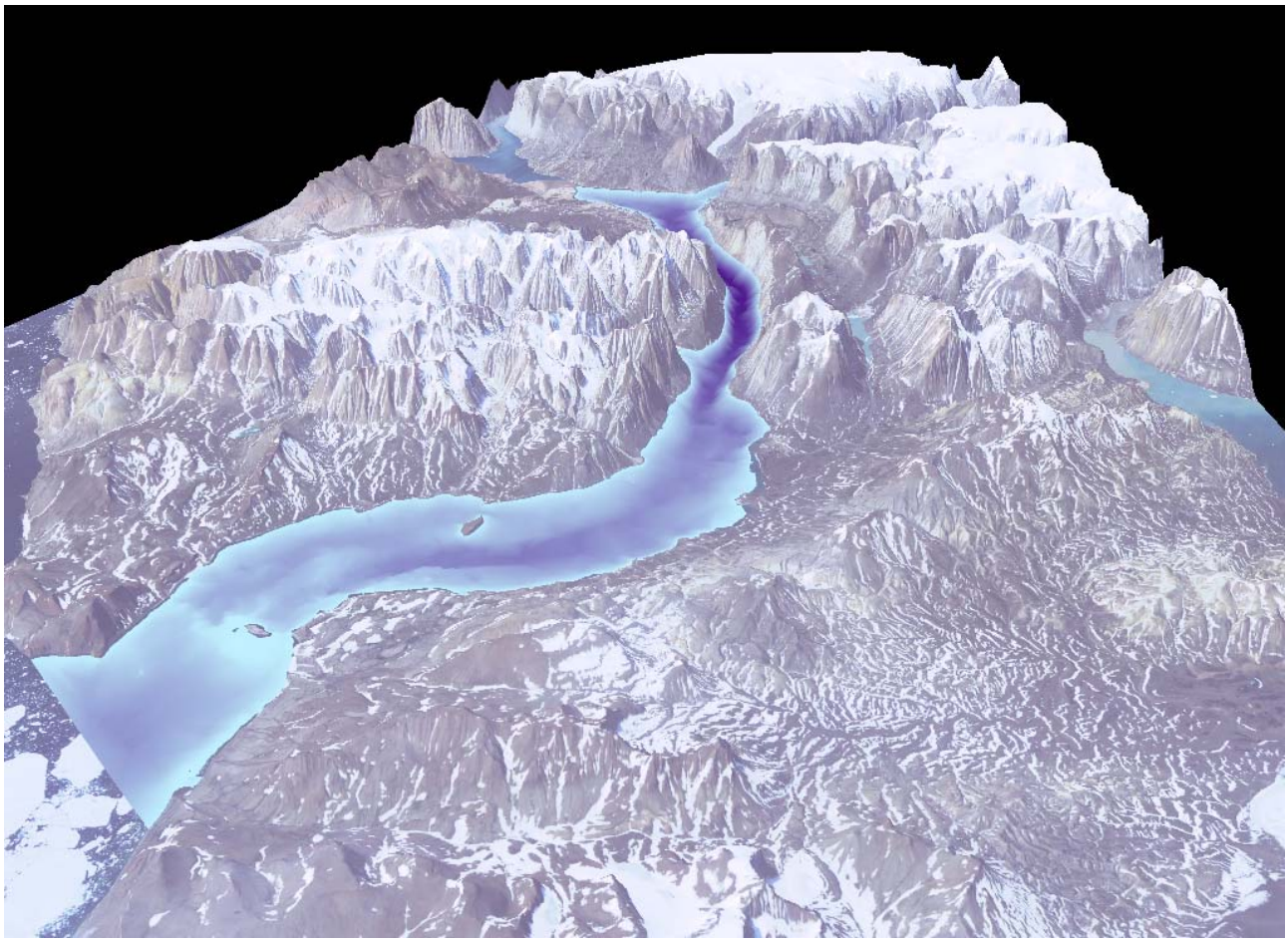
MarineBasic

The Zackenberg marine monitoring programme



Sampling manual for the 2005 field campaign

MarineBasic 2nd edition, 2004
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GREENLAND

Front cover illustration
Relief model of Young Sound.

Dates and times are in GMT
Geographic positions are in WGS-84
UTM, zone 27 and geographic co-ordinates in DD MM.MMMM (degrees & minutes & decimal minutes)

Sea ice

1. Daily measurements of sea-ice cover and snow thickness:

Geographic position
Camera 1 (Behind the Weather Station) 74°18.594'N, 20°12.59,8´W – 115 m above sea level
Camera 2 (North of Grønnedal) 74°14.403' N, 20°21.550'W – 165 m above sea level

Equipment: 2 automatic digital camera systems.
See Fig. 1.

Procedure:
(1) 1 digital camera is placed behind the Weather Station and 1 on the island Basaltø. In addition, 3 measuring sticks for determination of snow thickness are placed at each site. Each camera is mounted on a tripod (height 1.6 m) inside a weather resistant translucent box providing protection from wind and rain. Power is supplied by a rechargeable 12-V battery charged via 2 small solar panels on top of the camera box. Each camera is equipped with a 128-Mb PCMCIA card with capacity for saving 365 digital photos.

(2) Each camera is programmed to take 1 photo a day all year round.

(3) Photos are saved at the highest possible resolution.

Figure 1

Materials: 2 cameras, 2 tripods, 6 turnbuckles, 6 x 3 m wire (ø5 mm), 12 wire locks (ø5 mm), mooring kit (ø12 mm), stone drill (ø12 mm), 1 variable-voltage power supply, 6 measuring sticks for snow (including mooring).

2. Sea-ice thickness and snow thickness:

Geographic position: 74°18.59'N, 20°15.04'W – water depth 36 m
Equipment: Ice drill, measuring stick. (Figure 2).
Procedure: Members of the military sledge patrol SIRIUS measure sea-ice thickness and snow thickness once every 2-3 weeks and email the data to GINR. These data are not yet secured in the long term. For the present, collection of data is arranged by GINR and SIRIUS from year to year.

Figur 2

Materials: Ice drill, measuring stick.

Water column

1. Continuous measurements of temperature, salt, pressure and sedimentation:

Geographic position: 74°18.909'N, 20°16.730'W – depth 75 m

Equipment: Hydrographic mooring system: 2 SeaBird (Microcat 37) and 1 sediment trap (K/MT 320 or Technicap). Diagram of hydrographic mooring system: Figure 3

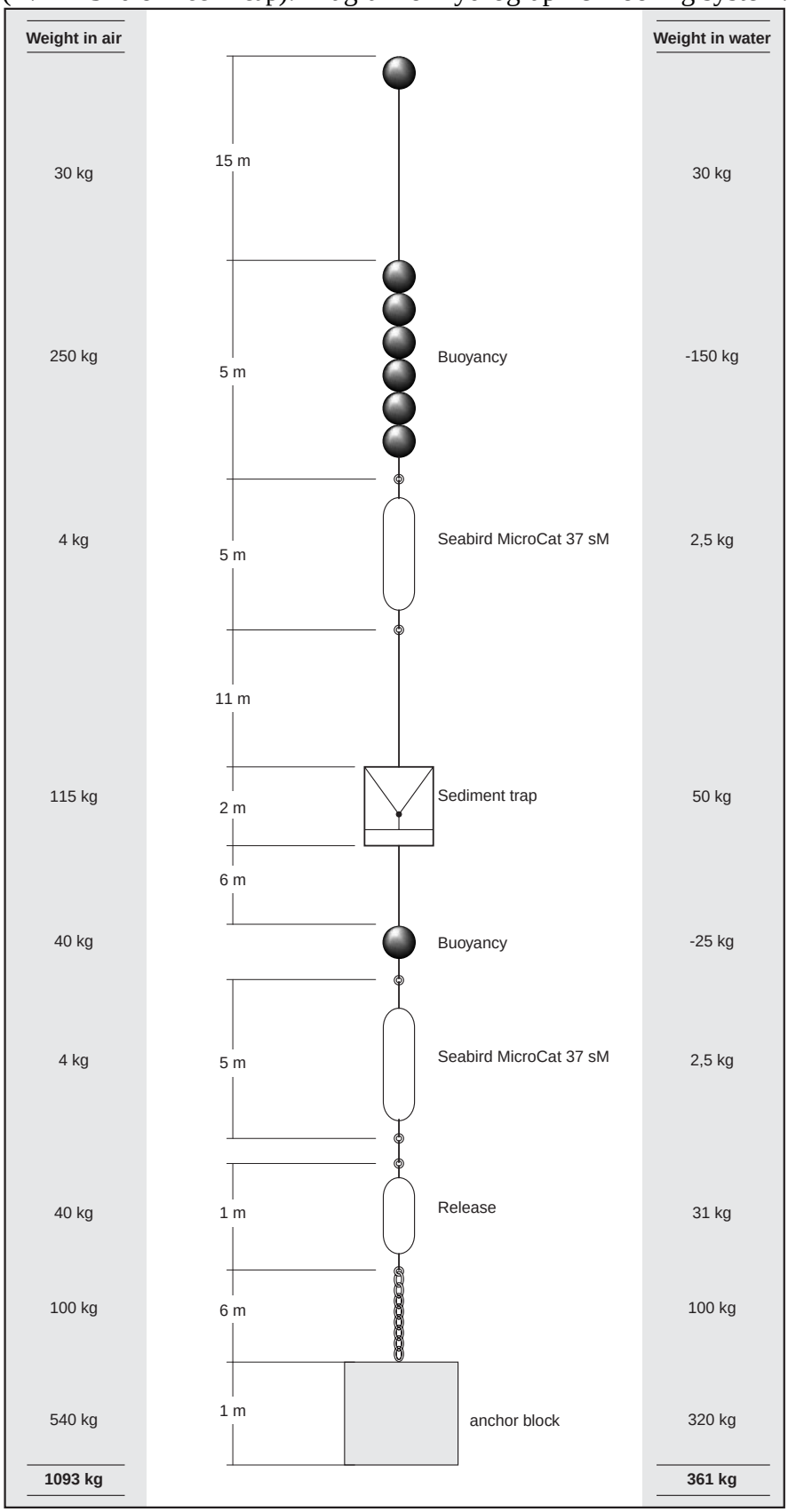


Figure 3

Materials:

1 concrete block 60 x 60 x 60 cm
1 6-m chain (100 kg)
1 acoustic release system with data sheet
1 sediment trap
2 Seabird SM37
6 25-kg buoy balls
5 17.5-kg trawl buoys
1 top buoy ball
1 release ring
2 swivels (sediment trap)
7 rings
14 shackles
2 x 5 mm steel wire (Seabird)
2 x 10 m METEOR rope ø11 mm
1 x 5 m METEOR rope ø11 mm
Eddigrip for six 6 buoy balls
$HgCl_2$ for preservation of trap flask contents and DIC samples
Plastic tea-spoon for $HgCl_2$
Laboratory gloves
Sediment trap manual
Cables for data transfer
Batteries for sampler (large 1.5 v)
Seabird manual
Acoustic telecommand unit incl. manual
21 flasks for sediment trap

Procedure:

Launching: Prior launching, the collector cups of the sediment trap were filled with GF/F filtered bottom water and poisoned with $HgCl_2$ (1 ml saturated solution per 100 ml water). NaCl was also added to the cup solution to increase salinity to ~40 psu. The trap is programmed with appropriate intervals.

Sample cup#	Date of rotation
1	20/8-05 kl 12:00
2	20/9-05 kl 13:00
3	20/10-05 kl 14:00
4	20/1-06 kl 15:00
5	20/4-06 kl 16:00
6	20/5-06 kl 17:00
7	20/6-06 kl 18:00
8	30/6-06 kl 19:00
9	7/7-06 kl 20:00
10	14/7-06 kl 21:00
11	21/7-06 kl 22:00
12	28/7-06 kl 23:00
end	4/8-06 kl 12:00

After recovery, another 0.5 ml of the $HgCl_2$ solution was added per 100 ml cup volume and samples were stored at 4°C. The filled sediment trap sampling flasks are sealed tightly (screw caps) and kept cool during transport to the laboratory.

Water column

2. Continuous measurements of temperature, salt and pressure:

Geographic position: 74°18.866'N, 20°14.782'W – water depth 29 m
Equipment: Hydrographic mooring system: 1 SeaBird (Microcat 37). Diagram of the hydrographic mooring system below (Figure 4). Is only deployed during field study period.

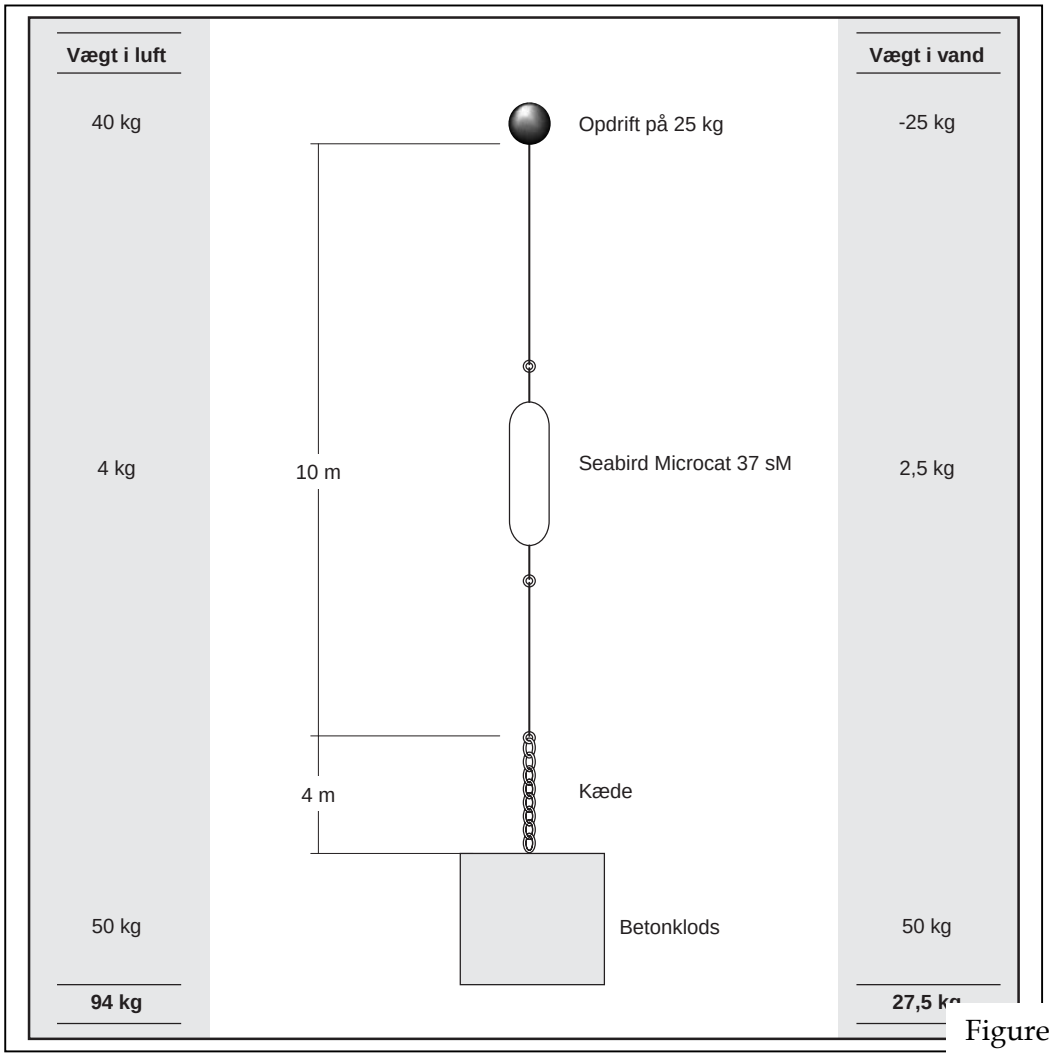


Figure 4

Materials: 1 shovel anchor, 4 m of chain (50kg), 10 m of steel wire (10 mm), 1 SeaBird, 3 trawl buoy balls (10.5 kg), 2 rings, 4 shackles, SeaBird data sheet, SeaBird manual.

SBE selection of data to text file (Excel):

name 0 = timeJ: Julian Days
name 1 = prdM: Pressure, Strain Gauge [db]
name 2 = depSM: Depth [salt water, m]
name 3 = tv290C: Temperature [ITS-90, deg C]
name 4 = potemp090C: Potential Temperature [ITS-90, deg C]
name 5 = c0S/m: Conductivity [S/m]
name 6 = sal00: Salinity [PSU]
name 7 = density00: Density [density, Kg/m^3]
name 8 = sigma-é00: Density [sigma-theta, Kg/m^3]
name 9 = sigma-t00: Density [sigma-t, Kg/m^3]
name 10 = svCM: Sound Velocity [Chen-Millero, m/s]
name 11 = flSCC: Fluorescence, Turner SCUFA Cor Chl [mg/m3]
name 12 = OBS: turner SCUFA [NTU]

Water column

3. Measurements on sediment trap material (21 samples):

Laboratory:

In the laboratory, zooplankton "swimmers" are removed from all samples prior further treatment. Samples are then freeze-dried to determine total fluxes (dry weight, dw), from which homogenized sub-samples of known weight were taken to analyze for particulate organic carbon (POC), particulate organic nitrogen (PON), chlorophyll (Chl.) and calcium carbonate ($CaCO_3$). Total carbon contents (TC) are determined on an elemental analyzer (Europa Scientific RoboPrep). The POC and PON content results from analyzing decalcified samples. Decalcification is done with H_2SO_3 and heating to 80°C. The $CaCO_3$ content is calculated as TC - POC.

Dry weight. A sub-sample of a known wet weight is freeze-dried.

Chlorophyll. An adequate amount of material is extracted (acetone) for determination of total Chlorophyll. Add a little deionized water ca. 1 ml to 1 g dried sediment shake and wait 4 h before extraction with acetone (NICE handbook procedure).

Organic content. An adequate amount of material is weighed into tin capsules (acid treated + non-acid treated) and analysed for C and N. Remember to remove copepods and other "swimmers".

Isotope composition. ^{13}C and ^{15}N in organic material. An adequate amount of material is weighed into tin capsules, acid treated and analysed by mass spectrometry for natural composition of ^{13}C and ^{15}N.

Equivalent measurements are made on material collected in the Zackenberg River (collected by GeoBasis – app. 50 samples).

Reserve. The remaining material is saved for possible analysis of other trace elements.

Materials: Insulated bag + cooler brick. 21 500-ml plastic flasks with tight-fitting lids.

Water column

4. Vertical measurements of salt, temperature and fluorescence (Chl *a*) along 3 transects:

Geographic positions: (see Figure 5 as well)

I. transect_Sandø:

ID #	DEPTH (m)	UTM_X	UTM_Y	LATITUDE	LONGITUDE
1,01	14	526955	8242691	74°16.3768'N	20°06.5436'W
1,02	5	526643	8242125	74°16.0754'N	20°07.1774'W
1,03	5	526545	8240820	74°15.3741'N	20°07.4109'W
1,04	16	526233	8240255	74°15.0727'N	20°08.0442'W
1,05	67	526134	8238949	74°14.3714'N	20°08.2773'W
1,06	72	526025	8238387	74°14.0700'N	20°08.5101'W
1,07	46	525724	8237078	74°13.3686'N	20°09.1427'W
1,08	5	525614	8236516	74°13.0672'N	20°09.3750'W

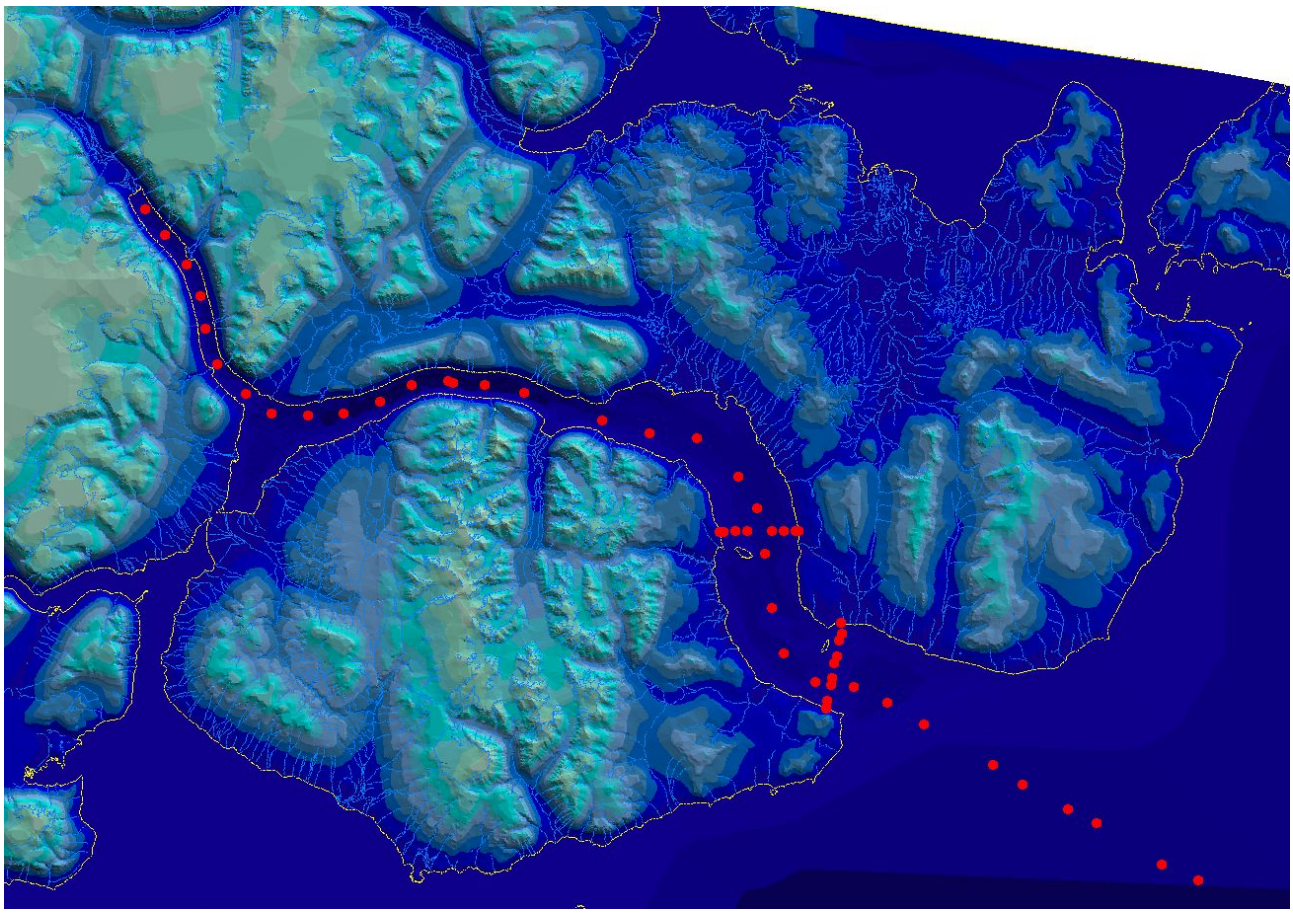
II. transect_Basaltø:

ID#	DEPTH (m)	UTM_X	UTM_Y	LATITUDE	LONGITUDE
2,01	12	523077	8251352	74°21.0636'N	20°14.0114'W
2,02	89	522061	8251338	74°21.0627'N	20°16.0360'W
2,03	139	521045	8251324	74°21.0616'N	20°18.0606'W
2,04	85	519013	8251296	74°21.0588'N	20°22.1098'W
2,05	88	517997	8251282	74°21.0571'N	20°24.1344'W
2,06	45	516981	8251269	74°21.0552'N	20°26.1590'W

III transect_Length:

ID#	DEPTH (m)	UTM_X	UTM_Y	LATITUDE	LONGITUDE
TYRO_01	106	468435	8278360	74°35.5160'N	22°03.8617'W
TYRO_02	128	470068	8276200	74°34.3697'N	22°00.4842'W
TYRO_03	102	471882	8273734	74°33.0597'N	21°56.7400'W
TYRO_04	122	473061	8271013	74°31.6063'N	21°54.2771'W
TYRO_05	128	473515	8268291	74°30.1466'N	21°53.2815'W
TYRO_06	95	474513	8265298	74°28.5448'N	21°51.1880'W
TYRO_07	50	476871	8262848	74°27.2451'N	21°46.3877'W
TYRO_08	157	479048	8261216	74°26.3818'N	21°41.9831'W
TYRO_09	157	482132	8261034	74°26.3021'N	21°35.7997'W
TYRO_10	290	485126	8261216	74°26.4145'N	21°29.8050'W
TYRO_11	336	488120	8262214	74°26.9632'N	21°23.8199'W
TYRO_12	347	490841	8263574	74°27.7036'N	21°18.3776'W
TYRO_13	339	493834	8263937	74°27.9057'N	21°12.3735'W
Dybet	342	494296	8263709	74°27.7840'N	21°11.4450'W
TYRO_14	325	496919	8263574	74°27.7148'N	21°06.1822'W
TYRO_15	282	500275	8262939	74°27.3748'N	20°59.4476'W
YOUNGSU_3.18	229	506834	8260612	74°26.1162'N	20°46.3090'W
YOUNGSU_3.16	149	510804	8259484	74°25.4991'N	20°38.3702'W
YOUNGSU_3.14	150	514766	8259095	74°25.2745'N	20°30.4446'W
YOUNGSU_3.12	118	518261	8255859	74°23.5169'N	20°23.5169'W
YOUNGSU_3.10	171	519845	8253223	74°22.0906'N	20°20.4106'W
YOUNGSU_3.08	172	520497	8249421	74°20.0420'N	20°19.1965'W
YOUNGSU_3.06	105	521059	8244829	74°17.5692'N	20°18.1839'W

YOUNGSU_3.04	115	522051	8241016	74°15.5119’N	20°16.3076’W
YOUNGSU_3.02	46	524691	8238682	74°14.2387’N	20°11.1397’W
GH01	96	527959	8238227	74°13.9686’N	20°04.6887’W
GH02	158	530708	8236891	74°13.2260’N	19°59.2960’W
GH03	219	533812	8235111	74°12.2388’N	19°53.2272’W
GH05	229	539586	8231712	74°10.3484’N	19°41.9763’W
GH06	233	542127	8230030	74°09.4133’N	19°37.0458’W
GH07	260	545950	8227995	74°08.2693’N	19°29.6223’W
GH08	308	548347	8226813	74°07.6004’N	19°24.9725’W
GH09	302	553741	8223353	74°05.6595’N	19°14.5759’W
GH10	258	556869	8221976	74°04.8680’N	19°08.5285’W



Figur 5

Equipment: CTD-sis, Scufa fluorometer, PC, Niskin water sampler + weight messenger, 9 5-liters water bottles.

Horisontal resolution: 1 km across, 2 km down.

Vertical resolution: 1 m

Temporal resolution: Performed once during the investigation period.

Procedure:
(1) Temperature, salt and Chl. *a*: Leave equipment suspended in surface water for at least 5 min before profiles are measured (from the surface to a few metres above the bottom). 5 liters from each of the sampling depths 1, 5, 10, 15, 20, 30, 50, 100 and 150 m are collected from the standard site (*Geographic position (off the Weather Station)*: 74°18,58'N, 20°18,00'W – depth 163 m) for calibration of CTD and fluorometer. Save 100 ml in amber glass bottles and store in a cool place for calibration of the CTD. An adequate volume is filtered (GF/F) and extracted in ethanol (96%) for Chl. *a* calibration of the fluorometer.

SBE19plus selection of data to text file (Excel):

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name 10 = svCM: Sound Velocity [Chen-Millero, m/s]
name 11 = flSCC: Fluorescence, Turner SCUFA Cor Chl [mg/m3]
name 12 = OBS: turner SCUFA [NTU]

Materials: 9 5-liters bottles with lids. Niskin water sampler, CTD, fluorometer, computer, weight messenger. GPS, Echo sounder.

Water column

5. Light, temperature, salt, nutrients (NO_3^-, PO_4^{3-} & SiO_4), pH, DIC/alkalinity, plankton composition, Chl. *a* and optical properties of DOM:

Geographic position (off the Weather Station): 74°18.58'N, 20°18.00'W – depth 163 m.

Sampling equipment: LiCor sensor, CTD-sis, Scufa fluorometer, Niskin water sampler + weight messenger, 9 5-liter plastic bottles. 20-µm and 50-µm plankton net + propeller, cod end and collecting bucket. Samples are brought to the field laboratory where they are shaken well and transferred to suitable containers for transport back to Denmark. DIC & TA samples are taken and preserved on location.

Vertical resolution: 1, 5, 10, 15, 20, 30, 50, 100 and 150 m water depth.

Temporal resolution: Collected three times (beginning, middle and end of the investigation period). Measurements of light, temperature, salt and Chl. *a* is performed every 2nd day throughout the field period (e.g. every 2nd day).

Light: Light is measured by LiCor. Incident light (PAR) is measured simultaneously with water column measurements.

Temperature, salt and Chl. *a*: Measured by CTD and fluorometer. Leave the device suspended in surface water for at least 5 min before profile measurement (0-150 m). 100 ml from each sampling depth is refrigerated for calibration of the CTD. Remember to calibrate fluorometer for Chl. *a* concentrations. Se data format above. Samples for Chl. *a* determination is, however, filtered and stored frozen on 5-ml ethanol until analysis, on the three sampling dates.

Nutrients: 4 x 20 ml from each sampling depth are frozen in plastic vials (-18°C) for later nutrient analyses. To PO_4^{3-} samples 50 µl $H_2SO_4^{2-}$ (4M)/10 ml sample is added. Samples are frozen in 4 separate vials.

DIC/alkalinity: 1 x 120 ml from each depth is saved in gas tight glass bottles and preserved with 0.02% $HgCl_2$ (saturated solution) for determination of DIC and TA. Fill bottles completely and store cool.

Planktonic composition:

300 ml from each sampling depth is saved in an amber glass bottles and preserved with 1% lugol.
Algae – Triplicate vertical hauls are taken from sea bottom to surface with a 20-µm net and preserved with 1 % lugol in 100-ml amber glass bottles.
Zooplankton – Triplicate vertical hauls are taken from sea bottom to surface with a 50-µm modified WP-2 net and preserved with borax-buffered formalin (final conc. 4 %) in 300-ml amber glass bottles.

Optical properties of DOM: 100-ml samples from 1 m, 5 m, 30 m and 150 m (3 samples total) are filtered (0.2 µm) and stored dark and cool (amber glass bottles) until analysis.

Materials:
Licor equipment
CTD
Fluorometer
Niskin water sampler
Weight messenger
Hydrosonde
Plankton net (20-µm & 45-µm) + propeller
Cod end
10 collecting bottles (1-l, screw-cap)
Plastic bottles (5-l, screw-cap)
Lugol
200 GF/F filters
200 vials (5-7-ml Packard? must have room for 5 ml of ethanol) for GF/F filters (ø25 mm)
400 plastic test tubes (10-ml + stoppers) for nutrient samples
60 gas tight glass vials (Winkler type) for DIC
60 amber glass bottles (100-ml) for Alk_t
100 amber glass bottles (300-ml)
150 amber glass bottles (100-ml)
Filtering equipment for ø25-mm filters
Vacuum pump

Sediment

1. Oxygen, carbon (DIC) and nutrient exchange between water column and sediment.

Geographic position (off the Weather Station): 74°18.58'N, 20°15.74'W – water depth 60 m.
Sampling equipment: Kajak sediment sampler, 22-cm^2 Plexiglass tubes, Niskin water sampler + weight messenger and 25-l bottle.
Number of cores: 10 are collected together with 25 l of bottom water.
Temporal resolution: Collected at the end of the sampling period.

Procedure: Collected sediment cores are adjusted to a sediment height of about 10 cm. A 3-cm Teflon-coated magnet is placed 5 cm above the sediment surface. Cores are placed in an incubator equipped with a stirring mechanism (60 rpm.) and containing *in situ* bottom water aerated with an *in situ* gas mixture.

Cores are incubated at *in situ* temperature. Three initial samples are taken of each nutrient (NO_3^-, NH_4^+, PO_4^{3-} & SiO_4 and an extra), the samples transferred to test tubes (10-ml) and frozen (-18°C) for later analysis. Likewise, three initial O_2 and DIC samples are taken. Oxygen samples are transferred to Exetainers (10-ml) and Winkler I+II are added. DIC samples are transferred to Exetainers and 50 µl $HgCl_2$ (saturated solution) is added. Incubation is started by sealing the cores. Incubate until about 20% of the initial oxygen content is consumed (app. 24-48 h). Within that time interval sediment cores are processed at 10 different times to document linear concentration changes. Incubation is ended by carefully removing the rubber stopper from the core and taking 1 sample for oxygen measurement with a glass syringe (Winkler I+II in Exetainer) followed by 1 DIC sample (Exetainer + 50 µl $HgCl_2$). Finally, water samples for nutrient analyses are taken with a plastic syringe and frozen (-18°C) in plastic test tubes for later analysis.

Materials:

Kajak sediment sampler
Niskin water sampler + weight messenger
1 25-l water bottle
10 kajak tubes + stoppers
10 teflon-coated magnets + positioners
Incubator + stirrer
Aquatic pump
Floating lids
Tubing
Airstone
Tweezers
100-ml plastic syringe
20-ml glass syringe
Filter holder
100 GF/F filters ø 25 mm
250 plastic test tubes (10 ml)
50 Exetainers for DIC and O_2
Winkler reagents I+II
10-ml beakers for titration
Small stir bars for titration
Microburette
Phosphorous acid 85%
Pipettes + tips
Starch

Sediment

2. Vertical sediment oxygen profiles.

Geographic position (off the Weather Station): 74°18.58'N, 20°15.74'W – water depth 60 m.
Sampling equipment: Kajak sediment sampler, 22-cm^2 Plexiglass tubes, Niskin water sampler + weight messenger, 25-l water bottle.
Number of cores: 4 cores are sampled together with 25 l of bottom water.
Temporal resolution: Collected at the end of the sampling period.

Procedure:
(1) A 3-cm Teflon-coated magnetic stir bar is positioned 5 cm above the sediment in each sediment core. Cores are left to stand overnight in the dark in an incubator containing *in situ* bottom water at *in situ* oxygen level with stirring on (60 rpm).

(2) Clarke-type microelectrodes with internal reference and guard cathode, measuring diameter <10 µm and a 90% response time <1 s are used for measuring the distribution of oxygen in the upper sediment layers. The electrode is positioned by a motorized micromanipulator connected to an A/D converter, which transmits the signal to a PC. Profiles are measured at a resolution of 200-500 µm in the dark.

(3) 3 profiles in 3 sediment cores are measured during stirring (air-flow over 2 cm water cover of sediment) at *in situ* temperature and oxygen conditions.

(4) One sediment core is used for determination of porosity and density.

Materials:

Kajak sediment sampler
5 kajak tubes + stoppers
25-l bottle
Weight messenger
Oxygen electrode mounting system and electrodes

Sediment

3. Vertical sulphate reduction profiles in the sediment.

Geographic position (off the Weather Station): 74°18.58'N, 20°15.74'W – water depth 60 m.
Sampling equipment: Kajak sediment sampler, 22-cm^2 Plexiglass tubes.
Number of cores: 4.
Temporal resolution: Collected at the end of the sampling period.

Procedure:
(1) Sample 4 cores (i.d. 26 mm, with silicone-filled holes for injection) 15-20 cm in length in the collected Kajak tubes (22-cm^2). Aspirate the water overlying the sediment (except for a 1-mm water film) and store the cores at *in situ* temperature.

(2) Into 3 sediment cores inject approximately 5 µl $^{35}SO_4^{2-}$ through each injection hole down the entire length of the core except the sediment nearest to the rubber stopper. Deposit the $^{35}SO_4^{2-}$ horizontally along the center 2/3 of the core with a 50-µl Hamilton syringe by extracting the syringe during injection. Note the time of injection of the first core – this is the incubation start time. Clean the Hamilton syringe after use in 3-5 x freshwater, followed by 3-5 x ethanol. Remove the syringe piston after cleaning to allow excess ethanol to evaporate. Freeze the $^{35}SO_4^{2-}$ solution after use.

(3) Incubate cores in the dark at *in situ* temperature for 24 h.

(4) End the incubation by sectioning the sediment and preserving it in 50-ml centrifuge tubes as follows:

1-cm slices from 0-6 cm (i.e. 0-1, 1-2, 2-3, 3-4, 4-5, 5-6) mix with 5 ml 20% ZnAc.
2-cm slices from 6 cm down (i.e. 6-8, 8-10, …) mix with 10 ml 20% ZnAc.

Mix quickly and thoroughly with ZnAc to ensure immediate preservation of all the sediment. Note the incubation end time.

(5) The preserved sediment is frozen (-18°C) until analysis.

Sulphate measurement:
(1) Sulphate concentrations are determined in sediment slices from the following sediment depths:
0-1, 5-6, 10-11 and 15-16 cm

(2) Transfer the sediment slice (1 cm) from the fourth core to 5.0 ml demineralized water or freshwater. Mix sediment and water well.

(3) Sample 2-3 ml of the supernatant, GF/F filter and freeze (-18°C) for later analysis of SO_4^{2-}.

Materiale:

Kajak sediment sampler
5 Kajak tubes + stoppers
5 sulphate reduction tubes + stoppers
20 bottles for preservation with ZnAc
ZnAc 10%→ 250 ml & 20% → 500 ml
50 centrifuge tubes (50-ml, red screw cap) for freezing SRR samples
Core sectioning system
$^{35}SO_4^{2-}$

Sediment

4. Carbon burial in the sediment.

Geographic position (off the Weather Station): 74°18.58'N, 20°15.74'W – water depth 60 m.

Sampling equipment: Kajak sediment sampler, 22-cm^2 Plexiglass tubes, sectioning system.
Number of cores: Collect 1 undisturbed core at least 20 cm in length.

Procedure:
(1) Sample cores about 30 cm in length (22 cm^2 Plexiglass tubes). Aspirate the water overlying the sediment (except for a 1-mm film of water) and store the cores at *in situ* temperature.

(2) Section the sediment cores into 1-cm slices, transfer the slices to separate plastic bags (zipper-type) and freeze (-18°C) for later analysis of Pb-210, Cs-137 and C and N. (NOTE: avoid contact with silver).

Materials:

Core sectioning system
Kajak sediment sampler
2 Kajak tubes
Zipper bags

Sediment

5. Composition and distribution of indicator species – benthic fauna.

Geographic positions: Three transects (20, 30, 40, 50 and 60 m). See Figure 6. 15 images per station.

Transect 1:

ID NO	DEPTH (m)	UTM_X	UTM_Y	LATITUDE	LONGITUDE
H1,20	-20.0	523004	8251787	74° 21.2980’ N	20° 14.1450’ W
H1,30	-30.1	522909	8251778	74° 21.2935’ N	20° 14.3350’ W
H1,40	-40.4	522844	8251736	74° 21.2715’ N	20° 14.4650’ W
H1,50	-50.1	522788	8251747	74° 21.2780’ N	20° 14.5772’ W
H1,60	-60.1	522631	8251763	74° 21.2875’ N	20° 14.8890’ W

Transect 2:

ID NO	DEPTH (m)	UTM_X	UTM_Y	LATITUDE	LONGITUDE
H2,20	-20.2	522905	8246693	74° 18.5590’ N	20° 14.4730’ W
H2,30	-30.9	522781	8246681	74° 18.5530’ N	20° 14.7200’ W
H2,40	-40.1	522458	8246488	74° 18.4520’ N	20° 15.3670’ W
H2,50	-49.8	522303	8246540	74° 18.4812’ N	20° 15.6730’ W
H2,60	-59.9	522145	8246601	74° 18.5150’ N	20° 15.9850’ W

Transect 3:

ID NO	DEPTH (m)	UTM_X	UTM_Y	LATITUDE	LONGITUDE
H3,20	-20.0	525299	8243111	74° 16.6160’ N	20° 09.8145’ W
H3,30	-30.2	525173	8243077	74° 16.5985’ N	20° 10.0650’ W
H3,40	-40.4	525067	8243125	74° 16.6250’ N	20° 10.2735’ W
H3,50	-50.2	524880	8243106	74° 16.6160’ N	20° 10.6450’ W
H3,60	-60.3	523984	8243074	74° 16.5990’ N	20° 11.2390’ W

Sampling equipment Digital camera on a frame with lighting. Image area app. 0.5 m^2

Procedure: Photography

(1) Camera focusing is set and locked.

(2) 15 images are recorded at each station and the quality of each image is checked (focusing, light etc.). Safety copies of images are made for each transect.

Procedure: Image processing

(1) Numbers of the following species are counted in the images: *Hiatella arctica*, *Mya truncata*, brittle stars, *Sclerocrangon boreas, Strongylocentrotus sp.* etc. Species determination is carried out using an image catalogue.

Figur 6

Materials:

Digital camera + lenses
Subal underwater housing + dome
Monitoring camera
Frame-system to camera
100 m cable
Monitor
2 x Kowalski underwater lamps
Charger
Laptop
Memory cards
Software
CDs for back up of images

Sediment

6. Measurement of annual growth in *Mya truncata*

Geographic position (off the Weather Station): 74°18.58'N, 20°14.48'W – 20-30 m
Sampling equipment: clams are collected by either dredging or diving.
Number of clams: 15 clams in each of the following size intervals: shell length: 20-30 mm, 30-40 mm and 40-50 mm.

Procedure for increment analysis:
(1) The right-hand valve is cut through the umbo and embedded in epoxy resin.

(2) The cross-section is etched 3 to 6 min using 4 ml 30% hydrochloric acid and 5 ml 85% formic acid in 1000 ml of demineralised water.

(3) The acetate peel replica of the etched cross-section is mounted in a dias frame with species name, year and ID number.

(4) High-resolution digital photos of the cross-section are produced at 5-12 × magnification through a dissection microscope (Fig. 7).

(5) Number and width of individual increments are measured digitally using standard software for image analysis.

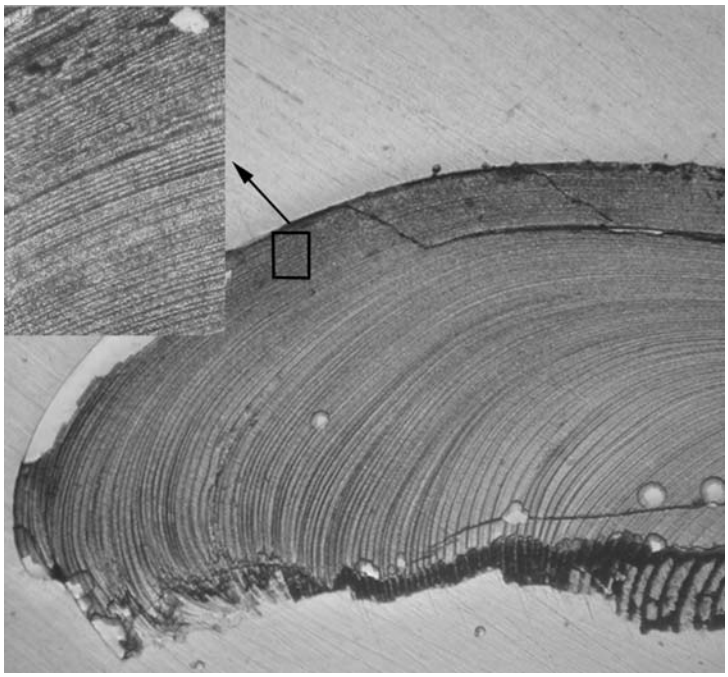


Figure 7

Materials: Triangular dredge, 2-l plastic bottles (10). Sampling can also be performed by diving.

Sediment

7. Measurement of annual growth of *Laminaria saccharina*

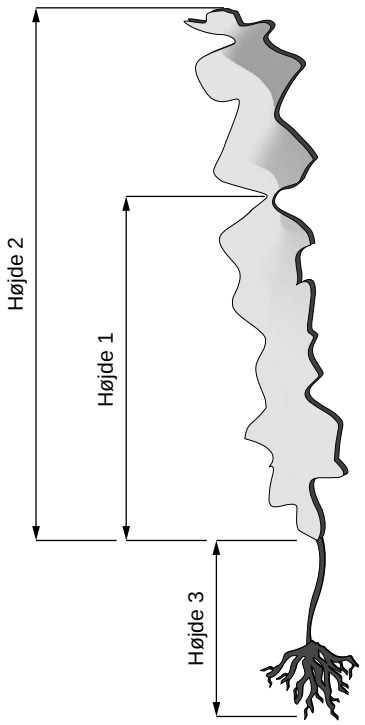
Geographic position (off the Weather Station): 74°18.59'N, 20°14.24'W – 10 m curve
Sampling equipment: KC plant rake, tape measure, plastic bags.
Number of plants: 10-20 *Laminaria saccharina* plants >1 m in length.

Procedure:
(1) Laminaria plants (10-20) are collected with a KC plant rake or by diving along the 10 m depth curve off the Weather Station.

(2) Plant length (cf. Figure 4) is determined using a tape measure to the nearest 5 mm. Height 1 is the length from blade base to the first marked constriction. Height 2 is the total blade length, and Height 3 is the length of the stem.

(3) Weigh the blade section corresponding to Height 1 and the blade section corresponding to Height 2 minus Height 1.

(4) Roll up the "Height 1" of the plants and freeze entire leaf (-18°C) in separate plastic bags until later analysis of dry matter and carbon content.



Figur 4

Materials: KC plant rake, plastic bags, tape measure, scales.

Walrus, seal and fish

1. Monitoring of walruses at the haul-out on the island Sandøen.

Geographic position: 74°15.30'N, 20°18.00'W

Procedure:
(1) Daily visits to Sandøen are made throughout the field campaign if weather conditions allow it. The number of walruses is counted from zodiac at a distance of ca. 100 m in order not to disturb the animals.

2. Sampling of tissue from ringed seal

Geographic position: Between Sandøen and Basaltø

I. Cross section_Sandø:	74°16.6280'N, 20°06.9060'W
	74°13.1120'N, 20°09.6250'W
II. Cross section_Basaltø:	74°21.1060'N, 20°14.0190'W
	74°21.0920'N, 20°26.2650'W

Sampling equipment: Knife, polyethylene flasks and zipper bags with data sheet.

Procedure:
The military division SIRIUS hunts ringed seal for dog food and in connection with these hunting trips, app. 50 g of muscle, liver, kidney and blubber as well as the jaw bone are collected from 5-10 individuals for age determination. Samples are stored in individual plastic flasks and frozen (-18°C) for later analysis.

3. Sampling of tissue from arctic char

Geographic position: (Off the Zackenberg hunting station) 74°27.9180'N, 20°38.3750'W
Sampling equipment: Tape measure, scales, knife, zipper bags with data sheet.

Procedure:
In connection with SIRIUS' annual catch of arctic char, 10 individuals are frozen (-18°C) until later analysis. Length and weight is noted. Each individual is frozen separately with a data sheet stating length and weight. Heads are stored for otolith analysis (age determination), and the tissue will serve as a data bank of contaminants, isotopic composition etc.

Materials:

Zipper bags for freezing, data sheets.