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Preliminary study through habitat modeling of bottlenose dolphin (*Tursiops truncatus*) distribution along the east coast of Liguria (North West Mediterranean Sea)

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INTRODUCTION

Habitat modeling is an important tool to investigate cetacean distribution and to relate this to environmental variables. Understanding the function of habitat features in determining cetaceans' distribution is a necessary step in planning management and conservation measures. Previous studies [1,2,3] showed significant correlations between some variables and different distribution of animals allowing the identification of micro area used for different purposes. The bottlenose dolphin (*Tursiops truncatus*) is widely distributed in the Mediterranean Sea and it is commonly sighted along the eastern Ligurian coast, usually within the 100m isobath [4]. This is the first attempt to build a habitat model in this area (fig.1), considering the distribution of bottlenose dolphin as the result of several environmental variables. The study area is characterized by a strong presence of human activities; maritime traffic is intense throughout the year with marked seasonal peaks, especially with regard to pleasure boating.

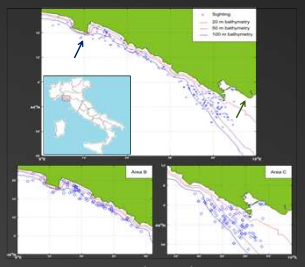

Fig.1 *The study area*

MATERIALS & METHODS

The study area stretches from Portofino Promontory (blue arrow) to Punta Bianca (green arrow) along the east coast of Ligurian sea. Two specific areas are reckoned: Area B from 8.90 to 9.65 Long-east and Area C from 9.65 to 10.00 Long-east (Fig. 1). Data were collected by means of on-board surveys on random tracks from 2005 to 2012 in the framework of the "Delfini metropolitani" project held by Acquario di Genova.

The whole area was divided into 1650 grid cells (0.02 Long X 0.02 Lat). In each cell six habitat variables were accounted: sea bottom depth (Depth), slope (Slope), distance from coast (Coast), distance from 100m isobath (100m), latitudine and longitudine. These variables were employed in a MDS (Multidimensional Scaling analysis) and in a PCA (Principal Component Analysis) to infer influence on ER (Encounter Rate) in the two areas (Fig. 5-6-7). In order to find the possible relationships between the animal distribution and variables, canonical correlation analyses were performed between the encounter rate (ER) of the total bottlenose dolphin sightings, newborn-sightings and calf-sightings and 100m isobath distance, distance from coast, depth and slope. ER was calculated as number of sightings per kilometers spent in each cell and separately plotted for all bottlenose dolphin sightings (BdS), newborn sightings (NbS) and calf-sightings (CS) (Fig. 2, 3 and 4). "Newborn" is here intended as an animal showing evident fetal folds; "calf" identifies a young animal approximately 2/3 length of an adult, without fetal folds.

RESULTS

23.820 km were monitored in "on-effort" state. 173 groups of dolphins were spotted: 65 including "calves" and 36 sightings including "newborns". Correlation analyses (CA) in Area B show no statistical significance for any of the variables (no r in Tab. 1). CA in Area C shows positive correlation and statistical significance between BdS Vs Coast and negative correlation with Depth as well as CS Vs Coast and negative correlation with CS Vs 100m and Depth (marked with r in Tab. 2). MDS and PCA results are plotted (Fig. 5-6-7).

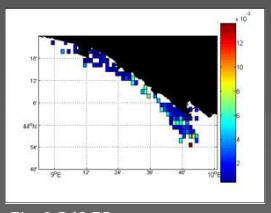

Fig. 2 *BdS ER*

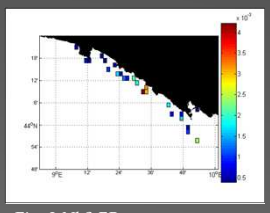

Fig. 3 *NbS ER*

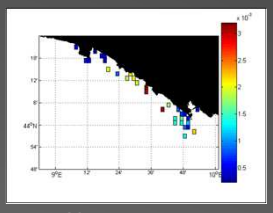

Fig. 4 *CS ER*

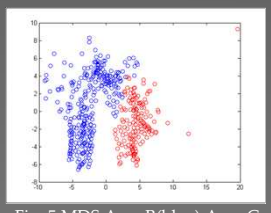

Fig. 5 MDS Area B(blue) Area C (red) BdS

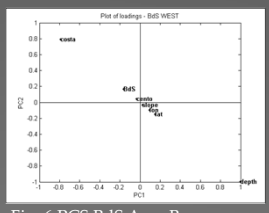

Fig. 6 PCS BdS Area B

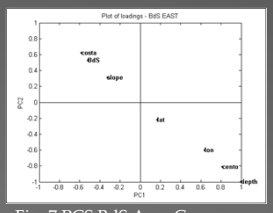

Fig. 7 PCS BdS Area C

Area B	BdS	NbS	CS
100m	r= -0.16	r= 0. 18	r= -0.21
COAST	r= 0.15	r= -0.18	r= 0.23
DEPTH	r= -0.16	r= -0.22	r= -0.21
SLOPE	r= -0.20	r= -0.21	r= -0.28

Tab. 1 *Area B - CA results (r= p value <0.05)*

Area C	BdS	NbS	CS
100m	r= -0.15	r= 0.60	**r= -0.55**
COAST	**r= 0.40**	r= -0.40	**r= 0.50**
DEPTH	**r= -0.52**	r= -0.38	**r= -0.74**
SLOPE	r= -0.20	r= 0.27	r= 0.33

Tab. 2 *Area C - CA results (r = p value <0.05)*

DISCUSSION

Bottlenose dolphins are distributed along the whole area, with a peak of presence few miles off Tino Island (Area C). This may be conditioned by the massive trawling activity of the fisheries coming from Northern Tuscany and Eastern Liguria. The MDS analyses show a separation between the two areas, confirming that the selected variables influence the bottlenose dolphin distribution. Calves and newborns distribution may suggest the presence of a nursery area probably due to more suitable environmental conditions in certain zones. Moreover, groups with calves may prefer a part of the area which is far from both strong fishing activities and tourist harbors. The PCAs confirm clear differences between the considered areas. These may be due to a possible selection of different areas for different uses or to a poor sensitivity particularly evident in Area B where variables such as Depth and Coast change abruptly over short distance.

Slope does not seem to influence bottlenose dolphin distribution in the whole area, while Coast and 100m seem to better describe bottlenose dolphin habitat, in particular in Area C and when calves are present.

ABOUT THE FUTURE

Further analysis including more habitat variables characterizing our area (presence of trawlers, presence of pleasure boating) are currently in progress. Also, we would like to improve our study including local currents and hake (*Merluccius merluccius*) distribution data. Any contribution will be really appreciated.

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