

Report to the Directorate of Fisheries  
and the Norwegian Petroleum Directorate  
on the HEINCKE-expedition HE605

Your references:

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RISING - Role and Distribution of Jellies in Norwegian waters

*The role and range boundaries of gelatinous zooplankton in the rapidly  
changing Arctic marginal seas*

09.08.2022 – 04.09.2022

Bremerhaven – Bremerhaven (Germany)

The expedition HE605 aimed to characterize the pelagic communities in fjords and open ocean, along a latitudinal gradient, from Northern Norway to Svalbard. The focus of the expedition was the study of gelatinous zooplankton (Cnidaria, Ctenophora), including their species diversity, distributions, ecological role and adaptation potential. By comparing Arctic and Atlantic fjords under the influence of distinct water regimes, we will use the obtained data to lay a baseline of gelatinous fauna and their range boundaries, in order to be able to predict poleward range shifts of Atlantic species.

During the HE605 expedition, we visited five western Svalbard fjords, of which the degree of Atlantic influence differs: Krossfjorden, Kongsfjorden, Billefjorden, van Mijenfjorden and Hornsund (see maps below). On the way south, we sampled at three different localities in the open ocean in the Barents Sea. Thereafter, we sampled in Porsangerfjorden, northern Norway, and finally, near Andøya on the borders of the Bleik Canyon.

### **Field work description**

The following field work was carried out on board RV Heincke:

*- Hydrography and sampling for environmental DNA:*

Standard hydrographic surveys were carried out using CTD casts (SBE 49, Sea-Bird Scientific) in the water column to the bottom depth for a complete profile of water column properties (salinity, temperature, fluorescence, oxygen). From the CTD rosette, water samples were taken at various depths (above bottom, 200m, 100m, 70m, 50m, 20m and surface), for conducting environmental DNA analyses on the filtered seawater samples.

*- Net sampling:*

Zooplankton and small nekton have been collected with plankton nets. Oblique hauls with the Midi-Multinet (0.25m<sup>2</sup> mouth opening, 5 nets of 335µm mesh size, Hydro-Bios) were towed at 0.5 m/s at different depth layers with a ship's speed of 2 knots. These tows covered part of the water column, from 20m above the seafloor to surface layers. A WP-3 net (1m Ø mouth opening, 1000 µm mesh size, Hydro-Bios) was used for vertical tows at 0.2-0.5 m/s through the water column, with aim to collect larger macrozooplankton from above the seafloor up to the surface layer. Finally, Bongo net tows (2x 60cm Ø mouth opening, 500 µm mesh size, Hydro-Bios) were carried

out at 0.5 m/s with a ship's speed of 2 knots. Large scyphozoan jellyfish were also collected with hand nets from the ship.

*- Sediment sampling:*

Van Veen grabs were deployed (0.5 m/s lowering speed) in the different stations in order to take sediment samples for environmental DNA analyses. In addition, samples were also examined and benthic animals were sorted and preserved for molecular analyses, as reference database for further studies.

*- Optical underwater transects:*

At several stations, we deployed the PELAGIOS in-situ observation system, a towed camera with an HD camera and LED lights. This camera system was deployed at 1 knot through the water column at various depth intervals for optical transects of 10min each. It was deployed in Krossfjorden, Kongsfjorden, Hornsund, in the Barents Sea and Porsangerfjorden. The OFOS (Ocean Floor Observation System), a benthic camera system equipped with lights, was towed above the seafloor at 0.5 kn for a duration of one hour at each of the surveyed localities in Billefjorden, van Mijenfjorden, Hornsund and Porsangerfjorden. In total, we gathered about 7 hours of pelagic and 7 hours of benthic video footage. In Porsangerfjorden, we deployed a tethered Remotely Operated Vehicle (BlueROV2) from the zodiac. With this, we carried out a horizontal and vertical dive for obtaining video material of jellyfish in the water column.

*- Scientific angling:*

In order to investigate the presence of gelatinous zooplankton in the diet of fish species with molecular methods, we carried out scientific angling at the following localities: near Kongsfjorden on the outer shelf (Station HE605\_6), on the Spitsbergen bank (Station HE605\_17) and in Porsangerfjorden (Station HE605\_25). At these stations, the only scientific work carried out was angling. In total 62 fish specimens were sampled including Atlantic cod (56), halibut (2), redfish (2), haddock (1), pollock (1). In addition to the DNA metabarcoding, biomarkers and stable isotopes will be used to determine their trophic role over an integrated period.

## **Collected samples**

We collected various species of gelatinous zooplankton taxa belonging to the scyphozoan cnidarians ("true" jellyfish, 2 species), hydrozoan cnidarians (ca. 30 species), ctenophores (comb jellies, ca. 5 species) and appendicularians. In addition, macrozooplankton (chaetognaths, polychaetes, pteropods, crustaceans, ...) and fish larvae were also sorted from the nets and preserved for further analyses.

We will use these samples for species inventories and abundance calculations, genetic analyses (species diversity, molecular identification), trophic studies (biomarkers, molecular diet studies), transcriptomics and microplastic contaminant studies.

Fish collected were dissected and their stomachs will be used for molecular diet analyses. Muscle tissue will be analyzed with biomarkers for determining their trophic position.

Filtered seawater and sediment samples will be used for environmental DNA analyses using DNA metabarcoding, for revealing metazoan communities and species richness.

Video footages will be analyzed for vertical distributions of gelatinous zooplankton, other macrozooplankton, fish and benthos.

## **Station details**

The following scientific stations were sampled with the aforementioned gear. The stations correspond to the ones specified in the diplomatic request, with some small changes in locality in

Kongsfjorden, due to sea ice conditions, and in the Vesterålen region, where we decided to sample a station at a lesser depth, but in the near vicinity of one of the stations initially planned.

Scientific station	Locality	Date	Latitude (N)	Longitude (E)	Depth
HE605_1	KROSSFJORDEN	15.8	79° 11,755'	011° 47,602'	365
HE605_2	KROSSFJORDEN	15.8	79° 07,751'	011° 40,583'	329
HE605_3	KONGSFJORDEN	15.8	78° 58,358'	011° 46,461'	221
HE605_4	KONGSFJORDEN	16.8	78° 55,585'	011° 59,631'	91
HE605_5	KONGSFJORDEN	16.8	78° 56,782'	011° 55,100'	292
HE605_6	KONGSFJORDEN	16.8	78° 57,180'	010° 26,362'	81
HE605_7	BILLEFJORDEN	17.8	78° 39,698'	016° 43,890'	192
HE605_8	BILLEFJORDEN	17.8	78° 39,555'	016° 40,611'	190
HE605_9	BILLEFJORDEN	17.8	78° 37,562'	016° 33,256'	140
HE605_10	VAN MIJENFJORDEN	18.8	77° 45,773'	015° 08,472'	105
HE605_11	VAN MIJENFJORDEN	18.8	77° 47,956'	015° 19,809'	104
HE605_12	VAN MIJENFJORDEN	18.8	77° 46,179'	015° 16,764'	101
HE605_13	HORNSUND	19.8	76° 59,806'	016° 26,708'	125
HE605_14	HORNSUND	19.8	76° 59,519'	016° 00,681'	107
HE605_15	HORNSUND	19.8	76° 57,742'	015° 49,667'	223
HE605_16	HORNSUND	19.8	76° 59,340'	015° 49,425'	200
HE605_17	SPITSBERGEN BANK	20.8	75° 14,554'	018° 34,672'	24
HE605_18	BARENTS SEA	21.8	72° 16,771'	024° 26,181'	268
HE605_19	BARENTS SEA	21.8	71° 48,735'	025° 34,401'	282
HE605_20	BARENTS SEA	21.8	71° 41,652'	026° 12,151'	326
HE605_21	PORSANGERFJORDEN	22.8	70° 31,774'	025° 39,012'	152
HE605_21	PORSANGERFJORDEN	22.8	70° 31,714'	025° 39,067'	148
HE605_23	PORSANGERFJORDEN	24.8	70° 05,294'	025° 06,593'	78
HE605_24	PORSANGERFJORDEN	25.8	70° 18,584'	025° 18,021'	87
HE605_25	PORSANGERFJORDEN	25.8	70° 31,682'	025° 22,824'	45
HE605_26	PORSANGERFJORDEN	26.8	70° 53,197'	026° 03,939'	194
HE605_27	PORSANGERFJORDEN	26.8	71° 05,466'	026° 19,723'	165

HE605_29	VESTERÅLEN	29.8	69° 30,362'	015° 45,681'	632
HE605_30	VESTERÅLEN	29.8	69° 28,026'	015° 38,991'	1278
HE605_31	VESTERÅLEN	30.8	69° 29,743'	015° 47,538'	317

**Maps of the sampled stations:**

