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Monitoring of the marine biosphere around Iceland 2010 and 2011

Hrönn Jörundsdóttir
Natasa Desnica
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Öryggi, umhverfi og erfðir

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UMHVERFISSTOFNUN

Skýrsluágrip Matís ohf
Icelandic Food and Biotech R&D

Report summary

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Titill / Title	**Monitoring of the marine biosphere around Iceland 2010 and 2011** / Mengunarvöktun í lífríki sjávar við Ísland 2010 og 2011		
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Ágrip á íslensku:	Í þessari skýrslu eru birtar niðurstöður árlegs vöktunarverkefnis sem styrkt var af umhverfisráðuneytinu og sjávarútvegs- og landbúnaðarráðuneytinu. Markmið með þessari vöktun er að uppfylla skuldbindingar Íslands varðandi Oslóar- og Parísarsamninginn (OSPAR), auk AMAP (Arctic Monitoring Assessment Program). Gögnin eru hluti af framlagi Íslands í gagnabanka Alþjóðahafrannsóknaráðsins (ICES). Hafrannsóknastofnunin sér um að afla sýna og Matís hefur umsjón með undirbúningi sýna og mælingum á snefilefnum í lífríki hafsins. Sýnin eru mæld á Matís og á Rannsóknastofu Háskóla Íslands í lyfja- og eiturefnafræði. Mæld voru ýmis ólífræn snefilefni og klórlífræn efni í þorski veiddum í árlegu vorralli Hafró í mars 2011 og í kræklingi sem safnað var á 11 stöðum í kringum landið í ágúst/sept 2010. Vöktun í lífríki sjávar við Ísland hófst 1989 og er sýnasöfnun eins frá ári til árs og unnið eftir alþjóðlegum sýnatökuleiðbeiningum. Gögnunum er safnað saman í gagnagrunn, í skýrslunni eru birtar yfirlitsmyndir fyrir sum efnanna sem fylgst er með. Kadmín er svæðisbundið hærra í íslenskum kræklingi samanborið við kræking frá öðrum löndum. Niðurstöður sýna breytingar í mynstri styrks klórlífrænna efna í kræklingi sem safnað var nálægt Hvalstöðinni í Hvalfirði í september 2010 sem eru sambærilegar við niðurstöður frá sama stað frá árinu 2009. Ekki voru sýnilegar breytingar í styrk þessara efna á söfnunarstað kræklings við Hvammsvík í Hvalfirði né á neinum öðrum söfnunarstað í kringum landið sem rannsakaður var 2010. Mikilvægt er að fylgjast með þessum breytingum í mynstri styrks klórlífrænna efna í kræklingi í vöktunarverkefninu á næstu árum til að sjá hvort þær eru enn til staðar. Ítarleg tölfræðigreiningu á gögnunum er í gangi þ.a. hægt sé að meta með vísindalegum aðferðum aukningu eða minnkun mengandi efna í lífríki sjávar hér við land.		
Lykilorð á íslensku:	*OSPAR, AMAP, vöktun á lífríki sjávar, ólífræn snefilefni, klórlífræn efni, þorskur, kræklingur.*		

Skýrsluágrip Matís ohf
Icelandic Food and Biotech R&D

Report summary

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Summary in English:	This report contains results of the annual monitoring of the biosphere around Iceland in 2010 and 2011. The project, overseen by the Environmental and Food Agency of Iceland, is to fulfil the OSPAR (Oslo and Paris agreement) and AMAP (Arctic Monitoring Assessment Program) agreements. The project was funded by Ministry for the Environment and Ministry of Fisheries and Agriculture. The data obtained is a part of Iceland´s contribution to the ICES databank (ices.dk). The collection of data started 1989. Matís is the coordinator for marine biota monitoring and is responsible for methods relating to sampling, preparation and analysis of samples. The samples were analyzed at Matís and the Department of Pharmacology and Toxicology at the University of Iceland. Trace metals and organochlorines were analysed in cod *(Gadus morhua)* caught in March 2011 and in blue mussel *(Mytilus edulis)* collected from 11 sites in August/Sept 2010. Marine monitoring began in Iceland 1989 and the sampling is carried out according to standardized sampling guidelines. Changes were observed in the organochlorine concentration patterns in blue mussels collected year 2010 at the sampling site Hvalstod in Hvalfjordur which are in line with results obtained year 2009. No noteworthy increase in organochlorine concentrations was however observed in blue mussels obtained at Hvammsvík in Hvalfjordur nor any of the other sample sites studied year 2010. These results need to be followed up in the annual monitoring of the biosphere around Iceland next year to see if this change in contaminant concentration pattern continues. A thorough statistical evaluation is on-going on all the available data from this monitoring program to analyse spatial and temporal trends of pollutants in the Icelandic marine biosphere.
English keywords:	*OSPAR, AMAP, monitoring, trace metals, organochlorine compounds, cod (Gadus Morhua), blue mussel (Mytilus edulis).*

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APPENDICES

I. Introduction

This report contains the results of the annual monitoring of heavy metals and organochlorine analyses for blue mussel (*Mytilus edulis*), collected along the coast around Iceland in 2010, as well as for cod (*Gadus morhua*), which is collected in Icelandic territorial waters in 2011. Annual monitoring of trace metals in the marine biota around Iceland began in 1989 and the monitoring of organochlorine compounds a few years later, in 1991. Several reports have already been published on this matter (1-17). To meet the requirements of the OSPAR (Oslo and Paris agreement) and the AMAP (Arctic Monitoring and Assessment Program), data has been submitted to the ICES databank (www.ices.dk), the first data from 1989. The project is supervised by the Environment and Food Agency in Iceland and financed by The Ministry for the Environment as well as the Ministry of Fisheries and Agriculture and Matís. Matís is the coordinator for the marine biota monitoring and responsible for methods relating to sampling, sample preparation, analysis of samples and writing of this report. The samples were analyzed at Matís and the Department of Pharmacology and Toxicology at the University of Iceland.

II. Sampling and preparation of samples

The Marine Research Institute handles all sampling, while Matís is responsible for the storage of samples, sample preparation and chemical analysis.

2.1 Sampling

Using standard sampling guidelines (JMP, ICES and OSPAR), the sampling of cod (30-45 cm length, 2 samples (N-NW and NE)) was carried out in the annual bottom trawl survey in March 2011. Blue mussel samples, 4-6 cm length, were collected from 11 sites along the coast of the country in August/September 2010. Sampling locations for the blue mussel samples changed slightly this year i.e. the sampling location at Dvergasteinn, Álftarfjörður was moved due to limited availability of mussels at the original site. Sampling sites, i.e. coordinates, for all cod and blue mussel measured are shown in Figure 1. Icelandic waters have been divided into five main locations (N-NW, NE, SE-E, S, and SW) (6).

	Sample	Location	Site specifications[a]	Type of industry
Blue mussel	Grímsey	66°33,134-18°01,407	B	
	Hvalstöð, Hvalfjörður	64°23,826-21°27,210	I	Landing and processing of whale catch
	Hvammsvík, Hvalfjörður	64°21,64-21°33,53	B	
	Hvítanes, Hvalfjörður	64°20,20-21°41,09	B	
	Hvassahraun	64°01,205-22°09,526	B	
	Straumur, Straumsvík	64°02,541-22°02,700	I	Aluminium factury
	Mjóifjörður I, (head)	65°11,28-14°00,48	B	
	Mjóifjörður II, (Hofsá)	65°12,156-13°47,733	B	
	Mjóifjörður III, Dalatangi	65°16,101-13°34,564	B	
	Úlfsá, Skutulsfjörður	66°03,36-23°10,02	I	Waste incineration
	Dvergasteinn, Álftafjörður	65°58,29-23°04,50	B	
Cod	Cod N-NW	67°02,55-23°29,93	B	
	Cod NE	67°01,77-15°44,86	B	

a: B = Baseline, I = Impact

Figure 1. Locations for sampling of blue mussel (Mytilus edulis) 2010 and cod (Gadus morhua) 2011.

2.2 Preparation of samples prior to analysing

Each sample of mussel contained 50 ± 5 individuals. Each mussel was weighed and its length (4-6 cm), height and width measured. The flesh and the shell were then weighed separately (Appendix I). After this each sample (50 individuals) was homogenized and frozen until analysis was performed.

30-45 cm long cod was selected, each sample containing 25 ± 5 individuals. At the time of the sampling, the total weight as well as the gender of each fish was determined, livers were put in pre-weighed and pre-cleaned glass jars and, finally, the fish was gutted. All samples were kept frozen until further preparation for analysis took place. Later, the otoliths were removed for age determination, the fish was filleted, skinned, and the flesh weighed (Appendix II). Finally, each sample of flesh (25 ± 5 individuals) was homogenized and frozen until analyses were performed. The livers of each cod sample were divided into sub samples, according to the weight of the livers. All liver samples were homogenized and kept frozen until analysis took place.

III. Analysis

3.1 Metals and organic contaminants in biota

The trace metal analysis of lead, cadmium, copper, zinc, mercury, arsenic and selenium was carried out at Matís, as well as analysis of the supporting parameters, dry matter and fat. The following Persistent Organic Pollutants (POP) were analysed at the Department of Pharmacology and Toxicology at the University of Iceland: 11 PCBs, HCB, α-HCH, β-HCH and γ-HCH, p,p'-DDT o,p'-DDT, p,p'-DDE and p,p'-DDD, transnonachlor, α-chlordan, γ-chlordan, oxychlordan, Tox-26, Tox-50, Tox-62, BDE-47, BDE-99, and BDE-100. Table 1 presents the samples and all the parameters measured in each sample.

Table 1. Parameters measured in different samples.

Species	Number of samples	Number of individuals	Type of sample	Number of group	Inorganic contaminants	Organic contaminants	Other
Mussel, 2010 (*Mytilus edulis*)	11	50			Cu, Zn, As, Se, Cd, Hg, Pb	*	Dry matter and fat
Cod, 2011 (*Gadus morhua*)	2	25	Flesh	1	Hg		Dry matter and fat
			Liver	6	Cu, Zn, As, Se, Cd, Pb	*	Dry matter and fat
Labels: Cod-N-NW(2) Cod-NE							

* PCB # 28, 31, 52, 101, 105, 118, 138, 153, 156, 170, 180, α-, β-, γ-HCH, HCB, p,p'-DDT, o,p'-DDT, p,p'-DDE, p,p'-DDD, *trans*-nonachlor, α-, γ-Chlordan, Oxychlordan, Toxaphene-26, -50, -62, BDE # 47, 99 and 100.

Only three liver groups from each cod sample were analyzed to optimize the project resources compared to 5-6 liver groups in the previous years.

3.2 Methods

Inorganic contaminants (Cd, Cu, Zn, As, Se, Hg, Pb) in the samples were determined by ICP-MS after mineralization of the samples with closed vessel acid digestion. Portions (up to 200 mg weighed to 0.1 mg) of freeze dried samples (cod liver was not freeze dried and weighted wet) together with 3 ml HNO_3 and 1.5 ml H_2O_2 were transferred to 50 ml digestion bombs. Samples were digested in a Mars5 microwave oven (CEM, North Carolina, USA), according to method SV-25-02-SN in Matis Quality manual. The digested sample solutions were quantitatively transferred to 50 ml polypropylene tubes and diluted to 30 ml with Milli-Q water. The concentration of the different elements (Cd, Cu, Zn, As, Se, Hg, Pb) in these digests was determined by ICP-MS (Agilent 7500ce, Waldbronn, Germany). ^{115}In was used as internal standard. The organochlorine compounds were analysed by GC-ECD using HP5890 Series II with an automatic injector (HP7673). A detailed description of the analyses of organic compounds and supporting parameters (dry matter and fat) has been given in a previous report (7) and for the inorganic contaminants the analytical method used is presented in details in method SV-22-02-SN-1 in Matis Quality manual.

3.3 Quality assurance

The quality of the metal analysis was checked in several ways. Certified reference materials are routinely treated and analysed in the same manner as the samples. Results for analysis of reference materials and limits of detection are shown in Table 2 and 3 in appendix III. Also shown are Z scores for the reference materials. The trace analytical lab at the Matís has participated in QUASIMEME annually with satisfactory results. Also, Matís participated in SLV test with satisfactory results. The limit of detection (LOD) was calculated as follows: 20 digested blank samples were

run and standard deviation (S.D.) calculated. LOD represents 3 x S.D. in blank samples.

For **organic contaminants,** a solvent blank and sample of certified reference material was extracted with each batch of samples. A certified standard solution was also run with the samples to check own standards. The limit of detection was estimated to be 3 x STDEV of the blanks. The Department of Pharmacology and Toxicology at the University of Iceland has participated in QUASIMEME annually with satisfactory results. Results for analysis in certificate mussel and cod liver samples are presented in appendix III, Tables 4 and 5 along with relevant detection limits in Table 6.

IV. Results

This report contains data from the years 2010 and 2011, due to budget constrains these results have not been statistically evaluated using present and previous data from the annual monitoring of the biosphere around Iceland in order to evaluate time trend or spatial difference. Similar changes as reported for the monitoring of blue mussel 2009 (17) regarding the contaminant concentration patterns were observed in blue mussels collected 2010 near the whale processing plant in Hvalfjordur, for details see Figure 5a in Appendix VII, site Hvalstod, Hvalfjordur, this sampling site is located 400m south-west of the processing plant of whale catch. The results show that the concentration of persistent organochlorine compounds in blue mussels are now highest at the site Hvalstod in Hvalfjordur, this site has until 2009 not been notably different from other sample sites in terms of POP concentrations, while year 2009 and 2010 an increase was observed for ∑3PCB, p,p´-DDE, HCB and trans-nonachlor in blue mussels from this site (Table 9a in Appendix V and Figure 5a in Appendix VII). Furthermore, the ratio PCB153/DDE has decreased from 2,8 (year 2008) to 0,4 (year 2009 and 2010). This ratio has typically been 2-4 in blue mussels at other sample sites around Iceland. This decrease in the PCB153/DDE ratio indicates that there is a new source of pollution at the site Hvalstod in Hvalfjordur. The reason for the new source pollution has not been studied, but a possible cause is that during the summer 2009 the whale processing plant in Hvalfjordur started processing fin whales (*Balaenoptera physalus*) again after a 20 year long break in its operation. No noteworthy increase in POP concentrations was observed year 2009 in blue mussels obtained from another annual sampling site in Hvalfjordur i.e. Hvítanes /Hvammsvík nor any of the other sample locations studied (Figures 5a and 5b). These results need to be followed up in the annual monitoring of the biosphere around Iceland next year to see if this change in contaminant concentration pattern continues. To be able to monitor long term trends and to indicate large scale spatial difference in the marine biota around Iceland, data from many years need to be assessed with statistical models. This work has now started as a Ph.D. project thanks to a project grant from the Icelandic Research Fund obtained January 2011.

4.1 Biological variations

Figures 2a-d in appendix VI shows the biological variation in cod *(Gadus morhua)* 1990-2011, (average age, average weight of ungutted fish, average weight of liver, and average fat content in liver).

4.2 Heavy metals

Results for metals in blue mussel (2010) and cod (2011) are presented in Tables 7 and 8 in appendix IV. New data is presented along with data from previous years (1, 4-14) in figures 3a-f and 4a-c (Appendix VII) for blue mussel and in figures 6a-b and 7a-f (Appendix VIII) for cod, giving an overview of a period of ca. 20 years. It should be noted that results for cod are presented on wet weight basis, while the result for mussel are presented on dry weight basis.

4.2.1 Blue mussel

In the year 2010 no blue mussel sample was obtained from Eyri in Hvalfjordur as the mussels at this site were all too small < 4 cm and the sampling site was therefore moved to Hvammsvík (64°21,64-21°33,53). The annual sampling site for the blue mussel sample taken at Hvítanes in Hvalfjordur (64°21,85-21°29,8) has been moved slightly from previous location. The name of this sampling station has though not been changed in the figures in appendix VII that illustrate the results obtained for trace metals and organic compounds in blue mussels at the various sample sites around Iceland over the past 21 years.

Figures 3a-f in appendix VII, show the average concentration of heavy metals in blue mussel from the years 1990-2010, on dry weight basis. The horizontal red line shows the ICES90 75% baseline (11). Figures 4a-c in appendix VII show average concentrations (dw), of heavy metals in blue mussel from different sampling sites, 1990-2010. Metal concentrations vary considerably between years and different locations. This year the concentration of cadmium is higher in Grímsey and Dvergasteinn compared to other locations. According to the existing monitoring data (1999-2010) the concentration of arsenic is noticeably higher at Úlfsá, Skutulsfjörður than at any of the other sample locations for blue mussel. The results show low values for mercury in blue mussel when compared with ICES90 75% baseline values. The copper concentrations are generally low in blue mussel, while the zink concentrations are close to the ICES90 75% value. The cadmium levels are high in blue mussels from Icelandic coasts, compared to other areas. This cadmium is considered to be of natural origin since no anthropogenic source is known.

4.2.2 Cod

Figures 6a-b in appendix VIII show the average heavy metal concentration in livers of 30-45 cm cod (wet weight), caught in Icelandic waters in March every year between 1990-2011. Figures 7a-f in appendix VIII show average concentrations (w.w.) of heavy metals in cod livers from different sampling sites, between the years 1990-2011. Mercury is measured in the flesh instead of in the liver. Lead concentration was below the limits of detection in all samples. Variations in concentration between years

and locations over the time interval are shown in Figures 6a-b and 7a-f in Appendix VIII. The concentration of heavy metals in cod from Icelandic waters is low compared to cod from other northern locations (6). As for the blue mussel the only exception is cadmium which is probably of natural origin reflecting the natural background values. However, the amount of cadmium in cod and other species in Icelandic coastal waters is far below the TWI (Tolerable Weekly Intake) standard of WHO, even with heavy consumption (6).

4.3 Organic compounds

Results for organic compounds in blue mussel (2010) and cod (2011) are presented in appendix V, Tables 9 and 10. The results for cod are presented on a wet-weight basis but results for blue mussel are on a dry-weight basis. New data is shown along with data from previous years (1, 4-10) in Figures 5a-b (Appendix VII) for blue mussel and in figures 8 and 9a-e (Appendix VIII) for cod, giving an overview of a 17-19 year period.

4.3.1 Blue mussel

Figures 5a-b in appendix VII, show the concentration on dry-weight basis of organic compounds in blue mussel from different locations in Iceland 1991-2010. The PCB congeners included in the Σ3PCBs are CB-118, CB-138 and CB-153 where the sum ranges from 50-80% of the sum of 11 PCB analysed. The most common organochlorines found in blue mussel are PCBs and DDE. As mentioned in results (i.e. section IV above) changes were observed in the organochlorine concentration patterns in blue mussels collected September 2010 at the sampling site Hvalstod in Hvalfjordur, for details see Figure 5a in Appendix VII and discussions in section Results IV. The concentration of PCBs in blue mussel found in Iceland are comparable with values found in mussels from remote areas of the west coast of United States and also similar to the lowest values found in mussels on the coast of the United Kingdom and Ireland (6). In general, concentrations of HCH, HCB and other DDTs except for DDE are low, close to the limit of detection.

4.3.2 Cod

Figure 8 in appendix VIII shows the average concentration on wet-weight basis of organic compounds in livers of 30-45 cm cod, caught in Icelandic waters in March every year between 1991 and 2011. Figures 9a-e in appendix VIII show the average concentrations (w.w.) of some organic compounds in cod from different sampling sites, 1991-2010. The sum of seven PCBs (CB-28, CB-52, CB-101, CB-118, CB-138, CB-153 and CB-180) is about 90% of the 11 PCBs measured. The concentrations of the organic substances that are measured in cod from Icelandic waters correspond to the lowest values observed elsewhere (6).

V. Conclusion

This report contains the results of an evaluation of trace elements in Icelandic marine biota for the years 2010 and 2011. It adds to the information gathered every year to

determine whether the concentration of trace elements is increasing, decreasing or not changing; if current situation is a cause for health concerns; and if the marine environment is being threatened by pollution**.**

This data has not been statistically evaluated using present and previous results in order to evaluate time trend or spatial difference. However, there are apparently no obvious changes in contaminant concentrations pattern seen in previous years. **A full statistical analysis of all data is needed to confirm changes if any.** This was done in 1998 (6) but additional data collected over the last 12 years calls for a new methodical statistical evaluation of the existing Icelandic monitoring data, this work has now started as a Ph.D. project thanks to a project grant from the Icelandic Research Fund obtained January 2011. In addition, when comparing data of livers it is necessary to keep in mind the factors (i.e. fat, age, d.w.) that may affect the quantity and concentration of trace elements.

Iceland is unique in terms of geology, oceanography and meteorology. High levels of heavy metals, particularly cadmium, occur naturally in the environment in Iceland. Therefore, natural background values need to be kept in mind when comparing contamination levels with other countries.

VI. Acknowledgement

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VII. References

1) Magnús Jóhannesson, Jón Ólafsson, Sigurður M. Magnússon, Davíð Egilson, Steinþór Sigurðsson, Guðjón Atli Auðunsson og Stefán Einarsson (1995). Mengunarmælingar í sjó við Ísland, lokaskýrsla, febrúar 1995, Útg. Umhverfisráðuneytið, 137 bls.

2) Guðjón Atli Auðunsson, Björn Gunnarsson, Elín Árnadóttir, Eyrún Þorsteinsdóttir, Eva Yngvadóttir, Gavin Norman Grewer, Guðrún I. Stefánsdóttir, Helga Halldórsdóttir, Þuríður Ragnarsdóttir, Öyvind Glömmi (1997). Verkefnaskýrsla til AMSUM hópsins, Efnasamsetning þorsks á Íslandsmiðum, Rannsóknastofnun fiskiðnaðarins, 42 bls.

3) Guðjón Atli Auðunsson (1999). The effect of nutritional status of Icelandic cod (Gadus morhua) on macroconstituents and trace elements in the liver. Journal of the Marine Research Institute, Reykjavík. **16**: 111-129.

4) Eva Yngvadóttir, Helga Halldórsdóttir (1998). Mengunarvöktun í sjó við Ísland 1996 og 1997. Skýrsla Rf 20-98.

5) Eva Yngvadóttir, Helga Halldórsdóttir (1999). Mengunarvöktun í lífríki sjávar við Ísland 1997 og 1998. Skýrsla Rf 6-99.

6) Davíð Egilson, Elísabet D. Ólafsdóttir, Eva Yngvadóttir, Helga Halldórsdóttir, Flosi Hrafn Sigurðsson, Gunnar Steinn Jónsson, Helgi Jensson, Karl Gunnarsson, Sigurður A. Þráinsson, Andri Stefánsson, Hallgrímur Daði Indriðason, Hreinn Hjartarsson, Jóhanna Torlacius, Kristín Ólafsdóttir, Sigurður R. Gíslason og Jörundur Svavarsson (1999). Mælingar á mengandi efnum á og við Ísland. Niðurstöður vöktunarmælinga. Starfshópur um mengunarmælingar. Mars 1999, 138 bls., kafli 8.

7) Eva Yngvadóttir, Helga Halldórsdóttir (2001). Marine monitoring in Iceland 1998-2000. IFL Project Report 13-02.

8) Eva Yngvadóttir, Helga Halldórsdóttir, Þuríður Ragnarsdóttir and Elín Árnadóttir (2002). Mengunarvöktun í lífríki sjávar við Ísland 2000-2001. Skýrsla Rf 14-02.

9) Eva Yngvadóttir, Helga Halldórsdóttir (2003). Monitoring of the marine biosphere around Iceland 2001 and 2002. IFL Project Report 27-03.

10) Eva Yngvadóttir (2004). Monitoring of the marine biosphere around Iceland 2002 and 2003. IFL Project Report 05-04.

11) Eva Yngvadóttir, Helga Halldórsdóttir, Taru Uusinoka, and Þuríður Ragnarsdóttir (2005). Monitoring of the marine biosphere around Iceland in 2003-2004. IFL project Report 13-05.

12) Sasan Rabieh, Ernst Schmeisser, Eva Yngvadóttir, Ingibjörg Jónsdóttir, Þuríður Ragnarsdóttir, and Helga Halldórsdóttir (2006). Monitoring of the marine biosphere around Iceland in 2005-2006. Matís project Report 28-07.

13) Oslo and Paris Commission Report 1991. Draft Report on the Results of the 1990 Supplementary Baseline Study of Contaminants in Fish and Shellfish.

14) Sasan Rabieh, Ingibjörg Jónsdóttir, Þuríður Ragnarsdóttir, Helga Gunnlaugsdóttir (2008). Monitoring of the marine biosphere around Iceland 2006 and 2007. Matís project Report 21-08.

15) Hrönn Ólína Jörundsdóttir, Sasan Rabieh, Hulda Soffía Jónasdóttir, Þuríður Ragnarsdóttir, Helga Gunnlaugsdóttir (2009). Monitoring of the marine biosphere around Iceland 2007 and 2008. Matís project Report 24-09.

16) Hrönn Ólína Jörundsdóttir, Natasa Desnica, Sonja Huld Guðjónsdóttir, Þuríður Ragnarsdóttir, Helga Gunnlaugsdóttir (2010). Monitoring of the marine biosphere around Iceland 2008 and 2009. Matís project Report 30-10.

17) Helga Gunnlaugsdóttir, Natasa Desnica, Þuríður Ragnarsdóttir, Hrönn Jörundsdóttir, (2011). Monitoring of the marine biosphere around Iceland 2009 and 2010. Matís project Report 24-11.

18) Matís Quality manual, Gæðahandbók Matís, SV-25-02 SN and SV-22-02 SN-1.

Appendix I.

Biological measurements of Blue mussel (*Mytilus edulis*)

2009

Species:	**Blue mussel (*Mytilus edulis*)**		Date of sampling:	**12.8.2010**		
Length:	4-6 cm		Sampled by:	Marine Inst.		
Location:	**Ulfsá**		Date of preparation	28.10.2011		
Coordinates:	66°03,36-23°10,02		Matis#	R11-2123-9		
	Length (mm)	**Width (mm)**	**Height (mm)**	**Total weight (g)**	**Weight soft body (g)**	**Weight shell (g)**
1	45,6	22,1	19,3	11,48	5,78	5,56
2	48,6	23,6	21,5	12,25	7,39	4,70
3	53,8	24,0	20,6	15,65	8,34	7,10
4	49,2	24,4	21,1	8,74	2,87	6,68
5	48,8	22,9	22,8	15,20	7,60	7,37
6	48,5	23,2	22,7	15,11	7,63	7,28
7	51,3	23,9	21,9	16,30	8,42	7,65
8	56,5	26,4	23,6	20,96	11,28	9,36
9	57,9	28,5	26,1	27,10	12,65	14,26
10	57,2	25,7	26,0	26,80	12,45	14,08
11	49,2	22,1	20,0	11,24	6,40	4,74
12	48,1	20,4	21,1	12,79	6,07	6,53
13	46,4	22,4	20,6	13,13	6,93	5,95
14	52,7	23,1	20,9	16,38	9,59	6,61
15	56,6	26,1	21,1	17,69	8,82	8,80
16	51,0	22,9	23,3	17,29	8,50	8,56
17	53,4	25,3	22,2	16,52	8,19	8,13
18	53,4	24,7	22,7	19,62	9,84	9,63
19	58,7	27,1	26,4	23,92	13,31	10,39
20	43,2	24,1	18,5	7,89	4,56	3,22
21	46,4	22,6	19,3	11,40	5,79	5,44
22	47,2	22,5	20,1	11,11	6,33	4,67
23	51,8	24,2	21,4	14,45	8,49	5,85
24	47,9	20,5	20,3	11,87	6,45	5,21
25	48,5	22,2	22,0	14,90	7,52	7,23
26	49,3	24,0	22,6	15,34	7,70	7,46
27	53,1	24,1	21,1	13,84	7,50	6,13
28	52,4	26,4	21,1	17,09	9,01	7,87
29	44,0	21,3	19,5	9,40	5,39	3,90
30	46,0	22,5	27,5	9,64	5,00	4,46
31	52,5	24,9	19,5	14,02	7,31	6,52
32	51,9	22,7	20,0	14,40	7,16	7,17
33	56,1	22,5	25,2	19,36	8,60	10,54
34	53,6	25,2	22,5	18,46	9,43	8,8
35	54,9	27,0	21,3	16,89	10,18	6,46
36	54,5	22,1	22,5	19,83	10,53	9,16
37	59,1	29,0	24,3	22,78	11,98	10,65
38	55,3	27,7	23,1	20,41	10,95	9,18
39	41,0	19,3	18,0	8,19	4,13	3,70
40	46,8	22,4	18,4	11,58	5,93	5,44
41	47,3	23,1	19,4	11,74	6,91	4,71
42	45,7	20,7	20,8	12,61	5,43	6,97
43	46,4	24,5	17,0	9,67	5,50	4,05
44	46,6	21,3	19,3	10,86	5,66	4,82
45	48,5	23,5	21,7	13,62	6,49	7,00
46	55,5	27,5	20,0	15,63	9,02	6,38
47	52,5	25,6	21,9	15,32	9,19	5,92
48	57,0	24,3	22,3	18,27	8,74	8,88
49	56,0	25,4	22,1	17,98	9,07	8,68
50	57,1	28,3	23,4	22,56	11,42	10,88
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	51,10	24,00	21,60	15,39	7,99	7,21
Stdev	4,48	2,23	2,20	4,56	2,32	2,41
Min	41,00	19,30	17,00	7,89	2,87	3,22
Max	59,10	29,00	27,50	27,10	13,31	14,26

Species:	**Blue mussel (*Mytilus edulis*)**		Date of sampling:	**14.08.2010**		
Length:	4-6 cm		Sampled by:	Marine Inst.		
Location:	**Hvassahraun**		Date of preparation	23.09.2011		
Coordinates:	64°01,205-22°09,526		Matis#:	R11-2123-4		
	Length (mm)	**Width (mm)**	**Height (mm)**	**Total weight (g)**	**Weight soft body (g)**	**Weight shell (g)**
1	54,0	27,3	22,7	17,85	9,55	8,04
2	55,2	30,5	23,4	19,68	11,63	7,73
3	55,0	27,2	25,7	21,56	10,33	10,69
4	54,8	28,0	23,0	19,03	9,84	8,89
5	50,8	25,2	22,4	15,39	8,04	7,22
6	51,3	26,4	24,1	19,20	9,83	9,27
7	51,2	26,1	20,8	15,52	8,27	7,03
8	47,5	24,5	23,5	14,78	8,11	6,50
9	48,5	25,4	20,5	13,48	7,71	5,61
10	53,6	26,9	22,5	17,20	9,22	7,58
11	52,8	26,3	24,1	18,46	10,80	7,43
12	51,3	25,8	22,6	15,31	8,85	6,27
13	47,4	24,0	21,5	12,84	6,31	6,32
14	52,7	26,7	21,7	16,27	8,83	7,34
15	39,7	26,7	22,6	14,22	7,36	6,79
16	54,2	25,5	24,1	18,11	10,14	7,71
17	48,5	26,4	20,2	12,71	7,27	5,29
18	54,2	26,1	21,4	16,13	9,64	6,44
19	47,9	24,6	21,4	13,13	6,85	5,98
20	47,0	24,8	20,6	13,04	6,19	6,32
21	41,6	24,2	18,2	8,99	4,42	4,24
22	46,8	24,9	20,4	11,98	6,18	5,62
23	47,8	24,8	21,4	12,78	6,79	5,93
24	46,3	25,0	21,5	12,80	6,90	5,80
25	46,5	23,6	19,9	11,12	6,20	4,79
26	49,1	28,7	19,8	14,16	8,49	5,57
27	52,7	26,0	22,0	16,37	9,24	6,92
28	56,6	27,2	23,8	21,85	11,95	9,63
29	51,3	26,9	21,5	16,47	9,57	6,84
30	51,3	28,1	25,6	23,50	12,08	11,33
31	42,9	23,0	18,1	9,88	5,74	4,05
32	49,9	26,0	21,3	15,80	8,05	7,62
33	47,3	27,7	21,1	14,47	7,75	6,60
34	51,1	26,6	22,7	15,85	7,99	7,40
35	57,9	26,1	25,6	24,28	12,91	11,22
36	52,6	25,7	23,6	16,74	9,21	7,41
37	52,9	26,2	20,9	14,60	8,66	5,70
38	53,7	27,3	23,3	19,05	10,84	8,12
39	51,1	25,4	22,3	16,19	8,43	7,44
40	56,5	28,0	24,7	22,71	12,87	9,66
41	44,6	25,3	16,6	9,58	5,22	4,27
42	46,2	26,0	21,8	13,97	7,49	6,40
43	50,6	25,9	19,6	12,79	7,23	5,45
44	47,0	25,8	19,2	10,90	6,49	4,32
45	48,8	25,1	21,3	14,20	6,81	6,31
46	50,1	25,8	21,4	15,02	7,81	7,03
47	51,5	25,6	24,0	17,10	10,42	6,55
48	57,3	27,7	25,3	22,08	12,68	9,29
49	55,1	27,7	22,0	18,68	10,50	8,04
50	55,9	26,0	25,5	19,74	11,00	8,65
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	50,61	26,13	22,06	15,95	8,69	7,05
Stdev	4,06	1,37	2,02	3,62	2,06	1,70
Min	39,70	23,00	16,60	8,99	4,42	4,05
Max	57,90	30,50	25,70	24,28	12,91	11,33

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**14.08.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Straumur,Straumsvík**	Date of preparation	04.10.2011
Coordinates:	64°02,541-22°02,700	Matis#:	R11-2123-5

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	44,8	22,1	15,6	7,74	4,16	3,42
2	47,1	22,1	18,3	9,73	5,73	3,87
3	48,1	23,3	18,0	10,06	5,59	4,34
4	44,6	23,8	18,0	9,47	5,10	4,13
5	49,9	24,0	19,3	11,98	6,80	5,00
6	42,8	22,2	16,6	8,06	4,33	3,65
7	47,6	23,5	18,3	10,22	6,42	3,77
8	48,0	25,0	18,2	11,16	6,34	4,71
9	53,7	27,0	21,8	15,42	9,57	5,74
10	54,6	26,9	22,8	15,57	8,85	6,10
11	43,9	21,1	18,2	9,43	5,31	4,04
12	47,2	24,5	15,6	10,86	6,26	4,53
13	46,1	22,8	17,3	10,06	5,81	4,24
14	45,0	21,7	17,1	7,76	3,71	4,02
15	48,3	22,8	19,5	11,20	6,63	4,50
16	49,4	22,2	19,5	12,17	6,85	5,27
17	52,2	23,9	18,9	13,74	7,74	5,83
18	52,8	28,9	19,5	15,18	8,95	6,11
19	52,2	26,1	18,9	12,86	8,02	4,81
20	57,1	26,1	21,1	15,70	9,04	6,57
21	41,7	19,5	17,8	8,74	4,74	3,87
22	42,8	20,6	16,7	8,67	4,82	3,81
23	41,7	19,5	13,9	7,09	3,76	3,25
24	40,6	21,7	16,1	8,02	4,36	3,49
25	46,1	21,7	18,3	10,54	5,81	4,65
26	50,6	23,9	18,3	11,62	6,16	5,20
27	50,6	26,1	20,0	12,76	7,20	5,38
28	53,3	27,2	26,1	16,37	8,74	7,53
29	57,8	28,3	22,7	18,79	11,33	7,35
30	58,3	29,0	23,9	21,83	12,65	9,00
31	40,3	19,8	17,4	7,33	3,94	3,31
32	41,7	20,2	15,9	6,08	3,49	2,51
33	39,4	21,1	16,3	6,74	3,85	2,78
34	48,0	23,0	19,5	10,82	5,31	5,35
35	45,8	23,2	19,5	10,23	5,28	4,76
36	43,8	22,2	18,6	9,17	4,96	4,13
37	53,8	23,3	22,1	13,63	7,19	6,29
38	50,5	19,9	22,6	13,83	7,26	6,43
39	49,6	24,6	20,1	11,99	6,57	5,33
40	47,7	21,2	18,8	10,05	5,83	4,16
41	43,0	22,0	17,8	8,64	4,76	3,79
42	41,2	20,1	16,0	8,09	3,91	4,07
43	43,3	22,0	16,5	7,09	4,24	2,79
44	48,3	23,3	17,8	10,73	5,91	4,75
45	37,0	22,5	22,0	13,90	6,80	6,92
46	45,3	23,3	18,0	9,59	6,10	3,34
47	50,9	25,0	20,0	11,98	7,12	4,61
48	64,5	29,1	27,1	25,77	14,22	10,96
49	62,3	27,0	24,4	23,06	13,37	9,45
50						

	Length	Width	Height	Total weight	Weight soft body	Weight shell
Average	48,07	23,48	19,12	11,66	6,55	4,98
Stdev	5,87	2,59	2,76	4,17	2,47	1,72
Min	37,00	19,50	13,90	6,08	3,49	2,51
Max	64,50	29,10	27,10	25,77	14,22	10,96

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**09.09.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Mjóifjörður I, head-Fjörður**	Date of preparation	22.09.2011
Coordinates:	65°11,28-14°00,48	Matis#:	R11-2123-6

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	47,1	23,1	20,0	12,06	6,27	5,57
2	51,7	22,5	21,8	13,66	7,63	5,88
3	50,5	25,1	18,3	11,75	6,69	4,92
4	51,4	24,8	20,9	15,76	9,12	6,51
5	53,1	25,2	21,3	16,58	8,75	7,49
6	53,6	25,1	21,6	13,70	7,38	5,92
7	53,8	24,7	24,2	16,60	9,33	6,82
8	53,2	27,0	21,7	18,49	11,34	7,06
9	48,2	21,4	18,5	11,23	5,79	5,39
10	56,1	27,1	22,3	18,22	10,90	6,93
11	58,4	25,0	23,3	19,80	10,51	9,27
12	56,1	28,3	24,0	21,74	12,23	9,43
13	53,3	29,4	24,9	17,27	6,96	10,23
14	52,8	24,0	20,0	15,15	8,60	6,52
15	53,4	23,9	20,0	14,67	7,53	6,93
16	51,7	25,0	22,2	15,60	8,62	6,86
17	59,4	23,3	20,0	11,73	6,03	5,53
18	51,0	24,5	20,0	13,65	6,98	6,63
19	50,5	22,8	20,6	13,96	8,43	5,52
20	50,5	24,5	19,9	13,19	6,80	6,33
21	54,5	25,0	21,1	17,23	8,51	8,62
22	52,2	23,3	20,0	14,36	7,94	6,17
23	53,3	22,6	20,1	15,71	8,34	7,22
24	50,4	23,9	17,8	11,45	6,03	5,31
25	48,3	22,2	17,8	8,11	3,92	4,13
26	48,3	22,8	16,1	9,94	4,98	4,89
27	47,8	21,7	18,3	10,28	6,32	3,87
28	50,4	22,2	18,3	11,51	5,71	5,74
29	46,7	21,6	15,1	9,49	5,02	4,35
30	46,7	21,6	19,4	11,54	6,01	5,43
31	57,8	26,2	22,3	18,90	10,64	8,13
32	58,3	24,5	22,7	18,72	9,63	9,01
33	48,4	22,2	20,6	12,11	6,30	5,78
34	49,5	24,5	19,5	12,83	6,01	6,81
35	41,2	22,2	17,7	10,60	5,25	4,95
36	48,9	23,9	19,4	12,22	6,40	5,77
37	57,2	21,1	17,8	10,64	6,10	4,40
38	42,3	20,1	17,2	8,00	3,61	4,36
39	46,1	20,6	16,1	8,75	5,42	3,27
40	44,5	21,7	16,1	9,07	4,48	4,46
41	61,2	28,9	24,5	24,22	13,17	10,64
42	58,9	27,2	22,2	20,10	9,46	10,55
43	57,2	27,2	22,8	19,71	11,02	8,62
44	53,9	24,5	20,0	14,14	6,35	7,59
45	52,3	25,0	18,4	12,93	7,25	5,59
46	51,1	22,2	21,7	15,06	7,74	7,24
47	48,9	23,4	23,4	16,14	7,69	8,42
48	42,2	20,0	17,3	9,65	4,97	4,65
49	45,0	21,7	16,7	9,60	5,52	4,01
50	41,2	22,2	17,3	10,02	5,60	4,34
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	51,21	23,86	20,06	13,96	7,43	6,40
Stdev	4,82	2,21	2,43	3,79	2,17	1,82
Min	41,20	20,00	15,10	8,00	3,61	3,27
Max	61,20	29,40	24,90	24,22	13,17	10,64

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**9.9.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Mjóifjörður II, Hofsá-brekka**	Date of preparation	19.9.2011
Coordinates:	65°12,156-13°47,733	Matis#:	R12-2123-7

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	46,5	20,2	18,8	8,69	4,39	4,11
2	45,7	22,2	17,5	10,27	4,62	5,15
3	48,9	22,6	18,6	11,88	4,96	6,58
4	47,4	22,4	18,0	10,49	4,64	5,61
5	52,0	23,4	17,8	10,73	5,94	4,53
6	52,8	25,6	17,9	11,95	6,20	5,41
7	55,5	26,6	21,3	17,77	9,52	7,86
8	64,1	26,8	23,1	20,30	12,29	7,6
9	64,8	28,8	22,0	21,49	12,82	8,36
10	64,2	29,5	23,3	22,14	13,68	8,17
11	43,2	20,4	15,8	7,46	4,13	3,22
12	44,6	21,5	15,5	8,56	4,55	3,87
13	43,1	20,0	17,2	8,49	4,32	3,88
14	48,7	21,2	17,9	9,15	4,74	4,22
15	50,7	23,3	18,9	12,35	6,87	5,28
16	50,5	24,8	20,4	14,62	6,92	7,26
17	54,5	25,3	19,5	13,44	7,38	5,71
18	54,3	27,1	21,1	16,30	8,96	7,07
19	58,3	28,0	19,9	11,44	5,57	5,59
20	58,4	28,5	21,8	18,15	10,68	7,36
21	45,3	21,5	17,1	9,22	4,96	4,04
22	46,3	24,0	19,1	12,64	6,03	6,37
23	51,2	24,4	20,4	13,76	7,45	5,99
24	51,6	24,3	21,3	15,03	8,09	6,77
25	51,6	23,9	21,4	14,00	7,26	6,49
26	51,4	24,5	18,9	12,57	6,58	5,61
27	51,4	23,7	19,4	12,18	7,22	4,68
28	52,7	26,0	24,1	18,80	9,99	8,71
29	60,0	28,7	23,7	21,57	11,63	9,69
30	60,6	19,6	21,3	16,87	9,42	6,91
31	41,2	20,7	17,8	8,83	4,20	4,24
32	43,5	20,4	17,0	8,15	4,42	3,69
33	49,2	21,0	18,9	11,11	6,28	4,63
34	48,8	23,6	19,5	12,74	7,04	5,61
35	49,8	22,9	18,0	10,84	6,20	4,5
36	55,2	25,4	21,8	13,98	7,86	5,96
37	57,0	26,0	21,4	16,38	9,19	6,49
38	56,1	28,2	21,4	13,68	7,63	5,25
39	61,1	27,9	21,1	18,17	11,83	5,85
40	66,0	30,4	26,6	23,83	14,23	9,27
41	43,9	20,9	17,2	9,53	4,84	4,59
42	44,8	22,1	17,0	8,95	5,03	3,78
43	45,5	21,6	19,0	8,38	3,40	4,9
44	44,5	20,9	17,8	8,76	3,78	4,87
45	51,0	23,5	19,7	14,24	7,85	6,22
46	45,3	21,0	18,0	8,88	4,73	3,97
47	50,2	24,5	20,5	12,45	6,69	5,63
48	54,0	25,3	21,5	14,95	8,92	5,91
49	55,2	26,8	21,3	18,01	8,64	8,81
50	63,0	29,5	23,0	20,78	12,64	7,95
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	51,9	24,2	19,8	13,50	7,34	5,88
Stdev	6,5	2,9	2,3	4,32	2,83	1,61
Min	41,2	19,6	15,5	7,46	3,40	3,22
Max	66,0	30,4	26,6	23,83	14,23	9,69

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**09.09.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Mjóifjörður III, Dalatangi**	Date of preparation	05.09.2011
Coordinates:	65°16,101-13°34,564	Matis#:	R11-2123-8

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	39,2	19,2	14,5	5,93	2,01	3,49
2	50,1	23,4	21,7	16,65	8,05	8,48
3	48,4	23,9	21,0	13,08	4,10	8,49
4	47,0	24,8	19,4	12,78	5,44	6,98
5	46,8	23,9	17,8	10,10	3,62	6,27
6	47,2	21,6	17,6	10,64	4,09	6,11
7	47,0	24,2	18,4	10,79	3,58	7,08
8	51,1	24,9	21,2	16,42	7,65	8,48
9	52,2	25,0	21,7	17,94	8,37	9,30
10	48,3	24,0	22,3	15,48	5,40	9,74
11	40,6	18,6	16,9	7,60	3,31	4,07
12	40,0	19,7	18,2	8,80	4,14	4,44
13	43,5	22,5	17,4	9,84	4,18	5,48
14	43,6	21,2	17,7	9,90	4,74	4,99
15	46,0	21,5	17,8	9,50	5,13	3,95
16	44,1	20,3	19,0	9,11	4,76	4,22
17	52,4	24,4	18,8	12,55	6,92	5,45
18	51,3	25,7	19,9	18,28	7,62	10,55
19	52,1	23,7	22,8	16,50	7,14	9,18
20	47,0	23,9	22,2	15,79	7,39	8,29
21	42,5	20,3	17,1	7,72	4,19	3,37
22	43,0	21,5	20,4	11,62	5,78	5,65
23	48,6	22,3	17,9	11,48	5,56	5,76
24	49,9	25,3	22,3	18,19	8,04	9,90
25	50,7	26,9	22,6	20,10	10,03	10,68
26	42,0	20,7	16,7	8,25	3,84	4,22
27	44,5	21,8	15,9	9,29	4,40	4,69
28	45,3	20,2	18,3	8,63	3,73	4,69
29	44,3	22,1	19,5	10,33	5,33	4,84
30	48,5	24,7	17,9	10,99	6,00	4,58
31	46,7	22,9	15,7	8,15	3,99	3,75
32	42,5	20,1	17,5	8,66	4,33	4,16
33	42,5	22,4	17,8	9,56	3,99	5,35
34	44,2	21,5	18,2	10,07	4,26	5,52
35	47,0	22,7	16,9	9,20	4,62	4,47
36	43,3	20,4	18,9	8,58	3,88	4,46
37	51,4	23,8	20,8	15,15	6,43	8,45
38	52,6	24,9	18,6	11,98	3,98	7,71
39	54,1	24,3	21,4	14,26	6,73	7,52
40	52,3	22,5	19,3	13,52	6,02	7,40
41	41,8	21,5	17,6	8,93	4,42	4,33
42	41,4	21,8	17,2	8,04	4,07	3,86
43	41,9	20,8	18,6	9,47	4,24	5,16
44	46,4	20,9	17,4	8,63	5,11	3,36
45	47,3	23,6	18,7	12,51	5,65	6,65
46	47,0	22,4	24,8	15,92	6,64	9,07
47	49,8	23,0	21,4	16,88	8,16	8,30
48	54,5	23,0	22,9	15,44	6,98	8,33
49	53,5	24,2	22,1	17,71	7,79	9,72
50	53,1	24,5	21,7	16,39	8,13	8,24
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	47,01	22,67	19,25	12,07	5,48	6,38
Stdev	4,14	1,86	2,25	3,61	1,72	2,17
Min	39,20	18,60	14,50	5,93	2,01	3,36
Max	54,50	26,90	24,80	20,10	10,03	10,68

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**12.8.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Hvalstöð, Hvalfjörður**	Date of preparation	27.9.2011
Coordinates:	64°23,826-21°27,210	Matis#:	R11-2123-2

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	52,1	24,1	19,1	13,19	6,65	6,36
2	51,0	24,1	21,7	14,12	7,21	6,69
3	55,5	27,0	23,2	18,24	9,76	8,67
4	57,3	24,2	23,8	17,97	9,10	8,55
5	56,7	27,0	22,9	19,66	9,20	10,29
6	58,8	25,9	24,5	19,65	10,17	9,38
7	59,2	27,5	24,6	21,73	12,47	9,12
8	56,9	27,4	22,7	19,77	10,09	9,47
9	58,7	26,2	25,1	22,41	11,09	10,90
10	58,4	26,4	27,1	23,54	11,49	11,85
11	53,8	23,8	22,5	16,55	8,09	8,21
12	58,3	27,8	23,0	20,13	10,32	9,44
13	51,2	23,6	23,2	16,30	8,18	7,67
14	54,6	25,8	23,7	18,64	9,86	8,55
15	54,9	24,2	21,2	16,83	8,87	7,56
16	56,5	27,1	23,5	20,85	10,97	9,57
17	57,0	25,2	25,0	21,21	10,87	10,12
18	53,3	26,5	22,8	18,63	9,50	8,90
19	55,0	25,3	23,3	18,59	9,42	8,97
20	55,1	27,3	23,9	20,30	9,95	10,02
21	44,0	23,0	19,2	9,09	4,83	4,17
22	55,0	25,9	19,8	15,45	7,85	7,35
23	59,2	25,0	24,1	21,74	11,05	10,38
24	48,0	24,9	22,4	13,14	7,35	5,66
25	57,0	25,7	24,8	21,06	10,02	10,75
26	56,5	25,7	22,5	17,33	9,02	8,07
27	55,2	27,7	23,3	21,15	10,06	10,72
28	57,7	28,3	22,8	19,60	11,08	8,37
29	56,9	26,0	26,3	20,80	11,03	9,53
30	55,0	25,8	22,2	17,65	9,37	7,97
31	62,0	28,4	26,0	26,29	14,07	12,04
32	60,0	28,2	28,6	29,24	15,16	13,87
33	60,0	26,2	26,1	23,70	12,60	10,84
34	58,7	26,0	24,2	20,54	11,34	9,05
35	57,1	25,9	26,7	22,97	12,77	10,02
36	58,9	25,5	25,4	21,60	10,97	10,27
37	53,6	24,3	25,0	19,89	9,57	10,04
38	47,5	25,4	18,0	10,53	4,95	5,00
39	56,0	25,2	23,6	19,32	10,22	8,84
40	50,6	23,2	22,9	16,28	8,74	7,20
41	48,2	22,2	21,8	12,63	6,33	5,96
42	58,5	27,5	23,8	20,92	11,32	9,26
43	55,2	24,4	24,5	19,65	9,39	9,77
44	50,5	24,8	21,4	14,75	7,99	6,52
45	52,1	22,5	21,5	14,97	7,74	7,04
46	59,6	26,0	24,8	24,99	11,59	12,83
47	57,2	24,0	25,3	22,24	10,76	11,24
48	58,3	28,0	23,5	21,96	11,20	10,45
49	60,2	25,6	25,8	24,23	12,68	11,09
50	62,0	27,1	25,0	27,09	12,66	13,56
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	55,70	25,70	23,56	19,38	9,94	9,16
Stdev	3,84	1,55	2,06	4,05	2,09	2,05
Min	44,00	22,20	18,00	9,09	4,83	4,17
Max	62,00	28,40	28,60	29,24	15,16	13,87

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**18.8.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Seljaland, Álftafjörður**	Date of preparation	3.11.2011
Coordinates:	65°58,29-23°04,50	Matis#:	R11-2123-10

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	49,1	23,7	18,6	10,82	6,20	4,53
2	49,5	23,0	23,1	14,22	8,07	5,93
3	49,5	22,2	20,9	10,83	6,55	4,03
4	42,5	22,0	16,8	8,32	4,40	3,75
5	51,7	24,6	20,0	12,93	7,13	5,74
6	46,6	21,8	20,3	10,67	6,17	4,42
7	50,7	23,7	21,0	13,66	7,46	6,16
8	47,3	23,1	17,4	10,10	5,98	3,93
9	51,0	24,2	19,8	12,76	7,14	5,56
10	52,1	27,0	22,5	15,07	8,79	6,24
11	47,8	21,7	18,5	9,20	5,68	3,43
12	47,2	24,2	20,2	10,55	5,93	4,57
13	47,4	23,6	18,9	10,70	6,34	4,28
14	46,1	23,7	19,2	11,12	6,33	4,75
15	49,7	23,7	20,7	12,33	7,97	4,27
16	46,9	23,6	18,5	10,39	6,52	3,75
17	47,7	24,2	19,2	10,82	6,52	4,14
18	54,4	24,0	22,7	15,46	8,80	6,62
19	55,8	26,1	21,3	15,80	9,03	6,64
20	58,3	27,6	24,2	19,59	11,68	7,76
21	45,3	22,3	17,9	8,37	4,78	3,50
22	46,0	22,1	18,2	8,36	4,54	3,75
23	46,4	22,4	19,2	9,91	5,86	3,94
24	45,5	20,7	16,9	8,25	5,11	3,08
25	49,3	24,2	18,3	10,96	6,98	3,93
26	47,4	22,5	20,5	10,73	6,55	4,12
27	50,3	23,8	22,0	13,18	8,50	4,62
28	52,5	24,6	20,3	13,74	8,06	5,51
29	50,7	26,9	22,3	15,02	8,47	6,43
30	49,0	24,1	19,1	11,97	6,87	5,00
31	44,9	21,3	22,0	11,35	6,39	4,81
32	46,5	22,3	19,7	9,83	5,59	4,12
33	48,2	21,2	20,9	11,75	6,60	5,10
34	49,0	24,2	18,6	10,59	6,09	4,42
35	50,8	23,5	19,8	11,17	7,17	3,90
36	49,3	21,8	22,9	12,33	7,43	4,85
37	50,0	24,9	20,9	10,54	5,63	4,83
38	48,8	22,8	21,1	12,11	7,02	5,05
39	50,3	25,2	18,7	11,70	7,15	4,50
40	54,8	24,3	22,6	16,46	9,27	7,02
41	44,1	22,7	19,3	10,32	5,05	5,12
42	46,2	20,4	21,6	11,08	6,28	4,66
43	47,0	22,7	19,5	10,40	5,92	4,27
44	46,4	22,2	20,2	11,44	5,52	5,68
45	47,8	22,8	18,5	10,54	5,62	4,76
46	54,1	25,1	21,4	14,04	8,08	5,74
47	50,2	23,7	21,3	13,10	6,98	5,85
48	48,7	24,4	21,5	12,85	7,46	5,23
49	51,4	25,4	21,5	13,93	8,66	5,16
50	53,1	25,8	21,9	15,82	8,03	7,49
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	49,1	23,6	20,2	11,94	6,89	4,94
Stdev	3,1	1,6	1,7	2,33	1,39	1,07
Min	42,5	20,4	16,8	8,25	4,40	3,08
Max	58,3	27,6	24,2	19,59	11,68	7,76

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**26.8.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Grímsey**	Date of preparation	24.10.2011
Coordinates:	66°33,134-18°01,407	Matís#	R11-2123-1

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	52,4	22,7	23,3	15,92	5,03	10,80
2	49,8	25,0	19,2	13,19	6,56	6,31
3	45,9	23,3	20,5	9,27	1,46	7,71
4	42,3	20,8	15,8	6,25	2,33	3,58
5	40,2	20,5	16,8	9,14	3,18	5,31
6	42,5	21,1	16,7	8,00	3,86	3,81
7	41,5	19,3	18,9	8,06	2,07	5,53
8	40,5	20,7	17,9	7,00	2,65	3,87
9	46,8	22,1	20,8	14,61	6,05	7,94
10	46,0	22,7	20,1	13,20	6,09	7,00
11	35,8	17,9	16,1	4,43	0,56	3,43
12	44,1	22,2	18,2	10,71	5,15	5,40
13	43,7	20,4	19,4	8,61	3,56	4,74
14	46,4	24,1	19,2	10,46	4,08	5,91
15	47,0	22,1	18,6	11,63	5,47	5,89
16	47,5	22,5	17,7	10,70	5,37	4,99
17	48,8	23,9	19,6	13,71	6,21	7,08
18	53,7	24,0	25,1	14,40	6,10	8,13
19	55,0	24,2	23,6	20,59	9,80	10,57
20	38,2	19,1	17,2	6,54	2,47	3,98
21	40,4	21,1	17,5	9,09	4,06	4,59
22	42,8	20,5	18,8	7,55	2,79	4,55
23	41,0	21,3	21,2	11,85	5,05	6,59
24	**	**	**	**	**	**
25	43,7	22,7	18,5	8,31	3,46	4,61
26	40,6	20,6	14,9	6,58	3,26	2,97
27	41,8	22,1	20,0	12,00	4,87	6,77
28	47,6	21,4	21,0	10,37	3,18	6,80
29	54,0	25,8	21,8	14,33	6,86	7,18
30	50,9	24,5	23,2	17,25	8,45	8,47
31	42,8	19,9	18,2	9,06	4,59	4,31
32	40,9	20,4	16,6	8,77	4,01	4,60
33	**	**	**	**	**	**
34	45,5	20,9	18,0	10,64	5,46	5,08
35	42,1	20,3	18,6	7,30	2,67	4,41
36	46,5	22,1	18,3	12,05	5,84	6,01
37	37,6	18,9	19,4	8,76	3,61	4,99
38	42,2	20,4	19,7	9,86	2,71	6,95
39	42,7	22,0	19,2	9,02	3,03	5,81
40	42,3	20,2	18,0	9,36	5,24	3,88
41	48,2	24,7	19,6	14,03	7,24	6,57
42	45,8	23,1	19,0	11,20	5,55	5,51
43	50,0	21,5	20,2	12,66	7,06	5,44
44	52,2	24,6	18,4	13,39	7,18	6,10
45	51,6	22,4	21,3	14,94	7,93	6,86
46	51,0	23,2	21,0	14,92	7,51	7,23
47	51,5	23,3	20,1	15,18	7,42	7,61
48	49,3	24,4	22,5	13,08	5,92	7,19
49	51,9	24,8	21,8	15,20	8,28	6,79
50	52,8	23,9	19,0	13,97	7,74	6,14
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	45,79	22,08	19,39	11,19	4,98	5,96
Stdev	4,83	1,84	2,11	3,31	2,07	1,69
Min	35,80	17,90	14,90	4,43	0,56	2,97
Max	55,00	25,80	25,10	20,59	9,80	10,80

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**12.8.2010**
Length:	4-6 cm	Sampled by:	Marine Inst.
Location:	**Hvammsvík**	Date of preparation	25.10.2011
Coordinates:	64°21,64-21°33,53	Matís#	R11-2123-3

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	42,2	19,2	19,9	8,81	4,70	3,89
2	44,1	24,3	21,4	12,32	6,84	5,27
3	46,3	21,2	16,9	8,55	4,37	4,04
4	49,0	24,1	19,6	12,98	7,24	5,44
5	47,4	21,5	20,0	11,19	6,47	4,56
6	47,3	21,2	21,1	11,35	6,26	4,89
7	49,3	21,8	22,3	14,79	7,40	7,22
8	45,7	21,5	19,6	10,91	4,92	5,68
9	47,6	24,9	20,8	12,60	6,97	5,44
10	53,0	26,6	22,3	15,36	9,32	5,86
11	49,0	25,7	20,9	13,25	7,59	5,54
12	57,1	21,2	19,3	10,01	5,44	4,51
13	45,6	24,9	20,7	14,13	7,50	6,51
14	51,3	22,8	20,1	12,44	7,11	5,27
15	52,0	26,8	20,2	16,82	9,03	7,53
16	50,3	23,7	22,3	16,16	8,37	7,63
17	52,9	26,1	22,4	16,22	9,31	6,73
18	55,7	25,7	23,1	16,86	10,34	6,40
19	57,7	26,5	25,5	21,98	12,87	8,95
20	57,9	27,6	23,5	20,14	11,42	8,61
21	44,6	21,1	19,8	10,28	5,51	4,68
22	46,1	21,6	21,1	12,15	7,20	4,84
23	47,4	23,9	21,5	13,02	6,65	6,30
24	47,5	23,5	21,0	12,87	7,64	5,15
25	47,2	23,7	19,2	11,40	6,35	4,96
26	52,3	23,2	21,0	14,75	8,19	6,45
27	51,7	23,7	23,1	15,65	8,50	7,00
28	52,8	26,7	21,6	16,21	9,76	6,33
29	57,5	25,6	21,2	17,39	8,99	8,24
30	58,3	27,2	24,0	21,81	11,84	9,86
31	44,2	21,0	17,7	8,07	4,89	3,05
32	40,7	20,8	17,6	8,73	4,80	3,81
33	45,6	21,3	21,3	11,51	6,24	5,15
34	49,5	23,8	19,6	12,14	6,69	5,37
35	45,3	23,2	21,7	11,72	7,40	4,25
36	53,0	24,1	20,4	14,11	8,37	5,60
37	51,1	25,4	19,4	14,20	7,26	6,83
38	48,5	24,0	20,7	13,85	7,44	6,32
39	50,3	25,1	19,9	13,42	7,62	5,68
40	55,9	24,6	23,5	17,04	9,37	7,58
41	43,1	22,0	18,7	9,16	5,51	3,56
42	44,9	21,9	16,7	9,23	4,63	4,49
43	45,4	20,2	18,9	10,88	5,97	4,75
44	51,2	24,5	22,0	14,48	8,20	6,03
45	50,4	25,5	20,8	14,18	7,70	6,34
46	46,3	22,2	20,8	12,51	6,56	5,84
47	47,7	24,5	23,2	13,06	7,10	5,84
48	47,7	24,3	21,9	14,03	7,82	6,12
49	49,9	24,6	21,4	12,94	7,45	5,40
50	42,6	22,3	18,3	9,35	5,33	3,85
	Length	**Width**	**Height**	**Total weight**	**Weight soft body**	**Weight shell**
Average	49,20	23,66	20,80	13,34	7,41	5,79
Stdev	4,42	2,04	1,81	3,16	1,86	1,42
Min	40,70	19,20	16,70	8,07	4,37	3,05
Max	58,30	27,60	25,50	21,98	12,87	9,86

Species:	**Blue mussel (*Mytilus edulis*)**	Date of sampling:	**12.8.2010**
Length:	4-6 cm	Sampled by:	Marine. Inst.
Location:	**Naust Laxárvogi, Hvalfjörður**	Date of preparation	27.10.2011
Coordinates:	64°20,20-21°41,09	Matis#:	R11-2123-11

	Length (mm)	Width (mm)	Height (mm)	Total weight (g)	Weight soft body (g)	Weight shell (g)
1	45,5	24,1	18,0	10,07	5,50	4,49
2	52,7	26,3	22,9	18,36	9,12	9,13
3	55,7	27,3	21,0	16,24	9,82	6,24
4	56,8	27,6	24,8	20,70	11,41	9,11
5	59,8	29,9	25,9	25,58	14,50	10,97
6	58,5	30,3	26,1	24,18	13,26	10,53
7	60,6	30,9	22,5	23,81	12,97	10,66
8	59,8	29,7	24,8	26,67	13,44	13,03
9	62,6	31,2	27,2	17,83	7,79	9,79
10	45,1	22,3	17,2	8,20	4,87	3,17
11	45,6	23,3	17,8	8,73	5,36	3,26
12	43,0	22,7	19,1	10,70	5,80	4,79
13	48,6	23,5	20,4	11,35	6,93	4,32
14	50,5	24,6	20,8	13,35	7,61	5,67
15	49,8	23,2	20,8	13,50	7,65	5,76
16	51,2	26,7	20,6	13,83	8,62	5,10
17	62,2	29,0	26,8	26,32	15,09	11,12
18	60,1	30,3	24,5	24,00	13,05	10,76
19	44,9	23,4	18,7	9,43	5,77	3,45
20	46,8	22,9	19,7	11,11	7,02	4,01
21	50,9	23,1	20,8	15,58	8,00	7,29
22	52,7	26,9	22,0	16,59	9,09	7,30
23	52,8	26,2	22,6	16,45	8,99	7,32
24	53,5	27,4	24,0	18,72	10,13	8,49
25	61,0	28,0	26,9	25,92	14,04	11,64
26	58,5	26,5	27,6	23,34	13,14	9,94
27	62,3	28,1	28,2	26,56	15,44	10,93
28	59,4	31,1	25,9	26,77	14,17	12,44
29	46,9	21,7	19,1	10,37	5,53	4,68
30	46,1	24,3	17,0	10,00	5,76	4,15
31	43,8	21,8	18,1	9,98	5,54	4,29
32	48,3	26,3	19,7	13,35	6,89	6,27
33	56,1	29,6	22,9	22,68	11,26	10,77
34	55,8	28,1	23,1	19,35	11,22	7,99
35	54,3	27,0	25,6	19,85	11,52	8,17
36	56,8	29,1	24,5	21,10	12,56	8,36
37	60,3	27,8	26,2	25,69	13,81	11,76
38	58,1	29,0	23,9	21,94	12,91	8,91
39	40,1	21,9	16,1	6,62	3,48	2,90
40	41,2	24,1	17,5	8,13	4,81	3,15
41	48,5	24,1	24,2	13,67	7,78	5,62
42	43,3	24,2	18,4	11,62	5,33	5,81
43	48,5	24,3	18,7	10,97	5,94	4,88
44	50,7	29,5	20,5	13,66	8,56	4,94
45	52,0	24,3	23,3	16,48	9,42	6,83
46	53,4	27,0	23,1	17,60	9,85	7,60
47	57,0	27,2	25,1	21,05	12,01	8,72
48	57,2	32,6	27,0	27,14	14,04	12,78
49	60,6	28,8	29,3	29,08	16,37	12,39
50	**	**	**	**	**	**

	Length	Width	Height	Total weight	Weight soft body	Weight shell
Average	52,9	26,5	22,5	17,43	9,66	7,59
Stdev	6,3	2,9	3,5	6,41	3,48	3,02
Min	40,1	21,7	16,1	6,62	3,48	2,90
Max	62,6	32,6	29,3	29,08	16,37	13,03

Appendix II.

Biological measurements of Cod (*Gadus morhua*) 2010

Species:	**Cod (*Gadus Morhua*)**		**exped./station**			**date**	**n**
Location:	**North- Northwest of Iceland (2)**		TJ1-2011			11,03,2011	25
Lenght:	30-45cm	n	station	°N	°W		
Ship:	Jón Vídalín	3	79	661995	254349		
Expd.leader:	Hjalti Karlsson	22	80	662150	254390		
						R12-383-1	

Group	exped.-station	Weight jar IFL g	Weight jar and liver g	Weight liver g	Weight ungutted fish, g	Sex 2=female 1=male	Lenght cm	Weight gutted fish, g	Weight fillets g	Age
H 1	80	98,67	109,11	10,44	330	2	35	298	95	3
	80	102,36	114,87	12,51	203	2	30	182	58	3
	80	98,76	112,74	13,98	435	2	37	369	138	3
	80	99,07	114,55	15,48	404	2	36	352	102	3
			Sum	52,41	1372,0		138,0	1201,0	393,0	12,0
			Average	13,10	343,0		34,5	300,3	98,3	3,0
			STDEV	2,15	103,2		3,1	84,4	32,8	0,0
			Min	10,44	203,0		30,0	182,0	58,0	3,0
			Max	15,48	435,0		37,0	369,0	138,0	3,0
H 2	80	105,95	123,83	17,88	385	2	35	313	110	3
	80	99,14	117,29	18,15	336	1	34	283	66	3
	80	98,25	119,44	21,19	398	2	35	340	120	3
	79	98,82	120,93	22,11	455	2	36	392	134	3
	80	98,46	120,83	22,37	480	1	36	411	140	3
			Sum	101,70	2054,0		176,0	1739,0	570,0	15,0
			Average	20,34	410,8		35,2	347,8	114,0	3,0
			STDEV	2,17	57,4		0,8	53,4	29,3	0,0
			Min	17,88	336,0		34,0	283,0	66,0	3,0
			Max	22,37	480,0		36,0	411,0	140,0	3,0
H 3	80	98,30	125,00	26,70	388	2	35	322	109	3
	80	98,71	128,28	29,57	658	1	40	572	173	3
	80	98,46	129,29	30,83	521	1	38	430	134	3
	80	98,46	130,92	32,46	419	2	35	345	96	4
	80	99,05	133,91	34,86	433	2	37	354	125	3
			Sum	154,42	2419,0		185,0	2023,0	637,0	16,0
			Average	30,88	483,8		37,0	404,6	127,4	3,2
			STDEV	3,06	109,2		2,1	102,0	29,4	0,4
			Min	26,70	388,0		35,0	322,0	96,0	3,0
			Max	34,86	658,0		40,0	572,0	173,0	4,0
H 4	80	98,64	135,16	36,52	681	2	41	575	190	3
	80	98,59	139,96	41,37	623	1	39	537	186	3
	80	98,64	140,44	41,80	610	1	38	502	181	3
	80	99,06	141,02	41,96	521	1	37	430	114	3
			Sum	161,65	2435,0		155,0	2044,0	671,0	12,0
			Average	40,41	608,8		38,8	511,0	167,8	3,0
			STDEV	2,61	66,1		1,7	61,7	36,0	0,0
			Min	36,52	521,0		37,0	430,0	114,0	3,0
			Max	41,96	681,0		41,0	575,0	190,0	3,0
H5	80	98,68	144,80	46,12	635	2	39	527	177	3
	79	98,86	145,76	46,90	685	2	43	591	189	3
	80	102,88	150,49	47,61	668	2	41	541	188	3
	80	97,73	147,31	49,58	693	2	40	564	202	3
	80	98,55	149,88	51,33	706	1	42	601	212	3
			Sum	241,54	3387,0		205,0	2824,0	968,0	15,0
			Average	48,31	677,4		41,0	564,8	193,6	3,0
			STDEV	2,12	27,4		1,6	31,6	13,6	0,0
			Min	46,12	635,0		39,0	527,0	177,0	3,0
			Max	51,33	706,0		43,0	601,0	212,0	3,0
H6	79	98,81	156,79	57,98	697	2	42	584	206	3
	80	98,65	162,50	63,85	707	2	41	587	240	3
			Sum	121,83	1404,0		83,0	1171,0	446,0	12,0
			Average	60,92	702,0		41,5	585,5	223,0	3,0
			STDEV	4,15	7,1		0,7	2,1	24,0	0,0
			Min	57,98	697,0		41,0	584,0	206,0	3,0
			Max	63,85	707,0		42,0	587,0	240,0	3,0
H1, H2, H3, H4, H5, H6			**Sum**	833,55	13071,0		942,0	11002,0	3685,0	76,0
			Average	33,34	522,8		37,7	440,1	147,4	3,0
			STDEV	15,11	147,5		3,1	122,0	48,4	0,2
			Min	10,44	203,0		30,0	182,0	58,0	3,0
			Max	63,85	707,0		43,0	601,0	240,0	4,0

Species:	**Cod (*Gadus Morhua*)**	**exped./station**			**date**	**n**
Location:	**Northeast of Iceland**	TB1-2011	651540	113940	12,03,2011	25
Lenght:	30-45cm					
Ship:	Bjartur NK					
Expd.leader:	Valur Bogason			**R12-383-2**		

Group	exped.-station	Weight jar IFL g	Weight jar and liver g	Weight liver g	Weight ungutted fish, g	Sex 2=female 1=male	Lenght cm	Weight gutted fish, g	Weight fillets g	Age
H 1	72	98,74	110,38	11,64	331	2	35,0	290	76	4
	72	102,40	115,27	12,87	378	1	35,0	315	88	3
	72	98,70	112,90	14,20	503	2	39,0	425	126	4
	72	98,68	113,49	14,81	414	2	35,0	360	99	3
	72	99,05	114,77	15,72	430	2	36,0	365	126	3
	72	99,02	114,99	15,97	322	2	34,0	275	85	4
			Sum	85,21	2378,0	11,0	214,0	2030,0	600,0	21,0
			Average	14,20	396,3	1,8	35,7	338,3	100,0	3,5
			STDEV	1,68	67,8	0,4	1,8	55,8	21,4	0,5
			Min	11,64	322,0	1,0	34,0	275,0	76,0	3,0
			Max	15,97	503,0	2,0	39,0	425,0	126,0	4,0
H 2	72	98,55	117,97	19,42	705	1	43,0	595	197	5
	72	98,19	119,23	21,04	338	2	35,0	280	85	3
	72	98,62	120,88	22,26	450	1	37,0	380	98	4
	72	99,21	123,72	24,51	438	1	37,0	370	133	4
			Sum	87,23	1931,0		152,0	1625,0	513,0	16,0
			Average	21,81	482,8		38,0	406,3	128,3	4,0
			STDEV	2,14	156,4		3,5	133,6	50,1	0,8
			Min	19,42	338,0		35,0	280,0	85,0	3,0
			Max	24,51	705,0		43,0	595,0	197,0	5,0
H 3	72	98,41	123,85	25,44	539	2	40,0	440	116	4
	72	99,25	125,03	25,78	493	2	38,0	410	126	4
	72	98,93	125,99	27,06	454	2	38,0	380	119	4
	72	98,82	126,08	27,26	577	1	40,0	480	145	4
	72	98,88	126,19	27,31	474	1	37,0	385	110	4
	72	99,00	127,89	28,89	534	1	39,0	445	134	4
			Sum	161,74	3071,0		232,0	2540,0	750,0	24,0
			Average	26,96	511,8		38,7	423,3	125,0	4,0
			STDEV	1,24	46,1		1,2	38,7	12,8	0,0
			Min	25,44	454,0		37,0	380,0	110,0	4,0
			Max	28,89	577,0		40,0	480,0	145,0	4,0
H 4	72	97,91	130,18	32,27	498	1	39,0	420	132	4
	72	99,61	132,17	32,56	520	2	39,0	440	130	4
	72	98,88	131,77	32,89	600	2	42,0	500	141	4
	72	98,94	131,93	32,99	581	2	41,0	475	157	4
	72	99,32	135,05	35,73	673	1	43,0	545	172	4
	72	98,45	138,09	39,64	571	1	40,0	475	138	4
			Sum	206,08	3443,0		244,0	2855,0	870,0	24,0
			Average	34,35	573,8		40,7	475,8	145,0	4,0
			STDEV	2,88	62,0		1,6	44,2	16,3	0,0
			Min	32,27	498,0		39,0	420,0	130,0	4,0
			Max	39,64	673,0		43,0	545,0	172,0	4,0
H5	72	98,48	144,53	46,05	754	1	45,0	610	195	4
	72	104,88	151,79	46,91	736	1	43,0	605	171	4
			Sum	92,96	1490,0		88,0	1215,0	366,0	8,0
			Average	46,48	745,0		44,0	607,5	183,0	4,0
			STDEV	0,61	12,7		1,4	3,5	17,0	0,0
			Min	46,05	736,0		43,0	605,0	171,0	4,0
			Max	46,91	754,0		45,0	610,0	195,0	4,0
H6	72	98,65	158,48	59,83	765	1	44,0	620	181	4
			Sum	59,83	765,0		44,0	620,0	181,0	4,0
			Average	59,83	765,0		44,0	620,0	181,0	4,0
			STDEV							
			Min	59,83	765,0		44,0	620,0	181,0	4,0
			Max	59,83	765,0		44,0	620,0	181,0	4,0
H1, H2, H3, H4, H5, H6			**Sum**	693,05	13078,0		974,0	10885,0	3280,0	97,0
			Average	27,72	523,1		39,0	435,4	131,2	3,9
			STDEV	11,75	129,5		3,1	102,1	33,8	0,4
			Min	11,64	322,0		34,0	275,0	76,0	3,0
			Max	59,83	765,0		45,0	620,0	197,0	5,0

Appendix III.

Quality assurance in metal analysis and persistent organochlorines analysis

Table 2. Results for trace metals in certified reference materials (DOLT-3, Quasimeme R93 and Mussel tissue) for the year 2011.

Analyte		QTM093BT Quasimeme R68 µg/g	I Z-scoreI	DOLT-3 NRC-CNRC mg/kg	I Z-score*I	Mussel tissue ERM-CE278 mg/kg	I Z-score*I	MLOD** mg/kg
As								
	Measured	2000,0		9,78		6,71		
	Certified	2,1	-0,2	10,2	-0,36	6,07	0,86	0,002
Cd								
	Measured	30,2		22,087		0,287		
	Certified			19,4	1,35	0,348	-0,93	0,03
Cu								
	Measured	151,0		35,242		7,675		
	Certified	168,3	-0,2	31,2	1,36	9,45	-1,65	0,002
Hg								
	Measured	106,00				0,183		
	Certified	116,5	-0,4			0,196	-0,33	0,06
Pb								
	Measured	3,0		0,329		1,67		
	Certified	7,1	-1,2	0,32	0,16	2,00	-1,15	0,04
Se								
	Measured	311,0				9,136		
	Certified	320	-0,2			7,06	2,47	
Zn								
	Measured	3,0		86,89				
	Certified	2,8	0,2	86,6	0,04			

* Z-score (calculated accoding to method SV-22-02 SN-1 in Matís quality manual)

** MLOD is on dry weight basis

NA: not analyzed

Table 3. Results for trace metals in certified reference materials (DORM-3 and Quasimeme R68) for the year 2011.

Analyte		QTM094BT Quasimeme R68 µg/g	I Z-scoreI	DORM-3 NRC-CNRC mg/kg	I Z-score*I	MLOD** mg/kg
As						
	Measured	10,00		8,126		
	Certified	9,42	0,5	6,88	1,51	0,002
Cd						
	Measured	26,00		0,300		
	Certified	26,02	0,0	0,29	0,18	0,03
Cu						
	Measured	2377,0		15,451		
	Certified	2422,0	-0,1	15,5	-0,03	0,002
Hg						
	Measured	81,00		0,352		
	Certified	75,21	0,3	0,382	-0,42	0,06
Pb						
	Measured	12,0		0,41		
	Certified	17,24	-1,1	0,395	0,2	0,04

* Z-score (calculated accoding to method SV-22-02 SN-1 in Matís quality manual)

** MLOD is on dry weight basis

NA: not analyzed

Table 4. Qualitative assurance. Persistent organochlorines (ng/g ww) in a certified mussel sample from QUASIMEME, that were analysed with the mussel samples from 2010

Blue mussel control								assign			
chemical	CRM	weight basis	anal. 1	anal. 2	anal.3	mean	SD	value	time	I Z I**	det. Lim.
CB28	QOR096BT	wet weight	0,16			0,16		0,15		0,32	0,02
CB31	QOR096BT	wet weight	0,1			0,10		0,10		0,00	0,02
CB52	QOR096BT	wet weight	0,26			0,26		0,26		0,00	0,02
CB101	QOR096BT	wet weight	1,12			1,12		1,10		0,13	0,01
CB105	QOR096BT	wet weight	0,22			0,22		0,21		0,26	0,01
CB118	QOR096BT	wet weight	0,94			0,94		0,92		0,16	0,01
CB138	QOR096BT	wet weight	2,1			2,10		2,28		-0,60	0,01
CB153	QOR096BT	wet weight	3,68			3,68		3,52		0,35	0,01
CB156	QOR096BT	wet weight	0,08			0,08		0,08		0,00	0,01
CB180	QOR096BT	wet weight	0,17			0,17		0,16		0,30	0,02
HCB	QOR096BT	wet weight	0,05			0,05		0,06		-0,50	0,01
a-HCH	QOR096BT	wet weight	<0.05			<0.02		0,03		c	0,05
b-HCH	QOR096BT	wet weight	0,02			0,02		0,02		0,00	0,02
g-HCH	QOR096BT	wet weight	<0.05			<0.02		0,03		c	0,05
pp'-DDE	QOR096BT	wet weight	0,7			0,70		0,66		0,42	0,01
pp'-DDD	QOR096BT	wet weight	0,24			0,24		0,22		0,49	0,01
pp'-DDT	QOR096BT	wet weight	<0.2			<0.2		*			0,05
op'-DDT	QOR096BT	wet weight	<0.1			<0.1		*			0,05
transn-chlor	QOR096BT	wet weight	0,05			0,05		0,06		-0,5	0,01

* no assigned value in this sample

**Z=(assigned value-mean)/assigned value*%error by the quasimeme laboratories

a- and g-chlordane, oxychlordane, toxaphenes and PBDEs are not certified in this sample by quasimeme

c: consistent

Table 5. Qualitative assurance. Persistent organochlorines (ng/g ww) in a certified cod liver sample from QUASIMEME, that were analysed with the cod liver samples from 2011

Cod liver control				assign		
chemical	CRM	weight basis	mean	value	I Z I	det. Lim.
CB28	QOR0108BT	wet weight	10,7	10,55	0,11	0,20
CB31	QOR0108BT	wet weight	4,18	3,78	0,82	0,20
CB52	QOR0108BT	wet weight	25,32	23,7	0,54	0,1
CB101	QOR0108BT	wet weight	65,28	63,7	0,20	0,2
CB105	QOR0108BT	wet weight	17,21	16,3	0,44	0,10
CB118	QOR0108BT	wet weight	71,01	69,9	0,13	0,10
CB138	QOR0108BT	wet weight	138,01	148	-0,54	0,1
CB153	QOR0108BT	wet weight	236,72	219	0,65	0,1
CB156	QOR0108BT	wet weight	8,69	8,41	0,26	0,10
CB180	QOR0108BT	wet weight	45,79	45,5	0,05	0,12
HCB	QOR0108BT	wet weight	14,72	14,0	0,41	0,1
a-HCH	QOR0108BT	wet weight	1,41	1,37	0,22	0,10
b-HCH	QOR0108BT	wet weight	1,37	1,40	-0,16	0,1
g-HCH	QOR0108BT	wet weight	0,55	0.60*		0,2
pp'-DDE	QOR0108BT	wet weight	88,92	83,1	0,56	0,10
pp'-DDD	QOR0108BT	wet weight	26,85	26,7	0,04	0,1
pp'-DDT	QOR0108BT	wet weight	<0.4	*0.48**		0,4
op'-DDT	QOR0108BT	wet weight	<0.8	*0.83**		0,80
transn-chlor	QOR0108BT	wet weight	8,06	7,43	0,67	0,1

*** "assigned value" only "indicative". Quasimeme does not assign %error and thus Z-score can not be calculated.**

a- and g-chlordane, oxychlordane, toxaphenes and PBDEs are not certified in this sample by quasimeme

Table 6. Detection limits* (ng/g)

	Detection limits	
chemical	**mussel ng/g sample dw**	**Cod liver ng/g sample ww**
a-HCH	0,05	0,05
HCB	0,02	0,05
b-HCH	0,10	0,05
g-HCH	0,10	0,16
PCB-31	0,20	0,20
PCB-28	0,25	0,20
PCB-52	0,10	0,10
oxychlordane	0,10	0,20
gamma-Chl.	0,20	0,05
PCB-101	0,10	0,20
alfa-Chl.	0,05	0,05
transnonachlor	0,05	0,05
4,4'-DDE	0,10	0,10
tox 26	0,05	0,10
PCB-118	0,10	0,05
4,4'-DDD	0,05	0,12
2,4'-DDT	0,10	0,20
PCB-153	0,05	0,05
PCB-105	0,05	0,05
4,4'-DDT	0,20	0,20
PCB-138	0,05	0,05
tox 50	0,10	0,10
PCB-156	0,05	0,05
PCB-180	0,05	0,12
tox 62	0,10	0,20
PCB-170	0,05	0,05
PBDE-47	0,05	0,20
PBDE-100	0,10	0,20
PBDE-99	0,10	0,20

***detection limits are 3 x std of blanks, or 3 x noise level or higher when other peaks interfer.**

Appendix IV.

Results of trace metal analysis for Blue mussel (*Mytilus edulis*) 2009 and Cod (*Gadus morhua*) 2010

Table 7. Results of trace metals in Blue mussel *(Mytilus edulis)* 2010 (dw)

Samples	Fat		Dry matter		Pb, mg/kg		Cd, mg/kg		Cu, mg/kg		Zn, mg/kg		As, mg/kg		Se, mg/kg		Hg, mg/kg	
	%	±	%	±	dw	±	dw	±	dw	±	dw	±	dw	±	dw	±	dw	±
Grímsey	0,18	0,01	7,20	0,3	0,07	0,015	3,64	0,7	7,19	1	314,58	63	14,40	3	2,44	0,5	0,08	0,02
Hvalstöð, Hvalfjörður	0,44	0,04	9,40	0,4	0,01	0,001	1,29	0,3	4,35	1	143,78	29	9,83	2	2,31	0,5	0,09	0,02
Hvammsvík, Hvalfjörður	0,22	0,02	8,30	0,3	0,00	0,001	1,31	0,3	3,56	1	133,36	27	9,11	2	2,91	0,6	0,04	0,01
Hvassahraun	0,25	0,02	5,80	0,23	0,02	0,003	1,44	0,3	5,76	1	183,03	37	19,41	4	2,30	0,5	0,06	0,01
Straumur,Straumsvík	0,69	0,06	8,90	0,36	0,01	0,001	1,73	0,3	4,85	1	125,10	25	11,64	2	2,89	0,6	0,06	0,01
Mjóifjörður I, head-Fjörður	0,20	0,02	7,60	0,30	0,01	0,001	2,60	0,5	4,18	1	112,59	23	8,92	2	2,28	0,5	0,07	0,01
Mjóifjörður II, Hofsá-brekka	0,26	0,02	7,90	0,32	0,01	0,002	2,75	0,5	3,80	1	128,73	26	9,94	2	1,83	0,4	0,08	0,02
Mjóifjörður III, Dalatangi	0,15	0,01	6,80	0,27	0,01	0,001	1,84	0,4	3,51	1	138,57	28	16,14	3	1,50	0,3	0,08	0,02
Úlfsá, Skutulsfj.	0,20	0,02	7,50	0,30	0,06	0,012	0,84	0,2	3,68	1	97,50	20	59,74	12	2,10	0,4	0,07	0,01
Seljaland, Álftafjörður	0,32	0,03	6,50	0,26	0,02	0,003	3,98	0,8	5,74	1	104,69	21	13,39	3	5,00	1,0	0,07	0,01
Naust Laxárvogi	0,51	0,04	11,30	0,45	0,06	0,011	1,46	0,3	10,48	2	120,56	24	10,05	2	3,35	0,7	0,04	0,01
Limit of detection for samples (MLOD)					0,04		0,03		0,002		0,002		0,002		0,07		0,06	

Table 8. Results of trace metals in liver and flesh of Cod (*Gadus morhua*) 2010 (ww)

Sample	Fat %		Dry matter %		Pb, mg/kg		Cd, mg/kg		Cu,mg/kg		Zn, mg/kg		As, mg/kg		Se, mg/kg		Dry matter %		Fat %		Hg, mg/kg	
	Liver	±	Liver	±	Liver		Liver	±	Liver	±	Liver	±	Liver	±	Liver	±	Flesh*	±	Flesh*	±	Flesh*	±
Cod N-NW (2) 07																						
Group 1	46,6	4	59,8	2	<0,04		0,33	0,07	3,9	0,8	15,2	3	6,0	1	1,1	0,2						
Group 3	57,8	5	68,7	3	<0,04		0,24	0,05	1,9	0,4	9,9	2	5,8	1	0,7	0,1						
Group 5	66,0	5	73,7	3	<0,04		0,13	0,03	2,9	0,6	9,6	2	5,2	1	0,5	0,1						
Average	***56,8***		***67,4***				***0,23***		***2,9***		***11,6***		***5,7***		***0,8***		***19,2***	***0,8***	***0,09***	***0,007***	***0,028***	***0,006***
Cod NA 07																						
Group 1	44,3	4	56,9	2	<0,04		0,25	0,05	4,3	0,9	14,3	3	9,1	2	1,3	0,3						
Group 3	51,1	4	62,0	2	<0,04		0,19	0,04	2,7	0,5	11,8	2	6,2	1	1,0	0,2						
Group 5	55,1	4	63,8	3	<0,04		0,12	0,02	2,1	0,4	10,1	2	5,5	1	0,9	0,2						
Average	***50,2***		***60,9***				***0,19***		***3,0***		***12,1***		***7,0***		***1,1***		***18,7***	***0,7***	***0,04***	***0,003***	***0,032***	***0,006***
Average of all measurements					<0,04		0,21		3,0		11,8		6,3		0,9						0,02	
Limit of detection for samples (MLOD)					0,04		0,03		0,002		0,002		0,002		0,07						0,06	

*Flesh was pooled into one sample

Appendix V.

Results of organochlorine analysis for Blue mussel (*Mytilus edulis*) 2009 and Cod (*Gadus morhua*) 2010

Table 9 a. Persistent organochlorines in Blue mussel (Mytulis edulis, ng/g dw) 2010

	Grímsey 10	Hvammsvík 10	Hvalstöð 10	Úlfsá 10	Seljaland 10	Hvassahraun 10
PCB28	<0.25	<0.25	<0.25	<0.25	<0.25	0,33
PCB31	<0.20	<0.20	<0.20	<0.20	<0.20	0,31
PCB52	<0.1	0,166	0,919	0,161	<0.1	0,32
PCB101	0,06	0,34	1,60	0,66	0,12	0,19
PCB105	0,05	0,13	0,36	0,17	0,08	0,08
PCB118	0,06	0,39	1,61	0,55	0,16	0,17
PCB138	0,18	0,90	2,61	1,08	0,29	0,38
PCB153	0,27	1,10	4,50	1,56	0,35	0,48
PCB156	<0.05	<0.05	0,124	<0.05	<0.05	<0.05
PCB170	<0.05	<0.05	0,073	<0.05	<0.05	<0.05
PCB180	<0.05	<0.05	0,48	0,09	<0.05	<0.05
S3PCB**	0,51	2,39	8,72	3,19	0,80	1,03
HCB	0,08	0,07	0,20	0,32	0,09	0,06
a-HCH	0,12	0,06	0,08	<0.05	<0.05	<0.05
b-HCH	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
g-HCH	<0.1	0,14	0,15	<0.1	<0.1	0,23
p,p'-DDE	0,26	0,55	11,33	0,49	0,21	0,26
p,p'-DDD	<0.05	0,12	1,65	0,12	<0.05	<0.05
p,p'-DDT	<0.2	<0.2	0,24	<0.2	<0.2	<0.2
o,p'-DDT***	<0.1	<0.1	0,33	<0.1	<0.1	<0.1
PCB153/DDE	1,0	2,0	0,4	3,2	1,7	1,85
transnonachlor	0,11	0,16	2,58	0,35	0,14	0,06
a-chlordan	0,06	0,09	0,24	0,08	0,08	0,07
g-chlordan	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
oxychlordan	<0.1	<0.1	0,31	<0.1	<0.1	<0.1
Tox-26	0,12	0,17	0,59	0,22	0,16	0,08
Tox-50	0,12	0,19	0,75	0,24	0,21	0,10
Tox-62	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
PBDE-47	1,17	0,23	0,62	0,74	<0.05	<0.05
PBDE-99	0,26	<0.1	0,17	0,30	<0.1	<0.1
PBDE-100	<0.1	<0.1	0,10	0,19	<0.1	<0.1
% extracted fat	26,0%	31,0%	43,0%	32,0%	31,0%	20,0%
% dw (Matis)	7,16	7,6	9,5	7,55	6,16	5,96

**** PCB # 118, 138 and 153**

*****Values are highly suspect and these are not certified in QUASIMEME blue mussel**

Table 9 b. Persistent organochlorines in Blue mussel (Mytulis edulis, ng/g dw) 2010

	Straumur 10	Dalatangi 10	Brekka 10	Fjörður 10	Naust 10
PCB28	0,93	0,24	<0.25	<0.25	<0.25
PCB31	0,69	0,23	<0.20	0,22	<0.20
PCB52	0,70	0,30	0,26	0,22	0,20
PCB101	0,63	0,32	0,40	0,09	0,44
PCB105	0,18	0,15	0,13	<0.05	0,16
PCB118	0,54	0,34	0,35	0,07	0,45
PCB138	1,16	0,42	1,51	0,19	0,86
PCB153	1,61	0,38	1,75	0,21	1,29
PCB156	0,08	<0.05	0,11	<0.05	<0.05
PCB170	<0.05	<0.05	<0.05	<0.05	<0.05
PCB180	0,08	<0.05	0,17	<0.05	0,11
S3PCB**	3,31	1,14	3,60	0,47	2,60
HCB	0,14	0,10	0,13	0,10	0,24
a-HCH	0,09	0,07	0,11	0,07	0,13
b-HCH	<0.1	<0.1	<0.1	<0.1	<0.1
g-HCH	0,31	0,44	0,67	0,58	0,15
p,p'-DDE	0,74	0,14	0,63	0,18	0,52
p,p'-DDD	0,32	<0.05	0,09	<0.05	0,09
p,p'-DDT	0,48	<0.2	<0.2	<0.2	<0.2
o,p'-DDT***	0,31	<0.1	<0.1	<0.1	<0.1
PCB153/DDE	2,17	2,70	2,78	1,15	2,46
transnonachlor	0,18	0,09	0,27	0,12	0,23
a-chlordan	0,13	0,09	0,13	0,09	0,13
g-chlordan	<0.2	<0.2	<0.2	<0.2	<0.2
oxychlordan	<0.1	<0.1	<0.1	<0.1	<0.1
Tox-26	0,22	0,11	0,24	0,17	0,21
Tox-50	0,26	0,15	0,36	0,23	0,24
Tox-62	<0.1	<0.1	<0.1	<0.1	<0.1
PBDE-47	0,507	<0.05	0,097	<0.05	0,31
PBDE-99	0,243	<0.1	<0.1	<0.1	0,116
PBDE-100	0,159	<0.1	<0.1	<0.1	<0.1
% extracted fat	71,0%	23,5%	36,0%	36,0%	62,0%
% dw (Matis)	9,04	7	7,94	7,79	11,12

**** PCB # 118, 138 and 153**

*****Values are highly suspect and these are not certified in QUASIMEME blue mussel**

Table 10 a. Persistent organochlorines in cod liver 2011 (ng/g ww)

	COD NE	COD NE	COD NE
	H1	H3	H5
PCB28	2,0	2,1	2,1
PCB31	1,0	1,2	1,2
PCB52	3,5	3,8	3,8
PCB101	5,9	5,3	5,3
PCB105	2,1	1,8	1,8
PCB118	9,1	7,8	7,8
PCB138	15,5	10,0	10,0
PCB153	27,3	16,9	16,9
PCB156	0,84	0,62	0,62
PCB170	2,5	1,2	1,2
PCB180	7,6	3,5	3,5
S7PCB**	70,8	49,4	49,4
HCB	13,9	17,2	17,2
a-HCH	1,9	2,2	2,2
b-HCH	0,48	0,55	0,55
g-HCH	0,64	0,76	0,76
p,p'-DDE	50,9	34,4	34,4
p,p'-DDD	10,5	11,4	11,4
p,p'-DDT****	4,2	4,3	4,3
o,p'-DDT****	2,5	3,3	3,3
SDDT	68,2	53,4	53,4
PCB153/DDE	0,54	0,49	0,49
transnonachlor	21,1	17,8	17,8
a-chlordan	12,9	14,1	14,1
g-chlordan	4,1	4,8	4,8
oxychlordan	3,7	3,0	3,0
SCHL	41,8	39,7	39,7
Tox-26	17,3	16,6	16,6
Tox-50	23,2	22,3	22,3
Tox-62	10,5	13,2	13,2
PBDE-47	2,3	2,2	2,2
PBDE-99	<0.2	<0.2	<0.2
PBDE-100	0,44	0,41	0,41
% extracted fat	43,9%	50,2%	54,3%

**** PCB # 28, 52, 101, 118, 138, 153, 180**

***** Contamination prevents accurate quantification**

****** Not certified values (indicative) in QUASIMEME cod liver**

Table 10 b. Persistent organochlorines in cod liver 2011 (ng/g ww)

	COD NNW2	COD NNW2	COD NNW2
	H1	H3	H5
PCB28	2,5	2,2	2,5
PCB31	1,4	1,1	1,4
PCB52	4,7	3,4	3,9
PCB101	6,9	4,7	4,8
PCB105	2,2	1,7	1,5
PCB118	9,4	6,9	6,4
PCB138	12,2	9,9	8,4
PCB153	19,4	15,0	12,9
PCB156	0,8	0,5	0,5
PCB170	1,4	1,2	0,8
PCB180	3,9	3,1	2,2
S7PCB**	59,0	45,1	41,1
HCB	15,7	14,7	16,7
a-HCH	2,0	2,6	2,6
b-HCH	0,52	0,64	0,68
g-HCH	0,62	0,79	0,78
p,p'-DDE	42,0	30,2	26,1
p,p'-DDD	12,6	10,4	10,9
p,p'-DDT****	3,6	2,9	3,0
o,p'-DDT****	3,0	2,4	2,7
SDDT	61,2	45,8	42,7
PCB153/DDE	0,46	0,50	0,50
transnonachlor	20,1	15,1	14,9
a-chlordan	13,9	11,1	12,8
g-chlordan	4,6	3,9	4,4
oxychlordan	4,2	3,8	3,5
SCHL	42,8	33,9	35,6
Tox-26	18,6	15,8	17,6
Tox-50	23,3	19,2	23,8
Tox-62	10,8	8,7	13,2
PBDE-47	2,6	2,0	1,8
PBDE-99	<0.2	<0.2	<0.2
PBDE-100	0,48	0,35	0,41
% extracted fat	48,5%	57,1%	63,9%

**** PCB # 28, 52, 101, 118, 138, 153, 180**

***** Contamination prevents accurate quantification**

****** Not certified values (indicative) in QUASIMEME cod liver**

Appendix VI.

Graphs of biological variation in Cod (Gadus morhua) 1990-2010

Biological variation in 30-45 cm Cod (Gadus morhua) from Icelandic waters in March 1990-2011

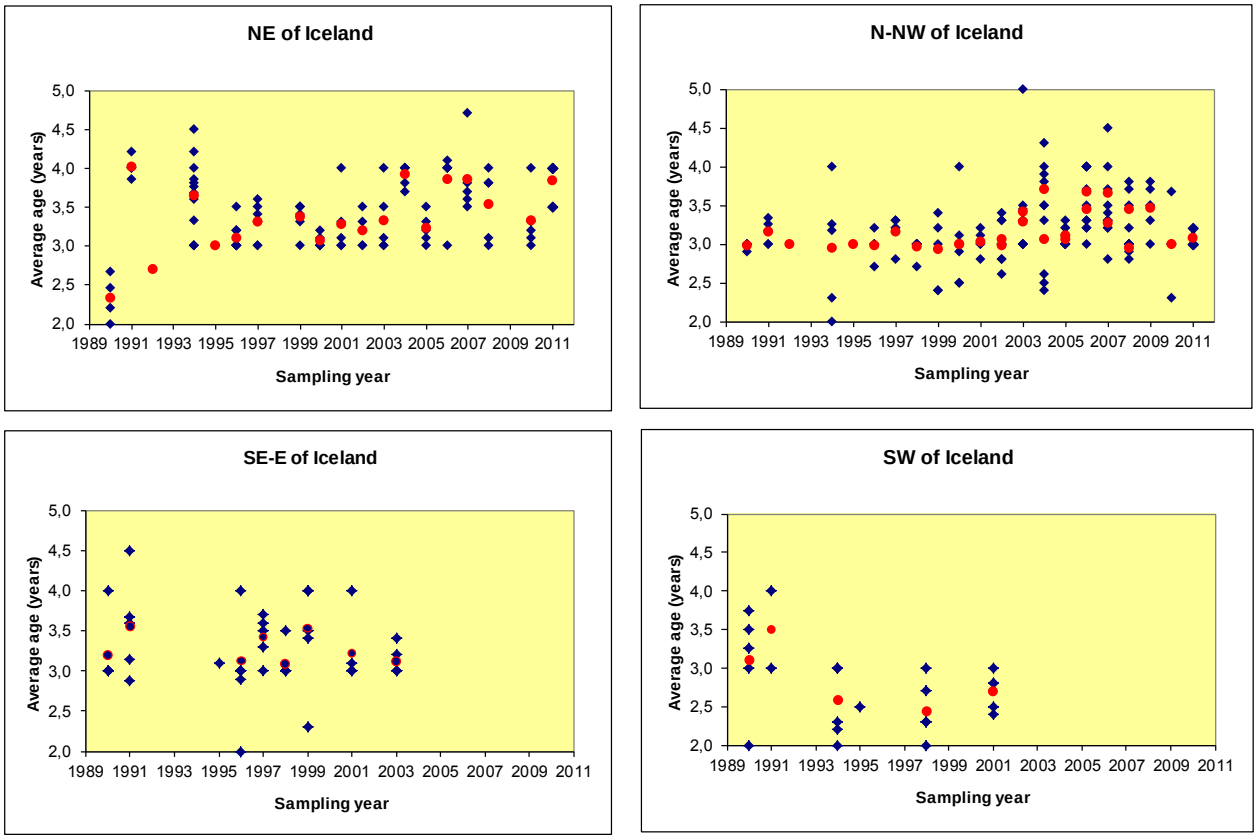


Figure 2a. Average age in 30-45 cm Cod (Gadus morhua) from Icelandic waters in March 1990-2011.The red dots represent the average values.

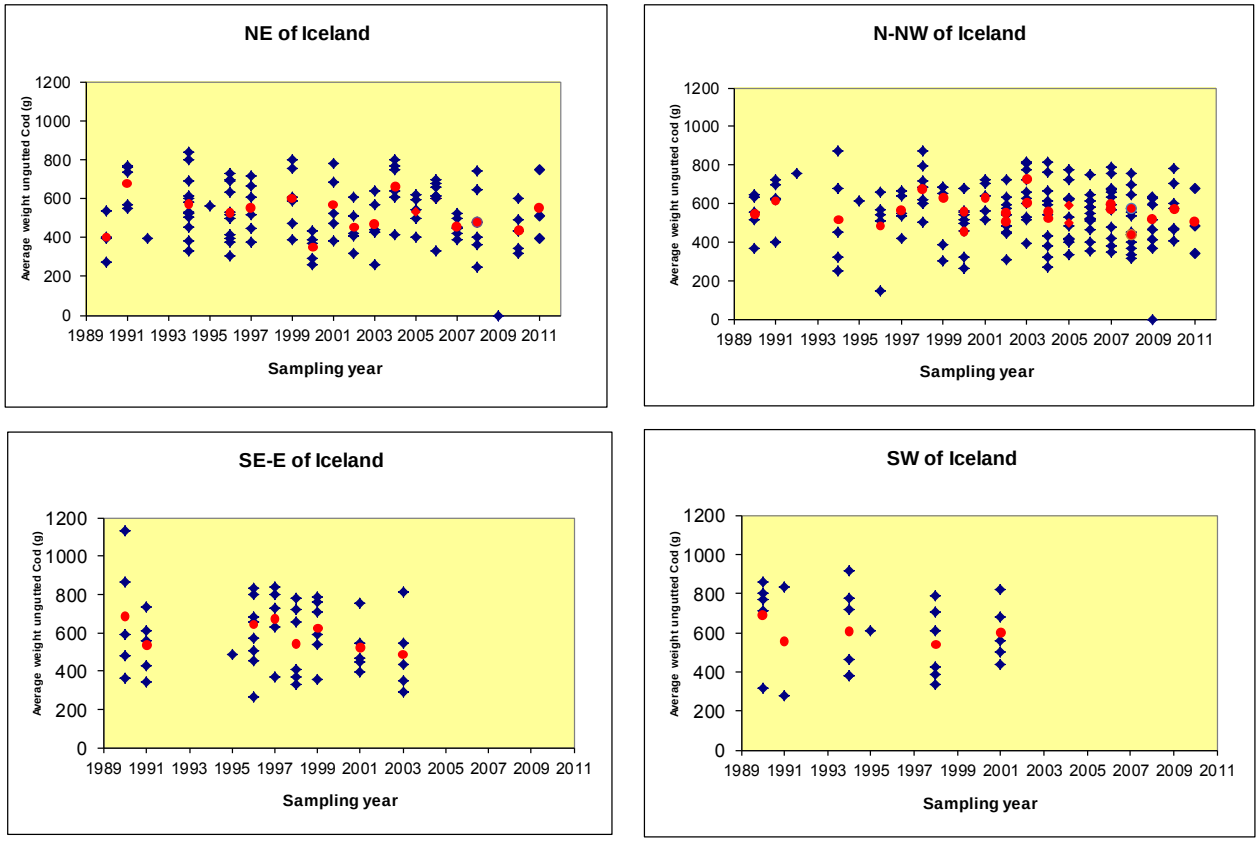


Figure 2b. Average weight ungutted Cod (Gadus morhua), 30-45 cm, from Icelandic waters in March 1990-2011.The red dots represent the average values.

Biological variation in 30-45 cm Cod (Gadus morhua) from Icelandic waters in March 1990-2011

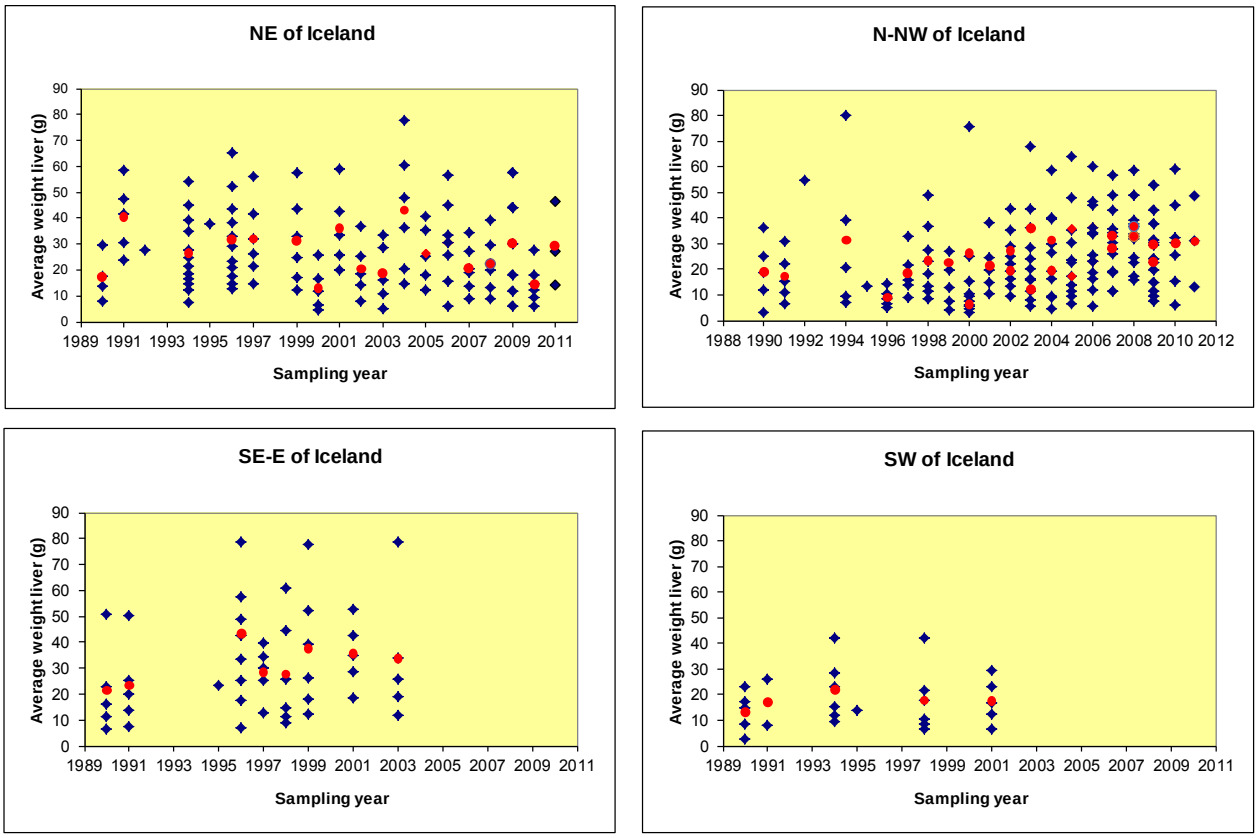


Figure 2c. Average weight liver of Cod (Gadus morhua), 30-45 cm, from Icelandic waters in March 1990-2011.The red dots represent the average values.

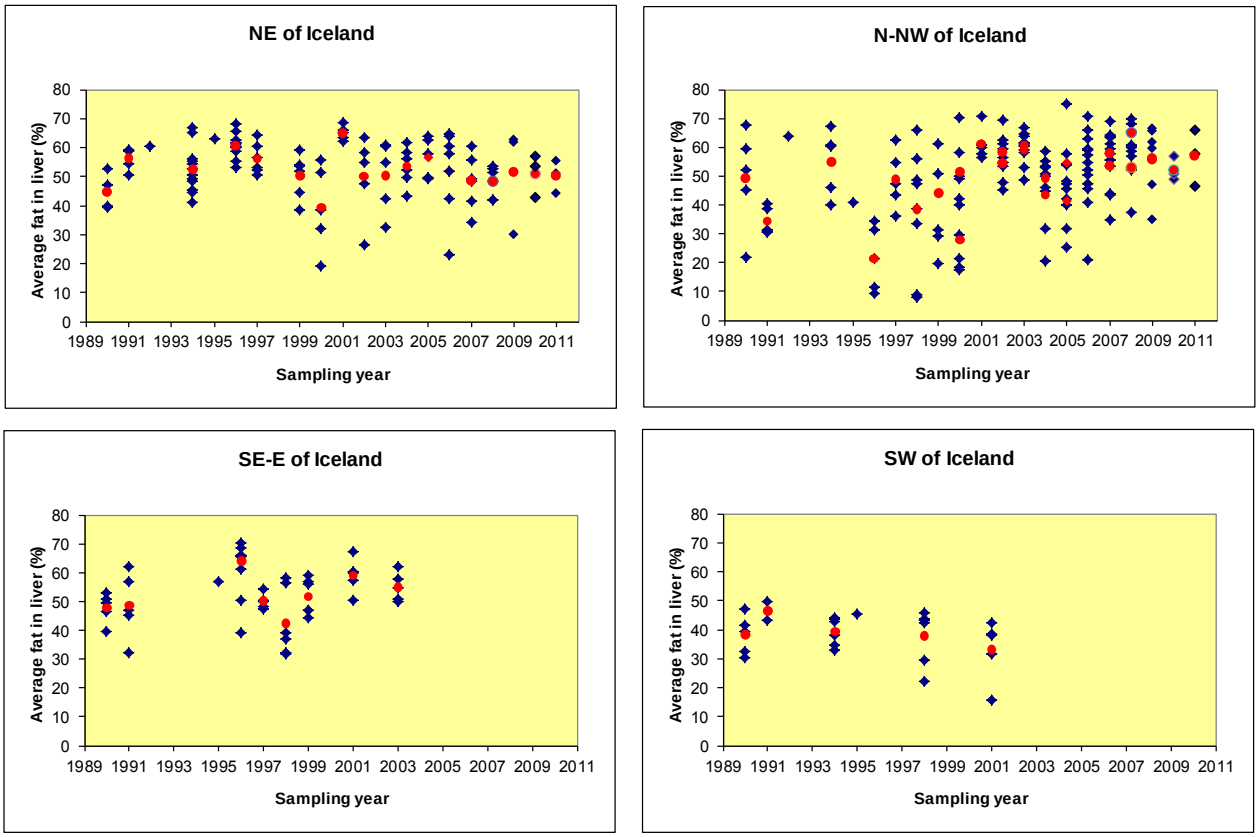


Figure 2d. Average fat (%) in liver of Cod (Gadus morhua), 30-45 cm, from Icelandic waters in March 1990-2011.The red dots represent the average values.

Appendix VII.

Graphs of metals and organic compounds in Blue mussel (*Mytilus edulis*) 1990-2009

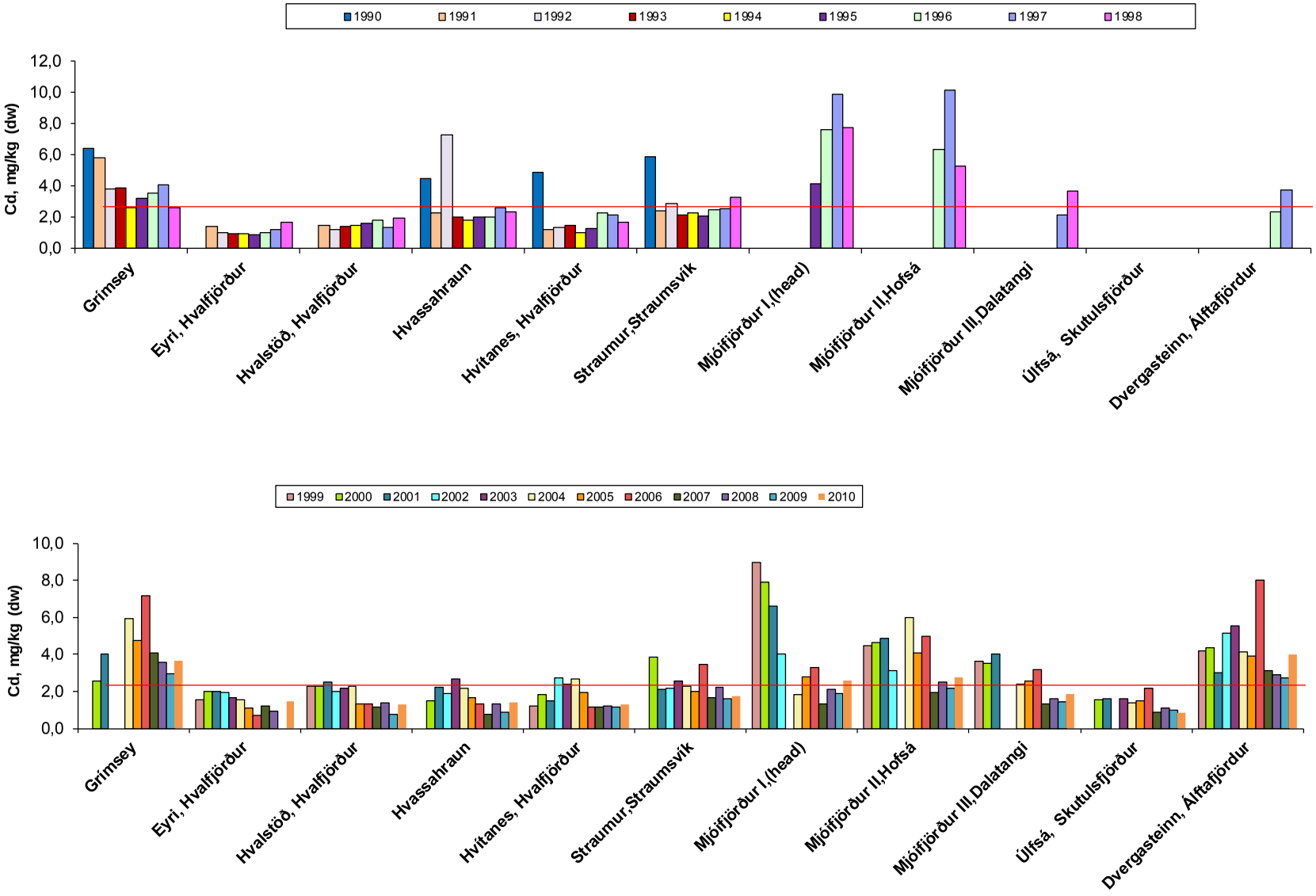


Figure 3a. Cadmium concentration (dw) in Blue mussel (Mytilus edulis) around Iceland 1991-2010. Red line indicates ICES 90 75% baseline (11).

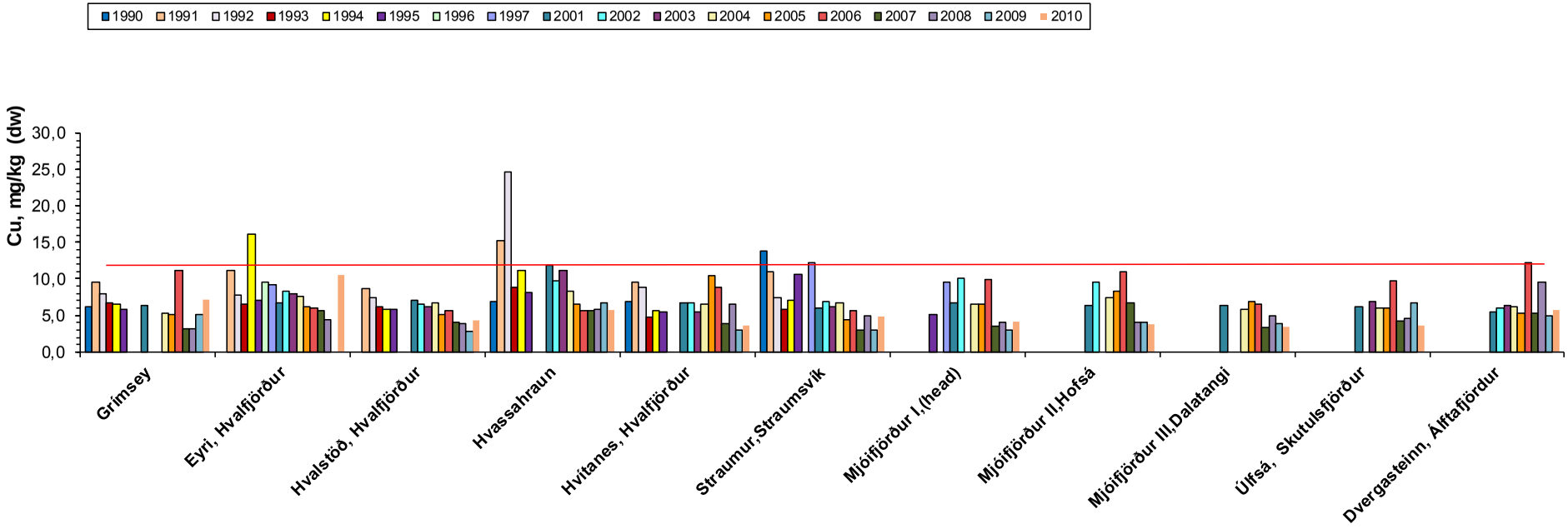


Figure 3b. Copper concentration (dw) in Blue mussel (Mytilus edulis) around Iceland 1990-2010. Red line indicates ICES 90 75% baseline (11).

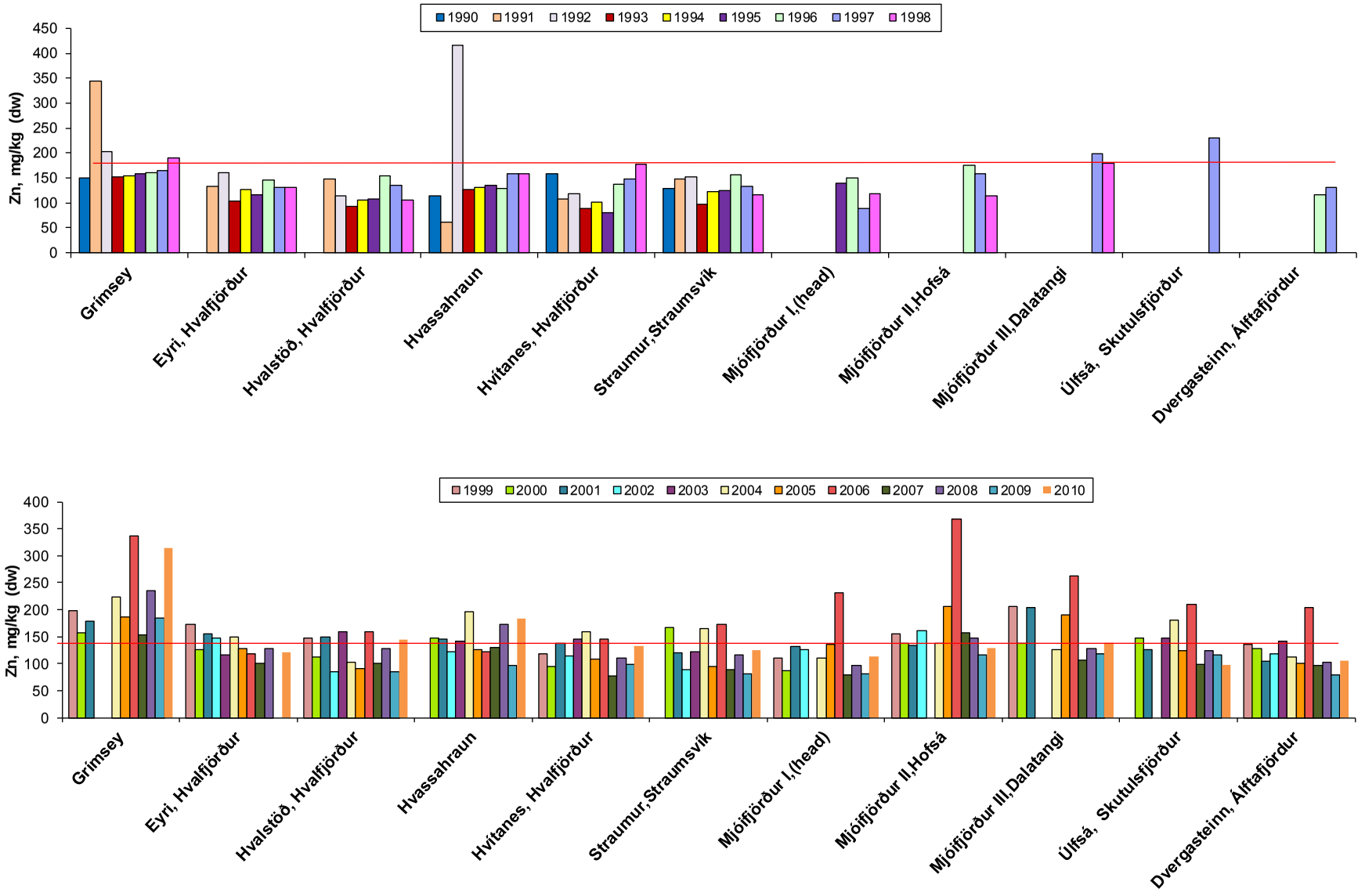


Figure 3c. Zinc concentration (dw) in Blue mussel (Mytilus edulis) around Iceland 1990-2010. Red line indicates ICES 90 75% baseline (11).

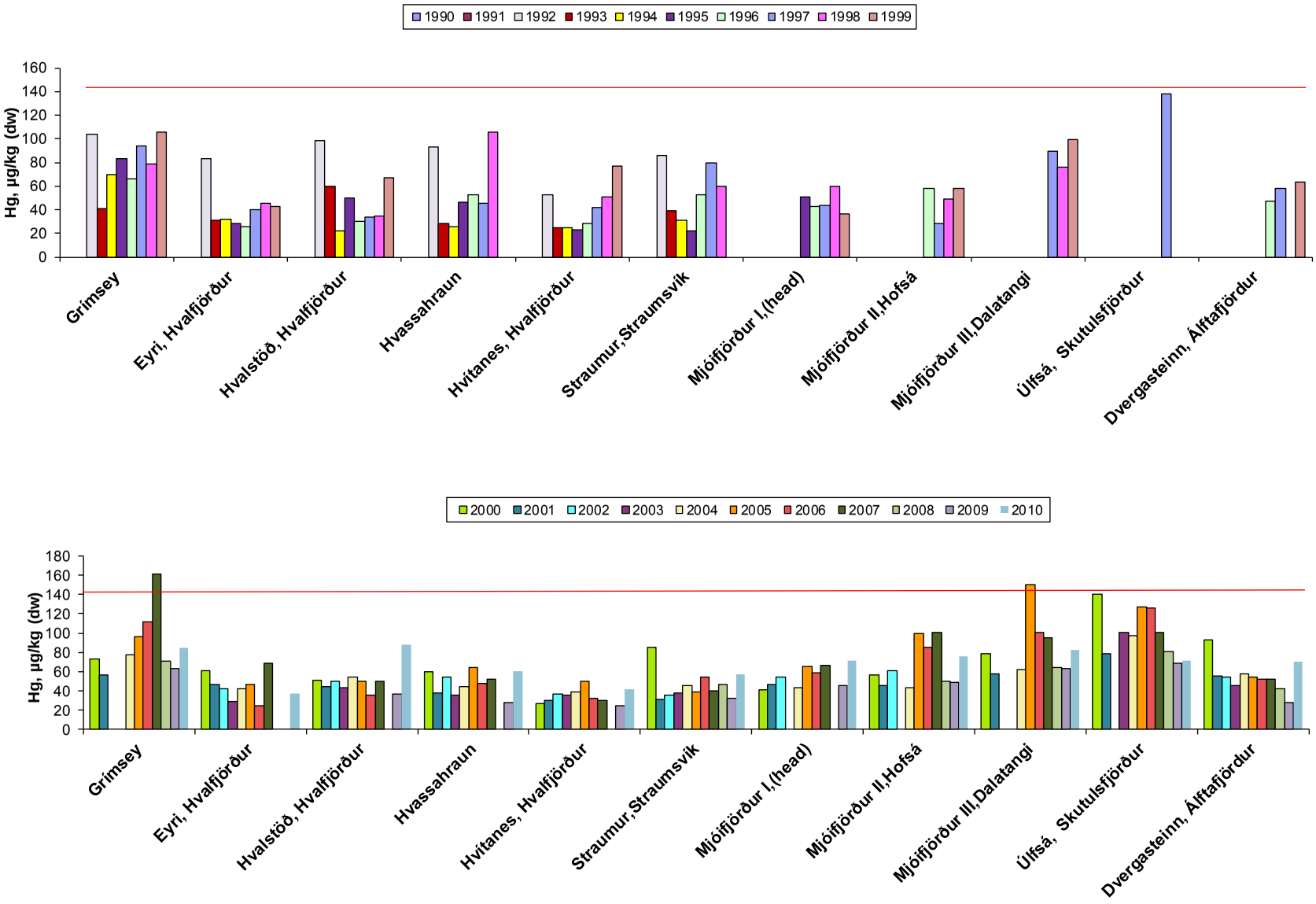


Figure 3d. Mercury concentration (dw) in Blue mussel (Mytilus edulis) around Iceland 1990-2010. Red line indicates ICES 90 75% baseline (11).

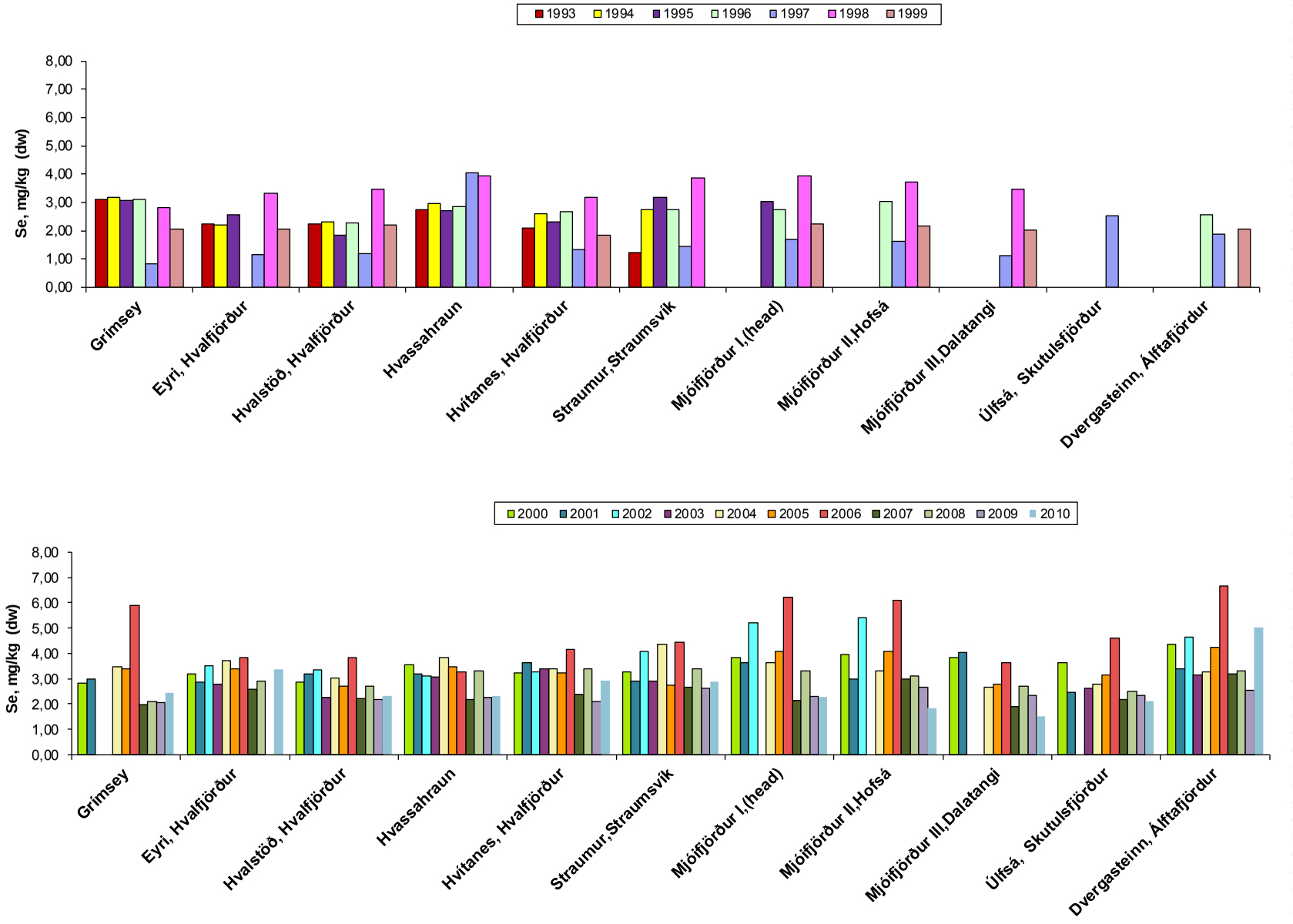


Figure 3e. Selenium concentration (dw) in Blue mussel (Mytilus edulis) around Iceland 1993-2010.

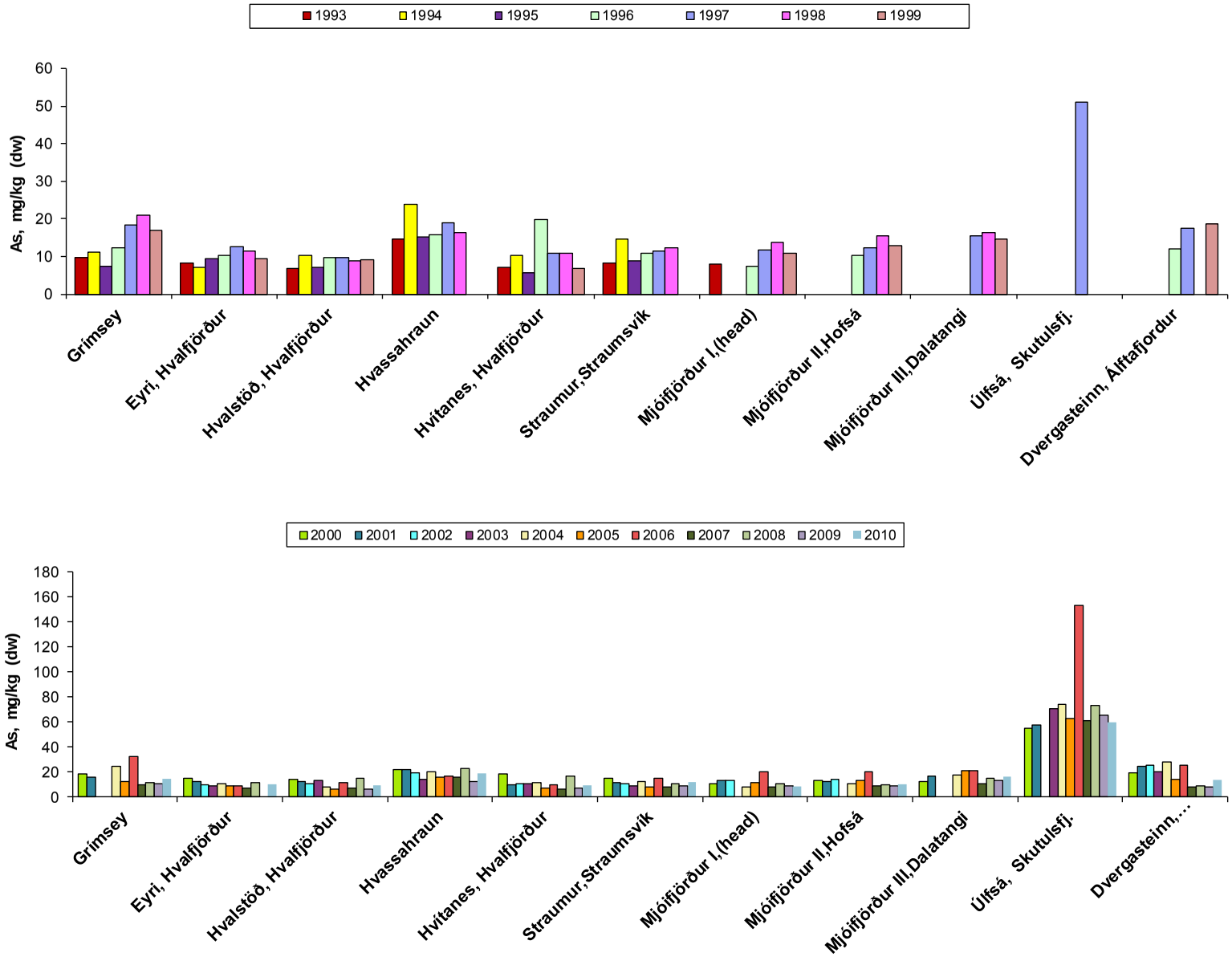


Figure 3f. Arsenic concentration (dw) in Blue mussel (Mytilus edulis) around Iceland 1993-2010.

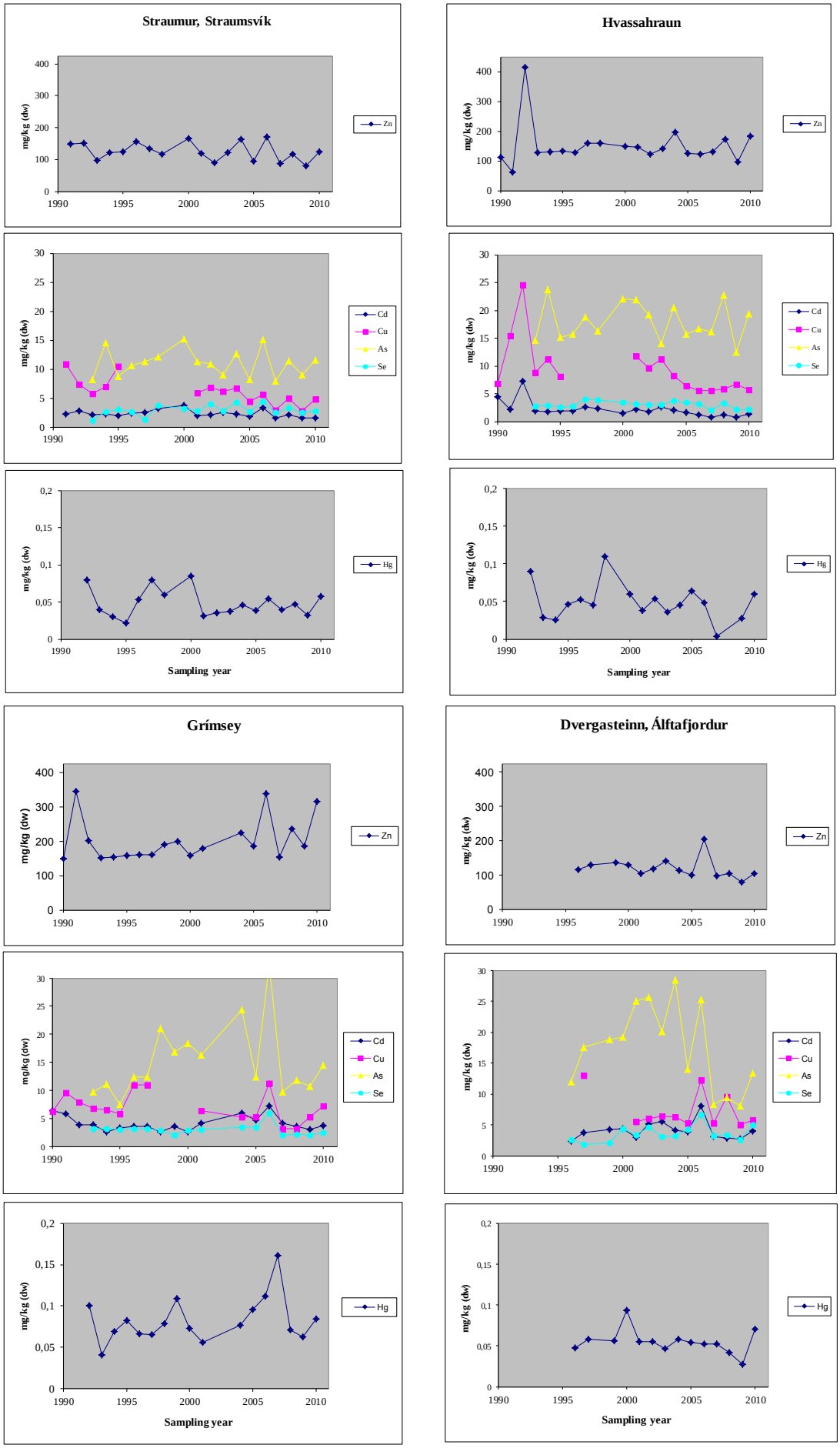


Figure 4a. Concentration of heavy metals (dry weight) in Blue mussel from different sampling sites around Iceland, 1990-2010.

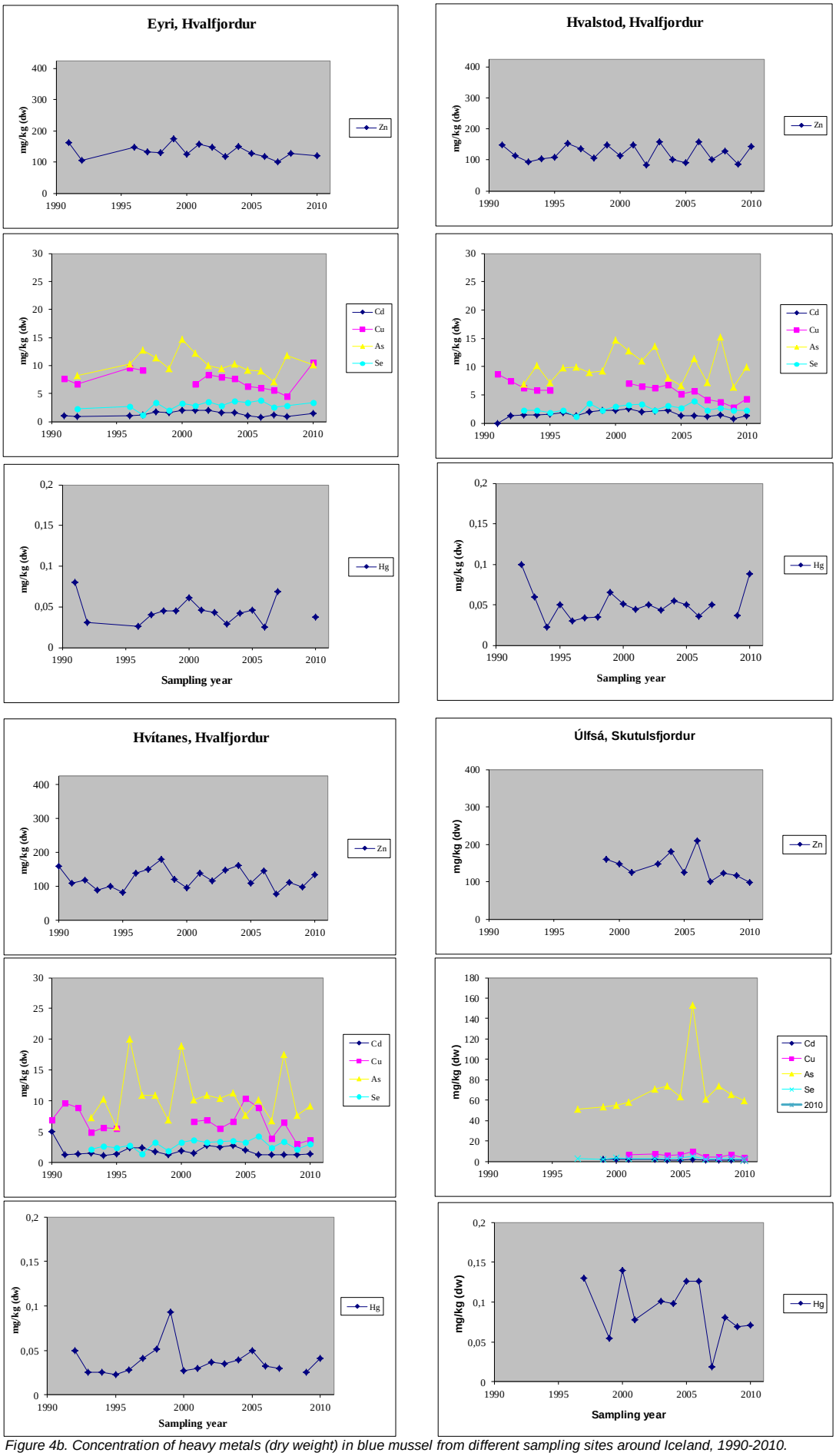


Figure 4b. Concentration of heavy metals (dry weight) in blue mussel from different sampling sites around Iceland, 1990-2010.

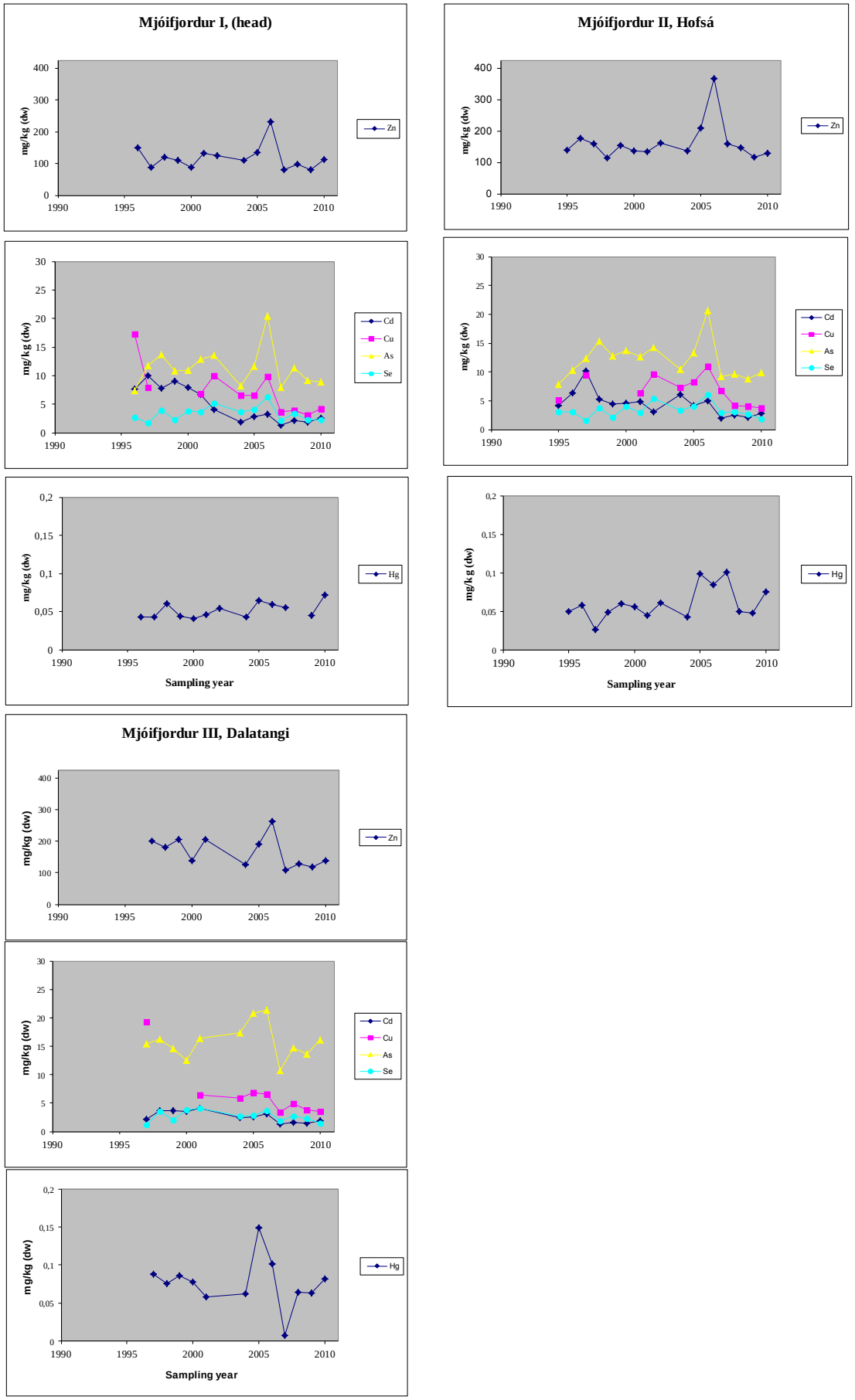


Figure 4c. Concentration of heavy metals (dry weight) in blue mussel from different sampling sites around Iceland, 1990-2010.

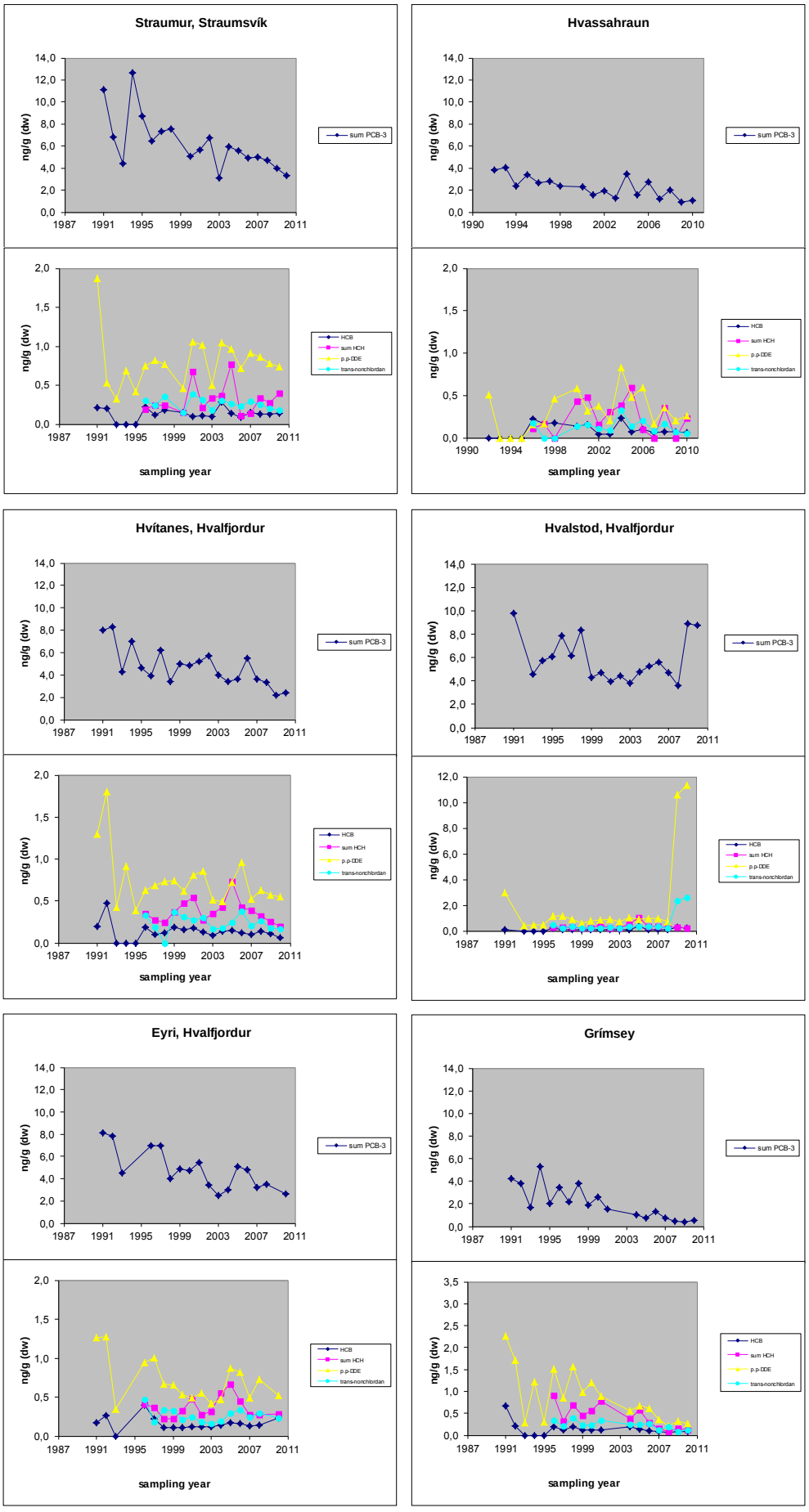


Figure 5a. Concentration of organochlorine compounds (dw) in Blue mussel (Mytilus edulis) at different locations 1991-2010.

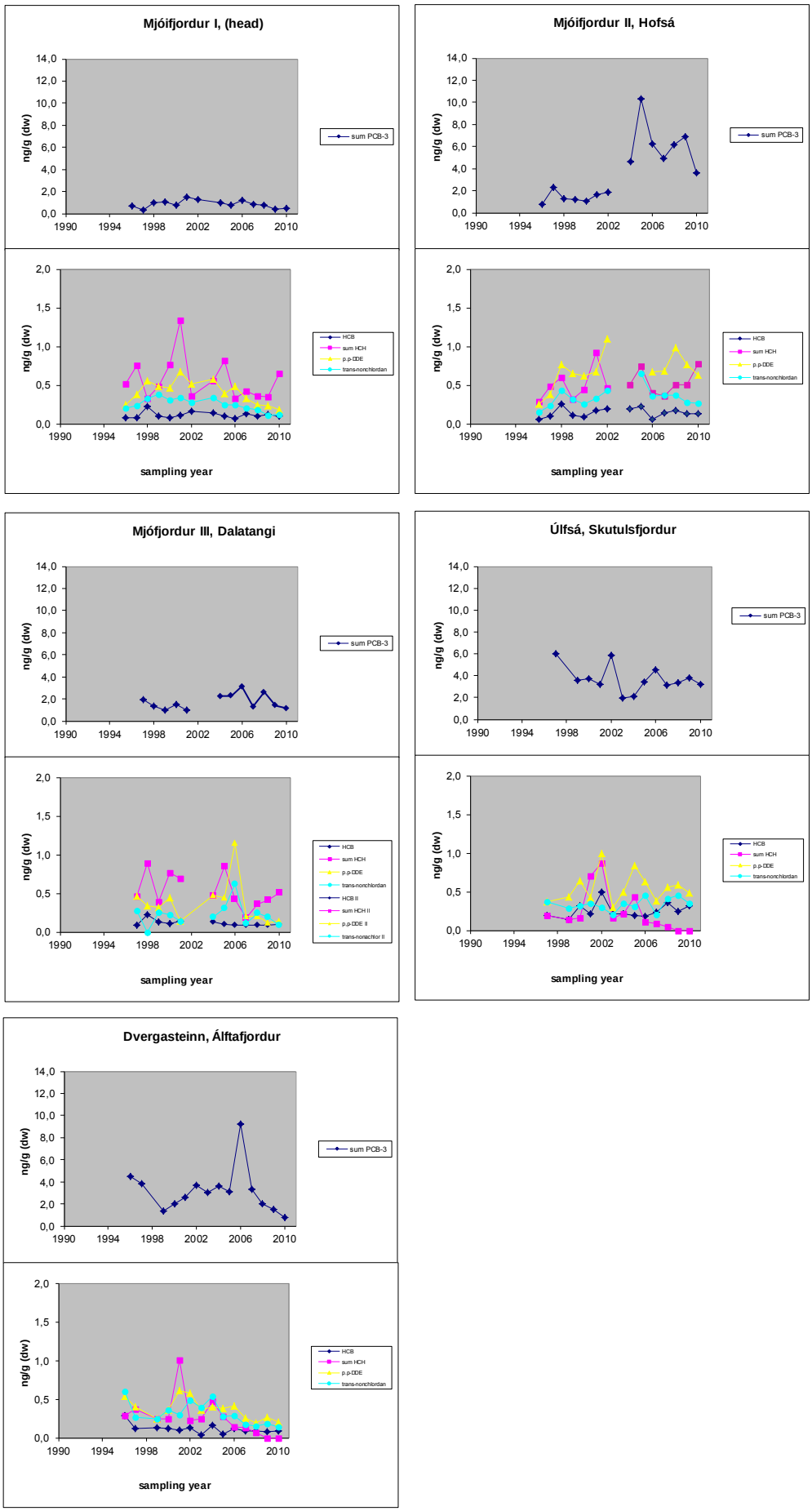


Figure 5b. Concentration of organochlorine compounds (dw) in Blue mussel (Mytilus edulis) at different locations 1991-2010.

Appendix VIII.

Graphs of metals and organic compounds in Cod (*Gadus morhua*) 1990-2009

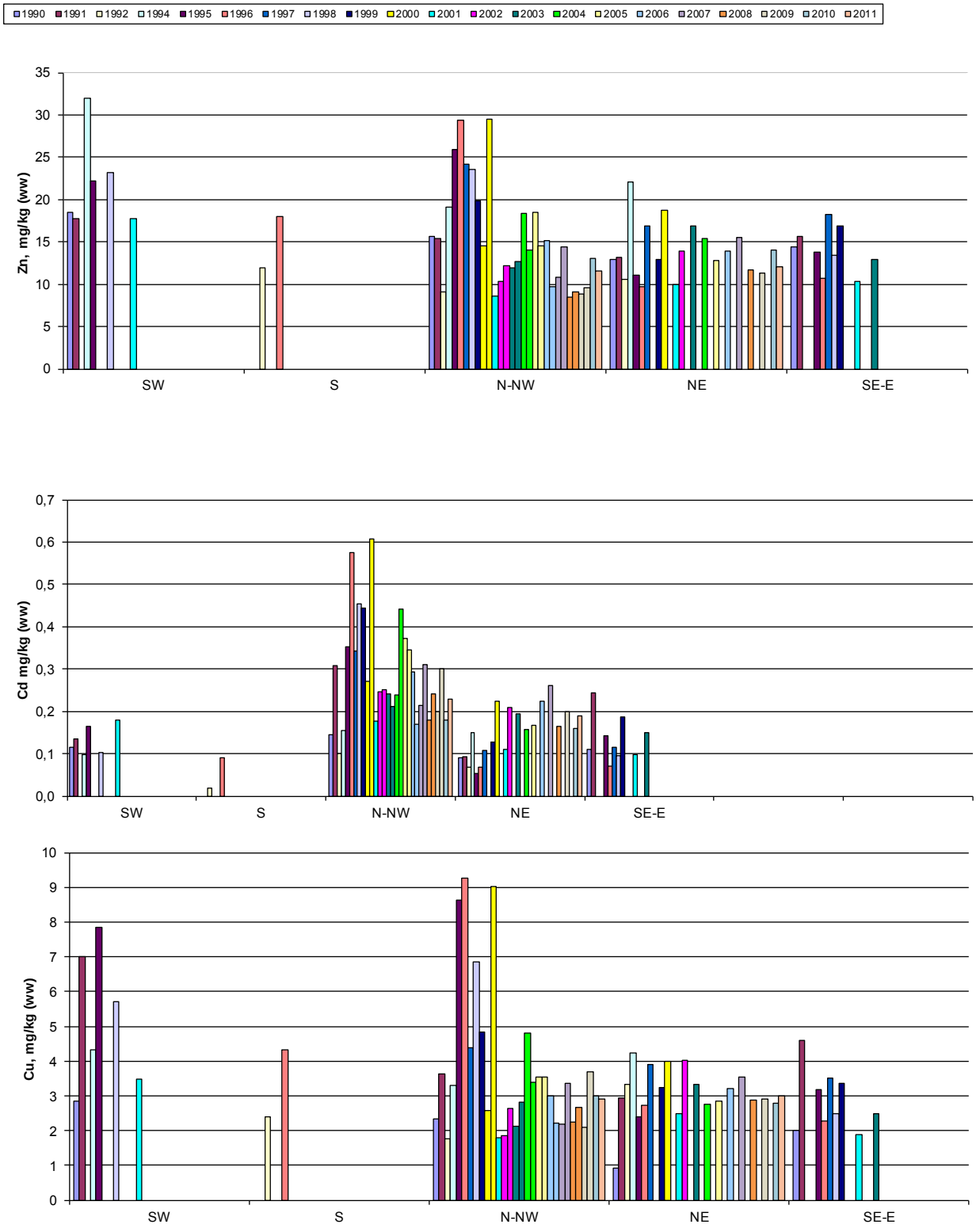


Figure 6a. Heavy metal concentration (ww) in livers of 30-45cm cod (Gadus morhua) from Icelandic waters in March 1990-2011.

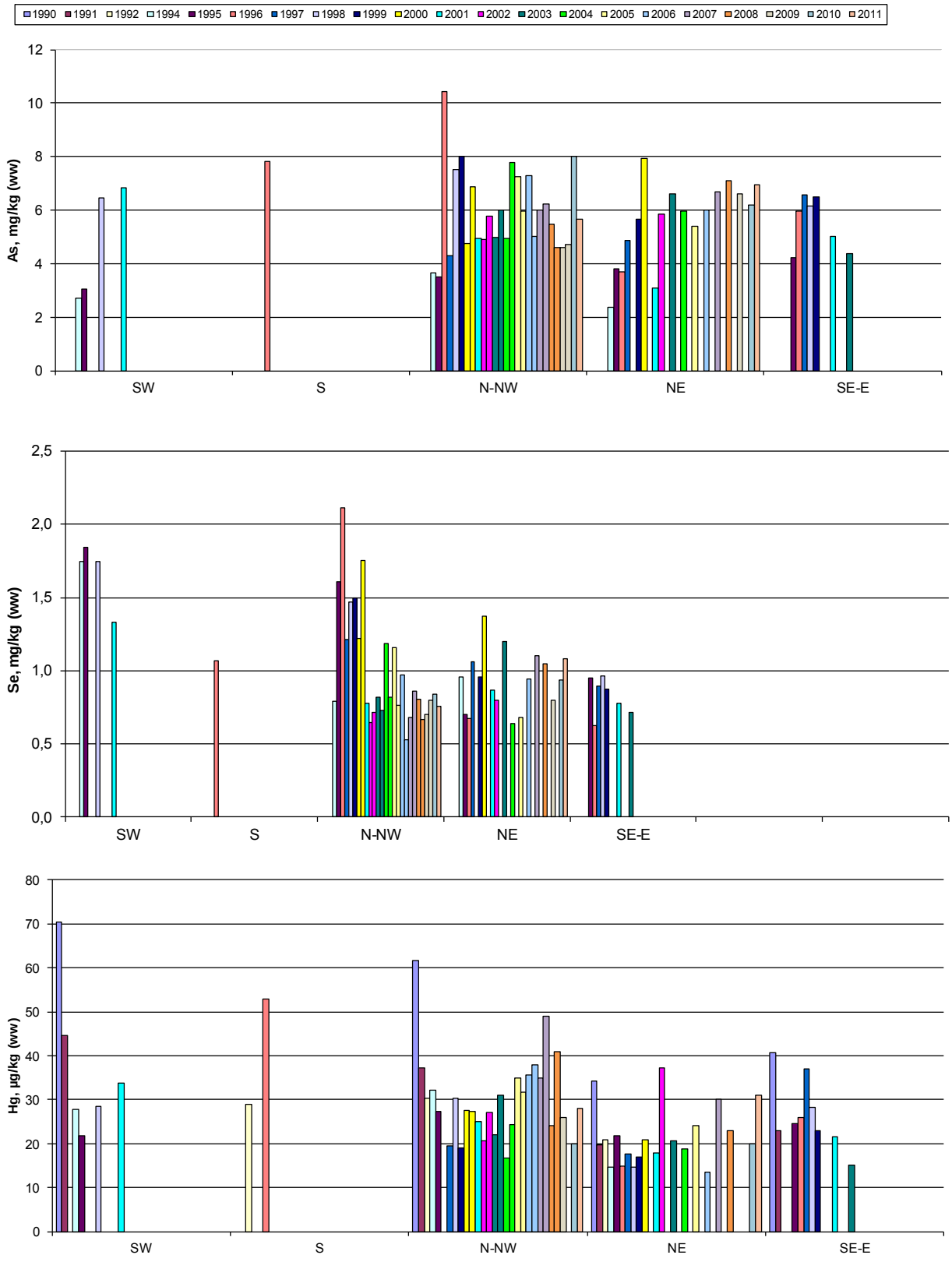


Figure 6b. Heavy metal concentration (ww) in livers of 30-45cm cod (Gadus morhua) from Icelandic waters in March 1990-2011 Mercury (Hg) was analysed in the flesh

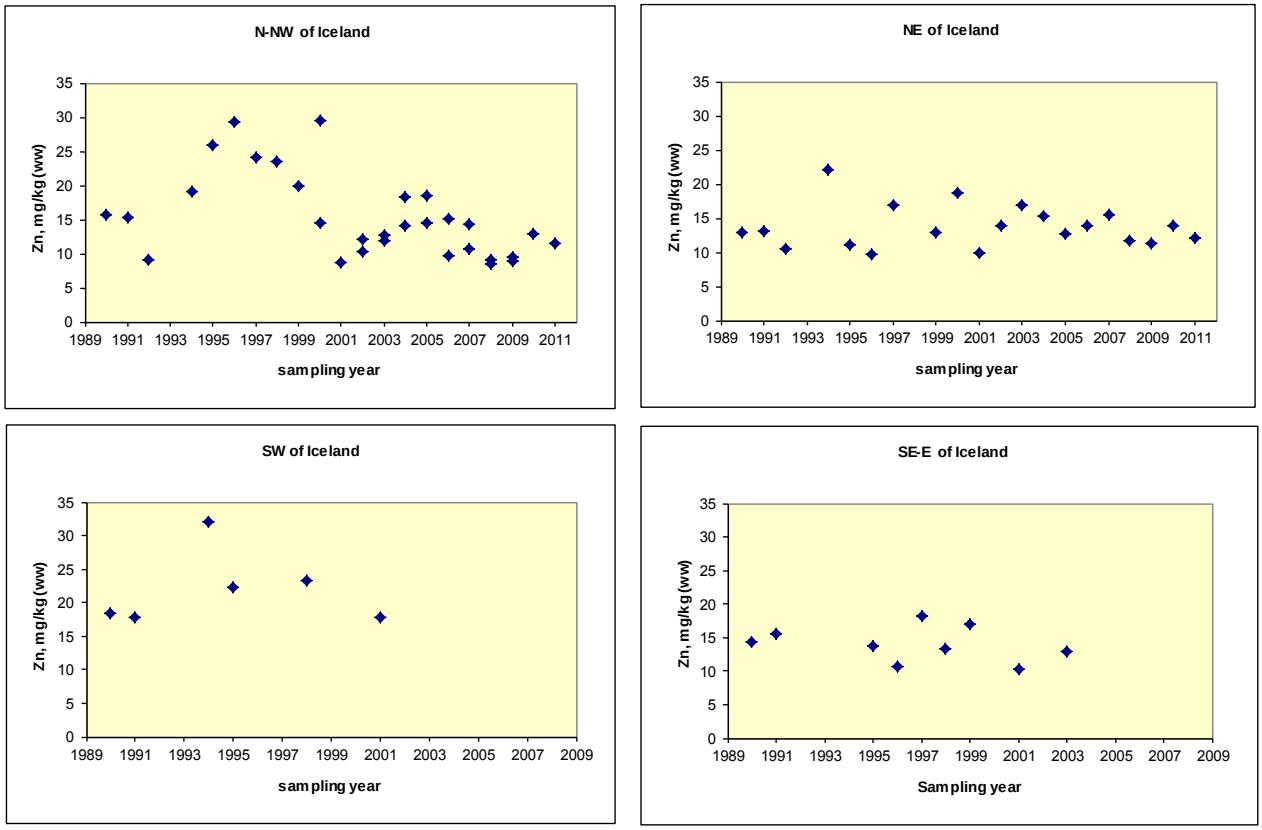


Figure 7a. Average concentration of Zinc (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1990-2011.

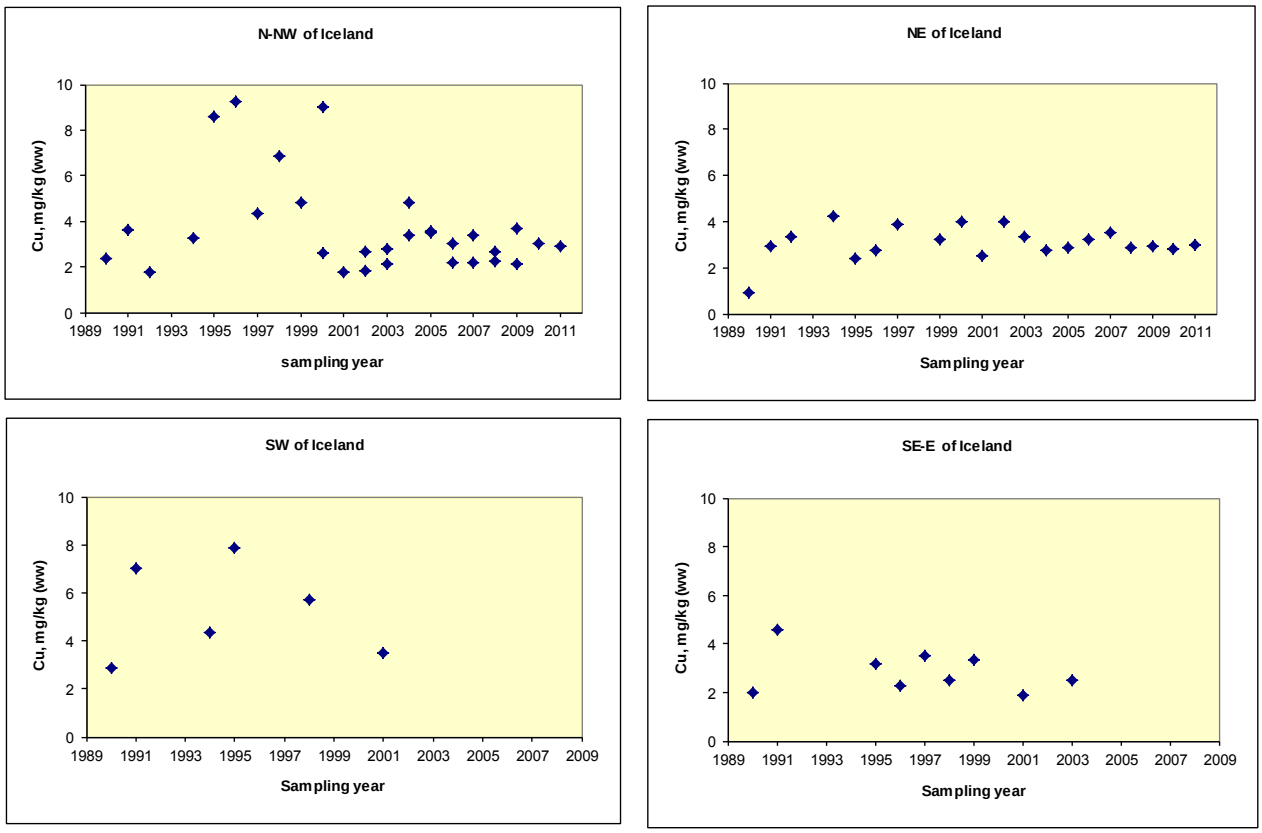


Figure 7b. Average concentration of Copper (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1990-2011.

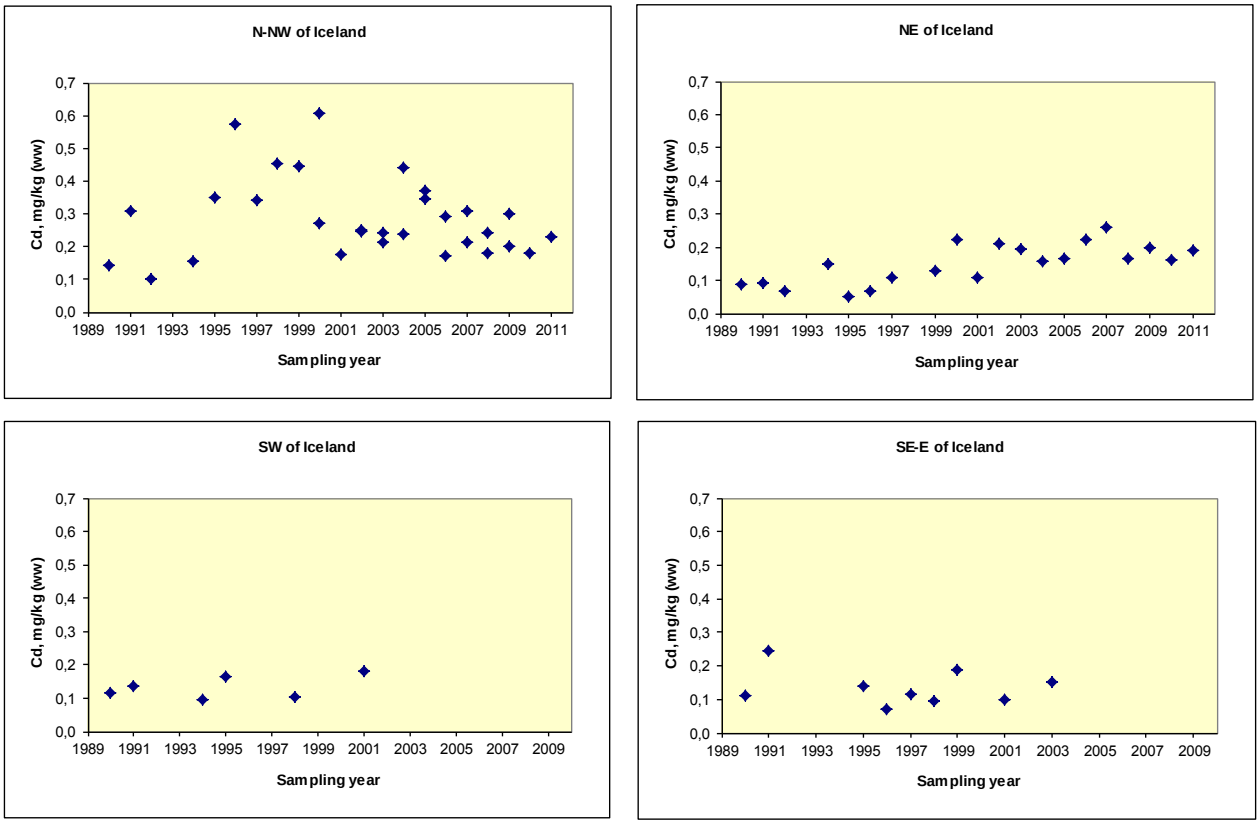


Figure 7c. Average concentration of Cadmium (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1990-2011.

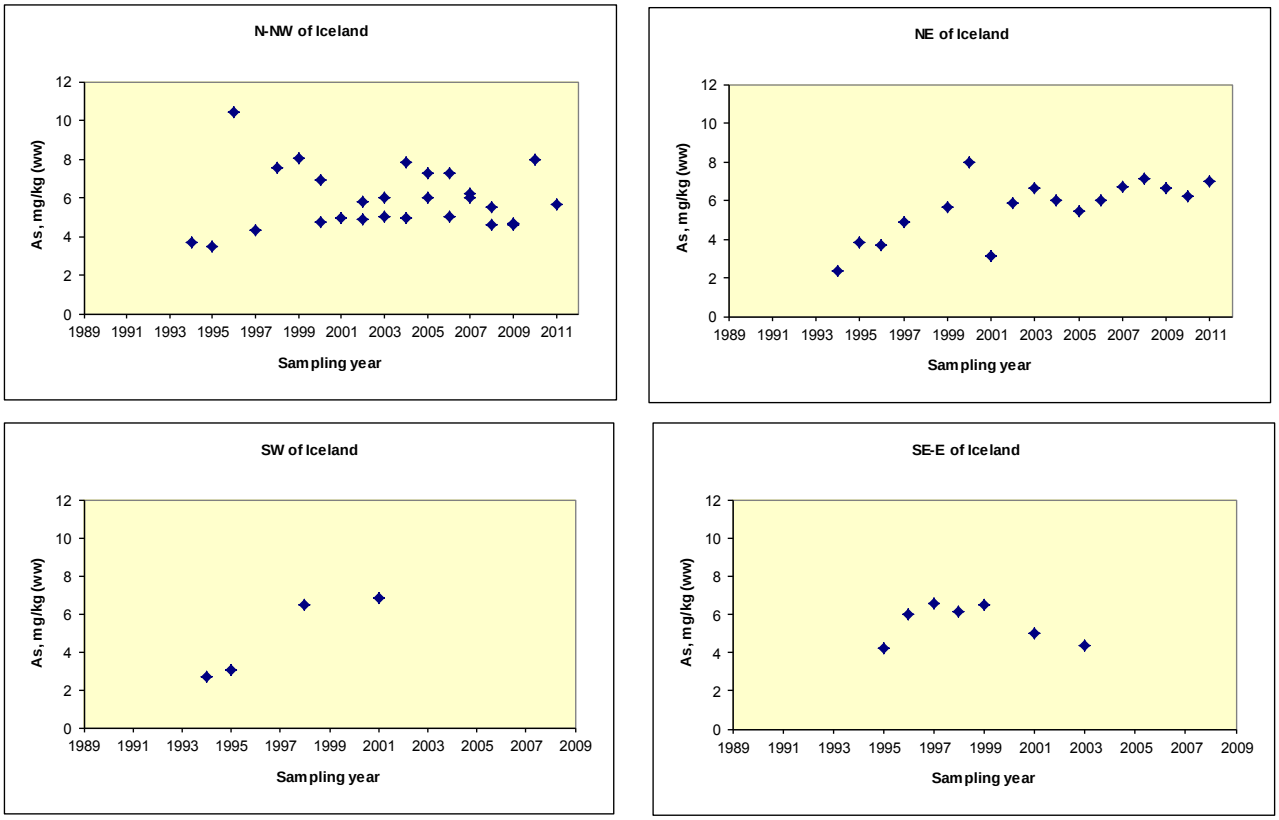


Figure 7d. Average concentration of Arsenic (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1990-2011.

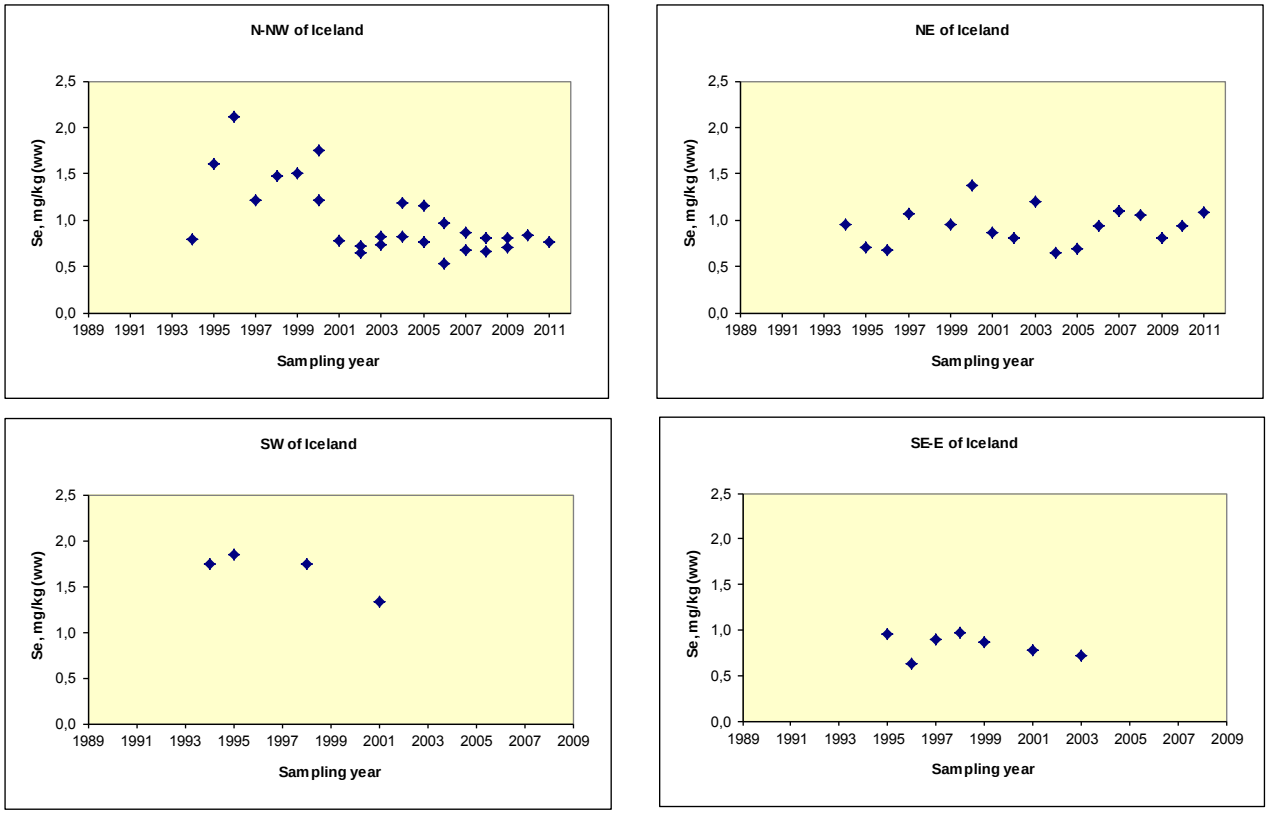


Figure 7e. Average concentration of Selenium (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1990-2011.

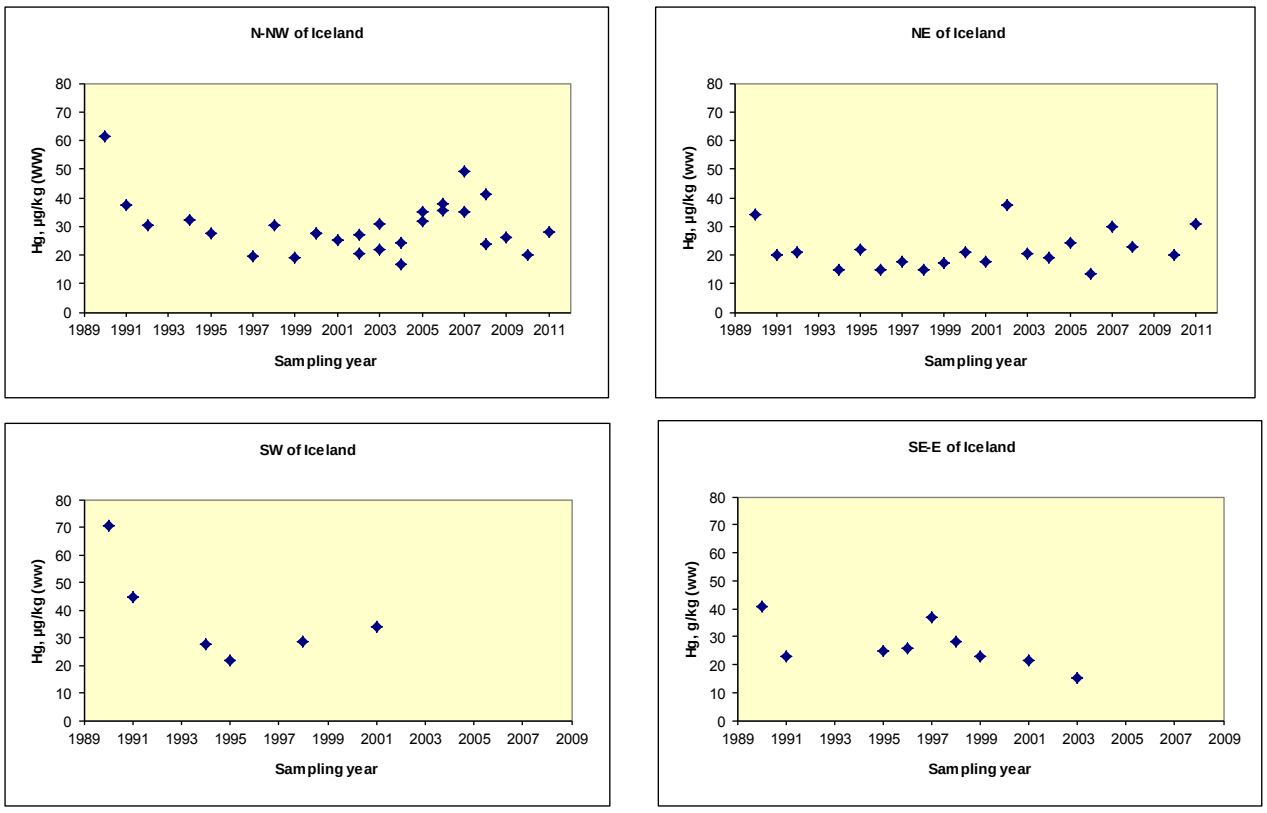
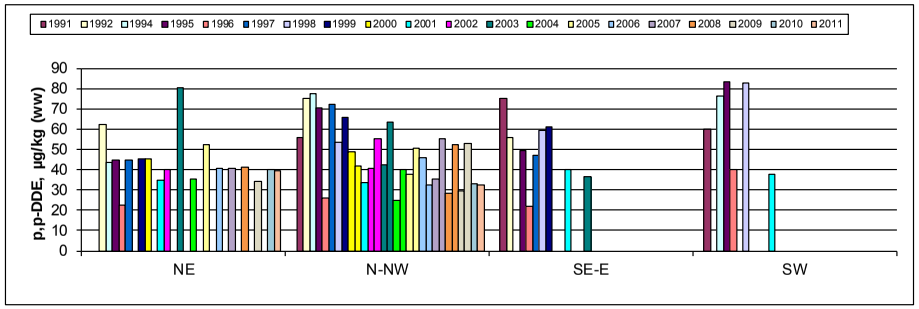
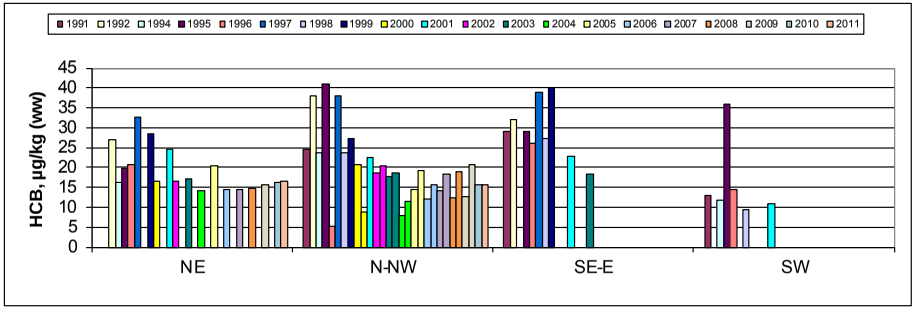
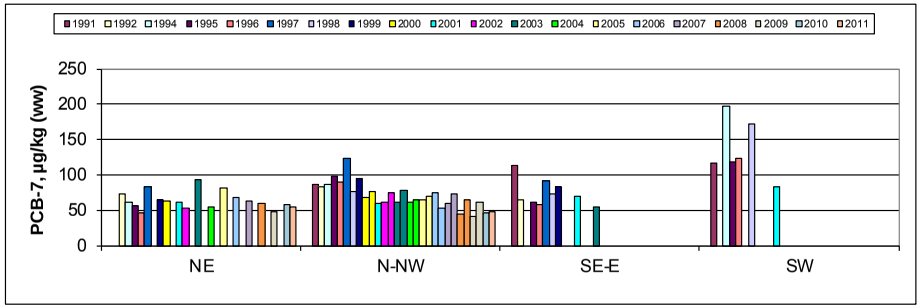
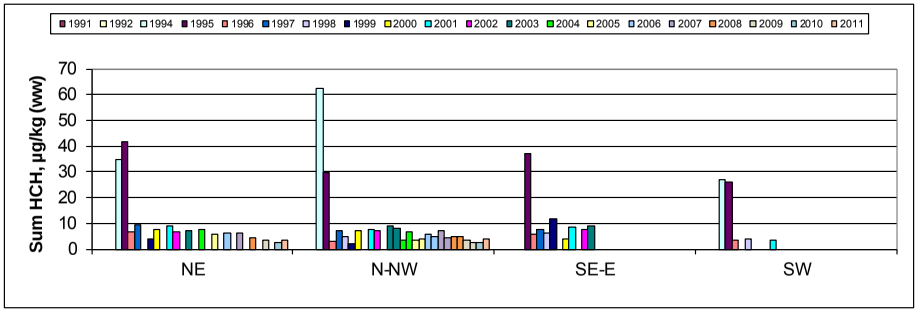


Figure 7f. Average concentration of Mercury (ww) in flesh of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1990-2011.









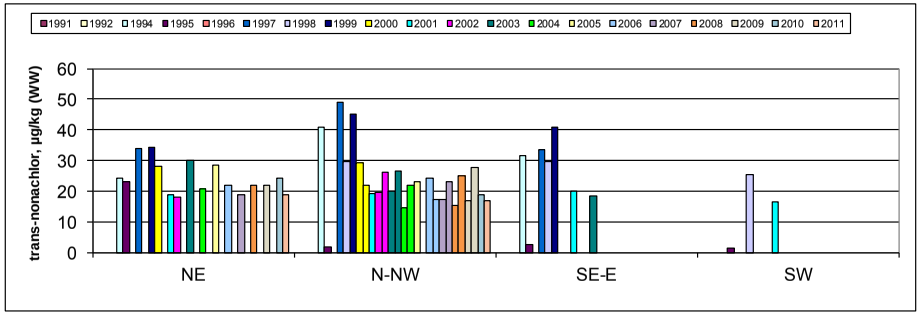


Figure 8. Average concentration of organochlorine compounds (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1991-2011.

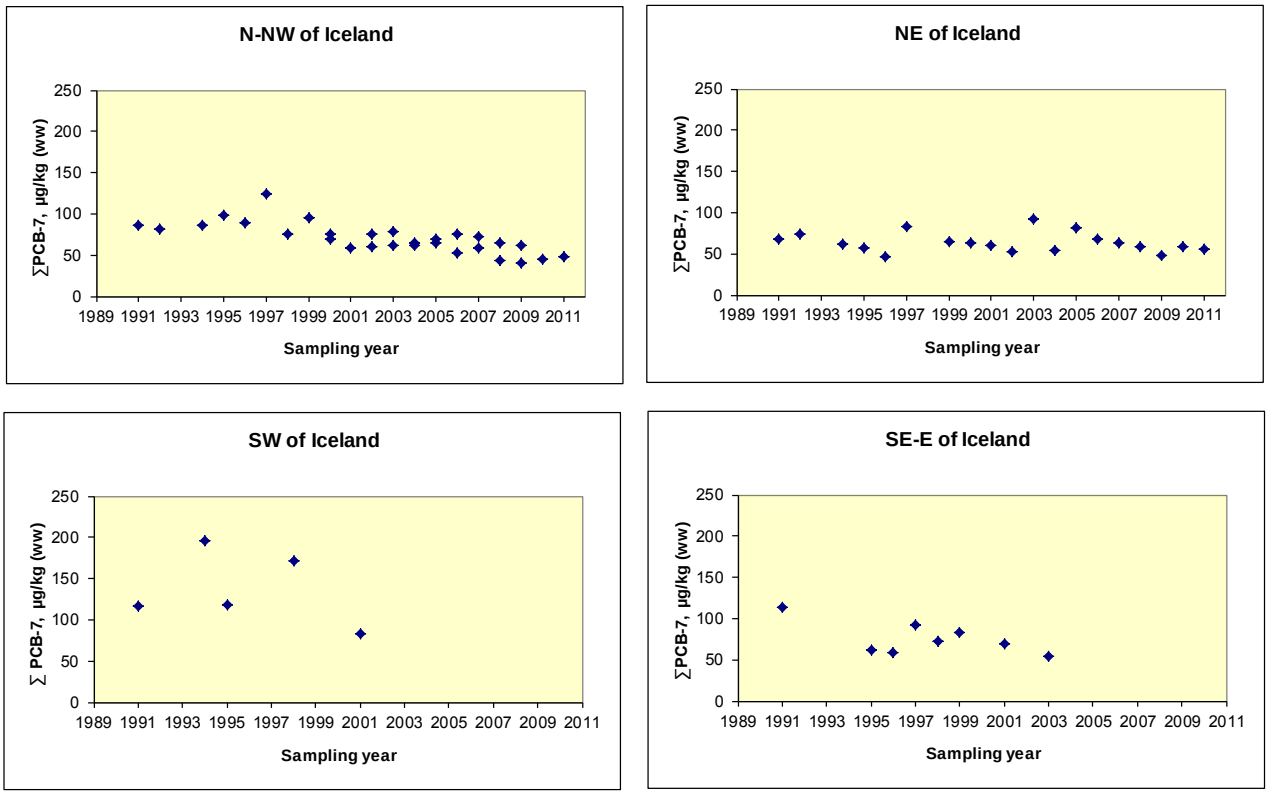


Figure 9a. Average concentration of ∑PCB-7 (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1991-2011.

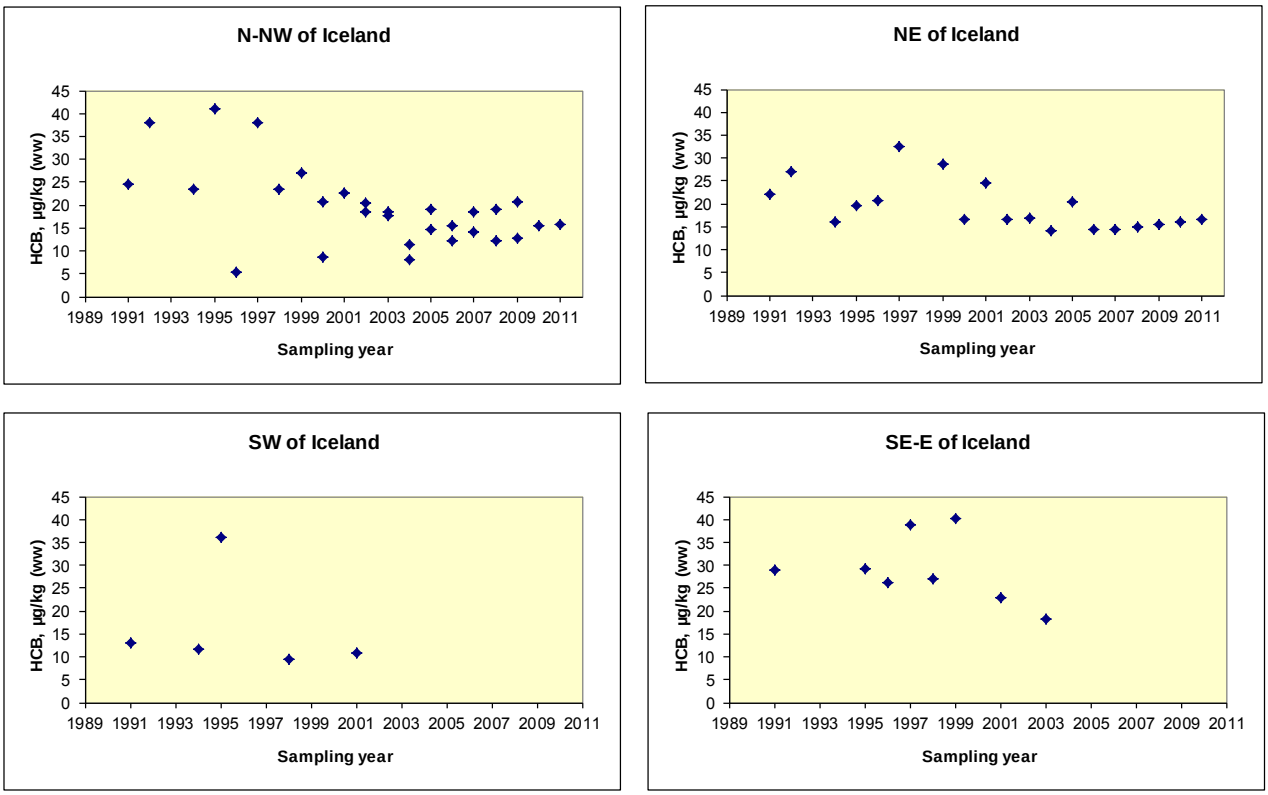


Figure 9b. Average concentration of HCB (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1991-2011.

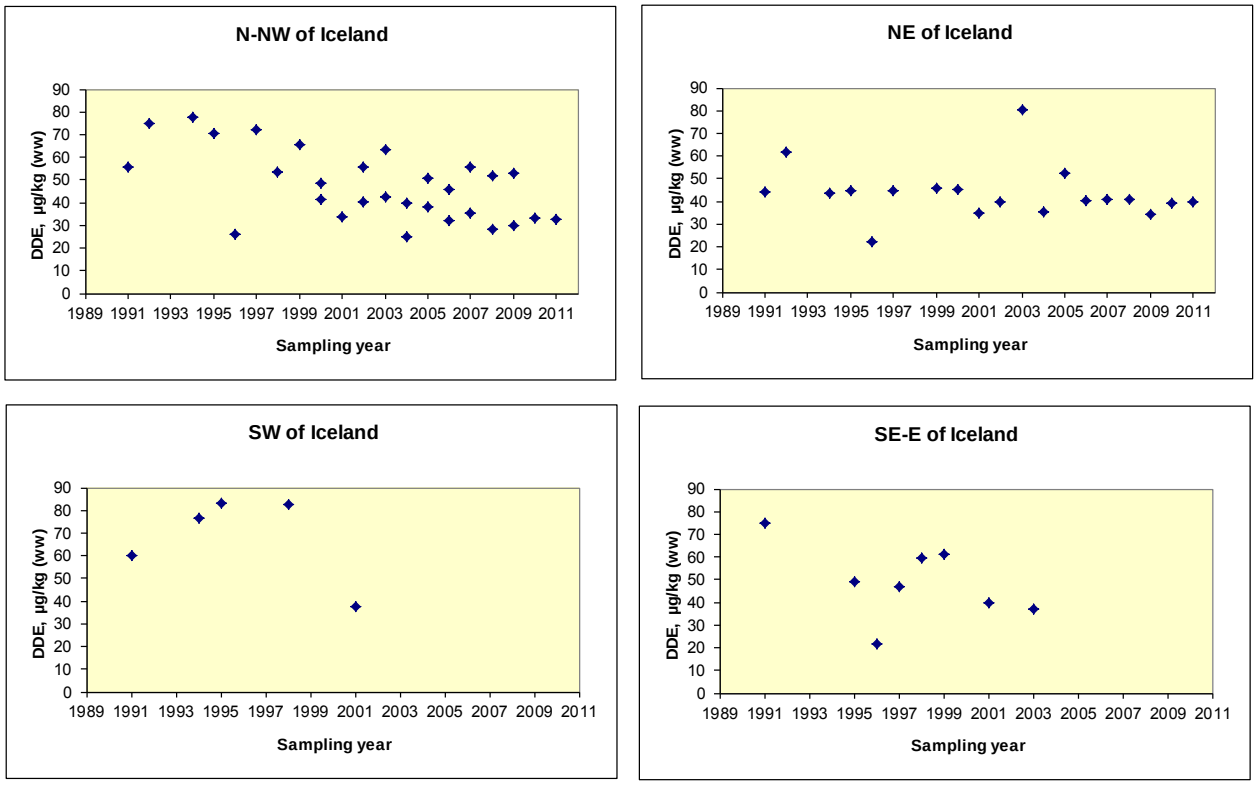


Figure 9c. Average concentration of DDE (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1991-2011.

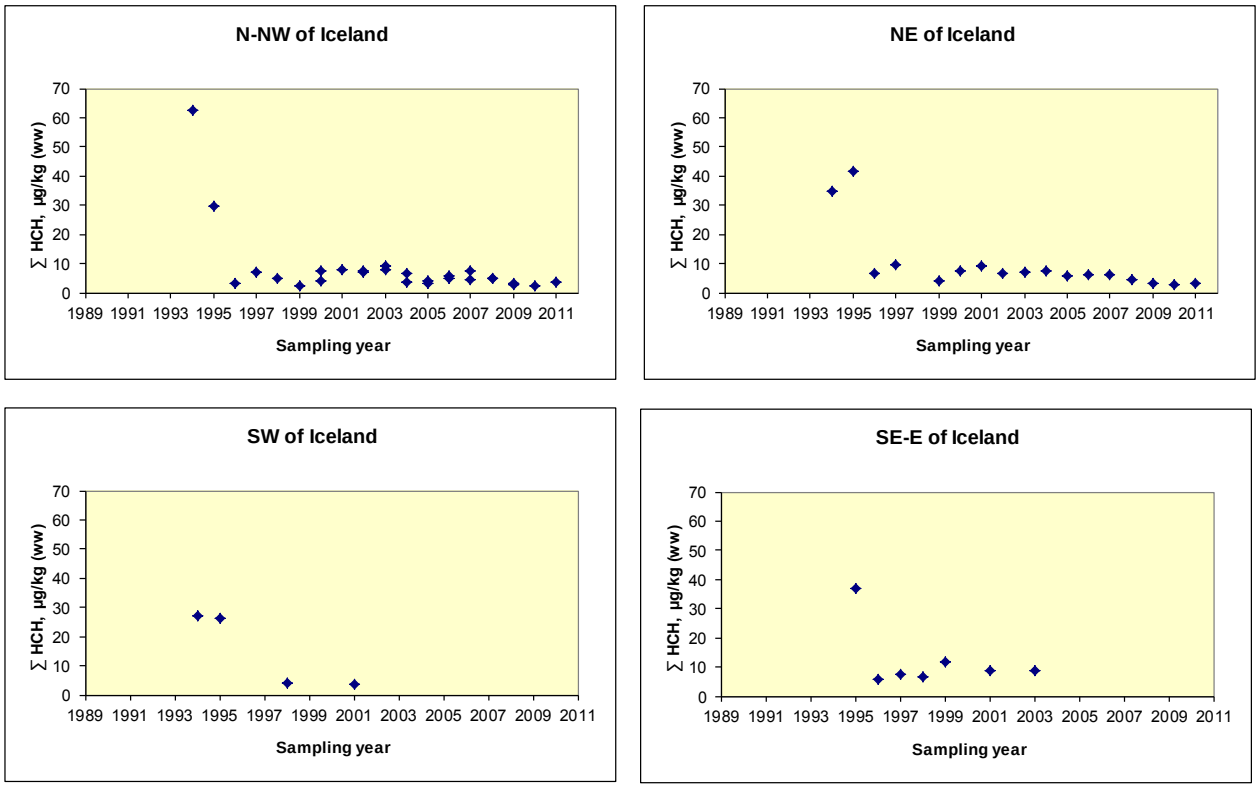


Figure 9d. Average concentration of ∑HCH (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1991-2011.

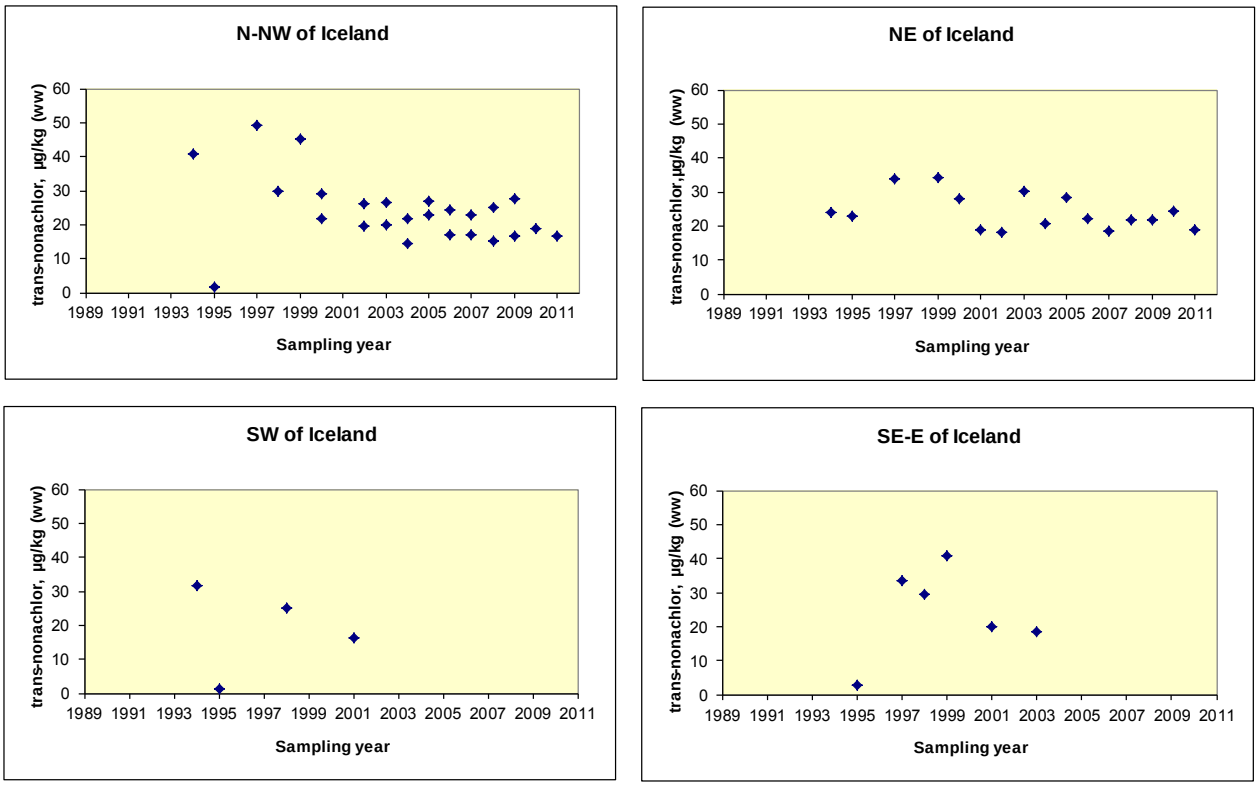


Figure 9e. Average concentration of transnonachlor (ww) in livers of 30-45 cm Cod (Gadus morhua) from different locations in Icelandic waters in March 1991-2011.