21 AUG ’21

Longyearbyen, Svalbard
Polarquest2021
#SavetheWhite

POLARQUEST2021: MISSION COMPLETE!

Highlights:

- Sonar Mapping
- e-DNA & Greenhouse gas sampling
- Drone Mapping
- Driftwood & Plastic Sampling

On 20 August 2021 at 20:30 CEST, the Polarquest 2021 team pulled into dock in Longyearbyen, Svalbard. They return triumphant, having successfully completed a 20-day scientific expedition around the archipelago, logging 1300 nautical miles.

The **Polarquest2021: Save the Arctic White** expedition team set out on 31 July 2021 aboard the Italian flag steel cutter Best Explorer. The vessel was crewed by a diverse team of researchers, science communicators and sailors, all carrying out valuable **scientific investigation** about the Arctic environment and the impact of human activity on its fragile ecosystems.

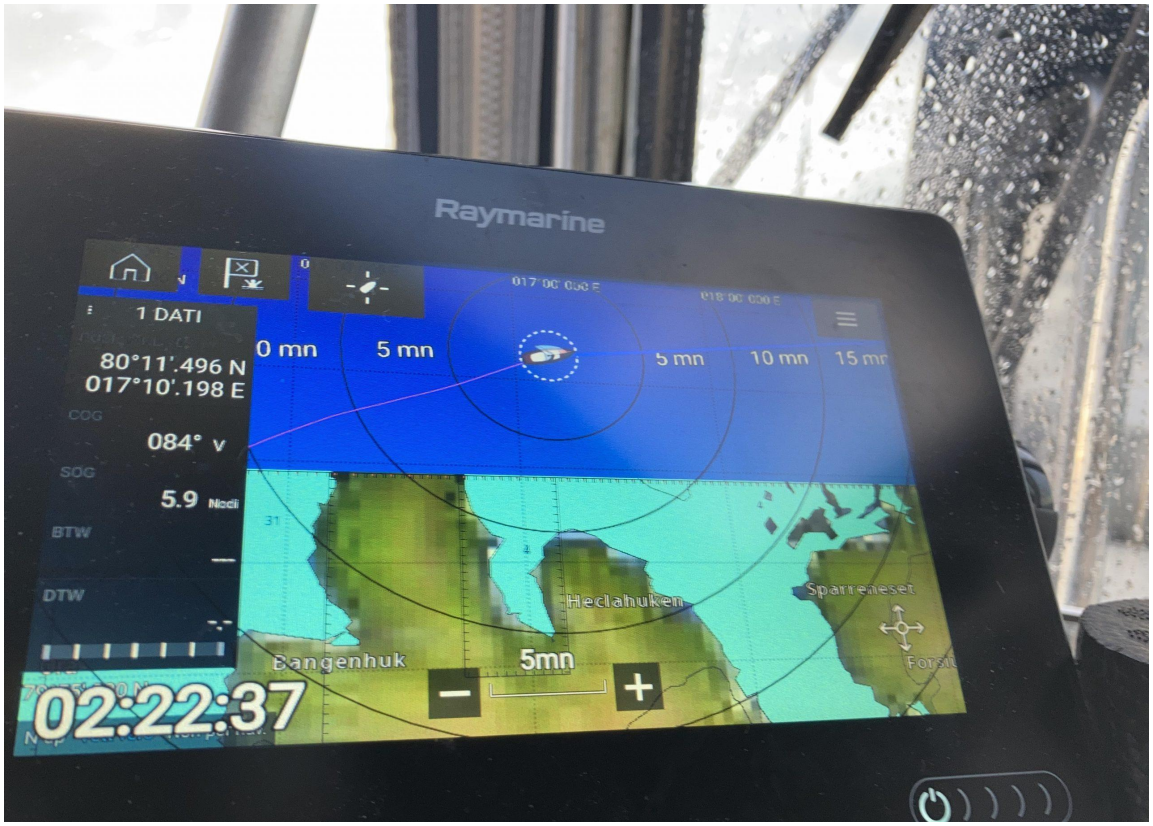
The expedition crossed the 80th parallel North, into uncharted waters in the Northeast of the Svalbard archipelago. The team carried out **first-of-a-kind** mapping by air and sea, giving testimony to the state of the Arctic environment in the northernmost regions of Svalbard.

In Lilliehöökfjord, they sampled **environmental DNA** (e-DNA) to measure the impact of climate change on biodiversity; the samples will be analysed at ETH Zürich. At every station along the itinerary, **greenhouse gasses** were sampled from the sea water and atmosphere. **Drones** were deployed to carry out highly detailed mapping in five locations in the North West and North East of Svalbard; data processing and analysis will be now carried out by the Geographical Laboratory of the European University of Rome (GREAL).

In the same regions, a multibeam **sonar scanning** of the seafloor was carried out, collecting unprecedented data which will be precious both for navigation purposes and environmental studies. They will be processed to make a case study by NORBIT Subsea, University of Gdansk and GREAL. Further, samples of **driftwood** and **macroplastic** on the shores of some the remotest islands of the planet were collected for further study by ISMAR-CNR, La Spezia.

Specific summaries of Polarquest2021's **scientific accomplishments** are given below.

THE POLARQUEST2021 TEAM ABOARD BEST EXPLORER!



CROSSING THE 80TH PARALLEL INTO UNCHARTED WATERS.

Sonar Mapping

Can an innovative compact sonar be used aboard a small sailing ship? Could it take detailed studies of greenhouse gas bubbles released underwater? And map the regions of the archipelago unreachable by larger scanning ships?

These were the questions the Polarquest2021 team set out to answer with their sonar mapping research activity; lead by the University of Gdansk, NORBIT Subsea, the European University of Rome and the Italian Geographical Society.

The sonar mapping activity began immediately upon leaving Ny Alesund on 8 August. The team deployed a NORBIT Subsea iWBM 200 kHz multibeam echosounder, installed on the right side of the stern platform with its GPS antennas placed on an A-frame above the navigation cockpit.

The multibeam sensor was used to conduct two different types of surveys: a route scanning during transits along the western and north-western area of Spitsbergen and Nordaustlandet; and a systematic survey of ~25 km^2 area Southwestern of Lady Franklinfjorden, Nordaustlandet, down to a distance of approximately 300 metres from glacier Søre Franklinbreen front, beyond the 80th parallel North. This activity produced **new data in partially charted or completely uncharted regions** of the archipelago, identifying potential corridors for navigation in several points of very shallow waters. In the scanning phases when water column data were acquired, no major presence of greenhouse gasses bubbles was observed. Further analysis will reveal the possible presence of the phenomenon.

Polarquest team involved: directed by sonar specialist Domink Pałgan (Norbit and University of Gdansk) and assisted by scientific coordinator Gianluca Casagrande

(GREAL), support engineer Kevin Monneron (Polarquest Association) and environmental science student Elias Meier (ETH Zürich) .

DEPLOYING THE NORBIT SUBSEA SONAR IN SVALBARD.

GIANLUCA MONITORS DATA GATHERED BY THE SONAR.

Environmental DNA and Greenhouse Gas Sampling

In an activity organised by the Swiss Polar Institute, researchers carried out a **full biodiversity sampling survey of Lilliehöökfjord**. In addition to sampling of environmental DNA (e-DNA), the team examined environmental parameters such as CTD profiles, nutrients and rare Earth element. The collected samples provide unique insight into the complex dynamics of fjords, where water circulation (and its impact on

biodiversity) is influenced by melting glaciers, icebergs and deep water intrusion from the open sea.

Samples were collected in the surface (3m), the depth of chlorophyll maximum, and at a depth of 100m. Their research had two major aims:

1. Study biodiversity using biomarkers for bacteria (16S rRNA) and eukaryotes (18S rRNA) as well as fish in synchrony with key parameters to grasp the potential complex in-situ circulation and inputs within the fjord.
2. Compare two sequencing methods – "Illumina" and "Oxford Nanopore" – for biodiversity determination and technological advancements.

With the successful sampling of these areas, work now begins on the analysis, to be carried out at ETH Zürich.

The same team carried out studies of greenhouse gasses (CO2 and Methane) in the seawater and atmosphere. Samples were taken at more than 40 sites, including at every e-DNA sampling station, totalling 3 sampling per expedition day! The samples will be analysed by the University of Geneva, Forel Institute (Prof. Daniel McGinnis).

Polarquest team involved: lead by expert Christel Hassler (Swiss Polar Institute), with environmental science student Elias Meier (ETH Zürich) and support engineer Kevin Monneron (Polarquest association) and Dominik Palgan (University of Gdansk).

CHRISTEL LOWERS THE SAMPLING DEVICE (NISKIN BOTTLES) FROM BEST EXPLORER.

GREENHOUSE GASSES SAMPLING IN LAGOYA CARRIED OUT BY ELIAS (LEFT) AND CHRISTEL (RIGHT).

Drone Mapping

Using small commercial drones, the Polarquest2021 team documented the **environmental status** of some uninhabited areas in the Eastern and Northern region of Svalbard. This provides not only first-of-a-kind mapping information of these regions, it also provides baseline information on the state of the environment. This is essential for scientists monitoring the archipelago for environmental and human induced change.

Four sites were surveyed by a GREAL/FlyToDiscover tethered drone, yielding over **2000 images** in the visible light (in Signehamna, Hansøya, Lågøya, Bockfjorden) and **thermal infrared** (Jotunkjeldene); a fifth survey was conducted using a free-flying DJI Mavic mini drone over the Sallyhamna archaeological site. Preliminary reports were prepared on board Best Explorer, with more comprehensive analyses to be performed at the European University of Rome. Geological analyses of images will be conducted at the University of Gdansk.

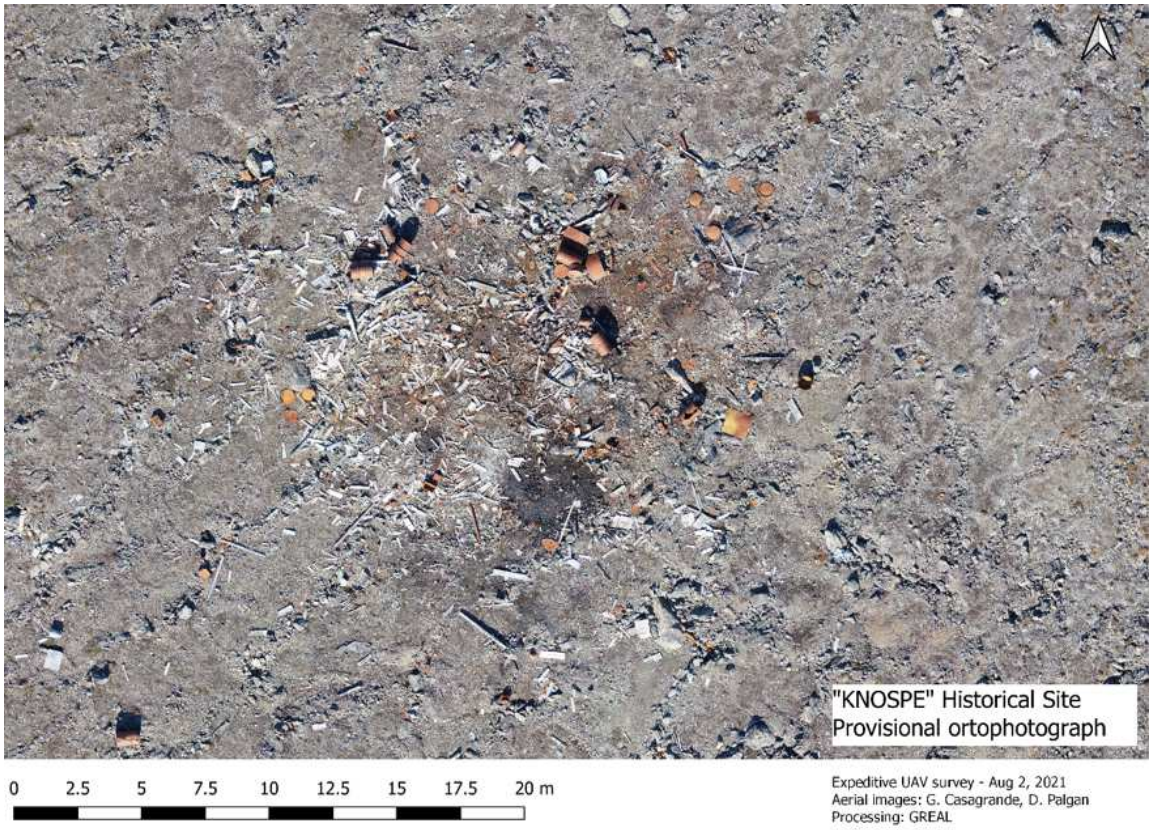
This activity was supported by the European University of Rome, Italian Geographical Society and University of Gdansk, with drones provided by Geographic Research and Application Laboratory (GREAL) and configured by FlyToDiscover.

Polarquest team involved: directed by scientific coordinator Gianluca Casagrande (GREAL), with support from Dominik Pałgan (University of Gdansk), Kevin Monneron (Polarquest Association) and Mike Struik (Polarquest Association).

Learn more:

- Mapping an Abandoned WWII Station in Svalbard, 9 Aug 2021

DOMINIK (LEFT) AND GIANLUCA (RIGHT) DEPLOY A DRONE OVER BOCKFJORDEN.



SAMPLE ORTOPHOTO COLLECTED WITH A DRONE, SHOWING WWII REMNANTS IN KNOSPE.

Driftwood & Plastic Sampling

The team also studied two key types of pollution in the Arctic: driftwood and plastic. The study was supported by ISMAR-CNR La Spezia.

Samples of driftwood and macroplastic were collected on the beaches of Hansøya and Lågøya in order to study the timing and – if possible – drifting paths of the driftwood and accumulation dynamics of the plastic in the same spots. The study will be **complemented by the aerial mapping** carried out over the same areas by the Drone Mapping project. Studies of this data will add to the information garnered about the state of biodiversity in those regions, while adding to the overall picture of plastic pollution in the Arctic.

Polarquest team involved: Gianluca Casagrande (GREAL), Christel Hassler (Swiss Polar Institute), Elias Meier (ETH Zürich) and Paola Catapano (Polarquest Association).

MASSIVE DRIFTWOOD FOUND ALONG THE BEACHES OF SALLYHAMNA, NORTHERN SVALBARD.

KEVIN (LEFT) AND PAOLA (RIGHT) EXAMINE THE INCREDIBLE PLASTIC WASTE WASHED UP ON SVALBARD BEACHES.

About the expedition

The Polarquest 2021 expedition was carried out aboard **Best Explorer**, a record-breaking sailboat. It was the second to ever circumnavigate the Arctic in a clockwise direction and the first Italian sailboat to sail the Northwest and Northeast passage.

For the 2021 expedition, Polarquest association partnered with **BlanX** as part of its Save the Arctic White campaign. Blanx shares our ethos: promoting the value of scientific research and ensuring the protection of the Arctic.

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Polarquest2021 was made possible thanks to the following partners

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