



Activity 4:

A4 – Support for and harmonisation of regional work on Descriptor 11 (underwater noise)



BLUES



Co-funded by the
European Union

Underwater Soundscape of the Gulf of Finland

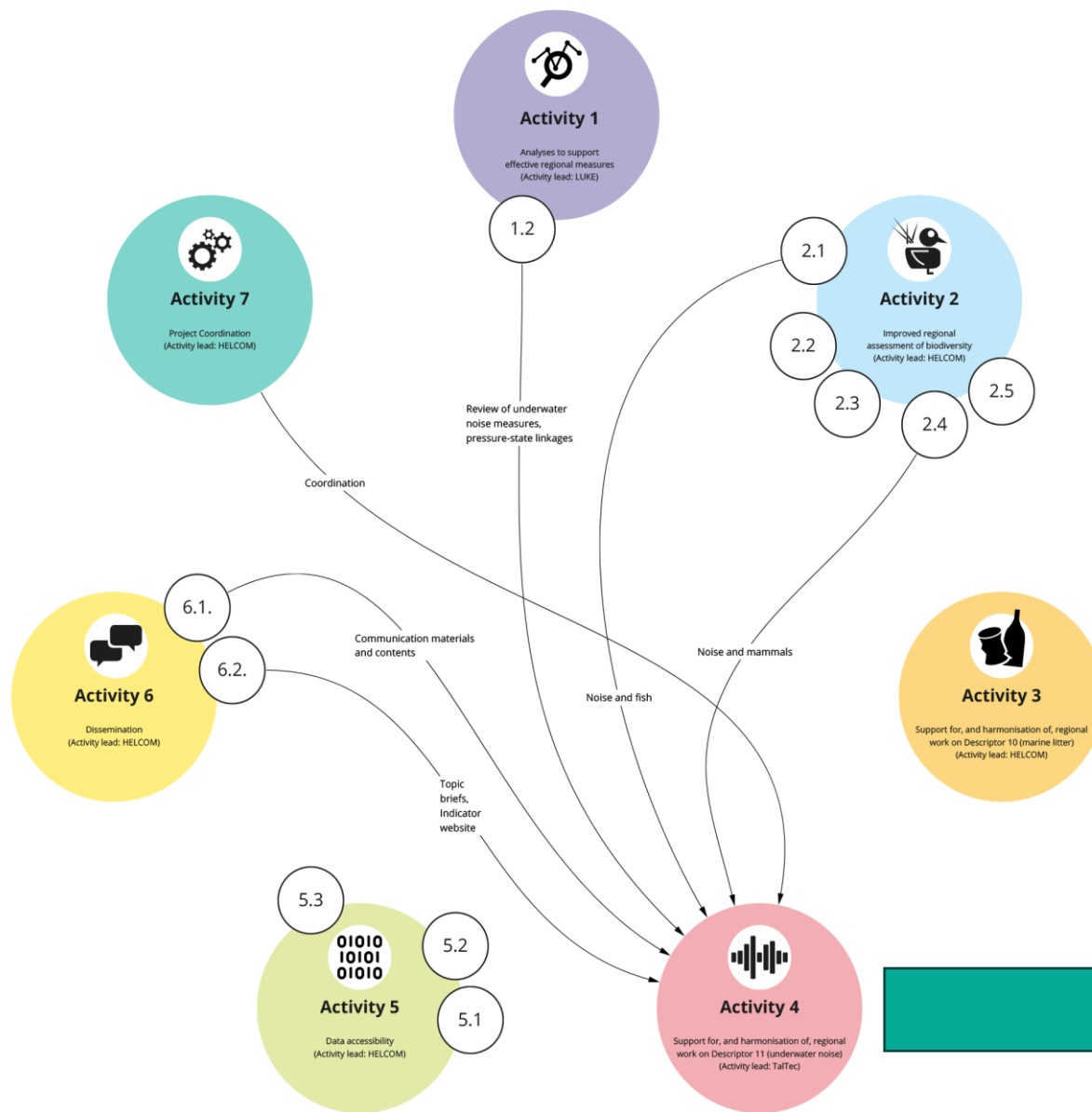
GoF Days 16-17 November 2023

Aleksander Klauson and Mirko Mustonen
Tallinn University of Technology

**TAL
TECH**



HELCOM



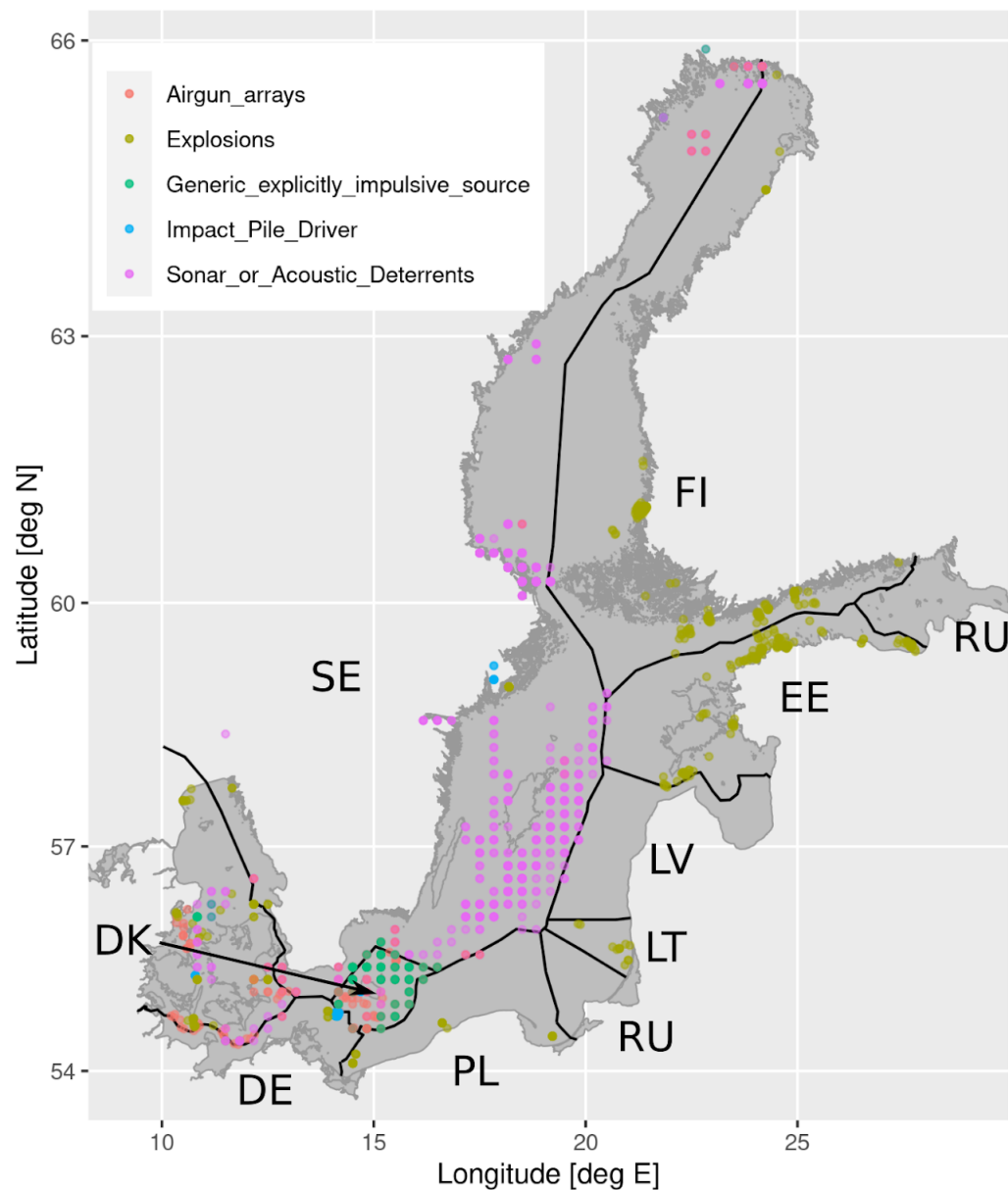
Task 4.1 Continuous noise

Task 4.2 Impulsive noise

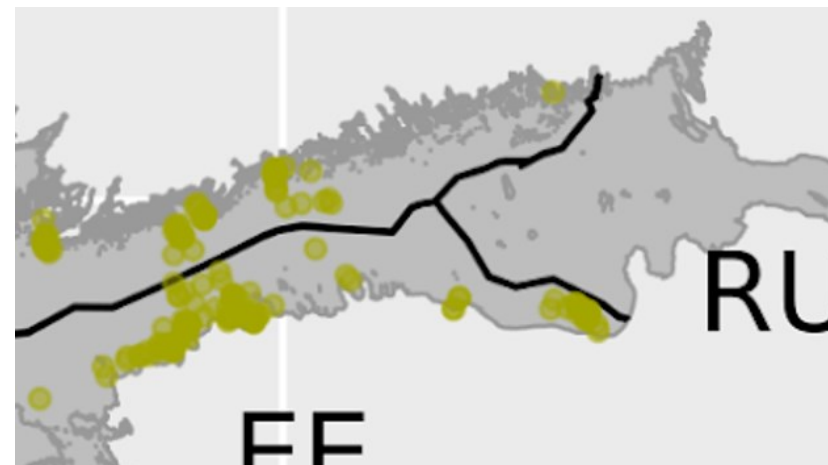


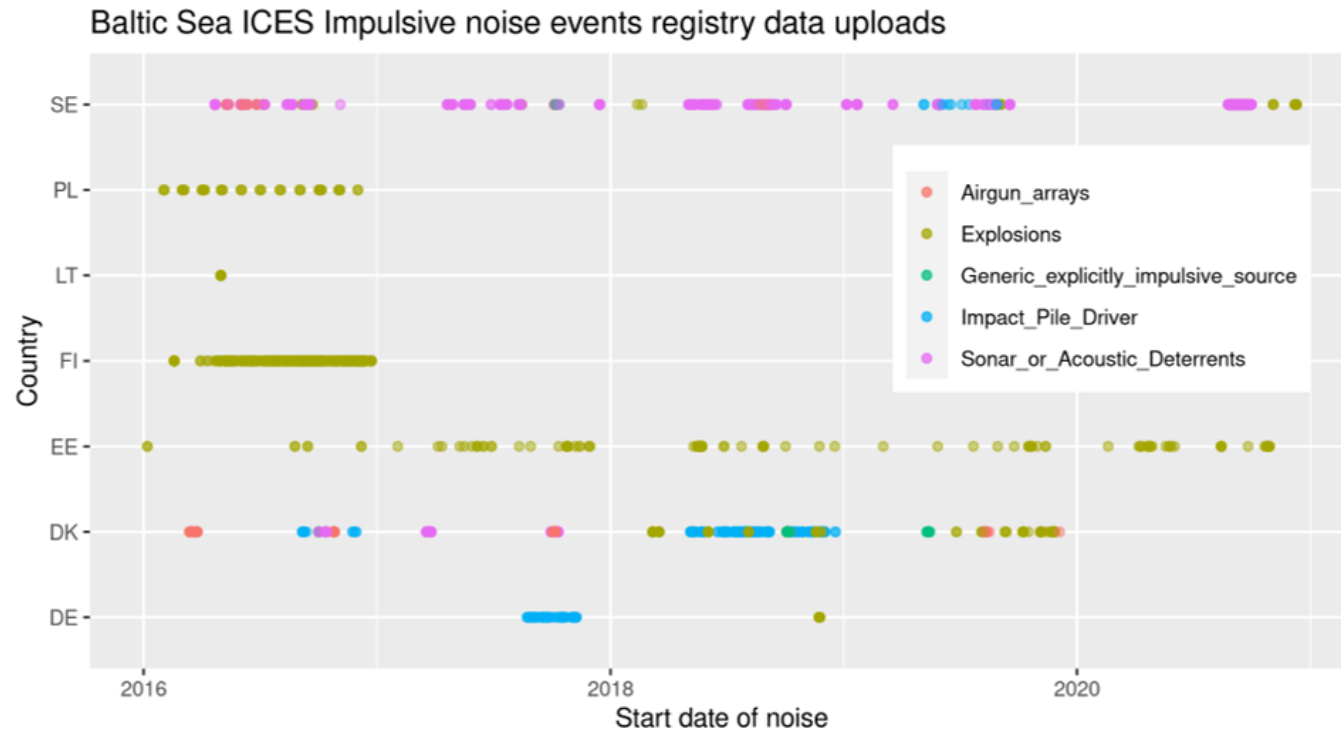


Baltic Sea ICES Impulsive noise events registry data uploads



Impulsive noise 2016-2021





All impulsive noise events are reported in ICES hosted HELCOM impulsive noise registry.

Major problem of the registry is the irregularity of data submission by country.

Figure 1: Start dates of impulsive noise events uploaded by Baltic Sea countries to the registry from the time period 2016-2021. An attempt was made to remove the Swedish (SE), Danish (DK), and German (DE) data from the North Sea area.

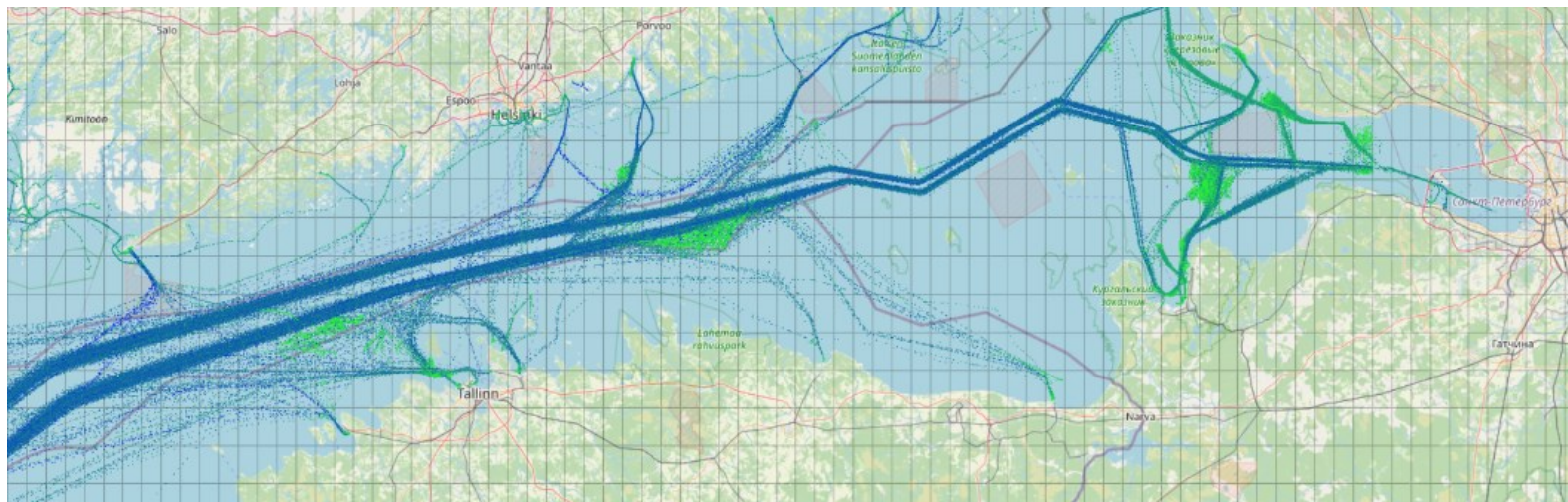




Continuous low-frequency noise. Ship traffic, August 2023



Passenger



Cargo and tanker



Continuous low-frequency noise, 2018



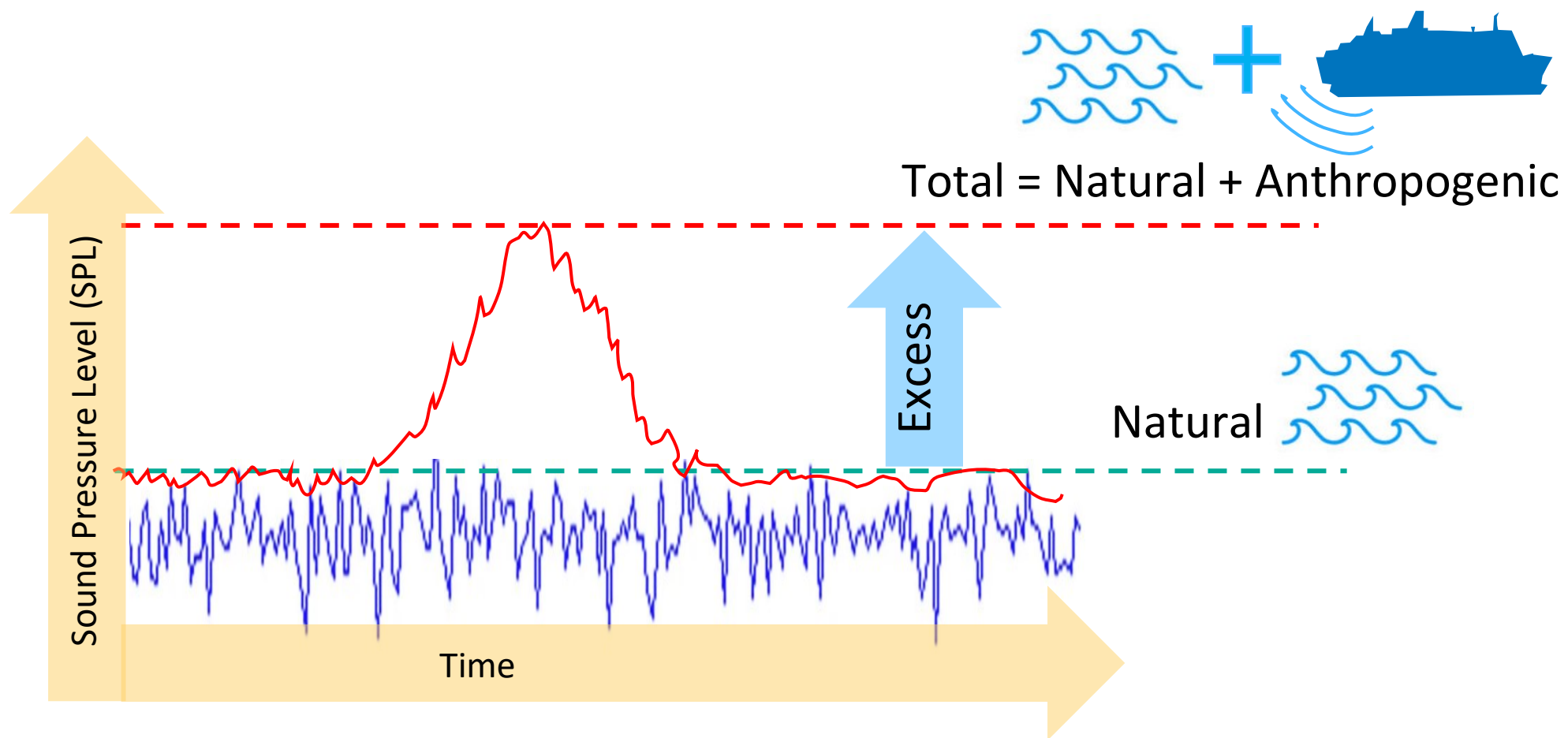
Continuous noise
INDICATOR TYPE: Pressure
INDICATOR CATEGORY: Pre-core
BSAP SEGMENT: Sea-based activities
MSFD CRITERIA: D11C2

https://indicators.helcom.fi/wp-content/uploads/2023/04/Continuous-noise_Final_April_2023-1.pdf



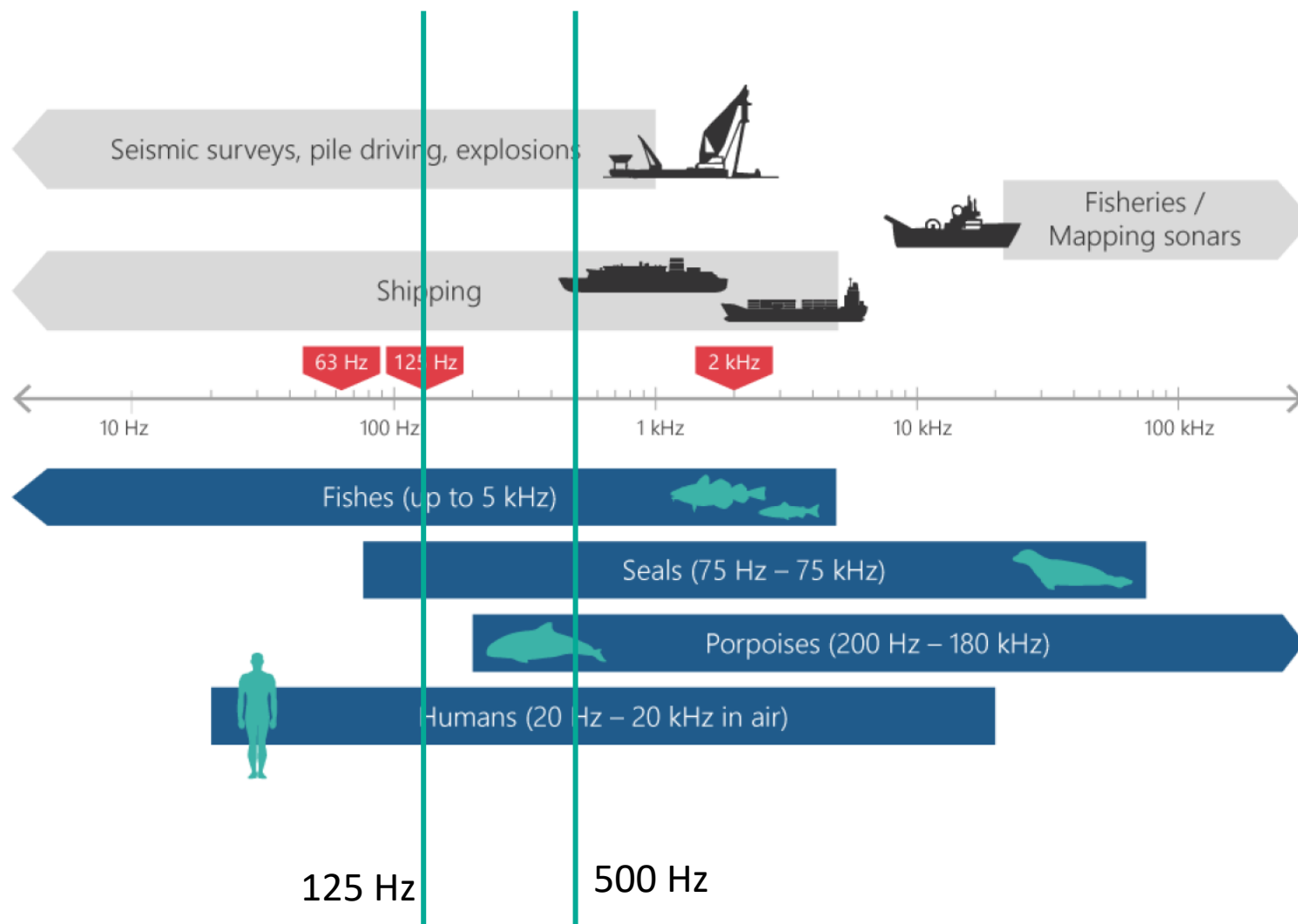


Continuous noise metrics



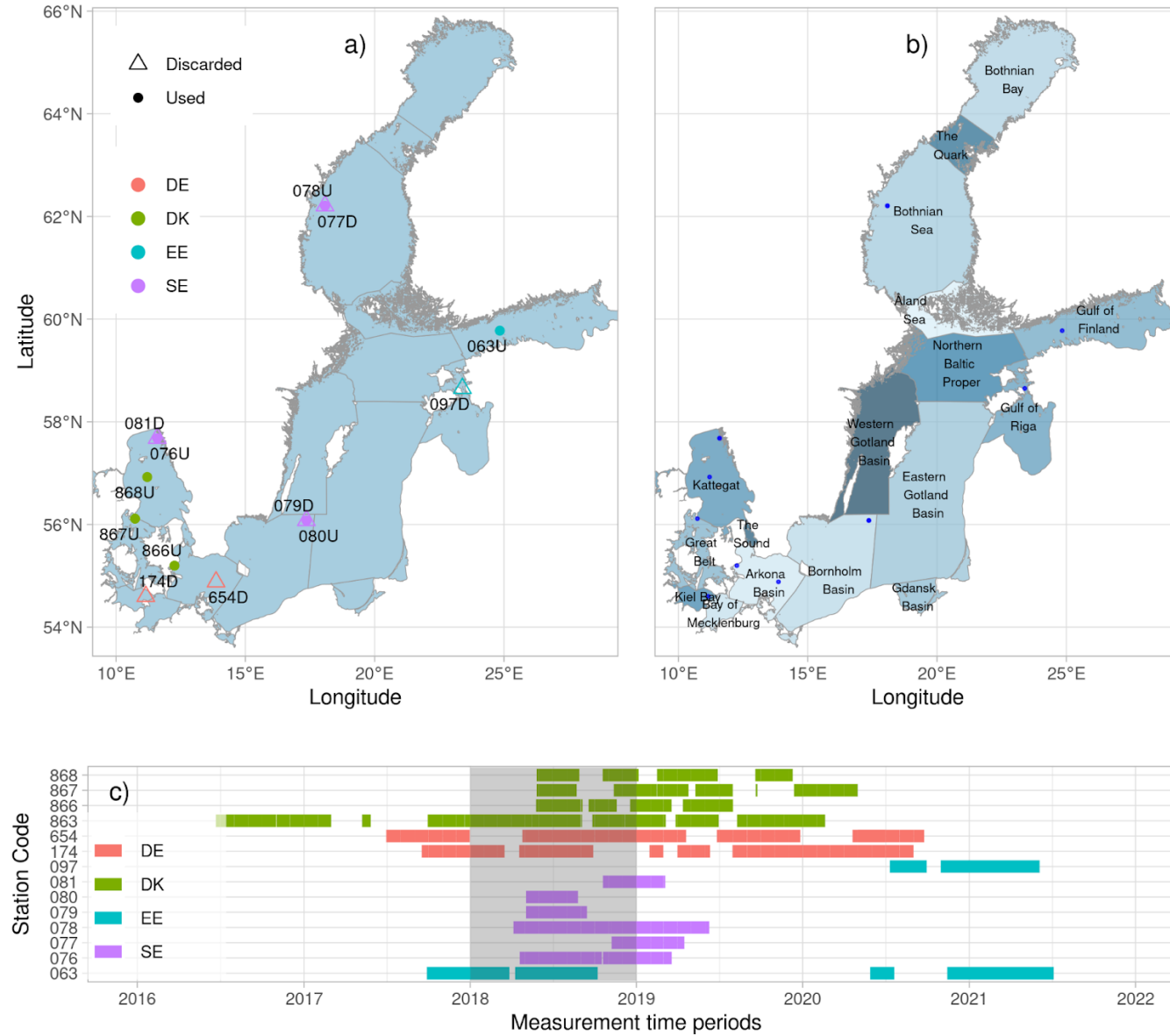


Auditory range of some marine species present in the Baltic Sea and sound frequencies generated by human activities



Monitoring data

- HELCOM subbasin = MRU;
- The modelling year is 2018.





Assessment of impact on noise sensitive species

Indicator species for the Baltic Sea



Baltic herring



Seals (Grey, Ringed and Harbor)



Cod



Harbor porpoise

Indicator species for the GoF

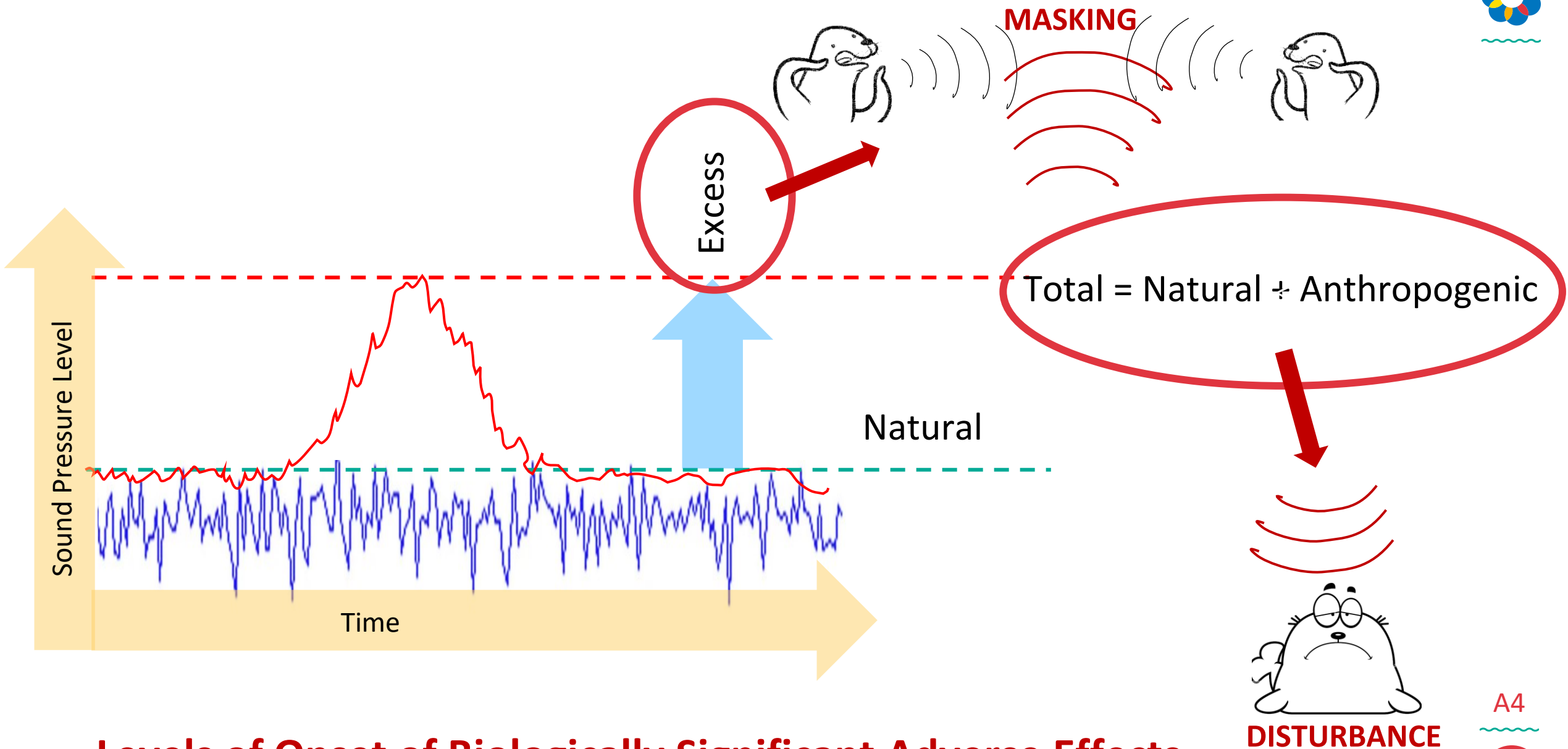


Seals (Grey, Ringed and Harbor)



Baltic herring





Levels of Onset of Biologically Significant Adverse Effects





Levels of Onset of Biologically Significant Adverse Effects (LOBE)

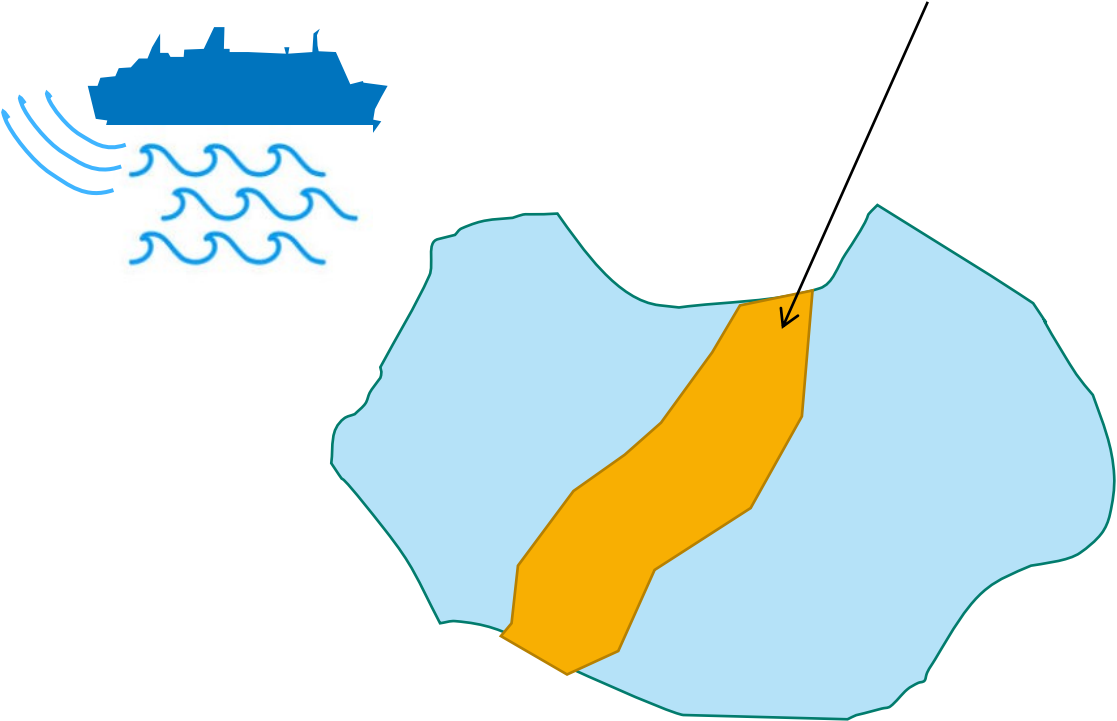
Marine species	Decidecade	Disturbance level	Masking	References and comments
	Hz	dB re 1 μ Pa		
		SPL	EL, excess level	
Seals	500	110	20	[Kastelein et al. , 2006]
Porpoise	500	109		EN Noise advise
Fish (Herring)	125	110	20	[Olsen, 1971] [Kastelein et al. 2008]



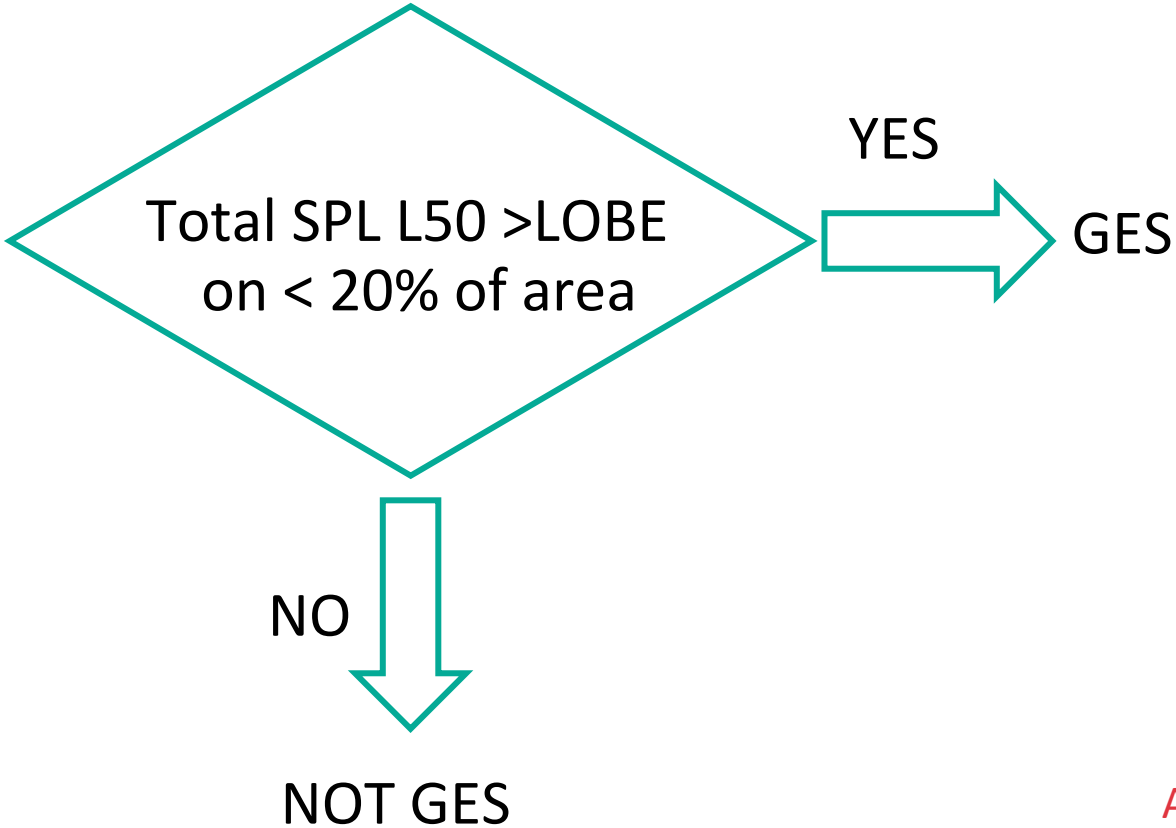
GES CRITERIUM 1 (DISTURBANCE)



$$\text{Median Total SPL} = \text{Natural} + \text{Anthropogenic} > \text{LOBE}$$



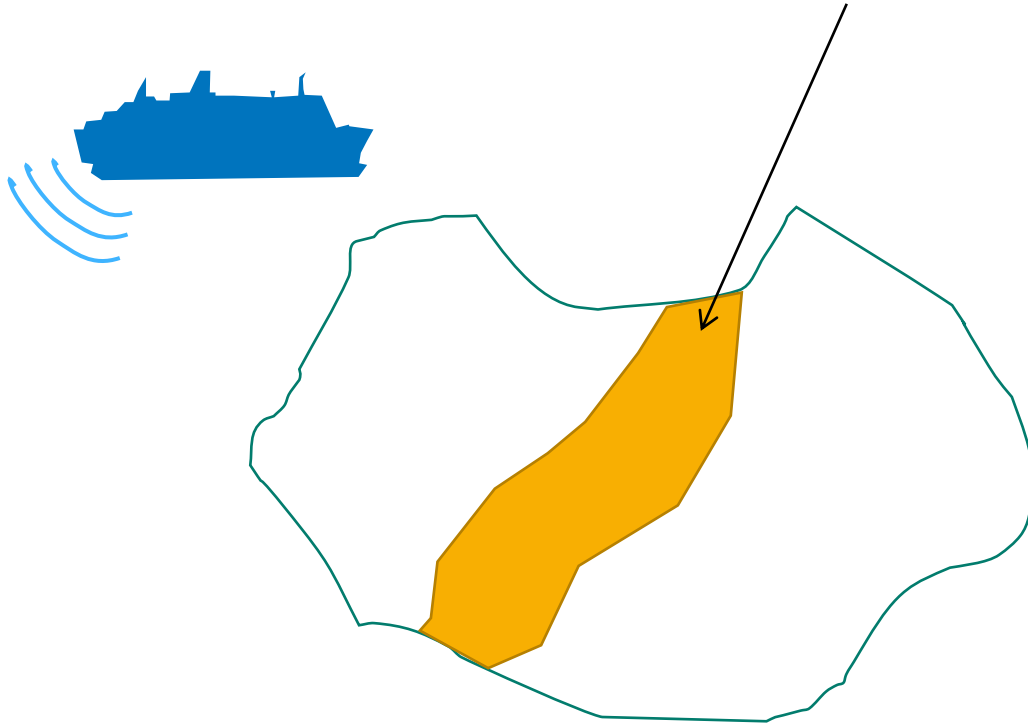
Marine Area



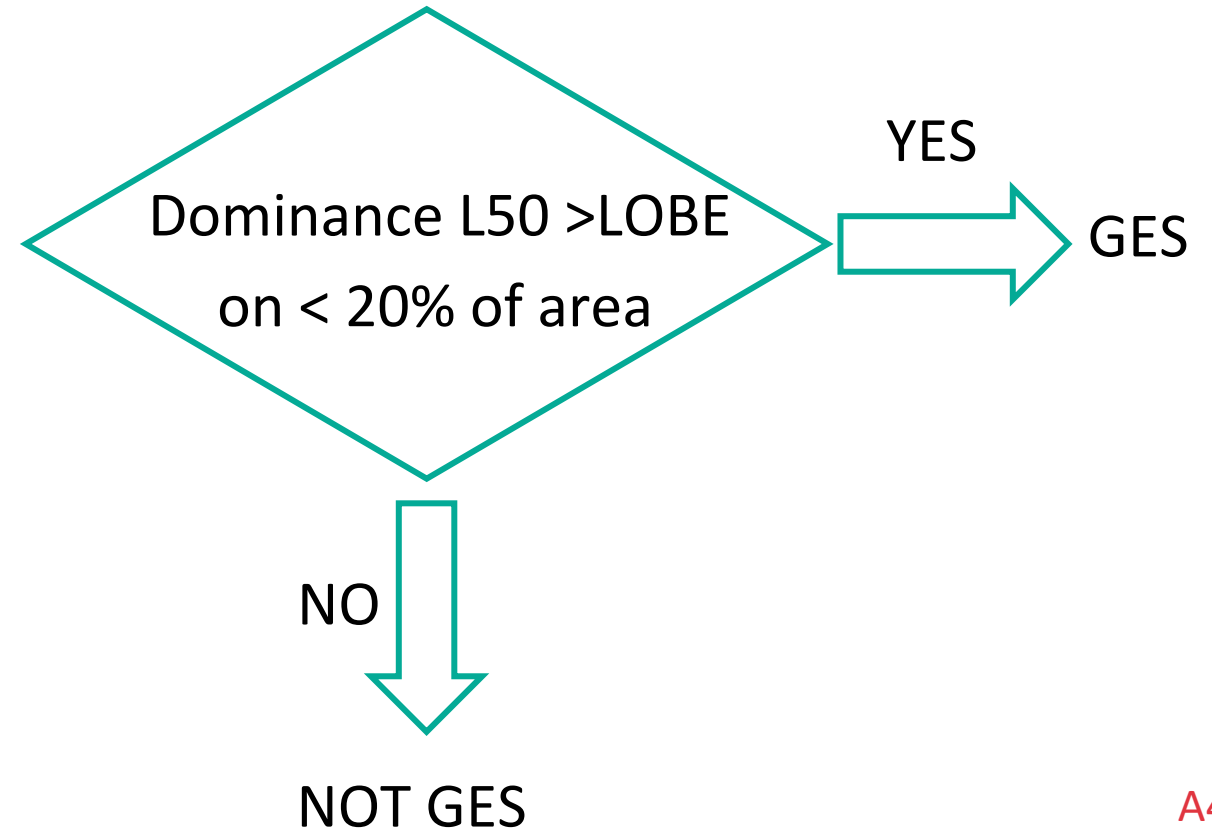
GES CRITERIUM 2 (MASKING)



Median Excess Level (dominance) > LOBE



Marine Area



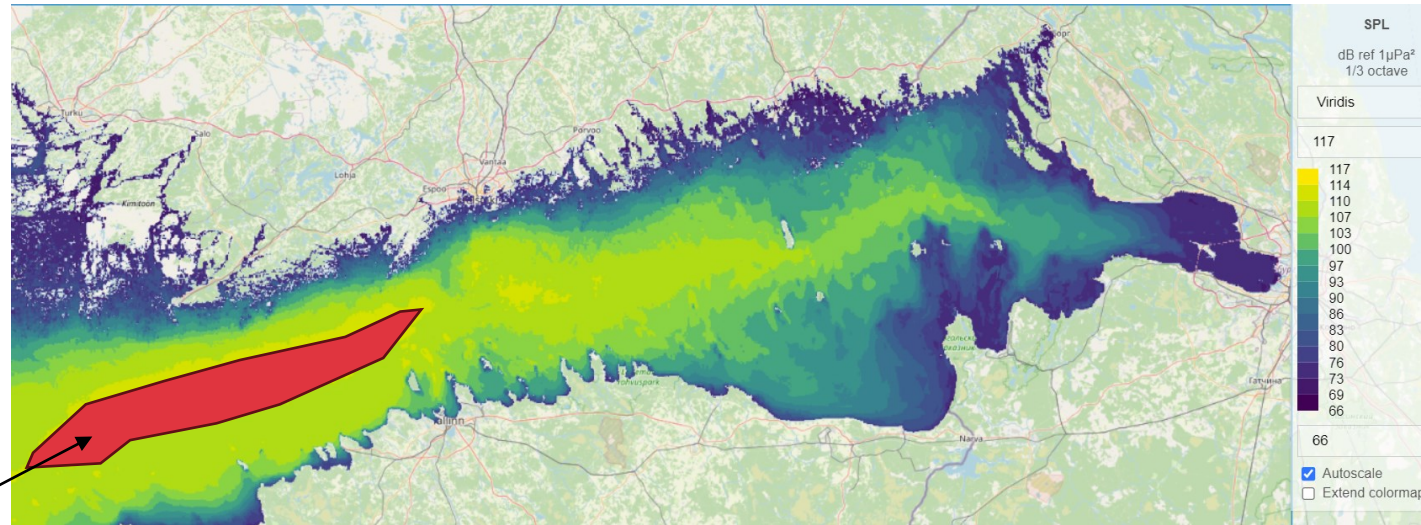
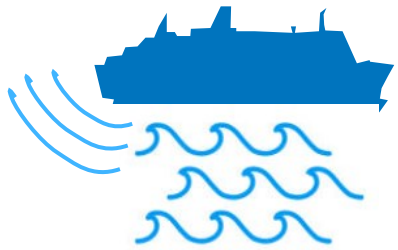


Decidecade 125 Hz, March 2018

GES CRITERIUM 1 (DISTURBANCE)



Median SPL



Median SPL > LOBE



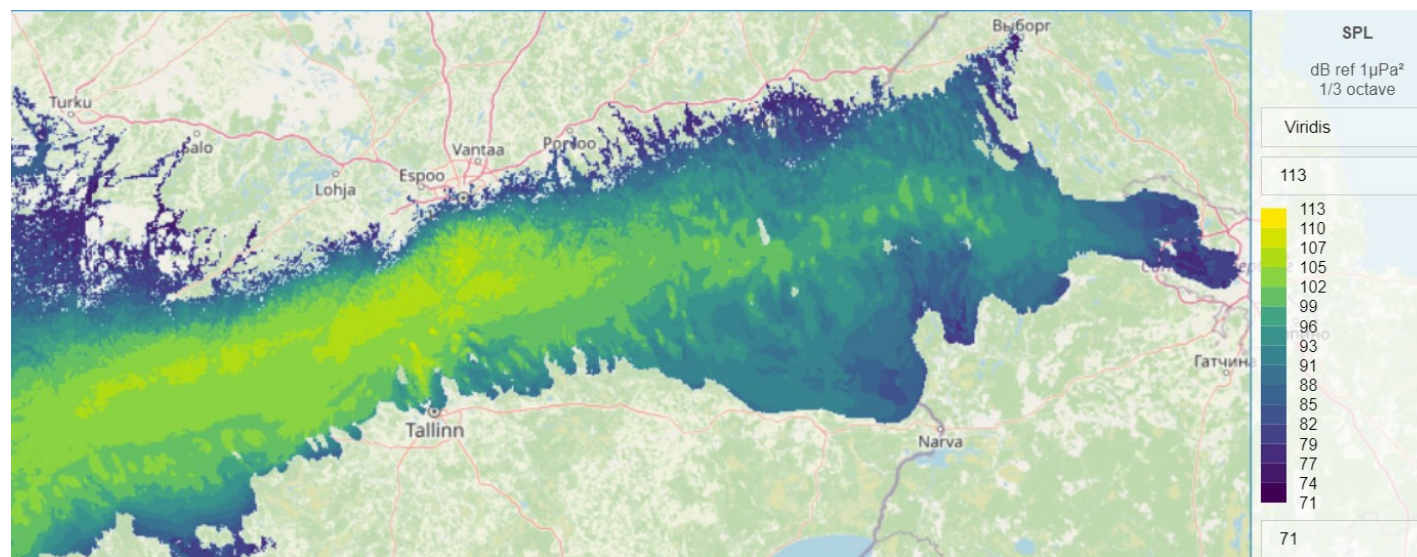
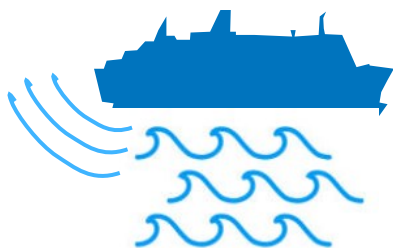


Decidecade 500 Hz, March 2018

GES CRITERIUM 1 (DISTURBANCE)



Median SPL



Median SPL < LOBE

A4



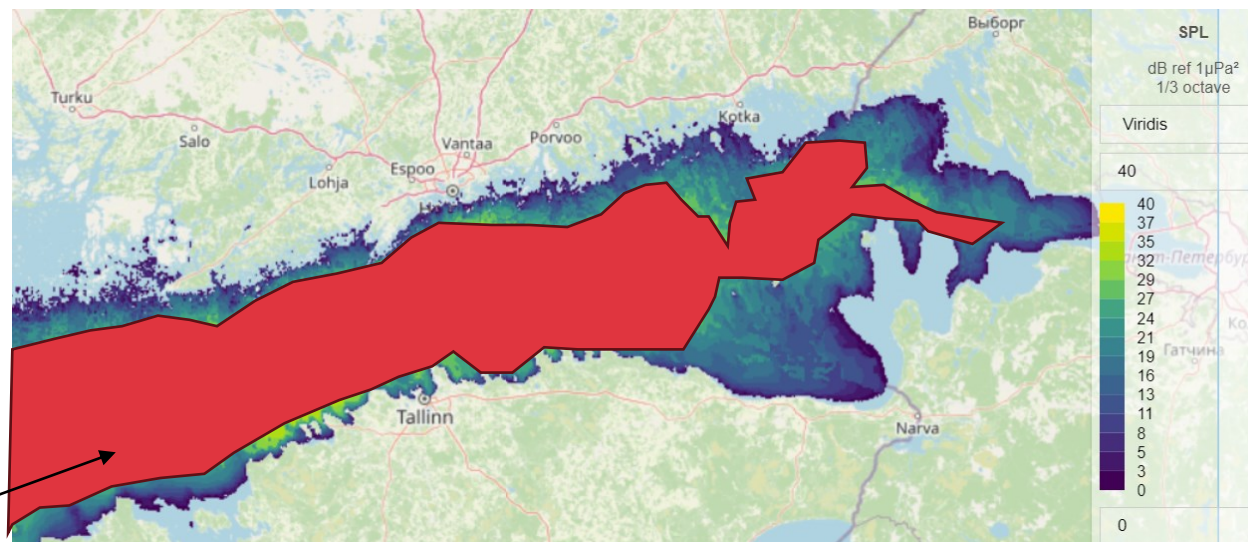


Decidecade 125 Hz, March 2018

GES CRITERIUM 2 (MASKING)



Median SPL



Median SPL > LOBE

A4



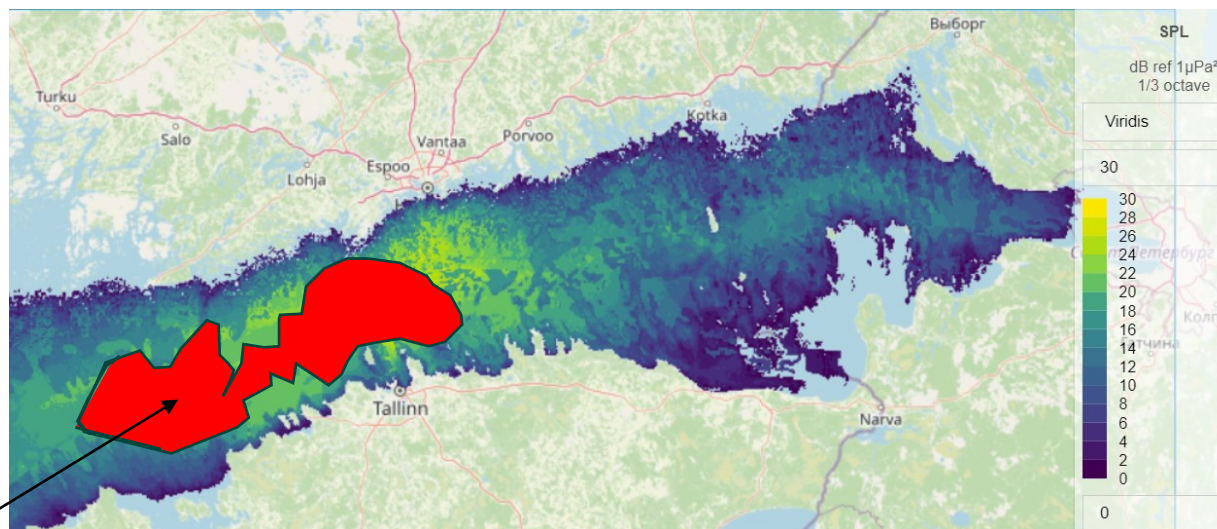


Decidecade 500 Hz, March 2018

GES CRITERIUM 2 (MASKING)



Median SPL



Median SPL > LOBE

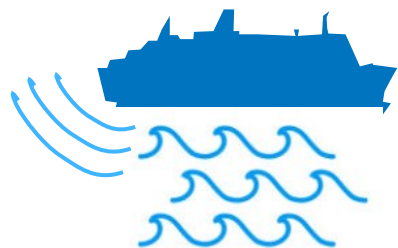
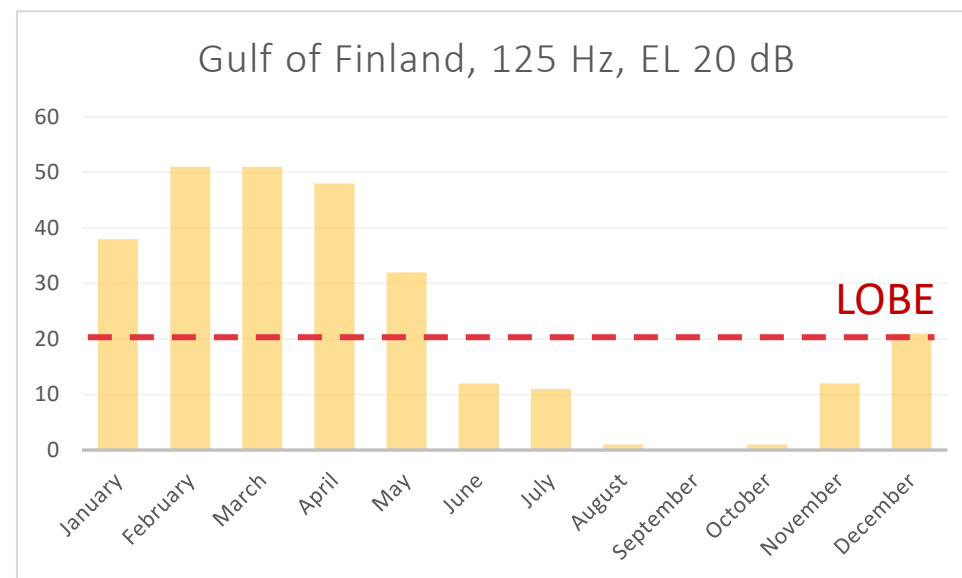
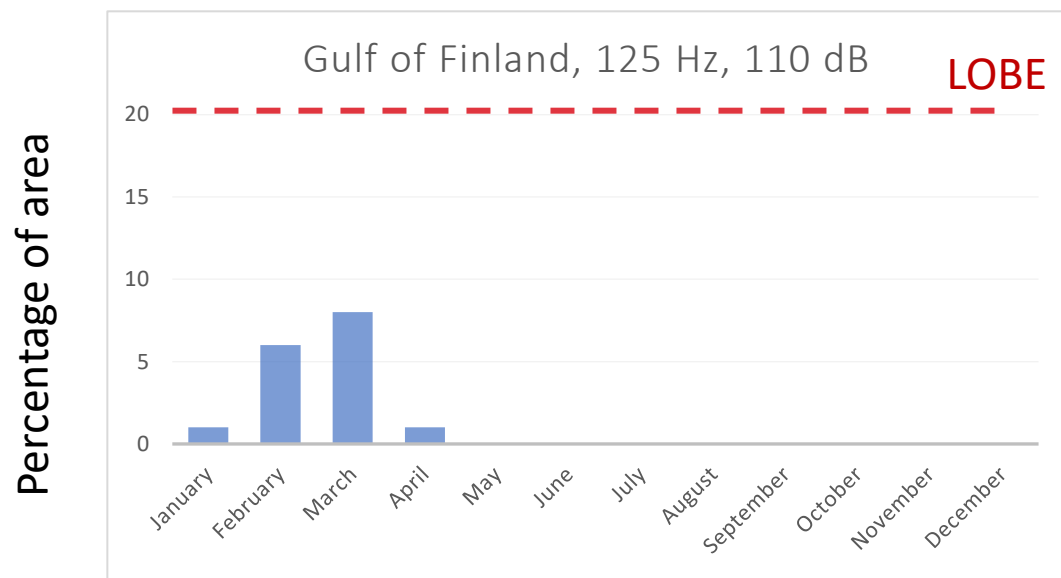
A4





GES CRITERIUM 1 (DISTURBANCE)

GES CRITERIUM 2 (MASKING)

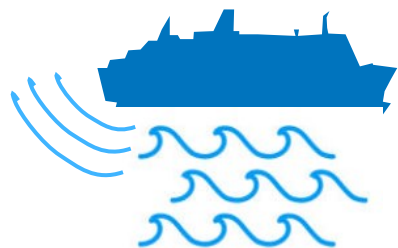
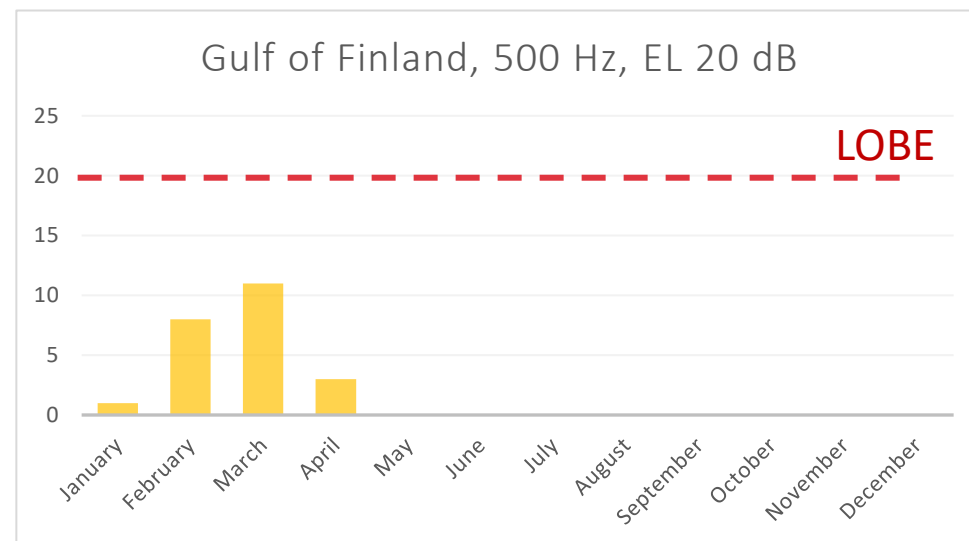
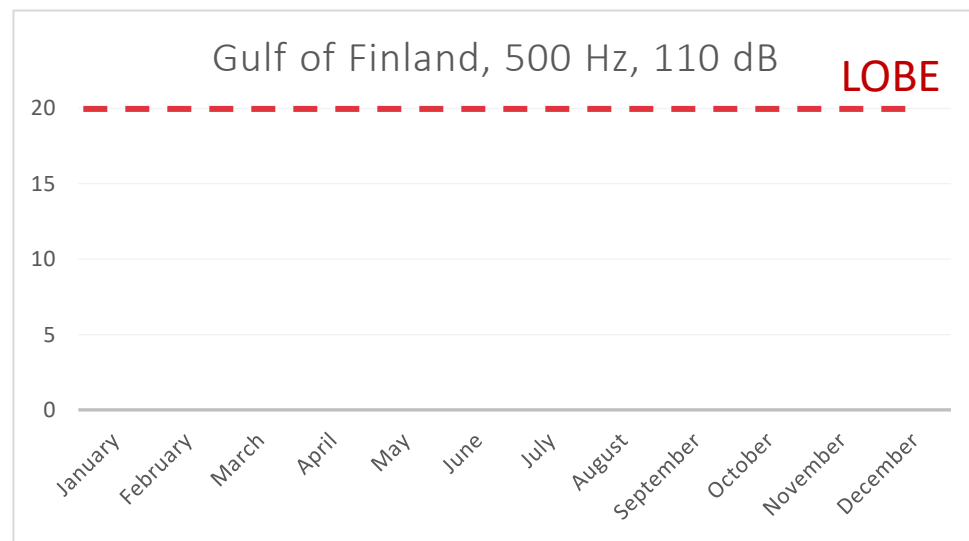


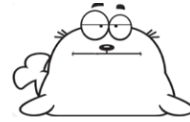


GES CRITERIUM 1 (DISTURBANCE)

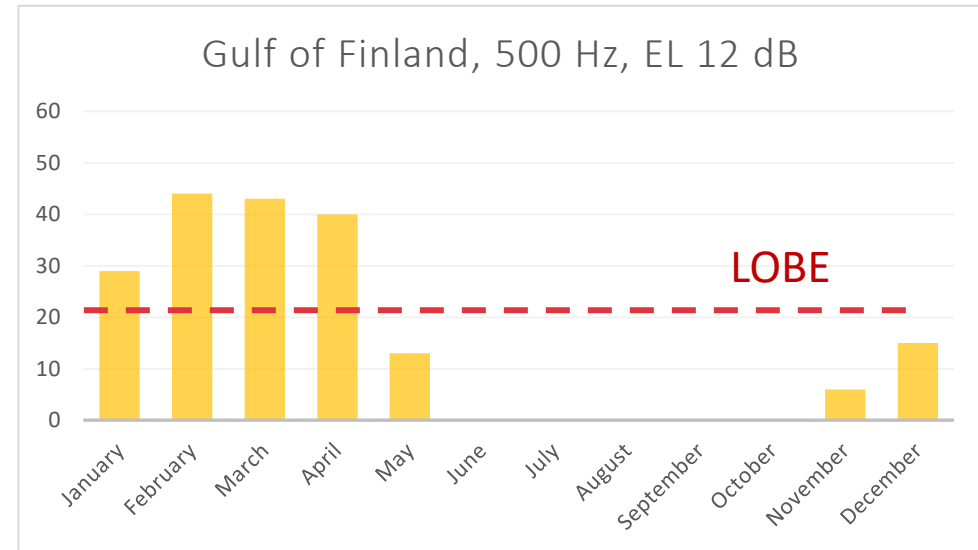
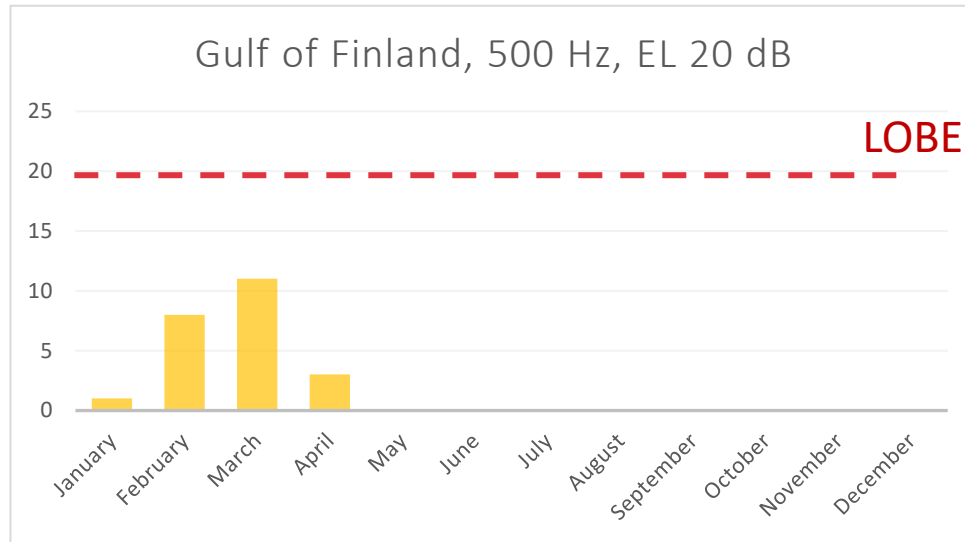
GES CRITERIUM 2 (MASKING)

Percentage of area



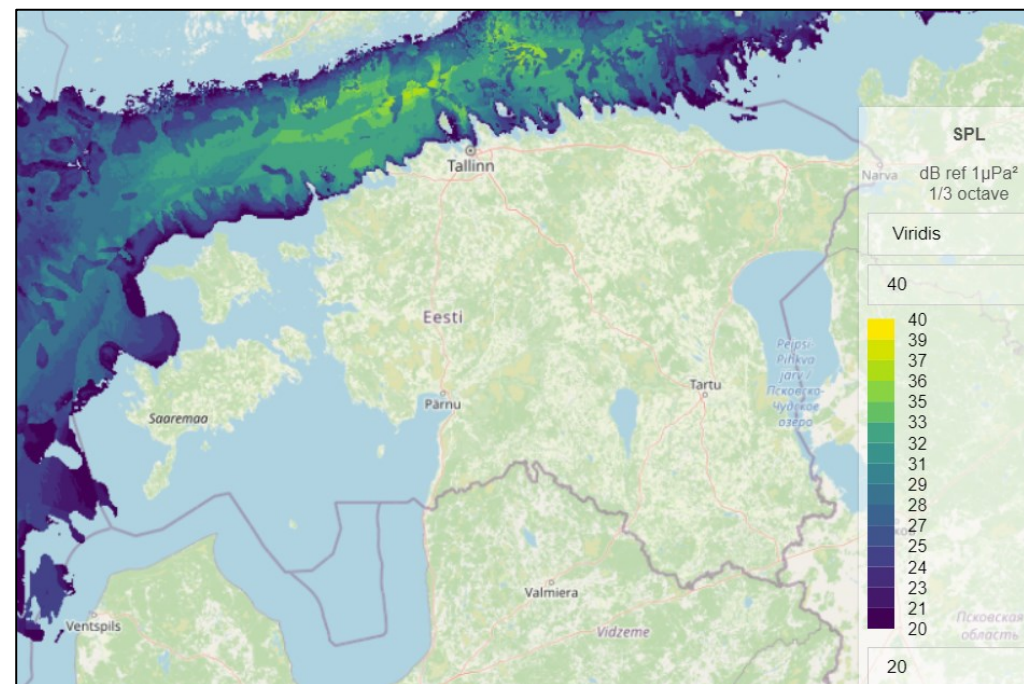
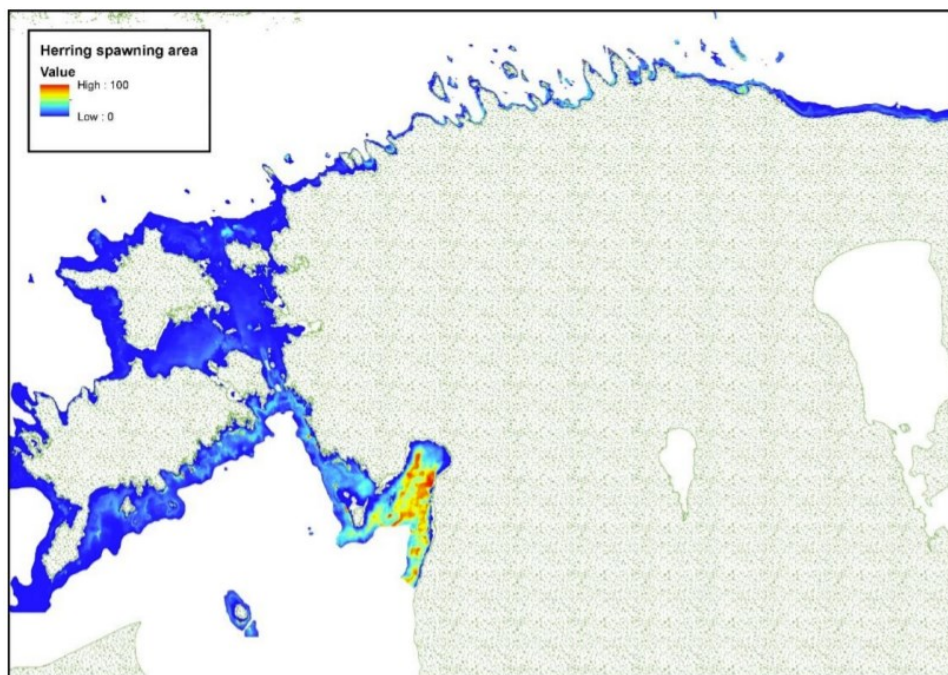


GES CRITERIUM 2 (MASKING). Excess Level 20 dB vs 12 dB





Noise exposure in Baltic herring spawning grounds (Estonia)



Baltic herring spawning grounds in Estonian EEZ
[Aps et al., 2019]

Median Excess Level (>20 dB), March 2018, 125 Hz ddec





Assessment of the continuous noise indicator

#	Subbasins (MRU-s)	125 Hz ddec		500 Hz ddec	
		Fish*		Marine mammals	
		SPL 110 dB	dom. 20 dB	SPL 110 dB**	dom. 20 dB***
1	Gulf of Finland	Green	Yellow	Blue	Green
2	Gulf of Riga	Blue	Blue	Blue	Blue
3	Northern Baltic Proper	Green	Orange	Blue	Blue
4	Aland Sea	Blue	Green	Blue	Blue
5	Bothnian Sea	Blue	Blue	Blue	Blue
6	The Quark	Blue	Blue	Blue	Blue
7	Bothnian Bay	Blue	Blue	Blue	Blue
8	Western Gotland Basin	Blue	Orange	Blue	Blue
9	Eastern Gotland Basin	Blue	Orange	Blue	Blue
10	Gdansk Basin	Blue	Yellow	Blue	Blue
11	Bornholm Basin	Blue	Yellow	Blue	Blue
12	Arkona Basin	Green	Yellow	Blue	Green
13	The Sound	Blue	Green	Blue	Blue
14	Bay of Meklenburg	Blue	Yellow	Blue	Blue
15	Kiel Bay	Blue	Green	Blue	Blue
16	Great Belt	Blue	Green	Blue	Blue
17	Kattegat	Green	Yellow	Blue	Blue

Environmental status	Fraction of MRU exposed
Pristine	0 -5%
In GES	6-20%
Below GES	21- 40%
Moderate	41-60%
Poor	61-80%



Conclusions



- Current assessment was made based on TG Noise and HELCOM recommendations for LOBE values and a spatial threshold (20% or less).
- The Baltic Sea marine mammals (seals and porpoises) are more sensitive to higher frequency sound (500 Hz), which do not propagate as far as indicator frequency sound (63 and 125 Hz) and do not reach the spatial threshold.
- Baltic herring spawn in shallow coastal waters where they are unaffected by low-frequency sound, while cod spawn in deep water and may be affected.
- The consequences of disturbing fish outside spawning areas are not clear, especially when compared to the consequences of fishing pressure.





Activity 4:
A4 – Support for and harmonisation of regional work on Descriptor 11 (underwater noise)



Thank you!



BLUES



Co-funded by the
European Union

**TAL
TECH**



HELCOM