

EUROPEAN RESEARCH ON
CETACEANS - 24

**PROCEEDINGS OF THE TWENTY-FOURTH ANNUAL CONFERENCE
OF THE EUROPEAN CETACEAN SOCIETY,
STRALSUND, GERMANY
22-24 MARCH 2010**



EDITORS: G.J. PIERCE AND R. LICK

CHANGES IN CETACEAN ABUNDANCE AND DISTRIBUTION OVER 20 YEARS ALONG A TRANS-REGIONAL FIXED LINE TRANSECT IN THE CENTRAL TYRRHENIAN SEA

L. Marini¹ & A. Arcangeli²

¹ Accademia del Leviatano Rome, Italy, ² ISPRA Dip. Difesa Natura, Via Curtatone 3 00185 Rome, Italy
(corresponding author: antonella.arcangeli@isprambiente.it)

INTRODUCTION

From 1989 to 1991 yearly round dedicated cetacean monitoring along fixed-transect was weekly carried out in Central Tyrrhenian Sea, using passengers ferries as a research platform. Collected data gave new information about some species and their distribution in the region (Marini et al., 1997). The most important findings were the observation of cyclical variations in the presence of fin whale (*Balaenoptera physalus*) in different seasons allowing the hypothesis of a migration pattern. In 2007 research restarted with same protocol and under supervision of same investigators (Arcangeli et al 2008). The new monitoring was carried out every summer, up to 2010.

This paper presents the results of one of the longest quantitative comparisons on temporal differences of cetacean presence, relative abundance and distribution in the Mediterranean Sea.

MATERIALS AND METHODS

The transect, from Civitavecchia (CIV, Rome district) to Golfo Aranci (GA, Sardinia), is 118.5 NM long and includes different habitats such as shelf, shelf-edge, seamount and deep sea. Trained marine mammal observers collected data on cetacean presence from both side of the command deck of ferries following the distance sampling protocol. Data from 90 weekly runs (totalling 603h on-effort) undertaken from June to September in the 1990s (1990, 1991 and 1992) were compared with data obtained from 95 runs (406h) in the same months in the 2000s (2007, 2008 and 2009) (Table 1), using a single transect as a statistical unit. Abundance was calculated using Encounter Rate (ER) measured as number of sightings per hour on effort in good weather condition: data were compared, after being tested for parametric assumptions, with ANOVA. Geographical data were analysed with GIS program performing spatial analysis and the non parametric Kernel analysis, after being tested for independency of the dataset, to map preferential habitat of species.

Table 1 Total effort and sightings during the two investigated periods

Fixed transects	Period June-September	Tot # of runs	Tot # hours in good weather condition	Tot # of sightings
CIV – GA	1990,1991,1992	90	603	344
CIV – GA	2007, 2008, 2009	95	406	376

RESULTS

Frequency. In the 1990s, 344 sightings of 7 cetacean species ($0.69 \pm C.I. 0.10$ sightings/hr) were recorded, compared to 376 sightings (0.94 ± 0.15) of the same species in the 2000s ($P < 0.001$) (Table 1). In both investigated periods the most common sighted species were striped dolphin (*Stenella coeruleoalba*), fin whale (*Balaenoptera physalus*) and common bottlenose dolphins (*Tursiops truncatus*). Results showed a surprisingly increase in ER of fin whale (more than 200%, $P < 0.0001$) while ER of the other commonly sighted species such as striped dolphin, common bottlenose dolphin and Cuvier's beaked whale (*Ziphius cavirostris*), showed no statistical significant difference. In both periods sperm whale (*Physeter macrocephalus*), short-beaked common dolphins (*Delphinus delphis*) and Risso's dolphin (*Grampus griseus*) were spotted only few times. Pilot whale (*Globicephala melas*) was never sighted both in 1990s and in 2000s. (Fig.1).

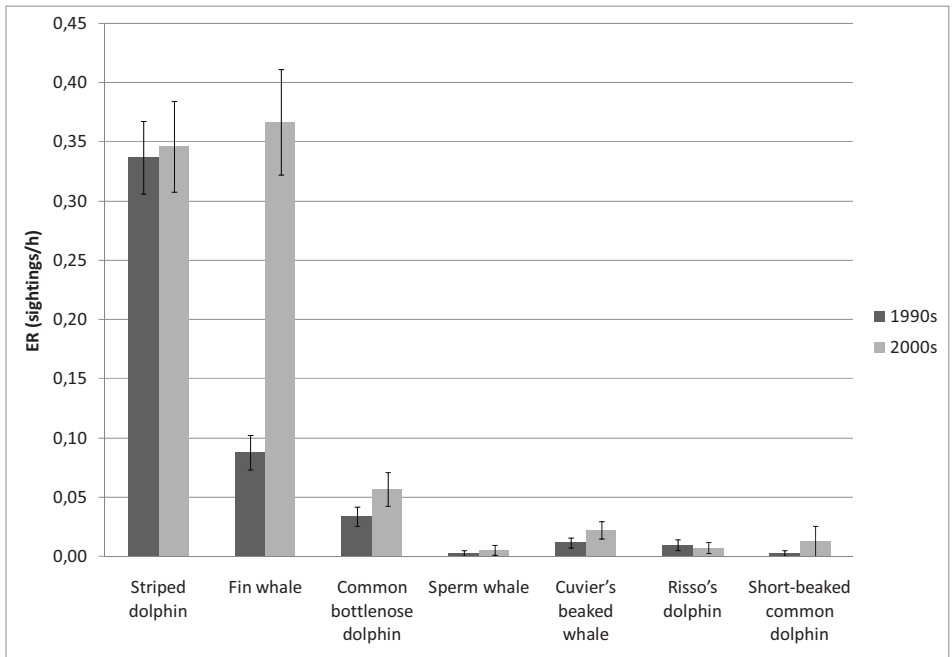
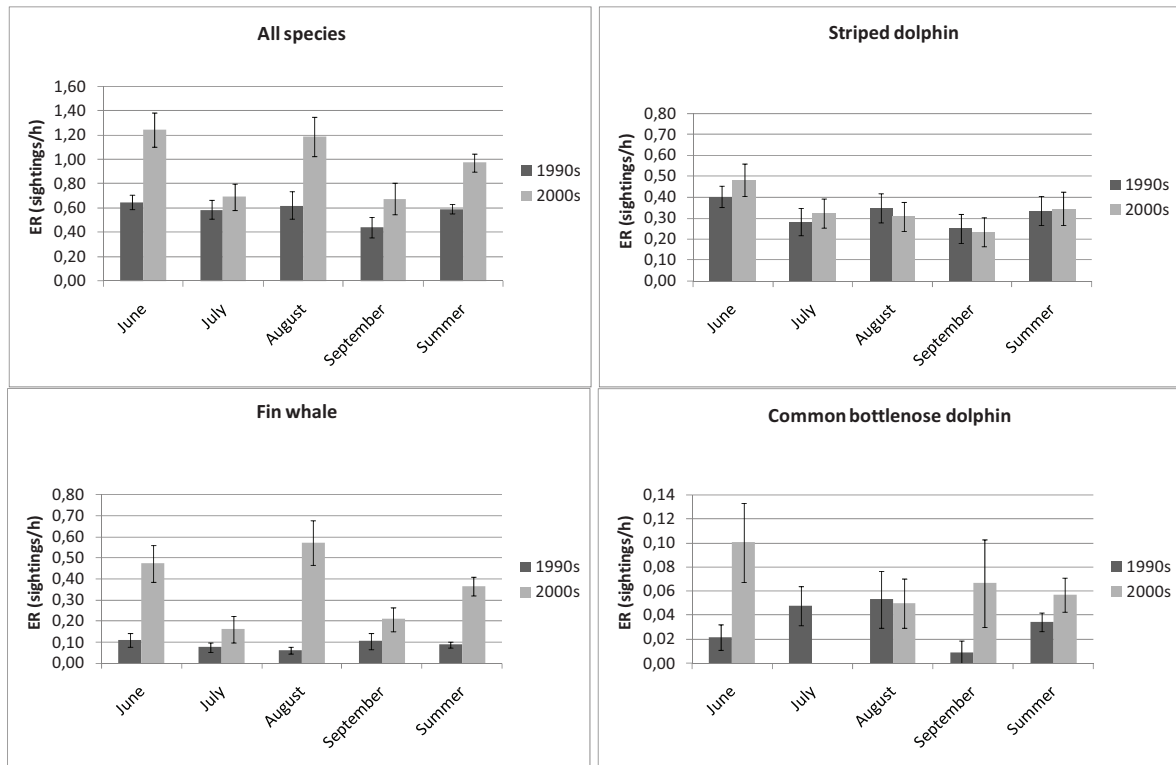


Fig. 1 Frequencies of species

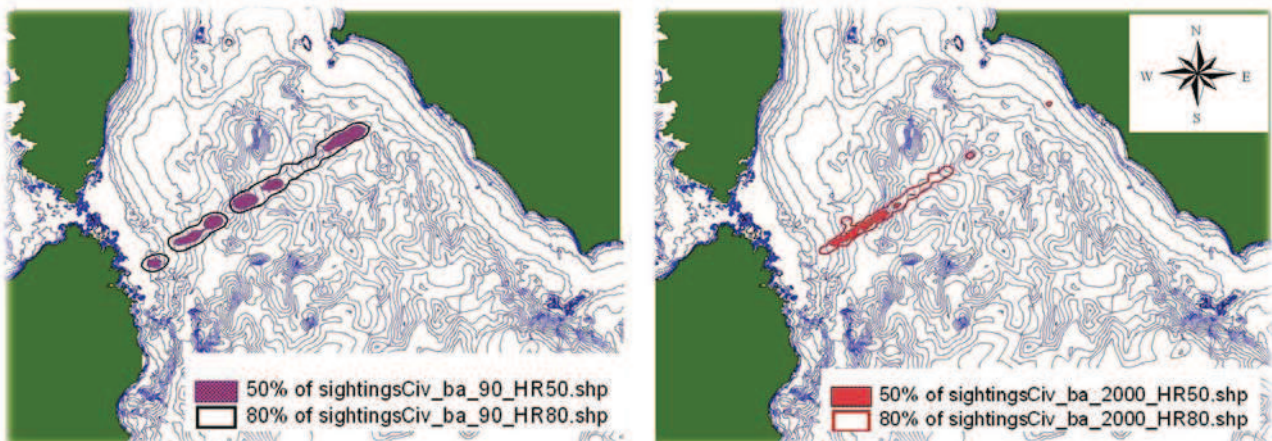
Total cetacean ER was similar among the different months in the 1990s while in the 2000s it showed two maximum in June and August, mostly determined by fin whale. Fin whale showed a bimodal trend, more evident in the 2000s than in the 1990s and with higher ER in June and August (in 2000s) compared to June and September (in 1990s). (Figs. 2).



Figs. 2 Monthly Encounter Rate

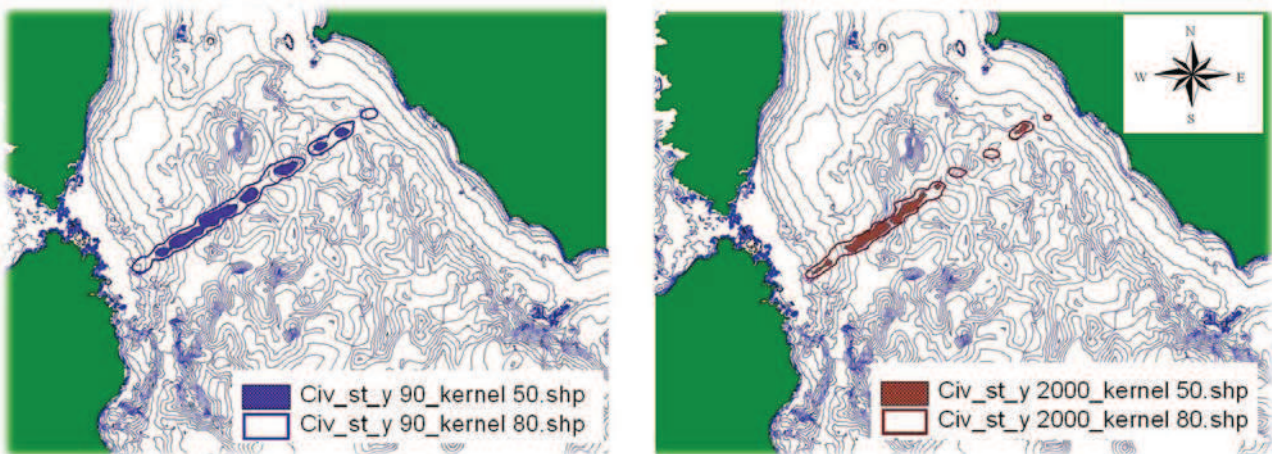
Distribution. Figs 3 shows results of Kernel analysis for fin whale assessed over the 50% (areas) and the 80% of sightings (lines). Fin whale sightings show a significant change in distribution, being more concentrate in the central-western side of the transect during the 2000s compared to the

1990s triennium. Both periods confirm the importance for the species of the area between 20 and 50 NM east of Sardinia.



Figs. 3 Fin whale sightings distribution compared: on the left, the uniform distribution recorded during 1990s and, on the right, the hot spot observed in 2000s

The same analysis conducted on the other most sighted pelagic species, striped dolphin, (Figs 4) did not show such a remarkable change.



Figs. 4 Striped dolphins sightings distribution compared: on the left, the distribution recorded during 1990s and, on the right, the sightings in 2000s

CONCLUSIONS

The use of platform of opportunity for dedicated monitoring of cetaceans population on a long term temporal scale was confirmed to be a reliable and economical method.

In particular, this first analysis suggests a remarkable change both in ER and in the distribution of fin whales, suggesting the existence of a hot-spot, from 20 to 50 nautical miles east of the Sardinia. In management terms, this recommends the enforcement of conservation measures such as an extension of Pelagos Sanctuary Southern border and a “code-of-conduct” to be adopted by the maritime company to prevent risk of collisions with whales.

This fix transect long-term monitoring project, is within a large network, coordinated by ISPRA (Institute for Environmental Protection and Research), which undertakes large scale cetacean monitoring, using ferries (Arcangeli *et al.* 2009), from Ligurian to the Central and northern Tyrrhenian Sea. The network will provide wide range of information on the distribution of migratory or wandering species.

The networked research bodies are also relating sightings collected on the field with environmental data such as water temperature and nutrient concentration that have been obtained by satellite

images that are easily obtained through the internet. The availability of such information and of new technologies permits us to draw integrated schemes that were not imaginable only 15 years ago.

ACKNOWLEDGEMENTS

We would like to thank the all Sardinia-Corsica Ferries staff for their kind collaboration and all the many researchers that contributed to the monitoring.

REFERENCES

Arcangeli A, Crosti R., Marini L, Poggi A., Poldi A., Pulcini M., Safontas C. , Sdringola S., and Ukmar E. 2008. Monitoring cetacean populations over 15 years in Central Tyrrhenian Sea using a non-dedicated ferry as a observation platform. *European Research on Cetaceans* 22.

Arcangeli, A., Muzi, E., Tepsich, P., Carcassi, S., Castelli, A., Crosti, R., Di Vincenzo, M., Magliozzi, C., Marini, L., Poggi, A., Poldi, A., Pulcini, M., Ricci, S., Safontas, C., Sdringola S. and Ukmar, E. 2009. Large scale cetacean monitoring from passenger ferries in Italy. Networking summer 2008 surveys. *European Research on Cetaceans* 23.

Marini, L., Consiglio, C., Angradi, A. M., Catalano, B., Sanna, A., Valentini, T., Finoia, M. G. and Villetti, G. 1997. Distribution, abundance and seasonality of cetaceans sighted during scheduled ferry crossings in the central Tyrrhenian Sea: 1989-1992. *Italian Journal of Zoology* 63: 381-388.