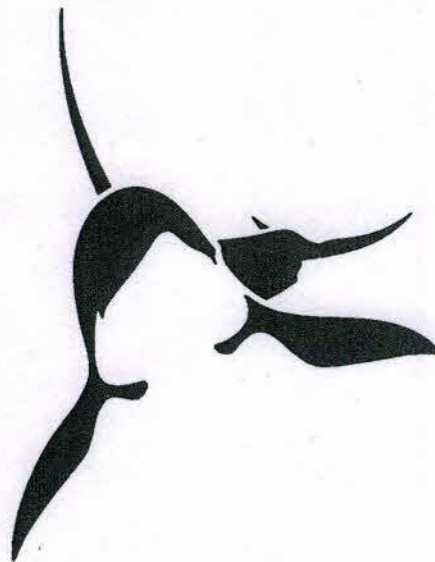


EUROPEAN RESEARCH ON
CETACEANS - 15

**PROCEEDINGS OF THE FIFTEENTH ANNUAL CONFERENCE
OF THE EUROPEAN CETACEAN SOCIETY,
ROME, ITALY
6-10 MAY 2001**



EDITORS: P. G. H. EVANS AND E. O'BOYLE

EVOLUTION OF A BOTTLENOSE DOLPHINS POPULATION IN THE NORTH-EASTERN WATERS OF SARDINIA (ITALY)

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INTRODUCTION Very few long-term studies on bottlenose dolphin (*Tursiops truncatus*) populations have been carried out in the Mediterranean Sea up until now. A comprehensive study on the behavioural ecology of a resident population of bottlenose dolphins in the waters of north-eastern Sardinia started in 1991. Summer observations were discontinuously carried out up to 1998, but since 1999 a constant monitoring of the area started again, and it is carried out throughout the year (except in summer months).

The area includes about 80 square nautical miles of water with a depth up to 100 metres, with large and small islands and a complex shoreline (Fig. 1).

In 1992, a fish farm has been built up just in the area: the surface of the cages was less than 1 ha, their volume being of 30.000 m³ and containing about 174 tons of fish biomass. In 1995, the plant was completely transformed and now covers about 2.4 ha and contains about 800-1000 tons of fish biomass.

MATERIALS AND METHODS Since observations have been carried out by the same research group, the same or similar methodologies have been adopted so the results that were recorded in the different periods are really comparable. A first study was carried out from 1991 to 1994, and observations were recorded both from independent boats, trawlers and shore-based observation points (Arcangeli *et al.*, in press; Marini *et al.*, 1996).

About 976 hours of observations were carried out from 1991-94, with 894 hours from 1999-2000. Sightings are recorded only from the shore-line and from boats close to a floating fish farm (which was built in 1992). Spotting and observations of the animals were carried out with the naked eye and 12x40 and 12x50 binoculars. Photographs have been taken by an automatic 35 mm reflex camera with 35-80 and 100-300 zoom lenses.

Sightings were considered satisfactory when the visibility was not too much reduced by rain or fog and sea conditions were equal or below 3 of the Douglas scale. To record the behaviour, an *ad libitum* method (Altmann, 1974) was chosen, with the sequences of observed behaviours by the focal groups dictated to a tape recorder.

RESULTS In the first period (1991-94), dolphin sightings (n=99) were relatively rare (Fig. 2), and the mean school size quite small, with a larger observed school of ten animals (Fig. 3).

Dolphins were shy and lacking confidence around boats. Animals were accustomed to follow trawlers to chase cephalopods and fishes in front of the nets: hard predation on trammels was carried out, causing serious damage to the nets.

Photo-identification processes were very hard to undertake because it was difficult to approach the animals and their dorsal fins were extremely "clean", with very rare notches or scars: no more than seven animals were identified and few of them had permanent notches. Anyway, apparently all the animals in the area that brought scars had been identified after some time (Fig. 4).

Nowadays, the number of sightings per hour has increased dramatically (n=225) (Fig. 2); mean school size is larger (R=1-17) (Fig. 3); dolphins are easy to approach, and notches and scars are more frequent, with the number of photo-identified animals still growing up after two years. "Old" animals, that had been identified since 1987, are still seen in the area, but "new" ones are constantly identified (Fig. 4).

DISCUSSION AND CONCLUSIONS The nourishment coming from the farm gave rise to an increase in the presence of "wild" fish in the surrounding area, and this trophic availability probably creates a "sponge" effect towards groups of dolphins originally living outside the area.

While, in the past, low numbers of animals in the area limited any competition, now that new animals are coming some kind of competition could occur (e.g. sexual competition) causing the evident scares on the dorsal fins.

Dolphins operate opportunistically in groups of different size, adopting different feeding strategies in different areas (offshore, inshore, close to the fish farm) (Díaz López, B. *et al*, in press): they have been seen feeding on dead fishes discarded by the farm or escaping from the nets of the cages, too, while in the past they have never been observed eating fishes that were discarded by trawlers.

Unlike in the past (Marini, 1994), the presence of dolphins in the area is nowadays conditioned more by the fish farm than the fishery activities: however, feeding on fishing gear seems to remain an important resource for dolphins. During winter season, dolphins seem to stop to follow trawling boats, preferring to feed on nets close to the coast.

Moreover, the fish farm clearly changed the presence and behaviour of bottlenose dolphins in the area.

Clearly, the radical change in trophic availability seems to be the main reason for the transformation of the presence and behaviour of the dolphins: this seems to be the first well documented case in the Mediterranean Sea of an alteration of the behaviour and ecological dynamics of a population of bottlenose dolphins to be driven by the human alteration of the environment.

ACKNOWLEDGEMENTS The research has been carried out in co-operation with the Compagnie Ittiche Riunite Fish Farm (C.I.R), the support of the Ferrovie dello Stato (Italian railways) and of *L'Immagine Foto Video* di Golfo Aranci. Our thanks also go to the numerous friends and field assistants who have been working with us during the project.

Special thanks go to the people of Golfo Aranci and to Manuela Brovelli for her help in sightings and analysis of data.

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