

Cruise HE 408 with RV Heincke

Bremerhaven – Tromsø – Ny Ålesund –
Longyearbyen – Tromsø – Bremerhaven

August 16th – September 14th 2013

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Summary

This cruise was a part of the “Verbundprojekt BIOACID” (Biological Impacts of Ocean ACIDification) Phase II (consortium 4 of 5), funded by the German Ministry for Education and Research (BMBF). It was also connected to the Norwegian programme on ecophysiology and ecotoxicology of Polar cod (*Boreogadus saida*) under global change, “POLARISATION”. Together, the team investigates how the combined effects of ocean acidification and warming (OAW) affect different life stages of the interacting fish species Atlantic cod (*G. morhua*) and Polar cod (*B. saida*) and their prey.

The main objectives of this cruise were to elucidate whether OAW affects interacting species differently due to divergent physiological optima and ranges, expressed in thermal tolerance windows and associated performance capacities and phenologies of specific life stages. Further, we intended to obtain specimens of both Polar cod (*B. saida*) and Atlantic cod (*G. morhua*) as well as planktonic organisms in the Atlantic and polar waters around Svalbard, which were used in experiments on board and back at the Alfred Wegener Institute and the University of Tromsø/Havbruksstasjonen i Tromsø.

We left Bremerhaven on the morning of August 16th, and arrived in Tromsø on Aug 21st, where we met with our Norwegian colleagues and took some samples and the fish-lift (Holst&McDonald, 2000) on board. We left for Northern Svalbard the same afternoon and sampled the Northern range of sites before calling at Ny-Ålesund on August 30th, where samples and material from the 2013 summer campaign was taken on board. On August 31st, we called at Longyearbyen to exchange personnel and leave the fish-lift for our Norwegian colleagues. Over the next four days, we sampled the southern stations before leaving Svalbard for the last sampling site at Bear Island on Sept 4th.

After this last sampling site, we left for Tromsø where we unloaded samples and live fish (*B. saida*) for the Havbruksstasjon in Kårvik on September 7th and 9th. In the late morning hours of Sept 9th, we left Tromsø towards Bremerhaven.

Sampling sites

In the following, the individual sampling sites are presented, together with some preliminary catch statistics for the fishery stations.

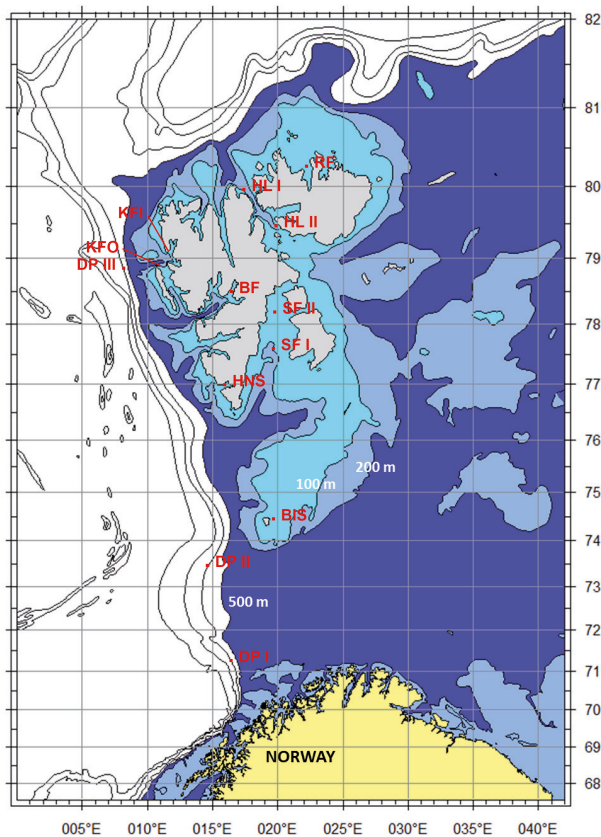


Figure 1: map of the stations of HE 408

1. **DP I:** Deep Plankton I (plankton net, CTD)
2. **DP II:** Deep Plankton II (plankton net, CTD)
3. **RF:** Rijpfjorden (fishery, plankton net, CTD)
4. **HL I:** Hinlopenstretet North (fishery, plankton net, CTD)
5. **HL II:** Hinlopenstretet South (fishery, plankton net, CTD)
6. **DP III:** Deep Plankton III (plankton net, CTD)
7. **KFI:** inner Kongsfjorden, Krossfjorden (fishery)
8. **KFO:** outer Kongsfjorden, Forlandsundet (fishery, plankton net, CTD)
9. **BF:** Billefjorden (fishery, plankton net, CTD)
10. **HNS:** Hornsund (fishery, plankton net, CTD)
11. **SF I:** Storfjorden South (CTD)
12. **SF II:** Storfjorden North (CTD, plankton net)
13. **BIS:** Bear Island (fishery, plankton net, CTD)

Fishery stations:

For the detection of fish schools, a Simrad EK60 hydro-acoustic system was applied. To effectively catch small and juvenile fish and surface them alive, we used a so-called fish-lift (Holst&MDonald, 2000, figure 2) connected to the juvenile fish trawl, which our Norwegian colleagues from UiT in Tromsø kindly offered. Trawl times never exceeded 15 minutes for each haul.

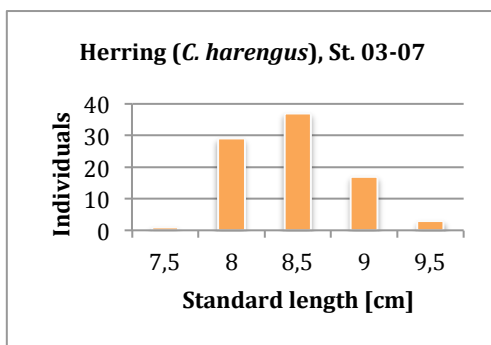
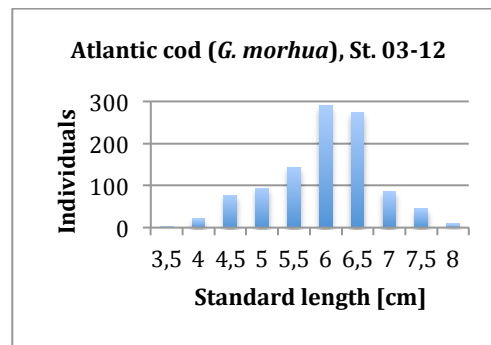
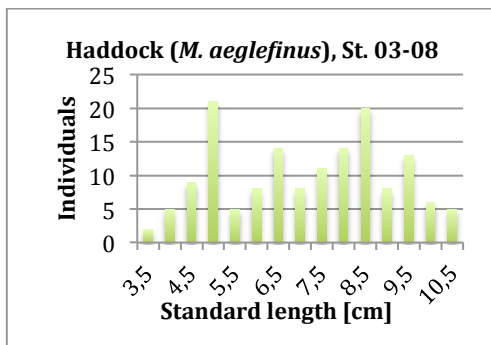


Figure 2: Fish-lift attached to the juvenile fish trawl of RV Heincke (photography: F. Mark).

Rijpfjorden (RF) 26.08.2013

Juvenile Fish Trawl (pelagic); Fish-Lift (pelagic)

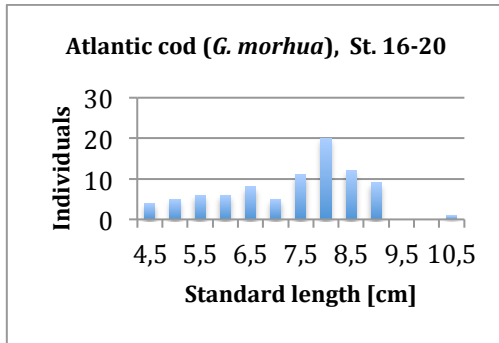
Mainly juvenile Atlantic cod, haddock and herring in the surface waters (0-40m).



Hinlopenstretet North (HL I); Hinlopenstretet South (HL II) 27.08.2013

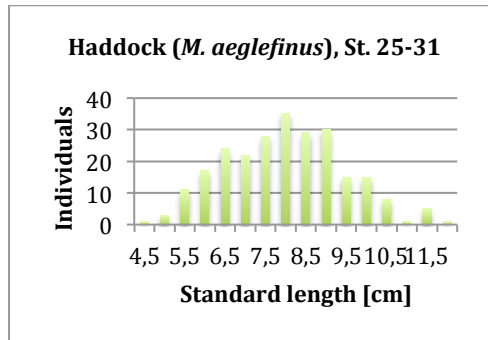
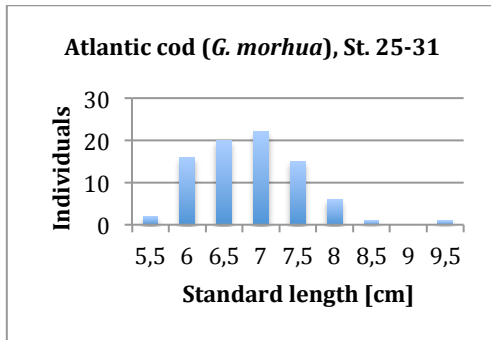
Fish-Lift (pelagic)

Mainly juvenile Atlantic cod and haddock in the surface waters (0-40m).

**Krossfjorden (KFI); Outer Kongsfjorden, Forlandsundet (KFO) 29.08.2013**

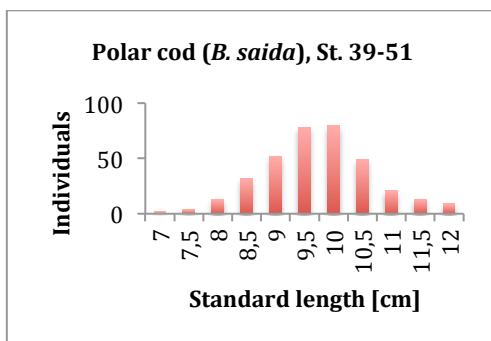
Fish-Lift (pelagic)

Juvenile Atlantic cod, haddock and herring in surface waters of Forlandsundet (0-50m), adult Atlantic cod at the bottom (170-200m).

**Billefjorden (BF) 31.08.-01.09.2013**

Fish-Lift (pelagic); Bottom Trawl; Juvenile Fish Trawl (pelagic)

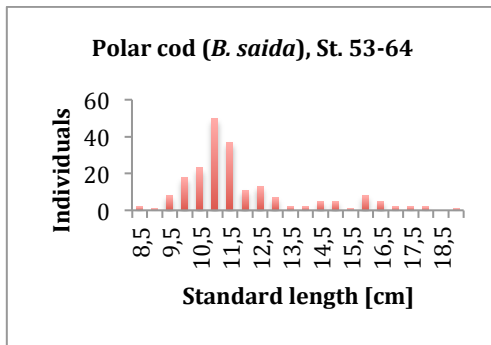
Some juvenile Atlantic cod and haddock in surface waters (0-40m), exclusively Polar cod at bottom of fjord (150m).



Hornsund (HNS) 02.-03.09.2013

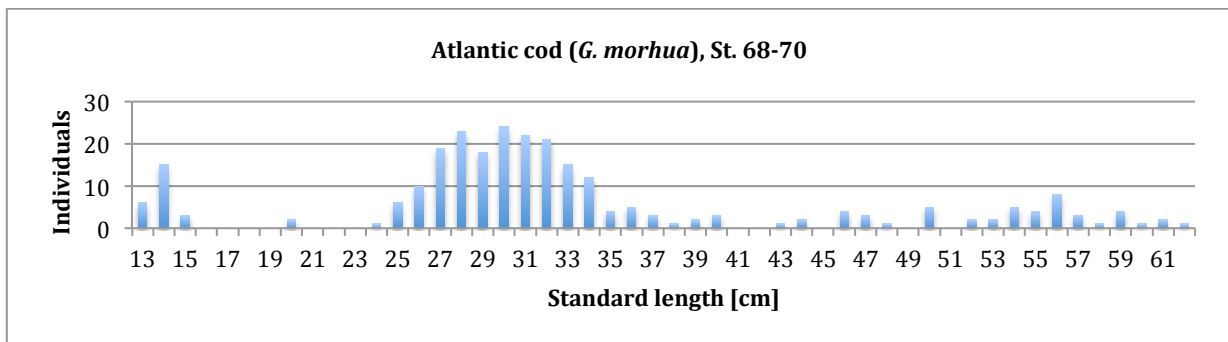
Juvenile Fish Trawl (pelagic)

Exclusively Polar cod at bottom of fjord (150-220m).

**Bear Island (BIS) 05.09.2013**

Bottom Trawl

Mainly adult Atlantic cod and haddock at bottom (50m).



In **Storfjorden** (SFI&II), water samples for quantification of microbiological turnover rates of methane were collected (collaboration with MPI-Bremen).

Preliminary results

The cruise found many schools of juvenile Atlantic cod in surface waters with Atlantic influence (4.0-6.0°C) on the west coast and in the fjords of Svalbard. Polar cod were only found in cold bottom waters in the fjords that ranged from -1.3 to 2.5°C in temperature. In bottom waters of higher temperature (ca. 2.5-3.0°C), the two species appeared to share the habitat in a few cases, although this finding needs to be verified by further sampling. The full catch statistics will be published and made available via PANGAEA later this year.

Juvenile cod (500 specimens), Polar cod (80 specimens) and copepods were successfully transported to Bremerhaven using the capacities on board and, for the first time, a custom-made fish transport container that was equipped with aquaria systems. In Bremerhaven, the fish are being used in experimental incubations to test their response towards ocean acidification and warming within the framework of the research initiative "BIOACID". The Atlantic cod population from Svalbard is compared to further populations from Kattegat and Norwegian coastal cod from the Troms area (the latter in a cooperation with NOFIMA within the framework of the European project "AQUAEXCEL"). Experiments with the copepods from the cruise began onboard the vessel and were continued at the Alfred Wegener Institute from October 2013 onwards.

Broodstock of Polar cod that was unloaded in Tromsø and transported to the Havbrukstasjonen in Kårvik is currently being used by the Norwegian research programme "POLARISATION" and the German research programme "BIOACID" in joint experiments on fertilisation and development in Tromsø, which last from 12/2013 to 05/2014.

Appendix

Literature cited:

Holst, JC; McDonald, A (2000) FISH-LIFT: a device for sampling live fish with trawls. Fisheries Research 48: 87-91

List of participants

Name	Institute
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Station list

The CTD data of cruise HE 408 can be accessed on the PANGAEA database under:
<http://doi.pangaea.de/10.1594/PANGAEA.824703>

Station	Date	PositionLat	PositionLon	Depth [m]	Gear	Station	Abbr.
HE408/001-1	22.08.13	71° 16.35' N	16° 27.32' E	411,8	CTD/rosette water sampler	Deep Plankton 1	DP I
HE408/001-2	22.08.13	71° 17.40' N	16° 24.87' E	1157,6	Bongo net	Deep Plankton 1	DP I
HE408/001-3	22.08.13	71° 17.64' N	16° 27.10' E	1089,7	Bongo net	Deep Plankton 1	DP I
HE408/002-1	23.08.13	73° 31.76' N	14° 31.20' E	1014,3	CTD/rosette water sampler	Deep Plankton 2	DP II
HE408/002-2	23.08.13	73° 31.57' N	14° 30.52' E	1017,5	Bongo net	Deep Plankton 2	DP II
HE408/003-1	26.08.13	80° 17.69' N	22° 11.02' E	183,7	Juvenile Fish Trawl	Rijpfjorden	RF
HE408/004-1	26.08.13	80° 15.42' N	22° 12.89' E	115	Juvenile Fish Trawl	Rijpfjorden	RF
HE408/005-1	26.08.13	80° 15.05' N	22° 14.78' E	162,2	Juvenile Fish Trawl	Rijpfjorden	RF
HE408/006-1	26.08.13	80° 16.74' N	22° 13.50' E	148,1	Juvenile Fish Trawl	Rijpfjorden	RF
HE408/007-1	26.08.13	80° 21.41' N	22° 11.79' E	207,2	Juvenile Fish Trawl	Rijpfjorden	RF
HE408/008-1	26.08.13	80° 18.02' N	22° 11.54' E	256,5	Fishlift	Rijpfjorden	RF
HE408/009-1	26.08.13	80° 16.58' N	22° 12.95' E	171,4	Fishlift	Rijpfjorden	RF
HE408/010-1	26.08.13	80° 15.17' N	22° 14.72' E	168,6	Fishlift	Rijpfjorden	RF
HE408/011-1	26.08.13	80° 21.40' N	22° 12.22' E	203	Fishlift	Rijpfjorden	RF
HE408/012-1	26.08.13	80° 23.30' N	22° 10.87' E	248,4	Fishlift	Rijpfjorden	RF
HE408/013-1	26.08.13	80° 21.77' N	22° 11.02' E	193,4	CTD	Rijpfjorden	RF
HE408/014-1	26.08.13	80° 21.75' N	22° 11.06' E	189,7	Bongo net	Rijpfjorden	RF
HE408/014-2	26.08.13	80° 21.60' N	22° 11.32' E	186,3	Bongo net	Rijpfjorden	RF
HE408/015-1	27.08.13	80° 1.27' N	17° 19.27' E	384,2	CTD/rosette water sampler	Hinlopen North	HL I
HE408/015-2	27.08.13	80° 1.27' N	17° 19.34' E	383,9	Bongo net	Hinlopen North	HL I
HE408/015-3	27.08.13	80° 1.31' N	17° 20.11' E	388,3	Bongo net	Hinlopen North	HL I
HE408/016-1	27.08.13	80° 0.36' N	17° 3.57' E	87,4	Fishlift	Hinlopen North	HL I
HE408/016-2	27.08.13	79° 59.09' N	17° 8.80' E	105,6	Fishlift	Hinlopen North	HL I
HE408/018-1	27.08.13	79° 30.19' N	18° 57.51' E	143,9	Fishlift	Hinlopen South	HL II

HE408/019-1	27.08.13	79° 28.82' N	18° 51.42' E	76,3	Fishlift	Hinlopen South	HL II
HE408/020-1	27.08.13	79° 29.87' N	19° 47.70' E	130,9	Fishlift	Hinlopen South	HL II
HE408/021-1	27.08.13	79° 30.24' N	19° 46.10' E	149,7	Fishlift	Hinlopen South	HL II
HE408/022-1	27.08.13	79° 32.77' N	19° 38.37' E	188,5	Bongo net	Hinlopen South	HL II
HE408/022-2	27.08.13	79° 32.68' N	19° 39.09' E	191,5	Bongo net	Hinlopen South	HL II
HE408/022-3	27.08.13	79° 32.66' N	19° 39.50' E	183,1	Bongo net	Hinlopen South	HL II
HE408/022-4	27.08.13	79° 32.64' N	19° 39.89' E	173,7	CTD/rosette water sampler	Hinlopen South	HL II
HE408/023-1	28.08.13	78° 59.78' N	7° 52.59' E	1162	CTD	Deep Plankton 3	DP III
HE408/024-1	28.08.13	78° 59.97' N	7° 53.51' E	1159,7	Bongo net	Deep Plankton 3	DP III
HE408/024-2	28.08.13	79° 0.47' N	7° 53.48' E	1162,4	Bongo net	Deep Plankton 3	DP III
HE408/025-1	29.08.13	79° 13.01' N	11° 54.11' E	286,5	Fishlift	Krossfjorden	KFI
HE408/026-1	29.08.13	79° 12.11' N	11° 51.82' E	259,4	Fishlift	Krossfjorden	KFI
HE408/027-1	29.08.13	79° 0.67' N	11° 8.93' E	289,6	Fishlift	Forlandsundet	KFO
HE408/028-1	29.08.13	79° 2.63' N	11° 17.33' E	320,1	Fishlift	Forlandsundet	KFO
HE408/029-1	29.08.13	78° 57.52' N	10° 58.54' E	133,2	Fishlift	Forlandsundet	KFO
HE408/030-1	29.08.13	78° 56.99' N	10° 58.25' E	130,5	Fishlift	Forlandsundet	KFO
HE408/031-1	29.08.13	78° 54.60' N	11° 3.66' E	32,6	Fishlift	Forlandsundet	KFO
HE408/032-1	29.08.13	78° 56.91' N	11° 0.91' E	169,6	CTD/rosette water sampler	Forlandsundet	KFO
HE408/033-1	29.08.13	78° 56.91' N	11° 0.78' E	168,9	Bongo net	Forlandsundet	KFO
HE408/034-1	29.08.13	78° 56.90' N	11° 0.61' E	166,6	Bongo net	Forlandsundet	KFO
HE408/035-1	29.08.13	78° 56.90' N	11° 0.44' E	164,1	Bongo net	Forlandsundet	KFO
HE408/036-1	30.08.13	78° 54.80' N	11° 22.17' E	92,7	Fishlift	Forlandsundet	KFO
HE408/037-1	30.08.13	78° 55.51' N	11° 20.87' E	81	Fishlift	Forlandsundet	KFO
HE408/038-1	30.08.13	78° 57.05' N	10° 53.48' E	59,7	Fishlift	Forlandsundet	KFO
HE408/039-1	31.08.13	78° 37.07' N	16° 33.11' E	151,7	Fishlift	Billefjord	BF
HE408/040-1	31.08.13	78° 34.62' N	16° 28.04' E	157	Fishlift	Billefjord	BF
HE408/041-1	31.08.13	78° 36.18' N	16° 31.78' E	154,4	CTD	Billefjord	BF
HE408/041-2	31.08.13	78° 36.26' N	16° 31.69' E	153,4	CTD/rosette water sampler	Billefjord	BF
HE408/041-3	31.08.13	78° 36.27' N	16° 31.58' E	152	CTD/rosette water sampler	Billefjord	BF
HE408/042-1	31.08.13	78° 35.02' N	16° 34.18' E	83,2	Fishlift	Billefjord	BF
HE408/043-1	31.08.13	78° 36.84' N	16° 35.77' E	123,2	Fishlift	Billefjord	BF
HE408/044-1	31.08.13	78° 34.29' N	16° 26.73' E	156	Fishlift	Billefjord	BF
HE408/045-1	01.09.13	78° 34.44' N	16° 26.91' E	156,2	Bottom trawl	Billefjord	BF
HE408/046-1	01.09.13	78° 35.94' N	16° 28.57' E	141,4	Bottom trawl	Billefjord	BF
HE408/047-1	01.09.13	78° 34.52' N	16° 27.77' E	156,8	Bottom trawl	Billefjord	BF
HE408/048-1	01.09.13	78° 36.78' N	16° 33.85' E	150,9	CTD/rosette water sampler	Billefjord	BF
HE408/048-2	01.09.13	78° 36.73' N	16° 33.95' E	153,4	CTD/rosette water sampler	Billefjord	BF
HE408/048-3	01.09.13	78° 36.70' N	16° 34.01' E	153,9	Bongo net	Billefjord	BF
HE408/048-4	01.09.13	78° 36.67' N	16° 34.06' E	152,4	Bongo net	Billefjord	BF
HE408/048-5	01.09.13	78° 36.63' N	16° 34.16' E	150,6	Bongo net	Billefjord	BF
HE408/049-1	01.09.13	78° 36.43' N	16° 33.89' E	151,8	Juvenile Fish Trawl	Billefjord	BF
HE408/050-1	01.09.13	78° 33.59' N	16° 23.35' E	150,3	Juvenile Fish Trawl	Billefjord	BF
HE408/051-1	01.09.13	78° 36.07' N	16° 27.29' E	144,3	Juvenile Fish Trawl	Billefjord	BF
HE408/052-1	02.09.13	76° 58.99' N	15° 47.63' E	210	CTD/rosette water sampler	Hornsund	HS
HE408/053-1	02.09.13	76° 59.09' N	15° 49.27' E	203,2	Juvenile Fish Trawl	Hornsund	HS
HE408/054-1	02.09.13	76° 59.75' N	15° 58.08' E	119,9	Juvenile Fish Trawl	Hornsund	HS

HE408/055-1	02.09.13	76° 58.92' N	15° 45.73' E	231,1	Juvenile Fish Trawl	Hornsund	HS
HE408/056-1	02.09.13	76° 58.61' N	15° 42.58' E	182,6	Juvenile Fish Trawl	Hornsund	HS
HE408/057-1	02.09.13	76° 58.72' N	15° 42.30' E	147,2	Juvenile Fish Trawl	Hornsund	HS
HE408/058-1	02.09.13	76° 58.79' N	15° 42.00' E	153,7	Juvenile Fish Trawl	Hornsund	HS
HE408/059-1	02.09.13	76° 59.13' N	15° 47.79' E	212,9	CTD/rosette water sampler	Hornsund	HS
HE408/060-1	02.09.13	76° 59.16' N	15° 47.21' E	208,8	Bongo net	Hornsund	HS
HE408/061-1	02.09.13	76° 59.19' N	15° 47.20' E	204,1	Bongo net	Hornsund	HS
HE408/062-1	03.09.13	76° 58.75' N	15° 45.20' E	234,4	CTD/rosette water sampler	Hornsund	HS
HE408/062-2	03.09.13	76° 58.82' N	15° 45.20' E	234	Bongo net	Hornsund	HS
HE408/062-3	03.09.13	76° 58.93' N	15° 45.19' E	231,6	Bongo net	Hornsund	HS
HE408/063-1	03.09.13	76° 59.00' N	15° 44.15' E	232,6	Juvenile Fish Trawl	Hornsund	HS
HE408/064-1	03.09.13	76° 58.80' N	15° 45.37' E	231,7	Juvenile Fish Trawl	Hornsund	HS
HE408/065-1	03.09.13	76° 58.79' N	15° 42.90' E	208,9	CTD/rosette water sampler	Hornsund	HS
HE408/066-1	04.09.13	77° 41.94' N	19° 14.50' E	128,1	CTD/rosette water sampler	Storfjorden S	SF I
HE408/067-1	04.09.13	78° 15.30' N	19° 29.05' E	114,9	CTD/rosette water sampler	Storfjorden N	SF II
HE408/067-2	04.09.13	78° 15.29' N	19° 29.03' E	114,7	Bongo net	Storfjorden N	SF II
HE408/067-3	04.09.13	78° 15.30' N	19° 29.26' E	114,1	Bongo net	Storfjorden N	SF II
HE408/067-4	04.09.13	78° 15.30' N	19° 29.21' E	114,1	Bongo net	Storfjorden N	SF II
HE408/068-1	05.09.13	74° 31.39' N	19° 28.32' E	48,4	Bottom trawl	Bear Island	BIS
HE408/069-1	05.09.13	74° 29.17' N	19° 31.65' E	52,4	Bottom trawl	Bear Island	BIS
HE408/070-1	05.09.13	74° 28.99' N	19° 31.49' E	53,1	Bottom trawl	Bear Island	BIS
HE408/071-1	05.09.13	74° 26.55' N	19° 48.75' E	75,8	CTD/rosette water sampler	Bear Island	BIS
HE408/072-1	05.09.13	74° 26.51' N	19° 48.64' E	75,9	Bongo net	Bear Island	BIS
HE408/073-1	05.09.13	74° 26.53' N	19° 48.67' E	75,7	Bongo net	Bear Island	BIS