Fish biophony in a Mediterranean submarine canyon
a preliminary investigation using Static Acoustic Monitoring and gliders

Bolgan M.[1,3], Gervaise C.[2], Di Iorio L.[2], Lossent J.[2], Lejeune P.[4], Raick X[1] & Parmentier E.[1]

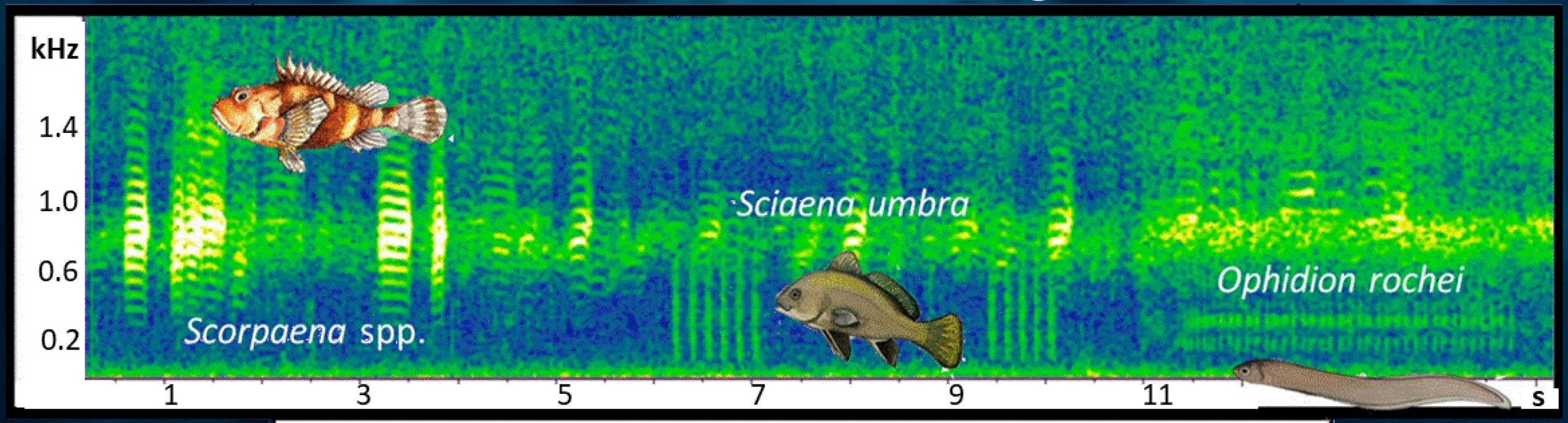
1 Laboratory of Functional and Evolutionary Morphology (Freshwater and Oceanic sCience Unit of reSearch), University of Liège, Liège 4000, Belgium

2 CHORUS Institute, INP Phelma Minatec, 3 Parvis Louis Néel 38016, Grenoble, France

3 Departamento de Biologia Animal and cE3c - Centre for Ecology, Evolution and Environmental Changes, Faculdade de Ciências, Universidade de Lisboa, Campo Grande, 1749-016 Lisboa, Portugal

4 Station de Recherches Sousmarines et Océanographiques, Pointe Revellata BP33 20260 Calvi, France

Fish biophony

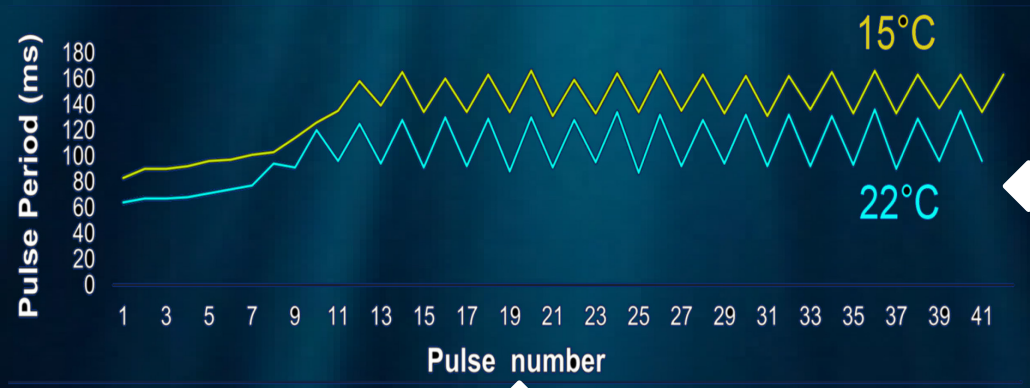


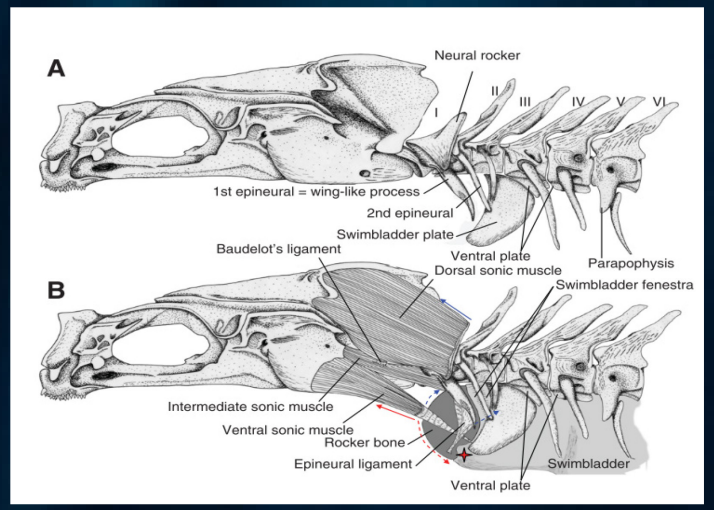
Mediterranean Sea, *Posidonia oceanica*, -20 m, summer night

Intra-specific variation of fish sounds is generally smaller than **inter-specific variation**

Once the sound repertoire of a species has ben characterised,
it is relatively easy to **identify which species vocalize in the wild.**

Using fish sounds as natural tags: Passive Acoustic Monitoring (PAM) of fish populations



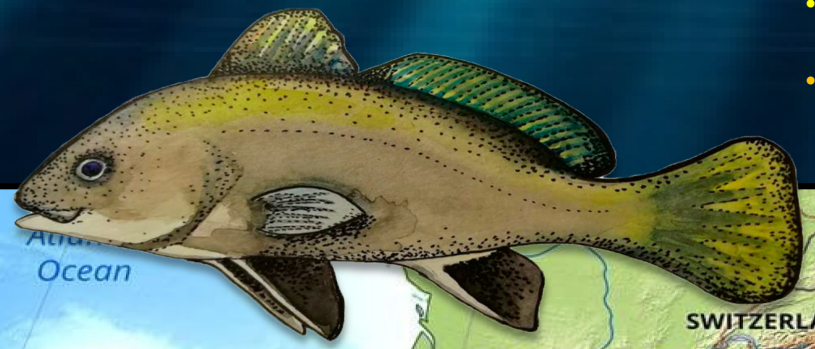


Parmentier et al. (2010) JEXBIO 213, 3230-3236

Ophidion rochei

- Parmentier et al (2010). JEXBIO *213*(18), 3230-3236.
- Kéver et al. (2015). JFB, 87(2), 502–509.
- Kéver et al. (2016). Mar Eco 37(6), 1315–1324.
- Ceraulo et al. (2018). Ecol ind, 85, 1030-1043.
- Picciulin et al. (2019). Aquatic Conserv, 2, 1-9
- Desiderà et al. (2019). MEPS 608, 183-197
- Bolgan et al. (2019) IBAC 2019
- https://chorusacoustics.com/monitoring

Sciaena umbra



- Bonacito et al. (2002). Bioacoustics 12, 292–294
- Codarin et al. (2012). Effects of Noise on Aquatic Life
- Picciulin et al. (2012a). Bioacoustics 2012, 1–12.
- Picciulin et al. (2012b). J. Acoust. Soc. Am. 132, 3118–3124.
- Picciulin et al. (2013) Fish. Res. 145, 76–81.
- Parmentier et al (2018). Animal conserv, 21(3), 211-220
- Correa et al. (2018). Ocean Coast. Manage. 168, 22-34.
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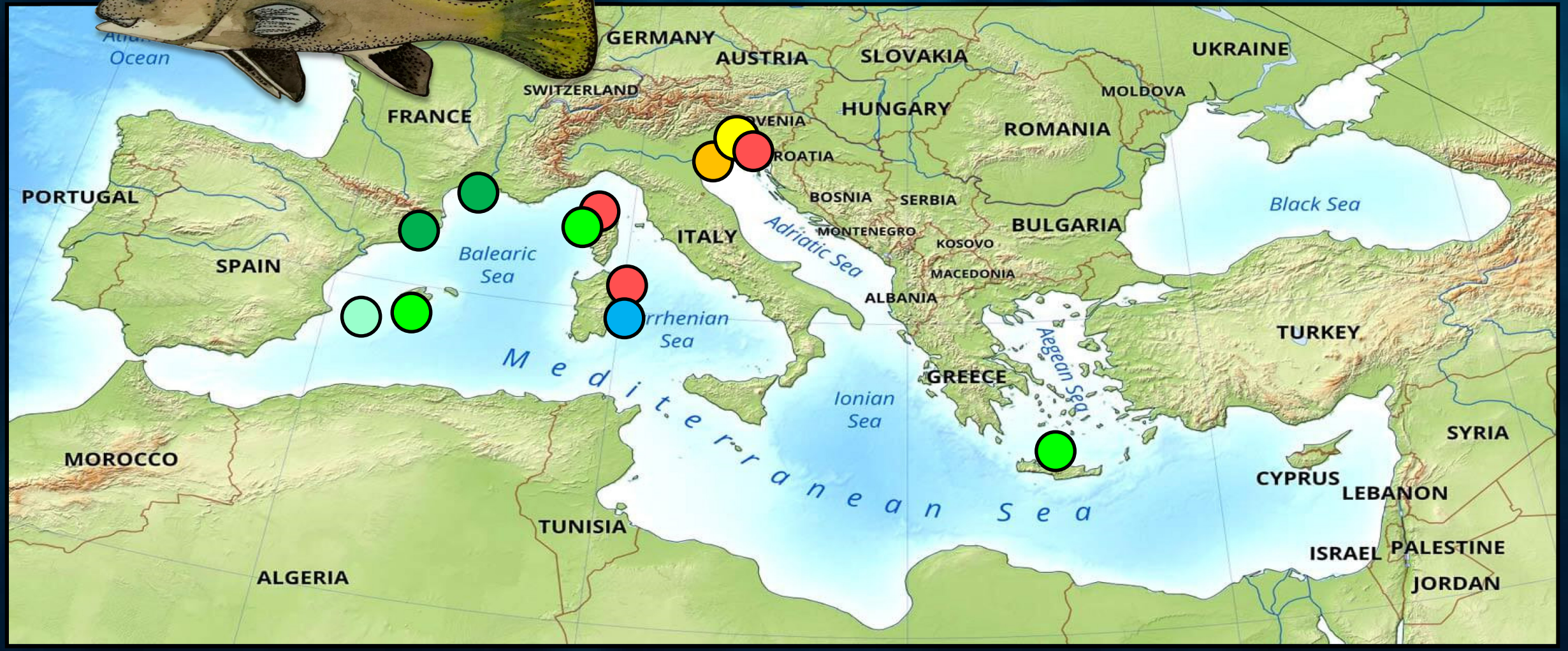
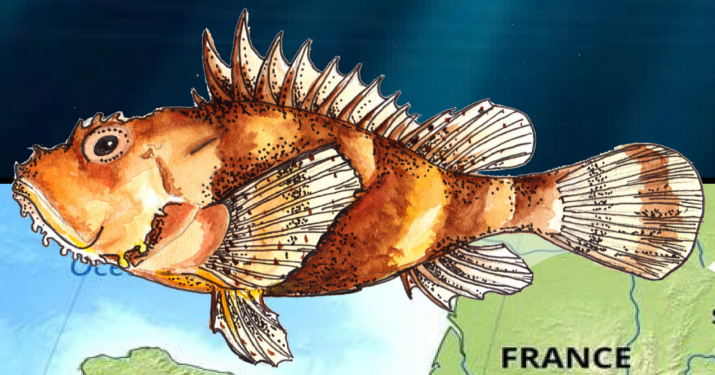


Scorpaena spp.



- Di Iorio et al. (2018). Remote Sens Ecol Conserv , 4, 248-263
- Ceraulo et al. (2018). Ecol ind, 85, 1030-104
- Correa et al. (2018). Ocean Coast. Manage. 168, 22-34.
- Desideràˋ et al. (2019). MEPS 608, 183-197
- Bolgan et al (2019). JEXBIO
- Bolgan et al. (2019) IBAC 2019
- https://chorusacoustics.com/monitoring

Deepest fish recordings reported in scientific literature:

-40 m depth

Kéver et al. (2016). Mar Eco 37(6), 1315–1324.

What happens deeper?

AIMS:

1- Describe **fish acoustic diversity in the soundscape of a Mediterranean underwater canyon**

2- Investigate the potential of different PAM configuration in providing information on fish populations

Material & Methods

SAM & glider PAM

Combination of Static Acoustic Monitoring (SAM) & hydrophone integrated gliders (SeaExplorer, Alseamar).

(2016-2017)

Calvi submarine canyon

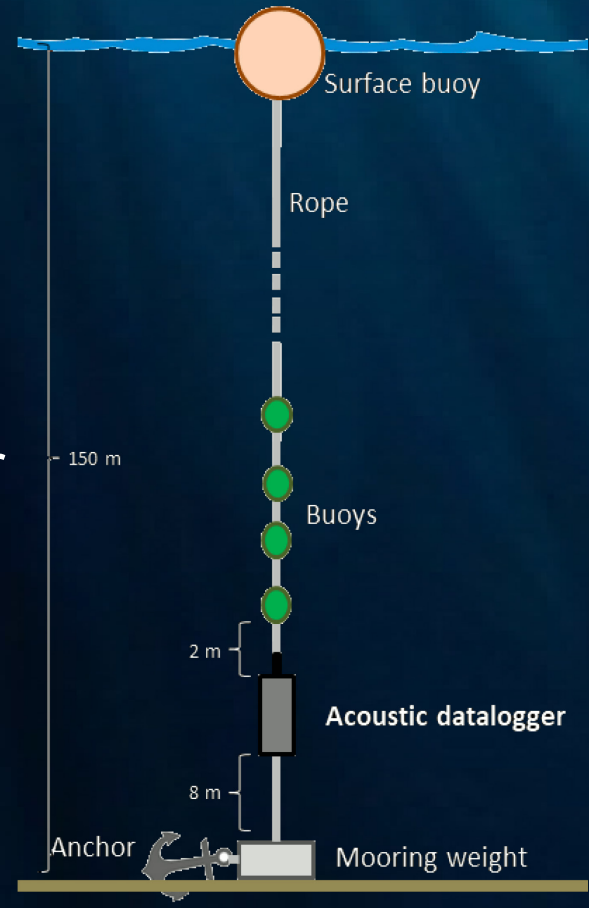
Total of **194 hours of recordings** analysed for

– **fish acoustic richness**

(i.e. number of sound types)

– **fish sound abundance**

(number of sounds per sound type and per unit of time).



Static Acoustic Monitoring

-125 to -162 m Head of the canyon

Station 1- October 2016, 31 hours (continuous)
Depth ~ 162 m
Depth hydrophone ~ 157 m

Station 2- August 2017, 44 hours (continuous)
Depth ~ 150 m
Depth hydrophone ~ 142 m

Station 3- October 2017, 31 hours (continuous)
Depth ~ 125m
Depth Hydrophone ~ 120 m

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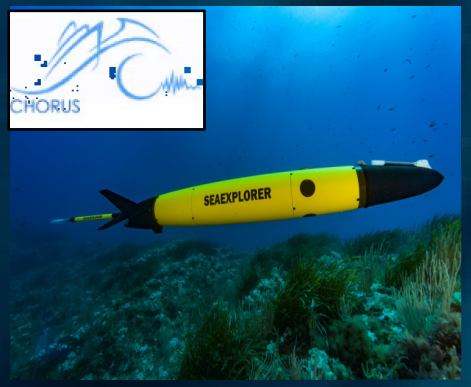
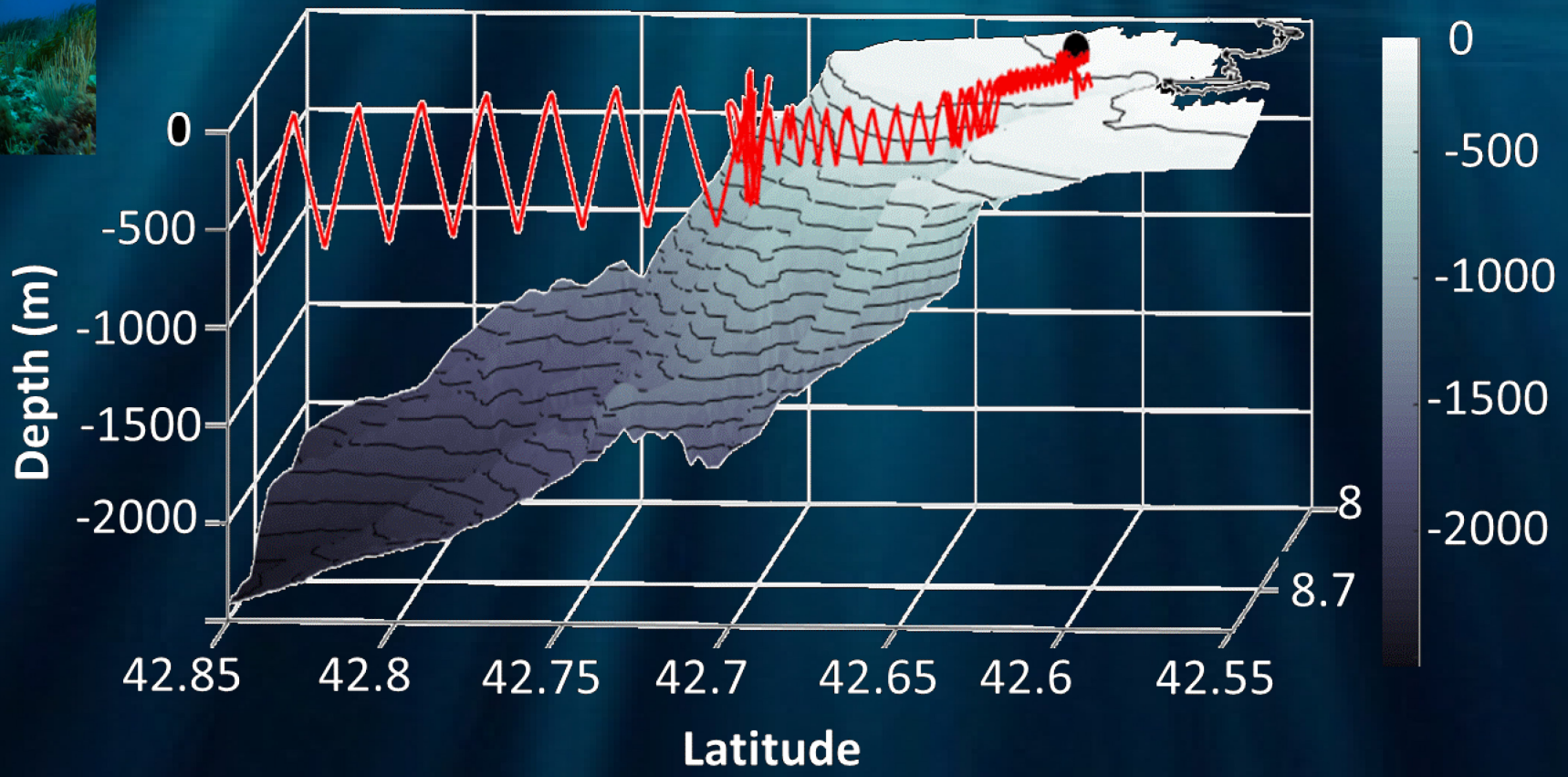
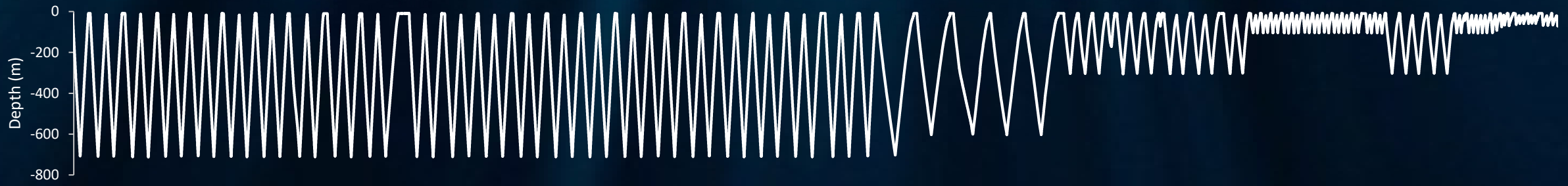
Glider integrated PAM

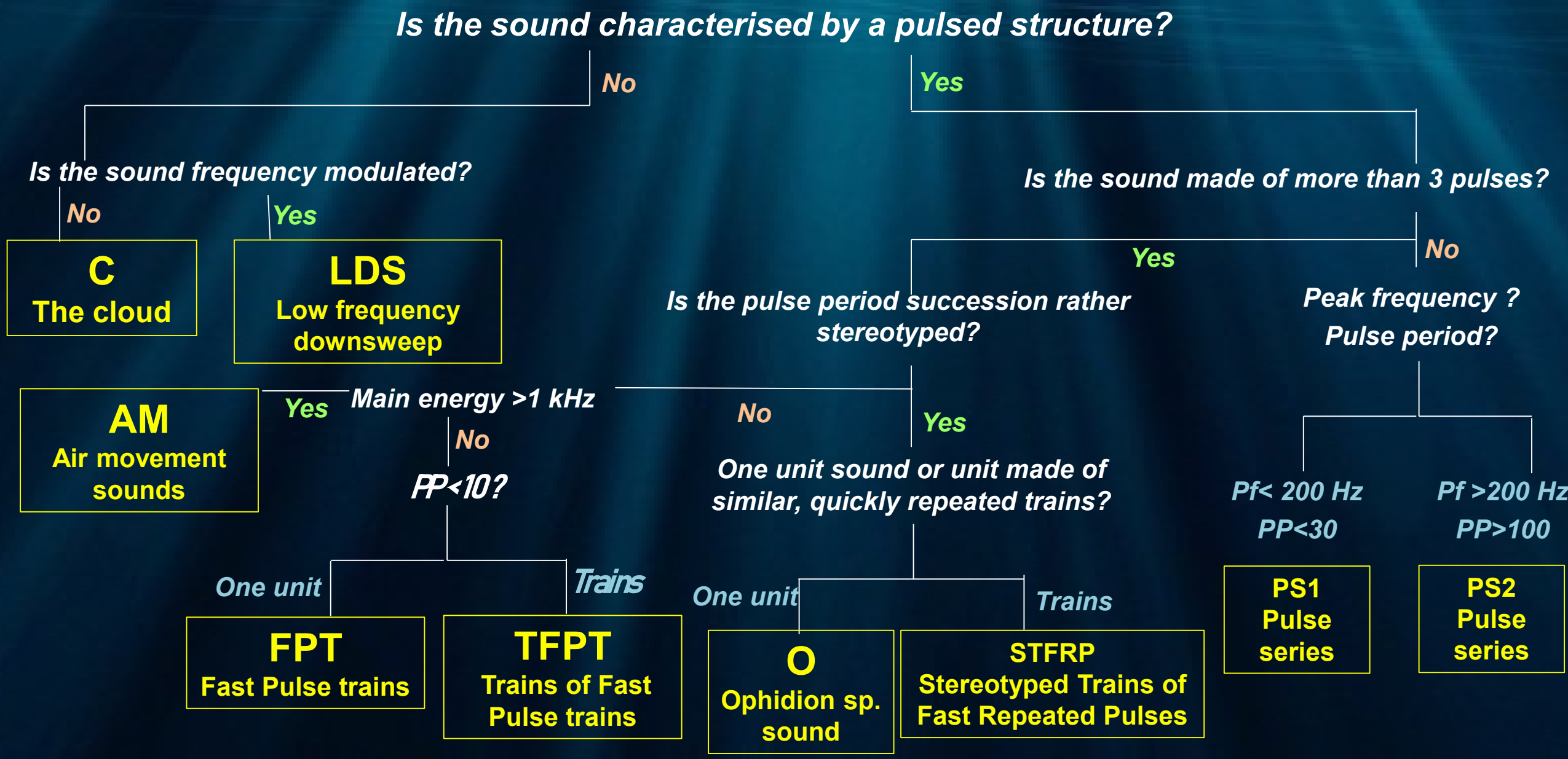






Sound types categorised on the basis of a dichotomous framework

(see Desiderà et al. (2019). MEPS 608, 183-197)

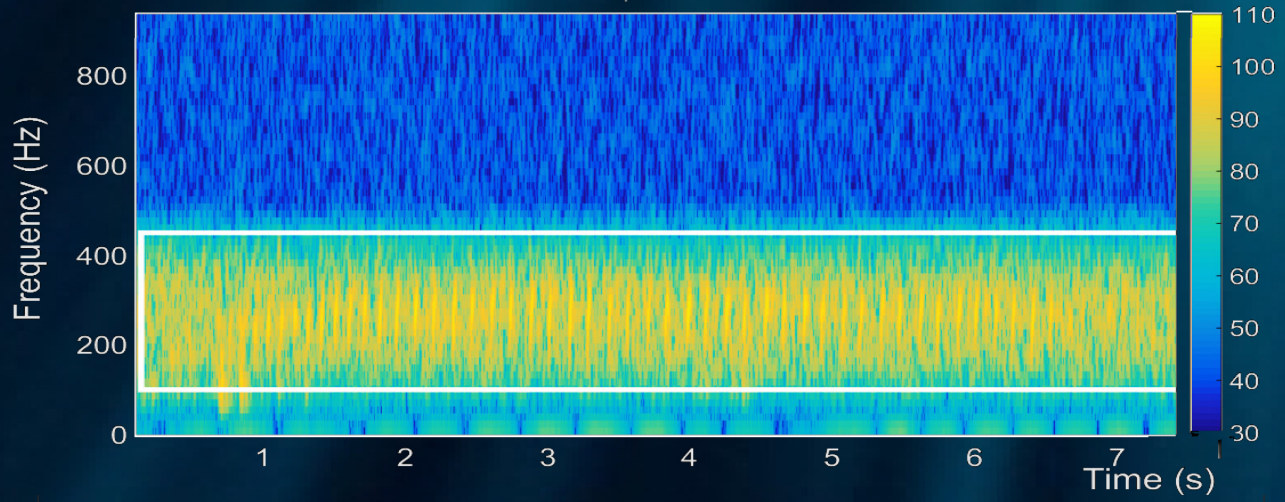


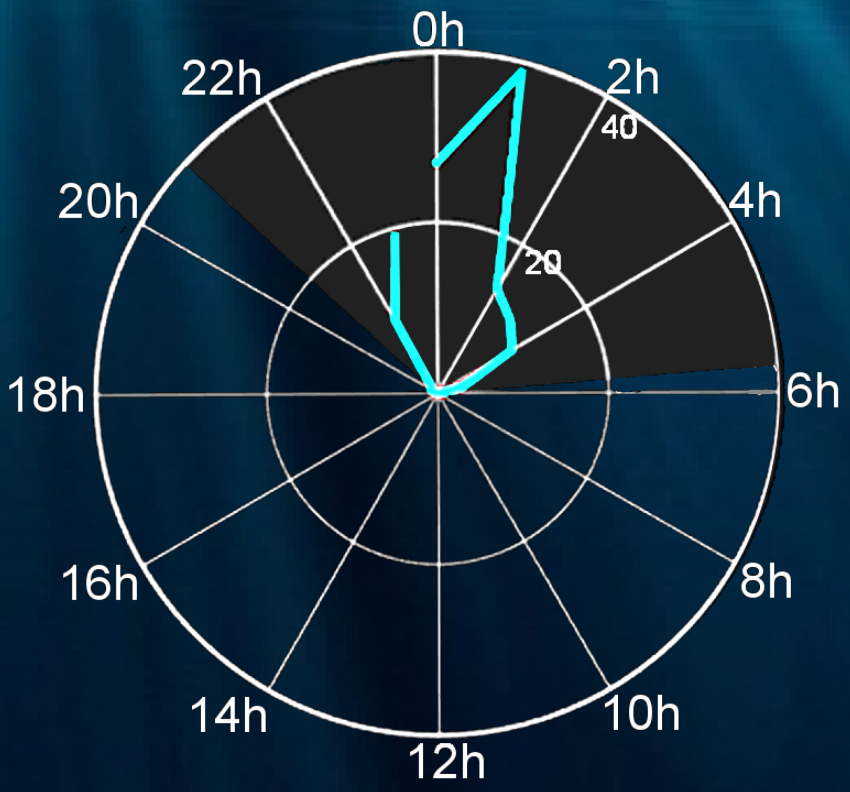
Results SAM

Station 2- August 2017

Depth -150 m

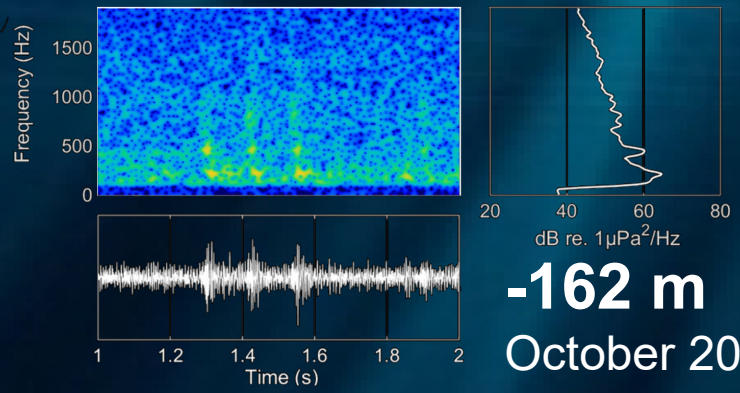
Depth hydrophone ~ 142 m





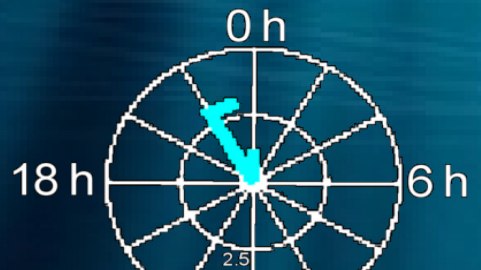
***Ophidion* sp.**

Results SAM

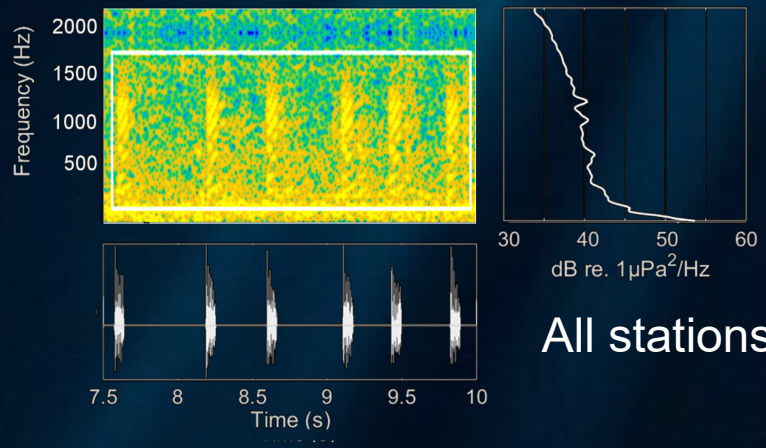


-162 m

October 2016

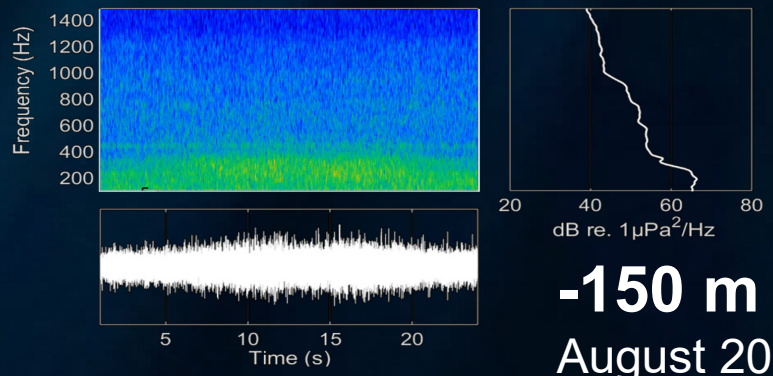


Pulse series



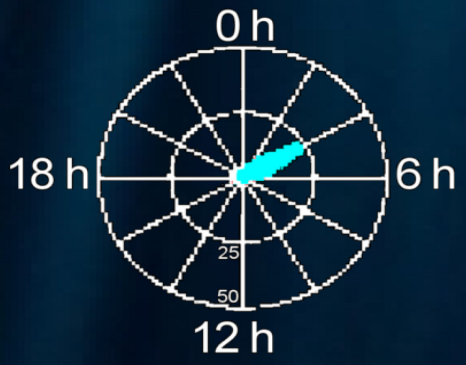
All stations

Stereotyped Trains of Fast Repeated Pulses



-150 m

August 2017

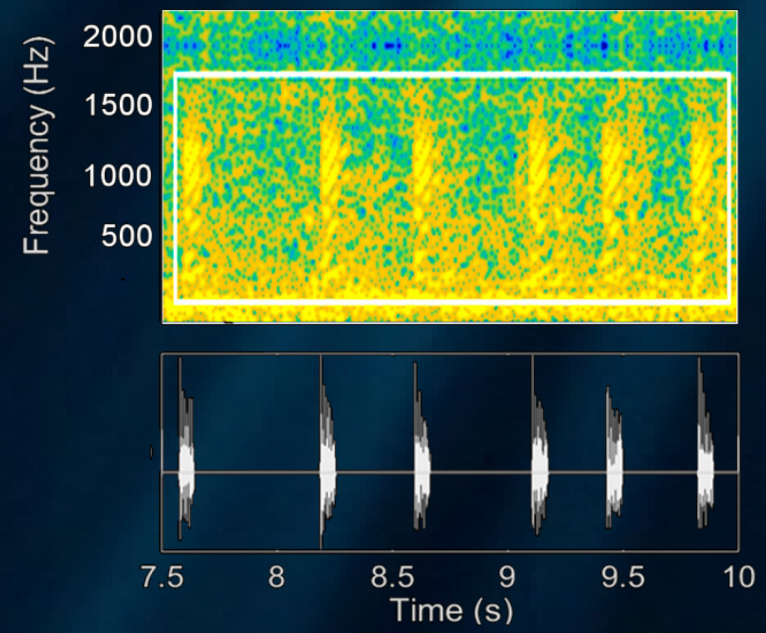


The cloud

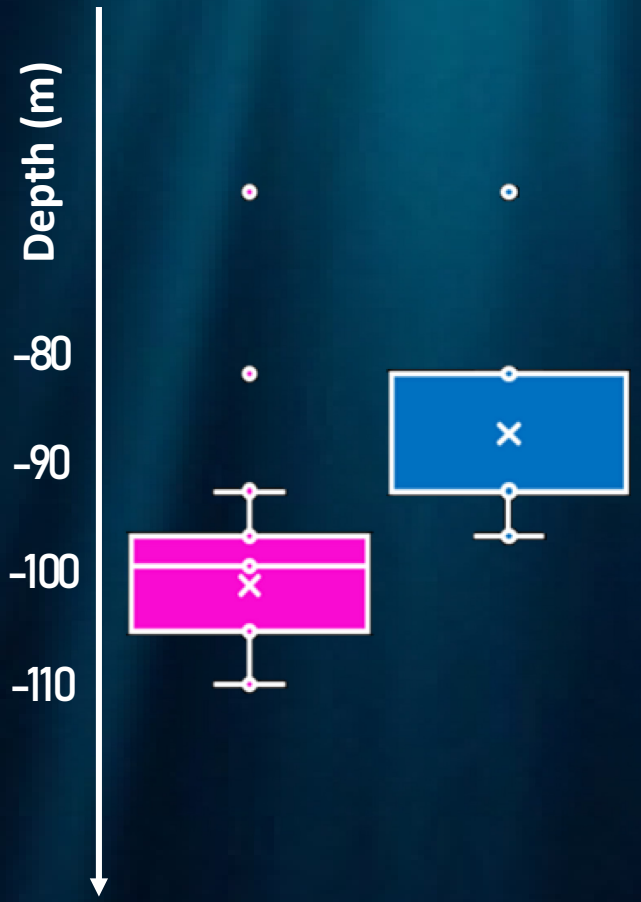
Other 3 sounds types potentially emitted by fish or associated with their presences

Results of the glider mission

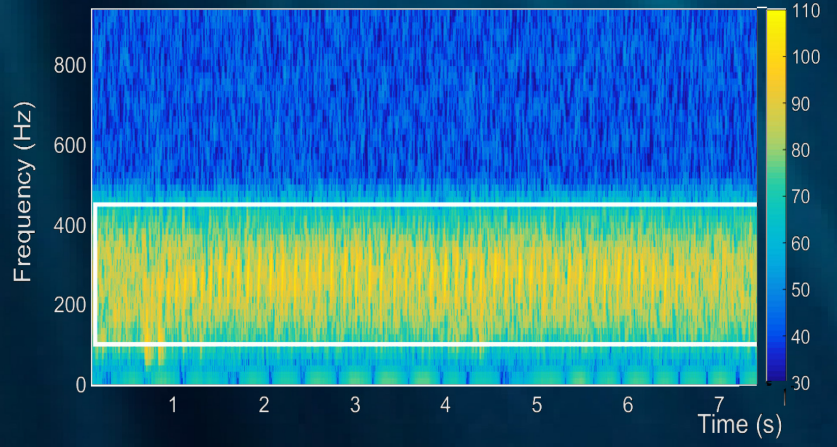
STFRP



Stereotyped Trains of Fast Repeated Pulses

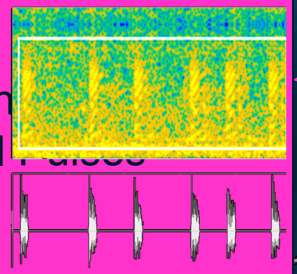


OPHIDION



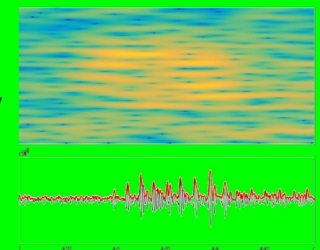
STFRP
Stereotyped Train of Fast Repeated Pulses

Ca. -100 m



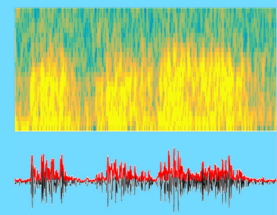
LDS
Low frequency downsweep

Ca. -80 m



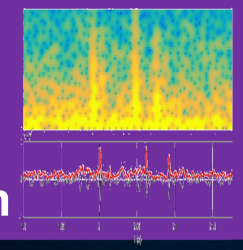
FPT
Fast Pulse trains

Ca. -100 m



PS2
Pulse series

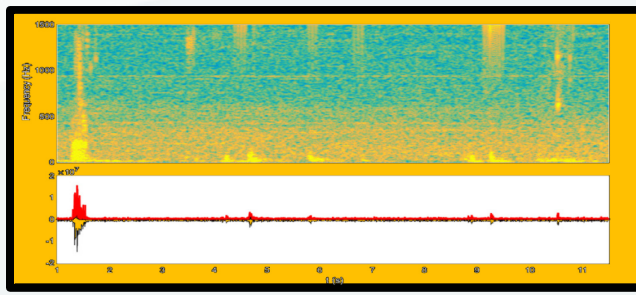
Ca. -1000 m



Ca. -80 m

Depth (m)
-500
-1000
-1500
-2000
-2500
8.8
8.75
8.7
8.65
Long (°)
42.85
42.8
42.75
42
Lat (°)
42.55

Results of the glider mission



AM

Air movement sounds

between which

Fast Repetitive Ticks

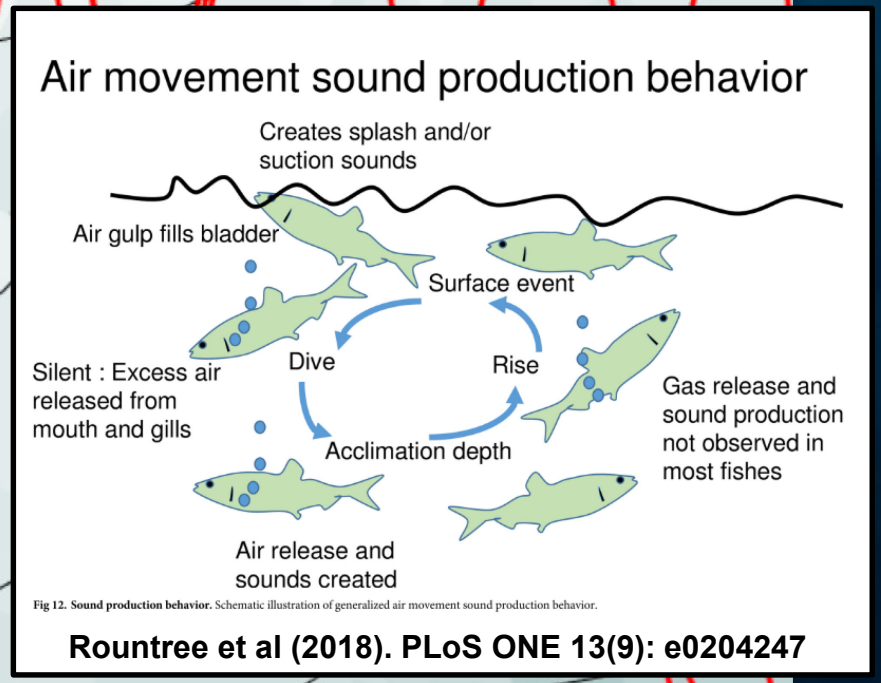
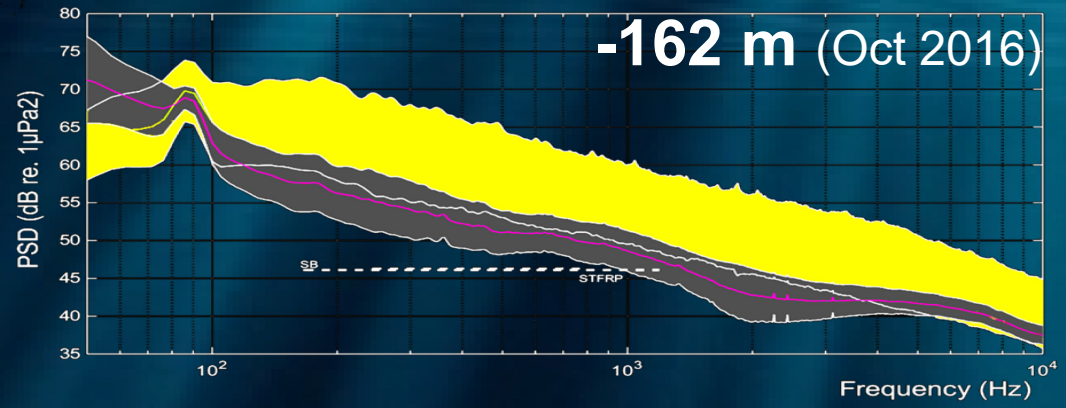
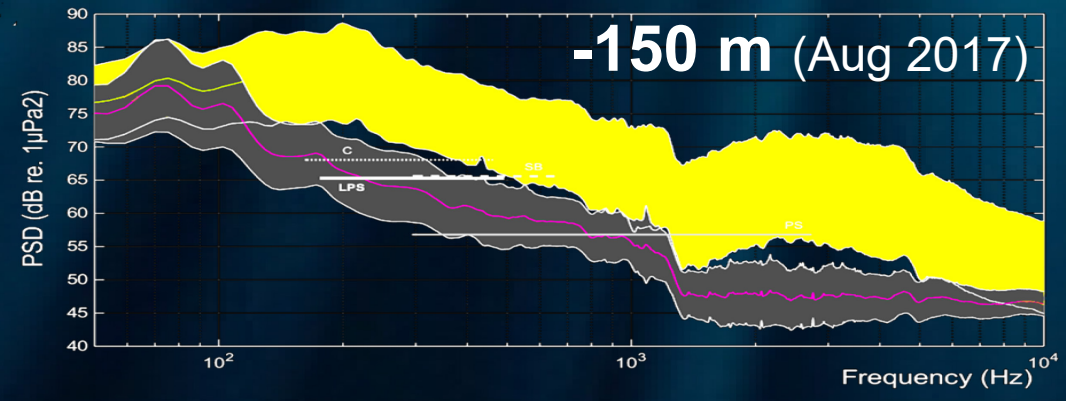


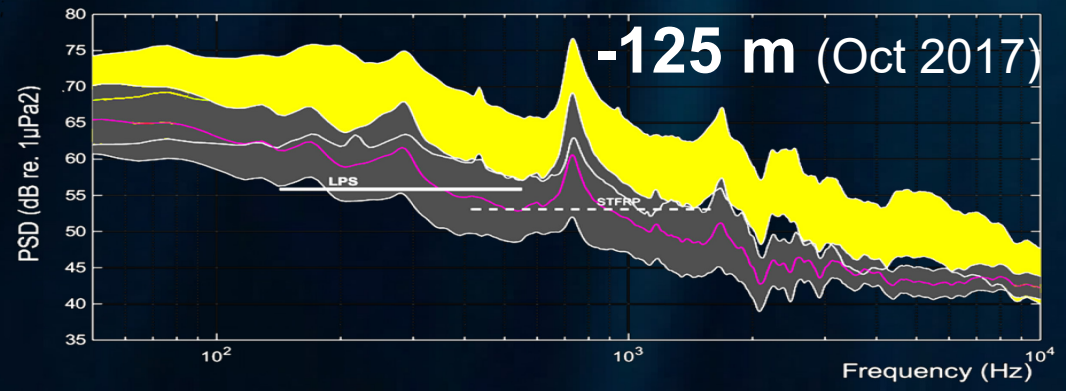
Fig 12. **Sound production behavior.** Schematic illustration of generalized air movement sound production behavior.

Rountree et al (2018). PLoS ONE 13(9): e0204247

What about Sea Ambient Noise?







Shift in Sea Ambient Noise during daytime hours due to boat traffic

+ 10 to 15 dB

Day
Night

Conclusion

Fish acoustic diversity in a Mediterranean underwater canyon?

FISH BIOPHONY EXISTS IN THE CANYON

Fish sounds in **37%** of the audio files, **9 sound types** (for a total of more than **8.000** sounds). Highest acoustic diversity at the head of the canyon, potential stratigraphical partition of vocal fish communities

Info provided by different PAM configuration on fish populations?

SAM= long-term, diel and seasonal patterns

Glider PAM= large scale, stratigraphic distribution

SUBMARINE CANYONS

⬇

PAM: holistic monitoring approach

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