IFL Project Report
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Rannsóknastofnun fiskiðnaðarins

Apríl 2005

Nordic information and communication network regarding safety of seafood products
1 st Workshop

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Skýrsluágrip Rannsóknastofnunar fiskiðnaðarins
Icelandic Fisheries Laboratories Report Summary

Titill / Title	**Nordic information and communication network regarding safety of seafood products, 1st workshop**		
Höfundar / Authors	*Eva Yngvadóttir and Helga Gunnlaugsdóttir*		
Skýrsla Rf /IFL report	02-05	*Útgáfudagur / Date:*	April 2005
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Ágrip á íslensku:

Þessi skýrsla greinir frá niðurstöðum fyrsta vinnufundar í samnorrænu verkefni um myndun upplýsinga- og tengslanets varðandi öryggi sjávarafurða, sem haldinn var í Reykjavík 4 og 5 apríl 2005.

Umræðuefnin á fundinum tengdust m.a. samræmingu gagna um ósækileg efni og næringarefni í sjávarafurðum og stofnun tengslanets um örggisþætti sem varða sjávarafurðir.

Helstu niðurstöður voru þær:

- Að erfitt getur verið að samræma og bera saman gögn og upplýsingar um sjávarfuðir frá mismunandi aðilum þar sem gögnin eru upprunin á mismunandi hátt og nauðsynlegar bakgrunnsupplýsingar liggja ekki fyrir. Hins vegar voru hindranir tilgreindar og lausnir ræddar sem gætu leitt til betri samanburðar á gögnum í framtíðinni.
- Samþykkt var að gera sameiginlega Norræna heimasíðu þar sem safnað væri saman á einum stað viðeigandi krækjur sem innihalda upplýsingar um efnainnihald sjávarafurða bæði óæskileg efni og næringarefni. Hvert land mun bera ábyrgð á sínum upplýsingum og á uppfærslu þeirra.
- Þátttakendur voru sammála um að ekki væri framkvæmanalegt að koma á laggirnar Norrænu vöktunarverkefni þar sem Norðurlöndin hafa mismunandi áherslur á þessu sviði.

Þátttakendur voru sérfræðingar frá Noregi, Finnlandi, Danmörku, Svíþjóð, Færeyjum og Íslandi.

Fundurinn var styrkur af NSK og NEF sjóðum Norrænu Ráðherranefndarinnar.

Lykilorð á íslensku: *Sjávarafurðir, upplýsingar,tengslanet, óæskileg efni, næringarefni*

Skýrsluágrip Rannsóknastofnunar fiskiðnaðarins
Icelandic Fisheries Laboratories Report Summary

Summary in English:

This report contains the outcome of the 1st workshop in a Nordic project called "Nordic information and communication network regarding safety of seafood products and utilisation of the resources from the sea". The workshop was held in Reykjavík, Iceland April 4-5th 2005.

The first objective of the meeting was to discuss the need to increase the comparability and harmonisation of Nordic data for chemical substances in seafood, i.e. nutrients and undesirable substances and to identify the main barriers for comparability and harmonisation of the data. The second objective of the meeting was to discuss how it is possible to establish an effective Nordic information and communication network regarding the safety of seafood products and utilization of the resources from the sea.

The main conclusions regarding the first objective were:

- That today it is difficult to harmonize and compare seafood data from different sources due to lack of guidelines and sufficient details about the data, however the barriers were identified and solutions discussed that could lead to increased comparability of seafood data (e.g. chemical composition) in the near future.

The main conclusions regarding the second objective were:

- That it is currently very difficult and hence not realistic to establish a common database for Nordic seafood data. However, there was keen interest among the participants to establish a common Nordic website with links to relevant information regarding the chemical composition of seafood, the safety of seafood products etc and thus build a common platform for the network. Each country should be responsible for its own documents as this would ensure that the information is updated and will help to keep the Website alive after this project ends. Furthermore, it is not feasible to establish a common Nordic surveillance program because the Nordic countries have different aims with their national surveillance programs or monitoring.

The participants were scientists from Norway, Denmark, Sweden, Finland, Faroe Islands and Iceland.

The workshop was funded by NEF and NSK

English keywords: *Seafood, information, communication network, web platform, contaminants, nutrition*

1. INTRODUCTION

This report describes the outcome of the first workshop held in the project "Nordic information and communication network regarding safety of seafood products and utilisation of the resources from the sea" funded by NSK and NEF. It contains overheads and summaries of the presentations and the results of the discussions that took place at the workshop.

The objective of this project is to establish a Nordic information and communication network regarding safety of seafood products and utilization of the resources from the sea. The network is a co-operative project with representatives from Denmark, Finland, Faros Islands, Iceland, Norway and Sweden. The project will build the base for co-ordination of information and the reporting of chemical substances i.e. nutrients and undesirable substances in seafood. The project will also be the cornerstone for further networking and innovative transnational research with the participation of scientists in the Nordic countries and EU.

The project started formally in November 2004 and the first project meeting was held in Reykjavik, Iceland on the 4-5th of April 2005. This meeting was attended by experts in the field of research and analysis of undesirable substances in fish and nutrition of fish from Faroe Island, Denmark, Sweden, Norway, Finland and Iceland.

The first objective of the meeting was to discuss the need to increase the comparability and harmonisation of Nordic data for chemical substances in seafood, i.e. nutrients and undesirable substances and to identify the main barriers for comparability and harmonisation of the data.
The second objective of the meeting was to discuss how it is possible to establish an effective Nordic information and communication network regarding the safety of seafood products and utilization of the resources from the sea.

In order to achieve the first objective the lecturers from each country were asked to address the following questions regarding undesirable substances and nutrition in seafood in their presentations:

1. What is presently analysed (e.g. species, season, undesirable substances, and nutrients)? *This was considered to be a short review from a workshop held in Bergen in March 2003 on the subject "Monitoring av innholdsstoffer (næringsstoffer og fremmedstoffer) I konsumfisk og industryfisk i de nordiske landene (Sluttrapport til Nordisk Ministerråd NMR prosjektnr.661045-00264)*".
2. How are the analyses carried out? Sampling and sample preparation. Principles for analytical methods and quality control.
3. How are the results presently disseminated in your home country? Specify the target groups.
4. What is your opinion/attitude towards coordination of data for chemical substances in seafood?
5. Other relevant research efforts related to this topic that you would like to address.

In order to achieve the second objective the participants were divided into two groups and encouraged to discuss the feasible structure of an effective Nordic information and communication network and how to ensure the viability of the network after the NMR funding has ceased. The groups were asked to answer following questions:

1. What kind of information and data should be included in the network? For example guidelines to increase comparability of data (nutrients and undesirable substances) in seafood.
2. Who are the stakeholders/end-users/target groups (e.g. governments, inspection party, industry, consumers, researchers etc.) define their different requirements and needs.
3. What is each participant/country capable of providing to the Network in terms of e.g. electronic data, reports, keywords (browser)? Should each country be responsible for its own documents?
4. In what form should the information and communication network be established? Web site, web platform etc.?
5. Who will be responsible to maintain the website in the future?
6. What are your expectations from this Nordic information and communication network?
7. Do you think it would be feasible to establish a joint Nordic surveillance program?

2. WORK PROGRAMME AND PARTICIPANTS

Monday April 4th 2005

9:00 **Welcome.** Sjöfn Sigurgísladóttir, director of Icelandic Fisheries Laboratories.
9:15-15:00 **Presentations from each country** (45 minutes /country, nutrients and undesirable substances in seafood)

9:15 **Faroe Island**

- Nordic information and communication network regarding safety of seafood products and utilization of the resources from the sea.
  Hóraldur Joensen, Food, Environment and Veterinary Agency
- Monitoring of fish in the Faroe Islands: Pollutants and What are the options for cooperation?
  Maria Dam, *Food, Environment and Veterinary Agency*

10:00 **Denmark**

- Organic environmental contaminants
  Arvid Fromberg, Danish Institute for Food and Veterinary Research
- Nutrients in fish
  Pia Knuthsen, *Danish Institute for Food and Veterinary Research*

10:45 **Coffee**

11:00 **Sweden**

- Analysis of contaminants in fish
  Marie Aune, Livsmedelsverket
- Swedish analysis of nutrients in fish
  Hanna Sara Strandler, *Livsmedelsverket*

11:45 **Norway**

- Norwegian surveillance programmes on seafood products related to food safety
  Amund Maage and Kåre Julshamn, National Institute of Nutrition and Seafood Research

12:30 **Lunch**

13:30 **Finland**

- Undesirable substances in fish, analysis in KTL
  Hannu Kiviranta, National Public Health Institute
- Undesirable substances (residues) in fish, analysis in EELA
  Christina Bäckman, National Veterinary and Food Research Institute

14:15 **Iceland**

- A brief summary of monitoring and research activities on contaminants at IFL
  Guðjón Atli Auðunsson, Icelandic Fisheries Laboratories
- The Icelandic Food Composition Database, Data on Fish
  Ólafur Reykdal, Centre of Food Technology at Keldnaholt

15:00 **Coffee**
15:30 **Discussions/conclusions**
Reach a consensus about the main barriers for comparability and harmonisation in the seafood data and suggestions for solutions.

17:30 **A bus from Grand Hotel to the Blue lagoon**
20:00 **Dinner at the Blue lagoon**

Tuesday April 5th 2005

9:00 **Introduction of EuroFIR; a way to give the Nordic countries a head start?**
Ólafur Reykdal, Centre of Food Technology at Keldnaholt

9:40 **Sharing research information on the Internet**
Ívar Gunnarson, Hugsjá ehf.

10.10-12.00 **Group discussions**

The groups are encouraged to discuss the feasible structure of the Nordic information and communication network and how to ensure the viability of the network after the NMR funding has ceased.

10:30 **Coffee**

12:00 **Lunch**

13:00 **Presentation of the results from the group work** (30 minutes for each group)

14:00 **Discussion**

15:00 **Conclusion and implementation plan** (website, next meeting)

16:00 **Coffee and closing of the workshop**

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Nordic Information and Communication Network regarding safety of seafood products and utilization of the resources from the sea

Hóraldur Joensen
Ministry of Fisheries & Maritime Affairs, Faroe Islands
Fisheries Research Project
C/o Food, Veterinary and Environmental Agency

- What is analysed presently: species, season, nutrients, sample preparation.
- Analysis methods at the Food, Veterinary and Environmental Agency. Utilized laboratories abroad.
- Results from Faroe Islands compared with corresponding findings in Iceland, Norway, Sweden and Denmark (Food Tables)
- Dissemination of results
- Opinions/attitudes towards coordination of data.

Nordic network meeting spunsored by the Nordic Council of Ministries (NSK and NEF), 4-5th April 2005, Reykjavik, Iceland

Food, Environmental and Veterinary Agency (Heilsufrøðiliga Starvsstovan(HFS)) has officially the responsibility for surveillance programs regarding analysis of nutrients/pollutants in fish for food and feed in the Faroe Islands.

Heilsufrøðiliga Starvsstovan

Food, Environmental and Veterinary Agency

www.hfs.fo

Surveillance programs for monitoring nutrients in the Faroe Islands

- No surveillance programs of nutrients exist.
- Analysis conducted recently:
- Cod (Gadus morhua) has been analyzed for nutrients (Heidi Gregersen 2001). Autumn. 24 specimens (-20ºC). 5 pooled samples (-78ºC). Anterior dorsal portion of the fillet.
- Cod analyzed for folic acid and fatty acids (Hóraldur Joensen 2003). Autumn. 125 specimens (-20ºC). Anterior dorsal portion of the fillet (-20ºC, HCl/MeOH, N_2).
- Herring analysed for fatty acids (Hóraldur and Jan Jacobsen 2004). Autumn, 100 specimen (-20ºC). Anterior dorsal portion of the fillet (-20ºC, HCl/MeOH, N_2).
- Analysis of cod liver every second month in 2005, and every third month in 2006, 2007 (Hóraldur). 25 specimens (0ºC). 5 pooled samples (-78ºC). The whole liver.
- Kroyer´s lantern fish (Notoscopelus kroeyri), Rakery beaconlamp (Lampanyctus macdonaldi) (Súni Lamhauge and Hóraldur 2005). Project not started yet.

Summary of the chemical analyses in the cod-project

(Heidi Gregersen 2001)

- **Nutritional value**: protein, water, ashes, fat content, cholesterol
- **Fatty acids**: saturated-, monounsaturated- and polyunsaturated fatty acids
- **Minerales and trace-elements**: Na, K, Ca, Mg, P, Fe, Mn, Zn Cu I, F, Se
- **Vitamins**: B1, B2, B3, B5, B6, B12, biotin, folic acid, A, D, E
- **Amino acids**: isoleucine, leucine, lysine, methionine, cystine, phenylalanine, tyrosine, tryptofane,valine, arginine, histidine, alanine, aspartic acid, glycine, proline and serine
- **Heavy metals**: Hg, Cd, Pb
- **Organochlorines**: PCB, pesticides, toxaphene, dioxine

Food, Veterinary and Environmental Agency

Analysismethods for measurements of nutrients and pollutants

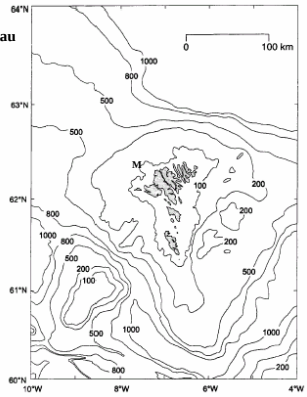
Offered accredited analyses, DANAK accr. nr. 303:

Parameter	Referencemetode	Detektions grænse	Relativ standardafvigelse	Pris, kr
Protein	mod. NMKL nr. 6, 3. ed	0,05 g/100 g	2,5 % (10,5 g/100g)	315,-
Fedt	mod. AOCS Official Meth. BA 3-38	0,5 g/100 g	5 % (5,3 g/100g)	263,-
Tørstof	mod. NMKL nr. 23, 3. ed		1 % (37,1 g/100g)	116,-
Gløderest	mod. NMKL nr. 23, 3. ed		2 % (2,78 g/100g)	116,-
Kviksølv	mod. Atomic Spectroscopy 1994, vol 15. No 4	10 µg/kg	20 % (2,14 mg/kg)	315,-
Cadmium, grafit	mod ISO 11047, 1. ed., mod ISO 5961 (del 3), 2.ed	2 µg/kg	15 % (43 µg/kg)	315,-
Bly, grafit	mod ISO 11047, 1. ed.	20 µg/kg	15 % (40 µg/kg) 15 % (220 µg/kg)	315,-

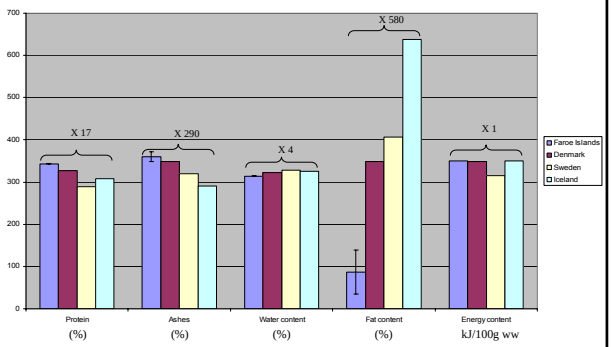
Utilized laboratories abroad

- **Icelandic Fisheries Laboratories, Reykjvík, Iceland** : total fat, fatty acids, iodine.
- **Centre de toxicologie du Quebec, Sainte-Foy,Canada**: Hg, Pb, Cd, Ca, Mg, Fe, Cu, Zn, Mn, Se, PBC (incl some congenes, chlordanes, ppDDT, ppDDE, β-HCH), DDT (o,p-isomers og metabolites) og toxaphenes (incl. total toxaphene)
- **University of Guelph, Ontario, Canada**: B1, B2, B3, B5, B6, B12, biotine, folic acid, amino acids.
- **Eclipse Scientific Group**, **Chatteris, England (2004):** Free fatty acid content, Peroxid value, Anisidine value, Water content, Ashes content, Protein content, Total fat content, Fatty acid analysis, Vitamin A, D, E, Contaminants {PCB (28, 52, 99, 101, 105, 118, 128, 138, 153, 156, 170, 180, 183, 187); chlordanes; DDT, DDD, DDE (o,p´ and p,p´); toxaphenes).

Cod caught on the Faroe Plateau (Mýlingsgrunnurin) in 2000 (Heidi Gregersen 2001)

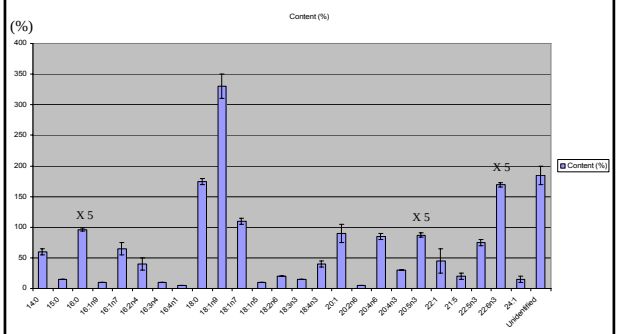


Relative content of protein, ashes, water, fat and energy in Faroese, Danish, Swedish and Icelandic cod-fillet

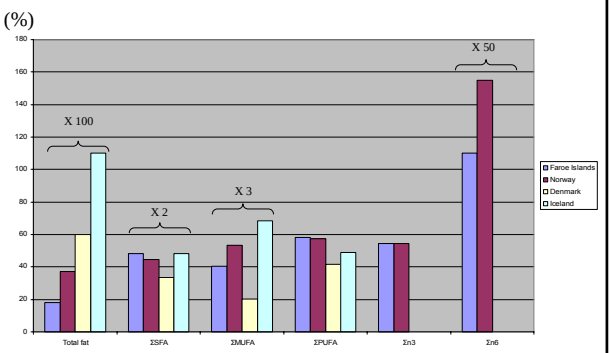


Amount of fatty acids in Faroese cod-fillet

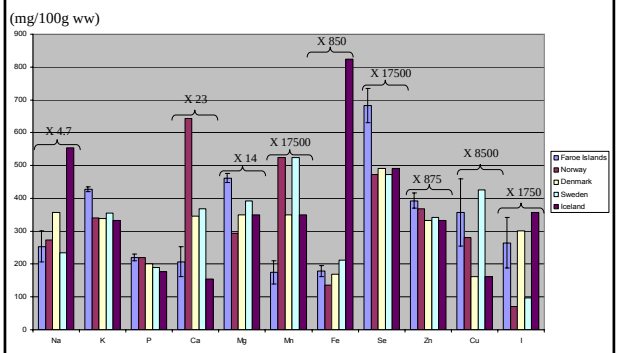
(The concentrations are multiplied by 50, except for 16:0, 20:5n3, 22:6n3)



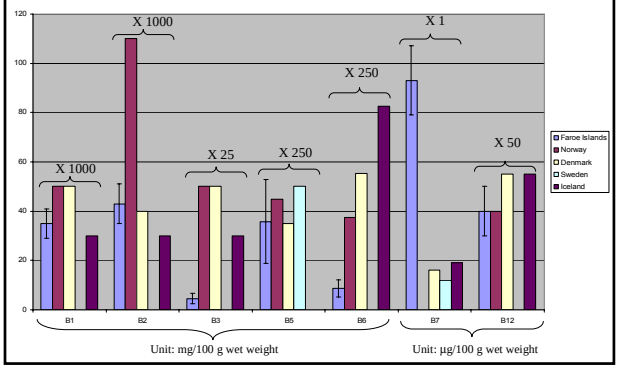
Amounts of ΣSFA, ΣMUFA, ΣPUFA, Σn3, Σn6 in cod from the North Atlantic



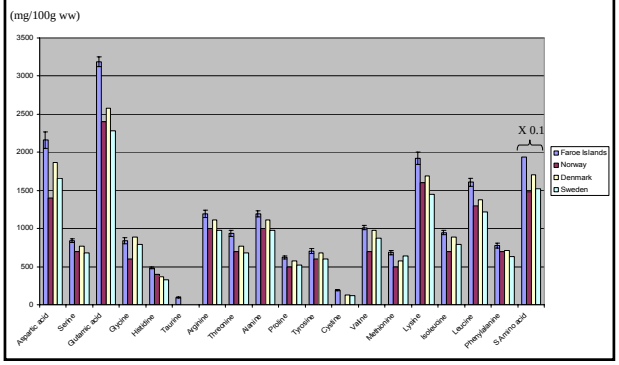
Content of minerals: Na, K, P, Ca, Mg and trace elements: Mn, Fe, Se, Zn, Cu, I in cod-fillet



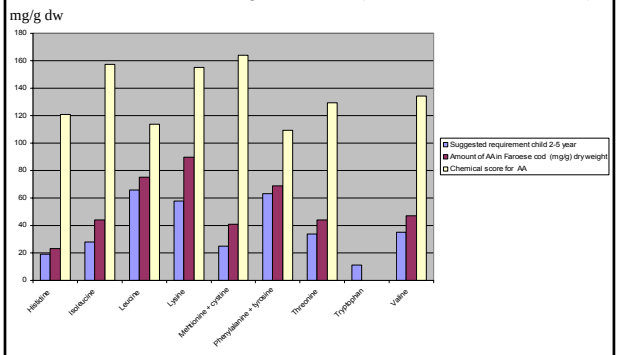
Quantities of vitmin B1 (thiamin), B2 (riboflavin), B3 (niacin), B5 (pantothenic acid) B6 (pyridoxine), B7 (folic acid), B12 (cobalamin) in cod-fillet



Amounts of amino acids in cod-fillet

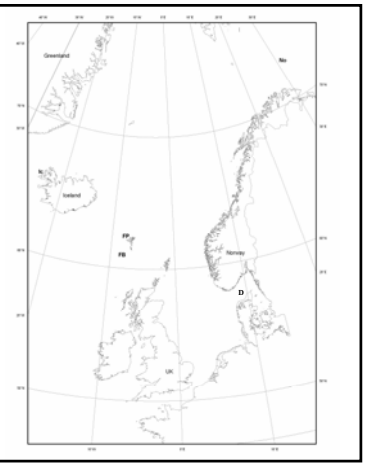


Suggested requirement for 2-5 year old children (FAO 1985), amounts of amino acids in Faroese cod and resulting chemical score (f. ex. 23/19x100 = 121 for histidine)

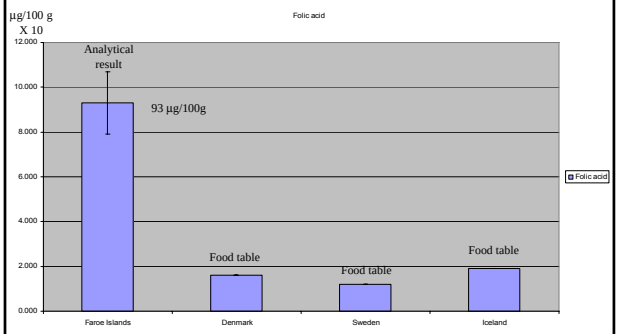


Folic acid project

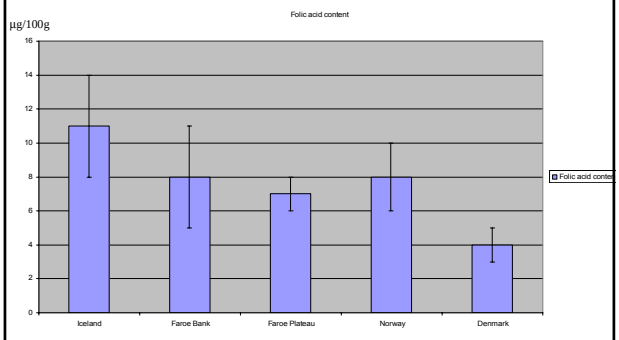
Cod caught in Icelandic, Faroese, Norwegian and Danish waters in the atumn 2003.



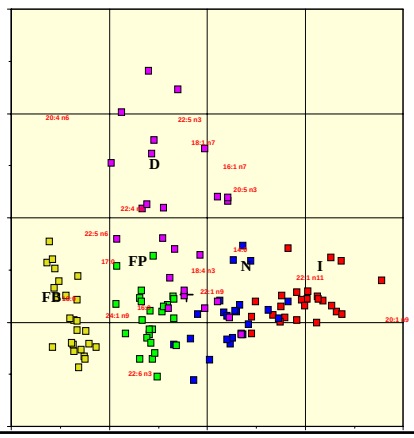
Folic acid content in cod-fillet from Faroese waters in autumn 2000



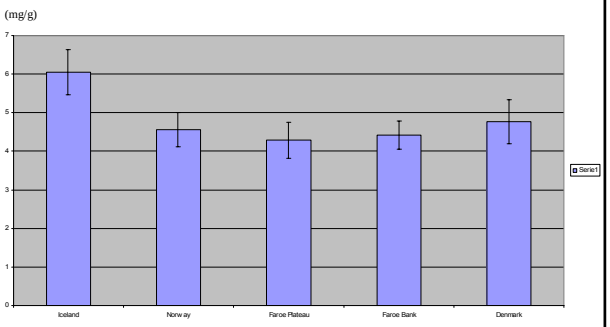
Folic acid content in cod-fillet from nordic waters in autumn 2003



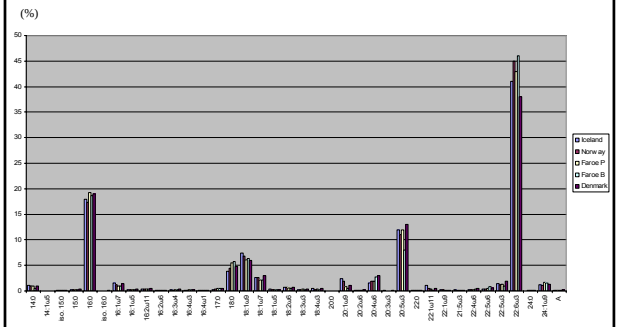
PCA of the fatty acid profile in cod-fillet of cod in the Northern Countries autumn 2003.



Fat content in cod-fillet based on the fatty acid profile; ΣFA (2003)



Fatty acid profile in cod-fillet (2003)



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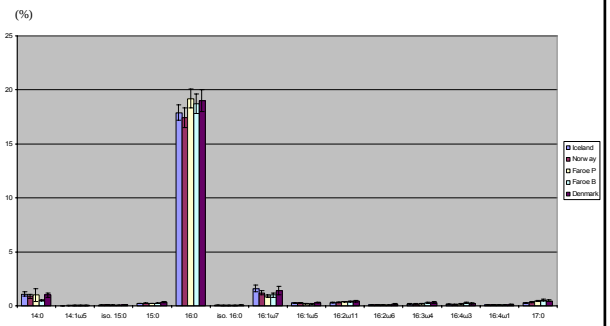
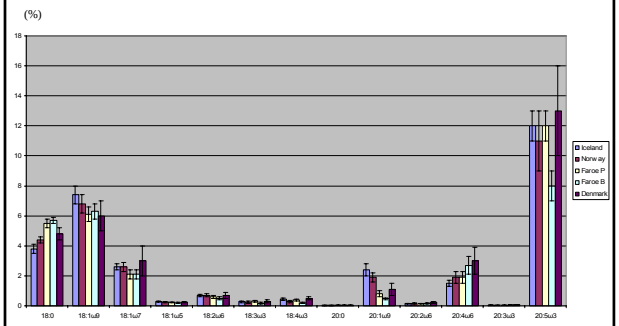
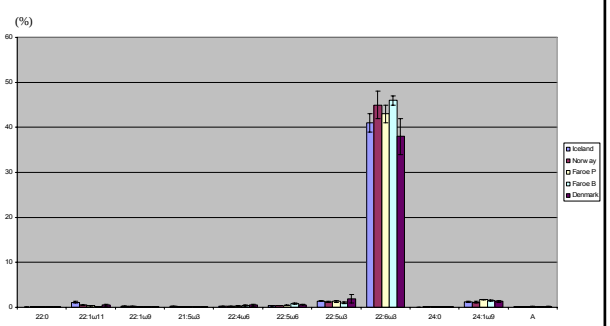


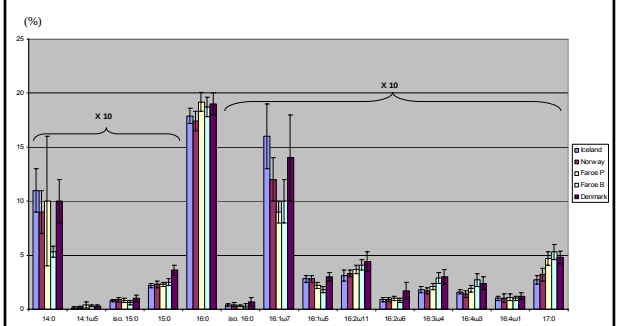
Fatty acid profile in cod-fillet (2003)

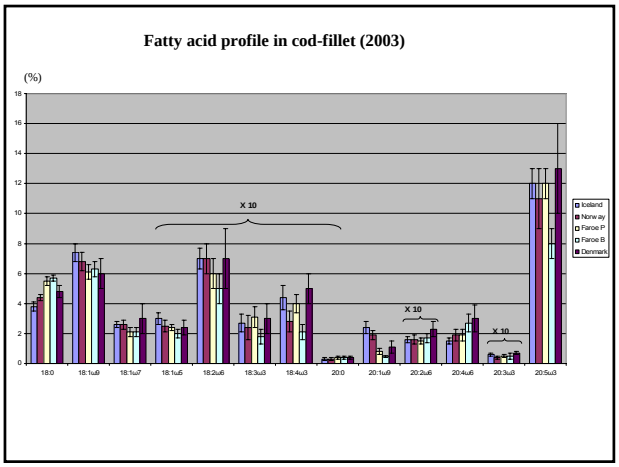


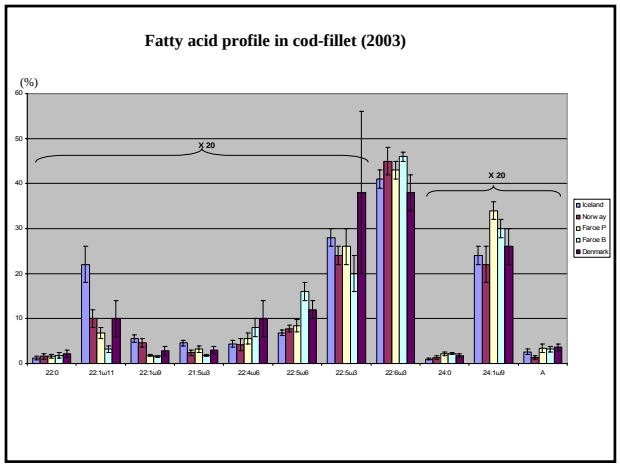
Fatty acid profile in cod-fillet (2003)



Fatty acid profile in cod-fillet (2003)







- Results are presented on the homepage of Food, Environmental and Veterinary Agency. As a book: “Føroya Umhvørvi í tølum” (The Faroese Environment in Numbers). As booklets. As scientific papers.
- Target groups: Schools, salespersons, the scientific community.
- Opinion/attitude towards coordination of data for chemical substances in seafood: It is desirable to exploit the synergy achieved by merging already existing seafood information. Establishment of a common fish-food-database opens up new opportunities for documentation of sound and safe fish from the Nordic Waters as well as for proactive and political actions, if environment pollutants become a cause for concern.

Thanks

for your attention

Nordic network meeting sponsored by the Nordic Council of Ministries (NSK and NEF), 4-5th April 2005, Reykjavik, Iceland

6.2 Monitoring of fish in the Faroe Islands: Pollutants

Maria Dam; Food, Environment and Veterinary Agency

The Monitoring of pollutants fish in the Faroe Islands comprises Pollutants in wild fish which monitored according to OSPAR Coordinated Environmental Monitoring Programme and the Arctic Monitoring and Assessment programme.
Pollutants in farmed fish are monitored according to the EU veterinary regulation (directive 96/23 and Council regulation 2377/90). The wild marine fish species analysed are cod (Gadus morhua) and sculpin (Myoxocephalus scorpius) and a some studies involving dab (L. limanda) has been done. The sampling season for cod is October and for sculpin June – July. Data are available for dab from a year round sampling study.
The farmed fish species analysed are salmon (Salmo salar) and trout (Salmo trutta). the sampling of farmed fish are done year round.
In addition, a wild-living and landlocked freshwater fish species Arctic char (Salvelinus alpinus), is monitored according to the AMAP guidelines for heavy metals and POPs with sampling during summer before spawning.
Wild fish monitoring parameters are the metals (Hg in muscle, and in liver Cd, Pb, Zn, Cu) and organochlorine pollutants like PCB (PCB 7) and the pesticides (DDE, toxaphen, HCH and chlordanes). The farmed fish monitoring is more comprehensive, and involves a PCB screening as well as analyses for dioxines, organochlorine and organophosphorous pesticides, anthelmintics (emamectines, teflubenzuron etc.), sex hormones, forbidden veterinary agents (chloramphenicol, malachite green), antibiotics (tetracyclines etc), metals (Cd, Hg, Pb) and mycotoxines in fodder used to feed the fish.
Data are available from other wild fish species as haddoc and halibut, but these are not subject to regular monitoring.
The economical aspect: The wild fish monitoring is not demanded by EU in exchange for import permits and is therefore of low priority- and low budget.

We present the results of the monitoring of the farmed fish to EU whereas the wild fish data are reported to databases (OSPAR /AMAP), in “grey” technical /semi-technical reports and in a popular environmental data report which is available at our web-page: www.hfs.fo under the item ”útgávur” as ”Føroya Umhvørvi í tølum” in Faroese of course! MD19-4-05

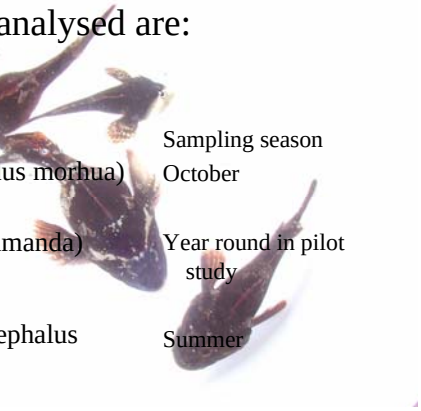
Monitoring of fish in the Faroes Islands: Pollutants

Maria Dam
Food, Veterinary and Environmental Agency

Monitoring comprises

- Pollutants in wild fish – monitored according to
  - OSPAR CEMP
  - Arctic Monitoring and Assessment programme
- Pollutants in farmed fish- monitored according to EU veterinary regulation (directive 96/23 and Council regulation 2377/90)

Species analysed are:



Wild fish

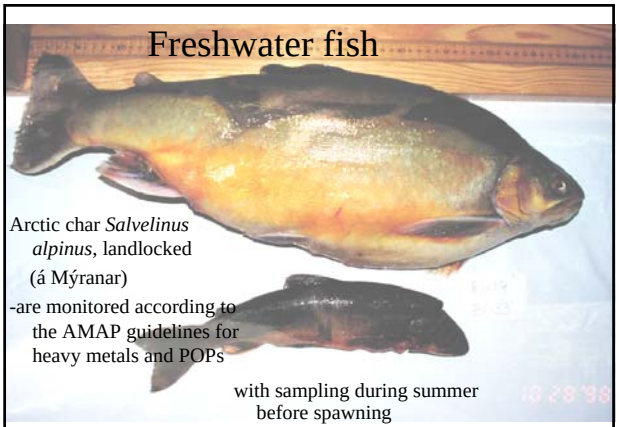
• Cod (Gadus morhua)	Sampling season October
• Dab (L. limanda)	Year round in pilot study
• Sculpin (Myoxocephalus scorpius)	Summer

Species analysed

Farmed fish

• Salmon (Salmo salar)	Sampling year round
• Trout (Salmo trutta)	Sampling year round

Freshwater fish



Arctic char *Salvelinus alpinus*, landlocked (á Mýranar)

-are monitored according to the AMAP guidelines for heavy metals and POPs

with sampling during summer before spawning

Wild fish monitoring parameters

- Metals (Hg muscle, Cd, Pb, Zn, Cu liver)
- PCB (PCB 7)
- Pesticides (DDE, toxaphen, HCH, chlordanes)

Farmed fish monitoring

- PCB (screening) and dioxines
- Anthelmintics (Emamectines, teflubenzuron etc)
- Organochlorine pesticides
- Organophosphorous pesticides
- Sex hormones
- Forbidden medicines (chloramphenicol, malachite green)
- Antibiotics (tetracyclines etc)
- Metals (Cd, Hg, Pb)
- Mycotoxines (in fodder)

Data are available from other wild fish species

Not subject to regular monitoring, but recent metal data available for:

- Haddoc (hýsa)
- Halibut (kalvi)

aquanic.org/images/photos/ingvar/Halibut.gif

The economical aspect...

- The wild fish monitoring is not demanded by EU in exchange for import permits and is therefore of low priority- and low budget.

- of course there are some very sound reasons for including many parameters in the farmed fish monitoring (in as much as medicies are used and hormones could be), but the key driver is the permit threath.

The Hites *et al.* paper in Science Jan. 2004

- Emphasis on PCB, dioxin, toxaphene and dieldrin (because pattern representative and human health risk info available).

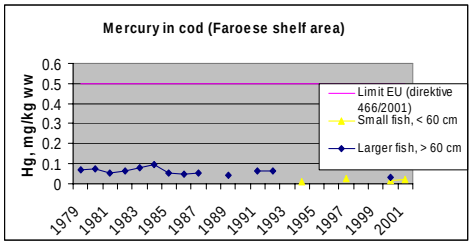
Comparing pollutants; salmon vs cod:

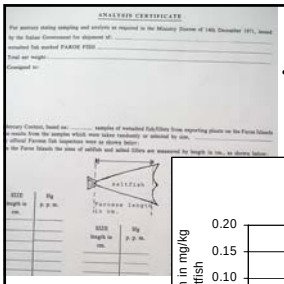
Units ng/g ww (if not other given)	Salmon [1] Faroe Isl	Cod [2] Faroe Isl	Ratio salmon:cod
PCB total	50	3,2	16
Dioxin (pgTEQ/g)	2,5	0,075	33
Toxaphene	180	10,4	17
Sum DDT		1,6	
Dieldrin	5,5	0,35	16
2.3.7.8 TCDD (pg/g ww)		0,003	
PCB as Arochlor 1260 (mg/kg ww)		0,0045	

[1] Hites et al., Science 2004

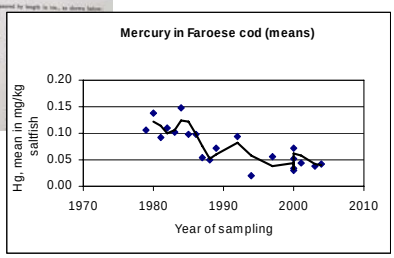
[2] Føroya Umhvørvi í tølum 2001 samt data fra overvåkning ved HS.

Mercury in cod is low



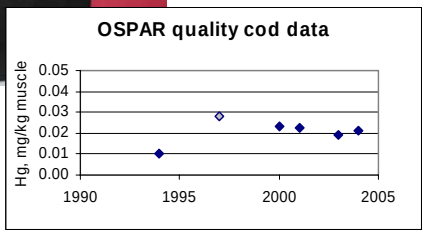


....and appears to be decreasing

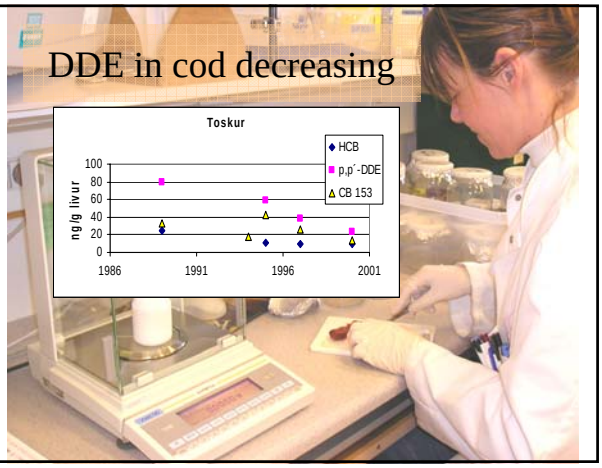


4-5 April 2005 NICN safety and utilisation of seafood

..but few data meet high QA/QC standards



4-5 April 2005 NICN safety and utilisation of seafood



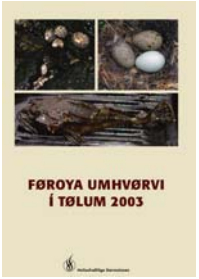
DDE in cod decreasing

Where do we present the results?

- To databases (OSPAR /AMAP)
- In “grey” technical /semi-technical reports
- In a popular environmental data report

4-5 April 2005 NICN safety and utilisation of seafood

All environmental pollution data are gathered in a data report



Available at www.hfs.fo

Photos:
By me and my collegue Katrin Hoydal

4-5 April 2005 NICN safety and utilisation of seafood

What are the options for cooperation?

Maria Dam
Food, Veterinary and Environmental Agency, Faroe Islands

4-5 April 2005 NICN seafood safety and utilisation

Hands tied regarding funding?

- May be difficult to cooperate by sending samples abroad and analyse foreign samples in return (monitoring resources available as in-kind contributions).
- Nordic program on screening of new pollutants toil with similar question.

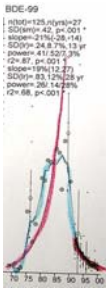
Cooperate by sharing info and presenting it in a concerted way

- Submit*method description (sample selection, sample preparation and pooling strategies)
- Submit analysis data for selected sample types and selected sampling stations.
- When possible, adjust national monitoring with common nordic benefit in mind.

* post on web page

What is the message we will confer?

- Seafood is basically good food
- Seafood may be polluted but is kept under close watch
- Pollution is not static – polluting activities – and thereby pollution- are regulated by national and international measures



Whom are we sharing info with?

1. The public
2. Collegues- therefore metods info

We will provide the public with scientifically sound and balanced information in a manner that allows efficient info flow

We will not issue dietary advice nor take on risk assessments, *but we may inform about the risk assessment method.*

Project based surveys put in system

The term monitoring implies that analyses are repeated with a regular interval-

Maintain time trend series

When detection of change over time is an issue, the monitoring needs to comprise the same kind of samples every time

Focus on selected species (cooperate in selection?)

Confounders needs to be kept in check, traceability of samples is a must

Adapt methodologies that allows one to circle inn a problem

Why a nordic info-site?

National agencies may have excellent sites- the added benefit from doing it in a Nordic cooperation is that we may provide

- More <u>data</u>
- Add <u>support</u> to national agencies
- Provide an <u>interface</u> for seafood consumers outside the Nordic countries

Clash/duplicate with EuroFir?

"Is it safe to eat salmon?"

It is permissible to pose a question, but is it fair? Perhaps we could spend some resources on considering "what info would provide the consumer with some background data on the studies done to uncover toxicity risks"? –as well of course with info about benefits.

4-5 April 2005 NICN safety and utilisation of seafood

6.3 Danish monitoring of fish

Arvid Fromberg; Danish Institute for Food and Veterinary Research

The Danish Institute for Food and Veterinary Research (DFVF) is a Governmental research institute under the Ministry of Family and Consumer Affairs. DFVF does research from table to stable. The work at Department of Food Chemistry includes Nutrients, Food Additives and Organic Environmental Contaminants e.g. Organochlorine pesticides (OCP), PCB and Dioxin.

The Danish monitoring system for foods started 1983 and runs for 5 or 6 year periods and includes 36 food categories for PCB and organochlorine pesticides. Lean fish such as cod, plaice, and flounder has appreciably lower contents of organochlorine compounds than fat fish such as herring or salmon. The monitoring study is planned with a view to closely follow all food items with either high contents or high consumption. Cod liver and herring are used for monitoring the pollution levels of the different Danish waters from the Baltic Sea in the East to the North Sea in the West. Furthermore, the levels in the following fish were investigated: Farmed trout from fish farming and sea farming and farmed eel as well as fish from retail trade; herring (raw, smoked, pickled), mackerel (raw, smoked, in tomato sauce), salmon, (raw), Greenland halibut (raw), garfish (raw), plaice (raw), cod (raw), swordfish (raw) and lumpsucker (raw).

The Danish Institute for Food and Veterinary Research makes sample plans in coordination with the Danish Veterinary and Food Administration. Samples are collected either by the Danish Directorate of Fisheries (fish from specific waters) or by the regional veterinary and food control centres (fish from the retail marked and farmed fish). During sample preparation the fish is skinned and filleted, fish meat is homogenised and a subsample is used.

The analytical method for PCB and organochlorine pesticides includes Soxhlet extraction, Florisil column cleanup and determination using GC-ECD equipped with two capillary columns in parallel. Quality control includes use of reference materials, blanks and recovery experiments as well as participation in interlaboratory performance studies. In the same analytical method ten indicator PCBs are included: IUPAC No. 28, 52, 101, 105, 118, 138, 153, 156, 170 and 180 and the organochlorine pesticides: *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD, *o,p'*-DDT, aldrin, isodrin, endrin, dieldrin, HCB, *alpha*-HCH, *beta*-HCH, *gamma*-HCH, heptachlor and heptachlor epoxide, *alpha*-chlordane, *gamma*-chlordane, oxychlordane, *trans*-nonachlor and *alpha*-endosulfan. These substances are characterized by their accumulation in the fatty tissues of animals and humans and being slowly degradable, they are still present in the environment.
The analytical method for dioxin and PCB includes Soxhlet or ASE extraction, multilayer column cleanup using sulphuric acid coated Silicagel or Powerprep and fractionation (mono- and diortho PCB; non-ortho-PCB and dioxin). Dioxin and PCB are analysed using a GC-HRMS instrument.
Dioxin quality assurance follows the Commission Directive 2002/69/EC of 26 July 2002 laying down the sampling methods and the methods of analysis for the official control of dioxins and the determination of dioxin-like PCBs in foodstuffs.

Results are presented in a 5 or 6 yearly report including all monitoring results. The report covering 1993-1997 is available on www.foedevarestyrelsen.dk in pdf-format and html-format in Danish and English and the report covering 1998-2003 will be available in English. Other surveys are available in pdf-format or html-format in Danish or English.

Danish monitoring of fish

Organic environmental contaminants

Arvid Fromberg
Arf@dfvf.dk

Danish Institute for Food and Veterinary Research

Workshop in Iceland 4-5. April 2005

The Danish Institute for Food and Veterinary Research

The Danish Institute for Food and Veterinary Research (DFVF) is a Governmental research institute under the Ministry of Family and Consumer Affairs. DFVF does research from table to stable.

The work at Department of Food Chemistry includes Nutrients, Food Additives and Organic Environmental Contaminants e.g. Organochlorine pesticides (OCP), PCB and Dioxin

Organic Environmental Contaminants

- Persistent organic compounds
- Accumulate
- Health hazardous effects

DK monitoring system for foods

- Started 1983
- 5 or 6 year periods
- 36 food categories for PCB and organochlorine pesticides
- to monitor, by means of analyses, the contents of desirable and undesirable substances in specific foods

Monitoring plans for fish

- Monitoring of fish and Cod liver from Danish waters
- Surveys of fish samples from the retail marked
- Surveys of fish oil

Monitoring of fish samples

- Herring (raw, smoked, pickled)
- Cod (raw and cod liver)
- Tune (tinned tune in water)
- Mackerel (raw, smoked, in tomato sauce)
- Salmon
- Greenland halibut
- Garfish
- Plaice
- Swordfish
- Lumpsucker
- Farmed trout (fish farming or sea farming)
- Farmed eel

Directive 96/23/EC

Council Directive 96/23/EC of 29 April 1996 on measures to monitor certain substances and residues thereof in live animals and animal products

Aquaculture fish

Sea trout
Farm trout
Eel

Dioxin and PCB monitoring

Survey 2000-2005

15-20 samples / year of fish

Herring
Salmon
Cod
Mackerel
Plaice
Fish oil

Organochlorine pesticides and PCBs

- Organochlorine Pesticides: *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD, o,*p'*-DDT, aldrin, isodrin, endrin, dieldrin, HCB, α-HCH, β-HCH, γ-HCH, heptachlor and heptachlor epoxide, α-chlordane, γ-chlordane, oxychlordane, trans-nonachlor and α-endosulfan.
- PCB congeners: e.g 28, 52, 101, 105, 118, 138, 153, 156, 170, 180

Sampling

Sample plans are made by the Danish Institute for Food and Veterinary Research in coordination with the Danish Veterinary and Food Administration

Samples collected either by:

- the Danish Directorate of Fisheries (fish from specific waters)
- or by the regional veterinary and food control centres (fish from the retail marked and farmed fish).

Sample preparation

The fish is skinned and filleted

Fish meat is homogenised

A subsample is used

Analytical method for PCB and Organochlorine pesticides

Analytical method

- Extraction: Soxhlet extraction
- Cleanup: Florisil column
- GC-ECD determination on two parallel capillary columns.

Quality control

- Reference materials, blanks and recovery experiments are used
- Participation in interlaboratory performance studies

Dioxin Analytical methods

Soxhlet or ASE extraction

Multilayer column using sulphuric acid coated Silicagel or Powerprep

Fractionation (mono- and diortho PCB; non-ortho-PCB and dioxin)

GC-HRMS

Dioxin quality assurance

Commission Directive 2002/69/EC

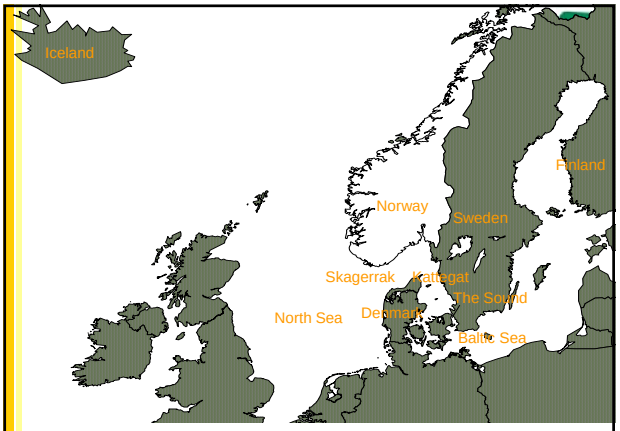
of 26 July 2002 laying down the sampling methods and the methods of analysis for the official control of dioxins and the determination of dioxin-like PCBs in foodstuffs

Results

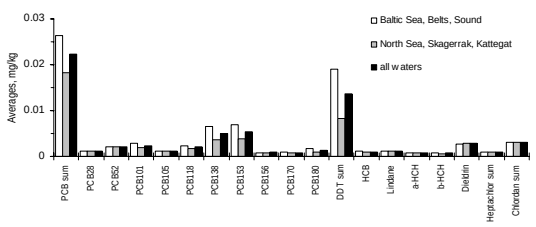
Results are presented in a 5 or 6 yearly report including all monitoring results.

The report covering 1993-1997 is available on www.foedevarestyrelsen.dk in pdf-format and html-format in Danish and English and the report covering 1998-2003 will be available in English.

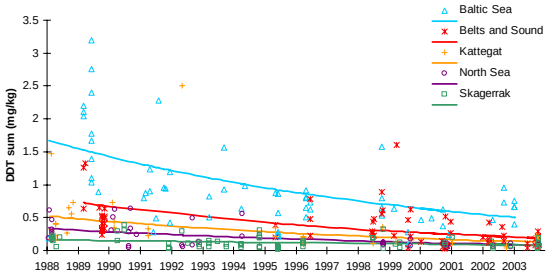
Other surveys are available in pdf-format or html-format in Danish.



Average contents (mg/kg) in herring



DDT in Cod liver 1988-2004



6.4 Nutrients in fish - Denmark

Pia Knuthsen, Danish Institute for Food and Veterinary Research

The Danish Institute for Food and Veterinary Research (DFVF) is a governmental research institute making research from ”table to stable/sea”. In cooperation with the Danish Veterinary and Food Administration (FVST), DFVF makes surveys and monitoring of nutrients, contaminants, food additives etc, and DFVF is also responsible for the Danish Food Composition Tables.

Danish data on nutrients and contaminants in fish mostly originate from our food monitoring system. The system started in 1983, and runs in periods of 5 years. Since then, nutrients in fish have been monitored 3 times, and trace elements 4 times.
The basic idea of the system is to monitor the contents, of nutrients and contaminants, in all food items with either high contents of the relevant compounds or high consumption of the food item, in order to reveal any significant changes.
Selected fish varieties for nutrient monitoring comprise cod, cod roe, flounder, herring (fresh and tinned), mackerel (fresh, smoked, and tinned), plaice, trout, tuna (tinned); and for trace elements cod, eel, flounder, garfish, herring, mackerel, plaice, and trout. Selected nutrients are fat, protein, dry matter, ash, vitamin B_{12}, iodine, and in fatty fish furthermore fatty acids, and vitamins A and D. Selected trace elements/minerals are arsenic, cadmium, mercury, nickel, lead, and selenium

Fish samples are collected by the Danish Directorate of Fisheries (specific waters) or by regional food control centres (retail and farmed fish).
Sampling plans are carefully made in order to cover the intake of the Danish population in a representative way.
Analyses are made using validated, accredited methods, and the quality of the analytical work is continuously assured by including duplicates, recoveries, reference materials, interlaboratory studies etc. Most of the analytical work is done at the regional control centres, with DFVF as project coordinator and leader.

Results are presented in reports for each 5year period, including all monitoring results. The report covering 1993-97 is available on www.foedevarestyrelsen.dk in pdf and html format in Danish as well as English, and the 1998-2003 report will soon be available in English. Other surveys are available in pdf or html format in Danish or English.
The results from the monitoring of nutrients are also included in the Danish Food Composition Tables: http://www.foodcomp.dk/fcdb_default.html.

The Danish monitoring of trace elements in fish will continue for more periods, while the monitoring of nutrients in fish has stopped because of scarce resources. But nutrients in will be analysed in a present food composition project, covering many fish varieties.

NUTRIENTS IN FISH

Danish Institute for Food and Vet. Research
Department of Food Chemistry

Senior Scientist Pia Knuthsen

Nordic Network Meeting, Reykjavik, April 2005

Food Monitoring system

- Periods of 5 years
- Food groups, important
- Nutrients, important for food group
- Sampling, representative
- Analytical results – mean and interval
- Intake calculations af specific nutrients by combination with intake of food items

Sampling of Fish

- Represent Danish intake
- Varieties
- Locations
- Season
- Number of samples *(6-32)*

Danish waters

9

Fish varieties

- Herring – fresh, tinned
- Mackerel – fresh, smoked, in tomato or water
- Trout
- Plaice
- Flounder
- Cod
- Cod roe
- Tuna, tinned

Vitamins and Minerals, intake from fish

Vitamin (% of total intake)

A	D	E	B_1	B_2	Nia	B_6	Fol	B_{12}	C
1	*32*	*5*	*2*	*2*	*6*	*4*	*1*	*18*	*0*

Mineral (% of total intake)

Ca	P	Mg	Fe	Zn	I	Se	K
1	*3*	*2*	*2*	*2*	*14*	*15*	*2*

Nutrients selected

All varieties:

- Proximate constituents:
  Fat, Protein (nitrogen), Dry matter, Ashes
- Vitamin B_{12}
- Iodide

Fat fish:

- Fatty acids
- Vitamin A and D

Danish Institute for Food and Vet. Research, Dep. of Food Chemistry

Analyses of fish

- Laboratory: Regional
- Sample preparation:
  Lean fish: flesh
  Fat fish: flesh and skin

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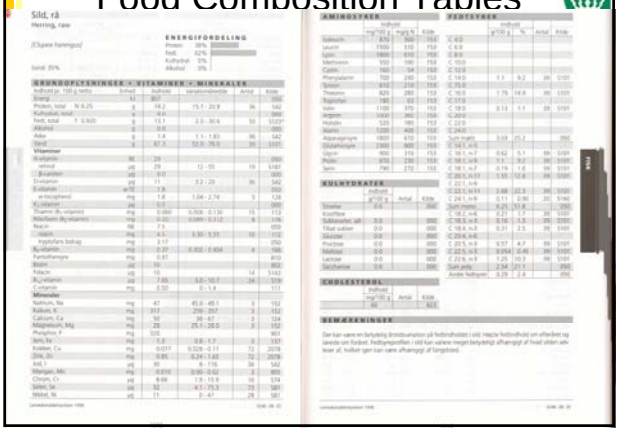
Quality Assurance

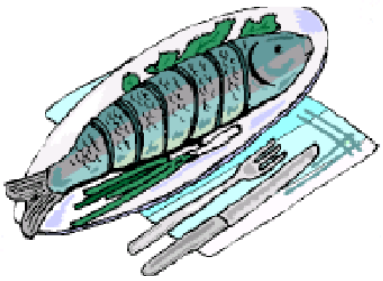
- Methods: validated
- Laboratory: accredited
- Reference material: CRM and in-house
- Recovery checked
- Duplicate analyses
- Interlaboratory studies, e.g. Fapas and Bipea

Danish Institute for Food and Vet. Research, Dep. of Food Chemistry

Food Composition Tables



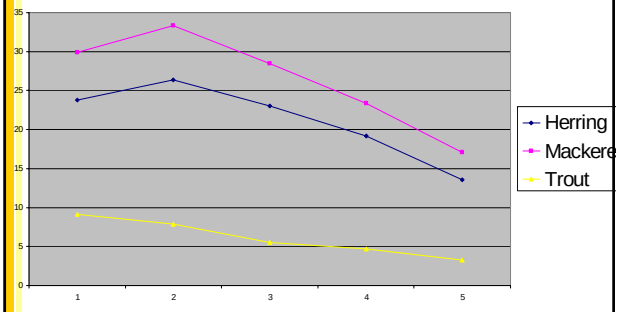
Fat in fish – head to tail



Danish Institute for Food and Vet. Research, Dep. of Food Chemistry

Fat head to tail

Fat distribution from fish head to tail



Danish Institute for Food and Vet. Research, Dep. of Food Chemistry

With and without skin

Fat content with and without skin

Future analyses of nutrients in fish

- Monitoring system reconsidered after 3-4 rounds ->
- Stop of monitoring nutrients in fish

  and
- Specific projects

Trace elements in Fish

Danish Institute for Food andVet. Research,and Regional Laboratories

Head of project: Erik H. Larsen

Food Monitoring System

- Periods of 5 years
- Food groups, important
- Trace elements, important for food roup
- Analalytical results – mean and interval
- Intake calculations of specific elements by combining with intake of different foods

Sampling of Fish

- Represent Danish average intake
- Varieties: *Cod, eel, flounder, garfish, herring, mackerel, plaice and trout*
- Locations
- Season
- Number of samples: *10-50*

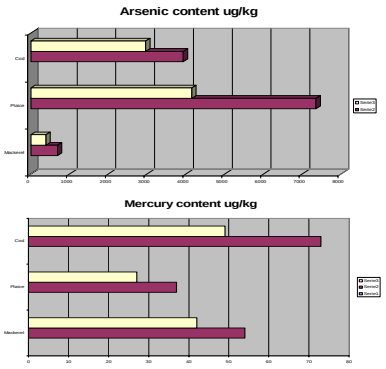
Analyses of Fish

- Laboratory: Regional
- Sample preparation: Flesh
- Elements: As, Cd, Hg, Ni, Pb and Se

Quality Assurance

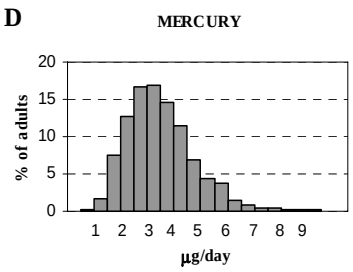
- Methods: validated
- Laboratory: accredited
- Reference materials: CRM and in-house
- Recovery checked
- Duplicate analyses
- Blind samples
- Interlab. Studies: e.g. Fapas

2nd and 3th monitoring round

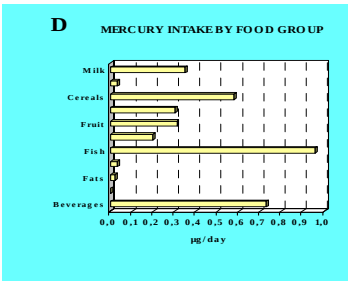


Hg intake

PTWI: 51 µg/person.day



Hg, Intake by Food Group



Future analyses of Trace elements in Fish

- Monitoring system reconsidered after 4 rounds

  ->
- Strictly focusing at problematic areas
- Control according to EU regulations

Biogenic amines

- Histamin:
- Control of imported of Tuna tins
- EU campain of selected fish species, 2003
- Biogenic amines (9 compounds):
- Suspicious samples analysed
- Surveys of relevant foods

6.5 Contaminants in fish – Sweden

Marie Aune, Livsmedelsverket

The responsibility for the monitoring of contaminants in fish is divided between different authorities in Sweden depending on the aim of the monitoring. The National Food Administration (NFA) has the responsibility of fish as food and the Swedish Board of Agriculture of fish as feed. The Environmental Protection Agency has the responsibility for environmental monitoring in Sweden and the contaminant programme for marine biota also includes monitoring of fish. This monitoring is performed by the Swedish Museum of Natural History and the Department of Applied Environmental Science, Stockholm University.

Regarding fish as food the NFA has carried several surveys regarding both persistent organic pollutants (POPs), including dioxins and PCBs, and trace elements during the last five years. The studies have been carried out to get updated levels on contaminants in fish for discussions regarding maximum residue levels, new data for intake calculations and for review of the Swedish dietary recommendations regarding fish. Results from the surveys are available as interim reports at www.slv.se. However, regular monitoring of fish is limited to a small number of samples of farmed fish according to Directive 96/23/EC (n=20) and some samples of wild and farmed fish within the dioxin-monitoring programme according to Directive 2004/705/EC (n=13). The NFA is working on a new database for POPs in food, which will be available on the Internet in the future.

The environmental monitoring of fish has the objective to estimate the levels and the normal variation of various contaminants in marine biota and to describe the general contaminant status. Comparable fishes are analysed annually and the specimens are generally young (not always representative of fish for human consumption). Results from the environmental monitoring can be found both in a database at www.ivl.se and compiled in a report "Comments concerning the national Swedish contaminant monitoring programme in marine biota" available at www.naturvardsverket.se. The Swedish Museum of Natural History also has a specimen bank where samples from the late 1960s up to now are stored (for more information www2.nrm.se/mg/mpb.html.en).

Large differences in levels of e.g. dioxins and PCBs can be found depending on which part of the fish is analysed. For example a reduction of up to about 50% of the PCB and dioxin content can be seen when analysing herring muscle without skin compared a sample prepared with skin. This stresses the importance of specific and clear instructions for sample preparation to avoid misleading results and is also to be further discussed within the EC Expert Committee "Dioxins and PCBs".

Analysis of contaminants in fish - SWEDEN

Workshop in Reykjavik 4-5 April 2005

Marie Aune
Livsmedelsverket, Uppsala
marie.aune@slv.se

Responsibility for the montoring of fish in Sweden?

• as food: National Food Administration

• as feed: Swedish Board of Agriculture

Responsibility for the environmental monitoring:

The Environmental Protection Agency in collaboration with the Swedish Museum of Natural History and the Department of Applied Environmental Science, Stockholm University

Annual monitoring of farmed fish (Directive 96/23/EC)

o PCB and chlorinated pesticides (10 samples)

o Trace elements (10 samples)

o Drug residues (70 samples)

o Ochratoxin (5 samples)

o Malachitgreen (12 samples)

Monitoring programme for dioxins and dioxin-like PCBs

o food – at least 13 fish samples and 4 fish oil samples

o feed – at least 9 "fish" samples

Environmental monitoring of fish

The Environmental Protection Agency - EPA

- The Swedish Museum of Natural History– sample collection and preparation,evaluation of results

- Department of Applied Environmental Science, Stockholm University – analysis of organic pollutants

- National Veterinary Institute – analysis of heavy metals

Current levels, regional differences, time trends etc

Comparable fishes every year, generally young specimens

Environmental monitoring of fish:

Annual sampling of different species at certain sampling sites

• herring

• cod

• blue mussel

• perch

• etc

Environmental monitoring of fish

	Number of sampling sites	Analysed contaminants
Herring	6 sites autumn herring (n=20)	muscle: PCB, DDT, HCH, HCB, Hg liver: Pb, Cd, Cu, Zn, Cr, Ni
	2 sites spring herring (n=20)	muscle : PCB, DDT, HCH, HCB, Hg, Pb, Cd, Cu, Zn, Cr, Ni
Cod	2 sites (n=10)	muscle: Hg liver: PB, Cd, Cu, Zn, Cr, Ni, PCB, DDT, HCH
Blue mussels	3 sites (n=25)	ind. samples : Pb, Cd, Cu, Zn, Hg, Cr and Ni pooled samples: PCB, DDT, HCH and HCB
Perch	2 sites	muscle: PCB, DDT, HCH and HCB liver: Pb, Cd, Cr, Ni, Cu and Zn

Dioxins and brominated flame retardants added to programme during recent years

Results from the environmental monitoring of fish

Report by Anders Bignert et al. available at www.naturvardsverket.se

"Comments Concerning the National Swedish Contaminant Monitoring Programme in Marine Biota"

Study of contaminants in fish at NFA 2000 –

Why?

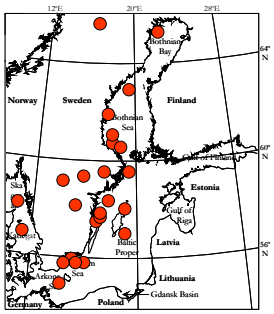
- updated levels
- new data for intake calculations
- review of dietary recommendations
- discussions of MRLs
- SE derogation from the dioxin MRL

What has been analysed?

- PCB
- chlorinated pesticides (OCP)
- dioxins (PCDD/DF)
- brominated flame retardants (BFRs)
- Pb, Cd, Cr, Cu, Zn, Ni, As and Hg

Sampling sites

Length
Weight
Gender
Date caught
Age
etc



Alla resultat finns detaljredovisade på www.slv.se fr.o.m. juli 2002

Samples analysed for dioxins, PCB, OCP and BFR

	No samples (ind. in pool)	Sampling sites
Baltic herring	30 (n=4-15)	Gotland, Landsort, Utlängan, Bålsen, V:a Banken, Piteå skärgård and Omnefjärden
Herring	15 (n=4-20)	"Rügen", Bornholm and Fladen
Salmon	26 (n=5-10) 10 ind. samples	Gotland, Dalälven, Lule älv, Mörrumsån, Ångermanälven, Vänern and Vättern Gotland
Brown trout	6 (n=4-5) 8 ind. samples	Sampling sites: Dalälven, Ångermanälven and Mörrumsån Gotland
Eel	9 (n=10-21)	Kvädofjärden, Marsö, Valjeviken, Karlshamn, Göteborg, Mälaren and Hjälmaren

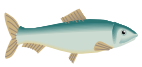
Samples analysed for dioxins, PCB, OCP and BFR

	No samples (ind. in pool)	Sampling sites
Sprat	10 (n=15-106)	N Öland and Bornholm
Turbot:	6 (n=9-10)	Gotland
Whitefish:	4 (n=7-10)	Öregrundgrepen and Ångermanälven
Crab	1	Skagerakk
Shrimp	1	Skagerakk
Blue mussels	1	Skagerakk
Mackerel	1 (n=20)	Skagerakk
Vendace roe	4	Luleå archipelago and lake Vänern

Samples analysed for dioxins, PCB, OCP and BFR

Feedingstuffs:
18 samples of fish, fiskmeal, fish oil and veg. oil

Other fish species:
Arctic char
Farmed salmon
Farmed rainbow trout

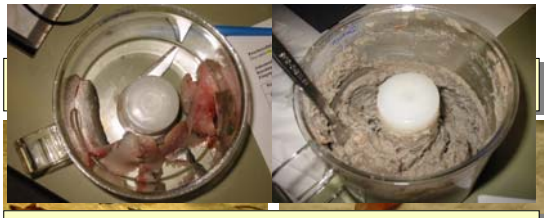


In total about 170 sampes have been analysed within the project

PCB and OCP also for individual fishes – about 300 samples

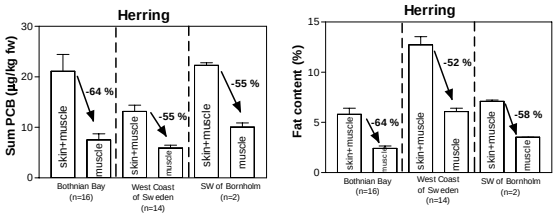
Results available at

www.slv.se

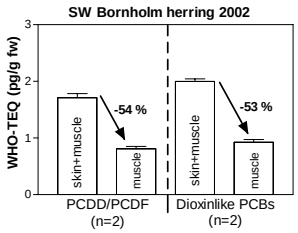


De analyserade proverna består av samlingsprover (5-15 strömmingar/prov och 14-22 skarpsillar/prov).

DISTRIBUTION OF **PCB** AND **FAT**
IN HERRING MUSCLE AND SKIN



DISTRIBUTION OF **DIOXIN** TEQ IN
BALTIC HERRING MUSCLE AND SKIN



Analysis of dioxins and non-ortho PCBs - Umeå university

- *Homogenisation with Na_2SO_4*
- *Extraction with acetone/n-hexane + n-hexane/dietyl ether*
- *Lipid removal with sulphuric acid/silica gel*
- *Fractionation on a carbon column (7,9% AX21 on Celite)*
- *Analysis on HRGC/HRMS*

Analysis of mono- and di-ortho PCB and OCP - NFA

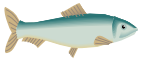
- o ***Extraction with acetone/n-hexane + n-hexane/dietyl ether***
- o ***Lipid removal with sulphuric acid***
- o ***Fractionation on a silica column***
- o ***Analysis on GC/ECD with a dual column system (Ultra-2 and DB-17)***

Analysis of brominated flame retardants - NFA
(PBDE-congeners and HBCD)

- o ***Extraction with acetone/n-hexane + n-hexane/dietyl ether***
- o ***Lipid removal with sulphuric acid***
- o ***Fractionation on a silica column***
- o ***Analysis on GC/ECD with a dual column system (Ultra-2 and DB-17) or GC/MS with NCI***

Fish samples analysed for metalls

- *Salmon*
- *Brown trout*
- *Whitefish*
- *Herring*
- *Eel*
- *Mackerel*
- *Blue mussels*
- *Shrimps*
- *Crab*
- *Pike*
- *Perch*
- *Pike perch*
- *Burbot*



Analysis of metals

National Food Administration:

Pb, Cd, Cr, Cu, Fe, Zn, Ni enligt NMKL No 139, Metaller med atomabsorptionsspektrofotometri i livsmedel.

”Provet förtorkas och inaskas, under successiv temperaturhöjning, vid 450 grader. Saltsyra tillsättes och lösningen indunstas. Återstoden löses i 0,1 M salpetersyra, metallhalterna bestäms med AAS med användning av flam- och grafitungsteknik.”

”As-speciering” in Copenhagen

Hg at the National Veterinary Institute, Uppsala

Livsmedelsverkets fiskundersökning har genomförts i samarbete med:

Fiskeriverket, Umeå universitet, Naturhistoriska riksmuseet, Uppsala universitet, Vänerns vattenvårdsförbund och Vättern vårdsförbundet

6.6 The Swedish Food Database

Hanna Sara Strandler, Livsmedelsverket

Presently the database comprises almost 2000 foods and dishes. Values for 50 nutrients are presented per 100 g edible part of each food or dish. The values are derived primarily from Swedish analyses of pooled samples. A second source of values is food tables or other work done in the Nordic countries. Thirdly, data from food tables and works published outside of Scandinavia have also been used. In food studies and epidemiology research it is important that as few nutritional values as possible are omitted from those foods included in a table or database. Hence estimated and calculated values, and values transferred from comparable foods or products, have been used where analyzed values were unavailable.

Most users of the food database are professionals whose work relates to food. Apart from National Food Administration itself, doctors, epidemiologists and researchers use the database when studying link between diet and health. In schools, health care and other forms of care, the database is used for dietary advice, planning, evaluation and calculating the nutritional content of menus and diets. The food industry needs the database for development activities and product labelling. The food database is a prerequisite for work on diet and health at the local, regional, national and international levels. 33 nutrients for 1300 foods and dishes are published in Swedish. There are two versions; one is for the web found at Livsmedelsverket's homepage www.slv.se/ldb . The other is a book "Livsmedelstabell Energi och näringsämnen 2002". In addition values are also given for other vitamins, trace elements and bioactive compounds in 250-350 foods.

Analyses of fish

In the Swedish database, nutrient data for muscle of 26 fish species are found, both marine and fresh water fish. For Salmon there are published additional data from six various waters.

In addition there are values for approximately 80 preparations of fish; frozen, fried, boiled, preserved, smoked or different dishes of fish.

The samples have been analyzed for water, ash, nitrogen, protein, fat, carbohydrates and cholesterol. Of the fat-soluble vitamins, α-retinol, retinol equivalents, vitamin D, tocopherols (vitamin E) and vitamin K. Water-soluble vitamins analyzed are thiamin, riboflavin, niacin, pyridoxin, vitamin B_{12} and folate. The values for calcium, phosphorous, sodium, magnesium, potassium, molybdenum, zinc, copper, manganese, iron, nickel, cobalt, chrome, iodine and selenium are also determined.

Analytical methods

The methods used are accredited and performed at accredited laboratories at Livsmedelsverket (The National Food Administration) and Statens veterinärmedicinska anstalt (The National Veterinary Institute).Gravimetric methods are used for determination of water, ash and fat. Nitrogen is analyzed with Kjeldahl and the values are used for the calculation of protein content. For analysis of fatty acids capillary-GC is used. Analytical methods used for trace elements are ICP-technique with wet digestion (Ca, P, Na, Mg, K, Mb) AAS with graphite furnace (Ni, Co, Cr), AAS with flame (Zn, Cu, MG, Fe), AAS with hydride generation (Se), and titration-spectrometry (I). Niacin, pyridoxine, vitamin B_{12} are hydrolyzed with acid and for folate a trienzymatic hydrolysis is used. They are then analyzed with microbiological methods with turbidimetric detection. Thiamin och riboflavin as well as the fat-soluble vitamins are determined with HPLC-technique with fluorescence- or UV-detection.

SWEDISH ANALYSIS OF NUTRIENTS IN FISH

Swedish analyses of nutrients in fish

Workshop in Reykjavik 4-5 April 2005

Hanna Sara Strandler
Livsmedelsverket, Uppsala
hans@slv.se

The Swedish food database

- 1800 foods and dishes
- About 50 nutrients for each food or dish

- Analytical data, **means** of **pooled samples** of the **edible part**
- Calculated data
- Borrowed data from other Nordic countries, U.K & U.S.A

- A new database system is under development (2008)

- www.slv.se/ldb

Nutrient data for fish in the Swedish food database

Färsk Raw
Abborre
Braxen
Regnbågslax
Sej fryst
Gädda
Gös
Hälleflundra
Kolja
Kummel
Lake
Lax
Makrill
Rödspätta
Sik
Siklöja
Sill
Flundra skrubbskädda
Strömming
Röding
Torsk
Vitling
Ål
Öring
Pinklax puckellax "stillahavslax
Piggvar
Marulk

Fryst Frozen
Lutfisk fryst
Fiskpinnar råa frysta

Stekt Fried
Sill salt panerad stekt hemlagad
Torskfilé panerad stekt hemlagad
Ål ugnsstekt hemlagad
Abborre panerad stekt
Fiskpanetter fiskpinnar stekta
Regnbågslax panerad stekt
Gädda panerad stekt
Hälleflundra panerad stekt
Kolja panerad stekt
Lax stekt
Makrill panerad stekt
Makrill opanerad stekt
Rödspättafilé panerad stekt
Rödspättafilé opanerad stekt
Sik panerad stekt
Sill panerad stekt
Strömming panerad stekt
Strömming opanerad stekt
Torskfilé stekt
Torsk panerad stekt
Torsk opanerad stekt
Vitlingfilé panerad stekt

Inlagd Pickled
Ansjovis skarpsill inlagd
Fisk inlagd gravad
Sill inlagd

Kokt Boiled
Lutfisk kokt hemlagad
Ål rökokt hemlagad
Abborre kokt
Regnbågslax inkokt
Gädda kokt
Hälleflundra kokt
Kolja kokt
Lax kokt
Makrill kokt
Piggvar kokt
Rödspättafilé kokt
Sik kokt
Sill salt kokt
Strömming kokt
Torskfilé kokt
Vitling kokt
Fisk kokt steat

Konserv Canned
Lax konserv
Sardeller konserv
Sardiner i olja konserv
Sardiner i tomatsås konserv
Tonfisk i olja konserv
Tonfisk i vatten konserv avrunnen
Tonfisk i vatten konserv avrunnen
Matjessill konserv
Makrill konserv
Sill salt urlattriad konserv
Makrillfilé i tomatsås konserv

Rökt Smoked
Lax sida kallrökt
Regnbågslax sida kallrökt
Fisk rökt
Sik urtagen varmrökt
Böckling varmrökt
Ål rund- o varmrökt
Makrill urtagen varmrökt
Böckling filé dubbel varmrökt Rospigg
Lax urtagen varmrökt
Makrill filé varmrökt
Regnbågslax urtagen varmrökt
Röding urtagen varmrökt
Ål fiat- o varmrökt

Övriga beredningar Other
Torkad fisk
Sill salt
Strömming salt
Gravlax
Lax rimmad
Surströmming
Strömmingsflundra panerad hemlagad
Fisk filterad
Aldskströmming
Kraftströmming

Fish project of 2002

• Lax V/V	**Salmon-lake**	*Salmo salar*
• Lax älv	**Salmon-river**	*Salmo salar*
• Lax norsk	**Salmon-norwegian**	*Salmo salar*
• Lake	**Burbot**	*Lota lota*
• Abborre	**Perch**	*Perca fluviatilis*
• Sik	**Whitefish**	*Coregonus maraena*
• Öring	**Trout, brown**	*Salmo trutta*
• Makrill	**Mackerel**	*Scomber scombrus*
• Gädda	**Pike Northern**	*Esox lucius*
• Gös	**Pike Perch**	*Sander lucioperca*
• Regnbåge	**Rainbow trout**	*Oncorhynchus mykiss*
• Rödspätta	**Plaice**	*Pleuronectoes platess*
• Räkor	**Northern schrimp**	*Pandalus borealis*

Nutrient data per 100g fish, edible part

Macro nutrients

%	Refuse from raw food
kJ/ kcal	Energy, fibre not included
g	Water
g	Ash
g	Nitrogen
g	Protein
g	Fat, total
g	Carbohydrates, total
mg	Cholesterol

Fat-soluble vitamins

µg	α-Retinol
µg	Retinolequiv.
µg	α- Vitamin D
mg	α-Tocopherol
mg	β- Tocopherol
mg	γ- Tocopherol
mg	δ- Tocopherol
mg	Vitamin E
µg	Vitamin K

Water-soluble vitamins

mg	Thiamine
mg	Riboflavin
mg	Niacin
mg	Niacinequiv.
mg	Vitamin B_6
µg	Vitamin B_{12}
µg	Folate

Trace elements

mg	Calcium
mg	Phosphorous
mg	Iron
mg	Magnesium
mg	Sodium
mg	Potassium
mg	Zinc
µg	Selenium
mg	Manganese
µg	Molybdenum
µg	Cobolt
µg	Nickel
mg	Copper
µg	Chrome
µg	Iodine

Analyses of nutrients

- Accredited laboratories
  - SLV, Livsmedelsverket, Uppsala
  - SVA, Statens veterinärmedicinska anstalt, Uppsala

- Accredited methods

- Quality assurance
  - Internal and external audits, each once a year
  - Use of certified as well as in-house reference materials
  - Participation in Proficiency Testing Programs, www.slv.se/pt
  - Duplicate analyses

SWEDISH ANALYSIS OF NUTRIENTS IN FISH

Methods – macro nutrients

Gravimetry
- Water
- Ash
- Fat- SBR

Kjeldahl
- Nitrogen

Calculated data
- Energy, kJ, kcal
- Protein
- Carbohydrates

Methods - lipids

Capillary gas chromatography
- FAME-methylesters of fatty acids
  - Fatty acids
- TMS – trimethylsilyl derivates
  - Cholesterol

Methods – trace elements

Wet digestion, ICP technique
- Calcium
- Phosphorous
- Sodium
- Magnesium
- Potassium
- Molybdenum

AAS, hydrid generation
- Selenium

Titration-spectrophotometry
- Iodine

AAS, flame
- Zinc
- Copper
- Manganese
- Iron

AAS, graphit furnace
- Nickel
- Cobolt
- Chrome

Analytical methods - vitamins

Microbiological methods

Turbidimetric detection
- Acidic hydrolysis
  - Niacin
  - Vitamin B6
  - Vitamin B12
- Trienzymatic extraction
  - Folate

HPLC methods

UV-detection
- Alkali hydrolysis
  - Retinol
  - Vitamin D
- Solvent extraction
  - β-Carotene

Fluorescense detection
- Alkali hydrolysis
  - α-Tocopherol
- Solvent extraction
  - Vitamin K
- Acid hydrolysis
  - Thiamine
  - Riboflavin

Nutrient data per 100g fish

			Salmon		
			Lake	River	Norway
Macro nutrients	**Water**	**g**	**73,9**	**74,8**	**57,4**
	Ash	g	1,3	1,3	1,6
	Nitrogen	g	3,2	3,5	3,1
	Protein	g	20,3	22,0	19,1
	Fat	**g**	**4,6**	**3,1**	**19,5**
	Carbohydrate	g	-0,1	-1,1	2,5
Fat-soluble vitamins	**Retinol**	**µg**	**26,1**	**<3**	**11,1**
	beta-Carotene	µg	X	X	X
	Retinolequiv.	µg	26,1	<3	11,1
	Vitamin D	**µg**	**8,3**	**14,3**	**11,3**
	alfa-Tocopherol	mg	0,99	0,39	2,23
	beta-Tocopherol	mg	<0,004	<0,004	0,004
	gamma-Tocopherol	mg	0,067	0,045	0,11
	delta-Tocopherol	mg	<0,004	<0,004	<0,004
	Vitamin E	**mg**	**1,0**	**0,4**	**2,2**
	Vitamin K	µg	<0,4	<0,4	<0,4

Nutrient data per 100g fish

			Salmon		
			Lake	River	Norway
Water-soluble vitamins	**Thiamine**	**mg**	**0,20**	**0,07**	**0,22**
	Riboflavin	mg	0,06	0,10	0,07
	Niacin	mg	8,4	8,7	8,1
	B6	mg	0,64	0,60	0,62
	B12	µg	5,2	3,2	2,9
	Folate	µg	10,8	10,0	10,1
Trace elements	**Calcium**	**mg**	**5,70**	**16,10**	**4,50**
	Phosphorous	mg	230,0	241,0	209,0
	Magnesium	mg	25,7	25,7	24,6
	Sodium	mg	24,3	31,3	32,4
	Potassium	mg	422,0	467,0	404,0
	Selenium	µg	29,2	28,1	18,5
	Molybdenum	µg	<0.5	<0.5	0,6
	Iodine	µg	8,0	41,0	45,0

Swedish food database - stakeholders

- Authorities
- Dieticians, health workers
- Food industry
- Restaurants, kitchen for schools and hospitals
- Food retailers
- Education institutes

6.7 Norwegian surveillance of seafood quality

Amund Maage & Kaare Julshamn, National Institute of Nutrition and Seafood Research

Toxic Substances:
Several programmes with the aim of controlling and documenting the content of marine foods are ongoing in Norway. Some of these are directed towards food quality while others are more designed at environmental monitoring than food monitoring. The latter includes several "hot spot" programmes at sites and areas with known pollution and is financed through the Ministry of Environment.

Several of the programmes aimed at food and marine feed quality was up to 1.1.2004 administered by the Directorate of Fisheries but was then taken over by the Norwegian Food Safety Authority. These programmes include:

- Surveillance of marine food and food ingredients
- Surveillance of cultured bivalves
- Surveillance of medical residues in cultured fish, mainly salmon
- EU programme on dioxins in food, where Norway has a large number of samples on fish

NIFES has run the programmes also in 2004 and 2005 and hope to continue even though these programmes partly will be open for tenders in the near future.

NIFES have also built up their own surveillance programme focusing on important fish species for exports. In this programme sampling frequencies are selected based on their economic importance or by their large volume (industrial fish). Sampling frequency is thereby every year or every second year for species such as salmon, cod, herring and saithe while more infrequent for species like ling, tusk and Greenland halibut.

For use in these programmes NIFES has gradually built up there portfolio of different chemical and microbiological analyses for the purpose of the surveillance. The portfolio now includes:
Metals by ICP-MS; Me-Hg by GC-ICP-MS; TBT and inorganic arsenic by LC-ICP-MS.
Dioxins and dioxin-like PCB's by SS – GC-MS
PCB, PAH and pesticides by GC-MS and also other analyses such as natural and artificial anti-oxidants.
The portfolio of analyses also includes a row of nutrients analyses including vitamins, minerals, fatty acids, amino acids and different carbohydrates.

Nutrients:
A large effort was undertaken by NIFES in the late 1980-ties and early 90-ties to produce the data necessary to make an overview of the nutrients of many important seafood products. The result of this work has been presented in the booklet "Facts about Fish" which is still in use in several languages and this material is available at www.seafood.no. Since then, however, little new data has been produced and there is clearly a need to update these data. For the year 2005, however, the samples collected for our own contaminant database, also will be analysed for nutrients.

NORWEGIAN SURVEILLANCE PROGRAMMES ON SEAFOOD PRODUCTS RELATED TO FOOD SAFETY

NIFES

National Institute of Nutrition and Seafood Research (NIFES)

NIFES conduct research and develop analytical methods within the health aspects of eating seafood in a whole food chain perspective which includes research within aquaculture nutrition, seafood as human nutrition, and documentation and surveillance of feed and seafood.

NIFES

NORWEGIAN SURVEILLANCE PROGRAMMES ON SEAFOOD PRODUCTS RELATED TO FOOD SAFETY

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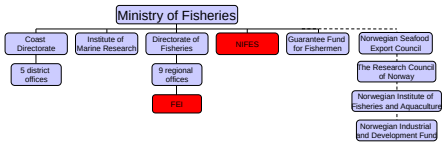
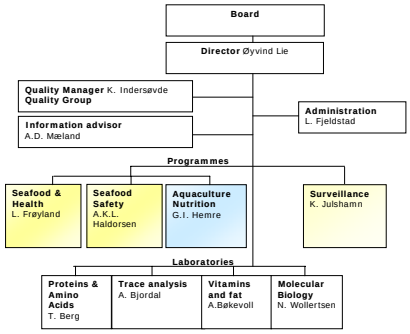
NIFES

NIFES affiliation



NIFES



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SURVEILLANCE PROGRAMMES, NORWAY

1. NIFES - own programme, ”Miljødatabase”, from 1994
2. Programmes on behalf of the Norwegian Food Safety Authorty
3. Research projects – different fundings
4. Other relevant programmes-financed by Ministry of Environment

NIFES

ACCREDITATION OF ANALYTICAL METHODS AT NIFES

- NIFES has numerous methods in use for surveillance and research
- 69 analytical methods have been accredited by Norwegian Accreditation as testing laboratory (i.e. nutrients, additives and contaminants) (Accreditation number TEST 050)
- The accreditation is carried out according to the requirements of NS-EN ISO/IEC 17025

NORWEGIAN SURVEILLANCE PROGRAMMES ON SEAFOOD PRODUCTS RELATED TO FOOD SAFETY

NIFES

NIFES OWN PROGRAMME, "MILJØDATABASEN" ;

AIM:

- To document the actual content of contaminants in Norwegian seafood harvested for export.
- Fulfill needs on indipendent data from food authorities, fisheries authorities, fisheriy and aquaculture industry and markets
- Be able to establish time trends and open and ucover research areas
- Present the data in an easily accessable way for the stakeholders (i.e. on the web)

NIFES

THE PROJECT:

Financing: Through NIFES basic funding in their budget from Departement of Fisheries 1994-2005, as well as the FHF-fund (in 2002 og 2003 which gave extra opportunities)

Volume: about 1500 samples divided on 20 of the most economically valuable species (includes industrial species)

Catchment area: Barents Sea, Norwegian Sea and North Sea; in addition is farmed salmon included (see map)

Sampling Frequency: It has been the aim to sample important species such as cod, herring, mackerel and salmon every year (since 2001), saithe and red fish every 3. year, while for example horse mackerel will be sampled every 7.-8 year.

Compunds analysed: Increasing.....

NIFES

Undesirable substances determined in wild fish from open seas and farmed fish

Inorganic compounds:

Mg, Al, Ca, V, Cr, Mn, Fe, Co, Cu, Zn, As, Se, Sr, Mo, Ag, Cd, Sn, Ba, Hg, Pb, U

Species of As, Hg og Sn

Organic compounds:

Pecticides; HCB, HCH, DDT (Extended from 2005)

PCBs (28, 52, 101, 105, 118, 138, 153,156, 180),

Dioxines og dioxin like PCBs, (from 2002)

Polybrominated flame retardants (from 2004),

PAH (from 2005).

Radioactive isotope:

Cesium137, technetium99

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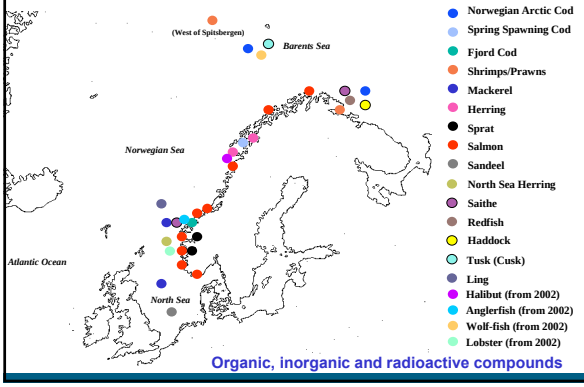
SURVEILLANCE PROGRAMME FOR POLLUTANTS IN FISH AND OTHER SEAFOOD 1994-



Organic, inorganic and radioactive compounds

NIFES

Seafood data 2005:

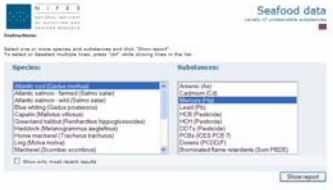
- The following species will be included: tusk, ling, horse mackerel, North Sea Herring, NVG-Herring, salmon and Atlantic halibut
- Number of fish and positions: Mainly 25 fish from a position, exept salmon – collect 50 fish from 10 locations-divided the along the whole coast)
- Frequence of sampling is set by economic importance for Norway, i.e. salmon every year, while tusk, ling and horse mackerel i ssheduled every 8. year (volume og catch about 10.000 tons/y. – area: Barents sea, Norwegian Sea and Northern North Sea.
- For 2005 also the the nutrients will be included for the first time (Since "Facts about Fish"). Will include fatty acids, cholesterol, proteins, amino acids, water soluble vitamins (9 stk), fat soluble vitamins, minerals and trace elements.
- Sea food data will for 2005 inculde nutrients as well – FIRST YEAR

NIFES

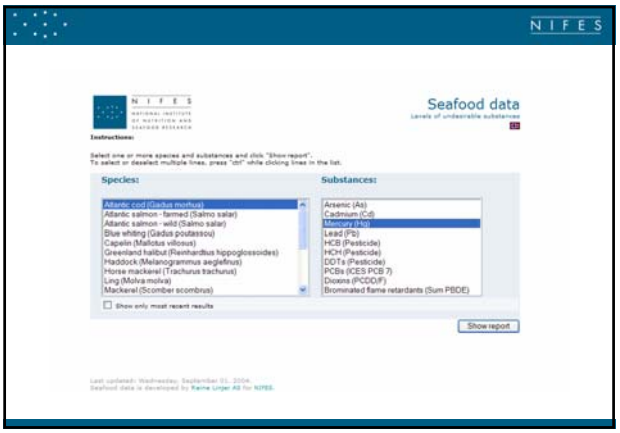
•August 2004: Searchable database established, available from link on www.nifes.no, of data from NIFES monitoring programmes.

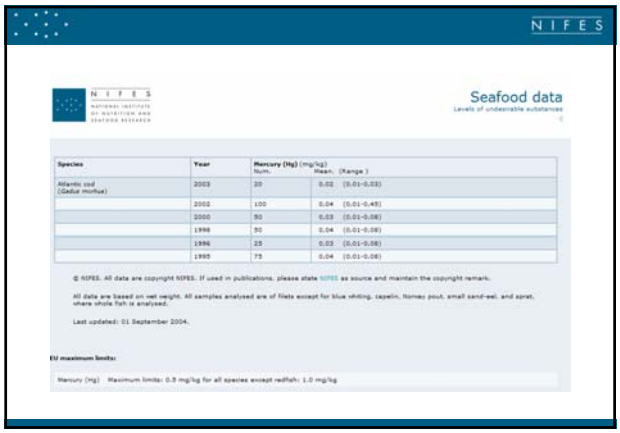
• So far 10 undesirable components and 19 species.

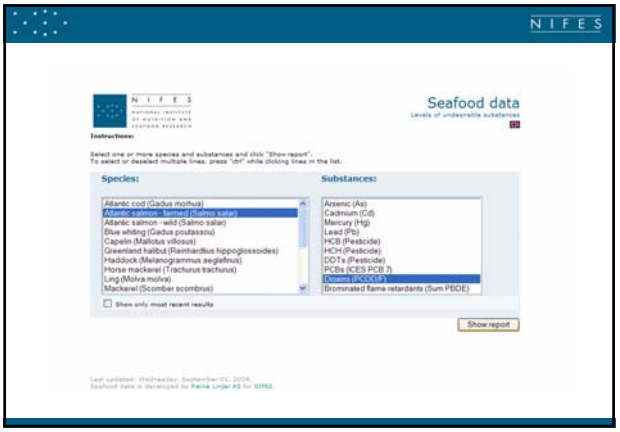
•Example: mercury in Cod

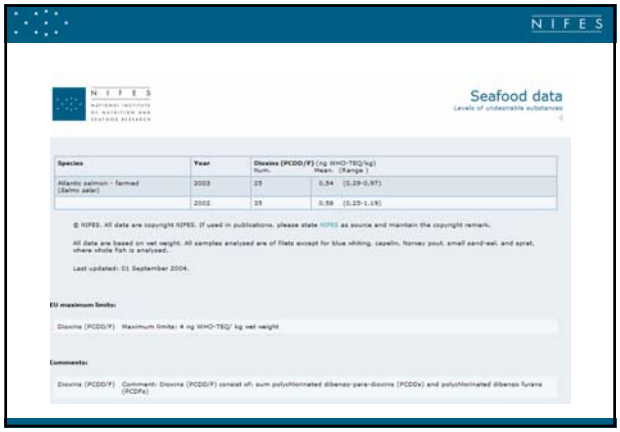


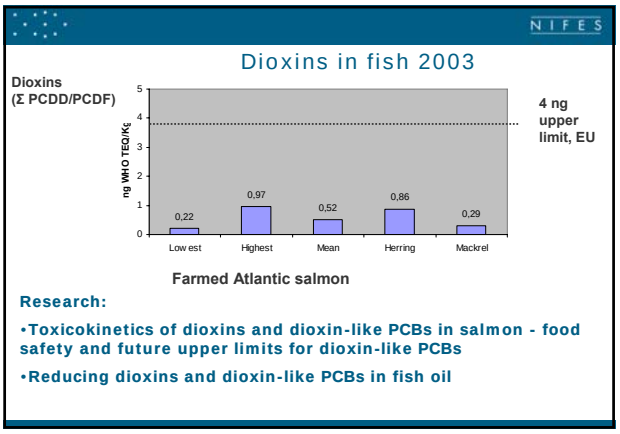
NORWEGIAN SURVEILLANCE PROGRAMMES ON SEAFOOD PRODUCTS RELATED TO FOOD SAFETY











NORWEGIAN SURVEILLANCE PROGRAMMES ON SEAFOOD PRODUCTS RELATED TO FOOD SAFETY

PBDEs in Norwegian Seafood (2003)

NIFES

Table 1: Concentrations of PBDE congeners (ng/g wet wt) in Norwegian seafood collected in 2003.

Sample		PBDE 28	PBDE 47	PBDE 99	PBDE 100	PBDE 153	PBDE 154	Sum
Atlantic Salmon	Average	0.12	1.66	0.27	0.30	0.05	0.11	2.51
(Salmo Salar, farmed, muscle, n=20)	SD	0.06	0.78	0.09	0.15	0.02	0.05	1.13
	Range	0.05-0.24	0.67-3.69	0.15-0.47	0.12-0.52	<0.03-0.07	0.05-0.16	1.14-4.49
Mackerel	Average	0.09	0.86	0.26	0.16	0.04	0.06	1.46
(Scomber scombrus, muscle, n=5)	SD	0.01	0.13	0.05	0.03	0.01	0.02	0.23
	Range	0.08-0.10	0.76-1.07	0.20-0.33	0.14-0.20	<0.03-0.05	0.05-0.08	1.26-1.78
Herring	Average	0.07	1.23	0.18	0.36	0.03	0.05	1.90
(Cupea harengus, muscle, n=10)	SD	0.01	0.38	0.09	0.39	0.01	0.02	0.82
	Range	0.06-0.08	0.75-1.81	0.08-0.29	0.01-1.39	<0.02-0.04	0.03-0.09	1.02-3.53
Atlantic Halibut	Average	0.21	4.68	0.15	0.44	0.07	0.19	5.65
(Hippoglossus hippoglossus, muscle, n=18)	SD	0.21	4.97	0.14	0.45	0.05	0.18	5.93
	Range	0.01-0.57	0.15-14.54	0.02-0.48	0.01-1.54	<0.02-0.18	<0.02-0.68	0.32-17.59
Cod	Average	<0.01	0.02	<0.01	<0.01	<0.02	<0.02	0.03
(Gadus morhua L., muscle, n=10)	SD		0.01					0.01
	Range	<0.01	0.02-0.04	<0.01-0.01	<0.01	<0.02	<0.02	0.02-0.04
Cod Liver	Average	0.37	5.70	0.15	0.67	0.03	0.40	7.32
(Gadus morhua L., liver, n=5)	SD	0.07	1.31	0.03	0.17	0.00	0.12	1.68
	Range	0.30-0.47	4.00-7.37	0.11-0.19	0.46-0.90	0.02-0.03	0.26-0.58	5.17-9.50
Blue mussels	Average	nd	0.08	0.04	0.02	0.02	0.02	0.15
(Mytilus edulis, n=14)	SD	nd	0.03	0.02	0.01	0.01	0.01	0.06
	Range	nd	0.03-0.12	0.01-0.07	<0.01-0.04	<0.01-0.03	<0.01-0.04	0.06-0.25
Crab	Average	<0.01	0.04	0.02	<0.01	<0.02	<0.02	0.05
(Cancer pagurus, muscle, n=6)	SD		0.01	0.01				0.02
	Range	<0.01	0.03-0.05	0.01-0.02	<0.01	<0.02	<0.02	0.03-0.07
Crab shell meat	Average	0.04	0.90	0.67	0.23	0.53	0.12	2.39
(Cancer pagurus, shell meat, n=8)	SD	0.03	1.24	1.00	0.34	0.48	0.15	2.60
	Range	<0.01-0.1	0.09-3.05	<0.01-2.34	0.02-0.80	0.08-1.61	<0.02-0.37	0.58-8.96

nd=not determined

Bellinne et al, Dioxin 2004 short paper

NIFES

NOT ALL SPECIES ARE WELL EASILY FITTED IN THIS CONCEPT:

- EEL
- SHELLFISH (I.E. BLUE MUSSEL)
- HALIBUT

LOCATIONS ARE "TOO" IMPORTANT
SIZE IS "TOO" IMPORTANT

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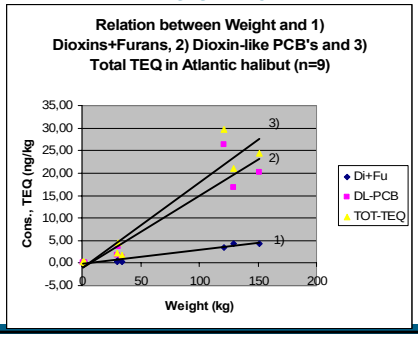
DIOXINS IN HALIBUT – EFFECT OF NEW LEGISLATION



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Ongoing surveillance programmes on behalf of the Norwegian Food Safety Authority:

- Control program on undesirable and desirable substances in complete feedingstuff, fishmeal and fish oil for farmed fish
- Program on undesirable substances in blue mussel (Mytilus edulis) (EU- Directive 91/492 EEC and 79/923 EEC)
- Program on drug residues and chemical undesirable substances in farmed fish (Directive 96/23 EC)
- EU-program on dioxin and dioxin like PCBs in foodstuffs and feedingstuffs

* Processed Seafoods ?? (Suggested programme)

NIFES

Surveillance program - farmed fish

Salmon (90 %) and trout (10 %)in accordance with 96/23/EC

1 sample for each 100 tons of fish produced (for 2003 ~5200 samples).

Pooled samples (n=5) have been analysed (for 2003 ~1000 pooled samples).

29 parameters are tested

NIFES

Including:

Hormones	Dienoestrol (A1),Trenbolone (A3)
Antibacterial agents	Chloramphenicol (A6), Oxolinic acid (B1)
Antiparasitic agents	Cypermethrin (B2a), Azamethiphos (B3a), Malachite green (B3e)
Organochlorine compounds	Dioxins, dioxin-like PCBs, PCB, DDT (B3b)
Heavy metals	Pb, Cd, Hg (B3a)
Mycotoxin	Mycotoxin (feed) (B3d)

Results:
Well below limits for those components where limits exists (e.g. dioxin, Pb, Cd, Hg, DDT). No antibacterial or antiparasitic components have been detected.

NORWEGIAN SURVEILLANCE PROGRAMMES ON SEAFOOD PRODUCTS RELATED TO FOOD SAFETY

Example – Antibacterial agents

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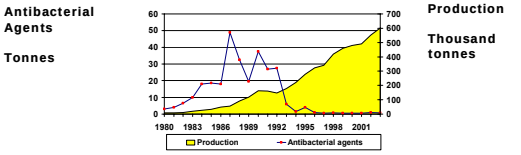
- Analysis since 1989 have not detected antibacterial agents in farmed fish for consumption
- Statistics show little use of antibacterial agents in aquaculture now:



Surveillance program - fish feed

NIFES

Microbiology (Salmonella)
Heavy metals (Hg, Pb, Cd, As, element species etc)
PCBs
DDT and metabolites
Dioxins and dioxin-like PCBs
ARG-GMO
Polybrominated flame retardants (BFR) (from 2003)

Antioxidants
Selected vitamins and trace elements
+ + +

Results 2003:
Do not exceed EU or national limits, except arsenic (upper limits 6 mg/kg)

Majority of arsenic is present as arsenobetain with a very low toxicity

Sampling for 2004: ca. 650; including ingredients

Full report (in Norwegian) at www.mattilsynet.no

Arsenic – legislation (animal feed)

NIFES

- EU maximum levels (directive 2003/100/EC):

  Animal feed: 6 mg/kg **total arsenic**
  Feed ingredients: 10 mg/kg **total arsenic**

  EFSA – risk assessment on As in animal feed ongoing

Results from the Norwegian Marine Monitoring Programme (2003)*.

	Average	Minimum	Maximum
Total arsenic (mg/kg ww)	5.8	3.4	8.3

39% of analysed fish feeds (n = 39) > EU limit 6.0 mg/kg

*Annual report on fish feed and ingredients, Norwegian Food Safety Authority (2003)

Surveillance program

NIFES

Blue mussel (*Mytilus edulis*) (EU directive 91/492)

- 50 farming locations along our coast tested every year

Analyced for:
- Metals (Cr, Cu, Zn, As, Ag, Cd, Hg, Pb)
- Microbiology
- Algal counts (water, NIVA) and toxins (shell, NIVA)

Results:

Little problems with microbiolgy and chemicals:
Exeption might be inorganic arsenic
Algal toxins causes problems

Metallinnhold (gjennomsnitt og standardavvik basert på våtvekt) i blåskjell fra undersøkelsene i 2000-2003

NIFES

År	Kobber (mg/kg)	Sink (mg/kg)	Arsen (mg/kg)	Kadmium (mg/kg)	Bly (mg/kg)
2000	1,16±0,62	17,8±5,6	2,8±2,5	0,17±0,10	0,28±0,27
2001	1,08±0,20	16,1±4,4	2,2±1,0	0,18±0,08	0,20±0,13
2002	1,10±0,22	17,0±4,5	2,1±0,6	0,18±0,10	0,18±0,13
2003	1,12±0,26	16,2±3,8	2,1±0,82	0,14±0,07	0,22±0,22

Kidney of O-shell (Horse shell)

NIFES

NIFES

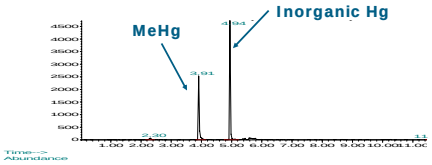
CHEMICAL METHODS

AMBITIOUS PROGRAM IN 2004:

- Methyl mercury
- Inorganic arsenic
- Organic tin compounds
- PAH
- Extended pesticides

NIFES

Mercury - Speciation



Apparature: GC-ICPMS

- Method accredited
- Today still do MeHg and Tot Hg separate. Further method development warranted to omit two analyses

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Microwave assisted alkaline hydrolysis

Subsample + 0.9M NaOH in 50% EtOH

↓

Microwave treatment 20 min, 90°C

I: Solubilisation of sample matrix
II: Conversion of As(III) to As(V)

↓

Determination of total inorganic arsenic by anion-exchange HPLC-ICP-MS

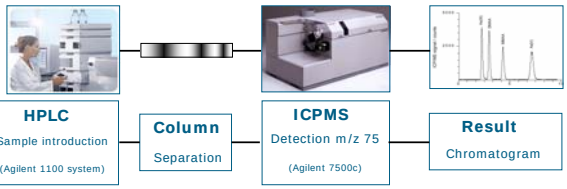
Total inorganic arsenic = As(V)

➢ **No conversion of other arsenic compounds to inorganic arsenic**

Larsen and Sloth, in prep.

NIFES

Arsenic - speciation analysis by HPLC-ICPMS



HPLC	Column	ICPMS	Result
Sample introduction (Agilent 1100 system)	Separation	Detection m/z 75 (Agilent 7500c)	Chromatogram

NIFES

CHEMICAL METHODS - II

PROGRAMME IN 2005:

- More brominated compounds
- Flurinated compounds
- More efficient extractions
- More efficient vitamin analyses

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Brominated Flame Retardants

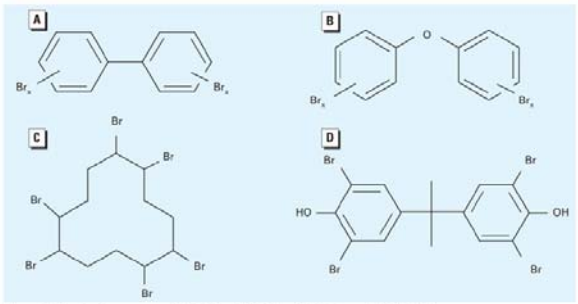


Figure 1. Chemical structures of (*A*) PBBs, (*B*) PBDEs, (*C*) HBCD, and (*D*) TBBPA.

Birnbaum et al., 2004, Env. Health Perspectives


NIFES
Nordic cooperation is wellcomme.
This fits well with the follow up on the roundtable conference last year where the Norwegian Minister of Fisheries called for closer cooperation between fish exporting countries
THANKS !!

6.8 Undersirable substances in fish, analysis in KTL

Hannu Kiviranta, national Public Health Institute

A brief summary of recent/ongoing projects in KTL of undesirable substances in fish was given. In addition the Finnish Food Composition Database was introduced briefly.

EU research project on dioxin in fish was carried out to obtain information about the concentrations of environmental toxins in Finnish domestic fish. The project focused on both the most relevant fish species consumed in Finland and the most relevant environmental toxins in two areas; the Baltic Sea and inland lakes.
The study showed that the accumulation of toxins in fish depends most of all on the fish species concerned. The ”problem” species were salmon and large-sized herring. In both of these species the concentration of dioxins was found to exceed the maximum limit value of 4 pg WHO-TEQ/g (fw) in many samples. Dioxin concentration correlated often with age; the older the fish, the higher the concentration. Also the fishing location correlated with concentration especially in Baltic herring samples. Almost all other domestic fish fell under the EU limit value. The dissemination of these results in Finland was given in the presentation.

In a recent *EU –project (Q5CR-2000-70418; DAPAFF)* Atlantic salmon were fed graded levels of dioxins and DLPCBs in their diets for seven months. The dioxin and DLPCB concentrations in salmon increased with increasing dietary exposure. At the end of the trial the maximum concentrations of dioxins in fillet and whole fish were 1.9 and 2.3 pg WHO-TEQ/g (fw), respectively. Hence with this feeding period even with the most contaminated experimental feed the dioxin concentrations in salmon did not exceed the maximum level set by the EU.

The main goal of *the project, DIOXMODE in BIREME program*, is to combine empirical research and past and new analytical data in order to investigate bioaccumulation pathways of OCs in the Baltic Sea food web. Better knowledge of the significance of food species in accumulation of different OCs into salmon will improve the development of means to diminish toxicant accumulation in Baltic fish, e.g. by changing fishing strategies and thereby reducing risks for human health from Baltic fish consumption and at the same time ensuring efficient exploitation of Baltic fish resources and the state of fisheries. The project will also provide data of causal connections between OCs and the reproduction disturbance, M74 of Baltic salmon. The specific objectives of the DIOXMODE project are: 1) to determine biomagnification of OCs from zooplankton through Baltic herring and sprat into salmon and to determine effects of accumulated toxicants on salmon, 2) to identify reasons for the great variation between individuals and species in concentrations and congener profiles of OCs in salmon and its prey species, 3) to construct and apply a bioenergetic-based bioaccumulation model to evaluate effects of stock size, age composition and individual growth rate of salmon and its prey species on their OC concentrations, and 4) to compare the effects of the alternative exploitation patterns (e.g. variable fishing efforts) and stocking rates on the contaminant accumulation.

A yearly based *EU monitoring program for dioxins and DLPCBs in fish* in Finland is quite small, only three fish samples per year of total 30 samples. The very recent fish species in this monitoring were farmed rainbow trout samples from different parts of Finland.

In Finland there exist already an open database of nutrients in food, *FINELI Finnish Food Composition Database*. This database provides an average nutrient composition of Finnish foods including 1823 different foods/food items and 47 nutrient factors. This database is maintained by KTL and can be found at www.fineli.fi/index.php.

Undesirable substances in fish: analysis in KTL

Recent research projects:

- EU research project on dioxin in fish

- EU CRAFT project (Q5CR-2000-70418)

- DIOXMODE project in BIREME

- Yearly based EU food monitoring projects

Hannu Kiviranta, KTL

EU research project on dioxin in fish

1.

- 239 fish samples of which
  - 136 were pooled (3-10 fish per pool)
  - 90 individual Baltic herring from Bothnian Sea
  - 13 processed Baltic herring products
- Species:
  - Baltic herring, sprat, salmon, whitefish, vendace, burbot, bream, pike-perch, perch, pike, and flounder as well as farmed whitefish and arctic charr
- Season:
  - Samples caught usually during the spawning season
- Analytes:
  - PCDD/Fs (17 congeners), PCBs (37), PBDE (15), PCNs (14), DDT+DDD+DDE (6)
  - also heavy metals (Pb, Cd, Hg, As) analysed in the project

Hannu Kiviranta, KTL

EU-research project on dioxin in fish

2.

- Sampling:
  - locations represent various sea areas as well as inland lakes
- Samples:
  - pooled samples consisted 3-10 fish each, small fish (10); head and gut removed, big fish (3); slice behind the dorsal fin
  - included skin and abdominal fat
- Analysis:
  - all POPs with HRGC/HRMS selective ion monitoring, resolution 10 000, ^{13}C i-std
  - accreditated lab T077
  - internal QA/QC; blanks + control fish sample in each batch of samples
  - external QA/QC; several international intercalibration studies every year

Hannu Kiviranta, KTL

EU-research project on dioxin in fish

3.

- Dissemination of results:

General public

- report of PCDD/Fs, PCBs, and PBDEs published in Finnish
- report of heavy metals published in Finnish
- press conference about results -> interviews and articles in newspapers
- National Food Agency has given fish consumption recommendations
- Ministry of Agriculture and Forestry has created so called "list of positive fish"

Commission

- results of PCDD/Fs and PCBs have been reported to Commission's database

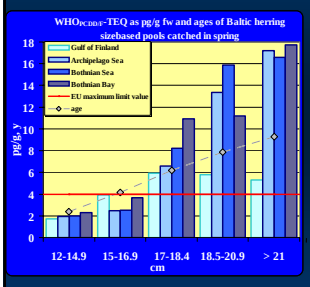
Research community

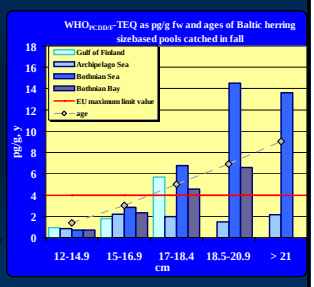
- two manuscripts of results ready to be submitted and more to come
- presentation at the Dioxin 2004 conference

Hannu Kiviranta, KTL

EU-research project on dioxin in fish

$WHO_{PCDD/F}$-TEQs as pg/g fw of Baltic herring size-based pools caught during spring and fall period

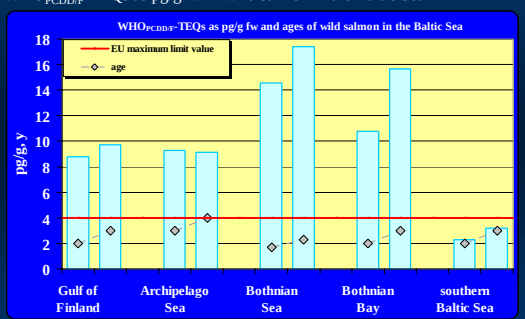




Hannu Kiviranta, KTL

EU-research project on dioxin in fish

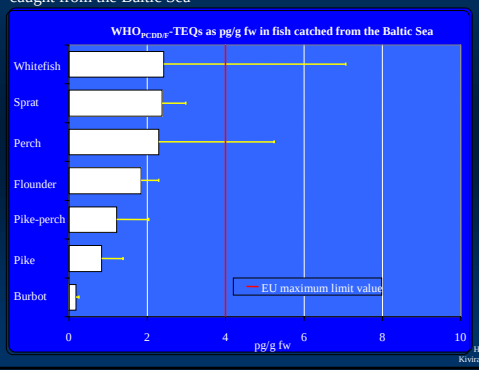
$WHO_{PCDD/F}$-TEQs as pg/g fw in wild salmon in the Baltic Sea



Hannu Kiviranta, KTL

EU-research project on dioxin in fish

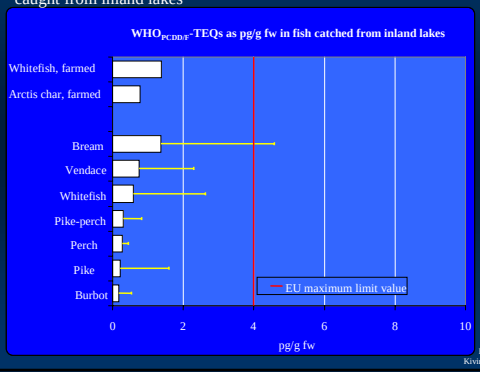
Medians and maximums of $WHO_{PCDD/F}$-TEQs as pg/g fw in fish caught from the Baltic Sea



Hannu Kiviranta, KTL

EU-research project on dioxin in fish

Medians and maximums of $WHO_{PCDD/F}$-TEQs as pg/g fw in fish caught from inland lakes



Hannu Kiviranta, KTL

EU CRAFT project (DAPAFF) (Q5CR-2000-70418)

1.

- 50 fish samples of which
  - pooled
- Species:
  - Species: Atlantic salmon, farmed
- Season:
  - 7 months feeding experiment
- Analytes:
  - PCDD/Fs (17 congeners), PCBs (37), PBDE (15)

Hannu Kiviranta, KTL

EU CRAFT project (DAPAFF) (Q5CR-2000-70418)

2.

- Sampling:
  - at the beginning of the feeding experiment
  - after 15 weeks of the experiment
  - after 30 weeks of the experiment
- Samples:
  - pooled samples consisted 3 fish each
  - fillet skin removed
  - whole fish
- Analysis:
  - all POPs with HRGC/HRMS selective ion monitoring, resolution 10 000, ^{13}C i-std
  - accreditated lab T077
  - internal QA/QC; blanks + control fish sample in each batch of samples
  - external QA/QC; several international intercalibration studies every year

Hannu Kiviranta, KTL

EU CRAFT project (DAPAFF) (Q5CR-2000-70418)

3.

- Dissemination of results:

EU
- report of the project submitted

Research community
- two papers published so far
- third paper about PBDEs submitted

Hannu Kiviranta, KTL

EU CRAFT project (DAPAFF) (Q5CR-2000-70418)

Table 3 Mean PCDD/F and dioxin-like PCB (DLPCB) concentrations in the raw materials and in the diets (pg WHO-TEQ g^{-1}dry weight, n= 2). Non-detected congeners are set at the limit of quantification (LOQ).

Sample	Dioxins (PCDD/F)	DLPCBs[1]	Total
Fish oil-low	1.08	5.94	7.02
Fish oil-high	14.1	15.5	29.5
Fishmeal	0.573	2.46	3.03
Diet A	0.71	2.79	3.50
Diet B	1.70	3.65	5.35
Diet C	3.89	4.99	8.88
Diet D	4.89	5.40	10.3

[1] PCB congeners included are non-*ortho* (PCB 77, 81, 126 and 169) and mono-*ortho* PCBs (PCB 105, 114, 118, 123, 156, 157, 167 and 189) which have been assigned TEFs by the WHO.

Lundebye A.-K. et al. 2004. ***Aquaculture Nutrition 10: 199-207***

Hannu Kiviranta, KTL

UNDESIRABLE SUBSTANCES IN FISH: ANALYSIS IN KTL

EU CRAFT project (DAPAFF) (Q5CR-2000-70418)

Table 5 Mean PCDD/F and dioxin-like PCB (pg WHO-TEQ g^{-1}) concentrations (n=3, except intial sample where n=1, standard deviation in parentheses) on a fresh weight (fw) basis, in Atlantic salmon (fillets and whole fish) at the beginning and after 15 weeks and 30 weeks of the feeding trial (with four different feeds, A-D). Non-detected congeners are set at the limit of quantification (LOQ).

	Fillet			Whole fish		
Sampling time	PCDD/F (pg g^{-1} fw)	DLPCB (pg g^{-1} fw)	Sum TEQ (pg g^{-1} fw)	PCDD/F (pg g^{-1} fw)	DLPCB (pg g^{-1} fw)	sum TEQ (pg g^{-1} fw)
Initial	0.869	1.63	2.50	1.09	1.86	2.95
15 weeks						
Diet A	0.507 (0.01)^a	1.68 (0.08)^a	2.19 (0.08)^a	0.71 (0.08)^a	2.24 (0.30)^a	2.94 (0.38)^a
Diet B	0.750 (0.04)^b	2.01 (0.02)^b	2.76 (0.03)^b	1.25 (0.29)^b	2.66 (0.13)^a	3.91 (0.26)^b
Diet C	1.25 (0.07)^c	2.41 (0.13)^c	3.66 (0.2)^c	1.72 (0.08)^c	3.13 (0.12)^b	4.85 (0.19)^c
Diet D	1.48 (0.03)^d	2.68 (0.02)^d	4.16 (0.05)^d	1.98 (0.08)^c	3.44 (0.11)^b	5.42 (0.16)^c
30 weeks						
Diet A	0.483 (0.05)^a	1.81 (0.11)^a	2.29 (0.15)^a	0.580 (0.05)^a	2.35 (0.07)^a	2.93 (0.13)^a
Diet B	0.903 (0.05)^b	2.44 (0.10)^b	3.34 (0.15)^b	1.13 (0.05)^c	2.97 (0.23)^a	4.10 (0.28)^b
Diet C	1.50 (0.14)^c	2.87 (0.24)^c	4.37 (0.30)^c	2.02 (0.11)^d	3.67 (0.13)^c	5.69 (0.22)^c
Diet D	1.86 (0.04)^d	3.23 (0.06)^e	5.09 (0.10)^d	2.37 (0.12)^d	4.01 (0.27)^c	6.29 (0.39)^c

Superscript values within a column denote significant differences among treatments at two different sampling times (15 weeks and 30 weeks).

Lundebye A.-K. et al. 2004. ***Aquaculture Nutrition 10: 199-207***

Hannu Kiviranta, KTL

DIOXMODE project in BIREME

1.

- About 290 fish samples
  - in different workpackages
    - feeding experiment of salmon, fed with sprat or Baltic herring based feeds
    - archived salmon muscle tissues for timetrend analysis
    - measurements of analytes from different levels in foodweb in order to model the exposure of wild salmon
- Species:
  - Species: Baltic herring, sprat, salmon, and three-spined stickleback
- Season:
  - Samples taken during the spawning season or during spring and fall
- Analytes:
  - PCDD/Fs (17 congeners), PCBs (37), PBDE (15)

Hannu Kiviranta, KTL

DIOXMODE project in BIREME

2.

- Sampling:
  - locations represent various sea areas
- Samples:
  - pooled samples consisted 4-10 fish each
  - whole fish analysed, exception: archived salmon muscle tissue samples
- Analysis:
  - all POPs with HRGC/HRMS selective ion monitoring, resolution 10 000, ^{13}C i-std
  - accreditated lab T077
  - internal QA/QC; blanks + control fish sample in each batch of samples
  - external QA/QC; several international intercalibration studies every year

Hannu Kiviranta, KTL

DIOXMODE project in BIREME

3.

- Planned dissemination of results:

General public
- articles in newspapers and magazines

Academy of Finland
- report of the results

Research community
- several manuscripts planned

Hannu Kiviranta, KTL

Yearly based EU food monitoring projects

1.

- Usually about 30 samples of which 3 fish samples

- Species:
  - Vary, most recent were farmed rainbow trout
- Season:
  - Not specified
- Analytes:
  - PCDD/Fs (17 congeners), PCBs (37), PBDE (15)

Hannu Kiviranta, KTL

Yearly based EU food monitoring projects

2.

- Sampling:
  - locations represent the whole country
- Samples:
  - pooled samples consist 3-10 fish each,
  - small fish (10); head and gut removed, big fish (3); slice behind the dorsal fin
  - included skin and abdominal fat
- Analysis:
  - all POPs with HRGC/HRMS selective ion monitoring, resolution 10 000, ^{13}C i-std
  - accreditated lab T077
  - internal QA/QC; blanks + control fish sample in each batch of samples
  - external QA/QC; several international intercalibration studies every year

Hannu Kiviranta, KTL

Yearly based EU food monitoring projects

3.

- Dissemination of results:

Commission

- results of PCDD/Fs and PCBs will be reported to Commission's database

Research community

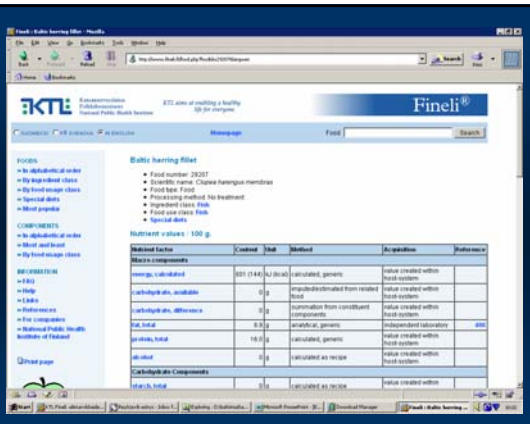
- when enough material is been analysed a manuscript of Finnish exposure to PCDD/Fs, PCBs, and PBDEs will be submitted

Hannu Kiviranta, KTL

Fineli ® - Finnish Food Composition Database

- in the Web: http://www.fineli.fi/index.php

Hannu Kiviranta, KTL



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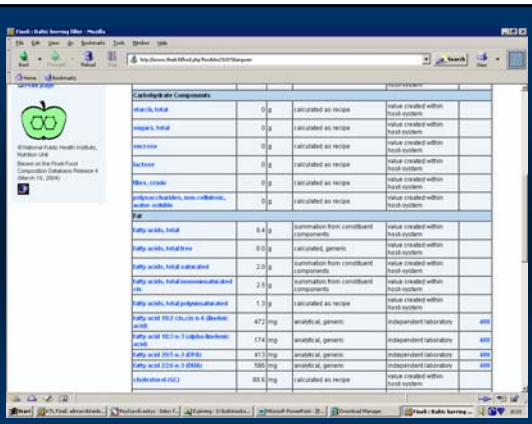

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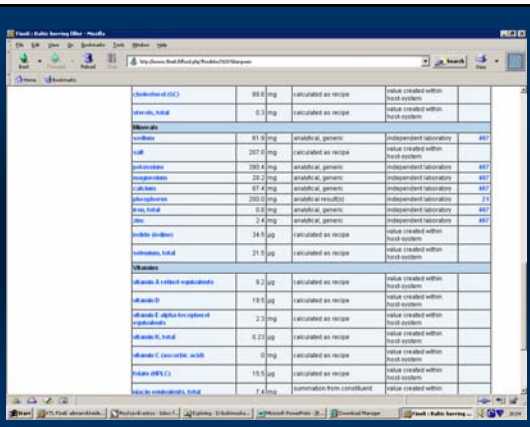

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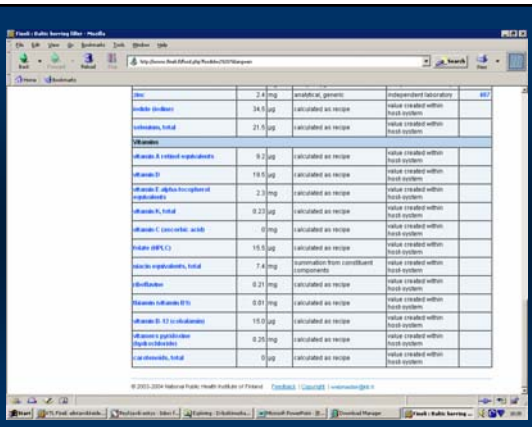


Hannu Kiviranta, KTL

6.9 Contaminants and nutrients in Finnish fish

Christina Bäckman, National Veterinary and Food research Institute

The fish control and analysis activities are devided between several authorities. The national residue control programme is accomplished in co-operation of National Food Agency (NFA) and National Veterinary and Food Research Institute (EELA). This control programme is carried out annually in accordance with both national and EU legislation. In 2003, 225 fish samples were analysed. Low levels of organochlorine substances were detected but the concentrations were below maximum residue levels. The concentration of mercury was 30-59 µg/kg, which is below the maximum values of legislation. Four samples of farmed rainbow trout contained small amounts of leucomalachite green which is a stable metabolite of malachite green, which was prohibited in Finland in october 2001. Malachite green has also been found in sediments which make the investigations quite complicated and there is a project going on to clarify this case. The implementation and results of the control programme are reported in a separate publication.

An EU project was carried out to obtain information about the contents of environmental toxins. The study was focused on the most important toxins; dioxins and heavy metals for which there was a need to adjust EU regulations. The study demonstrated low levels of heavy metals in all the fish included. Baltic herring accumulates cadmium, mercury and arsenic. The contents of mercury and arsenic correlate with the age and size of the fish. Pike show higher levels of mercury than other species, but the levels did not exceed 0.5 mg/kg. The concentrations of lead were close to the limit of quantification (0.01 mg/kg) in all species. Arsenic levels in fish caught in marine areas were higher than in fresh water fish but low in international comparison.

There are no legislated control programmes in for the nutritional values of fish.
Research projects in this field are continuously going on in cooperation with the Finnish Game and Fisheries Research Institute, national Food Administration and National Public Health Institute. Research is focused on the vitamins. Thiamine (B1) is analysed because it seems to play an important role in the M-74 syndrome which leads to high mortality in salmon fry.
Since vitamin A occurs in several different forms efforts have been made to analyse the most important forms. Vitamin A palmitate is monitored in environmental surveys because it acts as a biomarker indicating the degree of pollution in Baltic Sea, but the data also gives us valuable nutritional information of Baltic fish.
A research project concerning vitamin D contents in Baltic and fresh water fish was performed in 2002-2004. A huge variation of vitamin D contents were found even in the same species and statistical methods are used to investigate possible correlations between different factors like age, cathing time and toxin concentration. The study is still not concluded and the results will be published later.
The Nordic Metodic Committee on Food (NMKL) have an established expert laboratory network which could be connected to the proposed Nordic information and communication network on fish.
(www.NMKL.org)

Table 1.
Consumption of domestic fish, kg/ person, calculated as filled weight.

Fish	1999	2003
Cultivated rainbow trout	1,6	1,3
Herring	0,8	0,9
Pike	0,8	0,7
Perch	0,7	0,6
Vendace	0,8	0,8
Powan	0,4	0,3
Others	1	1
Together	6,1	5,6

Table 2.
Consumption of imported fish, kg/person, as product weigt.

Fish	1999	2003
Cultivated salmon (scaled)	1,3	2,2
Cultivated rainbow trout (scaled)	0,1	1,4
Tuna fish (canned)	1	1,5
Coalfish (frozen fillet)	0,6	0,6
Shrimp	0,5	0,5
Herring products	0,4	1,1
Others	2,7	2,1
Together	6,6	9,4

Tables 1 and 2 contain consumption figures of fish in Finnish markets (www.rktl.fi) Consumption of domestic fish has slightly reduced from 1999 to 2003. On the opposite, there is a clear increase in volume of imported fish, especially in the case of cultivated salmon and rainbow trout. It seems that this is also a tendence in near future. Thus, there is an obvious need to improve control methods in order to maintain the quality of fish throughout the logistics chain.

From other database (www.finfood.fi, tietovakka), there is a summary on the consumption of scaled fish, and this figure is slightly growing from 1995 to 2002: 14,0 to 14,4 kg / inhabitant. It can be concluded that the sales of packed fish, as fillets is increasing. The need of new and efficient quality control tools is obvious also in the case of packed fish, to obtain it as good as possible to consumers.

EELA

Undesirable substances (residues) in fish:

Analysis in National Veterinary and Food Research Institute (EELA)

-EU Residue control programme
-Project on malachite green in farmed salmon
-EU research project on heavy metals in fish

EELA

The national residue control programme

- The national residue control programme is carried out annually in accordance with both national and EU legislation.
- The programme is accomplished in co-operation of National Food Agency (NFA) and National Veterinary and Food Research Institute (EELA)
- The local food authorities and inspection veterinarians are responsible for an appropriate sampling

EELA

The national residue control programme

- In 2003, 225 fish samples were analysed
- low levels of organochlorine substances were detected but the levels were below maximum residue levels
- The level of mercury was 30-59 µg/kg, which is below the maximum values of legislation.
- Four samples of rainbow trout contained small amounts of malachite green
- The implementation and results are reported in a separate publication.

EELA

Heavy metal contents in fish from the Baltic Sea and freshwaters

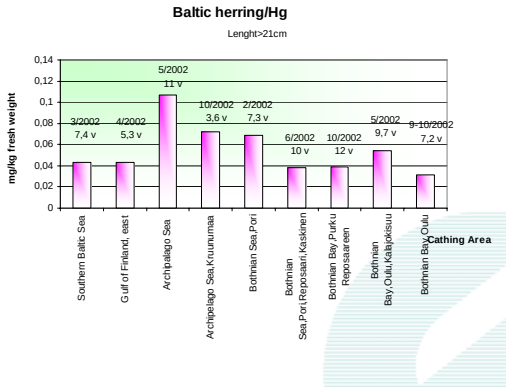
- The EU project was carried out to obtain information about the contents of environmental toxins.
- The study was focused on the most important toxins; dioxins and heavy metals for which there was a need to adjust EU regulations.
- This would give the whole picture of the contaminants in domestic fish.

EELA

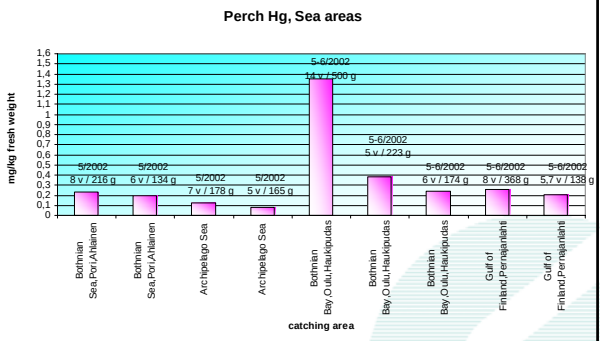
Sampling and sample pretreatment

- a part of the EU-research project on toxins in fish
- The project expanded to cover also heavy metals in fish
- sampling procedure could be done at the same time with the sampling for dioxins
- samples were pooled and the heavy metals were determined without the skin according to the practise of EELA

EELA



EELA



EELA

Heavy metal contents in fish from the Baltic Sea and freshwaters

- The study demonstrated low levels of heavy metals in all the fish included
- Baltic herring appears to accumulate cadmium, mercury and arsenic. The contents of mercury and arsenic correlate with the age and size of the fish.
- Pike show higher levels of mercury than other species, but the level was not found to exceed 0.5 mg/kg.
- Lead levels were close to the limit of quantification (0.01 mg/kg) in all species.
- Arsenic levels in fish caught in marine areas were higher than in fresh water but low in international comparison.

EELA

Nutrients in fish

- No legislated control programmes
- Reasearch projects in cooperation with the Finnish Game and Fisheries Research Institute, national Food Administration and National Public Health Institute
- Vitamins as biomarkers connected to the Dioxmode project
- Reasearch and development in EELA is focused on the field of vitamin analysis

EELA

Research and development in the nutritional area

- Thiamine
- Vitamin A active substances (A_1, A_2, retinyl esters, retinoic acid)
- Carotenoids (astaxanthin, cantaxanthin, β-caroten)
- Vitamin E
- Vitamin D

EELA

Vitamin D in Baltic Sea and Finnish lake fish

- The EU project on dioxin was extended to vitamin D as a separate research project
- The same sampling procedure could be used

EELA

Vitamin D in Baltic Sea and Finnish lake fish

- The method (HPLC) is accreditated and measures up to the ISO/IEC 17025 standard
- Quality control samples were analysed in every sample set
- The laboratory participated in a FAPAS collaborative study while the project was going on

EELA

Vitamin D in Baltic Sea and Finnish lake fish

- Huge variation even in the same species
- Statistical methods should be used to investigate possible correlations between different factors

EELA

Correlation between different factors in the content of vitamin D? Some guesses so far

- no correlation between vitamin D content and fat content, dioxin content, age or cathing time
- a moderate correlation between vitamin D content and weight and length
- a slight correlation could be observed between higher Cd content and low vitamin D-content

The project is not completed, more statistical investigations should be done

EELA

New fish consuming guidelines

- As a consequence of the EU research project guidelines for consumption of Finnish fish (Baltic Sea and fresh water fish) were redefined while both disadvantages (dioxins) and advantages (Vitamin D and fatty acids) were taken into account

6.10 A brief summary of monitoring and research activities on contaminants at IFL

Guðjón Atli Auðunsson, Icelandic Fisheries Laboratories

The Ministry of Fisheries finances a project involving evaluation of the concentrations of various undesirable substances in the edible portion of marine catches. This is the first time that systematic collection of information is carried out for a number of substances and many kinds of marine catches from Icelandic fishing grounds; in addition, information is being gathered on numerous substances that have not been previously examined. The substances being investigated are trace elements (mercury, cadmium, lead and the total concentration of arsenic as well as the concentration of inorganic arsenic), PAHs (17 of them), polychlorinated dibenzodioxins and dibenzofurans (17), dioxinlike PCBs (12), marker PCBs (6), polybrominated flame retardants (10 PBDEs), organotins (10 substances), and numerous pesticides (HCB, DDTs, HCHs, aldrin/endrin/dieldrin, chlordanes, toxaphenes and endosulfan substances, altogether 29 chemical compounds). The purpose of this collection of samples and analyses is, on the one hand, to examine how products measure up against the new limits for dioxins (polychlorinated dibenzodioxins and dibenzofurans) and, on the other, to check the concentration of dioxin-like PCBs as a basis for setting maximum values within the EU before the end of 2004. EU plans to lower the limits for both dioxins and dioxin-like PCBs before the end of 2007. Thirdly, the purpose of these analyses is to gather information on the concentration of marker PCBs for the purpose of setting limits; a risk assessment is now in progress regarding this class of substances, and its completion was planned at the end of 2004. Information on marker PCBs will also be utilised for this risk assessment. Fourth, the findings will be utilised to evaluate how products measure up to limits currently in effect in Iceland, the EU and Iceland's trading partners (inorganic trace elements and pesticides). Finally, it can be mentioned that this information will be utilised for a risk assessment and the setting maximum values that are now under consideration within EU (PAHs, inorganic arsenic, organotins and brominated flame retardants). The collection of samples and quality criteria for the analytical methods were in accordance with the conditions set out by the EU for the information gathering campaign on dioxins and dioxin-like PCBs, but countries were also directed to collect information about marker PCBs. The collection of samples was divided among the member states, Iceland and Norway, in proportion to the production quantity in each country. Regarding food, the collection of samples covers seafood products (29 annual samples of fish and 12 annual samples of fish oil from Iceland, a total of at least 41 annual samples) and agricultural products (at least 26 annual samples from Iceland). In addition, Iceland is supposed to gather samples of compound feeds and feed components: 35 samples of fishmeal and fish oil and 32 samples of other feeds, for a total of at least 67 samples. The EU campaign continues until at least 2006. Regarding information about feed fish oil and fishmeal, in addition to fish oil for human consumption, there was a close collaboration with the industry, for in these industries the sellers must provide numerous tests and analyses on their products. Collection of samples and their analysis will continue.

Annual monitoring of heavy metals in marine biota (livers of cod and dab except mercury, where muscle meat is used, and whole soft tissue of blue mussels) around Iceland began in 1989 and monitoring of organochlorine compounds in these tissues in 1991. The work is done to fulfill the commitments of Iceland to the Oslo and Paris agreement (OSPAR) and the Arctic Monitoring Assessment program (AMAP).

A BRIEF SUMMARY ON MONITORING AND RESEARCH ACTIVITIES ON CONTAMINANTS AT IFL

A brief summary on monitoring and research activities on contaminants at IFL

Undesirable substances in Icelandic Seafood

- Systematic collection of information
- Analysed in the edible portion of marine catches
- Substances investigated:
  - Trace elements (Cd, Hg, Pb and As)
  - Polychlorinated dibenzodioxins and dibenzofurans (17)
  - Dioxin-like PCBs (12)
  - Marker PCBs (6)
  - Numerous pesticides (29 groups)
  - PAHs (17)
  - Polybrominated flame retardants (10 PBDEs),
  - Organotins (10 substances),

Undesirable substances in Icelandic Seafood

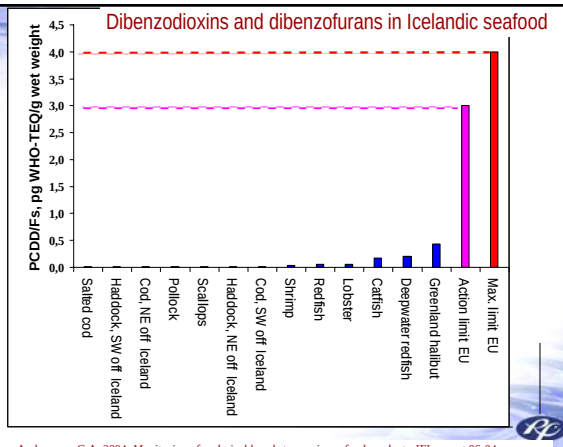
- The work is part of an EU campaign to collect information on dioxins (PCCD/Fs), dioxinlike PCBs (DL- PCBs) and marker PCBs for risk evaluation and establishing maximum limits
- The collection of samples and the quality criteria on the analytical methods were in accordance with conditions set out by the EU

Undesirable substances in Icelandic Seafood

Objective:

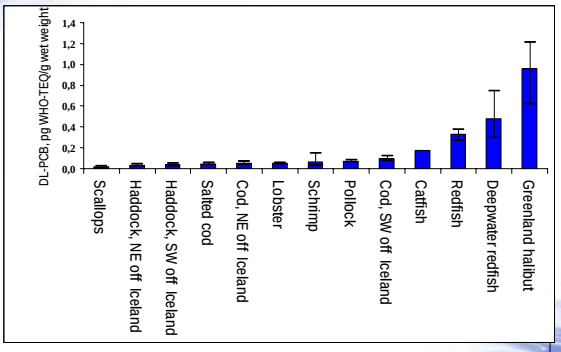
- To evaluate the status of Icelandic seafood products
- To evaluate how products measure up to limits currently in effect in Iceland, the EU and Iceland's trading partners
- To examine how products measure against new limits in EU

Dibenzodioxins and dibenzofurans in Icelandic seafood



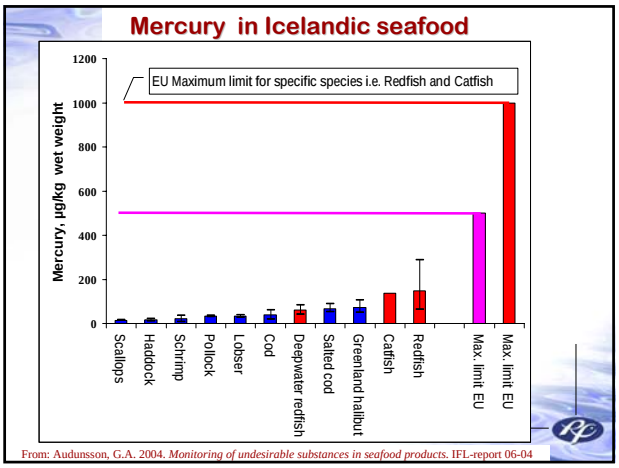
From: Audunsson, G.A. 2004. *Monitoring of undesirable substances in seafood products.* IFL-report 06-04

Dioxin-like PCBs in Icelandic seafood



From: Audunsson, G.A. 2004. *Monitoring of undesirable substances in seafood products.* IFL-report 06-04

A BRIEF SUMMARY ON MONITORING AND RESEARCH ACTIVITIES ON CONTAMINANTS AT IFL



Undesirable substances in Icelandic Seafood

- Overall results indicate that the level of pollutants is very low in Icelandic seafood products
- The highest measured value for organic contaminants was only 12,5% of the most stringent limits in Iceland's most important trading countries
- The measured values for inorganic contaminants are also well below the limits set by EU
- This work has confirmed that Icelandic seafood products are relatively little affected by anthropogenic contamination

6.11. The Icelandic food composition database

Ólafur Reykdal, Centre of Food Technology at Keldnaholt

The Icelandic food compositional database is an official database for food composition in Iceland. The purpose of maintaining this database is to provide reliable data on food composition for consumers, food industry, schools, diet counselling and food inspection. This is achieved by counselling, publication of food composition tables and maintaining of a home page for calculation of nutrient intake (www.matarvefurinn.is). New data are provided by participation in research projects dealing with food composition and cooperation with food industry.

The database includes 1148 foods and data for 140 compounds (including 86 fatty acids and four heavy metals) are reported when available. Data on composition of 130 fish items are included. Data on amino acids and vitamins in Icelandic fish is limited. Data on fatty acids and trace elements in the most important fish species are available. Data is however most complete for the proximate.

Food composition activities are found in different institutes in Iceland. The Icelandic Food Composition Database is maintained at the Technological Institute of Iceland. In this field cooperation exits with The Icelandic Fisheries Laboratories, University of Iceland, The Public Health Institute, The Federation of Icelandic Industries and The Environmental and Food Agency of Iceland. Cooperation with Icelandic software companies has led to the development of user-friendly educational software for nutrient calculations on the Internet using the Icelandic Food Composition Database.

The Icelandic Food Composition Database
Data on fish

Ólafur Reykdal

matra

Collaboration

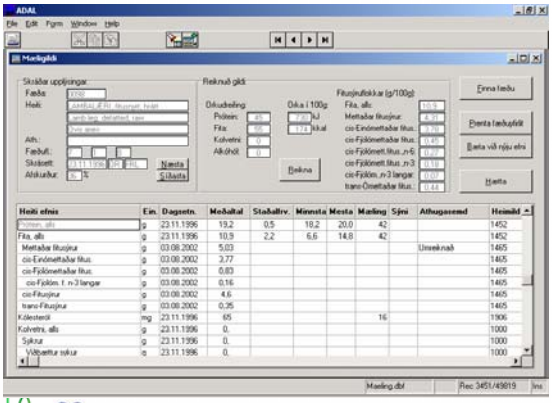
- IceTec & the Agricultural University
- Icelandic Fisheries Laboratories
- University of Iceland
- Public Health Institute
- Hugsjá

matra

ISGEM Database

- 1148 foods
- 130 fish items
- 140 compounds
- Mean, SD, Min-max, n, reference

matra



matra

Available Icelandic analytical data

	Proxi-mates	Fatty acids	Amino acids	Minerals	Trace elements	Vita-mins
Fish						
Crustacea, molluscs						
Cooked fish						
Fish products & dishes						

matra

Available Icelandic analytical data

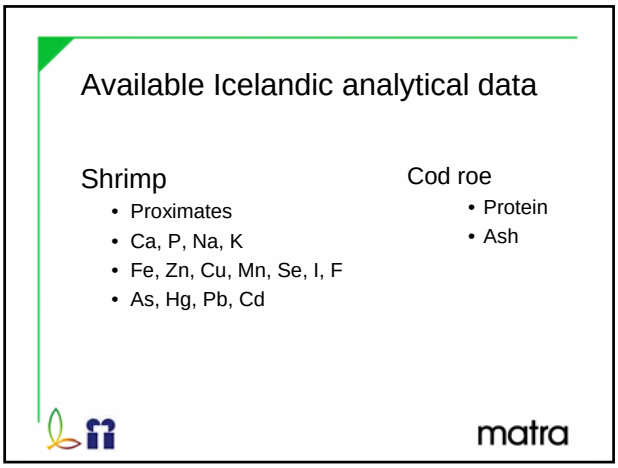
Cod

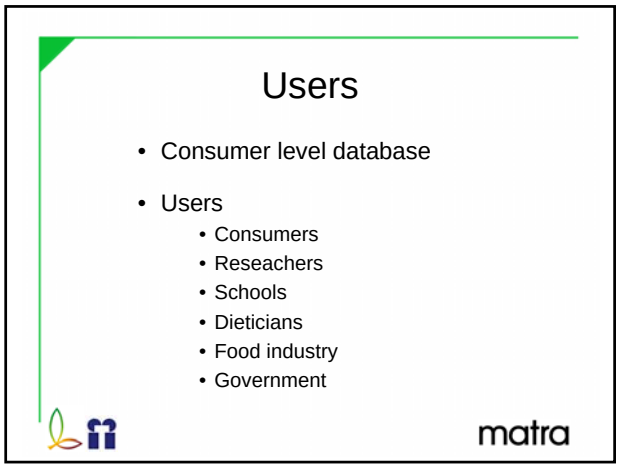
- Proximates
- Fatty acids
- Ca, P, Na, K
- Fe, Zn, Cu, Mn, Se, I, F
- As, Hg, Pb, Cd

Lumpsucker

- Proximates
- Fatty acids
- Ca, P, Na, K

matra


Available Icelandic analytical data
Shrimp
Proximates
Ca, P, Na, K
Fe, Zn, Cu, Mn, Se, I, F
As, Hg, Pb, Cd
Cod roe
Protein
Ash
matra


Users
Consumer level database
Users
Consumers
Reseachers
Schools
Dieticians
Food industry
Government
matra

6.12 The European Food Information Resource Network (EuroFIR) Can a network on seafood benefit?

Ólafur Reykdal, Centre of Food Technology at Keldnaholt

EuroFIR

EuroFIR, an European network of excellence on food composition data systems (www.eurofir.net), is a partnership between 40 universities, research institutes and small-to-medium sized enterprises (SMEs) from 21 countries. EuroFIR aims to develop and integrate a comprehensive, coherent and validated databank providing a single, authoritative source of food composition data for Europe. The European Commission's Research Directorate General under the Food Quality and Safety priority funds EuroFIR. The project started on 1st January 2005 and will run for 5 years.

Activities

EuroFIR includes work on nutrients and bioactive compounds but contaminants are not included. The activities are based on 15 work packages. Among the work packages are: (a) Food description and identification. (b) Standards development and deployment (c) Data documentation and harmonisation. (d) Internet development and deployment of databank systems.

EuroFIR will establish a common standard for the description and identification of foods in European food composition databases. This allows for application of state-of-the-art concepts in database linking and management and their compatibility as well as the comparison and interchange of food composition data. The recommended presentation of food compounds (forms, units, methods etc.) in databases will be described in a special standard. Each partner will develop their own database according to the proposed standard and provide data for the EuroFIR database. Data quality will be an important criterion for the validated EuroFIR database.

Opportunities for other networks

The EuroFir project is important for all database work regarding food in Europe. EuroFIR will be a leading source for standards on food description, data quality and presentation. Therefor it is important for people working with safety of seafood to interact with this project.

A Nordic network on safety of seafood will benefit from the EuroFIR project by adopting appropriate standards and guidelines. The EuroFIR project is divided into 18 months periods and results will be delivered after each period. All the Nordic countries participate in the EuroFIR project and this will help Nordic networks to utilise the deliverables. EuroFIR can therefor act as a head start for Nordic work in the field of seafood safety.

It is import to inform EuoroFIR about the special requirements of people working with safety of seafood. In this field more information is needed on sources and characteristics of seafood samples than is commonly used in the traditional food composition databases. It is important that these requirements will be included in new food standards proposed by EuroFIR.

INTRODUCTION TO EuroFIR, EUROPEAN FOOD INFORMATION RESOURCE

Introduction to EuroFIR,
European Food Information Resource

Ólafur Reykdal

Nordic information and communication network regarding safety of seafood

5.04.2005

EuroFIR

- **A network of excellence 2005 - 2009**
- **40 partners, 20 countries**
- **15 work packages**

Partners

- **Coordinator: Paul Finglas, IFR, UK**
- **Nordic partners**
  - Denmark: DFVF: Anders Møller
  - Finland: KTL: Marja-Lena Ovaskainen
  - Norway: UiO: Elin Bjorge Løken
  - Sweden: NFA: Wulf Becker
  - Iceland: Ólafur Reykdal

A few of the objectives

- **Integrate databank systems at the European level.**
- **Provide standards for food composition data.**
- **Identify and provide new information.**

but ...

- **Contaminants are not included**
- **This is a huge and a broad project**

Some work packages

- **Internet development and deployment**
- **Standards development**
- **Food identification and description**

Internet development and deployment

- **Review Internet technologies**
  - Storage and display formats
- **Evaluate databases**
- **Recommend datasets**
- **Study quality assurance**

Internet development and deployment

Output:

- **Datasets on Internet**

Standards

- **Provide guidelines**
- **Identify components**
- **Identify foods**
- **Standardise national data: Units, forms etc.**
- **Review contaminants**

Contaminants

- **What are food-derived contaminants?**
- **Identify other data resources for contaminants.**
- **Identify coding issues for contaminants.**
- **Study data sharing.**
- **Study a common format of data.**

Standards

Output

- An European Food Data Standard
  - e.g. a CEN standard

Food identification & description

- **Culture and language barriers**
- **Many different systems**

Food identification & description

- **Recommend a food identification and description system for use in European food composition databases.**
- **Develop support facilities**
  - Software

Description systems in use (1)

- **Food coding systems**
  - Eurocode
  - Facetted food code
- **Food classification systems**
  - National
  - International

Description systems in use (2)

- **Food description systems**
  - Structured food nomenclature
  - Facetted free text description (INFOODS)
  - Facetted thesaurus (LanguaL)
- **Combined systems**
  - COST Action 99 Recommendations

LanguaL

- **LanguaL will be used for EuroFIR.**
- **Method for describing, capturing and retrieving data about food.**
- **Any food can be described by a combination of characters.**
- **www.langual.org**

LanguaL (2)

- **LanguaL is considered the most definitive system.**
- **Over 40 thousend food products have been coded.**
- **LanguaL is a good starting point.**

14 facets of LanguaL

1. **Product type**
2. **Food source**
3. **Part of plant or animal**
4. **Physical state, shape, form**
5. **Extent of heat treatment**
6. **Cooking method**
7. **Treatment applied**
8. **Preservation method**
9. **Packing medium**
10. **Container or wrapping**
11. **Food contact**
12. **Consumer group / Dietary use**
13. **Geographic regions**
14. **Additional descriptors**

May be the description system should be modified for fish?

A validated food information resource

Evaluation of data quality

- Sampling plan
- Sampling handling
- Number of samples
- Analytical methodology
- Analytical quality control

Data quality

We need standardised evaluation

- Qality index (e.g. 0-100)
- Confidence code (e.g. A, B, C, D)

EuroFIR

Provided	Not provided
Some standards	**Work on contaminants**
A coding system	**Quality / validation procedures**

Opportunities

- **Use EuroFIR as a head start for the fish safety field.**
- **Provide information to EuroFIR.**
- **Build a Nordic communication network**
  - Start with a home page with practical information and links.
- **It is not possible to wait until 2009.**

6.13 Sharing research information on the Internet

Ívar Gunnarsson, Hugsjá ehf.

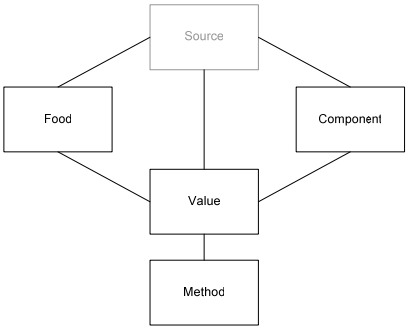
Sharing research information on the Internet

Ivar Gunnarsson,
Hugsja, 2005

Hugsjá

- Software development / consultancy
- Food related projects
  - Food Composition db software
  - Food intake calculations
  - Food surveys
- EDI (paperless trade)
  - UN standards for sending business messages likt Invoices, Orders and Customs declaration

Food Composition data



Source

- Author / Organisation
- Name
- Version
- ...

Food

Dags.	Enskt heiti	Latneskt heiti	FF1	FF2	FF3	Heiti fæðu
24.05.2003	Cod, roe, boiled		8	1	13	ÞORSKHROGN
10.06.1996	Cod liver, raw		8	1	13	ÞORSKLIFUR
03.04.1992	Cod liver, canned		8	5	13	ÞORSKLIFUR,
24.05.2003	Cod liver, boiled		8	1	13	ÞORSKLIFUR,
18.06.1996	Cod, fillet, raw	Gadus morhua	8	1	13	ÞORSKUR
25.07.1988	Cod, fillet, boiled	Gadus morhua	8	1	13	ÞORSKUR, flök
25.07.1988	Cod, fillet, breaded, fri	Gadus morhua	8	1	13	ÞORSKUR, flök
31.03.1992	Cod, partly dried	Gadus morhua	8	4	13	ÞORSKUR, sigi
25.07.1988	Cod, breaded, precoo		8	1	13	ÞORSKUR, sne
18.07.1988	Cod, breaded, raw		8	1	13	ÞORSKUR, sne
16.07.1988	Cod in batter, raw		8	1	13	ÞORSKUR, sne
07.08.1987	Cod tails		8	1	13	ÞORSKUR, stir

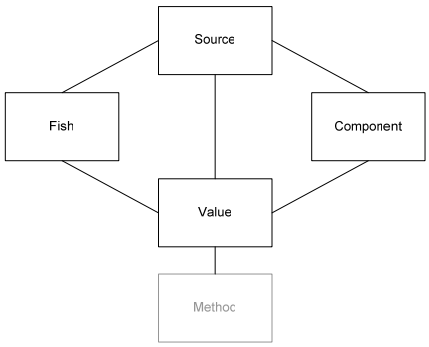
Componenet

Rec	Nr.	Heiti	Ein.
16	0016	Vatn	g
17	0017	A-vítamín, RJ	µg
18	0018	Retinol	µg
19	0019	Beta-karótín	µg
20	0020	D-vítamín	µg
21	0021	E-vítamín, a-TJ	mg
22	0022	Alfa-tókóferól	mg
23	0023	B1-vítamín, þíamín	mg
24	0024	B2-vítamín, ríbóflavín	mg
25	0025	Níasín-jafngildi	mg

Value

Heiti efnis	Ein.	Dagsetn.	Meðaltal	S
Vatn	g	18.06.1996	81,2	
A-vítamín, RJ	µg	18.06.1996	1,9	
Retinol	µg	18.06.1996	1,9	
Beta-karótín	µg	18.06.1996	0,	
D-vítamín	µg	18.06.1996	0,	
E-vítamín, a-TJ	mg	18.06.1996	1,10	
Alfa-tókóferól	mg	18.06.1996	1,10	
B1-vítamín, þíamín	mg	18.06.1996	0,03	
B2-vítamín, ríbóflavín	mg	18.06.1996	0,03	

SeaFood data



Ways to share data

- Printed tables
- Download tables (excel, txt)
- Web
  - http://www.nifes.no/seafood-data/indexe.html
  - http://www.foodcomp.dk/fcdb_default.htm

Deep Linking

- http://www.foodcomp.dk/fcdb_details.asp?FoodId=0011

FNR	DAGS	HEITI_ENS	DK
0782	9.3.1993	Avocado, raw	http://www.foodcomp.dk/fcdb_details.asp?FoodId=0011
0743	9.3.1992	Apricots, raw	http://www.foodcomp.dk/fcdb_details.asp?FoodId=0626
1037	24.5.2001	1944 dish, Bolognese	
0972	24.5.2001	1944 dish, cacao soup	
1051	23.6.2001	1944 dish, chicken breast	
0974	24.5.2001	1944 dish, chicken lasagne	

Web Services

- http://212.30.214.254:8300/HelloWorld/service1.asmx/HelloWorld
- A call from within an application yields answers from the remote database
- Remote data can be viewed in local application

Requirements for sharing

- Common set of components
- Common set of methods

Web service reply