

**PAME II-2019: Agenda 6.5(a)**  
**DRAFT Statement of Work**  
**Developing Acoustic Intensity Maps for Shipping in the Circumpolar Arctic**

This Statement of Work outlines the scope, timelines and deliverables for a specific segment of work - underwater noise mapping - as part of the 2019-21 PAME project: *Underwater Noise in the Arctic – Understanding Impacts and Mitigation Strategy Options*.

**Project Background and Summary**

As summer sea ice retreats in the Arctic, new shipping routes are becoming available and more accessible. Furthermore, as the demand for resources continues to grow, new development opportunities arise in the Arctic with new stresses that, if not properly managed, could put ecosystems and cultures at risk. The resulting increase in shipping brings a variety of benefits and impacts; understanding and mitigating the risks, while ensuring benefits to people in the north, is critical.

Sound levels in the Arctic are relatively lower than in non-polar regions. However, levels are projected to rise in the coming decades. Declines in sea ice extent, thickness and duration, and increases in human activity – in particular shipping, resource exploration and development, construction and other industrial activities – will contribute to a louder, busier Arctic. In absolute terms, the Arctic is likely to remain quieter than many regions around the world where activity is particularly intense, but the relative change may be dramatic.

The Arctic is a special case for underwater noise:

- Any significant introduction of noise in the Arctic is likely to have a greater impact than in a region where the levels are already consistently high. Indeed, Arctic marine species are not acclimated to noisy environments and therefore may be disproportionately affected by even modest noise increases;
- There are novel noise sources that are particular to the Arctic such as ice formation and break-up, as well as anthropogenic noise associated with ice breaking activity;
- Sound travels differently in Arctic waters - over much greater distances and at shallower depths than in non-Arctic waters; and
- Most importantly, the culture and livelihoods of Arctic Indigenous Peoples depend on the continued health of living marine resources. Noise impacts affecting these species will be immediately felt in these communities.

Internationally, work is either being advocated for or currently underway in numerous fora to better understand and mitigate the impacts of underwater noise, including at the International Maritime Organization (IMO), the International Whaling Commission (IWC) and at the United Nations (UN) more generally. Accordingly, given its mandate to address marine policy measures, PAME has a valuable role to play in providing insight and information to these and other fora.

The *Underwater Noise in the Arctic – Understanding Impacts and Mitigation Strategy Options* project for 2019-2021 is designed as an adaptable and multi-phased project, with a scope that will focus on coordinating and collaborating with other Arctic Council working groups (e.g., CAFF) to assemble and integrate existing information about shipping patterns in the Arctic, estimating and mapping vessel noise levels as well as areas of ecological and cultural overlap, and ultimately identifying possible mitigation strategy options.

### **Project Objectives (2019-21):**

Using information from the PAME Arctic Ship Tracking Data (ASTD) project, and in collaboration with CAFF as appropriate:

1. Obtain a better understanding of the underwater noise emissions (or ‘noiseprint’) from shipping in the Arctic.
2. Identify areas where underwater noise from shipping and areas of heightened ecological or cultural significance (as identified by the Arctic Council) overlap and pose a risk.
3. Based on the results obtained, and recognizing the limitations inherent to high-level analyses, investigate possible mitigation strategy options to reduce the impact of underwater noise incidentally generated by shipping in the Arctic. Expert input and traditional and local knowledge will be used to inform any such options.

### **Project Scope**

This project will follow on and utilize information from, *inter alia*, PAME’s Arctic Marine Shipping Assessment (2009)<sup>1</sup>, AMAP/CAFF/SDWG’s report to identify Arctic marine areas of heightened ecological and cultural significance (2013)<sup>2</sup>, and State of Knowledge Report on underwater noise in the Arctic (2019)<sup>3</sup>. Geographically, the project will encompass the marine environment of the Arctic (as defined by CAFF) and focus on noise incidentally generated by ships.

### **Acoustic Intensity Mapping in the Circumpolar Arctic**

To address objectives 1 and 2 of this project, a spatial analysis will be completed of noise emissions incidentally generated by ships in the Arctic. Being technical in nature, this work will be contracted to a specialist in the field of acoustic modelling, with the following conditions to be met:

#### **Scope and technical considerations:**

- The work will focus on mapping vessel traffic and associated underwater noise from 2013 to 2019.
- Ship tracks will be mapped year-round and seasonally [***to be discussed with potential contractors***], using AIS data from the PAME ASTD (Arctic Shipping Traffic Database) project.
- Noise outputs [***to be discussed with potential contractors; monthly averaged, or time dependent, over what frequency range, etc.***] will be estimated using existing knowledge on ship noise emissions complemented as needed by other data sources available through the ASTD project (e.g. IHS Fairplay, Shipinfo, DNV-GL, ECHO program, JOMOPANS (Joint Monitoring Programme for Ambient Noise North Sea) etc). The calculations should account for different

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<sup>1</sup> <https://oaarchive.arctic-council.org/handle/11374/54>

<sup>2</sup> <https://www.caff.is/assessment-series/251-arctic-marine-areas-of-heightened-ecological-and-cultural-significance-arctic-ma>

<sup>3</sup> <https://oaarchive.arctic-council.org/handle/11374/2394>

vessel class source levels, operating conditions, and be reported both individually and cumulatively.

- Models used will be fit for purpose [*to be discussed with potential contractors: year round, seasonal or both, as well as feasibility of the entire Arctic*] in the Arctic marine environment and take into account Arctic physical oceanographic characteristics, including but not limited to ice, sediment, currents, water depth, temperature and salinity.
- Ideally the work will include calibration of the noise maps produced, at least in a small number of locations using existing field-collected hydrophone data. If this is not possible in the given time frame, the work will be designed to enable future calibration.

### **Deliverables**

- A report that determines, catalogs, and maps estimated noise emissions incidentally generated by commercial vessels in the Arctic, from 2013 to 2019.
- A series of circumpolar Arctic acoustic intensity maps from ships based on available data, which spatially and seasonally depict and estimate underwater noise from commercial shipping.
- Regional, finer scale acoustic intensity maps in areas of the Arctic that have hydrophone data which could be used in subsequent research to ground truth and calibrate the models used and maps produced. [*quantity and locations to be discussed with potential contractors*]

### **Timeline:**

An expert workshop on this project is being scoped to take place during the first half of 2020. Therefore, the aim is to have a draft report and acoustic maps completed in time for consideration at the first PAME meeting in February 2020. The report and maps would be used as the foundation for a discussion amongst Arctic States, Permanent Participants, and Observers to identify areas where underwater noise from shipping and areas of heightened ecological or cultural significance overlap (as identified by the Arctic Council).

### **Suggested Dates for Deliverables:**

- January 2020: draft report and maps presented to SEG (PAME shipping expert group) members for input and feedback.
- February 2020: Revised report and maps presented at expert workshop
- September 2020: Final report and maps completed for approval at PAME.

Please note that there are other elements of this project that will need to take place simultaneously and intersessionally (from February 2020 to February 2021).

### **Selection Process**

The successful candidate should demonstrate the following qualifications:

- Extensive technical expertise and prior published research of acoustic intensity mapping for ship traffic.
- Expertise in a range of acoustic models and their suitability and effectiveness for the Arctic environment.
- Access to physical oceanographic data for the Arctic and the ability to use PAME's Arctic Ship Traffic Database and other available information to carry out required analyses.