

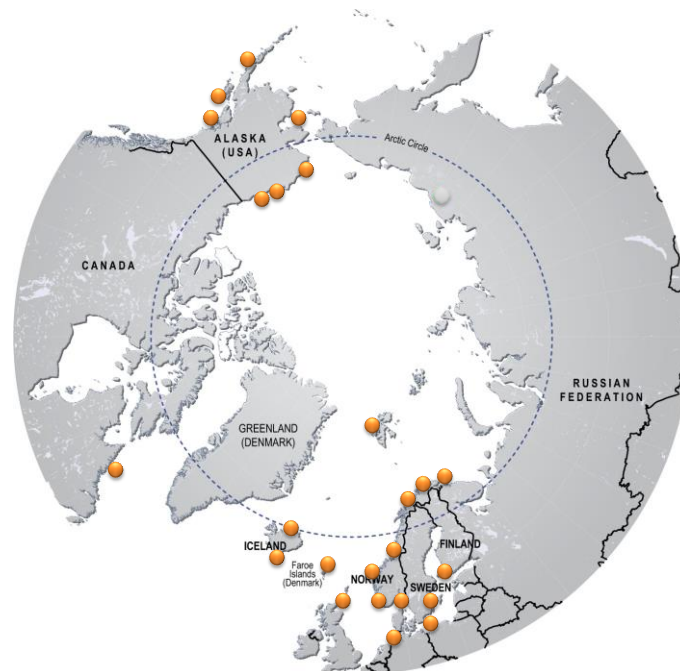


GRACE grant no 679266

Environmental Specimen Banks: Sample and Data Inventory in Marine Areas of Arctic and Sub-Arctic Regions

D3.4

WP3: Determination of oil and dispersant impacts on biota using effect-based tools and ecological risk assessment



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Executive Summary

Environmental specimen banks (ESBs) provide support oil spill impact diagnosis and prognosis. , ESBs are preparing to investigate how chemicals and to what extent their biological effects can be (and will be) determined. GRACE aims at providing a first step to take advantage of the resources available in N. Atlantic ocean and Baltic sea to launch regional archives suitable for the biological effects assessment of oil spills and oil spill responses. This report is a first step to take advantage of the resources available in the northern Atlantic and Baltic Sea to launch regional archives suitable for the biological effects assessment of oil spills and oil spill responses. For this purpose, an inventory of samples and data has been carried out. The environmental specimen banks active in the Arctic and sub-arctic region and the type and characteristics of the archived specimens are introduced herein, together with references to the main information sources and with links or contact persons to access the banked archives, whenever available.

Environmental Specimen Banks

Environmental specimen banks (ESBs) provide support oil spill impact diagnosis and prognosis. The history of ESBs goes back to the 1960s, when the first ESB was established in the Sweden (SNRM), and then in 1979 in the USA (HML) and in Germany (UBA-UPB). Since then, several ESBs in Europe have been launched. Historically, the primary reason for environmental specimen banking was to provide researchers and ecologists with materials that could be used for analyzing temporal trends in exposure for previously unrecognized pollutants or for pollutants for which analytical techniques were inadequate at the time of collection. Presently, ESBs are preparing to investigate how chemicals and to what extent their biological effects can be (and will be) determined. GRACE aims at providing a first step to take advantage of the resources available in N. Atlantic ocean and Baltic sea to launch regional archives suitable for the biological effects assessment of oil spills and oil spill responses. For this purpose, the field campaigns (September-October 2016 and 2017) constitute kick-off activities to start systematic sampling programmes; together with the inventory of samples/data presented herein.

The International Environmental Specimen Bank Group (IESB) promotes the world-wide development of techniques and strategies of environmental specimen banking. IESB is devoted to both, established Environmental Specimen Banks (ESBs) and new ESBs in the planning stages. The following environmental specimen banks are active at different levels (e.g. the first four are relevant for the Arctic and sub-arctic region and were pioneers in the field):

- [Swedish Environmental Specimen Bank](#) at Swedish Museum of Natural History; Stockholm
- [German Environmental Specimen Bank](#) at Federal Environment Agency; Dessau-Roßlau
- [U.S. Environmental Specimen Bank Group](#) at National Institute of Standards and Technology (NIST)
- [Norwegian Environmental Specimen Bank](#) at Oslo Centre for Interdisciplinary Environmental and Social Research; Oslo
- [Canada's National Aquatic Biological Specimen Bank and Database](#) at the Canada Centre for Inland Waters/Environment Canada; Burlington, Ontario
- [Canadian Wildlife Service Specimen Bank](#) at National Wildlife Research Centre (Wildlife Toxicology Division - Specimen Bank)
- [Japanese Environmental Specimen Bank for Global Monitoring \(es-BANK\)](#) at Center for Marine Environmental Studies, Ehime University; Matsuyama
- [Japanese Environmental Specimen Time Capsule Program](#) at National Institute of Environmental Science (NIES); Tsukuba
- [BCAA - Antarctic Environmental Specimen Bank \(Italy\)](#) at the University of Genova; Genova
- [The Mediterranean Marine Mammals Tissue Bank \(Italy\)](#) of the University of Padova
- Korean National Environmental Specimen Bank at National Institute of Environmental Sciences (NIER); Seoul (Republic of Korea)
- French Environmental Specimen Bank at Observatoire de Recherche sur la Qualité de l'Environnement
- [French Environmental Specimen Bank](#) at Observatoire Pérenne de l'Environnement
- [British National Fish Tissue Archive](#) at the Centre for Ecology and Hydrology (CEH)
- [Yangtze Environmental Specimen Bank](#) at Tongji University; Shanghai at the Centre for Ecology and Hydrology (CEH)
- [Biscay Bay Environmental Biospecimen Bank \(BBEBB\)](#) at Research Centre for Experimental Marine Biology & Biotechnology; Plentzia (Spain)
- [Library of Marine Samples](#) at Korea Institute of Ocean Science and Technology (KIOST); (Republic of Korea)

In Nordic countries, under the authority of the Nordic Council of Ministers and their Working Group for Environmental Monitoring, a project for coordination of environmental specimen banking in the Nordic Countries started in 1991. Originally the project concerned the established and planned central ESBs in

Denmark, Finland, Norway and Sweden. In 1993, representatives from Iceland and Greenland joined the Project Group. The project aimed at coordination and harmonizing of procedures and methods used in specimen banking as, e.g., collection of specimens, transport, preparation and storage in order to increase the possibilities for international cooperation in monitoring work. The main task for the Project Group in the first phase was to select base-line information on specimen banking and to form the principles and strategy for coordination and cooperation. The work continued on basis of the suggested outlines and the primary goal was to compile an inventory and directory of all methods, or as many as possible in practice.

References:

<http://www.inter-esb.org/index.html>

Nordic Council of Ministers. 1995. Nordic Environmental Specimen Banking: Methods in Use in ESB : Manual for the Nordic Countries. Temanord Series. Nordic Council of Ministers, ISBN 9291206628, 9789291206629

Swedish ESB

Mussels

Blue mussels (*Mytilus edulis*) are the only mussel species that is collected within the Swedish environmental monitoring program. Localities used for collection within the Swedish environmental monitoring program is; Kvädöfjärden at the Swedish east coast (Baltic Sea), Nidingen and Fjällbacka, at the Swedish west coast. Collection is carried out annually during the late autumn when the reproduction period is over and the population structure is as homogenous as possible. Collections of material can in some cases be based on commercial capturing methods and are not standardized in those cases. The size interval should be narrow, preferably between 3 - 8 cm at the Swedish west coast, and 1- 4 cm at the Swedish east coast. The dried shells are stored in plastic bags at room temperature (c. 18°C). Samples of homogenized soft bodies are packed separately and stored frozen (-20°C).

Fish

The fish collected are collected in sampling localities selected in order to represent the condition in coastal marine waters and in lakes throughout Sweden. The localities are regarded as not polluted from any local sources and are chosen in a way that influences from river outlets are avoided. Most sampling programs are designed in a way that requires annual sampling to detect changes of concentrations of contaminants. The season of collection is important as the level of many contaminants fluctuate over the year in fish. Certain substances show a maximum during late spring in both marine and fresh water species. Most sampling takes place during late summer and early autumn and collection at periods of reproduction are generally avoided. Species in the Swedish marine and fresh water monitoring programmes are:

- herring (*Clupea harengus*) since the 1970s,
- cod (*Gadus morhua*), collected in the autumn in the southern parts of the Baltic and at the Swedish West coast;
- flounder (*Platichthys flesus*) and dab (*Pleuronectes limanda*)
- eelpout (*Zoarces viviparus*)
- perch (*Perca fluviatilis*), collected for coastal monitoring of the Baltic as well as for freshwater monitoring.
- pike (*Esox lucius*), collected for freshwater monitoring since the late 1960s.
- Arctic char (*Salvelinus alpinus*), collected for freshwater monitoring at localities near the northern Scandinavian mountain range

Bird eggs

Guillemot eggs (N=20 per sample) are yearly collected for storage in the SESB and chemical analysis. Collection is carried out as early as possible during the breeding period, not later than 14 d after the laying of the first egg in the colony. Eggs from the population in the Baltic area are collected soon after the laying of eggs in the population is completed. When specimens are expected to be used for biochemical studies or for analyses of non-persistent compounds, the ambition is to store the material at as low temperature as possible, from collection to the final storage (-80°C). When specimens are intended to be used for analyses of highly persistent compounds, storage at -25°C is used. Eggshells can be stored at room temperature, temperature <20°C, if nothing else is prescribed. The shell fragments are dried at room temperature and stored dark at a temperature <20°C in jars with a tight lid.

References:

T. Odsjo (2006) The environmental specimen bank, Swedish Museum of Natural History—A base for contaminant monitoring and environmental research. *J ENVIR MONIT* 8, 791–794

USA Federal Scientific Collections

Institutional Collection: Marine Environmental Specimen Bank

The Marine Environmental Specimen Bank (Marine ESB) was established by the National Institute of Standards and Technology (NIST) in 2002 at the Hollings Marine Laboratory. It is devoted to the cryogenic banking of marine environmental specimens (e.g., fish tissues, mussels, oysters, marine mammal tissues, bird eggs and feathers, sea turtle tissues and eggs, coral tissues and coral ecosystem specimens) as part of ongoing research and monitoring programs conducted in the marine and coastal environment of the USA, including Alaska and the Pacific Islands Region. In addition, the Marine ESB houses all samples (e.g., frozen (-80/-196°C) animal-derived (skins, eggs, feathers, etc.), biofluids (blood, urine, etc.) (non-human), cells and tissue (non-human); sediments) that were maintained at the former NIST National Biomonitoring Specimen Bank which was established in 1979.

The Marine ESB is specifically designed to cryogenically store these environmental specimens over long periods of time (50-100 years). Samples are not limited to just pollution research but have also been used to determine cellular and biomolecular measurements, RNA analysis for genetics and evolutionary studies, as well as food web studies through stable isotope and fatty acid analysis. Formal tissue access policies have been put in place for specific projects within the collection in coordination with partnership with other government agencies (i.e. marine mammal tissues collected as a part of the National Marine Mammal Tissue Bank). Tissue access policies have also been established for other projects (i.e seabirds, sea turtles, coral ecosystems) which are not mandated by federal law but through the Marine ESB management at NIST. The Marine Sample Tracking and Analytical Reporting (Marine STAR) is a web-based interface to provide easy access to sample information from the Marine ESB. Information includes, but is not limited to, sample availability, chemical analysis status and results, and links to publications. Metadata associated with each sample and subsample, such as sample collection and status, is maintained by the Marine ESB in a relational database.

National Marine Mammal Tissue Bank (NMMTB)

The Alaska Marine Mammal Tissue Archival (AMMTAP) was the earliest organized effort to develop an environmental specimen bank specifically designed for long-term archival under cryogenic conditions of biological specimens from the US Arctic. AMMTAP has been identified as part of the US agencies' contribution to the international Arctic Monitoring and Assessment Program. The AMMTAP began in 1987 as a cooperative effort between the Arctic Environmental Assessment Center of the NOAA and the NIST to establish and conduct a program of collecting tissues from Alaska marine mammals and storing them under conditions which allow future analyses for substances indicative of contamination from offshore petroleum and mining activities. Further on, in 1989, the National Marine Fisheries Service, in collaboration with the NIST established the National Marine Mammal Tissue Bank (NMMTB) for long-term cryogenic archival of selected marine

mammal tissues. The NMMTB, an important component of NOAA Fisheries Marine Mammal Health and Stranding Response Program, is maintained by NIST as part of the Marine ESB and has samples from over 45 species of marine mammals.

Seabird Tissue and Archival Monitoring Project (STAMP)

In 1999, USFWS-AMNWR, USGS-BRD and NIST implemented the Seabird Tissue Archival and Monitoring (STAMP) to monitor contaminants in Alaska's marine environments. STAMP was designed as an ongoing long-term effort to track geographic and temporal trends in environmental quality by collecting seabird eggs using standardized protocols, processing and banking the contents under conditions that ensure chemical stability during long-term (decadal) storage, and analyzing subsamples of the stored material to determine baseline levels of persistent bioaccumulative contaminants. The seabird egg collection is maintained in NIST's Marine ESB at the Hollings Marine Laboratory. Since 1999, STAMP has collected and banked eggs from nine species of seabirds (common and thick-billed murre, glaucous and glaucous-winged gull, black-legged kittiwake, black-footed and Laysan albatross, brown booby, and sooty tern);

Info+: Rebecca Pugh (HML); rebecca.pugh@nist.gov

References:

URL for Collection: <https://www.nist.gov/programs-projects/marine-environmental-specimen-bank>

URL for Collection's Web Services: <https://www.nist.gov/programs-projects/marine-environmental-specimen-bank>

German ESB

The German ESB (launched in 1985) is a major component of the German environmental observation system. Specimens from typical ecosystems all over Germany, including coastal regions, urban settlements and mountainous terrain, are collected at regular intervals and stored in the German ESB. As well as specimens representing various levels of the food chain such as algae, mussels, fish, herring gulls, human specimens (blood and urine) are collected from student volunteers at four different sites. All collected specimens are tested for the presence of a wide variety of chemical substances (including heavy metals) before being deep-frozen and consigned to storage. Low-temperature storage ensures that the specimens remain virtually unaltered, and can be taken out for analysis even many years later. The ESB's routine analysis programme not only involves measuring the concentration of specific substances but also evaluating the fitness of the sampled organisms on the basis of biometric factors, e.g. age, size, weight, state of health. Archives of marine ecosystems (Wadden Sea, Bodden Natural Park) and riverine ecosystems (Elbe, Rhine, Danube) include a variety of target species (see attached excel sheet), say: common bladder wrack, common mussel, zebra mussel, eelpout and bream (muscle and liver), herring gull eggs.

The archive for environmental specimens is located at the Fraunhofer Institute for Molecular Biology and Applied Ecology IME, Schmallingenberg-Grafschaft. Immediately after sampling, the pre-cleaned and biometrically characterised material is deep-frozen in the gaseous phase above liquid nitrogen. The transport of specimens to Schmallingenberg is carried out in cryogenic containers at temperatures below -150°C. At Fraunhofer IME, the specimens are ground in deep-frozen condition to produce a fine homogeneous powder. About 10 g portions of standardized sub-specimens are stored. As part of the chemical characterization of specimens, some of these sub-specimens are analyzed for inorganic substances, CHCs and PAHs. Remaining sub-specimens are long-term stored above liquid nitrogen at temperatures below -150°C. The stock of archived specimens is updated annually.

References:

<https://www.umweltprobenbank.de/en/documents>

ESB Norway

ESB Norway contains frozen samples of animals, plants, air and mud from across Norway and the Arctic since 2007, as well as mussel shells and fish otoliths (stored at -25°C). ESB Norway is owned by The Ministry of Climate and Environment and managed by The Norwegian Environment Agency. The daily operations are attributed to CIENS as a national assignment. CIENS is a strategic research collaboration between independent research institutes and the University of Oslo. Its expert advisory board includes GRACE members (**Bjørn Munro Jenssen, NTNU**) and collaborators (**Anders Bignert, Stockholm NHM**). Sampling sites and organisms are summarised in the annexed maps.

Info+: Eirik Fjeld (NIVA-CIENS); eirik.fjeld@niva.no

References:

<https://miljoprobebanken.no/english/>

Iceland

Mussel biomonitoring is being carried out since 1989 and chemical pollutants are recorded and data submitted to ICES. The Marine Research Institute handles all sampling. Each sample of mussel contains 50 individuals (4-6 cm length), Biometrical data are recorded and the specimens are homogenized, frozen stored before analysis.

References:

<http://www.fisheries.is/products/pollution-and-threats/monitoring-programes/>

Finland/Lapland

AMAP (Monitoring of pollutant bioaccumulation in mussel culture; 1988-2012) is a National Implementation Plan project that includes 7 sites around the country and Kemijärvi in Lapland. Parameter groups measured/observed/modelled are biological effects and POPs. Data are not archived or planned to be archived at an AMAP Thematic Data Centre; they are stored SYKE and not archived in specimen banks.

Info+: Sirpa Helve; if.otsirapmy@emantsal.emantsrif

References:

<http://www.ymparisto.fi/en-US>

<http://projects.amap.no/project/monitoring-of-pollutant-bioaccumulation-in-mussel-culture/>

<http://projects.amap.no/project/bioaccumulation-physiological-and-biochemical-effects-of-pollutants-in-mussels/>

Koistinen, J., Herve, S., Ruokojärvi, P., Koponen, J., Vartiainen, T. 2010 Persistent organic pollutants in two Finnish watercourses: Levels, congener profiles and source estimation by mussel incubation, *Chemosphere* 80 (6): 625-633.

Canada

Community Aquatic Monitoring Program (CAMP) - Dept. Fisheries and Oceans

CAMP offers guidance for environmental community groups monitoring the health of their local watershed. Through monitoring methods established by the Department of Fisheries and Oceans (DFO), community groups are conducting a science-based program with the intent to examine the health of bays and estuaries throughout the Gulf Region. Each summer, environmental community groups collect important data to determine if groupings of fish, shrimp and crab – what is called a community- can be used as an indicator of the health status of bays and estuaries. With this information, DFO scientists working with government agencies and universities can conduct analyses to determine the suitability of indicators to assess the health of bays and estuaries. CAMP research takes place from northeastern New Brunswick to Cheticamp, Nova Scotia and all around Prince Edward Island.

Info+: DFO CAMP coordinator; camp-psca@dfo-mpo.gc.ca.

References:

Weldon, J., Courtenay, S. and Garbary, D. 2008. The Community Aquatic Monitoring Program (CAMP) for measuring Marine Environmental Health in Coastal Waters of the southern Gulf of St. Lawrence: 2006 Overview. Can. Tech. Rep. Fish. Aquat. Sci. 2783:viii + 61 p.

Environmental Specimen Banks - Dept. Environment

In the 1960s and 1970s, the Government of Canada established a range of monitoring programs in response to concerns about chemicals in the environment. Samples of fish, bird and mammalian tissues collected as part of these programs became the first specimens stored in what are now Environment Canada's tissue specimen banks, the National Wildlife Specimen Bank and the National Aquatic Biological Specimen Bank. **The National Wildlife Specimen Bank** was established in the 1960s, maintained in Ottawa, Ontario, at the National Wildlife Research Centre. Tissues of over 90 000 specimens from over 800 species, including 77% birds, 9% mammals, 14% other (i.e., fish and amphibians). Primarily preserved in an environmentally controlled facility at -40°C and -80°C in a series of freezers and liquid nitrogen vapour phase. A full database inventory is maintained for efficient access. **The National Aquatic Biological Specimen Bank** was established in 1977, maintained in Burlington, Ontario, at the Canada Centre for Inland Waters. Over 52 000 samples from more than 50 species of fish and various aquatic invertebrates. Cryo-preserved in an environmentally controlled facility at -80°C in a series of freezers. A full database inventory is maintained for efficient access.

Today, over 100 000 samples are stored, with more added every year. Each specimen is homogenized and divided into 5 to 15 subsamples of ~20 g. All samples are stored at -80°C in a dedicated climate-controlled building with continuous monitoring of security and storage conditions. In the event of power failure, electricity to the facility is maintained by backup generators. In the event of mechanical failure in any of the freezer units, temperature sensors will trigger the release of liquid CO_2 to maintain freezing temperatures until the specimens can be manually transferred to another freezer. All information related to the NABSB is maintained within a secured relational database. All specimens received and/or collected are registered and assigned with successive and unique identification numbers. The database maintains all biological data (length, age, etc.) associated with each specimen number as well as data with regard to location, collection methods, storage and the results of all chemical analyses that have been performed on the specimen.

Info+: NABSB@ec.gc.ca.

References :

Canada's National Aquatic Biological Specimen Bank and Database (NABSB)—details on the NABSB specimen collection online on the National Water Research Institute website. www.ec.gc.ca/inre-nwri/default.asp?lang=En&n=D488F7DE-1

ANNEX 1: SAMPLE AND DATA INVENTORY

ESB	SPECIES	REGION	LOCALITY	YEARS	SAMPLING TYPE	SPECIMEN TYPE	AVAILABLE DATA
Germany	Mussels	North Sea	see attached Excel WS	1985-to date	Annual / yearly	<ul style="list-style-type: none"> Freeze-dried soft tissue pools Shells (partial) 	<ul style="list-style-type: none"> Biometry Gender Condition Bioaccumulation
Germany	Mussels	Baltic Sea	see attached Excel WS	1992-to date	Annual / yearly	<ul style="list-style-type: none"> Freeze-dried soft tissue pools Shell (partial) 	<ul style="list-style-type: none"> Biometry Gender Condition Bioaccumulation
Germany	Eelpout and other fish sps.	Baltic Sea	see attached Excel WS	1985-to date	Annual / yearly	<ul style="list-style-type: none"> Freeze-dried soft tissue pools Shell (partial) 	<ul style="list-style-type: none"> Biometry Gender Condition Bioaccumulation
Japan	Mussels	Labrador Sea	57°31'38.95"N, 60°54'21.95"W	1996	Only once	<ul style="list-style-type: none"> Frozen soft tissue homog 	<ul style="list-style-type: none"> -
Norway	Mussels	Norwegian Sea	see annexed maps	2007- to date	Annual / yearly	<ul style="list-style-type: none"> Frozen soft tissue pools Frozen (-80°C) subsamples for genetic analysis Shells (N=25) (-25°C) partial 	<ul style="list-style-type: none"> Biometry Gender Condition Bioaccumulation
Sweden	Mussels	Baltic Sea	see attached Excel WS	2006-to date	Annual / yearly	<ul style="list-style-type: none"> Individual Soft Tissues (-25°C) 	<ul style="list-style-type: none"> Biometry Gender Reproductive status Condition Bioaccumulation
Sweden	Mussels	North Sea	see attached Excel WS	1997-to date	Annual / yearly	<ul style="list-style-type: none"> Individual Soft Tissues (-25°C) 	<ul style="list-style-type: none"> Biometry Gender Reproductive status Condition Bioaccumulation
Sweden	Several Fish sps	Marine, brackish water and freshwater	see attached Excel WS	1977-to date	Annual / yearly	<ul style="list-style-type: none"> Individual Soft Tissues (-25°C) 	<ul style="list-style-type: none"> Biometry Gender Reproductive status Condition Bioaccumulation
Iceland	Mussels	North Sea		1989-to date	Annual / yearly	<ul style="list-style-type: none"> Frozen soft tissue homog. for monitoring for ICES (N=50) 	<ul style="list-style-type: none"> Biometry Condition
AMAP ¹	Mussels (Cultured)	Baltic Sea		1988-2012	Annual / yearly	<ul style="list-style-type: none"> No banked specimen 	<ul style="list-style-type: none"> Data stored in SYKE: Biol. effects, POPs
AMAP	Mussels (Cultured)	North Sea	<ul style="list-style-type: none"> Faeroe Islands Skagerrak 	1988-2012	Annual / yearly	<ul style="list-style-type: none"> No banked specimen 	<ul style="list-style-type: none"> Data stored in SYKE: Biol. effects, POPs
AMAP	Mussels (Caged)	Baltic Sea	<ul style="list-style-type: none"> Faeroe Islands Kristineber Scandinavia 	1998-2000		<ul style="list-style-type: none"> No banked specimen 	<ul style="list-style-type: none"> Biological effects: SFG, Growth, NRU, GI, P450 PCBs, PAHs, PBDEs
AMAP	Perch and other fish sps ²	Baltic Sea	<ul style="list-style-type: none"> Gulf of Bothnia 	2005-2007	Annual / yearly	<ul style="list-style-type: none"> No banked specimen 	<ul style="list-style-type: none"> Data stored in SYKE: Biological

¹ Arctic Monitoring and Assessment Programme (AMAP):

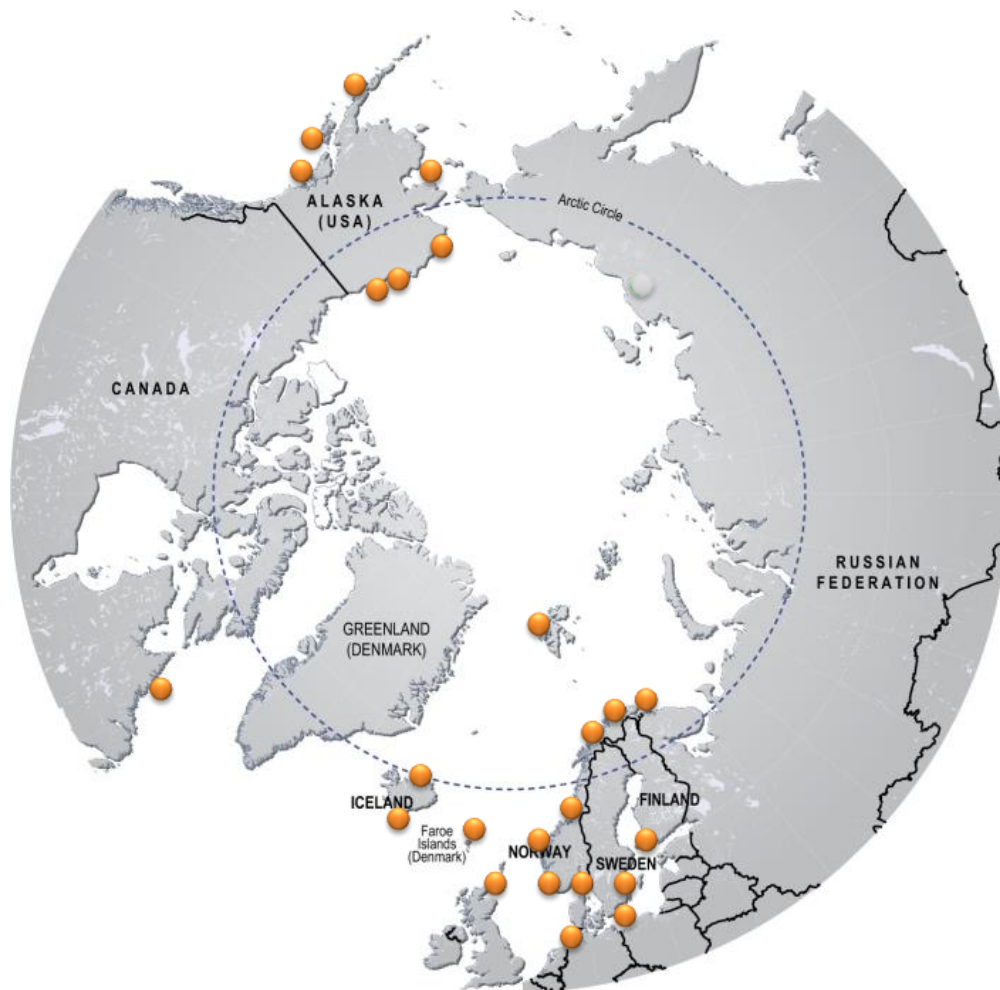
<http://projects.amap.no/project/monitoring-of-pollutant-bioaccumulation-in-mussel-culture/>

<http://projects.amap.no/project/bioaccumulation-physiological-and-biochemical-effects-of-pollutants-in-mussels/>

² Rantakokko, P., Hallikainen, A., Airaksinen, R., Vuorinen, P.J., Lappalainen, A., Mannio, J., Vartiainen, T. 2010. Concentrations of organotin compounds in various fish species in the Finnish lake waters and Finnish coast of the Baltic Sea, Science of The Total Environment. 408(12):2474-2481

			<ul style="list-style-type: none"> • Gulf of Finland 				effects, metals, POPs, PHCs
AMAP	Freshwater fish	Sweden Lakes	<ul style="list-style-type: none"> • Abiskojaure • Stor-Tjulträsket • Storrindeln • Brännträsket 	1981-to date	Annual / yearly	<ul style="list-style-type: none"> • Freeze-dried soft tissues³ 	<ul style="list-style-type: none"> • POPs • Metals

Map: Localities of interest where banked specimens or active monitoring can be useful to support further development of an Arctic ESB strategy suitable for oil spill and oil spill response ERA



NOTE: More details in the corresponding websites of the IESB and the individual ESBs, as well as summarised in the accompanying Excel Worksheet file:

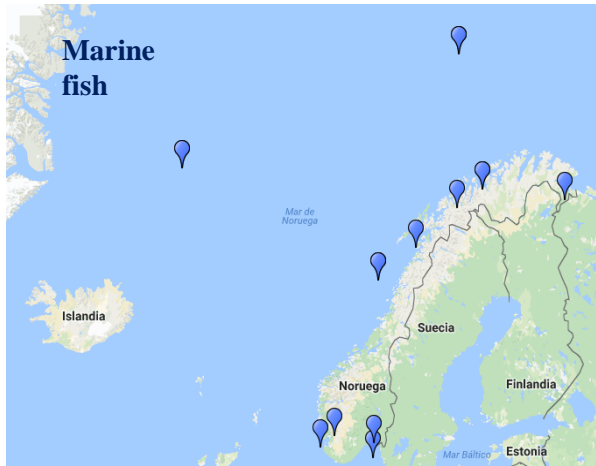
INVENTORY ESB GRACE 2017.xls

³ Environmental Specimen Bank's (ESB) methods are available on NRM website:
http://www.nrm.se/en/menu/researchandcollections/departments/contaminantresearch/environmentalspecimenbank.937_en.html

ANNEX 2: ESB Norway: Sampling Sites & Archived Organisms



- 📍 Færder fyr
- 📍 Espevær, Bømlo
- 📍 Gressholmen
- 📍 Indre Sør fjorden
- 📍 Byfjorden Bergen
- 📍 Munkholmen, Trondheim
- 📍 Sklinna, Nord-Trøndelag
- 📍 Røst, Nordland
- 📍 Bjørnerøya, Lofoten



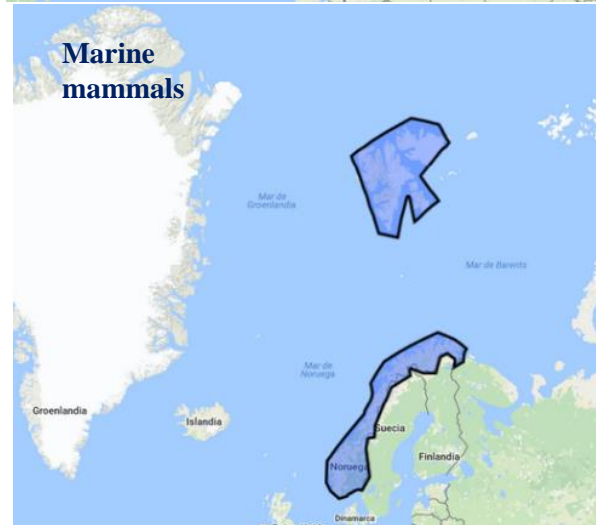
- 📍 Stasjon 29 Norskehavet
- 📍 LoppHAVet, Finnmark
- 📍 Stasjon 5 Norskehavet
- 📍 Bjørnerøya
- 📍 Færder fyr
- 📍 Espevær, Bømlo
- 📍 Indre Oslofjord
- 📍 Indre Sør fjorden
- 📍 Stasjon 29 Norskehavet
- 📍 Bjørnerøya, Lofoten
- 📍 Tromsø
- 📍 Varangerfjorden
- 📍 LoppHAVet, Finnmark
- 📍 Stasjon 5 Norskehavet
- 📍 Bjørnerøya



- 📍 Vest-Agder/Rogaland
- 📍 Hvaler
- 📍 Sklinna, Nord-Trøndelag
- 📍 Røst, Nordland
- 📍 Hornøya, Finnmark
- 📍 Ser-Gjæslingen, Nord-Trøndelag
- 📍 Røst, Nordland
- 📍 Hornøya, Finnmark
- 📍 Bjørnerøya
- 📍 Kongsfjorden
- 📍 Bjørnerøya
- 📍 Kongsfjorden
- 📍 Bjørnerøya, Lofoten
- 📍 Munkholmen, Trondheim



- 📍 Vegår
- 📍 Breidtjern
- 📍 Vannsjø
- 📍 Gærðusjvrit
- 📍 Mjøsa
- 📍 Ellasjøen
- 📍 Richardvann
- 📍 Vegår
- 📍 Fjellgardsvatn
- 📍 Dargesjøen
- 📍 Mjøsa
- 📍 Atnsjøen
- 📍 Store Høysjøen
- 📍 Valnesvatn
- 📍 Dalvatn



- 📍 Oter fra hele Norge
- 📍 Svalbard

ANNEX 3: Detailed inventories of the different ESBs

Table 1 Main groups of specimens stored in the Swedish ESB. Date: by 2006.

Type of specimens	Number
Birds 21 000	21000
Eggs	6500
Wings of birds	30000
Fish	115000
Soil, sediment and humus	1200
Food products	12000
Other	13500
TOTAL SPECIMENS	199200

Table 2 Specimens collected for the Swedish ESB, Date; by 2006

Specimens	Number of sites
Marine areas	
Herring (<i>Clupea harengus</i>)	8
Guillemot eggs (<i>Uria aalge</i>)	2
Atlantic cod (<i>Gadus morhua</i>)	2
Perch (<i>Perca fluviatilis</i>)	2
Eelpout (<i>Zoarces viviparus</i>)	3
Common dab (<i>Limanda limanda</i>)	1
European flounder (<i>Platichthys flesus</i>)	2
Blue mussel (<i>Mytilus edulis</i>)	3
Fresh-water areas	
Arctic char (<i>Salvelinus alpinus</i>)	2
Roach (<i>Rutilus rutilus</i>)	3
Pike (<i>Esox lucius</i>)	2
Perch (<i>Perca fluviatilis</i>)	14
TOTAL SITES	44

T. Odsjo (2006) The environmental specimen bank, Swedish Museum of Natural History—A base for contaminant monitoring and environmental research. J ENVIR MONIT 8, 791–794

NS&T SPECIMEN BANK INVENTORY: MAINE, WASHINGTON, ALASKA

Sample type and species key:

AF - *Arius felis* (Hardhead catfish)
 CS - *Cheilotrema saturnum* (Black croaker)
 CV - *Crassostrea virginica* (American oyster)
 GL - *Genyonemus lineatus* (White croaker)
 HS - *Hippoglossus stenolepis* (Pacific halibut)
 LX - *Leiostomus xanthurus* (Spot)
 MA - *Morone americana* (White perch)
 MC - *Mytilus californianus* (California mussel)
 ME - *Mytilus edulis* (Blue mussel)
 MO - *Myoxocephalus octodecemspinosus* (Longhorn sculpin)
 MU - *Micropogonias undulatus* (Atlantic croaker)
 OK - *Oncorhynchus keta* (chum salmon)
 OS - *Ostrea sandvicensis* (Hawaiian oyster)
 PA - *Pleuronectes americanus* (Winter flounder)
 PnV - *Pleuronichthys verticalis* (Hornyhead turbot)
 PS - *Platichthys stellatus* (Starry flounder)
 PV - *Parophrys vetulus* (English sole)
 SED - Sediment

Table E.1. Specimen Bank Inventory for the Mussel Watch Project (1986 - 1992).

NIST ID Code Site name Site area State Latitude (N) Longitude (W) Collection date Sample type

NIST ID Code	Site name	Site area	State	Latitude (N)	Longitude (W)	Collection date	Sample type
MW2M178	PBSI* Sears Island	Penobscot Bay	ME	44°27.13'	68°53.38'	27-Mar-87	ME
MW2S179	PBSI Sears Island	Penobscot Bay	ME	44°27.13'	68°53.38'	27-Mar-87	SED
MW3M231	PBPI Pickering Island	Penobscot Bay	ME	44°15.88'	68°44.05'	19-Mar-88	ME
MW3S232	PBPI Pickering Island	Penobscot Bay	ME	44°15.88'	68°44.05'	19-Mar-88	SED
MW4M313	CA KP Cape Arundel	Kennebunkport	ME	43°20.87'	70°28.48'	23-Mar-89	ME
MW4M305	CRNJ North Jetty	Columbia River	WA	46°16.67'	124°03.73'	15-Feb-89	ME
MW4S309	CRNJ North Jetty	Columbia River	WA	46°16.15'	123°59.92'	23-Mar-89	SED
MW5M376	WBNA Nahcotta	Willapa Bay	WA	46°29.80'	124°01.72'	6-Feb-90	ME
MW5S377	WBNA Nahcotta	Willapa Bay	WA	46°30.48'	124°00.36'	6-Apr-90	SED
MW5S374	GHWJ Westport Jetty	Gray's Harbor	WA	46°52.55'	124°04.87'	9-Apr-90	SED
MW3M221	GHWJ Westport Jetty	Gray's Harbor	WA	46°54.75'	124°07.05'	29-Jan-88	MC
MW3M222	JFCF Cape Flattery Str.	of Juan De Fuca	WA	48°23.30'	124°43.28'	27-Jan-88	MC
MW3S223	JFNB Neah Bay Str.	of Juan De Fuca	WA	48°22.48'	124°37.00'	17-Nov-87	SED
MW2M141	SSBI Budd Inlet	South Puget Sound	WA	47°05.94'	122°53.60'	12-Dec-86	ME
MW2S142	SSBI Budd Inlet	South Puget Sound	WA	47°06.03'	122°54.73'	17-Nov-86	SED
MW7M457	SSBI Budd Inlet	South Puget Sound	WA	47°05.94'	122°53.60'	14-Jan-92	ME
MW4M302	CBTP Commencement Bay	Tahlequah Point	WA	47°20.15'	122°30.10'	8-Dec-88	ME
MW4M301	PSSS Puget Sound	South Seattle	WA	47°31.73'	122°23.92'	7-Dec-88	ME
MW4S312	PSSS Puget Sound	South Seattle	WA	47°31.55'	122°24.27'	16-Mar-89	SED
MW5M339	EBFR Fourmile Rock	Elliott Bay	WA	47°38.35'	122°24.74'	11-Dec-89	ME
MW5S375	EBFR Fourmile Rock	Elliott Bay	WA	47°37.67'	122°24.33'	15-Mar-90	SED
MW5M338	EBDH Duwamish Head	Elliott Bay	WA	47°35.73'	122°23.20'	9-Jan-90	ME
MW5S378	EBDH Duwamish Head	Elliott Bay	WA	47°34.55'	122°25.08'	15-Mar-90	SED
MW2M143	SIWP Waterman Point	Sinclair Inlet	WA	47°35.12'	122°34.15'	18-Dec-86	ME
MW2S144	SIWP Waterman Point	Sinclair Inlet	WA	47°33.05'	122°37.62'	14-Nov-86	SED
MW5M337	PSHC Hood Canal	Puget Sound	WA	47°49.90'	122°41.20'	8-Jan-90	ME
MW1M055	WIPP Possession Point	Whidbey Island	WA	47°54.15'	122°22.80'	21-Jan-86	ME
MW1S058	WIPP Possession Point	Whidbey Island	WA	47°54.61'	122°20.64'	29-Jan-86	SED
MW6M396	WIPP Possession Point	Whidbey Island	WA	47°54.15'	122°22.80'	13-Dec-90	ME
MW5M340	PSPT Port Townsend	Puget Sound	WA	48°06.32'	122°46.63'	8-Jan-90	ME

MW5S379 PSPT Port Townsend Puget Sound WA 48°06.18' 122°45.90' 14-Mar-90 SED
 MW4M304 PSEH Everett Harbor Puget Sound WA 47°58.42' 122°13.72' 5-Jan-89 ME
 MW4S310 PSEH Everett Harbor Puget Sound WA 47°58.43' 122°14.22' 15-Mar-89 SED

MW4M303 PSPA Port Angeles Puget Sound WA 48°08.38' 123°25.01' 9-Jan-89 ME
 MW4S311 PSPA Port Angeles Puget Sound WA 48°08.28' 123°25.10' 8-Mar-89 SED
 MW2M145 BBSM Saqualicum Marina Jetty Bellingham Bay WA 48°45.25' 122°29.97' 27-Jan-87 ME
 MW2S146 BBSM Saqualicum Marina Jetty Bellingham Bay WA 48°44.77' 122°30.72' 24-Nov-86 SED
 MW6M401 PRPR Point Roberts Point Roberts WA 48°59.30' 123°05.30' 14-Jan-91 ME
 MW2M180 PVMC Mineral Creek Flats Port Valdez A K 61°08.17' 146°27.75' 27-Mar-87 ME
 MW2S181 PVMC Mineral Creek Flats Port Valdez A K 61°06.75' 146°28.17' 27-Mar-87 SED
 MW6M441 UISB Siwash Bay Unakwik Inlet A K 60°57.62' 147°38.67' 28-Mar-91 ME

Table E.2. Specimen Bank inventory for the National Benthic Surveillance Project (1985-1991).
 NIST ID†* Code Site name Site area State Latitude (N) Longitude (W) Collection date Sample type

BS2F186 PNBCH Penobscot Bay Colt Head Island ME 44°15.0' 68°50.0' 24-Apr-87 MO
 BS2L185 PNBCH Penobscot Bay Colt Head Island ME 44°15.0' 68°50.0' 24-Apr-87 MO
 BS2S187 PNBCH Penobscot Bay Colt Head Island ME 44°15.0' 68°50.0' 27-Apr-87 SED
 BS6S448 CA PRI Cape Elizabeth Richmond Island ME 43°31.9' 70°16.6' 6-May-91 SED
 BS1F014 PUGNR Puget Sound Nisqually Reach WA 47°06.8' 122°41.6' 14-Aug-85 PV
 BS1L015 PUGNR Puget Sound Nisqually Reach WA 47°06.8' 122°41.6' 14-Aug-85 PV
 BS1S013 PUGNR Puget Sound Nisqually Reach WA 47°06.8' 122°41.6' 14-Aug-85 SED
 BS6F446 PUGCB Puget Sound Commencement Bay WA 47°17.0' 122°25.3' 22-May-91 PV
 BS6L445 PUGCB Puget Sound Commencement Bay WA 47°17.0' 122°25.3' 22-May-91 PV
 BS6S447 PUGCB Puget Sound Commencement Bay WA 47°17.0' 122°25.3' 23-May-91 SED
 BS1F011 PUGEB Puget Sound Elliott Bay WA 47°36.0' 122°21.0' 12-Aug-85 PV
 BS1L012 PUGEB Puget Sound Elliott Bay WA 47°36.0' 122°21.0' 12-Aug-85 PV
 BS1S010 PUGEB Puget Sound Elliott Bay WA 47°36.0' 122°21.0' 12-Aug-85 SED

† The NIST sample code provides information about the collection year. The first year samples were collected for the specimen bank was 1985. All samples indicated with a "1" in the third column with the last three digits equal to or less than "028" were in fact collected in 1985. Samples with the "1" in the third column and numbers greater than 028 were collected in 1986. For all other samples, to calculate the collection year add the number found in the third column to 1985 plus one.

* Key for first column fourth character

F - Fish muscle sample

L - Liver sample

S - Sediment sample

Table E.3. Specimen Bank inventory for Alaska samples from the 1989 Exxon Valdez Damage Assessment.
 NIST ID◇ NMFS ID Site name Site area Lat (N) Long (W) Collect date Wt. A/B (g) N. pooled Species

EX1L001 NMFS #1227 Outside Bay Naked Is. 60°38.67' 147°28.05' 23-May-89 146/150 9 HS
 EX1F002 NMFS #1227 Outside Bay Naked Is. 60°38.67' 147°28.05' 23-May-89 177/163 9 HS
 EX1S003 NMFS #1227 Outside Bay Naked Is. 25-May-89 135/141
 EX1L004 NMFS #1228 Snug Harbor Knight Is. 60°14.23' 147°41.10' 30-May-89 189/188 6 OK
 EX1F005 NMFS #1228 Snug Harbor Knight Is. 60°14.23' 147°41.10' 30-May-89 180/168 6 OK
 EX1S006 NMFS #1228 Snug Harbor Knight Is. 31-May-89 145/146
 EX1E007 NMFS #1228 Snug Harbor Knight Is. 60°14.23' 147°41.10' 30-May-89 162/154 5 OK
 EX1L008 NMFS #1228 Snug Harbor Knight Is. 60°15.75' 147°41.75' 31-May-89 126/142 10 HS
 EX1F009 NMFS #1228 Snug Harbor Knight Is. 60°15.75' 147°41.75' 31-May-89 172/174 10 HS
 EX1L010 Evans Is. Prince William S. 60°01.05' 148°08.5' 4-Jun-89 192/225 7 OK
 EX1F011 Evans Is. Prince William S. 60°01.05' 148°08.5' 4-Jun-89 148/156 7 OK
 EX1S012 Evans Is. Prince William S. 60°00.4' 148°08.9' 4-Jun-89 143/145
 EX1M013* 5 Mummy Is. Prince William S. 60°17.26' 147°54.38' 5-Jul-89 69/71 ME
 EX1M014* 6 Snug Harbor Knight Is. 60°14.38' 147°43.11' 6-Jul-89 54/116 ME
 EX1M015* 8 Knight Is. Bay of Isles 60°23.0' 147°44.9' 8-Jul-89 84/175 ME
 EX1M016* 10 Naked Is. Cabin Bay 60°40.0' 147°30.0' 10-Jul-89 100/107 ME
 EX1M017* 13 Disk Is. Western PWS 60°29.9' 147°39.5' 13-Jul-89 119/103 ME

EX1M018* 18 Olsen Bay Eastern PWS 60°43.0' 146°14.0' 18-Jul-89 155/300 ME
 EX1M019* 20 Humpy Cove Resurrection Bay 59°56.2' 149°19.0' 25-Jul-89 59/60 ME
 EX1M020* 21 Pony (Agnes) Aialik Penin. Cove 59°46.2' 149°34.9' 26-Jul-89 22/107 ME
 EX1M021* 22 Taroka Arm Two Arm Bay 59°37.5' 150°08.3' 27-Jul-89 78/74 ME
 EX1M022* 25 Nuka Passage Tonsina Bay 59°18.7' 150°55.0' 30-Jul-89 39/41 ME
 EX1M023* 26 Gore Point 59°14.2' 150°58.8' 31-Jul-89 58/63 ME
 EX1M024* 27 West Arm Port Dick 59°17.2' 151°08.8' 1-Aug-89 57/50 ME
 EX1M025* 28 Windy Bay S. Kenai Peninsula 59°13.8' 151°31.0' 2-Aug-89 40/42 ME
 EX1M026* 30 Seldovia Seldovia Bay 59°25.8' 151°44.3' 4-Aug-89 30/68 ME
 EX1M027* 31 Ursus Cove N. Kamishak Bay 59°30.8' 153°45.1' 5-Aug-89 64/77 ME
 EX1M029* 35 Shuyak Is. 58°30.2' 152°25.1' 9-Aug-89 48/48 ME

* Sampling Protocol not followed

◇ EX1L - Fish liver

EX1F - Fish muscle

EXIS - Sediment

EXIE - Fish eggs

EX1M - Mussel soft tissues

Table E.4. EPA Mussel Watch Program sample inventory in NS&T Specimen Bank.

EPA sample ID NS&T nearest Year collected Sample condition Amount stored NIST number siteΔ

Blue Hills Falls, ME PBPI 1976 Good 307 g EP7M032
 Sears Island, ME PBSI 1976 Small 131 g EP7M076
 Sears Island, ME PBSI 1978 Very Good 245 g EP7M091
 Cape Newagen, ME MSSP 1976 Good 294 g EP7M031
 Bailey Island, ME MSSP 1978 Very Good 288 g EP7M019
 Portland, ME MSSP 1978 Fair 310 g EP7M081
 Willapa Bay, WA GHWJ 1976 Small 277 g EP7M051
 Grays Harbor, WA GHWJ 1976 Poor 320 g EP7M038
 Cape Flattery, WA JFCF 1978 Poor 295 g EP7M029
 Puget Sound, WA WIPP 1978 Small, Dirty 348 g EP7M116
 Puget Sound, WA WIPP 1976 Fair 222 g EP7M003*
 Boundary Bay, WA PRPR 1976 Small 259 g EP7M053

* Homogenized at NIST for analysis by NIST and shipped to Battelle and TAMU for analysis.

TISSUE CONDITION LEGEND:

Poor : tissue completely dry, ice crystals and dirt present.

Fair : tissue mostly dry, slightly gummy, ice crystals present.

Good : approx 50%+ Of the mussel tissue remained. Some ice crystals, drying around edge of shell.

Very Good : approximately 75% of mussel tissue remained, minimal ice crystals.

Small/Tiny : either small batch or small mussels.

Large : either large batch or large mussels.

Dirty : sample could not be shucked without some dirt on/in the sample.

SOURCE:

G.G. Lauenstein, A.Y. Cantillo, B.J. Koster, M.M. Schantz, SF. Stone, R. Zeisler and S.A. Wise, National Status and Trends Program Specimen Bank: sampling protocols, analytical methods, results, and archive samples, NOAA Tech. Mem. NOS/ORCA XX, National Oceanic and Atmospheric Administration, Rockville, Maryland (1996).

Sampling area	Specimen	Sex	Biometry	1988	1989	1990	1991	1992	1993	1994
Darßer Ort (Halbinsel Fischland/Darß/Zingst)	Blue mussel (Marine samples)		YES							
Darßer Ort (Halbinsel Fischland/Darß/Zingst)	Soft body (Blue mussel)		YES						98	100
Königshafen (Sylt-Römö-Watt)	Blue mussel (Marine samples)		YES							
Königshafen (Sylt-Römö-Watt)	Soft body (Blue mussel)		YES					90	284	597
Eckwarderhörne (Jadebusen incl. Mellum)	Blue mussel (Marine samples)		YES							
Eckwarderhörne (Jadebusen incl. Mellum)	Soft body (Blue mussel)		YES					90	343	594
MUSSEL SPECIMENS				0	0	0	0	180	725	1291
Darßer Ort (Halbinsel Fischland/Darß/Zingst)	Eelpout (Marine samples)	YES	YES							16
Darßer Ort (Halbinsel Fischland/Darß/Zingst)	Musculature (Eelpout)	YES	YES							16
Darßer Ort (Halbinsel Fischland/Darß/Zingst)	Liver (Eelpout)	YES	YES							16
Hauptprielsystem Meldorfer Bucht (Meldorfer Buch	Eelpout (Marine samples)	YES	YES					8	75	89
Hauptprielsystem Meldorfer Bucht (Meldorfer Buch	Musculature (Eelpout)	YES	YES					8	75	89
Hauptprielsystem Meldorfer Bucht (Meldorfer Buch	Liver (Eelpout)	YES	YES					8	74	87
Transekt Varel-Mellum (Jadebusen incl. Mellum)	Eelpout (Marine samples)	YES	YES							86
Transekt Varel-Mellum (Jadebusen incl. Mellum)	Musculature (Eelpout)	YES	YES							86
Transekt Varel-Mellum (Jadebusen incl. Mellum)	Liver (Eelpout)	YES	YES							85
EELPOUT SPECIMENS				0	0	0	0	24	224	570
Heuwiese (Kubitzer Bodden)	Egg (Herring gull)		YES				159		114	
Trischen (Meldorfer Bucht incl. Trischen)	Egg (Herring gull)		YES	120	124	120	140	120	120	120
Mellum (Jadebusen incl. Mellum)	Egg (Herring gull)		YES	120	120	119	128	120	121	120
HERRING GULL EGG SPECIMENS				240	240	240	240	240	240	240
TOTAL SPECIMENS				240	0	0	0	204	949	1861

1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
100	100		100		95	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
100	100		100		95	98	97	100	100	100	100	100	100	100	100	100	100	100	100	100	100
298	300	300	300	50	294	300	300	300	300	300	296	295	300	300	300	300	298	299	298	297	
298	300	300	300	50	294	293	291	294	295	298	296	294	300	298	300	300	298	296	296	297	
300	300	300	300	50	300	300	300	250	300	300	274	300	300	300	300	300	298	299	300	296	300
300	300	300	300	50	300	299	299	248	300	300	274	300	300	300	299	300	298	299	300	296	300
1396	1400	1200	1400	200	1378	1390	1387	1292	1395	1398	1340	1389	1400	1398	1399	1400	1392	1393	1394	1386	800
48	43		43	58		16	30	32		9	7	30	15		21	22	42	41	23	13	11
48	43		43	58		16	30	32		9	7	30	15		21	22	42	41	23	13	11
45	43		43	58		16	30	32		9	7	30	15		21	22	42	41	22	12	11
125	53	90	108	76		17	100	85	69	38	53	134	120	85	86	109	132	121	64	79	46
125	53	90	108	76		17	100	85	69	38	53	134	120	85	86	108	132	121	64	79	46
125	53	90	108	76		17	98	84	69	38	52	134	120	85	86	109	132	121	64	79	46
66	107	96	88	92			115	86	41	93	65	75	92	86	84	80	79	121	40	86	64
66	107	96	88	92			115	86	41	93	65	75	92	86	84	80	79	119	40	86	64
66	107	96	88	92			111	86	41	93	65	75	92	86	84	80	79	121	40	80	64
714	609	558	717	678	0	99	729	608	330	420	374	717	681	513	573	632	759	847	380	527	363
	120		120	120	75	44	50	50	50	50	50	40	30	25	25	25	25	25	25	25	25
120	120	70	70	120	120	50	90	50	50	50	50	30	29	25	25	25	25	25	25	25	
120	120	120	120	120	120	51	97	50	50	45	50	30	30	25	25	25	25	25	25	18	25
240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240	240
2110	2009	1758	2117	878	1378	1489	2116	1900	1725	1818	1714	2106	2081	1911	1972	2032	2151	2240	1774	1913	1163

TOTAL SPCM
1995
2188
6025
6959
6267
7289
30723
520
520
515
1962
1961
1955
1742
1740
1731
12646
1272
2058
2164
6960
43609

Table 1 Main groups of specimens archived in ESB NORWAY.

Blue mussel	Number of specimens	Since
Mytilus edulis (N=25)	189	2007
Fish: cod, haddock, perch, brown trout, vendance, Arctic char, smaelt, bogus fish	2216	1993
Bird eggs: black legged kittiwake, gall, eider, common gull, Euopean herring gull, European shag, hokked crow	1017	1999
TOTAL SPECIMENS	3422	

Summary of the holdings of the National Aquatic Biological Specimen Bank - (DATE: January 2012)

Family Name	Scientific Name	Common Name	# of specimens	# of sub-samples
Fish				
Acipenseridae	<i>Acipenser fulvescens</i>	lake sturgeon	8	33
Anguillidae	<i>Anguilla rostrata</i>	american eel	95	690
Anguillidae	<i>Anguilla anguilla</i>	european eel	9	106
Catostomidae	<i>Catostomus commersonii</i>	white sucker	213	1845
Catostomidae	<i>Catostomus cotostomus</i>	longnose sucker	20	71
Centrarchidae	<i>Micropterus dolomieu</i>	smallmouth bass	87	929
Centrarchidae	<i>Micropterus salmoides</i>	largemouth bass	1	4
Clupeidae	<i>Alosa pseudoharengus</i>	alewife	454	785
Clupeidae	<i>Dorosoma cepedianum</i>	gizzard shad	35	
Cottidae	<i>Cottus aper</i>	prickly sculpin	14	23
Cottidae	<i>Cottus cognatus</i>	slimy sculpin	411	783
Cottidae	<i>Cottus ricei</i>	spoonhead sculpin	10	33
Cottidae	<i>Myoxocephalus thompsonii</i>	deepwater sculpin	226	474
Cyprinidae	<i>Couesius plumbeus</i>	lake chub	21	53
Cyprinidae	<i>Cyprinus carpio</i>	common carp	101	474
Cyprinidae	<i>Luxilus cornutus</i>	common shiner	22	50
Cyprinidae	<i>Notemigonus crysoleucas</i>	golden shiner	3	5
Cyprinidae	<i>Notropus atherinoides</i>	emerald shiner	52	133
Cyprinidae	<i>Notropis hudsonius</i>	spottail shiner	4	4
Cyprinidae	<i>Phoxinus eos</i>	northern redbelly dace	4	4
Cyprinidae	<i>Rhinichthys cataractae</i>	longnose dace	1	1
Cyprinidae	<i>Semotilus atromaculatus</i>	creek chub	3	4
Esocidae	<i>Esox lucius</i>	northern pike	245	2726
Esocidae	<i>Esox masquinongy</i>	muskellunge	3	41
Esocidae	<i>Esox niger</i>	chain pickerel	53	408
Gadidae	<i>Lota lota</i>	burbot	269	778
Gasterosteidae	<i>Gasterosteus aculeatus aculeatus</i>	three-spined stickleback	4	7
Gobiidae	<i>Neogobius melanostomus</i>	round goby	162	411
Hiodontidae	<i>Hiodon alosoides</i>	goldeye	2	2

Hiodontidae	<i>Hiodon tergisus</i>	mooneye	15	46
Ictaluridae	<i>Ameiurus nebulosus</i>	brown bullhead	43	178
Ictaluridae	<i>Ictalurus punctatus</i>	channel catfish	129	978
Moronidae	<i>Morone americana</i>	white perch	88	266
Moronidae	<i>Morone chrysops</i>	white bass	9	9
Osmeridae	<i>Osmerus mordax</i>	rainbow smelt	1009	
Percidae	<i>Etheostoma blennioides</i>	greenside darter	6	6
Percidae	<i>Perca flavescens</i>	yellow perch	310	709
Percidae	<i>Sander vitreus</i>	walleye	2368	9919
Percidae	<i>Stizostedion canadense</i>	sauger	29	141
Percopsidae	<i>Percopsis omiscomaycus</i>	trout perch	24	66
Petromyzontidae	<i>Petromyzon marinus</i>	sea lamprey	190	313
Salmonidae	<i>Coregonus spp.</i>	cisco	235	643
Salmonidae	<i>Coregonus clupeaformis</i>	lake whitefish	589	2049
Salmonidae	<i>Coregonus hoyi</i>	bloater	69	176
Salmonidae	<i>Oncorhynchus clarki clarki</i>	cutthroat trout	61	221
Salmonidae	<i>Oncorhynchus gorbuscha</i>	pink salmon	32	32
Salmonidae	<i>Oncorhynchus kisutch</i>	coho salmon	364	441
Salmonidae	<i>Oncorhynchus mykiss</i>	rainbow trout	189	447
Salmonidae	<i>Oncorhynchus tshawytscha</i>	chinook salmon	2	2
Salmonidae	<i>Prosopium coulterii</i>	pygmy whitefish	5	20
Salmonidae	<i>Prosopium cylindraceum</i>	round whitefish	85	255
Salmonidae	<i>Prosopium williamsonii</i>	mountain whitefish	11	125
Salmonidae	<i>Salmo trutta</i>	brown trout	7	8
Salmonidae	<i>Salvelinus fontinalis</i>	brook trout	189	529
Salmonidae	<i>Salvelinus fontinalis X namaycush</i>	splake	307	411
Salmonidae	<i>Salvelinus namaycush</i>	lake trout	11214	48916
Sciaenidae	<i>Aplodinotus grunniens</i>	freshwater drum	145	649
Invertebrates				
Pontoporeiidae	<i>Diporeia hoyi</i>		695	705
Mysidae	<i>Mysis relicta</i>	opossum shrimp	827	872
		Bulk plankton (153µm)	966	1040
		Other invertebrates	110	116

TOTAL		
	22855	83025