

## NOTIFICATION OF PROPOSED RESEARCH CRUISE

### PART A: GENERAL

1. NAME OF RESEARCH SHIP : "Fridtjof Nansen"
2. DATES OF CRUISE: 16<sup>th</sup> Mai – 18<sup>th</sup> September 2024
3. OPERATING AUTHORITY: Hurtigruten Expedition

TELEPHONE: + 47 51 00 53 20

TELEFAX: N/A

TELEX: 425901035

4. OWNER (if different from no. 3)

5. PARTICULARS OF SHIP:

Name: "Fridtjof Nansen"  
Nationality: Norway (NIS)  
Overall length: 140,0 m  
Maximum draught: 5,5 m  
Net tonnage: 7545  
Propulsion e.g. diesel/steam: diesel-electric  
Call sign: LACN8  
Registration port and number: Longyearbyen,  
IMO-9813084

6. CREW

Name of master: Raymond Andre Martinsen

Number of crew: 175

7. SCIENTIFIC PERSONNEL

Dr. Andreas Herber  
Klußmannstrasse 3d  
27570 Bremerhaven  
Germany  
+49-471-4831-1489  
Andreas.herber@awi.de

No. of scientists (details see below) in total: 8

- FNICE2412 (16/05-24/05/24): 1
- FNICE2413 (24/05-01/06/24): 1
- FNICE2414 (01/06-09/06/24): 1
- FNICE2416 (24/06-09/07/24): 1
- FNICE2417 (09/07-24/07/24): 1
- FNICE2418 (24/07-08/08/24): 2
- FNICE2420 (02/09-18/09/24): 1

8. GEOGRAPHICAL AREA IN WHICH SHIP WILL OPERATE  
(with reference to latitude and longitude)

Iceland, Greenland, Canada, USA (63 °N– 75°N, 13°W – 174°W)

9. BRIEF DESCRIPTION OF PURPOSE OF CRUISE

In addition to the tourist program, a scientific program will also be carried out. The measurements onboard this vessel take place within the framework of “SOOP – Shaping an Ocean Of Possibilities”. SOOP (<https://www.soop-platform.earth/en/homepage-2/>) is an initiative of the Helmholtz Association of German Research Centres, the largest scientific organization in Germany. SOOP is a technology platform under participation of AWI Bremerhaven, ([www.awi.de/en](http://www.awi.de/en)), GEOMAR Kiel ([www.geomar.de/en](http://www.geomar.de/en)) and Hereon Geesthacht ([www.hereon.de/index.php.en](http://www.hereon.de/index.php.en)). SOOP aims to improve ocean observations by involving citizens and engage with industry. SOOP activates the knowledge, awareness and interest of science, society, business and politics, develops reliable, cost-efficient and user-friendly, standardized measurement systems, services and provides a data platform that can be used to collect, provide and use ocean data, and establishes an innovation-based value creation to strengthen ocean observation.

10. DATES AND NAMES OF INTENDED PORTS OF CALL

Reykjavík – Iceland 16 May 2024, first call followed by others pls refer to attachment file:

Fridtjof-Nansen\_SOOP\_160524-180924.xlsx

Vancouver, Canada on 18 September 2024, last port

11. ANY SPECIAL REQUIREMENTS AT PORTS OF CALL NOTIFICATION OF PROPOSED RESEARCH CRUISE

No

**PART B: DETAILS**

1. NAME OF RESEARCH SHIP: “Fridtjof Nansen”
2. DATES OF CRUISE : 16 May – 18 September 2024
3. a) PURPOSE OF RESEARCH

This vessel does measurements to support the mission of SOOP. The program on board involves chemical, meteorological, physical, and biological measurements in the ocean and the atmosphere. Surface water will be continuously sampled from the ship’s water intake at approximately 5 m depth with approximately 100 l/min. The water will be pumped through different instruments to measure various parameters (see below). After passing through the instruments, that water will be pumped back outside. **NOTE:** The water will not be contaminated with any chemicals or other substances. Some measurements need referencing measurements. For this purpose, a small amount of surface water will be filled in sample containers for analysis in the laboratories at land.

## b) GENERAL OPERATIONAL METHODS

(including full description of any fish gear, trawl type, mesh size, etc.)

### Temperature and Salinity - Instrument: Seabird SBE45

The water temperature will be measured as close to the water inlet as possible and again close to the setup of the measurement setup. There also the salinity of the seawater will be measured.

Installation of the system on 16 May 2024, afterwards start of the operation.

### Partial pressure of CO<sub>2</sub> -Instrument: 4H-Jena Contros HydroC-FT

While the seawater is pumped through the instrument it is passing a membrane. The membrane allows gases that are dissolved in the water to pass through it, without letting the water through. This way the same amount of gases will be present on the water side and air side of the membrane. The air side is measured using an infra-red detector for its CO<sub>2</sub> content. The water will be not altered. The data can be used to estimate the exchange of CO<sub>2</sub> between the ocean and the atmosphere and this help to constraint the ocean carbon sink.

Installation of the system on 16 May 2024, afterwards start of the operation.

### Dissolved Oxygen - Instrument: Seabird SBE63

The seawater is passing a membrane and dissolved oxygen is dissolving in a foil that is constantly exposed to the water. The amount of oxygen dissolved in the foil is equivalent to the amount of oxygen dissolved in the seawater. The oxygen in the foil changes its structure, which can be measured by diodes. The data will give insight to gas exchange at the sea surface (together with CO<sub>2</sub>) and biological productivity

Installation of the system on 16 May 2024, afterwards start of the operation.

### Microplastic - Instrument: Geesthacht Inert Microplastic Fractionator V3

Seawater is pumped through a cascade of stainless-steel cartridge filters (300, 100 and 10 µm). Microplastic particles and interfering matrix constituents (organic and sediment particles) are retained on the filters. After sampling, the particles are removed from the cartridge filters using ultrasound and detergent, stabilized and stored until the sample purification and subsequent final IR microspectroscopic analysis in the laboratory. Microplastic particles and fibers are omnipresent and persistent environmental pollutants and subjected to long-range transport. Microplastic number concentrations (10 µm – 5000 µm, particles per cubic meter) However, there are still many data gaps that need to be filled to enable a better understanding of the environmental fate of microplastics as well as a more accurate assessment of the corresponding risks.

Installation of the system on 1 June 2024, afterwards start of the operation.

### eDNA - Instrument: Particle and Phytoplankton Sampler (McLance; USA)

The automated filtration system is equipped with a set of 24 membrane filters with a pore-size of 0.4 µm. Seawater is passing the filter and particulate organic matter, including eDNA is collected on the filters. Subsequent to filtration, filters are stored frozen until further molecular analyses in the laboratory to identify the biodiversity of the ocean.

Installation of the system on 24 May 2024, afterwards start of the operation.

### Hyperspectral (HyperSpecBox) - Instrument: Seabird AC-S

The seawater passes two tubes where it is illuminated by an LED light source. Two detectors measure the attenuation and absorption of the water passing through the instrument between 400nm and 730nm. The data are used to determine the particulate organic matter and the composition of different phytoplankton groups.

Test installation of the system on 16 May – only for one voyage until 24 May 2024

Atmospheric box - Instrument: PAMOS (Portable Atmospheric Measuringbox On Sea)  
The system is installed on the helicopter deck and measures continuously different trace gas concentrations and aerosol parameters, such as number concentration and black carbon. An air inlet is used for the measurements and simultaneously weather parameters are collected, like wind speed and direction, to identify critical situations for the airflow. If there is rain or the wind is too strong, the airflow will be stopped. The data will allow to investigate the impact of ships on the lower atmosphere and improve the atmospheric data coverage over the oceans. Test installation of the system on 24 July – only for one voyage until 8 August 2024

4. ATTACH CHART showing (on an appropriate scale) the geographical area of intended work, positions of intended stations, tracks of survey lines, positions of moored/seabed equipment, areas to be fished.

In Figure 1 – 4 you can see the different routes during the voyages of the Nansen.

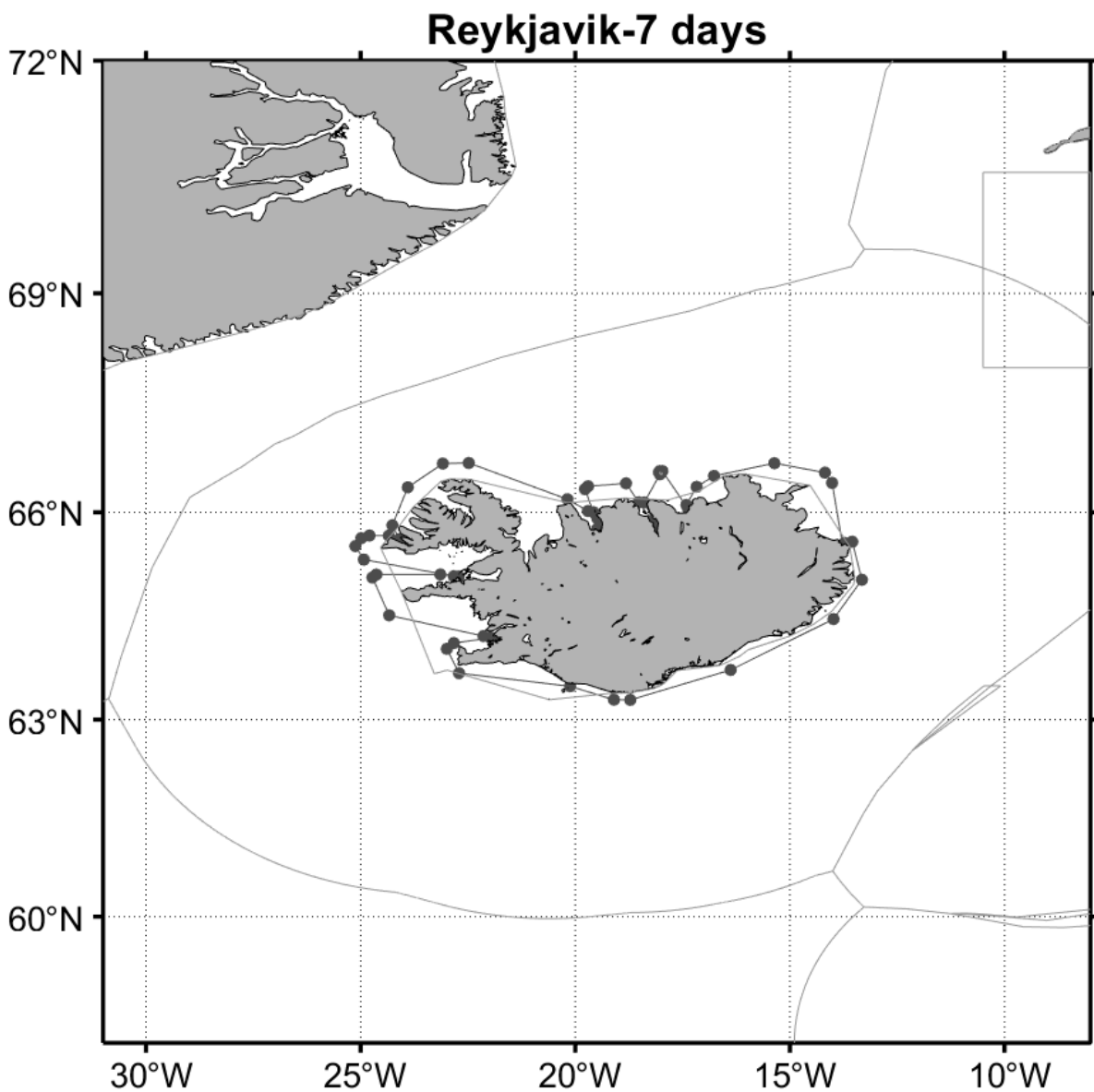


Figure 1 Round Trip Iceland

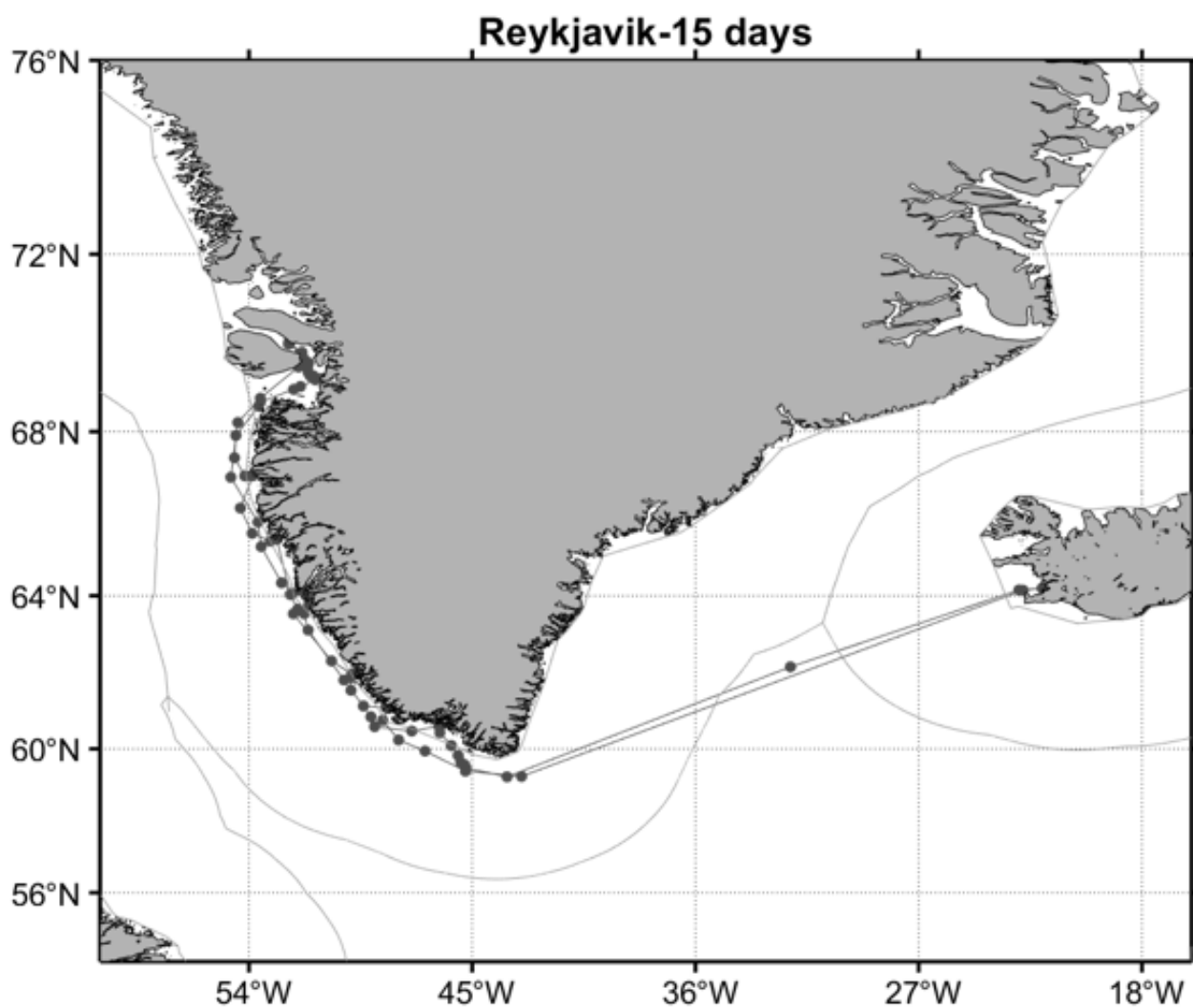


Figure 2: Iceland - Greenland

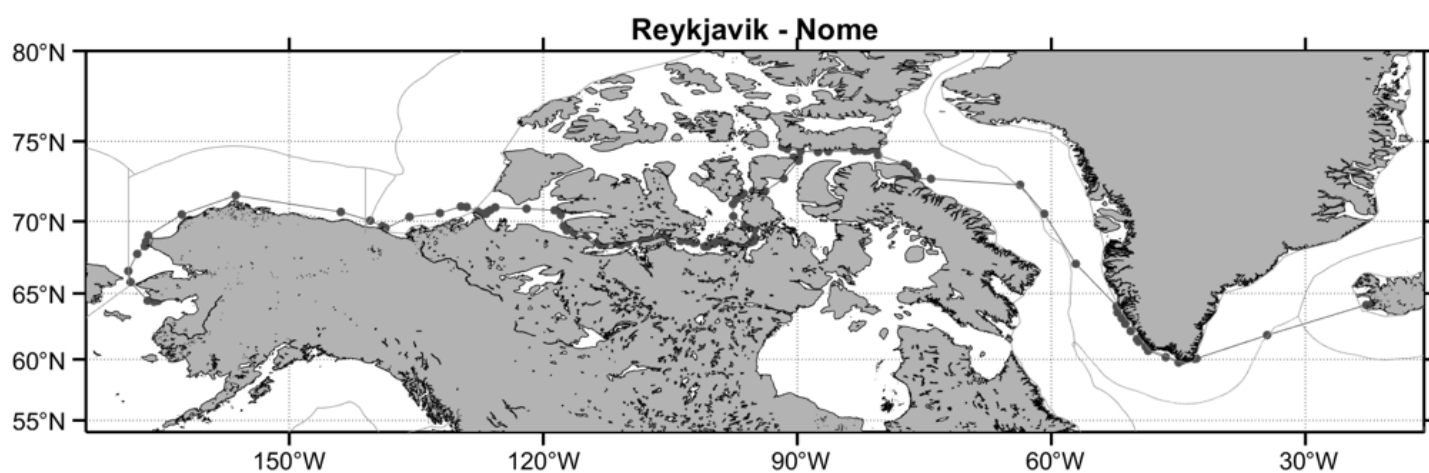


Figure 3 Iceland – NWP – Nome

## Nome - Vancouver

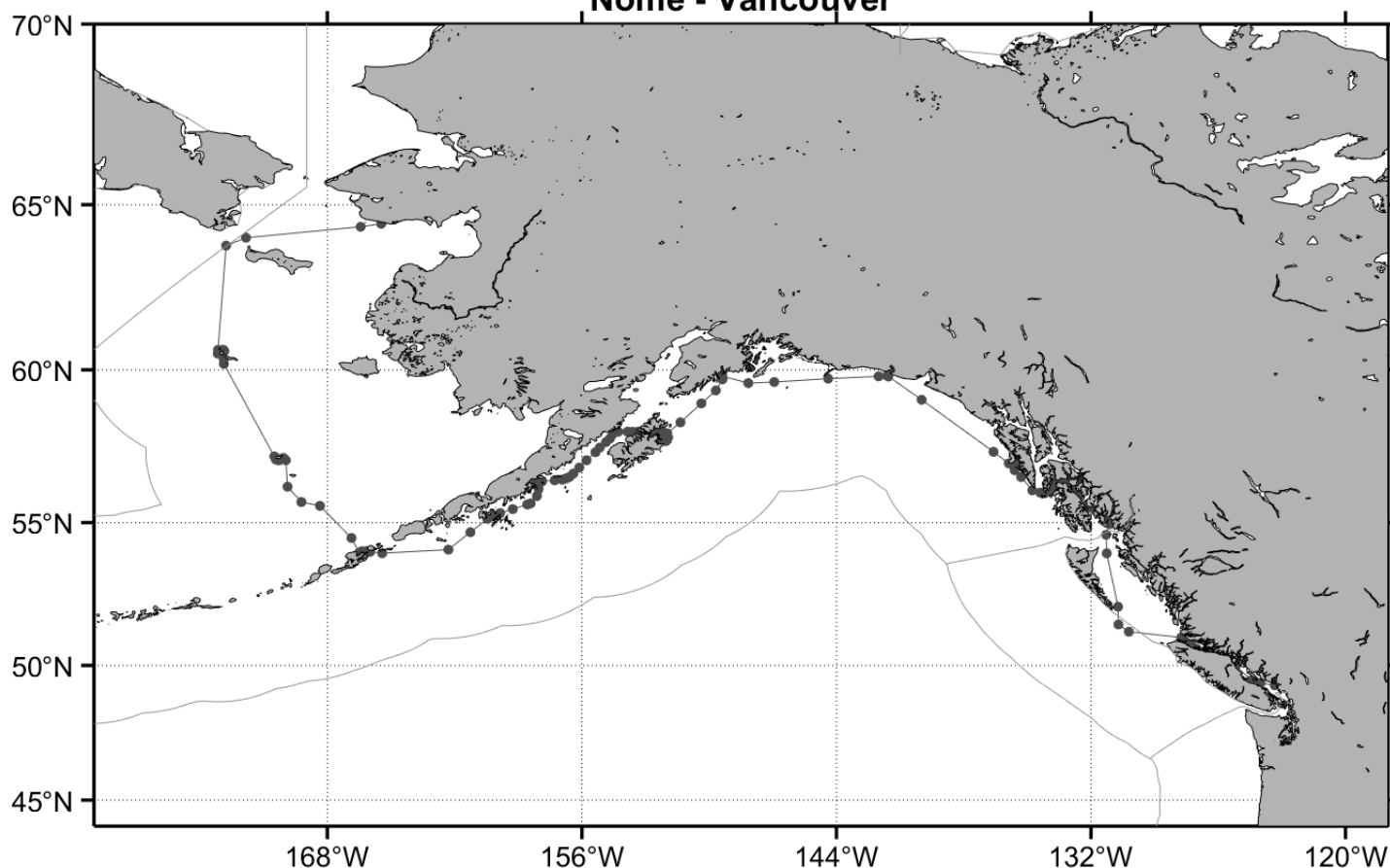


Figure 4 Nome – Vancouver

5. a) TYPES OF SAMPLES REQUIRE  
(e.g., geological/water/plankton/fish/radionuclide):  
Seawater samples and atmospheric measurements, including weather data
- b) METHODS OF OBTAINING SAMPLES  
(e.g., dredging/coring/drilling/fishing, etc. When using fishing gear, indicate fish stocks being worked, quantity of each species required, and quantity of fish to be retained- on board).

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6. DETAILS OF MOORED EQUIPMENT

N/A

7. ANY HAZARDOUS MATERIALS

(chemicals/explosives/gasses/radioactives, etc., (Use separate sheet if necessary)

For eDNA sampling is needed:

a) Type and trade name

Ethanol, 99%

b) Chemical content (and formula)

C<sub>2</sub>H<sub>6</sub>O

c) IMO IMDG code (reference and UN no.)

IMO 3/II UN-Code UN 1170

d) Quantity and method of storage on board

1000 ml (storage in lab)

e) If explosives give dates of detonation: N/A

- Method of detonation
- Position of detonation
- Position of detonation
- Frequency of detonation

- Depth of detonation
- Size of explosive charge in kg.

## 8. DETAIL AND REFERENCE OF

### a) Any relevant previous/future cruises

The complete voyages from Reykjavik (16 May 2024) to Vancouver (18 September 2024) on board of the Fridtjof Nansen (Hurtigruten Expedition) is the first one. Further expedition on the Hurtigruten Expedition vessels are planned.

### b) Any previously published research data relating to the proposed cruise

- Friedlingstein, P., O'Sullivan, M., Jones, M. W., Andrew, R. M., Gregor, L., Steinhoff, T., et al., (2022) Global Carbon Budget 2022, *Earth Syst. Sci. Data*, 14, 4811–4900, <https://doi.org/10.5194/essd-14-4811-2022>
- Hansen, J., Hildebrandt, L., Zimmermann, T., Gareb, G., Fischer, E., Pröfrock, D., (2023) Quantification and characterization of microplastics in surface water samples from the Northeast Atlantic Ocean using laser direct infrared imaging, *Marine Pollution Bulletin*, Vol. 190, 114880
- Hildebrandt, L., Gareb, F., Zimmermann, T., Klein, O., Kerstan, A., Emeis, K., Pröfrock, D., (2022) Spatial distribution of microplastics in the tropical Indian Ocean based on laser direct infrared imaging and microwave-assisted matrix digestion, *Environmental Pollution*, Vol. 307, 119547
- Hildebrandt, L., Zimmermann, T., Primpke, S., Fischer, D., Gerdt, G., Pröfrock, D., (2021) Comparison and uncertainty evaluation of two centrifugal separators for microplastic sampling, *Journal of Hazardous Materials*, Vol. 414, 125482
- Liu, Y.; Röttgers, R.; Ramírez-Pérez, M.; Dinter, T.; Steinmetz, F.; Nöthig, E.M.; Hellmann, S.; Wiegmann, S.; Bracher, A. Underway spectrophotometry in the Fram Strait (European Arctic Ocean): A highly resolved chlorophyll a data source for complementing satellite ocean color. *Opt. Exp.* 2018, 26, A678–A696. <https://doi.org/10.1364/OE.26.00A678>
- Liu, Y., Boss, E., Chase, A. P., Xi, H., Zhang, X., Röttgers, R., et al. (2019). Retrieval of phytoplankton pigments from underway spectrophotometry in the Fram Strait. *Remote Sens.* 11:318. <https://doi.org/10.3390/rs11030318>
- Oldenburg, E., Popa, O., Wietz, M., von Appen, W., Torres-Valdes, S., Bienhold, C., Ebenhö, O., Metfies (2024), Sea-ice melt determines seasonal phytoplankton dynamics and delimits the habitat of temperate Atlantic taxa as the Arctic Ocean atlantifies, *ISME Communications*, Volume 4, <https://doi.org/10.1093/ismeco/ycae027>
- Seelmann K., Steinhoff T., Aßmann S. and Körtzinger A (2020). Enhance Ocean Carbon Observations: Successful Implementation of a Novel Autonomous Total Alkalinity Analyzer on a Ship of Opportunity. *Front. Mar. Sci.* 7:571301. doi: 10.3389/fmars.2020.571301.
- Weiß, J.F., von Appen, W.J., Niehoff, B. et al. Unprecedented insights into extents of biological responses to physical forcing in an Arctic sub-mesoscale filament by combining high-resolution measurement approaches. *Sci Rep* 14, 8192 (2024). <https://doi.org/10.1038/s41598-024-58511-y>



9. NAMES AND ADDRESSES OF SCIENTISTS OF THE COASTAL STATE(S) IN WHOSE WATERS THE PROPOSED CRUISE TAKES PLACE WITH WHOM PREVIOUS CONTACT HAS BEEN MADE

Solveig R. Olafsdottir  
Marine and Freshwater Research Institute  
Fornubúðum 5  
220 Hafnarfjörður, Iceland  
[solveig.rosa.olafsdottir@hafogvatn.is](mailto:solveig.rosa.olafsdottir@hafogvatn.is)

10. STATE

a) Whether visits to the ship in port by scientists of the coastal state concerned will be acceptable

YES

b) Participation of an observer from the coastal state for any part of the cruise together with the dates and the ports for embarkation and disembarkation

The voyages with the Nansen between Reykjavik and Vancouver are fully booked, and it is not possible for an observer to travel with the ship

c) When research data from the intended cruise are likely to be made available to the coastal state and by what means

If relevant, data and findings of the cruise will be published in international, scientific, peer-reviewed journals and at international conferences. As the project is part of a doctoral dissertation, results will be published within the next three years. Furthermore, all cruise data will be made available through the German research portal [www.pangaea.de](http://www.pangaea.de).

PART C. SCIENTIFIC EQUIPMENT

Complete the following table using a separate page for each coastal state

Coastal state: Iceland

Port of call: Reykjavik

Date: 16/05/2024 first call

Indicate "YES" or "NO"

				distance	from the	Coast
<u>List scientific work by function</u> e.g.	Water column including sediment sampling of the seabed	Fisheries research within fishing limits	Research concerning the natural resources of the continental shelf or its physical characteristics	Within 3 nm	between 3-12 nm	between 12-200 nm
pCO2	Yes	No	No	Yes	Yes	Yes
Temperature and Salinity	Yes	No	No	Yes	Yes	Yes
Microplastic	Yes	No	No	Yes	Yes	Yes
Hyperspectral	Yes	No	No	Yes	Yes	Yes
eDNA	Yes	No	No	Yes	Yes	Yes
Atmospheric Box	No	No	No	Yes	Yes	Yes



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Logistik und Forschungsplattformen  
Am Alten Hafen 26  
27568 Bremerhaven

Dated 02.05.2024

(on behalf of the Principal Scientist)

NB IF ANY DETAILS ARE MATERIALLY CHANGED REGARDING DATES/AREA OF OPERATION AFTER THIS FORM HAS BEEN SUBMITTED, THE COASTAL STATE AUTHORITIES MUST BE NOTIFIED IMMEDIATELY

Attached are also following files:

- Waypoints for the four different voyages: Reykjavik-round-trip.txt; Iceland–Greenland.txt, Reyjavik–NWP–Nome.txt; Nome–Vancouver.txt
- Detailed list of the daily routing from 16 May to 18 September 2024: Fridtjof-Nansen\_SOOP\_160524-180924.xlsx