



SATURN: Developing Solutions to Underwater Noise

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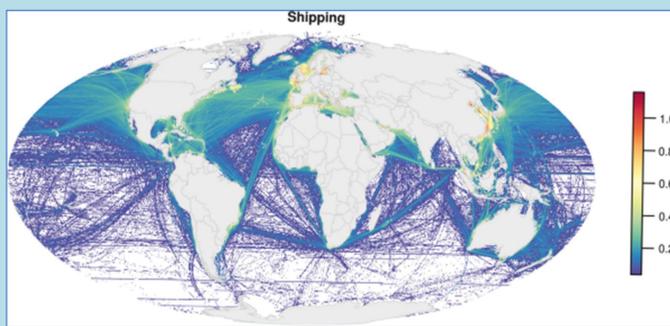
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² <https://www.saturnh2020.eu/>

Underwater radiated noise from shipping and other human activities, is a complex global issue that requires a transdisciplinary approach. SATURN is a Horizon 2020-funded project that began on 1st February 2021 and which brings together leading experts in bioacoustics; population biology; marine mammal, fish and invertebrate biology; maritime architecture and engineering; shipping; maritime policy; stakeholder engagement and science communication, to work with unity of purpose and clarity of intent to identify:

- a. The sounds that are most detrimental to aquatic species and how they are produced and propagated.
- b. The short-term and cumulative long-term negative impacts of noise from shipping and boats on three representative groups of aquatic species in rivers and the sea (invertebrates, fish and marine mammals).
- c. The most promising options for measuring and reducing the negative impacts of ship noise that can be applied to current and future vessels.

SATURN will develop and contribute to the establishment of terminology and methodology standards to be used across all disciplines working on underwater radiated noise. These standards will underpin the proposed research. The consortium will create and nurture an effective community of researchers, practitioners, competent authorities, maritime operators, shipping/offshore/naval industries and NGOs that will work closely with the project to ensure that outputs are tailored to the needs of all stakeholders thus maximising their uptake and application. SATURN proposes to confront the complex global issue of underwater radiated noise in a truly inclusive, transdisciplinary way that will ensure that the interests and knowledge of all stakeholders and the environment are represented.



Halpern et al. (2015) Spatial and temporal changes in cumulative human impacts on the world's ocean. Nature Communications 6: 7615.

What is Underwater Radiated Noise (URN)?

The shipping industry is an important mainstay of the EU economy, directly employing 640,000 people and contributing €57 billion to the European GDP in 2015. International maritime trade has doubled over the past two decades from 30,000 to 60,000 billion cargo tonne-miles, and is projected to continue increasing at up to 3.5% annually. One cost of such growth is the increase in noise pollution in the form of Underwater Radiated Noise (URN). URN is produced by all types of vessels, from large ships that generally emit low frequency acoustic energy (<10kHz), to smaller recreational vessels that emit higher frequency sound (10-100kHz) in shallower coastal areas

or in rivers and lakes. Consequently, all aquatic species are potentially at risk of exposure.

The majority of aquatic species use sound for vital life functions such as communication, foraging, and avoiding predators. Unfortunately, the sounds made by human activities at sea can interfere with the ability of organisms to carry out these vital life functions. Underwater radiated noise from shipping and other vessels can disrupt and cause changes in anatomy, development, behaviour, and physiological stress levels in mammals, fish, reptiles, and invertebrates — effects which can sometimes be lethal.

These impacts are increasingly apparent at the ecosystem level, with implications for protected areas and species, food security, and the blue economy. For example, fisheries may be at risk where the abundance and behaviour of fish leads to reduced catches, and declines in charismatic megafauna such as marine mammals could affect the growth of ecotourism.

Thankfully, there are a number of ways we can reduce URN, including slowing down ships, rerouting shipping lanes to avoid sensitive areas, and implementing sound mitigation technologies on vessels.

WHAT WILL SATURN DELIVER?

Develop Standards & Methods

SATURN will define standards for terminology, methodology, tools and metrics to measure, assess, and compare the impacts of noise from shipping and boats. This includes spatially mapping particle motion, quantifying underwater radiated noise (URN) in shallow water, and defining standards for sound exposure experiments to ensure lab results can be translated to field populations.



Quantify Ship Underwater Radiated Noise

Quantifying the URN from individual vessels is an essential first step towards quantifying the dose and frequency range of noise to which animals can be exposed. Although the technology for measuring and predicting URN from naval platforms and research vessels is well developed, its application to other vessel types needs to be better understood.



Quantify Sound Exposure

URN from ships and boats propagates through the underwater environment to locations where animals are exposed to it. Quantifying sound exposure will involve the use of state-of-the-art miniature tags attached to marine mammals, which will, in combination with advanced modelling, give us a better understanding of where, when, and how wild animals are exposed to ship noise. Innovative methods are being developed to better understand effects on fish and invertebrate spp.



Quantify Individual & Population-level Responses

Standards, methods, and standardized test signals will be used within SATURN to assess the impact of URN on representative aquatic species, including invertebrates, migratory fish, and three species of marine mammals. Both acute and cumulative effects will be measured

Develop and Assess Mitigation Solutions

Having identified the most harmful aspects of the source level of ship and vessel sound, we will evaluate which of the existing and novel solutions are the most feasible and effective to mitigate these effects. The benefits and costs of these solutions will be weighed up and presented in terms of capital expenditures and operational expenditures.

Engage Stakeholders & Raise Awareness

SATURN will establish a stakeholder group across a range of disciplines (e.g. shipping, research, policy, and NGOs) and ensure their engagement in all stages of the project, including the development of standards and methodologies. SATURN will also continuously communicate our research and raise awareness of the issue of URN.

SATURN AND SOCIETY

SATURN's objectives align with the **UN Agenda 2030** to decouple economic development from environmental degradation. In particular, SATURN contributes to **SDG 14: Life Below Water**, which strives for careful management of the ocean as an essential global resource and key feature of a sustainable future.

At the European level, SATURN directly feeds into the European Union's

Green Deal for Europe, contributing to the transformation of the shipping industry into a zero emissions mode of transport. Our aim is to assess mitigation measures that curb underwater noise while contributing to resource-efficient and safe transport. By developing innovative solutions to mitigate noise, and strong policy recommendations, SATURN aims to make the European shipping industry more competitive and quieter at the same time.

The project goals also include a strong emphasis on demonstrating and assessing solutions, not just reaching proof-of-concept or performing unapplied fundamental research. At all stages, participants are aware that their work will be used and applied by practitioners from distinct disciplines and that the goal is to benefit the citizens and ecosystems of Europe.