

Enhanced Environmental Impact Assessment for  
DY151 (SME 18/785 and 19/1086):  
“Shipping Emissions in the Arctic and North  
Atlantic Atmosphere (SEANA) Intensive”  
and  
“M-Phase: Resolving Climate Sensitivity  
Associated with Shallow Mixed Phase Cloud in  
the Oceanic Mid-to-High Latitudes”

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Chief Scientist: Zongbo Shi

Ship: RRS *Discovery*

16/05/2022 Reykjavik, Iceland – 27/06/2022 Southampton, UK

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## PURPOSE OF EIA

The purpose of this Environmental Impact Assessment (EIA) is to assess the marine environmental impacts associated with the scientific research activities during the research cruise occurring around the Labrador Sea and Baffin Bay on the RRS *Discovery*. A set of suggested mitigation measures (MEMP) will be produced for the purpose of undertaking the project in a way that will be of minimal detriment to the marine environment, and in a way that is reasonable and commensurate with achieving the stated scientific objectives. This EIA and associated MEMP have been prepared based on the information provided by the Principal Investigator in the SME and associated EIA questionnaire.

## PROJECT DESCRIPTION AND OBJECTIVES

The cruise DY151 will combine two projects: SEANA and M-Phase. The aim of the SEANA project is to determine an understanding of the atmospheric aerosol baseline in the Arctic, in order to be able to predict future impacts of aerosols from shipping on the Arctic climate. The aim of the M-Phase project is to improve understanding of how ice particles form in clouds, and to understand the response of mixed phase clouds to a changing climate. The cruise will therefore primarily involve atmospheric focused observations, with various instruments being used to collect air samples. Seawater samples will also be collected, and the ship-fitted single-beam and multibeam echosounder will be in operation continuously throughout the cruise.

## ACTIVITIES

### Location of activities

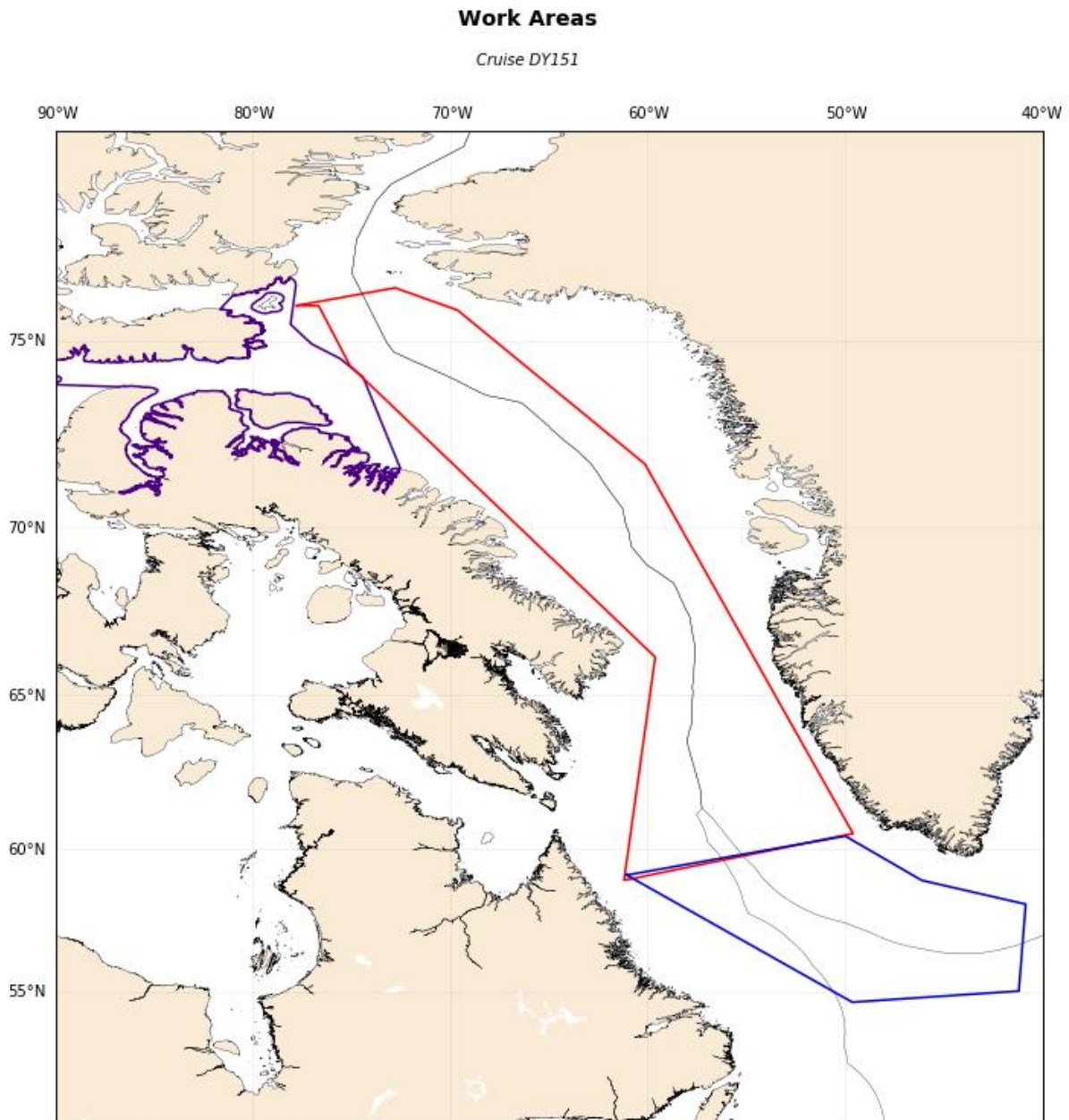
The work will take place around the Labrador Sea and Baffin Bay, within the EEZs of Canada and Greenland, as well as international waters (**Figure 1**).

### Schedule

- Port of departure: Reykjavik, Iceland
- Port of arrival: Southampton, UK
- Date of sail: 16/05/2022
- Date of arrival into port: 27/06/2022

### Source Vessel Specifications

- Ship name: RRS *Discovery*
- Ship operator: National Marine Facilities
- Ship flag: United Kingdom
- Ship length: 99.7 m
- Ship breadth: 18 m
- Ship draft: 6.5 m
- Gross tonnage: 5952 T
- Endurance: 50 days
- Fuel consumption: 9 m<sup>3</sup>/day on 2 generators



**Figure 1.** The work areas for DY151 are marked by the red (Research Area 1) and blue (Research Area 2) boundaries. The purple contour represents the boundary of the Tallurutiup Imanga National Marine Conservation Area (UNEP-WCMC and IUCN 2022), and the black contours represent the EEZ boundaries of Greenland and Canada (Flanders Marine Institute 2019).

### Description of activities

Various instruments, including unmanned air vehicles, will be deployed in the air to collect atmospheric observations, and seawater samples will be collected. Depth measurements will be continuously taken using the ship-fitted single-beam echosounder, and the seabed will be continuously mapped using the ship-fitted 12 kHz multibeam echosounder.

## Specific Activity details

### Seabed imaging

#### *Single-beam echosounder:*

The *Discovery* has a drop keel-mounted Kongsberg EA600 10/12 kHz single-beam echosounder. This will be run port-port to provide depth measurements throughout the cruise. This has a maximum power of 2000 W and a pulse length range of between 1-16 ms.

#### *Deep water multi-beam echosounder:*

The *Discovery* has a hull-mounted 12 kHz Kongsberg EM122 multi-beam echosounder. It has a swath width of 6 x depth (m), and has a maximum power of 2000 W, and a maximum sound intensity of 210 dB. It has a pulse length ranging between 1-100 ms. This will be run continuously throughout the cruise.

### Water-column sampling

#### *Sea water samples:*

Sea water samples will be taken from the underway sampling system, as well as direct surface sea water samples.

### Autonomously/remotely operated vehicles

#### *Unmanned Air Vehicles*

An Unmanned Air Vehicle may be deployed for vertical profile observations of gases and particles.

## STATUTORY REQUIREMENTS/PERMITS

The work will be undertaken within the EEZs of Canada and Greenland, as well as in international waters (**Figure 1**). Diplomatic clearance has been requested, and any requirements will be added to the MEMP when required. The working area lies outside of any Marine Protected Areas (MPAs), but the Tallurutiup Imanga National Marine Conservation Area sits to the west of the northern end of Research Area 1 (**Figure 1**).

## MONITORING AND MITIGATION

### Description of environment

The work will take place in the Labrador Sea and Baffin Bay (**Figure 1**). There are no MPAs within the working boundaries, but the Tallurutiup Imanga National Marine Conservation Area sits to the west of the northern end of Research Area 1 (**Figure 1**). Sea ice is present to varying degrees in the area between November and June/July (Bi *et al* 2019). Various species of marine mammals are found within both research areas, with ringed seals, harp seals, bearded seals, hooded seals, harbour seals, walrus, belugas, narwhals, bowhead whales, and polar bears being the most common (Finley *et al* 1983; Laidre *et al* 2008; Andersen *et al* 2009; Cameron *et al* 2010; Stenson *et al* 2015; ONCS *et al* 2018; Stenson *et al* 2020). The seal species as well as the walrus and polar bear are most likely to be found on and around sea ice. Marine mammals that are most likely to be found in the study area are summarised in **Table 1**.

**Table 1. Summary of species that may be present within the research areas, based on a literature review of their distribution, and their current status according to the IUCN and CITES.**

Species	IUCN <sup>1</sup>	CITES <sup>2</sup>
Harp seal	LC	-
Hooded seal	Vul.	-
Bearded seal	LC	-
Ringed seal	LC	-
Harbour seal	LC	-
Walrus	Vul.	-
Beluga	LC	II
Narwhal	LC	II
Bowhead whale	LC	I
Polar bear	Vul.	-
Humpback whale	LC	I
Fin whale	Vul.	I
Minke whale	LC	II
Killer whale	DD	II

1. IUCN Classification: End. = Endangered, Vul. = Vulnerable, LC = Least Concern, DD = Data Deficient, NT=Near Threatened (IUCN, 2021).
2. CITES Appendix I = Threatened with Extinction, Appendix II = Not currently threatened with extinction, but may become so unless trade is closely controlled (Convention on International Trade in Endangered Species of Wild Fauna and Flora).

## Potential impacts to the marine environment

### Acoustic-based data collection

The potential impacts associated with acoustic data collection relate to marine mammals. The primary concerns to marine mammals as a result of acoustic systems are considered to be masking effects, behavioural changes, and physiological effects such as temporary threshold shift (TTS) and permanent threshold shift (PTS). While it is difficult to be certain of the potential for physiological damage as a result of various acoustic activities, localised behavioural disturbance is considered a possibility. These concerns are considered below.

#### *Deep-water multibeam echosounder:*

The effects of multibeam echosounders on marine mammals has not been widely studied, such that it is unclear what impacts these may have on them. While Lurton and DeRuiter (2011) suggested that the risk of the sounds causing physiological auditory damage to marine mammals is likely to be low, a few studies have observed potential behavioural changes as an apparent result of the operation of multibeam echosounders (Quick *et al* 2016; Cholewiak *et al* 2017). Due to this uncertainty, the JNCC have created a set of best-practice guidelines to follow in the case of deep-water multibeam echosounder surveys (see MEMP). With the proposed mitigation recommendations outlined in the MEMP, the effects of the multibeam echosounder on any marine mammals present in the area is expected to be minimal.

### Environmental contamination and pollution

#### *Chemicals:*

All chemicals will have accompanying COSHH and risk assessments. They will be stored, handled and disposed of appropriately as per standard NMF procedure.

*Ship's waste:*

All cardboard and paper products are incinerated at sea on the *Discovery*. Recyclable items are stored for appropriate recycling upon arrival into port. Any non-burnable or non-recyclable waste (e.g. batteries) is stored appropriately and disposed of upon arrival into port.

*Incidental waste:*

Unrecovered instruments:

It is intended that all equipment will be recovered.

## Appendix 1 – Glossary of Terms

**Marine Protected Area (MPA):** “A clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values.” (Dudley, 2008 in JNCC, 2017).

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