5.1.2 Chemical pollution

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Every third year (2009, 2012 etc.), IMR carries out thorough investigations of the levels of organic pollutants, metals/GS (grain size)/TOC and radionuclides in sea water, sediments and marine biota in the Barents Sea. The analysis includes different hydrocarbons, persistent organic pollutants (POPs) (PCB, DDT, HCH, HCB) and radionuclides. Monitoring of radionuclides is performed within the monitoring programme "Radioactivity in the Marine Environment" (RAME), which is coordinated by the Norwegian Radiation Protection Authority (NRPA). Monitoring of organic contaminants is performed in close cooperation with NGU (The Geological Survey of Norway) and National Institute of Nutrition and Seafood Research (NIFES).

5.1.2.1. Sediments and seawater

We aim to collect sediment and seawater samples from the same stations every third year in order to study time trends. An overview of the station set used in 2012 is given in Table 5.1.2.1.1. There may be small variations in the station set between each sample collection. This will be specified during the planning of each sample collection.

In addition to these investigations, IMR investigate once a year the levels of radioactive contamination in the vicinity of the Russian nuclear submarine "Komsomolets", which sank in 1989 in international waters in the Norwegian Sea 180-190 km south-southwest of Bear Island at 73°43'16''N and 13°16'52'' E (e.g. Høibråten et al., 1997.). Here, samples of surface water (approximately 500 L) and bottom seawater (approximately 500 L) are collected. The samples are analysed for a range of radionuclides (e.g. plutonium-238, plutonium-239,240, cesium-137 and strontium-90).

The Russian vessels have taken samples from different geographical areas including water, bottom sediments and biota for analyses PCB, DDT, HCH, HCB and radionuclides.

Table 5.1.2.1.1. An example of the station set for investigations of the levels of organic pollutants, metals/GS (grain size)/TOC and radionuclides in sea water and sediments in Norwegian waters. This station set was used in 2012. There may be small changes in between each sample collection. The station marked with bold letters is "Komsomolets".

Lat	Long	Ca depth	Surface seawater (Pu/Am,Cs, Sr, Tc, Ra/Po)	Bottom seawater (Pu/Am)	Surf. Sed.	Sed. core
71°19,2N	22°29,3E	450	X		X	
72°57,2N	26°29,4E	400			X	
73°30N	29°08,4E	450	X		X	
73°58,2N	21°57,4E	500			X	
74°48,7N	18°01,1E	300	X		X	
73°43,3N	**13°16,9E**	**1700**	**X**	**X**	**X**	**X (2)**
72°24,4N	34°19,7E				X	
73°34,1N	34°32E				X	
75°16,1E	25°45E	200			X	
75°49,8N	15°10,3E	400			X	
76°55,8N	12°45,1E	800	X		X	
76°34,8N	19°60E	200			X	
76°37,2N	34°27,2E	200			X	
74°43,7N	34°46,2E				X	
75°50,4N	37°24,9E				X	
71°00N	31°13,2E	300			X	
75°00N	31°13,2E	350			X	
78°12,5N	27°10,6E	350			X	
78°49N	35°49,8E	300	X		X	
77°28N	24°38,4E				X	
77°27,2N	37°54,1E				X	
79°15,7N	26°42,3E				X	

Sampling of sediments is performed as follows:

The Smögen box corer is lowered to the bottom with a speed of about 1 m/s. 10 m above the bottom, the speed is lowered to about 0.5 m/s. After sampling, the box corer is lifted carefully from the seabed, and is raised to the surface with a speed of about 1 m/s. When the box is on board the ship, the sample is checked to see if the quality is satisfactory, and that the box is filled to the brink. The seawater on top of the sample is carefully siphoned off the sample with a plastic tube. Samples of sediments consisting of clay or silt are preferable.

One grab shot is taken from each sediment station. The subsamples which should be taken from each grab shot will be specified before each sample collection. The following samples may be taken from each grab shot: surface sample for analysis of organic pollutants, surface sample for analyses of metals/GS/TOC surface sample for analyses of radionuclides, sediment core for analyses of radionuclide. The subsamples are collected as follows:

I. Surface samples for analyses of organic pollutants

1. The upper sediment layer, about 15x15 cm and 0-2 cm thick layer is collected. The sample should consist of at least 200 g wet sediment. Use a *metal spade*! Not plastic!
2. The samples are packed in aluminum foil. Pack the samples as tight and small as possible, but be careful so no sample material is lost. Surface samples often contain a lot of water.
3. The sample should be marked with a label containing the following information: ship, boxcorer station number, date and ”ORG”. *Use pencil!*
4. The two (well labeled) samples are put together into a plastic bag.
5. The plastic bags from all the sediment stations are stored together in the ships freezer room in a labeled plastic box. The samples are transported in a frozen state to IMR.

II. Surface sample for analyses of metals/GS/TOC (the sample are to be sent to NGU)

1. The upper sediment layer, about 15x15 cm and 0-2 cm thick layer is collected. The sample should consist of at least 200 g wet sediment. Use a *plastic spade*! Not metal!
2. The sample is put directly into a plastic bag.
3. The following information is written directly on the plastic bag (with a waterproof marker): ship, boxcorer station number, date and ”MET”.
4. The plastic bags from all the sediment stations are stored together in the ships freezer room in a labeled plastic box. The samples are transported in a frozen state to IMR.

III. Surface sample for analysis of radionuclides

1. Surface samples are collected as follows: 1-2 cm (depending on how much water the sample contains) of the upper sediment layer is collected and filled into an aluminum tray (Ø about 20 cm).
2. The aluminum tray should be well labeled beforehand (use a waterproof marker) with the following information: ship, boxcorer station number, date and ”RAD”.
3. Put the sample in a plastic bag.

4. The plastic bags from all the sediment stations are stored together in the ships freezer room in a labeled plastic box. The samples are transported in a frozen state to IMR.

IV. Sediment core for analysis of radionuclides

PVC tubes of length of about 50 cm and Ø 10 cm is lowered carefully into the box, and lids are carefully added on top and bottom. To secure the lids, tape may be added outside the lids. The tubes must be kept in a standing position. The plastic tubes should be labeled beforehand with the following information: ship, boxcorer station number, date and ”RAD”. The cores should be frozen and stored in a standing position and transported to IMR.

5.1.2.2. Biota

From the Barents Sea, we aim for collecting samples of *cod, haddock, saithe, greenland halibut, redfish, herring, capelin, polar cod, long rough dab and deep-sea shrimp* from the following main areas:

- Bear Island area
- The Finnmark coast
- The North Eastern part of the Barents Sea

It may be necessary to combine samples from several stations in order to get enough sample material. Within the three main areas mentioned above, it should be trawled in areas with acoustic registrations, along transects where acoustic registrations already is planned to take place.

Along with all samples, the following information has to be written down in a note book/journal: ship, station number, position, date, length, weight, sex and the weight of gonads and liver. Samples for organic pollution should be marked ”ORG” or “POPs”, samples for metal analysis should be marked ”MET” and samples for radionuclides should be marked ”RAD”. Otholits for determination of age should be taken from samples of haddock, cod, saith, redfish and Greenland halibut. When it comes to size of the fish, samples representative for the area should be taken. Avoid very small/big fish. The fish should be in a good condition, and it should be written down in the note book/journal if the fish has parasites of if the liver is discolored. In addition to the information written down in the note book/journal, a copy of the fish station scheme in a

separate plastic bag should follow each sample. Single samples should be marked with ship, station number, date, species and sample type (for example: muscle, liver, whole body). Use the standard template when printing the labels. Remember to use waterproof marker or pencil so the marking don't disappear!! All samples from each position or area should be put together in an appropriate packaging, e.g. plastic bag, and transported to IMR in a frozen state. A copy of the station scheme should follow the samples. The copy of the fish station schemes should be collected in a ring binder or similar and be sent to IMR.

The following samples of fish and deep-sea shrimps should be collected:

Fish species	**The Bear Island area**	**The Finnmark coast**	**The North Eastern part of the Barents Sea**
Cod	25 individuals	25 individuals	25 individuals
Haddock	25 individuals	25 individuals	25 individuals
Saithe	25 individuals	25 individuals	25 individuals
Greenland halibut	25 individuals	25 individuals	25 individuals
Redfish	25 individuals	25 individuals	25 individuals
Herring	2 bulk samples (25 + 25 individuals)	2 bulk samples (25 + 25 individuals)	2 bulk samples (25 + 25 individuals)
Capelin	2 bulk samples (ca. 3 + 3 kg)	2 bulk samples (ca. 3 + 3 kg)	2 bulk samples (ca. 3 + 3 kg)
Polar cod			2 bulk samples (ca. 5 + 5 kg)
Long rough dab	2 bulk samples (25 + 25 individuals)	2 bulk samples (25 + 25 individuals)	2 bulk samples (25 + 25 individuals)
Deep sea shrimp	2 bulk samples (ca. 3 + 3 kg)	2 bulk samples (ca. 3 + 3 kg)	2 bulk samples (ca. 3 + 3 kg)

Cod, haddock, saithe, Greenland halibut and redfishes

From each fish, the following samples should be taken:

1. The whole liver should be taken and kept in labeled glasses at ÷20 ºC (POPs)

2. Samples of muscle: 2 filets from each fish of about 100-200 grams each should be sampled, one filet should be backed in a plastic bag for analyses of metals, and the other filet should be packed in a plastic bag for analyses of radionuclides (all filets for analyses of radionuclides taken at the same station should be combined to a bulk sample). The samples should be labeled well and kept at ÷20 ºC. Small fish can be freezed as whole fish. The muscle subsamples for the different analyses should be marked with ”MET” and ”RAD”, respectively.
3. Otoliths for age determination should be put in otolith envelopes.

Herring, capelin, polar cod, long rough dab and deep-sea shrimps

Bulk samples (2-3 kg) are put into large plastic bags, labeled as described above and stored at ÷20 ºC. It should be taken 2 bulk samples of each species from each area. One sample is for analyses or organic pollutants, and the other is for analyses of radionuclides. The samples should be marked with “POPs” and “RAD”, respectively.

5.1.2.3. Sampling for biomarkers

Biological data:

Length of fish, weight of fish, liver and gonad, sex and maturation, other comments. Otoliths (in envelopes).

Samples for biochemical analyses:

Tissues wanted for haddock, cod and Greenland halibut to be frozen at -80°C

Liver, cryo tubes: 4 Minimum 0.5 g per vial.

Bile: cryotube 2

We need the fish to be freshly caught, for good quality samples for biochemical analyses.

Comments:

Haddock should have length > 30 cm.

Please take also stomach content of Greenland halibut. Use two plastic bags, with label outside first plastic bag. Frozen at -20°C

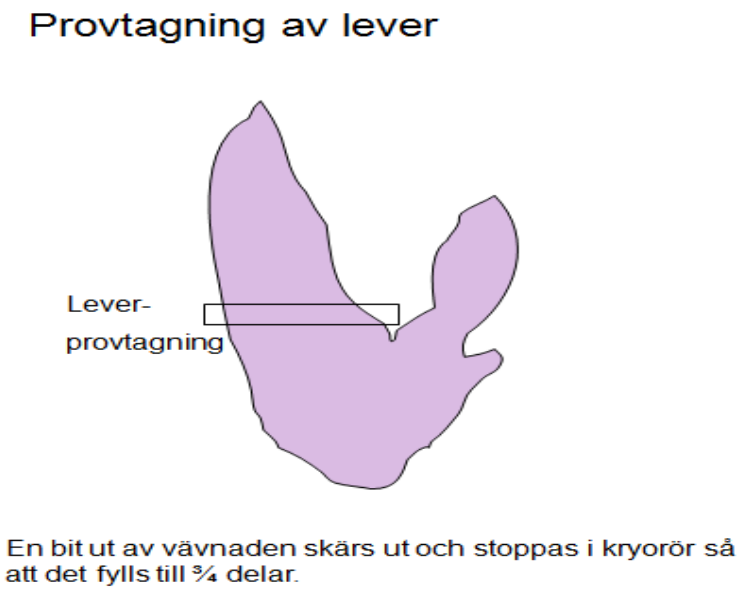

Figure 5.1.2.1. Drawing of fish liver with indications of which part to sample.

Labelling:

T= torsk, H=hyse, S= sei, B= blåkveite, U = uer, G= gapeflyndre

GOS Finnmark: T1-1L

GOS Bjørnøya: T2-1L

J Hjort Bjørnøya: T3-1L

J Hjort BH Nordøst: T4-1L

Samples of zooplankton and phytoplankton for fatty acid analyses.

We would be interested in 3 samples per cruise.

Taken with standard sampling methods, and frozen at -80°C. Also in fix for identification.

Zooplankton: 2 Fractions: 1000 µM and 180 µm.

Phytoplankton: Sampling as for chlorophyll measurements, at 10 and 20 m depth, filter water and filters frozen at -80°C.