

SILENCIO: Introduction of electric propulsion to small inshore fishing boats to reduce their impact in the environment

Clara Almécija¹, Ignacio González¹, Pablo Álvarez¹, Antonio Cardenal-López², Enoc Martínez³, Joaquín del Río³, Cristian Simoes¹, Soledad Torres-Guijarro², Marta Vazquez¹ and Silvia Torres¹

¹ *Unidad de Tecnologías Marinas, Centro Tecnológico del Mar-Fundación CETMAR, C/Eduardo Cabello s/n 36208 Vigo (Pontevedra), Tel:(+34)986247047, utmar@cetmar.org, storres@cetmar.org*

² *atlanTTic, Universidade de Vigo, Escola de Enxeñaría de Telecomunicación, 36310 Vigo (Pontevedra), España, Tel: (+34)986818674, Fax: (+34)986812116, cardenal@gts.uvigo.es, soledadtorres@uvigo.es*

³ *Observatorio OBSEA, Universitat Politècnica de Catalunya, Rambla Exposición 24 08800 Vilanova i la Geltrú (Barcelona), Tel: (+34)938967200, fax: (+34)938967201, enoc.martinez@upc.edu, joaquin.del.rio@upc.edu*

Abstract – Human activities affects each environment, even the most remote, and the acoustic impact that these activities generate on the marine environment is not an exception. The Silencio project aims to developed innovative and sustainable solutions to reduce the impact of fisheries and shell-fisheries in ecosystems, mainly noise but also carbon footprint, by the assessment of the use of electric propulsion by small inshore fishing boat. Besides, the knowledge about the sources of underwater noise in areas under high fishing pressure will be improved by the characterization of the ambient noise in Rías Baixas. Further, the project will spread the idea of an environmentally sustainable, socially responsible and economically viable extractive sector.

Keywords – Underwater ambient noise, noise monitoring, Rías Baixas, Electric engines, Inshore fishing

I. CONTEXT

The human introduction of noise in the environment is considered one of the most stressful disturbances for animals and plants in the terrestrial environment [1]. However how the marine noise is and how water ecosystems are affected by the anthropogenic noise-sources have been less studied. Several studies and reviews characterize wide natural soundscapes and their vary sources as rain, ice-melting or underwater volcanos [2, 3]. Other authors highlight that numerous groups of animals are using the sound to perform their biological and social functions -not only marine mammals [4] but also less evolved animals as crustaceans [5]- and they evidence that human activities in the soundscape, especially impulsive noise, are impacting in their hearing, communication capability, behaviour and physiology, from invertebrates [6] to fishes [7] or cetaceans [8].

In order to assess and mitigate this impact some policy frameworks, as United Nations or the European Union by several programmes, are encouraging and supporting initiatives and projects that improve the knowledge of underwater noise and propose innovative solutions to alleviate its effects in the ecosystems and to achieve a good marine environmental status (e.g. Implementations of the Marine Strategy Framework Directive MSFD, 2008/56/CE).

On this context Silencio Project arises (December 2020-December 2021). Silencio's main goal is to establish the bases for a more sustainable and noiseless fishing and shell-fishing activities, contributing to minimize their acoustic impact. Silencio's team aimed objectives to reach this purpose:

- (1) Improvement of knowledge about the principal sources of marine noise in areas with high fishing and shell-fishing pressure by the characterization of the ambient noise in Rías Baixas, an incomparable natural seascape, where there are several areas with special protection of natural values. Besides, this area is (and has been) exposed to significant inshore-fishing pressure.
- (2) Development of innovative and sustainable solutions to reduce the impact of fishing (and shell-fishing) activities in the environment (noise and carbon footprint) by the assessment of the use of electric propulsion by small inshore fishing boat.
- (3) Strengthening the fishing sector's commitment with the problem of marine noise and spreading the idea of an environmentally sustainable, socially responsible and economically viable extractive sector.

Therefore, Silencio Project is aligned with the priorities of the European Maritime and Fisheries Fund (EMFF), especially with priority 1 "Fostering sustainable fisheries and the conservation of marine biological resources".

II. CHARACTERIZATION OF UNDERWATER AMBIENT NOISE IN RÍAS BAIXAS (GALICIA, NW IBERIAN PENÍNSULA)

Cortegada platform, one of the recording stations of RIAA Observatory (<http://marnaraia.org>), is settled in the Ría de Arousa, near the Illa of Cortegada, next to the border of the National Park NPMT Illas Atlánticas but into the Marine

Martech 2021.
Marine Technology Workshop
16,18th June. Vigo, Spain

ZEPA Rías Baixas (ES0000499). It was installed in 2008, therefore more than 10 years of several oceanic data -like Temperature, Conductivity or water currents (direction and velocity)- and meteorological -like temperature, humidity, wind (direction and velocity) have been recorded.

A hydrophone (IcListenHF) is also installed in Cortegada since 2016, although the record exhibits several gaps and changes of configuration. Currently, in the framework of SILENCIO project, an IcListenHF hydrophone is performing at a sampling rate of 51.2 kHz, recoding 1 minute of raw data every 3 minutes. Data are processed every 36 minutes, focused in computing sound pressure levels (SPL re μPa) at the targeted frequencies of the MSFD (63 Hz and 125 Hz) as well as 2 kHz and global (full band), and the results are sent in real-time to Emodnet Physics Portal (www.emodnet-physics.eu) in order to make data accessible and available to the community. Afterwards, raw data are downloaded directly in Cortegada Platform each maintenance visit, every 2 or 3 weeks.

The ambient noise records have been treated and studied by the Universidade de Vigo, an international reference Group in Underwater noise, in order to detect natural and human sources of noise. Clicks and whistles of cetaceans have been located in Cortegada's record.

Besides, Obsea (Expandable Seafloor Observatory from UPC) located on the seabed off the coast of Vilanova i la Geltrú (Barcelona, NE Iberian Peninsula) will install another IcListenHF hydrophone to compare the underwater sound record and to assess the capability of applying the algorithm developed in the project to other noise records.

III. THE ASSESSMENT OF THE USE OF ELECTRIC PROPULSION BY SMALL INSHORE FISHING BOAT.

Small Inshore fishing boats carry out lots of different extractive activities depending on the type that fishing gear that is allowed to use, the closure of fishing seasons (to protect fishies and shellfishies species), the ocean-meteorological conditions or the market value of their captures.

Firstly, Silencio's team is characterizing inshore fishing fleet by the use of the Register of Fishing Vessels of Galicia [9], especially data for the Fishing guild that collaborate with Silencio. Inshore fishing boats up to 10 and 7 meters of length are studied attending to their fishing gear and engine power to distinguish the more usual inshore fishing-activity type. Afterward all this fishing types are typified in terms to time, distance, kind and uses of the engine, gas consume, dock facilities, etc. Some of them are being also tracked by a GPS device.

Silencio's team will assess the capability of current affordable technology to perform some of these fishing activities attending to autonomy, volume and weight of batteries, price, profitability, etc. Furthermore, some of these activities will be recreated by the use of some electrified outboard engines, developed in Silencio. Besides, regarding to the reduction of the impact this innovative solution could involve, some experiences will be recreated to quantify the noise and carbon footprint reduction.

IV. CONCLUSIONS.

Silencio Project is a small but ambitious project that contributes to the underwater noise knowledge and to clarify which is the human effect in the marine soundscape. In addition, the outboard engine electrification of small inshore boats will be evaluated to the feasibility of reducing the anthropogenic marine noise. Further information will be available in the project website: <https://www.programapleamar.es/proyectos/silencio-introduccion-de-sistemas-de-propulsion-electrica-en-embarcaciones-pesqueras-de> and in different outreach events. Please, be in contact by @SILENCIO_CETMAR.

V. ACKNOWLEDGEMENTS

Silencio Project is performed by Unidad de Tecnologías Marinas from Centro Tecnológico del Mar, in collaboration with Fundación Biodiversidad, from Ministerio para la Transición Ecológica y el Reto Demográfico of Spain, by the programa Pleamar, cofounded by EMFF. Silencio is possible thanks to the participation of Universidade de Vigo and Universidad Politécnic de Catalunya and the collaboration of several Fishing Guilds (Baiona, Bueu, Cangas, Lira, Muros, Portonovo, Vigo), Coastal Observatories (Ocaso, OBSEA, SOCIB), pt-Protecta, Instituto Español de Oceanografía and Parque Nacional Marítimo Terrestre das Illas Atlánticas. Opinions provided in this publication are exclusive authors' responsibility, and they do not necessarily reflect the points of view of the institutions that fund the project.

REFERENCES

- [1] Pijanowski *et al.*, "What is soundscape ecology? An introduction and overview of an emerging new science", *Landscape Ecology*, vol. 26, pp. 1213–1232, 2011.
- [2] Howe *et al.*, "Observing the oceans acoustically", *Frontiers in Marine Science*, vol. 6, pp. 42, 2019.
- [3] Duarte *et al.*, "The soundscape of the Anthropocene ocean", *Science*, vol. 371, 583, 2021.
- [4] Erbe *et al.*, "Communication masking in marine mammals: A review and research strategy", *Marine Pollution Bulletin*, vol. 103, pp. 15–38, 2016.
- [5] Montgomery *et al.*, "Sound as an orientation cue for the pelagic larvae of reef fishes and decapod crustaceans", *Advances in Marine Biology*, vol. 51, pp. 143–196, 2006.
- [6] Walsh *et al.*, "Noise affects resource assessment in an invertebrate", *Biology Letters*, vol. 13, 20170098, 2017.
- [7] Simpson *et al.*, "Anthropogenic noise increases fish mortality by predation", *Nature Communications*, vol. 7, 10544, 2016.
- [8] Erbe *et al.*, "The effects of ship noise on marine mammals: A review", *Frontiers in Marine Science*, vol. 6, 606, 2019.
- [9] <https://www.pescadegalicia.gal/rexboque/>