



Interdépendances d'Invisibles Acoustiques : Perceptions distribuées inter-individus versus Anthropophonie ?

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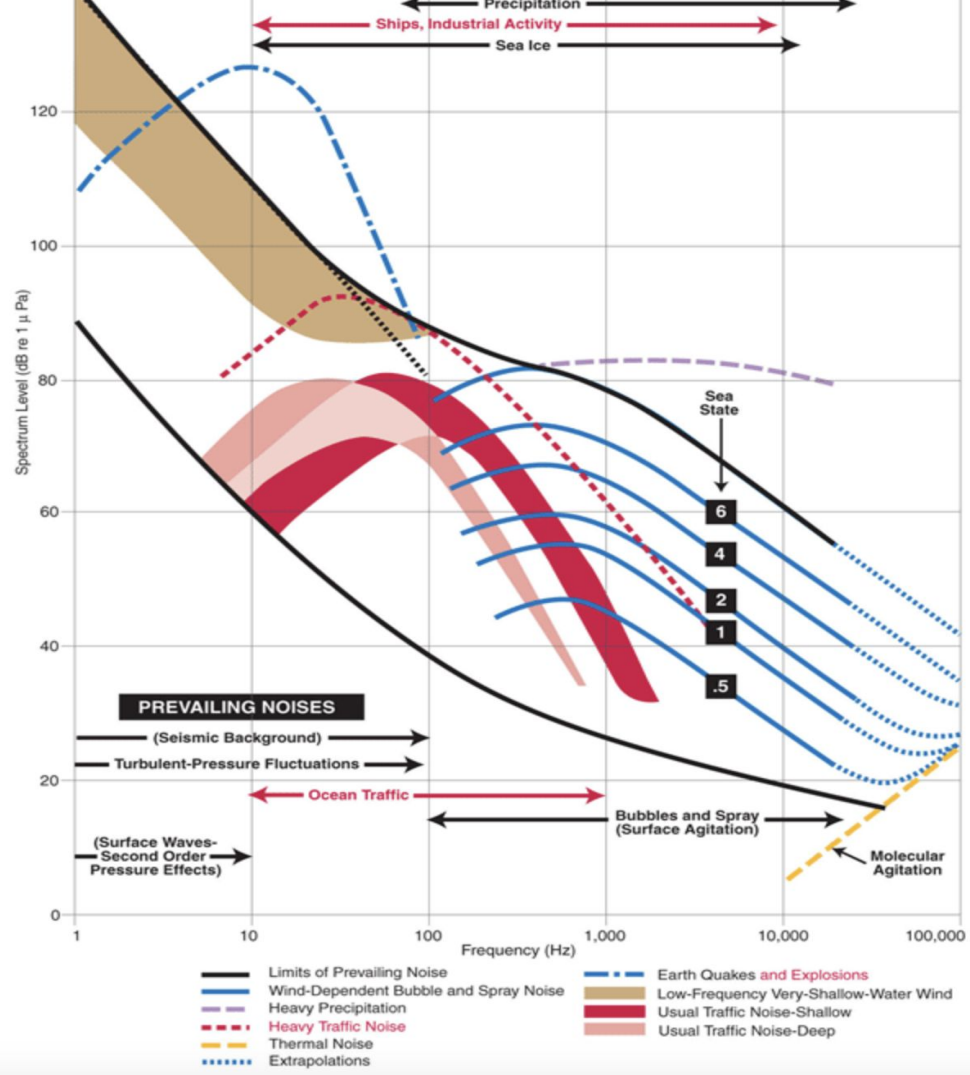
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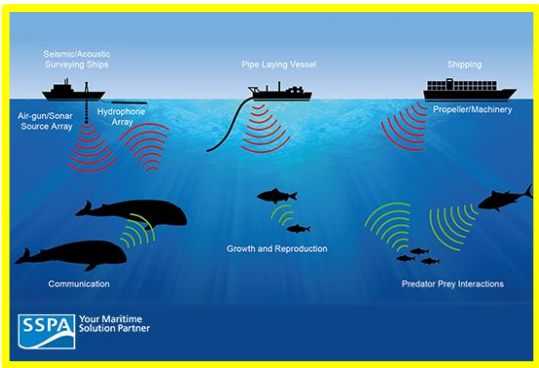
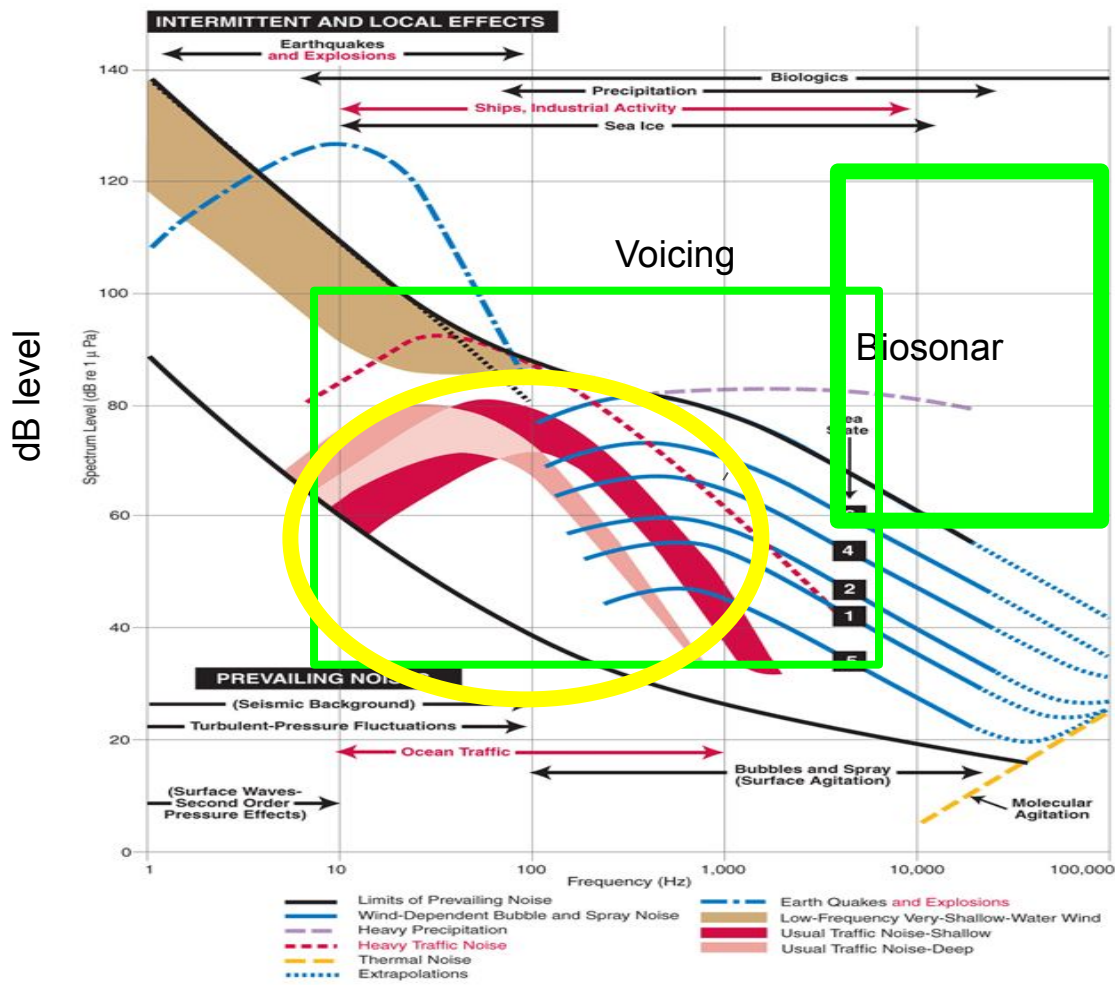
&

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

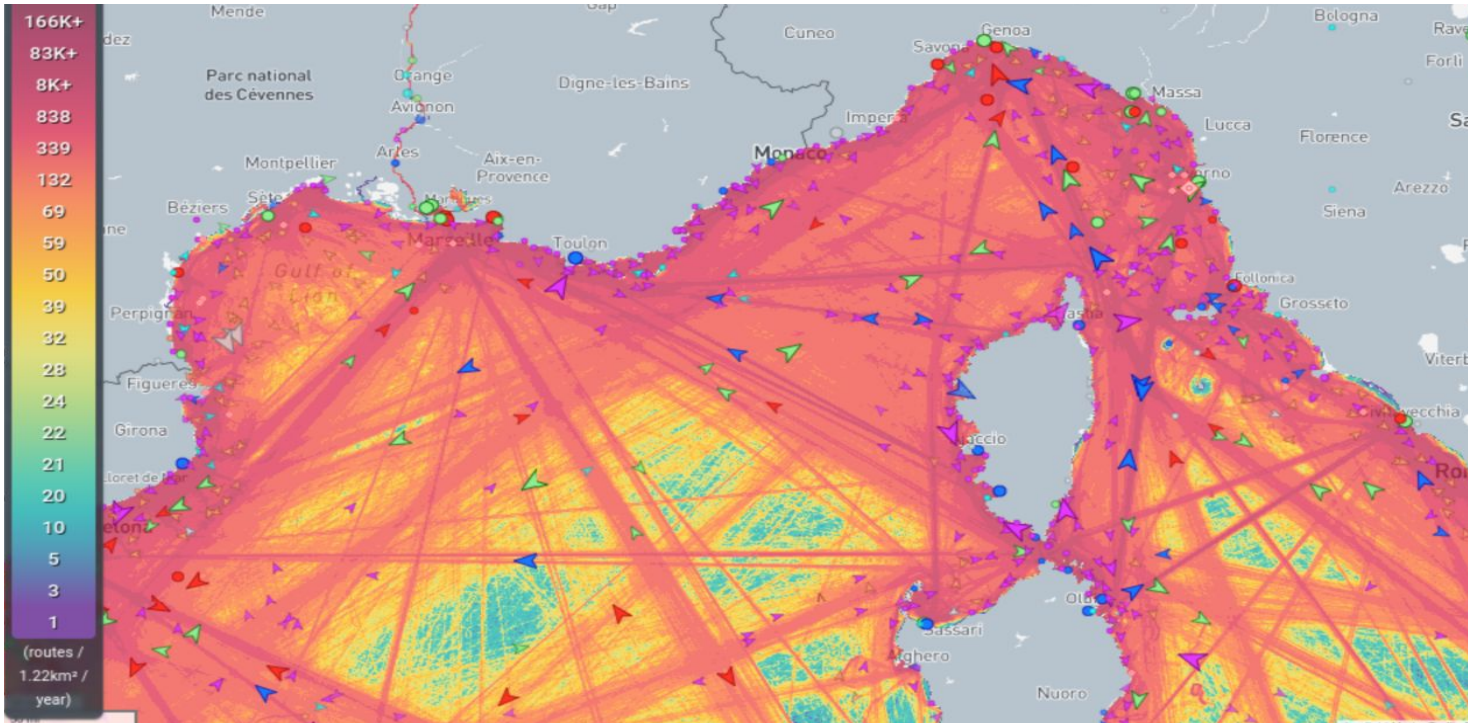
Baseline of the noises of the ocean (From Wentz 1985)



Context : Anthropogenic Pressures In the Sea & Impacts to Biodiversity (Marine Mammals) & Awareness



Un triste exemple : la pression anthropique en Méditerranée



Carte de densité du trafic maritime (routes/km2/an) maritime en Méditerranée en 2022 © MarineTraffic

15% du transport maritime global est concentré en Méditerranée

Le trafic maritime en Méditerranée doit encore augmenter de 4% par an

Exemple de propagation acoustique de
 pulse de rorqual vs d'une seule impulsion de canon à air
 -> Désorientation, échouage...

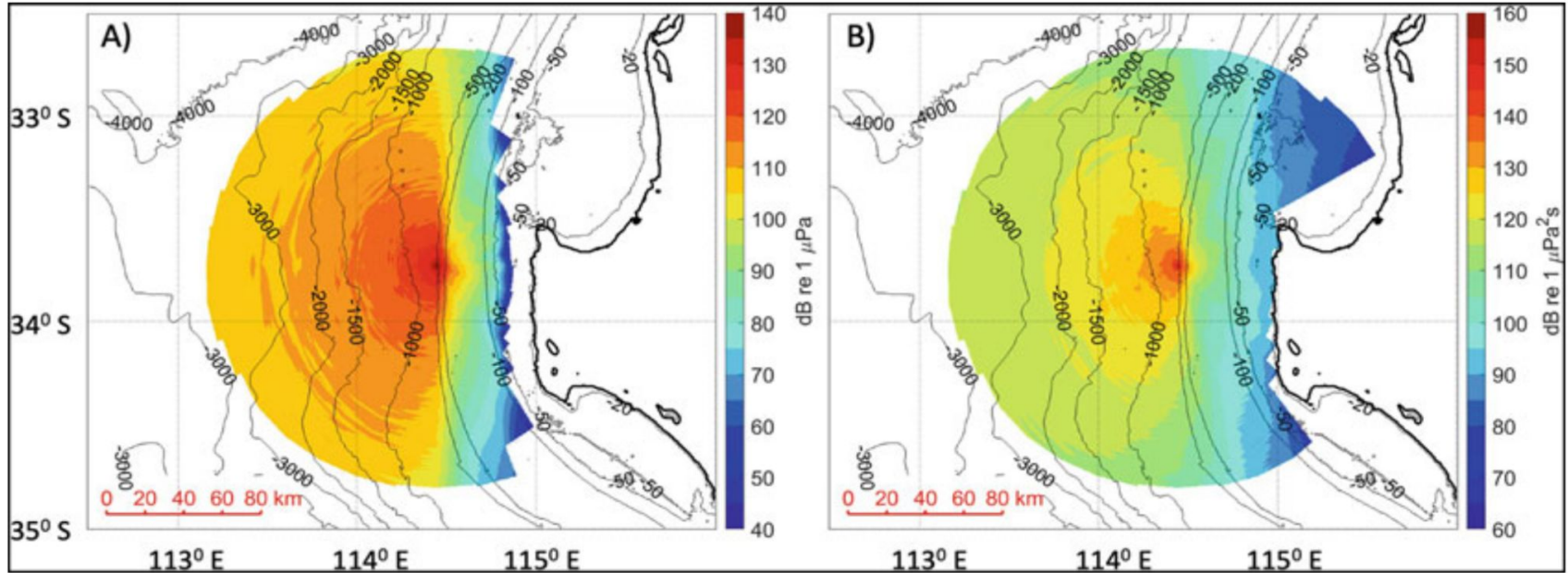


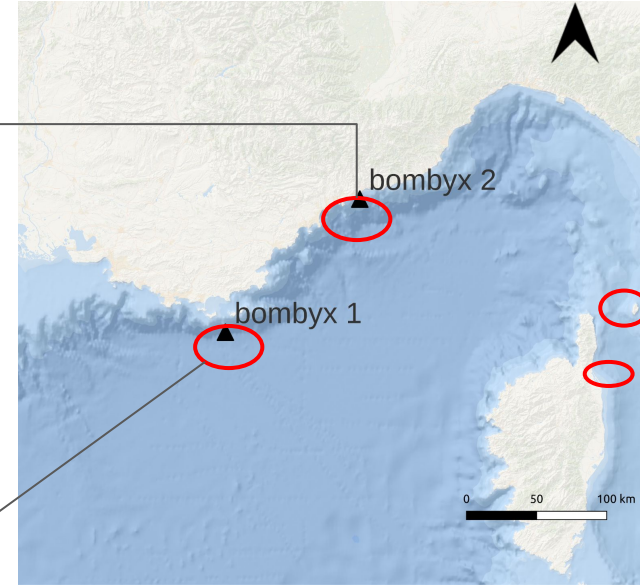
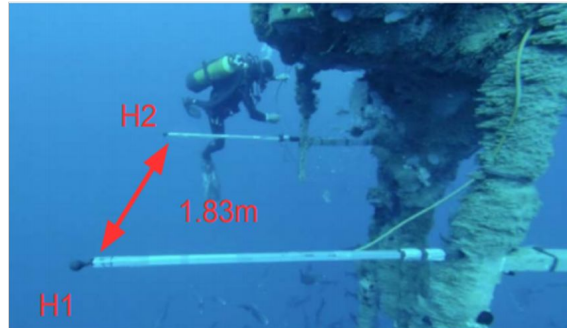
Fig. 6.19 (a) Map of maximum SPL over depth as a function of geographical position due to a fin whale calling at a depth of 50 m off the southwest coast of Australia. (b)

Map of maximum SEL over depth due to a single firing of an airgun of volume 3.3 l (200 cui) at a depth of 6 m
 (C. Erbe et al)

ANTHROPOPHONIE COMPORTEMENT



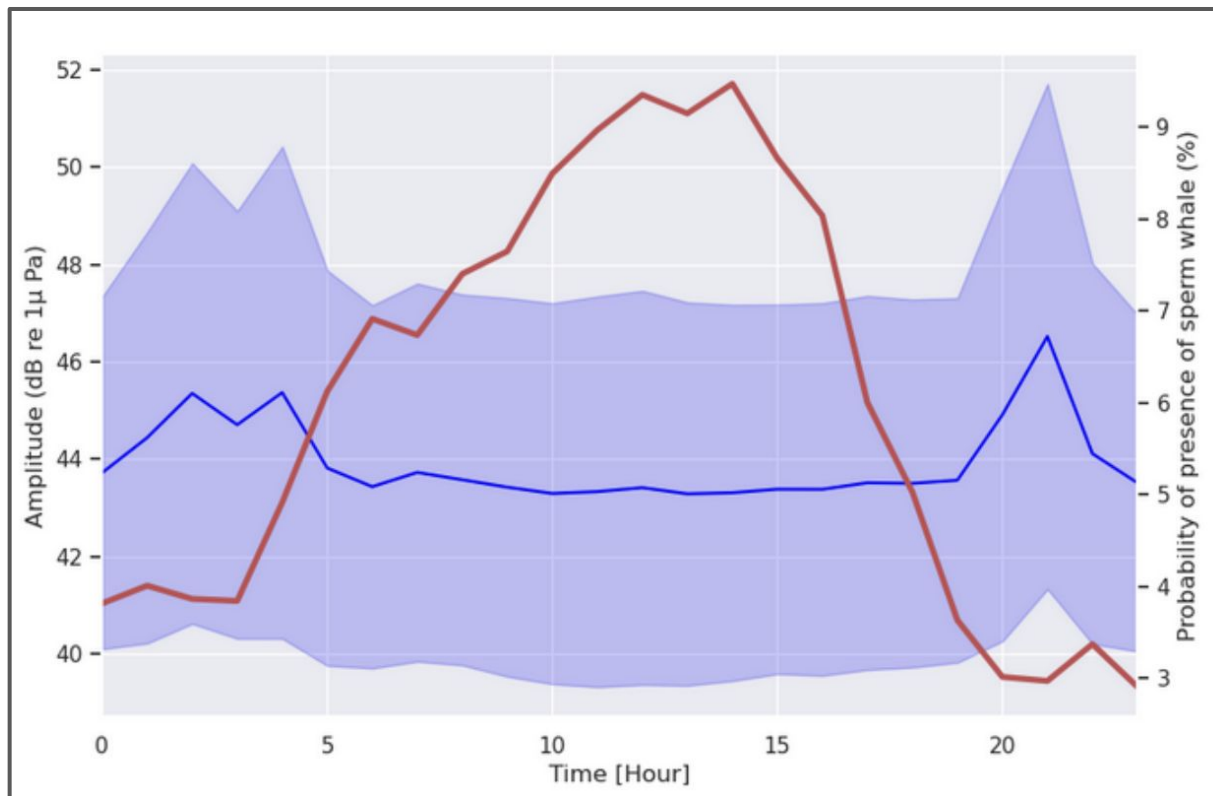
Élément de surface de l'antenne BOMBYX4



Dépendance à l' ANTHROPOPHONIE

Niveau de bruit
du trafic

Présence des
cachalots



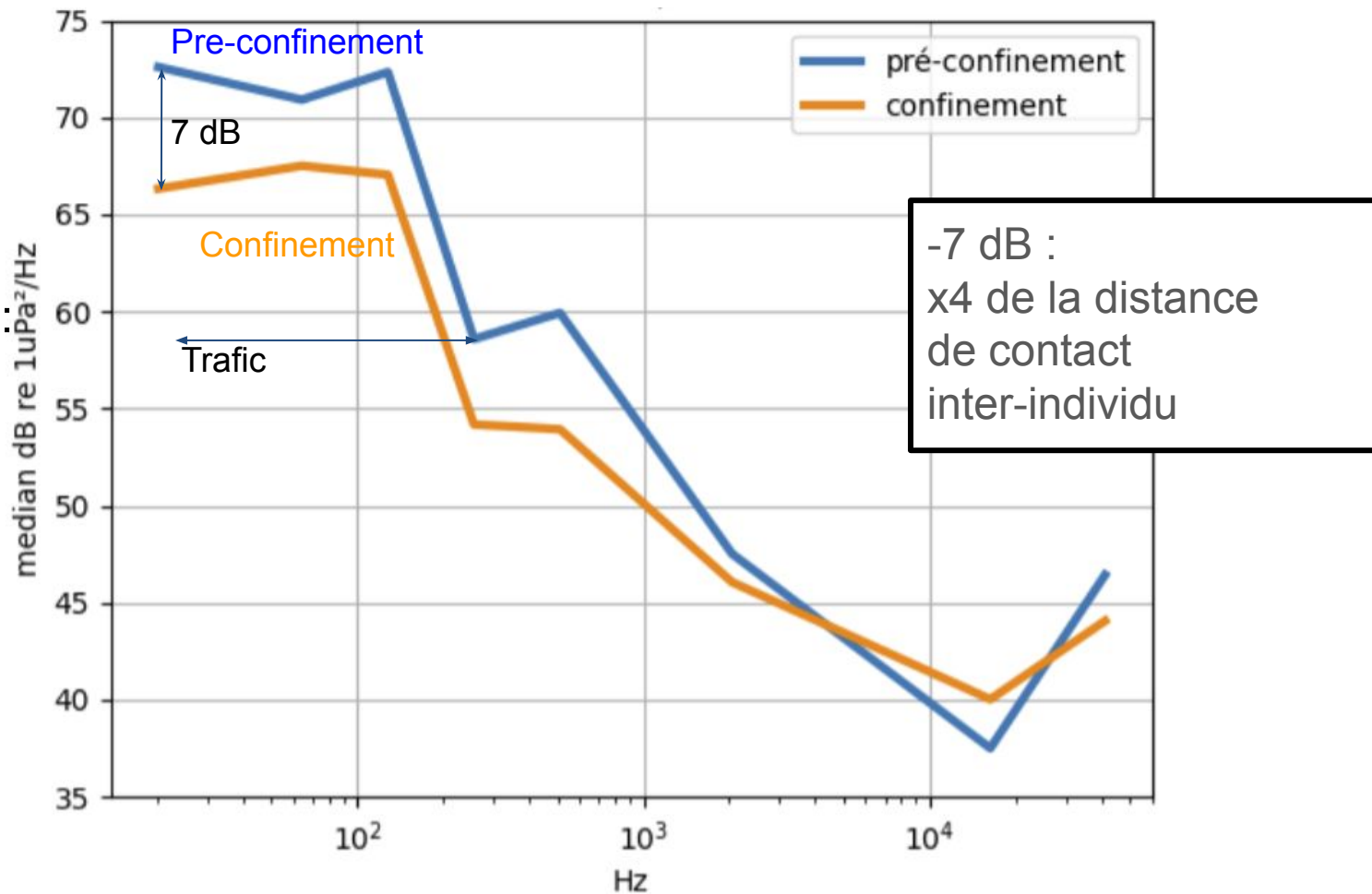
=> Les
cachalots
exploitent
la zone au
minimum
du bruit du
trafic

Superposition of dial pattern of amplitudes for the octave 12 800 Hz and probability of presence of sperm whales.

IMPACT
CONTRÔLABLE

(contrairement
au plastique...)

DEMO Covid :



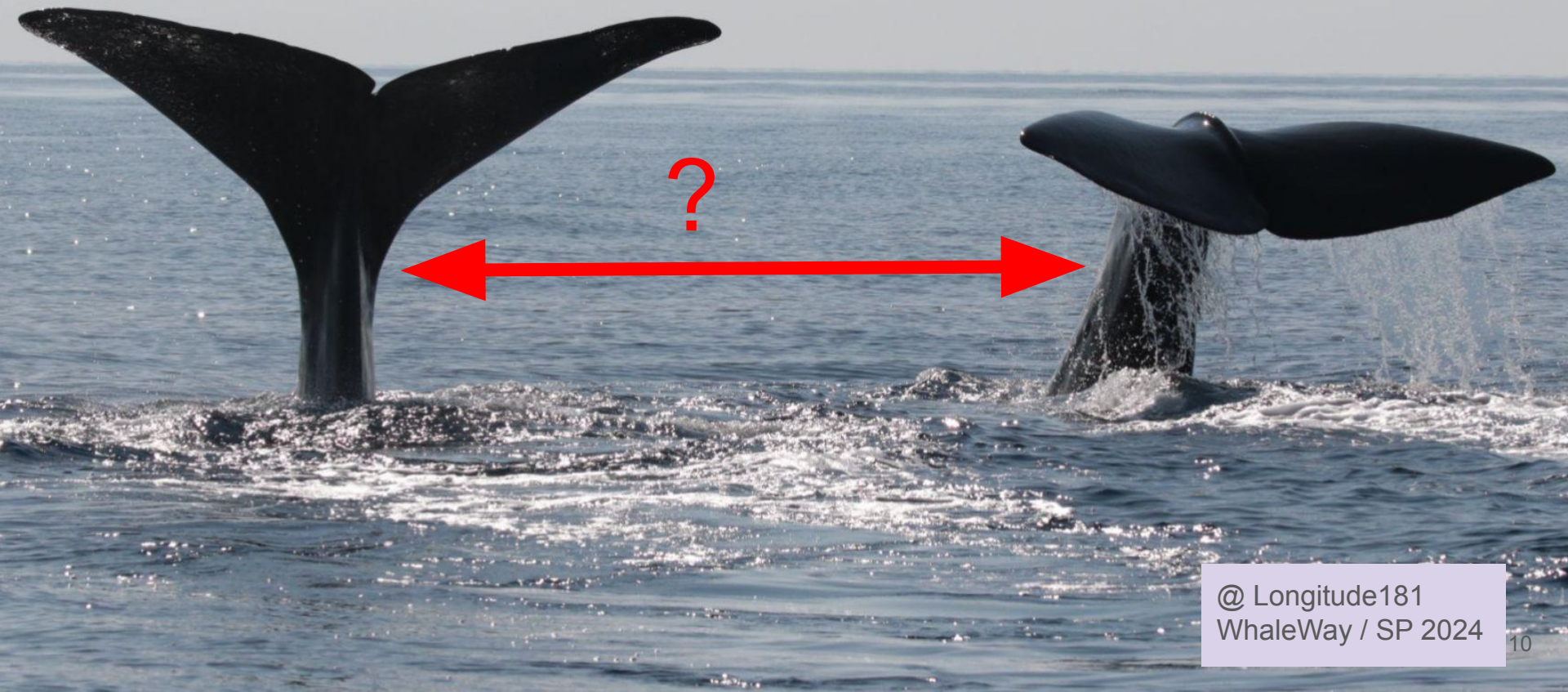
Medium of minimum dB levels, hourly, for each octave during (blue) vs out (orange) lock down, (from Glotin et al 2020 Sphyrna Odyssee research report, Explorations de Monaco FPA2).

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 ?





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)

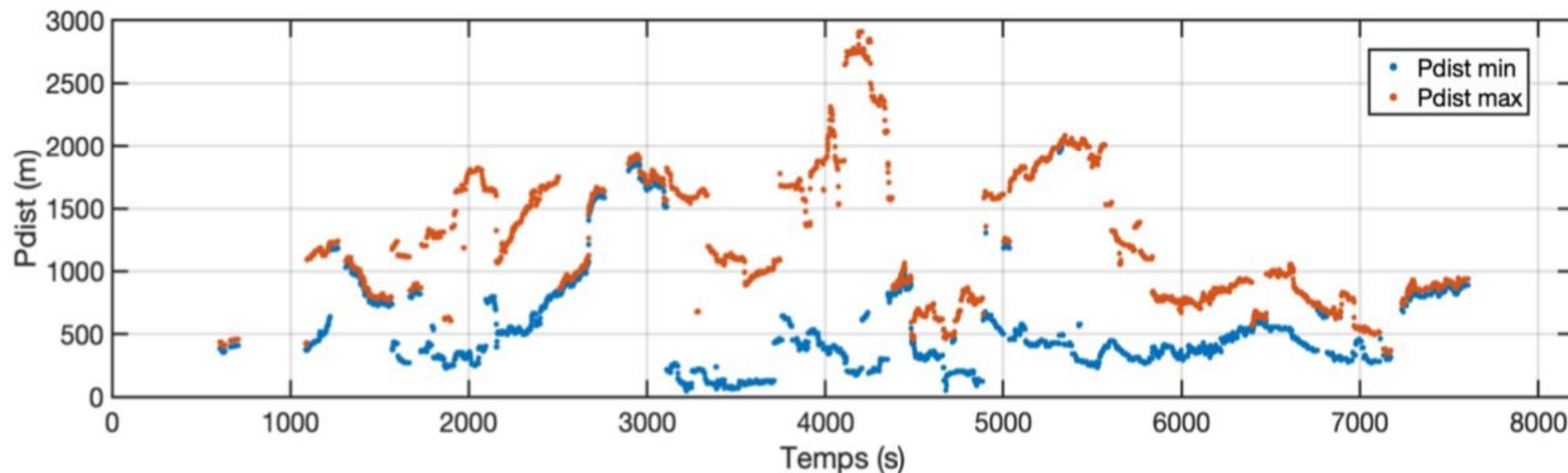


Figure: The minimal and maximal distances of the individuals in the group of 6 hunters during 2 hours of foraging the 14th January 2020 south of Antibes, France, from their 3D tracks computed from passive acoustics (Glotin et al 2020). The biosonar emission @ 180 dB allows a way and return of the sonar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

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

=> 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.

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

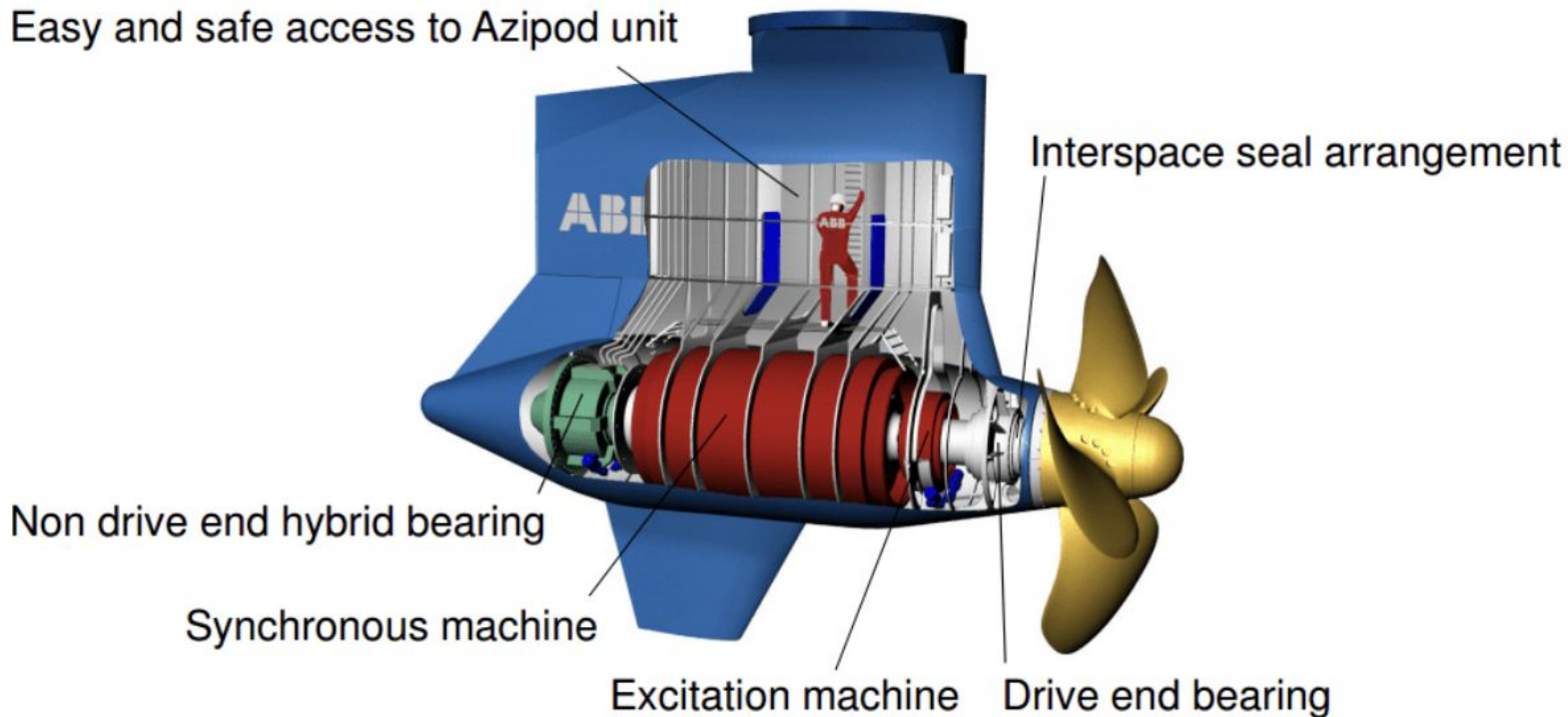


Nouvelle propulsion dévastatrice : l' AZIPOD

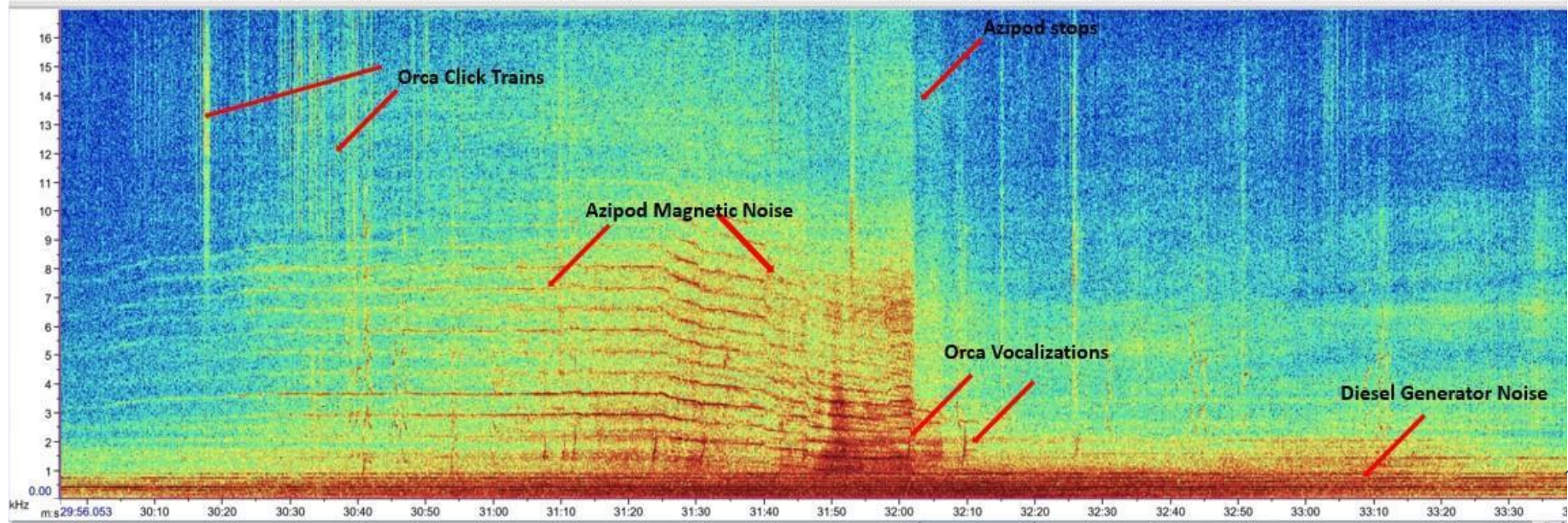
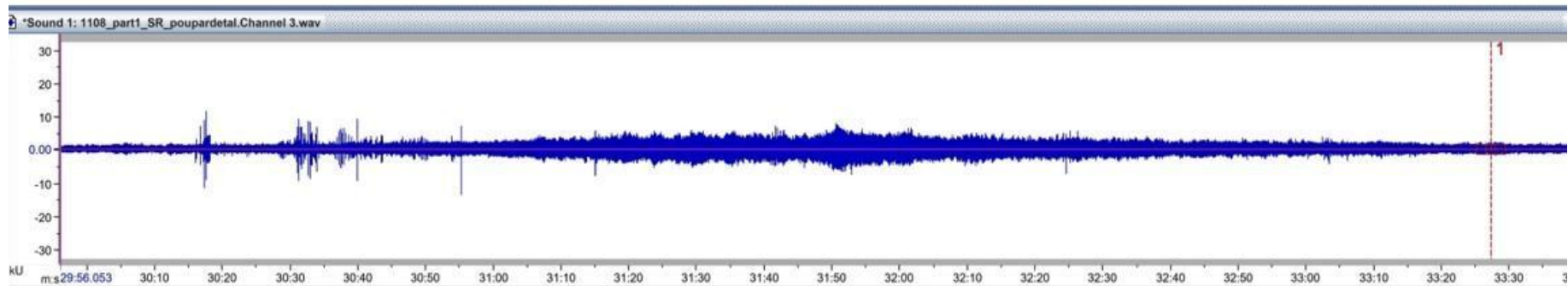
Advanced condition monitoring

Steering torque reduced over 20 %

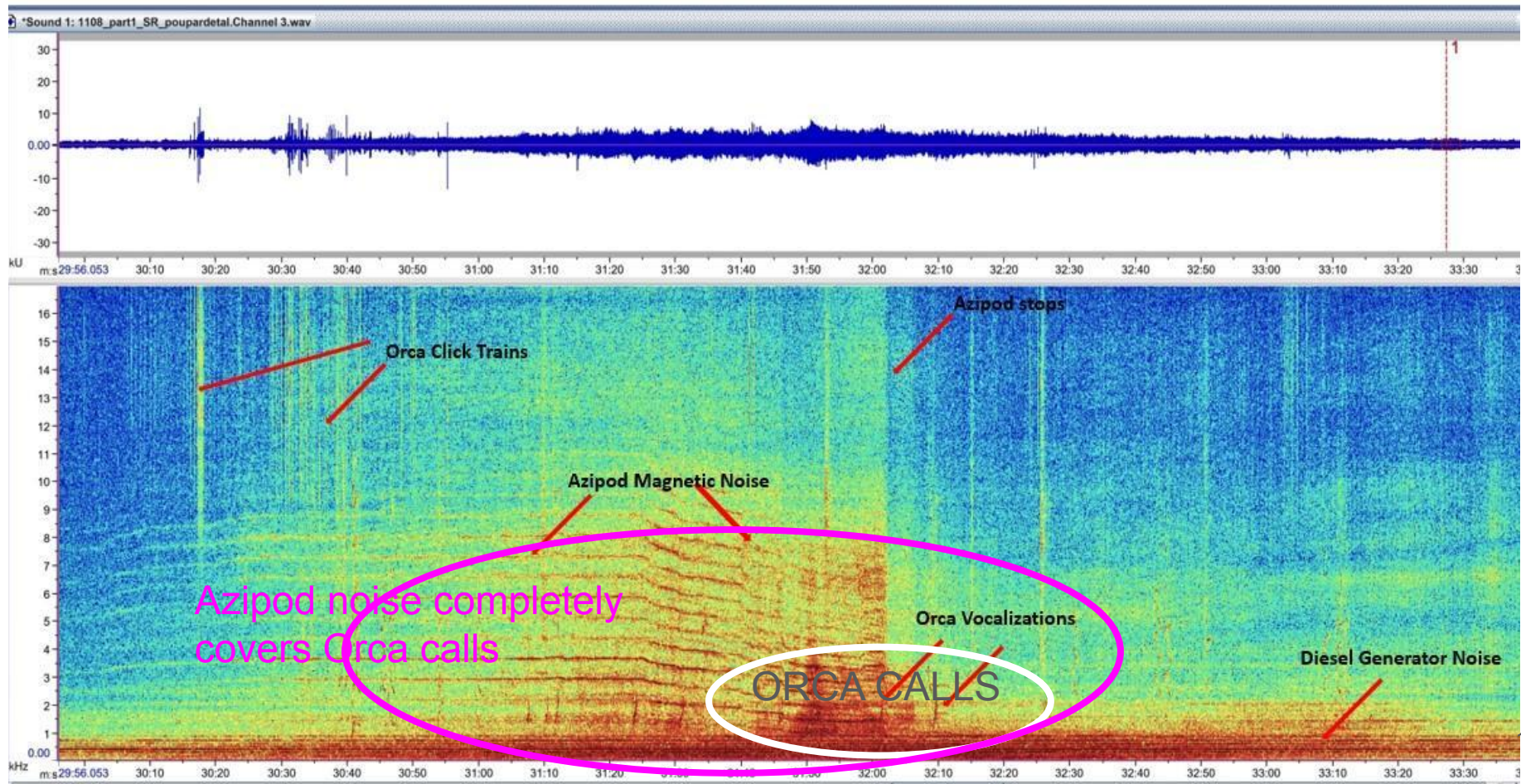
Easy and safe access to Azipod unit



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 anthropony degrades Orca's ability to adequately "see" its environment.

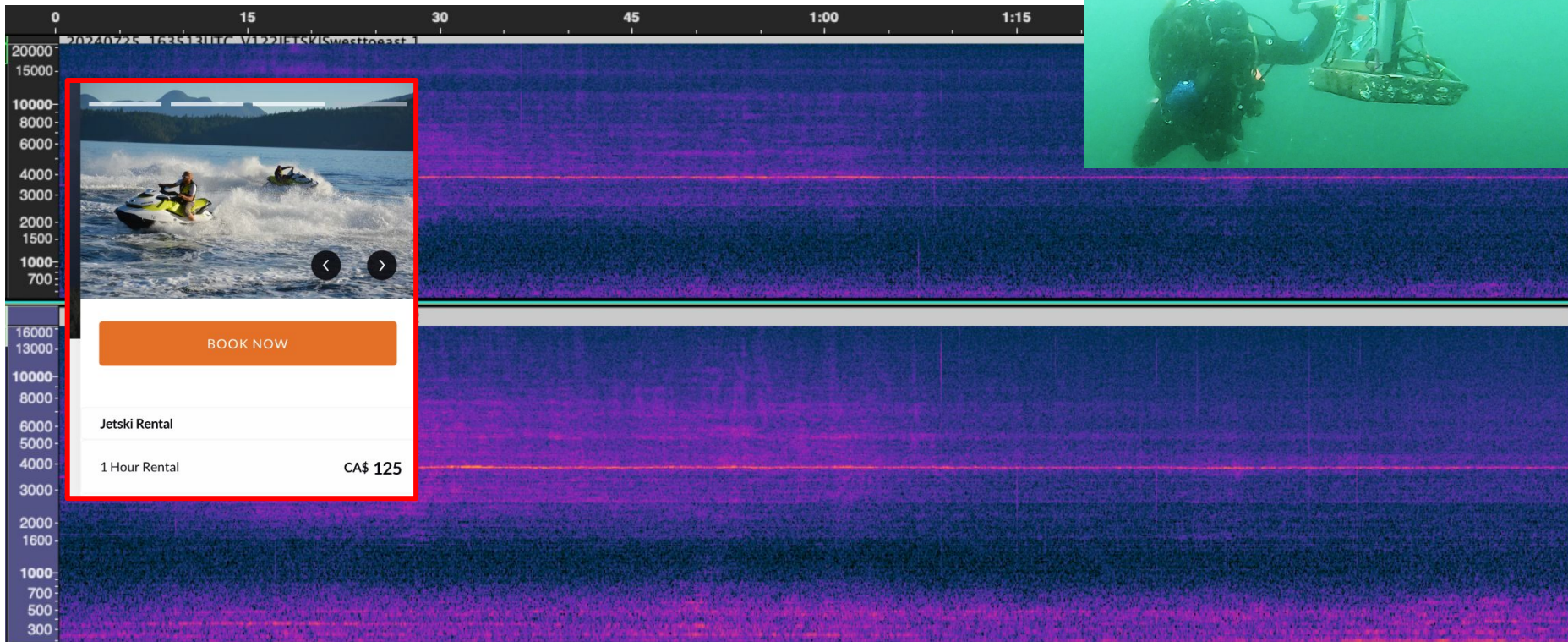
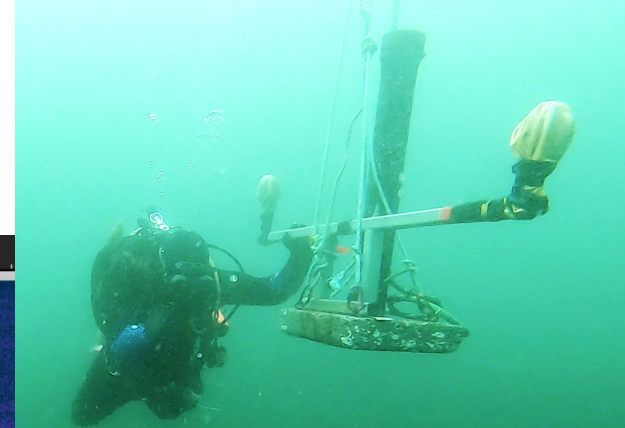


< 1 Kilometer

Effect of Jetski

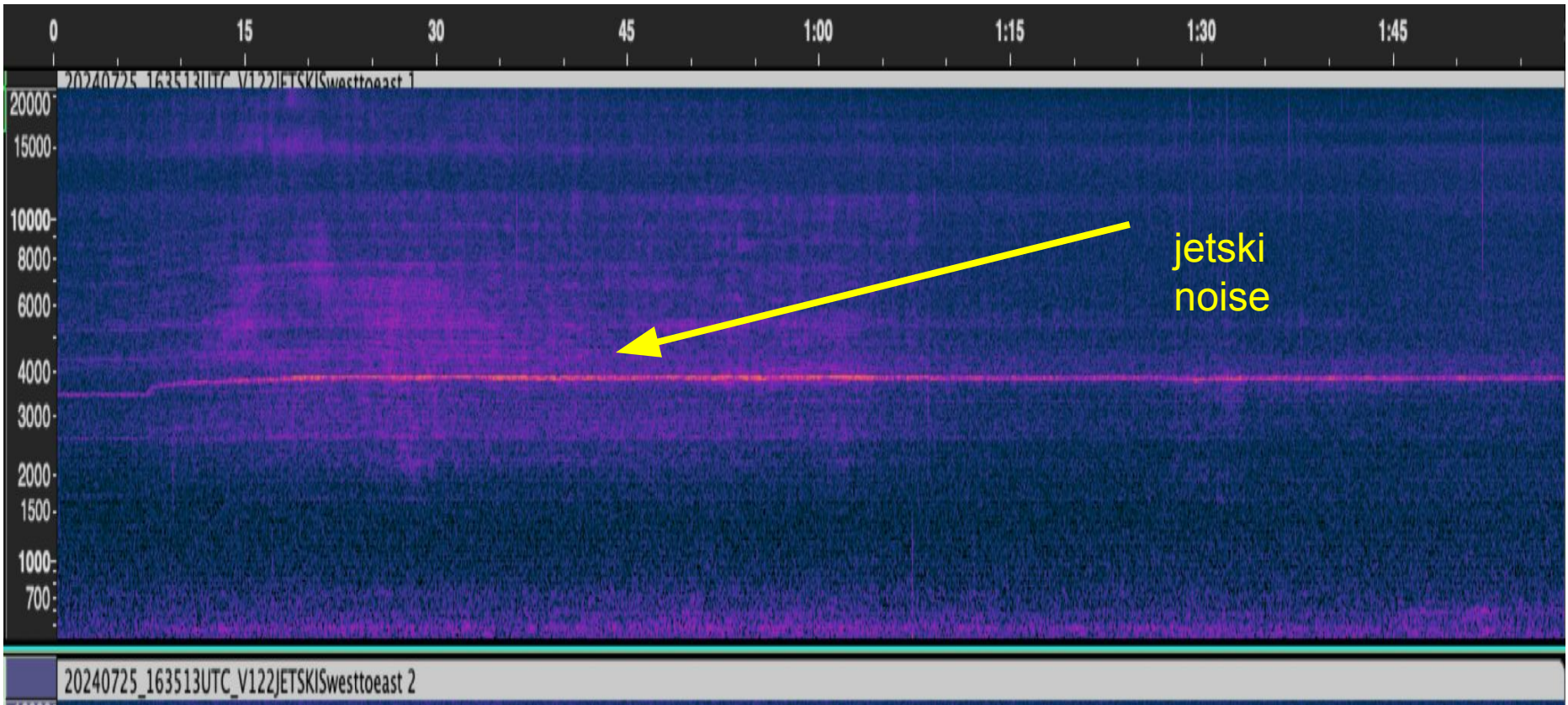
recorded in 2022
front of Orcalab in Blackney Pass
BC Canada
habitat of resident Orcas

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

10Hz

100Hz

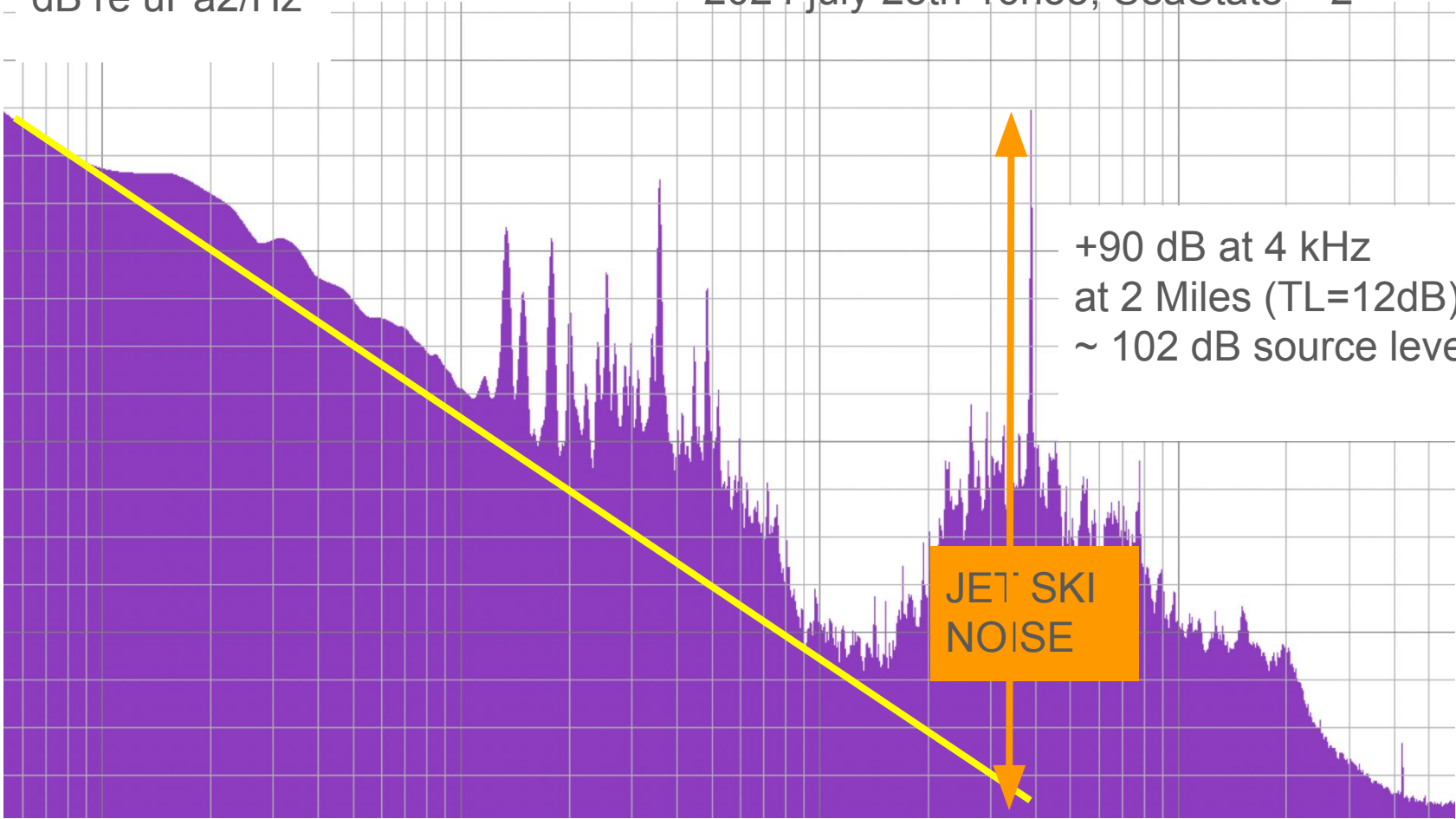
1000Hz

4 000Hz

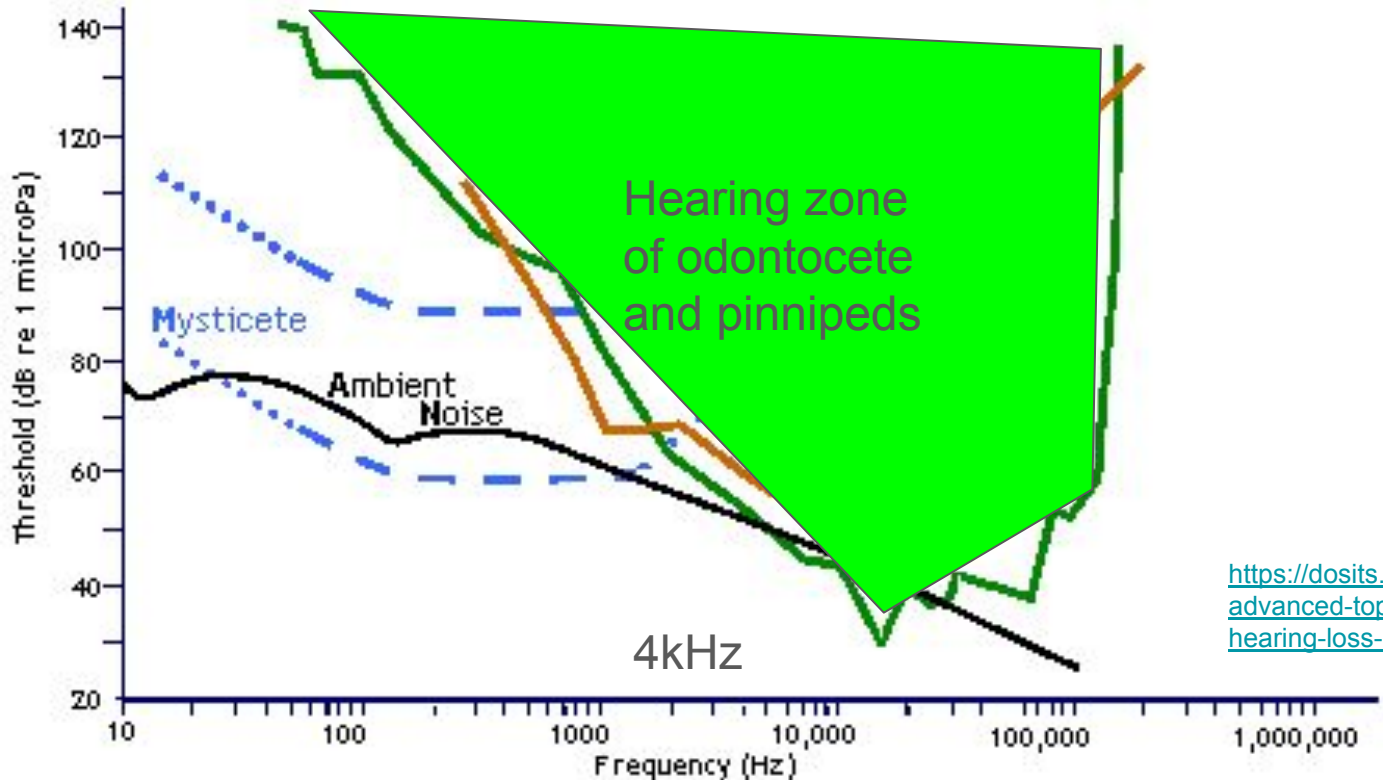
10 000Hz

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

JET SKI
NOISE



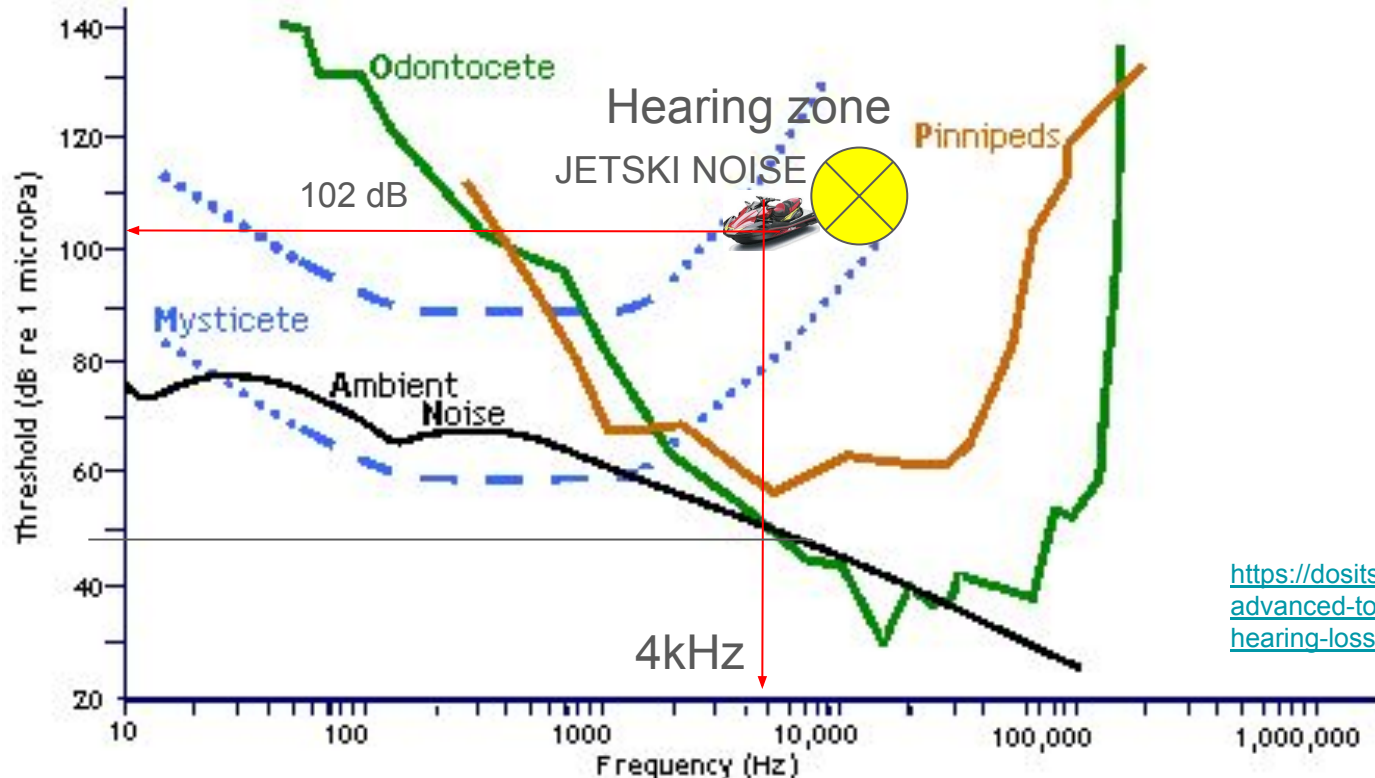
Hearing in cetaceans and others



<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)

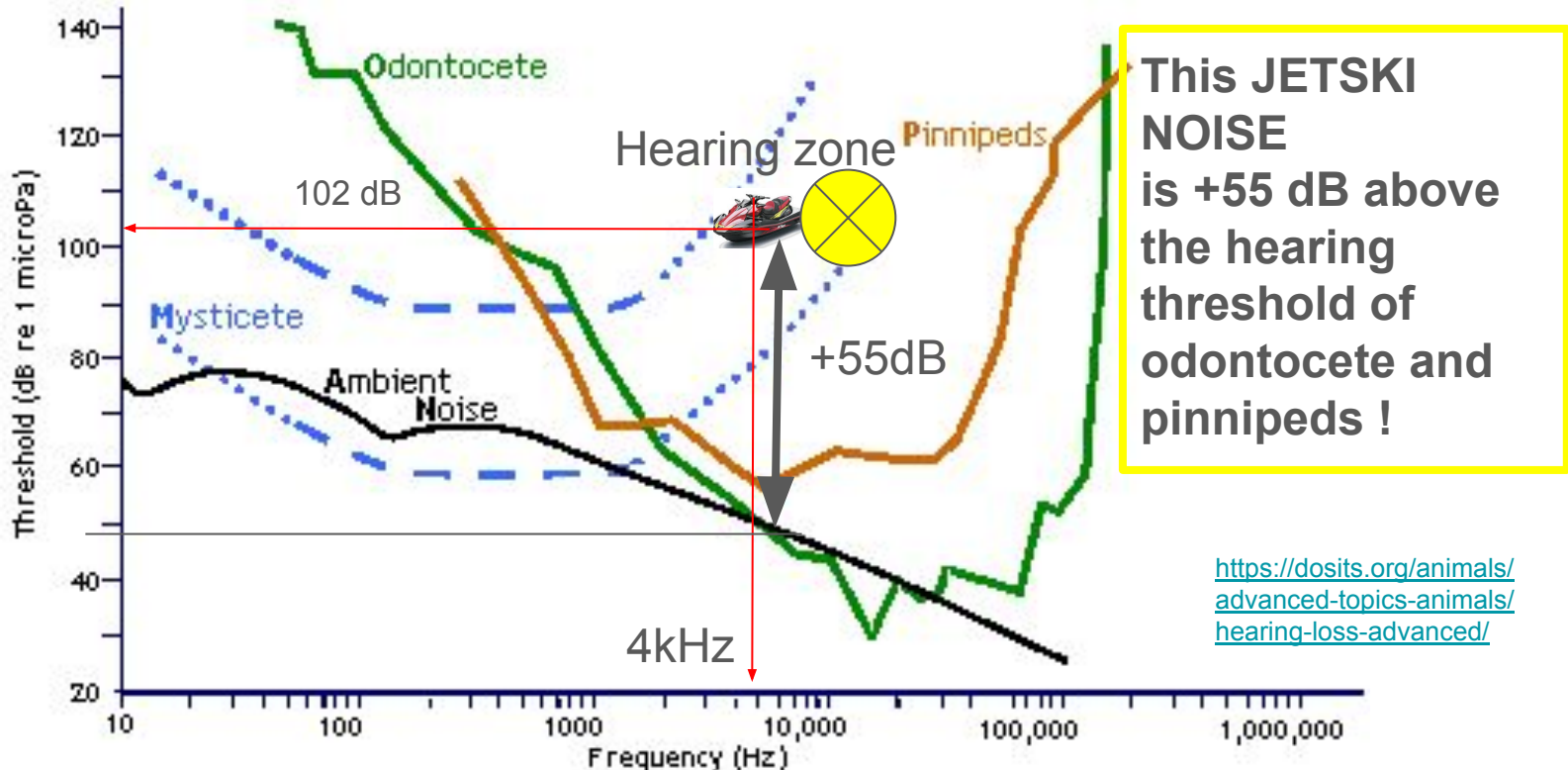
Hearing in cetaceans and others & this Jet ski noise : it is in the middle of the Hearing area of Odontocete and Pinnipeds, then it disturbs their audition, communication and foraging



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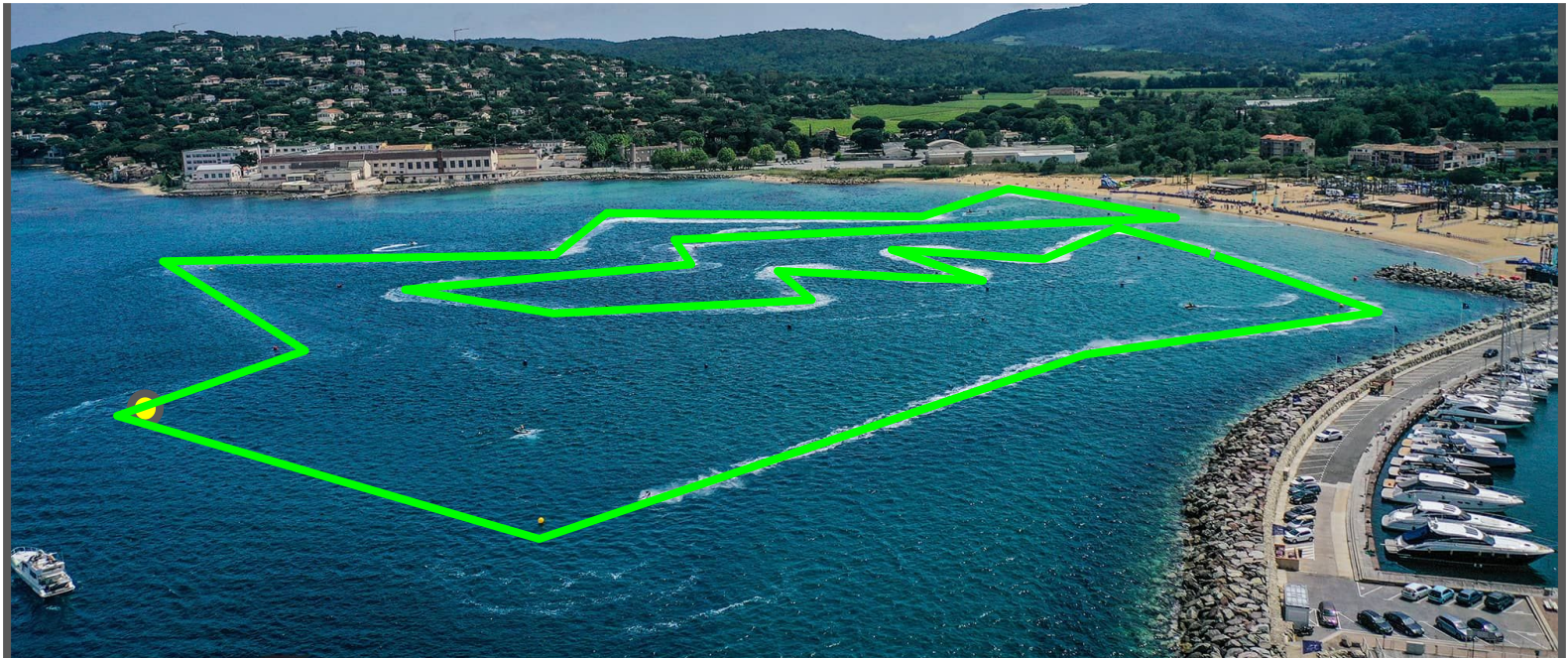
Antropophony & JETSKI

Suivi de Jet ski cup

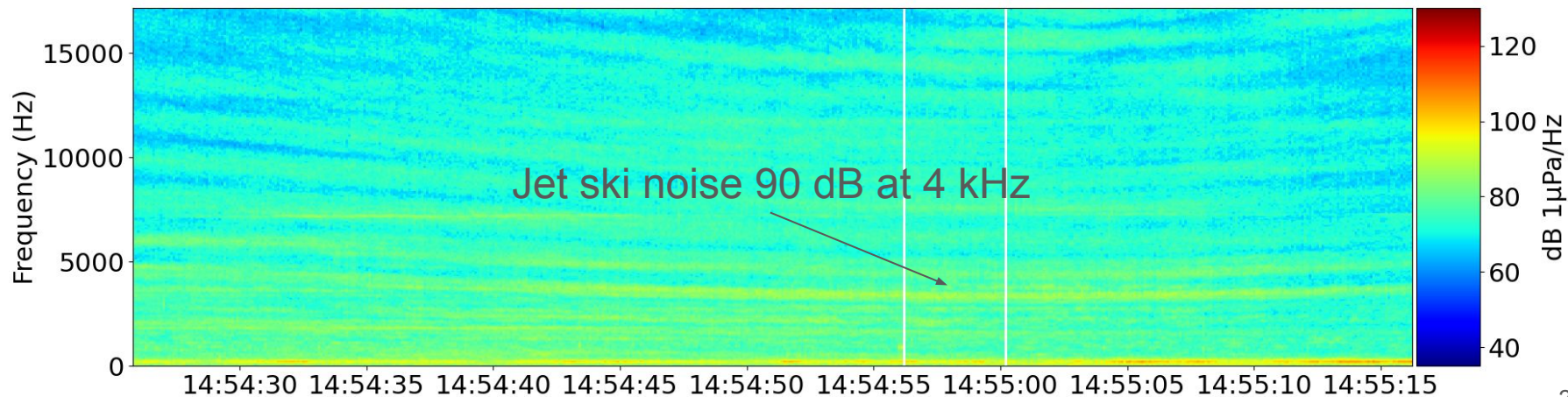
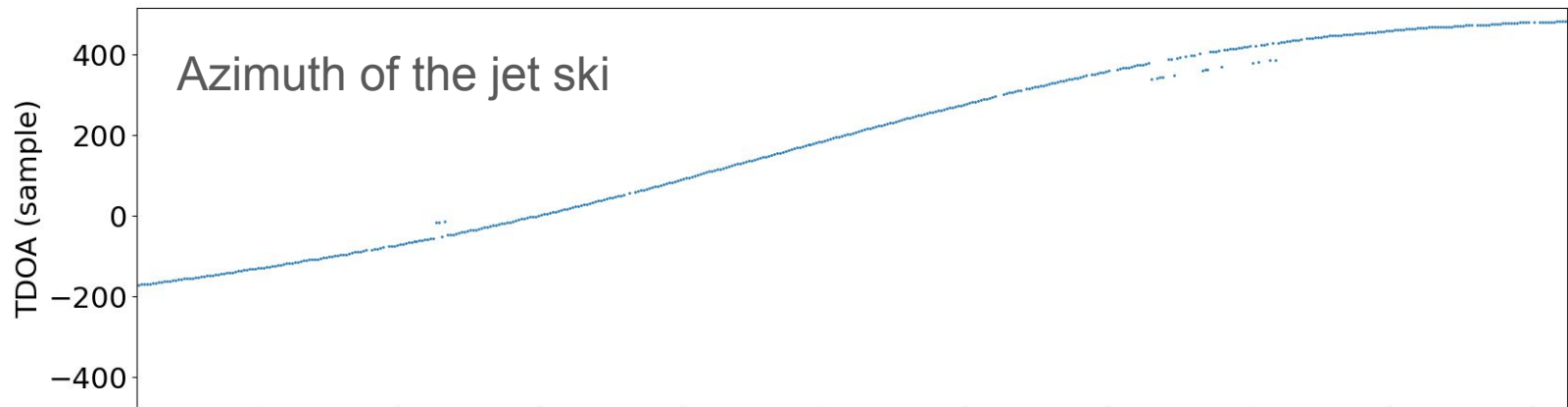
St Tropez, France, 21th May 2022



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 de la “tapisserie” 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
- Membre du 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**