FAST FERRIES IN THE STRAIT OF GIBRALTAR. STUDY OF THEIR POTENTIAL IMPACT ON CETACEANS POPULATIONS.

E. Urquiola Pascual [2], N. Pérez-Gimeno [1, 2, 3, 4], R. De Stephanis [1, 2, 3, 4], R. Láiz Carrión [2, 4], M. Martínez Serrano [4], E. Puente [4], J.L. Cueto [1], R. Hernández Molina [1]

1- Laboratorio de Acústica y Vibraciones de la Universidad de Cádiz, CASEM, Puerto Real 11510, Cádiz.
2- Sociedad Española de Cetáceos, C/Nalón nº16, Hoyo del Manzanares, Madrid.
3- Circe, Conservación, Información y estudio de los Cetáceos, Aptdo 92, Algeciras, 11280, Cádiz. (www.circe-asso.org).
4- Facultad de Ciencias del Mar de la Universidad d Cádiz, CASEM, Puerto Real S/N, 11510, Cádiz.

INTRODUCTION: Throughout the world, data regarding possible impacts between boats and cetaceans have been recorded. From acoustic disturbance to direct collisions, those impacts are putting under threat populations of different species (Laist et al in press). This study analyses the potential impact of the high-speed vessels in the Strait of Gibraltar. The Strait is the second most transited channel in the world and, at the same time, an interesting area for cetaceans due to its position between Mediterranean and Atlantic waters, as suggested by the high cetacean biodiversity registered (Fernández-Casado, M. et al, 1999a, Fernández-Casado, M. et al, 2000, Cañadas et al, 2000). In 1999 a total of 83,856 boats crossed the channel (N-S and E-W axis), including 17,047 high-speed ferries (de Stephanis, R. et al, 2000).). The Spanish Ministry for the Environment asked the Spanish Cetacean Society (SEC) to analyze the possible incidence of the high-speed vessel traffic in the Strait of Gibraltar taking into account the presence in the channel of cetaceans included in the National Catalogue of Endangered Species, as Bottlenose Dolphin (*Tursiops truncatus*), Pilot Whale (*Globicephala melas*), Common Dolphin (*Delphinus delphis*), Stripped Dolphin (*Stenella coeruleoalba*), and Sperm Whale (*Physeter macrocephalus*).
The Acoustic and Vibratory Laboratory of the University of Cadiz (Spain) carried out the study on the possible acoustic impact.

OBJETIVES:

- To locate the potential areas where a possible collision (physical impact) between cetaceans and boats can occur throughout the identification of the fast ferries routes in the Strait of Gibraltar and its overlapping with the information of density sightings of different cetacean species.
- To compile the bibliography about research on possible physical impacts in the study area
- To determine the frequency spectrums of the different Fast ferries and compare them with those relating to cetaceans present in the area of high density of fast ferries.
- The proposal of measures and analysis of alternatives to minimise the potential impacts using comparative data.

METHODOLOGY:

- **ABOUT THE POTENTIAL PHYSICAL IMPACTS:** Cetacean distribution maps in the study area were made and compared with the different fast ferries routes. The data considered for the analysis were 1084 sightings recorded from April to October in 1999 and 2000 from whale watching vessels in the area, and all the different aspects of the fast-ferries in the area (Nº, characteristics, routes, etc. The data respecting the distribution of

Sperm Whale in the channel Algeciras- Ceuta are coming from 2001 CIRCE´s campaing (February- April)

- ABOUT THE SOUNDS: The Laboratory of Acoustics and Vibrations of the Cadiz University developed the frequency spectrums of boats and cetaceans. Records of the fast ferries were taken using an Offshore-Acoustic hydrophone directly at the entrance of the Algeciras harbor and registered in a Sony digital (DAT) TDC-D100 tape-recorder. Frequency spectrums for visualize the registers were carried out. The STFT (Short Time Fourier Transform) was applied softening the temporal variation between each of the frequencies with a mobile medium filter for 30 samples. Likewise an average of these windows was made (total average spectrum), which revealed the energetic distribution in the frequency bands of the ships. For the spectrums of the different species, the register (data o sample) used were taken during summer 2000 by CIRCE research group in the Strait and ALNITAK in the Alboran Sea

RESULTS:

Identification of physical impacts:

Stranding data gave no evidence of physical negative impacts registered up to date. The fast ferries carried out 24 journeys per day between Ceuta and Algeciras localities and one more between Tanger and Gibraltar since January 2001. New lines between Spain and Tanger are expected to run this summer 2001 and 2001. The distribution maps (fig 1 and 2) shows the most frequent areas of sighting of cetacean (for Pilot whales and Sperm whales) and the fast ferries routes in the study area.

Frequency Spectrum and Total Average Spectrum of the different boats sampled.

In fig 3 and 4, can be seen the spectrums of the different boats sampled.

DISCUSSION

PHYSICAL IMPACTS :There is no evidence of collisions in The Strait. Nevertheless, as can be seen in the distribution maps, the area with the density sightings of cetaceans larger than 8-9 meters(Sperm Whale), is the same as that transited by the fast-ferries. The opening of a new fast ferries route on a NE-SW axis between Tanger and Algeciras which directly crosses the area with the highest density of sightings for Pilot Whales and Sperm Whales might increase the collision probabilities with those vulnerable species due to their size and behavior. A similar case is the Canary Islands where have already been collisions with a similar panorama as the one expected with the new routes in The Strait of Gibraltar.

ACOUSTICS IMPACTS: The figure 5 shows that theoretically there is not an overlap between the sounds emitted by the cetaceans present in the area and the fast ferries ones. Nevertheless, using the data of frequency range of sounds emitted by the cetacean species present in the Strait of Gibraltar found in the bibliography, the overlapping is possible. The Strait is a temporally important area relative to the presence of mysticets as Fin Whale (*Balaenoptera physalus*) which emits low frequency sounds, and thus could be affected by the fast ferries emissions. Nevertheless, a conclusion is not possible due to the lack of data about the intensity of the fast ferries emissions and on to the potential cetacean populations alterations due to those signals. In that sense studies that focus on the acoustic impacts must take into account not only the fast ferries emissions but also the ones of the others boats as well.

PROPOSED CORRECTIVE MEASURES: The peculiarity of the area must be taken into account in order to take effective measures. Not forgetting the precautionary principle and with this first approach to the problem, the following corrective measures are proposed

- Possible reduction of the boat speed: Different studies (Clyne, 1999 & Laist et al, in press) suggests that the speed is the most important factor related to the severity and frequency of the potential collisions. For this reason, a speed limit of 13 knots in the high-risk area was present as the best solution. That is no so simply and normally is not possible, then is important to promote the agreements with the companies in order to reduce the speed and the number of trips as much as possible
- Installation of a WDA (Whale Detector Apparatus): By a horizontal Eco-sounder, the WDA can detect animals in enough time to avoid them, reducing the possibility of collisions
- Changing the Fast ferries routes in the high risk collisions zones -high density of cetacean sighting areas.
- Secondary measures: Formative courses for the fast ferries crew, presence of experimented observers onboard.

CONCLUSIONS:

1 - The initial and basic conclusion is to accept that the problem exist and solution measures must been taken in order to avoid the negatives impact.

2 - All the proposed whale detection systems could be apply, but always with the criteria of the best effectiveness (and optimum function) for the established area.

3 - Routes and speed are the essential factors related to the impacts between boats and cetaceans. Because of that, the speed must be reduced in the high-risk collision area and the routes must be changed to avoid these areas.

4 More acoustic data studies and distribution and behaviour of cetacean studies are necessary in order to adopt measures for the reduction of the negative impact

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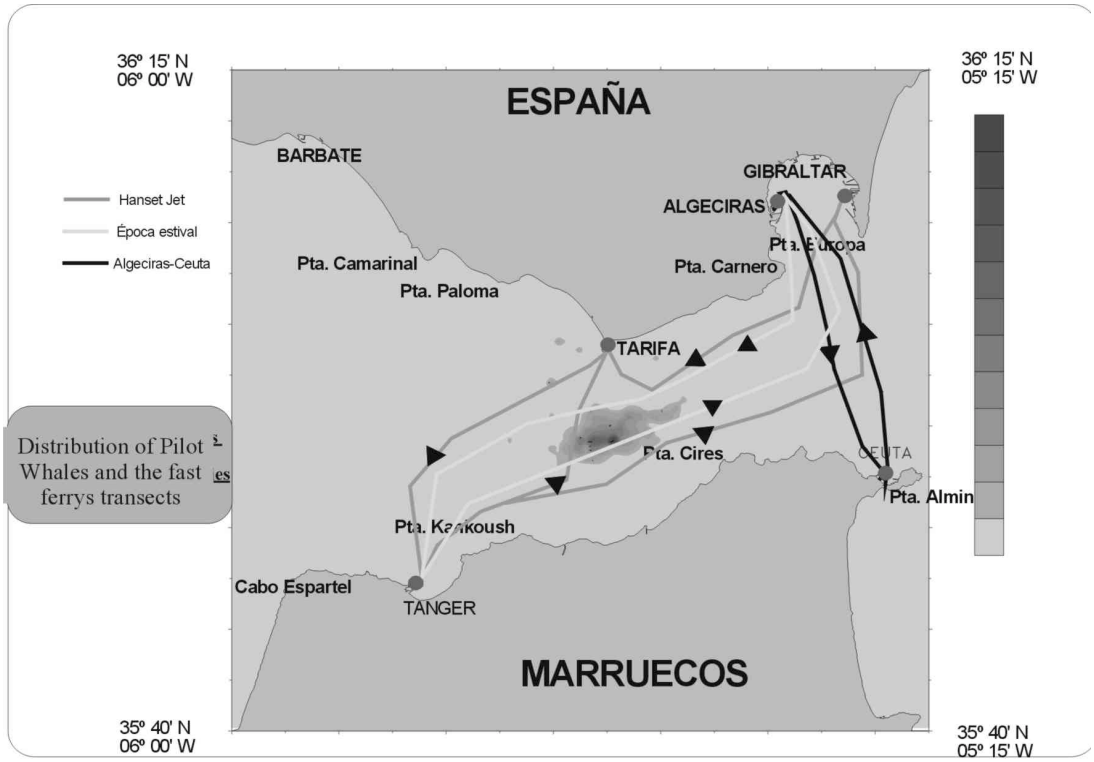

FIG 1

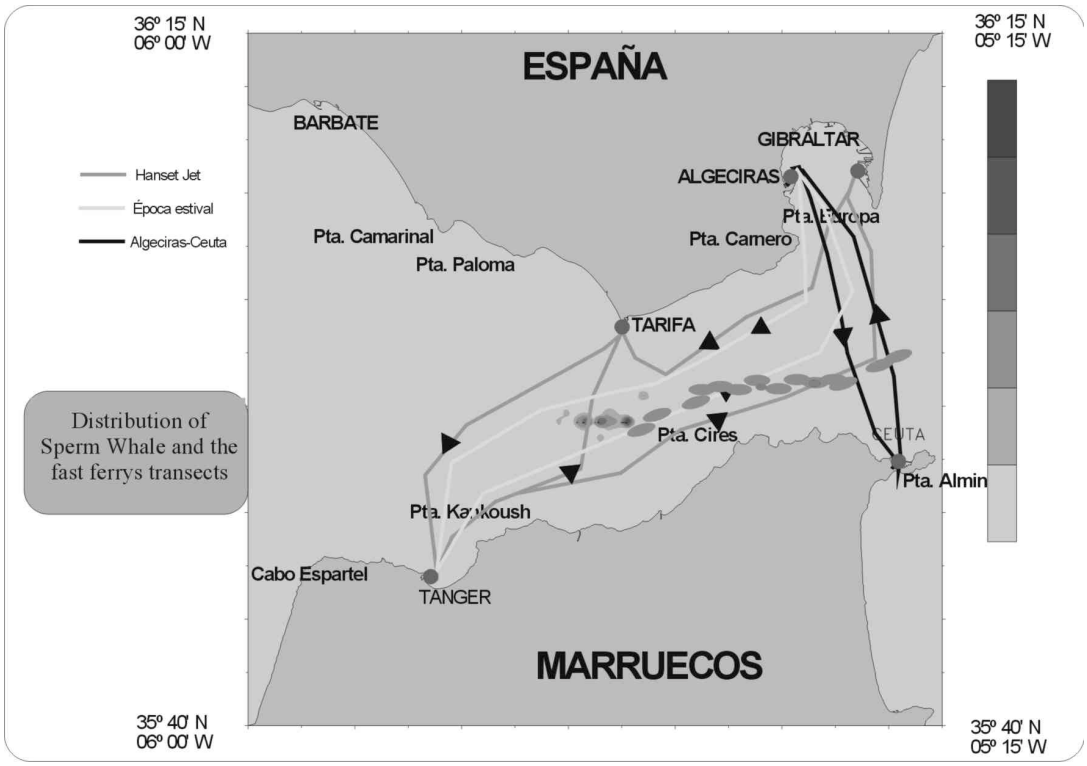

FIG 2

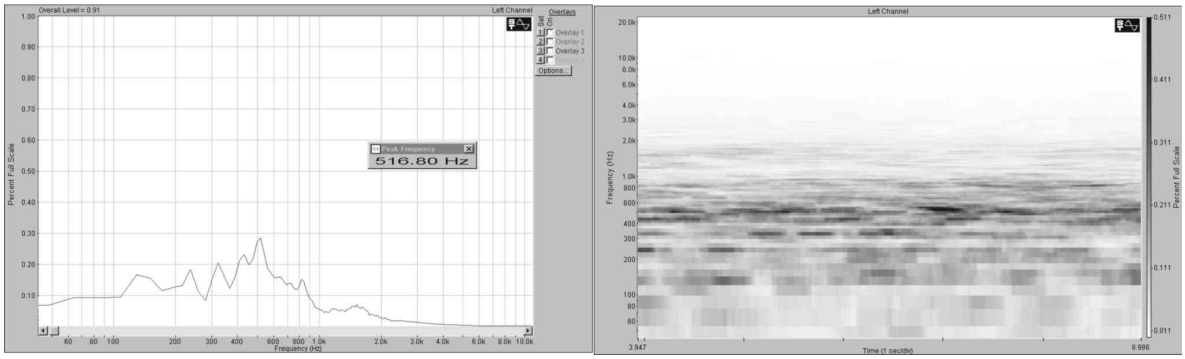

FIG 3, Spectrums of fast ferry Euroferrys.

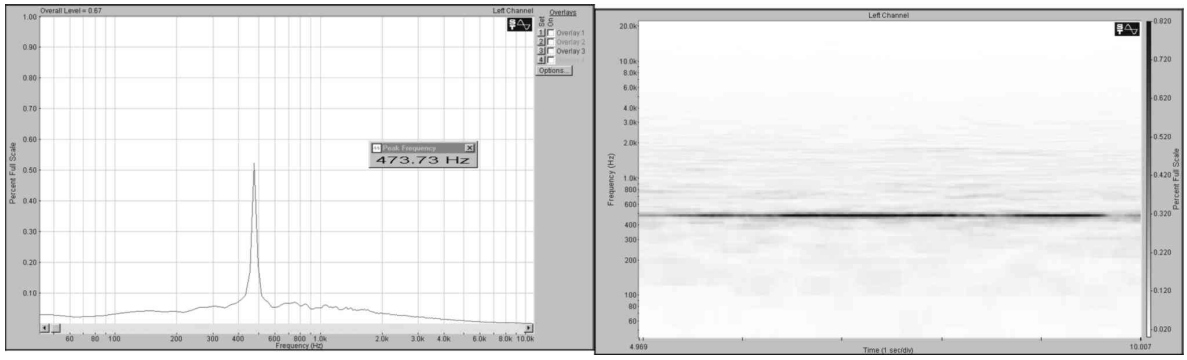

Fig 4: spectrums of fast ferry Hanset jet.

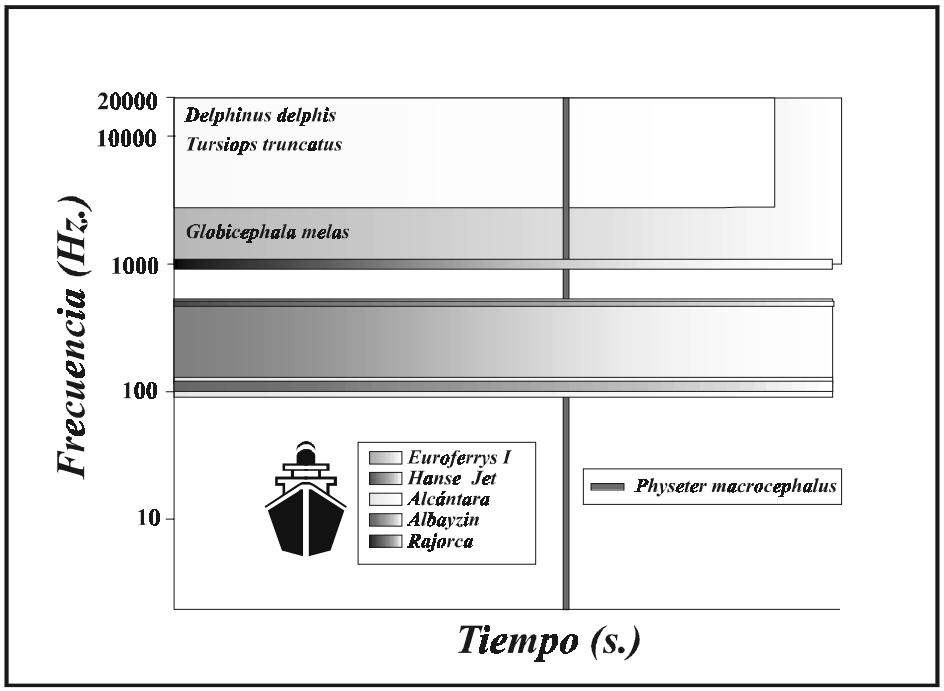

Fig 5: Frequency overlaps of fast ferries sampled and different species.