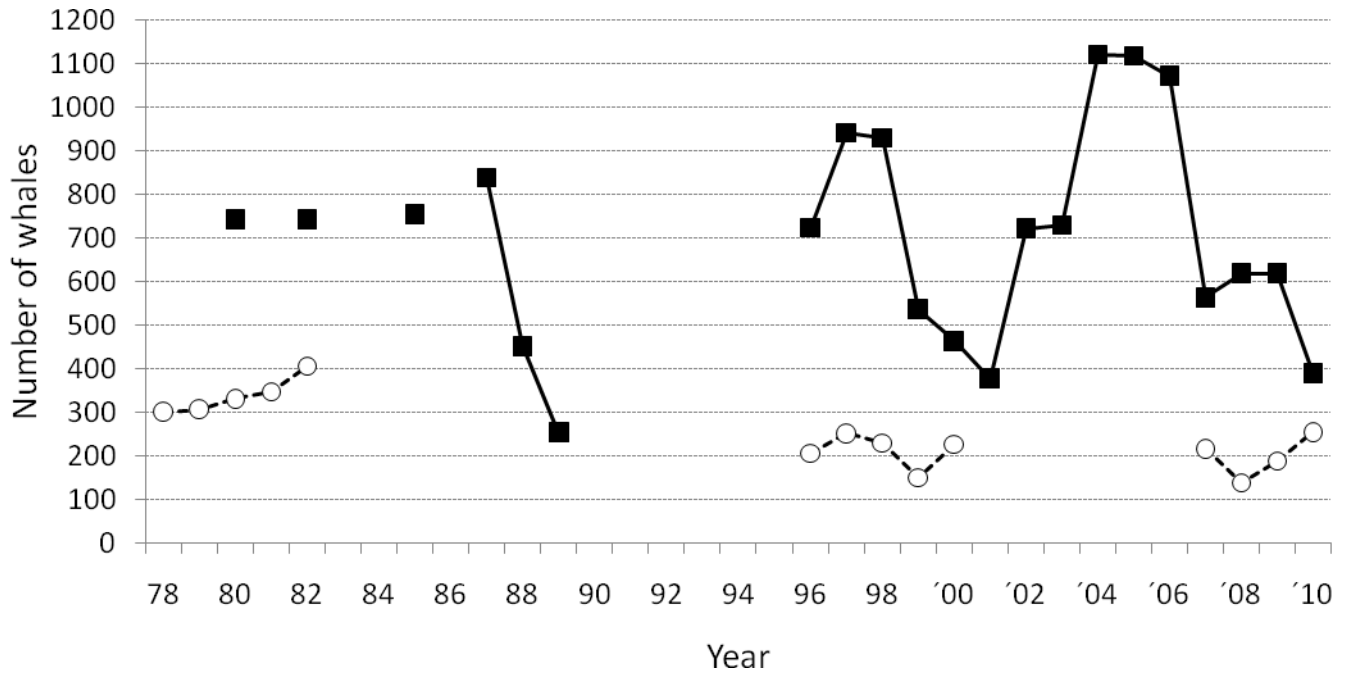


Figure 2. Comparison between number of adult whales counted in San Ignacio and Ojo de Liebre Lagoons. Lines between points represent surveys in continuous years. Black circles are counts from Ojo de Liebre Lagoon and white circles are counts from Laguna San Ignacio.

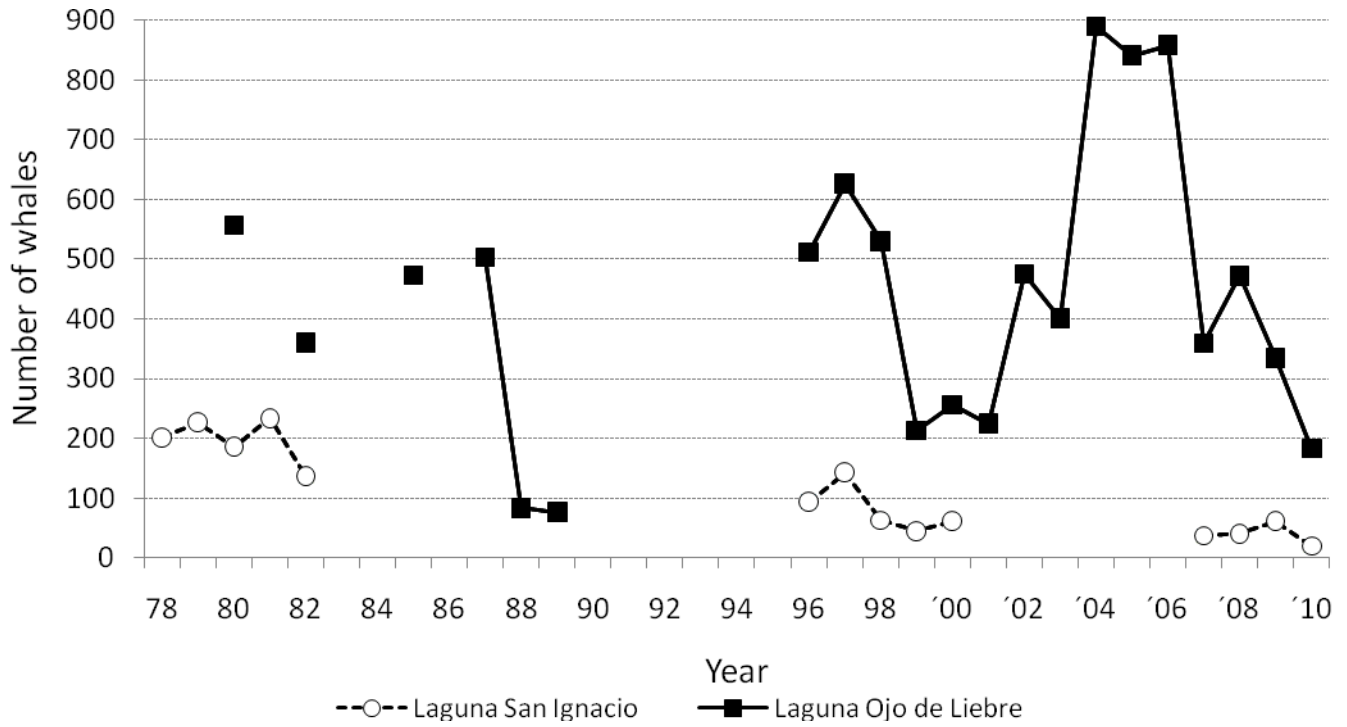


Figure 3. Number of cow-calf pairs counted in San Ignacio and Ojo de Liebre Lagoons. Lines between points represent surveys in continuous years. Black circles are counts from Ojo de Liebre Lagoon and white circles are counts from Laguna San Ignacio.

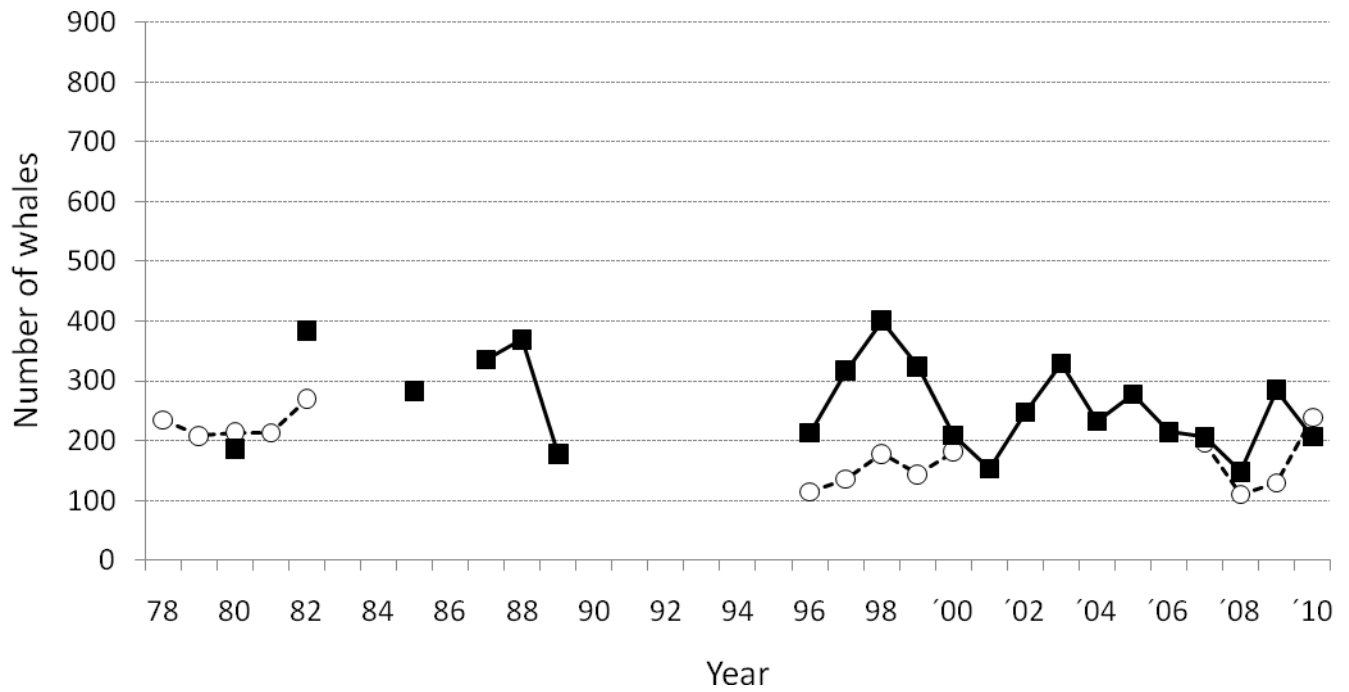


Figure 4. Number of single whales counted in San Ignacio and Ojo de Liebre Lagoons. Lines between points represent surveys in continuous years. Black circles are counts from Ojo de Liebre Lagoon and white circles are counts from Laguna San Ignacio.

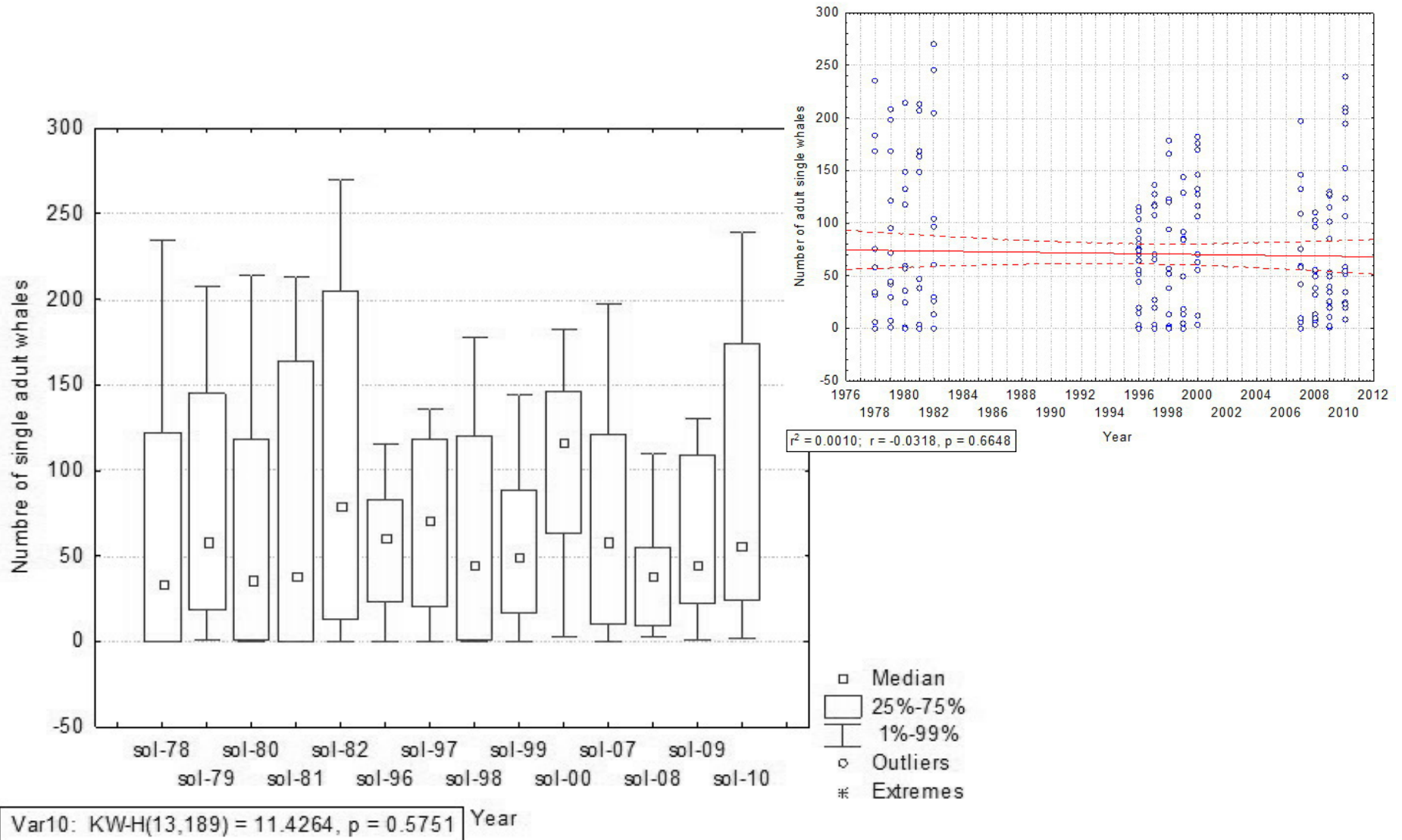


Figure 5. Comparison between the number of single whales counted in boat surveys at San Ignacio Lagoon in three study periods (1978-82, 1996-2000 & 2007-2010), showing no significant differences between years. At top right is the regression analysis with no significant result.

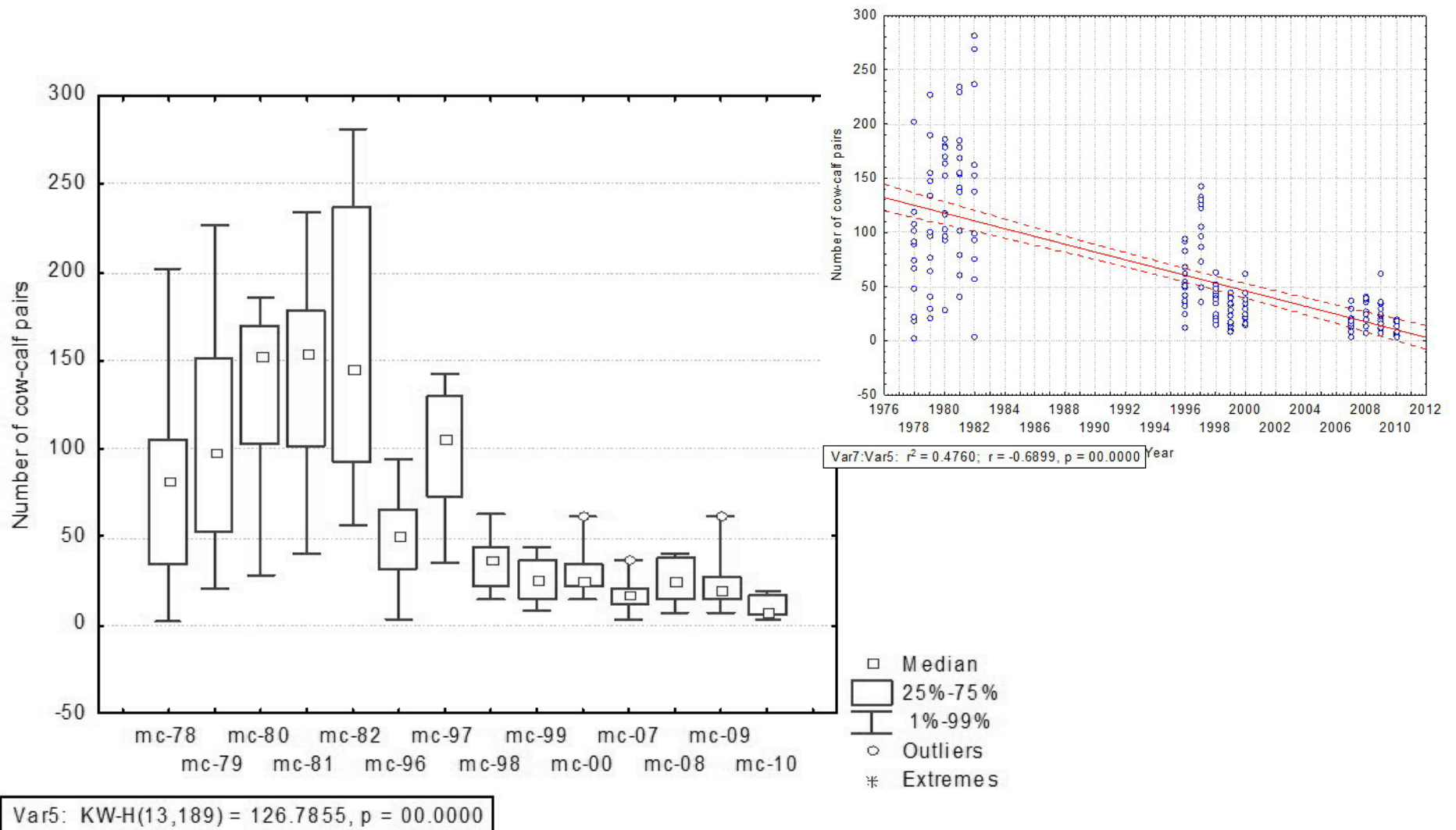


Figure 6. Comparison between the number of Cow-calf pairs counted in boat surveys at San Ignacio Lagoon in three study periods (1978-82, 1996-2000 & 2007-2010), showing significant differences between years (mostly 1998 to 2010 vs 1978-82). At top right is the regression analysis with negative significant result.

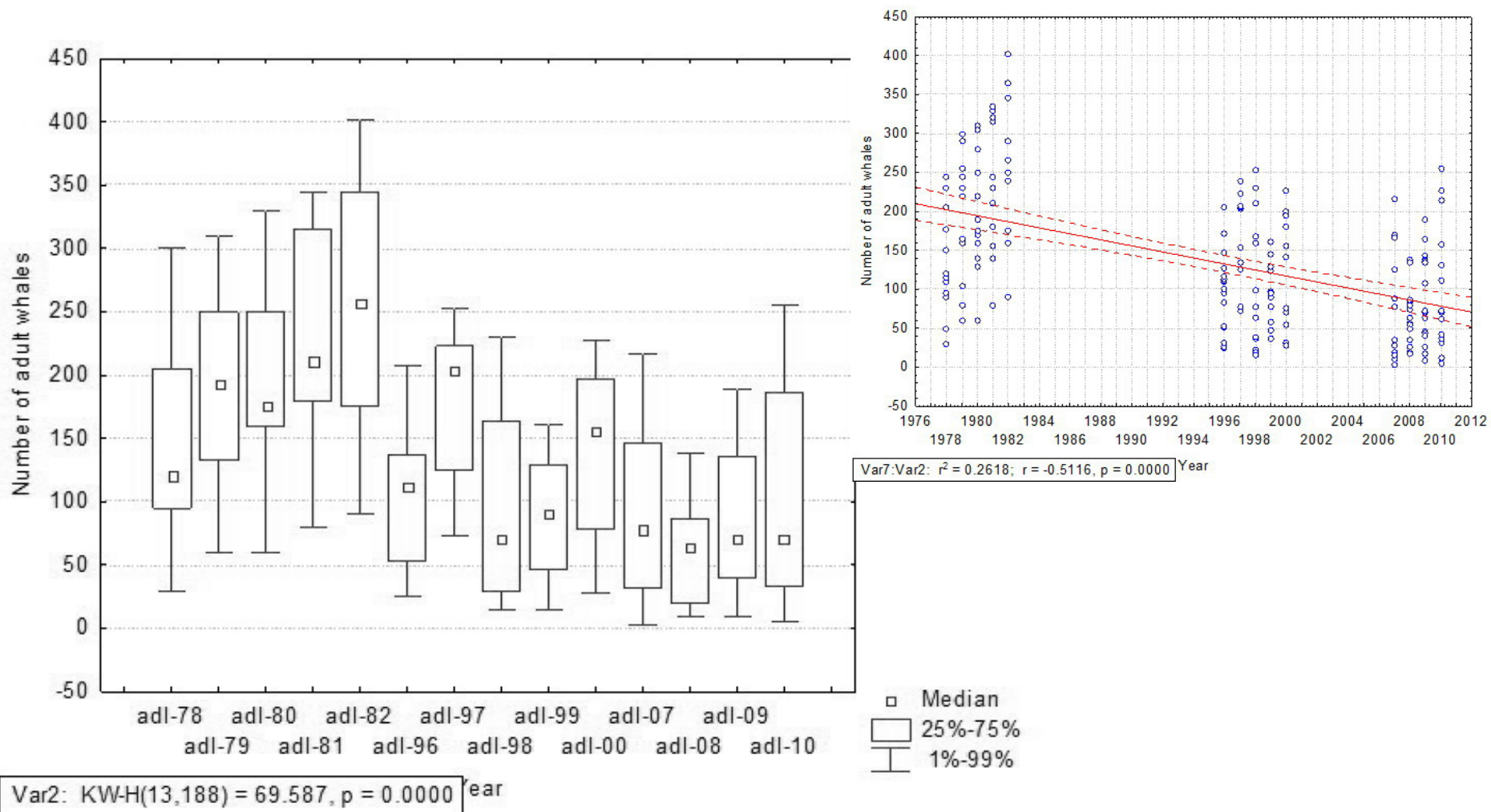


Figure 7. Comparison between the number of Adult whales counted in boat surveys at San Ignacio Lagoon in three study periods (1978-82, 1996-2000 & 2007-2010), showing significant differences between years (influenced by cow-calf pairs numbers). At top right is the regression analysis with negative significant result.

