Interactions between small-scale fisheries and marine mammals in the Eastern Mediterranean: case studies from the South Adriatic and the Levantine Sea.

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Abstract

Paucity of bycatch data in the Eastern Mediterranean Sea

Marine mammal distribution data | Small-scale fisheries (boats <12m) GPS tracking | Interviews with fishermen

Estimation of the probability of interaction between marine mammals and fishing activities

Areas of spatial overlap

T. truncatus (Albania, Montenegro, Turkey) ← | → ***M. Monachus*** (Turkey)

Efficient new method | Lack of a standardized method for quantifying bycatch | Needs to be implemented in more areas

Introduction

Small-scale fisheries and marine mammal interactions may entail incidental catches and injuries, entanglement, changes in behaviour, economic loss for the fishermen and intentional killing of the animals (Díaz López 2006; Bearzi et al. 2008; Gonzalvo et al. 2015; Revuelta et al. 2018). These interactions are most likely to happen in areas where spatial overlap between cetacean distribution and fisheries occurs (Fossa et al. 2011; Di Tullio et al. 2016; Zappes et al. 2016). The present study intends to delve into the unexplored research niche that exists in the South Adriatic and Levantine Sea regions and investigate the extent of interactions between small-scale fisheries and marine mammals in the Montenegrin, Albanian and Turkish coastline. The overall objective of this pilot study is to provide a cost-effective, initial assessment of the impact of small-scale fisheries on marine mammal populations, by identifying critical areas with spatial overlap between fishing grounds and marine mammal presence.

Materials and Methods

(a) GPS loggers on boats

(b) Land survey

(c) Boat survey

ArcMap 10.6.1 (ESRI)

$$P_{rel,mammal_i} = \frac{density_i}{\sum_{i=1}^{n} density_i} \quad \& \quad P_{rel,activity_i} = \frac{activity_i}{\sum_{i=1}^{n} activity_i}$$

$$P_{rel,interaction_i} = \frac{(P_{rel,mammal_i}) \times (P_{rel,activity_i})}{\sum_{i=1}^{n}[(P_{rel,mammal_i}) \times (P_{rel,activity_i})]}$$

Vanderlaan et al. (2008)

Results

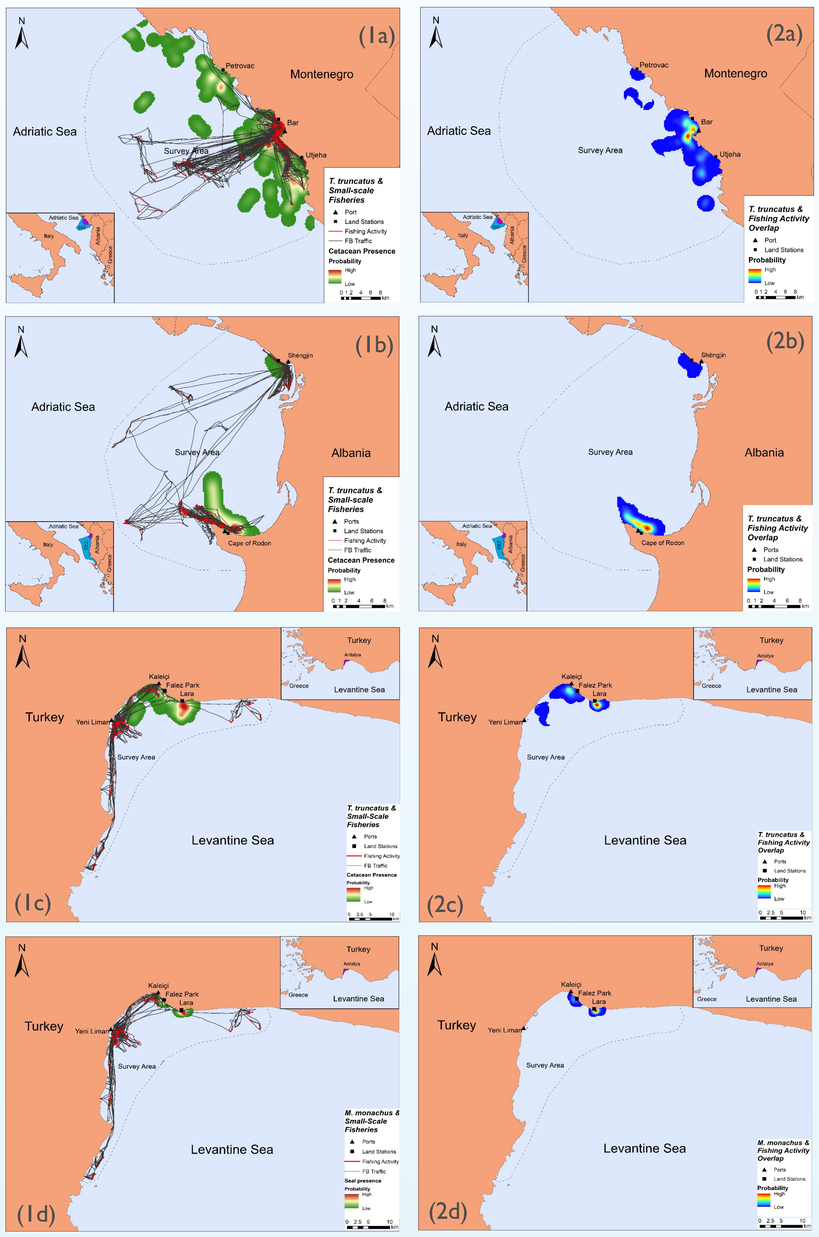

Figure 1. Our survey areas with the present of boats and **(a)** *T. truncatus* in the Montenegrin coast, **(b)** *T. truncatus* in the Albanian coast, **(c)** *T. truncatus* in the Turkish coast (Antalya Bay) and **(d)** *M. monachus* in the Turkish coast (Antalya Bay). The green track lines represent all fishing boat traffic, the red part represent specifically the fishing activities. Marine mammal presence is illustrated with Kernel density estimation.

Figure 2. Areas with spatial overlap between small-scale fishing activity and **(a)** *T. truncatus* presence in the Montenegrin coast, **(b)** *T. truncatus* presence in the Albanian coast, **(c)** *T. truncatus* presence in the Turkish coast (Antalya Bay) and **(d)** *M. monachus* presence in the Turkish coast (Antalya Bay). The density maps demonstrate the probability of interaction within 200m x 200m grid cells.

Fishing activities x Marine mammal	Spatial overlap (%)
Albania (*T. truncatus*)	16,73
Montenegro (*T. truncatus*)	21,48
Turkey (*T. truncatus*)	17,21
Turkey (*M. monachus*)	5,88

- No spatial overlap between Small-Scale Fisheries and *Ziphius cavirostris* in Turkey
- No spatial overlap between Small-Scale Fisheries and *Stenella coeruleoalba* in Montenegro and Turkey

Conclusions

- \+ Low cost
- \+ Easy to replicate
- \+ Optimal for SSF
- \+ Appropriate for coastal species

→ − Requires monitoring for long-term studies

→ − Need to develop a standardized method

→ **More areas with bycatch data deficiency need to be assessed**

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