



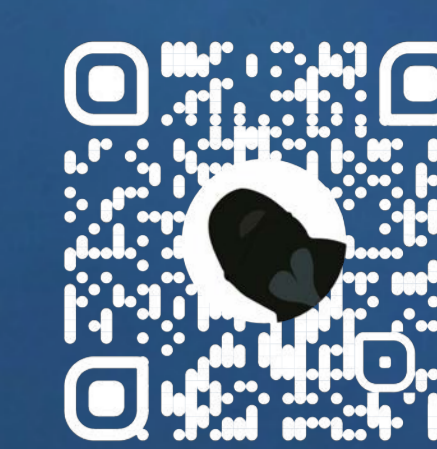
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Potential SIGNATURE WHISTLES identified in groups of inner Mediterranean sub-population of LONG-FINNED PILOT WHALES (*Globicephala melas*)

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INTRODUCTION

The long-finned pilot whale (*Globicephala melas*) is a species with a **complex and structurally variable vocal repertoire**. Such as all the odontocetes produces **whistles**, which are **tonal and continuous** sounds with 0.1 s minimum length and modulated contour with at least one part that reaches 3 kHz frequency. Often these vocalizations present a multiples of the contour named «overtones»¹. Very little is known regarding of the **inner Mediterranean sub-populations** occurring from the eastern Alborán Sea to the Ligurian Sea².

METHODS



Fig. 2 Study Area.

The acoustic features of **919 pilot whales' whistles** (i.e., tonal, frequency-modulated sounds with a variable/aberrant contour) were identified in **30 recordings** collected **between 2011 and 2020** in the north-western portion of the **Pelagos Sanctuary** (NW Mediterranean Sea). Each whistle was characterized by extracting the maximum, minimum, starting and ending frequency, duration, number of inflection points and overtones. Then, the presence of **potential signature whistles (pSW)**, a category of whistles used to **transmit identity information within the group**², was investigated using the SIGnature IDentification (SIGID) method based on the whistles' repetition pattern (at least 5 times in an interval of 1–10 s)³.

RESULTS

About 50% (n=430) of the analyzed whistles was classified as **pSW**, seemingly belonging to **17 different types** (3 of which recorded in different years). Minimum and maximum frequency averaged 2.4 ± 1.2 KHz and 10.2 ± 4 KHz, respectively, with an initial frequency of 2.8 ± 1.6 KHz, a final frequency of 4.5 ± 3.8 Hz, and a duration of 1.1 ± 0.4 seconds. The number of inflections and overtones averaged 1.5 ± 3.3 and 2.5 ± 1.5 , respectively (**Tab. 1**).

Tab. 1 Descriptive statistics of the pSW acoustic parameters.

	Low Frequency (Hz)	High frequency (Hz)	Duration (s)	Start frequency (Hz)	End frequency (Hz)	Frequency range (Hz)	Inflection points (n)	Overtones (n)
Median	2061	10545	1.11	2262	2849	8010	0	2
Mean	2417	10270	1.05	2874	4554	7774	1.47	2.39
SD	1247	4021	0.39	1632	3840	3812	3.23	1.47

CONCLUSIONS

pSWs maximum frequency and duration, and the overtones occurrence, resulted significantly higher than other whistles (Kruskal-Wallis H test, $p < 0.05$), allowing **discrimination between pSWs and non-signature whistles**. Overall, the whistles' maximum frequency, duration, and the number of inflection points seem higher than values reported in other geographical areas (Indian Ocean⁴, Atlantic Ocean⁵, Pacific Ocean⁴), suggesting **possible group-specific vocalization patterns** and/or effect of **anthropogenic disturbance**.

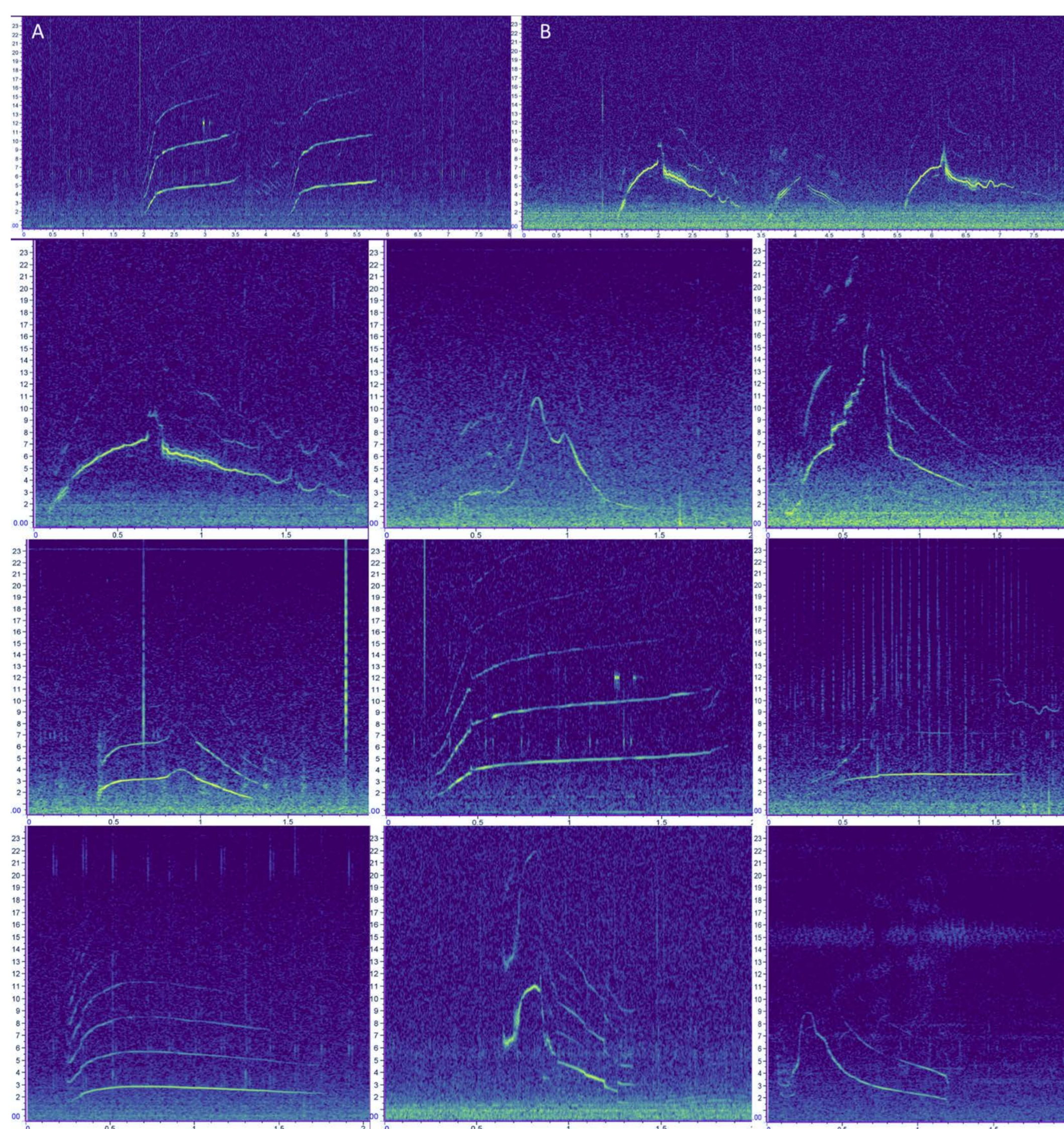


Fig. 1 A) and B) are two examples of pSW sequences. Nine boxes: spectrograms showing nine different pSW extracted from the recordings.

REFERENCES

- 1- Kriesell, H. J., Elwen, S. H., Nastasi, A., & Gridley, T. (2014). Identification and characteristics of signature whistles in wild bottlenose dolphins (*Tursiops truncatus*) from Namibia. *PLoS one*, 9(9), e106317.
- 2- Verborgh, P., Gauffier, P., Esteban, R., Cimenez, J., Cañadas, A., Salazar-Sierra, J.M., De Stephanis, R. (2016). Conservation Status of Long-Finned Pilot Whales, *Globicephala melas*, in the Mediterranean Sea. *Advances in Marine Biology* 75, 173-203.
- 3- Janik, V. M., King, S. L., Sayigh, L. S., & Wells, R. S. (2013). Identifying signature whistles from recordings of groups of unrestrained bottlenose dolphins (*Tursiops truncatus*). *Marine Mammal Science*, 29(1), 109-122.
- 4-Courts, R., Erbe, C., Wellard, R., Boisseau, O., Jenner, K.C., Jenner, M.N. (2020) Australian long-finned pilot whales (*Globicephala melas*) emit stereotypical, variable, biphonic, multi-component, and sequenced vocalisations, similar to those recorded in the northern hemisphere. *Scientific Report* 10, 20609.
- 5-Rendell, L.E., Matthews, J.N., Gill, A., Gordon, J.C.D., Macdonald, D.W. (1999) Quantitative analysis of tonal calls from five odontocete species, examining interspecific and intraspecific variation. *J Zool (Lond)* 249:403–410

ACKNOWLEDGMENT

Our thanks go to all those who contributed to field data collection, to the skippers Roberto Raineri and Paolo Pinto and to the volunteers who helped in the field. Thanks to Michele Manghi (Nauta scientific s.r.l.) for the hydrophone array development and the technical support. IFAW provided the software Logger2000. Special thanks to Portosole, Sanremo and to The Milan Civic Aquarium and Hydrobiological Station for providing logistic support. Special thanks to Valentina De Santis for the contribution to the design of the Poster.