

Can human activities influence foraging habitat selection in wild bottlenose dolphins?



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Introduction

Bottlenose dolphin, exhibiting a great behavioural plasticity, is expected to be more adaptive than other small cetacean species in highly impacted coastal ecosystems. A resident population of common bottlenose dolphins (*Tursiops truncatus*) is present in the Ría of Arousa (Fig. 1), an important area for shellfish aquaculture. While this industry has an impact on dolphins' use of habitat (Díaz López & Methion 2017), there are no studies regarding its influence their behaviour. This is the first study aiming to determine whether the presence shellfish farms induces behavioural changes in bottlenose dolphins.

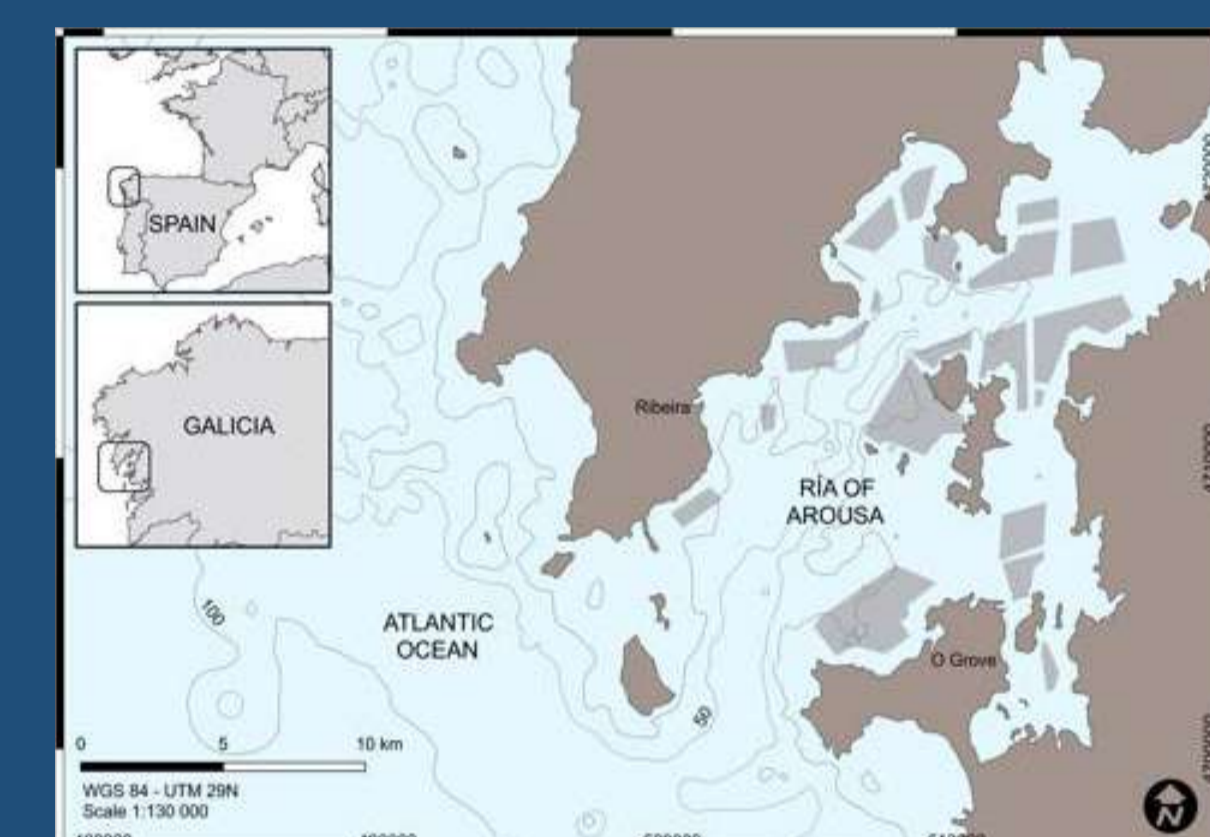


Fig 1. Map of study area. Polygons represent shellfish farm areas.

Methods

Data were collected year round from 2014 to 2017 in the Ría of Arousa (NW Spain) on-board BDRI's research vessel. Upon a sighting of bottlenose dolphins, environmental variables and dolphins' behaviour were collected every 5 minutes. The behaviour was determined using group follow protocol and predominant activity sampling method (Mann 1999). To minimise boat impact and auto-correlation, only the 1st sample of each sighting was selected for the analysis. A contingency table was used to determine the predominant behaviour inside and outside shellfish farm areas. A binomial GAM with a multi-model inference approach was used to determine which variables affect foraging activities.

Results

In all, 273 boat-based observation surveys were carried out (9 416 km). Bottlenose dolphins were encountered 712 times and their behaviour was monitored during 445 hours (2 454 km). A total of 5 482 samples were collected of which 693 were selected. Feeding behaviour was predominant inside of shellfish farm areas (contingency table, χ^2 $p < 0.01$, 3 df) (Fig. 2-3). GAM results: 512 models (18 best models < 2 AICc) (Fig. 4-5).

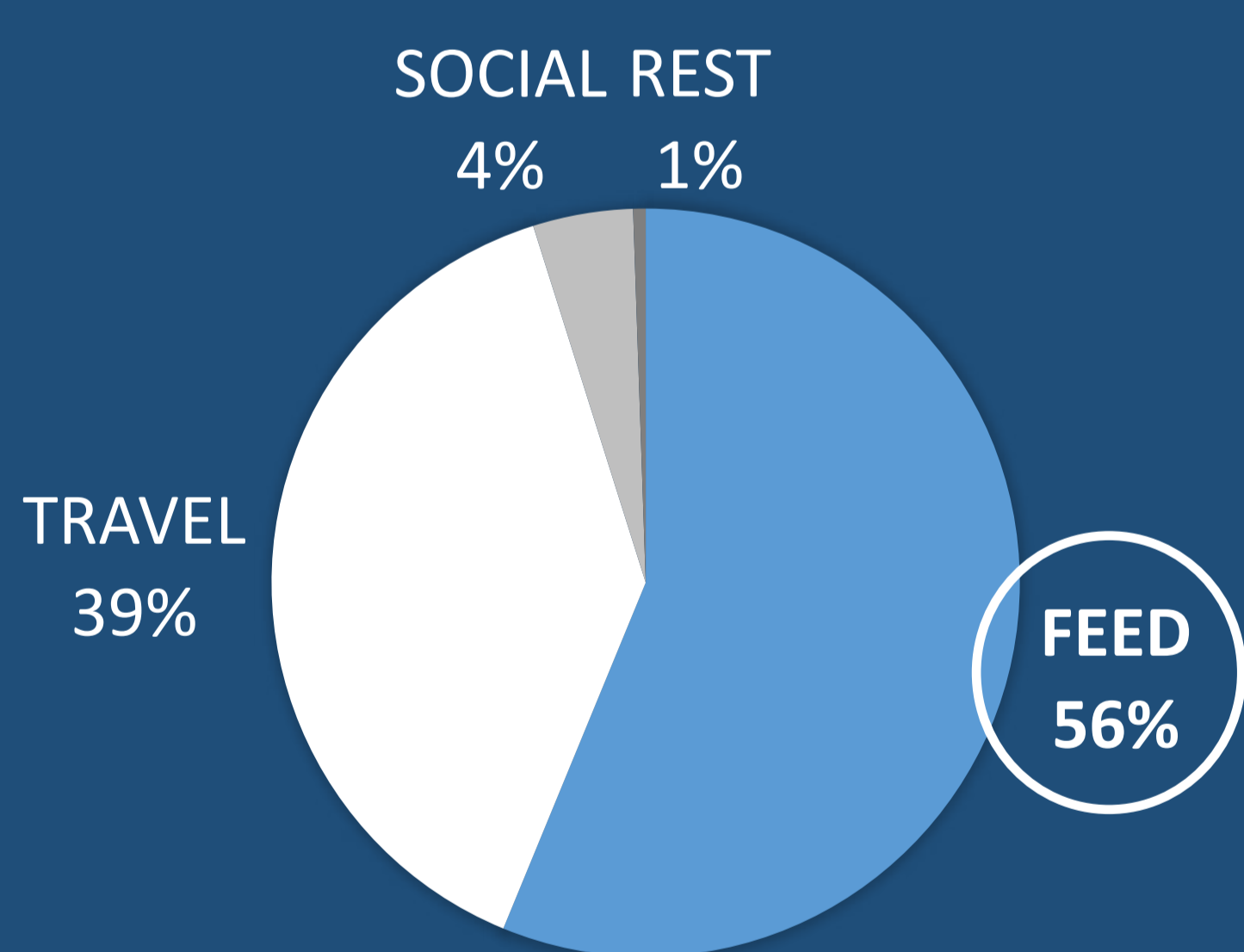


Fig 2. Behaviour inside shellfish farm areas.

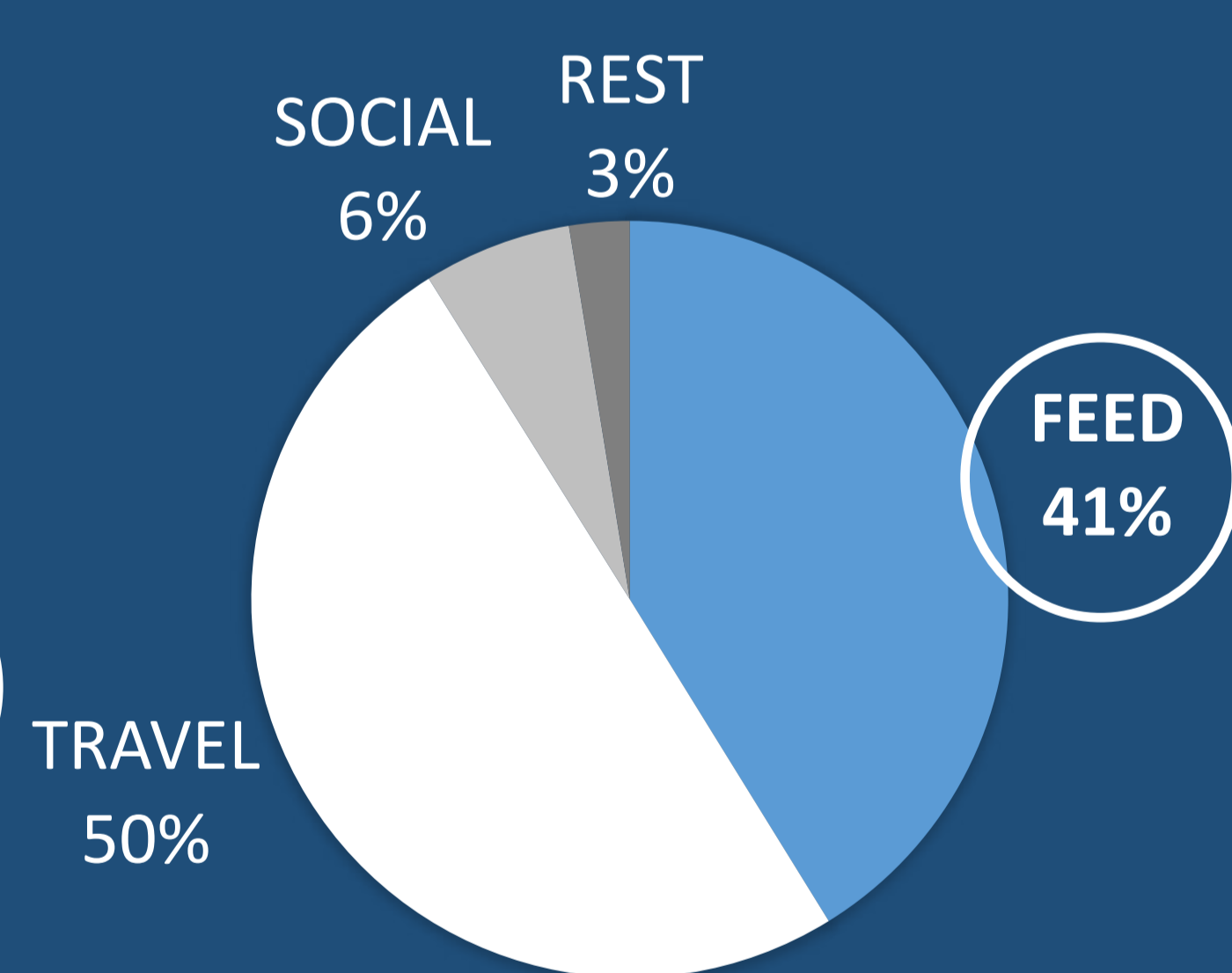
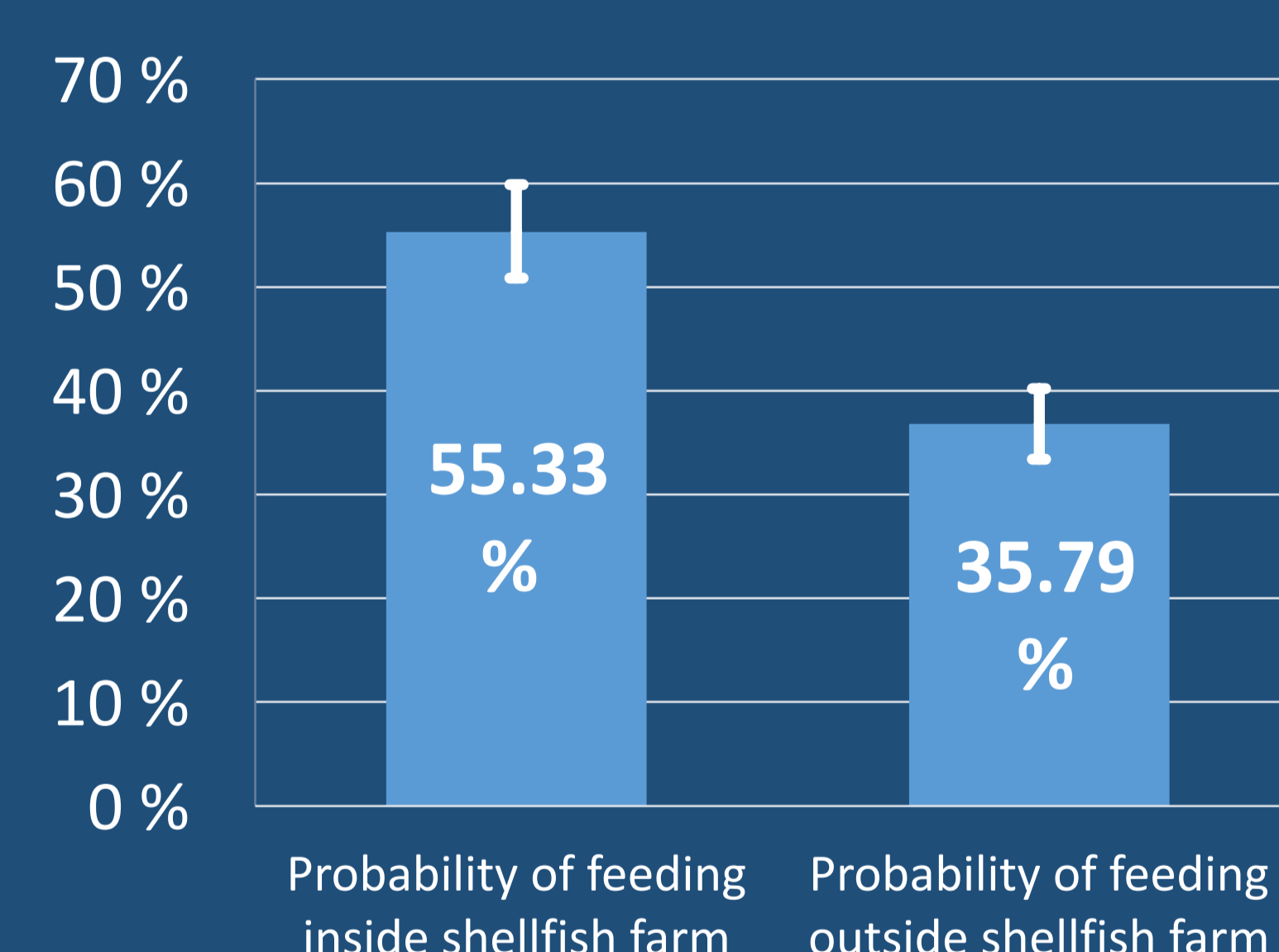


Fig 3. Behaviour outside shellfish farm areas.

	N models	Relative variable importance
Mussel farms	18	1
SST	18	1
Time	18	1
Depth	12	0.72
Distance coast	9	0.49
Slope	6	0.29
SSS	4	0.22
Wind	2	0.08

Fig 4. Model averaging results.



Probability of feeding inside shellfish farm vs outside shellfish farm

Fig 5. Model prediction of feeding behaviour.

- Shellfish farms are an **effective foraging alternative** for bottlenose dolphins: **fish attraction device** that concentrates prey in coastal environment
- Important information for management and conservation of coastal areas



References
 Díaz López B, Methion S (2017) The impact of shellfish farming on common bottlenose dolphins' use of habitat. *Marine Biology* 164: 83.
 Mann J (1999) Behavioral sampling methods for cetaceans: a review and critique. *Marine Mammal Science* 15(1): 102-122.



Acknowledgements
 We thank all BDRI interns and volunteers for assisting with data collection.

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