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DISTRIBUTION, RANGE AND HABITAT OF BOTTLENOSE DOLPHIN IN THE ADRION REGION

DISTRIBUZIONE, RANGE E HABITAT DEL TURSIOPE NELLA REGIONE ADRION

Abstract - Since December 2014, a systematic survey of cetaceans has been conducted in the Adriatic and Ionian Seas using ferries as observation platforms. This research, coordinated by the University of Torino, Gaia Research Institute and ISPRA's FLT-Med Network, aims to monitor cetacean activity in both inshore and offshore areas of the ADRION Region. Over nine years, the study shows the bottlenose dolphin (*Tursiops truncatus*) as one of the most frequently sighted species. The research highlights that the distribution and range of bottlenose dolphins, highlighted with the Kernel Density Estimation analysis, vary across seasons, with wider distribution in spring and summer. The Species Distribution Model indicates that the continental shelf areas are the most suitable habitats for the species, as expected based on its ecology. Understanding the seasonal ecology and habitat preferences of bottlenose dolphins will help develop targeted conservation measures to protect this highly mobile species.

Keywords: Tursiops truncatus*, Species Distribution Model, Conservation*

Introduction - Since 2014, systematic monitoring activities have been conducted in the ADRION region, which includes the central-southern Adriatic and the north-eastern Ionian seas. This area is significant area for various species of cetaceans (Phillips *et al*., 2004), such as the bottlenose dolphin (*Tursiops truncatus* Montagu, 1821), object of the present study, a frequently sighted delphinid, listed in Annexes II and IV of the Habitats Directive (Council Directive 92/43/EEC, HD) and protected by International Convention and Regional Agreement such as ACCOBAMS, which aim to conserve marine biodiversity and ensure sustainable management practices in the Mediterranean Sea (Azzolin *et al*., 2016). The primary goal of this study is to understand the distribution, range, and habitat preferences of bottlenose dolphins in the Adriatic and Ionian Seas. This knowledge provides valuable insights for conservation efforts.

Materials and methods - The monitoring activities began in December 2014, utilizing ferries as observation platforms. The routes involved ferries operated by Grimaldi-Minoan, covering the Ancona-Igoumenitsa-Patras transect. Observations were conducted by a team of four experienced observers per survey.
Key details of the monitoring effort include:

- Surveys: 205 surveys from December 2014 to December 2023.
- Coverage: approximately 53,056 km covered across 1,196 hours of observation.
- Sampling design: five surveys per season, each covering three days and roughly 1,000 km.

Data were recorded by systematically logging sightings of cetaceans, including their location, group size and behaviour, and environmental conditions.
The distribution and range of the species across all seasons were calculated using the mean Sightings per Unit of Effort (SPUE) and the Kernel Density Estimation (KDE)

analysis, with a resolution cell of 500 m and a search radius of 50,000 m (Arcangeli *et al*., 2024). A Kruskall-Wallis Test was performed to compare SPUE values among years and seasons. A Species Distribution Model (SDM) obtained with Maxent was employed to assess the habitat suitability of bottlenose dolphins, considering physiographic variables such as bathymetry, slope, and distance from shore.

Results - From December 2014 to December 2023, a total of 394 cetacean sightings were recorded, with 144 sightings attributed to bottlenose dolphins (Fig.1).

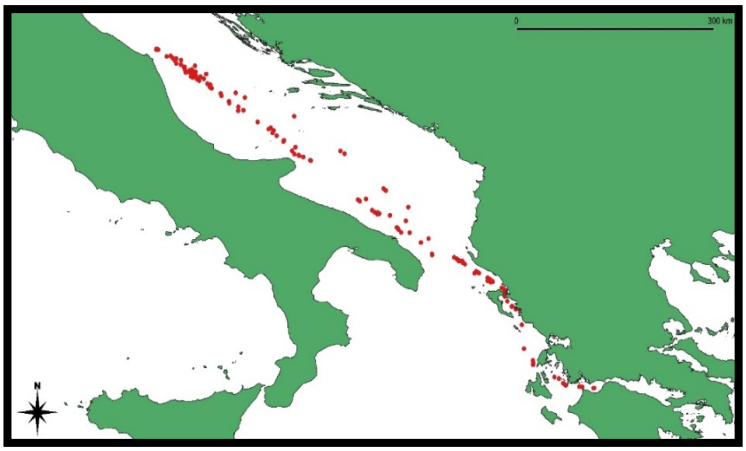

Fig. 1 – Bottlenose dolphin sightings in the study area
Avvistamenti totali di tursiope nell'area di studio

The collected data show that bottlenose dolphins are present in the ADRION region year-round, with a slight prevalence of sightings in spring and summer, with the following breakdown:

- Spring: 40 sightings over 15,709 km surveyed (SPUE=0,0025);
- Summer: 39 sightings over 10,294 km surveyed (SPUE=0,0038);
- Autumn: 30 sightings over 14,950 km surveyed (SPUE=0,0020);
- Winter: 35 sightings over 12,103 km surveyed (SPUE=0,0029).

The average Sighting per Unit of Effort (SPUE) across all seasons is 0.0031. There are some variations between different years and seasons (see Fig. 2). The Kruskal-Wallis test indicates that the differences among years are statistically significant (p = 0.021), whereas the differences among seasons are not significant (p = 0.518).

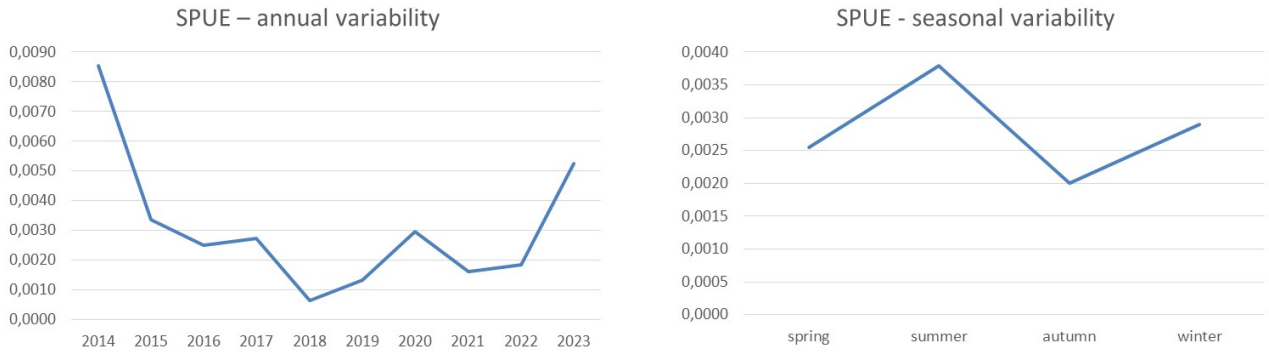

Fig. 2 - SPUE (Sighting per Unit of Effort) variability across years and seasons
Variabilità annuale e stagionale della SPUE (Sighting per Unit of Effort)

Similarly dolphin distribution varies among seasons (Fig. 3).

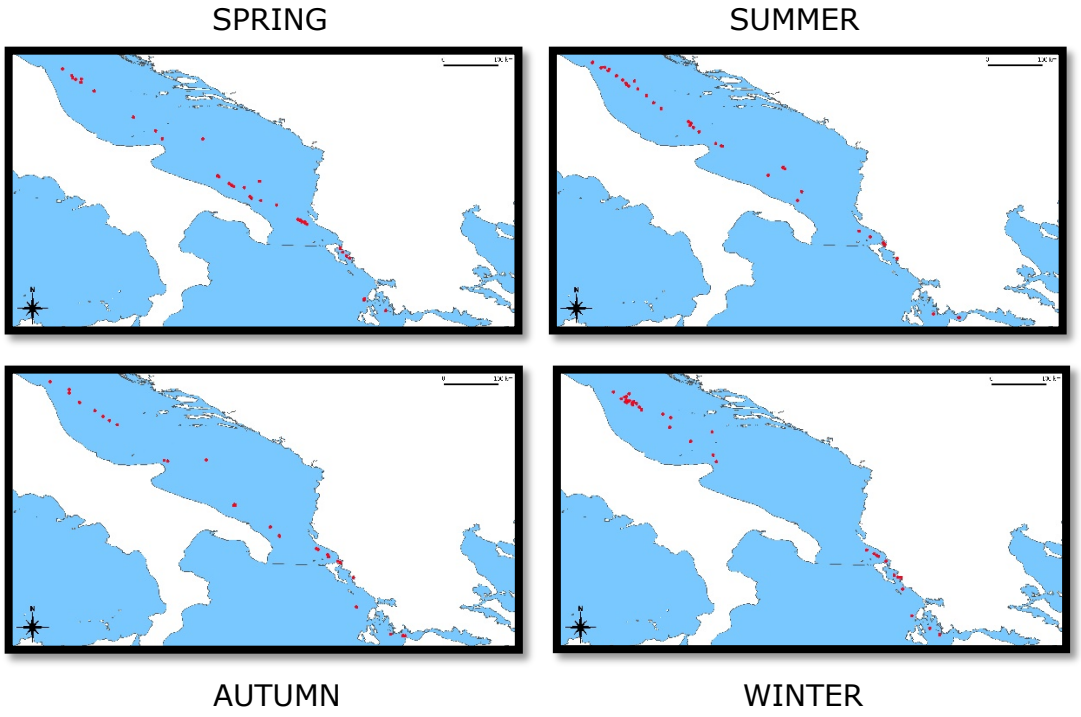

Fig. 3 – Seasonal distribution of sightings
Distribuzione stagionale degli avvistamenti

The Kernel Density Estimation (KDE) analysis identifies variable areas of high density in different seasons (Fig. 4), highlighting a dynamic use of the environment by the species.

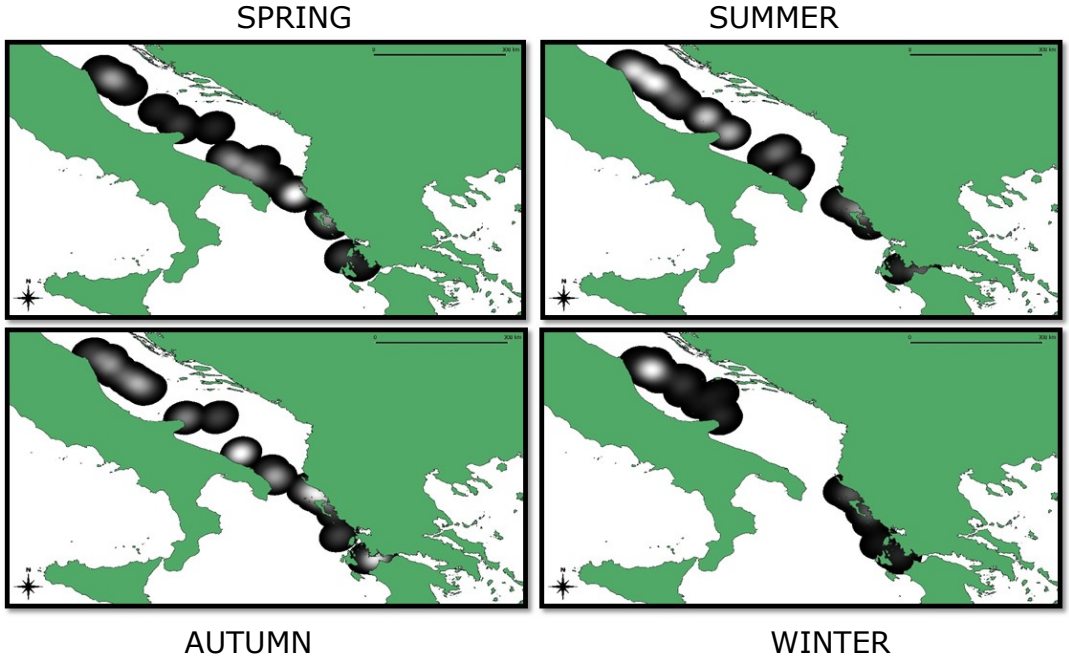

Fig. 4 – Seasonal KDE (Kernel Density Estimation) variability
Variabilità stagionale della KDE (Kernel Density Estimation)

SDMs provide valuable information on the habitat preferences of bottlenose dolphins, allowing to identify marine areas that offer the most favourable environmental conditions for this species (Fig. 5). The AUCs of the Species Distribution Models (SDMs), an indicator of model quality, show values of 0.799 and 0.879, respectively for the Adriatic and the Ionian seas, indicating a good level of accuracy of both models.

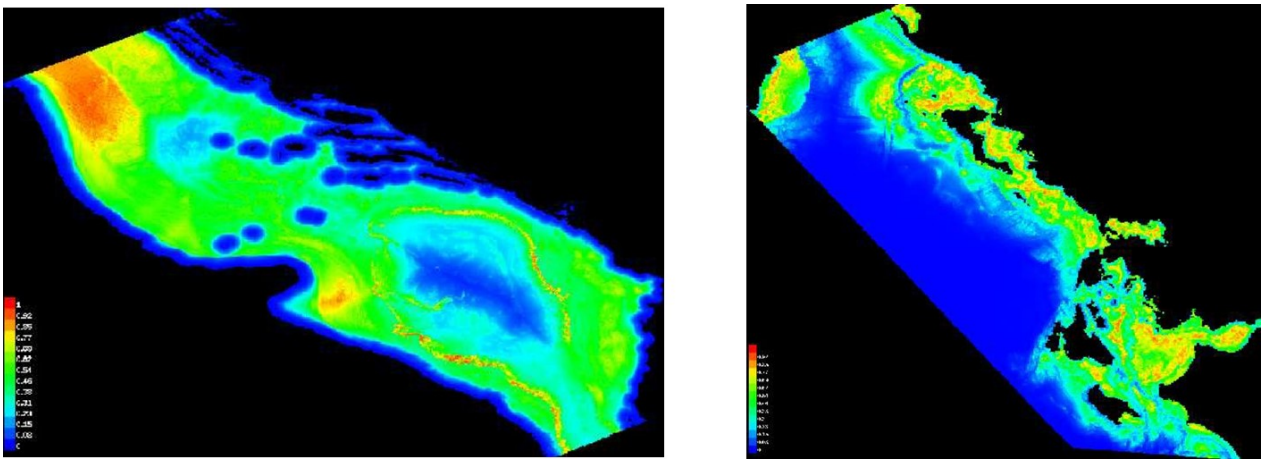

Fig. 5 – SDM (Species Distribution Model) for Adriatic and Ionian Seas
SDM (Species Distribution Model) per Mar Adriatico e Mar Ionio.

Conclusion – Analysing seasonal variations of the presence and distribution of a protected species is crucial for identifying its key habitat areas and its spatial shift over time. The monitoring effort conducted from December 2014 to December 2023 provides a comprehensive understanding of bottlenose dolphin distribution and habitat preferences within the ADRION region. The stable sighting rates across seasons suggest that the region serves as a consistent habitat for the species. The variation of SPUE and distribution suggest a potential migratory behaviour or a behavioural response to environmental changes. Bathymetric features, such as the underwater slopes and the proximity to shorelines, prove to be significant factors influencing habitat suitability distribution, highlighting the known preference for continental shelf areas with rich prey resources. The Species Distribution Model (SDM) and KDE analyses identified key regions within the ADRION area where bottlenose dolphins are most likely to be found and on which managers and spatial planners should focus their conservation actions.

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