

# SEISMIC EXPLORATION INSIDE THE INTERNATIONAL SANCTUARY FOR THE PROTECTION OF MARINE MAMMALS: RESULTS OF THE MARINE MAMMAL OBSERVERS MONITORING

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## Abstract

Since 2002, the Pelagos Sanctuary have entered into force, delimiting a large marine area (100,000 km<sup>2</sup>) where cetaceans populations are protected. Being in its first stage, Pelagos aims to estimate the human impacts on long-term cetacean conservation. The study presents the results of the April 2008 seismic operations and proposes some recommendations.

*Keywords: Seismics, Cetacea, Ligurian Sea*

## Introduction

Marine anthropogenic noise increases decade by decade with the current uses of sonars and seismic devices. However, effects on the marine ecosystems are not mostly unknown. On cetaceans, the assumed effects are mainly distinguished into three categories: (i) effects on the physiology of the animals; (ii) effects on the behaviour of the animal; (iii) indirect effects on prey [1]. All species of the Pelagos Sanctuary can be affected and specifically some had already been involved in mass strandings as Cuvier's beaked whales (*Ziphius cavirostris*), long-finned pilot whales (*Globicephala melas*) or sperm whales (*Physeter catodon*).

## Material and methods

The seismic campaign was realized in April 2008 (20-27). The aim was to characterize the seismic activity in the Ligurian basin using ocean-bottom seismometers (OBS) as recorders of air gun shots realized in the study area. The 21 OBS deployed were then left for six months in the area to monitor the seismic activity. Five Marine Mammal Observers (MMO) participated to the campaign in order to detect visually cetaceans. Visual detection was realized using naked-eyes and binoculars. The 360° around the boat were divided into 4 sectors of 90°, each sector was watched by one MMO. The 5<sup>th</sup> MMO was in charge of the data recording and of communications with the cruise staff for eventual interruptions of the air gun shots. All MMO were positioned at 10 meters above the sea surface and their positions were shifted each 30 min to avoid tiredness. Observation period initiated at 8:30AM and finished at 6:30PM with a 1-hour lunch break for each of the MMO organized into two shifts. Observation was interrupted with bad weather conditions (wind stronger than 15 knots or low visibility). The procedure applied for the campaign was: (1) to start visual detection 30 minutes before any emission of sound; (2) to realize a RAM-UP period of 20 minutes with half of the air guns; (3) then to proceed with all air guns. In the case of cetacean detection inside the 3200 meters around the vessel, sound emissions were automatically interrupted. Once the animal(s) got out of the 3200 meter area, the RAM-UP procedure re-start for 20 minutes then the air gun shots were set as normal capacity.

## Results and Discussion

The before exposure period was monitored only during the morning before (4 hours and a half) then the weather got bad (with wind stronger than 15 knots). Three sightings occurred on the continental slope (where water depth is between 1000 and 2000 m): 3 groups of striped dolphins. The last group was the larger group with about 40 dolphins. No other species has been observed during the morning. On April, the 21<sup>st</sup>, after 30 minutes of no cetacean detection, the RAM-UP period started at 9:17AM, then "full" air gun shots started at 9:37AM and emission went on until the 27<sup>th</sup> in the early morning. During the 6 days of sound emission, the vessel covered 1308 km: 563 km during the night (43 %). Considering the working period of the 5 MMO (limited to 8:30AM-6:30PM), 56 % of the sound emission period were not monitored including the 175 km realized during the early morning or during the late evening. On the total period of sound emission, 27 % were realized with bad weather conditions (that did not allow cetacean detection); however, a part of those occurred during the night period. On 7 occasions, cetaceans were detected. In all cases, they were striped dolphins. Only in two cases, dolphins were inside the 2000 meter area, therefore sound emission have been interrupted until the animals got away. Both times, no direct modification of the behaviour have been registered before and after the interruption (looking at group head or breaching behaviour). Nevertheless, the direct influence of sounds is hard to determine. The after-exposure period was monitored for 7.5 hours on the track to the home port. Eight sightings occurred inside the study area (where air gun shots have been performed before). The sighted species were: fin whales (3 times), sperm whale (1) and striped dolphins (4). No unusual behaviour have been sighted.

Data from the French stranding network registered before, during and after the seismic exploration did not indicate particular increase of strandings (personal communication from F. Dhermain).

In conclusion, the seismic campaign was realized during April, month of spring period in which the Ligurian sea gets usually rich in biodiversity. Considering the high presence of cetaceans in the Pelagos area especially at this moment of the year, MMO were necessary. Results of this campaign could be used for further recommendations: (1) to ensure success of visual detection (and avoid of tiredness) during the 14 hours of daytime period, it is necessary to organize shifts with sufficient number of MMO; (2) pre-exposure and post-exposure periods (being fundamental to determine the effects of sound emissions) should be extended to more than one day (to maximize the potential of monitoring); (3) the RAM-UP period seems to allow cetaceans to get out of the risky area without having physiological damages; (4) the choice of emission survey period should depend on the seasonal use of cetaceans, especially in the Pelagos Sanctuary; (5) the survey organization should take into account of the use of the study area by the species; for instance covering areas with higher risk during the daytime.

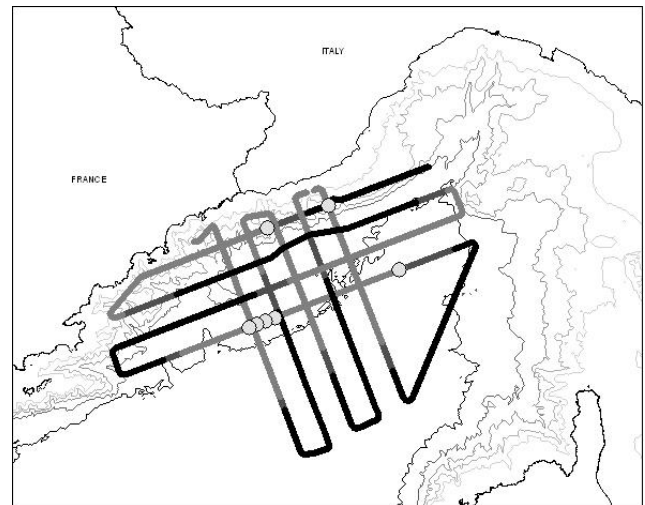


Fig. 1. Sound emission track during the MMO monitoring (light grey), during the daytime without MMO (dark grey) and during the night (black); dots: positions of striped dolphin sightings; depths: 500m, 1000m, 1500m, 2000m and 2500m.

**Acknowledgements :** We thank *Geoazur* for the logistic support and all the GROSAMARIN team on board.

## References

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