Mapping marine litter in the Norwegian and Russian Arctic Seas, using robotics and digital solutions

«…a single one replaces them all: the whole world *can* be plasticized, and even life itself…»
Roland Barthes in Mythologies (1957)

Contact: Frank Beuchel, Akvaplan-niva, Norway frb@akvaplan.niva.no

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Primary objective:

To detect, identify and map areas of plastic litter in the Norwegian and Russian Arctic, offshore and on the shore by developing robotics, digital solutions, machine learning and ocean modelling. The primary objective is to facilitate the acquisition of data at a reduced cost and low CO2 emission, in difficult and vast areas, and to use these data to provide recommendations for mitigation, prevention, monitoring and education with a multi-disciplinary approach in collaboration between Norwegian and Russian institutions.

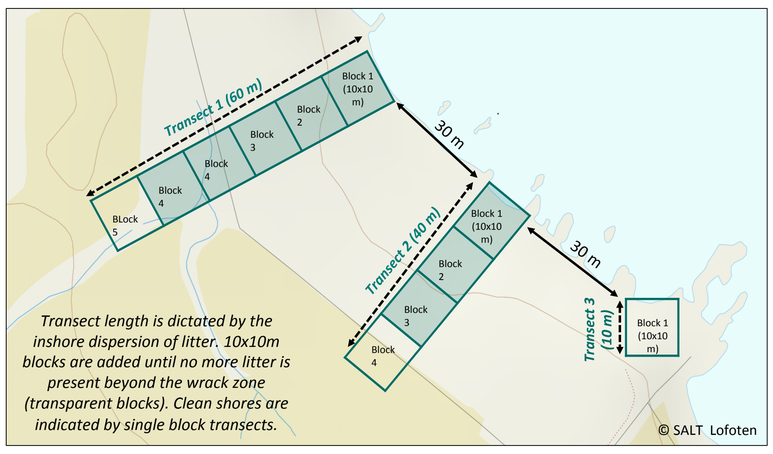
Secondary objectives:

- To develop and implement a high definition subsea camera system on an autonomous unmanned surface vehicle (WaveGlider) that uses renewable energy (waves) to cover long distance and to power instruments (sun) to collect data on floating litter at the surface of the Barents Sea
- To optimize and validate the use of aerial battery powered drones to map litter on the shore of the Barents Sea
- To use high definition satellite picture (~30cm) for detecting and mapping lost fishing gear ("ghost fishing nets") stranded on the shore
- To identify ongoing activities on these topics both in Norway and Russia
- To develop a predictive tool for litter distribution using high resolution ocean model
- To disseminate the findings to students, public, civil industry, and policy makers

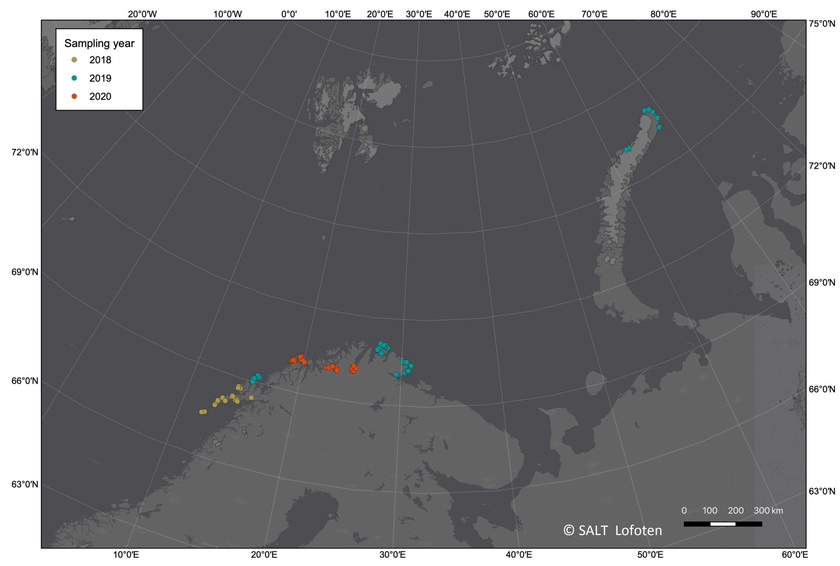
Norwegian partners:

International partners:

Ground truth:

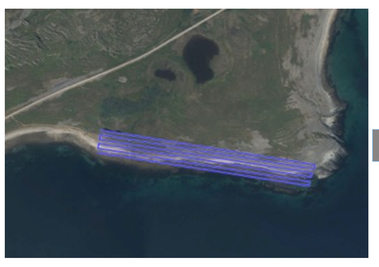


Sample design for calculation of beach litter. The sites are randomly selected based on a grid system.

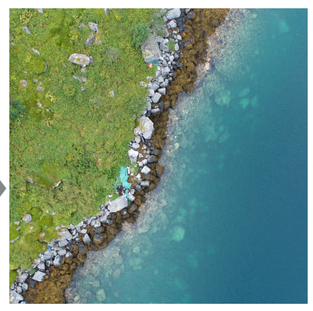


Map of sample locations used in the projects.

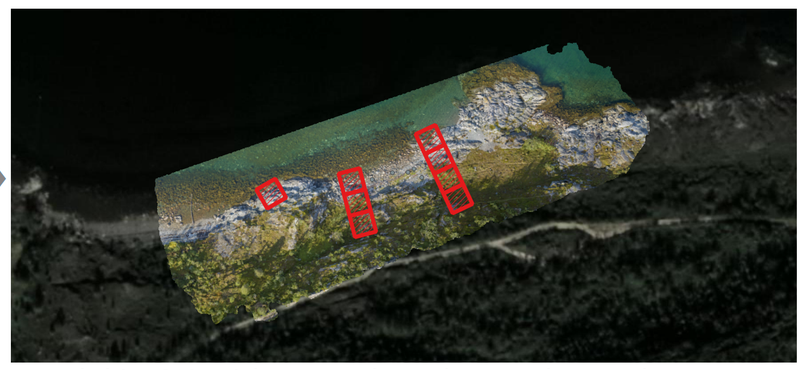
Aerial drone:



Planning of drone-transect



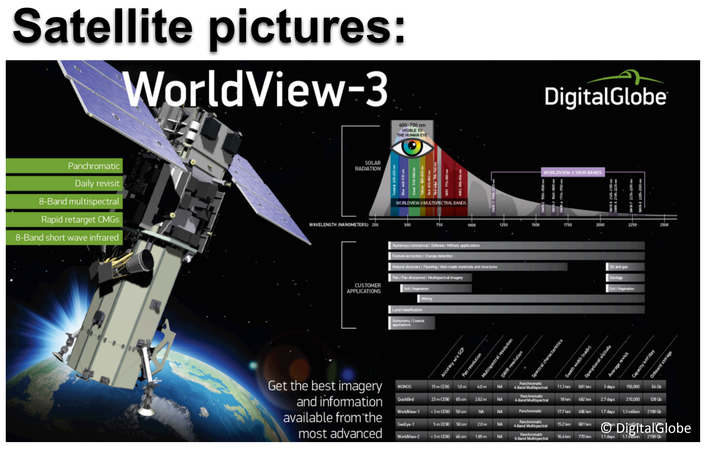
Raw- image



Model in GIS with ground-truth sample quadrats

Different types of beaches (sandy, stony, rocks) were visited to validate the method.

Satellite pictures:



High resolution satellite images 30-50cm

Detection of "ghost net" from satellite images

Machine learning:

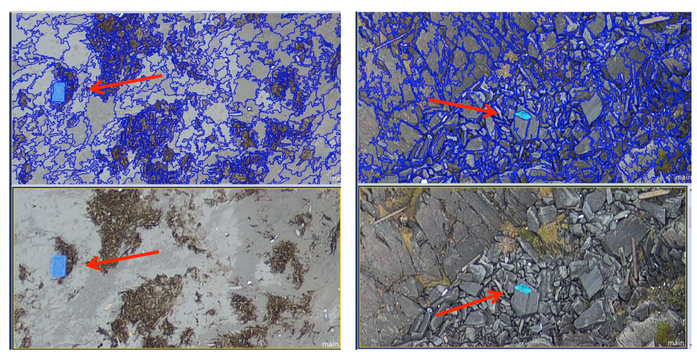
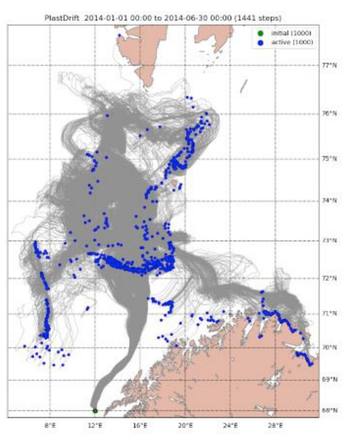
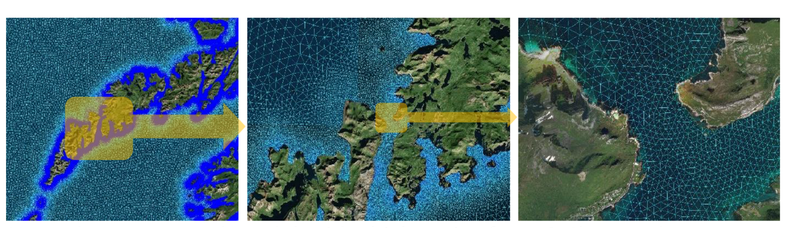


Image analysis using segmentation algorithms in eCognition to detect and quantify plastic debris on different beach types for drone, satellite and offshore Wave glider images

Ocean model:

High-resolution model predicting drift of offshore plastic particles and their potential accumulation areas. Wave gliders are used for ground truth.





Nested unstructured model grid which varies from 2.4km on the outer boundaries to 100m in straits and fjords