Application for Consent to conduct
Marine Scientific Research

Date: 11.03.2020

1. General Information

1.1 Cruise name and/or number: HE 557

1.2 Sponsoring Institution(s):	
Name:	Alfred-Wegener-Institute for Polar- and Marine Research
Address:	Am Handelshafen 12 27570 Bremerhaven Germany
Name of Director:	Prof. Dr. Antje Boetius

1.3 Scientist in charge of the Project:	
Name:	Dr. Gunnar Gerdts
Country:	Germany
Affiliation:	Alfred-Wegener-Institute for Polar- and Marine Research
Address:	Kurpromenade 201, D-27498 Helgoland
Telephone:	+49 4725 819 3245
Fax:	+49 4725 819 3283
Email:	Gunnar.gerdts@awi.de
Website (for CV and photo):	https://www.awi.de/nc/en/about-us/organisation/staff/gunnar-gerdts.html https://www.awi.de/en/focus/marine-litter/tracking-down-microplastic.html

1.4 Entity(ies)/Participant(s) from coastal State involved in the planning of the project:	
Name:	
Affiliation:	
Address:	
Telephone:	
Fax:	
Email:	
Website (for CV and photo):	

2. Description of Project

2.1 Nature and objectives of the project:
JPI-O FACTS "Fluxes and Fate of Microplastics in Northern European Waters“; WP 1: Large Scale Transport – South to North. **The large scale transport of MP in surface waters from the southern North Sea to the Arctic is investigated and the major MP pathways feeding from northern Europe into the arctic waters are mapped**. Oceanographic models have shown that the major water masses that can convey plastics from the south to the arctic go via the Norwegian Coastal Current (NCC). This water mass is made up from several distinct water masses: Atlantic water, German Bight water, Baltic Sea water, and a less distinct water mass coming from the North Sea. Water, and herewith plastics, is also added to the NCC from sources along the Danish and Norwegian coast. However, the coastal population from these countries is low, compared to more southern regions. Plastic of densities lower than water represent the bulk production, especially for packaging, and will initially float. Therefore, although there are uncertainties, the NCC may well describe the main transport of plastics toward the Arctic as most North Sea water (collecting plastics from eastern UK, Belgium, Netherlands and German North Sea coast), and all Baltic water (collecting plastics from the countries surrounding the Baltic), will follow this path.

Plastic particle concentrations, obtained from the proposed sampling campaigns will be implemented in oceanographic models. Even though plastic particles do not fully follow water masses, as they can penetrate density gradients in frontal regions, and accumulate in the bottom sediments, this can be described in the models. The modelling approach will be used to integrate release and transport scenarios, as the content of MP may not be known well enough in the source water masses to exclusively use measurements to “validate” the models. The likelihood and timescale for particle pathways is estimated based on sinking, defragmentation, and beaching rates, obtained from observations.

On its journey to the Arctic, there are several sinks. Skagerrak, receiving water from the Baltic Sea and the North Sea, is likely to be an important one. The deep Skagerrak sediments represent an accumulation zone where the sediments conveyed at the bottoms of the North Sea and Kattegat eventually deposit, creating a sink for the associated pollutants like certain metals and priority pollutants. It is hypothesized that a similar process takes place for the MP in the sediments. The sinks of the Skagerrak are hence studied in-depth with the overall aim to better understand the Skagerrak current gyre and frontal systems as an accumulation and sink region for plastics from both the North Sea and the Baltic drainage basins. The aims are to map the geographical distribution of sediment MP in the deep Skagerrak, and Southern Norwegian trench, and link abundance with bathymetry, bottom water currents and sediment characteristics, 1) to understand how vertical transport processes influence downward transport of MP; 2) to correlate MP abundance to accurately measured sediment accumulation rates in eastern Skagerrak and Gullmar fjord along the Baltic Current; and 3) to investigate how the lateral and vertical distribution of small microplastic particles is governed by hydrographical features such as fronts and strong stratifications and presence of a nepheloid layer (benthic boundary layer). After being advected into the Arctic by large scale currents, marine debris locally accumulates driven by specific ocean processes, for example at mesoscale and submesoscale. What happens at these scales cannot be fully explored by large scale models, due to their resolution limits when attempting to describe local processes. The aim is hence to use high resolution models to provide better description of local processes, relating them with data of MP concentration of Arctic surface layer from in situ samples.

Additionally, educated guesses derived from other pollutants point towards several input routes of MP to marine waters from air, land, and freshwater. As an example, for black carbon and the associated organic contaminants, it is well-known that atmospheric air currents are important transport routes from lower latitudes to the North. Precipitation, especially snow, is regarded as the most efficient scavenger of organic contaminants from the air for deposition on land, ice, and ocean surfaces. Dry deposition due to turbulent transport can also be an important sink for atmospheric particles over ice and the waters of the Arctic. FACTS will investigate how different shapes and sizes of MP are transported along a south-north gradient by atmospheric air currents and assess the contribution of long-range-transport versus local emission of MP. The scavenging potential of precipitation will be evaluated and compared to dry deposition and the concentrations, polymer types, shapes, and sizes found in the sea surface microlayer (SML). In mesocosm studies (seawater pools) typical residence times of different polymer types and shapes in SML will be determined under controlled conditions which consider e.g. effect of photochemistry, microorganism and density gradients.

The transport of MP in the atmosphere will be modelled by a Lagrangian particle dispersion model, which uses meteorological input data from different sources, and has detailed parameterizations for atmospheric turbulence, convection, as well as for removal processes (dry deposition, gravitational settling, wet scavenging). The model will be used applying prescribed density and size distribution of mobilized plastic particles, and will yield how these are transported downwind, as well as deposited. Inverse modelling will be used to attempt a quantification of emission sources. Usually such approaches require a lot of observations to improve the available emission data. However, given the paucity of emission estimates for plastic particles, even a simplified inversion with the limited observation data that can be expected within the time frame of FACTS, would be sensible. The expectation is that this could at least estimate the order of magnitude of the emissions, even with little regional discretization.

2.2 If designated as part of a larger scale project, then provide the name of the project and the Organisation responsible for coordinating the project:
JPI-O FACTS "Fluxes and Fate of Microplastics in Northern European Waters“; Aalborg University, Department of Civil Engineering (Denmark)

2.3 Relevant previous or future research projects:
JPI-O BASEMAN „Defining the baselines and standards for microplastics analyses in European waters“; http://www.jpi-oceans.eu/baseman/main-page

2.4 Previous publications relating to the project:
Bergmann M, Mützel S, Primpke S, Tekman MB, Trachsel J, **Gerdts G**. 2019. White and wonderful? Microplastics prevail in snow from the Alps to the Arctic. Science Advances Vol. 5, no. 8, eaax1157 Lorenz C, Roscher L, Meyer MS, Hildebrandt L, Prume J, Löder MGJ, Primpke S, **Gerdts G.** 2019. Spatial distribution of microplastics in sediments and surface waters of the southern North Sea. Environmental Pollution Volume 252, Part B: 1719-1729. Peeken I, Primpke S, Beyer B, Guetermann J, Katlein C, Krumpen T, Bergmann M, Hehemann L, **Gerdts G.** 2018. Arctic sea ice is an important temporal sink and means of transport for microplastic. Nature Communications 9, Article number: 1505 Bergmann M, Wirzberger V, Krumpen T, Lorenz C, Primpke S, Tekman MB, **Gerdts G**. 2017. High Quantities of Microplastic in Arctic Deep-Sea Sediments from the HAUSGARTEN Observatory. Environmental Science and Technology 51(19): 11000-11010. Primpke S, Lorenz C, Rascher-Friesenhausen R, **Gerdts G.** 2017. An automated approach for microplastics analysis using focal plane array (FPA) FTIR microscopy and image analysis. Analytical Methods 9: 1499-1511.

3. Geographical Areas

3.1 Indicate geographical areas in which the project is to be conducted (with reference in Latitude and longitude in decimal degrees, including coordinates of cruise/track/way points/sampling stations). Please provide coordinates in a separate excel spreadsheet.
Northern North Sea/North Atlantic Faroe Shetland Channel See attached maps “He557 FACTS complete.pdf” & “He557 FACTS Faroe Shetland Channel.pdf” and Excel sheet “He557 FACTS station list.xlsx”

3.2 Attach chart(s) at an appropriate scale (1 page, high-resolution) showing the geographical Areas of the intended work and, as far as practicable, the location and depth of sampling Stations, the tracks of survey lines, and the locations of installations and equipment.
See Attachment

4. Methods and means to be used

4.1 Particulars of vessel:	
Name:	HEINCKE
Type/Class:	RV
Nationality (Flag State):	GERMAN
Identification Number (IMO/Lloyds No.):	8806113
Owner:	Federal Ministry of Education and Research, German Government
Operator:	Alfred-Wegener-Institute for Polar- and Marine Research
Overall length (meters):	55,20
Maximum draught:	3,95
Displacement/Gross Tonnage:	1451 / 999
Propulsion:	Diesel Electric
Cruising & maximum speed:	
Call sign:	DBCK

INMARSAT number and method and capability of communication (including emergency frequencies):	INMARSAT +870-764-140-491 IRIDIUM +881-631-815-155
Name of Master:	Haye Diecks
Number of Crew:	11
Number of Scientists on board:	10

4.2 Particulars of Aircraft:	
Name:	Not applicable
Make/Model:	
Nationality (flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall Length (meters):	
Propulsion:	
Cruising & Maximum speed:	
Registration No.:	
Call Sign:	
Method and capability of communication (including emergency frequencies):	
Name of Pilot:	
Number of crew:	
Number of scientists on board:	
Details of sensor packages:	
Other relevant information:	

4.3 Particulars of Autonomous Underwater Vehicle (AUV):	
Name:	Not applicable
Manufacturer and make/model:	
Nationality (Flag State):	
Website for diagram & Specifications:	
Owner:	
Operator:	
Overall length (meters):	
Displacement/Gross tonnage:	
Cruising & Maximum speed:	
Range/Endurance:	
Method and capability of communication (including emergency frequencies):	
Details of sensor packages:	
Other relevant information:	
Operator:	

4.4 other craft in the project, including its use:
Not applicable

4.5 Particulars of methods, full description of scientific instruments to be used (for fishing gear specify type and dimension) and location			
Types of samples and Measurements:	Methods to be used:	Instruments to be used:	To be carried out within 12nm (yes or no):
Meteorology &Radiation	Miscl.	Miscl.	yes
Water	Net sampling, pump sampling, discrete depth water sampling, marine snow sampling	Neuston catamaran (300 µm net and pumping/filtration system), giant water sampler (500 L), marine snow catcher	yes

	Thermosalinograph	Thermosalinograph	yes
	Watersoundvelocity	SVP/T Sonde	yes
Oceanography	CTD	CTD Thermosalinograph	yes
Sediment	Sediment sampling	Box corer	yes
Atmosphere	Particulate aerosol sampling	Impact sampler	yes

4.6 Indicate nature and quantity of substances to be released into the marine environment:
None

4.7 Indicate whether drilling will be carried out. If yes, please specify:
None

4.8 Indicate whether explosives will be used. If yes, please specify type and trade name, Chemical content, depth of trade class and stowage, size, depth of detonation, frequency of Detonation, and position in latitude and longitude:
None

5. Installations and Equipment

Details of installations and equipment (including dates of laying, servicing, method and Anticipated timeframe for recover, as far as possible exact locations and depth, and Measurements):
Not applicable

6. Dates

6.1 Expected dates of first entry into and final departure from the research area by the research vessel and/or other platforms:
Approx. first entry: 11.06.2020 Approx. departure: 13.06.2020
6.2 Indicate if multiple entries are expected:
No

7. Port Calls

7.1 Dates and Names of intended ports of call:
Departure: Bremerhaven, 04.06.2020 Arrival : Tromsoe, 05.07.2020

7.2 Any special logistical requirements at ports of call:
Not applicable

7.3 Name/Address/Telephone of shipping agent (if available):
Not applicable

8. Participation of the representative of the coastal State

8.1 Modalities of the participation of the representative of the coastal State in the research Project:
Possible but not planned.

8.2 Proposed dates and ports for embarkation/disembarkation:
Bremerhaven, 04.06.2020 - Tromsoe, 05.07.2020

9. Access to Data, Samples and Research Results

9.1 Expected dates of submission to coastal State of preliminary report, which should include The expected dates of submission of the data and research results:
6 months after the end of the cruise

9.2 Anticipated dates of submission to the coastal State of the final report:
12 months after the end of the cruise

9.3 Proposed means for access by coastal State to data (including format) and samples:
Data and preliminary results will be made available through a cruise report 1 year after the end of the cruise. Publications of the results in peer-reviewed scientific journals are intended. After publication or after 2 years after the cruise all results and the data will be available in the scientific online database PANGAEA (https://www.pangaea.de/expeditions/cr.php/Heincke)

9.4 Proposed means to provide coastal State with assessment of data, samples and Research results:
See 9.3

9.5 Proposed means to provide assistance in assessment or interpretation of data, samples And research results:
See 9.3

9.6 Proposed means of making results internationally available:
See 9.3

10. Other permits Submitted

10.1 Indicate other types of coastal state permits anticipated for this research (received or Pending):
Similar notification to all coastal states en route (Norway, Denmark)

11. List of Supporting Documentation

11.1 List of attachments, such as additional forms required by the coastal State, etc.:
• Attachment I: Map • Attachment II: List of estimated Waypoints

Signature:

Alfred-Wegener-Institut
Helmholtz-Zentrum für
Polar- und Meeresforschung
Logistik und Forschungsplattformen
Am Alten Hafen 26
27568 Bremerhaven

11.03.2020,
(On behalf of the chief scientist)

Contact information of the focal point:

Name:	Marius Hirsekorn	Telephone:	+49-(0)471-4831-2241
Country:	Germany	Email:	schiffskoord@awi.de
Affiliation:	Alfred Wegner Institute Operations Research Vessels	Address:	Am Alten Hafen 26

Attachment I. (maps)