REPORT

# MALINOR progress report Workpackage 2:

## A BRIEF SUMMARY OF FIELD DATA COLLECTION ON NOVAYA ZEMLYA, RUSSIA AUGUST 2019

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This document is a progress report for workpackage 2 of the project MALINOR, describing the data collection efforts made and preliminary results for quantitative beach litter registrations on northern Novaya Zemlya.

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# PREFACE

This progress report provides a brief summary of the field work conducted by SALT on Novaya Zemlya in August 2019 as part of Workpackage 2 in the project MALINOR. The summary is intended for our Russian partner Association Maritime Heritage who arranged the cruise aboard the yacht Alter Ego and without whom we would not have been able to access Novaya Zemlya for data collection. We are infinitely grateful for this opportunity given to us by the Association Maritime Heritage.

Svolvær, Norway 30.09.2019

**Marthe Larsen Haarr**

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## Report chapters




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# 1. MALINOR: PROJECT OVERVIEW

The project "Mapping marine litter in the Norwegian and Russian Arctic seas" (MALINOR) is a Norwegian – Russian research collaboration funded by the Norwegian Research Council's NORRUSS program (project # 288079). The project is led by Akvaplan-niva AS (Norway); a full partner list is given in Table 1.

The primary objective of MALINOR is to **map areas of marine litter and describe its characteristics in the Norwegian Sea, Barents Sea, the High Arctic and the Kara Sea with a multi-disciplinary approach in collaboration with Norwegian and Russian institutions**. Secondary objectives include **(1)** extracting data from the scientific and grey literature on the distribution of litter in the Norwegian Russian Arctic, **(2)** identifying ongoing activities on this topic both in Norway and Russia, **(3)** building up a joint Norwegian Russian database, **(4)** performing mapping using multidisciplinary approaches (robotics, digital solutions, GIS), **(5)** developing a predictive tool for litter distribution using high resolution ocean model, and **(6)** disseminating findings to the student, public, civil industry, and policy makers in respective countries and globally.

*Table 1: List of MALINOR project partners.*

| Institution name | City | Country |
|---|---|---|
| Akvaplan-niva AS | Tromsø | Norway |
| Salt Lofoten AS | Svolvær | Norway |
| Maritime Robotic AS | Trondheim | Norway |
| The University Centre in Svalbard | Longyearbyen | Norway |
| Norwegian Institute for Air Research (NILU) | Kjeller | Norway |
| Murmansk Biological Institute (MMBI) | Murmansk | Russian Federation |
| Zubov State Oceanographic Institute of Roshydromet | Moscow | Russian Federation |
| WWF Russia | Moscow | Russian Federation |
| Association Maritime Heritage | Saint Petersburg | Russian Federation |
| GRID-Arendal | Arendal | Norway |
| Norwegian Meterological Institute | Oslo | Norway |
| University of Tromsø | Tromsø | Norway |

Project objectives will be met through the following workpackages:

1. **Data mining and database fabrication.** A desktop study to extract existing data and to build a joint Norweigan – Russian database.
2. **Mapping and quantification of coastal macrolitter.** SALT and GRID-Arendal's Marine Debris Action Planner (MAP) framework for beach litter analyses will be used to quantify coastal macrolitter and identify hotspots along the coasts of the Norwegian Sea (Lofoten and Vesterålen, Norway), southern Barents Sea (eastern Finnmark, Norway), and the northeastern Barents Sea and northwestern Kara Sea (northern Novaya Zemlya, Russia).
3. **Methods development using robotics and artificial intelligence for data collection and analysis.** Methods development for image analyses of satellite, air- and underwater drone footage to map litter densities.
4. **Modelling framework to predict marine litter fate.** Oceanographic modeling will be used to predict distribution and accumulation zones of marine litter in the region.

This report provides a brief summary of the data collection efforts carried out on Novaya Zemlya in August 2019 as part of workpackage 2.

# 2. THE RESEARCH CRUISE

SALT has collected considerable quantitative beach litter data from the Lofoten and Vesterålen archipelagos in the Norwegian Sea 2018-2019, as well as spent four weeks summer 2019 collecting quantitative beach litter along the southern Barents Sea coast in eastern Finnmark, Norway. In addition to these data, we sought to collect data from the northern Barents Sea as well as the Kara Sea. The northern part of Severny Island (Novaya Zemlya, Russia) offers a unique opportunity to assess beach litter along shores of both seas.

*Photo 1: The Alter Ego (photo by SALT/Marthe Larsen Haarr).*

However, accessing northern Novaya Zemlya is challenging, both because of its remoteness and because of travel restrictions. The Association Maritime Heritage provided SALT with a unique opportunity to join a 3-week cruise aboard the yacht Alter Ego departing from Murmansk early August 2019. The cruise was scheduled to land at select locations starting in Russian Harbour on the Barents Sea coast of Severny Island and ending in Ice Harbour on its Kara Sea shore. In total, the cruise landed in eight areas (Figure 1).

Two SALT staff, Marthe Larsen Haarr and Michael Pantalos, participated in the expedition.

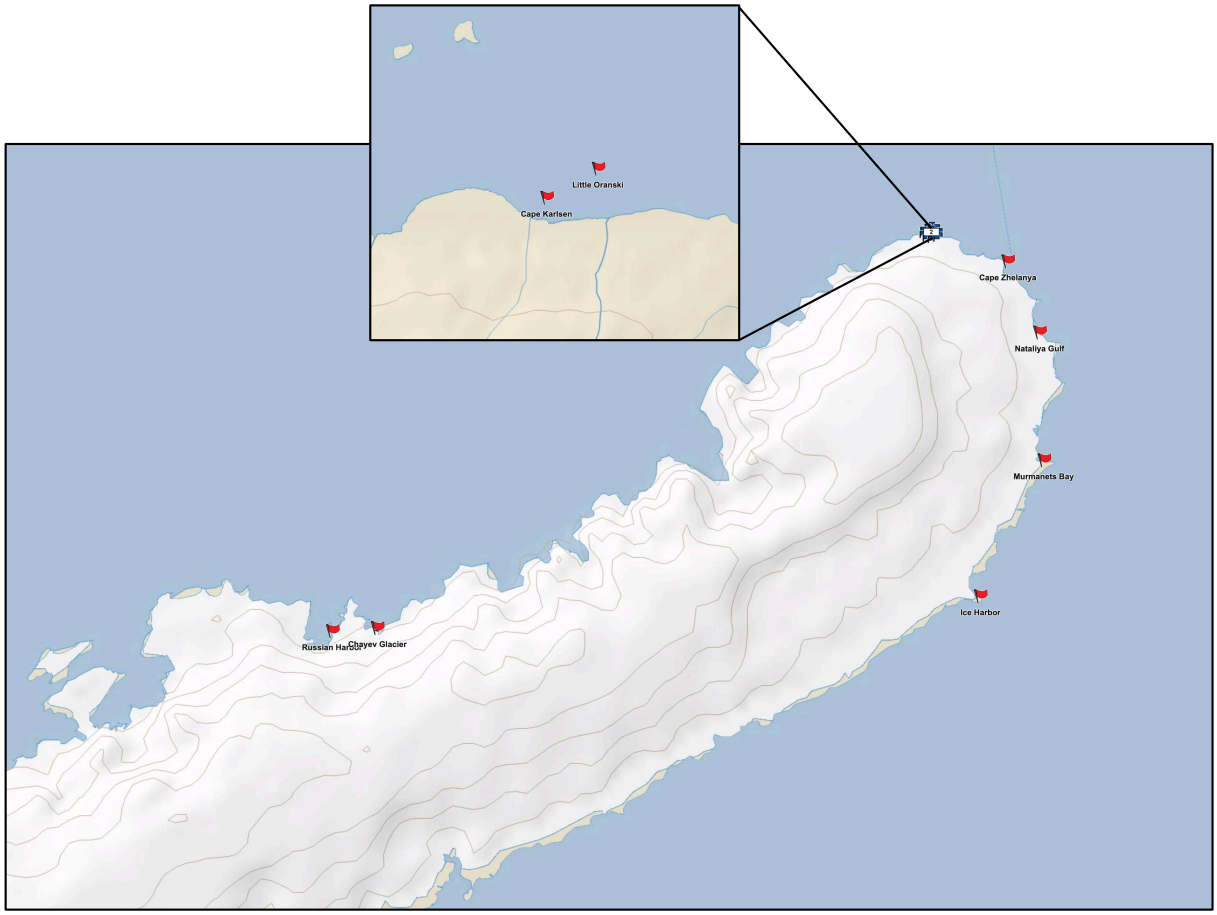


*Figure 1: Map showing general landing areas on northern Severny Island.*

# 3. BEACH LITTER REGISTRATIONS

## 3.1 Methodology

Beach litter was registered opportunistically upon each landing. Minimum one beach and up to five were registered upon each landing. A beach in this case simply refers to 100 m of coastline, and does not imply a sandy substrate. The number of beaches registered in each of the eight areas depended upon the time available on shore. Within an area each beach was minimum 100 m apart.

Within each beach, data were collected according to SALT's quantitative beach litter registration protocol (Figure 2). In order to assess both litter density and its variability within a beach, litter is registered in three 10 m wide transects on each beach. The transects are spaced 30 m apart. Each transect runs perpendicular to shore and is divided into 10x10 m blocks. The transect length is determined by how far inshore litter has been deposited; one continues adding blocks until the last one contains no significant litter. This ensures that the entire backshore area affected by litter is surveyed, while also allowing standardisation of transect length during analyses if desired.

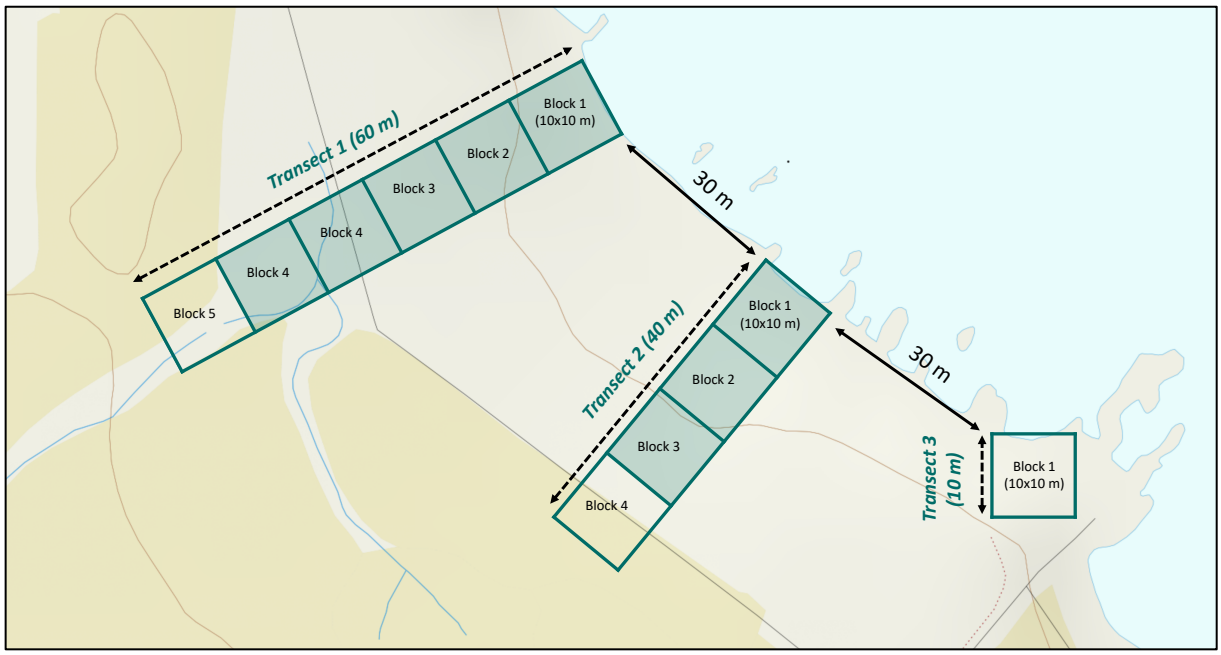


*Figure 2: Graphic illustrating the quantitative beach litter registration protocol. Three 10 m wide transects, placed 30 m apart, are sampled on each beach (i.e., 100 m stretch of coastline). Each transect is built of 10x10 m blocks, which continue perpendicular to shore until no significant litter is found in the final block (non-shaded blocks in graphic). Transect length is thus variable and dictated by how far inshore litter has been deposited.*

Litter is recorded within each block in a total of eight categories based on size and source/release points. Litter is firstly classified by size into four categories: meso, macro, mega and giga litter (Figure 3). Within each size class litter is then further subdivided based on the most likely source/release point: sea-based and land-based/unknown. Litter classified as sea-based includes ropes, fishing gear, floats and buoys, etc. (i.e., items almost certainly released directly into the sea).


*Figure 3: Size classes of litter recorded. Note that within each size class litter is further subdivided into originating from sea-based vs. land-based/unknown sources.*

In SALT's original protocol all observed litter is registered. For this project, however, we chose to add the option of classifying a transect block as "containing no significant litter". This was done to save time during registrations and thus ensure the time to survey a greater number of transects. This was deemed necessary given the limited time available on shore during each landing and the impossibility of returning to an area to continue registrations. The threshold for "no significant litter" was determined based on the 25$^{th}$ percentile block litter density from complimentary data from the southern Barents Sea along the coast of eastern Finnmark, Norway. Based on these data, only blocks containing ≥10 meso-sized items, and/or ≥3 macro-sized items, and/or ≥1 mega- or giga-sized items were considered to contain significant amounts of litter.

## 3.2 Preliminary results

Litter was registered in a total of 53 transects spread across 19 beaches. Three transects were registered on all but one beach where sampling had to be terminated due to the presence of polar bears. Of the 53 transects registered, 34% contained significant amounts of litter. In these transects, a total of 553 litter items weighing a total of 241 kg were registered. Of these registered litter items, 31% could be said with certainty to have originated from sea-based sources by count and 63% by weight. In addition, 42% of transects contained non-significant amounts of litter and 25% were empty.

The percentage of significantly polluted transects (34%) was similar to that in the Lofoten and Vesterålen archipelagos in the Norwegian Sea (30%), but considerably lower than in eastern Finnmark in the southern Barents Sea (58%). The average amount of litter in the significantly polluted transects (mean = 31 items and 13 kg) was considerably lower than in both Lofoten-Vesterålen (mean = 565 items and 30 kg) and eastern Finnmark (mean = 135 items and 47 kg).

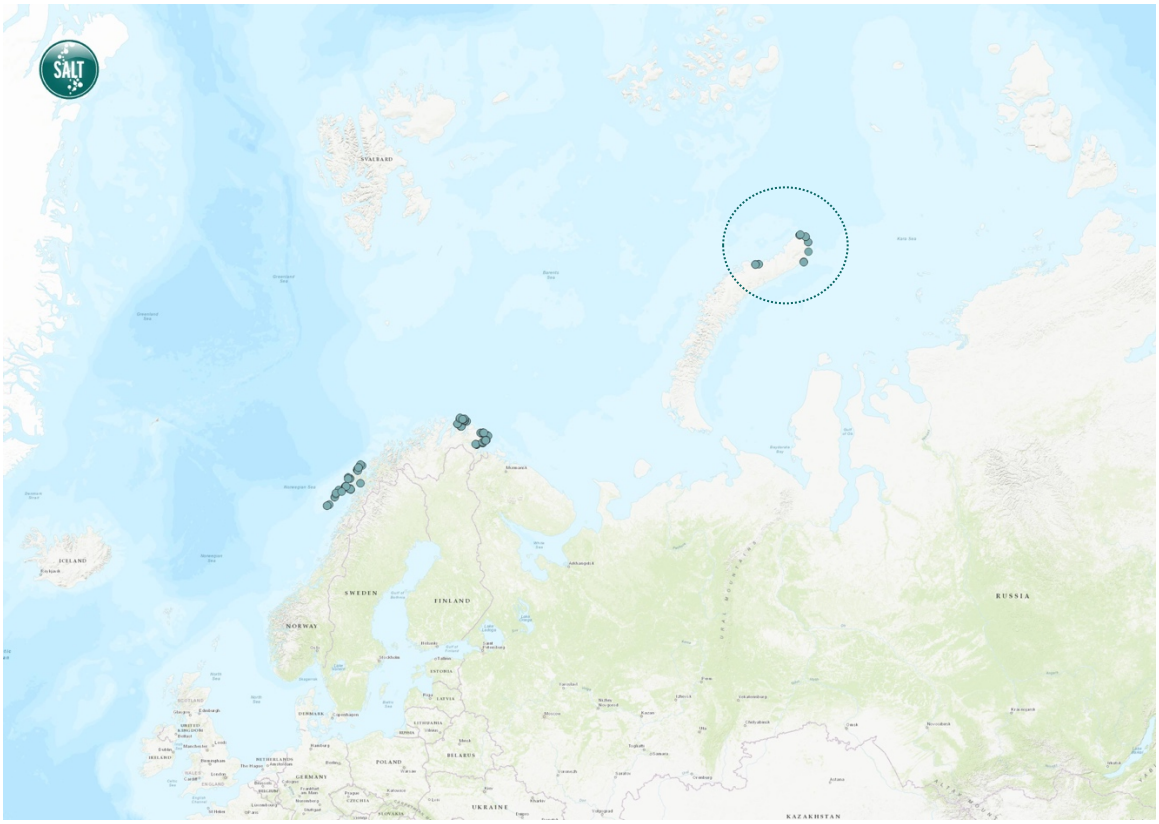


*Figure 4: Map showing all beaches surveyed quantitatively to be included in MALINOR. Registrations from the current field expedition to Novaya Zemlya are circled. The remaining two areas are the Lofoten-Vesterålen archipelagos in the Norwegian Sea and eastern Finnmark in the southern Barents Sea.*


*Photo 2: Examples of litter items registered on beaches on northern Novaya Zemlya. Left: Large rope. Middle, top: a metal bouy and a military sonobouy. Middle, bottom: Mass of packing bands, likely discarded from a trawler following clogging of packing machine. Right, top: Food and sanitary packaging (butter and hand cream containers). Right, bottom: Large metal mouring buoy. All photos by SALT/Marthe Larsen Haarr.*

# 4. ADDITIONAL DATA COLLECTION: AT-SEA OBSERVATIONS OF FLOATING LITTER

## 4.1 Methodology

As accessing the beaches of northern Novaya Zemlya required significant transit time (approx. 1 week each direction), we also made surface observations of floating debris, both natural and anthropogenic, to make the most of the time spent. Surface observations were made for 10-15 min (mean = 12) transects, depending on conditions. The relatively short transect duration was chosen to minimise observer fatigue. The observer was situated on deck, approximately 2 m above sea level, with a clear view in an approximately 10 m wide corridor. Two observers rotated observations when weather conditions allowed. The track of each transect was recorded using a Garmin InReach logging at 1 min intervals. The length of the each transect varied with the cruising speed of the vessel. Observations were only made when the sea state was at Beaufort 4 or less. Observations were made on either side of the vessel according to where sun glare was less. Floating debris observed in each transect was categorised as “anthropogenic: fisheries”, “anthropogenic: other/unknown”, “natural: seaweed”, “natural: wood”, and “other” for items that fit none of the four main categories. Objects were also classified according to the same size classes as beach litter (note that the lower limit for meso-sized items was 2.5 cm rather 0.5 cm). Notes were made for each object identifying items to the highest level possible.

## 4.2 Preliminary results

A total of 165 transects were surveyed with a total of 33 hours of observations over a total distance of 265 km (Figure 5). A total of 108 items of anthropogenic litter, and 162 items of natural debris, were observed. One third (33%) of transects contained anthropogenic litter. Meso-sized items (2.5-20 cm) were the most common (86% of observed anthropogenic litter). Macro-sized items (20-50

cm) constituted 10% of observed anthropogenic litter. Mega and giga-sized items were rare with only one and three observed, respectively.

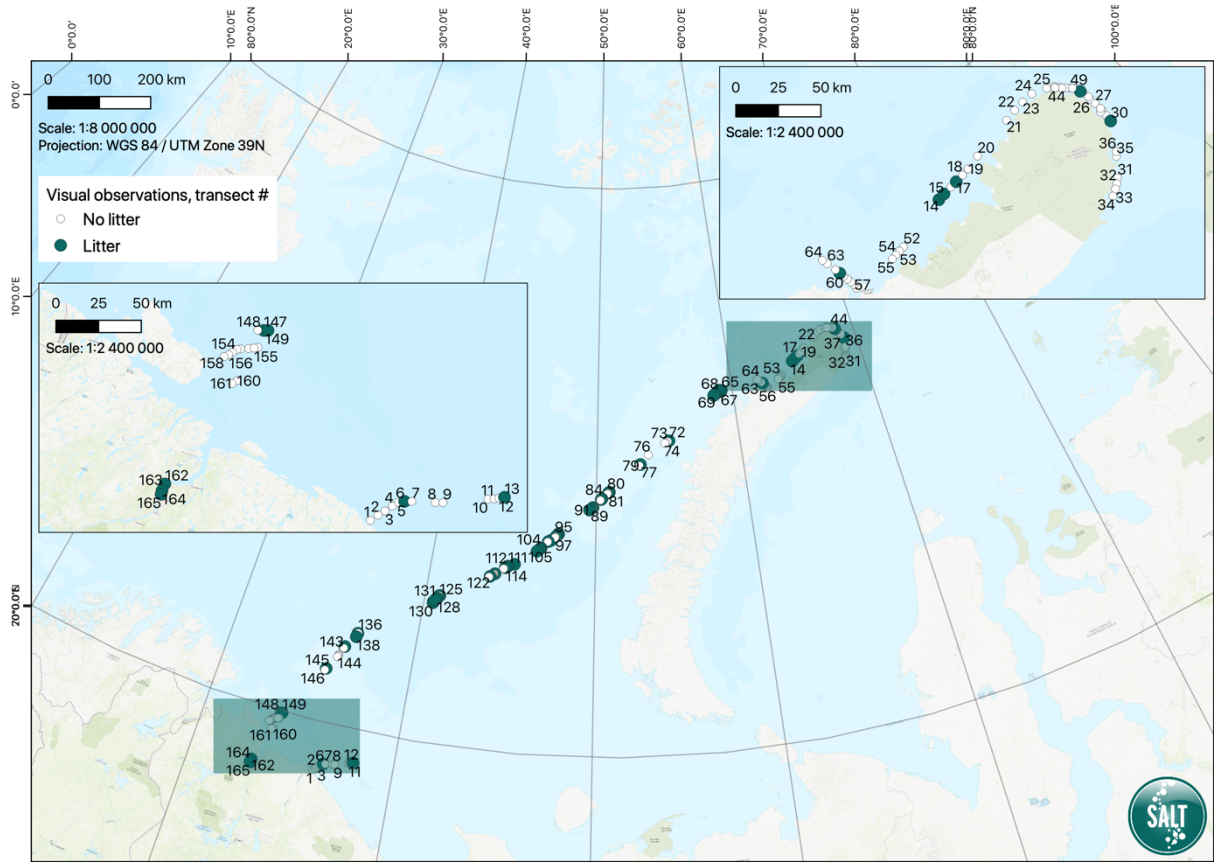


*Figure 5: Map showing transects surveyed for floating debris.*

*Photo 3: Examples of floating anthropogenic litter observed. Left: A plastic trawl bobbin. Middle: Lost, abandoned or otherwise discarded fishing gear. Right: Large sheet of soft plastic, presumably for packaging. All photos by SALT/Marthe Larsen Haarr.*

# 5. SUMMARY

In summary, this expedition has provided the first quantitative beach litter data from the northeastern Barents Sea and northwestern Kara Sea, as well as the first observations of floating litter in the eastern Barents Sea categorized by source and size. In general, pollution levels along the shore of Northern Novaya Zemlya were considerably less than what has been documented in the southern Barents Sea.

# SALT kunnskap – friske ideer

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