A01

Designing Natura 2000 Marine Protected Areas in Northeastern Spain: the use of passive acoustic recorders as a tool for long term monitoring of cetaceans.

Carla A. Chicote[1], Manuel Castellote[2], Marc O. Lammers[3], Manel Gazo[1,4]

1 SUBMON - Conservation, study and awareness of the marine environment; Rabassa, 49; 08024 Barcelona, Spain. www.submon.org
2 National Marine Mammal Laboratory. AFSC/NOAA.; 7600 Sand Point Way N.E. F/AKC3 Seattle, WA 98115-6349, USA
3 Hawaii Institute of Marine Biology; . P.O. Pox 61692 Honolulu, HI 96839, USA
5 Department of Animal Biology, Faculty of Biology, University of Barcelona; Diagonal 645; 08028 Barcelona, Spain

carlachicote@submon.org

INTRODUCTION

The project LIFE+ INDEMARES "Inventory and designation of marine Natura 2000 areas in the Spanish sea" (2009-2013) aims to contribute to the protection and sustainable use of marine biodiversity through identification of valuable areas for Natura 2000 Network.

As a part of this initiative an acoustic monitoring program was established in order to improve the knowledge of seasonal presence and population identity of fin whales (*Balaenoptera physalus*) and sperm whales (*Physeter macrocephalus*) in two areas, located in the northern Spanish Mediterranean Sea: Creus Canyon and Delta Ebro-Columbretes (Figure 1).

MATERIALS AND METHODS

A one year study was conducted using passive acoustic techniques. A deep water Ecological Acoustic Recorder (EAR) (Oceanwide Science Institute, Honolulu, USA) (figure 2) was deployed during September-November 2009 and March-May 2010 at Creus Canyon and Delta Ebro-Columbretes respectively (Figure 1). The EAR was set to a recording speed of 6250Hz in a cycle of 10mn every 30 mn. The device was prepared to be moored at 500 mt deep (figure 3). Table 1 summarizes information on the sampling period.

Besides, following Whitehead (2008) methodology, an acoustic transect survey (Cañadas 2006) (figure 4) was conducted in the northern area (Creus Canyon) in order to detect and localize sperm whales. A towed array hydrophone (figure 4) (Nauta, Milano, Italy) was used to verify the sperm whale ecolocalization behaviour and to determine the angles of animals positions.

Area	Position	Deep	Period	Total days
Creus Canyon	42º 21' 41''N 3º 20' 99''E	363 m	27/09/2009 26/11/2009	61
Delta Ebro-Columbretes	40º 29' 37.4''N 1º 21' 03.8''E	330 m	16/03/2010 25/05/2010	71

Table 1. Details of the areas and positions of the EAR.

Figure 2: Ecological Acoustic Recorder (EAR).

Figure 3: Mooring System: EAR attached to the acoustic release device (7986 LRT,Sonardyne Ltd,Hampshire, UK). The system was moored on the seafloor with a sinker weight of 200kg and a floating line of 2 buoys (12kg).

STUDY AREA

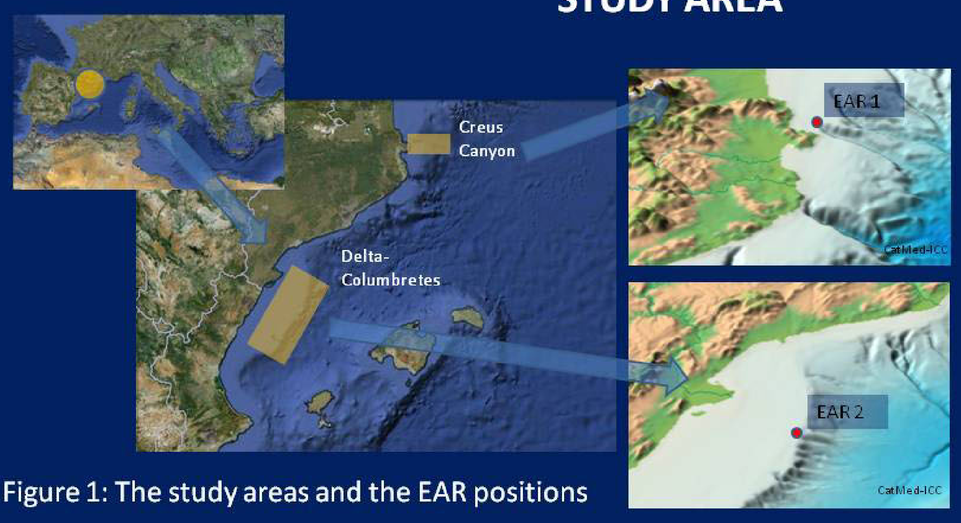

Figure 1: The study areas and the EAR positions

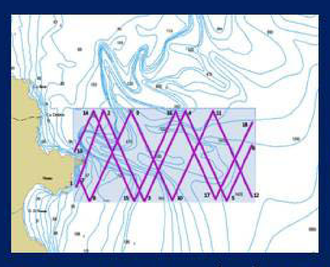

Figure 4: A total of 370 km from the area were surveyed .

Figure 5: The registration chain: Towed array hydrophone, an amplifier ROLLS MX54s ProMix Plus, a converter from analog to digital signal E-MU USB 2.0, a low frequency filter and a computer with specialized software (Ishmael 2.0 (NOAA), whistles (IFAW), Rainbowclick (IFAW)) that allows the visualization of the sound and its interpretation by the observer.

RESULTS

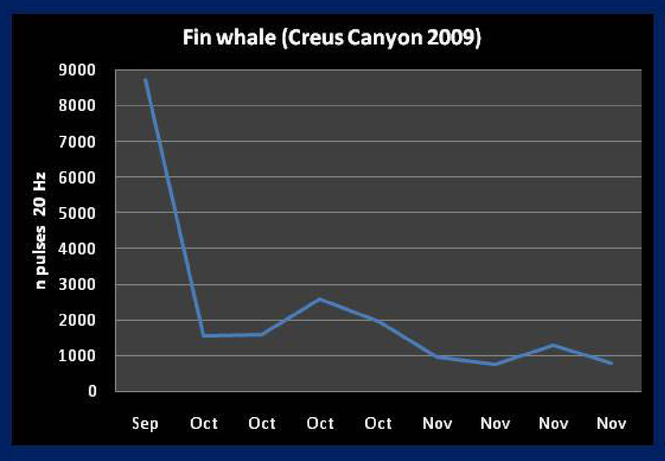

Figure 6. Weekly distribution of detections of 20 Hz pulses in Creus Canyon.

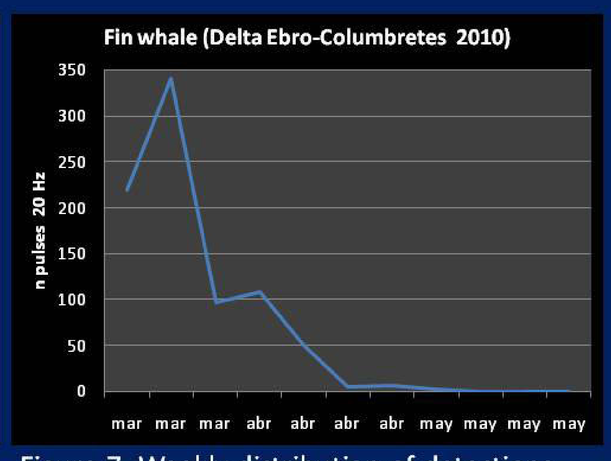

Figure 7. Weekly distribution of detections of pulses of 20 Hzin Delta Ebro-Columbretes.

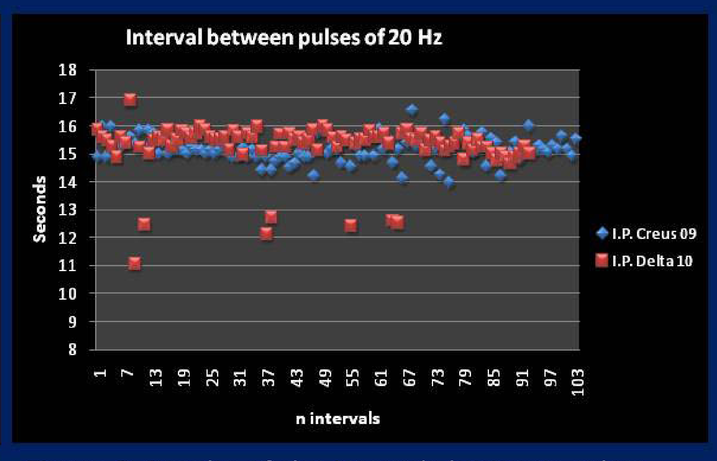

Figure 8. Results of the intervals between pulses of 20 Hz measured from 100 of the best examples in each study area.

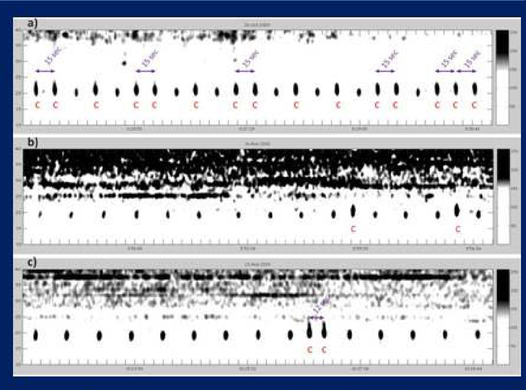

Figure 9. Spectrograms 10-40 Hz range of 6 mn of a) typical sequence of the Mediterranean population containing pulses of 20 Hz at intervals of 15 s and prepulses, b) typical sequence of the North Atlantic population containing almost exclusively prepulse c) typical sequence of the North Atlantic population where 20 Hz pulses appear in pairs at intervals of 12 s. The red "c" identify pulses (20 Hz) of the prepulse.

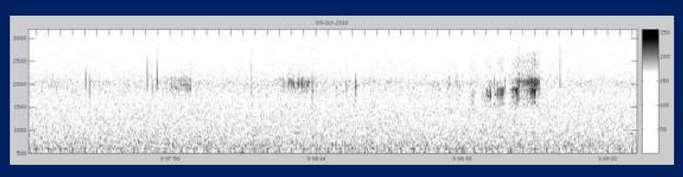

Figure 10: Spectrogram in the range 500-3125 Hz of 4 minutes of clicks and creaks associated with feeding behavior of sperm whales.

	N	Encounter Rate (ER)	Mean depth (meters)	IC-95%	IC+95%	median	min	max	Standard desv.
Sperm whale	7	1.909	1110	799.49	1420.51	1180	900	1300	419.16

Table 2: Results of the acoustic transects in the Creus Canyion.

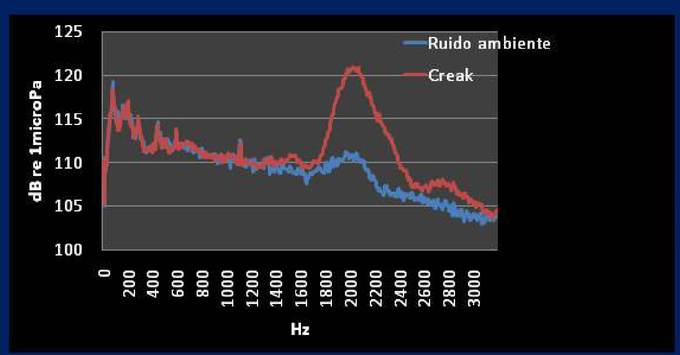

Figura 11 – Spectral density analysis of a creak (red line) containing about 250 clicks and background noise (blue line) 5 seconds prior to creak. Creak optimal energy is around 2000 Hz.

CONCLUSIONS

➢ Abundant vocalizations of fin whales registered in autumn season verifies migration pattern to Mediterranean southern areas following the continental slope and using the Balearic flyway to reach overwinter areas (Castellote 2009).

➢ Low detections of fin whales during spring in Delta-Columbretes suggest that migration to summer feeding grounds (Pantoja 2004) do not follow a seasonal pattern as significant as the migration to overwinter areas .

➢Most of the detected animals belonged to the Mediterranean Population.

➢Temporal and geographical overlap of Mediterranean and Atlantic populations of fin whales during the breeding season in the Mediterranean supports and extends previous studies of genetic flow between populations (Palsbøll 2004).

➢Place and type of sperm whale detections point out the deeper waters of Creus Canyon as relevant feeding area for the specie.

Fundación Biodiversidad

submon
conservación, estudio y divulgación del medio marino

REFERENCES

Cañadas A. 2006. *Hacia la conservación de los delfines en el mar de Alborán.* Tesis doctoral. Universidad Autonoma de Madrid y SMRU.
Castellote M. 2009. *Patrón migratorio, identidad poblacional e impacto del ruido en la comunicación del rorcual común (Balaenoptera physalus L. 1758) en el mar Mediterráneo occidental.* Tesis doctoral. Universidad Complutense de Madrid. 250 p.
Palsbøll PJ, Bérubé M, Aguilar A, Notarbartolo-di-Sciara G y R Nielsen. 2004. *Discerning between recurrent gene flow and recent divergence under a finite-site mutation model applied to North Atlantic and Mediterranean.*
Raga JA y J Pantoja (eds). 2004. *Proyecto Mediterráneo: Zonas de especial interés para la conservación de los cetáceos en el Mediterráneo español.* Ministerio de Medio Ambiente. Naturaleza y Parques Nacionales. Serie Técnica. Madrid. 219 p.
Whitehead H. 2008. *The sperm whale.* pp. 1165-1171. En: The Encyclopedia of Marine Mammals. En Encyclopedia of marine mammals, Eds. Perrin, W.F.; Würsig, B. y J.G.M. Thewissen. Academic Press, 2nd Edition. 1382 p.