

Anthropophonie versus les activités de chasse des odontocètes : le cas des meutes cachalots et des Azipodes sur les Orques

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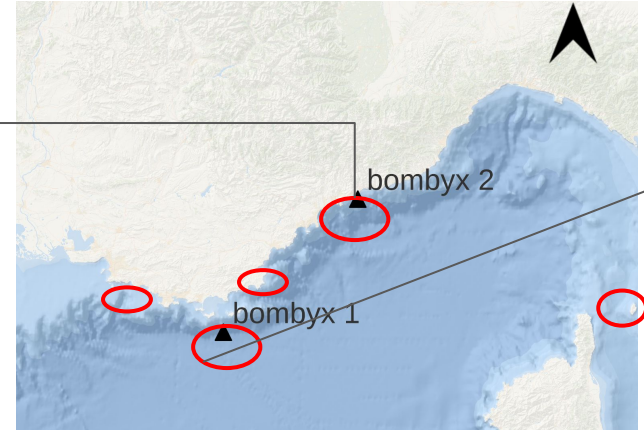
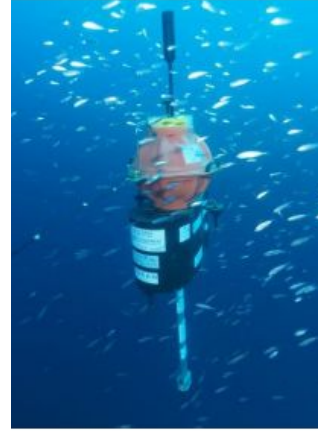
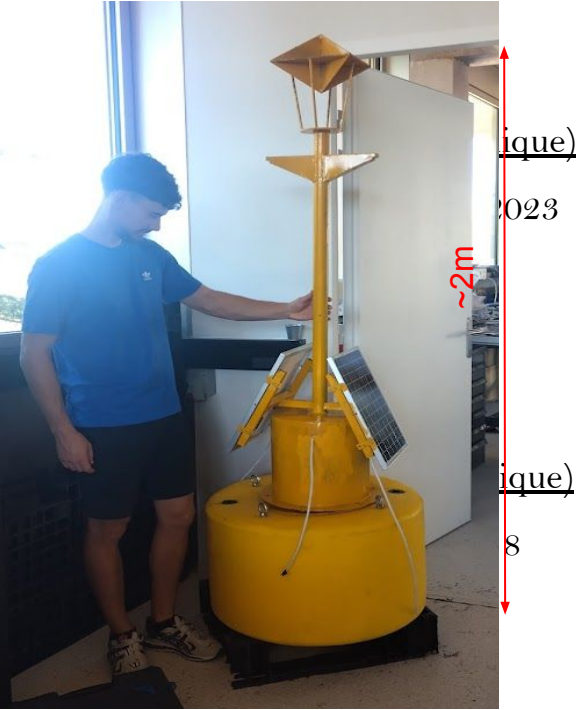
glotin@univ-tln.fr <https://cian.univ-tln.fr>

&

L181, PNPV, ORCALAB (Paul Spong, Helena Symonds)

Symposium “Les Rencontres pour l’Océan & le Vivant”, Longitude181, Parc nat. Port-Cros 2024 10

ANTHROPOPHONIE COMPORTEMENT



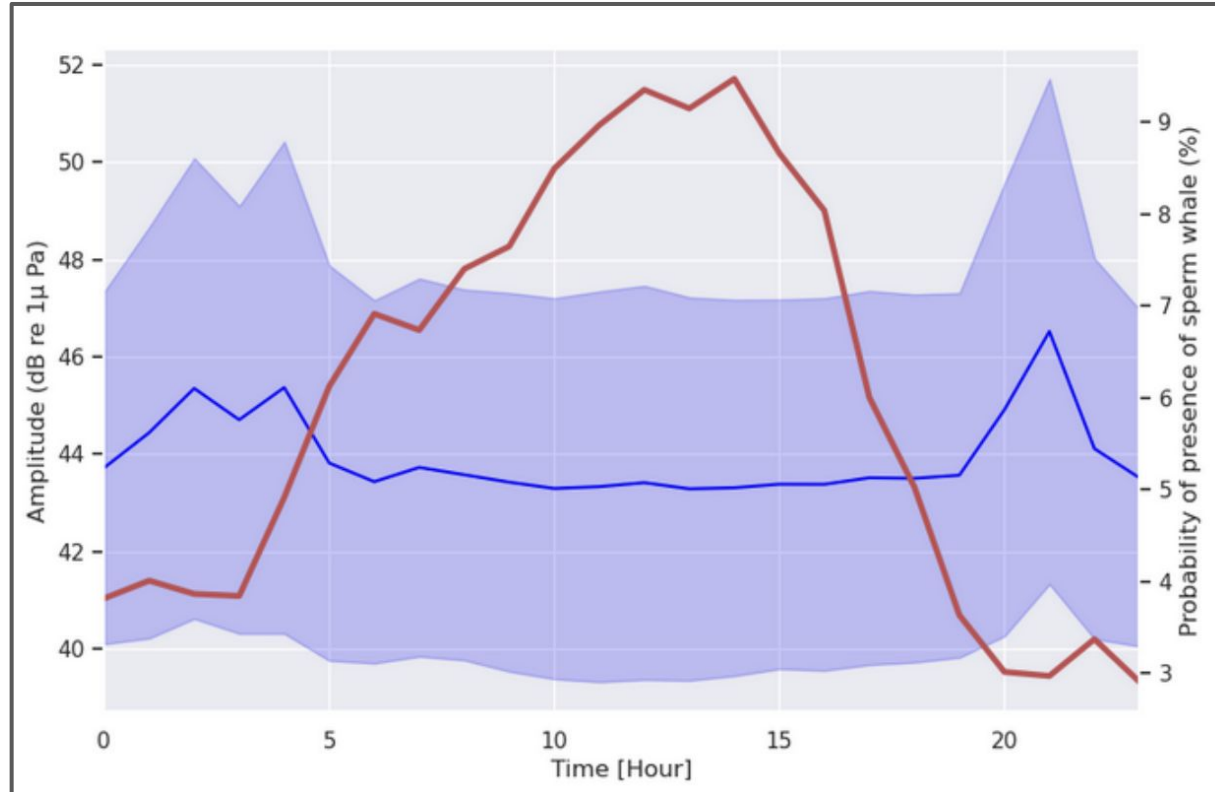
Placement of the Bombyx in the
EUROPAM and IUF project 2025-2030

Left : BOMBYX3 (2024-26). Midd. Bombyx2 (GIAS Geder PI Glotin), Right Bombyx1 (Glotin IUF 2015)

Dépendance à l'ANTHROPOPHONIE

Niveau de bruit
du trafic

Présence des
cachalots



=> Les
cachalots
exploitent
la zone au
minimum
du bruit du
trafic

*Superposition of dial pattern of amplitudes for the octave 12 800 Hz and
probability of presence of sperm whales (Poupard ... Glotin 2023)*

Drone Surface Acoustique Sphyrna

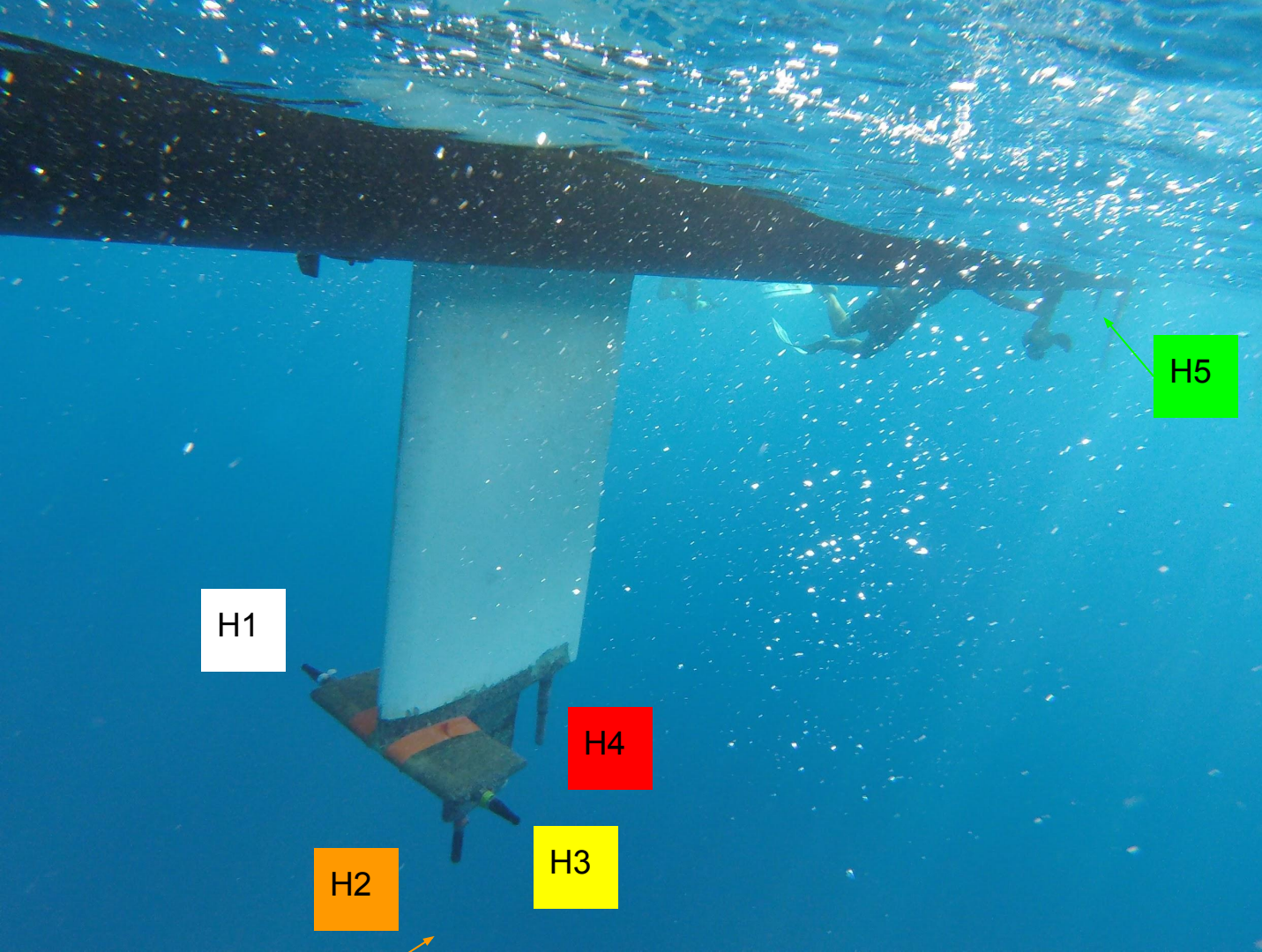
ALV Sphyrna (SeaProven)

Polynesian Design, 20 m, Stable

Hydrodynamic, Low acoustic print

1 t. useful charge.





The 5 hydros fixed
under the keel of the
ASV.

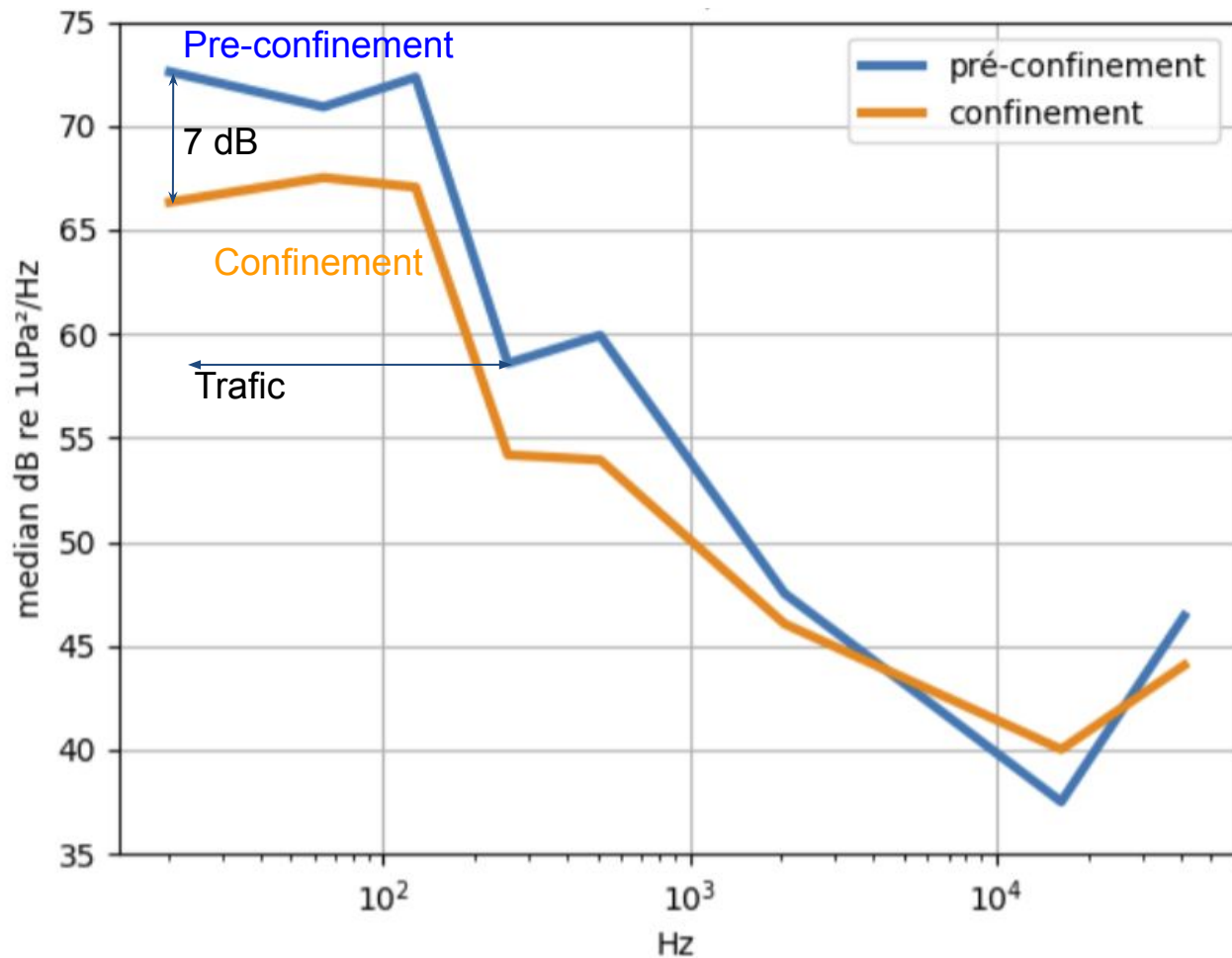
H1

H4

H2

H3

H5



Effet Covid :
-7 dB
x4 de la
distance
de contact
inter-individu

Medium of minimum dB levels, hourly, for each octave during (blue) vs out (orange) lock down, (from Glotin et al 2020 Sphyrna Odyssey research report, Explorations de Monaco FPA2).

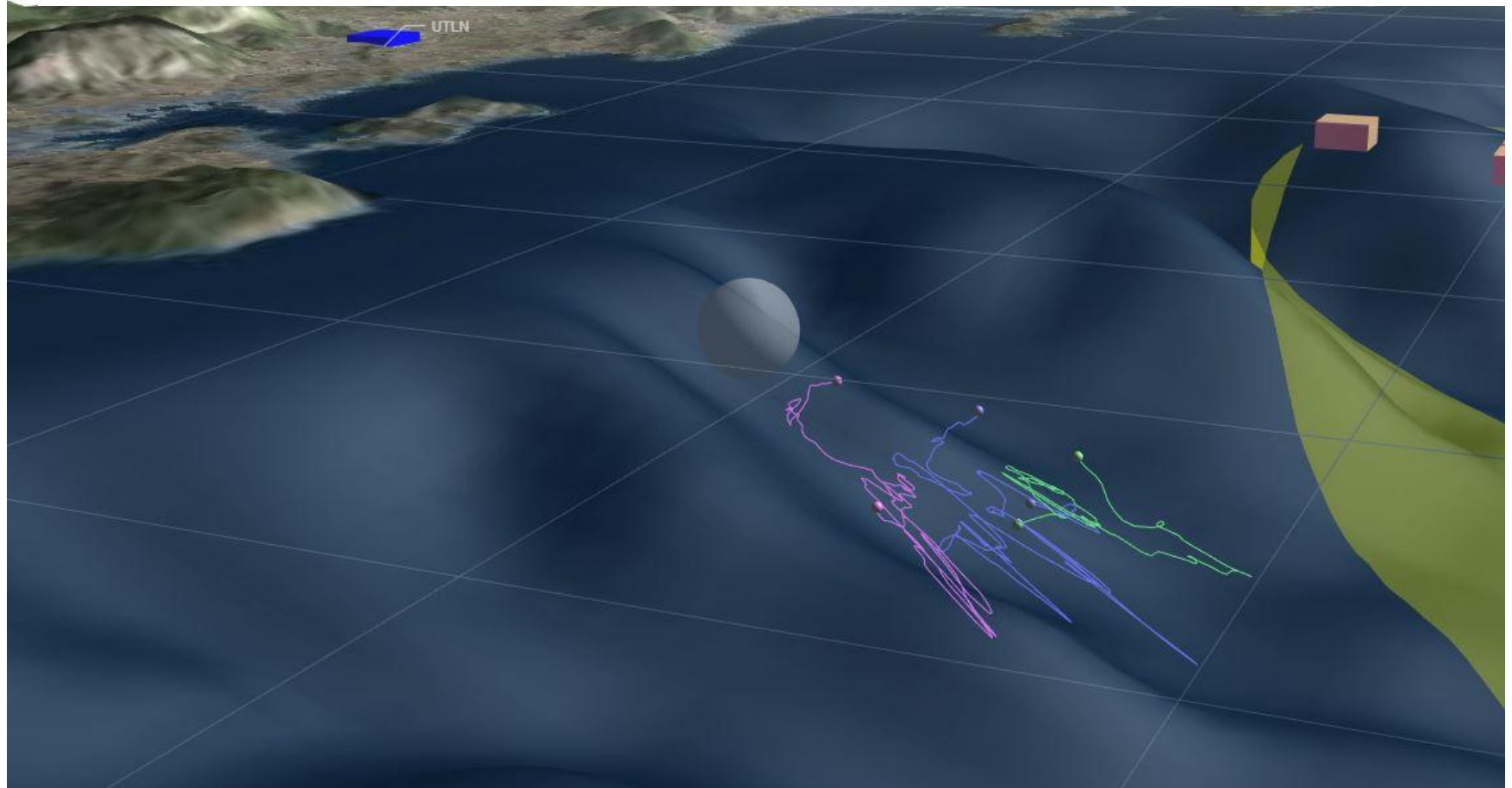
Clear dolphin clicks, TDOA measures, recorded on 5 channels, Chan 1, 4, 5 = gain x 4, Chan 2, 3 = gain 1/2



Direct

Echo surface

August 2018, 1 Physeter, 3 tracks, 50 minutes each, down to -1000 m



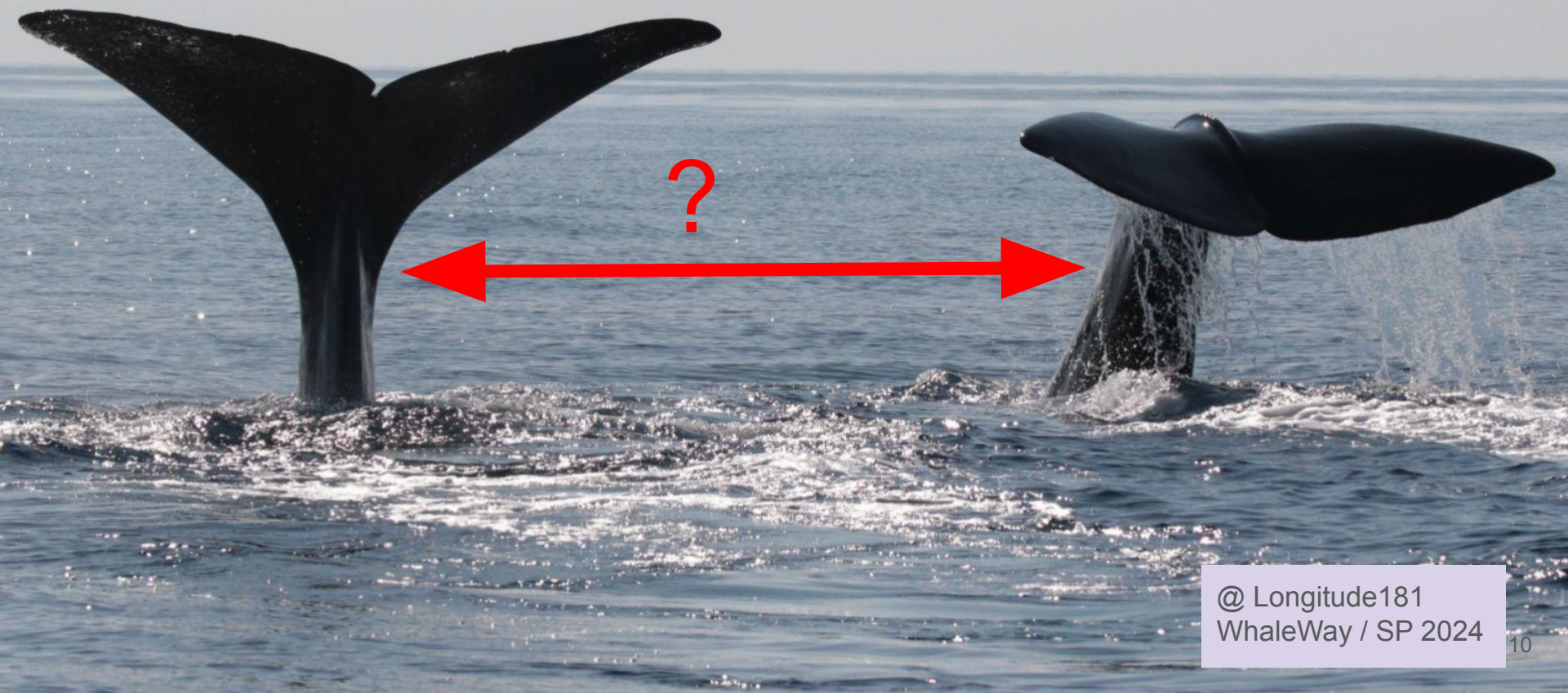
Interdépendance des super-prédateurs... Chasses en Meute
dans le noir, à des Km de distance... comment ?

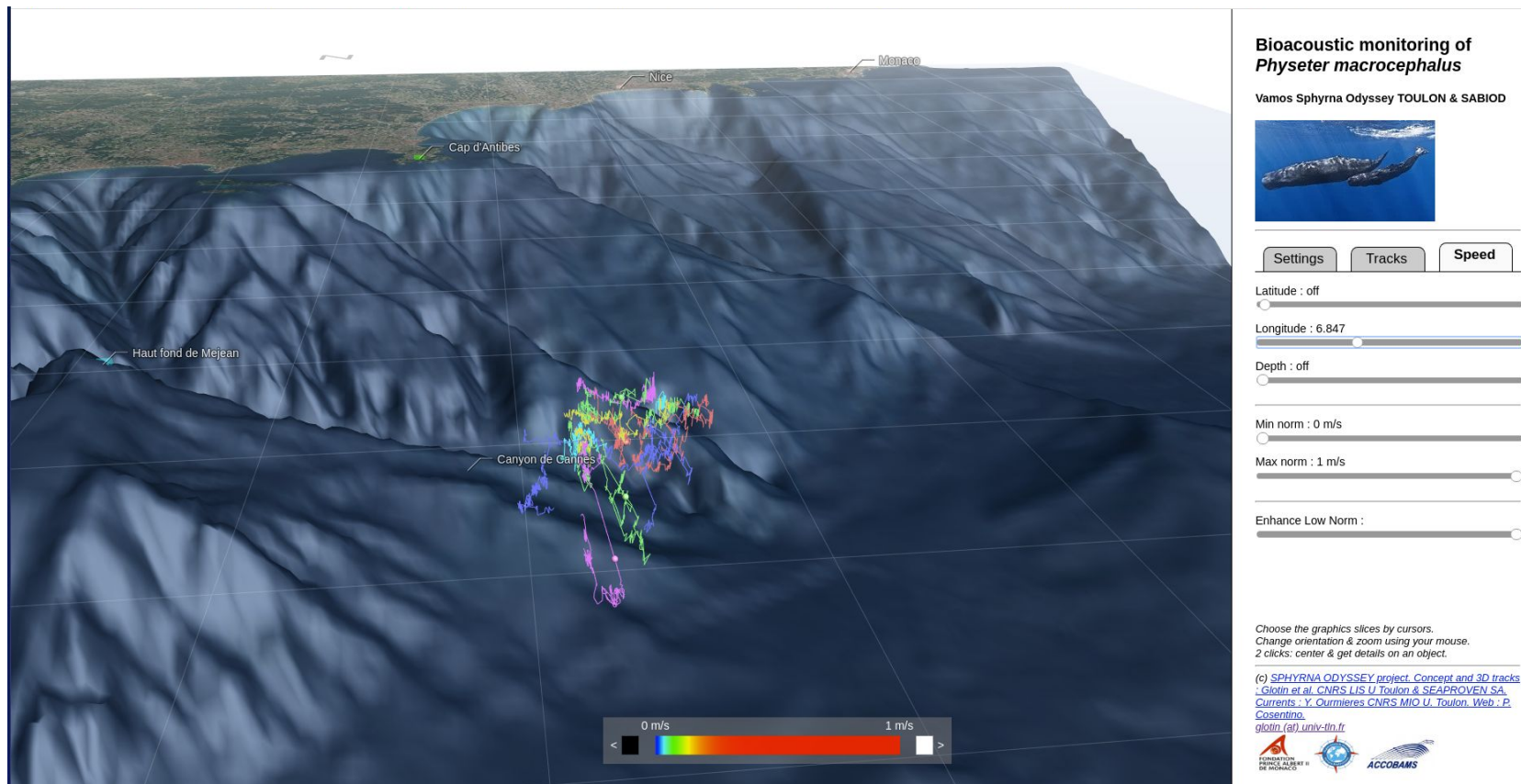


@ Longitude181
WhaleWay / SP 2024

Interdépendance des super-prédateurs... Chasses en Meute

dans l'obscurité totale à des Km de distance... comment ?





Matching pursuit & tracking 3D : Missions Sphyrna 2018, 2020, 2021...

Bio-Multistatisme ?

=> corpus & AI

Det Class Loc & Propagation joints



Sphyrna Odyssey
Surface Passive Acoustics and Artificial Intelligence
First Demonstration of Sperm Whales Collaborative Hunting in the Abyss
(South of Monaco, 2020.01.14, -500 to -1500 m deep, time accel. x10)
Glotin H., Thellier N. et al.

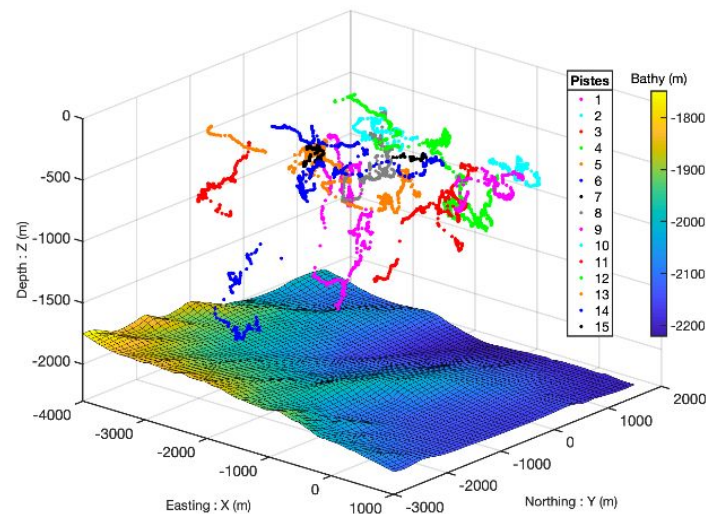
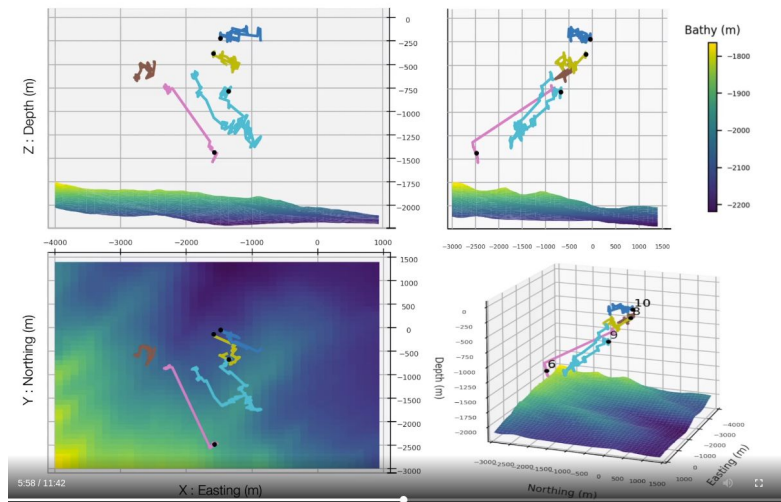
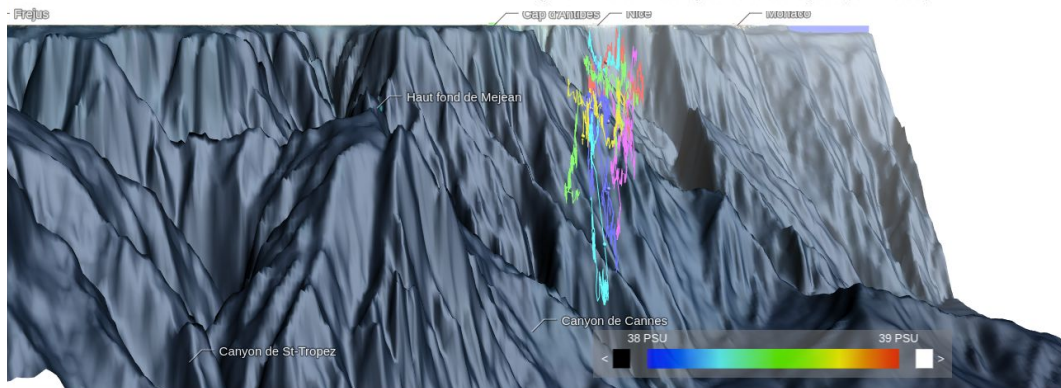
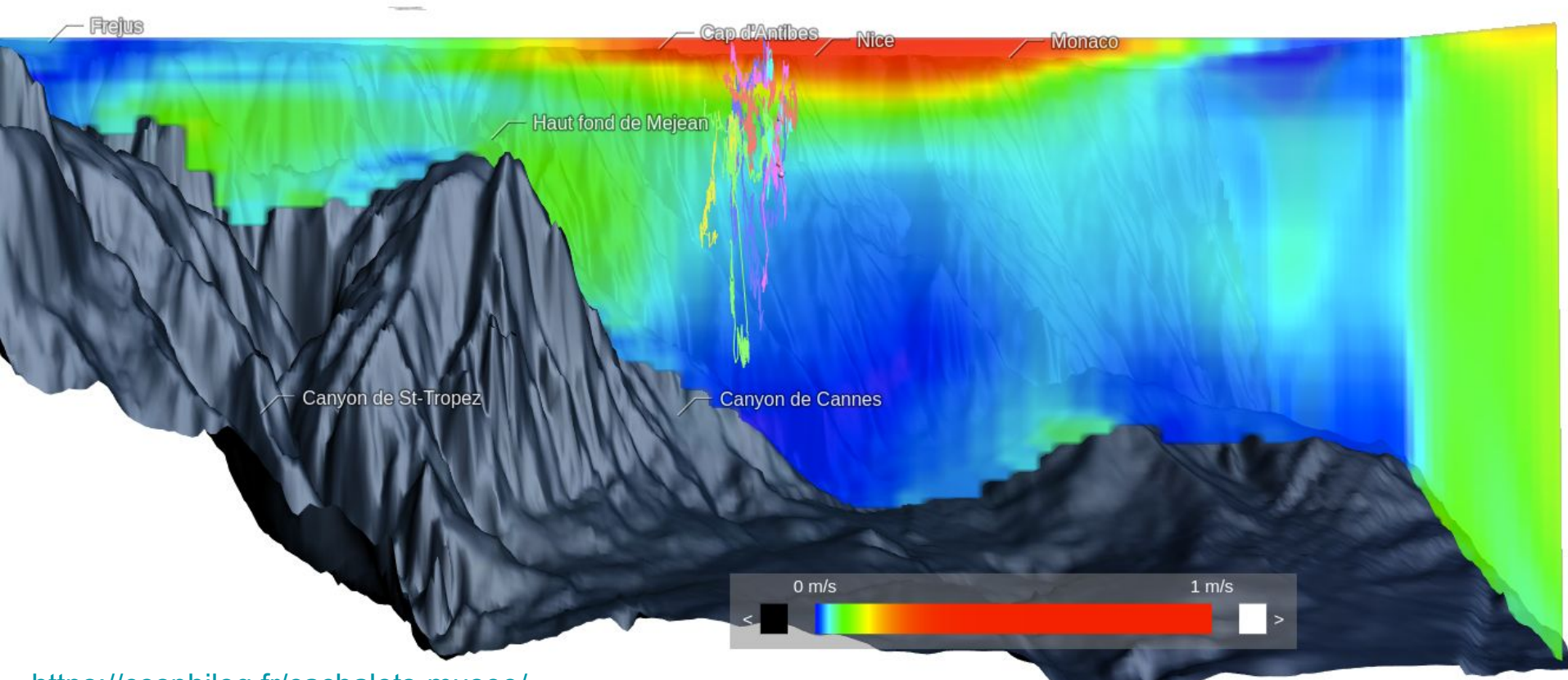


Figure 3.1: Traces 3D des déplacements des 15 pistes (record entier)



Deep divers and streams velocity / vortex





Les plus âgés sondent plus profondément,
les jeunes restent vers - 400 m
Constat : comportement individuel ?
Contraintes physiologiques individuels ?
Conscience partagée



Canyon de Cannes

H.Glotin (concept)
P.Cosentino (interface)
H.Glotin & P.Giraudet (acoustique, localisation 3D)

Les cachalots ne sont pas à l'échelle.
Le temps est accéléré 140x.

demo at

<https://cosphilog.fr/cachalots-musee/>

Les estimations des distances inter-individus démontrent qu'ils conservent un contact acoustique durant leur chasse engendrant une perception et conscience collaborative (sonar multidynamique)

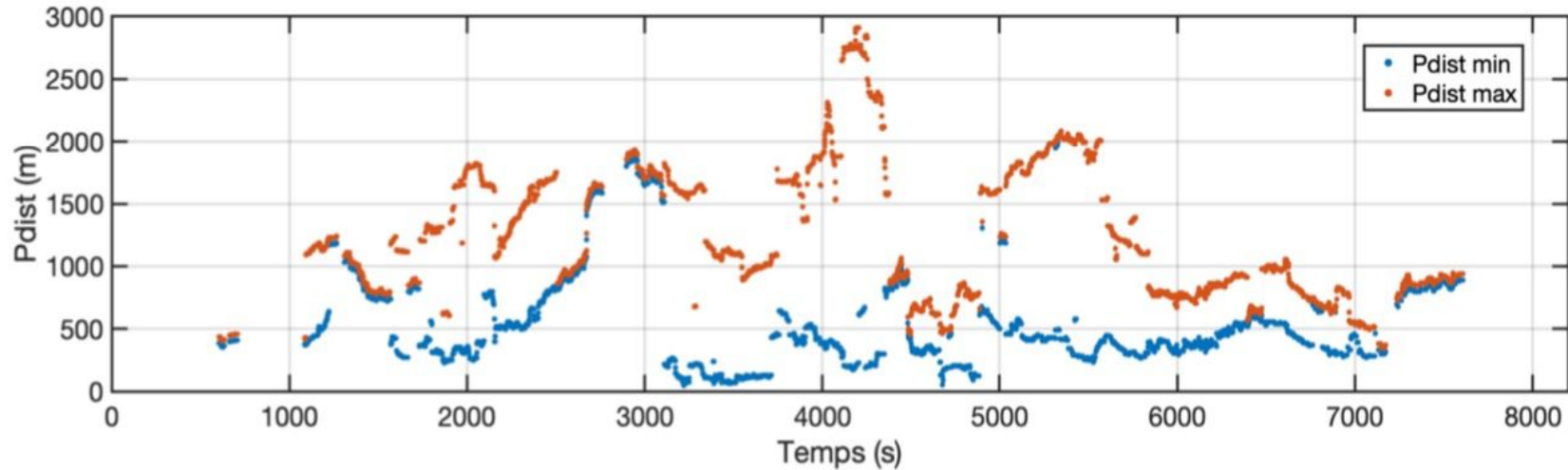


Figure: The minimal and maximal distances of the individuals in the group of 6 hunters during 2 hours of foraging the 14th January 2020 south of Antibes, France, from their 3D tracks computed from passive acoustics (Glotin et al 2020). The biosonar emission @ 180 dB allows a way and return of the sonar of at least 500m as shown by the sonar equation :

Echo Energy = SourceLevel - 40 log(Range) - $2\alpha(f)$ Range + 20 log(0.5) dB, target of 50cm diameter, $\alpha=1.3$ dB/m, $f=12$ kHz.

=> Our discovery suggests new criteria for the regulation of temporal noise level pollution that could cover the foraging interindividual communication, and thus would contract the hunt and reduce the number of captured preys.

Nouveaux moteurs électriques (Azipodes) :
nouvelles menaces anthropophoniques ?

This boat, the Norwegian Jewel, is powered by a diesel-electric propulsion system comprising five MAN - B&W 12V48/60B diesel engines providing power to two Azipod thrusters. The system is variably rated at 75,000 kilowatts (100,000 hp), and 39,000 kW (52,000 hp). This gives the cruise ship a maximum speed of 25.6 knots (47.4 km/h; 29.5 mph).

Laid down: 28 October 2003

Launched: 12 June 2005

Length: 294.13 m (965 ft 0 in) **oa**, 263.5 m (864 ft 6 in) **pp**

Speed: 25.6 knots (47.4 km/h; 29.5 mph)

***The Norwegian Jewel
in waters known to
have Orcas presence,
Hanson, BC, 2019***

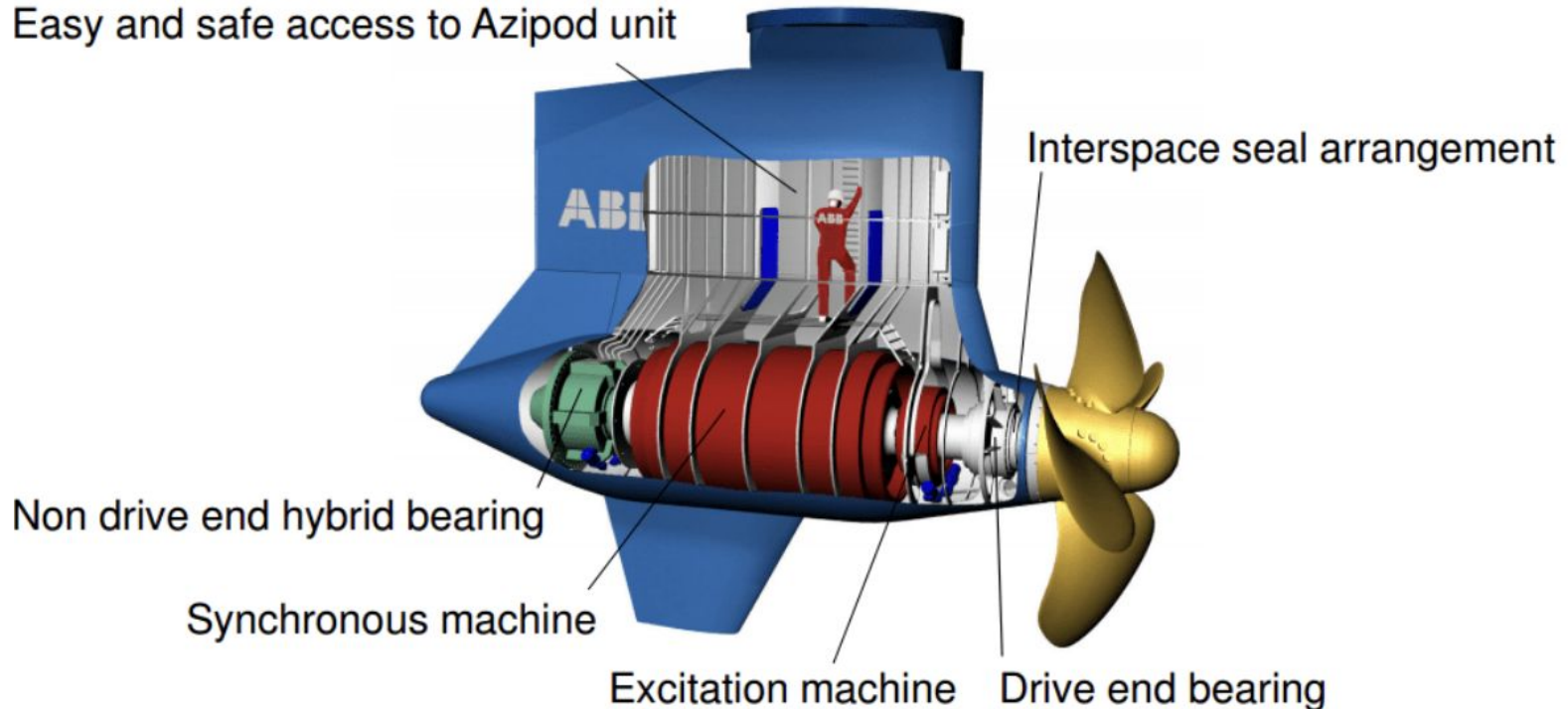


Nouvelle propulsion nuisible : l' AZIPOD

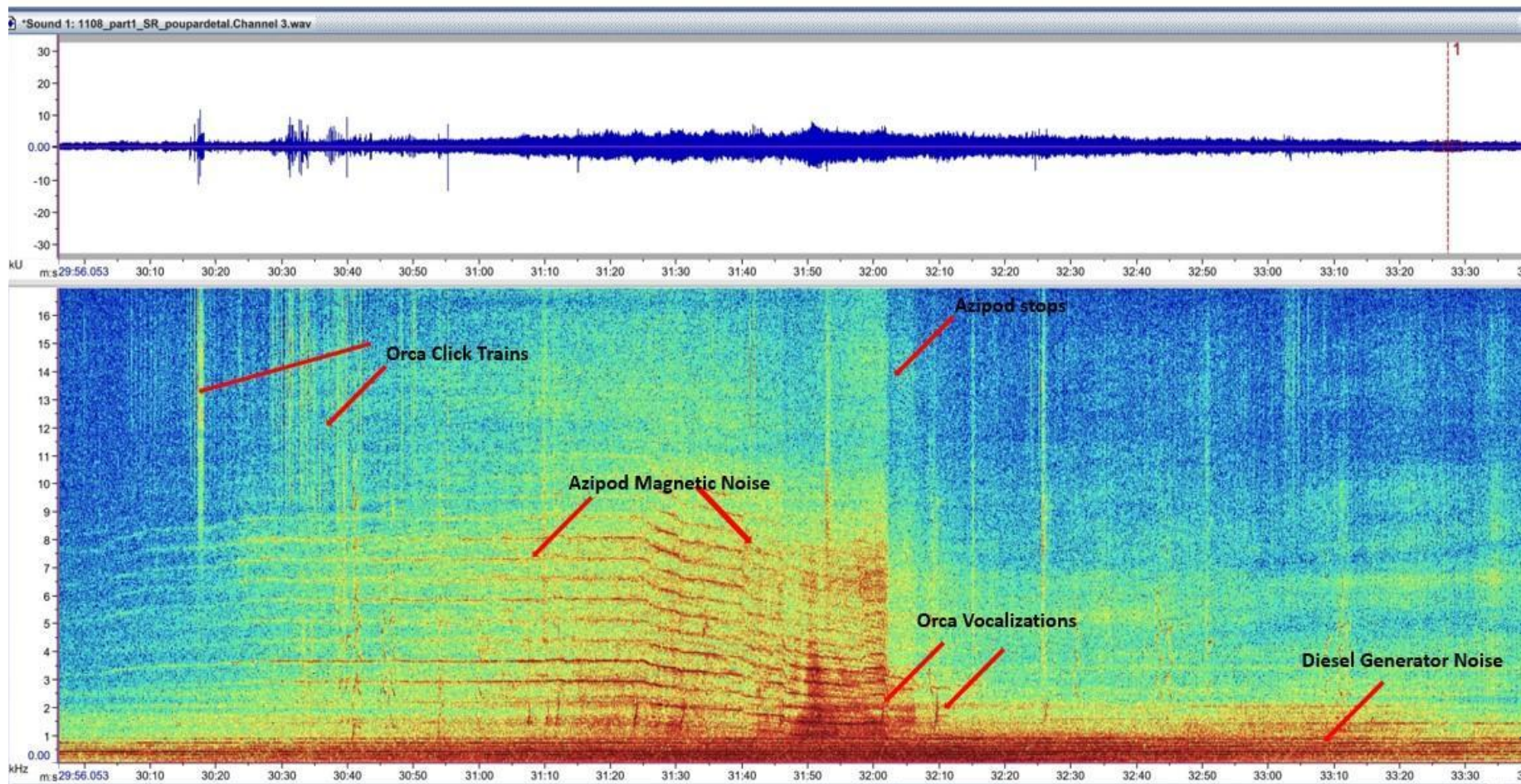
Advanced condition monitoring

Steering torque reduced over 20 %

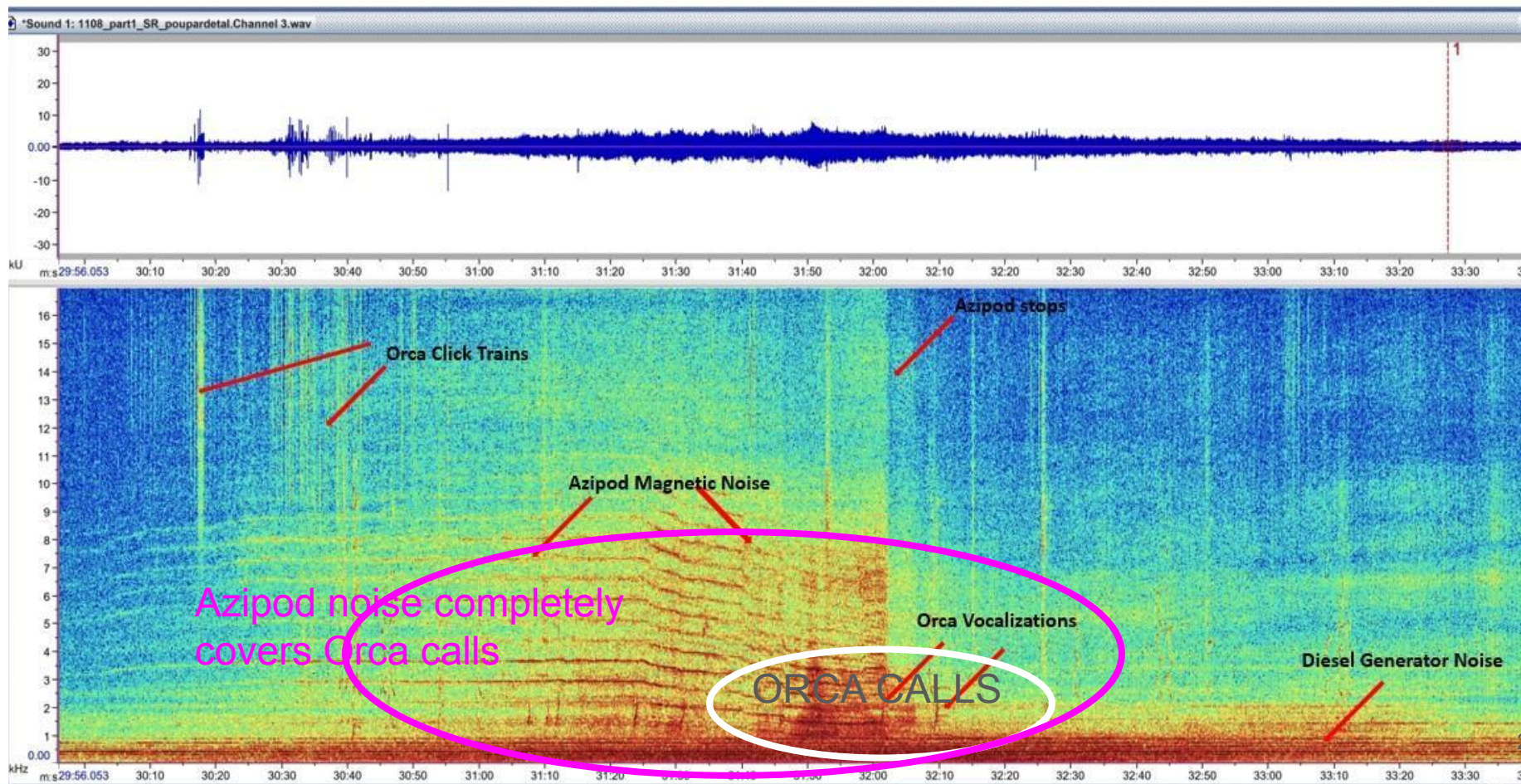
Easy and safe access to Azipod unit



Underwater Radiated Noise with Orcas Present

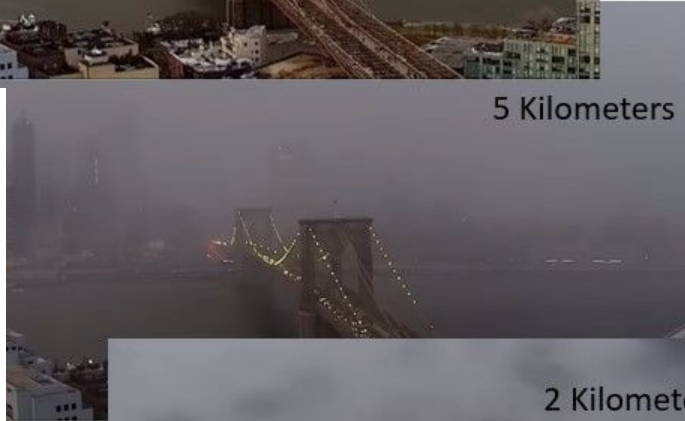


Underwater Radiated Noise with Orcas Present





10 Kilometers



5 Kilometers



2 Kilometers

Orcas use sound to see. The underwater soundscape is profoundly impacted by manmade noise. The frequency (pitch) and amplitude of this anthrophony degrades Orca's ability to adequately "see" its environment.



< 1 Kilometer

Effect of Jetski

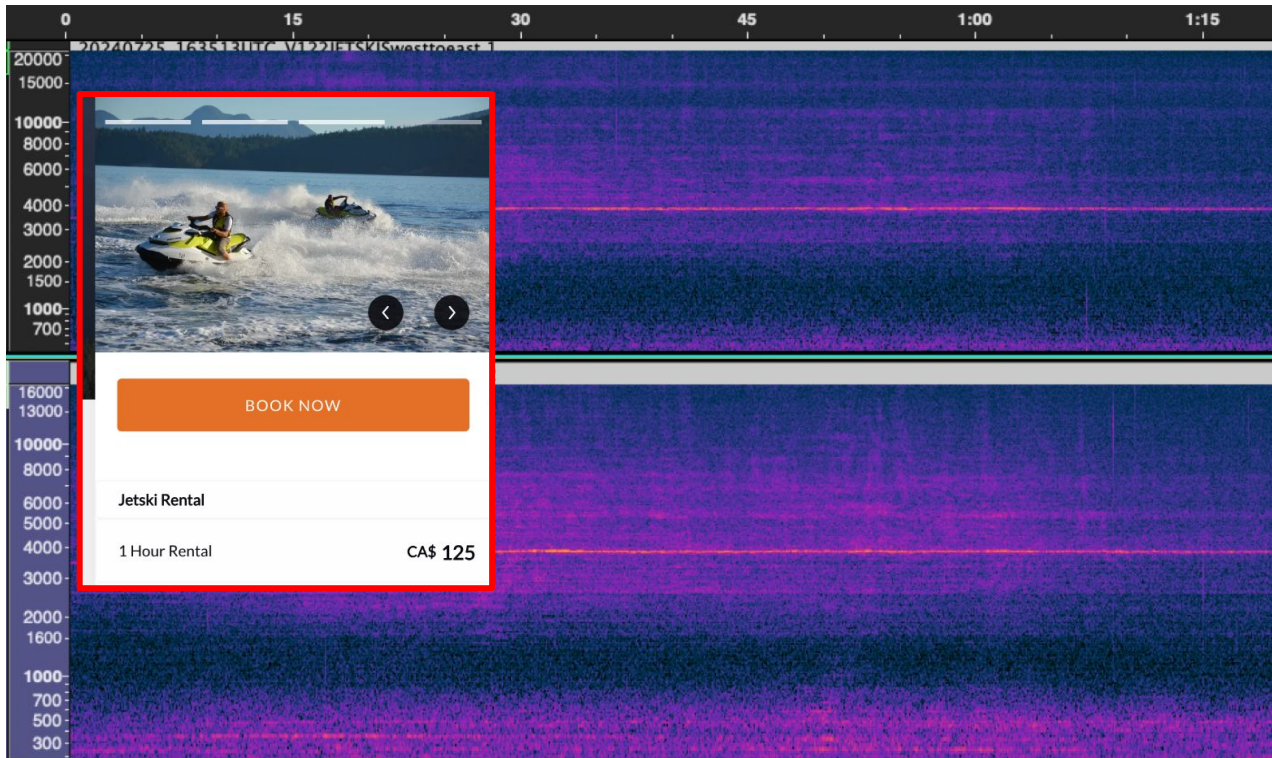
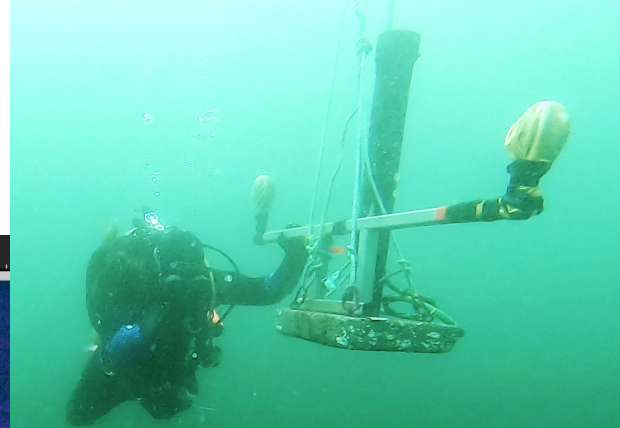
recorded in 2022

front of Orcalab in Blackney Pass

BC Canada

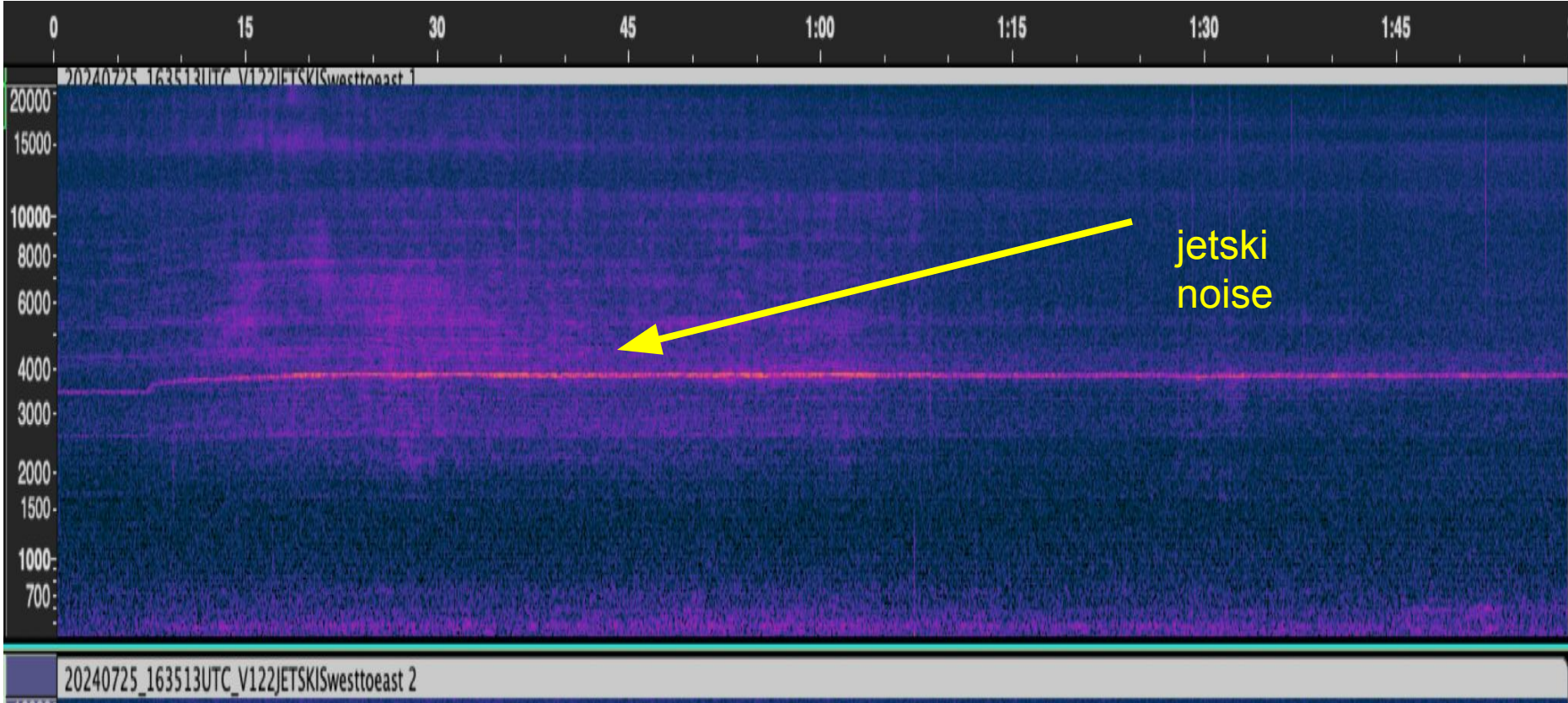
habitat of resident Orcas

Jet ski noise, 2024 07 25, in Blacknet Pass,
OrcaLab Hanson Isl., 2 Miles N.
(Stethorca antenna CR75+CR305 QHB sound card),;



This recording is available at :

https://sabiod.lis-lab.fr/pub/OLJETSKI/20240725_163513_JETSKIS_1NMfromOrcalab.wav



dB re uPa²/Hz

2024 july 25th 16h35, SeaState = 2

90

69

60

54

45

+90 dB at 4 kHz
at 2 Miles (TL=12dB)
~ 102 dB source level

JET SKI
NOISE

10Hz

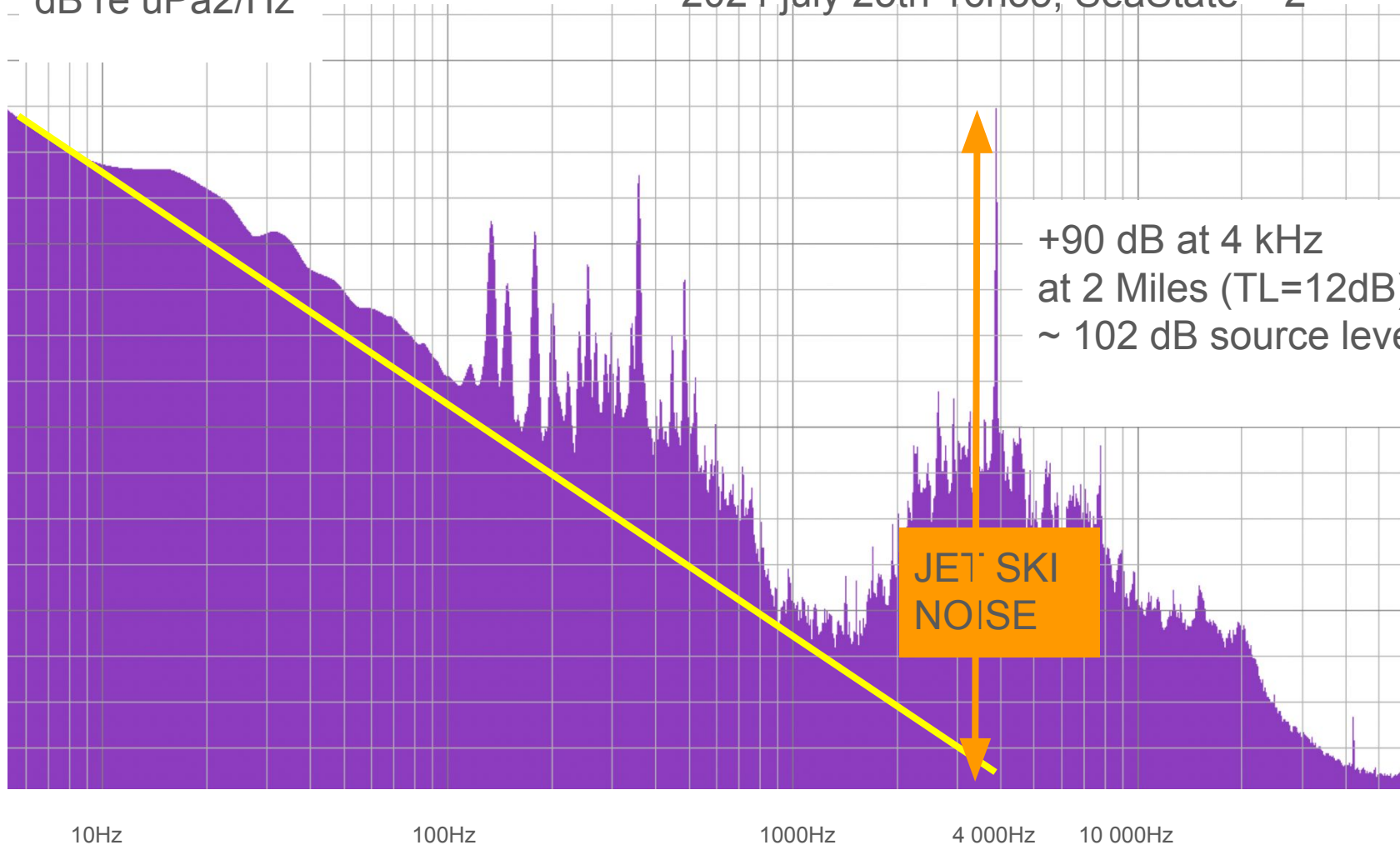
100Hz

1000Hz

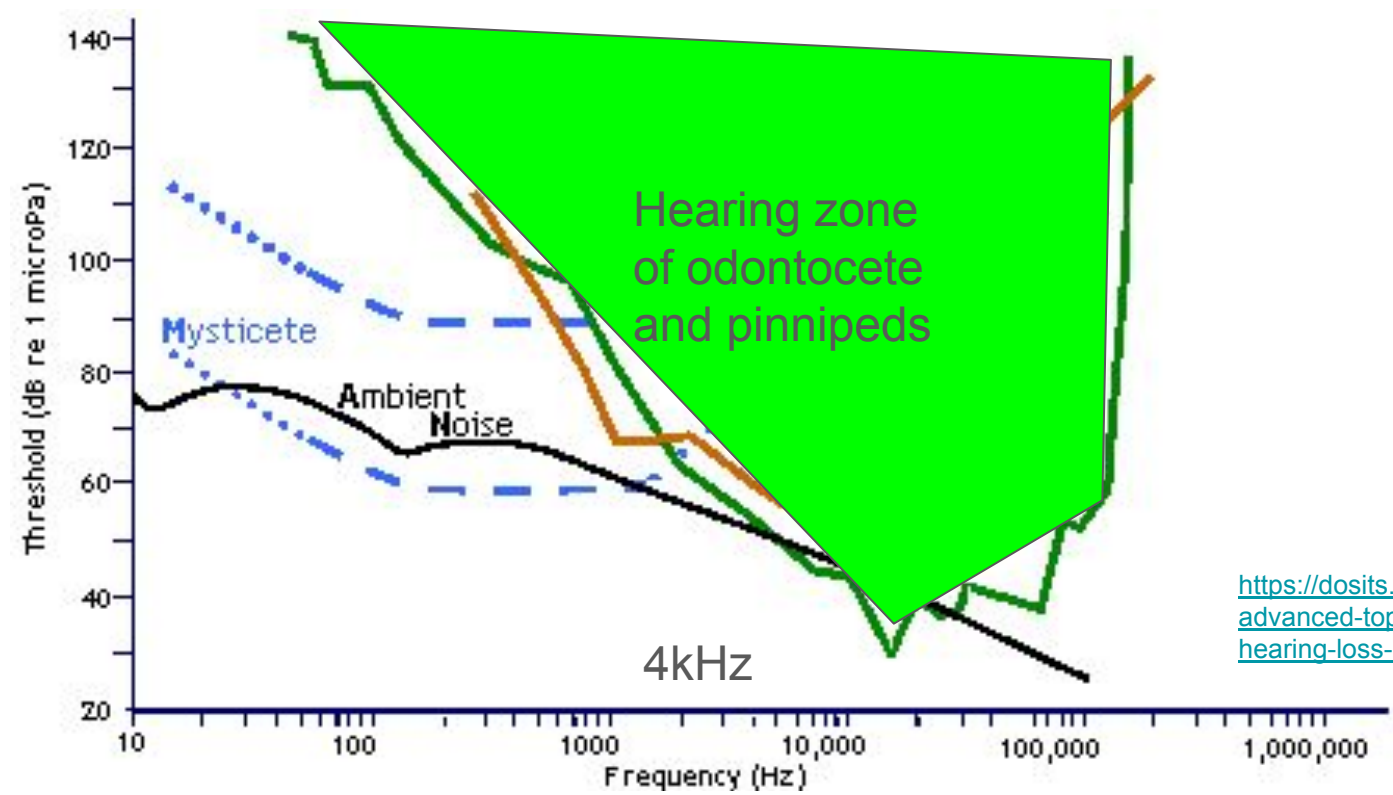
4 000Hz

10 000Hz

25



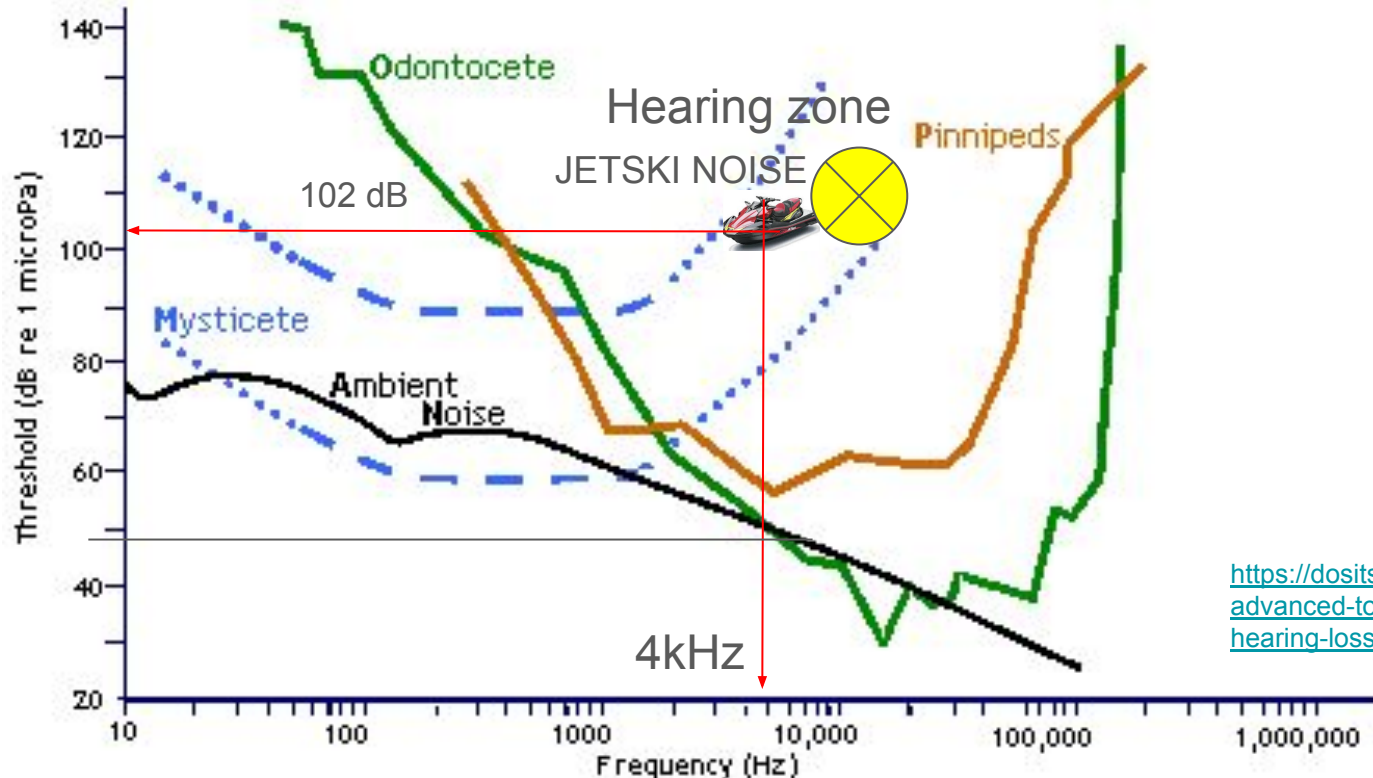
Hearing in cetaceans and others



<https://dosits.org/animals/advanced-topics-animals/hearing-loss-advanced/>

Estimates of the hearing thresholds for some groups of marine mammals along with typical ambient noise levels. The y-axis (vertical) for the hearing thresholds is relative intensity in underwater dB. The y-axis for the ambient noise curve is spectral level in 1 Hertz frequency bands with units of dB re 1 $\mu\text{Pa}^2/\text{Hz}$. The x-axis (horizontal) is the frequency of a sound on a logarithmic scale. (Figure is adapted from Office of Naval Research, 2001)

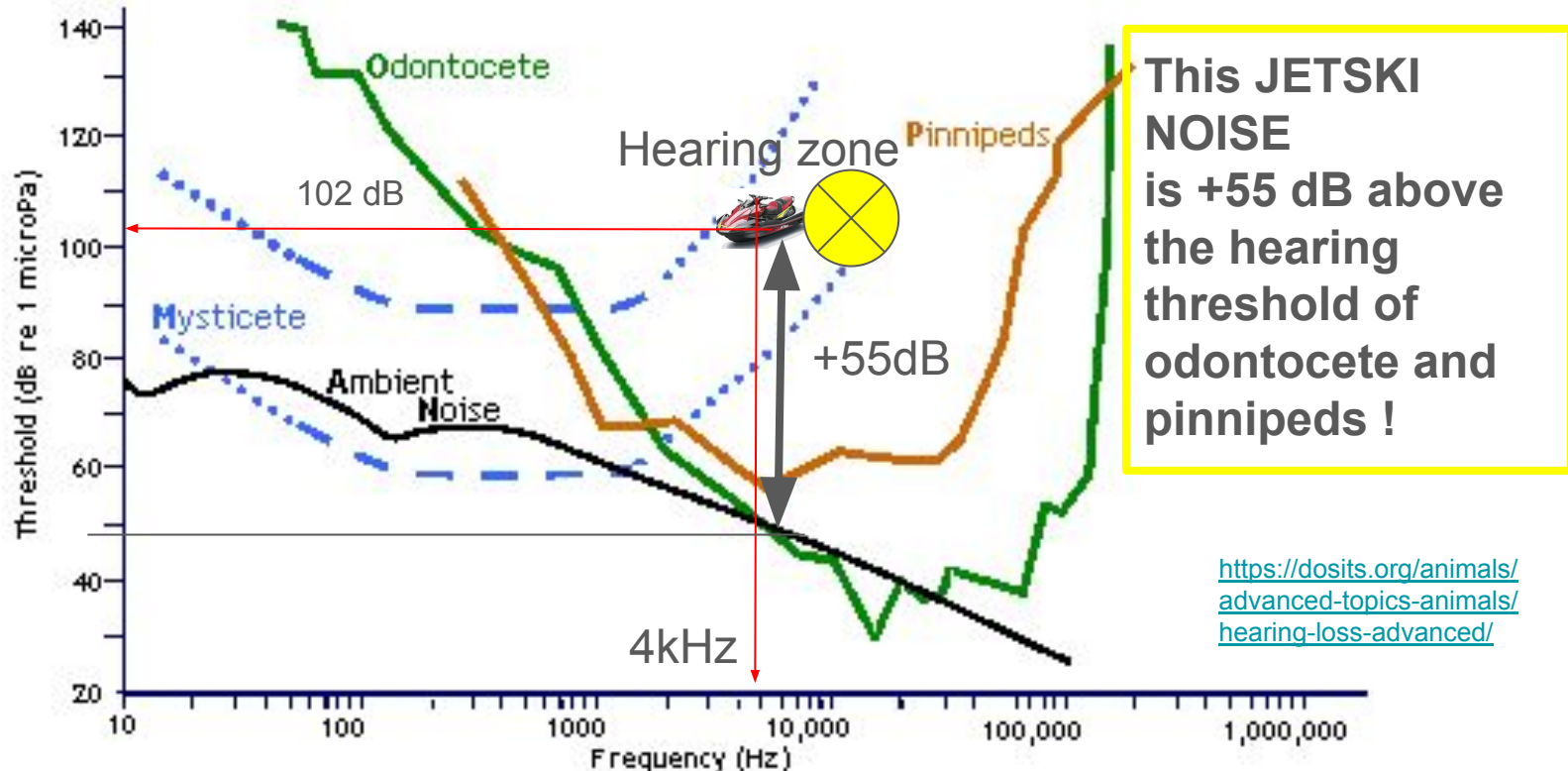
Hearing in cetaceans and others & this Jet ski noise : it is in the middle of the Hearing area of Odontocete and Pinnipeds, then it disturbs their audition, communication and foraging



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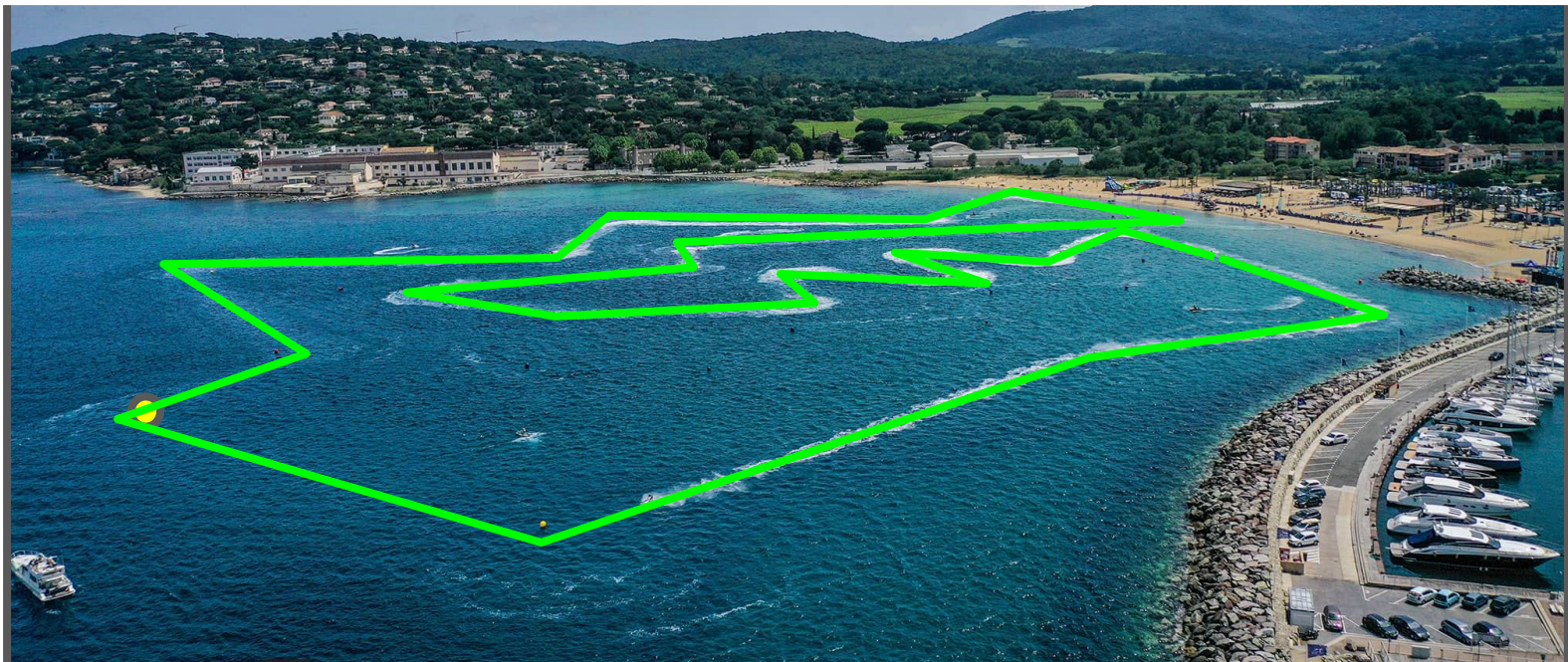
Antropophony & JETSKI

Suivi de Jet ski cup

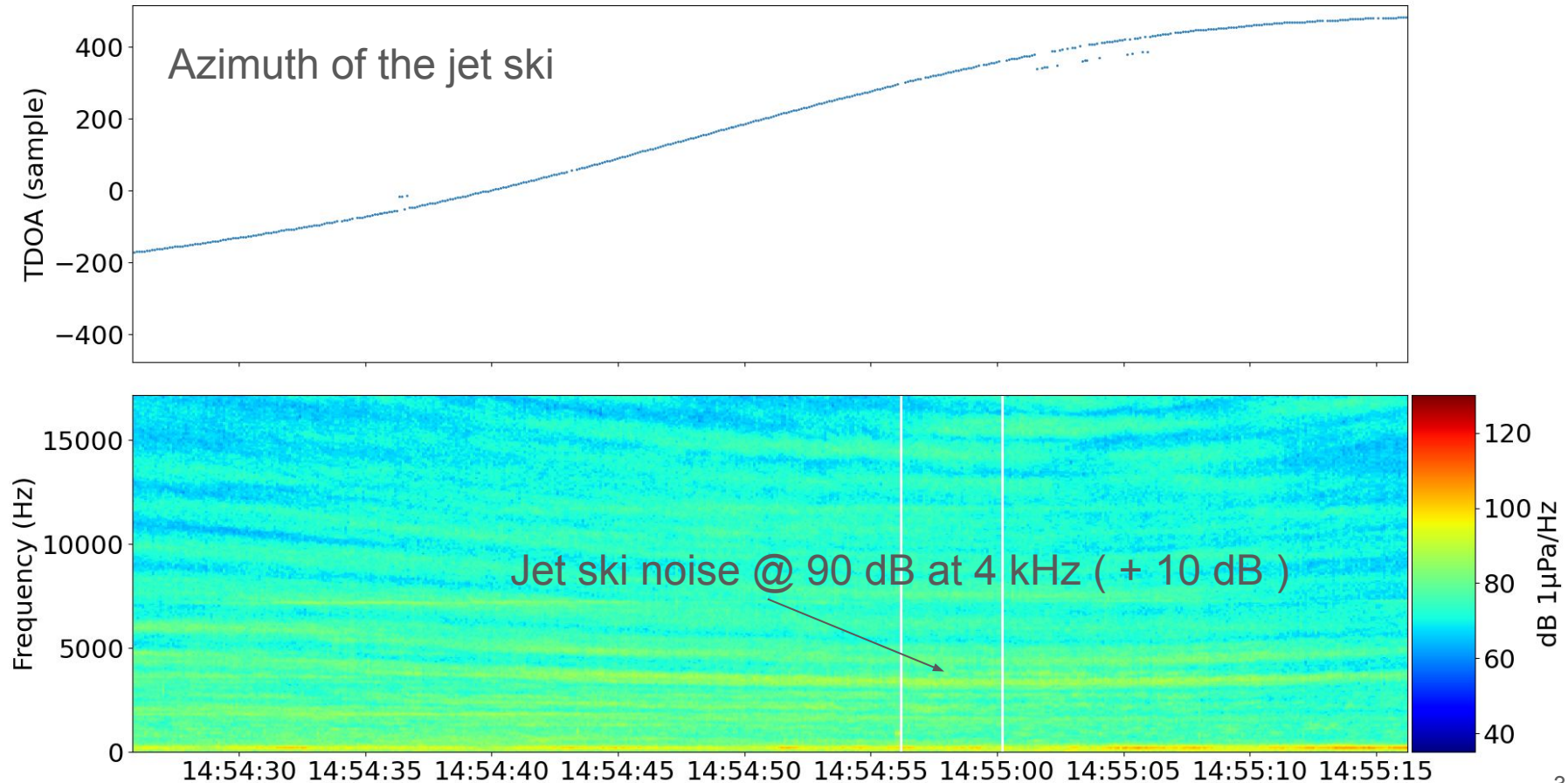
St Tropez, France, 21th May 2022



Conseil National Scientifique Pelagos
2022 oct.



JetSKI NOISE : Results show also almost 100 dB re $\mu\text{Pa}^2/\text{Hz}$ at 4 kHz



Interdépendance acoustique des individus vs perturbations du 'tissus' acoustique

- Impacts létaux (assourdissement...) ou long termes de nouvelles pollutions anthropophoniques peu documentées: raréfaction des contacts inter-individus, prédation moins efficace...

Actions en cours :

- Législation => DCSMM14 / Expertise pour le Préfecture Maritime de la Méd. mai 2023 => interdiction de la compétition de Jet ski en déc. 2023 suite à notre rapport.
- Témoin à procès Canadiens sur l'habitat d'Orques, clan par clan, cf tradition Premières Nations qui nomment les individus totem ORCA => protection accrue
- Groupe de travail BRUIT en MER au ministère de la transition écologique et du consortium de normalisation d'acoustique sous marine ISO9001
- Projets de suivis de la mégafaune à l'échelle Européenne : GIAS, SeaStMar, EUROPAM BIODIVERSA, ADSIL, avec 6 doctorats en cours, 3 ingénieurs, 1 postdoc, 10 chercheurs permanents... cf <https://cian.univ-tln.fr>
- Missions WhaleWay en Méd., ARCTICFjord3D => Légiférer suivant la CULTURE de l'HABITAT de ses INDIVIDUS
- Bouées BOMBYX ETHAC et EUROPAM pour la veille