Influence of fish farms and bottom trawlers on habitat utilization of coastal dolphins along the Israeli Mediterranean shallow shelf

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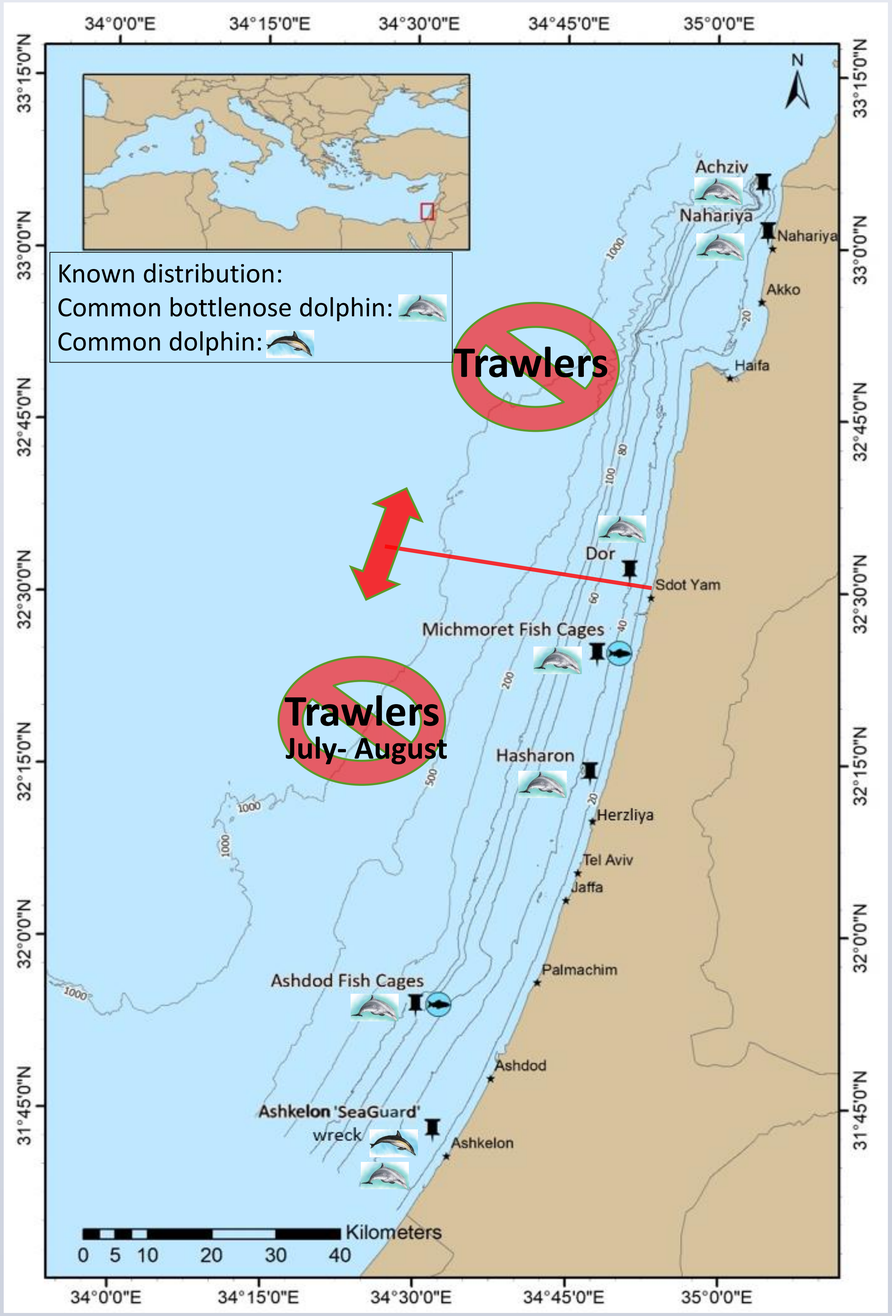
Introduction

- Common bottlenose dolphin (*Tursiops truncatus*) and Common dolphin (*Delphinus delphis*) distribution, preference, and usage of both natural habitats and anthropogenic features (fish farms & shipwreck) were investigated for the first time along the Israeli shallow coastal shelf with passive acoustic monitoring devices.
- Since 2016, north of Dor is a 'No Trawler' area all year round, while south of Dor is a 'No Trawler' area during July & August. The influence of trawler spatiotemporal prohibitions activity was examined.

Methods

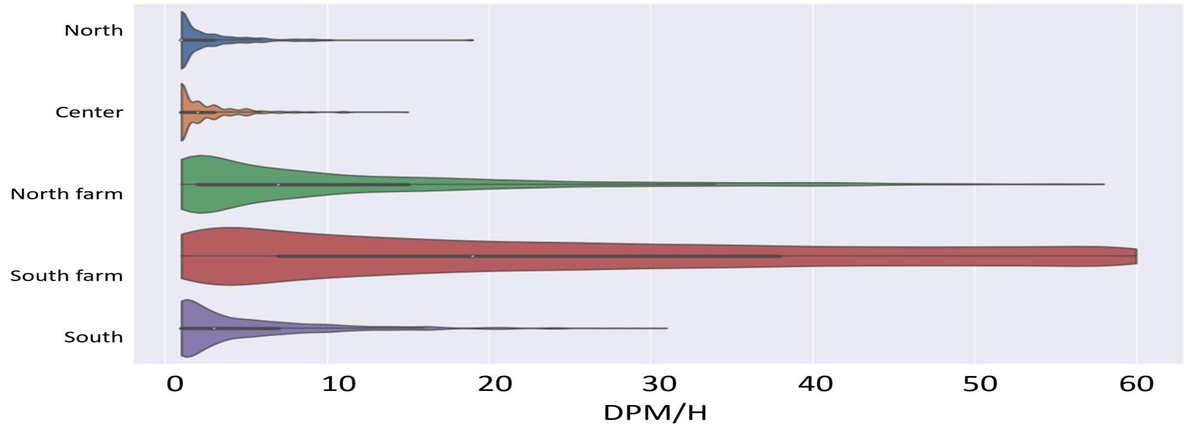
- **Passive Acoustic Monitoring (PAM) -** C-POD and F-POD - deployed at various natural locations along the coast: 'North' (Nahariya & Achziv), 'Center' (Dor and Hasharon), and near a shipwreck - 'South' (Ashkelon), at depths of 20m & 45m, 45m & 20m, and 27m, respectively. Two open-sea fish farms: 'North Farm' (Michmoret; 36m) and 'South Farm' (Ashdod; 80m) were also monitored.
- **Modelling -** Hurdle model used to examine dolphin visiting probability and visit duration, with habitat, diurnal cycle, and warm/cold season as explanatory variables.
- **Trawler effect -** 'No trawlers' season (months '07', '08') ↔ 'Trawlers' (rest of the year), and ↔ 'Trawlers Summer' (months '06', '09','10', '11'), were tested as well.



Map showing C/F-Pod sample points (pushpin icons), including open-sea marine fish farms (Fish icons).

Results

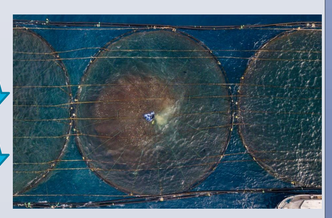
- Dolphin presence in this ultra-oligotrophic region was 20 times lower than in more fertile waters.
- Presence was up to 3 orders of magnitude higher in the proximity of fish farms, with visit durations of up to 10 h recorded at South Farm.
- Winter and night were the preferred season and time of day, respectively.
- Fishing prohibition on bottom trawlers increased visiting probability at both farms and also visit duration at South Farm.



Visit duration- DPM/H distributions of dolphins at the different habitats. Y-axes show the number of visits according to their duration.

Trawlers (rest of the year)

No trawlers (months '07', '08')



Conclusions

- Fish farms are a major dolphin attractor, more so when trawlers don't operate
- During the 'No Trawlers' season, longer visits at South Farm seem advantageous but the expectations from 'North Farm' to compensate for the loss of the 'moving food source' were not fulfilled.
- Similar low visiting probability & visit duration across all natural habitats is indicative of homogeneity in oligotrophic conditions along the coastline.
- Also, in terms of energy balance, benthic areas recovered following cessation of trawler activity seem to be comparable to areas where trawlers operate.
- Further restrictions on fisheries may enhance dolphin presence, through lack of competition and the recovery of the benthic ecosystem.

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