

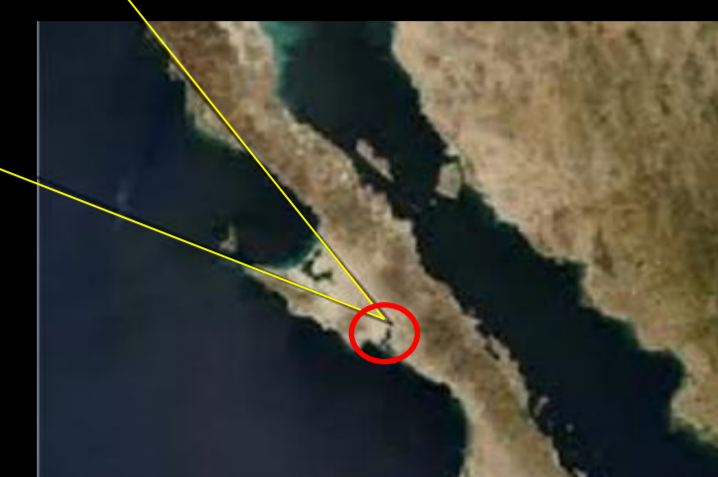


Gray whale sounds in their breeding and reproduction area of San Ignacio Lagoon Baja California Sur, Mexico.



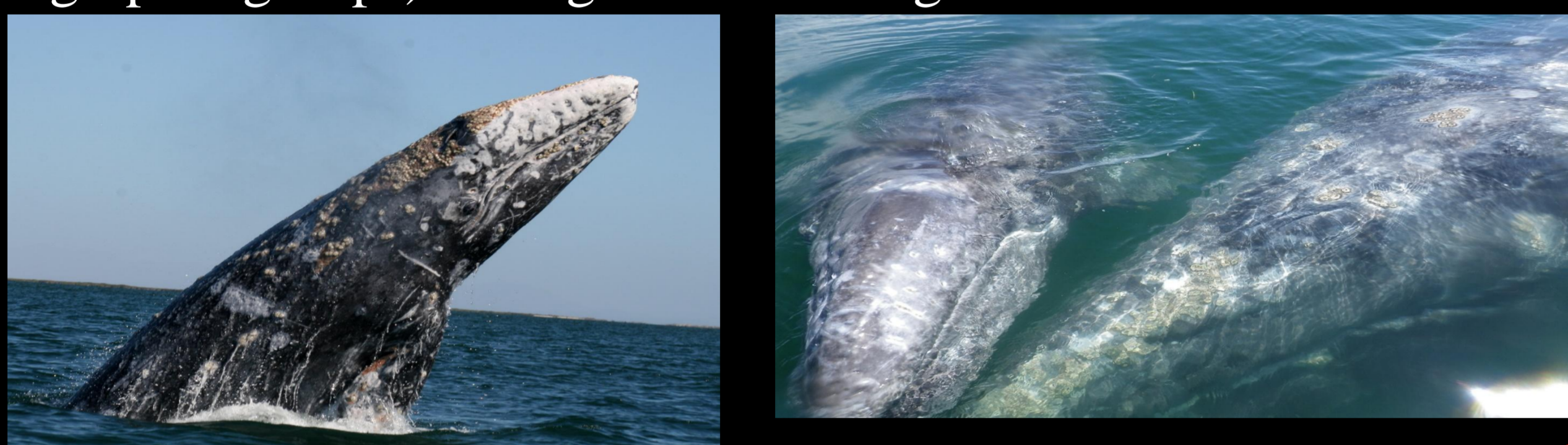
López-Urban Anaid^{1,4}, Thode Aaron M², Bazúa -Durán Carmen³, Guerra Melania², Urbán Jorge⁴.

1. Posgrado de Ciencias del Mar, Instituto de Limnología y Ciencias del Mar, Universidad Nacional Autónoma de México.
 2. Marine Physical Laboratory Scripps Institution of Oceanography University of California San Diego
 3. Laboratorio de Acústica, Facultad de Ciencias, UNAM.
 4. Departamento de Biología Marina, Universidad Autónoma de Baja California Sur.
- soyanaid@hotmail.com



Introduction

The gray whale is the only species in the mysticete family *Eschrichtidae*. The monitoring data have revealed that gray whales are, producing several low frequency calls ranging from 50 to 2000 Hz. Both in the feeding grounds in the Arctic and in the breeding/calving grounds, the most common sounds produced by gray whales are pulses ranging from 50 to 800 Hz.. This study described the acoustic behavior of gray whales by determining if there was a relationship between calling rate, call type and call structure, among mothers with calves and singles whales (demographic groups). Using Bio-Probe tags.



Methods

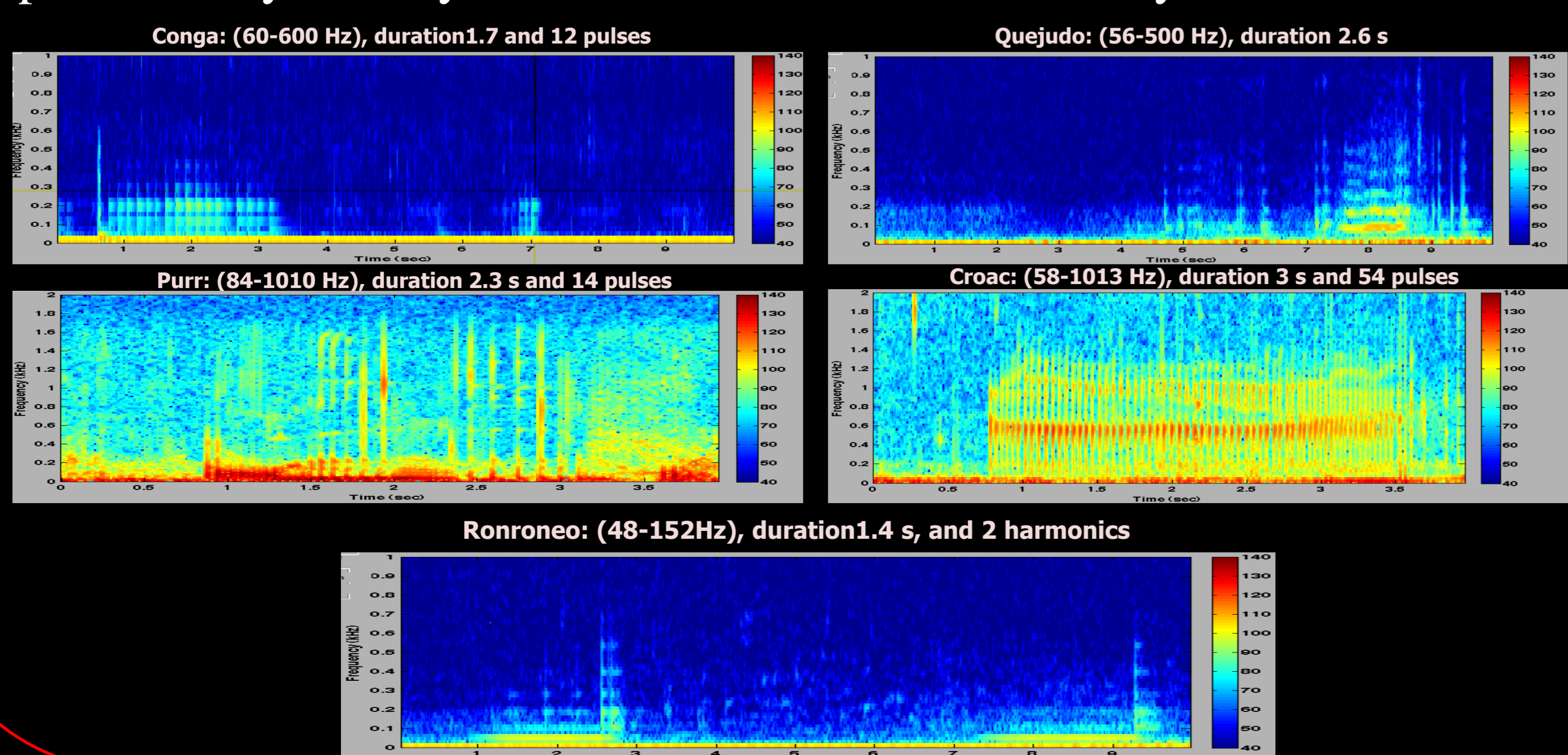
Tagging records were taken during: March, 2008; March, 2009, and February and March, 2010; comprising a total of 405 hours of recordings. The tags were deployed from a small outboard engine boat and the tags were attached on the dorsal section of the whale's body using suction cups. The tag was tracked using a Yagi antenna and a R410 receiver using the VHF transmitter of the Bio-probe.



For the analysis for the acoustic recordings obtained, two MATLAB routines used to extract and visualize the vocalizations registered in the recordings. The pulsed calls were divided in 4 categories: *CONGA*, *CROAC*, *QUEJIDO* and *PURR*; the only group of FM calls was named *RONRONEO*.

Results

A total of 24 tags were placed in three years of which only 17 registered whale sounds: 9 were placed on mothers with calves, 5 on solitary whales and 3 on calves with mother. A total of 1638 minutes of recordings were analyzed, comprising 1255 calls. Calls recorded were attributed to the whale on which the tag was placed. From the calls analyzed 239 were produced by solitary whales and 804 were emitted by mother with calves.



Results

The types of calls produced were dependent of the demographic group. For the mothers with calves, the conga and the *QUEJIDO* were the more frequently used vocalizations, whereas the solitary whales mainly used the *RONRONEO* and the *CROAC* calls. The *PURR* call was present in the same proportion in the both groups. The relationship of the call's type and demographic group was done with the chi-square distribution test, we obtained ($X^2=112.67$ g.l= 0.95, 4) ($p \ll 0.05$) and the follow percentage's table.

	Total calls loeed for each type for demographic group					
	Mothers with calves (%)		Solitary whales (%)		Total (%)	
Conga	800	92.9	238	75.1	1038	88.1
Ronroneo	11	1.3	49	15.5	60	5.1
Quejido	29	3.4	7	20.2	36	3.1
Purr	20	2.3	20	6.3	40	3.4
Croac	1	0.1	3	0.9	4	0.3
Total	861	100	317	100	1178	100

Differences in the acoustic structure of each call type (Call duration, minimum, maximum and low-maximum frequency, number of pulses could only be determined for CONGA calls for which statistically significant differences were found among demographic groups.

Conga call's parameters	ANOVA Kruskal-Wallis P ≤ 0.05
Minimum frequency	0.05
Maximum frequency	0.2246
Low-Maximum frequency	0.05
Duration call	0.278
Pulses number	0.009

Conclusion

The correlation between a type of call and a particular demographic group indicated that the most common call for both groups was the *CONGA*. Mothers with calf used the *QUEJIDO* call more frequently than solitary whales, which showed a greater production of the *RONRRONEO* and *CROAC* calls and both groups used the *PURR* call to the same extent. These results indicate that both groups use the entire acoustic repertoire, nevertheless with different preferences and periodicity. In the case of the gray whale none of the calls recorded were exclusive of one demographic group, although the vocalizations weren't used in the same way; except for the *CONGA*, which was produced in a similar manner by both demographic groups. Crane and Lasharki (1996) proposed that the pulsed call of the gray whale could be used for communication between whales at short distances. This agrees with the results of this study showing a greater frequency in the use of this type of call and with the fact that it happens more in cow/calf groups; suggesting a particular importance of this call for the rearing process (Crane & Lasharki 1996). The production of *CONGAS* by solitary whales could be associated to communication with con-specifics, although the context under which it occurs is yet to be analyzed.

Acknowledgments

I want to thank Steven Swartz and the Laguna San Ignacio Ecosystem Science Program, a project of The Ocean Foundation. Then World Wildlife Fund-Mexico and Telcel funded the opportunity to study gray whales in Laguna San Ignacio and provided support to travel to the Scripps Institution of Oceanography in San Diego to analyze the acoustic data. AIUL was supported by a CONACYT scholarship. To Dra. Carmen Bazua Duran for the support and Cetacean Society International for the scholarship.

