

Monitoring and Assessment Group
First Meeting
Tallinn, Estonia, 22 - 24 March 2004

OUTCOME OF THE WORKSHOP

0.1 HELCOM MONAS Coastal Fish Monitoring Workshop 1/2004 was held in Tallinn, Estonia from 22 to 24 March 2004, in accordance with the decision by the Sixth Meeting of the Monitoring and Assessment Group (HELCOM MONAS 6/2003, 10/2, Paragraphs 6.15 – 6.17 (LD 26))

0.2 The Workshop was attended by the experts from Estonia, Finland, Latvia, Lithuania, Poland and Sweden. The list of Participants is contained in **Annex 1** to this Outcome.

0.3 Mr. Magnus Appelberg, Sweden, the Chairman of the Workshop welcomed the Participants and introduced the objectives of the Workshop. The Professional Secretary of the Helsinki Commission, Mr. Juha-Markku Leppänen acted as a Secretary of the Workshop. Mr. Leppänen introduced briefly HELCOM monitoring and assessment programmes as well as the future plans concerning the overall review of these programmes.

Agenda Item 1. Adoption of the Agenda

Documents: 1/1, 1/2

1.1. The Agenda, document 1/1, as adopted by the Workshop is attached as **Annex 2** to the Outcome.

Agenda Item 2. Review of the current uses and needs for coastal fish monitoring data

Documents: none

2.1. The Workshop discussed objectives of national coastal fish monitoring programmes and noted that the coastal fish data are used to indicate environmental conditions affecting fish population and effects of fisheries.

2.2. Coastal fish data have been used in national assessments and also international assessments have been compiled. Data compiled in the COBRA (Co-ordination Organ for Baltic Reference Areas) database has been used e.g. for:

- Stock forecasts of perch and pikeperch
- Long-term stock development evaluated with respect to eutrophication and general increases in temperature, over-fishing, etc.
- In Åland, for stock development and subsequent regulation of professional fisheries.

2.3. The Participants reviewed the current national coastal fish monitoring programmes as contained in **Annex 3**.

2.4. Mr. Henn Ojaveer, Estonia, informed the Workshop on the GEF-funded Baltic Sea Regional Project (BSRP) activities related to coastal fish and fisheries. The Participants of the ICES/BSRP SGBIFF suggested a compilation of a meta-database on coastal fish sampling and monitoring.

2.5. **(LD 1)** The Workshop welcomed the initiative by the ICES/BSRP SGBIFF and invited the Study Group to give HELCOM MONAS an access to the collected information when available.

Goal 1: Restore and maintain structure and functioning of coastal fish communities

Goal 2: Restore and maintain species and genetic diversity of coastal fish including non-commercial species

Goal 3: Restore and maintain healthy fish (individuals) causing harm neither to marine biota nor human population and ensure healthy fish populations

4.4. For Goal 1, predator – prey relationship and size distribution, functioning of the reproduction cycles – spawning areas – loss of critical habitats, for Goal 2, declining and endangered species and populations and non-indigenous species and for Goal 3, healthy reproduction, fish as healthy food for top predators and no new introductions of parasites were considered as potential starting points for development of EcoQOs and indicators.

4.5. (LD 7) The workshop was of the opinion that there are a number of indicators possible to be derived based on data in COBRA database as shown in **Annex 4**.

4.6. (LD 8) The workshop decided to revise the initial list in Annex 4 by and requested the Participants to send their amendments to Mr. Magnus Appelberg latest by 7 May.

4.7. The Workshop was aware of several biological effect studies/ecophysiological methods used at national level, but was hesitant to include them into the list of potential indicators before the outcome of the EU funded BEEP project.

Agenda Item 5. Recommendations for future monitoring strategy, methodology and data handling to provide indices of abundance and biodiversity and any other appropriate indicators of coastal fish fauna

5.1. (LD 9) The Workshop discussed the value of the present datasets and was of the opinion that in future it is most important to continue the present long-term data sets.

5.2. (LD 10) The Workshop also noted that there is rather limited information on non-commercial coastal fish in most of the sub-basins of the Baltic Sea. The Workshop further noted that not all Contracting Parties are participating in the joint coastal fish monitoring programme and therefore invited Denmark, Germany, Poland and Russia to include coastal fish monitoring in their HELCOM monitoring activities.

5.3. The Workshop discussed problems related to the strategy and methods of the present joint coastal fish monitoring programme and the new ones developed at national and international for a (e.g. Nordic Council of Ministers). The problems are partly site-specific related to e.g. depth of the area.

5.4. At the moment two different methods are in use: one in the northern and the other in the southern parts of the Baltic Sea. Additionally, Sweden is implementing a new method (Nordic random stratified sampling) that is currently been compared with the existing methods in a national three-year project.

5.5. (LD 11) The Workshop was of the opinion that the Nordic method might be suitable for the Baltic-wide use in the future but a combination of various methods could be used to produce EcoQOs/Indicator-based assessments.

5.6. The Workshop felt that adding especially smaller mesh sizes to the sampling nets would give supplementary information on e.g. recruitment.

5.7. (LD 12) The Workshop was of the opinion that the current methods should not be changed prior to the full assessment of the alternative method comparison and invited Sweden to submit the results for the consideration of HELCOM MONAS in 2005.

5.8. The Workshop compiled a list of description of the reference areas, sampling strategy, gear specification, age determination and the institutional stability to carry out

coastal fish monitoring as contained in **Annex 5**. The Workshop noted with satisfaction the strong commitment of the national institutes to carry out coastal fish monitoring.

5.9. **(LD 13)** The Workshop was of the opinion that the present system for data submission to the COBRA database is well functioning. However, the system is now fully dependant on the financing of Finland and Sweden only and of the willingness of Mr. Kaj Ådjers, Finland, to maintain and update the database. The Workshop emphasized that in case the amount of data submissions will increase in the future, there might be a need to develop a standardised electronic data reporting format for the COBRA database and negotiate for moving it to ICES and its broader financing.

5.10. The Workshop discussed possibilities to include coldwater species, already partly contained in some national surveys, better in the coastal fish monitoring since not all data are submitted to ICES and not assessed internationally. The Workshop did not find at the moment possibilities to compile the data in an assessment report.

5.11. **(LD 14)** The Workshop was aware that data on coastal coldwater fish communities are available mainly nationally and emphasized the need to collect and assess the information internationally and considered it suitable for a thematic report of HELCOM. The Participants from Estonia, Latvia, Lithuania and Sweden expressed their interest to carry out the assessment work. The Workshop invited the Baltic Sea Regional Project to consider possibilities to assist the process. The Workshop welcomed the offer by Mr. Henn Ojaveer and Mr. Jan Andersson, Sweden, to prepare an outline for national reporting and to draft the report.

Agenda Item 6.

Future work

6.1. **(LD 14)** The Workshop decided to submit a draft assessment on coastal fish to the next meeting of HELCOM MONAS in November 2004 for endorsement to publication in HELCOM BSEP. The Workshop welcomed the offer by Mr. Magnus Appelberg to coordinate the effort.

6.2. The Workshop welcomed the offer of Mr. Magnus Appelberg and Mr. Kaj Ådjers to produce a draft indicator fact sheet for the consideration of the HELCOM Indicator workshop in May 2004.

6.3. The Workshop emphasized the need to continue the development of coastal fish monitoring strategy and methodology as well as assessment products, and invited the BSRP to consider including the following topics into the work programme and to report to the next HELCOM MONAS in November 2004:

- to consider and recommend methods complementary to gillnet sampling to improve future fish monitoring taking into account that small-sized fish species and coldwater species are insufficiently covered at present;
- to consider and recommend how to improve comparability of data at national and international levels to harmonize fish monitoring programmes at all levels taking also into account the fish monitoring for the EU Water Framework Directive;
- to consider and recommend EcoQOs for coastal fish;
- to develop indicators based on data in COBRA database;
- to evaluate the value of the present datasets for continuation;
- to consider, together with Sweden, the value of the Nordic method for the Baltic-wide use;
- to consider developing a standardised electronic data reporting format of the COBRA database for inclusion of existing coastal fish monitoring data into the joint system.

ANNEX 1 LIST OF PARTICIPANTS

CHAIRMEN

Mr. Magnus Appelberg	National Board of Fisheries Institute of Coastal Research Gamla Slipvägen 19 S-Öregrund	Dir.Phone: +46 17346460 Fax: +46 17330949 Email: magnus.appelberg@fiskeriverket.se
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ESTONIA

Mr. Henn Ojaveer	Estonian Marine Institute University of Tartu Mäealuse 10 A EE-12618 Tallinn	Dir.Phone: +372 4433800 Fax: 372 4433800 Email: henn@pc.parnu.ee
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Mr Redik Eschbaum	Estonian Marine Institute University of Tartu Vanemuise 46 A EE-51014 Tartu	Dir.Phone: 372 7375 095 Fax: 372 6267417 Email: eschbaum@ut.ee
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FINLAND

Mr. Antti Lappalainen	Finnish Game and Fisheries Research Institute Pukinmäenaukio 4 P.O. Box 6 FIN-00721 HELSINKI	Dir.Phone: +358 (0)9 205751222 Fax: +358 (0)9 205751201 Email: antti.lappalainen@rktl.fi
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Mr. Juha-Markku Leppänen	Helsinki Commission Katajanokanlaituri 6 B FIN-00160 Helsinki	Dir.Phone: +358 (0)9 62202227 Fax: +358 (0)9 62202239 Email: juha-markku.leppanen@helcom.fi
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Mr. Mika Rahikainen	University of Helsinki Keskuskatu 19 FIN-48100 Kotka	Dir.Phone: +358 (0)5 2344853 Fax: +358 (0)5 2344275 Email: mika.rahikainen@helsinki.fi
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Mr. Jari Raitaniemi	Finnish Game and Fisheries Research Turku Game and Fisheries Research Itäinen Pitkätatu 3 FIN-20520 Turku	Dir.Phone: +358 (0)2 5751685 Fax: +358 (0)2 5751689 Email: jari.raitaniemi@rktl.fi
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Mr. Kaj Adjers	Provincial Government of Åland Islands Fisheries Division P.O. Box 1060 FIN-AX-22101 Mariehamn, Åland	Dir.Phone: +358 (18) 25297 Fax: +358 (18) 19240 Email: kaj.adjers@ls.aland.fi
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LATVIA

Mr. Evalds Urtans	Latvian Fisheries Research Institute Daugavgrivas Str. 8 LV-1048 Riga	Dir.Phone: +371 9268311 Fax: +371 7616946 Email: federacija@apollo.lv
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LITHUANIA

Mr. Rimantas Repecka	Institute of Ecology University of Vilnius Acadmijos 2 LT-08412 Vilnius 21	Dir.Phone: +370 (5) 2729284 Fax: +370 (5) 2729257 Email: repecka@ekoi.lt
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POLAND

Mr. Wojciech Pelczarski	Sea Fisheries Institute Kollataja 1 Str. PL- 81 332 Gdynia	Dir.Phone: +48 (58) 6201728 Fax: +48 (58) 6202831 Email: wpelczar@mir.gdynia.pl
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Ms. Iwona Psuty	Sea Fisheries Institute Kollataja 1 PL-81 332 Gdynia	Dir.Phone: +48 (58) 6201728 Fax: +48 (58) 6202831 Email: iwcia@mir.gdynia.pl
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SWEDEN

Mr. Jan Andersson	National Board of Fisheries Institute of Coastal Research Ävrö 16 S-57295 Figeholm	Dir.Phone: +46 (49) 1762841 Fax: +46 (49) 1762845 Email: jan.andersson@fiskeriverket.se
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ANNEX 2 AGENDA

1. Adoption of the Agenda
2. Review of the current uses and needs for coastal fish monitoring data
3. Review of the current monitoring strategy methods and data handling used for coastal fish monitoring
4. Proposals for coastal fish indicators for HELCOM
5. Recommendations for future monitoring strategy, methodology and data handling to provide indices of abundance and biodiversity and any other appropriate indicators of coastal fish fauna
6. Future work
7. Other business
8. Outcome of the Workshop

ANNEX 3 NATIONAL COASTAL FISH MONITORING PROGRAMMES

ESTONIA

In Estonia, experimental gillnet surveys using methods described by Thoresson (1993) were started in early 1990s in three areas of western Estonia (Matsalu, Hiiumaa and Vilsandi).. In 1997 two more areas in the Gulf of Finland and one area in the Gulf of Riga was included to warm water annual monitoring program. The program of cold water fish community monitoring was started also in early 1990s in west Estonia (Kudema bay).

Sampling from commercial catches has been performed in the Gulf of Riga since the 1950 and for selected species (perch, vimba, pikeperch, smelt, whitefish flounder) these studies are continued until now. The routinely measure parameters include length, weight, age, developmental stage of gonads and stomach content (non-systematic and if applicable). Tagging of perch, pikeperch and vimba has been performed. During the experimental bottom trawl surveys in the Gulf of Riga in the 1970s-1990s, several coastal fish (incl. non-commercial) were caught and analysed routinely, incl. for stomach content and in the 1990s for parasites. Ichthyoplankton studies have been performed in several stations in the NE Gulf of Riga during the 1950s-1990s. In these samples, fish larvae were generally identified to the species level.

FINLAND

In Finland, there is an exploratory gillnet fishing program (COBRA) ongoing in co-operation with Swedish Institute of Coastal Research and several other Baltic laboratories, covering sampling areas in the Åland Islands (see below), and Archipelago Sea, and Gulf of Finland. The main species under monitoring are common marine and freshwater species. The Brunskär reference area in the southern Archipelago Sea has been investigated by coastal survey nets since 1991. Perch has been age sampled.

In Haapasaari archipelago, eastern Gulf of Finland, coastal fish survey was commenced in 2003. Surveys are supported by three year project funding, but survey for 2004 only is financially secured currently. Methods are applied from Guidelines for Coastal Fish Monitoring by National Board of Fisheries. Sampling strategy involves stratified (by depth) random sampling using 45 stations, each of them fished once. Nordic multi-mesh gill nets with nine mesh sizes starting from 10 mm are used. Liver somatic index has been measured as an additional variable to account for detection of exposure for possible oil or chemical accident in the area. Haapasaari archipelago provides a potential case study for integrated coastal monitoring. In addition to coastal fish survey, in the area there is monitoring in progress related to water quality, benthic fauna, and macrophytes.

Commercially important fish species are sampled regularly as a part of the Data Collection Programme, funded partly by the EU Commission. The sampling is mainly conducted from the catches of professional fisheries in each gear (e.g. trawl, gillnets, fyke nets) and ICES subdivision in the area where the Finnish fishermen operate, to get a figure of age structure, growth rate, number and biomass of the fish in the catch and the recruited or soon recruiting part of the population. Stock assessments of herring, sprat, and cod are conducted for the purposes of fisheries management. The Data Collection Programme has two programmes with different funding level. In Finland, 1) Minimum programme includes species with populations living in areas of several countries: herring, sprat, cod, salmon, and flounder. 2) Extended programme covers species with local populations and national importance (coastal fish species): pikeperch, perch, whitefish, and sea-trout. Some activities are done in addition to the data collection programme. Tagging or marking studies have been done on whitefish,

pikeperch, salmon and sea trout. Genetic studies have been carried out on all salmonid species.

Åland Islands

Annual experimental fish monitoring started in late 1970's in Finbo reference area, located in the north-western archipelago of Åland Islands. Due to method alterations comparable data are available since 1983. Coastal survey nets were used since 1983 and Nordic nets since 2002. Age samples were collected from perch during the whole monitoring period and from roach during a few years in the middle of 1990's. The monitoring is used as a reference area for similar investigations in the recipient area from the Swedish nuclear power plant at Forsmark. The investigations at Finbo are financed by Sweden.

The fisheries authorities of Åland Islands investigate the pikeperch population in two areas by annual monitoring with nets series. Pikeperch is age sampled. The purpose of the monitoring is to collect information used for regulation of the professional fishery on pikeperch.

A new monitoring area, Kumlinge, in the eastern archipelago of Åland Islands, was established in 2003. Nordic nets are used and perch is age sampled. The area is affected by fish farming.

LATVIA

Integrated Coastal Fish Monitoring Programme

This monitoring is part of the Baltic Sea monitoring. It is being carried out in two sites (Daugava estuary and open coast near Ventspils) in July-August period since 1993. Integrated coastal monitoring in Latvia is used mainly for stock assessment and prognosis of several fish species (perch, pike-perch, vimba). Data are also used for general assessment of the state and changes of fish communities well. The survey at both places Daugavgriva and Jurkalne (first eutrophicated area and second - reference area) is done in 6 stations in depth 3-5 m. The analysis was done according Guidelines.

At the same time fish material (mainly perch) females (15-18 cm) are analysed for contamination (radiation, heavy metals and nucleotides).

Data series of this monitoring goes back to 1992 for Daugavgriva and 1999 for Jurkalne.

Monitoring of Biological Diversity

This monitoring is part of National Biological Diversity Monitoring Program. It is still in a development phase and it is planned to be carried out in shallow waters of four HELCOM Baltic Sea Protected Areas: Pape - Perkone, Kolka - Lielirbe, Engure - Kaltene and Dzeni – Ainazi. The main objective of this monitoring is to assess the state and changes in fish communities and population structure of economically important species (perch, pike-perch, vimba) in these areas.

At present, the monitoring is done twice a year (in spring and summer) in Pape – Perkone and Kolka – Lielirbe regions. The surveys are done using standard gillnet set and beach seine in depths 2.5-4 m and 0-2 m respectively. In Pape – Perkone region the sampling is done in 6 stations using gillnets and 10 stations using beach seine, in Kolka – Lielirbe region – in 3 stations using gillnets and 15 stations using beach seine.

Pape – Perkone region is also connected with need to monitor because it has some permanent presence of oil products and is considered as a risk area of oil spills.

Data series for Pape – Perkone area exist from 1998, for Kolka – Lielirbe the data go back to 1986.

Scientific survey with bottom trawl in Gulf of Riga

The survey using experimental bottom trawl is done twice a year – in May, June and July, August – in 15 stations. Trawling is done in coastal area in 10 m depth as well as in the central part of the Gulf in 30-40 m depth. These surveys were originally designed for eelpout research, but the fish community data are also obtained.

The Survey is done annually since 1975.

Other scientific surveys and databases

- Ichthyoplankton surveys that are continued currently are being carried out in several stations in two regions (Gulf of Riga and open coast) since 1998.
- Introduction of the system of fishermen observers allows routine collection of daily logbook data, incl. bycatch of marine mammals and seabirds since 1994.
- Sampling from commercial catches dates for some species back to 1992, but for several anadromous species back to 20-years.
- Data of stomach content analysis of various fish species from Gulf of Riga.
- Tagging experiments were carried out for flounder (in the 1960s), perch and pikeperch (in the 1990s) and routinely for salmonids since 1970s.

Multi-purpose scientific fishing in Latvian coastal waters is done in three seasons (spring, summer and autumn) to collect biological data for several important fish species (perch, flounder) and research general processes in coastal fish communities.

LITHUANIA

Overview of previous and ongoing monitoring of fish fauna of Lithuania in the Curonian Lagoon

Objective

The monitoring of abundance of coastal fish species in the Baltic Sea started in the Sweden and Finland, later, in 1991, it started in the Baltic countries. The point of the method is that ichthyological data according standardised methods are collecting in the fixed stations (Thoresson, 1993).

Curonian Lagoon is included to international coastal monitoring programme as one of regional reference areas (Sandström et al., 1994; Ådjers et al, 2001). Coordination Organ for Baltic Reference Areas (COBRA) administrates coastal fish monitoring in six international and three regional reference areas in the coastal zone of the Baltic Sea. The regional reference areas are situated at the Curonian Lagoon in Lithuania, which is polluted by effluents from populated areas and agriculture.

Fish monitoring is performed annually in August with multimesh gill nets at fixed stations. The method is standardised and adopted by HELCOM to be used along the coastal zone of the Baltic Sea (Neuman et al., 1997). Monitoring is mainly directed towards species occupying shallow waters throughout the year, such as perch, roach, silver bream, pike, pikeperch, ruffe and rudd. Time series now include 10 – 20 years monitoring.

Monitoring stations, sampling period, methods used

The first investigations by using multi-mesh-size nets in the Curonian Lagoon there performed in 1991 but only since 1992 data for international coastal monitoring programme are collected in central and northern parts of Lagoon (Fig. 5.1.). The data are collected in the end of July and beginning of August. According these programme the fishing with nets with different mesh sizes (17, 22, 25, 30 mm) are provided in central part of the Curonian Lagoon near River Nemunas branch Atmata and in the northern part of Lagoon near Dreverna in the end of July or beginning of August. The depth in central part is 3,8-4,0 m, in northern part – 1,8 – 2,0 m. The fishing was provided in 3-6 stations for 4-6 times in each section. The data are processed according Thoresson method (1993; 1996). Fish abundance data are described mainly by catches for 1 standard net (CPUE).

The state monitoring programme on the base of the same method (Thoresson, 1993) is provided in central part of Lagoon since 1993 (Virbickas et al., 1994; 1996). In the lack of money state monitoring programme is provided only in central part of Lagoon in 2 stations only 2 times in the end of July.

Institution responsible

The Institute of Ecology of Vilnius University was and is responsible for almost all monitoring programmes. International monitoring (COBRA) programme was financed in 1992-1997 by international organizations BITS and SIDA. Since 1998 data for this programme are collecting without financing;

State monitoring programme is financed by Environmental Ministry.



The scheme of previous and ongoing monitoring stations on fish fauna in the Curonian Lagoon.

- 1 stations for international monitoring (COBRA) programme;
- ▲ 2 stations for state monitoring programme;
- ↑ 3 major station for state monitoring programme for abundance of migratory fish species;
- 4 Klaipėda port monitoring programme;
- ◆ 5 state monitoring on fish stock assessment

POLAND

Implications and status of coastal fish monitoring in Poland

Coastal fish monitoring in Poland is not carried out on regular basis, like it is done for example in Sweden, mostly due to economical reasons. Most of the commercial fish species, which are caught in the Polish coastal area, are sampled from landings mainly. The best coverage of fisheries and biological long-term data, necessary for assessments, exists mainly for species inhabiting Vistula Lagoon, like pikeperch and bream.

On the basis of 1998-99 research, the fish assemblages of Vistula Lagoon from fyke-nets catches were described.

In the 1994-1998 in Gdansk Bay monitoring on juvenile flounder and turbot was carried out but later on was stopped due to economical constraints.

In 1993-2002 systematic studies on whitefish population in Puck Bay were carried out including effectiveness of restocking. Other non-systematic studies involve a few species like turbot, garfish, selectivity studies with roach, bream and perch in the 1990s.

Several activities, which could serve to coastal monitoring, were also carried out. In September 1998 research catches were conducted in two naturally varied basins of the southern Baltic. Sand eel and greater sand eel dominated the catches. The presence of clupeoids, flatfish, goby fish and eelpout were also noted. Water depth in both areas not exceeded 10 m.

Research on year-class strength of eelpout collected in bottom trawl surveys of r/v "Baltica" in Gdansk Bay was conducted in the period 1993-1999.

Studies on reproduction cycle, food habits, distribution of round goby (*Neogobius melanostomus*) are carried out since first record of that alien species was found.

Age structure monitoring of perch from commercial catches in Vistula and Szczecin lagoons was carried out on the yearly basis up to 2001, since then is carried out on three-year basis.

In the 2002 and 2003 a pilot study on bioindicator species - eelpout (*Zoarces viviparus*) from the Gdansk Bay were carried out. Three important enzyme biomarkers in fish were used: muscular acetyl cholinesterase (AChE) as marker of exposure to neurotoxins (especially some of pesticides), hepatic ethoxyresorufin-O-deethylase (EROD) and glutathione -S-transferase (GST) as markers to exposure to organic xenobiotics (especially PAHs, polycyclic aromatic hydrocarbons and PCBs, polychlorinated biphenyls). Reproductive success in eelpout was determined by analysing survival of eggs and fry condition. Higher activities of EROD were observed in individuals of eelpout with distinct pathological changes. In dead eelpout fry and fry with deformations, higher concentrations of the sum of PCB, HCH, DDT, Cu and Zn were observed comparing to the fry from fish without any visible pathological changes.

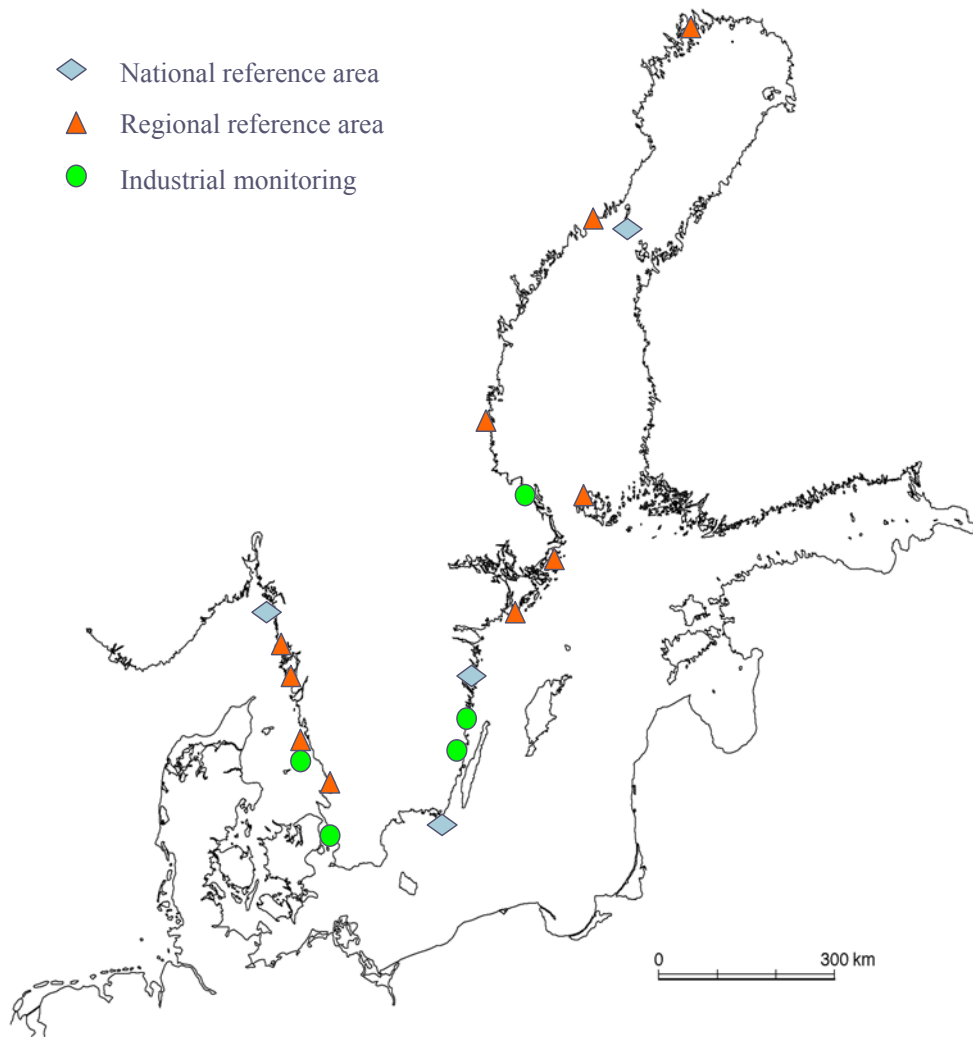
In 2003, biological measurements, including: length, weight, gonad stage, otolith reading, liver weight, number and condition of fry were conducted on 30 eelpout females from Gdansk Bay.

SWEDEN

In Sweden, exploratory monitoring programmes of coastal fish communities in Sweden cover the whole Baltic and Kattegat coastline. The programmes have several purposes, the most important ones being the environmental and resource monitoring programmes. Test fishing is

carried out by gill netting and fyke-nets according to standardised methods. Sampling programmes covers a large part of the coastal fish community, although the main focus is on shallow water fish communities, dominated by fresh water species in the Baltic and of a variety of marine species in the Kattegat. Monitoring directed to marine and cold water species is carried out in two reference areas in the Baltic Proper. The experimental fishing started in the early 1960's due to the onset of localising nuclear power plants on the Swedish coast. After several years of baseline studies, effects on fish communities by thermal discharges were thoroughly studied. Mostly on the basis of these studies, a national programme for coastal fish monitoring started in the late 1980's. Three reference areas with low anthropogenic impact were selected. Two of them, Holmöarna in the Northern Quark and Kvädöfjärden in the Baltic Proper are part of the COBRA programme and sampling follows the present HELCOM guidelines. In these areas physiological and biochemical analysis of sentinel species, perch and eel-pout, is carried out in a so called integrated fish monitoring. The national programme was expanded in 2002 with a new area, Torhamn, in Sweden. In addition to the monitoring of nuclear power and to the national programme, fish studies are performed in several regional reference areas, in most cases following HELCOM standard. Two of these areas, Råneå in the Bothnian Bay and Muskö in the Stockholm archipelago are part of the present COBRA programme. To meet new objectives, sampling strategies are under revision since 2002 and the results of these evaluations will be presented to HELCOM MONAS in 2005.

Commercial sampling of pike has been performed since 1987, of vendace since 1992, of turbot since 1998, of perch since 1999 and of flounder since 2002. Sampling of perch, pikeperch, pike, whitefish, flounder and eel will be expanded and implemented according to EU Sampling Directive in 2004. Larval samplings are carried out in several locations in the Baltic each year. Tagging experiments have been performed for perch, pikeperch, eel, sea trout, turbot and tagging of flounder will be initiated in 2004. Population genetic studies have been done for populations of pikeperch, pike, whitefish and vendace, and genetic analysis of perch, turbot and flounder are in progress.



ANNEX 4 POTENTIAL INDICATORS BASED ON DATA IN COBRA DATABASE

Indicator	Concern – environmental problem - explanation	Sampling
<i>Fish Community</i> (catchable with gillnets)		
No of species by appropriate category - No of threatened species (C?) - No of alien species (C?)	Biodiversity Fisheries	Standardized methods (at community level) to be used in all study areas
Species diversity (C)	Changes in fish fauna	Standardized methods (at community level) to be used in all study areas
Ratio between functional groups - Cyprinid/perchids (C) - Proportion of piscivorous fish (C?) - Benthic/pelagic species (-)	Fisheries Eutrophication Community function Community function	Locally adapted methods Locally adapted methods Locally adapted methods
Size structure of community (C)	Fisheries Environmental conditions	Standardized methods (e.g. same selectivity)
No of specimens – total abundance (C)	Productivity	Locally adapted methods
Total biomass (C)	Productivity	Locally adapted methods
<i>Fish populations</i>		
Abundance - Threatened species/populations (C?) - Sentinel species (C) - Larval abundance (N)	Fisheries Habitat quality Predation and competition Recovery actions	Standardized methods (minimum core set) Locally adapted methods Locally adapted methods
Recruitment - No of juvenile fish (C?) - Ichthyoplankton studies (N)	Habitats Spawning stock Health Climate	Locally adapted methods
Year class strength (C)	Habitats Spawning stock Health Climate	Locally adapted methods
Mortality (C)	Exploitation Predation Health status	Locally adapted methods (Standardized methods)
Size and age structure of population (C)	Fisheries Recruitment success/failure	Standardized methods

Sex ratio (C)	Fisheries Hormone disruptions	Locally adapted methods
Age and size at first maturity (C)	Fisheries Climate Environmental conditions	Locally adapted methods
<i>Individual level</i>		
Growth rate (C)	Feeding conditions (long-term) Competition Climate/temperature Salinity	Standardized methods
Liver somatic index (N)	Exposure to contaminants	Locally adapted methods
Gonad somatic index (N)	Exposure to contaminants Climate	Locally adapted methods
Condition factor (C)	Feeding conditions (short-term)	Locally adapted methods
Fat content (N)	Environmental conditions Feeding conditions	Locally adapted methods
Fecundity (N)	Exposure to contaminants Climate	Locally adapted methods
Prevalence of parasites and diseases (C)	Health/stress	Locally adapted methods

C= can be derived from data in COBRA database

N = can be derived from data in national databases

Outcome of HELCOM MONAS coastal fish monitoring 1/2004 Annex 5 COBRA reference areas

Annex 5 COBRA reference areas

AREA	Haapasaari	Brunskär	Finbo	Forsmark	Holmöarna	Råneå	Hiiumaa	Muskö	Kväddfjärden	Curonian Lagoon north	Curonian Lagoon south	Daugava	Kumlinge	Lagnö	Torhamn	
Sampling strategy																
Repeated sampling (number of stations)		9	8	8	10	7	12	7	12	4	5	6				
Stratified random sampling (number of stations)	45	30	45	45	30	45			45				45	45	40	
Gear specification (starting year)																
Multimesh coastal survey net (17, 22, 25, 33, 50 mm)		91	87	83	89	94										
Net series (17, 22, 25, 30 mm)							91	89	87	93	93	92				
Net series (17, 22, 25, 30, 33, 38 mm)							99									
Net series (17, 22, 25, 30, 33, 38, 40, 45, 50, 70 mm)										x	x					
Multimesh Nordic survey net (10, 12, 15, 19, 24, 30, 38, 47, 60 mm)	03	02	02	02	02	02			02				03	02	02	
Age determination																
Perch	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Roach										x	x					
Pikeperch										x	x	x				
Vimba bream										x	x	x				
Auxiliary environmental data																
Water temperature profile (sampling interval 1/week)									x							
Water temperature (sampling interval 2/day)										x	x					
Water temperature (loggers)	x	x	x	x	x	x			x				x	x	x	
Secchi depth (whole season)									x							
Physical and chemical water quality	x									x	x					
Macrophyte transects	x								x							
Benthic fauna			x	x					x	x	x					
Other measurements																
Genetic (pike, whitefish, perch, flounder)									x							
Liver weight (female perch)	x				x		x	x	x							x
Institutional stability																
Strong		x	x	x	x	x	x	x	x	x	x	x		x	x	
Weak	x												x			