Into the deep central Arctic Basin – the Nansen Legacy Arctic Basin expedition 2021

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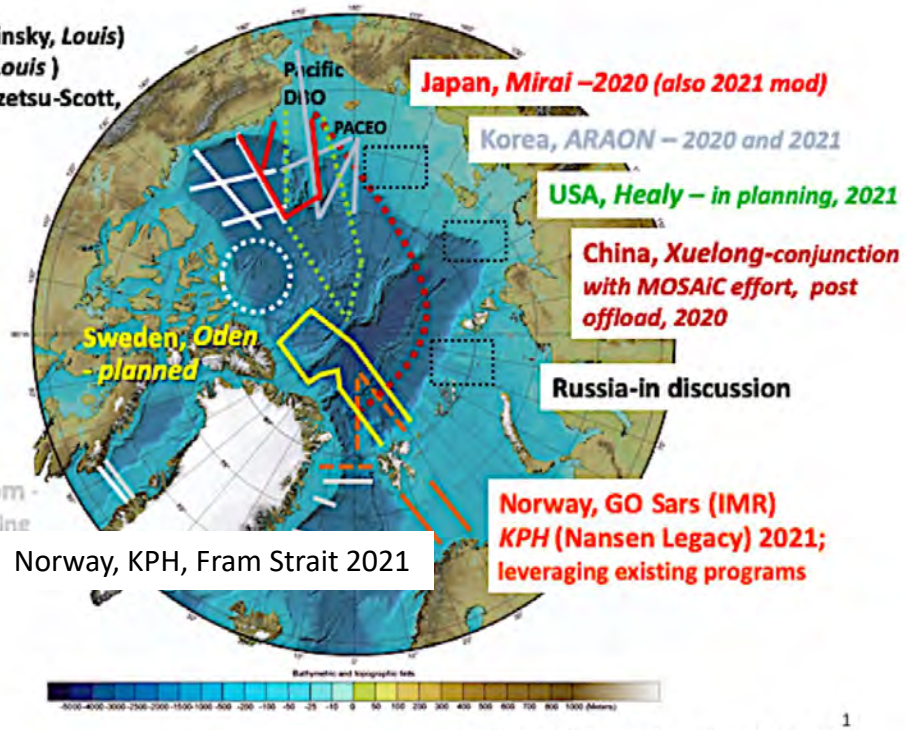
Contributions: Bodil Bluhm and Marit Reigstad, UiT
Mats Granskog, NPI
Melissa Chierici, IMR
and all cruise participants

Photo: Agneta Fransson, NPI

Norwegian contribution to «Synoptic Arctic Survey» (SAS)

International cruise plan

Canada, USA (white lines) – collaborations, 2020 and 2021:
JOIS/AON-BGOS
(Williams/Proshutinsky, *Louis*)
LIA-MPA (Michel, *Louis*)
Davis Strait (Lee/Azetsu-Scott, *Armstrong*)



Japan, *Mirai –2020 (also 2021 mod)*

Korea, *ARAON – 2020 and 2021*

USA, *Healy – in planning, 2021*

China, *Xuelong-conjunction with MOSAiC effort, post offload, 2020*

Russia-in discussion

Norway, GO Sars (IMR)
KPH (Nansen Legacy) 2021;
leveraging existing programs

United Kingdom - proposing ongoing (NERC highlight

Norway, KPH, Fram Strait 2021

[modified B. Williams and J. Grebmeier, May 2019]

Modified by A. Fransson, 2021

Synoptic Arctic Survey

Results 2020-2021

SAS map, A. Olsen, modified by A. Fransson

RV Kronprins Haakon and «Nansen Legacy»

- Purpose: to provide integrated scientific knowledge on the rapidly changing marine climate and ecosystem of the northern Barents Sea and adjacent Arctic Basin → facilitate sustainable management through the 21st century
- Research focus on physical, chemical and biological processes in a climate change perspective
- Expedition: 24 August-25 September 2021
- Chief scientists: Agneta Fransson NPI, Bodil Bluhm UiT

Agneta Fransson, NPI, 31 March 2022

Foto: Elin Vinje Jenssen, NPI

Research

Five scientific teams:

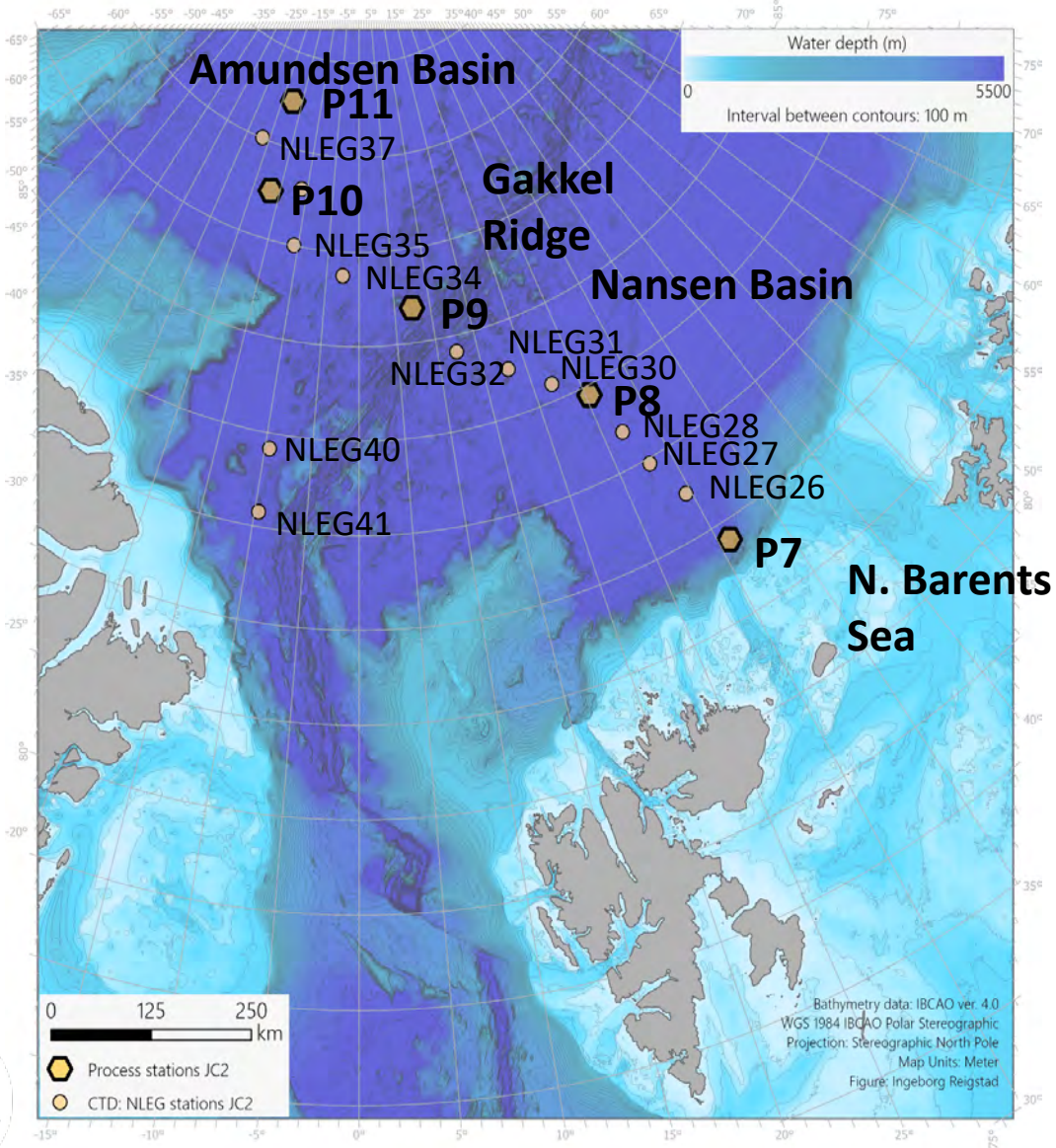
- physical oceanography and sea ice physics,
- ocean and sea ice chemistry,
- lower trophic levels,
- zooplankton and pelagic fish,
- benthic organisms and sediment work

Challenging sampling on depths >4000m) and in thick sea ice!

Agneta Fransson, NPI, 31 March 2022

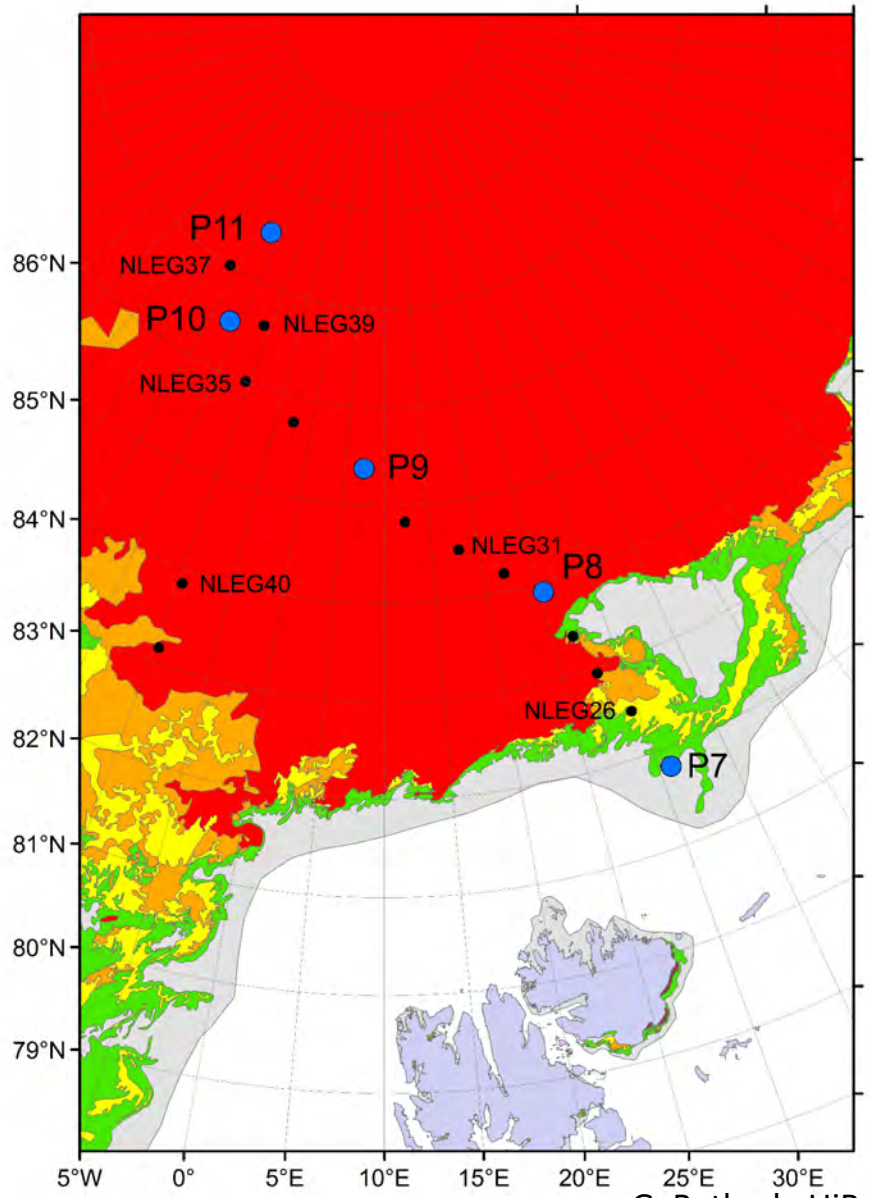
Cruise track and stations

Dark blue=3000->4000m, light blue=200m



I. Reigstadt, UiT

Red=pack ice yellow=open drift ice, green= open water



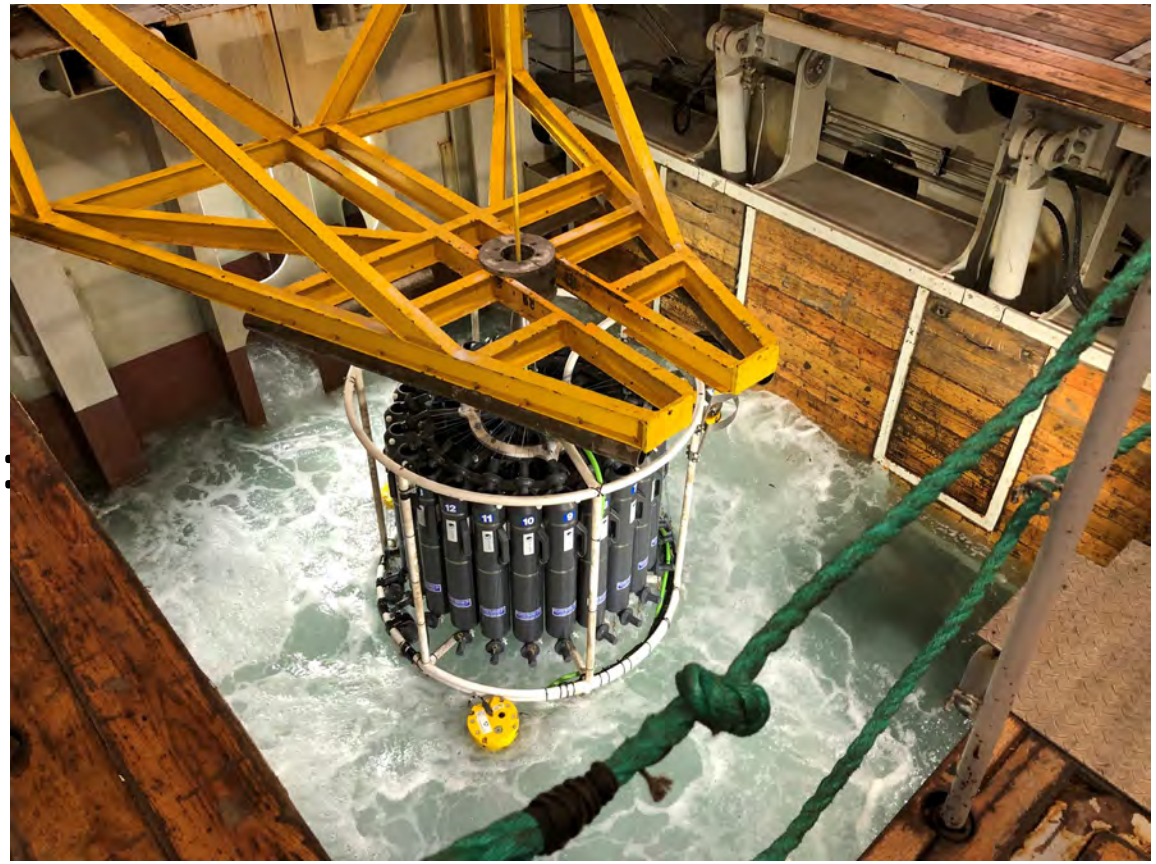
G. Batbrak, UiB

Arctic Basin 2021 stations:

1 x Process stn P7, 48 hrs, (bottom 2600m)
4 x Process stns P8-P11, 72 hrs, (bottom 3000->4000m)
11 x NLEG stns (3 hrs; CTD + water 1500m)

Process stations and activities (236 logged):

- CTD/ADCP on KPH in «moonpool» water sampling (44)
- Lead sampling in open lead, under-ice water and sensors, new sea ice, microstucture (MSS), CTD
- Plankton nets (94)
- Sediment traps (3x5), incubations
- Box corer (22) for benthos and experiments
- Trawling (12)
- Sea ice and snow sampling (17 days)
- Helicopter flying +EM bird (electromagnetic sond, 7 flights)
- Buoy deployments
- Filtrations, biological analyses, DNA, bacteria, chlorofyll
- Chemical analyses …and a lot more…



CTD-rosette and water sampling in «moonpool»

the Nansen LEGACY

Drone photo: Adam Steer, NP

Agneta Fransson, NPI, 31 March 2022

Sampling from bottom to surface in the water column

Photo: B. Bluhm, UiT, A. Fransson, NPI
C. Svendsen, UiT

Sediment/benthos work and filtrations

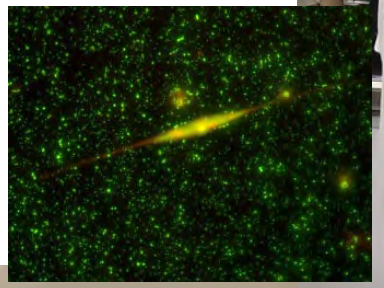


Photo: A. Fransson NPI, B. Bluhm UiT, G. Batbrak UiB

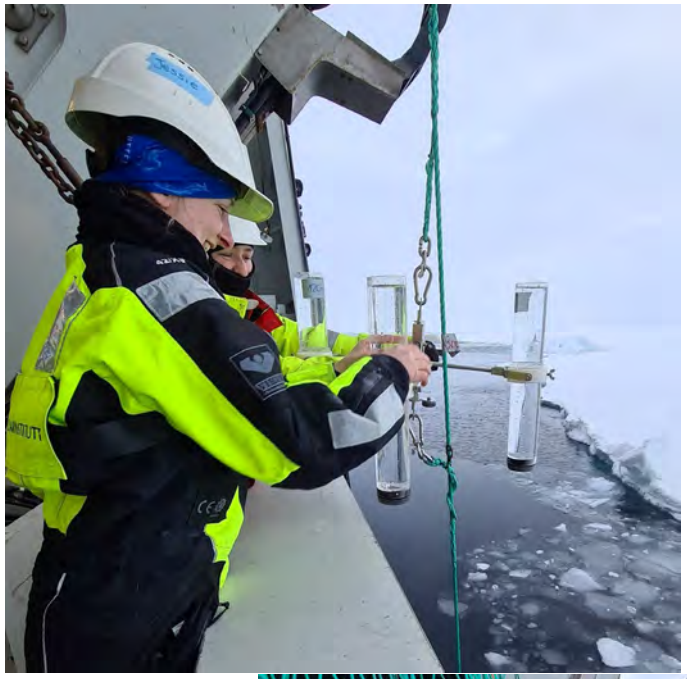


Photo: B. Bluhm, UiT, M. Marquant UiT, E. Hellerud, NPI, A. Fransson, NPI

Sea ice and lead work and sampling of sea ice and water for physics, chemistry and biology

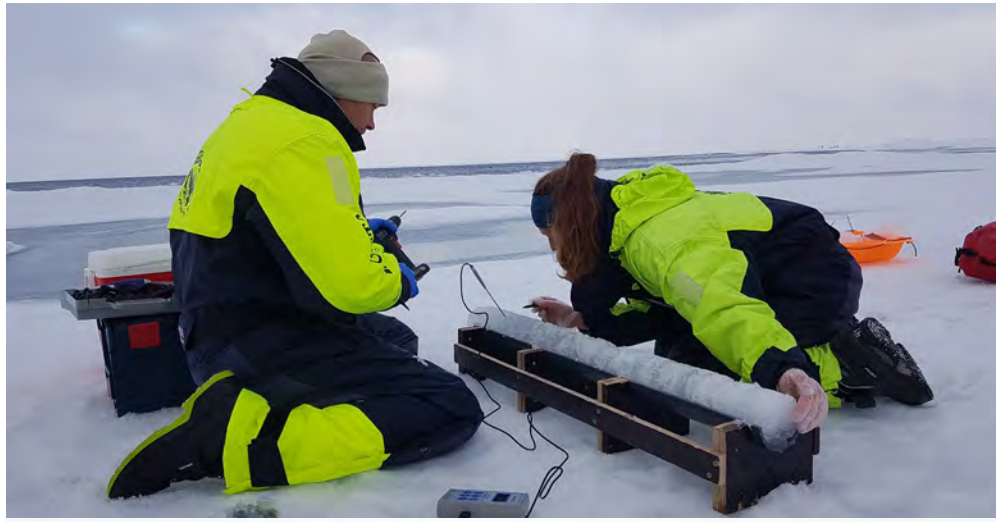


Photo: M. Marquant UiT, A. Fransson, NPI, B. Bluhm UiT

Data and PIs

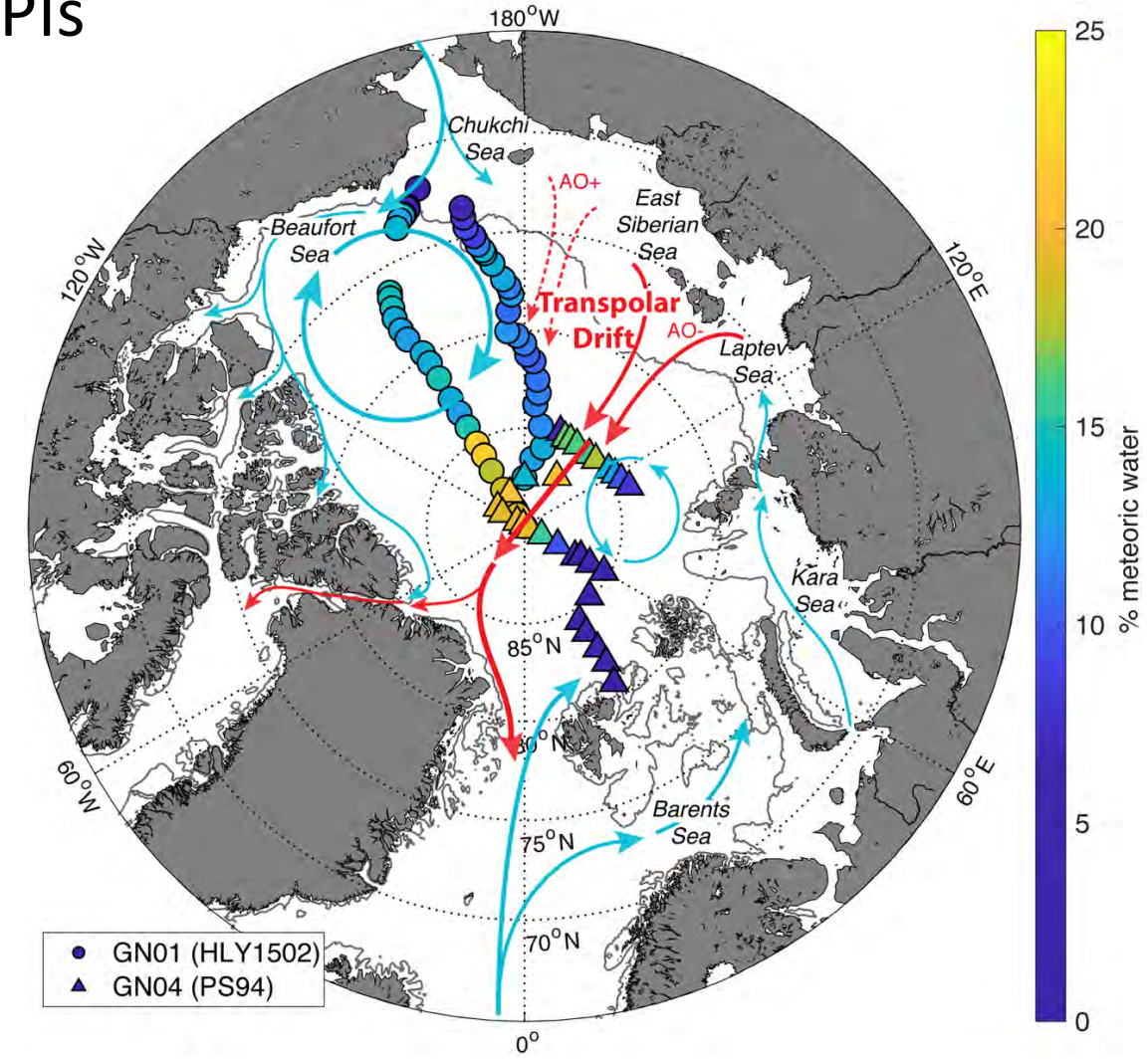
PI	NO	UNITS	DATA TYPE	DESCRIPTION
MC/AF	18	stations	H27	Alkalinity in seawater (18 sw stn), and sea ice, snow, meltponds (5 ice stn)
MC/AF	18	stations	H28	pH in seawater (18 sw stn), sea ice, snow, meltponds (5 ice stn)
MC	18	stations	H74	Total carbon dioxide/inorganic carbon in seawater (18 sw stn), and sea ice, snow, meltponds (5 ice stn)
AF	18	stations	H32	Oxygen stable isotopic ratio in seawater (18 sw stn), and sea ice, snow, meltponds (5 ice stn)
MC	18	stations	H22	Phosphate samples in seawater (18 sw stn), and sea ice, snow, meltponds (5 ice stn)
MC	18	stations	H24	Nitrate samples in seawater (18 sw stn), and sea ice, snow, meltponds (5 ice stn)
MC	18	stations	H26	Silicate samples in seawater (18 sw stn), and sea ice, snow, meltponds (5 ice stn)
MC	8	stations	H21	Dissolved oxygen in seawater
MG	6	stations	H90	Dissolved coloured organic matter (CDOM)
AS	18	stations	H10	CTD casts (salinity, temperature, depth)
AS	20	days	D71	Current profiler (ADCP) Along track ADCP
AS	18	stations	D71	Current profiler (ADCP) vertical profiles
RK	32	days	M06	Routine standard measurements, along track meteorological data (wind speed, direction, air temperature, air pressure)
RK	60	stations	M06	Radiosond measurements of atmosphere
MM	16	stations	H09	Water bottle stations
MA	9	stations	H30	Trace elements (rare elements, mercury) in seawater, sea ice, zooplankton, surface sediment
MA	9	stations	P01	Trace metals (iron) in seawater, sea ice
AS	26	days	H71	Surface measurements underway (T, S), along track salinity and temperature
AS	17	stations	D90	Microstructure profiling (MSS)
AS	4	stations	D90	Lead sampling of physical properties, CTD in water column
SG	5	stations	D90	Sea ice physical properties, thickness, salinity, temperature from ice cores
SG	5	stations	D90	Snow physical properties, thickness
SG	8.5	hours	D90	Helicopter flights, sea ice electromagnetic observations for thickness
SG	5	stations	D90	High resolution radar images for sea ice thickness and ice cover
SG	4	stations	D90	Electromagnetic measurements for ice-snow thickness
DD	24	days	D90	Sea ice observations ASSIST
KB	5	stations	P90	Other contaminants (oil components, pyrene) measurements, multi-stressor experiments on effects on zooplankton
GB	18	stations	B07	Bacteria, viruses (water column, sea ice)
GB	5	Stations	B07	Bacterial production
RG	5	stations	B01	Primary production
PA/BE	5	stations	B08	Phytoplankton and ice protist
AV	18	stations	B90	Chlorophyll in seawater, sea ice, meltponds
CS/AW	5	stations	B09	Zooplankton taxonomic composition, abundance, biomass and genomics, fatty acids
TR	5	stations	B09	Zooplankton: marine calcifiers (foraminifera, pteropods and coccolithophores) in seawater and sea ice
JS	5	stations	B09	Mesozooplankton community (180 um net)
RI	5	stations	B14	Pelagic fish (trawl) Harstad/Krill trawls, 50-550m
BB/EA	5	stations	B18	Zoobenthos
CS	5	stations	B13	Mesozooplankton community (64 um net)
LØ/GB	5	stations	B16	Benthic bacteria/micro-organisms
EA	5	stations	G04	Core, soft bottom sediments (environmental measurements)
EA	5	stations	B18	Benthic meiofauna
BB/PR	5	stations	B18	Benthic macrofauna
TR	4	stations	G71	Palaeosampling in sediments
MA	4	stations	G71	In situ seafloor sediment sampling for rare elements, toxic and trace metals
PR	4	stations	B17	Phytobenthos: Sediments pigments
MR	5	stations	B73	Isotopes, pigments, IP25, chlorophyll, silica, DNA/RNA, C/N
HH/GWG	3	stations	B90	Experiments on metabolic responses of living copepods to stressors of ocean acidification, lipids
PR	4	stations	B90	Sediment community oxygen uptake experiments
CS	5	stations	B90	Feeding experiments and respirometry and egg production experiments
RG	5	stations	B90	Experiments on nitrogen uptake by phytoplankton
RI	5	days	B28	EK80 acoustic data of zooplankton and fish along track
RI	5	stations	B28	EK80 acoustic data of zooplankton and fish
BB	5	Stations	B18	Zoobenthos for stable isotope (food web) analysis

Data and collaboration

- Data planned for publication in 2023
- For collaboration, data sharing within the project, please contact Marit Reigstad/Agneta Fransson/Bodil Bluhm and PIs of dataset

Transport of freshwater, organic material, carbon and changes in the chemistry of the Arctic Basins from the Siberian shelf is investigated.

For more information on NL cruise data and results, please contact project leader, cruise leaders and PIs



Charette et al. (2020)

JC2-2 Arctic Basin cruise 2021
18 September
87°31'N, 018°W

Agneta Fransson, NPI, 31 March 2022

Photo: Kay Jørgensen, IMR

the Nansen LEGACY

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Norwegian Meteorological Institute

NTNU

Akvaplan-niva

NERSC

Thanks!

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Storymap på https://arvenetternansen.com/joint-cruise-2-2
and https://sciencenorway.no/blog-nansen-legacy-project

Foto: Agneta Fransson, NPI