

Monitoring Continuous Underwater Radiated Noise (URN) in Europe: A Retrospective and Predictive Approach

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Actions at EU level to reduce URN



European Green Deal



Sustainable & Smart Mobility Strategy



Zero Pollution Action Plan

EU Marine Strategy Framework Directive

- Development of Marine Strategies
- Reporting on Good Environmental Status



- 11 overall Descriptors: one includes URN
- Introduction of LOBE (Level of Onset of Biological Effects) concept and associated Threshold Values

Summary of TVs for continuous sound

The spatial distribution, temporal extent and levels of anthropogenic continuous low-frequency sound do not exceed levels that adversely affect populations of marine animals.

- ✓ No more than 20% of a given marine area, can be exposed to continuous underwater noise higher than LOBE over a year

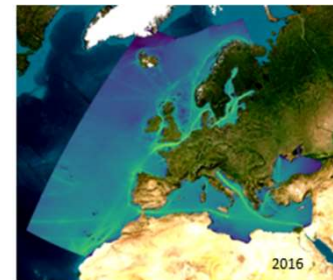
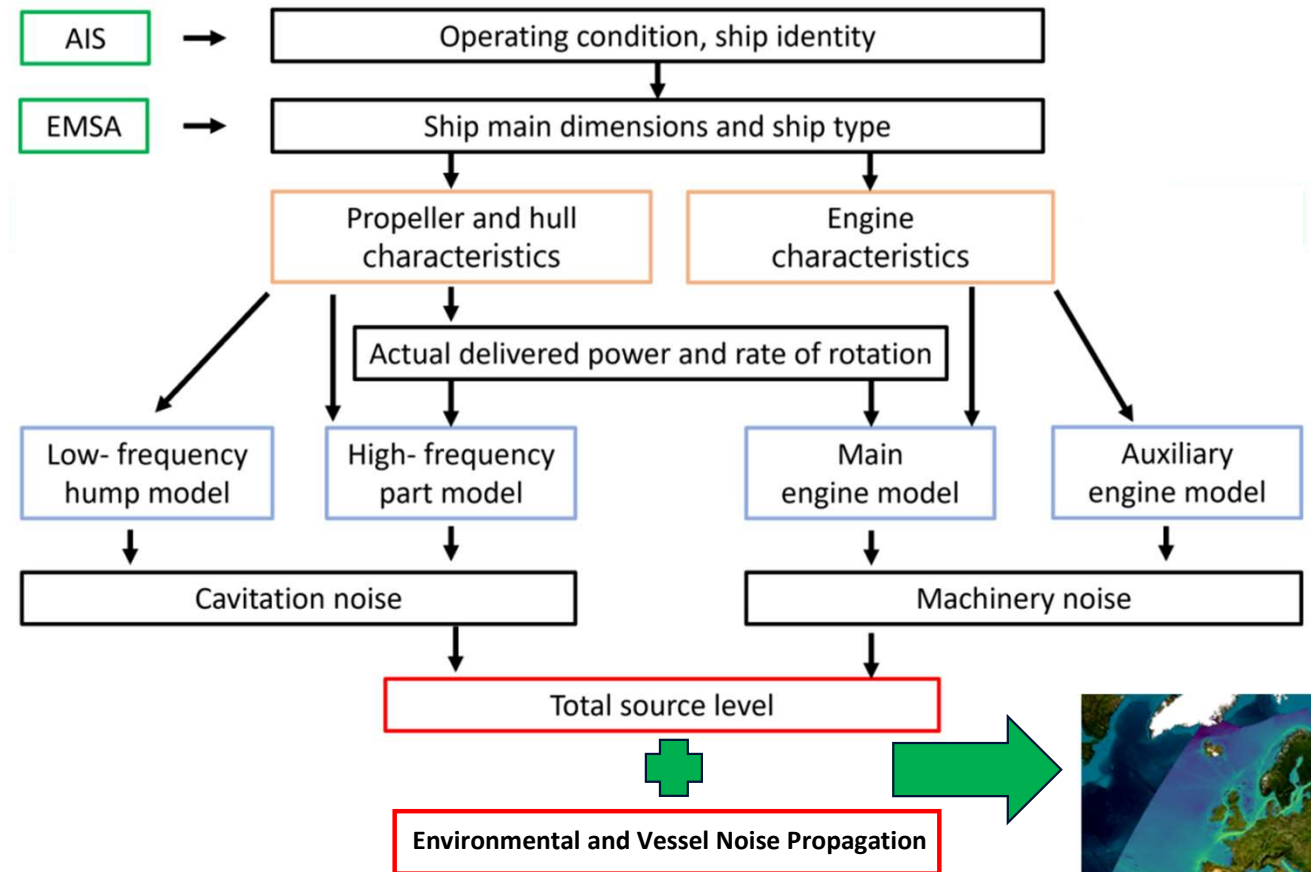
NAVISION Project



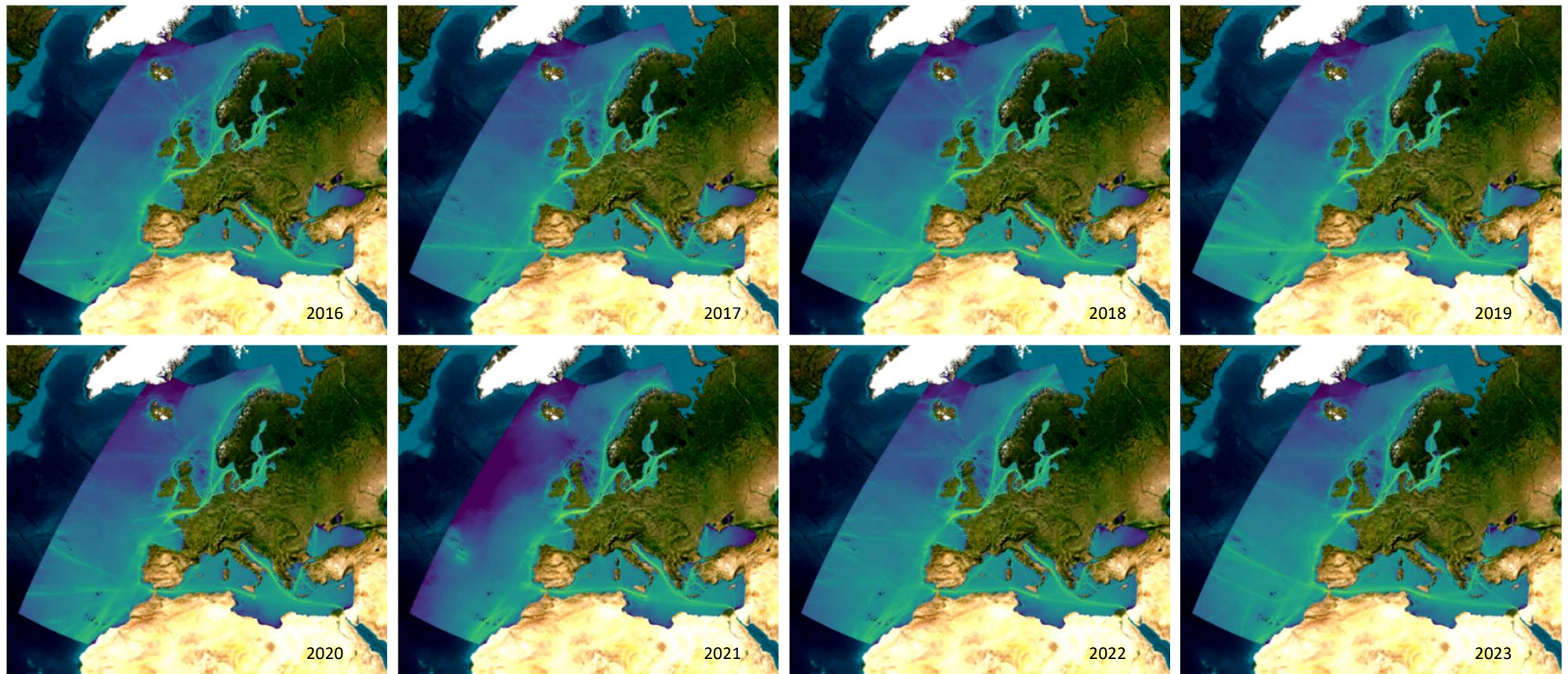
- Where are the noisiest and quietest spots in all European seas?
- Which EU region has the greatest sound energy density?
- How do environmental parameters affect the URN sound maps?
- What non-environmental factors are responsible for temporal changes in the URN sound maps?
- What is the absolute and relative contribution of different vessel categories to URN in all European seas?
- Can we predict how Greenhouse Gas and URN mitigation measures may impact URN in all European seas (per different vessel categories) up to 2050?

Hindcast Soundscape maps (and data)

- Per **YEAR**: 2016-2023
- Per **REGION**: EU, Baltic, Black, Med, NE-Atlantic, North Seas
- Per **SHIP TYPE**: All, Cargo, Containers, Passengers, Ro-Ro, Tankers
- Per **FREQUENCY**: 63Hz, 125Hz
- Total of **576 COMBINATIONS**: 8 years*6 regions*6 ship types*2 frequencies



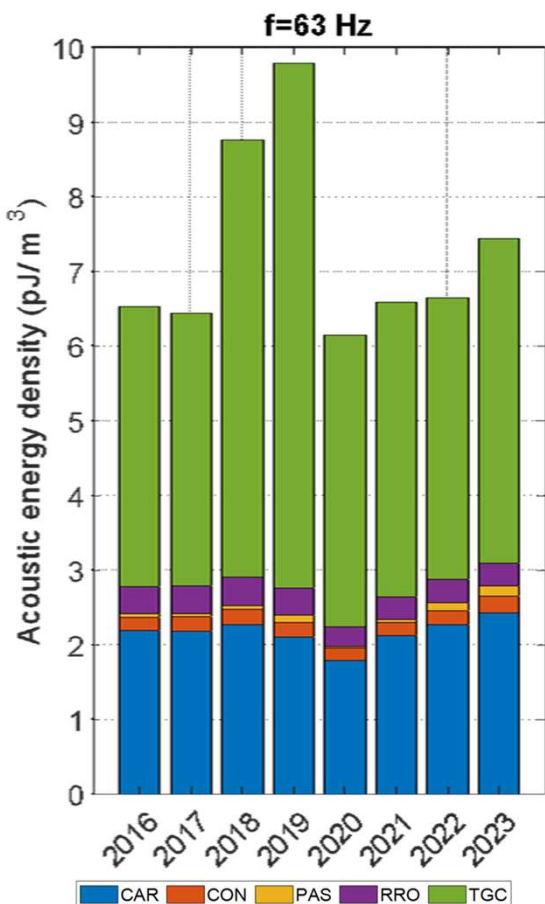
NAVISION – Results at EU level



- NAVISON soundscape maps at 63 Hz
- All Europe
- All Ship Types
- Yearly average

NAVISON – Results at EU level

Hindcast Soundscapes



The **CARGO** vessel category exhibits the second-largest contribution, ranging from 21.5 to 34.2 %.

At 63 Hz, the **TANKER** vessels have the largest contribution to sound energy density, with their contribution between 56.7 and 71.8 %.

Year	63 Hz				
	CAR	CON	PAS	RRO	TGC
2016	33.54%	2.79%	0.69%	5.53%	57.45%
2017	33.85%	3.02%	0.75%	5.70%	56.69%
2018	25.89%	2.35%	0.63%	4.30%	66.82%
2019	21.54%	2.02%	0.94%	3.73%	71.77%
2020	29.24%	2.64%	0.37%	4.26%	63.49%
2021	32.24%	2.75%	0.47%	4.65%	59.89%
2022	34.16%	2.80%	1.62%	4.71%	56.71%
2023	32.72%	2.94%	1.88%	4.02%	58.45%

We quantify the percentage contribution of each ship type (per year and per region)

We can use sound energy density to analyse the content of the soundscape maps ⁷

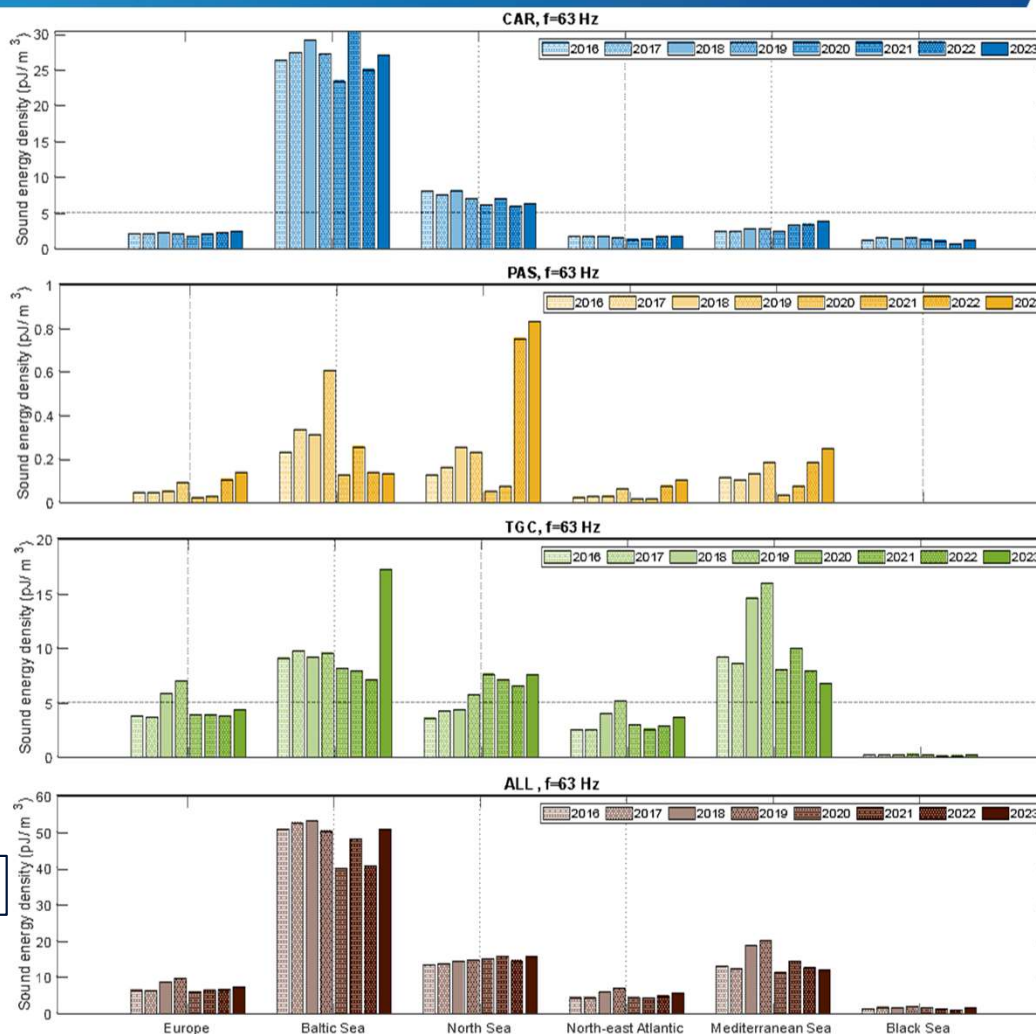
NAVISION – Results at Regional level



Hindcast Soundscapes

We can analyse the sound energy density to evaluate the impact of ship types within different the EU seas, throughout 2016-2023

Important: Note different y-axis values!



Cargo

Cruise/Passenger

Tankers

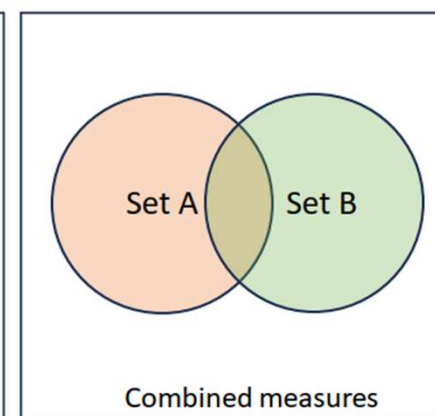
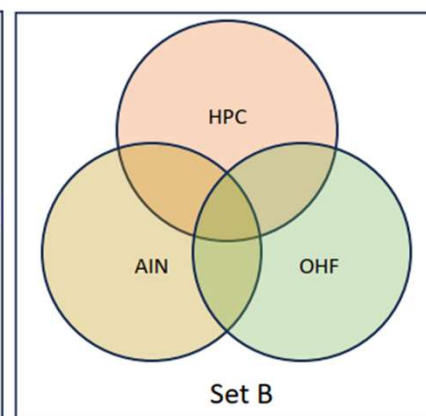
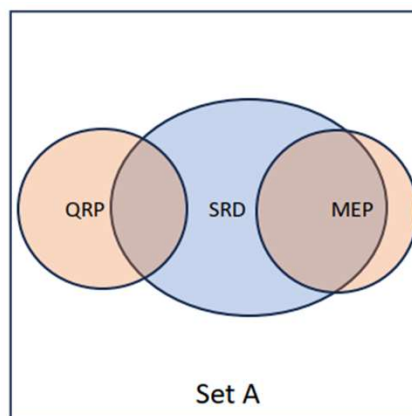
All Ship Types

Forecast Soundscape maps (and data)



- Per **YEAR**: 2030, 2040, 2050
- Per **REGION**: EU, Baltic, Black, Med, NE-Atlantic, North Seas
- Per **SHIP TYPE**: All, Cargo, Containers, Passengers, Ro-Ro, Tankers
- Per **SCENARIO**: Business As Usual (BAU), Greenhouse Gas (GHG), Underwater Radiated Noise (URN), Combination of GHG and URN (U&G)
- Per **FREQUENCY**: 63Hz
- Total of **432 COMBINATIONS**: 3 years*6 regions*6 ship types*4 scenarios*1 frequency

Measure name	Measure code	Category	Type	Main stakeholder group(s)	2022	2030	2040	2050	Cavitation	Machinery
Speed reduction	SRD	GHG/URN	Operational	Regulatory bodies	*	✓	✓	✓	✓	✓
Hull and propeller cleaning	HPC	GHG	Operational	Ship operators	*	✓	✓	✓	✓	✓
More efficient propeller	MEP	GHG	Technical	Propeller designers	*	✓	✓	*	✓	✓
Optimised hull form	OHF	GHG	Technical	Ship builders/naval architects	*	*	✓	✓	✓	✓
Air injection (for propeller and machinery noise)	AIN	URN	Technical	Equipment manufacturers/ship builders	*	*	✓	✓	✓	✓
Quieter propeller	QRP	URN	Technical	Propeller designers	*	*	✓	✓	✓	*



NAVISON – Results at EU level

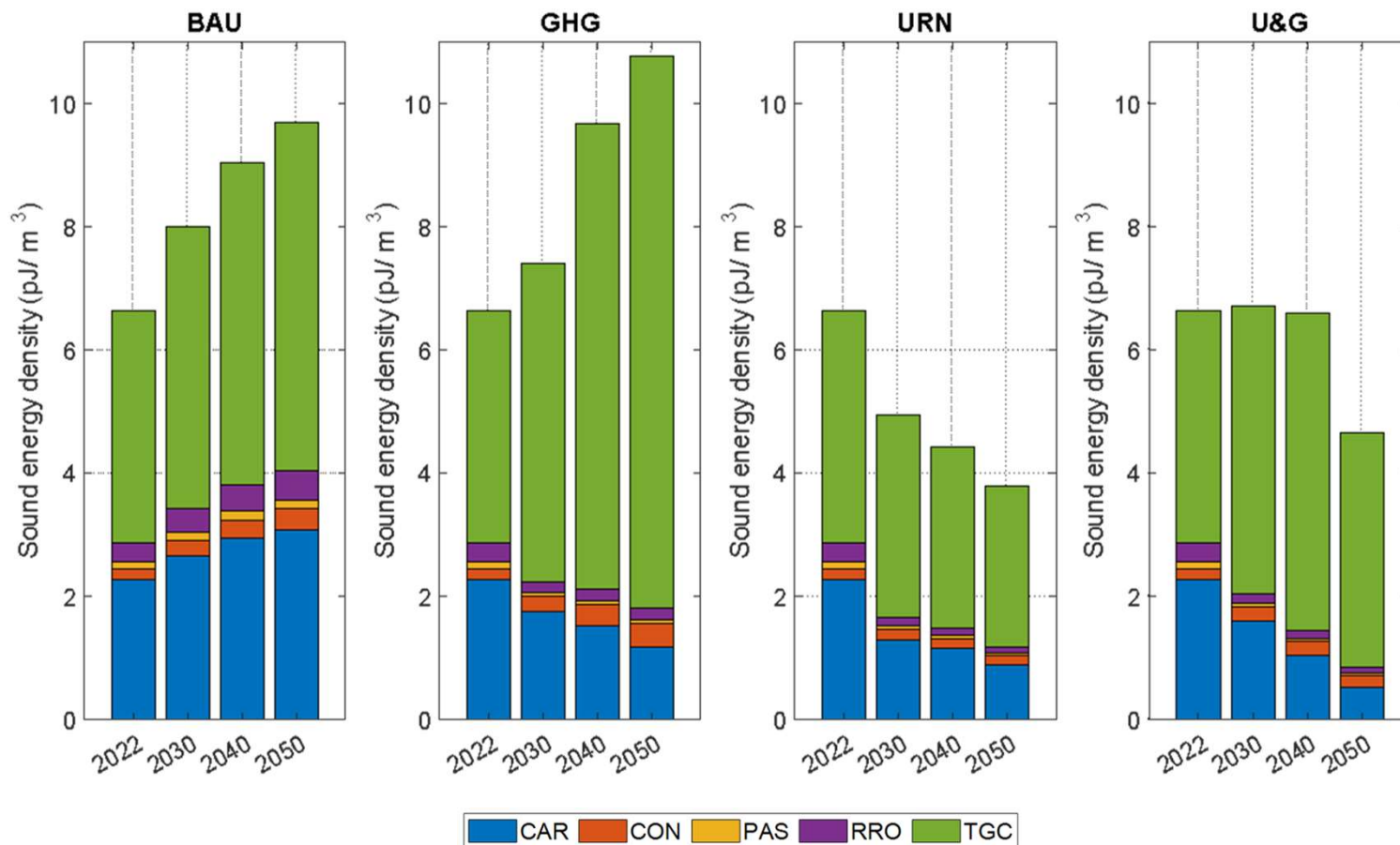


Difference between BAU and mitigated forecast sound map layers

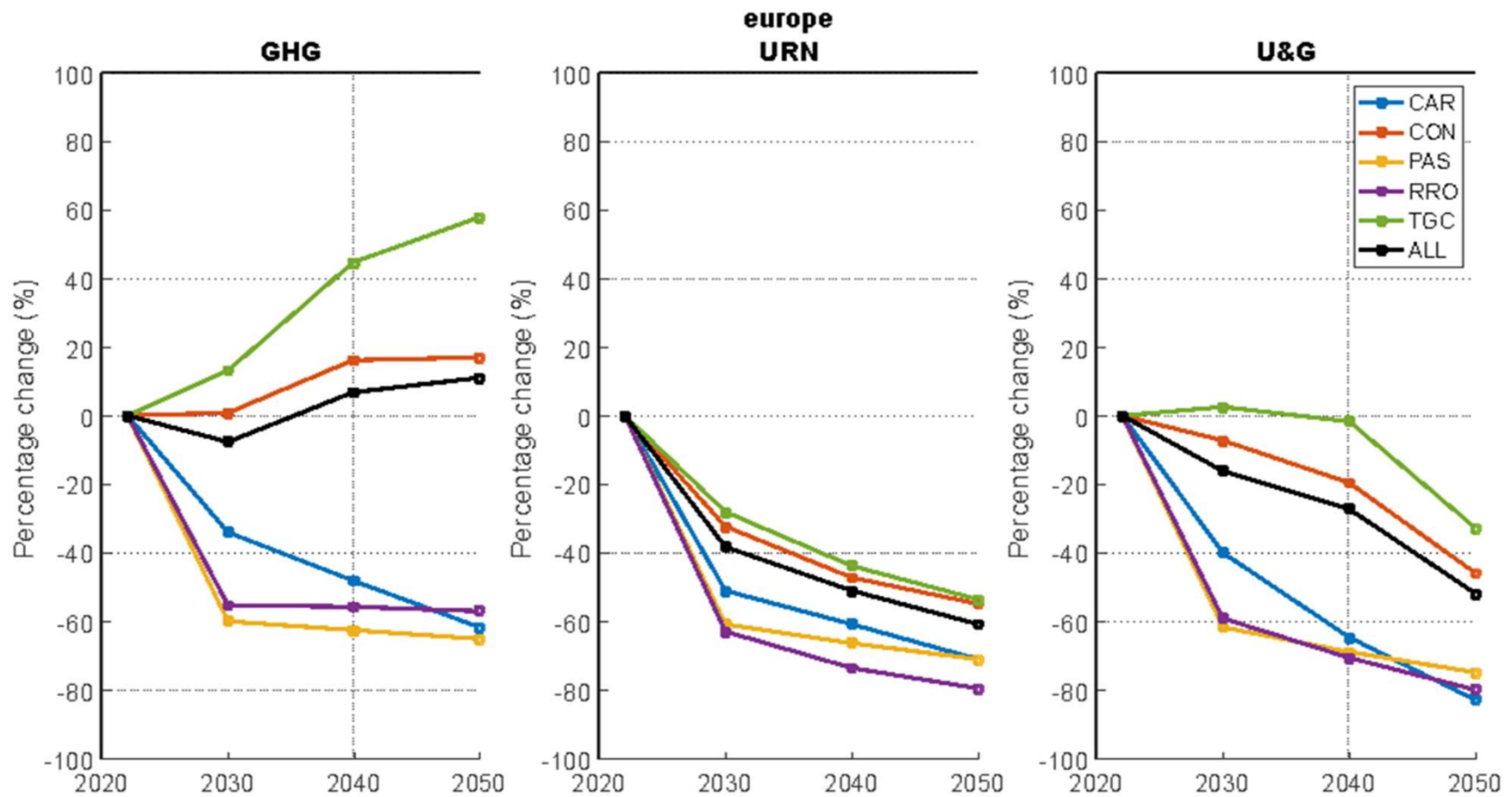


NAVISON – Results at EU level

Forecast Soundscapes



NAVISON – Results at EU level



The mitigation performance of each vessel category as quantified based on the percentage changes relative to the BAU scenario ¹²

Conclusions

- **Availability of first EU comparative URN dataset for MS.**
 - Identify high priority regions and ship types.
- **Availability of first EU URN foresight dataset, integrating both GHG & URN scenarios.**
 - Evaluate impact and prioritise effective mitigation measures.
- **IMO Guidelines Experience Building Phase.**
 - Share information, knowledge and experience with all stakeholders.

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