THE USE OF EXPEDITION GRUISE SHIPS AND CITIZEN SCIENCE TO BRIDGE THE GAPS IN PLASTIC MARINE LITTER KNOWLEDGE IN REMOTE AREAS

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OMNIPRESENT PLASTIC LITTER

Data on spatial and temporal dynamics of plastic litter in remote areas is required

- Only limited data on occurrence is available
- Long-term data series are required to address changes in occurrence related to other factors such as season, weather and hydrological conditions
- Ships of opportunity are an ideal platform to collect replicable data on established transects
- New, advanced technologies allow assessment of microplastic abundance and simultaneous collection of oceanographic meta-data: FerryBox on MS Roald Amundsen

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MODERN RESEARCH PLATFORM OF OPPORTUNITY

Modul 6. Console for Ocean Literacy

Touch screens displaying observational data and ocean related "key stories"

Modul x: Towed/hull-mounted observations Towed plankton collector (CPR) profiling sensors (XBT), acoustic

current meters (ADCP). Ofte 3dje part

Modul 0: FerryBox system

Clean seawater intake, pipes, pumps, computer, electronics, network

Modul 1: FerryBox standard sensors Inlet temperature, Salinity, temperature, Oxygen

Modul 7: Metrological and atmospheric observations Metrological variables of wind direction and strength

Modul 8: Advanced above water observations Light sensors, sea surface skin temperature, downwardfacing sensors for Ocean Colour

Modul 5. Laboratory Ranging from proper labs, small lab benches, to citizen science labs. Used for advanced sensors (Flowcytometry, Nutrients)

Modul 2: FerryBox optical sensors Chlorophyll a, cDOM, turbidity, Phycocyanin

Modul 3. FerryBox carbon sensors pCO₂, pH, Alkalinity,

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Modul 4: FerryBox advanced samplers Water sampler, microplastics, contaminants, sample filter collector



MICROPLASTIC SAMPLER



Filters: 500µm 300µm 100µm

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BEAGH GLEAN-UPS

United Nations Clean Seas campaign We are working to combat marine plastic pollution by adhering to the Clean Seas campaign four goals: Significantly reduce the use of single-use plastics onboard expedition cruise vessels Enhance cleanup efforts in the Arctic – very active in Svalbard (Clean Up Svalbard and SALT) Educate and motivate passengers, staff and crew – developing Citizen Science project related to plastic waste Share knowledge and best practices

Association of Arctic Expedition Cruise Operators

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GTZEN SCENCE

Use Beach Clean-ups and Citizen Science to identify sources of plastic into pristine environments

In this example, plastic samples were collected in Carcass Island, west Falkland/Malvinas Islands following the NOAA Marine Debris Shoreline Survey Guide and analysed on board Smaller fragments were taken on board for analysis

the second





On board identification

 Identification of plastics by guests using a pocket Near Infra Red scanners linked to NIVAs data cloud, increased awareness of the extent and type of plastics in the marine environment

MicroNIR™ Pro

Analyze Sample

- One missing link in plastic litter research is the fragmentation of macro plastic into micro plastic
- Guests are able to identify meso plastics (particles of a few mm) and fill the gap between macro data from beach cleanings and micro data from on board analysis (research data)





Polyethylene

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MICROPLASTIC IN THE ARCTIC

Results obtained during MS Roald Amundsen's (RA) fir validating the system





Results obtained during MS Roald Amundsen's (RA) first operation in the Arctic are in agreement with published data,

SCIENTIFIC **REPORTS**

 OPEN
 Microplastics in Arctic polar

 waters: the first reported values of

 particles in surface and sub-surface

 samples

Amy L. Lusher¹, Valentina Tirelli², Ian O'Connor¹ & Rick Officer¹

Plastic, as a form of marine litter, is found in varying quantities and sizes around the globe from surface waters to deep-sea sediments. Identifying patterns of microplastic distribution will benefit an understanding of the scale of their potential effect on the environment and organisms. As sea

Total number of plastics (n/m³⁾

Tromsø-Svalbard - av 5.4, min 1.8, max 10.0 Tromsø-Svalbard - av 5.5, min 3.4, max 7.9 Research Vessel

(Lusher et al.) - av 2.7, min 0, max 11.5 Russian Arctic - av 1.6, min 0.2, max 3.6



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MICROPLASTIC IN ANTARCTICA 300-2000 µm



Most fibres from natural origin

• Cellulose based fibres • Cotton fibres • Biological fur fibres

Plastics

• Polyester fibres • Viscose fibres • Rubber particles



MICROPLASTIC IN ANTARCTICA 300-2000 µm

Microplastics Fibres Date n/m³ Date n/m³ Feb 8th, 2020 2,39 Feb 8th, 2020 0,00041 Feb 7th, 2020 1,79 Feb 7th, 2020 0,00041 Feb 6th, 2020 0,00089 Feb 6th, 2020 4,55 Jan 11th, 2020 2,32 Jan 11th, 2020 0,00017 Jan 6th, 2020 3,70 Jan 6th, 2020 0,00077 Jan 1st, 2020 3,55 Jan 1st, 2020 0,00044 **Average 0,00051** Average 3,05



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CONCLUSIONS AND WAY FORWARD

- Partnership between Hurtigruten and The Norwegian Institute for Water Research successfully launched a research platform for microplastic research: we will expand this work
- Beach clean-up and onboard analysis of macro- and meso seized litter is an excellent way to both, create awareness and collect 'citizen science' data
- Preliminary results in the Arctic show that microplastic levels were higher around Svalbard and the coast of Norway (Tromsø), samples contained significantly more fibers than fragments and varied from 1.8 to 10 particles per m³
- In the Antarctic samples, cellulose and cotton-based fibers dominate and polyester is the predominant polymer fibre
- Over 50 samples taken over a period of 4 months are being analyzed and correlated to the meta-data from the FerryBox
- When operations resume, further long-term sampling of different trajectories in the Arctic, Norwegian coast and Antarctica will be conducted



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