

INFLUENCE OF ENVIRONNEMENTAL FACTORS ON SPERM WHALE DISTRIBUTION IN NORTH WESTERN MEDITERRANEAN SEA



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INTRODUCTION

In the Mediterranean northwestern basin, large scale studies have shown that the distribution of sperm whale (*Physeter macrocephalus*) is spatially heterogeneous (Gannier *et al.*, 2002 ; Drouot *et al.*, 2004).

The study area is characterized by specific environmental conditions :

- ➔ a variable, but often narrow shelf break,

- ➔ a mesotrophic period in spring, followed by oligotrophy in summer,
 - ➔ numerous frontal zones, with the permanent North Balearic Front.
- Our objective was then to show how those particular environmental factors influence the distribution of sperm whale in summer.

MATERIAL AND METHODS

802 sperm whale acoustic detections, obtained between 1998 and 2003 summer surveys, were divided according to four areas : Balearic, Provence, Gulf of Lions and Central regions (Figure 1). Geographic positions of these observations were compiled in a Geographic Information System (GIS), with the sea surface temperature, chlorophyll concentration and topographic maps. For the 4 areas, distances were calculated between acoustic points and the following parameters:

- ➔ the shelf break (2000 m isobath),
- ➔ high primary production zones (chlorophyll concentrations > 0.9 mg.m⁻³),
- ➔ frontal zones (temperature difference > 1.2°C).

In the Central zone, an additional analysis was done considering the North Balearic front singly.

We then compared, with a Mann-Whitney test, the distance between each parameters and :

- ➔ the positive acoustic detections of sperm whale (d_1),
- ➔ others acoustic detections (d_0 , no sperm whale detection).

RESULTS AND DISCUSSION

1) In the Provence and the Balearic zones, the most important factor was the shelf break ($\bar{d}_1 < \bar{d}_0$, $p < 0.001$; Figure 1). Near this topographic variation, the currents might be deflected, forme upwellings, develop the trophic web and might increase the number of available preys (*e.g.* Gregr & Trites, 2001 ; Waring *et al.*, 2001).

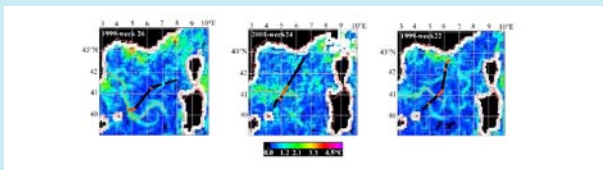


Figure 2 : Temperature difference maps showing the grouping of sperm whale detections (red dots) around North Balearic Front (orange line) or other frontal zones.

2) In the Gulf of Lions and the Central Zone, the presence of frontal zones appeared as the most influential factor ($\bar{d}_1 < \bar{d}_0$, $p < 0.001$; Figure 1). Particularly, in the Central Zones, most of the detections were located near the permanent North Balearic Front (Figure 2).

Upwellings and/or downwellings of frontal zones are both known to be favourable to sperm whale. First, upwellings develop trophic web at the surface and attract

The main factors influencing sperm whale's distribution, in northwestern Mediterranean Sea, are :

- ➔ the shelf break in coastal zones,
- ➔ the frontal zones, in oceanic region.

CONCLUSION

buoyant prey in deep water (Smith & Whitehead, 1993 ; Rendell *et al.*, 2004). Second, with downwellings, oxygen and organic substances sink and develop the trophic web in depth (Berzin, 1971).

- ➔ So the frontal zones could then represent the principal feeding sources for sperm whales in areas distant from shelf break.

These results reflect the opportunist behavior of sperm whale, in which foraging is adapted to the local environment.

Then, it will be interesting to know if the sperm whale's distribution follows the same trend throughout the year.

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