ASSESSING THE CONSISTENCY OF DATA COLLECTED USING FERRIES AS PLATFORMS OF OPPORTUNITY FOR CETACEAN MONITORING PROGRAMS

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Introduction

The aim of this work is to investigate the consistency of data collected using ferries as platform of opportunity, for applying distance sampling analysis and estimate cetacean density. The study analyzes the influence of MMOs and ferry characteristics (height of bridge and speed) as possible bias on data collected during summer 2011 in the PELAGOS Sanctuary, northwestern Mediterranean Sea.

Material and methods

During summer 2011, 32 different Marine Mammal Observers (MMOs) collected data onboard of 10 different ferries along 4 routes (Toulon-Ajaccio TA; Nice-Calvi NC; Savona-Bastia SB; Leghorn-Bastia LB) which cross the Ligurian Sea (Fig. 1). Surveys have been conducted once a week from June to September, performing a round trip within the same day. A transect is considered as a journey from port to port. A round trip accounts then for 2 transects. Table 1 summarizes the ferries and number of different MMOs for each route, as well as number of transects surveyed for each ferry. The 10 ferries have been grouped on the basis of the height of the observation point Type I (H=12-15 m), Type II (H=20-22 m), Type III (H=25 m).
The data were analyzed in a three-step process:
1. Using the software Distance to estimate detection probability and ESW for every route (all species together) and for the species with at least 30 sightings: striped dolphins (SC) and fin whales (BP);
2. Using a linear model (stepwise-backward model fitting, AIC model selection) to test the effect of ferry characteristics on sighting distances separately for SC and BP (thus excluding the variability linked to the species);
3. Using qualitative box-plots to assess MMOs capabilities. For this analysis we considered only MMOs with at least 10 sightings distributed on at least 5 different transects.

Acknowledgments

1) Distance Analysis - ESW

The ESW for each route shows a wide variation among routes, ranging from 290 m to 1360 m (Fig. 2A). When considering species separately (Fig. 2B and 2C), differences among track are less pronounced while a strong difference among ESW for the two species persists (mean ESW_{BP}=1640.5 m and mean ESW_{SC}=441.5 m).
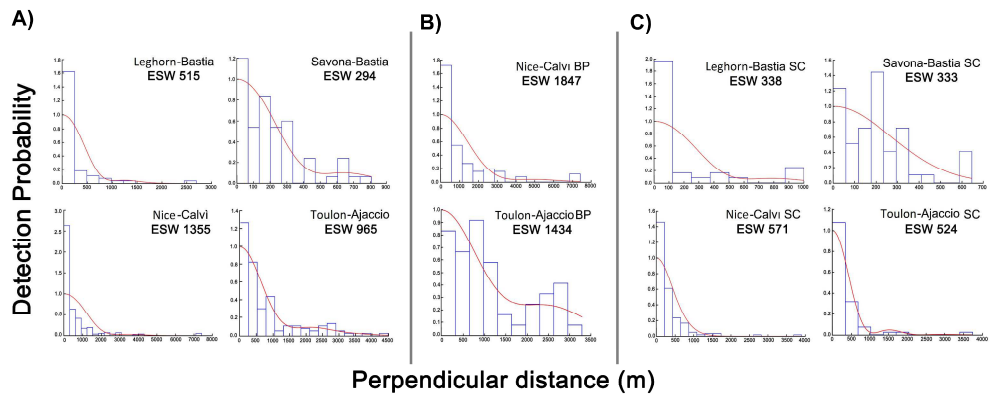
Figure 2. Detection probabilities and perpendicular sighting distances per route (A) and per species (B and C, respectively for fin whales BP and striped dolphins SC)
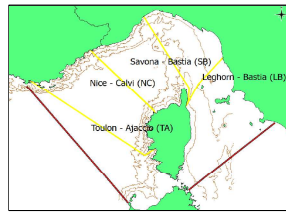
Figure 1. The PELAGOS Sanctuary border (red lines) and the four surveyed routes (yellow lines).

Table 1. Surveyed routes and characteristics of the ferries.

Route	Ferry	H (m)	Transects	MMO
TA	Mega Smeralda	25	8	
	Mega Express 5	22	3	
	Mega Express	20	5	14
	Mega Express 4	22	4	
	Mega Express 2	20	2	
	Mega Express 3	20	1	
NC	Sardinia Vera	15	29	
	Mega Smeralda	25	1	
SB	Corsica Victoria	12	14	14
	Sardinia Regina	12	19	
LB	Corsica Marina II	15	30	
	Sardinia Regina	12	14	
	Mega Express 2	20	6	
	Mega Express 3	20	10	6
	Sardinia Vera	15	8	
	Corsica Victoria	12	2	

2) Linear Models

Both the model for SC and the model for BP show that the most influential factor on the sighting distances is the height of the observation point (P_{SC}<0.01; P_{BP}<-0.1) (Tab. 2).

Table 2. Linear Model summary.

		Value	Standard Deviation	T value	P value	Significance
SC	Intersection	-205	119	-1.73	0.085	*
	Coef. H	40	7	5.49	1.01 E-07	***
BP	Intersection	772	822	0.94	0.349	-
	Coef. H	84	1.76	1.76	8.05 E-02	*

3) MMOs Variability

Given the type of ferry and the species, the ability of the MMOs becomes relevant with the increase of height of observation point (Fig. 3). Differences are more relevant for fin whales sighting distances.
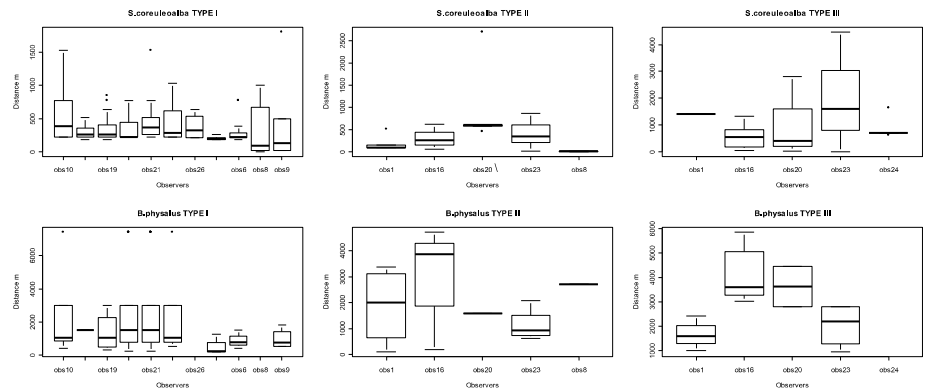
Figure 3. Qualitative box-plots of sighting distances by MMOs by species (*S. coeruleoalba*-SC and *B. physalus*-BP) and height of the observation point (TYPE I, TYPE II and TYPE III ferries)

Conclusions

• Type III ferries have been used only on 9 transects, so all analysis on these ferries should be considered as very preliminary.
• Route, species and height of observation deck have an influence on the definition of the ESW, thus species/ferry specific analysis should be done for intra-route density estimates. Nevertheless, for inter-route analysis, this possible bias does not overcome the overall results.
• MMOs ability is not relevant in ferries of Type I. More analysis should be done to better understand MMOs effect on Type II and Type III.
These preliminary results highlight the importance of such long-term cost-effective monitoring programs: bigger dataset would allow bias reduction.

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