



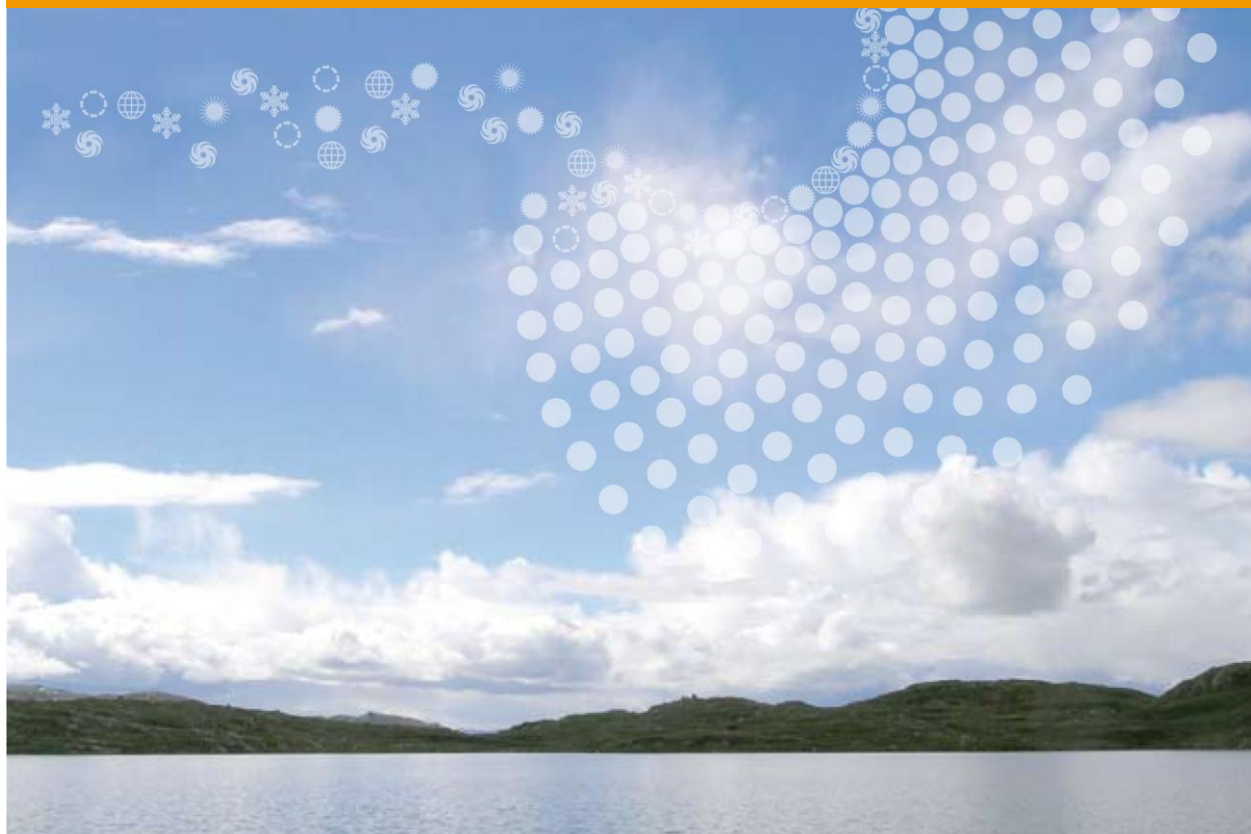
**CLIMATE AND
POLLUTION
AGENCY**

Statlig program for forurensningsovervåking, rapportnr: 1079/2010
Long-term monitoring of environmental quality in Norwegian coastal waters

Levels, trends and effects

Hazardous substances in fjords and coastal waters - 2009

TA
2716
2010



NIVA

Norwegian Institute for Water Research



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Norwegian coastal waters**

SPFO-report: 1079/2010
TA-2716/2010
ISBN 978-82-577-5783-0



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Report
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NIVA report no. 6048-2010

Norwegian Institute for Water Research

– an institute in the Environmental Research Alliance of Norway

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Title Hazardous substances in fjords and coastal waters - 2009. Levels, trends and effects. Long-term monitoring of environmental quality in Norwegian coastal waters.	Serial No. 6048-2010	Date 26-11-2010	
	Report No. O-10106	Pages 287	
Author(s) Norman W. Green Merete Schøyen Sigurd Øxnevad Anders Ruus	Tore Høgåsen Bjørnar Beylich Jarle Håvardstun Åse K. Gudmundson Rogne Lise Tveiten	Topic group Marine ecology	Distribution Open
		Geographical area Oslofjord to Varangerfjord	Printed NIVA

Client(s) Climate and Pollution Agency / Klima- og forurensningsdirektoratet, Klif	Client ref. Jon L. Fuglestad
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Abstract

This report is part of the Norwegian contribution to OSPAR's Coordinated Environmental Monitoring Programme (CEMP). CEMP 2009 included the monitoring of contaminants in blue mussel, dogwhelk, cod, and flatfish along the coast of Norway from the Oslofjord to the Varangerfjord. Time trend analyses were performed on a selection of representative contaminants of totalled 859 data series. Of the 538 time series evaluated for the 2009 investigations, 211 were statistically significant trends, 189 of these were downward trends and 22 were upwards. There were 186 of the 538 cases where concentrations in 2009 exceeded the upper limit to presumed background or the upper limit to Class I (insignificantly polluted). The dominance of downward trends indicates that contamination is decreasing.

4 keywords, Norwegian 1. Miljøgifter 2. Biologiske effekter 3. Marin 4. Norge	4 keywords, English 1. Contaminants 2. Biological effects 3. Marine 4. Norway
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Foreword

This report represents the Norwegian national comments on the 2009 investigations for the Coordinated Environmental Monitoring Programme (CEMP – a part of and referred to in earlier reports as the Joint Assessment and Monitoring Programme JAMP). CEMP is administered by the Oslo and Paris Commissions (OSPAR) in their effort to assess and remedy anthropogenic impact on the marine environment of the North East Atlantic. The current focus of the Norwegian contribution is on the levels, trends and effects of hazardous substances. CEMP-results from Norway and other OSPAR countries provide a basis for a paramount evaluation of the state of the marine environment. OSPAR receives guidance from the International Council for the Exploration of the Sea (ICES).

The Norwegian CEMP for 2009 was carried out by the Norwegian Institute for Water Research (NIVA) by contract from the The Climate and Pollution Agency, Klif (former Norwegian Pollution Control Authority, SFT). The project leader at Klif was Jon L. Fuglestad.

The Norwegian contribution to the CEMP was initiated by Klif in 1981 as part of the national monitoring programme. It now comprises three areas: the Oslofjord and adjacent areas (Hvaler-Singlefjord area and Grenlandsfjord, 1981-), Sør fjord/Hardangerfjord (1983-84, 1987-) and Orkdalsfjord area (1984-89, 1991-93, 1995-96, 2004-05), and stations in merely diffusely contaminated areas of Arendal, Lista and Bømlo-Sotra (1990-), areas from Bergen to Lofoten (1992-) and areas from Lofoten to the Norwegian-Russian border (1994-).

Acknowledgments: Thanks are due to many colleagues at NIVA, for fieldwork, sample preparations and data entry: Lise Tveiten, Merete Schøyen, Åse K. Gudmundson Rogne, Sigurd Øxnevad, Jarle Håvardstun, Janne Gitmark, Åse Bakketun, Marijana Brkljacic, Bjørnar Beylich, John Arthur Berge, Einar Kleiven, Torbjørn Johnsen, Arne Jørgen Kjøsnes and Mette Cecilie Lie. Thanks to our colleagues at Akvaplan-niva: Guttorm Christensen and Anita Evenset. For organic analyses: Kine Bæk, Alfild Kringstad, Katherine Langford and their colleagues. For metal analyses: Bente Hiort Lauritzen, Marit Villø and their colleagues. For biological effects measurements: Oscar Fogelberg, Kenneth Macrae and their colleagues. For analytical quality assurance: Eva Hagebø and her colleagues. For data programme management and operation: Tore Høgåsen. To the other authors: Merete Schøyen, Sigurd Øxnevad and Anders Ruus (biological effects methods). For quality assurance: John Arthur Berge. Thanks go also to the numerous fishermen and their boat crews for which we have had the pleasure of working with.

Oslo, 26th November 2010.

Norman W. Green
Project co-ordinator
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1. Executive Summary/Sammendrag

The Norwegian contribution to OSPAR's Coordinated Environmental Monitoring Programme (CEMP) in 2009 included the monitoring of micropollutants (contaminants) in blue mussel (49 stations), dogwhelk (10 stations), cod (14 stations) and flatfish (dab, flounder, plaice, megrim; 11 stations) along the coast of Norway from the Oslofjord and Hvaler region in the southeast to the Varangerfjord in the northeast. The stations are located both in areas with known or presumed point sources of contaminants and in areas more remote, exposed to presumed diffuse contamination. The mussel sites include supplementary stations for the Norwegian Index Programme. There were totally 859 time series and 538 of these included results from 2009. Of these, 211 showed statistically significant trends; 189 were downwards and 22 were upwards. The dominance of downward trends indicates that contamination is decreasing. In 186 cases, concentrations were above what is expected in only diffusely contaminated areas (collectively termed over expected high background concentrations). The general situation for the two major impacted areas of CEMP is as follows:

The Oslofjord/Hvaler/Grenlandsfjord area

The Oslofjord was contaminated with PCBs (expressed the sum of seven PCB congeners), mercury and cadmium. Cod fillet from the Inner Oslofjord was moderately polluted by mercury, and had a significant upward trend for the period 1984-2009. Cod liver from the Inner Oslofjord had median concentrations of lead and cadmium higher than presumed high background, and there was a significant upward trend for cadmium in cod liver from the Inner Oslofjord for the same period. Cod liver from the Inner Oslofjord was markedly polluted with PCBs. Cod fillet from the Inner Oslofjord was also markedly polluted with PCBs in 2009. This was higher than the concentration in 2008 and there was a significant upward trend for the period 2000-2009. Cod from the outer part of the Oslofjord (Færder) were only insignificantly polluted by mercury, lead, cadmium and PCBs.

Blue mussel from Gressholmen, Akershuskaia and Ramtonholmen were moderately polluted by PCBs. There were significant downward trends for PCBs at these three stations for the whole monitoring period from 1987, 1992 and 1995, respectively, to 2009. The other blue mussel stations in the Oslofjord area were only insignificantly polluted by PCBs. Blue mussel from Damholmen in the Hvaler area were moderately polluted by mercury. The other blue mussel stations in the Oslofjord area were only insignificantly polluted by mercury. Blue mussel from Fugleskjær in the Hvaler area were moderately polluted by cadmium. Blue mussel from Gressholmen, Ramtonholmen, Solbergstrand and Mølen were insignificantly/slightly polluted by cadmium but had upward trends for the whole monitoring period from 1984, 1995, 1983 and 1983, respectively, to 2009. None of the blue mussel stations in the Oslofjord area were polluted by lead.

Blue mussel from stations in the Grenlandsfjord area were extremely polluted by dioxins. The concentrations of dioxins have increased every year in blue mussel at Gjemesholmen since 2005. There was a tendency towards an increase also at Bjørkøya and Strømtangen, but there were no significant trends for any of these stations.

The Sørfjord/Hardangerfjord area

The Sørfjord and Hardangerfjord were contaminated with DDE (p,p'DDE, a metabolite of DDT), cadmium, mercury and to a lesser degree PCBs. Cod fillet from the Inner Sørfjord was moderately polluted by mercury. Cod from Strandebarm in the Hardangerfjord was insignificantly polluted by mercury. There were concentrations over presumed high background levels and an upward trend for the period 1986-2009 for mercury in flounder fillet from the Inner Sørfjord.

Cod from the Inner Sørfjord showed concentrations of cadmium in the liver that exceeded presumed high background level. There was a significant upward trend for cadmium in cod liver for this station for the period 1986-2009. Cod from Strandebarm in the Hardangerfjord had a significant downward trend for the period 1987-2009 and median concentration of cadmium in 2009 was below presumed high background. Cod from the Inner Sørfjord had a median concentration of lead in the liver that exceeded presumed high background level. The median concentration of lead in cod liver from here had increased slightly compared to 2008, and there was a significant upward trend for the period 1990-2009. Inhibition of ALA-D in cod was commonly observed in the Sørfjord, also in 2009, as a result of the lead exposure. Cod liver from Strandebarm had a median concentration of lead below presumed high background level in 2009 and there was a significant downward trend for the same period.

Liver of cod from the Inner Sør fjord was insignificantly polluted by PCBs. The fillet of the same fish was however moderately polluted by PCBs. Liver and fillet of cod from Strandebarm in the Hardanger fjord were insignificantly polluted by PCBs. There was a significant downward trend for PCBs in cod liver from Strandebarm for the period 1990-2009. Cod liver and fillet from the Inner Sør fjord was moderately polluted by DDE. Both liver and fillet of cod from Strandebarm were insignificantly polluted by DDE, and showed significant downward trends for the same period.

Significant downward trends have been observed for cadmium in blue mussel in the Inner and Mid Sør fjord during the last two decades. In 2009 the blue mussel from the Inner and Mid Sør fjord were insignificantly to moderately polluted by mercury and lead. For three blue mussel stations in the Sør fjord, there were concentrations classified up to markedly polluted by DDE. The blue mussel at Kvalnes in the Mid Sør fjord has declined two classes in the classification system from extremely polluted in 2008 to markedly polluted in 2009.

Biological effects

Biological effects methods are included for in the monitoring programme to evaluate whether marine organisms are affected by contaminants in their environment, something that can not be assessed from concentrations of chemicals in tissues alone. Biological effects were investigated in cod from four areas: Inner Oslofjord, Lista, Bømlo-Sotra (Karihavet) and the Inner Sør fjord. The median amount of CYP1A protein in the liver of cod from the Inner Oslofjord in 2009 was lowest since investigations began in 2003; 50 % lower compared to 2008, however no significant trend could be detected. CYP1A protein levels were however higher in the Inner Oslofjord compared to the Inner Sør fjord and Karihavet, as was observed for the EROD activities. An explanation could be that the exposure to PCBs is higher in the Inner Oslofjord than in the Sør fjord and Karihavet.

In 2009, the median concentration of OH-pyrene metabolites in bile from cod was higher in the Inner Oslofjord compared to samples from the Inner Sør fjord, the Bømlo-Sotra area and Lista. Changes in concentrations of PAHs measured in blue mussel from the Inner Oslofjord correlate moderately well to alterations in OH-pyrene concentrations in the bile of cod from the same area. Since the year 2000 investigations have shown that EROD-activity in fish from the Inner Oslofjord is often higher than presumed cleaner stations. In the Inner Sør fjord EROD activities were often lower than at the reference Karihavet (although higher in 2009).

Of the time series investigated for biological effects (imposex) of TBT in dogwhelk, seven stations showed significant downward trends and two had no significant trends for the entire monitoring period, the first year of which varied from 1997 to 2002. The effects from TBT were low (VDSI<2) at eight of 10 stations investigated in 2009.

Other observations

Polybrominated diphenyl ethers (PBDEs) and perfluoroalkyl compounds (PFCs) have been investigated in cod liver since 2005. In 2009, the concentration of sum PBDE and PFOS (the most abundant PFC) was highest in cod from the Inner Oslofjord. PBDE was lowest in cod east of Bjørnerøya in Lofoten. BDE47 was the dominant PBDE in all samples. PFOS was lowest in the Sør fjord.

Blue mussel from two stations in the Kristiansandsfjord were markedly and moderately polluted by PAHs. Blue mussel from Ranfjord were extremely polluted by B[a]P, and blue mussel from the Kristiansandsfjord were up to severely polluted by benzo[a]pyrene.

Based on nine fjord areas, that are effected by point sources of contaminants, the Pollution Index for 2009 was 2.8, which was 0.2 lower than in 2008. A value between 2 and 3 would be termed by the Klif environmental system as "Marked" polluted. For the Reference Index based on four fjord areas that are presumably little polluted with contaminants, the Index value for 2009 was 1.2, which was 0.4 lower than the revised index 2008. A lower index in each of these cases indicates that contamination has decreased.

Sammendrag

Det norske bidraget til OSPARs felles overvåkingsprogram CEMP 2009 inkluderer overvåking av miljøgifter i blåskjell (49 stasjoner inkludert stasjoner for beregning av forurensningsindeks), purpursnegl (10 stasjoner), torsk (14 stasjoner) og flatfisk (sandflyndre, skrubbe, rødspette, glassvar; 11 stasjoner) langs kysten fra Oslofjordområdet til Varangerfjorden. Stasjonene er lokalisert i områder med kjente eller antatte punktkilder av miljøgifter og i områder med antatt diffus belastning. Undersøkelsene omfatter totalt resultater fra 859 tidsserier hvorav 538 inkluderer resultater fra 2009. 257 av disse viste signifikante trender hvorav 189 viste en nedadgående trend og 22 viste en oppadgående trend. Dominans av nedadgående trender tyder på mindre forurensning av miljøgifter. Det var 186 tilfeller hvor resultatene viste konsentrasjoner over antatt høyt bakgrunnsnivå. Tilstand og utvikling i to områder som er påvirket av forurensninger er som følgende:

Oslofjorden/Hvaler/Grenlandsfjorden

Oslofjorden er forurenset med PCB (uttrykt som sum av syv PCB kongener), kvikksølv og kadmium. Filet av torsk fra Indre Oslofjord var moderat forurenset av kvikksølv, og det var en oppadgående trend for perioden 1984-2009. Torskelever fra Indre Oslofjord hadde nivåer av bly og kadmium som var over antatt høyt bakgrunnsnivå, og det var signifikant oppadgående trend for kadmium i torskelever for den samme perioden. Torskelever fra Indre Oslofjord var markert forurenset av PCB. Også filet av torsk fra Indre Oslofjord var markert forurenset av PCB i 2009. Dette var en økning siden 2008, og det var en signifikant oppadgående trend for perioden 2000 til 2009. Torsk fra Ytre Oslofjord var ikke forurenset av kvikksølv, bly, kadmium eller PCB.

Blåskjell fra Gressholmen, Akershuskaia og Ramtonholmen i Indre Oslofjord var moderat forurenset av PCB. Det var imidlertid en signifikant nedadgående trend for PCB i blåskjell for disse stasjonene for hele undersøkelsesperioden fra hhv. 1987, 1992, 1995 til 2009. De andre blåskjellstasjonene i Oslofjordområdet var ubetydelig forurenset av PCB. Blåskjell fra Damholmen på Hvaler var moderat forurenset av kvikksølv. De andre blåskjellstasjonene i Oslofjordområdet var ubetydelig forurenset av kvikksølv. Blåskjell fra Fugleskjær på Hvaler var moderat forurenset av kadmium. Blåskjell fra Gressholmen, Ramtonholmen, Solbergstrand og Mølen var ubetydelig forurenset av kadmium, men hadde oppadgående trender for hele perioden fra hhv. 1984, 1995, 1983, 1983 til 2009. Ingen av blåskjellstasjonene i Oslofjordområdet var forurenset av bly.

Blåskjell fra stasjonene i Grenlandsfjorden var meget sterkt forurenset av dioksiner. Konsentrasjonen av dioksiner i blåskjell fra Gjemesholmen har økt hvert år siden 2005. Også ved Bjørkøya og Strømtangen var det økende tendens for dioksiner i blåskjell. Økningen var imidlertid ikke signifikant.

Sørfjorden/Hardangerfjorden

Sørfjorden og Hardangerfjorden var forurenset med DDE (p,p'DDE, en metabolitt av DDT), kadmium, kvikksølv og i mindre grad PCB. Torskefilet fra Indre Sørfjorden var moderat forurenset av kvikksølv. Torskefilet fra Strandebarm i Hardangerfjorden var ubetydelig forurenset av kvikksølv. I skrubbefilet var det konsentrasjon av kvikksølv over antatt høyt bakgrunnsnivå, og stigende trend for perioden 1988-2009.

I torskelever fra Indre Sørfjorden var det nivåer av kadmium og bly høyere enn antatt høyt bakgrunnsnivå og oppadgående trend for perioden 1986-2009. Kadmium i torskelever fra Strandebarm i Hardangerfjorden avtok signifikant i perioden 1987-2009 og median konsentrasjon i 2009 var under antatt bakgrunn. Torsk fra Indre Sørfjorden hadde median konsentrasjon av bly over antatt høyt bakgrunnsnivå. Konsentrasjonen var litt høyere enn i 2008, og en signifikant oppadgående trend var registrert for perioden 1990-2009. Inhibering av ALA-D i torsk har vært ofte registrert i Sørfjorden, også i 2009, som et resultat av torskens eksponering for bly. Torskelever fra Strandebarm var lite forurenset av bly i 2009 og det ble registrert en signifikant nedadgående trend for samme periode.

Lever av torsk fra Indre Sørfjorden var ubetydelig forurenset av PCB, men fileten fra den samme torsken var moderat forurenset av PCB. Torskelever og -filet fra Strandebarm var ubetydelig forurenset av PCB. En signifikant nedadgående trend for PCB i torskelever her var registrert for perioden 1990-2009. Torskelever og -filet fra Indre Sørfjorden var også moderat forurenset av DDE. Torskelever og -filet fra Strandebarm var ubetydelig forurenset med DDE, og viste nedadgående trend for samme periode.

Det har vært signifikant nedadgående trender for kadmium i blåskjell fra den indre- og midtre Sørfjorden de siste 20 år. I 2009 var blåskjellene i den indre- og midtre delen av Sørfjorden ubetydelig til moderat forurenset av kvikksølv og bly. Lenger utover Sørfjorden og Hardangerfjorden var blåskjellene ubetydelig forurenset av kvikksølv og bly. Tre av blåskjellstasjonene i Sørfjorden var markert forurenset av DDE. Ved den ene av stasjonene (Kvalnes) var det en nedgang siden 2008, da blåskjellene var meget sterkt forurenset av DDE i 2009.

Biologiske effekter

Biologiske effekt-parametre er inkludert i overvåkingsprogrammet for å evaluere eventuell påvirkning på organismer av forurensning, noe som kan ikke tilegnes kun fra konsentrasjoner av kjemikalier i vevsprøver alene. Biologiske effekt-parametre ble undersøkt i torsk fra fire stasjoner langs kysten: Indre Oslofjord, Lista, Bømlo–Sotra og Indre Sørfjorden. Effekt-parameterene er: OH-pyren (pyren metabolitt; markør for PAH-eksponering), δ -aminolevulinsyre dehydrase (ALA-D; markør for bly-eksponering), og mengde protein (CYP1A), samt aktivitet av cytokrom P4501A (EROD; markør for plane hydrokarboner, slik som PCB/PCN, PAH og dioksiner). Konsentrasjonen av CYP1A protein i torskelever fra Indre Oslofjord var i 2009 lavest siden undersøkelsen begynte i 2003; 50 % lavere enn i 2008. Nivået av CYP1A protein var imidlertid høyere i Indre Oslofjord enn i Indre Sørfjorden og Karihavet, noe som også ble funnet for EROD aktivitet. En mulig forklaring kan være at eksponering for PCB er høyere i Indre Oslofjord enn i Sørfjorden og Karihavet.

I 2009 var konsentrasjonen av OH-pyren metabolitter i galle fra torsk høyere i Indre Oslofjord enn i prøver fra Indre Sørfjorden, Karihavet og Lista. Endringer i PAH-konsentrasjoner i blåskjell fra Indre Oslofjord korrelerte bra med OH-pyren i torskegalle fra samme område. Siden 2000 har EROD-aktivitet i torsk fra dette området ofte vært noe høyere enn antatt mindre belastede steder. EROD i torsk fra Indre Sørfjord var ofte lavere (ikke i 2009) enn torsk fra Karihavet; et sted som antas å være mindre belastet med miljøgifter.

Biologiske effekter av TBT (imposex) ble undersøkt på purpurnegl. Sju av ti stasjoner hadde signifikant nedadgående trender, og for to av stasjonene var det ingen signifikant trend. Effektene av TBT var lave (VDSI<2) ved åtte av de ti undersøkte stasjonene i 2009.

Andre observasjoner

Polybrominerte difenyletere (PBDE) og perfluoroalkyl stoffer (PFC) har vært undersøkt i torskelever siden 2005. I 2009, var median konsentrasjoner av sum-PBDE og PFOS, (det PFC-stoffet som det er mest av) høyest i Indre Oslofjord. PBDE var lavest i torsk øst for Bjørnerøya i Lofoten området. Av PBDE'ne var det mest av BDE47. PFOS var lavest i Indre Sørfjorden.

Blåskjell fra Kristiansandsfjorden var moderat til markert forurenset av PAH. Blåskjell fra Ranfjorden var meget sterkt forurenset av Benzo[a]Pyren, og blåskjell fra stasjonene i Kristiansandsfjorden var opptil sterkt forurenset av Benzo[a]Pyren.

På basis av forekomst av noen utvalgte miljøgifter i blåskjell har en siden 1995 beregnet en blåskjell-forurensningsindeks og en blåskjell-referanseindeks på basis av resultatene fra en gruppe forurensede og referansefjordområder. Basert på ni påvirkede fjordområder var forurensningsindeksen for 2009 på 2.8, som er 0.2 lavere enn i 2008. En verdi mellom 2 og 3 blir klassifisert som "markert" forurenset i henhold til Klifs klassifiseringssystem. Referanseindeksen er basert på fire antatt lite påvirkede fjordområder, og var i 2009 på 1.9, som er 0.4 lavere enn i 2008. At indeksene i hvert tilfelle har avtatt indikerer at områdene har blitt mindre forurenset med hensyn til miljøgifter.

2. Introduction

2.1. Background

Environmental concerns include the risks due to the pollution of air, soil and water. The Norwegian Pollution Monitoring Programme, administered by the Norwegian Climate and Pollution Agency (Klif), is designed to deal with these aspects. A part of this programme focuses on the levels, trends and effects of hazardous substances in fjords and coastal waters, which also represents the Norwegian contribution to the Coordinated Environmental Monitoring Programme (CEMP). CEMP is a common European monitoring programme under the auspices of Oslo and Paris Commissions (OSPAR). The Norwegian contribution to CEMP addresses several aspects of OSPAR's assessment hazardous substances. For this report the term CEMP only refers to the Norwegian contribution.

An overview of CEMP stations in Norway is shown in the tables in Appendix F and maps in Appendix G. It has included the monitoring of sediment, sea water and biota since 1981 with particular emphasis on three areas:

- Oslofjord-area (including the Hvaler area, Singlefjord and Grenland fjords area)
- Sørfjord/Hardangerfjord
- Orkdalsfjord area

During 1990-1995 and 2008-2009 Norway has also included

- Arendal and Lista areas

The previous investigations (cf. Appendix A) have shown that the Inner Oslofjord area has enhanced levels of PCBs in cod liver, mercury, lead and zinc in sediments and moderately elevated values of mercury in cod fillet. Investigations of the Sørfjord/Hardangerfjord have shown elevated levels of PCBs, DDT, cadmium, mercury and lead. The Norwegian Food Safety Authority (*Mattilsynet*) has issued warnings about the consumption of fish and/or mussel in the Oslofjord and Sørfjord partly based on these investigations. Investigations in Orkdalsfjord were discontinued during the period 1996 to 2003 and from 2006. Blue mussel from the Orkdalsfjord were monitored for the period 1984-1996, and then not again until 2004-2005 when bulk samples from three stations were investigated. The results from these investigations have been reported earlier (Green *et al.* 2007, Green & Ruus 2008).

In addition to the monitoring of Oslofjord area and Sørfjord/Hardangerfjord CEMP also includes the annual monitoring of selected stations in Lista and Bømlo areas on the south and west coast of Norway, respectively. CEMP includes sampling of blue mussel from reference areas along the coast from Lofoten to the Russian border, which were included in a 1993-1996 and 2006-2007 survey. The sampling also includes fish from four key areas north of Lofoten: Finnsnes-Skjervøy area, Hammerfest-Honningsvåg area, and Varanger Peninsula area. Fish from the Lofoten and Varanger Peninsula areas are sampled annually. The intention is to assess the level of contaminants in reference areas, areas that are considered to be little affected by contaminants, and to assess possible temporal trends.

Concentrations of metals, organochlorines (including pesticides), polycyclic aromatic hydrocarbons, polybrominated diphenyl ethers or perfluorinated compounds in blue mussel or fish were determined at the Norwegian Institute for Water Research (NIVA). Dioxins were analysed by the Norwegian Institute for Air Research (NILU). TBT analyses on blue mussel and dogwhelk were done at Eurofins.

Analytical methods have been described previously (Green *et al.* 2008a). Parameter abbreviations are given in Appendix C.

Biological effects methods, BEM or biomarkers were introduced in the Norwegian CEMP (former JAMP) in 1997. The purpose of these markers is, by investigations on molecular/cell/individual level, to give warning signals if ecosystems are affected by toxic compounds, i.e. contaminants, and to assist in establishing an understanding of the specific mechanisms involved. The reason to use

biological effects methods within monitoring programmes is to evaluate whether marine organisms are affected by contaminant inputs. Such knowledge can not be derived from tissue levels of contaminants only. Just one reason is the vast number of chemicals (known and unknown) that organisms are exposed to, in combination, in the environment. In addition to enable conclusions on the health of marine organisms, some biomarkers assist in the interpretation of contaminant bioaccumulation. The biological effects component of the Norwegian CEMP is possibly the most extensive of its type in Europe and includes Imposax in gastropods as well as biomarkers in fish. The methods for fish were selected for specificity, for robustness and because they are among a limited set of methods proposed by international organisations, including OSPAR and ICES.

2.2. Purpose

The general purpose of CEMP is to assess the state of contamination in the marine environments in order to provide a basis for remedial action. The Norwegian contribution to CEMP is designed to address issues relevant to OSPAR (cf., OSPAR 2007, SIME 2004a) including OSPAR priority substances (SIME 2004b). And in this regard will be relevant to implementation of international initiatives such as The Water Framework Directive (WFD) (2000/60/EC) and the Marine Strategy Framework Directive (MSFD) (2008/56/EC). One of the goals of both of these EU directives is to achieve concentrations of hazardous substances in the marine environment near background values for naturally occurring substances and close to zero for manmade synthetic substances. OSPAR has also adopted this goal (OSPAR 1998b).

The state of contamination is divided into three issues of concern: levels, trends and effects. These are applied to the following regions:

- Oslofjord, Hvaler and Grenland area
- Sør fjord/Hardangerfjord
- Selected stations, remote from known point sources, along the entire coast of Norway
- Selected impacted blue mussel stations used for determination of Klif's pollution index

Different monitoring strategies are used, in particular with regard to the selection of indicator media (sediment, blue mussel, cod liver etc.) and sampling frequencies (generally every 5-10 years for sediment, annually for biota). The programme may be supplemented with long or short-term investigations of hazardous substances that are not routinely monitored.

Where possible CEMP is integrated with other national monitoring programmes to achieve a better practical and scientific solution to assessing the levels, trends and effects of micropollutants. In particular, this concerns Comprehensive Study on Riverine Inputs and Direct Discharges (RID) and The Norwegian Coastal Monitoring Programme (*Kystovervåkingsprogrammet*, KYO). Both programmes are operated by NIVA on behalf of Klif.

3. Materials and methods

3.1. Sampling

The objective for the performed monitoring is to obtain updated information on levels and trends of selected hazardous substances, which are known to have a potential for causing detrimental biological effects on humans and wildlife that feed on marine organisms. In the marine environment, these substances may accumulate in the bottom sediment/porewater and in fish and shellfish. Because these fish and shellfish are a food source for marine wildlife and humans, the substances may be transferred to higher levels in the food chain. In humans, long-term exposure to or consumption of sea foods contaminated with these substances can cause severe health problems. The pathway of contamination is not always obvious. Although hot spots tend to be directly linked to particular human activities, the substances are also found in organisms that are collected far away from point sources because of transport by ocean currents, atmosphere or migration of prey species. The transport of these substances by these means can not be disregarded in this respect.

Concentrations of hazardous substances in sediment/porewater, mussel and fish constitute time-integrating state indicators for coastal water quality. With respect to organism, these substances have a tendency to accumulate in their tissues (bioaccumulation), and show higher concentrations relative to their surroundings (water and in some cases also sediment). Hence, it follows that the substances may be detected, which would otherwise be difficult when analysing water or sediment. Another advantage of using biota concentrations as indicators, as opposed to using water or sediment, is that they are of direct ecological importance as well as being important for human health considerations and quality assurance related to commercial interests involved in harvesting marine resources.

CEMP uses sediment monitored at about 10-year intervals and blue mussel, cod, and several flatfish species on a yearly basis. Mussels are attached to shallow-water surfaces, thus reflecting exposure at a fixed point (local pollution). Mussels are also abundant, robust and widely monitored in a comparable way. Mussels are, however, restricted to the coastal zone. Cod is a widely distributed and commercially important fish species. Fish are predators and, as such, will reflect contamination levels in their prey.

Samples were collected and analysed, where practical, according to OSPAR guidelines (more explicitly for 2009 sampling: OSPAR 2003b and OSPAR 2009)¹ and screened and submitted to ICES by agreed procedures (ICES 1996).

The sampling for 2009 involved blue mussel (49 stations), dogwhelk (10 stations), cod (14 stations), and flatfish (11 stations). (Figure 1, cf. Appendix F). This included three new cod-stations in the harbour areas of: Kristiansand (st.13BH), Trondheim (st.80BH) and Tromsø (st.43BH). The Norwegian CEMP has been expanded since 1989 to include monitoring in more diffusely polluted areas. Sufficient samples have not always been practical to obtain. When this applies to blue mussel, a new site in the vicinity is often chosen. As for fish, the quota of 25 individuals ($\pm 10\%$), indicated in (Appendix F), as either 25 individuals or 5 bulked samples consisting of 5 fish per bulked sample, was not always met.

¹ See also www.ospar.org/eng/ > measures > list of other agreements

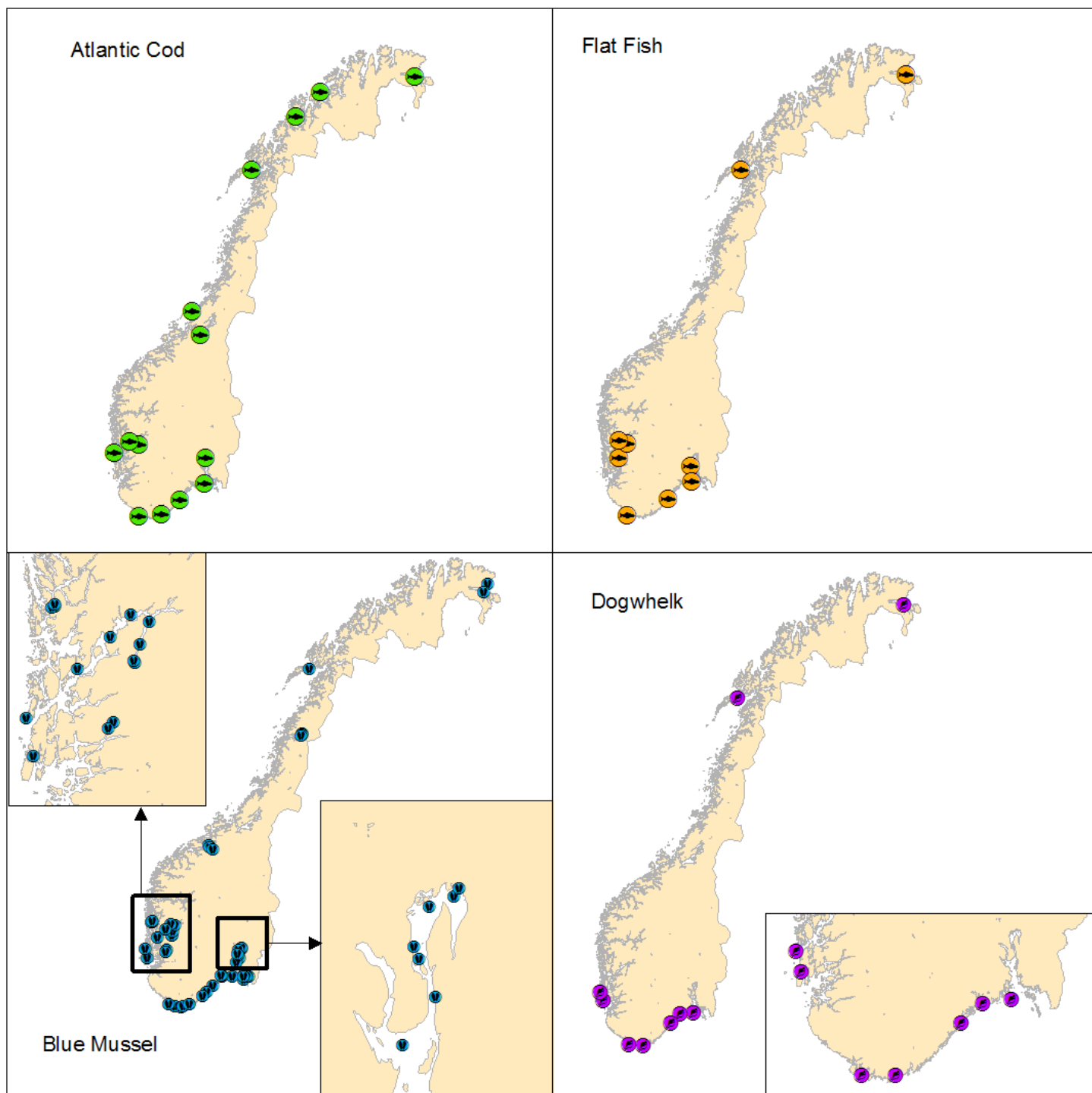


Figure 1. Stations samples where sampling of blue mussel, dogwhelk, cod and flatfish in 2009 is indicated. See also station information in Appendix F and detailed maps in Appendix G.

Blue mussel

There is some evidence that the effect of shell length and difference in bulk sample size are of little or no significance (WGSAEM 1993; Bjerkeng & Green 1994). However, for historical reasons, three size groups of blue mussel (*Mytilus edulis*) have been sampled from most of the stations: 2-3 cm (100 individuals), 3-4 cm (50 individuals) and 4-5 cm (50 individuals). In order to obtain about 50 g wet weight, which is necessary for analyses and potential reanalyses of all variables, fifty to hundred individuals were sampled for each class. In 1992 a stricter approach (ICES 1992) was applied for new stations north of the Bømlo area at which 3 pooled samples of 20 individuals each were collected in the size range of 3-5 cm. Pending further investigation, all blue mussel samples from the new stations are collected according to this ICES method. Shell length was measured by slide callipers. The blue mussel were scraped clean on the outside by using knives or scalpels before taking out the tissue for the analysis.

To empty the intestinal canal (deuration) the mussel were kept alive for 12-24 hours in sea water (about 15 litres) collected in close proximity to the station. The shells were spread out on a perforated polyethylene platform and submerged in the sea water in a container and an aquarium pump pumped air to bottom of the aquarium which kept the water oxygenated. The container used was lined with polyethylene plastic bags and the bags were replaced for each station or sample. The temperature was kept at ambient conditions. Following deuration, the mussel were shucked and frozen (-20°C) to avoid excessive cutting of the soft tissue. The deuration was omitted if there was sufficient evidence that for a specific population/place the process has no significant influence on the body burden of the contaminants measured (cf. Green 1989a; Green *et al.* 1996). With one exception (st.227A2, Høgevarde in the Haugesund area) those samples that were not deurated were part of the Klif blue mussel pollution index (see Appendix M1).

The blue mussel samples were collected from August 25th to December 9th, 2009. Generally, blue mussel are not abundant on the exposed coastline from Lista (southern Norway) to the north of Norway. A number of samples were collected from dock areas, buoys or anchor lines. All blue mussel were collected by NIVA except for the blue mussel collected in the Ranfjord, Lofoten and Varangerfjord which were collected by local contacts.

Fish

For fish, 25 individuals of Atlantic Cod (*Gadus morhua*) or one flatfish species have been sampled for each station. If possible, the same species as collected in previous years at the selected stations where used. The order of preference for flatfish species is according the OSPAR guidelines: dab (*Limanda limanda*), flounder (*Platichthys flesus*), plaice (*Pleuronectes platessa*), and megrim (*Lepidorhombus wiffiagonis*). For some areas the first preferred flatfish species have not been available. Then the same species collected in previous years at the selected stations have been collected to obtain best possible time series. Occasionally, ling (*Molva molva*) and/or tusk (*Brosme brosme*) are collected to investigate conditions in deeper waters.

If possible, the 25 individuals were sampled with five individuals within each of the five length classes (Table 1). The fish are either prepared in the field and the samples are stored frozen (-20°C) until analysis or the fish is frozen directly and later prepared at NIVA.

Table 1. Target length groups for sampling of cod and flatfish.

Size-class	Cod (mm)	Flatfish (mm)
1	370-420	300-320
2	420-475	320-340
3	475-540	340-365
4	540-615	365-390
5	615-700	390-420

Cod

The cod were generally sampled from October 1st to December 20th 2009. All the cod were sampled by local fishermen except for the cod in the Inner Oslofjord (st. 30B) that was collected by NIVA on November 10th 2009 by trawling from the research vessel F/F *Trygve Braarud* owned by University of Oslo.

Flatfish

Dab, flounder, plaice and megrim were collected in the period from September 20th to December 1st 2009. All flatfish were sampled by local fishermen.

Dogwhelk

TBT-induced development of male sex-characters in females, known as Imposex. Imposex was quantified by the *Vas Deferens Sequence Index* (VDSI) analysed according to OSPAR-CEMP guidelines. The VDSI ranges from zero (no effect) to six (maximum effect) (Gibbs *et al.* 1987). Detailed information about the chemical analyses of the animals is given in Følsvik *et al.* (1999).

Effects (Imposex) and concentrations of organotin in dogwhelk (*Nucella lapillus*) were investigated using 50 individuals from each station. Individuals were kept alive in a refrigerator (at +4°C) until the effects (Imposex) were quantified. All dogwhelk were sampled by NIVA except for the dogwhelk collected in Lofoten and in the Varangerfjord. The dogwhelk samples were collected from September 11th to October 14th 2009.

3.2. Chemical variables

Hazardous substances have been analysed in different species tissues (Table 2).

Table 2. Number of stations (see Appendix F) and indicator media with results for 2009. Indicator media include: selected tissues from blue mussel, dogwhelk, Atlantic cod and flatfish species. (See Appendix C for description of chemical codes.)

Description	Blue mussel, soft body	Dog-whelk, soft body	Atlantic cod bile	Atlantic cod blood	Atlantic cod liver	Atlantic cod fillet	Flatfish liver	Flatfish fillet
Cd, Cu, Pb, Zn, Ag, As, Co, Cr, Ni, Sn	49				12-14		10-11	
Hg	46					13		10
TBT ¹⁾	14	10						
PCBs ²⁾	41				14	11	11	11
HCB	41				11	11	11	9
DDT, DDE, DDD	41				11	11	11	9
α-, γ-HCH	41				14	11	11	11
Dioxins ³⁾	8							
PBDE ⁴⁾					10 ⁷⁾			
PFC ⁵⁾					10 ⁷⁾			
PAHs ⁶⁾	17							
Biological effects methods ⁷⁾		10 Imposex	4 OH-pyrene ⁷⁾	3 ALA-D ⁷⁾	3 EROD-activity, CYP1A ⁷⁾			

1) Includes: DBTIN, DPTIN, MBTIN, MPTIN, TBTIN, TPTIN

2) Includes the congeners: CB-28,-52,-101,-105,-118,-138,-153,-156,-180, 209, 5-CB, OCS and, when dioxins are analysed, the non-orto-PCBs, i.e. CB-77, -81, -126, -169

3) Includes: CDD1N, CDD4X, CDD6P, CDD6X, CDD9X, CDDO, CDF2N, CDF2T, CDF4X, CDF6P, CDF6X, CDF9P, CDF9X, CDFDN, CDFDX, CDFO, TCDD

4) Polybrominated diphenyl ethers (PBDE), including brominated flame retardants and includes: BDE28, BDE47, BDE49, BDE66, BDE71, BDE77, BDE85, BDE99, BDE100, BDE119, BDE138, BDE153, BDE154, BDE183, BDE205 (and for some samples BDE196 and BDE209)

5) Includes: PFNA, PFOA, PFHpA, PFHxA, PFOS, PFBS, PFOSA

6) Includes (with NPDs): ACNE, ACNLE, ANT, BAP, BBJF, BEP, BGHIP, BKF, BAA, CHR, DBA3A, DBT, DBTC1, DBTC2, DBTC3, FLE, FLU, ICDP, NAP, NAPC1, NAPC2, NAPC3, PA, PAC1, PAC2, PAC3, PER, PYR.

Table 3. Overview of method of analyses (See Appendix C for description of chemical codes).

Medium analysed	Detection		Methods	Sample description
	Basis	limit.		
Biota	w.w.	µg/kg		
Mercury (Hg)	w.w.	5	NS-EN 1483 + NIVA's accredited method E4-3	bulk or individual
Cadmium (Cd)	w.w.	100	NIVA's accredited method E10-4 and E8-3	bulk or individual
Lead (Pb)	w.w.	1000	NIVA's accredited method E10-4 and E8-3	bulk or individual
Copper (Cu)	w.w.	200	NIVA's accredited method E10-4 and E8-3	bulk or individual
Zinc (Zn)	w.w.	150	NIVA's accredited method E10-4 and E8-3	bulk or individual
Arsenic (As)	w.w.	2000	NIVA's accredited method E10-4 and E8-3	bulk or individual
Barium (Ba)	w.w.	100	NIVA's accredited method E10-4 and E8-3	bulk or individual
Cobalt (Co)	w.w.	200	NIVA's accredited method E10-4 and E8-3	bulk or individual
Chromium (Cr)	w.w.	200	NIVA's accredited method E10-4 and E8-3 or E9-5	bulk or individual
Nickel (Ni)	w.w.	400	NIVA's accredited method E10-4 and E8-3	bulk or individual
Vanadium (V)	w.w.	100	NIVA's accredited method E10-4 and E8-3	bulk or individual
Persistent organic pollutants ¹⁾	w.w.	0.05-0.1	NIVA's accredited method H3-4	bulk or individual
PAH ²⁾	w.w.	0.2-0.5	NIVA's accredited method H2-4	bulk or individual
TBT and others ³⁾	w.w.	0.2-2	NIVA's method H14-2	bulk
PBDE ⁴⁾	w.w.	0.01-0.03		
HBDC (and BDE209)	w.w.			
PFCs: ⁵⁾	w.w.			
Dioxins: ⁶⁾	w.w.	0.0001-0.00002	NILU's method	bulk
OH-pyrene ⁷⁾			NIVA's method	Ind. samples of cod bile
Dry matter			NIVA's accredited method B3	bulk or individual
Biological Effect Methods (BEM)				
EROD ⁷⁾			NIVA-internal method, after ICES (TIMES no. 13)	Ind. fish liver samples
CYP1A (when EROD is analysed) ⁷⁾			NIVA-internal method, after ICES (TIMES no. 23)	Ind. fish liver samples
ALA-D ⁷⁾			NIVA internal method, after ICES-TIMES (in press)	Ind. fish blood samples
Other analyses				
Age determination			Otolith	Individual fish
IMPOSEX			NIVA-internal method, after ICES (TIMES no. 24)	One station with ca. 60 ind.

- 1) Includes the congeners: CB-28,-52,-101,-105,-118,-138,-153,-156,-180, 209, 5-CB, OCS and, when dioxins are analysed, the non-orto-PCBs, i.e. CB-77, -81, -126, -169, see parameter group OC-CB, OC-DD, OC-CL, in Appendix C.
- 2) Polycyclic aromatic hydrocarbons and includes (with NPDs): ACNE, ACNLE, ANT, BAP, BBJF, BEP, BGHIP, BKF, BAA, CHR, DBA3A, DBT, DBTC1, DBTC2, DBTC3, FLE, FLU, ICDP, NAP, NAPC1, NAPC2, NAPC3, PA, PAC1, PAC2, PAC3, PER, PYR.
- 3) Includes the mono-, di- and tri forms of both butyltin and phenyltin, see parameter group O-MET in Appendix C.
- 4) Polybrominated diphenyl ethers (PBDE), and includes: BDE28, BDE47, BDE49, BDE66, BDE71, BDE77, BDE85, BDE99, BDE100, BDE119, BDE138, BDE153, BDE154, BDE183, BDE205 (and for some samples BDE196 and BDE209), see parameter group OC-BB in Appendix C.
- 5) Perfluorinated alkylated substances and includes PFOS, see parameter group PFAS in Appendix C.
- 6) Includes a number of dibenzodioxins and dibenzo furans, see parameter group OC-DX in Appendix C.
- 7) Cod only

An overview of the applied analytic methods method is presented in Table 3. Chemical analyses were performed on the of each cod liver and for mercury on the filet of each cod. Furthermore, Biological Effects Methods (BEM) were performed on individual cod. The remaining chemical analyses were performed on homogenates of each size class.

Several laboratories have been used in performing the chemical analysis since 1981 (cf. Green *et al.* 2008a). However, in general chemical analyses have been done at NIVA. One major exception has been the analyses of dioxins carried out by the Norwegian Institute for Air Research (NILU). A brief description of the analytical methods used follows (from Green *et al.* 2008a) below.

Metals were analysed at NIVA. Before 2002, these were done using Atomic Absorption Spectrometry (AAS). Biota samples were extracted using nitric acid. Sediment samples were extracted using 'Total' digestion with mineral acids including hydrofluoric acid (HF). Concentrations are determined either by Flame AAS (FAAS, for high concentrations) or Graphite furnace AAS (GAAS, for low concentrations). GAAS was always used for zinc and often for copper determinations. Since 2002, metals have been determined using Inductively Coupled Plasma Mass Spectrometry (ICP-MS), except for chromium, which was determined using GAAS or ICP-Atomic Emission Spectroscopy (ICP-AES). Mercury (total) has been analysed using Cold-Vapour AAS (CVAAS).

Polychlorinated biphenyls (PCBs) and other chlororganic hazardous substances in biota were analysed at Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology – SINTEF and at NIVA. Both laboratories have used gas chromatograph, with capillary column, (GC) and an electron capture detector (ECD). Fat content was extracted using a mixture of cyclohexane and acetone on the target tissue. Among the individual PCBs quantified, seven (Σ PCB-7) are commonly used for interpretation of the results¹ (Table 4).

Table 4. Suggested PCB-congeners which are to be quantified in biota (ICES 1986).

IUPAC/CB no.	Structure
28	2 4 - 4'
52	2 5 - 2'5'
101	2 4 5 - 2'5'
118	2 4 5 - 3'4'
138	2 3 4 - 2'4'5'
153	2 4 5 - 2'4'5'
180	2 3 4 5 - 2'4'5'

Polycyclic aromatic hydrocarbons (PAH) have been analysed at NIVA using a GC coupled to a Mass-selective detector (MSD). The individual PAHs are distinguished by the retention time and/or significant ions. All seven potentially carcinogen PAHs (IARC 1987) are included in the list of single components determined to constitute the total concentration of PAH.

Organic tin compounds have been analysed at NIVA except for the years 2001-2002 when GALAB (Germany) and Eurofins (Denmark) did the analyses. Analyses at NIVA were done using a GC-MSD in Selected Ion Monitoring mode (SIM). The other laboratories used a GC equipped with Atomic Emission Detector (AED), a method comparable to NIVA's.

Analyses of polybrominated diphenylether (PBDE) where done at NIVA. Determinations are made on the fat content of the target tissue using a GC-MSD-SIM. Some alterations were needed to analyse BDE196 and BDE209 *inter alia* with respect to the temperature programme and steps taken to reduce the samples exposure to light.

Perfluorinated compounds (PFC) are determined using liquid-chromatography coupled to tandem MS (LC/MS/MS) operated in negative electro-spray-ionisation (ESI) mode using multiple reaction monitoring.

For fish, the target tissues are; liver and fillet for hazardous substance and liver; blood and bile for the biological effects methods (BEM) (cf. Table 5). The fish fillet are analysed for the mercury and PCBs content. In addition, the age, sex, and visual pathological state for each individual are determined. Other measurements include: fish weight and length, weight of liver, liver dry weight and fat content (% total extractable fat), the fillet dry weight and its % fat content. These measurements are stored in the database and published periodically (e.g. Shi *et al.* 2008).

The mussel are analysed for all contaminants including organotin. The shell length of each mussel is measured. On a bulk basis the total shell weight, total soft tissue weight, dry weight and % fat content is measured. These measurements are stored in the database and published periodically.

The dogwhelk are analysed for all organotin compounds and biological effects (Imposex²).

¹ Several marine conventions (e.g. OSPAR and HELCOM¹) use Σ PCB-7 to provide a common basis for PCB assessment.

² Vas Deferens Stage Index

3.3. Biological-effect analyses

There are currently five BEM applied on an annual basis. Each method is more or less specific for one or a group of contaminants. An overview of the methods, tissues sampled and contaminant specificity is shown in Table 5. One of the major benefits of biological effects methods (BEM) used at the individual level (biomarkers) is the feasibility of integrating biological and chemical methods, as both analyses are done on the same individual.

BEM-sampling requires that the target fish are kept alive until just prior to sampling. Sampling for BEM-analysis are performed by trained personnel, most often under field conditions. Immediately after the fish are inactivated by a blow to the head samples are collected and stored in liquid nitrogen. OH-pyrene analyses can also be done on bile samples stored at -20°C.

Table 5. The relevant contaminant-specific biological effects methods applied on an annual basis.

Code	Name	Tissue sampled	Specificity
OH-pyrene	Pyrene metabolite	fish bile	PAH
ALA-D	δ -aminolevulinic acid dehydrase inhibition	fish red blood cells	Pb
EROD-activity	Cytochrome P4501A-activity (CYP1A/P4501A1, EROD)	fish liver	planar PCB/PCNs, PAHs, dioxins
CYP1A	Relative amount of cytochrome P450 1A-protein	fish liver	Supporting parameter for EROD-activity
TBT	Imposex	snail soft tissue	organotin

3.4. Information on Quality Assurance

NIVA has participated in all the QUASIMEME international intercalibration exercises relevant to chemical and Imposex analyses. For chemical analyses, these include Round 58 of July-October 2010 which would apply to the 2009 samples. These QUASIMEME exercises have included nearly all the contaminants as well as Imposex analysed in this programme. Quality assurance programme for NIVA is similar to the 2008 programme (cf. Green *et al.* 2010). In addition, NIVA was accredited in 1993 and since 2001 accredited in accordance with the NS-EN ISO/IEC 17025 standard by the Norwegian Accreditation (reference P009). A summary of the quality assurance programme at NIVA is given in Appendix B.

NIVA participated in the QUASIMEME Laboratory Performance Studies “Exercise 801-Round 53 Imposex in Marine Snails BE1” in June 2008. Measures were taken of shell height, penis-length-male, penis-length-female, average-shell-length and female-male-ratio. NIVA got the score satisfactory (which is the top score ranked after the following system: Satisfactory, Questionable, Unsatisfactory, Consistent, Inconsistent and Blanc). VDSI (Imposex stage values of all females sampled/number of females) was 1.545 compared to lab average 1.821. NIVA got satisfactory on all measured parameters in 2008.

In addition to these QUASIMEME exercises, certified reference materials (CRM) are also analysed routinely with the CEMP samples. It should be noted that for biota the type of tissue used in the CRMs do not always match the target tissue for analyses. Uncertain values identified by the analytical laboratory or the reporting institute are flagged in the database. The results are also “screened” during the import to the database at NIVA and ICES.

3.5. Norwegian blue mussel Pollution and Reference Indices (The Index Programme)

The Climate and Pollution Agency (Klif) is interested in obtaining a small group of indices to assess the united quality of the environment with respect to a selected group of contaminants and stations.

The target medium indices may vary depending on the purpose, though sediment, cod and mussel are considered to be the most likely choices. The blue mussel have been selected as the target medium since 1995.

The Index scale varies from 1 to 5, where 1 means that stations within an area are insignificantly polluted (Class I in Klif's classification system) with respect to contaminants measured. Index of 5 would mean that at least one station from any fjord or area is classified as "Extreme" (Class V in the Klif system) for at least one of the contaminants measured. More details concerning the methods and results for 2009 are shown in Appendix L.

3.6. Classification of environmental quality

Classifications used in earlier CEMP-reports are based on the Climate and Pollution agency environmental classification system (Molvær *et al.* 1997). The revised classification system (Bakke *et al.* 2007c) are used for sediments (not investigated in 2009). Focus is on the principle cases where median concentrations exceeded the upper limit to Class I in the Climate and Pollution Agency's (Klif's) environmental quality classification system (cf. Molvær *et al.* 1997). The relevant part of the system is shown in Appendix D, and includes unofficial conversion to other bases. The system has five classes from Class I, insignificantly polluted, to Class V, extremely polluted. However, the system does not cover all the contaminants in indicator species-tissues used in CEMP. To assess concentrations not included in the system provisional expected high background values were used (cf. Appendix D). The factor by which this limit or the Class I limit is exceeded is calculated (cf. Appendix J). High background concentration corresponds to the upper limit to Class I; insignificantly polluted, which in this context has no statistical implications.

The median concentration are assessed according to the Klif system, but where this is not possible, presumed high background levels are used. The term "significant" refers to the results of a statistical analysis of linear trends and can be found in the tables in Appendix J or figures in Appendix K. It should be noted that there is in general a need for periodic review and supplement of this list of limits in the light of results from reference localities and introduction of new analytical methods, and/or units. Because of changes in the limits, assessments of presumed high background levels over the years may not correspond.

Recommendations for changes to Class I (cf. Knutzen & Green 2001b, Green & Knutzen 2003) have been taken into account in this report. Revisions to corresponding Classes II-V have not been done, Klif is considering these recommendations in a current review of their classification system.

No attempt has been made to compensate for differences in size groups or number of individuals of blue mussel or fish. The exception was with mercury in fish fillet where six data sets in both cod and flatfish in this study showed significant differences between "small" and "large" fish (Appendix J). With respect to blue mussel, there is some evidence that concentrations do not vary significantly among the three size groups employed for this study (i.e. 2-3, 3-4 and 4-5 cm) (WGSAEM 1993).

With respect to Purpose A (health risk assessment), the Norwegian Food Safety Authority (*Mattilsynet*) is responsible for official commentary as to possible health risk due to consumption of seafood. Hence, the results of the CEMP pertaining to this purpose are presented only as a partial basis for evaluation.

The results can also be useful as part of the implementation of The Water Framework Directive (WFD) (2000/60/EC) ratified by Norway in 2009, and the Marine Strategy Directive (MSFD) (2008/56/EC), which by early 2010 has not yet been ratified by Norway. These two directives together concern all waters out to territorial borders. They are the main policies at the EU level designed to achieve good "ecological" (WFD) or "environmental" (MSFD) status, herein termed GES, in the European marine environment, by the year 2015 (2021 for Norway) and 2020 at the latest, respectively. The directives also set out to ensure the continued protection and preservation

of the environment and the prevention of deterioration. The Norwegian framework regulation on water management (the Water Regulation) was adopted on December 15th 2006, and incorporates the WFD into Norwegian law. The Environmental Quality Standards (EQS) for 33 priority substances or groups of substances have been outlined in the EQS Directive (EQSD) (2008/105/EC). Several of these substances are monitored by CEMP. The EQS apply to concentrations in water, and for three substances (mercury, hexachlorobenzene (HCB) and hexachlorobutadiene (HCBd)) in “prey tissue” (Table 6). There is also a provision which allows a country to use other EQS in sediment and biota provided these offer the same level of protection as the EQS set for water. It should be noted that application of the EQS set for “prey tissue” is in conflict with the best class in the Climate and Pollution Agency system for classification of environmental quality; e.g. lower than the Class I for mercury and higher for Class V for HCB in blue mussel. This has not been resolved and for this report, only the Klif system will be used.

Table 6. The Water Framework Directive (WFD) Environmental Quality Standards for “prey tissue” (cf. Environmental Quality Standard Directive – 2008/105/EC) and the Class I and V (upper limit to insignificant and extreme degree of pollution, respectively) in the Klif environmental classification system (Molvær *et al.* 1997). Concentrations in µg/kg wet weight.

Media	Class	Mercury	Hexachlorobenzene (HCB)	Hexachlorobutadiene (HCBd)
“Prey tissue”		20	10	55
Blue mussel	Class I ¹⁾	40	0.1	-
	Class V ¹⁾	40000	5	-
Cod liver	Class I	-	20	-
	Class V	-	40	-
Cod fillet	Class I	100	0.2	-
	Class V	1000	5	-

1) Conversion assuming 20% dry weight

3.7. Statistical time trends analyses

A simple 3-model approach has been developed to study time trends for contaminants in biota based on median concentration (ASMO 1994). The results for this assessment are presented earlier (cf. ASMO 1994). The method has been applied to Norwegian data and results are shown in Appendix H. The results are presented in a type as shown in Figure 2.

A Loess smoother is based on a running seven-year interval, a non-parametric curve fitted to median log-concentration (Nicholson *et al.* 1991, 1994 and 1997 with revisions noted by Fryer & Nicholson 1999). For statistical tests based on a fitted smoother to be valid the contaminants indices should be independent to a constant level of variance and the residuals for the fitted model should be log-normally distributed (cf. Nicholson *et al.* 1998). No transformation was applied to the Imposex (VSDI) data.

The smoothed median for the last three sampling years is linearly projected for the next three years to assess the likelihood of presumed high background levels (not shown in figures).

An estimate of the power of the temporal trend series expressed as the number of years to detect a 10 % change per year with a 90% power (cf. Nicholson *et al.* 1997). The fewer the years the easier it is to detect a trend. The power is based on the percentage relative standard deviation (RLSD) estimated using the robust method described by ASMO (1994) and Nicholson *et al.* (1998). The estimate was made for series with at least 3 years of data and covers the entire period monitored. This fixed means of treating all the datasets may give misleading results especially where non-linear temporal changes are known to occur, such as for HCB in blue mussel from Grenland fjords area (Figure 2).

The statistical analysis was carried out on temporal trend data series for cadmium, mercury, lead, ΣPCB-7 (sum of congeners: 28, 52, 101, 118, 138, 153, 180), ppDDE (ICES code DDEPP), HCB,

non-dicyclic PAHs, sum carcinogenic PAHs, B[a]P, TBT, and the biological effects parameters Imposex (VSDI), OH-pyrene, ALA-D and EROD-activity.

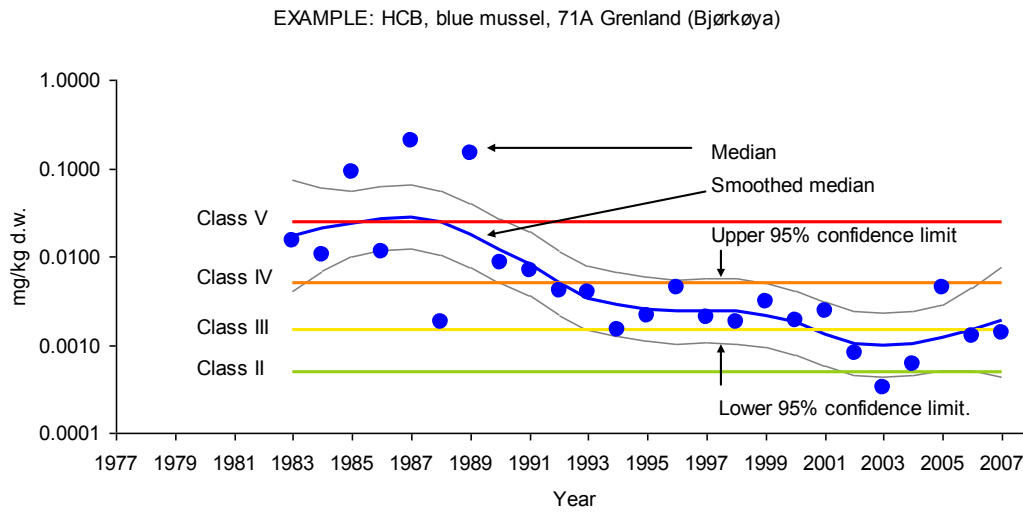


Figure 2. Example time trend that indicates the median concentration, running mean of median values (Loess smoother), 95 % confidence intervals. The horizontal lines indicate the lower boundaries to Klif classes of pollution: Class II (moderate=upper boundary to Class I (insignificant)), III (marked), IV (severe) and V (extreme), or alternatively the Class II boundary is replaced by the upper boundary to provisional "high background level" as in which case no class-boundaries are shown. (see text and refer to Appendix D).

4. Results and discussion

4.1. General information on measurements

Samples along the Norwegian coast, from the border to Sweden in the south to the border to Russia in the north (cf. Appendix G, Figure 1), were collected. The stations and number of samples relevant for the 2009 investigations are noted in the tables in Appendix F. Time trend analyses were performed on a selection of representative contaminants and totalled 859 data series (cf. Appendix J), and 538 of these time series included results from 2009. In 186 of the 538 cases, concentrations were above what is expected in only diffusely contaminated areas (collectively termed: “over expected high background concentrations”). The focus of the overview presented below is based on these time series, of which 189 were downwards trends and 22 were upwards trends. The priorities of the results were systematized in order of concentrations over expected high background level (>Class I, insignificantly polluted, acceptable levels) in combination with significant upward trends, no trends or downward trends. Then results with concentrations below expected high background level (<Class I, insignificantly polluted) in combination with significant upward trends, no trends or downward trends were remarked. An overview of trends, classification and median concentrations is presented in Appendix I. The results are presented by classes and with results for observed trend analyses. For some stations there were insufficient data to do trend analyses.

4.2. National levels and trends

An overview of samples collected in 2009 with results is presented in Table 9 and Appendix I.

Cod

Cod (*Gadus morhua*) were sampled at 14 stations along the Norwegian coast (Appendix F and maps in Appendix G). Cod have been collected in the port areas in Kristiansand (st. 13BH), Trondheim (Munkholmen st. 80BH) and Tromsø (st. 43BH) for the first time in 2009.

Flatfish

Flatfish were collected at 11 stations along the Norwegian coast (Appendix F and maps in Appendix G). The flatfish species were dab (*Limanda limanda*), flounder (*Platichthys flesus*), plaice (*Pleuronectes platessa*) and megrim (*Lepidorhombus wiffiagonis*).

Blue mussel

Blue mussel (*Mytilus edulis*) were sampled at 49 stations (including supplementary stations for Index and TBT) located along the coast of Norway (Appendix F and maps in Appendix G). The Index Programme in Norway started in 1995. It is a set of key contaminants monitored in blue mussel from selected fjords with historical discharges of contaminants. The indexes from the contaminated areas (“Pollution Index”) are related to corresponding measurements at reference sites (“Reference Index”). In total, the monitoring programme covers a number of 11 pollution and eight reference site stations in all five fjords.

Locations of stations are shown in Figure 1 and Appendix G. Trends and median concentrations for 2009 for a selection of the stations are shown from Figure 3 to Figure 23. The stations were chosen to show highly polluted stations and reference stations distributed along the Norwegian coast. A summary of the results for 2009 are shown in Table 9 and more details are given in Appendix I. The trend analyses for the entire monitored period are shown in Appendix J. Geographical distributions of contaminants are also shown in Appendix K.

Dogwhelk

Concentrations and effects of organotin in dogwhelk (*Nucella lapillus*) were quantified at 10 stations located along the coast of Norway (Appendix F and maps in Appendix G).

Mercury (Hg)

Cod fillet

The median concentration of Hg in cod fillet exceeded Class I (insignificantly polluted) at 2 of 14 cod stations analysed (Figure 3). The two stations were the Inner Oslofjord (st. 30B) and the Inner Sør fjord (st. 53B), both classified to Class II (moderately polluted). A significant upward trend was found for cod from the Inner Oslofjord (st. 30B) for the sampling entire period (1984-2009), but no trend was found during the period 2000-2009. No significant trend was observed in the cod from the Inner Sør fjord (st. 53B). The cod from the Færder area (st. 36B), Borøy area (st. 77B), Ullerø area (st. 15B), Karihavet area (st. 23B), Stokken (st. 92B), Kvænangen/ Olderfjord (st. 43B) and Bjørnerøya (st. 98B1) showed low levels of Hg (Class I) and no significant trends. No trends could be calculated for cod from Kristiansand harbour (st. 13BH), Munkholmen (Trondheim harbour) (st. 80BH) and Tromsø harbour (st. 43BH) because of few years of measurements. Cod fillet from the Strandebarm area (st. 67B) and in the Varangerfjord (st. 10B) also showed acceptable low levels of Hg (Class I) and a significant downward trend.

Flounder fillet

Three flounder stations were analysed for Hg in fillet and all stations showed median concentrations below expected high background levels. In addition, the flounder in the Inner Sør fjord (st. 53F) had a significant upward trend, while the two other stations at Sande (st. 33F) and in the Strandebarm area (st. 67F) showed a significant downward trend (Table 9).

Dab fillet

Fish from four stations were analysed; Færder area (st. 36F), Borøy area (st. 77F), Ullerø area (st. 15F) and in the Åkrafjord (st. 21F) (see Table 9). The median concentrations observed in dab from the Færder area (st. 36F) and in the Åkrafjord (st. 21F) exceeded the acceptable level, but showed no significant trends. The dab at the Ullerø area (st. 15F) showed an acceptable level and a significant upward trend. The dab at Borøy area (st. 77F) had a median acceptable level of Hg, but no trend could be calculated because of few years of measurements.

Plaice fillet

Fish from two stations were analysed. Plaice fillet from the Skogerøy area (st. 10F) in the Varangerfjord and from Husholmen area (st. 98F2) were not polluted by Hg nor had any significant trend.

Megrim fillet

Megrim fillet from two stations on the west coast of Norway were analysed for Hg. The station in the Strandebarm area (st. 67F) in the Hardangerfjord showed a significant downward trend while the megrim in the Åkrafjord (st. 21F) had no significant trend.

Blue mussel

The presence of Hg in blue mussel exceeded Class I (insignificantly polluted) at 7 of 46 blue mussel stations analysed (cf. Table 9). A graphical presentation of results from some of the stations is shown in Figure 4. No significant trends were found at Byrkjenes (st. 51A), Damholmen (st. I022) and Kirkøy (st. I024) (all Class II, moderately polluted). The combination of concentrations being over expected high background and a significant downward trend was found in mussels from Kvalnes (st. 56A) (Class II, moderately polluted). Blue mussel from Fugleskjær (st. 02A), Gjerdsvoldøyen (st. 79A) and Høgevarde (st. 227A2) were also moderately polluted (Class II) by Hg, but no trends could be calculated because of insufficient data.

In blue mussel that were not polluted by Hg (Class I), significant upward trends were found at Akershuskaia (st. I301), Solbergstrand (st. 31A) and Espevær (st. 22A). Mussels from the majority of the stations did however revealed acceptable median level of Hg (Class I) in combination with no significant trend (Table 9). This was the case for Gressholmen (st. 30A), Gåsøya (st. I304), Ramtonholmen (st. I307), Håøya (st. I306) and Mølen (st. 35A) in the Oslofjord, Singlekalven (st. I023) in the Hvaler area, and Gjemesholmen (st. I712) and Strømtangen (st. I713) in the Grenlandsfjord area. This was also the result for Risøy (st. 76A), Gåsøy/ Ullerø (st. 15A) and Lastad

(st. I131A) in the southern part of Norway. Further, no significant trends were found at Ekkjegrunn (st. I201) and Bølsnes (st. I205) in the inner part of the Saudafjord, and at Ranaskjær (st. 63A), Vikingneset (st. 65A) and Lille Terøy (st. 69A) in the Hardangerfjord. Blue mussel at Moholmen (st. I965), Toraneskaia (st. I964) and Bjørnbærviken (st. I969) in the Ranfjord, Husvaagen area (st. 98A2) in Lofoten and Brashavn (st. 11X) in the Varangerfjord showed all no significant trends. Significant downward trends were found at Bjørkøya/ Risøyodden (st. 71A), Eitrheimsneset (st. 52A), Krossanes (st. 57A) and Skallneset (st. 10A2).

Concluding remarks

Trend analyses of Hg showed concentrations higher than Class I and upward trends for cod fillet in the Inner Oslofjord, for flounder fillet in the Inner Sør fjord and for dab in the Ullerø area. The fillet of cod from the Inner Sør fjord was moderately polluted with Hg but no trend was observed. Blue mussel from Akershuskaia, Solbergstrand and Espevær showed significant upward trends but an acceptable level of Hg.

In 2008, concentrations of Hg were over expected high background level in combination with a significant upward trend in blue mussel at Bølsnes in the Saudafjord. In 2009 the blue mussel were not polluted by Hg and no significant trend was found. Øxnevad and Schøyen (2010) found that blue mussel at Bølsnes in 2009 were moderately polluted by Hg and insignificantly polluted at Ekkjegrunn in the Inner Saudafjord.

Bakke *et al.* (2010) showed that there has been a significant increase in Hg-concentrations in cod fillet from the Frierfjord the last 10 years, even though the samples from 2009 are classified as moderately polluted. Ruus *et al.* (2010) showed that the average concentration of Hg in cod fillet from the Sør fjord also corresponded to moderately polluted. Ruus *et al.* (2010) also showed that the concentrations of Hg in blue mussel in the Sør fjord was up to moderately polluted.

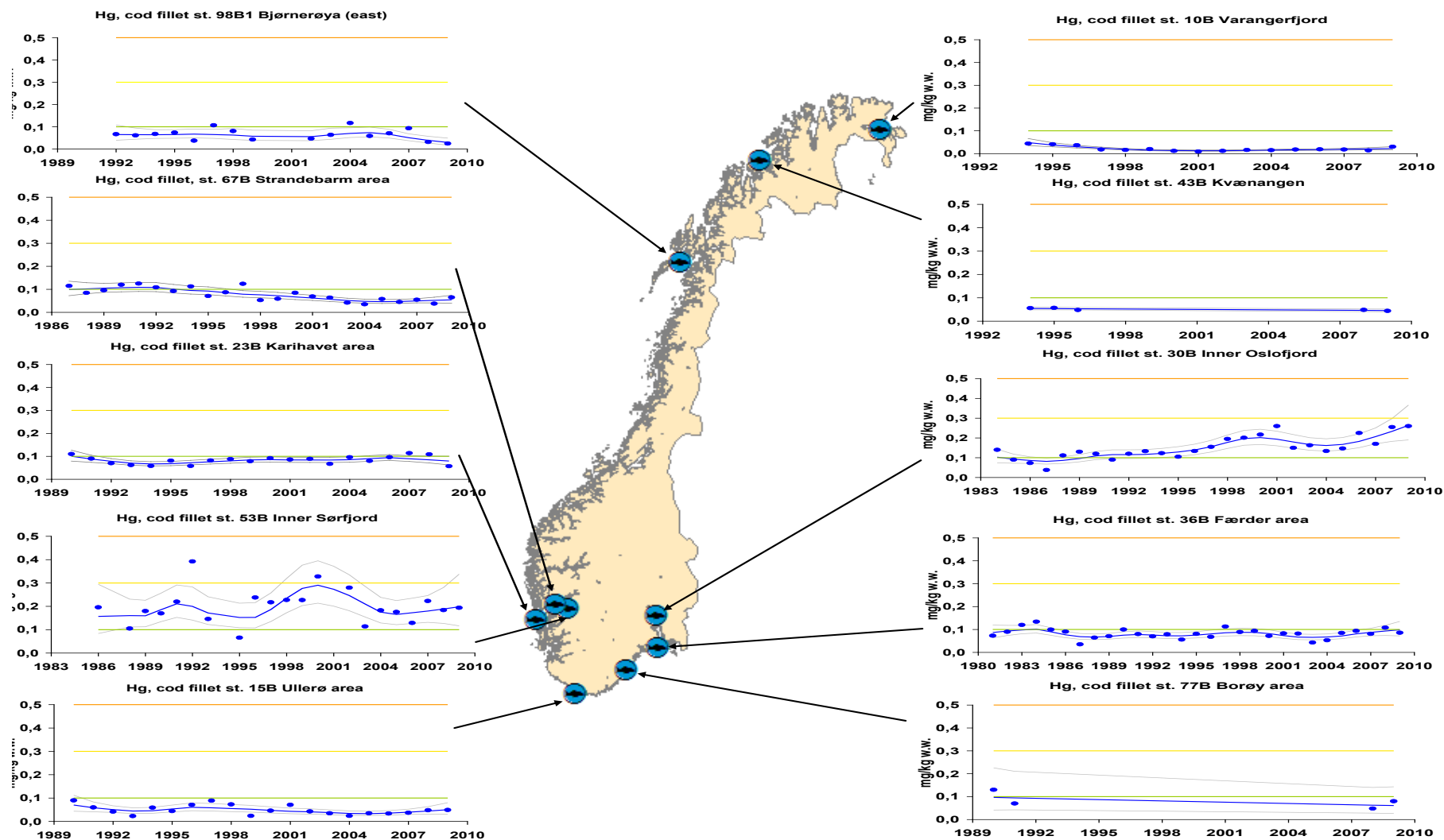


Figure 3. Trend and median concentration of Hg in cod fillet, mg/kg (mg Hg/kg) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

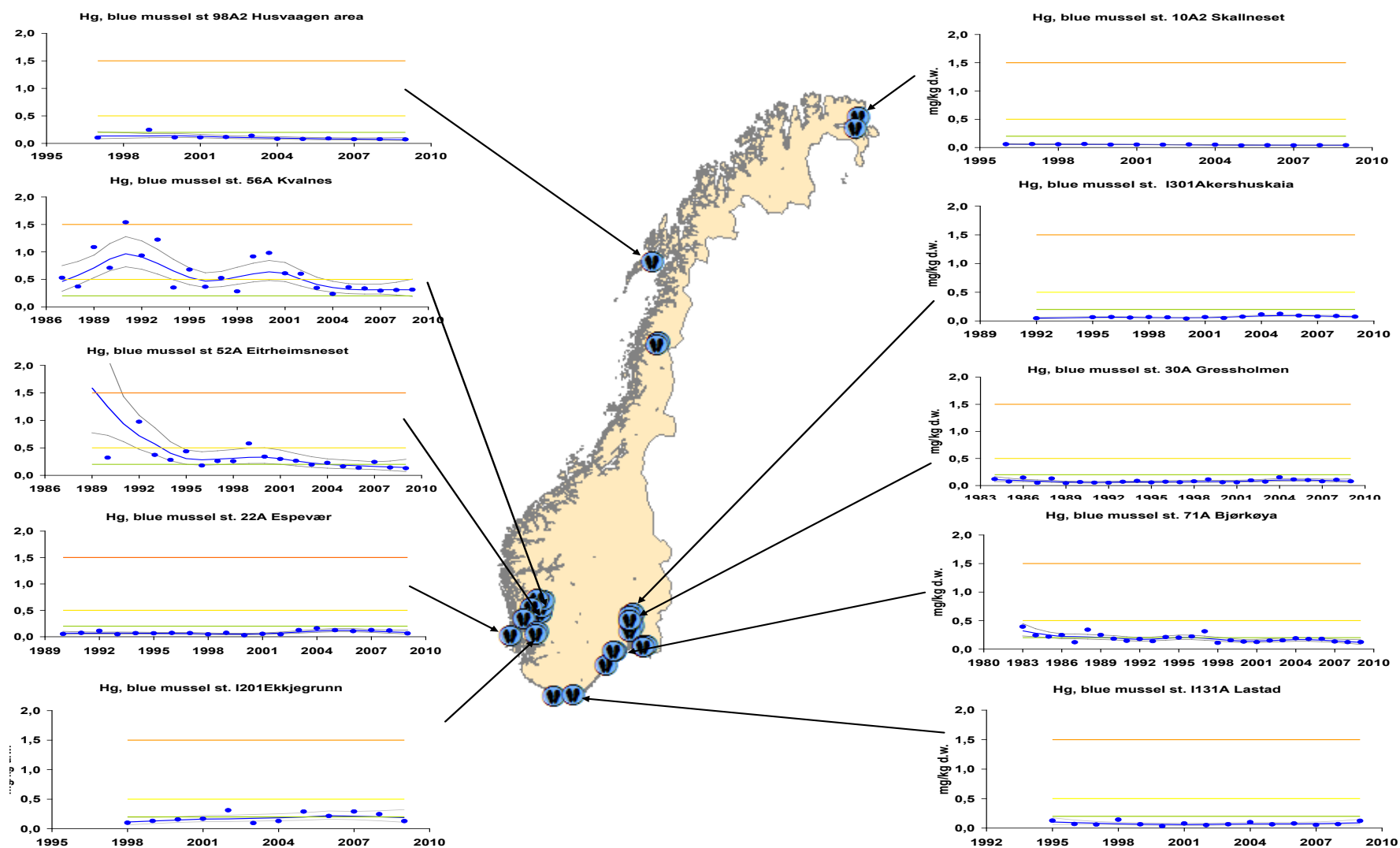


Figure 4. Trend and median concentration of Hg in blue mussel, mg/kg (mg Hg/kg) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Cadmium (Cd)

Cod liver

The concentrations of Cd in cod liver exceeded expected high background levels at four out of 14 stations along the Norwegian coast (Table 9). A significant upward trend was also observed at two of the four stations, one in the Inner Oslofjord (st. 30B) and the second in the Inner Sør fjord (st. 53B). No significant trend was found for cod at Kvænangen/ Olderfjord (st. 43B). Results for Kristiansand harbour (st. 13BH), Munkholmen close to Trondheim harbour (st. 80BH) and Tromsø harbour (st. 43BH) were few to do a trend analysis. The cod from Børøy area (st. 77B), Ullerø area (st. 15B), Stokken (st. 92B), the Karihavet area (st. 23B) and from Bjørnerøya (st. 98B1) showed Cd-levels below an expected high background and no significant trends. Cod from three cod stations showed acceptable levels of Cd and a significant downward trend (Færder area (st. 36B), the Strandebarm area (st. 67B) in the Hardangerfjord and in the Varangerfjord (st. 10B)). No significant trend was found for cod in the Stokken area (st. 92B).

Flounder liver

Flounder from three stations were analysed for Cd in liver and they were below expected high background level. The stations at Sande (st. 33F) and Strandebarm area (st. 67F) had significant downward trends while flounder in the Inner Sør fjord (st. 53F) showed no significant trend.

Dab liver

Dab from four stations were analysed for Cd in liver; Færder area (st. 36F), Ullerø area (st. 15F) Børøy area (st. 77F) and Åkrafjord (st. 21F). All stations had an acceptable level of Cd and no significant trends were observed, except for Børøy area (st. 77F) where no trend could be calculated because of few years of measurements.

Plaice liver

The concentrations of Cd in liver from plaice caught at Skogerøy (st. 10F) in the Varangerfjord showed concentrations over an acceptable level and no significant trend. The plaice from Husholmen (st. 98F2) contained an acceptable level of Cd in liver, but there was no value for trend analyses because of lack of data.

Megrim liver

The megrim from Strandebarm (st. 67F) in Hardangerfjord showed a significant downward trend while the megrim in the Åkrafjord (st. 21F) showed no trend.

Blue mussel

The presence of Cd exceeded Class I (insignificantly polluted) in mussel samples from six out of 46 stations. Results from some of the stations are presented in Figure 6. Significant downward trends were observed in mussels from Byrkjenes (st. 51A), Eitrheimsneset (st. 52A), Kvalnes (st. 56A) and Ranaskjær (st. 63A) and all were Class II (moderately polluted). Blue mussel from Fugleskjær (st. 02A) and Gjerdvoldsøyen (st. 94A) were moderately polluted (Class II) by Cd, but no trend analyses could be calculated because the data was insufficient for trend analyses.

In blue mussel that showed an acceptable level of Cd (Class I), significant upward trends were found at stations from the Inner Oslofjord and outward the fjord at Gressholmen (st. 30A), Ramtonholmen (st. I307), Solbergstrand (st. 31A) and Mølen (st. 35A), and significant downward trends were observed at Bjørkøya (st. 71A) in the Grenlandsfjord area, Krossanes (st. 57A) in the Sør fjord, Vikingneset (st. 65A) and Lille Terøy (st. 69A) in the Hardangerfjord, and at Husvaagen area (st. 98A2) in the Lofoten. Blue mussel stations that were classified as Class I and showed no trends were: Akershuskaia (st. I301), Gåsøya (st. I304) and Håøya (st. I306) in the Inner Oslofjord. This was also found at Damholmen (st. I022), Singlekalven (st. I023) and Kirkøy (st. I024) in the Hvaler area, and at Risøy (st. 76A), Lastad (st. 131A) and Gåsøy/ Ullerø (st. 15A) in the southern part of Norway. Further, this was also found at Ekkjegrunn (st. I201) and Bølsnes (st. I205) in the Saudafjord, at Espevær (st. 22A) on the west coast, at Moholmen (st. I965), Toraneskaien (st. I964) and Bjørnbærviken (st. I969) in the Ranfjord and at Skallneset (st. 10A2) and Brashavn (st. 11X) in the Varangerfjord.

Concluding remarks

Trend analyses of Cd showed concentrations over expected high background levels and upward trends for cod liver in the Inner Oslofjord and in the Inner Sør fjord. Significant downward trends have been observed for Cd in blue mussel in the Inner and Mid Sør fjord during the last two decades. Ruus *et al.* (2010) found that blue mussel at Kvalnes (st. 56A) in the Sør fjord was markedly polluted of Cd.

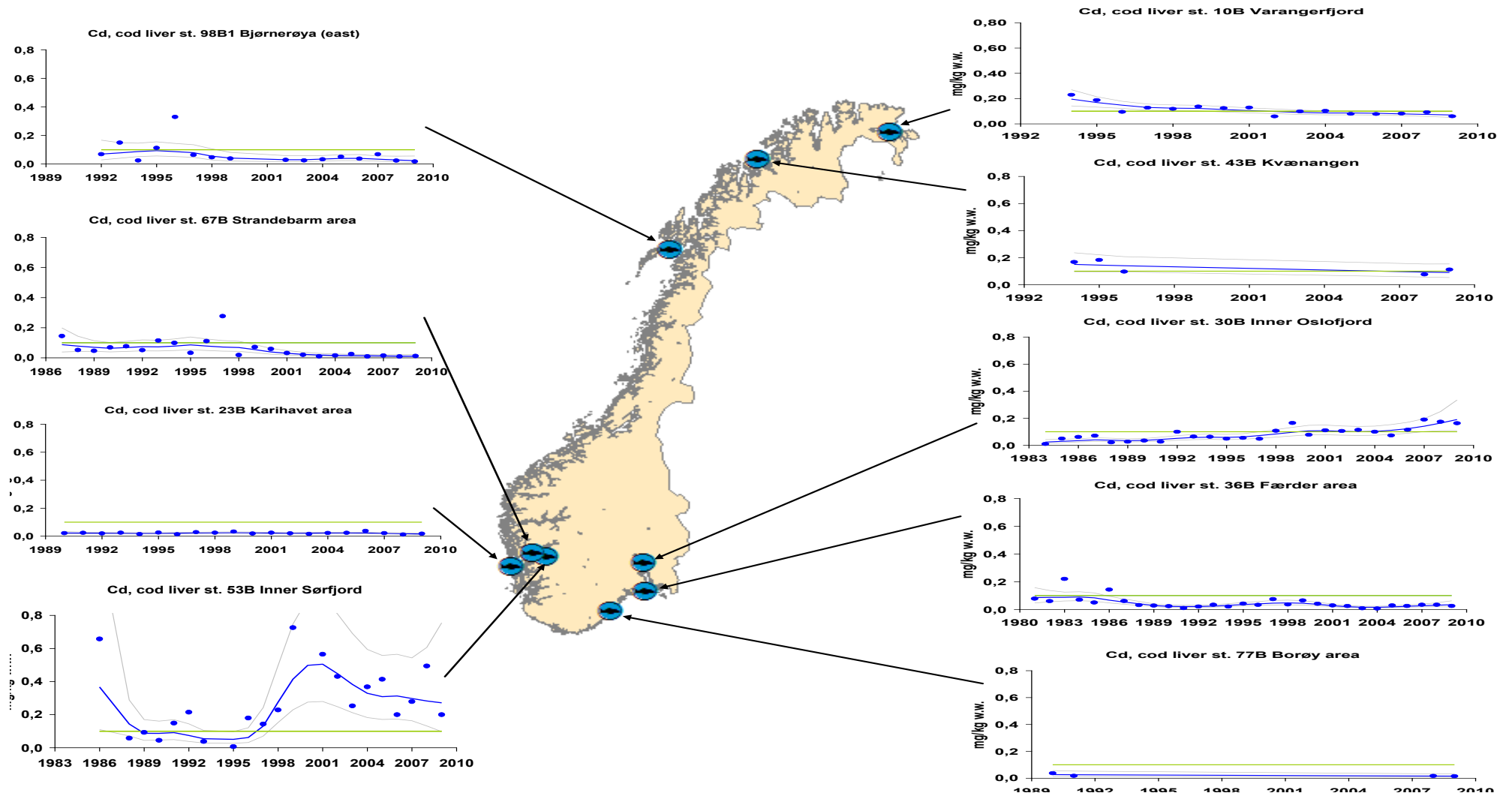


Figure 5. Trend and median concentration of Cd in cod liver, mg/kg (mg Cd/kg) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

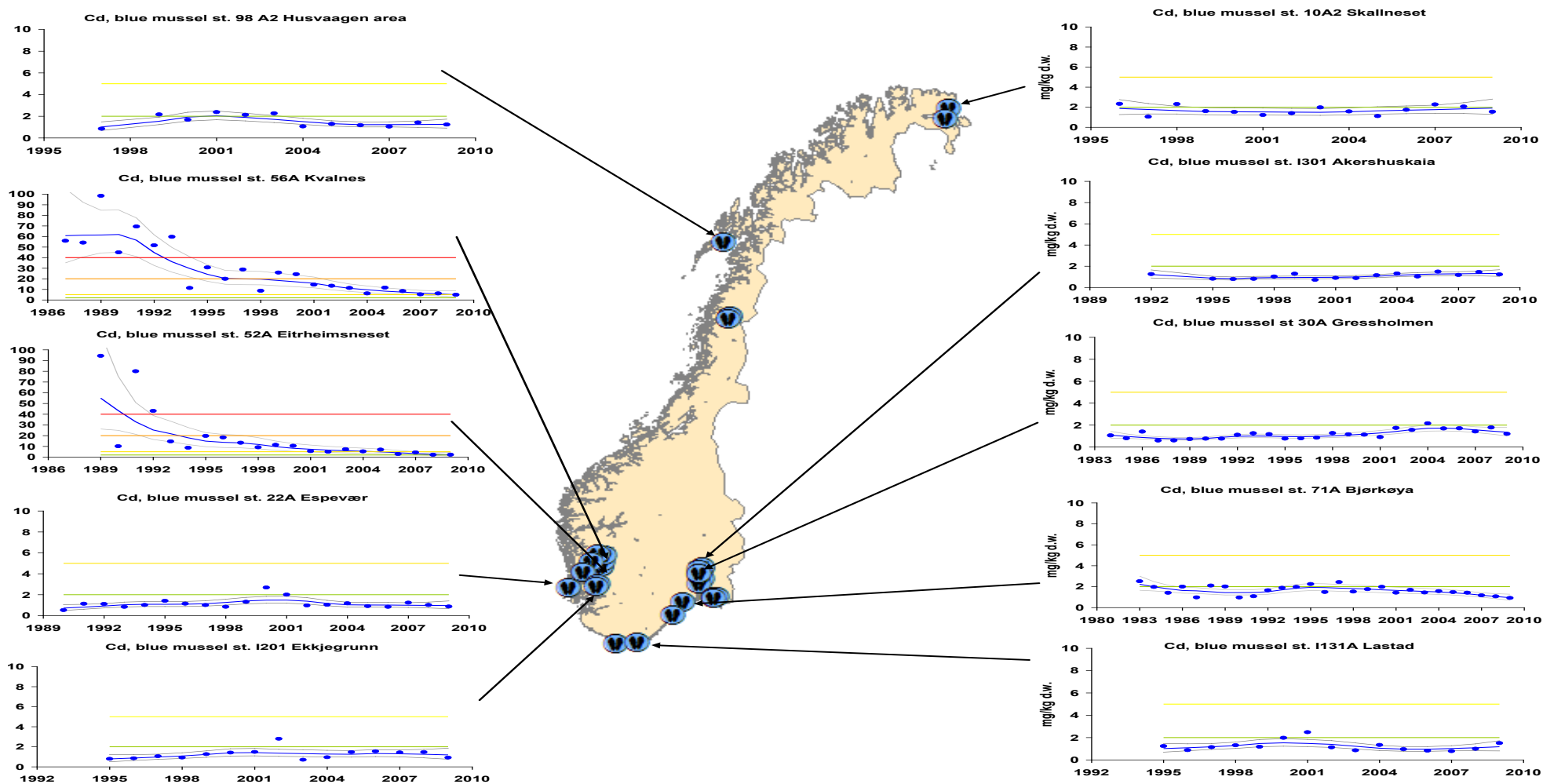


Figure 6. Trend and median concentration of Cd in blue mussel, mg/kg (mg Cd/kg) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Lead (Pb)

Cod liver

The median concentration of Pb in cod liver exceeded expected high background levels at two of 14 cod stations (Inner Oslofjord st. 30B and Inner Sørfjord st. 53B). The station in the Inner Sørfjord (st. 53B) had a significant upward trend while the station in the Inner Oslofjord (st. 30B) showed no significant trend (see also Table 9). Most of the stations showed low levels of Pb (acceptable levels) and significant downward trends. This combination was observed in the Færder area (st. 36B), Borøy area (st. 77B), Strandebar area (st. 67B), Karihavet area (st. 23B), Stokken area (st. 92B), Bjørnerøya (st. 98B1), Kvænangen/ Olderfjord (st. 43B) and in the Varangerfjord (st. 10B). The median concentration of Pb in cod liver had acceptable concentrations but no trends could be calculated at Ullerø area (st. 15B), Munkholmen close to Trondheim harbour (st. 80BH), Kristiansand harbour (st. 13BH) or Tromsø harbour (st. 43BH) because of lack of data.

Flounder liver

Three flounder stations were analysed for Pb in liver and they all showed acceptable concentrations. The two stations, Sande (st. 33F) and Strandebar (st. 67F), showed significant downward trends while the flounder in the Inner Sørfjord (st. 53F) showed no significant trend.

Dab liver

There were observed acceptable levels of Pb in dab samples from the four stations analysed (Færder area st. 36F, Borøy area st. 77F, Ullerø area st. 15F and Åkrafjord st. 21F, see also Table 9). Dab from the Åkrafjord (st. 21F) showed a significant upward trend while dab at Ullerø area (st. 15F) showed no significant trend. Dab from the Færder area (st. 36F) had a significant downward trend. Because of few years of sampling, no trend measurements were done for Pb in dab from the Borøy station (st. 77F).

Plaice liver

An acceptable level and a significant downward trend was observed for Pb in plaice liver from Skogerøy (st. 10F) in the Varangerfjord. Plaice at Husholmen in the Lofoten (st. 98F2) had an acceptable level of Pb but no trend could be calculated because the data was insufficient for trend analysis.

Megrim liver

Megrim from the Strandebar area (st. 67F) in the Hardangerfjord showed a significant downward trend for Pb in liver. No significant trend was found for the megrim in the Åkrafjord (st. 21F).

Blue mussel

The presence of Pb in blue mussel exceeded Class I (insignificantly polluted) at 15 of the 46 blue mussel stations analysed (some of the stations are presented in Figure 8 and an overview of all the results is found in Table 9). No significant trends were observed in mussel from Byrkjenes (st. 51A) and Kvalnes (st. 56A) in the Sørfjord or at Moholmen (st. I965) (all Class III, markedly polluted) and Toraneskaien (st. I964) (Class II, moderately polluted) in the Ranfjord. Blue mussel at Nordnes (st. I241) close to Bergen was markedly polluted (Class III) by Pb, but there was no values for trend analyses. Significant downward trends were found at Eitrheimsneset (st. 52A) and Krossanes (st. 57A) in the Sørfjord, and at Ranaskjær (st. 63A) and Vikingneset (st. 65A) (all Class II, moderately polluted) in the Hardangerfjord. Blue mussel from the six stations Svensholmen (st. I132) and Odderøy (st. I133) in the Kristiansandsfjord, Høgevarde (st. 227A2) close to Haugesund, Gravdalsneset (st. I242), Hegreneset (st. I243) and Gjemesholmen (st. I712) were moderately polluted (Class II) by Pb but no trend measurements could be done because the data was insufficient for trend analysis.

In blue mussel that were insignificantly polluted (Class I) of Pb, no significant trends were found in the Oslofjord at Akershuskaia (st. I301), Gressholmen (st. 30A), Gåsøya (st. I304), Ramtonholmen (st. I307), Håøya (st. I306) and Solbergstrand (st. 31A). This was also found in the Hvaler area in the outer Oslofjord at Damholmen (st. I022), Singlekalven (st. I023) and at Kirkøy (st. I024), as well as at Risøy (st. 76A) and Gåsøy/ Ullerø (st. 15A) in the southern part of Norway. Further, this was also

found at Ekkjegrunn (st. I201) and Bølsnes (st. I205) in the Saudafjord, at Espevær (st. 22A) on the west coast at Bjørnbærviken (st. I969) in the Ranfjord and at Skallneset (st. 10A2) and Brashavn (st. 11X) in the Varangerfjord. In blue mussel that were insignificantly polluted (Class I) of Pb, a significant downward trend was found at the stations Mølen (st. 35A), Bjørkøya/ Risøyodden (st. 71A), Lille Terøy (st. 69A) and Husvaagen area (st. 98A2).

Concluding remarks

Only two upward trends of Pb were found; cod liver at Inner Sør fjord (st. 53B) and dab liver at the Åkra fjord (st. 21F). Concentrations over expected high background levels of Pb were found in cod liver from the Inner Oslofjord (st. 30B) and the Inner Sør fjord (st. 53B). Blue mussel at Byrkjenes (st. 51A), Kvalnes (st. 56A), Nordnes (st. I241) and Moholmen (st. I965) were markedly polluted with Pb.

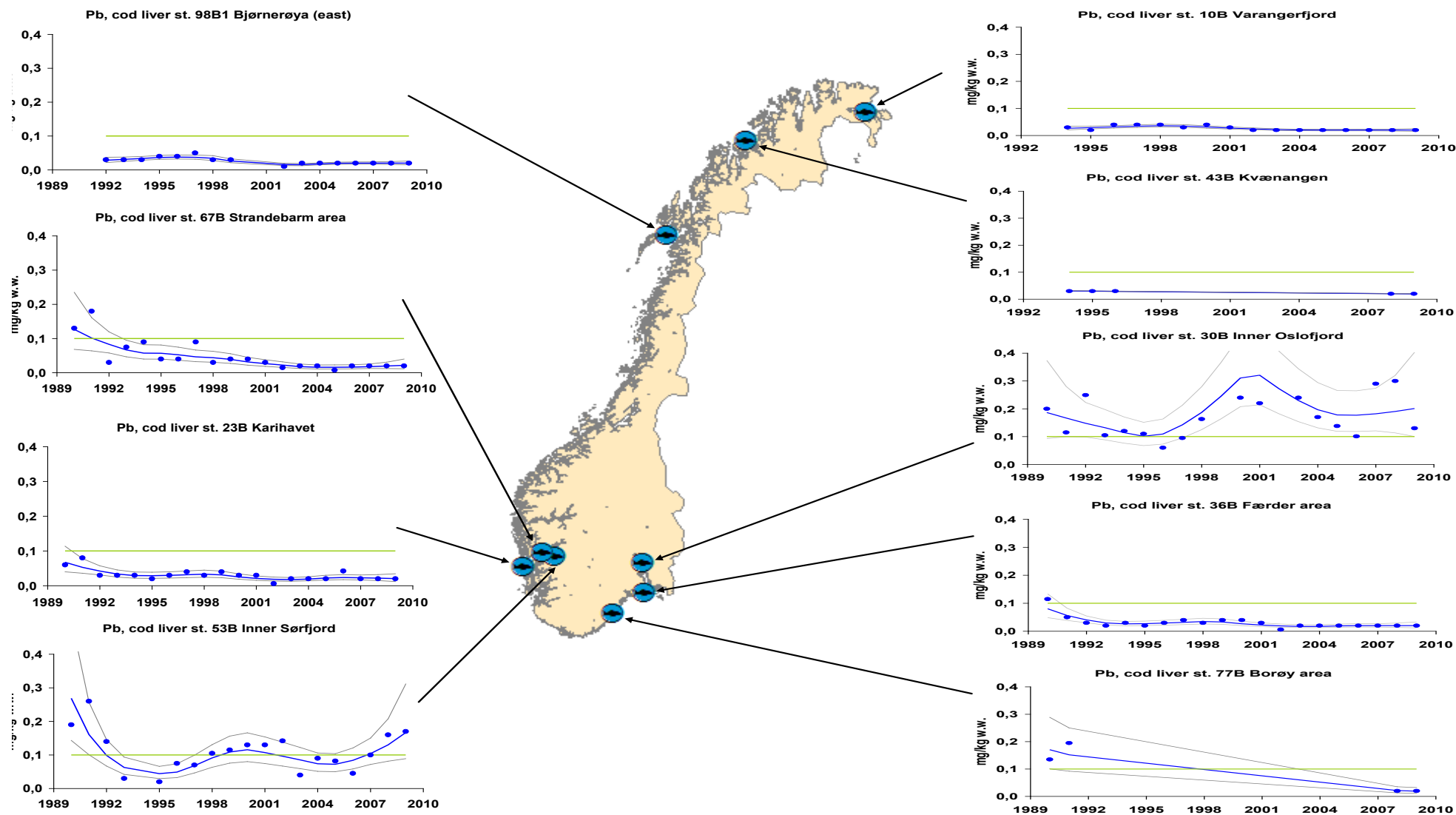


Figure 7. Trend and median concentration of Pb in cod liver, mg/kg (mg Pb/kg) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

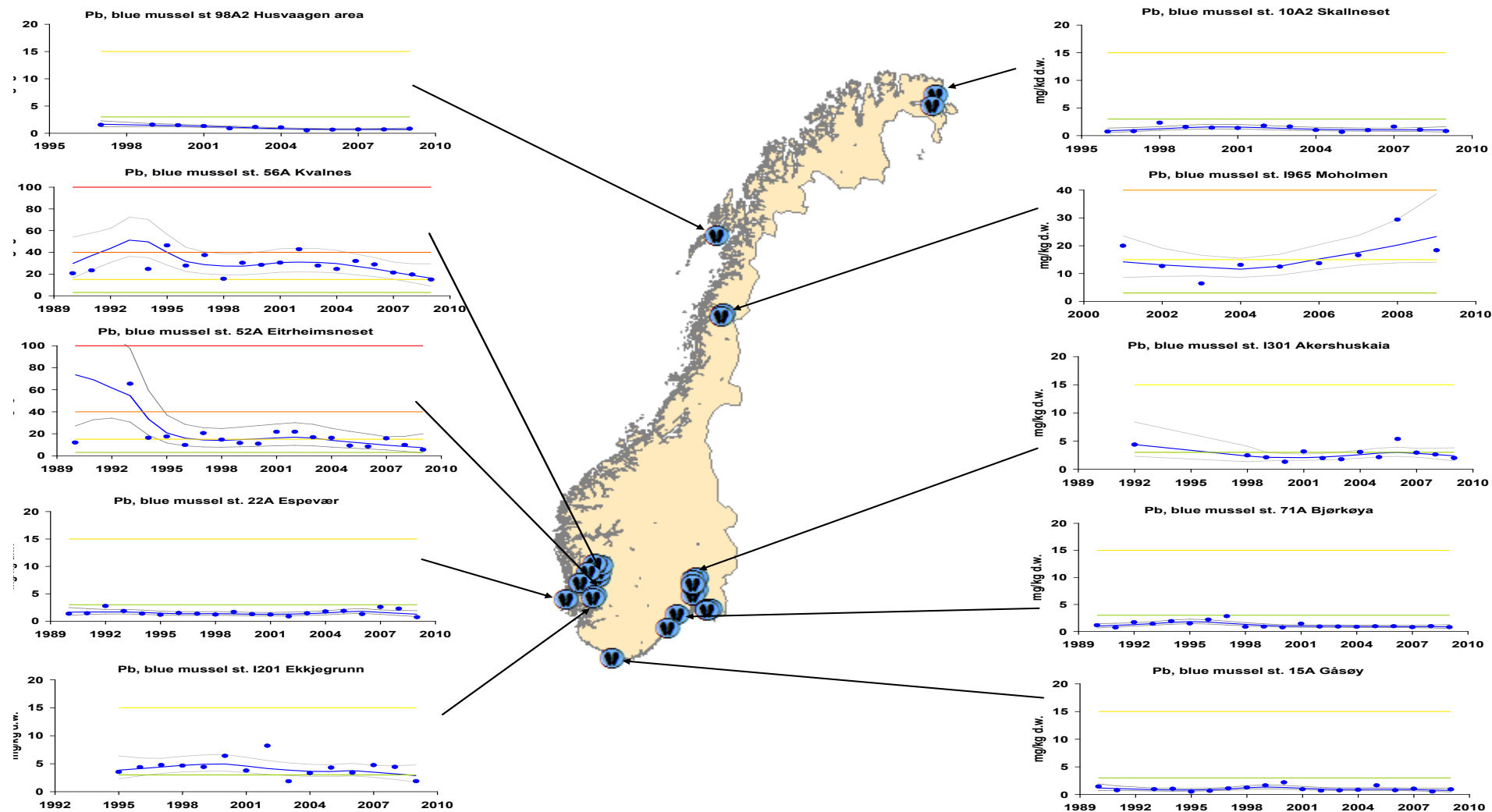


Figure 8. Trend and median concentration of Pb in blue mussel, mg/kg (mg Pb/kg) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Copper (Cu)

Results for Cu are presented in Table 9 and Appendix I. Trend analyses are only presented for some blue mussel stations (cf. Appendix J).

Cod liver

All 14 cod stations that were analysed for Cu in liver had acceptable levels.

Flounder liver

Flounder at all three stations at Sande (st. 33F), in the Inner Sør fjord (st. 53F) and in the Strandebarm area (st. 67F) had acceptable levels of Cu in liver.

Dab liver

Dab at Færder (st. 36F), Borøy (st. 77F), Ullerø area (st. 15F) and Åkrafjord (st. 21F) were analysed for Cu in liver and all four stations showed acceptable concentrations.

Plaice liver

Plaice at the two stations Husholmen (st. 98F2) in Lofoten and at Skogerøy (st. 10F) in the Varangerfjord had acceptable levels of Cu-concentrations in the liver.

Megrim liver

Two megrim stations were analysed for Cu in liver. No trend could be calculated for megrim at the Strandebarm area (st. 67F) in the Hardangerfjord because of lack of data. Relevant values for median expected high background levels were not available.

Blue mussel

The presence of Cu in blue mussel exceeded Class I (insignificantly polluted) at six of 46 stations. The blue mussel were moderately polluted (Class II) at Gjerdsvoldøyen (st. 79A), Svensholmen (st. I132), Odderøy (st. I133), Kirkøy (st. I024), Toraneskaien (st. I964) and Moholmen (st. I965).

Blue mussel were insignificantly polluted (Class I) and showed no significant trends at most stations in the Oslofjord at Gressholmen (st. 30A), Solbergstrand (st. 31A), Mølen (st. 35A), and in the southern part at Bjørkøya/ Risodden (st. 71A), Risøy (st. 76A) and Gåsøy/ Ullerø (st. 15A). This were also the results in the Sør fjord at Byrkjenes (st. 51A), Eitrheimsneset (st. 52A), Kvalnes (st. 56A) and Krossanes (st. 57A), and outwards the Hardangerfjord at Ranaskjær (st. 63A), Vikingneset (st. 65A) and Lille Terøy (st. 69A). This was also found at Espevær (st. 22A) on the west coast, in the Husvaagen area (st. 98A2) in Lofoten and in Skallneset (st. 10A2) and Brashavn (st. 11X) in the northern part of Norway.

Concluding remarks

Blue mussel were up to moderately polluted by Cu and no upward trends were found. The median concentration of Cu has decreased the recent years at Espevær were the blue mussel was severely polluted in 2007 and insignificantly polluted in 2008 and 2009.

Zinc (Zn)

Results for Zn are presented in Table 9 and Appendix I. Trend analyses are only presented for some blue mussel stations (cf. Appendix J).

Cod liver

Samples from the Inner Oslofjord (st. 30B) were the only samples from the 14 stations that exceeded expected high background level for Zn. Cod from Færder area (st. 36B), Borøy area (st. 77B), Ullerø area (st. 15B), Kristiansand harbour (st. 13 BH), Inner Sør fjord (st. 53B), Strandebarm area (st. 67B), Karihavet area (st. 23B), Munkholmen (st. 80BH), Kvænangen/ Olderfjord (st. 43B), Tromsø harbour (st. 43BH), Stokken (st. 92B), Bjørnerøya east (st. 98B1) and the Varangerfjord (st. 10B) had all concentrations below background levels.

Flounder liver

Flounder from the east side of Sande (st. 33F), Inner Sør fjord (st. 53F) and Strandebarm area (st. 67F) had acceptable levels of Zn in liver.

Dab liver

Dab at Færder (st. 36F), Borøy (st. 77F), Ullerø area (st. 15F) and Åkrafjord (st. 21F) showed acceptable levels of Zn in the liver.

Plaice liver

Plaice at the two stations Husholmen (st. 98F2) in Lofoten and at Skogerøy (st. 10F) in the Varangerfjord had acceptable levels of Zn-concentrations in the liver.

Megrim liver

Two megrim stations were analysed for Zn in liver in the Åkrafjord (st. 21F) on the west coast and in the Strandebarm area (st. 67F) in the Hardangerfjord. Values for median concentration over expected high background levels were not given.

Blue mussel

Blue mussel at 46 locations were analysed for Zn. Blue mussel at Toraneskaaien (st. I964) and Moholmen (st. I965) were moderately polluted (Class II) by Zn.

All the 17 blue mussel stations that had values for trend analyses were insignificantly polluted (Class I). Significant upward trend was only found at Mølen (st. 35A). No trends were observed in the Oslofjord at Gressholmen (st. 30A) and Solbergstrand (st. 31A) or at Risøy (st. 76A) and Gåsøy/ Ullerø (st. 15A) in the southern part of Norway. Further, no trends were found at Byrkjenes (st. 51A) in the Sør fjord, at Espevær (st. 22A) on the west coast, at Husvaagen area (st. 98A2) in the Lofoten or at Skallneset (st. 10A2) and Brashavn (st. 11X) in the Varangerfjord. Significant downward trends were observed in mussel from Bjørkøya/ Risøyodden (st. 71A) and stations in the Sør fjord and Hardangerfjord; Eitrheimsneset (st. 52A), Kvalnes (st. 56A), Krossanes (st. 57A), Ranaskjær (st. 63A), Vikingneset (st. 65A) and Lille Terøy (st. 69A).

Concluding remarks

The two blue mussel stations with highest concentrations (moderately polluted) were found in the Ranfjord. The only upward trend for Zn was observed in blue mussel from Mølen.

Silver (Ag)

Results for Ag are presented in Table 9 and Appendix I. Relevant values for median expected high background levels of Ag are not available for any of the analysed fish samples. No trends for Ag in fish or blue mussel were measured because the data was insufficient for trend analysis.

Cod liver

Cod liver from 12 stations were analysed for Ag with a range of median concentrations of 0.07 – 10.70 mg/kg w.wt. The three highest concentrations were from Inner Oslofjord (st. 30B), Karihavet area (st. 23B) and Kristiansand harbour (st. 13BH) with 10.7, 3.77 and 2.11 mg/kg w.wt., respectively (cf. Appendix I).

Flounder liver

Flounder from Sande (st. 33F), the Inner Sørfjord (st. 53F) and the Strandebarm area (st. 67F) were analysed for Ag in liver with a range in median concentrations of 0.01 – 0.09 mg/kg w.wt.

Dab liver

Dab liver at the four stations Færder area (st. 36F), Ullerø area (st. 15F), Borøy area (st. 77F) and Åkrafjord (st. 21F) were analysed for Ag with a range of median concentrations of 0.01 – 0.06 mg/kg w.wt.

Plaice liver

Ag in plaice liver was analysed at the two stations Husholmen (st. 98F2) in Lofoten and at Skogerøy (st. 10F) in the Varangerfjord with median concentrations of 0.05 and 0.18 mg/kg w.wt., respectively.

Megrim liver

Two megrim stations were analysed for Ag in liver; the Åkrafjord (st. 21F) on the west coast and the Strandebarm area (st. 67F) in the Hardangerfjord with median concentrations of 0.08 and 0.06 mg/kg w.wt., respectively.

Blue mussel

Blue mussel was insignificantly polluted (Class I) at all 46 stations that were analysed in 2009 (see Appendix I). There were no values for trend analyses.

Concluding remarks

All blue mussel were classified as insignificantly polluted by Ag.

Arsenic (As)

Results for As is presented in Table 9 and Appendix I. No trends for As in fish and blue mussel were measured because the data was insufficient for trend analysis. Relevant values for median expected high background levels of As are not available for any of the analysed fish samples.

Cod liver

Cod at 13 stations were analysed for As and median concentrations varied between 2 and 10 mg/kg w.wt. with two exceptions; 43.5 mg/kg w.wt. in the Inner Oslofjord (st. 30B) and 48.5 mg/kg w.wt. in the Karihavet area (st. 23B). The reason for these maxima has not yet been determined.

Dab liver

Dab liver at the four stations Færder area (st. 36F), Ullerø area (st. 15F), Borøy area (st. 77F) and Åkrafjord (st. 21F) were analysed for As and median concentration range was 5-24 mg/kg w.wt.

Plaice liver

Liver in the two plaice stations at Husholmen (st. 98F2) in Lofoten and at Skogerøy (st. 10F) in the Varangerfjord were analysed for As with median concentrations of 3.75 and 11.40 mg/kg w.wt., respectively.

Megrim liver

Liver samples from the two stations Åkrafjord (st. 21F) on the west coast and the Strandebarne area (st. 67F) in the Hardangerfjord were analysed for As with median concentrations of 9.91 and 3.52 mg/kg w.wt., respectively.

Blue mussel

Blue mussel at 46 stations were analysed for As. At the two stations Høgevarde (st. 227A2) in the Karmsund close to Haugesund and Nordstrand (st. 77A) close to Arendal blue mussel were markedly polluted (Class III) by As. Blue mussel was moderately polluted (Class II) at 39 stations and insignificantly polluted (Class I) at five stations analysed for As (see Appendix I).

Concluding remarks

Most of the blue mussel were moderately polluted by As but Høgevarde close to Haugesund and Nordstrand close to Arendal were markedly polluted by As.

Nickel (Ni)

Results for Ni are presented in Table 9 and Appendix I. No trends for Ni in fish and blue mussel were measured because the data was insufficient for trend analysis. Relevant values for median expected high background levels of Ni are not available for any of the analysed fish samples.

Cod liver

Cod at 13 stations were analysed for Ni with a range of median concentrations of 0.03 – 0.50 mg/kg w.wt. The highest concentration was found in Karihavet area (st. 23B) and the next highest was found in Kristiansand harbour (st. 13BH) with a median concentration of 0.39 mg/kg w.wt.

Dab liver

Dab liver at the four stations Færder area (st. 36F), Ullerø area (st. 15F), Borøy area (st. 77F) and Åkra fjord (st. 21F) were analysed for Ni with a range of median concentrations of 0.09 – 0.23 mg/kg w.wt.

Plaice liver

No trends were measured in liver samples from the station at Husholmen (st. 98F2) in Lofoten and at Skogerøy (st. 10F) in the Varangerfjord with median concentrations of 0.05 and 0.10 mg/kg w.wt., respectively.

Megrim liver

Samples from the two stations that were analysed for Ni in liver were Åkra fjord (st. 21F) on the west coast and the Strandebar area (st. 67F) in the Hardangerfjord with median concentrations of 0.02 mg/kg w.wt. in both cases.

Blue mussel

Blue mussel at 46 stations were analysed for Ni. Blue mussel at the two stations Toraneskaien (st. I964) and Moholmen (st. I965) in the Ranfjord were markedly polluted (Class III) by Ni. Blue mussel was moderately polluted (Class II) at the three stations Svendsholmen (st. I132), Odderøy (st. I133) and Kirkøy (st. I024). Blue mussel were insignificantly polluted (Class I) at 41 stations analysed for Ni (see Appendix I). There were no values for trend analyses for any of the blue mussel locations.

Concluding remarks

Two blue mussel stations in the Ranfjord were markedly polluted by Ni and the two blue mussel stations in the Kristiansandsfjord were moderately polluted by Ni.

Chromium (Cr)

Results for Cr are presented in Table 9 and Appendix I. No trends for Cr in fish and blue mussel were measured because the data was insufficient for trend analysis. Relevant values for median expected high background levels of Cr are not available for any of the analysed fish samples.

Cod liver

Cod at 12 stations were analysed for Cr with a range of median concentrations of <0.1 – 0.4 mg/kg w.wt., respectively.

Dab liver

Dab liver at the four stations Færder area (st. 36F), Ullerø area (st. 15F), Borøy area (st. 77F) and Åkrafjord (st. 21F) were analysed for Cr with median concentrations of <0.2 mg/kg w.wt., respectively.

Plaice liver

Liver samples from the two plaice stations at Husholmen (st. 98F2) in Lofoten and at Skogerøy (st. 10F) in the Varangerfjord were analysed with median concentrations of <0.2 mg/kg w.wt.

Megrim liver

Megrim liver from the Åkrafjord (st. 21F) on the west coast and the Strandebarm area (st. 67F) in the Hardangerfjord were analysed for Cr with median concentrations of <0.2 mg/kg w.wt.

Blue mussel

Blue mussel at 46 stations were analysed for Cr. Blue mussel at the two stations Toraneskaien (st. I964) and Moholmen (st. I965) in the Ranfjord were severely polluted (Class IV) by Cr. Blue mussel was moderately polluted (Class II) at three stations Odderøy (st. I133), Gjemesholmen (st. I712) and Kirkøy (st. I024). Blue mussel were insignificantly polluted (Class I) at 41 stations analysed for Cr (see Appendix I).

Concluding remarks

Two blue mussel stations in the Ranfjord were severely polluted by Cr; the reason for this is not yet determined.

Polychlorinated biphenyls (Σ PCB-7)

Cod liver

The median concentration of Σ PCB-7 in cod liver exceeded Class I (insignificantly polluted) in only diffusely contaminated areas at three of the 14 stations (Figure 9). The observations from the station in Inner Oslofjord (st. 30B) (Class III, markedly polluted) revealed no significant trend. Cod liver at Kristiansand harbour (st. 13 BH) and Munkholmen in Trondheim (st. 80BH) were moderately polluted (Class II) by PCBs, but no trend measurements could be done because of insufficient data. Cod liver that were insignificantly polluted of Σ PCB-7 and had a significant downward trend, were found at the six stations; Færder area (st. 36B), Ullerø area (15B), Strandebarm area (st. 67B), Karihavet area (st. 23B), Bjørnerøya east (st. 98B1) and in the Varangerfjord (st. 10B). There was no significant trend and the cod liver was insignificantly polluted by Σ PCB-7 in the inner Sør fjord (st. 53B) and Stokken area (st. 92B). Due to insufficient data, no trend could be calculated for the cod from Borøy area (st. 77B), Kvænangen/ Olderfjord (st. 43B) and Tromsø harbour (st. 43BH).

Cod fillet

The median concentration of Σ PCB-7 in cod fillet exceeded Class I (insignificantly polluted) at four of the 12 cod stations (Figure 10). The station in Inner Oslofjord (st. 30B) was classified in Class III (markedly polluted), and revealed no significant trend for the entire monitoring period (1990-2009), but for the period 2000-2009 an upward trend was detected (cf. Appendix J). The cod in Inner Sør fjord (st. 53B) was moderately polluted (Class II) and showed no significant trend. The cod fillet in samples from Kristiansand harbour (st. 13BH) and at Munkholmen (st. 80BH) in the Trondheimsfjord were moderately polluted (Class II) by PCBs, but no trend could be calculated. The cod in the Færder area (st. 36B), Borøy area (st. 77B), Ullerø area (st. 15B), the Strandebarm area (st. 67B), the Karihavet area (st. 23B) and Bjørnerøya east (st. 98B1) and the Varangerfjord (st. 10B) had acceptable levels of Σ PCB-7 (Class I) and showed no significant trends. No trend could be calculated for the cod in Tromsø harbour (st. 43BH) because the data were insufficient for trend analyses.

Flounder liver

Results from liver samples from the three stations that were analysed for Σ PCB-7 (Sande east side (st. 33F), the Inner Sør fjord (st. 53F), and Strandebarm area (st. 67F)) showed levels below the expected high background level. The Σ PCB-7 concentration in flounder from the Inner Sør fjord and in Strandebarm revealed a significant downward trend, while the flounder in Sande showed no significant trend.

Flounder fillet

Observations of Σ PCB-7 in fillet from flounder caught at Sande (st. 33F), in the Inner Sør fjord (st. 53F), and in the Strandebarm area (st. 67F) showed concentrations below expected high background level. The flounder in Inner Sør fjord and in Strandebarm showed a significant downward trend, and the flounder in Sande revealed no significant trend.

Dab liver

Results from analysis for Σ PCB-7 in liver of dab showed acceptable concentrations in samples from the Færder area (st. 36F), Borøy area (st. 77F), Ullerø area (st. 15F) and Åkrafjord (st. 21F). In addition, the data from dab at Færder and Ullerø showed no significant trend while dab from the Åkrafjord showed a downward trend.

Dab fillet

Results from analysis for Σ PCB-7 in fillet of dab showed concentrations over acceptable level at the Færder area (st. 36F), but acceptable levels at Ullerø area (st. 15F), Åkrafjord (st. 21F) and Borøy area (st. 77F). In addition, the data from dab at Færder showed an upward trend while dab at Ullerø and the Åkrafjord showed no trend. No trend could be calculated for dab at Borøy area (st. 77F) because the data were insufficient for trend analyses.

Plaice liver

The presence of Σ PCB-7 in liver showed value below expected high background level at Husholmen (st. 98F2) in the Lofoten area and Skogerøy (st. 10F) in the Varangerfjord. Skogerøy showed no significant trend whereas a significant downward trend was found at Husholmen.

Plaice fillet

The value in fillet from fish from Husholmen (st. 98F2) and Skogerøy (st. 10F) was below expected high background level of Σ PCB-7 and no significant trend was observed.

Megrim liver

Megrim liver from fish caught at two stations on the west coast of Norway (Åkrafjord (st. 21F) and Strandebarm area (st. 67F) in the Hardangerfjord) were analysed for Σ PCB-7. The results from megrim in Strandebarm showed a significant downward trend while the results from megrim in the Åkrafjord showed no significant trend. Values for background concentrations for Σ PCB-7 in liver from megrim are not given.

Megrim fillet

The results from megrim fillet from the Strandebarm area (st. 67F) and Åkrafjord (st. 21F) showed no trend. Values for background concentrations for Σ PCB-7 in fillet from megrim are not available.

Blue mussel

Blue mussel at 41 stations were analysed for Σ PCB-7. The presence of Σ PCB-7 in blue mussel exceeded Class I (insignificantly polluted) at 12 blue mussel stations (some of the stations are presented in Figure 11). No significant trends were found at Gåsøya (st. I304), Svensholmen (st. I132), Nordnes (st. I241), Gravdalsneset (st. I242) and Hegreneset (st. I243) (all Class II, moderately polluted). Significant downward trends were found at Gressholmen (st. 30A), Akershuskaia (st. I301) and Ramtonholmen (st. I307) (all Class II, moderately polluted). Blue mussel at Sponvika (st. 01A), Nordstrand (st. 77A), Odderøy (st. I133) and Høgevarde (st. 227A2) were moderately polluted (Class II) by PCBs but no trends could be measured because the data were insufficient to do trend analyses.

Blue mussel were insignificant polluted (Class I) and no trends were found at Håøya (st. I306) in the inner Oslofjord, at Strømtangen (st. I713) in the Frierfjord and at Lastad (st. I131A) in the southern part of Norway. This was also found at Byrkjenes (st. 51A), Eitrheimsneset (st. 52A), Kvalnes (st. 56A) and Krossanes (st. 57A) in the Sørfjord and at Lille Terøy (st. 69A) in the Hardangerfjord. This was also the case at Espevær (st. 22A) on the west coast, at Husvaagen area (st. 98A2) in Lofoten, and at Brashavn (st. 11X) in the Varangerfjord. Significant downward trends were observed at the nine stations Solbergstrand (st. 31A), Mølen (st. 35A), Singlekalven (st. I023), Kirkøy (st. I024), Bjørkøya/ Risøyodden (st. 71A), Risøy (st. 76A), Gåsøy/ Ullerø (st. 15A), Gjemesholmen (st. I712) and Skallneset (st. 10A2).

Concluding remarks

Both cod liver and fillet were markedly polluted by Σ PCB-7 in Inner Oslofjord (st. 30B), but no significant trends were observed. The Σ PCB-7 in the cod liver in Inner Oslofjord was markedly polluted while the cod fillet was moderately polluted in 2009. There was no significant trend and the cod liver was insignificantly polluted by Σ PCB-7 in the inner Sørfjord. The cod fillet in Inner Sørfjord (st. 53B) was moderately polluted and showed no significant trend.

Concentrations above expected high background levels of Σ PCB-7 were found in blue mussel at 12 stations but no significant upward trends were observed. All the four blue mussel stations in the Inner Oslofjord were moderately polluted by Σ PCB-7. All four blue mussel stations in the Sørfjord were insignificantly polluted by Σ PCB-7. Ruus *et al.* (2010) also found that blue mussel from all stations in the Sørfjord were insignificantly polluted Class I with Σ PCB-7 in 2009.

It can be noted that the Norwegian Food Safety Authority (*Mattilsynet*) has issued consumption advice for some areas along the coast due to concern about PCBs in cod liver (Økland 2005, cf. Appendix E).

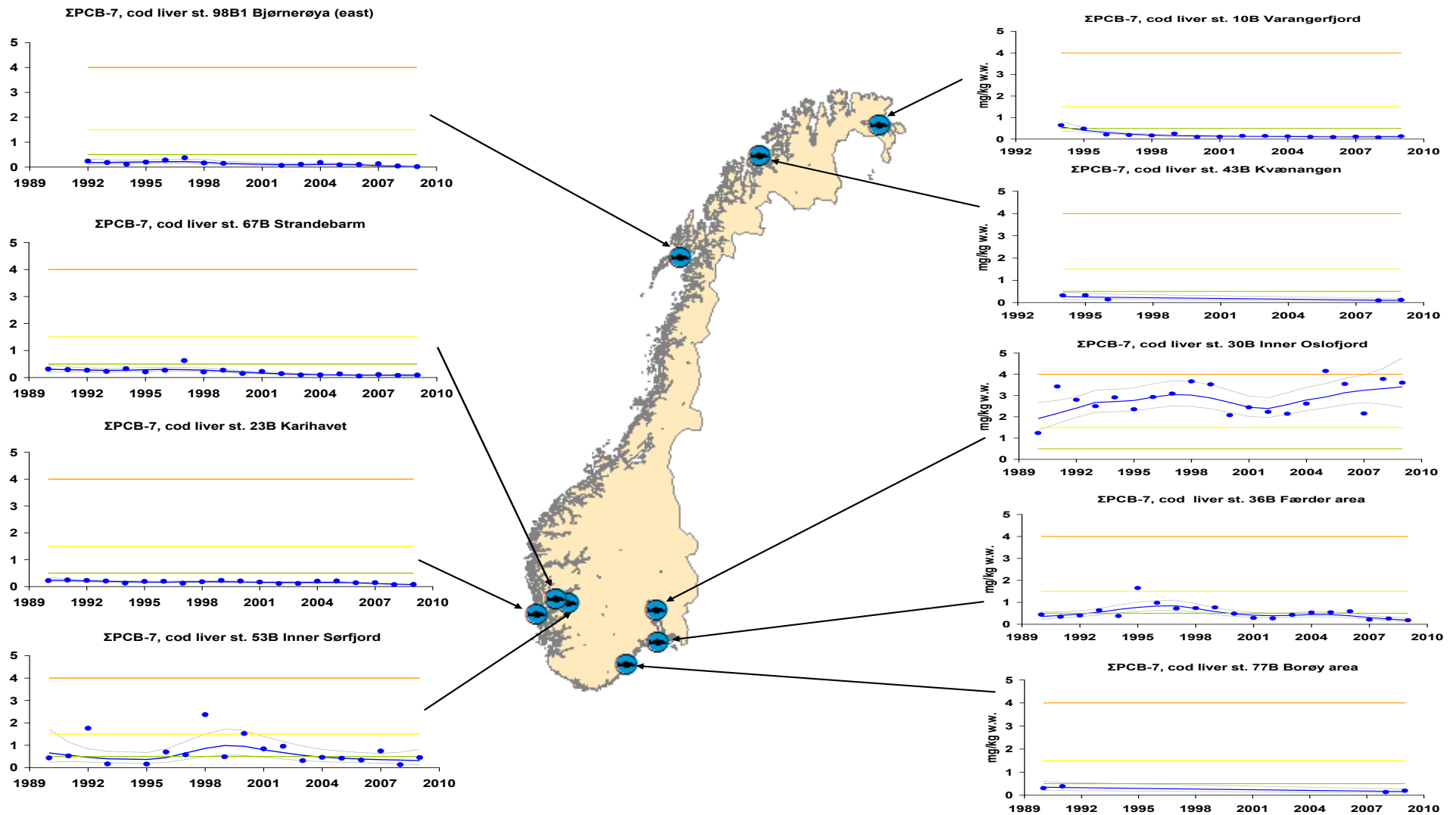


Figure 9. Trend and median concentration of ΣPCB-7 in cod liver, mg/kg (mg ΣPCB-7/kg) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

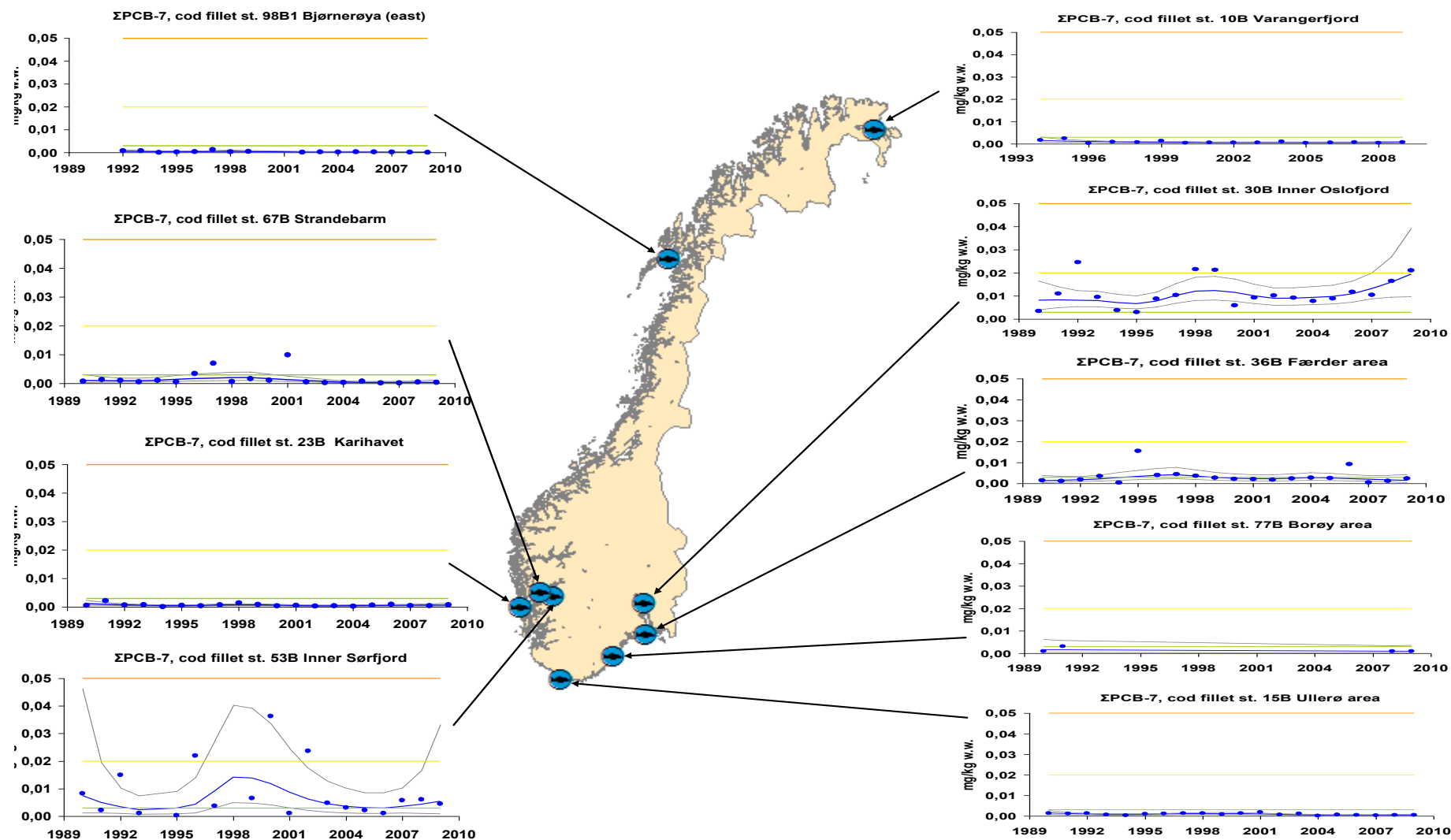


Figure 10. Trend and median concentration of ΣPCB-7 in cod fillet, mg/kg (mg ΣPCB-7 /kg) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

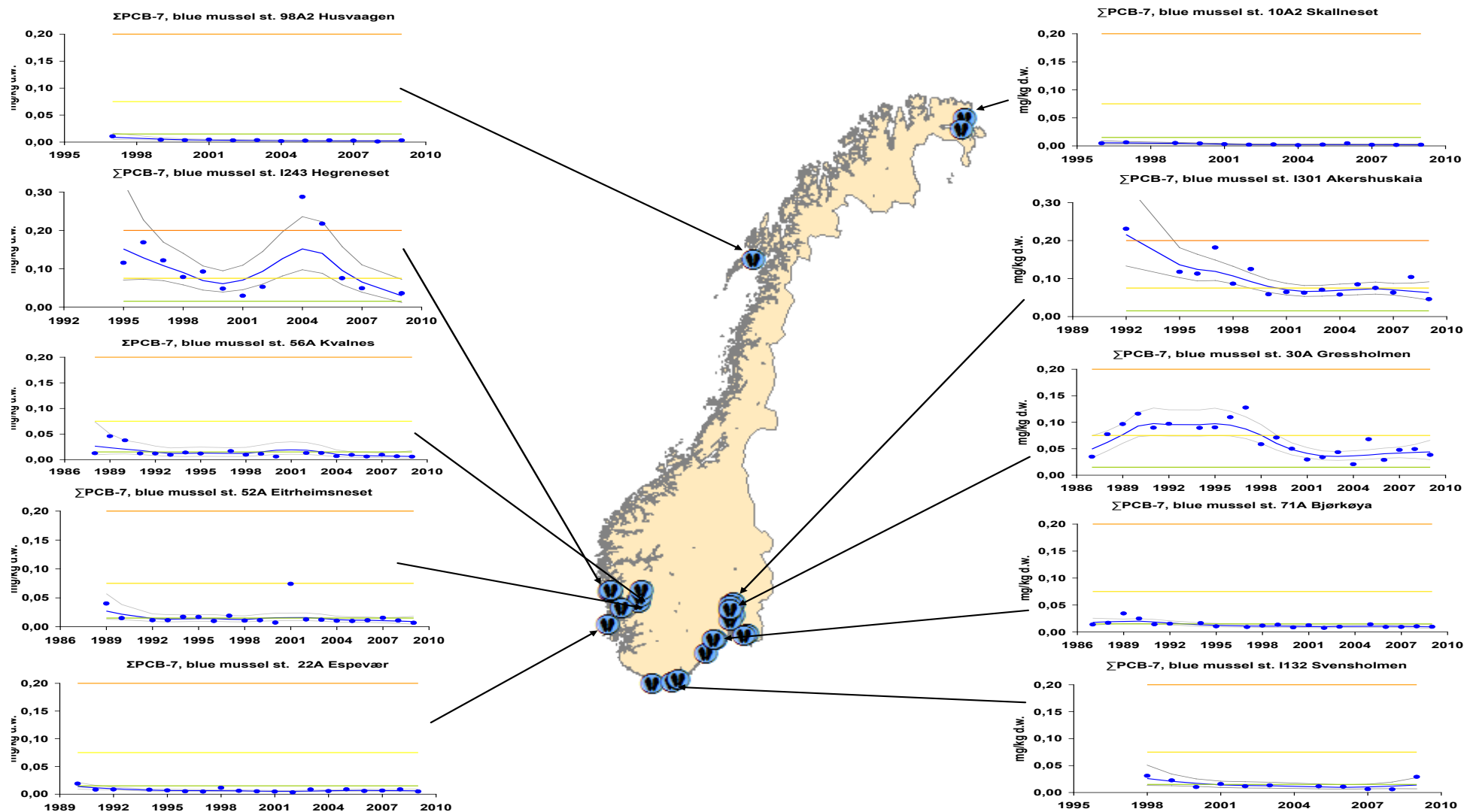


Figure 11. Trend and median concentration of Σ PCB-7 in blue mussel mg/kg (mg Σ PCB-7/kg) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Polycyclic aromatic hydrocarbons (PAHs)

Blue mussel

The presence of PAHs in blue mussel exceeded Class I (insignificantly polluted) at 6 of the 17 blue mussel stations (results from 10 of the stations are presented in Figure 12). No significant trends were observed in mussel from Odderø (st. I133) in the Kristiansandsfjord, Toraneskaia (st. I964) and Moholmen (st. I965) in the Ranfjord (all Class III, markedly polluted) and Akershuskaia (st. I301), Svensholmen (st. I132) and Bjørnebærviken (st. I969) (all Class II, moderately polluted). No upward or downward trends for PAHs were observed in blue mussel with concentrations exceeding background levels in only diffusely contaminated area.

Blue mussel from Gressholmen (st. 30A), Gåsøya (st. I304), Ramtonholmen (st. I307), Håøya (st. I306) and Lastad (I131A) were insignificantly polluted (Class I) of PAHs and revealed no significant trends. The blue mussel from Ekkjegrunn (st. I201) and Bølsnes (st. I205) in the Saudafjord, and Honnhammer (st. I912) and Fjøseid (st. I913) in the Sunndalsfjord were also insignificantly polluted by PAHs, but for these stations significant downward trends were also observed. Similarly, the blue mussel at Mølen (st. 35A) and Flåøya (st. I915) were insignificantly polluted by PAHs, but no trend analysis could be performed for these stations due to insufficient data. No upward trends for PAHs were observed in blue mussel from stations with concentrations below background levels in only diffusely contaminated areas.

Concluding remarks

No upward trends for PAHs in blue mussel were observed. Mussels from Ranfjord were markedly polluted by PAHs (Class III), but no significant trends was observed. Norwegian Food Safety Authority (*Mattilsynet*) has issued recommendations regarding consumption of seafood from the Ranfjord area due to the high levels of PAHs in blue mussel from the fjord (Appendix E).

PAHs in blue mussel at Odderø were also markedly polluted while the mussel was moderately polluted at Svensholmen in the Kristiansandsfjord.

There was a significant downward trend in concentrations of PAHs in the Sunndalsfjord. Norwegian Food Safety Authority issued recommendations/restrictions regarding consumption and trade of seafood in 2005 from the area due to concern about PAHs in blue mussel and fish liver from the Sunndalsfjord (Appendix E). Changes in the production process at the aluminium plant in Sunndalsfjord in 2002-2003 (from Søderberg plant to 100 % Prebake) have resulted in a reduction in dissolved PAHs in seawater around the outlet from the treatment plant during summer 2003 (Bakke and Uriansrud 2004). Measurements outside the industrial land fill and in the seawater intake at The Norwegian Institute of Food, Fisheries and Aquaculture Research (former Akvaforsk) also indicated a reduction in the concentrations of dissolved PAHs in the inner part of the fjord. The concentrations of dissolved PAHs components in the seawater outside Hydro Aluminium Sunndal AS were expected to be high compared to other harbour areas, but much lower than from areas with analogous industrial activity. The PAHs accumulated from the seawater intake at The Norwegian Institute of Food, Fisheries and Aquaculture Research was 2-20 times higher than has been found with the same methodology in assumed clean fjord areas.

The two blue mussel stations in the Saudafjord were insignificantly polluted by PAHs and Øxnevad and Schøyen (2010) found the same result at the same stations in 2009.

Ruus *et al.* (2010) found that concentrations of Σ PAH in blue mussel were insignificantly polluted at all stations in the Sørfjord in 2009.

Sum carcinogenic polycyclic aromatic hydrocarbons (KPAHs)

Blue mussel

The presence of the potentially carcinogenic PAHs (KPAHs) in blue mussel exceeded Class I (insignificantly polluted) at six of 17 stations. A significant trend downward trend was observed in mussels from Ekkjegrunn (st. I201) in the Saudafjord. Toraneskaien (st. I964) in the Ranfjord was extremely polluted (Class V) by KPAHs. At Odderø (st. I133) in the Kristiansandsfjord and Moholmen (st. I965) in the Ranfjord, the blue mussel were severely polluted (Class IV) by KPAHs. At Svensholmen (st. I132), the blue mussel were markedly polluted (Class III) and the blue mussel from Ekkjegrunn (st. I201) in the Saudafjord and Bjørnebærviken (st. I969) in the Ranfjord were classified in Class II (moderately polluted).

The combination of insignificantly polluted (Class I) blue mussel of KPAHs and no significant trend were found in blue mussel from Akershuskaia (st. I301), Gressholmen (st. 30A), Gåsøya (st. I304), Ramtonholmen (st. I307) and Håøya (st. I306) in the Inner Oslofjord, and Lastad (I131A) close to Mandal and Bølsnes (st. I205) in the Saudafjord. Blue mussel were insignificantly polluted (Class I) of KPAHs and significant downward trends were observed in blue mussel from Honnhammer (st. I912) and Fjoseid (st. I913) in the Sunndalsfjord. The blue mussel at Mølen (st. 35A) and Flåøya (st. I915) were insignificantly polluted by KPAHs, but there were no values for trend analyses because the data were insufficient for trend analysis.

Concluding remarks

No upward trends for KPAHs was observed in blue mussel from any of the analysed stations. The results from the analyses showed concentrations over expected high background levels at six of 17 stations. The highest concentrations were observed in mussels from the Ranfjord (extremely polluted) and no trends were observed in the mussels from this area.

The blue mussel from the Kristiansandsfjord was up to severely polluted. No trends were observed in mussels from the Kristiansandsfjord. Acceptable levels of KPAHs were observed in mussels from the Sunndalsfjord and a significant downward trend for KPAHs was observed.

The blue mussel in the Inner Sørfjord were moderately polluted by KPAHs. Øxnevad and Schøyen (2010) found that blue mussel at four stations in the Saudafjord were insignificantly polluted in 2009.

Benzo[a]pyrene B[a]P

Blue mussel

The presence of B[a]P in blue mussel exceeded Class I (insignificantly polluted) at six of the 15 stations (some of the stations are presented in Figure 13). Toraneskaien (st. I964) and Moholmen (st. I965) in the Ranfjord were extremely polluted (Class V) and no significant trend were found. No significant trends were observed in blue mussel from Odderøy (st. I133) (Class IV, severely polluted) and Svensholmen (st. I132) (Class III, markedly polluted) in the Kristiansandsfjord, and Bjørnbærviken (st. I969) (Class II, moderately polluted) in the Ranfjord. A significant downward trend was found at Ekkjegrunn (st. I201) in the Inner Saudafjord (Class II, moderately polluted).

Blue mussel at Ramtonholmen (st. I307) and Håøya (st. I306) in the Inner Oslofjord were insignificantly polluted (Class I) and a significant upward trend was observed. Similar levels of B[a]P (Class I, insignificantly polluted) was observed in mussels from Akershuskaia (st. I301), Gressholmen (st. 30A) and Gåsøya (st. I304) in the Inner Oslofjord, but no significant trend were detected. Low levels of B[a]P (Class I) and lack of observed trends was also observed in mussels from Lastad (st. I131A) close to Mandal, Bølsnes (st. I205) in the Saudafjord, and Honnhammer (st. I912) and Fjøseid (st. I913) in the Sunndalsfjord. No stations revealed low levels of B[a]P (Class I) in combination with a downward trend.

Concluding remarks

Blue mussel in the Ranfjord were extremely polluted with B[a]P, and blue mussel in the Kristiansandsfjord were up to severely polluted. The monitoring results from these stations did not reveal any trends because of lack of data. A downward trend was found at Ekkjegrunn in Inner Saudafjord where the mussel was moderately polluted by B[a]P. Øxnevad and Schøyen (2010) found, however, that blue mussel at four stations in the Saudafjord were insignificantly polluted by B[a]P in 2009. Upward trends of B[a]P were observed at the two stations Ramtonholmen and Håøya in the Inner Oslofjord, even though the pollution was insignificantly. Other stations in the Inner Oslofjord (Akershuskaia, Gressholmen, Gåsøya) revealed no trend and the blue mussel were insignificantly polluted by B[a]P.

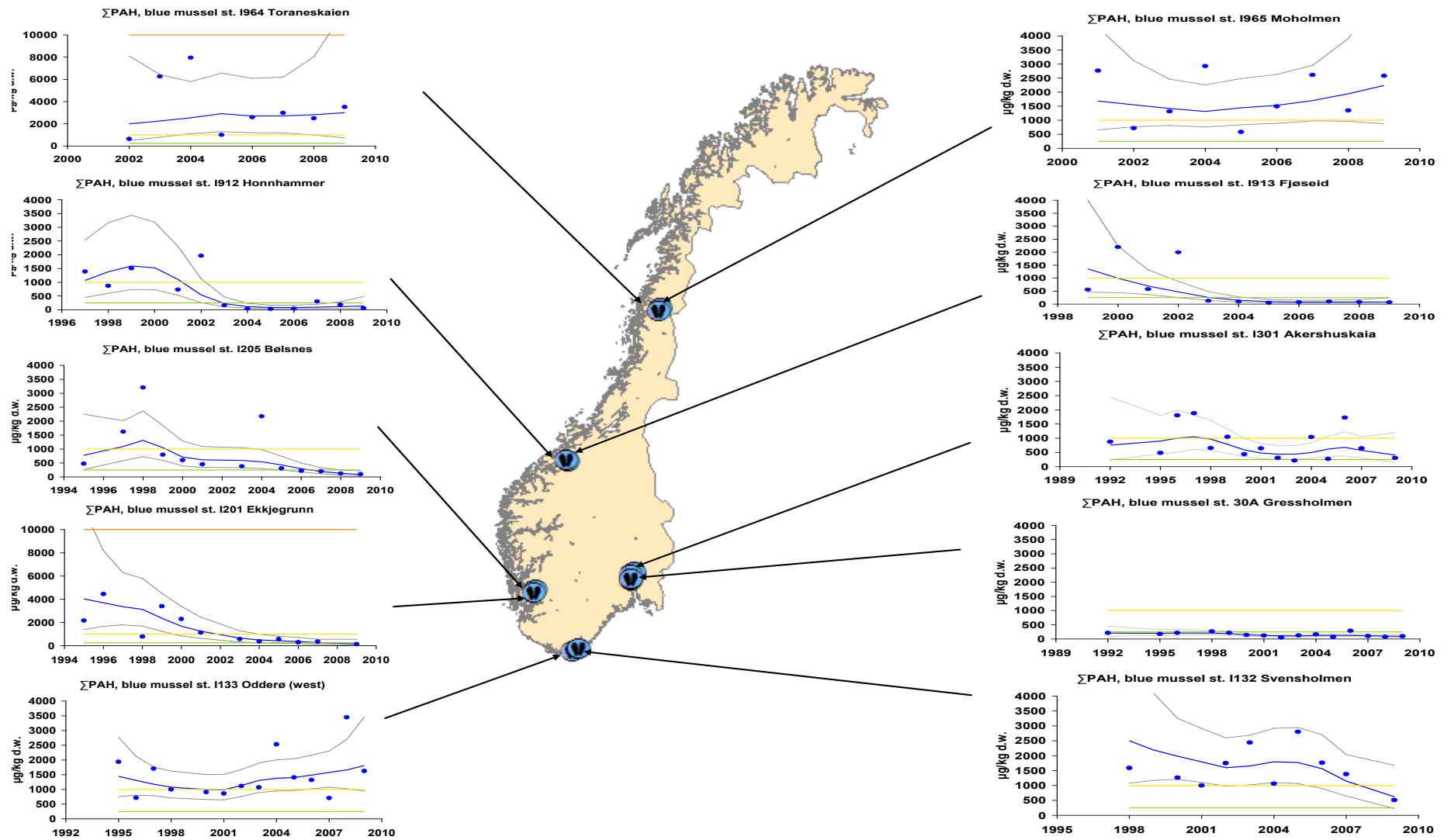


Figure 12. Trend and median concentration of PAH in blue mussel, µg/kg (µg PAH/kg) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

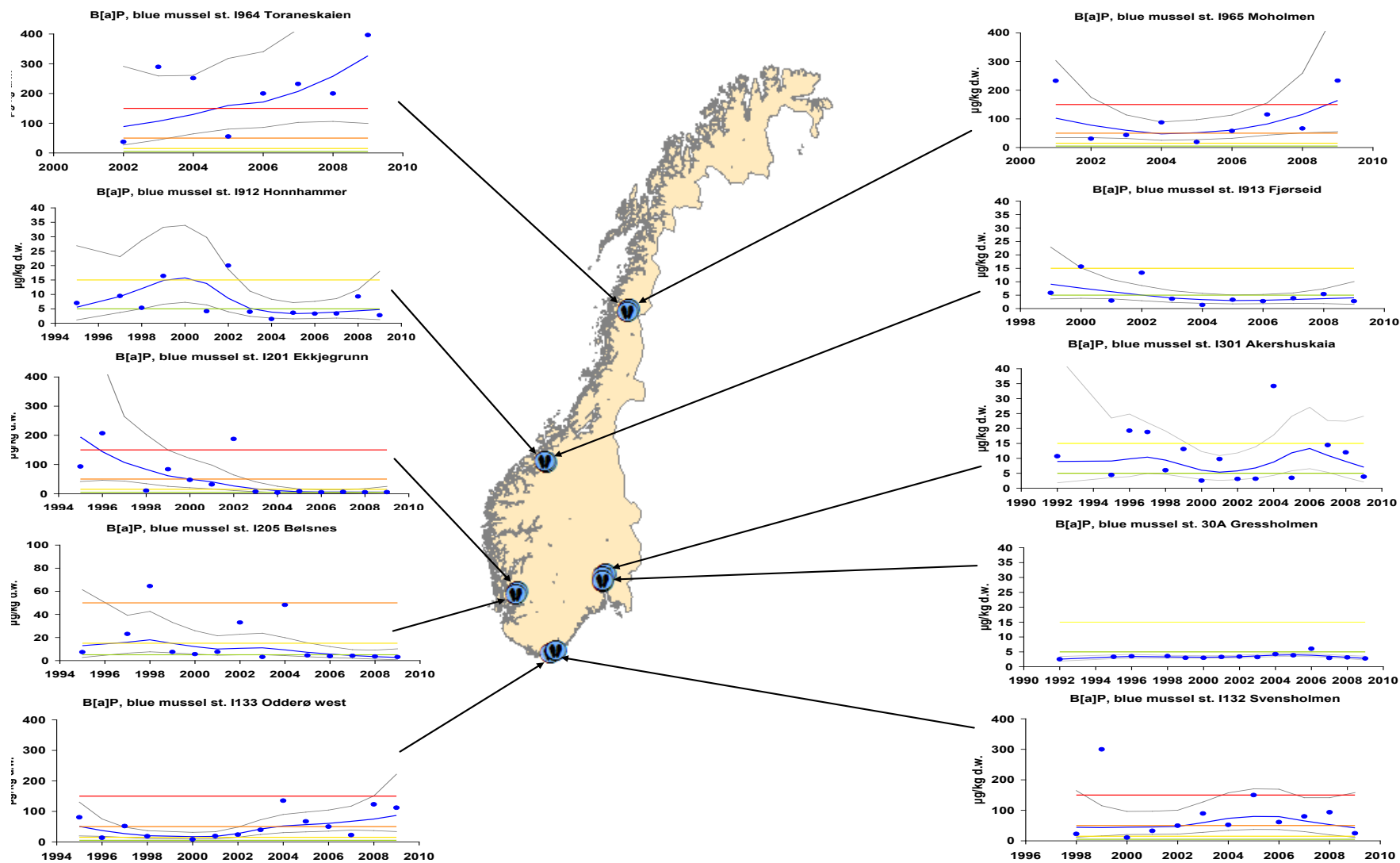


Figure 13. Trend and median concentration of B[a]P in blue mussel, $\mu\text{g/kg}$ ($\mu\text{g B[a]P/kg}$) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Dichlorodiphenyldichloroethylene (ppDDE)

The concentrations of ppDDE are compared with Class limits for Σ DDT.

Cod liver

The concentrations of ppDDE in cod liver exceeded Class I (insignificantly polluted) in one of the 14 stations investigated (Figure 14). This station was located in the inner Sør fjord (st. 53B) and the concentration level in cod liver from fish caught there in 2009 was classified to Class II (moderately polluted). Cod in the Inner Oslofjord (st. 30B), Borøy (st. 77B), Ullerø area (st. 15B), Stokken (st. 92B), and Kvænangen/ Olderfjord (st. 43B) contained ppDDE-levels equivalent to Class I (Class limits for Σ DDT) and no significant trends were found. A significant downward trend was observed in the ppDDE levels at five stations: Færder area (st. 36B), Strandebarm area (st. 67B), Karihavet area (st. 23B), Bjørnerøya in the Lofoten (st. 98B1) and in the Varangerfjord (st. 10B). Trends for cod from Kristiansand harbour (st. 13BH), Munkholmen (st. 80BH), and Tromsø harbour (st. 43BH) could not be calculated due to insufficient data.

Cod fillet

Concentrations of ppDDE exceeding background levels in only diffusely contaminated areas were only observed in cod fillet from the inner Oslofjord (st. 30B) and in the Inner Sør fjord (st. 53B) (Class II, moderately polluted). No significant trends were found at these stations.

Cod at the other stations contained ppDDE -levels equivalent to Class I (insignificantly polluted). A downward trend was observed at the station in the Strandebarm area (st. 67B) in the Hardangerfjord. The stations in the Færder area (st. 36B), at Borøy (st. 77B), in the Ullerø area (15B), in the Karihavet area (st. 23B) and in Bjørnerøya in the Lofoten (st. 98B1) had no significant trends. For the stations Kristiansand harbour (st. 13BH), Munkholmen (st. 80BH), Tromsø harbour (st. 43BH) and Varangerfjord (st. 10B) there were no values for trend analyses due to insufficient data.

Flounder liver

Flounder liver from three stations were analysed for ppDDE. The results from the station in Sande (st. 33F), the Inner Sør fjord (st. 53F) and in the Strandebarm area (st. 67F) revealed concentrations of ppDDE below background levels in only diffusely contaminated area. No significant trends were observed.

Flounder fillet

There observed concentrations of ppDDE were below background levels in only diffusely contaminated area in flounder from Sande (st. 33F), Strandebarm area (st. 67F) in the Hardangerfjord and in the Inner Sør fjord (st. 53F). The data revealed no significant trend in Sande and significant downward trends for the stations in the Hardangerfjord and Sør fjord.

Dab liver

All of the four stations analysed for ppDDE in dab liver revealed concentrations of ppDDE below background levels in only diffusely contaminated area (Class I). Dab from the Færder area (st. 36F), Borøy area (st. 77F) and the Ullerø area (st. 15F) showed no significant trends. Dab from the Åkrafjord (st. 21F) showed a downward trend.

Dab fillet

Dab fillet from Færder area (st. 36F), Ullerø area (st. 15F) and the Åkrafjord (st. 21F) were analysed for ppDDE. The results from all three areas revealed concentrations of ppDDE below background levels in only diffusely contaminated area and no significant trends were detected.

Plaice liver

There were an acceptable background level and a significant downward trend of ppDDE in plaice liver from Skogerøy (st. 10F) in the Varangerfjord. Plaice at Husholmen (st. 98F2) had acceptable concentrations of ppDDE but no trend could be calculated.

Plaice fillet

The results revealed concentrations of ppDDE below background levels in only diffusely contaminated area and a significant downward trend in plaice fillet from Skogerøy (st. 10F) in the Varangerfjord. The ppDDE-concentrations was also low in plaice fillet from Husholmen (st. 98F2), and no significant trend was found.

Megrim liver

Fish from two stations on the west coast were analysed for ppDDE, the Åkrafjord (st. 21F) and the Strandebarm area (st. 67F). The results from the station in Strandebarm showed a significant downward trend while the megrim in the Åkrafjord had no significant trend.

Megrim fillet

Fish from the Åkrafjord (st. 21F) and the Strandebarm area (st. 67F) were analysed for ppDDE. The results from the station in Strandebarm showed a significant downward trend while the megrim in the Åkrafjord revealed no significant trend. Both had acceptable levels of ppDDE in the fillet.

Blue mussel

The presence of ppDDE in blue mussel exceeded Class I (insignificantly polluted) in mussel from three out of 41 blue stations, (results from some of the stations are presented in Figure 15). These three stations in the Sørfjord at Kvalnes (st. 56A) and Krossanes (st. 57A) (both markedly polluted, Class III) and Byrkjenes (st. 51A) (moderately polluted, Class II), showed no significant trends.

Concentrations of ppDDE below background level in only diffusely contaminated area (Class I) and no significant trends were observed in most of the data. This was the case for Akershuskaia (st. I301), Gåsøya (st. I304), Ramtonholmen (st. I307), Håøya (st. I306), Solbergstrand (st. 31A) and Mølen (st. 35A) in the Oslofjord. Similar results were also observed in mussels from Gjemesholmen (st. I712), Strømtangen (st. I713) and Bjørkøya (Risøyodden) (st. 71A) in the Frierfjord, Risøy (st. 76A) close to Risør, Odderø (st. I133) and Svensholmen (st. I132) in the Kristiansandsfjord, Lastad (st. I131A) in the southern part of Norway and Gåsøy/ Ullerø (st. 15A) close to Farsund. Further, this was also the result in Eitrheimsneset (st. 52A) in the Sørfjord, Ranaskjær (st. 63A), Vikingneset (st. 65A) and Lille Terøy (st. 69A) in the Hardangerfjord, Espevær (st. 22A) on the west coast, Nordnes (st. I241), Gravdalsneset (st. I242) and Hegreneset (st. I243) close to Bergen. Acceptable levels of ppDDE and no significant trends were also observed at Husvaagen area (st. 98A2) in the Lofoten, and Skallneset (st. 10A2) and Brashavn (st. 11X) in the Varangerfjord.

A significant downward trend and insignificantly polluted blue mussel were observed in samples from the Inner Oslofjord at Gressholmen (st. 30A) and in the Hvaler area; Damholmen (st. I022), Singlekalven (st. I023) and Kirkøy (st. I024). For the period 2000-2009, no trend was detected at Gressholmen (cf. Appendix J).

Concluding remarks

No upward trends for ppDDE were observed. Blue mussel from three stations in the Sørfjord were classified up to markedly polluted with ppDDE. The concentrations in blue mussel at Kvalnes in the mid Sørfjord have declined from extremely polluted in 2008 to markedly polluted in 2009. Ruus *et al.* (2010) found that concentrations of Σ DDT in blue mussel were classified up to extremely polluted at Utne (Outer Sørfjord) and at Måge (in the mid Sørfjord). At the other stations, concentrations in mussel corresponded to be classified as insignificantly polluted to severely polluted. Downward trends were found in blue mussel from Gressholmen in Inner Oslofjord and the three locations in the Hvaler area.

Both cod liver and fillet from the Inner Sørfjord were moderately polluted by ppDDE. Ruus *et al.* (2010) found that the average Σ DDT-concentrations in both cod liver and fillet from the Sørfjord were moderately polluted. Cod fillet from the Inner Oslofjord was also moderately polluted by ppDDE.

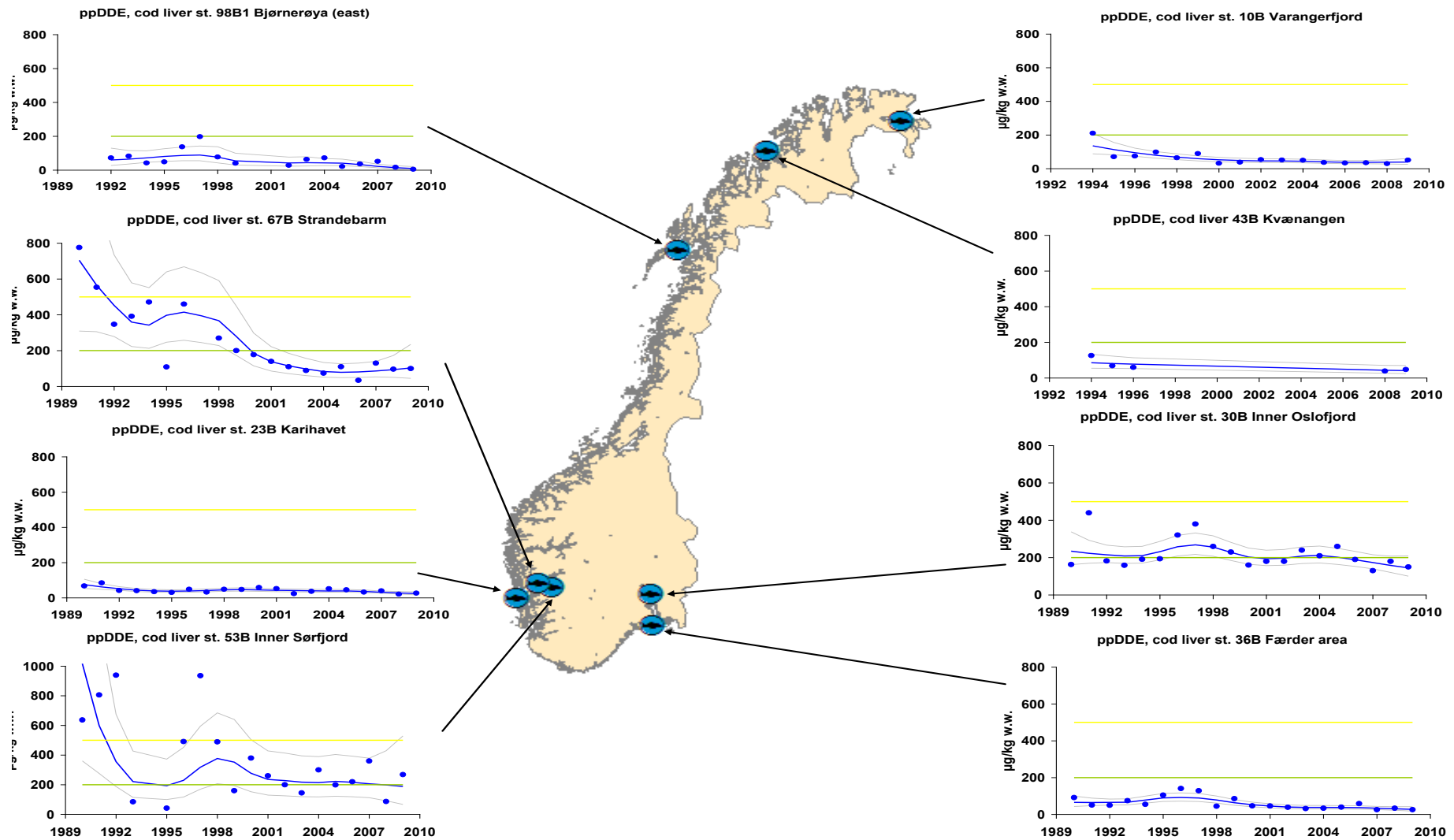


Figure 14. Trend and median concentration of ppDDE in cod liver, µg/kg (µg ppDDE/kg) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2). Note: Class limits for ΣDDT used.

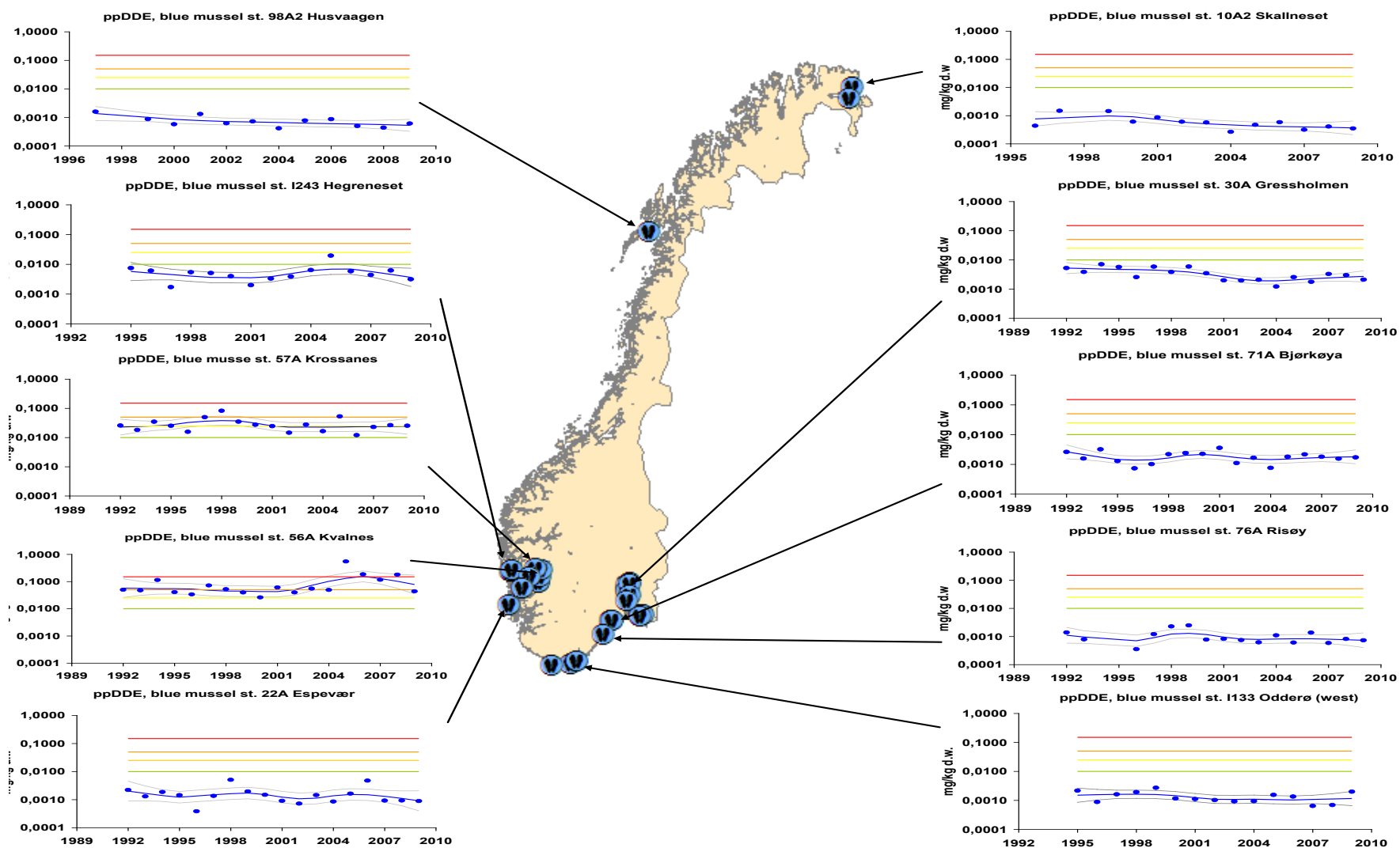


Figure 15. Trend and median concentration of ppDDE in blue mussel, mg/kg (mg ppDDE/kg) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2). **Note:** Log-scale and Class limits for ΣDDT used.

Hexachlorobenzene (HCB)

Cod liver

Observed concentrations of HCB in cod liver exceeded Class I (insignificantly polluted) in samples from 12 of the 14 cod stations investigated (Figure 16). Cod liver in the Kristiansand harbour (st. 13BH) was classified as markedly polluted (Class III) by HCB, and cod from Munkholmen in the Trondheimsfjord (st. 80BH) as moderately polluted (Class II). No trend measurements were done for these two locations, due to insufficient data. There were observed low levels of HCB (Class I) and downward trends for data from six stations: Inner Oslofjord (st. 30B), Færder area (st. 36B), Borøy area (st. 77B), Strandebarm area (st. 67B), Bjørnerøya in the Lofoten (st. 98B1) and in the Varangerfjord (st. 10B). Similar low levels of HCB and no significant trend were observed for data from the Inner Sørfjord (st. 53B), Karihavet (st. 23B), Stokken area (92B), and Kvæningen/Olderfjord (st. 43B). Data on HCB in cod from Tromsø harbour (st. 43BH) also revealed HCB concentrations below the background level (Class I), but the data was insufficient for trend analyses.

Cod fillet

There were acceptable levels (Class I, insignificantly polluted) of HCB in cod fillet in 11 out of 12 stations investigated (some of the result are shown in Figure 16), the exception being cod from the Kristiansand harbour (st. 13BH). The fish from the Kristiansand harbour was classified as markedly polluted (Class III) by HCB and no trend could be detected due to insufficient data.

A significant downward trends was observed in the data from the five stations; Inner Oslofjord (st. 30B), Færder area (st. 36B), Ullerø area (st. 15B), Strandebarm area (st. 67B) and Bjørnerøya in Lofoten (st. 98B1). No significant trend was observed in the data from the Inner Sørfjord (st. 53B), Karihavet (st. 23B) and in the Varangerfjord (st. 10B). There were insufficient data to evaluate trends in cod Munkholmen (st. 80BH) and Tromsø harbour (st. 43BH).

Flounder liver

Flounder liver from three stations were analysed for HCB. None of the results from the samples from stations in Sande (st. 33F), the Inner Sørfjord (st. 53F) and the Strandebarm area (st. 67F) revealed concentrations of HCB over expected high background. A significant downward trend was found in the data from the Inner Sørfjord, while there were no significant trends for the data from Sande or Strandebarm.

Flounder fillet

Flounder fillet from three stations were analysed for HCB. Only the station in the Strandebarm area (st. 67F) showed concentrations over high background level, but no significant trend was found in the data from this station. The results from stations in Sande (st. 33F) and Inner Sørfjord (st. 53F) showed concentrations below a high background level for HCB. The station in the Inner Sørfjord showed a significant downward trend, while the flounder fillet from Sande had no significant trend.

Dab liver

Concentrations below expected high background levels of HCB were observed in dab liver from four investigated stations. There was not observed any significant trend for the data from the Borøy area (st. 77F), Ullerø area (st. 15F) or Åkrafjord (st. 21F). The results from dab from the Færder area (st. 36F) revealed a significant downward trend.

Dab fillet

Concentrations below expected high background levels were observed in dab fillet from all four investigated stations. There was not observed any significant trend in the data from the Ullerø area (st. 15F) and Åkrafjord (st. 21F). The data for dab from the Færder area (st. 36F) did show a significant downward trend. There was insufficient data for a trend analyse for dab from the Borøy area (st. 77F).

Plaice liver

The results from Husholmen (st. 98F2) in the Lofoten area and Skogerøy (st. 10F) in the Varangerfjord revealed concentrations below expected high background levels. The results for Skogerøy showed a significant downward trend.

Plaice fillet

The data from plaice fillet from Husholmen (st. 98F2) in the Lofoten area and Skogerøy (st. 10F) in the Varangerfjord showed HCB concentrations below the expected high background level. A downward significant trend was found at Skogerøy.

Megrim liver

The two stations Åkrafjord (st. 21F) and the Strandebarm area (st. 67F) in the mid Hardangerfjord were analysed for HCB in megrim liver. The data from the station in Strandebarm showed a significant downward trend while the data for megrim in the Åkrafjord showed no significant trend.

Megrim fillet

The same two stations Åkrafjord (st. 21F) and Strandebarm (st. 67F) were used for analysis of megrim fillet. The data for megrim in Strandebarm showed a significant downward trend and the data from Åkrafjord showed no significant trend.

Blue mussel

The presence of HCB in blue mussel exceeded Class I (insignificantly polluted) in samples from 24 out of 41 stations investigated (some of the stations are presented in Figure 17). Blue mussel were markedly polluted (Class III) at Strømtangen (st. I713) and at Odderø (st. I133). The data from Strømtangen showed no significant trend whereas a significant downward trend was observed in the data from Odderø (st. I133). Blue mussel from Lastad (st. I131A) and Nordnes (st. I241) were moderately polluted (Class II) and the data showed a significant upward trend. The combination of concentrations classified as moderately polluted (Class II) and no significant trends were observed in mussel from Byrkjenes (st. 51A) and Krossanes (st. 57A) in the Sørfjord, and at Ranaskjær (st. 63A), Vikingeset (st. 65A) and Lille Terøy (st. 69A) in the Hardangerfjord. Similar results were also observed in mussels from Akershuskaia (st. I301), Damholmen (st. I022), Kirkøy (st. I024), Gjemesholmen (st. I712), Svensholmen (st. I132), Hegreneset (st. I243) and Brashavn (st. 11X). The combination of concentrations classified as moderately polluted (Class II) and significant downward trends were observed in data from Solbergstrand (st. 31A), Bjørkøya/ Risøyodden (st. 71A) and Gravdalsneset (st. I242). Blue mussel from Sponvika (st. 01A, Langøsund (st. 13A), Aavigen (st. 14A), Nordstrand (st. 77A) and Gjerdsvoildsøyen (st. 79A) were also classified as moderately polluted (Class II), but the data from these stations were insufficient to calculate trends.

Acceptable levels of HCB (Class I) and no significant trends were observed in the data from Gåsøya (st. I304), Ramtonholmen (st. I307) and Håøya (st. I306) in the inner Oslofjord and at Singlekalven (st. I023) in the Hvaler area. Similar observations were also made based on the data from Risøy (st. 76A) and Gåsøy/ Ullerøy (st. 15A), at Eitrheimsneset (st. 52A) and Kvalnes (st. 56A) in the Inner Sørfjord, and at Husvaagen (st. 98A2) and Skallneset (st. 10A2) northern part of Norway. There were acceptable levels of HCB (Class I) and significant downward trends in the data from Gressholmen (st. 30A), Mølen (st. 35A) and Espevær (st. 22A).

Concluding remarks

Both cod liver and fillet in the Kristiansand harbour (st. 13 BH) were markedly polluted by HCB. Cod liver in Munkholmen in the Trondheimsfjord was moderately polluted by HCB. For all other stations, HCB in cod liver and fillet were at background level and no upward trends were observed. Blue mussel in the Frierfjord and the Kristiansandsfjord in 2009 were up to markedly polluted with HCB as in 2008. Only two significant upward trends were found in blue mussel, Lastad and Nordnes, which were moderately polluted.

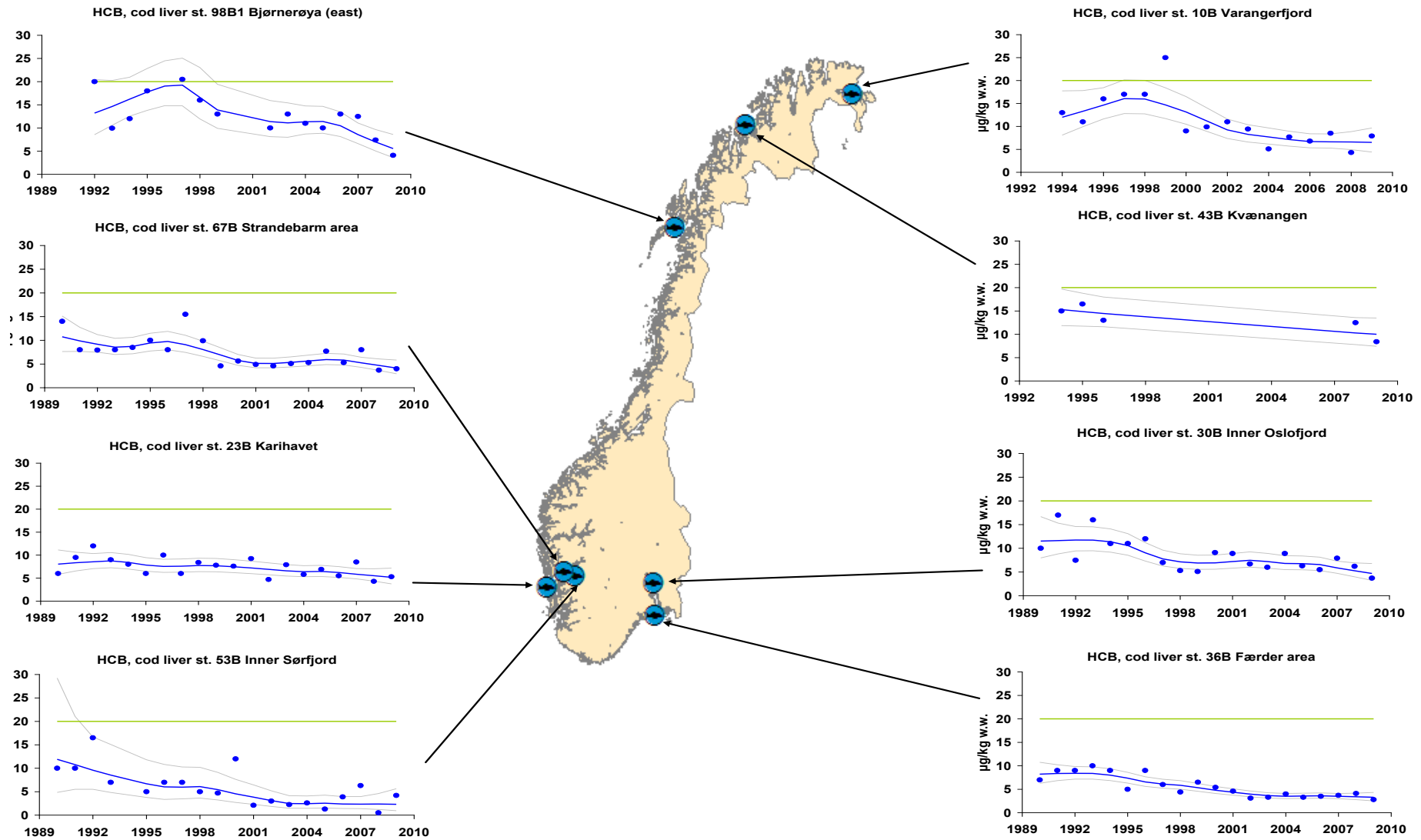


Figure 16. Trend and median concentration of HCB in cod liver, $\mu\text{g/kg}$ ($\mu\text{g HCB/kg}$) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

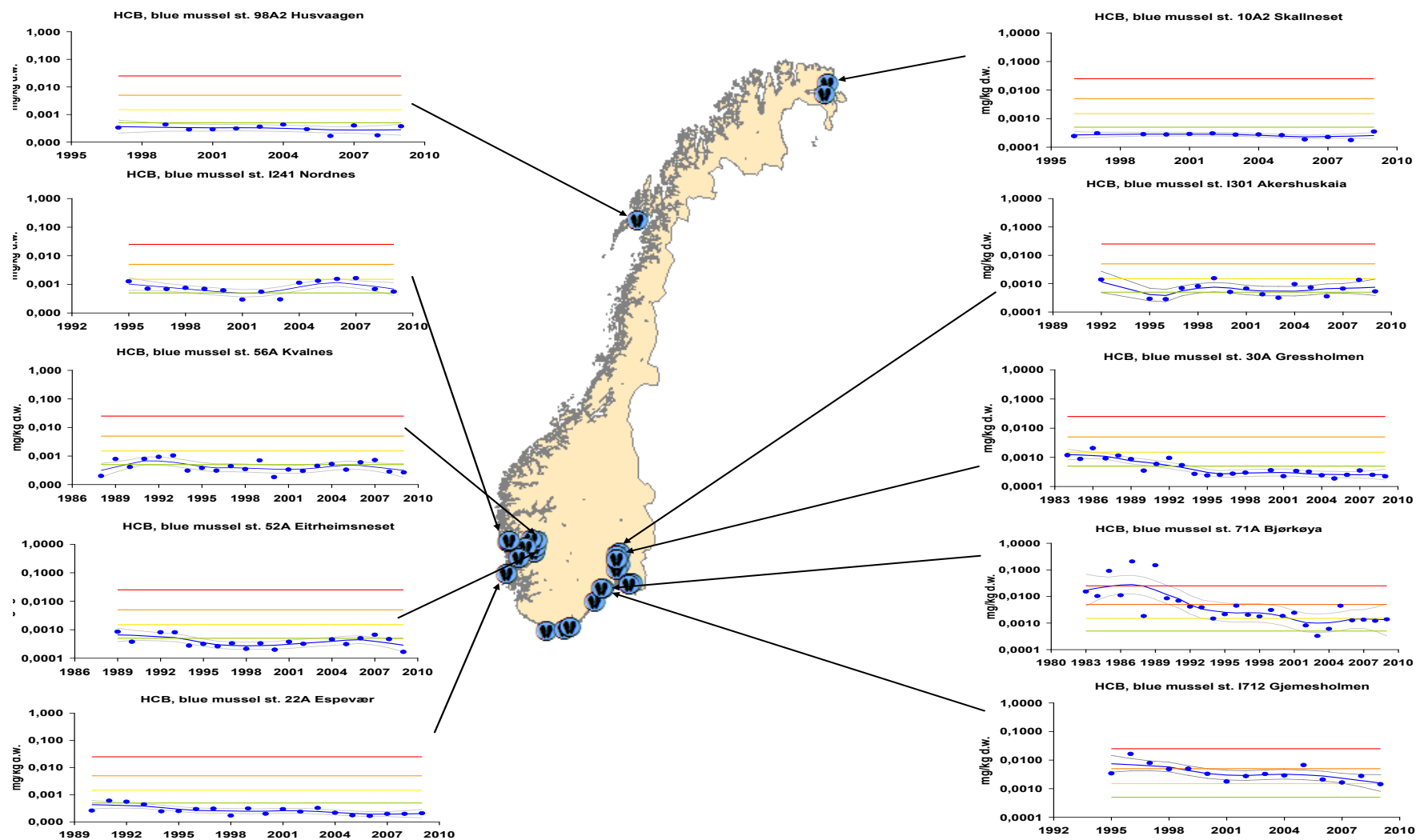


Figure 17. Trend and median concentration of HCB in blue mussel, mg/kg (mgHCB/kg) dry weight for selected stations (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2). **NB: log-scale.**

Dioxins (dioxin toxicity equivalents – Nordic model, TCDDN)

Blue mussel

The classifications are based on analysis of TCDD/F and subsequent calculation of dioxin toxicity equivalents (TCDDN) after the Nordic model (Ahlborg 1989).

Mussels from eight stations were investigated; in the Oslofjord (Gressholmen st. 30A, Mølen st. 35A), the Grenlandsfjord area (Bjørkøya/ Risøyodden st. 71A, Risøy st. 76A, Gjemesholmen st. I712 and Strømtangen st. I713), and in the Kristiansandsfjord at Svensholmen (st. I132) and Odderø (st. I133) (Figure 18). No significant trends were observed for dioxins. Trend analysis for Mølen could not be done because of insufficient data.

Blue mussel in the Grenland area at Bjørkøya/Risodden (st. 71A), Gjemesholmen (st. I712) and Strømtangen (st. I713) were extremely polluted (Class V) by dioxins. In the Kristiansandsfjord, blue mussel samples were markedly polluted (Class III) at Odderøy (st. I133), and moderately polluted (Class II) at Svensholmen (st. I132). At Mølen (st. 35A), the blue mussel were markedly polluted (Class III) by dioxins. Blue mussel at Gressholmen (st. 30A) and Risøy (st. 76A) were insignificantly polluted (Class I) by dioxins.

Concluding remarks

Dioxins have been included in Klif's Pollution Index for blue mussel since 2002 (cf. chapter 4.4). No significant trends were observed for dioxins in blue mussel. Blue mussel from three stations in the Grenlandsfjord were extremely polluted with dioxins both in 2008 and 2009. Consumption advice has been issued for fish and shellfish in the Grenlandsfjord area due to the high concentrations of organochlorines including dioxins. It can be noted that environmental status is classified according to environmental quality criteria (based on ecotoxicological marginal values or presumed background levels) and must not be confused with limit values for human consumption and associated advices issued by the Norwegian Food Safety Authorities (*Mattilsynet*). Monitoring of contaminants in organisms from Grenland showed that the dioxins content in blue mussel is far over expected high background level, and this has not changed systematically since 1995 (Bakke *et al.* 2010). Results presented by Bakke *et al.* (2010) also indicated that dioxin concentrations have shown a tendency to increase outside the Frierfjord during the period 2002 to 2009 (examples dioxins in the Langesundfjord (Croftsholmen), Helgeroa and Klokkartangen). A similar trend was also shown for CEMP data (cf. st. 71A and I712) but the trend was not significant.

In the Kristiansandsfjord, blue mussel were markedly polluted at Odderøy in 2009 and insignificant polluted in 2008. The blue mussel at Svensholmen were moderately polluted in 2009 and markedly polluted in 2008.

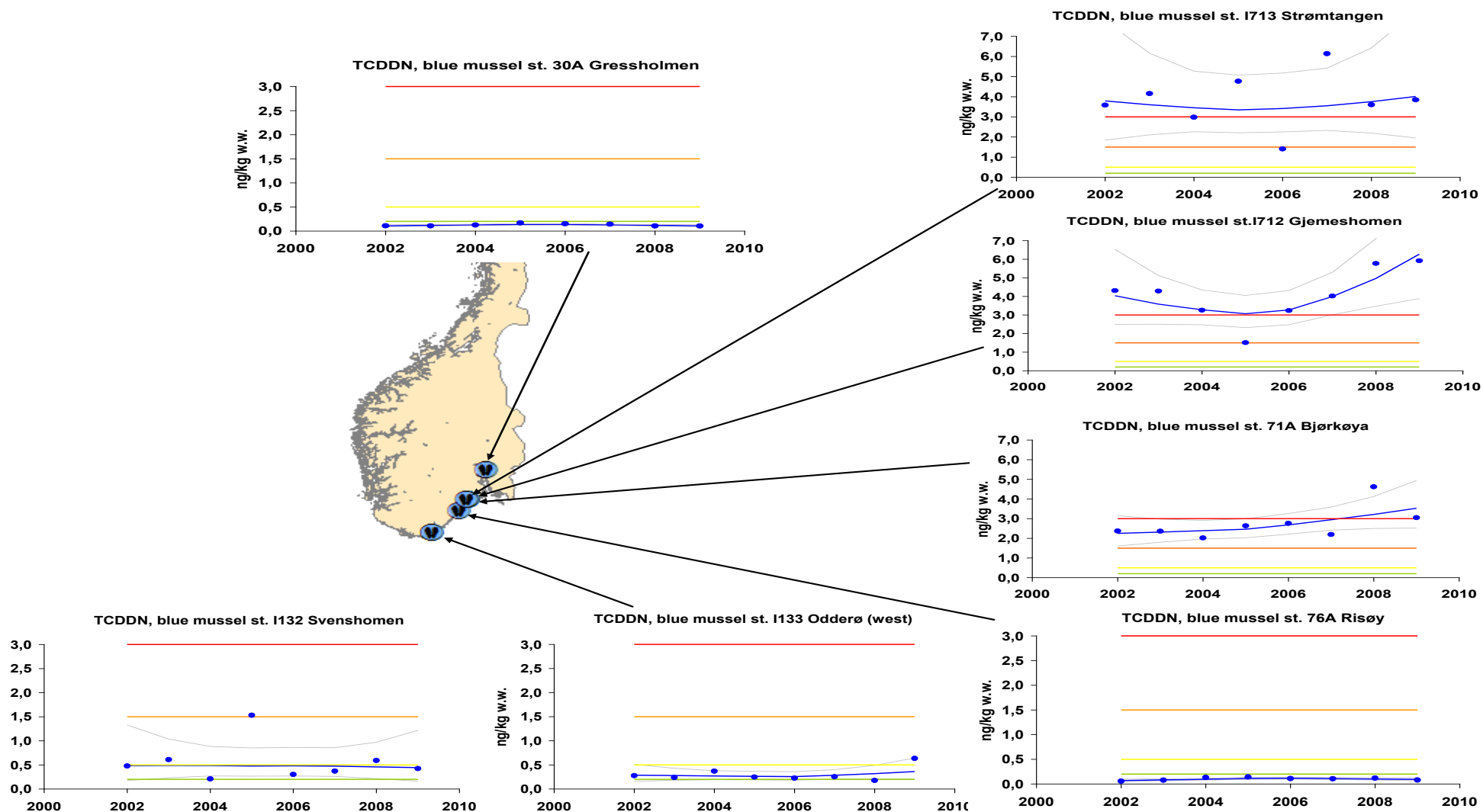


Figure 18. Trend and median concentration of dioxins TCDD-toxicity equivalents after Nordic model (TCDDN cf. Appendix C) in blue mussel, ng/kg TCDDN/kg) (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Polybrominated diphenyl ethers (PBDE)

Cod liver

Polybrominated diphenyl ethers (PBDEs) have been investigated in cod liver since 2005. PBDEs were analysed in cod from 10 stations (see Table 7 and Figure 19). In 2009, the median concentration of sum PBDE was highest in cod from the Inner Oslofjord (61 µg/kg w.w.) and lowest in samples east of Bjørnerøya in Lofoten (2.7 µg/kg w.w.) (Table 7). No significant trends were observed. The tetrabromodiphenyl ether BDE47 was the most dominant PBDE, whereas the pentabromodiphenyl ether BDE100 and the tetrabromodiphenyl ether BDE49 were either the second or third most dominant. The median concentration of decabromodiphenyl ether BDE209 was below the detection limit at all stations.

Table 7. Concentrations of PBDE analysed in cod liver (*Gadus morhua*) 2009.

Station	SUM PBDE (µg/kg w.w.)
Inner Oslofjord (st. 30B)	61
Færder (st. 36B)	2.9
Kristiansand harbour (st. 13BH)	19.8
Inner Sørfjord (st. 53B)	33.2
Karihavet area (st. 23B)	9.5
Munkholmen (st. 80BH)	38.7
Stokken (st. 92B)	5.5
Bjørnerøya (st. 98B1)	2.7
Kvænangen/ Olderfjord (st. 43B)	11
Tromsø harbour (st. 43BH)	36.13

Concluding remarks

The concentrations of PBDE was highest in cod liver from the Inner Oslofjord. The values of the median concentration of PBDE in Inner Oslofjord and Karihavet were lower in 2009 than in 2008.

Median concentration found at presumed reference stations like Svolvær, Færder, Utsira and Bømlo-Sotra indicate that a high background level in diffusely contaminated areas might be 30 µg/kg w.w. for cod liver (Fjeld *et al.* 2005). This is higher than the median found in Færder, Kristiansand, Kvænangen, Karihavet, Stokken and Lofoten. It can not be disregarded that this high background concentration might be too high. The median found in the inner Oslofjord was 60 µg/kg w.w. and in the interval of 37-112 µg/kg w.w. found in other contaminated areas (Fjeld *et al.* 2005; Berge *et al.* 2006). Bakke (*et al.* 2008) found a range of mean concentrations in remote areas to be 3.4 – 29.0 µg/kg w.w.

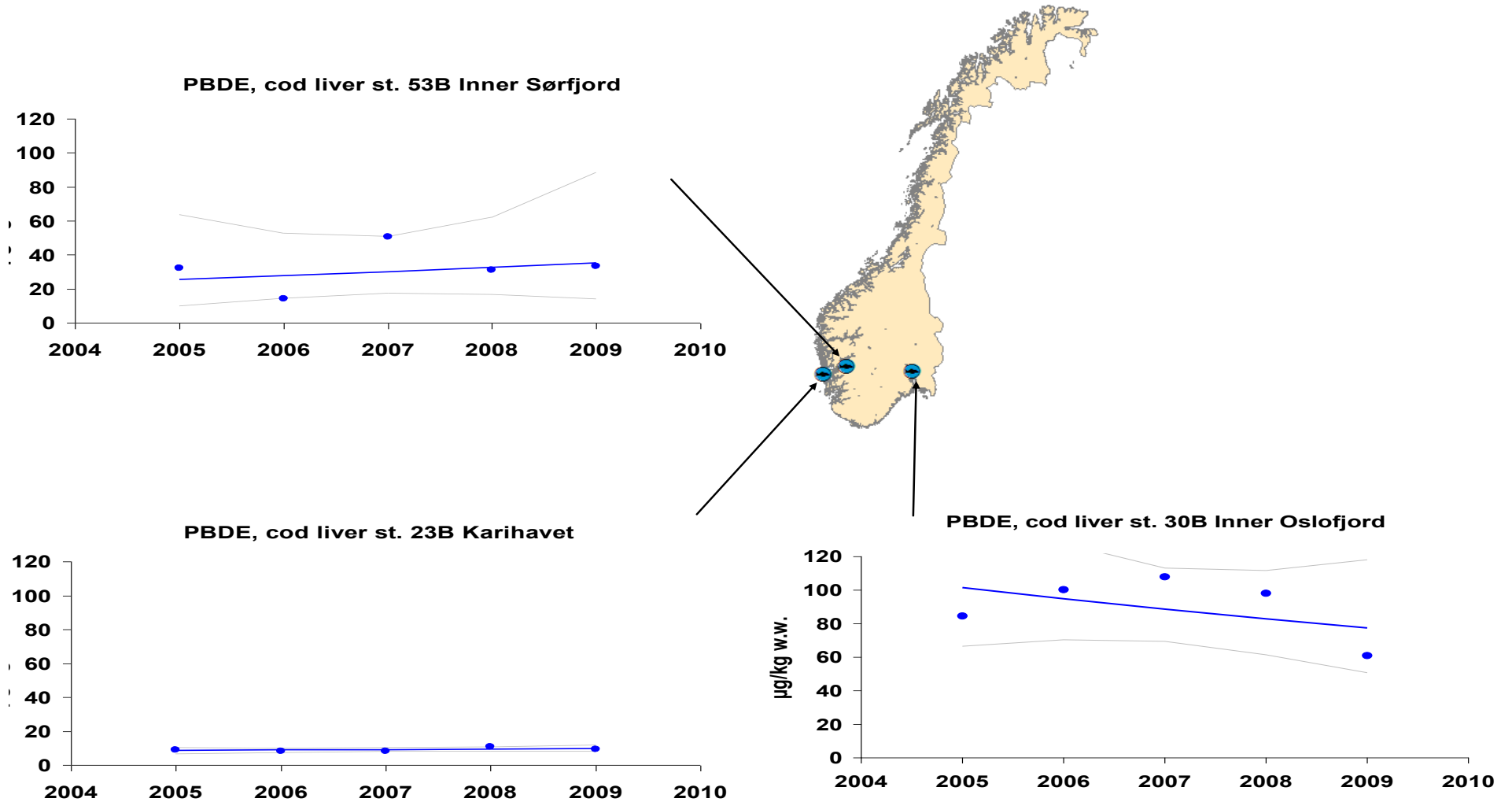


Figure 19. Trend (not significant) and median concentration of PBDE in cod liver from Karihavet (st. 23B), Inner Sør fjord (st. 53B) and Inner Oslofjord (st. 30B), $\mu\text{g/kg}$ ($\mu\text{g PBDE/kg}$ wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2). There is no limit to classify the results from 2009.

Perfluorooctanoic sulphonate (PFOS)

Cod liver

Perfluoroalkyl compounds (PFC¹) have been analysed in cod liver since 2005. PFOS were in 2009 analysed in cod from 10 stations (see Table 8 and Figure 20). The median concentration of the indicator PFC compound perfluorooctanoic sulphonate (PFOS), the most abundant PFC, was highest in Inner Oslofjord (48 µg/kg w.w.). The lowest median concentration was found in the inner Sørfjord (3.2 µg/kg w.w.). The second most abundant PFC was perfluorooctanesulfonic acid (PFOSA) with a median concentration of 41.5 µg/kg w.w. in the Inner Oslofjord and 2.2 µg/kg w.w. in Kristiansand harbour. The median concentrations of the remaining PFCs were below the limit of detection.

Table 8. Concentrations of PFOS analysed in cod liver (*Gadus morhua*) 2009.

Stations	PFOS (µg/kg w.w.)
Inner Oslofjord (st. 30B)	48
Færder (st. 36B)	29
Kristiansand harbour (st. 13BH)	9
Inner Sørfjord (st. 53B)	3.2
Karihavet area (st. 23B)	8.9
Munkholmen (st. 80BH)	4.3
Stokken (st. 92B)	9.1
Bjørnerøya (st. 98B1)	6.8
Kvænangen/ Olderfjord (st. 43B)	5.5
Tromsø harbour (st. 43BH)	6.3

Concluding remarks

PFOS was the most dominant PFC found in cod liver. Concentrations of PFOS in the Inner Oslofjord was clearly higher than for the other stations. There were higher values of PFOS in the Inner Oslofjord and in Karihavet in 2009 (respectively 48 µg/kg w.w. and 8.9 µg/kg w.w.) was higher than in 2008 (respectively 42 µg/kg w.w. and 6.9 µg/kg w.w.). The values in the Inner Sørfjord in 2009 (3.2 µg/kg w.w.) were lower than in the previous year (10 µg/kg w.w.).

Median concentration observed in cod from presumed reference stations like Svolvær, Kvænangen/ Olderfjord north of Skjervøy and the Varangerfjord indicated that a high background concentrations in only diffusely contaminated areas might be around 10 µg/kg w.w. (Bakke *et al.* 2007a). The concentrations observed in the Inner Oslofjord and Færder were higher. The other eight stations were quite near this level or lower. No significant trends were observed.

¹ PFCs included PFBS, PFHpA, PFHxA, PFNA, PFOA, PFOS, and PFOSA

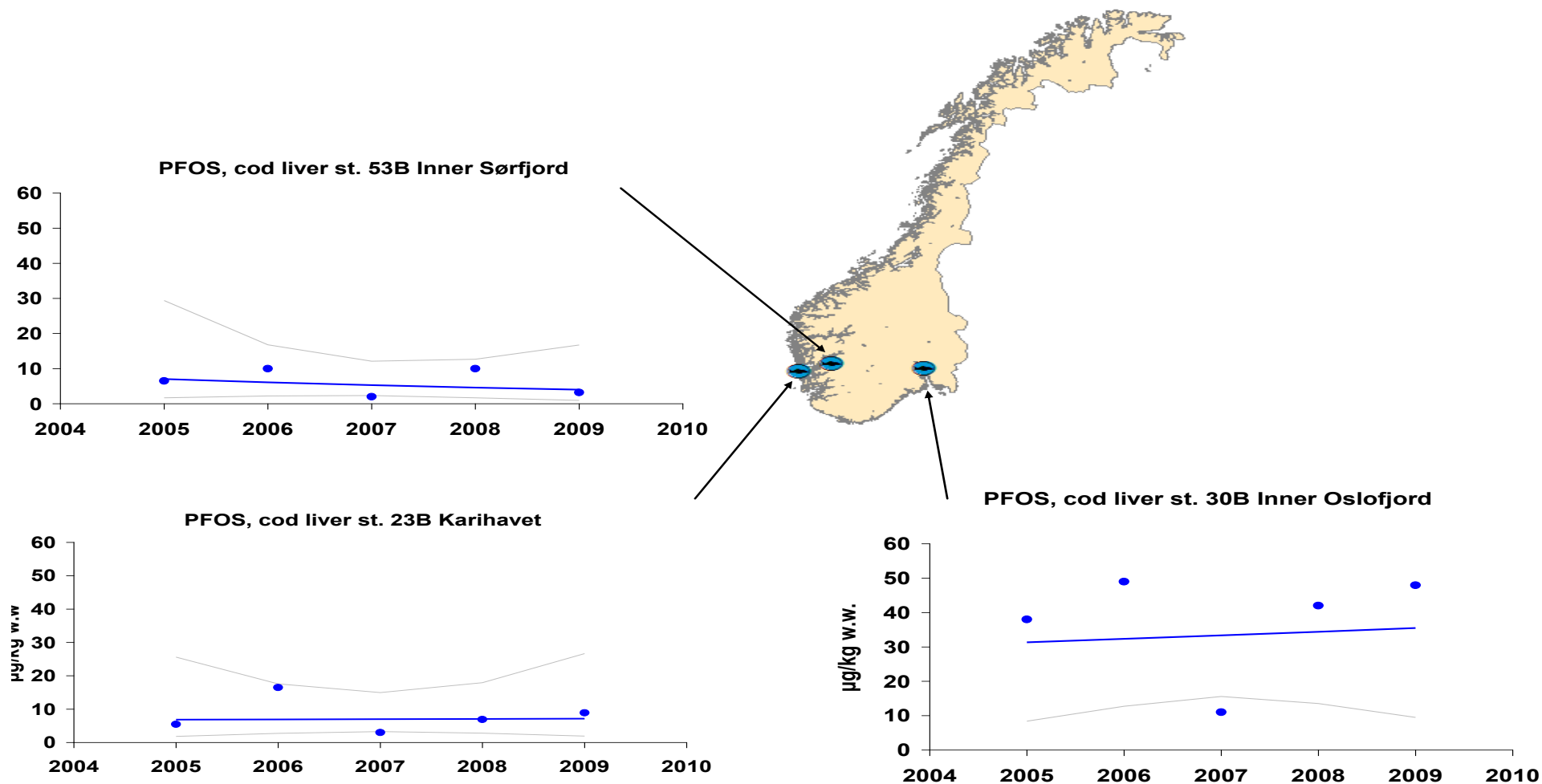


Figure 20. Trend (not significant) and median concentration of PFOS in cod liver from Karihavet (st. 23B), Inner Sør fjord (st. 53B) and Inner Oslofjord (st. 30B), µg/kg (µg PFOS/kg) wet weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2). There is no limit to classify the results from 2009.

Gamma-hexachlorocyclohexane (HCHG)

There are class limits for Σ HCH, which is the sum of alpha-, beta- and gamma isomers; (Molvær *et al.* 1997). However, not all isomers are analysed and hence, the system was applied to HCHG, the results are shown in Appendix J and Appendix K.

Cod liver

Samples of cod liver from all 14 cod stations that were analysed were insignificantly polluted by HCHG (Class I). Significant downward trends were detected at all stations except for Borøy (st. 77B) where no trend was detected and Kristiansand harbour (st. 13BH), Munkholmen in the Trondheimsfjord (st. 80BH) and Tromsø harbour (st. 43BH), where there was insufficient data to do trend analysis.

Cod fillet

Samples of cod fillet from all 12 cod stations that were analysed were insignificantly polluted by HCHG (Class I). Significant downward trends were found at Færder (st. 36B) and Borøy (st. 77B). No trends were found at the remaining stations in part due to insufficient data (i.e. Kristiansand harbour (st. 13BH), Munkholmen in the Trondheimsfjord (st. 80BH) and Tromsø harbour (st. 43BH)).

Flounder liver

The sample from the three flounder stations in Sande (st. 33F), Inner Sørfjord (st. 53F) and Strandebarm (st. 67F) showed levels of HCHG in liver which were below a high background level. The results from the Inner Sørfjord and Strandebarm also showed a significant downward trend.

Flounder fillet

The same three flounder stations showed levels of HCHG in fillet which were below a high background level and showed a significant downward trend.

Dab liver

Dab samples from all the four stations Færder (st. 36F), Borøy (st. 77F), Ullerø (st. 15F) and Åkrafjord (st. 21F) showed levels of HCHG which were below a high background level for liver. The results from Færder, Ullerø and Åkrafjord also showed a significant downward trend.

Dab fillet

Dab from the same four stations showed levels of HCHG which were below a high background level for fillet. The results from Færder and Ullerø also showed a significant downward trend.

Plaice liver

Plaice from Husholmen (st. 98F2) in Lofoten and Skogerøy (st. 10F) in the Varangerfjord showed both levels of HCHG which were below a high background level for plaice liver. No significant trends were detected.

Plaice fillet

Plaice from Husholmen (st. 98F2) in Lofoten and Skogerøy (st. 10F) in the Varangerfjord showed both levels of HCHG which were below a high background level for fillet in plaice. No significant trends were detected.

Megrim liver

Megrim from Strandebarm (st. 67F) in the Hardangerfjord and Åkrafjord (st.21F) on the west coast showed both levels of HCHG which were below a high background level for liver in megrim. There was insufficient data to do a trend analysis.

Megrim fillet

Megrim from Strandebarm (st. 67F) in the Hardangerfjord and Åkrafjord (st.21F) on the west coast showed both levels of HCHG which were below a high background level for fillet in megrim. There was insufficient data to do a trend analysis.

Blue mussel

All 41 blue mussel stations that were analysed for HCHG were insignificantly polluted (Class I), and all significant trends were downward.

Concluding remarks

All cod liver and fillet, and blue mussel that were analysed for HCHG were insignificantly polluted. All dab, flounder and megrim liver and fillet had acceptable levels of HCHG.

Tributyltin (TBT)

Blue mussel

Concentrations of organotin (TBT) in blue mussel were quantified at 14 stations (results from some of the stations are presented in Figure 21). The presence of TBT exceeded Class I (insignificantly polluted) at six blue mussel stations. No significant downward trends were observed at Akershuskaia (st. I301), Gressholmen (st. 30A), Gjemesholmen (st. I712) and Høgevarde (st. 227A2) (all Class II, moderately polluted). Blue mussel at Svensholmen (st. I132) and Odderøy (st. I133) in the Kristiansandsfjord were also moderately polluted (Class II) by TBT, but no significant trend measurements were done due to insufficient data.

Blue mussel at Espevær (st. 22A) were insignificantly polluted (Class I) by TBT but no significant trend was observed. Significant downward trends were found in mussel at Bjørkøya/ Risøyodden (st. 71A), Strømtangen (st. I713), Risøy (st. 76A), Gåsøy/ Ullerø (st. 15A), Husvaagen area (st. 98A2) and Brashavn (st. 11X) (all Class I). Blue mussel from Mølen (st. 35A) showed also concentrations below background, but no significant trend measurements could be done for this station.

Concentrations of TBT in dogwhelk

The concentrations of TBT in dogwhelk from the 10 stations investigated in 2009 were relatively low. As in 2003, 2004, 2005, 2007 and 2008 the highest organotin level was found at Melandsholmen close to Haugesund (st. 227G1, Figure 22) (<0.0323 mg/kg d.w.) on the west coast of Norway. Significant downward trends were found on the data from Færder (st. 36G), Lista at Gåsøy/ Ullerø (st. 15G), Lastad (st. 131G), Svolvær (st. 98G) and Brashavn (st. 11G).

There were no significant trends in the data on dogwhelk from Fugløyskjær (st. 71G), Risøy (st. 76G), Espevær (st. 22G) or Melandholmen (st. 227G1). The lowest organotin levels (0.00225 mg/kg d.w.) were found at Brashavn (st. 11G) in the Varangerfjord.

TBT-concentrations were 0.018103 mg/kg d.w. at Langholmane (st. 74G) and since this station is new in 2009, there were no values for trend analysis.

Biological effects of TBT (Imposex/VDSI) in dogwhelk

The effects from TBT were low ($VDSI < 2$) at eight of 10 stations investigated in 2009. A pronounced effect of TBT was however observed in dogwhelks from the Svolvær area (st. 98G) where VDSI was 3.03 and at Melandholmen (st. 227G1) where VDSI was 2.32 (Figure 23). No effects ($VDSI = 0$) were found at Risøy (st. 76G), Lastad (st. 131G), Gåsøy/ Ullerø (st. 15G) and Brashavn (st. 11G) (Figure 23). There were significant downward trends at all the stations except for at Svolvær (st. 98G) and Brashavn (st. 11G) (Figure 23). At Langholmane (st. 74G) the VDSI was 0.033 but since this station is new in 2009, there were no values for significant trend analysis.

Concluding remarks

No significant upward trends were found in either blue mussel or snails. The presence of organotin (as TBT) in Norwegian waters Class I (insignificantly polluted) at six of the 14 blue mussel stations monitored in 2009. This was observed in harbour areas like Akershuskaia (st. I301) and Gressholmen (st. 30A) in the Oslofjord, Gjemesholmen (st. I712) in the Frierfjord, Svensholmen (st. I132) and Odderøy (st. I133) in the Kristiansandsfjord, and Høgevarde (st. 227A2) in the Karmsund close to Haugesund. However, of the time series investigated, 10 stations showed significant downward trends for TBT in blue mussel, and one stations (Espevær st. 22A) showed no significant trend. The TBT-concentrations have decreased in blue mussel at Gressholmen (st. 30A) and Gjemesholmen (st. I712) from markedly polluted in 2008 to moderately polluted in 2009, and at Akershuskaia (st. I301) from severely polluted in 2008 to moderately polluted in 2009.

Of the time series investigated for biological effects (Imposex) of TBT in dogwhelk, seven showed significant downward trends and two had no significant trend. Significant downward trends for TBT concentrations in gastropods were found at Færder (st. 36G), Lista at Gåsøy/ Ullerø (st. 15G), Lastad

(st. 131G), Svolvær (st. 98G) and Brashavn (st. 11G). The effects from TBT were low (VDSI<2) at eight of 10 stations investigated in 2009. Dogwhelks from the Svolvær area (st. 98G) showed a VDSI of 3.03 in 2009 which was higher than in 2008. There was no trend at this station in 2009 but a downward trend in 2008.

The results show that the restrictions introduced in Norway banning the use of organotins on ships shorter than 25 meters in 1990 and longer than 25 meters in 2003 have been effective in reducing Imposex in dogwhelk populations and some of the gastropod populations have re-established. The international convention that was initiated by the International Maritime Organization (IMO) has also resulted in a ban on the presence of organotin-based antifouling paints on the hulls of large ships from 2008.

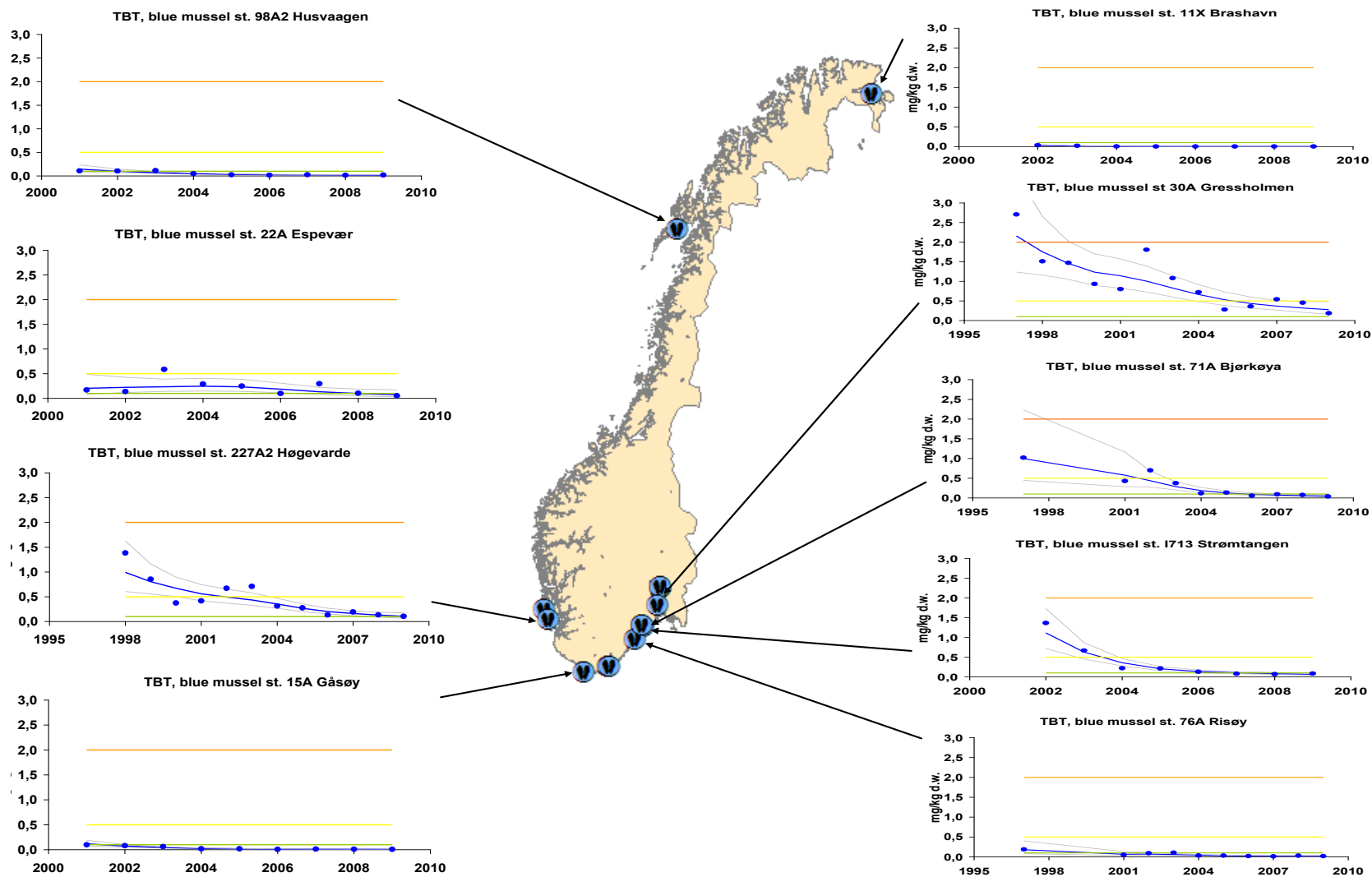


Figure 21. Trend and median concentration of TBT (on a formulation basis) in blue mussel, mg/kg (mg TBT/kg) dry weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

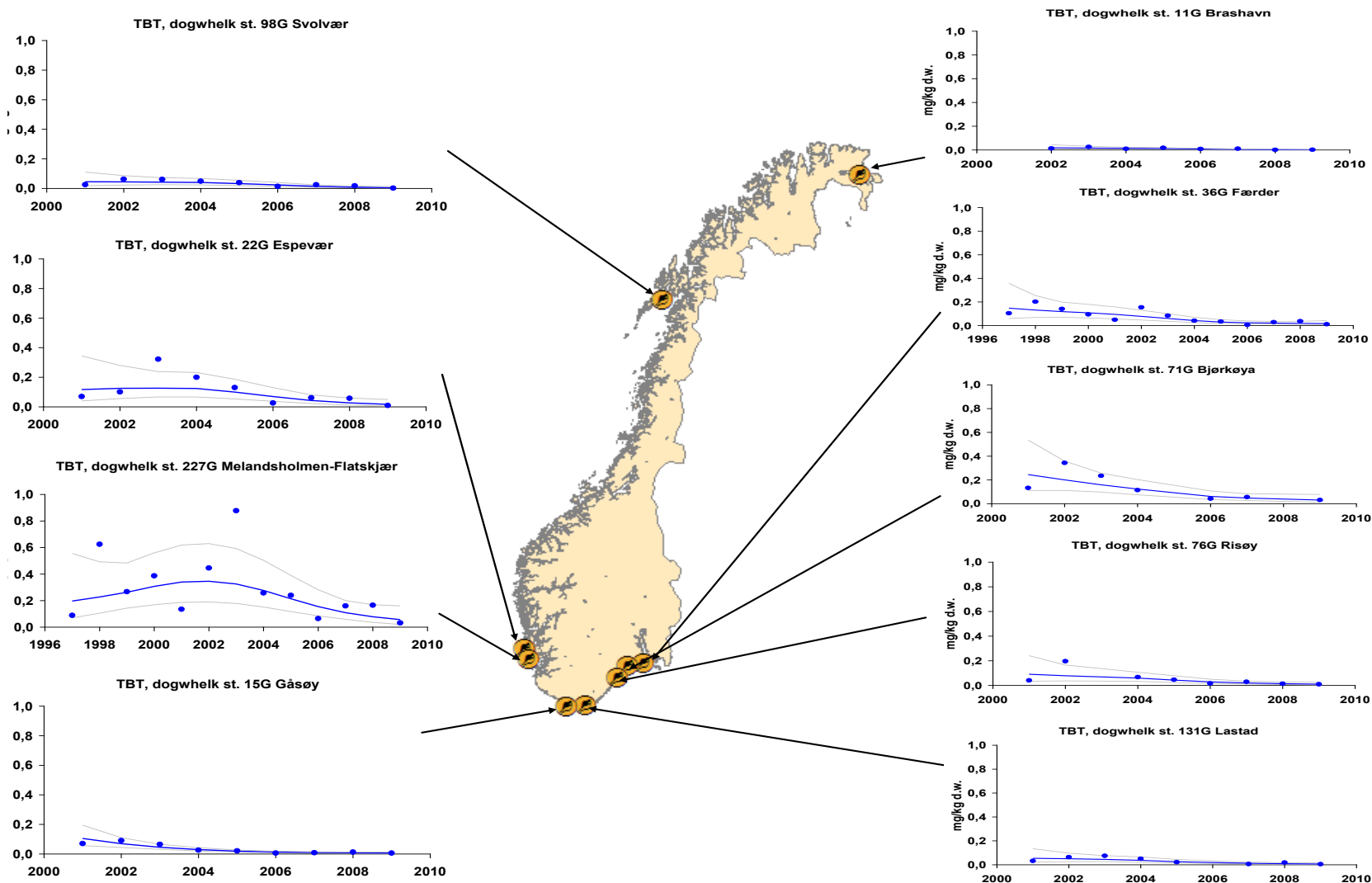


Figure 22. Trend and median concentration of TBT (on a formulation basis) in dogwhelk at 9 stations, mg/kg (mg TBT/kg) dry weight (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2). There is no limit to classify the results from 2009.

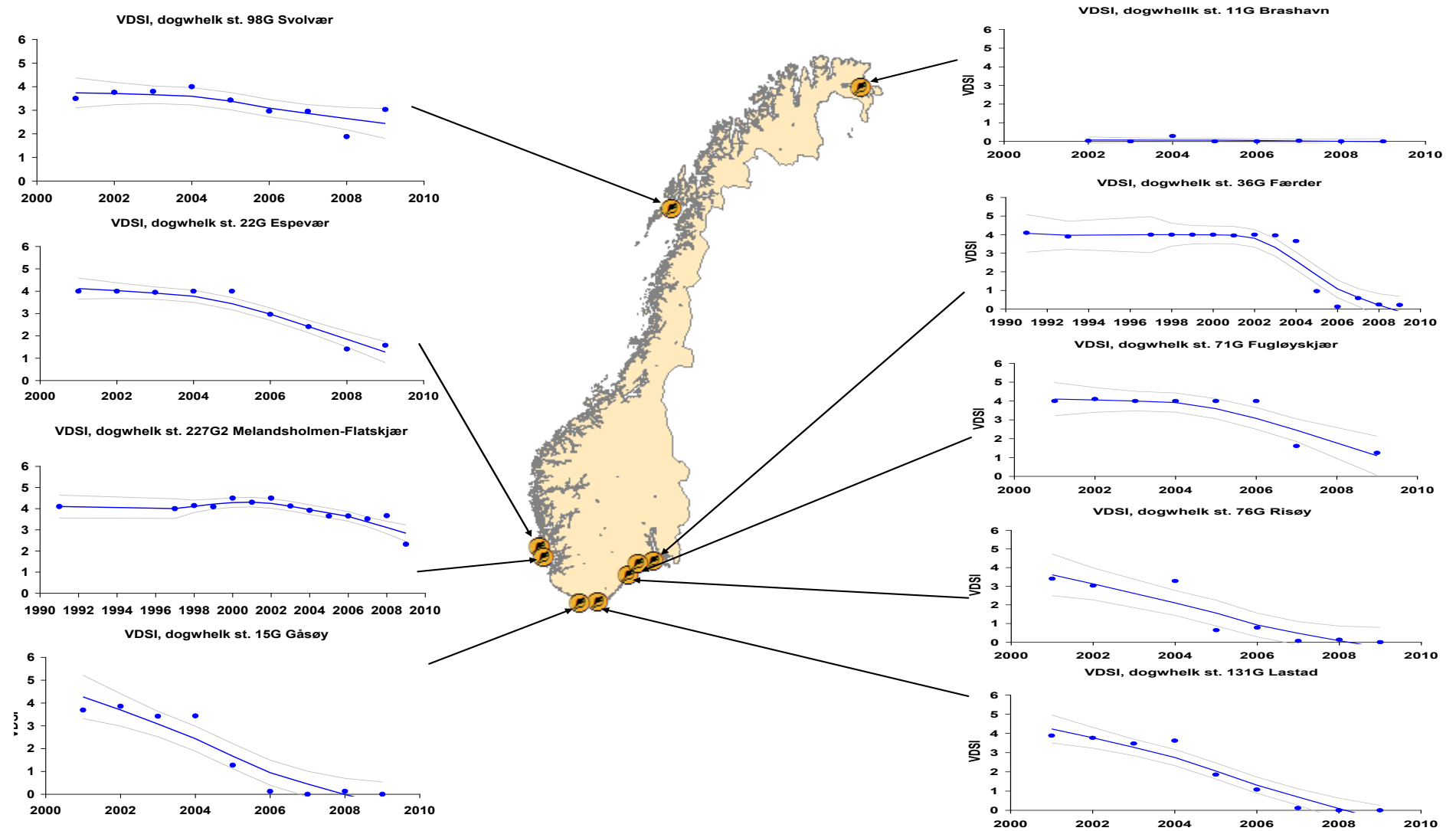


Figure 23. Trends in *Imposex* (VDSI) in dogwhelk at 8 stations. Data from 1991 (Harding et al. 1992) and 1993 (Walday et al. 1997) (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2). There is no limit to classify the results from 2009.

Table 9. Overview of samples collected in 2009 with indication of levels and trends in concentrations of contaminants monitored. Classification is based on observed concentrations in cod, flatfish and blue mussel. Tissues: soft body (SB), muscle (MU), liver (LI), whole organism (WO), fish bile (BI) and fish blood (BL). Klif Classification system is used for biota (Molvær et al. 1997: Classes: I (blue), II (green), III (yellow), IV (orange) and V (red) (see Appendix D). For biota, trend analyses were done on time series with three or more years and the results are indicated by an upward or downward arrow where significant trends were found, or a zero if no trend was detected. A small filled square (*) indicates that chemical analysis has been performed, but either data were insufficient to do a trend analysis or was not presented. Dark grey indicates concentrations higher than estimated high background levels. Light grey indicates concentrations lower than high background levels. **Note: Class limits for ΣDDT are used for ppDDE. Class limits for ΣHCH are used for HCHG.**

Station	Station	Medium	Tissue	VDSI	Ag	ALAD	As	BA	B[a]P	BDE	ΣPCB-7	Cd	Co	Cr	Cu	CYP1A	ppDDE	EROD	HCHG	HCB	Hg	KPAH	Mo	Ni	OCS	PAH	Pb	PFOS	PYR10	QCB	Sn	TBT	TCDDN	V	Zn	
01A	Sponvika	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
02A	Fugleskjær	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
03A	Tisler	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
10A2	Skallneset	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
11X	Brashavn	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
13A	Langøsund	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
14A	Aavigen	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
15A	Gåsøy (Ullerø)	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
227A2	Høgevarde	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
22A	Espevær	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
30A	Gressholmen	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
31A	Solbergstrand	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
35A	Mølen	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
51A	Byrkjenes	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
52A	Eitrheimsneset	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
56A	Kvalnes	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
57A	Krossanes	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
63A	Rånaskjær	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
65A	Vikingneset	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
69A	Lille Terøy	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
71A	Bjørkøya	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
73A	Lyngholmen	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
76A	Risøy	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
77A	Nordstrand	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
79A	Gjerdsvoldsøyen	Blue mussel	SB	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Station	Station	Medium	Tissue	VDSI	Ag	ALAD	As	BA	B[a]P	BDE	∑PCB-7	Cd	Co	Cr	Cu	CYP1A	ppDDE	EROD	HCHG	HCB	Hg	KPAH	Mo	Ni	OCS	PAH	Pb	PFOS	PYR10	QCB	Sn	TBT	TCDDN	V	Zn
98A2	Husvaagen area	Blue mussel	SB		■		■				○	◀	■	■	○		○		◀	○	○					◀					◀			○	
I022	West Damholmen	Blue mussel	SB		■		■				■	○	○	■	■	■	◀		■	■	○					○	○							○	
I023	Singlekalven	Blue mussel	SB		■		■				◀	○	○	■	■	■	◀		■	○	○					○	○							○	
I024	Kirkøy	Blue mussel	SB		■		■				◀	○	○	■	■	■	◀		■	○	○					○	○							○	
I131A	Lastad	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○					○	○							○	
I132	Svensholmen	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○					○	○							○	
I133	Odderø (west)	Blue mussel	SB		■		■		○		■	○	○	■	■		○		■	○	○					○	○							○	
I201	Ekkjegrunn (G1)	Blue mussel	SB		■		■		◀		○	○	■	■	■		○		■	○	○					◀	○							○	
I205	Bølsnes (G5)	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○					◀	○							○	
I241	Nordnes	Blue mussel	SB		■		■				○	○	■	■	■		○		■	○	○					○	○							○	
I242	Gravdalsneset	Blue mussel	SB		■		■				○	○	■	■	■		○		■	○	○					○	○							○	
I243	Hegreneset	Blue mussel	SB		■		■				○	○	■	■	■		○		■	○	○					○	○							○	
I301	Akershuskaia	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○					○	○							○	
I304	Gåsøya	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○					○	○							○	
I306	Håøya	Blue mussel	SB		■		■		▶		○	○	■	■	■		○		■	○	○					○	○							○	
I307	Ramtonholmen	Blue mussel	SB		■		■		▶		○	○	■	■	■		○		■	○	○					○	○							○	
I712	Gjemesholmen	Blue mussel	SB		■		■				○	○	■	■	■		○		■	○	○					○	○							○	
I713	Strømtangen	Blue mussel	SB		■		■				○	○	■	■	■		○		■	○	○					○	○							○	
I912	Honnhammer	Blue mussel	SB		■		■		○			○	○	■	■		○		■	○	○					◀	○							○	
I913	Fjøseid	Blue mussel	SB		■		■		○			○	○	■	■		○		■	○	○					◀	○							○	
I915	Flåøya	Blue mussel	SB		■		■					○	○	■	■		○		■	○	○					○	○							○	
I964	Toraneskaien (B4)	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○				■	○	○							○	
I965	Moholmen (B5)	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○				■	○	○							○	
I969	Bjørnbærviken (B9)	Blue mussel	SB		■		■		○		○	○	■	■	■		○		■	○	○				■	○	○							○	
10B	Varangerfjorden	Cod	LI		■		■				◀	◀	■	■	■		◀		◀	◀						◀								■	
10B	Varangerfjorden	Cod	MU		■		■				○	○	■	■	■		■		○	○														■	
13BH	Kristiansand harbour	Cod	LI		■		■				■	■	■	■	■		■		■	■						■								■	
13BH	Kristiansand harbour	Cod	MU		■		■				■	■	■	■	■		■		■	■						■								■	
15B	Ullerø area	Cod	BI		■		■					○	○	■	■		○		○	○														○	
15B	Ullerø area	Cod	LI		■		■				◀	○	○	■	■		○		◀	○						◀								○	
15B	Ullerø area	Cod	MU		■		■				○	○	■	■	■		○		○	○														○	
23B	Karihavet area	Cod	BI		■		■					○	○	■	■		○		○	○														○	
23B	Karihavet area	Cod	BL		○																														○

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Station	Station	Medium	Tissue	VDSI	Ag	ALAD	As	BA	B[a]P	BDE	∑PCB-7	Cd	Co	Cr	Cu	CYP1A	ppDDE	EROD	HCHG	HCB	Hg	KPAH	Mo	Ni	OCS	PAH	Pb	PFOS	PYR10	QCB	Sn	TBT	TCDDN	V	Zn	
23B	Karihavet area	Cod	LI		■		■			■	◀	○	■	■	■	■	◀	○	◀	○				■	■	◀	■							■		
23B	Karihavet area	Cod	MU								○						○		○	○	○					◀	■								■	
30B	Oslo City area	Cod	BI																										○							
30B	Oslo City area	Cod	BL			○																														
30B	Oslo City area	Cod	LI		■		■			■	○	▶	■	■	■	○	○	○	◀	◀					■	■	◀	■						■		
30B	Oslo City area	Cod	MU								○	○					○		○	◀	◀	▶				■	■								■	
36B	Færder area	Cod	LI		■		■			■	◀	◀	■	■	■	○	◀		◀	◀	◀				■	■	◀	■						■		
36B	Færder area	Cod	MU								○	○					○		◀	◀	◀	○				■	■								■	
43B	Kvænangen	Cod	LI							■	■	■	■	■	■		■		◀	■					■	■	◀	■						■		
43B	Kvænangen	Cod	MU																◀	■					■	■	◀	■							■	
43BH	Tromsø harbour	Cod	LI		■		■			■	■	■	■	■	■		■		■	■					■	■	■	■							■	
43BH	Tromsø harbour	Cod	MU							■	■	■	■	■	■		■		■	■					■	■	■	■							■	
53B	Inner Sør fjord	Cod	BI																										○							
53B	Inner Sør fjord	Cod	BL			○																														
53B	Inner Sør fjord	Cod	LI		■		■			■	○	▶	■	■	■	○	○	○	◀	◀	◀				■	■	▶	■							■	
53B	Inner Sør fjord	Cod	MU								○	○					○		○	○	○	○				■	■									■
67B	Strandebarm area	Cod	LI		■		■			■	◀	◀	■	■	■		◀		◀	◀	◀				■	■	◀	■							■	
67B	Strandebarm area	Cod	MU								○	○					○		○	○	◀	◀				■	■									■
77B	Borøy area	Cod	LI		■		■			■	■	■	■	■	■		■		○	○	○				■	■	◀	■							■	
77B	Borøy area	Cod	MU								■	■	■	■	■		■		◀	■					■	■	◀	■							■	
80BH	Munkholmen	Cod	LI		■		■			■	■	■	■	■	■		■		■	■	■				■	■	■	■							■	
80BH	Munkholmen	Cod	MU								■	■	■	■	■		■		■	■	■				■	■	■	■							■	
92B	Stokken area	Cod	LI							■	■	■	■	■	■		■		◀	■					■	■	■	■							■	
92B	Stokken area	Cod	MU								■	■	■	■	■		■		◀	■					■	■	■	■							■	
98B1	Bjørnerøya	Cod	LI		■		■			■	◀	○	■	■	■		◀		◀	◀	◀				■	■	◀	■							■	
98B1	Bjørnerøya	Cod	MU								○	○					○		○	◀	◀	○				■	■									■
15F	Ullerø area	Dab	LI		■		■				○	○	■	■	■		○		■	○					■	■	○	■							■	
15F	Ullerø area	Dab	MU								○	○					○		■	■					■	■	○	■								■
21F	Åkrafjord	Dab	LI		■		■				◀	○	■	■	■		◀		■	○				■	■	▶	■								■	
21F	Åkrafjord	Dab	MU								○	○					○		■	○	○				■	■	○	■								■
36F	Færder area	Dab	LI		■		■				○	○	■	■	■		○		■	◀					■	■	◀	■							■	
36F	Færder area	Dab	MU								▶	○					○		■	◀				■	■	○	■								■	
77F	Borøy area	Dab	LI		■		■				■	■	■	■	■		■		■	■					■	■	■	■								■

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Station	Station	Medium	Tissue	VDSI	Ag	ALAD	As	BA	B[a]P	BDE	∑PCB-7	Cd	Co	Cr	Cu	CYP1A	ppDDE	EROD	HCHG	HCB	Hg	KPAH	Mo	Ni	OCS	PAH	Pb	PFOS	PYR10	QCB	Sn	TBT	TCDDN	V	Zn	
77F	Borøy area	Dab	MU							■							■		■	■	■				■											
11G	Brashavn	Dogwhelk	SB																																	
11G	Brashavn	Dogwhelk	WO	○																																
131G	Lastad	Dogwhelk	SB																																	
131G	Lastad	Dogwhelk	WO	↓																																
15G	Gåsøy (Ullerø)	Dogwhelk	SB																																	
15G	Gåsøy (Ullerø)	Dogwhelk	WO	↓																																
227G1	Melandholmen	Dogwhelk	SB																																	
227G1	Melandholmen	Dogwhelk	WO	↓																																
22G	Espevær	Dogwhelk	SB																																	
22G	Espevær	Dogwhelk	WO	↓																																
36G	Færder	Dogwhelk	SB																																	
36G	Færder	Dogwhelk	WO	↓																																
71G	Fugløyskjær	Dogwhelk	SB																																	
71G	Fugløyskjær	Dogwhelk	WO	↓																																
74G	Langholmane	Dogwhelk	SB																																	
74G	Langholmane	Dogwhelk	WO	■																																
76G	Risøy	Dogwhelk	SB																																	
76G	Risøy	Dogwhelk	WO	↓																																
98G	Svolvær area	Dogwhelk	SB																																	
98G	Svolvær area	Dogwhelk	WO	○																																
33F	Sande	Flounder	LI		■	■						○	↓	■	■	■		○		○	○		■	■		↓									■	
33F	Sande	Flounder	MU									○		■	■	■		○		○	○		■	■		↓									■	
53F	Inner Sør fjord	Flounder	LI		■	■						↓	○	■	■	■		○		○	○		■	■		○									■	
53F	Inner Sør fjord	Flounder	MU									↓		■	■	■		○		○	○		■	■		○									■	
67F	Strandebarm area	Flounder	LI		■	■						↓	↓	■	■	■		○		○	○		■	■		↓									■	
67F	Strandebarm area	Flounder	MU									↓		■	■	■		○		○	○		■	■		↓									■	
21F	Åkrafjord	Megrim	LI		■	■						○	○	■	■	○		○		○	○		■	■		■									■	
21F	Åkrafjord	Megrim	MU									■		■	■	○		○		○	○		■	■		■									■	
67F	Strandebarm area	Megrim	LI		■	■						↓	↓	■	■	■		↓		↓	↓		■	■		↓									■	
67F	Strandebarm area	Megrim	MU									○		■	■	○		↓		↓	↓		■	■		↓									■	
10F	Skogerøy	Plaice	LI		■	■						○	○	■	■	■		↓		↓	↓		■	■		↓									■	
10F	Skogerøy	Plaice	MU									○		■	■	○		↓		↓	↓		■	■		↓									■	

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Station	Station	Medium	Tissue	VDSI	Ag	ALAD	As	BA	B[a]P	BDE	∑PCB-7	Cd	Co	Cr	Cu	CYP1A	ppDDE	EROD	HCHG	HCB	Hg	KPAH	Mo	Ni	OCS	PAH	Pb	PFOS	PYR10	QCB	Sn	TBT	TCDDN	V	Zn	
98F2	Husholmen	Plaice	LI		▪	▪					⬅	⊙	▪	▪	▪		⬅		⊙	⊙				▪	▪	⊙				▪	▪				▪	
98F2	Husholmen	Plaice	MU								⊙						⊙		⊙	⊙	⊙			▪						▪						▪

4.3. Areas of special concern (Impacted)

Oslofjord/Hvaler/Grenlandsfjord area and Sør fjord/Hardangerfjord area

This report focus on two main areas of special concern; the Oslofjord/Hvaler/Grenlandsfjord area, and the Sør fjord/Hardangerfjord area. 170 time series concerned the Oslofjord area, including the Hvaler area and Grenlandsfjord area. In 2009, 144 of these had a concentrations that could be classified as insignificantly polluted (Class I), or did not exceed provisional “high background”. There were 69 significant trends, and 57 of these were downwards. 169 time series had data from the Sør fjord and Hardangerfjord area in 2009. Of these time series, 69 were downwards and six were upwards.

Oslofjord/Hvaler/Grenlandsfjord area

The investigations for the Oslofjord/Hvaler/Grenlandsfjord area in 2009 included 17 blue mussel stations one flounder station, two cod stations and one dogwhelk station. Points of concern are described below.

Mercury (Hg)

There was significant upward trend for Hg in cod fillet from the Inner Oslofjord (st. 30B) for the entire sampling period (1984-2009) but no trend was found recently, for the period 2000-2009. Cod fillet from the Inner Oslofjord was moderately polluted (Class II) by Hg (Figure 24). Cod from the outer part of the Oslofjord, (Færder, st. 36B), was insignificantly polluted by Hg.

Blue mussel from Damholmen (st. I022) was moderately polluted by Hg, but had no significant trend. Two upward trends were found in blue mussel from the mid Oslofjord at Solbergstrand (st. 31A) and the Inner Oslofjord at Akershuskaia (st. I301), however concentrations in 2009 were low (Class I). The other blue mussel stations in the Oslofjord area were insignificantly polluted by Hg.

The concentrations of mercury in fillet of cod from Inner Oslofjord (st. 30B) is similar to the concentrations found in Bekkelagsbassenget and Frognerkilen in 2006, inner basin and Bekkelagsbassenget (1997 and 1998), and Hvervenbukta and Breivold/Bunnefjorden in 1997 and 1998 (Berge 2009). The discharge of mercury in Norway has been reduced by 60 % from 1995 to 2005. From 2008 products containing mercury was prohibited in Norway. In 2009 a survey of contaminants in freshwater fish in Norway revealed very high concentrations of mercury (Fjeld and Rognerud 2009). This increase was unexpected as the atmospheric mercury depositions most likely have decreased in southeast Norway since the beginning of the 1990s. Mercury in fish exists mainly as methyl mercury, and factors stimulating the mercury methylation, such as warmer and wetter climate and also forestry lumbering, may have contributed to the observed increase. This might also be the case for the contamination of cod in the Oslofjord. The mechanism for the increase of Hg in fish in Norway is not fully understood. An alternative explanation might be the increasing trends in dissolved organic carbon (DOC) that have been shown in surface waters in Norway (De Wit *et al.* 2007) and boreal areas elsewhere in North America and Europe (Monteith *et al.* 2007) which were attributed to a decline in sulphate deposition. The DOC is derived from soil organic material and may act as a carrier for organic pollutants (Ding and Wu 1997). Thus, the increase in DOC would contribute to increased transport of Hg sorbed to dissolved humic substances and wash-out to the fjord.

Cadmium (Cd)

There was a significant upward trend for Cd in cod liver from the Inner Oslofjord (st. 30B). The concentrations were above presumed high background level (Figure 25). Cod from the Færder area (st. 36B) had concentrations of Cd that were below presumed high background level, and showed a downward trend. Blue mussel from Fugleskjær (st. 02A) in the Hvaler area were moderately polluted by Cd. Blue mussel from Gressholmen (st. 30A), Ramtonholmen (st. I307), Solbergstrand (st. 31A) and Mølen (st. 35A) were insignificantly/slightly polluted (Class I) by Cd but had upward trends. Blue mussel from Bjørkøya (st. 71A) was insignificantly polluted by Cd and had a significant downward trend.

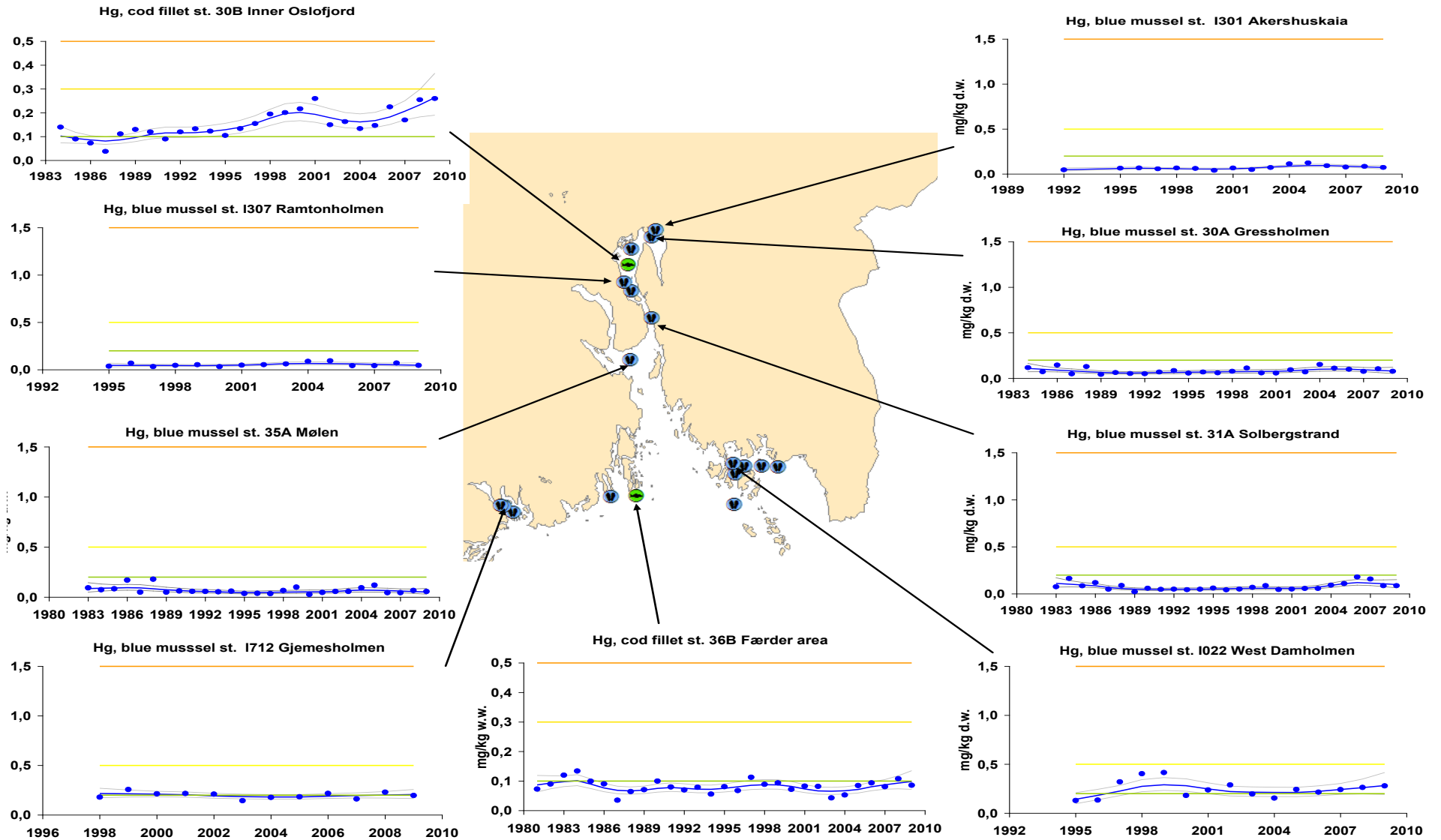


Figure 24. Trend for median Hg concentrations in cod and blue mussel from the Oslofjord area (cf. Appendix J and Appendix I, see otherwise key to detail in Figure 2).

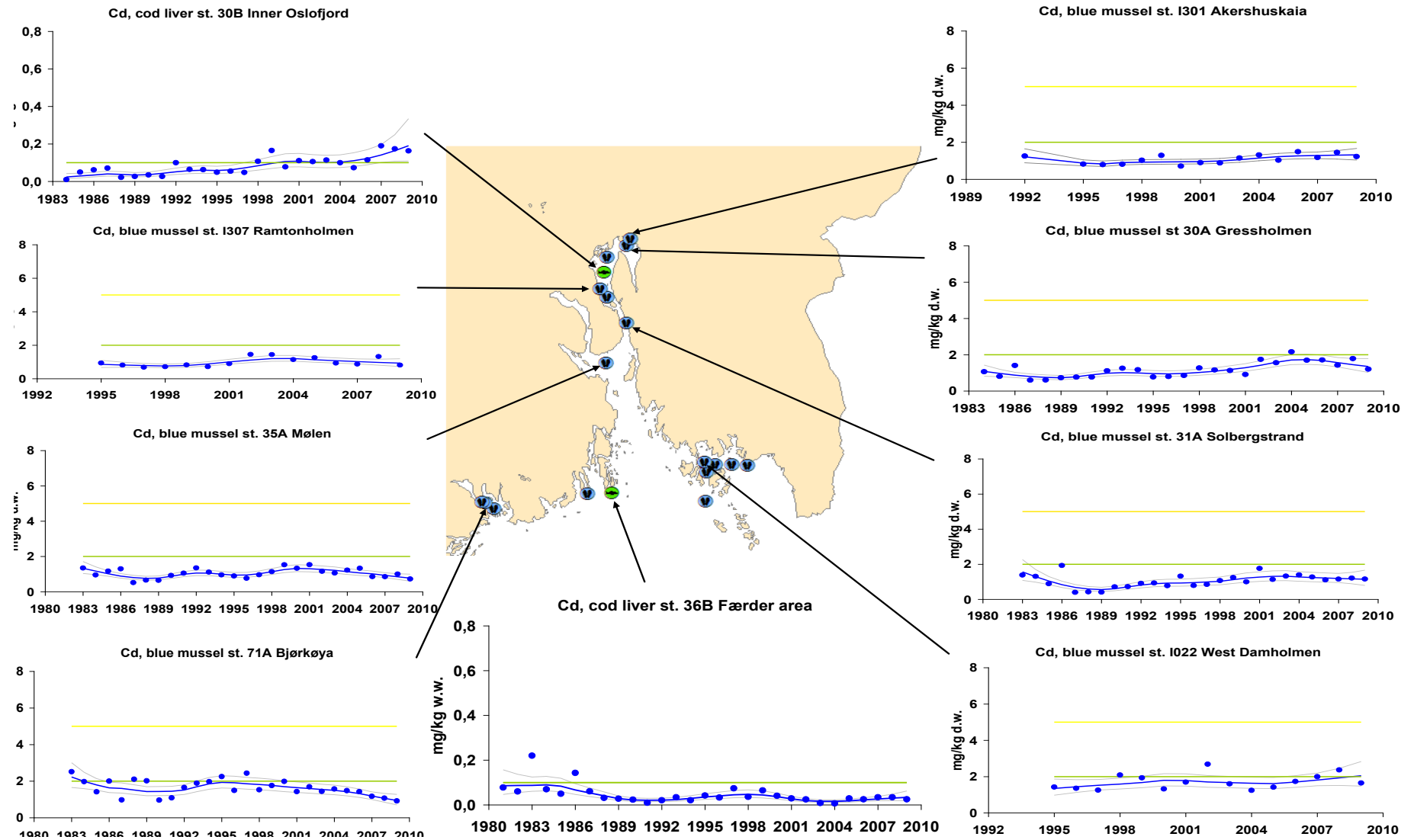


Figure 25. Trend for median Cd concentrations in cod and blue mussel from the Oslofjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Lead (Pb)

The concentrations of Pb in cod liver exceeded presumed high background level in the Inner Oslofjord (st. 30B). The concentrations of Pb in cod liver from the Inner Oslofjord has been high most of the years since 1989 (Figure 26). Cod from the Færder area (st. 36B) did not have elevated concentrations of Pb in the liver. The concentrations of Pb in blue mussel from Gressholmen (st. 30A) were slightly lower than in 2008, and was in Class I. The other blue mussel stations in the Oslofjord area were insignificantly polluted by Pb (Class I).

Polychlorinated biphenyls (Σ PCB-7)

Cod liver from the Inner Oslofjord was markedly polluted by PCBs, as it has been for many years (Figure 27). The concentrations of Σ PCB-7 in cod fillet had increased since 2008, and was in 2009 markedly polluted (Class III). Though no trend was detected in cod fillet, either on a wet weight (standard for this investigation) or a lipid weight basis (results not shown) for the entire sampling period (1990-2009), a significant upward trend for the period 2000-2009 was found (on a wet weight basis, cf. Appendix J). Cod from the Færder area (st. 36B) was not polluted by PCBs. Blue mussel from Akershuskaia (st. I301), Gressholmen (st. 30A) and Ramtonholmen (st. I307) was moderately polluted (Class II) by Σ PCB-7. There were significant downward trends for Σ PCB-7 at these three stations. However, no trend was detected at Gressholmen for the period 2000-2009. The other blue mussel stations in the Oslofjord area were insignificantly/slightly polluted (Class I) by PCBs.

The Norwegian Food Safety Authority (*Mattilsynet*) has issued advice against consumption of eel and fish liver from the Inner Oslofjord due to high concentrations of PCBs. Blue mussel are found in shallow water, and are filter-feeders. Cod are found in the whole water body, and feed on fish, prawns and benthic fauna. Cod will therefore bioaccumulate contaminants like PCBs from sediments to a higher extent than blue mussel. This might be the reason for the observed differences in trends for Σ PCB-7 in blue mussel and cod. An alternative explanation might be the increasing trends in dissolved DOC that would contribute to increased transport of organochlorines sorbed to dissolved humic substances, like explained for Hg.

From 2006 to 2008 approximately 440 000 m³ polluted sediment was dredged from the harbour area in the Inner Oslofjord. Monitoring of contaminants in blue mussel in this period showed relatively high levels of PCBs (Class II-III) but no significant increase. Berge *et al.* (2009) concluded that the dredging activity probably was not the most important explanation for the observed elevated concentrations of contaminants in blue mussel in the harbour area. Berge (in prep. 2010) noted the concentrations of HCB and, to a lesser degree PCBs, in cod liver from Frognerkilden and Bekkelaget was lower in 2009 compared to 2006. For the CEMP results, this was evident for HCB but not so for PCBs, which was higher in 2009 compared to 2006. Frognerkilden and Bekkelaget are closer to the Oslo harbour areas than the CEMP station (st. 30B) and differences in contaminant exposure may partly account for why HCB correlates well but not PCBs. It is surprising to find an increase of PCBs in cod liver and fillet from the Inner Oslofjord since polluted sediment has been removed from the harbour area and capped with clean sediments.

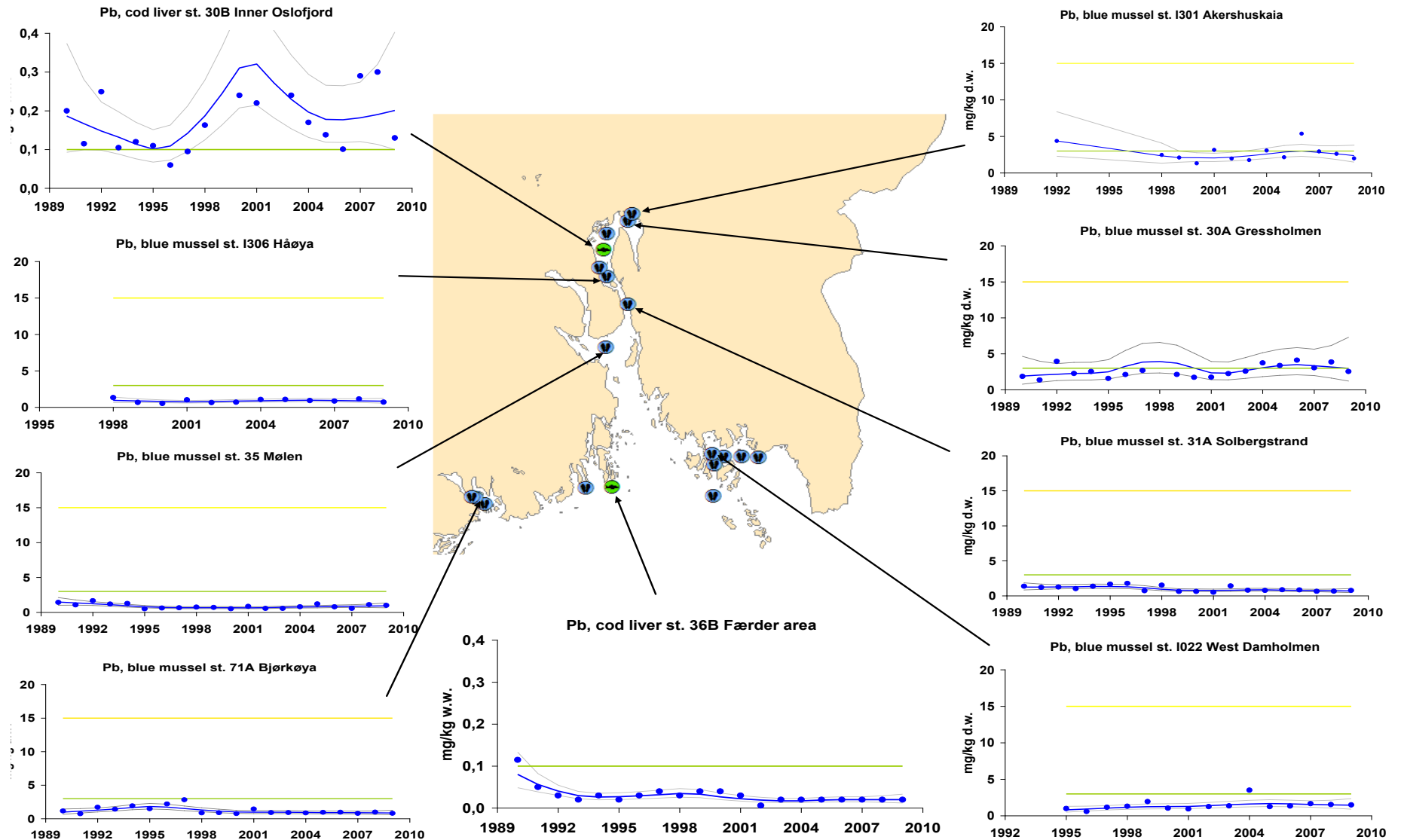


Figure 26. Trend for median Pb concentrations in cod liver and blue mussel from the Oslofjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

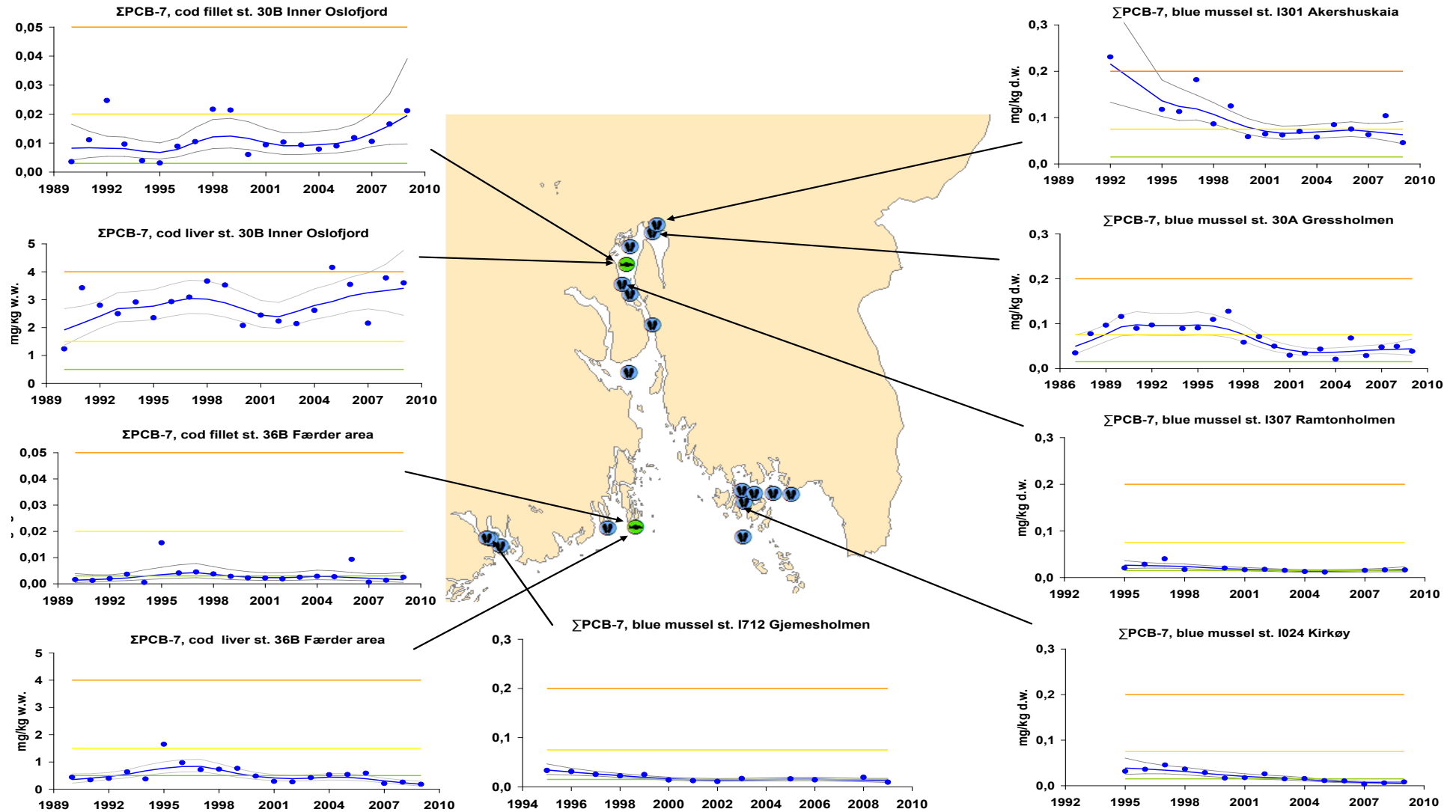


Figure 27. Trend for median Σ PCB-7 concentrations in cod and blue mussel from the Oslofjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Hexachlorobenzene (HCB)

Cod from both the Inner Oslofjord (st. 30B) and the Færder area (st. 36B) showed concentrations of HCB in the liver that was below presumed high background level (Figure 28). Blue mussel from Strømtangen (st. I713) in the Grenlandsfjord were markedly polluted (Class III) by HCB. Blue mussel from Gjemesholmen (st. I712), Bjørkøya (st. 71A), Akershuskaia (st. I301) and Solbergstrand (st. 31A) was moderately polluted (Class II) by HCB. There were significant downward trends for HCB in blue mussel at Solbergstrand and Bjørkøya. Blue mussel from the other stations in the Oslofjord area were insignificantly/ slightly polluted (Class I) by HCB.

Dioxins (dioxin toxicity equivalents – Nordic model, TCDDN)

Blue mussel from Bjørkøya (st. 71A), Gjemesholmen (st. I712) and Strømtangen (st. I713) in the Grenlandsfjord area were extremely polluted (Class V) by dioxins (Figure 29). The concentrations of dioxins have increased every year in blue mussel at Gjemesholmen (st. I712) since 2005. There was a tendency towards an increase also at Bjørkøya and Strømtangen, but there were no significant trends for any of these stations. Blue mussel from Gressholmen (st. 30A) and Risøy (st. 76A) were not polluted by dioxins.

Large reductions in the industrial effluents resulted in a strong decline in contaminant levels in fish and shellfish around 1990, but still the dioxin concentrations in seafood from the Grenlandsfjord is too high. Concentrations of dioxins in blue mussel showed no reduction in the Grenlandsfjord area from 1997 to 2007 (Bakke *et al.* 2009).

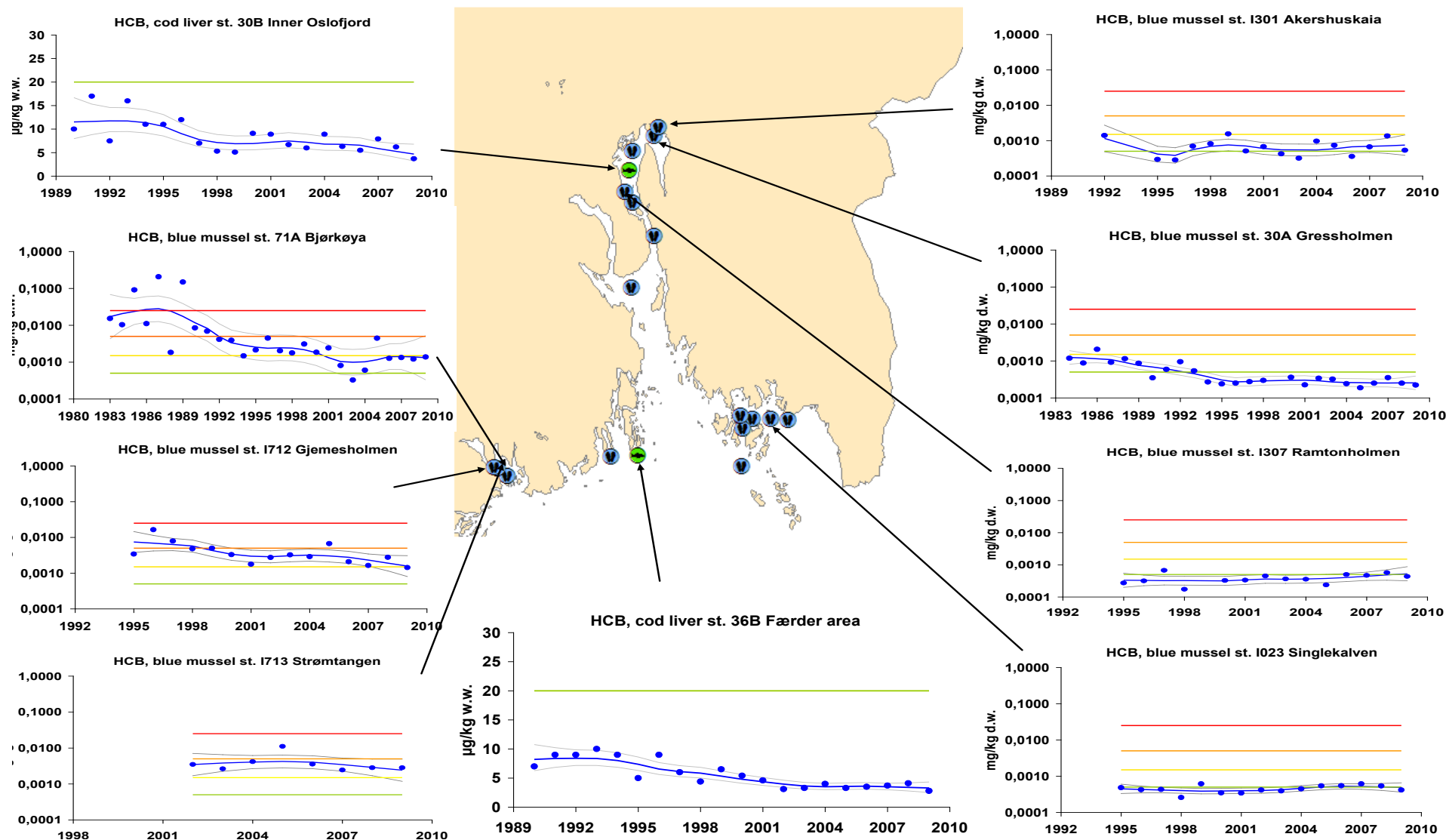


Figure 28. Trend for median HCB concentrations in cod and blue mussel from the Oslofjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

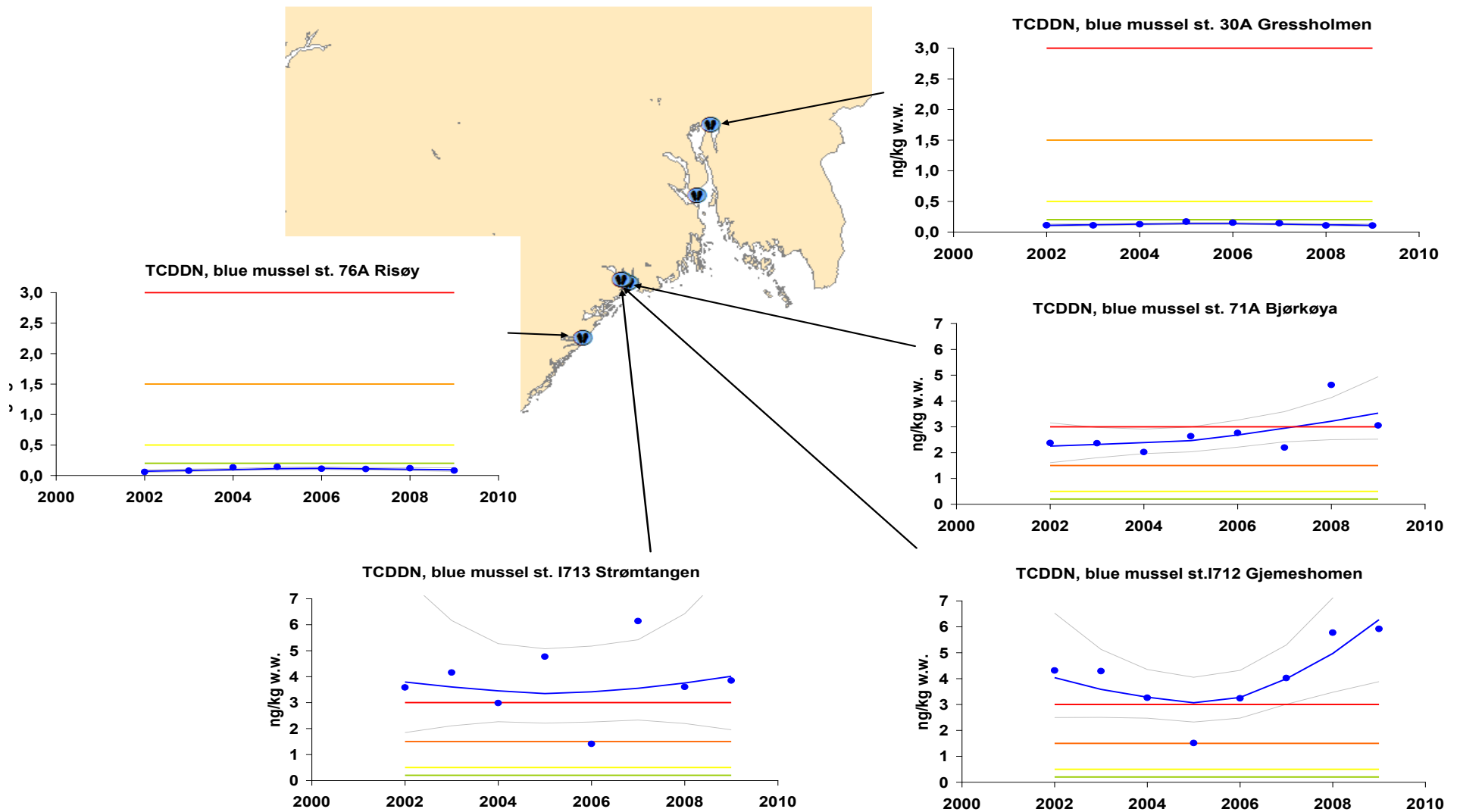


Figure 29. Trends and median concentrations for dioxins TCDDN-toxicity equivalents after Nordic model (TCDDN) in blue mussel, ng/kg TCDDN/kg from the Oslofjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

The Sør fjord and Hardanger fjord area

Investigations for 2009 in this area included seven blue mussel stations, two cod and three flatfish stations in the Sør fjord and Hardanger fjord area. Flounder were collected from Inner Sør fjord and both flounder and megrim were collected from the Hardanger fjord. Points of concern are described below.

Mercury (Hg)

Cod from the Inner Sør fjord (st. 53B) was moderately polluted (Class II) by Hg in the fillet (Figure 30). The median concentration of Hg in the fillet was approximately the same as in 2008 and there was no significant trend. Cod from Strandebarm (st. 67B) in the Hardanger fjord was insignificantly polluted by Hg.

Blue mussel from Kvalnes (st. 56A) in the mid part of the Sør fjord was moderately polluted by Hg, and showed a significant downward trend. Blue mussel from Byrkjenes was also moderately polluted by Hg. Blue mussel from Byrkjenes (st. 51A), Eitrheimsneset (st. 52A) and Krossanes (st. 57A) showed significant downward trends for 2000 to 2009. The other blue mussel stations in this area were only insignificantly/ slightly polluted (Class I) by Hg.

Cadmium (Cd)

Cod from the Inner Sør fjord (st. 53B) showed concentrations of Cd in the liver that exceeded presumed high background level (Figure 31). There was a significant upward trend for Cd in cod liver for this station. Cod from Strandebarm (st. 67B) in the Hardanger fjord had a significant downward trend and median concentration of Cd that was below presumed high background level.

Significant downward trends were found for Cd in blue mussel from Byrkjenes (st. 51A), Eitrheimsneset (st. 52A), Kvalnes (st. 56A) and Ranaskjær (st. 63A). These stations had blue mussel that were moderately polluted (Class II) by Cd. Blue mussel from Krossanes (st. 57A), Vikingneset (st. 65A) and Lille Terøy (st. 69A) were not polluted by Cd (Class I), and showed significant downward trends.

Lead (Pb)

Cod from the Inner Sør fjord (st. 53B) had concentrations of Pb in the liver that exceeded presumed high background level (Figure 32). The median concentration of Pb in cod liver had increased slightly compared to 2008, and there was a significant upward trend. Inhibition of ALA-D in cod is commonly observed in the Sør fjord as a result of the Pb exposure (c.f. chapter 4.5). Cod liver from Strandebarm (st. 67B) was not contaminated by Pb, the concentrations were below presumed high background level and there was a significant downward trend.

Blue mussel from Byrkjenes (st. 51A) and Kvalnes (st. 56A) were markedly polluted (Class III) by Pb. At both stations, the concentrations of Pb were slightly lower in 2009 than in 2008, and for Kvalnes it was a significant downward trend from 2000 to 2009. At the stations Eitrheimsneset (st. 52A), Krossanes (st. 57A), Ranaskjær (st. 63A) and Vikingneset (st. 65A) the blue mussel were moderately contaminated (Class II) by Pb and showed significant downward trends. Blue mussel from Lille Terøy (st. 69A) was insignificantly polluted (Class I) by Pb and had a significant downward trend.

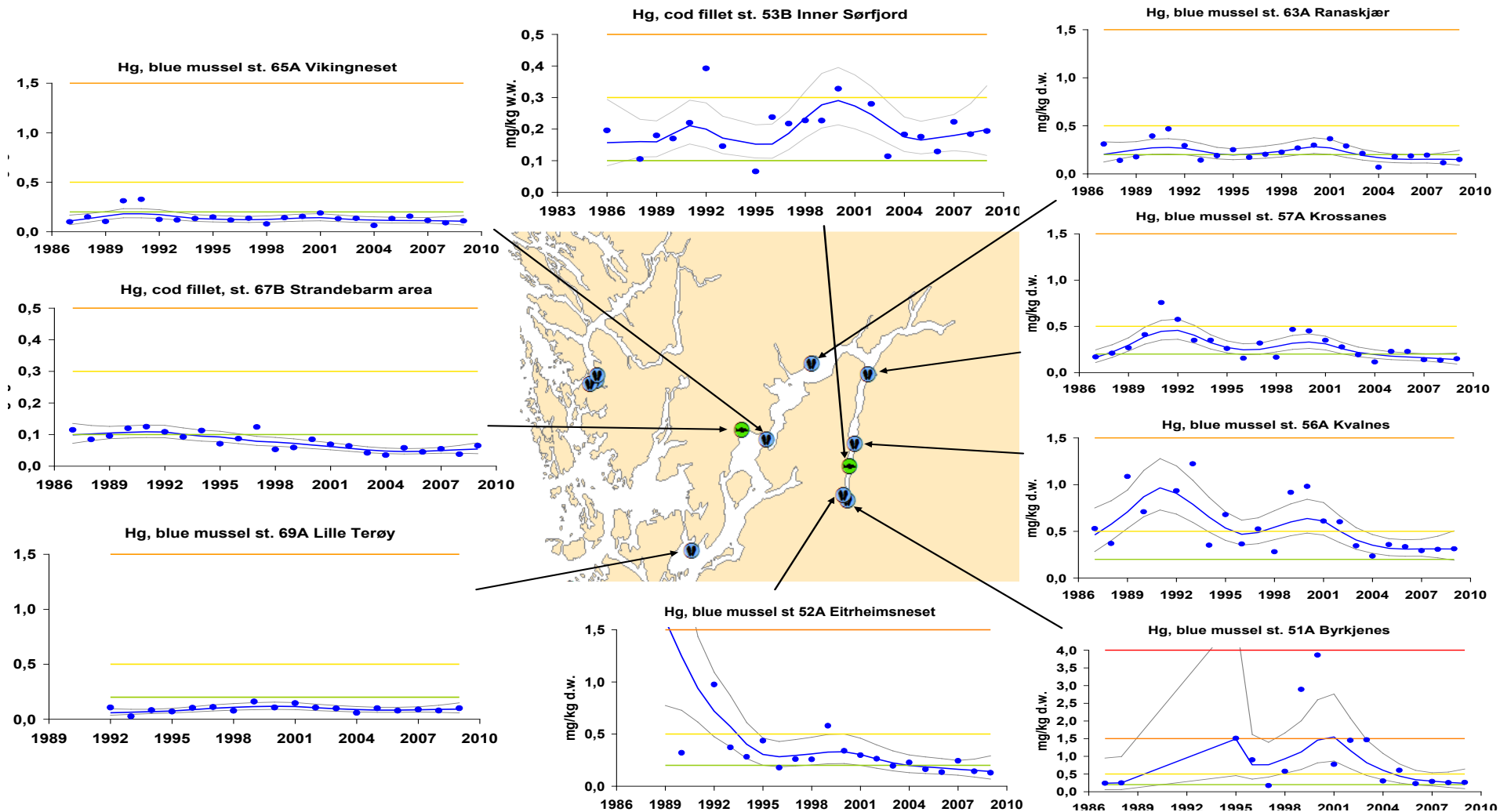


Figure 30. Trends and median concentrations for Hg in cod and blue mussel from the Sør fjord and Hardanger fjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

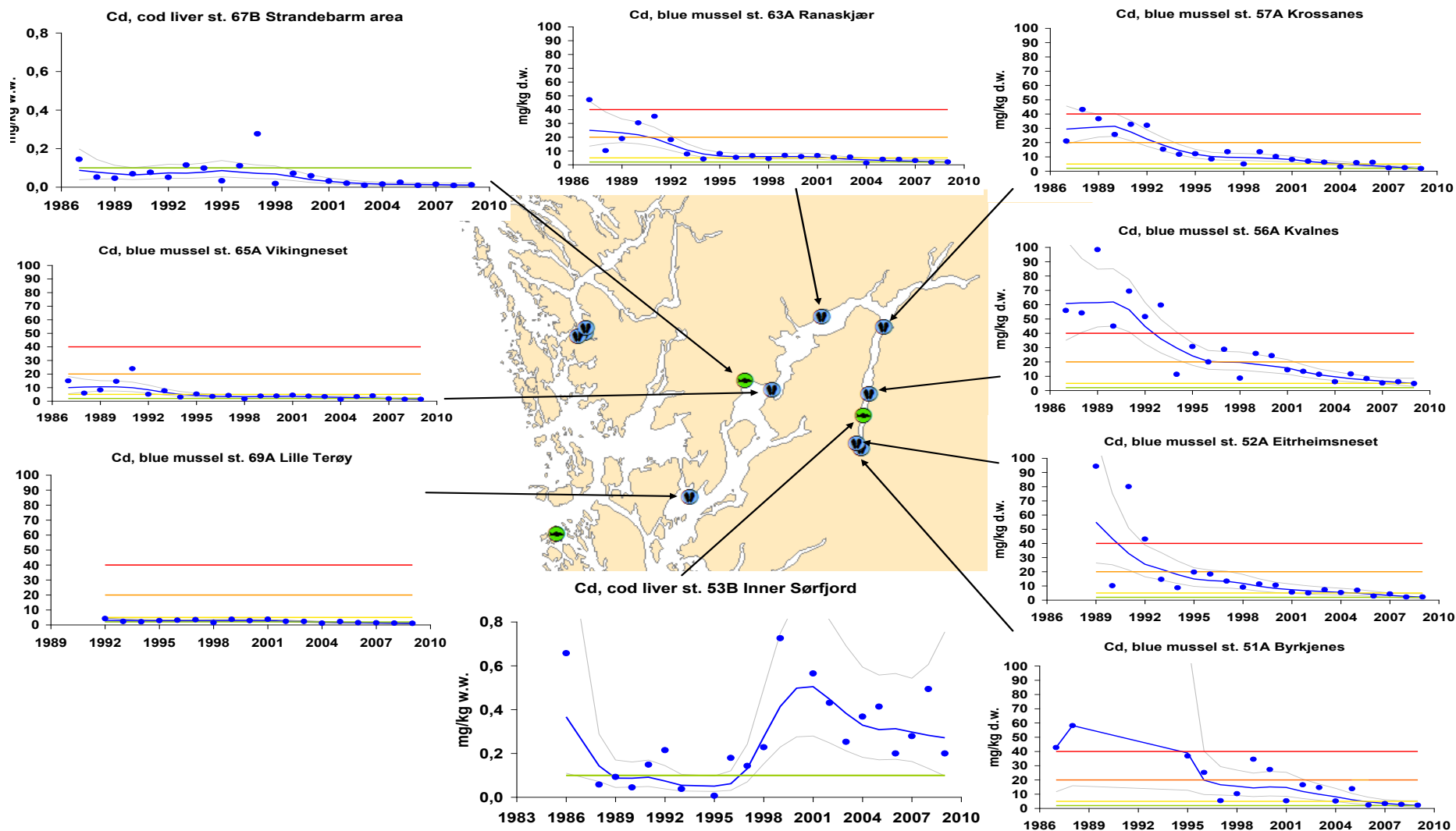


Figure 31. Trends and median concentrations of Cd in cod and blue mussel from the Sør fjord and Hardangerfjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

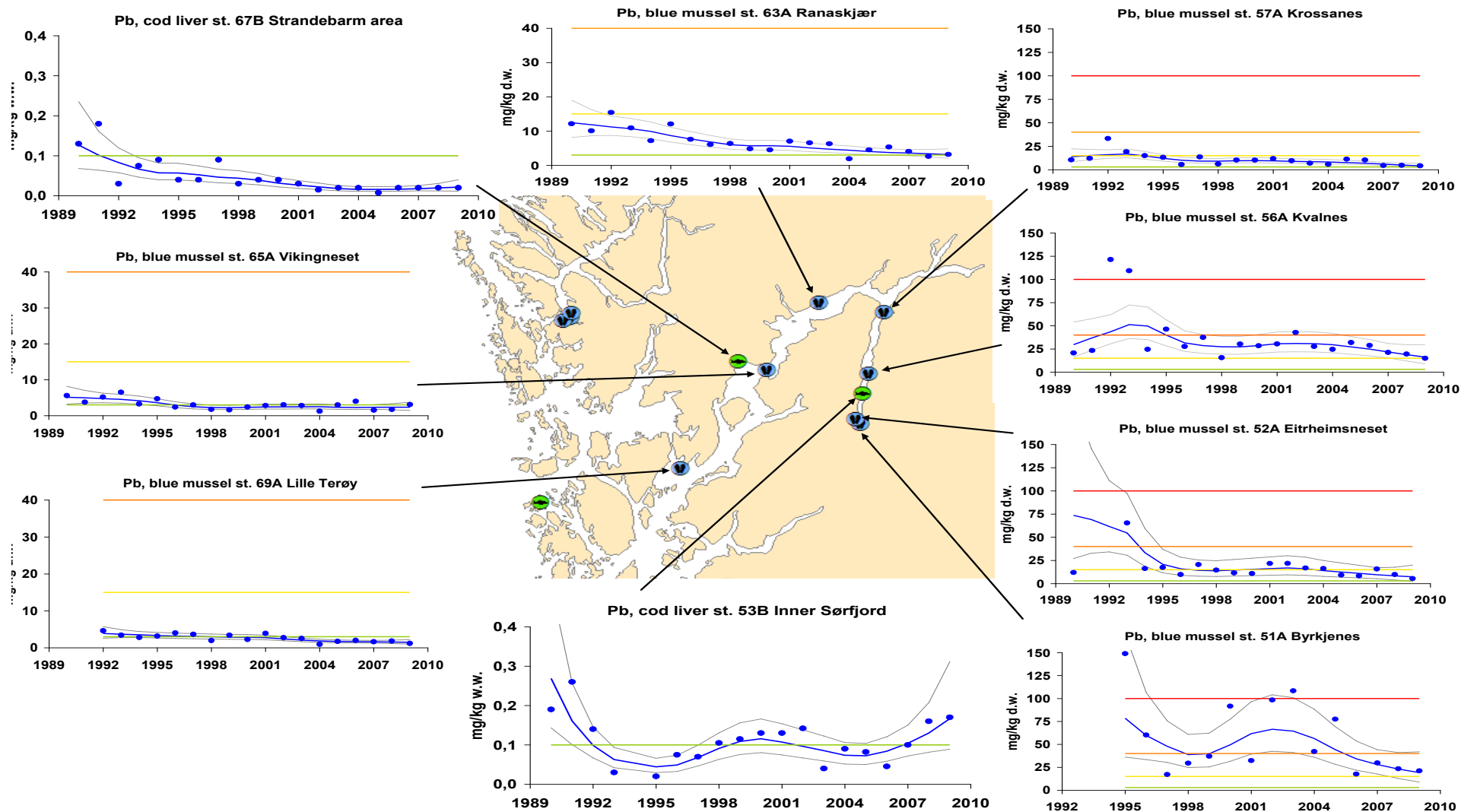


Figure 32. Median concentrations of Pb in cod and blue mussel from the Sør fjord and Hardanger fjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

Polychlorinated biphenyls (Σ PCB-7)

Liver of cod from the Inner Sør fjord (st. 53B) was insignificantly polluted (Class I) by Σ PCB-7 (Figure 33). The fillet of the same fish was however moderately polluted (Class II) by Σ PCB-7. Liver and fillet of cod from Strande barm (st. 67B) in the Hardanger fjord were insignificantly polluted (Class I) by Σ PCB-7. There was a significant downward trend for Σ PCB-7 in cod liver from Strande barm.

Dichlorodiphenyldichloroethylene (ppDDE)

Cod liver from the Inner Sør fjord (st. 53B) was moderately polluted (Class II, limits for Σ DDT) by ppDDE (Figure 34). Cod fillet from the Inner Sør fjord was also moderately polluted (Class II) by ppDDE. Both liver and fillet of cod from Strande barm (st. 67B) in the Hardanger fjord were insignificantly polluted (Class I) by ppDDE, and showed significant downward trends.

Blue mussel from Kvalnes (st. 56A) and Krossanes (st. 57A) were markedly polluted (Class III) by ppDDE. Blue mussel from Kvalnes were less polluted by ppDDE in 2009 than in 2008, when they were classified as extremely polluted (Class V) by ppDDE. Blue mussel from Byrkjenes (st. 51A) was moderately polluted (Class II) by ppDDE. Farther out in the Hardanger fjord, at Vikingneset (st. 65A) and Lille Terøy (st. 69A), the blue mussel were insignificantly polluted (Class I) by ppDDE.

The Sør fjord area has a considerable number of fruit orchards and earlier use and persistence of DDT and leaching from contaminated soil is probably the main reason for the observed high concentrations of ppDDE in the Sør fjord area. It must however be noted that the use of DDT products have been prohibited in Norway since 1970. Green *et al.* (2004) concluded that the source of ppDDE was uncertain. Analyses of supplementary stations between Kvalnes (st. 56A) and Krossanes (st. 57A) in 1999 indicated that there could be several sources (Green *et al.* 2001). A more intensive investigation in 2002 with seven sampling stations confirmed that there were two main areas with high concentrations north of Kvalnes and near Urdheim south of Krossanes (Green *et al.* 2004). Skei *et al.* (2005) concluded that the variations in concentrations of Σ DDT and the ratio between p,p'-DDT/p,p'-DDE (insecticide vs. metabolite) in blue mussel from Byrkjenes and Krossanes corresponds with periods with much precipitation and is most likely a result of wash-out from sources on shore. Botnen and Johansen (2006) set out passive samplers (SPMD- and PCC-18 samplers) at 12 locations along the Sør fjord to sample for DDT and its derivatives in sea water. Blue mussel and sediments were also taken at fewer stations. The results indicated that further and more detailed surveys should be undertaken along the west side of the Sør fjord between Måge and Jåstad, and that replanting of old orchards might release DDT through erosion. Concentrations of Σ DDT in blue mussel in the Sør fjord in 2008 showed up to Class V (extremely polluted) at Utne and at Kvalnes (Ruus *et al.* 2009). There was high variability in the concentrations of Σ DDT in replicate samples from Utne, indicating that the station is affected by DDT-compounds in varying degree, dependent on local conditions. Increased Σ DDT-concentrations in blue mussel from the Sør fjord were discussed by Ruus *et al.* (2010). Possible explanations that were discussed were that an increase in DOC would contribute to increased transport of DDT sorbed to dissolved humic substances and wash-out to the fjord.

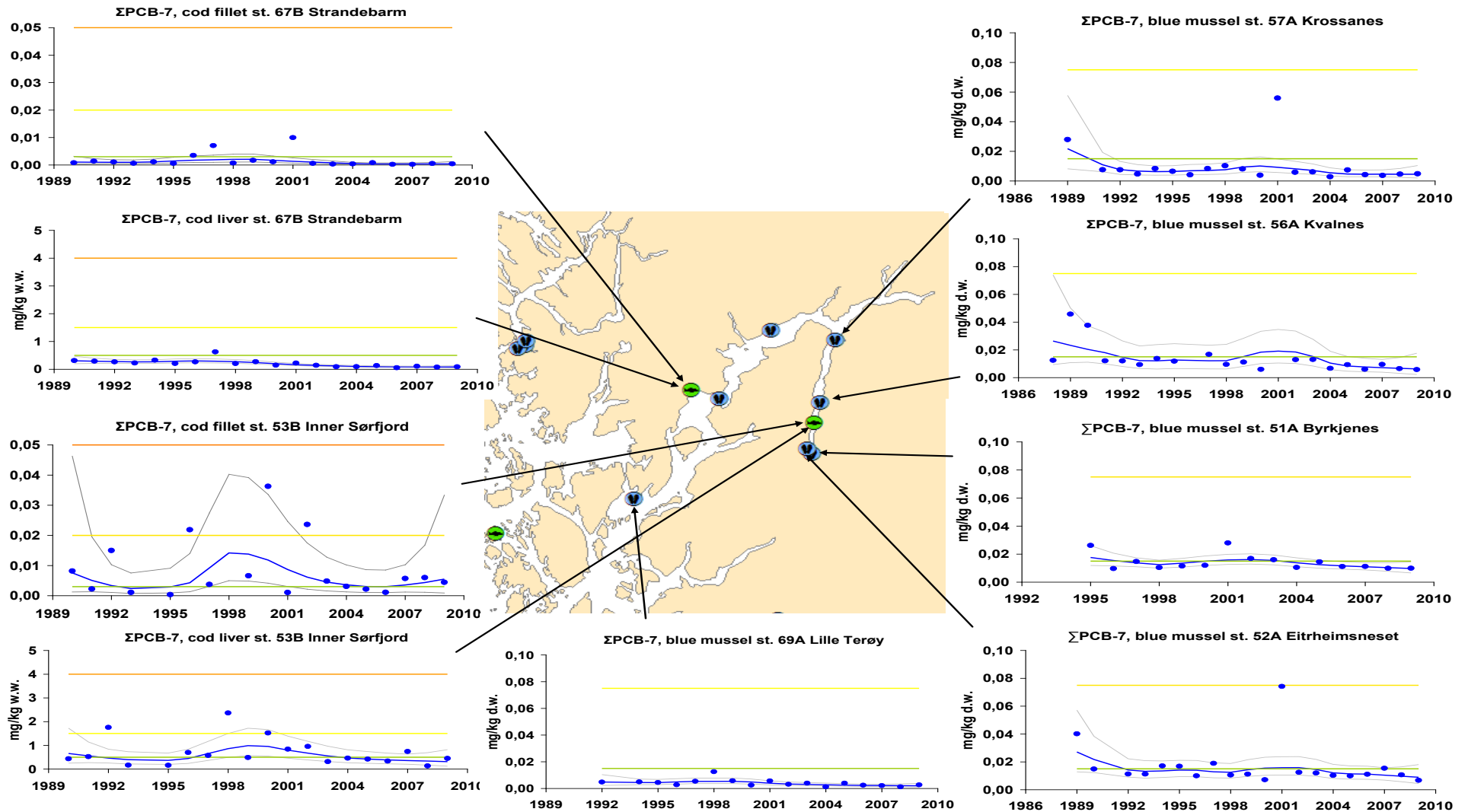


Figure 33. Median concentrations of Σ PCB-7 in cod and blue mussel from the Sør fjord and Hardanger fjord area (cf. Appendix I and Appendix J, see otherwise key to detail in Figure 2).

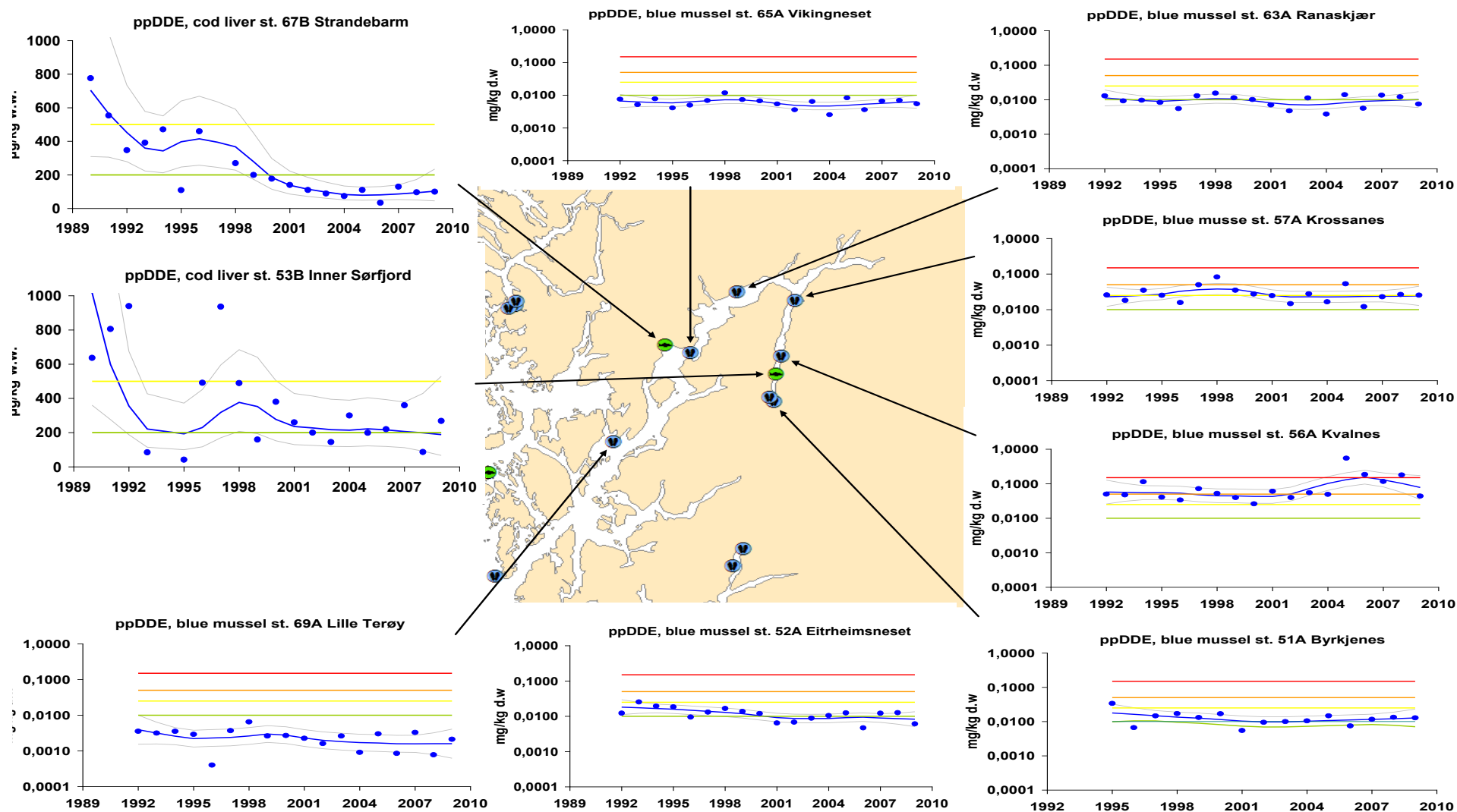


Figure 34. Median concentrations of ppDDE in cod and blue mussel from the Sør fjord and Hardangerfjord area (cf. Appendix I and Appendix J and see otherwise key to map and detail in Figure 2).

Cod from harbour areas of Kristiansand, Trondheim and Tromsø

In 2009, CEMP included for the first time investigations of cod in Kristiansand, Trondheim and Tromsø harbours. Nineteen contaminants were analysed including 11 metals, organochlorines, PBDEs and PFCs (represented here by PFOS, perfluorooctanoic sulfonate). The classification systems applied in the study has not been developed to include arsenic, nickel, chromium, cobalt, tin, octachlorostyrene, pentachlorobenzene, PBDEs and PFCs. Points of concern are described below.

Kristiansand harbour

Both the liver and muscle of cod from Kristiansand harbour (st. 13BH) were markedly polluted with HCB (Klif's Class III). Both tissues were moderately polluted with Σ PCB-7 (Klif's Class II). The classification systems applied did not reveal any other elevated concentrations. Median concentrations of octachlorostyrene was 70 $\mu\text{g}/\text{kg}$ w.w. and over 26 times higher than that found in the four other harbour areas. The reason for this has not been determined. PBDE was in the range found in the inner Oslofjord and the inner Sør fjord areas. The median concentration of PFOS was 9.0 mg/kg w.w. and about one fifth the concentrations found in the inner Oslofjord (48 $\mu\text{g}/\text{kg}$ w.w.). The second most abundant PFC was perfluorooctanesulfonic acid (PFOSA) with a median concentration of 2.2 $\mu\text{g}/\text{kg}$ w.w. The median concentrations of the remaining PFCs were below the limit of detection.

The Norwegian Food Safety Authority (*Mattilsynet*) has issued advice against consumption of fish from the Kristiansand harbour area due to high concentrations of organochlorines including dioxins (Appendix E).

Trondheim harbour

The liver of cod from Trondheim harbour (st. 80BH) were moderately polluted with HCB (Klif's Class II), however both tissues were moderately polluted with Σ PCB-7. The classification systems applied did not indicate any other elevated concentrations. PBDE and PFOS were in the range found in the inner Oslofjord and the inner Sør fjord areas. The median concentrations of the remaining PFCs were below the limit of detection.

The Norwegian Food Safety Authority (*Mattilsynet*) has issued advice against consumption of fish and mussels from the Trondheim harbour area due to high concentrations of PCBs and PAHs (Appendix E).

Tromsø harbour

The median concentration of cadmium in cod liver Tromsø harbour (st. 43BH) was over expected high background, and within the range found in the Inner Oslofjord and Sør fjord areas (0.16 – 0.20 mg/kg w.w.). The classification systems applied did not reveal any other elevated concentrations. PBDE and PFOS were in the range found in the inner Oslofjord and the inner Sør fjord areas. The median concentrations of the remaining PFCs were below the limit of detection.

The Norwegian Food Safety Authority (*Mattilsynet*) has issued advice against consumption of fish and mussels from the Tromsø harbour area due to high concentrations of PAHs and PCBs (Appendix E).

Table 10. Median concentrations of contaminants in cod (*Gadus morhua*) from the harbour areas of Kristiansand, Trondheim, Tromsø and (for comparison) Oslo and the Inner Sør fjord. Klif Classification system is used for sediment (Bakke et al. 2007c) and biota (Molvær et al. 1997) for Classes: I (blue), II (green), III (yellow), IV (orange) and V (red) (see Appendix D). Dark grey indicates concentrations higher than estimated high background levels. Light grey indicates concentrations lower than high background levels. Note: Class limits for Σ DDT are used for ppDDE. Class limits for Σ HCH are used for HCHG.

Contaminant	Unit & basis	Kristiansand		Trondheim (Munkholmen)		Tromsø		Oslo City area		Inner Sør fjord	
		13BH		80BH		43BH		30B		53B	
		Liver	Fillet	Liver	Fillet	Liver	Fillet	Liver	Fillet	Liver	Fillet
Mercury	mg/kg w.w.		0.073		0.060		0.028		0.260		0.194
Cadmium	mg/kg w.w.	0.04		0.02		0.17		0.16		0.20	
Lead	mg/kg w.w.	0.04		0.03		0.02		0.13		0.17	
Copper	mg/kg w.w.	7.44		4.45		3.59		6.54		7.94	
Zinc	mg/kg w.w.	29.6		23.0		23.8		30.6		28.7	
Silver	mg/kg w.w.	2.11		0.19		0.19		10.70		0.24	
Arsenic	mg/kg w.w.	5.10		2.40		6.17		43.50		4.21	
Nickel	mg/kg w.w.	0.39		0.10		0.06		0.17		0.15	
Chromium	mg/kg w.w.	0.4		0.3		0.1		0.2		0.2	
Cobalt	mg/kg w.w.	0.08		0.03		0.01		0.10		0.06	
Tin	mg/kg w.w.	0.3		0.3		0.3		0.3		0.3	
Σ PCB-7	μ g/kg w.w.	1299.8	6.06	1252.7	4.46	290.1	1.44	3600.0	21.20	449.0	4.44
DDT	μ g/kg w.w.	58.0	0.31	60.0	0.21	33.0	0.14	150.0	1.10	268.0	1.30
HCB	μ g/kg w.w.	110.0	1.40	22.0	0.16	7.7	0.08	3.7	0.06	4.2	0.04
Lindane	μ g/kg w.w.	1.0	0.05	1.0	0.05	1.0	0.05	0.6	0.05	1.0	0.05
Octachlorostyrene	μ g/kg w.w.	70.0	0.46	1.0	0.05	1.0	0.05	2.6	0.05	1.0	0.05
Pentachlorobenzene	μ g/kg w.w.	5.5	0.08	1.2	0.03	1.0	0.03	1.1	0.03		0.03
PBDE	μ g/kg w.w.	19.8		38.7		36.1		61.0		33.2	
PFOS	μ g/kg w.w.	9.0		4.3		6.3		48.0		3.2	

4.4. Norwegian blue mussel Pollution and Reference Indices (The Index Programme)

Stations involved in 2009 are shown in Figure 35. More details on the methods and results for 2009 can be found in Appendix L.

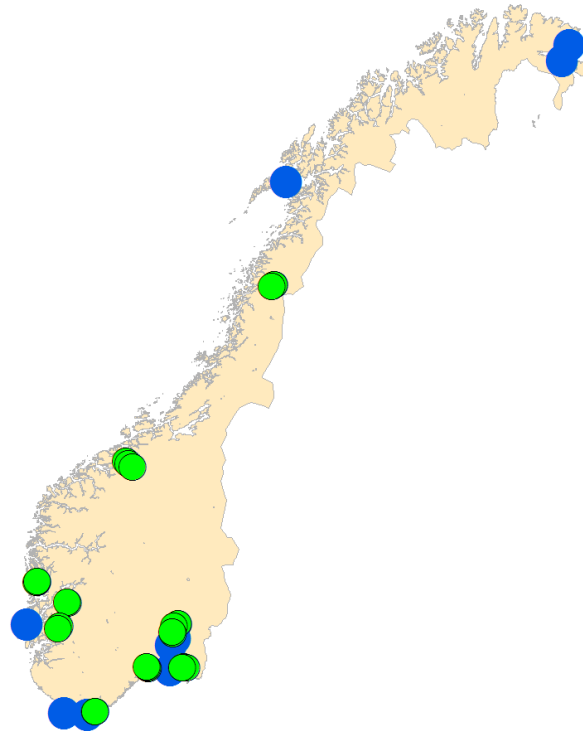


Figure 35. Blue mussel Index stations sampled in 2009; pollution (green circles), reference (blue circles).

Based on nine fjord areas the Pollution Index for 2009 was 2.8, 0.2 lower than in 2008 (Appendix M4, Green *et al.* 2010). A value between 2 and 3 would be termed by the Klif system as “Marked” and between 3 and 4 “Severe”.

For the Reference Index based on four fjord areas, the Index for 2009 was 1.2, 0.4 lower than the revised index 2008 (see Appendix L). An index value between 1 and 2 would be termed by the Klif system as “Moderate”.

A decrease in each of the indices indicates that the respective fjord areas are less contaminated.

It is not the intent of the application of the indices to give a station by station account. However, time trend analyses for the entire period (1995-2009) have been calculated and show both significant upward and downward trends in blue mussel (cf. Appendix J). Some cases for downward and upward trends are worth noting (2009 median Class, maps refer to Appendix G):

Downward trends

- Inner Oslofjord, Akershuskaia (st. I301) Gressholmen (st.30A) (Map 1) - TBT, ΣPCB-7, Class II
- Inner Oslofjord, Ramtonholmen (st. I307, Map 1) - ΣPCB-7, Class II
- Mid Oslofjord, Solbergstrand (st. 31A, Map 1) - TBT, Class II
- Frierfjord area, Bjørkøya (Risøyodden) (st. 71A, Map 3) - HCB, Class II
- Frierfjord area, Gjemesholmen (st. I712) (Map 3) - TBT, Class II
- Kristiansand harbour, Odderø (west) (st. I133) – HCB, Class II
- Saudafjord, Ekjegrunn (st. I201, Map 5) - B[a]P, sum carcinogen-PAHs, Class II
- Sørfjord, Bykjenes (st. 51A, Map 6) - Cd, Class II
- Sørfjord, Eitrheimsneset (st. 52A), Hardangerfjorden, Ranaskjær (st.63A) (Map 6) - Cd, Pb, Class II
- Sørfjord, Eitrheimsneset (st. 56A, Map 6) - Cd, Hg, Class II
- Hardangerfjord, Vikingneset (st. 65A, Map 6) - Pb, Class II
- Byfjorden (Bergen), Gravdalsneset (st. I242) in Bergen harbour (Map 7) - HCB, Class II

Upward trends

- Kristiansand - Mandal area, Lastad (st. I131A, Map 4) - HCB, Class II
- Byfjorden (Bergen), Nordnes (st. I241) in Bergen harbour (Map 7) - HCB, Class II

4.5. Biological effects methods for cod

Rationale and overview

The rationale to use biological effects methods (BEM) within monitoring programmes is to evaluate whether marine organisms are affected by contaminant inputs. Such knowledge can not be derived from tissue levels of contaminants only. Just one reason is the vast number of chemicals (known and unknown) that organisms are exposed to, in combination, in the environment. In addition to enable conclusions on the health of marine organisms, some biomarkers assist in the interpretation of contaminant exposure and bioaccumulation. The biological effects component of the Norwegian CEMP is possibly the most extensive of its type in Europe and includes Imposex in gastropods as well as biomarkers in fish. The four chosen methods for fish were selected for specificity, for robustness and because they are among a limited set of methods proposed by international organisations, including OSPAR and ICES (see Table 3 for parameter list with method specificity and Figure 1 for map of stations).

A thorough analysis and review of BEM-results has been performed twice since their inclusion in 1997 (Ruus *et al.* 2003; Hylland *et al.* 2009). Clear relationships were shown between tissue contaminants, physiological status, and responses in BEM parameters in cod (Hylland *et al.* 2009). Although metals contributed substantially to the models for ALA-D and metallothionein (MT; included in the programme 1997-2001) and organochlorines in the model for CYP1A activity, other factors were also shown to be important. Liver lipid and liver somatic index (LSI) contributed for all three BEM-parameters, presumably reflecting the general health of the fish. Size or age of the fish also exerted significant contributions to the regression models. It was concluded that the biological effect methods clearly reflected relevant processes in the fish even if they may not be used singly to indicate pollution status for specific locations at given times. Furthermore, the study showed that it is important to integrate a range of biological and chemical methods in any assessment of contaminant impacts. Through continuous monitoring within CEMP, a unique BEM time series / dataset is generated, that will also be of high value as a basis of comparison for future environmental surveys.

Biological effect methods were first included in the programme in 1997, after which some modifications have been done. In 2002, reductions were made in parameters and species analysed. There have also been improvements in the methods, such as discontinuation of single wavelength fluorescence and use of HPLC in the analysis of bile metabolites (2000).

The CEMP-programme for 2009 included four biological effects methods (BEM) (cf. Table 5). For the 2009 investigations OH-pyrene, ALA-D, EROD-activity and CYP1A were measured in Atlantic cod from the Inner Oslofjord (st. 30B), the Inner Sør fjord (st. 53B) and Karihavet (st. 23B). OH-pyrene was also analysed in cod from Lista (st. 15B).

Under controlled conditions the measures derived from OH-pyrene, EROD-activity and CYP1A increase with increased exposure to their respective inducing contaminants. The activity of ALA-D on the other hand is inhibited by contamination (i.e., lead), thus lower activity means a response to higher exposure.

As in most previous years, 25 individual cod were sampled for biological effects measurements. Since 2002 three stations (four for OH-pyrene) have been sampled, instead of eight stations as in previous years. No samples for BEM have taken from flatfish since 2002. All fish were collected by local fishermen and kept alive until sampling by NIVA staff within 5 days.

OH-pyrene metabolites in bile

Detection methods for OH-pyrene have been improved two times since the initiation of these analyses in the CEMP programme. In 1998, the wavelength for measurement of light absorbance of the support/normalisation parameter biliverdine was changed to 380 nm. In 2000, the use of single-wavelength fluorescence for quantification of OH-pyrene was replaced with HPLC separation preceding fluorescence detection. The single wavelength fluorescence method is much less specific than the HPLC method. Although there is a good correlation between results from the two methods, they can not be compared directly.

PAH compounds are effectively metabolized in vertebrates. As such, when fish are exposed to and take up PAHs, the compounds are biotransformed into polar metabolites which enhances the efficiency of excretion. It is therefore not suitable to analyse fish tissues for PAH parent compounds as a measure of exposure. However, since the bile is a dominant excretion route of PAH metabolites, and since the metabolites are stored for some time in the gall bladder, the bile is regarded as a suitable matrix for analyses of PAH metabolites as a measure of PAH exposure.

In 2009, as it has been since 2002, the median concentration of OH-pyrene metabolites in bile from cod were higher in the Inner Oslofjord (st. 30B) compared to samples from the Inner Sør fjord (st. 53B), the Bømlo-Sotra area (reference, st. 23B) and Lista (st. 15B). No significant trends for the period 2000-2009 were detected (cf. Appendix J). In other words, the concentrations have fluctuated around the same levels, with a trend towards an apparent reduction at Lista (st. 15B) towards the last few years (not significant; Figure 37, and Appendix J).

PAHs are measured in blue mussel from the Inner Oslofjord (st. 30A). The changes in concentrations correlate moderately well to the changes in OH-pyrene in cod from the same area (st. 30B). These results indicate general changes in PAH exposure in this fjord area, since cod and blue mussel apparently experience similar alterations in PAH exposure, despite biological differences. Blue mussel is a sessile, filtering organism, while cod is mobile and exposed to PAHs both through food and through direct partitioning from water (over respiratory surfaces).

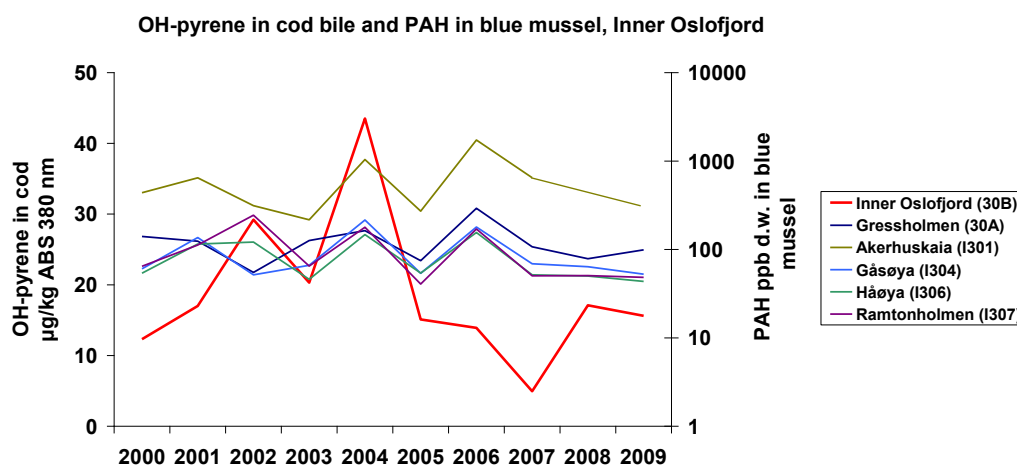


Figure 36. Changes in median concentration of OH-pyrene ($\mu\text{g}/\text{kg}$ ABS 380 nm) in bile from Atlantic cod collected from the Inner Oslofjord (st. 30B Inner Oslofjord; thick red line) and total PAH in blue mussel from the same area. **NB: concentrations of PAHs are on a log scale.**

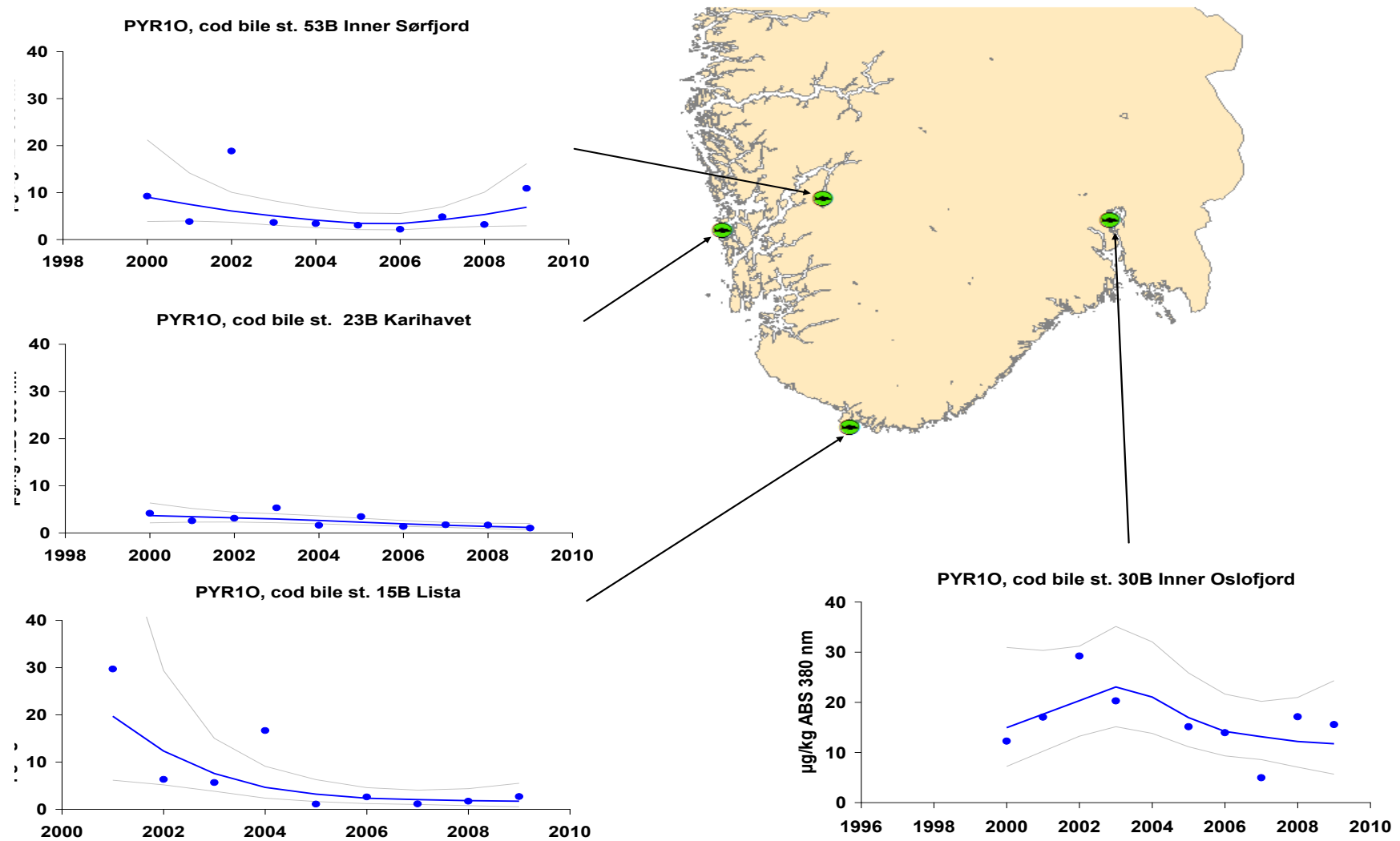


Figure 37. Trend and median concentration of OH-pyrene ($\mu\text{g}/\text{kg}$ ABS 380 nm) in bile from Atlantic cod collected from southern Norway (cf. Appendix I and Appendix J and see otherwise key to detail in Figure 2). There is no limit to classify the result from 2009.

ALA-D in blood cells

Inhibited activity of ALA-D indicates the influence of lead contamination. Although ALA-D inhibition is lead-specific, it is not possible to rule out interference by other metals or organic contaminants. Previous studies indicate that zinc may ameliorate the effect of lead to some extent, but the effect is variable and weak. Other studies have also shown ALA-D to be a remarkably robust biomarker and factors such as sex, age or season does not appear to affect the response.

Most years the activity of ALA-D in cod was somewhat inhibited in the Inner Oslofjord (st. 30B) and Inner Sør fjord (st. 53B), compared to reference stations, i.e. outer Oslofjord (st. 36B; only data to 2001), Karihavet in the Bømlo-Sotra area (st. 23B), and Varangerfjord (st. 10B; only data to 2001, not shown) (Appendix I and Appendix J). For the years 1997-2006 and 2009 the median activity of the enzyme in cod from Inner Sør fjord (st. 53B) was generally lower than on the open coast (Karihavet, st. 23B), about 130 km to the west. As mentioned (chapter 3.3), the lower activities of ALA-D in cod from the Sør fjord compared to the reference station (basis for comparison prior to 2007 and in 2009) indicate the contamination of lead in the Sør fjord.

In 2009 ALA-D levels were over twice as high in the blood of cod from the Inner Oslofjord (st. 30B) as compared to 2008. ALA-D levels were also higher in the Inner Oslofjord than in the Inner Sør fjord (st. 53A). However, no trend could be shown for the period 1997-2009 (Appendix J), indicating fluctuations in the enzyme activity around a similar level for the whole period.

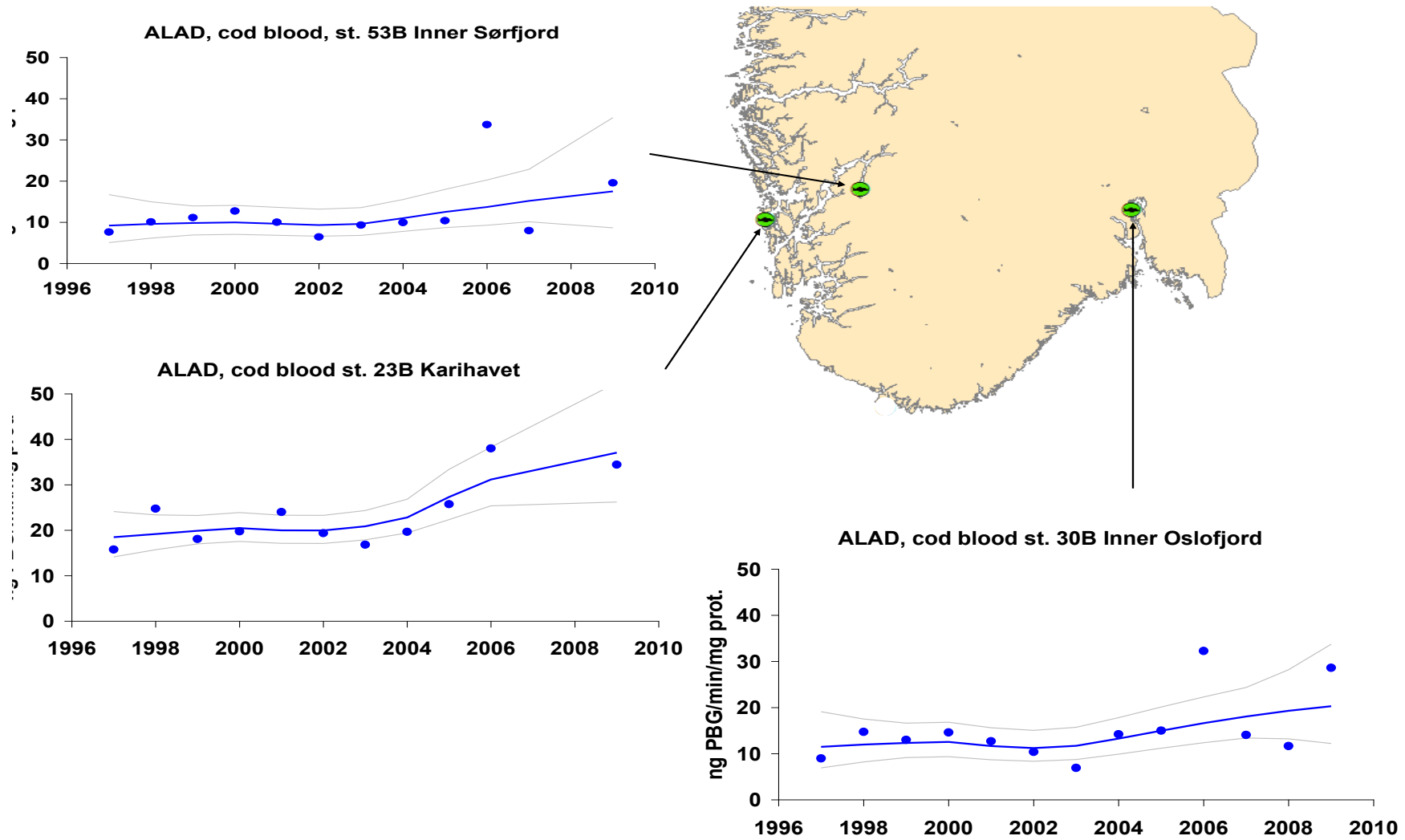


Figure 38. Trend and median activity of δ -aminolevulinic acid dehydrase (ALA-D, ng PBG/min/mg protein) in red blood cells from Atlantic cod collected from southern Norway (cf. Appendix I and Appendix J and see otherwise key to detail in Figure 2). There is no limit to classify the results from 2009. Note that lower activity means higher exposure and vice versa.

EROD-activity and amount of CYP1A protein in liver

EROD-activity

High activity of hepatic cytochrome P4501A activity (EROD-activity) normally occurs as a response to the contaminants indicated in Table 5. It was expected that higher activity would be found at the stations that were presumed to be most impacted by planar PCBs, PCNs, PAHs or dioxins, i.e. Inner Oslofjord (st. 30B) and Inner Sør fjord (st. 53B/F). Since 2000 the median EROD-activity has been higher in the Inner Oslofjord compared to the reference station on the west coast (Karihavet, st. 23B). However, in the Inner Sør fjord EROD activities were not consistently higher than at the reference Karihavet. No significant downward trends for EROD in cod liver in the Inner Oslofjord, Inner Sør fjord (st. 53B) or Karihavet (st. 23B) could be shown for the period 1997-2009 (st. 30B, Figure 39 and Appendix J).

No adjustment for water temperature has been made. Fish are sampled at the same time of year (September-November) when differences between the sexes should be at a minimum. Statistical analyses indicate no clear difference in activity between the sexes (Ruus *et al.* 2003). It has been shown that generally higher activity occurs at more contaminated stations (Ruus *et al.* 2003). However, the response is inconsistent (cf. Appendix J), perhaps due to sampling of populations with variable exposure history. Besides, there is evidence from other fish species that continuous exposure to e.g. PCBs may cause adaptation, i.e. decreased EROD-activity response.

The median amount of CYP1A protein in the liver of cod from the Inner Oslofjord (st. 30B) in 2009 was lowest since investigations began in 2003; 50 % lower compared to 2008, however no significant trend could be detected (Figure 40). CYP1A protein levels were however higher in the Inner Oslofjord compared to the Inner Sør fjord (st. 53B) and Karihavet (st. 23B), as was observed for the EROD activities. An explanation could be that the exposure to PCBs is higher in the inner Oslofjord than in the Sør fjord and Karihavet. It was earlier observed, however, that EROD activities apparently were not significantly influenced by a substantial increase in cod liver PCB content (Ruus *et al.* 2006). An explanation (besides the adaptation hypothesis, mentioned above) may be that the inducing effect of specific contaminants may be inhibited by other contaminants present. The significant reduction in EROD activity for the period 1997-2008 was not supported in 2009 where the activity was nearly 10 times higher than in 2008. The variability in 2009 was however high (Figure 58, appendix J).

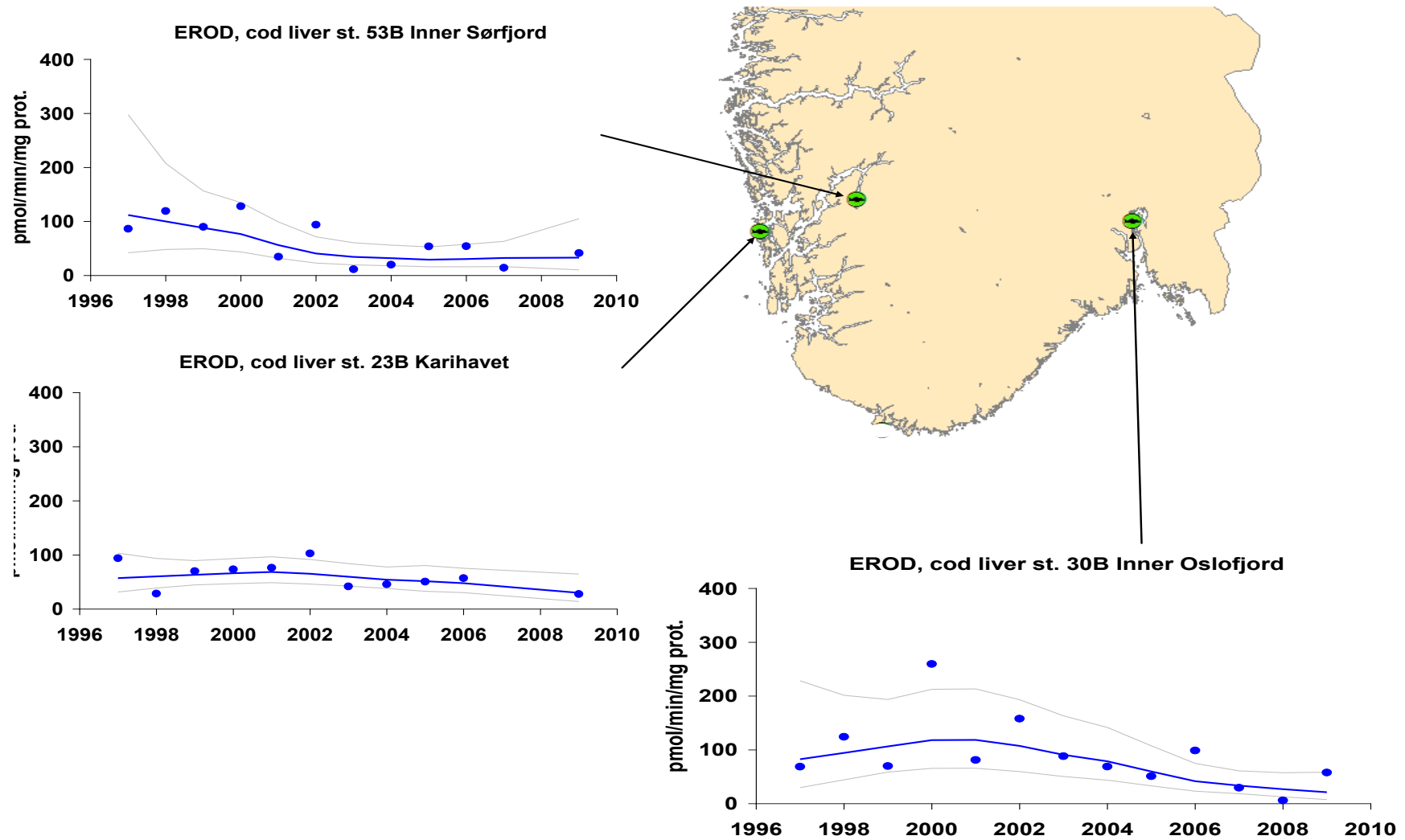


Figure 39. Trend and median activity of cytochrome P4501A (EROD-activity, pmol/min/mg protein) in liver from Atlantic cod collected from southern Norway (cf. Appendix I and Appendix J and see otherwise key to map and detail in Figure 2). There is no limit to classify the results from 2009.

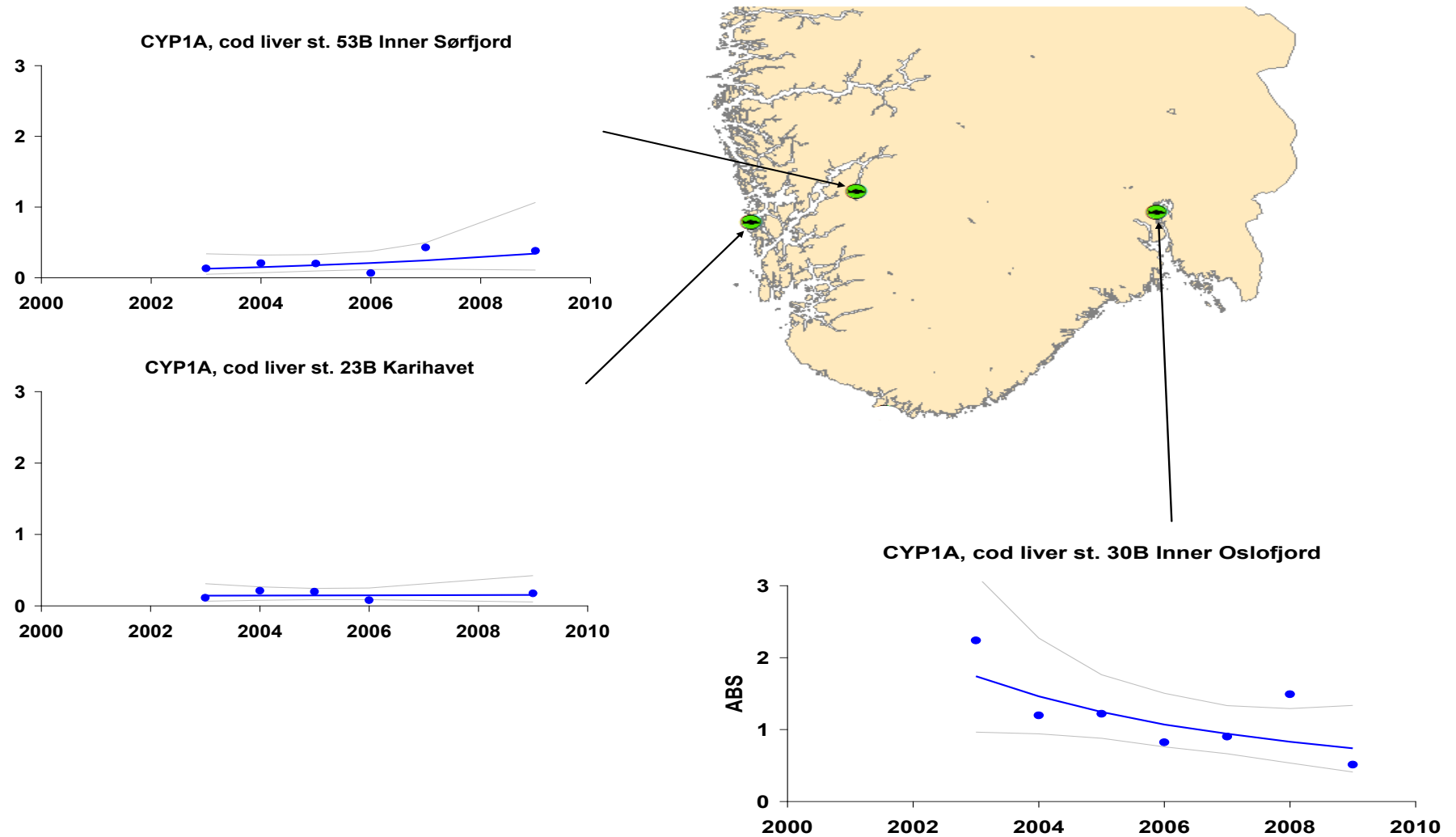


Figure 40. Trend and median activity of cytochrome CYP1A (relative amount of cytochrome P4501A-protein) in liver from Atlantic cod collected from southern Norway (cf. Appendix I and Appendix J and see otherwise key to map and detail in Figure 2). There is no limit to classify the results from 2009.

Concluding remarks

The application of BEM methods within CEMP through the years 1997-2001 indicated that the location Lista (st. 15B), which was previously regarded as only diffusely polluted, had an input of PAH which was sufficient to affect fish in the area. However, in 2002 and 2003 the median concentrations of OH-pyrene in cod from Lista were lower than those from the Inner Oslofjord (st. 30B) and Inner Sør fjord (st. 53B). Since 2005, the OH-pyrene concentrations in cod from Lista have been low (the same level as the reference). No significant time-trends could be detected for the period 2000-2009 at any stations. In other words, the concentrations have fluctuated around the same levels, with a trend towards an apparent reduction at Lista towards the last few years. In 2009, the median concentration of OH-pyrene metabolites in bile from cod was higher in the Inner Oslofjord (st. 30B) compared to samples from the Inner Sør fjord (st. 53B), the Bømlo-Sotra area (st. 23B) and Lista (st. 15B). Changes in concentrations of PAH measured in blue mussel from the Inner Oslofjord correlate moderately well to alterations in OH-pyrene concentrations in the bile of cod from the same area.

Results for the period 1997-2005 and 2009 indicated that there are lead effects, shown by decreased activity of the enzyme ALA-D in the two most contaminated areas, i.e. cod from the Inner Oslofjord (st. 30B) and cod from the Inner Sør fjord (st. 53B). This indication was less evident in 2006. No trend could be shown for the period 1997-2009.

Since 2000 investigations have shown that EROD-activity in fish from the Inner Oslofjord is often higher than presumed cleaner stations, however this trend is not consistent. In the Inner Sør fjord EROD activities were often lower than at the reference Karihavet (st. 23B; although higher in 2009). An explanation may be that the inducing effect of specific contaminants may be inhibited by other contaminants present. The median amount of CYP1A protein in the liver of cod from the Inner Oslofjord (st. 30B) in 2009 was 50 % lower as in 2008 (despite the increase in EROD activity). No significant time-trend could be observed for CYP1A.

5. Conclusions

The Norwegian contribution to OSPAR's Coordinated Environmental Monitoring Programme (CEMP) in 2009 included the monitoring of micropollutants (contaminants) in blue mussel (49 stations), dogwhelk (10 stations), cod (14 stations) and flatfish (dab, flounder, plaice, megrim; 11 stations) along the coast of Norway from the Oslofjord and Hvaler region in the southeast to the Varangerfjord in the northeast. The stations are located both in areas with known or presumed point sources of contaminants and in areas more remote, exposed to presumed diffuse contamination. The mussel sites include supplementary stations for the Norwegian Index Programme. There were totally 859 time series and 538 of these included results from 2009. Of these, 211 showed statistically significant trends; 189 were downwards and 22 were upwards. The dominance of downward trends indicates that contamination is decreasing. In 186 cases, concentrations were above what is expected in only diffusely contaminated areas (collectively termed over expected high background concentrations). The general situation for the two major impacted areas of CEMP is as follows:

The Oslofjord/Hvaler/Grenlandsfjord area

The Oslofjord was contaminated with PCBs (expressed the sum of seven PCB congeners), mercury and cadmium. Cod fillet from the Inner Oslofjord was moderately polluted by mercury, and had a significant upward trend for the period 1984-2009. Cod liver from the Inner Oslofjord had median concentrations of lead and cadmium higher than presumed high background, and there was a significant upward trend for cadmium in cod liver from the Inner Oslofjord for the same period. Cod liver from the Inner Oslofjord was markedly polluted with PCBs. Cod fillet from the Inner Oslofjord was also markedly polluted with PCBs in 2009. This was higher than the concentration in 2008 and there was a significant upward trend for the period 2000-2009. Cod from the outer part of the Oslofjord (Færder) were only insignificantly polluted by mercury, lead, cadmium and PCBs.

Blue mussel from Gressholmen, Akershuskaia and Ramtonholmen were moderately polluted by PCBs. There were significant downward trends for PCBs at these three stations for the whole monitoring period from 1987, 1992 and 1995, respectively, to 2009. The other blue mussel stations in the Oslofjord area were only insignificantly polluted by PCBs. Blue mussel from Damholmen in the Hvaler area were moderately polluted by mercury. The other blue mussel stations in the Oslofjord area were only insignificantly polluted by mercury. Blue mussel from Fugleskjær in the Hvaler area were moderately polluted by cadmium. Blue mussel from Gressholmen, Ramtonholmen, Solbergstrand and Mølen were insignificantly/slightly polluted by cadmium but had upward trends for the whole monitoring period from 1984, 1995, 1983 and 1983, respectively, to 2009. None of the blue mussel stations in the Oslofjord area were polluted by lead.

Blue mussel from stations in the Grenlandsfjord area were extremely polluted by dioxins. The concentrations of dioxins have increased every year in blue mussel at Gjemesholmen since 2005. There was a tendency towards an increase also at Bjørkøya and Strømtangen, but there were no significant trends for any of these stations.

The Sørfjord/Hardangerfjord area

The Sørfjord and Hardangerfjord were contaminated with DDE (p,p'DDE, a metabolite of DDT), cadmium, mercury and to a lesser degree PCBs. Cod fillet from the Inner Sørfjord was moderately polluted by mercury. Cod from Strandebarm in the Hardangerfjord was insignificantly polluted by mercury. There were concentrations over presumed high background levels and an upward trend for the period 1986-2009 for mercury in flounder fillet from the Inner Sørfjord.

Cod from the Inner Sørfjord showed concentrations of cadmium in the liver that exceeded presumed high background level. There was a significant upward trend for cadmium in cod liver for this station for the period 1986-2009. Cod from Strandebarm in the Hardangerfjord had a significant downward trend for the period 1987-2009 and median concentration of cadmium in 2009 was below presumed high background. Cod from the Inner Sørfjord had a median concentration of lead in the liver that exceeded presumed high background level. The median concentration of lead in cod liver from here had increased slightly compared to 2008, and there was a significant upward trend for the period 1990-2009. Inhibition of ALA-D in cod was commonly observed in the Sørfjord, also in 2009, as a result of the lead exposure. Cod liver from Strandebarm had a median concentration of lead below presumed high background level in 2009 and there was a significant downward trend for the same period.

Liver of cod from the Inner Sør fjord was insignificantly polluted by PCBs. The fillet of the same fish was however moderately polluted by PCBs. Liver and fillet of cod from Strandebarm in the Hardanger fjord were insignificantly polluted by PCBs. There was a significant downward trend for PCBs in cod liver from Strandebarm for the period 1990-2009. Cod liver and fillet from the Inner Sør fjord was moderately polluted by DDE. Both liver and fillet of cod from Strandebarm were insignificantly polluted by DDE, and showed significant downward trends for the same period.

Significant downward trends have been observed for cadmium in blue mussel in the Inner and Mid Sør fjord during the last two decades. In 2009 the blue mussel from the Inner and Mid Sør fjord were insignificantly to moderately polluted by mercury and lead. For three blue mussel stations in the Sør fjord, there were concentrations classified up to markedly polluted by DDE. The blue mussel at Kvalnes in the Mid Sør fjord has declined two classes in the classification system from extremely polluted in 2008 to markedly polluted in 2009.

Biological effects

Biological effects methods are included for in the monitoring programme to evaluate whether marine organisms are affected by contaminants in their environment, something that can not be assessed from concentrations of chemicals in tissues alone. Biological effects were investigated in cod from four areas: Inner Oslofjord, Lista, Bømlo-Sotra (Karihavet) and the Inner Sør fjord. The median amount of CYP1A protein in the liver of cod from the Inner Oslofjord in 2009 was lowest since investigations began in 2003; 50 % lower compared to 2008, however no significant trend could be detected. CYP1A protein levels were however higher in the Inner Oslofjord compared to the Inner Sør fjord and Karihavet, as was observed for the EROD activities. An explanation could be that the exposure to PCBs is higher in the Inner Oslofjord than in the Sør fjord and Karihavet.

In 2009, the median concentration of OH-pyrene metabolites in bile from cod was higher in the Inner Oslofjord compared to samples from the Inner Sør fjord, the Bømlo-Sotra area and Lista. Changes in concentrations of PAHs measured in blue mussel from the Inner Oslofjord correlate moderately well to alterations in OH-pyrene concentrations in the bile of cod from the same area. Since the year 2000 investigations have shown that EROD-activity in fish from the Inner Oslofjord is often higher than presumed cleaner stations. In the Inner Sør fjord EROD activities were often lower than at the reference Karihavet (although higher in 2009).

Of the time series investigated for biological effects (imposex) of TBT in dogwhelk, seven stations showed significant downward trends and two had no significant trends for the entire monitoring period, the first year of which varied from 1997 to 2002. The effects from TBT were low (VDSI<2) at eight of 10 stations investigated in 2009.

Other observations

Polybrominated diphenyl ethers (PBDEs) and perfluoroalkyl compounds (PFCs) have been investigated in cod liver since 2005. In 2009, the concentration of sum PBDE and PFOS (the most abundant PFC) was highest in cod from the Inner Oslofjord. PBDE was lowest in cod east of Bjørnerøya in Lofoten. BDE47 was the dominant PBDE in all samples. PFOS was lowest in the Sør fjord.

Blue mussel from two stations in the Kristiansandsfjord were markedly and moderately polluted by PAHs. Blue mussel from Ranfjord were extremely polluted by B[a]P, and blue mussel from the Kristiansandsfjord were up to severely polluted by benzo[a]pyrene.

Based on nine fjord areas, that are effected by point sources of contaminants, the Pollution Index for 2009 was 2.8, which was 0.2 lower than in 2008. A value between 2 and 3 would be termed by the Klif environmental system as "Marked" polluted. For the Reference Index based on four fjord areas that are presumably little polluted with contaminants, the Index value for 2009 was 1.2, which was 0.4 lower than the revised index 2008. A lower index in each of these cases indicates that contamination has decreased.

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Appendix A

Overview of previous CEMP investigations

Previous investigations

The results for CEMP have previously been presented for:

- 1981-1983 (only Oslofjord; Enger *et al.* 1984, 1985)
- 1984-1985 (Green 1988)
- 1986 (Green 1987; SFT 1987)
- 1987 (SFT 1988)
- 1988 (Green 1989b; SFT 1989)
- 1989 (Green 1991a, SFT 1990)
- 1990 (Green 1992, JMG 1994)
- 1991 (Green 1993a)
- 1992 (Green 1994, Green & Knutzen 1994)
- 1993 (Green 1995a)
- 1994 (Green 1995b)
- 1995 (Green 1997a)
- 1996 (Green 1997b)
- 1997 (Green *et al.* 1999)
- 1998 (Green *et al.* 2000)
- 1999 (Green *et al.* 2001a)
- 2000 (Green *et al.* 2002a)
- 2001 (Green, *et al.* 2003)
- 2002 (Green, *et al.* 2004a)
- 2003 (Green, *et al.* 2004b)
- 2004 (Green, *et al.* 2005)
- 2005 (Green, *et al.* 2007)
- 2006 (Green, *et al.* 2008b)
- 2007 (Green, *et al.* 2009)
- 2008 (Green, *et al.* 2010)

The results have been incorporated in OSPAR's European regional assessments of sediment (JMG 1993) and biota (ICES 1988, JMG 1992) and temporal trends in biota (ICES 1989; 1991; ASMO 1994).

An overview of the analytical methods (1981-2000) has been presented in Green 1993b; Green *et al.* 2001b, Green *et al.* 2008a.

The raw data or statistical summaries have been presented for:

- sediment 1986-1997 (Green & Klungsøyr 1994; Green *et al.* 2002b)
- biota 1981-1992 (Green & Rønningen 1994)
- biota 1993-1997 (Green & Severinsen 1999a, b)
- biota 1998-2001 (Green *et al.* 2002c, d) and
- sediment and biota 1981-2006 (cf. Shi *et al.* 2008)

Summary assessments have been made for the periods:

- 1981-1992 (Green *et al.* 1995)
- 1981-1999 (Green *et al.* 2002c)
- 1981-2006 (Green & Ruus 2008)

An evaluation of "background" levels of contaminants in biota based on CEMP data has been done by Knutzen & Green (1995, 2001a) and Green & Knutzen (2003). Application of pollution and reference indices using the blue mussel and coordinated with CEMP has also been assessed (Green & Knutzen 2001). Results from biological effects methods 1997-2001 have been assessed as well (Ruus *et al.* 2003).

Appendix B

Quality assurance programme

Information on Quality Assurance

NIVA has participated in all the QUASIMEME international intercalibration exercises relevant to chemical and Imposex analyses. For chemical analyses, these include Round 58 of July-October 2009 and round 60, which would apply to the 2009 samples. These QUASIMEME exercises have included nearly all the contaminants as well as Imposex analysed in this programme. In addition, NIVA was accredited in 1993 and since 2001 accredited in accordance with the NS-EN ISO/IEC 17025 standard by the Norwegian Accreditation (reference P009).

In addition to these QUASIMEME exercises, Standard Reference Materials (SRM) are also analyzed routinely with the CEMP samples. It should be noted that for biota the type of tissue used in the SRMs do not always match the target tissue for analyses. Uncertain values identified by the analytical laboratory or the reporting institute are flagged in the database. The results are also “screened” when submitted to the database at NIVA and ICES.

Accreditation

The laboratories at NIVA, both the chemical, microbiological and the ecotoxicological laboratories, were accredited in 1993 for quality assurance system by the National Measurement Service - Norwegian Accreditation and based on European Standard EN45000/ISO71EC Guide 25. NIVA has reference number P009. The chemical laboratory has satisfied the requirements in NS-EN ISO/IEC 17025 since 2001.

Summary of quality control results

Standard Reference Materials (SRM) were analysed regularly (Table 11). Fish protein (DORM-3) or dogfish liver (DOLT-4) was used as SRM for the control of the determination of metals. Cod liver oil (1588) and mussel tissue (2977) was used as SRM for controls of PCBs and PAHs, respectively. NIES 11 was used for tin organic compounds. Cyprinid fish (EDF2525) at NILU was used as SRM for control of determination of dioxins.

Following results for round QUASIMEME –Round 58, January-April 2009, were used. This round would apply to the 2009 samples. All samples have been analysed but for an unknown reason not reported to QUASIMEME. However, it can be noted that all the results are within the uncertainty limits of 20% deviation from the true value with few exceptions.

- QTM083BT (no.1) and QTM084BT (no.2) for metals in biota.
The results were all very good with the exception of the results for cadmium (Cd in no.1), but the uncertainty in the true value here is relatively large.
- QOR100BT (no.1) and QOR101BT (no.2) for organochlorines in biota.
The results were all acceptable. All the true values of the samples were very low and close to the detection limits. Therefore the results are in percent deviation.
- QPH055BT (no.1) and QPH056BT (no.2) for PAH in biota.
The results were acceptable except for benzo(a)fluoranthene where the result is too high. The reason for this is that NIVA determine the j-isomere in the same measurement. The result for phenanthrene (no. 2) the result also was too high, but acceptable. Over all very good results.

Table 11. Summary of the quality control of results for the 2009 biota samples analysed in 2009-2010. The Standard Reference Materials (SRM) were DORM-3* (fish protein) for blue mussel and fish fillet, DOLT-4* (dogfish liver) for fish liver, 1588** (cod liver oil) for blue mussel and fish liver and 2977** (mussel tissue) for blue mussel. SRM was analysed in series with the CEMP-samples for analyses of metals (mg/kg d.w.), NIES 11 for organochlorines or PAH ($\mu\text{g}/\text{kg}$ d.w.) and EDF2525**** for fish (cyprinid) was analysed for dioxin (ng/kg) by NILU (Norwegian Institute for Air Research – results for 2009 material are shown here; cf. Green et al.2010). Tissue types were: mussel softbody (SB), fish liver (LI) and fish fillet (MU). SRMs were measured several times (N) over a number of weeks (W).

Code	Contaminant	Tissue type	SRM type	SRM value confidence interval	N	W	Mean value	Standard deviation
As	Arsenic	LI	DOLT-4	9.66 ± 0.62	16	23	11.29	0.394
Cd	Cadmium	LI	DOLT-4	24.3 ± 0.8	16	23	24.45	0.818
Cr	Chromium	LI	DOLT-4	Missing	16	23	1.30	0.092
Cu	Copper	LI	DOLT-4	31.2 ± 1.1	16	23	33.46	1.366
Ni	Nickel	LI	DOLT-4	0.97 ± 0.11	16	23	1.046	0.156
Pb	Lead	LI	DOLT-4	0.16	13	23	0.154	0.018
Zn	Zinc	LI	DOLT-4	116 ± 6	16	23	124.81	2.762
As	Arsenic	SB	DORM-3	6.88±0.30	12	22	8.24	0.38
Cd	Cadmium	SB	DORM-3	0.290 ± 0.020	12	22	0.317	0.008
Co	Cobalt	SB	DORM-3	missing	11	22	0.261	0.008
Cr	Chromium	SB	DORM-3	1.89 ± 5.5	12	22	1.79	0.13
Cu	Copper	SB	DORM-3	15.5 ± 0.63	12	22	15.2	0.36
Hg	Mercury	MU	DORM-3	0.409 ± 0.027	38	23	0.408	0.03
Hg	Mercury	SB	DORM-3	0.409 ± 0.027	38	23	0.408	0.03
Ni	Nickel	SB	DORM-3	1.28± 0.24	12	22	1.28	0.11
Pb	Lead	SB	DORM-3	0.395 ± 0.050	12	22	0.415	0.013
Zn	Zinc	SB	DORM-3	51.3 ± 3.1	12	22	53.1	2.16
BDE100	2,2',4,4',6-Pentabromidiphenylether	LI	SRM1588b	1.89 ± 0.45	13	18	2.08	0.459
BDE154	2,2',4,4',5,6'-Hexabromidiphenylether	LI	SRM1588b	0.495 ± 0.069	13	18	0.36	0.21
BDE28	2,2,4'-Tribromodiphenylether	LI	SRM1588b	1.08 ± 0.23	13	18	0.914	0.577
BDE47	2,2',4,4',-Tetrabromidiphenylether	LI	SRM1588b	17.8 ± 2.0	13	18	19.09	5.98
BDE49	2,2',4,5'-Tetrabromidiphenylether	LI	SRM1588b	2.25 ± 0.24	13	18	2.25	0.78
BDE99	2,2',4,4',5-Pentabromidiphenylether	LI	SRM1588b	0.56 ± 0.20	12	18	0.56	0.18
CB101	PCB congener CB-101	LI	SRM1588b	127 ± 9	16	21	131.25	15.86
CB105	PCB congener CB-105	LI	SRM1588b	59.2 ± 1.2	16	21	64.3	5.72
CB118	PCB congener CB-118	LI	SRM1588b	172 ± 7	16	21	175.6	9.63
CB138	PCB congener CB-138	LI	SRM1588b	212 ± 29	16	21	206.25	13.1
CB153	PCB congener CB-153	LI	SRM1588b	275 ± 4	16	21	278.12	26.63
CB156	PCB congener CB-156	LI	SRM1588b	18.0 ± 2.1	16	21	19.18	1.64
CB180	PCB congener CB-180	LI	SRM1588b	98.5 ± 6.3	16	21	101.4	7.62
CB209	PCB congener CB-209	LI	SRM1588b	3.2 ± 0.26	16	21	3.48	1.05
CB28	PCB congener CB-28	LI	SRM1588b	27.8 ± 1.4	16	21	23.3	1.49
CB52	PCB congener CB-52	LI	SRM1588b	82.4 ± 1.7	16	21	75.4	8.43
DDEPP	4,4'-DDE	LI	SRM1588b	676 ± 36	16	21	596.9	53.0
DDTPP	4,4'-DDT	LI	SRM1588b	570 ± 27	16	21	430	212
HCB	Hexachlorobenzene	LI	SRM1588b	163 ± 16	16	21	150	13.7
HCHA	α -hexachlorohexene	LI	SRM1588b	99 ± 15	16	21	93.5	8.83
HCHG	γ -hexachlorohexene	LI	SRM1588b	23.3 ± 1.7	16	21	20	2.68
OCS	Octachlorostyrene	LI	SRM1588b	9.14 ± 0.74	16	21	14.8	1.08
QCB	Pentachlorobenzene	LI	SRM1588b	16.1 ± 0.6	16	21	19.75	2.74
TDEPP	4,4'-DDD	LI	SRM1588b	285 ± 37	16	21	263.12	48.95
ACNE	Acenaphthene	SB	SRM2977	4.2 ± 0.4	2	1	2.9	0.70
ACNLE	Acenaphthylene	SB	SRM2977	m	2	1	2.86	0.79
ANT	Anthracene	SB	SRM2977	8 ± 4	2	1	3.55	0.49
BAP	benzo[a]pyrene ¹⁾	SB	SRM2977	8.35 ± 0.72	2	1	5.55	0.21
BBJF	Benzo(b+j)fluoranthene ²⁾	SB	SRM2977	m	2	1	17.5	0.70
BEP	benzo[e]pyrene	SB	SRM2977	13.1 ± 1.1	2	1	20	0
BGHIP	benzo[ghi]perylene	SB	SRM2977	9.53 ± 0.43	2	1	11.5	0.71
BKF	benzo[k]fluoranthene	SB	SRM2977	4 ± 1	2	1	6.05	0.212
BAA	benzo[a]anthracene ¹⁾	SB	SRM2977	20.34 ± 0.78	2	1	19	0

Code	Contaminant	Tis- sue type	SRM type	SRM value confidence interval	N	W	Mean value	Standard deviation
CHR	Chrysene	SB	SRM2977	49 ± 2	2	1	52	2.8
DBA3A	Dibenz[a,h]anthracene/ Dibenz[a,c]anthracene ³⁾	SB	SRM2977	2.0 ± 0.2	2	1	1.55	0.21
FLE	Fluorene	SB	SRM2977	10.24 ± 0.43	2	1	7.65	1.62
FLU	fluoranthene	SB	SRM2977	38.7 ± 1.0	2	1	29.5	7.78
ICDP	indeno[1,2,3-cd]pyrene	SB	SRM2977	4.84 ± 0.81	2	1	4.45	0.212
NAP	Naphthalene	SB	SRM2977	19 ± 5	2	1	8.45	0.92
PA	Phenanthrene	SB	SRM2977	35.1 ± 3.8	2	1	38	2.82
PER	perylene	SB	SRM2977	3.50 ± 0.76	2	1	1.8	0.42
PYR	pyrene	SB	SRM2977	78.9 ± 3.5	2	1	62	18.38
CB126	3,3',4,4',5-PeCB	SB	EDF2525	647 ± 211	4	30	675	Missing
CB169	3,3',4,4',5,5'-HxCB	SB	EDF2525	55.8 ± 12.6	4	30	57.5	Missing
CB77	3,3',4,4'-TeCB	SB	EDF2525	1980 ± 659	4	30	1986	Missing
CB81	3,4,4',5'-TeCB	SB	EDF2525	179 ± 35.1	4	30	178	Missing
CDD1N	1,2,3,7,8-PeCDD	SB	EDF2525	3.88 ± 1.22	4	30	4.65	Missing
CDD4X	1,2,3,4,7,8-HxCDD	SB	EDF2525	0.31 ± 0.14	4	30	0.51	Missing
CDD6X	1,2,3,6,7,8-HxCDD	SB	EDF2525	2.19 ± 0.76	4	30	2.29	Missing
CDD9X	1,2,3,7,8,9-HxCDD	SB	EDF2525	0.32 ± 0.11	4	30	0.26	Missing
CDDO	OCDD	SB	EDF2525	2.57 ± 2.59	4	30	2.02	Missing
CDF2N	2,3,4,7,8-PeCDF	SB	EDF2525	14.5 ± 2.41	4	30	16	Missing
CDF2T	2,3,7,8-TCDF	SB	EDF2525	24.5 ± 5.52	4	30	25.2	Missing
CDF4X	2,3,4,6,7,8-HxCDF	SB	EDF2525	1.09 ± 0.55	4	30	1.05	Missing
CDF6P	1,2,3,4,6,7,8-HpCDF	SB	EDF2525	0.59 ± 0.61	4	30	0.55	Missing
CDF6X	1,2,3,6,7,8-HxCDF	SB	EDF2525	1.65 ± 0.56	4	30	1.87	Missing
CDF9P	1,2,3,4,7,8,9-HpCDF	SB	EDF2525	0.08 ± 0.11	4	30	0.18	Missing
CDFDN	1,2,3,7,8/1,2,3,4,8-PeCDF	SB	EDF2525	4.88 ± 1.46	4	30	4.84	Missing
CDFDX	1,2,3,4,7,8/1,2,3,4,7,9- HxCDF	SB	EDF2525	5.8 ± 0.99	4	30	6.39	Missing
CDFO	OCDF	SB	EDF2525	0.78 ± 1	4	30	0.33	Missing
TCDD	2,3,7,8-tetrachl-DiBpD (TCDD)	SB	EDF2525	17.3 ± 2.58	4	30	19.7	Missing

*) National Research Council Canada, Division of Chemistry, Marine Analytical Chemistry Standards

**) BCR, Community Bureau of Reference, Commission of the European Communities

***) National Institute of Standards & Technology (NIST)

****) CIL, US

¹⁾ Not certified (see NIST certificate)

²⁾ Calculated from separate values for **Benzo(b)fluoranthene** and **Benzo(j)fluoranthene**

³⁾ Calculated from separate values for **Dibenz(a,c)anthracene** and **Dibenz(a,h)anthracene**

Appendix C

Abbreviations

Abbreviation ¹	English	Norwegian	Param. group
ELEMENTS			
Al	aluminium	<i>aluminium</i>	I-MET
As	arsenic	<i>arsen</i>	I-MET
Cd	cadmium	<i>kadmium</i>	I-MET
Co	cobalt	<i>kobolt</i>	I-MET
Cr	chromium	<i>krom</i>	I-MET
Cu	copper	<i>kobber</i>	I-MET
Fe	iron	<i>jern</i>	I-MET
Hg	mercury	<i>kvikksølv</i>	I-MET
Li	lithium	<i>litium</i>	I-MET
Mn	manganese	<i>mangan</i>	I-MET
Ni	nickel	<i>nikkel</i>	I-MET
Pb	lead	<i>bly</i>	I-MET
Pb210	lead-210	<i>bly-210</i>	I-RNC
Se	selenium	<i>selen</i>	I-MET
Ti	titanium	<i>titan</i>	I-MET
Zn	zinc	<i>sink</i>	I-MET
METAL COMPOUNDS			
TBT	tributyltin	<i>tributyltinn</i>	O-MET
MBTIN	monobutyltin	<i>monobutyltinn</i>	O-MET
DBTIN	dibutyltin	<i>dibutyltinn</i>	O-MET
TBTIN	tributyltin	<i>tributyltinn</i>	O-MET
MPTIN	monophenyltin	<i>monofenyltinn</i>	O-MET
DPTIN	diphenyltin	<i>difenyltinn</i>	O-MET
TPTIN	triphenyltin	<i>trifenyltinn</i>	O-MET
PAHs			
PAH	polycyclic aromatic hydrocarbons	<i>polysykliske aromatiske hydrokarboner</i>	
ACNE ³			
ACNE ³	acenaphthene	<i>acenaften</i>	PAH
ACNLE ³			
ACNLE ³	acenaphthylene	<i>acenaftalen</i>	PAH
ANT ³			
ANT ³	anthracene	<i>antracen</i>	PAH
BAA ^{3,4}			
BAA ^{3,4}	benzo[a]anthracene	<i>benzo[a]antracen</i>	PAH
BAP ^{3,4}			
BAP ^{3,4}	benzo[a]pyrene	<i>benzo[a]pyren</i>	PAH
BBF ^{3,4}			
BBF ^{3,4}	benzo[b]fluoranthene	<i>benzo[b]fluoranten</i>	PAH
BBJKF ^{3,4}			
BBJKF ^{3,4}	benzo[b,j,k]fluoranthene	<i>benzo[b,j,k]fluoranten</i>	PAH
BBJKF ^{3,4}			
BBJKF ^{3,4}	benzo[b+j,k]fluoranthene	<i>benzo[b+j,k]fluoranten</i>	PAH
BBKF ^{3,4}			
BBKF ^{3,4}	benzo[b+k]fluoranthene	<i>benzo[b+k]fluoranten</i>	PAH
BEP			
BEP	benzo[e]pyrene	<i>benzo[e]pyren</i>	PAH
BGHIP ³			
BGHIP ³	benzo[ghi]perylene	<i>benzo[ghi]perylen</i>	PAH
BIPN ²			
BIPN ²	biphenyl	<i>bifenyl</i>	PAH
BJKF ^{3,4}			
BJKF ^{3,4}	benzo[j,k]fluoranthene	<i>benzo[j,k]fluorantren</i>	PAH
BKF ^{3,4}			
BKF ^{3,4}	benzo[k]fluoranthene	<i>benzo[k]fluorantren</i>	PAH
CHR ^{3,4}			
CHR ^{3,4}	chrysene	<i>chrysen</i>	PAH
CHRTR ^{3,4}			
CHRTR ^{3,4}	chrysene+triphenylene	<i>chrysen+trifenylen</i>	PAH
COR			
COR	coronene	<i>coronen</i>	PAH
DBAHA ^{3,4}			
DBAHA ^{3,4}	dibenz[a,h]anthracene	<i>dibenz[a,h]antracen</i>	PAH
DBA3A ^{3,4}			
DBA3A ^{3,4}	dibenz[a,c/a,h]anthracene	<i>dibenz[a,c/a,h]antracen</i>	PAH
DBP ⁴			
DBP ⁴	dibenzopyrenes	<i>dibenzopyren</i>	PAH
DBT			
DBT	dibenzothiophene	<i>dibenzotiofen</i>	PAH
DBTC1			
DBTC1	C ₁ -dibenzothiophenes	<i>C₁-dibenzotiofen</i>	PAH
DBTC2			
DBTC2	C ₂ -dibenzothiophenes	<i>C₂-dibenzotiofen</i>	PAH
DBTC3			
DBTC3	C ₃ -dibenzothiophenes	<i>C₃-dibenzotiofen</i>	PAH
FLE ³			
FLE ³	fluorene	<i>fluoren</i>	PAH
FLU ³			
FLU ³	fluoranthene	<i>fluoranten</i>	PAH
ICDP ^{3,4}			
ICDP ^{3,4}	indeno[1,2,3-cd]pyrene	<i>indeno[1,2,3-cd]pyren</i>	PAH
NAP ²			
NAP ²	naphthalene	<i>naftalen</i>	PAH
NAPC1 ²			
NAPC1 ²	C ₁ -naphthalenes	<i>C₁-naftalen</i>	PAH
NAPC2 ²			
NAPC2 ²	C ₂ -naphthalenes	<i>C₂-naftalen</i>	PAH
NAPC3 ²			
NAPC3 ²	C ₃ -naphthalenes	<i>C₃-naftalen</i>	PAH
NAP1M ²			
NAP1M ²	1-methylnaphthalene	<i>1-metylnaftalen</i>	PAH
NAP2M ²			
NAP2M ²	2-methylnaphthalene	<i>2-metylnaftalen</i>	PAH
NAPD2 ²			
NAPD2 ²	1,6-dimethylnaphthalene	<i>1,6-dimetylnaftalen</i>	PAH
NAPD3 ²			
NAPD3 ²	1,5-dimethylnaphthalene	<i>1,5-dimetylnaftalen</i>	PAH

Abbreviation ¹	English	Norwegian	Param. group
NAPDI ²	2,6-dimethylnaphthalene	<i>2,6-dimetylnaftalen</i>	PAH
NAPT2 ²	2,3,6-trimethylnaphthalene	<i>2,3,6-trimetylnaftalen</i>	PAH
NAPT3 ²	1,2,4-trimethylnaphthalene	<i>1,2,4-trimetylnaftalen</i>	PAH
NAPT4 ²	1,2,3-trimethylnaphthalene	<i>1,2,3-trimetylnaftalen</i>	PAH
NAPTM ²	2,3,5-trimethylnaphthalene	<i>2,3,5-trimetylnaftalen</i>	PAH
NP	Collective term for naphthalenes, phenanthrenes and dibenzothiophenes	<i>Sammebetegnelse for naftalen, fenantren og dibenzotiofens</i>	PAH
PA ³	phenanthrene	<i>fenantren</i>	PAH
PAC1	C ₁ -phenanthrenes	<i>C₁-fenantren</i>	PAH
PAC2	C ₂ -phenanthrenes	<i>C₂-fenantren</i>	PAH
PAC3	C ₃ -phenanthrenes	<i>C₃-fenantren</i>	PAH
PAM1	1-methylphenanthrene	<i>1-metylfenantren</i>	PAH
PAM2	2-methylphenanthrene	<i>2-metylfenantren</i>	PAH
PADM1	3,6-dimethylphenanthrene	<i>3,6-dimetylfenantren</i>	PAH
PADM2	9,10-dimethylphenanthrene	<i>9,10-dimetylfenantren</i>	PAH
PER	perylene	<i>perylene</i>	PAH
PYR ³	pyrene	<i>pyren</i>	PAH
DI-Σ_n	sum of "n" dicyclic "PAH"s (footnote 2)	<i>sum "n" disykliske "PAH" (fotnote 2)</i>	
P-Σ_n / P-Σ	sum "n" PAH (DI-Σ _n not included, footnote 3)	<i>sum "n" PAH (DI-Σ_n ikke inkludert, fotnot 3)</i>	
PK-Σ_n / PK-Σ	sum carcinogen PAHs (footnote 4)	<i>sum kreftfremkallende PAH (fotnote 4)</i>	
PAHΣΣ	DI-Σ _n + P-Σ _n etc.	<i>DI-Σ_n + P-Σ_n mm.</i>	
SPA	"total" PAH, specific compounds not quantified (outdated analytical method)	<i>"total" PAH, spesifik forbindelser ikke kvantifisert (foreldret metode)</i>	
BAP_P	% BAP of PAHΣΣ	<i>% BAP av PAHΣΣ</i>	
BAPP	% BAP of P-Σ _n	<i>% BAP av P-Σ_n</i>	
BPK_P	% BAP of PK-Σ _n	<i>% BAP av PK-Σ_n</i>	
PK_n_P	% PK-Σ _n of PAHΣΣ	<i>% PK-Σ_n av PAHΣΣ</i>	
PK_nPP	% PK-Σ _n of P-Σ _n	<i>% PK-Σ_n av P-Σ_n</i>	
PCBs			
PCB	polychlorinated biphenyls	<i>polyklorete bifenyler</i>	
CB	individual chlorobiphenyls (CB)	<i>enkelte klorobifenyl</i>	
CB28	CB28 (IUPAC)	<i>CB28 (IUPAC)</i>	OC-CB
CB31	CB31 (IUPAC)	<i>CB31 (IUPAC)</i>	OC-CB
CB44	CB44 (IUPAC)	<i>CB44 (IUPAC)</i>	OC-CB
CB52	CB52 (IUPAC)	<i>CB52 (IUPAC)</i>	OC-CB
CB77 ⁵	CB77 (IUPAC)	<i>CB77 (IUPAC)</i>	OC-CB
CB81 ⁵	CB81 (IUPAC)	<i>CB81 (IUPAC)</i>	OC-CB
CB95	CB95 (IUPAC)	<i>CB95 (IUPAC)</i>	OC-CB
CB101	CB101 (IUPAC)	<i>CB101 (IUPAC)</i>	OC-CB
CB105	CB105 (IUPAC)	<i>CB105 (IUPAC)</i>	OC-CB
CB110	CB110 (IUPAC)	<i>CB110 (IUPAC)</i>	OC-CB
CB118	CB118 (IUPAC)	<i>CB118 (IUPAC)</i>	OC-CB
CB126 ⁵	CB126 (IUPAC)	<i>CB126 (IUPAC)</i>	OC-CB
CB128	CB128 (IUPAC)	<i>CB128 (IUPAC)</i>	OC-CB
CB138	CB138 (IUPAC)	<i>CB138 (IUPAC)</i>	OC-CB
CB149	CB149 (IUPAC)	<i>CB149 (IUPAC)</i>	OC-CB
CB153	CB153 (IUPAC)	<i>CB153 (IUPAC)</i>	OC-CB
CB156	CB156 (IUPAC)	<i>CB156 (IUPAC)</i>	OC-CB
CB169 ⁵	CB169 (IUPAC)	<i>CB169 (IUPAC)</i>	OC-CB
CB170	CB170 (IUPAC)	<i>CB170 (IUPAC)</i>	OC-CB
CB180	CB180 (IUPAC)	<i>CB180 (IUPAC)</i>	OC-CB
CB194	CB194 (IUPAC)	<i>CB194 (IUPAC)</i>	OC-CB
CB209	CB209 (IUPAC)	<i>CB209 (IUPAC)</i>	OC-CB
CB-Σ₇	CB: 28+52+101+118+138+153+180	<i>CB: 28+52+101+118+138+153+180</i>	
CB-ΣΣ	sum of CBs, includes CB-Σ ₇	<i>sum Cber, inkluderer CB-Σ₇</i>	
TECBW	Sum of CB-toxicity equivalents after WHO model, see TEQ	<i>Sum CB- toksitets ekvivalenter etter WHO modell, se TEQ</i>	
TECBS	Sum of CB-toxicity equivalents after SAFE model, see TEQ	<i>Sum CB-toksitets ekvivalenter etter SAFE modell, se TEQ</i>	

Abbreviation ¹	English	Norwegian	Param. group
DIOXINS			
TCDD	2, 3, 7, 8-tetrachloro-dibenzo dioxin	<i>2, 3, 7, 8-tetrakloro-dibenzo dioksin</i>	OC-DX
CDDST CDD1N	Sum of tetrachloro-dibenzo dioxins 1, 2, 3, 7, 8-pentachloro-dibenzo dioxin	<i>Sum tetrakloro-dibenzo dioksiner</i> <i>1, 2, 3, 7, 8-pentakloro-dibenzo dioksin</i>	OC-DX
CDDSN	Sum of pentachloro-dibenzo dioxins	<i>Sum pentakloro-dibenzo dioksiner</i>	
CDD4X	1, 2, 3, 4, 7, 8-hexachloro-dibenzo dioxin	<i>1, 2, 3, 4, 7, 8-heksakloro-dibenzo dioksin</i>	OC-DX
CDD6X	1, 2, 3, 6, 7, 8-hexachloro-dibenzo dioxin	<i>1, 2, 3, 6, 7, 8-heksakloro-dibenzo dioksin</i>	OC-DX
CDD9X	1, 2, 3, 7, 8, 9-hexachloro-dibenzo dioxin	<i>1, 2, 3, 7, 8, 9-heksakloro-dibenzo dioksin</i>	OC-DX
CDDSX	Sum of hexachloro-dibenzo dioxins	<i>Sum heksakloro-dibenzo dioksiner</i>	
CDD6P	1, 2, 3, 4, 6, 7, 8-heptachloro-dibenzo dioxin	<i>1, 2, 3, 4, 6, 7, 8-heptakloro-dibenzo dioksin</i>	OC-DX
CDDSP	Sum of heptachloro-dibenzo dioxins	<i>Sum heptakloro-dibenzo dioksiner</i>	
CDDO PCDD	Octachloro-dibenzo dioxin Sum of polychlorinated dibenzo-p-dioxins	<i>Oktakloro-dibenzo dioksin</i> <i>Sum polyklorinaterte-dibenzo-p-dioksiner</i>	OC-DX
CDF2T CDFST CDFDN	2, 3, 7, 8-tetrachloro-dibenzofuran Sum of tetrachloro-dibenzofurans 1, 2, 3, 7, 8/1, 2, 3, 4, 8-pentachloro-dibenzofuran	<i>2, 3, 7, 8-tetrakloro-dibenzofuran</i> <i>Sum tetrakloro-dibenzofuraner</i> <i>1, 2, 3, 7, 8/1, 2, 3, 4, 8-pentakloro-dibenzofuran</i>	OC-DX
CDF2N	2, 3, 4, 7, 8-pentachloro-dibenzofuran	<i>2, 3, 4, 7, 8-pentakloro-dibenzofuran</i>	OC-DX
CDFSN CDFDX	Sum of pentachloro-dibenzofurans 1, 2, 3, 4, 7, 8/1, 2, 3, 4, 7, 9-hexachloro-dibenzofuran	<i>Sum pentakloro-dibenzofuraner</i> <i>1, 2, 3, 4, 7, 8/1, 2, 3, 4, 7, 9-heksakloro-dibenzofuran</i>	OC-DX
CDF6X	1, 2, 3, 6, 7, 8-hexachloro-dibenzofuran	<i>1, 2, 3, 6, 7, 8-heksakloro-dibenzofuran</i>	OC-DX
CDF9X	1, 2, 3, 7, 8, 9-hexachloro-dibenzofuran	<i>1, 2, 3, 7, 8, 9-heksakloro-dibenzofuran</i>	OC-DX
CDF4X	2, 3, 4, 6, 7, 8-hexachloro-dibenzofuran	<i>2, 3, 4, 6, 7, 8-heksakloro-dibenzofuran</i>	OC-DX
CDFSX CDF6P	Sum of hexachloro-dibenzofurans 1, 2, 3, 4, 6, 7, 8-heptachloro-dibenzofuran	<i>Sum heksakloro-dibenzofuraner</i> <i>1, 2, 3, 4, 6, 7, 8-heptakloro-dibenzofuran</i>	OC-DX
CDF9P	1, 2, 3, 4, 7, 8, 9-heptachloro-dibenzofuran	<i>1, 2, 3, 4, 7, 8, 9-heptakloro-dibenzofuran</i>	OC-DX
CDFSP CDFO PCDF	Sum of heptachloro-dibenzofurans Octachloro-dibenzofurans Sum of polychlorinated dibenzofurans	<i>Sum heptakloro-dibenzofuraner</i> <i>Octakloro-dibenzofuran</i> <i>Sum polyklorinated dibenzo-furaner</i>	OC-DX OC-DX
CDDFS TCDNN	Sum of PCDD and PCDF Sum of TCDD-toxicity equivalents after Nordic model, see TEQ	<i>Sum PCDD og PCDF</i> <i>Sum TCDD- toksitets ekvivalenter etter Nordisk modell, se TEQ</i>	
TCDDI	Sum of TCDD-toxicity equivalents after international model, see TEQ	<i>Sum TCDD-toksitets ekvivalenter etter internasjonale modell, se TEQ</i>	
PESTICIDES			
ALD	aldrin	<i>aldrin</i>	OC-DN
DIELD	dieldrin	<i>dieldrin</i>	OC-DN
ENDA	endrin	<i>endrin</i>	OC-DN
CCDAN	cis-chlordane (=α-chlordane)	<i>cis-klordan (=α-klordan)</i>	OC-DN
TC DAN	trans-chlordane (=γ-chlordane)	<i>trans-klordan (=γ-klordan)</i>	OC-DN
 OCDAN	oxy-chlordane	<i>oksy-klordan</i>	OC-DN
TNONC	trans-nonachlor	<i>trans-nonaklor</i>	OC-DN
TC DAN	trans-chlordane	<i>trans-klordan</i>	OC-DN
OCS	octachlorostyrene	<i>oktaklorstyren</i>	OC-CL
QCB	pentachlorobenzene	<i>pentaklorbenzen</i>	OC-CL
DDD	dichlorodiphenyldichloroethane 1,1-dichloro-2,2-bis-(4-chlorophenyl)ethane	<i>diklordifenyldikloreten</i> <i>1,1-dikloro-2,2-bis-(4-klorofenyl)etan</i>	OC-DD

Abbreviation ¹	English	Norwegian	Param. group
DDE	dichlorodipenyldichloroethylene (principle metabolite of DDT) 1,1-dichloro-2,2-bis-(4-chlorophenyl)ethylene*	<i>diklordifenyldikloretylen</i> (<i>hovedmetabolitt av DDT</i>) <i>1,1-dikloro-2,2-bis-(4-klorofenyl)etylen</i>	OC-DD
DDT	dichlorodipenyltrichloroethane 1,1,1-trichloro-2,2-bis-(4-chlorophenyl)ethane	<i>diklordifenyiltrikloreetan</i> <i>1,1,1-trikloro-2,2-bis-(4-klorofenyl)etan</i>	OC-DD
DDEOP	o,p'-DDE	<i>o,p'-DDE</i>	OC-DD
DDEPP	p,p'-DDE	<i>p,p'-DDE</i>	OC-DD
DDTOP	o,p'-DDT	<i>o,p'-DDT</i>	OC-DD
DDTPP	p,p'-DDT	<i>p,p'-DDT</i>	OC-DD
TDEPP	p,p'-DDD	<i>p,p'-DDD</i>	OC-DD
DDTEP	p,p'-DDE + p,p'-DDT	<i>p,p'-DDE + p,p'-DDT</i>	OC-DD
DD-nΣ	sum of DDT and metabolites, n = number of compounds	<i>sum DDT og metabolitter,</i> <i>n = antall forbindelser</i>	OC-DD
HCB	hexachlorobenzene	<i>heksaklorbenzen</i>	OC-CL
HCHG	Lindane γ HCH = gamma hexachlorocyclohexane (γ BHC = gamma benzenehexachloride, outdated synonym)	<i>Lindan</i> γ HCH = gamma <i>heksaklorsyκλοheksan</i> (γ BHC = gamma benzenheksaklorid, foreldret betegnelse)	OC-HC
HCHA	α HCH = alpha HCH	α HCH = alpha HCH	OC-HC
HCHB	β HCH = beta HCH	β HCH = beta HCH	OC-HC
HC-nΣ	sum of HCHs, n = count	<i>sum av HCHs, n = antall</i>	
EOCI	extractable organically bound chlorine	<i>ekstraherbart organisk bundet klor</i>	OC-CL
EPOCI	extractable persistent organically bound chlorine	<i>ekstraherbart persistent organisk bundet klor</i>	OC-CL
PBDEs			
PBDE	polybrominated diphenyl ethers	<i>polybromerte difenyletere</i>	OC-BB
BDE	brominated diphenyl ethers		OC-BB
BDE-28	2,4,4'-tribromodiphenyl ether	<i>2,4,4'-tribromdifenyleter</i>	OC-BB
BDE-47	2,2',4,4'-tetrabromodiphenyl ether	<i>2,2',4,4'-tetrabromdifenyleter</i>	OC-BB
BDE-49*	2,2',4,5'- tetrabromodiphenyl ether	<i>2,2',4,5'- tetrabromdifenyleter</i>	OC-BB
BDE-66*	2,3',4',6- tetrabromodiphenyl ether	<i>2,3',4',6- tetrabromdifenyleter</i>	OC-BB
BDE-71*	2,3',4',6- tetrabromodiphenyl ether	<i>2,3',4',6- tetrabromdifenyleter</i>	OC-BB
BDE-77	3,3',4,4'-tetrabromodiphenyl ether	<i>3,3',4,4'-tetrabromdifenyleter</i>	OC-BB
BDE-85	2,2',3,4,4'-pentabromodiphenyl ether	<i>2,2',3,4,4'-pentabromdifenyleter</i>	OC-BB
BDE-99	2,2',4,4',5-pentabromodiphenyl ether	<i>2,2',4,4',5-pentabromdifenyleter</i>	OC-BB
BDE-100	2,2',4,4',6-pentabromodiphenyl ether	<i>2,2',4,4',6-pentabromdifenyleter</i>	OC-BB
BDE-119	2,3',4,4',6-pentabromodiphenyl ether	<i>2,3',4,4',6-pentabromdifenyleter</i>	OC-BB
BDE-138	2,2',3,4,4',5'-hexabromodiphenyl ether	<i>2,2',3,4,4',5'-heksabromdifenyleter</i>	OC-BB
BDE-153	2,2',4,4',5,5'-hexabromodiphenyl ether	<i>2,2',4,4',5,5'-heksabromdifenyleter</i>	OC-BB
BDE-154	2,2',4,4',5,6'-hexabromodiphenyl ether	<i>2,2',4,4',5,6'-heksabromdifenyleter</i>	OC-BB
BDE-183	2,2',3,4,4',5',6- heptabromodiphenyl ether	<i>2,2',3,4,4',5',6-heptabromdifenyleter</i>	OC-BB
BDE-196	2,2',3,3',4,4',5',6- octabromodiphenyl ether	<i>2,2',3,3',4,4',5',6-octabromdifenyleter</i>	OC-BB
BDE-205	2,2',3,3',4,4',5,5',6'- nonabromodiphenyl ether	<i>2,2',3,3',4,4',5,5',6'- nonabromdifenyleter</i>	OC-BB
BDE-209	Decabromodiphenyl ether	<i>Dekabromdifenyleter</i>	OC-BB
PFAS	perfluorinated alkylated substances	perfluoralkylertestoffer	
PFBS	perfluorobutane sulfonate	perfluorbutan sulfonat	PFAS
PFHxA	perfluorohexanoic acid	perfluorhexansyre	PFAS
PFHpA	perfluoroheptanoic acid	perfluorheptansyre	PFAS

Abbreviation ¹	English	Norwegian	Param. group
PFOA	perfluorooctanoic acid	perfluoroktansyre	PFAS
PFNA	perfluorononanoic acid	perfluornonansyre	PFAS
PFOS	perfluorooctanoic sulfonate	perfluoroktansulfonat	PFAS
PFOSA	perfluorooctanesulfonic acid	perfluoroktansulfon syre	PFAS
NTOT	total organic nitrogen	<i>total organisk nitrogen</i>	I-NUT
CTOT	total organic carbon	<i>total organisk karbon</i>	O-MAJ
CORG	organic carbon	<i>organisk karbon</i>	O-MAJ
GSAMT	grain size	<i>kornfordeling</i>	P-PHY
MOCON	moisture content	<i>vanninnhold</i>	P-PHY
INSTITUTES			
EFDH	Eurofins [DK]	<i>Eurofins [DK]</i>	
FIER	Institute for Nutrition, Fisheries Directorate	<i>Fiskeridirektoratets Ernæringsinstitutt</i>	
FORC	FORCE Institutes, Div. for Isotope Technique and Analysis [DK]	<i>FORCE Institutterne, Div. for Isotopteknik og Analyse [DK]</i>	
GALG	GALAB Laboratories GmbH [D]	<i>GALAB Laboratories GmbH [D]</i>	
IFEN	Institute for Energy Technology	<i>Institutt for energiteknikk</i>	
IMRN	Institute of Marine Research (IMR)	<i>Havforskningsinstituttet</i>	
NACE	Nordic Analytical Center	<i>Nordisk Analyse Center</i>	
NILU	Norwegian Institute for Air Research	<i>Norsk institutt for luftforskning</i>	
NIVA	Norwegian Institute for Water Research	<i>Norsk institutt for vannforskning</i>	
SERI	Swedish Environmental Research Institute	<i>Institutionen för vatten- och luftvårdsforskning</i>	
SIIF	Fondation for Scientific and Industrial Research at the Norwegian Institute of Technology - SINTEF (a division, previously: Center for Industrial Research SI)	<i>Stiftelsen for industriell og teknisk forskning ved Norges tekniske høgskole- SINTEF (en avdeling, tidligere: Senter for industriforskning SI)</i>	
VETN	Norwegian Veterinary Institute	<i>Veterinærinstituttet</i>	
VKID	Water Quality Institute [DK]	<i>Vannkvalitetsinstitutt [DK]</i>	

- 1) After: ICES Environmental Data Reporting Formats. International Council for the Exploration of the Sea. July 1996 and supplementary codes related to non-ortho and mono-ortho PCBs and "dioxins" (ICES pers. comm.)
- 2) Indicates "PAH" compounds that are dicyclic and not truly PAHs typically identified during the analyses of PAH, include naphthalenes and "biphenyls".
- 3) Indicates the sum of tri- to hexacyclic PAH compounds named in EPA protocol 8310 minus naphthalene (dicyclic), so that the SFT classification system can be applied
- 4) Indicates PAH compounds potentially cancerogenic for humans according to IARC (1987, updated 14.August 2007 at <http://monographs.iarc.fr/ENG/Classification/crthgr01.php>), i.e., categories 1, 2A, and 2B (are, possibly and probably carcinogenic). NB.: the update includes Chrysene as cancerogenic and hence, KPAH with Chrysene should not be used in Klif's classification system for this sum-variable (Molvær *et al.* 1997).
- 5) Indicates non ortho- co-planer PCB compounds i.e., those that lack Cl in positions 1, 1', 5, and 5'
- *) The Pesticide Index, second edition. The Royal Society of Chemistry, 1991.

Other abbreviations *andre forkortelser*

	English	Norwegian
TEQ	"Toxicity equivalency factors" for the most toxic compounds within the following groups:	" <i>Toxisitetskvivalentfaktorer</i> " for de giftigste forbindelsene innen følgende grupper.
	<ul style="list-style-type: none"> polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/PCDFs). Equivalents calculated after Nordic model (Ahlborg 1989)¹ or international model (Int./EPA, cf. Van den Berg <i>et al.</i> 1998)² non-ortho and mono-ortho substituted chlorobiphenyls after WHO model (Ahlborg <i>et al.</i> 1994)³ or Safe (1994, cf. NILU pers. comm.) 	<ul style="list-style-type: none"> <i>polykloreerte dibenzo-p-dioksiner og dibenzofuraner (PCDD/PCDF)</i>. <i>Ekvivalentberegning etter nordisk modell (Ahlborg 1989)¹ eller etter internasjonal modell (Int./EPA, cf. Van den Berg et al. 1998)²</i> <i>non-orto og mono-orto substituerte klorobifenylar etter WHO modell (Ahlborg et al. 1994)³ eller Safe (1994, cf. NILU pers. medd.)</i>
ppm	parts per million, mg/kg	<i>deler pr. milliondeler, mg/kg</i>
ppb	parts per billion, µg/kg	<i>deler pr. milliarddeler, µg/kg</i>
ppp	parts per trillion, ng/kg	<i>deler pr. tusen-milliarddeler, ng/kg</i>
d.w.	dry weight basis	<i>tørrvekt basis</i>
w.w.	wet weight or fresh weight basis	<i>våttvekt eller friskvekt basis</i>

¹) Ahlborg, U.G., 1989. Nordic risk assessment of PCDDs and PCDFs. Chemosphere 19:603-608.

²) Van den Berg, Birnbaum, L, Bosveld, A. T. C. and co-workers, 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ Hlth. Perspect. 106:775-792.

³) Ahlborg, U.G., Becking G.B., Birnbaum, L.S., Brouwer, A, Derks, H.J.G.M., Feely, M., Golor, G., Hanberg, A., Larsen, J.C., J.C., Liem, A.K.G., Safe, S.H., Schlatter, C., Wärn, F., Younes, M., Yrjänheikki, E., 1994. Toxic equivalency factors for dioxin-like PCBs. Report on a WHO-ECEH and IPSC consultation, December 1993. Chemosphere 28:1049-1067.

Appendix D

Classification of environmental quality

Table 12. Climate and Pollution Agency environmental classification system of contaminants in blue mussel and fish (Molvær et al. 1997) and proposed revisions (shaded) for Class I concentrations (Knutzen & Green 2001b) used in this report.

Contaminant		Classification (upper limit for Classes I-IV) Degree of pollution				
		I Insignificant	II Moderate	III Marked	IV Severe	V Extreme
Blue mussel						
Lead (Pb)	mg/kg w.w. ²⁾	0.6	3	8	20	>20
	mg/kg d.w.	3	15	40	100	>100
Cadmium (Cd)	mg/kg w.w. ²⁾	0.4	1	4	8	>8
	mg/kg d.w.	2	5	20	40	>40
Copper (Cu)	mg/kg w.w. ²⁾	2	6	20	40	>40
	mg/kg d.w.	10	30	100	200	>200
Mercury (Hg)	mg/kg w.w. ²⁾	0.04	0.1	0.3	0.8	>0.8
	mg/kg d.w.	0.2	0.5	1.5	4	>4
Zinc (Zn)	mg/kg w.w. ²⁾	40	80	200	500	>500
	mg/kg d.w.	200	400	1000	2500	>2500
TBT ¹⁾	mg/kg d.w.	0.1	0.5	2	5	>5
ΣPCB-7	µg/kg w.w.	3 ⁵⁾	15	40	100	>100
	µg/kg d.w. ²⁾	15 ²⁾	75	200	500	>500
ΣDDT	µg/kg w.w.	2	5	10	30	>30
	µg/kg d.w. ²⁾	10	25	50	150	>150
ΣHCH	µg/kg w.w.	1	3	10	30	>30
	µg/kg d.w. ²⁾	5	15	50	150	>150
HCB	µg/kg w.w.	0.1	0.3	1	5	>5
	µg/kg d.w. ²⁾	0.5	1.5	5	25	>25
ΣPAH	µg/kg w.w.	50	200	2000	5000	>5000
	µg/kg d.w. ²⁾	250	1000	10000	25000	>25000
ΣKPAH	µg/kg w.w.	10	30	100	300	>300
	µg/kg d.w. ²⁾	50	150	500	1500	>1500
B[a]P	µg/kg w.w.	1	3	10	30	>30
	µg/kg d.w. ²⁾	5	15	50	150	>150
TE _{PCDF/D} ³⁾	µg/t ⁴⁾ w.w.	0.2	0.5	1.5	3	>3
Cod, fillet						
Mercury (Hg)	mg/kg w.w.	0.1	0.3	0.5	1	>1
ΣPCB-7	µg/kg w.w.	3 ⁶⁾	20	50	150	>150
ΣDDT	µg/kg w.w.	1	3	10	25	>25
ΣHCH	µg/kg w.w.	0.3 ⁷⁾	2	5	15	>15
HCB	µg/kg w.w.	0.2	0.5	2	5	>5
TE _{PCDF/D}	ng/kg w.w.	< 0.1	0.3	1	2	> 2
Cod, liver						
ΣPCB-7	µg/kg w.w.	500	1500	4000	10000	>10000
ΣDDT	µg/kg w.w.	200 ⁸⁾	500	1500	3000	>3000
ΣHCH	µg/kg w.w.	30 ⁹⁾	200	500	1000	>1000
HCB	µg/kg w.w.	20	50	200	400	>400
TE _{PCDF/D} ³⁾	µg/t ⁴⁾ w.w.	10 ¹⁰⁾	40	100	300	>300
Flounder, fillet						
ΣPCB-7	µg/kg w.w.	<5	20	50	150	>150
ΣDDT	µg/kg w.w.	<2	4	15	40	>40
ΣHCH	µg/kg w.w.	<1	3	10	30	>30
HCB	µg/kg w.w.	<0.2	0.5	2	5	>5
TE _{PCDF/D}	ng/kg w.w.	<0.1	0.3	1	3	>3

¹⁾ Tributyltin on a formula basis

²⁾ Conversion assuming 20% dry weight

³⁾ TCDDN (Appendix C)

⁴⁾ µg/1000 kg (Appendix C)

⁵⁾ Blue mussel - ΣPCB7: Decrease limit from 4 to 3

⁶⁾ Cod fillet - ΣPCB7: Decrease limit from 5 to 3

⁷⁾ Cod fillet - ΣHCH: Decrease limit from 0.5 to 0.3

⁸⁾ Cod liver - ΣDDT: Proposal to either increase limit from 200 to 300 or, preferably, replace ΣDDT with p,p'-DDE and keep the limit (Knutzen & Green 2001b)

⁹⁾ Cod liver - ΣHCH: Decrease limit from 50 to 30

¹⁰⁾ Cod liver: TEPCDD/PCDF: Decrease limit from 0.015 to 0.010

Table 13. Provisional "high background levels" of selected contaminants, in **mg/kg dry weight** (blue mussel) and **mg/kg wet weight** (blue mussel and fish) used in this report. The respective "high background" limits are from Knutzen & Skei (1990) with mostly minor adjustments (Knutzen & Green 1995, 2001b; Molvær et al. 1997), except for dab where the suggested limit is based on CEMP-data (Knutzen & Green 1995). Especially uncertain values are marked with "?".

Cont.	Blue mussel ¹		Cod ¹		Flounder ¹		Dab ¹		Plaice ¹	
			liver	fillet	liver	fillet	liver	fillet	liver	fillet
	mg/kg d.w.	mg/kg w.w.	mg/kg w.w.	mg/kg w.w.	mg/kg w.w.	mg/kg w.w.	mg/kg w.w.	mg/kg w.w.	mg/kg w.w.	mg/kg w.w.
Lead	3.0 ²⁾	0.6 ³⁾	0.1		0.3 ?		0.3 ?		0.2 ?	
Cadmium	2.0 ²⁾	0.4 ³⁾	0.3		0.3 ?		0.3 ?		0.2 ?	
Copper	10 ²⁾	2 ³⁾	20		10 ?		30 ?		10 ?	
Mercury	0.2 ²⁾	0.04 ³⁾		0.1 ²⁾		0.1		0.1		0.1
Zinc	200 ²⁾	40 ³⁾	30		50 ?		60 ?		50 ?	
ΣPCB-7⁸⁾	0.015 ^{3,9)}	0.003 ^{2,9)}	0.50 ²⁾	0.003 ⁹⁾	0.1	0.003 ⁹⁾	0.5	0.005 ⁹⁾	0.05 ?	0.004 ⁹⁾
ppDDE	0.010 ³⁾	0.002 ⁶⁾	0.2 ⁹⁾		0.03	0.001 ⁹⁾	0.1	0.002 ⁹⁾	0.01 ? ⁶⁾	0.001 ⁹⁾
γ HCH	0.005 ³⁾	0.001 ⁶⁾	0.03 ⁹⁾	0.0003 ⁹⁾	0.01	0.0003 ⁹⁾	0.03	0.0005 ⁹⁾	0.005 ? ⁶⁾	0.0003 ⁹⁾
HCB	0.0005 ³⁾	0.0001 ²⁾	0.02 ²⁾		0.005	0.0001 ⁹⁾	0.01	0.0002 ⁹⁾	0.005 ?	0.0002 ⁹⁾
TCDDN	0.000001 ³⁾		0.00001 ⁹⁾							
	0.0000002 ²⁾									

¹⁾ Respectively: *Mytilus edulis*, *Gadus morhua*, *Platichthys flesus* and *Limanda limanda*

²⁾ From the Norwegian Pollution Control Authority Environmental Class I ("good") (Molvær et al. 1997)

³⁾ Conversion assuming 20% dry weight

⁴⁾ Approximately 25% of ΣPCB-7 (Knutzen & Green 1995)

⁵⁾ 1.5-2 times 75% quartile (cf. Annex B in Knutzen & Green 1995)

⁶⁾ Assumed equal to limit for ΣDDT or ΣHCH, respectively, from the Norwegian Pollution Control Authority Environmental Class I ("good") (Molvær et al. 1997). Hence, limits for ppDDE and γHCH are probably too high (lacking sufficient and reliable reference values)

⁷⁾ Mean plus 2 times standard deviation (cf. Annex B in Knutzen & Green 1995)

⁸⁾ Estimated as sum of 7 individual PCB compounds (CB-28, -52, -101, -118, -138, -153 and -180) and assumed to be ca. 50% and 70% of total PCB for blue mussel and cod/flatfish, respectively

⁹⁾ Flounder liver: Decrease limit from 5 to 3 and from 2 to 1 for ΣPCB7 and p,p-DDE, respectively, with regard to revisions suggested by Knutzen & Green (2001b) and Green & Knutzen (2003)

Appendix E
Summary of action taken by Norwegian Food
Safety Authority

Table 14. Summary of action taken by the Norwegian Food Safety Authority (Mattilsynet) concerning the consumption and sale of fish products along the Norwegian Coast (see www.miljostatus.no > tema/Hav-og-vann/pavikninger-pa-livet-i-vann > miljøgifter_vann > miljøgifter_marint > kostholdsrad and review by Økland 2005). Restrictions on sale vary and may concern the whole or part of fish product.

Area of concern (km ²)	Main parameters of concern	Last year of issue/adjustment	Main fish/shellfish product of concern	Recommendations or restrictions of concern:
Mid ¹⁾ and Inner Oslofjord (498.9) (includes Drammensfj.)	PCB	2002	fish liver, eel	Consumption
Tønsberg area (23.7) (includes (Vrengen)	PCB	2003	fish liver, eel, mussels	Consumption
Inner Sandefjordfjord (1.5)	PCB	1999	fish liver	Consumption
Grenland fjords, Langesundsfjord (90.3)	Chl.org ^{2)/} Dioxins	2004	fish, shellfish	Consumption
Kragerø (3.2)	PAH Dioxins	2002	eel, mussels	Consumption
Tvedestrand (2.3)	PCB	2000	fish liver	Consumption
Arendal (8.0)	PCB	2000	fish liver	Consumption
Inner Kristiansandsfjord (33.3)	Chl.org ^{2)/} Dioxins/PCB	2000	fish, shellfish	Consumption
Farsund area (42.0)	PCB PAH	2000	fish liver, mussels	Consumption
Fedafjord (11.2)	PAH	2002	mussels	Consumption
Fedje	Hg	2010	fish, shellfish	Consumption
Flekkefjord (4.2)	PCB	2000	fish liver	Consumption
Stavanger (4.0)	PCB PAH	2001	fish liver, mussels	Consumption
Sandnes (1.7)	PAH	2001	mussels	Consumption
Karmsund-Eidsbotn, Vedavågen (24.1 ⁶⁾)	PCB, PAH	2005	fish liver ³⁾ , shellfish	Consumption
Saudafjord (16.6 ⁷⁾)	PAH	2007	fish liver, mussels	Consumption
Sørfjord (62.2)	Cd Pb Hg PCB	2005	fish, shellfish	Consumption
Bergen area (169.9)	PCB Hg	2008	fish, shellfish	Consumption
Høyangerfjorden (10.2 ⁷⁾)	Cd Pb	2008	fish liver, shellfish	Consumption
Årdalsfjord (30.4)	PAH	2002	mussels	Consumption
Åsefjorden/Ellingsøyfjorden (8 ⁷⁾)	HBCDD ⁴⁾ Hg	2006/2007	fish, shellfish	Consumption
Sunnalsfjord (100.1)	PAH	2005	fish liver, mussels	Consumption
Hommelvik (2.6)	PAH	1985	mussels	Consumption
Inner Trondheimfjorden (1.2)	PAH PCB	2002	fish liver, mussels	Consumption
Brønnøysund (7.0)	PAH	2003	mussels	Consumption
Vefsnfjord (76.4) ⁵⁾				
Sandnessjøen (0.4)	PAH	2005	mussels	Consumption
Inner Ranfjord (16.6)	PAH	2005	mussels	Consumption
Ramsund (5.4)	PCB	2000	fish, shellfish	Consumption
Harstad (2.9)	PCB Pb Cd	2003	fish liver, mussels	Consumption
Narvik (11.6)	PCB PAH	2005	fish liver, mussels	Consumption
Tromsø (17.7)	PAH	2006	fish liver, mussels	Consumption
Hammerfest (4.1)	PAH	2003	mussels	Consumption
Honningsvåg (3.3)	PAH	2000	mussels	Consumption

¹⁾ Includes, Hvitsten, Moss, Horten og Holmenstrand

²⁾ Organochlorine compounds

³⁾ Concerns only Eidsbotn

⁴⁾ A brominated flame retardant

⁵⁾ Grounds for concern were cleared in 2005

⁶⁾ Exclusive Vedavågen

⁷⁾ Estimated from map shown in www.miljostatus.no

Appendix F

Overview of localities and sample count for biota 1981-2009

Nominal station positions are shown on maps in Appendix G

jmpco: CEMP area code (J99 = unclassified)
jmpst: station code
stnam: station name
nom_lon: Longitude (nominal)
nom_lat: Latitude (nominal)
speci: species code (English, Norwegian (Latin))
MYTI EDU - blue mussel, blåskjell (*Mytilus edulis*)
NUCE LAP - dogwhelk, purpursnegl (*Nucella lapillus*)
BROS BRO - tusk, brosme (*Brosme brosme*)
CHIM MON - rat fish, havmus (*Chimaera monstrosa*)
GADU MOR - Atlantic cod, torsk (*Gadus morhua*)
LEPI WHI - megrim, glassvar (*Lepidorhombus whiffiagonis*)
LIMA LIM - dab, sandflyndre (*Limanda limanda*)
MICR KIT - lemon sole, lomre (*Microstomus kitt*)
MOLV MOL - ling, lange (*Molva molva*)
PAND BOR - shrimp, reker (*Pandalus borealis*)
PLAT FLE - flounder, skrubbe (*Platichthys flesus*)
PLEU PLA - plaice, rødspette (*Pleuronectes platessa*)
tissu: tissue:
SB - soft body
LI - liver
MU - fillet
TM - tail muscle

STATIONS AND SAMPLE COUNT FOR BIOTA

impst	Station Name	Latitude	Longitude	speci	tissu	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	
01A	Sponvika	59.088	11.226	MYTI EDU	SB		3			3					3																		3	3	
02A	Fuoleskiær	59.115	10.983	MYTI EDU	SB		3			3					3																		2	3	
03A	Tisler	58.980	10.958	MYTI EDU	SB		2			3					3																		3	3	
10A1	Skaoodden	70.104	30.262	MYTI EDU	SB															3	3														
10A2	Skallneset	70.104	30.262	MYTI EDU	SB																4	3	3	3	3	3	3	3	3	3	3	3	3		
10B	Varangerfjorden	69.933	29.667	BROS BRO	LI																														
10B	Varangerfjorden	69.933	29.667	BROS BRO	MU																														
10B	Varangerfjorden	69.933	29.667	GADU MOR	BI																					22	21								
10B	Varangerfjorden	69.933	29.667	GADU MOR	BL																					25	25								
10B	Varangerfjorden	69.933	29.667	GADU MOR	LI																														
10B	Varangerfjorden	69.933	29.667	GADU MOR	MU																														
10F	Skogerøy	69.917	29.850	PLEU PLA	BI																														
10F	Skogerøy	69.917	29.850	PLEU PLA	BL																														
10F	Skogerøy	69.917	29.850	PLEU PLA	LI																														
10F	Skogerøy	69.917	29.850	PLEU PLA	MU																														
10G3	Vardø	70.378	31.108	NUCE LAP	SB																														
10G4	Vadsø	70.075	29.715	NUCE LAP	SB																														
11A1	Sildkrokneset (south)	69.785	30.185	MYTI EDU	SB																														
11A2	Sildkrokneset (north)	69.785	30.185	MYTI EDU	SB																														
11G	Brashavn	69.899	29.744	NUCE LAP	SB																														
11X	Brashavn	69.899	29.744	MYTI EDU	SB																														
131G	Lastad	58.056	7.709	NUCE LAP	SB																														
13A	Lanøesund	57.998	7.577	MYTI EDU	SB																														
13BH	Kristiansand harbour	58.135	7.988	GADU MOR	LI																														
13BH	Kristiansand harbour	58.135	7.988	GADU MOR	MU																														
145B	Andøya	69.254	16.170	GADU MOR	LI																														
145B	Andøya	69.254	16.170	GADU MOR	MU																														
146B	Bjørnøya	73.830	19.920	GADU MOR	LI																														
146B	Bjørnøya	73.830	19.920	GADU MOR	MU																														
147B	Svalbard	78.170	13.457	GADU MOR	LI																														
147B	Svalbard	78.170	13.457	GADU MOR	MU																														
14A	Aaviken	58.033	7.216	MYTI EDU	SB																														
15A	Gåsey (Ullørø)	58.048	6.895	MYTI EDU	SB																														
15B	Ullørø area	58.050	6.717	GADU MOR	BI																														
15B	Ullørø area	58.050	6.717	GADU MOR	BL																														
15B	Ullørø area	58.050	6.717	GADU MOR	LI																														
15B	Ullørø area	58.050	6.717	GADU MOR	MU																														
15C	Gåsey (Ullørø)	57.988	7.244	PAND BOR	TM																														
15F	Ullørø area	58.050	6.717	LIMA LIM	BI																														
15F	Ullørø area	58.050	6.717	LIMA LIM	BL																														
15F	Ullørø area	58.050	6.717	LIMA LIM	LI																														
15F	Ullørø area	58.050	6.717	LIMA LIM	MU																														
15F	Ullørø area	58.050	6.717	MICR KIT	LI																														
15F	Ullørø area	58.050	6.717	MICR KIT	MU																														
15F	Ullørø area	58.050	6.717	PLEU PLA	LI																														
15F	Ullørø area	58.050	6.717	PLEU PLA	MU																														
15G	Gåsey (Ullørø)	58.050	6.896	NUCE LAP	MU																														
15G	Gåsey (Ullørø)	58.050	6.896	NUCE LAP	SB																														
21D	Akraford	59.800	6.183	BROS BRO	LI																														
21D	Akraford	59.800	6.183	BROS BRO	MU																														
21D	Akraford	59.800	6.183	CHIM MON	LI																														
21D	Akraford	59.800	6.183	CHIM MON	MU																														
21D	Akraford	59.800	6.183	MOLV MOL	LI																														
21D	Akraford	59.800	6.183	MOLV MOL	MU																														
21F	Akraford	59.750	6.117	LEPI WHI	LI																														
21F	Akraford	59.750	6.117	LEPI WHI	MU																														
21F	Akraford	59.750	6.117	LIMA LIM	LI																														
21F	Akraford	59.750	6.117	LIMA LIM	MU																														
21F	Akraford	59.750	6.117	PLAT FLE	BI																														
21F	Akraford	59.750	6.117	PLAT FLE	BL																														
21F	Akraford	59.750	6.117	PLAT FLE	LI																														
21F	Akraford	59.750	6.117	PLAT FLE	MU																														
220G	Smørstakk	59.252	5.352	NUCE LAP	SB																														
221A	Stangeland	59.277	5.328	MYTI EDU	SB																														
221G	Stangeland	59.270	5.330	NUCE LAP	SB																														
222A	Kopervik harbour	59.283	5.316	MYTI EDU	SB																														
224G	Hegeleien	59.416	5.232	NUCE LAP	SB																														
226G	Karmsund bridge (east)	59.378																																	

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Impst	Station Name	Latitude	Longitude	speci	tissu	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009				
22F	Borøyfjorden	59.710	5.330	LIMA LIM	LI										5	5	4		5	2																		
22F	Borøyfjorden	59.710	5.330	LIMA LIM	MU										5	5	4		5	2																		
22F	Borøyfjorden	59.710	5.330	MICR KIT	LI													5																				
22F	Borøyfjorden	59.710	5.330	MICR KIT	MU													5																				
22F	Borøyfjorden	59.710	5.330	PLEU PLA	LI																5	5	5															
22F	Borøyfjorden	59.710	5.330	PLEU PLA	MU																5	5	5															
22G	Espevær (west)	59.584	5.144	NUCE LAP	SB																					1	1	1	2	2	2	2	2	2	2			
23A	Austvik	59.870	5.108	MYTI EDU	SB										3	3																						
23B	Karihavet area	59.900	5.133	GADU MOR	BI																22	23	24	23	25	25	25	24	25	25	25	25	25	25	25			
23B	Karihavet area	59.900	5.133	GADU MOR	BL																25	25	25	24	25	25	25	25	25	25	25	25	25	25	25			
23B	Karihavet area	59.900	5.133	GADU MOR	LI										25	25	25	25	26	25	26	25	25	25	25	25	25	25	25	25	25	25	25	25	25			
23B	Karihavet area	59.900	5.133	GADU MOR	MU										30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30			
23F	Karihavet area	59.900	5.133	MICR KIT	LI													1	4																			
23F	Karihavet area	59.900	5.133	MICR KIT	MU													1	4																			
23F	Karihavet area	59.900	5.133	PLAT FLE	LI													1																				
23F	Karihavet area	59.900	5.133	PLAT FLE	MU													1																				
23F	Karihavet area	59.900	5.133	PLEU PLA	LI													3																				
23F	Karihavet area	59.900	5.133	PLEU PLA	MU													3																				
24A	Vardøy	60.171	5.010	MYTI EDU	SB										3	3																						
24G	Vardøy	60.171	5.010	NUCE LAP	SB																																	
25A	Hinnøv	61.370	4.879	MYTI EDU	SB													3	3																			
25G	Hinnøv	61.370	4.879	NUCE LAP	SB													2																				
26A	Hammen	61.876	5.222	MYTI EDU	SB													6	3																			
26G	Hammen	61.875	5.222	NUCE LAP	SB													2																				
27A	Grinden	62.202	5.421	MYTI EDU	SB													2																				
27G	Røydeskjær	62.183	5.740	NUCE LAP	SB													2																				
27H	Storholmen	62.190	5.393	NUCE LAP	SB													2																				
28A	Eiksundet	62.252	5.864	MYTI EDU	SB													6	3																			
28G	Grønevikholmen (Eiksundet)	62.247	5.883	NUCE LAP	SB													2																				
28H	Øveråneset (Hareid)	62.362	6.078	NUCE LAP	SB													2																				
302	Ormøva	59.878	10.758	MYTI EDU	SB													2																				
303	Malmøva	59.863	10.766	MYTI EDU	SB													2																				
304	Gåsøva	59.851	10.589	MYTI EDU	SB													3																				
305	Lysaker	59.906	10.643	MYTI EDU	SB													2																				
306	Høyva	59.713	10.555	MYTI EDU	SB													2																				
30A	Gressholmen	59.882	10.712	MYTI EDU	SB										3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
30B	Oslo City area	59.799	10.560	GADU MOR	BI																																	
30B	Oslo City area	59.799	10.560	GADU MOR	BL																																	
30B	Oslo City area	59.799	10.560	GADU MOR	LI										29	25	25	25	25	25	50	20	27	23	23	25	25	25	25	25	25	25	25	25	25	25		
30B	Oslo City area	59.799	10.560	GADU MOR	MU										29	25	25	26	26	30	30	60	60	60	30	30	30	30	30	30	30	30	30	30	30	30		
30C	Oslo City area	59.817	10.550	PAND BOR	TM										1			2																				
30F	Oslo City area	59.783	10.567	PLEU PLA	LI													2			5	5																
30F	Oslo City area	59.783	10.567	PLEU PLA	MU													2			5	5																
30J	Spro	59.799	10.560	PAND BOR	TM																																	
30K	Storegrunn	59.799	10.560	PAND BOR	TM																																	
30X	West of Nesodden	59.808	10.600	GADU MOR	LI																																	
30X	West of Nesodden	59.808	10.600	GADU MOR	MU																																	
31A	Solberstrand	59.619	10.650	MYTI EDU	SB																																	
31B	Solberstrand	59.615	10.640	GADU MOR	LI										2																							
31B	Solberstrand	59.615	10.640	GADU MOR	MU										10																							
31C	Solberstrand	59.615	10.640	PAND BOR	TM																																	
31F	Solberstrand	59.615	10.640	PLAT FLE	LI																																	
31F	Solberstrand	59.615	10.640	PLAT FLE	MU																																	
32A	Redtangen	59.525	10.427	MYTI EDU	SB																																	
33C	Sande	59.528	10.350	PAND BOR	TM																																	
33F	Sande (east side)	59.528	10.350	PLAT FLE	LI																																	
33F	Sande (east side)	59.528	10.350	PLAT FLE	MU																																	
33X	Sande (west side)	59.528	10.340	PLAT FLE	LI																																	
33X	Sande (west side)	59.528	10.340	PLAT FLE	MU																																	
35A	Mølen	59.488	10.498	MYTI EDU	SB																																	
35C	Mølen-Moss	59.483	10.529	PAND BOR	TM																																	
35C	Mølen-Moss	59.483	10.529	PAND BOR	XX																																	
36A	Færder	59.027	10.526	MYTI EDU	SB																																	

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Impst	Station Name	Latitude	Longitude	speci	tissu	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009		
98B1	Bjørnerøva (east)	68.247	14.803	GADU MOR	MU												30	29	30	29	30	30	30	30												
98B2	Austnesfjorden	68.247	14.803	GADU MOR	BI																					14	22									
98B2	Austnesfjorden	68.247	14.803	GADU MOR	BL																					5	25									
98B2	Austnesfjorden	68.247	14.803	GADU MOR	LI																					25	25									
98B2	Austnesfjorden	68.247	14.803	GADU MOR	MU																					30	30									
98F1	Bjørnerøva (east)	68.219	14.808	GLYP CYN	LI																															
98F1	Bjørnerøva (east)	68.219	14.808	GLYP CYN	MU																															
98F1	Bjørnerøva (east)	68.219	14.808	LIMA LIM	LI																															
98F1	Bjørnerøva (east)	68.219	14.808	LIMA LIM	MU																															
98F1	Bjørnerøva (east)	68.219	14.808	MICR KIT	LI																															
98F1	Bjørnerøva (east)	68.219	14.808	MICR KIT	MU																															
98F1	Bjørnerøva (east)	68.219	14.808	PLEU PLA	LI																															
98F1	Bjørnerøva (east)	68.219	14.808	PLEU PLA	MU																															
98F2	Husholmen	68.219	14.808	PLEU PLA	BI																															
98F2	Husholmen	68.219	14.808	PLEU PLA	BL																															
98F2	Husholmen	68.219	14.808	PLEU PLA	LI																															
98F2	Husholmen	68.219	14.808	PLEU PLA	MU																															
98G	Svolvær area	68.249	14.663	NUCE LAP	SB																															
98X	Skrova harbour	68.165	14.659	MYTI EDU	SB																															
99A	Brunvær	68.005	15.093	MYTI EDU	SB																															
I001	Spoonvikskansen	59.090	11.210	MYTI EDU	SB																															
I011	Kråkenebbet	59.101	11.289	MYTI EDU	SB																															
I021	Kjøke (south)	59.130	10.952	MYTI EDU	SB																															
I022	West Damholmen	59.102	11.045	MYTI EDU	SB																															
I023	Singlekalven (south)	59.095	11.137	MYTI EDU	SB																															
I024	Kirkøy (north west)	59.080	10.986	MYTI EDU	SB																															
I080	Østmerknes	63.457	10.450	MYTI EDU	SB																															
I131A	Lastad	58.056	7.709	MYTI EDU	SB																															
I132	Svensholmen	58.125	7.989	MYTI EDU	SB																															
I1321	Fiskåtangen	58.128	7.977	MYTI EDU	SB																															
I133	Odderø (west)	58.132	8.002	MYTI EDU	SB																															
I201	Ekklegrunn (G1)	59.643	6.357	MYTI EDU	SB																															
I205	Bølsnes (G5)	59.592	6.300	MYTI EDU	SB																															
I241	Nordnes	60.401	5.302	MYTI EDU	SB																															
I242	Gravdalsneset	60.395	5.287	MYTI EDU	SB																															
I243	Heorøneset	60.415	5.305	MYTI EDU	SB																															
I301	Akershuskaia	59.905	10.736	MYTI EDU	SB																															
I304	Gåseya	59.851	10.589	MYTI EDU	SB																															
I306	Håøya	59.713	10.555	MYTI EDU	SB																															
I307	Ramtonholmen	59.744	10.523	MYTI EDU	SB																															
I711	Steinholmen	59.052	9.677	MYTI EDU	SB																															
I712	Gjemsholmen	59.045	9.707	MYTI EDU	SB																															
I713	Strømtangen	59.050	9.692	MYTI EDU	SB																															
I911	Horvika	62.735	8.523	MYTI EDU	SB																															
I912	Honnhammer	62.853	8.162	MYTI EDU	SB																															
I913	Fløseid	62.810	8.275	MYTI EDU	SB																															
I914	Flåøya (southeast)	62.756	8.445	MYTI EDU	SB																															
I915	Flåøya (northwest)	62.758	8.440	MYTI EDU	SB																															
I916	Sundalsfjord (Hydro kai)	62.684	8.552	MYTI EDU	SB																															
I962	Koksverktomta (B2)	66.326	14.140	MYTI EDU	SB																															
I964	Toraneskaia (B4)	66.319	14.128	MYTI EDU	SB																															
I965	Moholmen (B5)	66.312	14.126	MYTI EDU	SB																															
I969	Bjørnbaerviken (B9)	66.280	14.035	MYTI EDU	SB																															
R096	Breiviken (Tomma)	66.294	12.841	MYTI EDU	SB																															

Appendix G

Map of stations




















Nominal station positions 1981-2009
(cf. Appendix H and Appendix L)

Appendix G (cont.) Map of stations

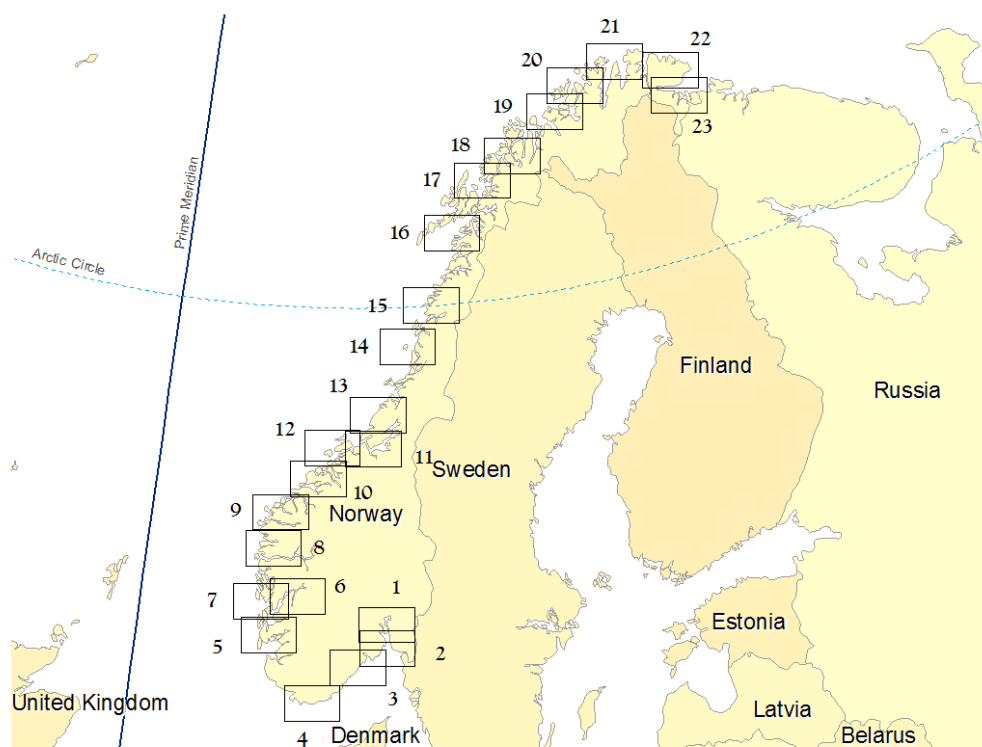
NOTES

The station's nominal position is plotted, and not the specific positions that may have differed from one year to another. The maps are generated using ArcGIS version 9.1.

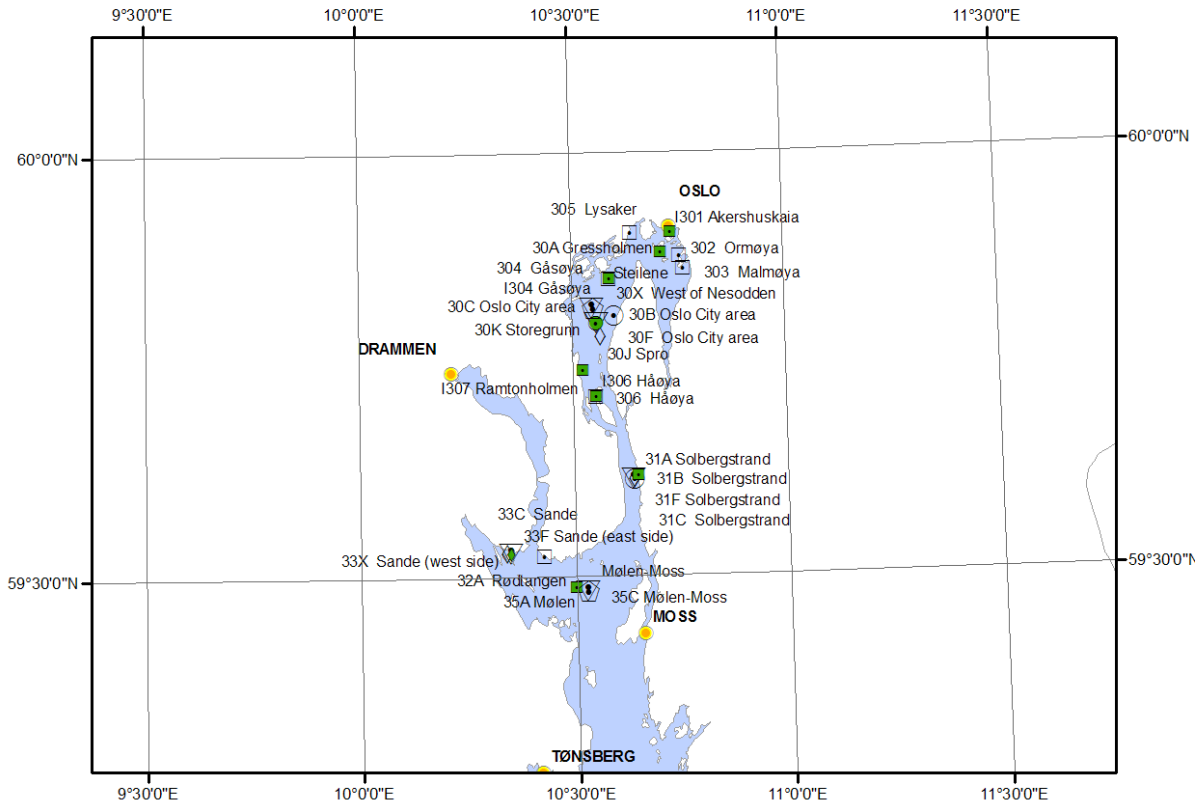
The following symbols and codes apply:

All years	2009	Explanation	Station code
		Sediment	<number>S
		Blue mussel	<number>A
		Blue mussel	I<number/letter> ¹⁾
		Blue mussel	R<number/letter> ¹⁾
		Dogwhelk	<number>F
		Prawn	<number>C
		Atlantic cod	<number>A
		Flatfish	<number>D/E
		Other round fish	
		Town or city	

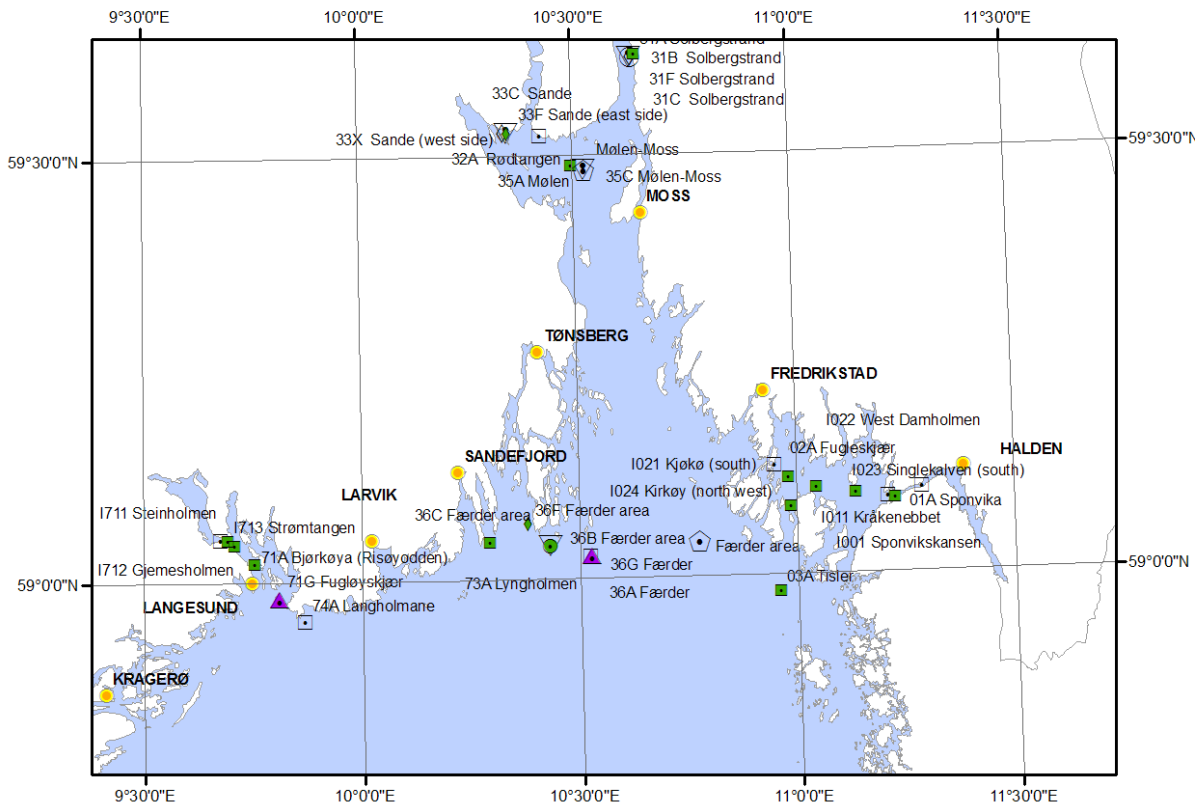
1) Supplementary station used in Klif blue mussel pollution (I) or reference (R) index (cf. Appendix L).



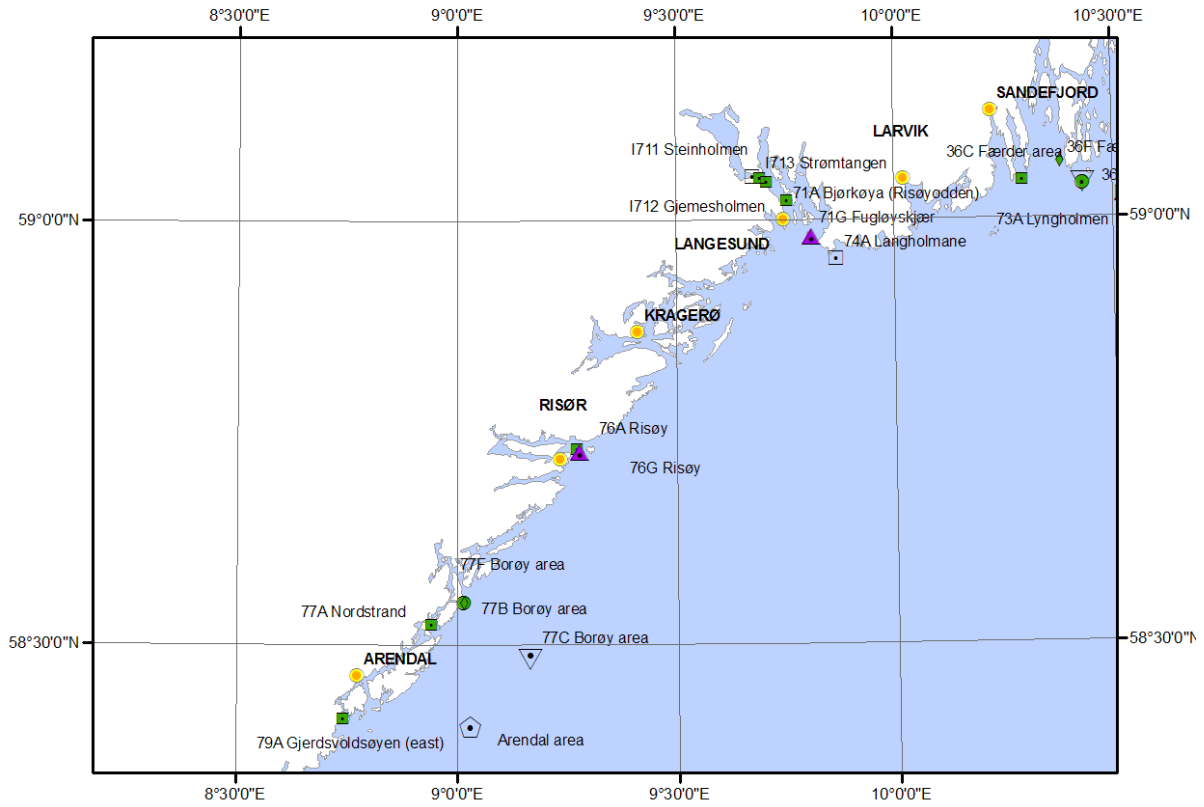
CEMP stations Norway. Numbers indicate map reference that follow.
Note: distance between two lines of latitude is 15 nautical miles (= 27.8 km).



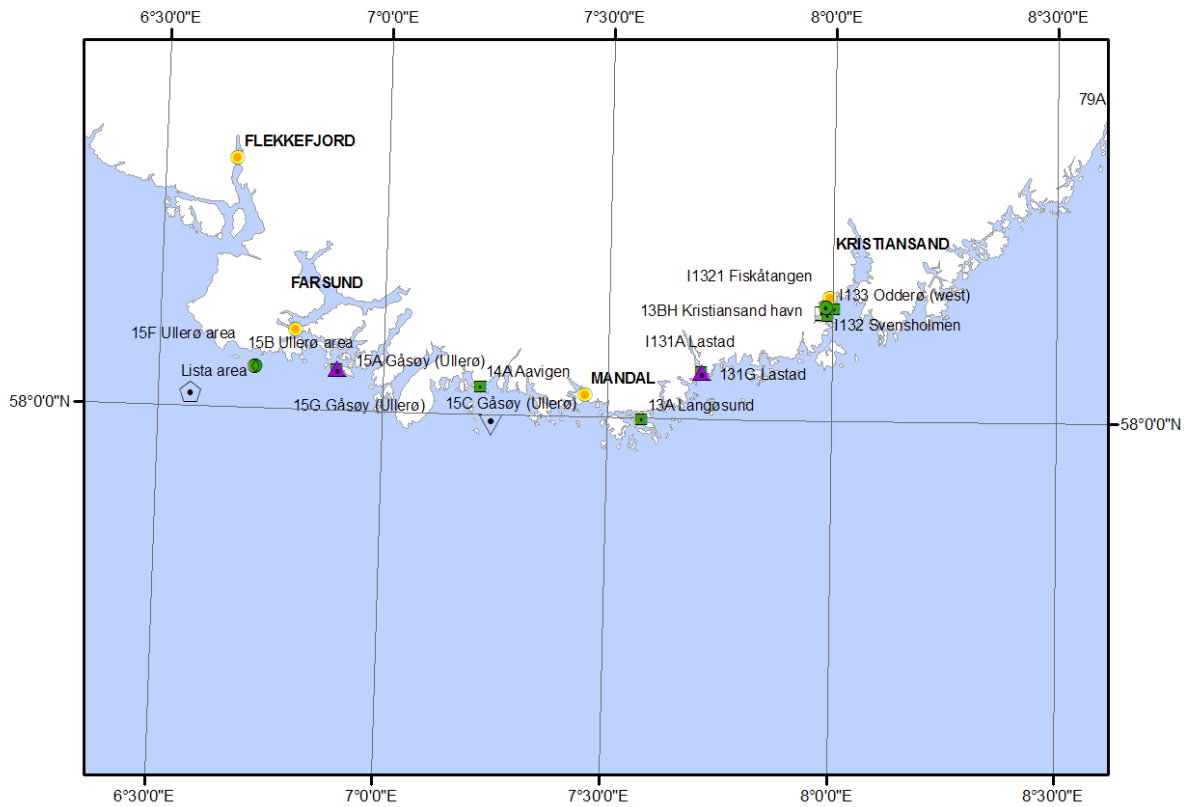
MAP 1



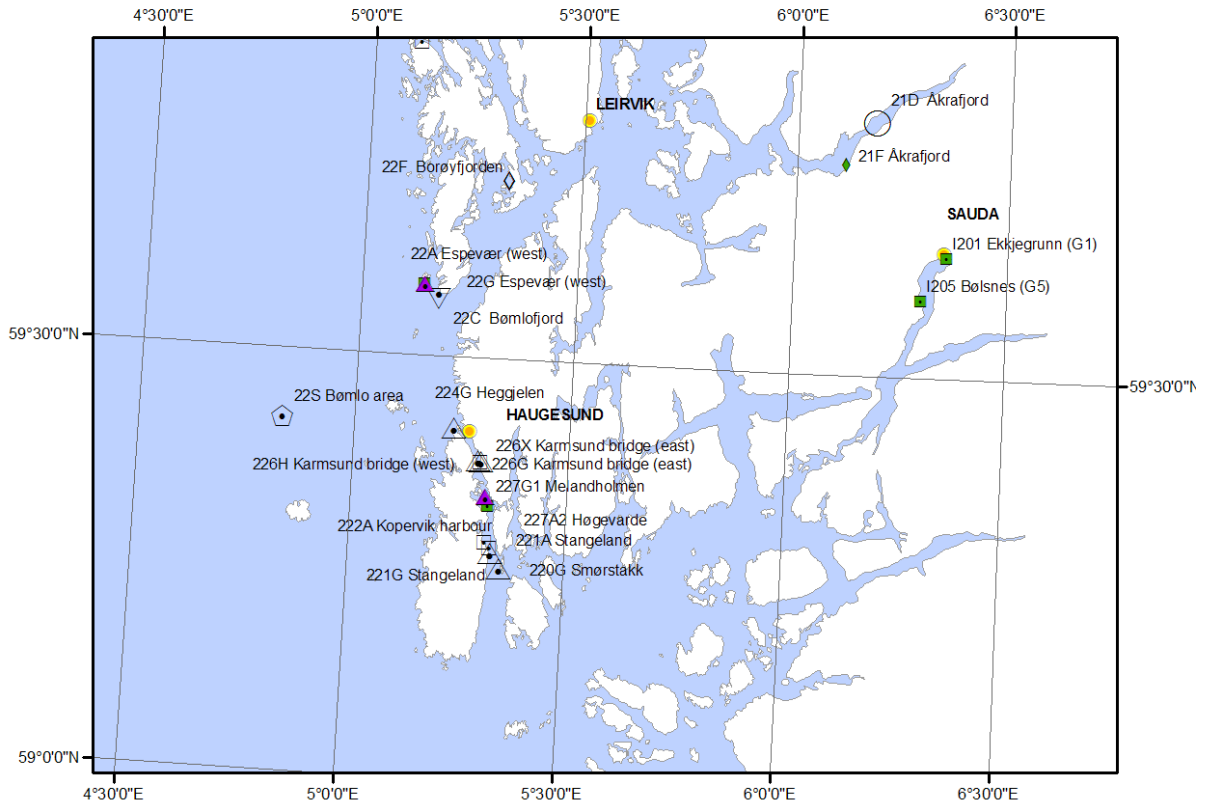
MAP 2



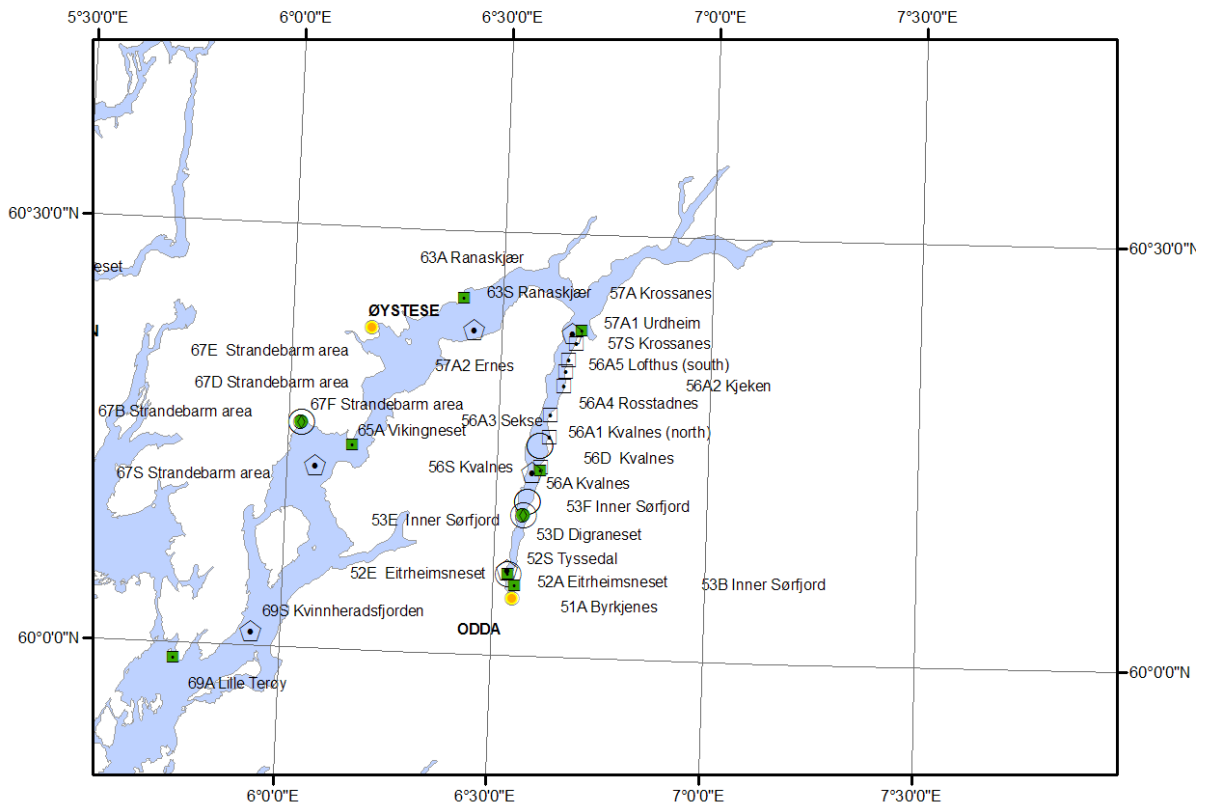
MAP 3



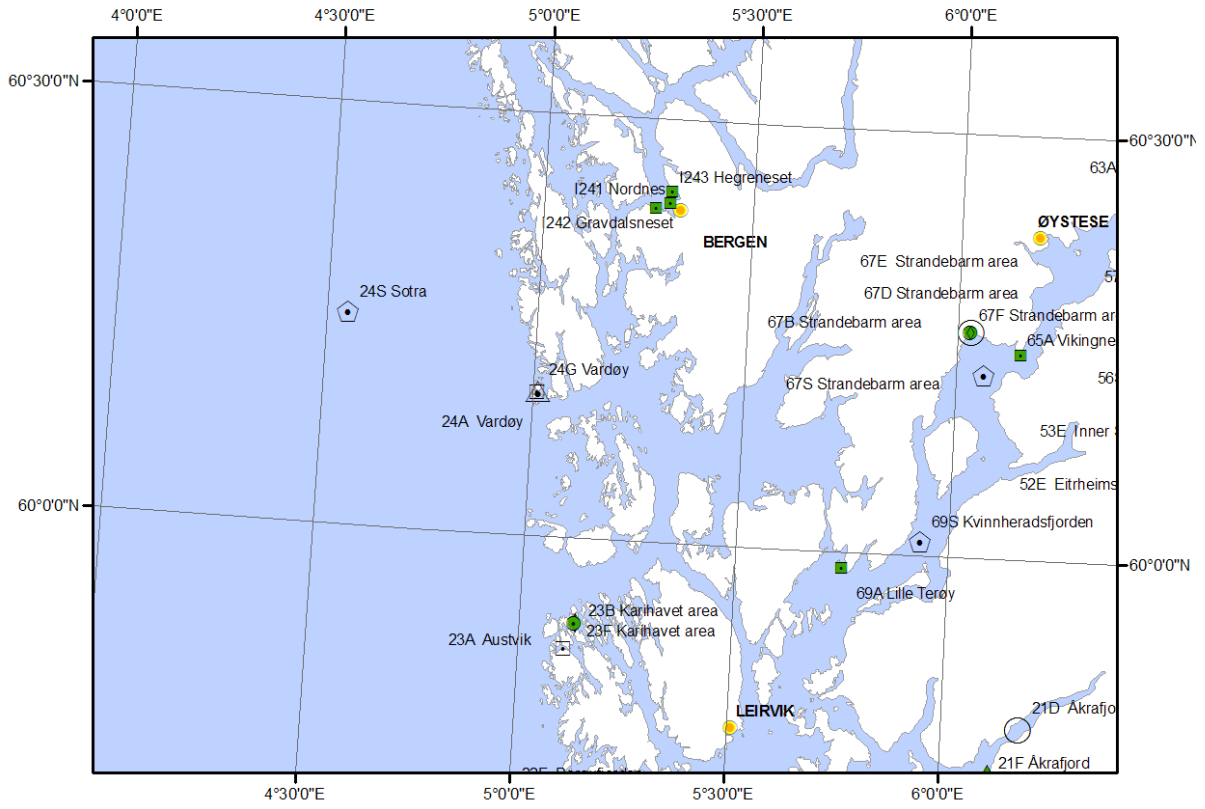
MAP 4



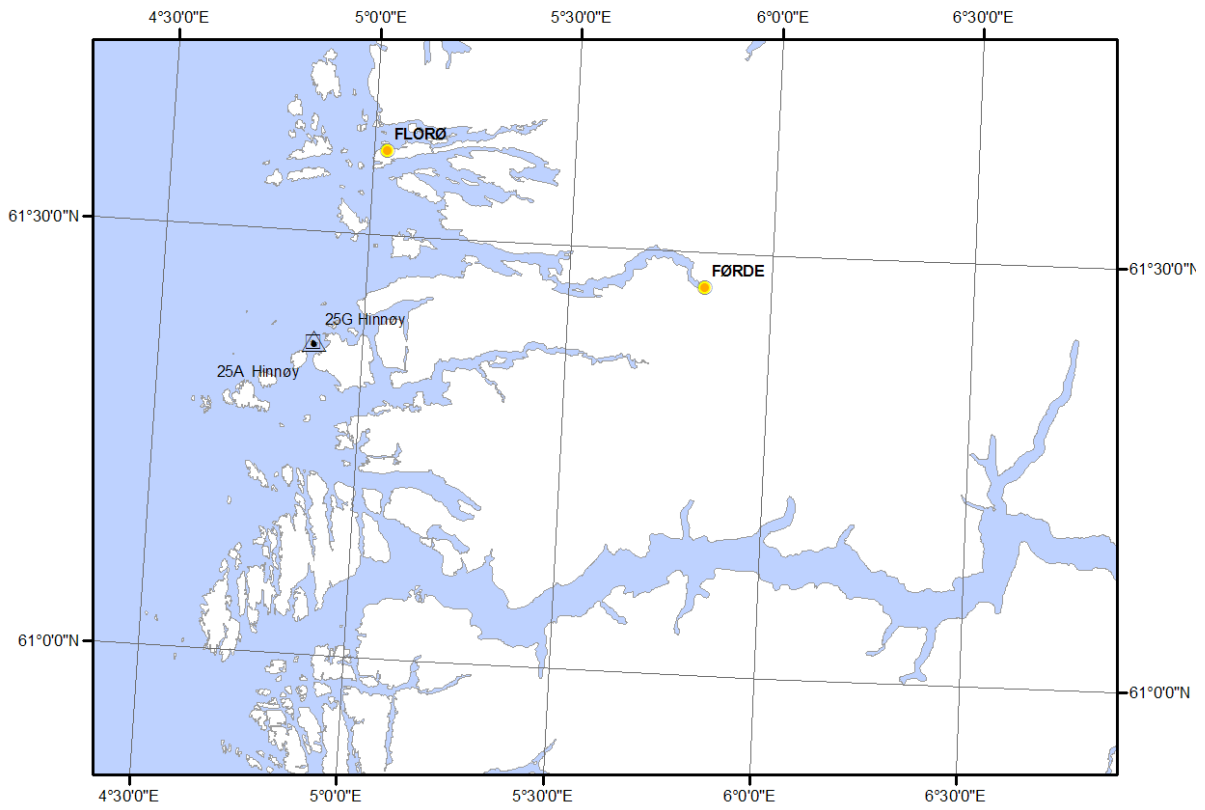
MAP 5



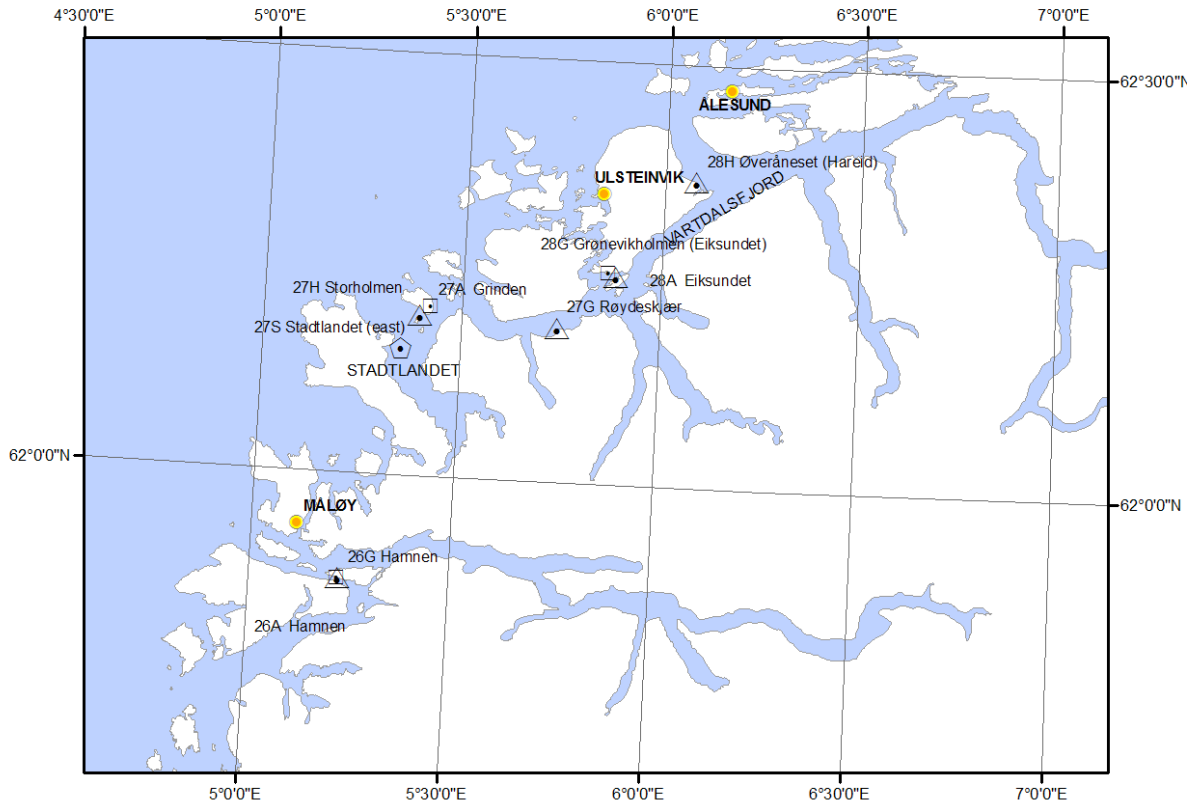
MAP 6



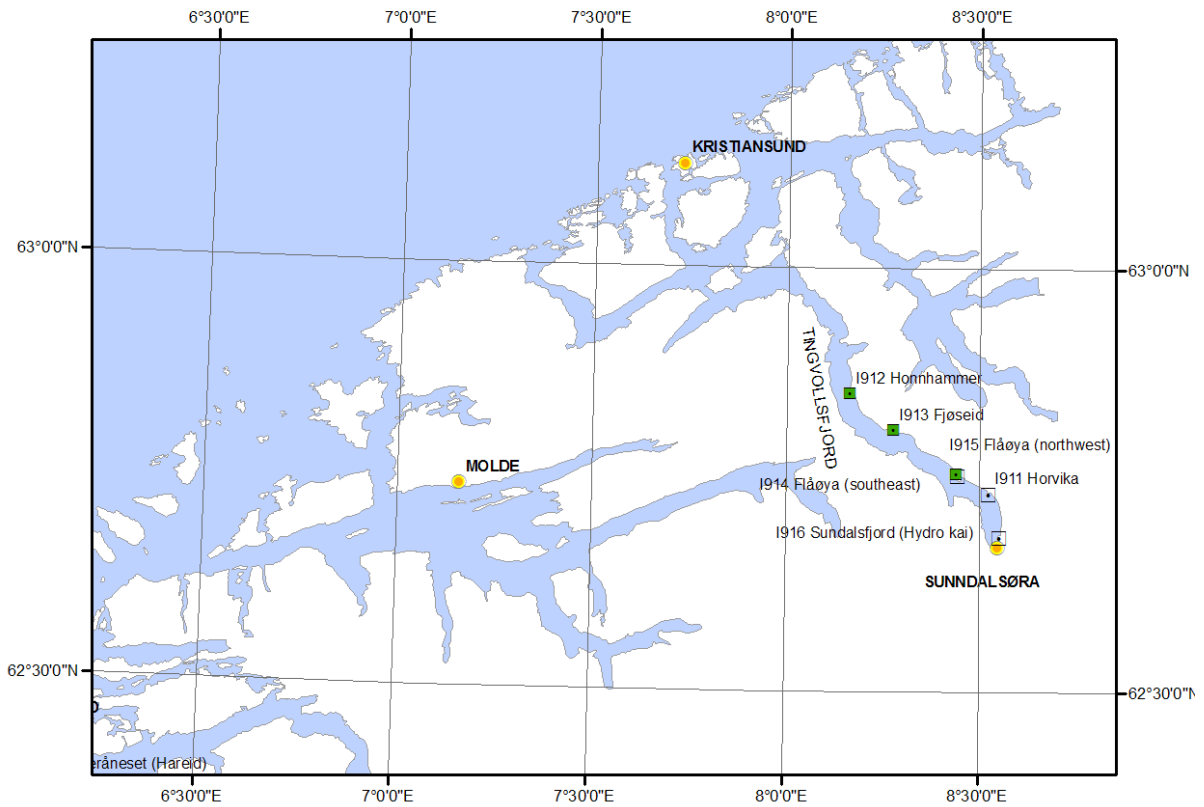
MAP 7



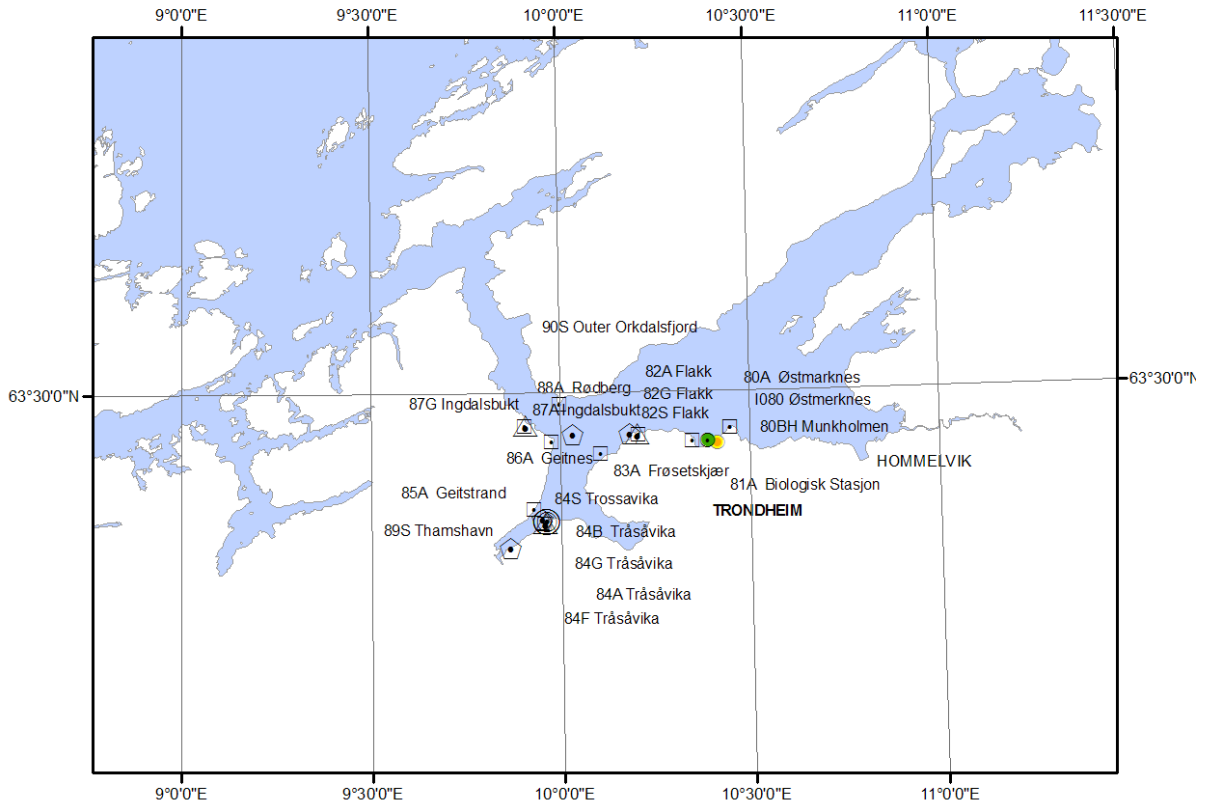
MAP 8



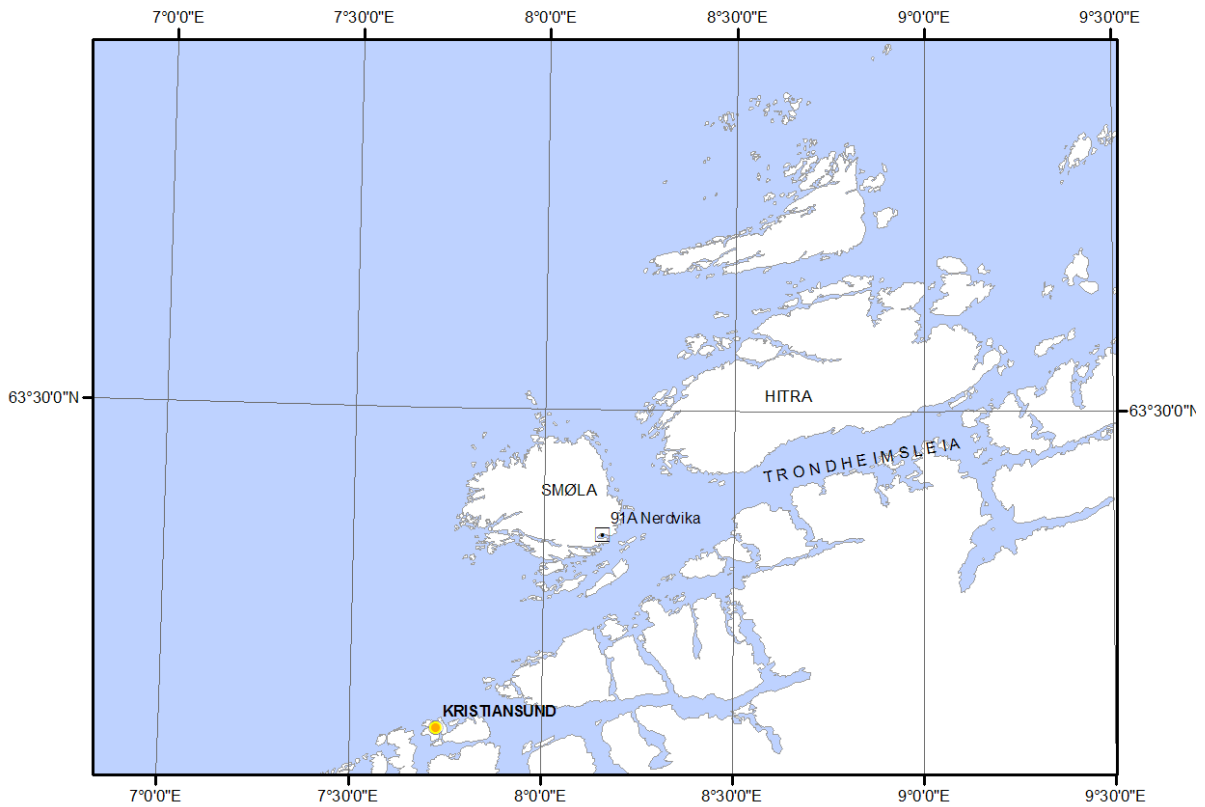
MAP 9



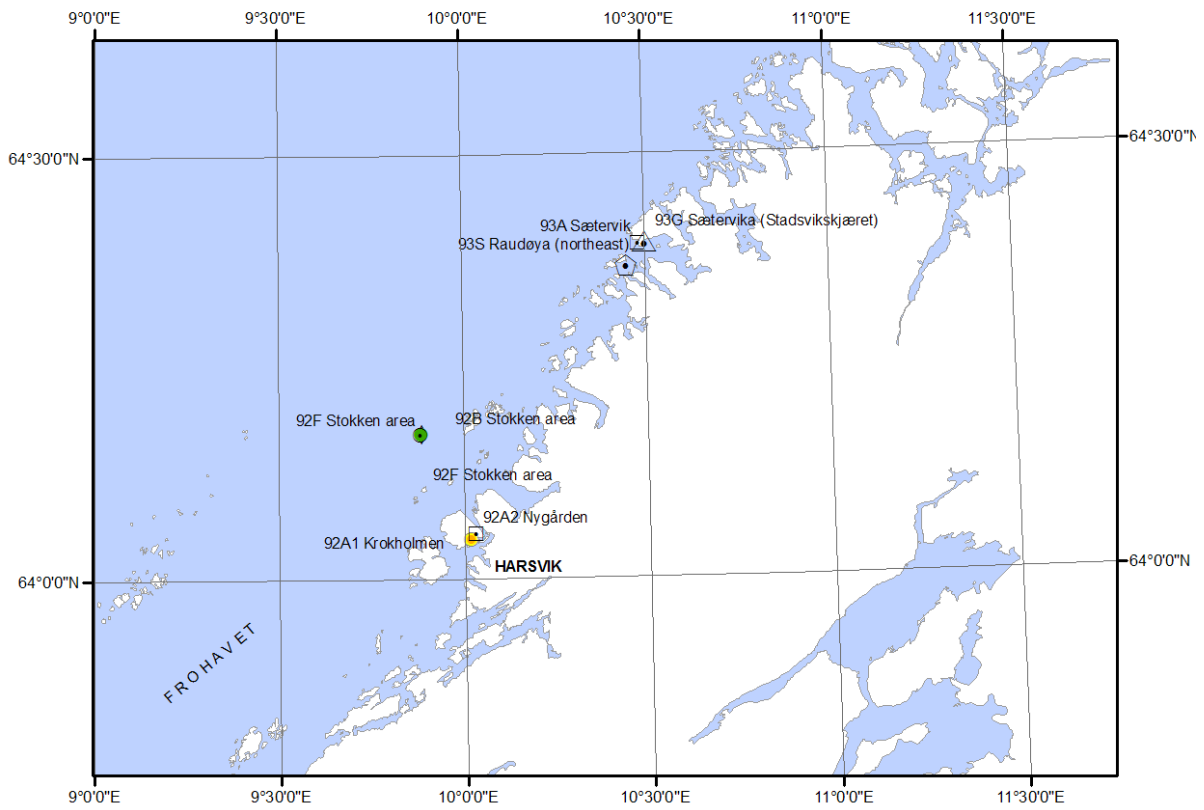
MAP 10



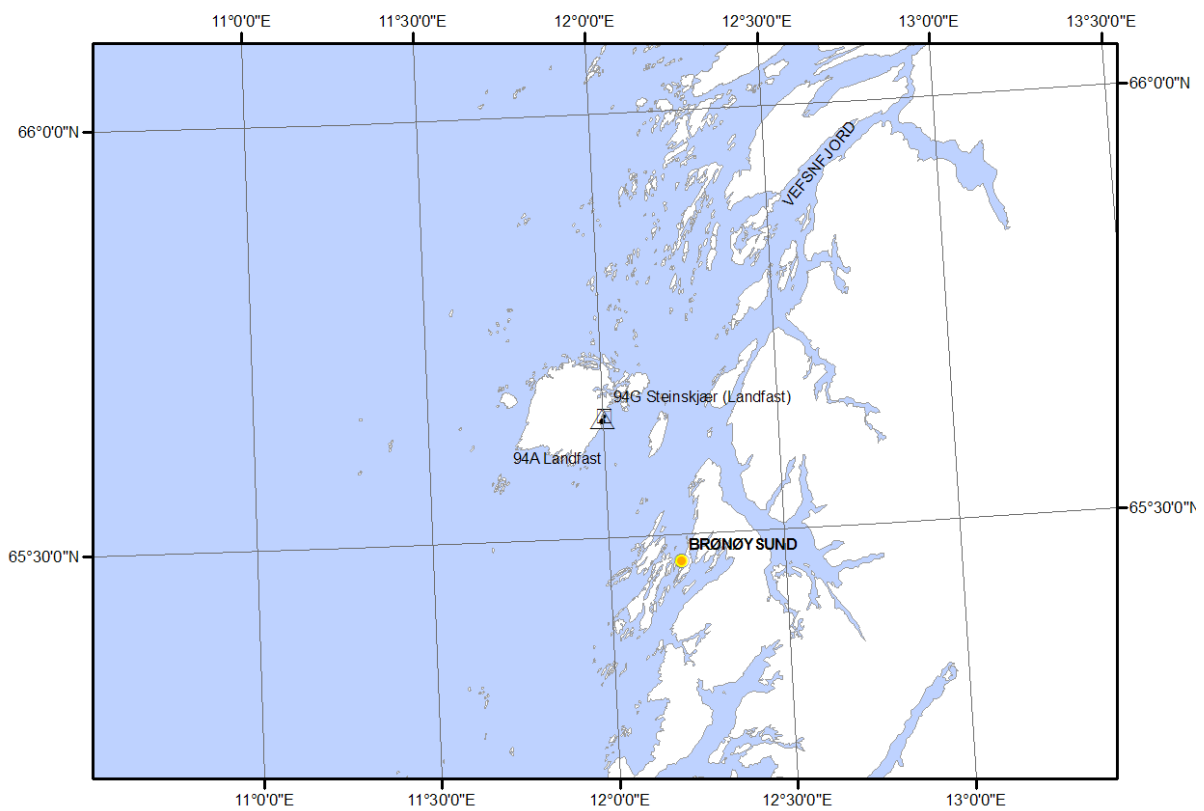
MAP 11



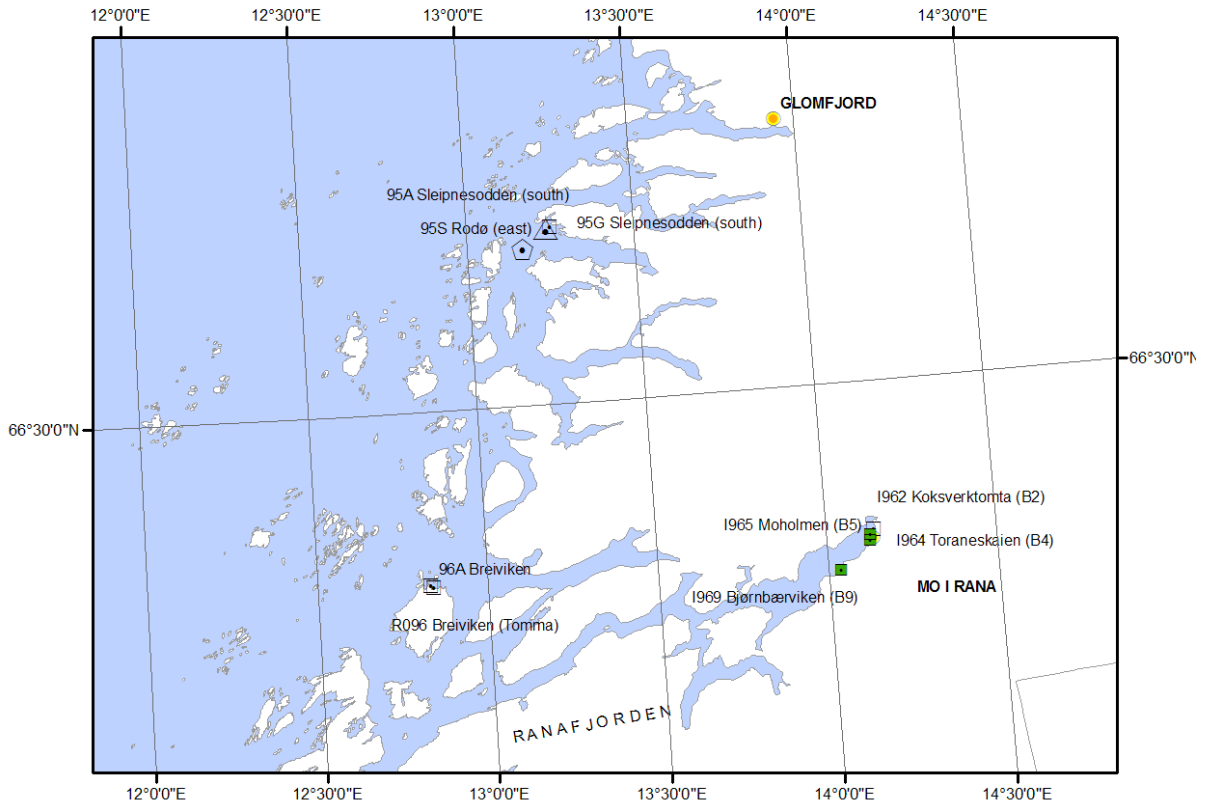
MAP 12



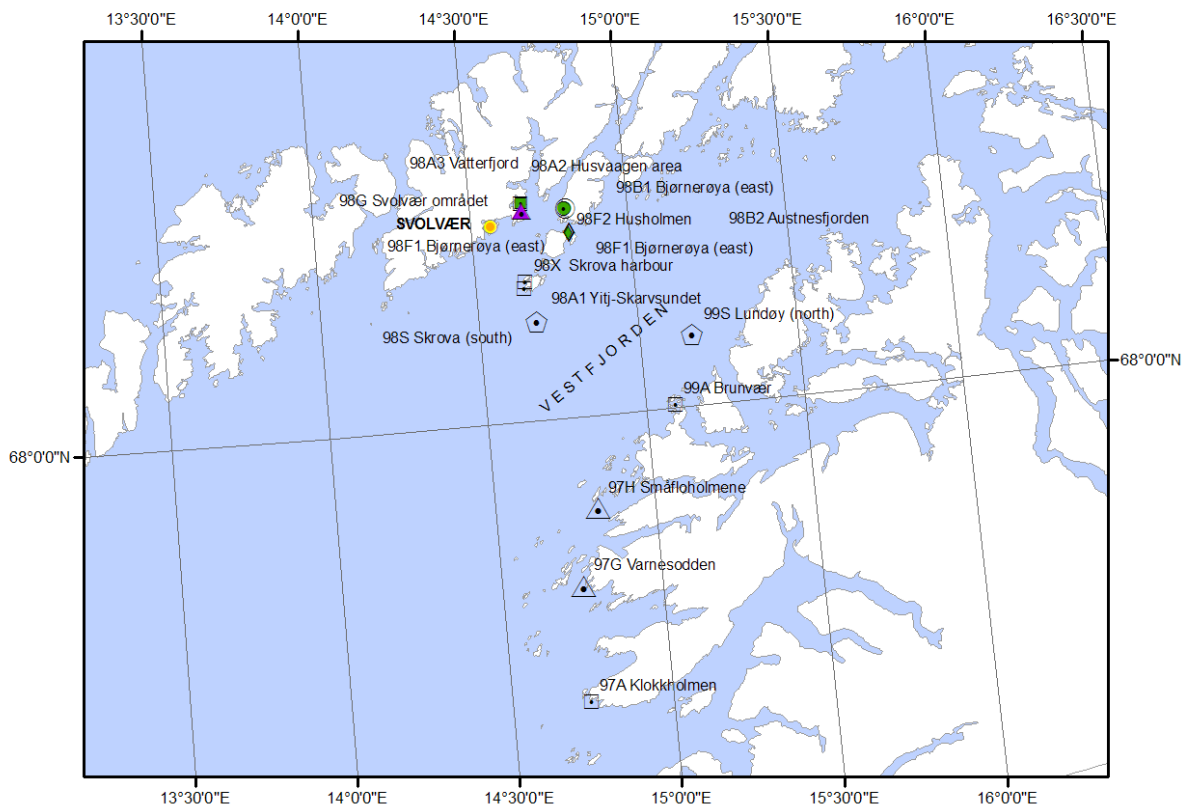
MAP 13



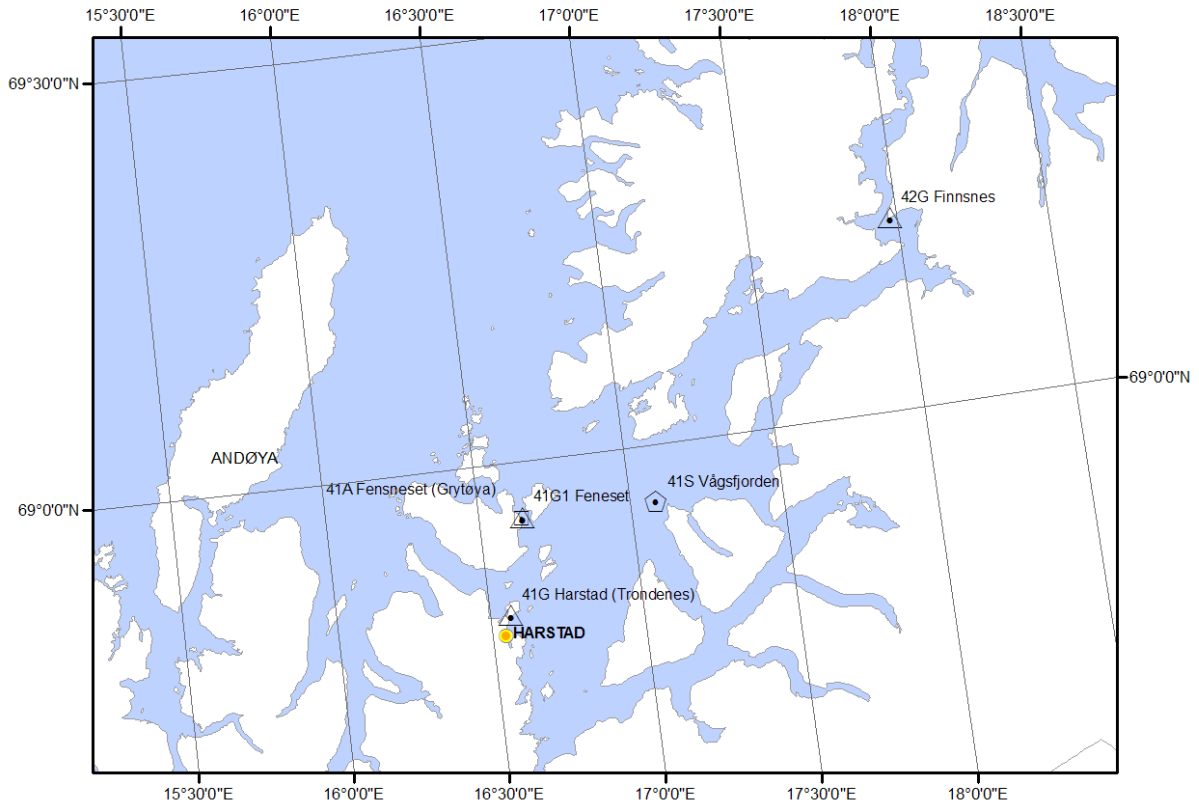
MAP 14



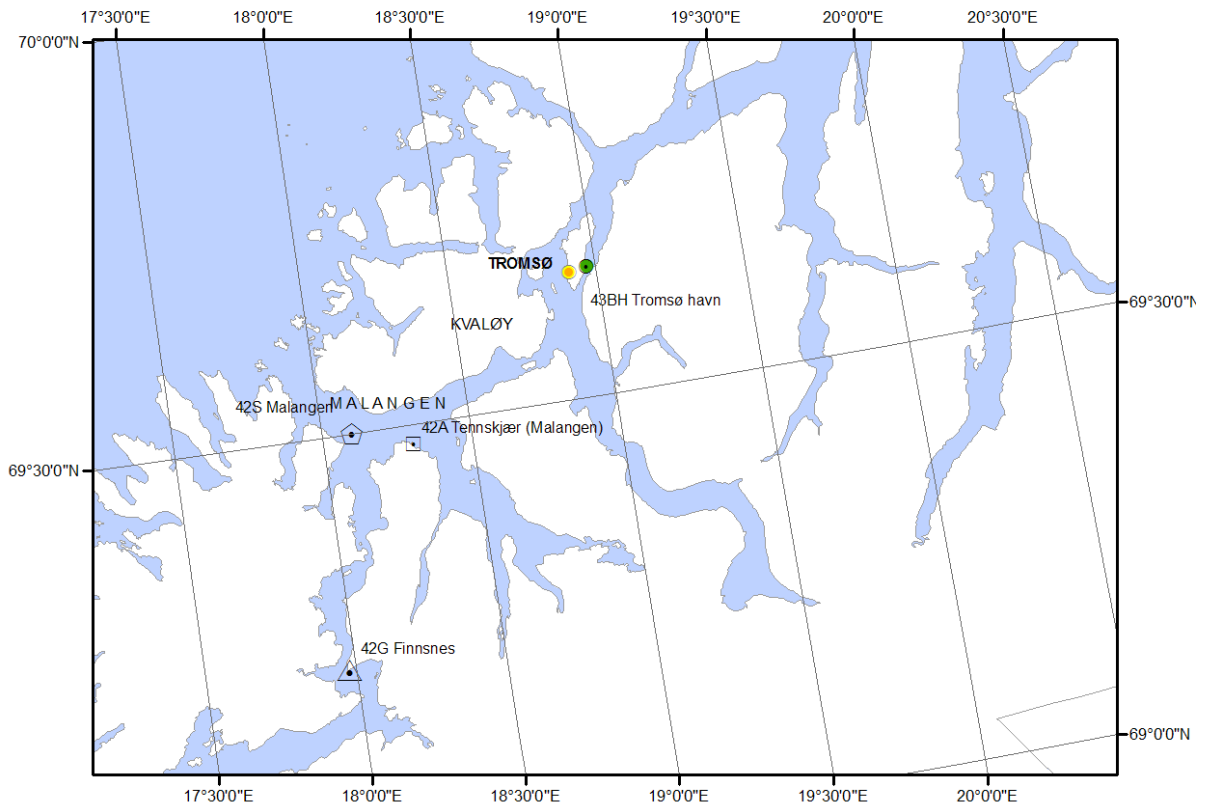
MAP 15



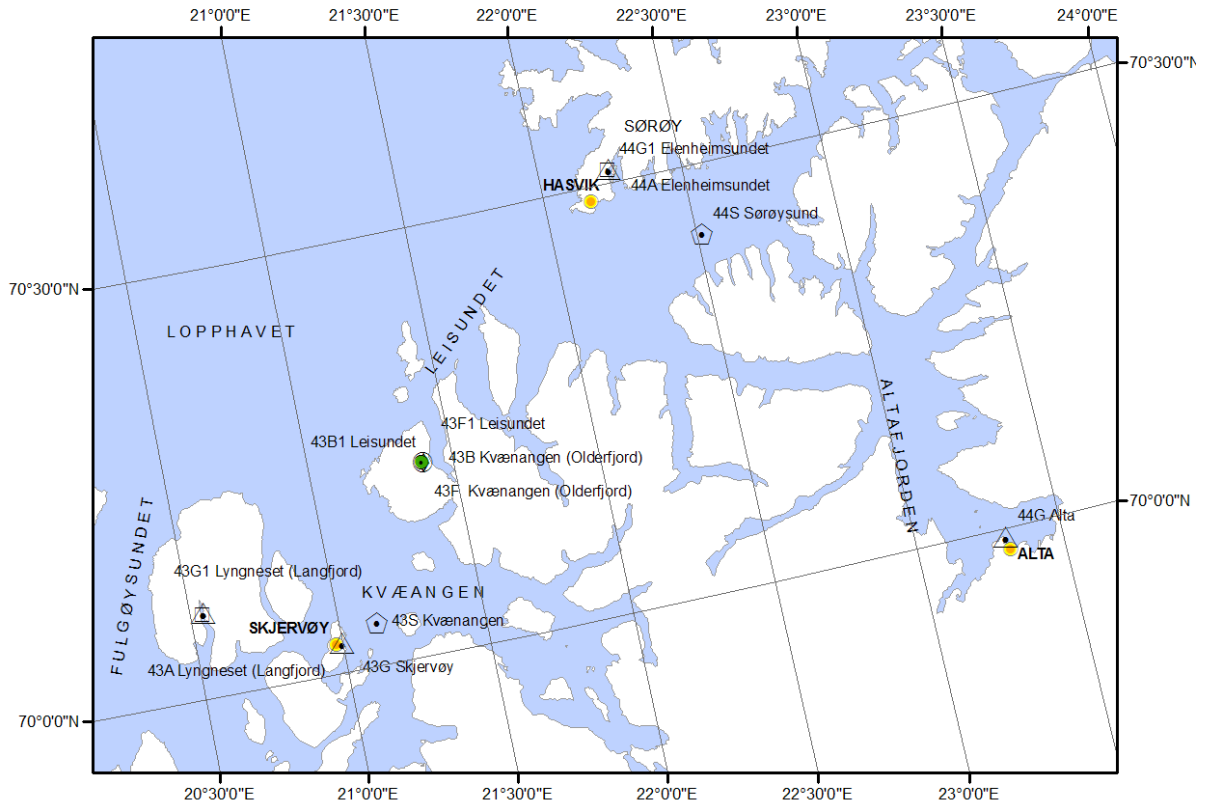
MAP 16



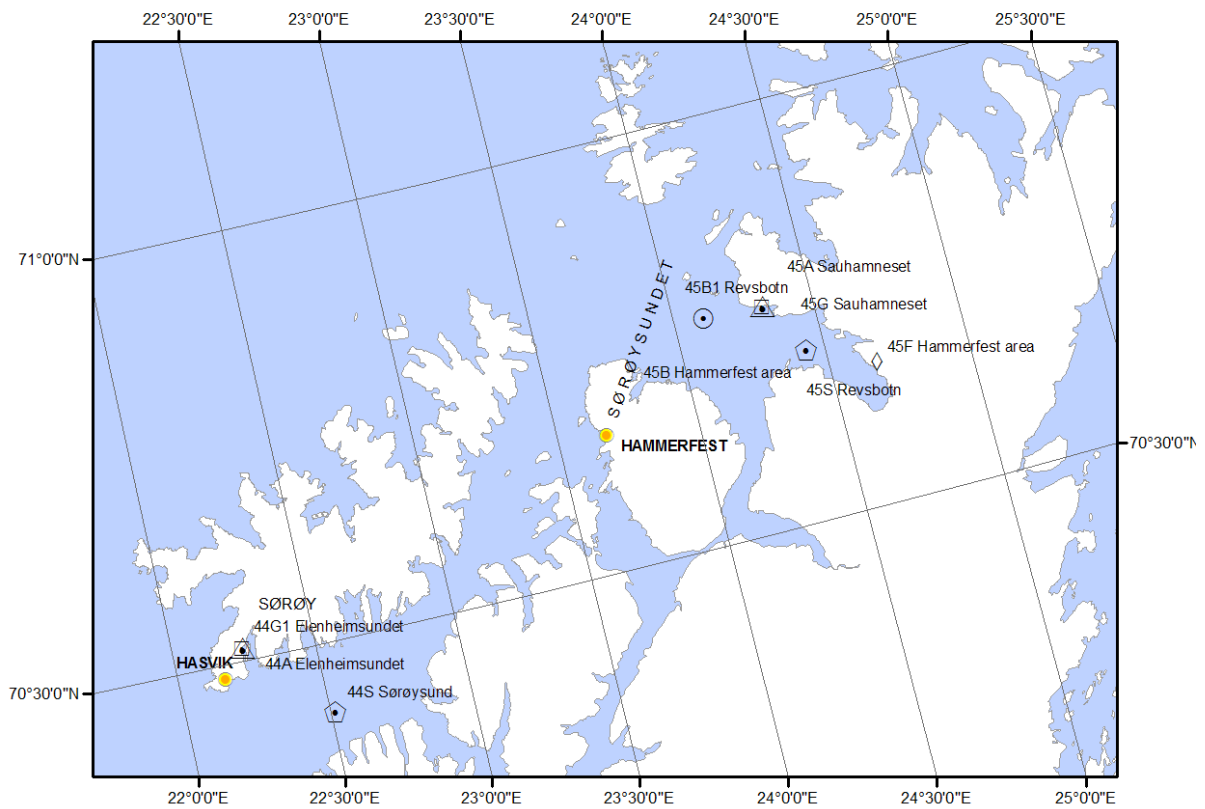
MAP 17



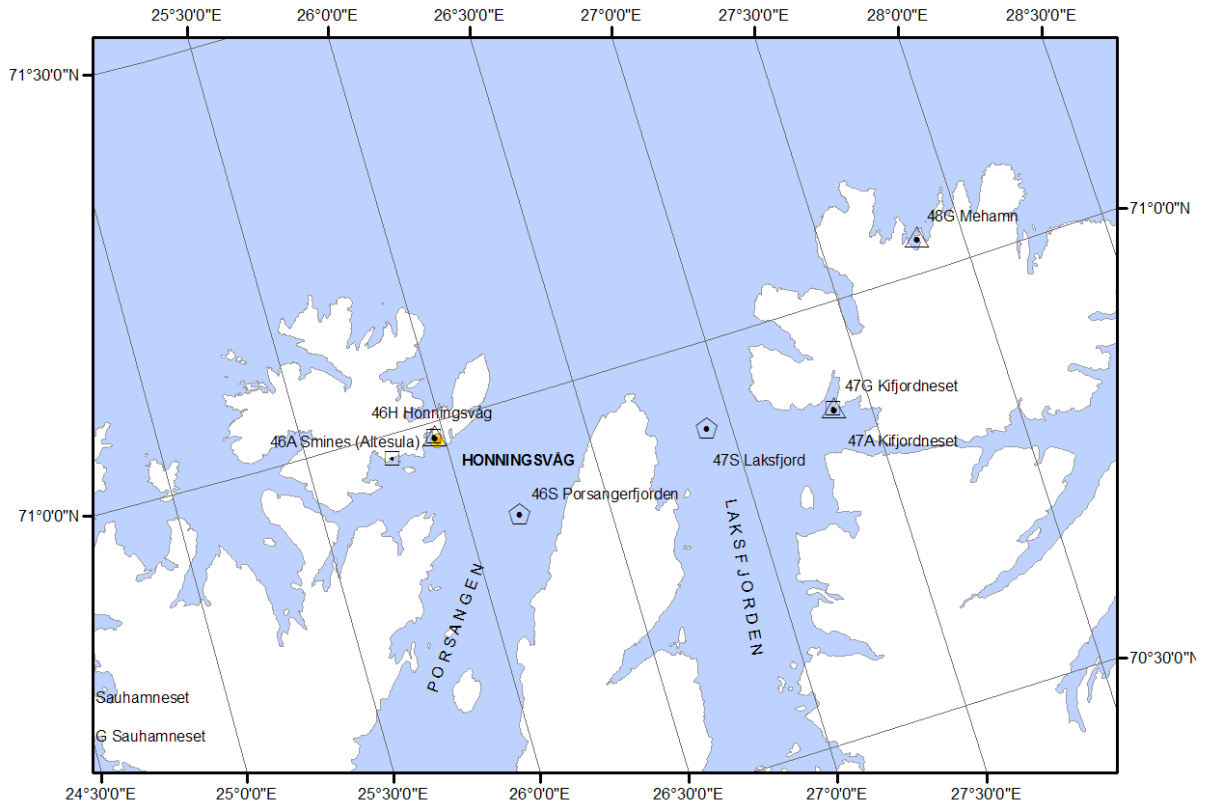
MAP 18



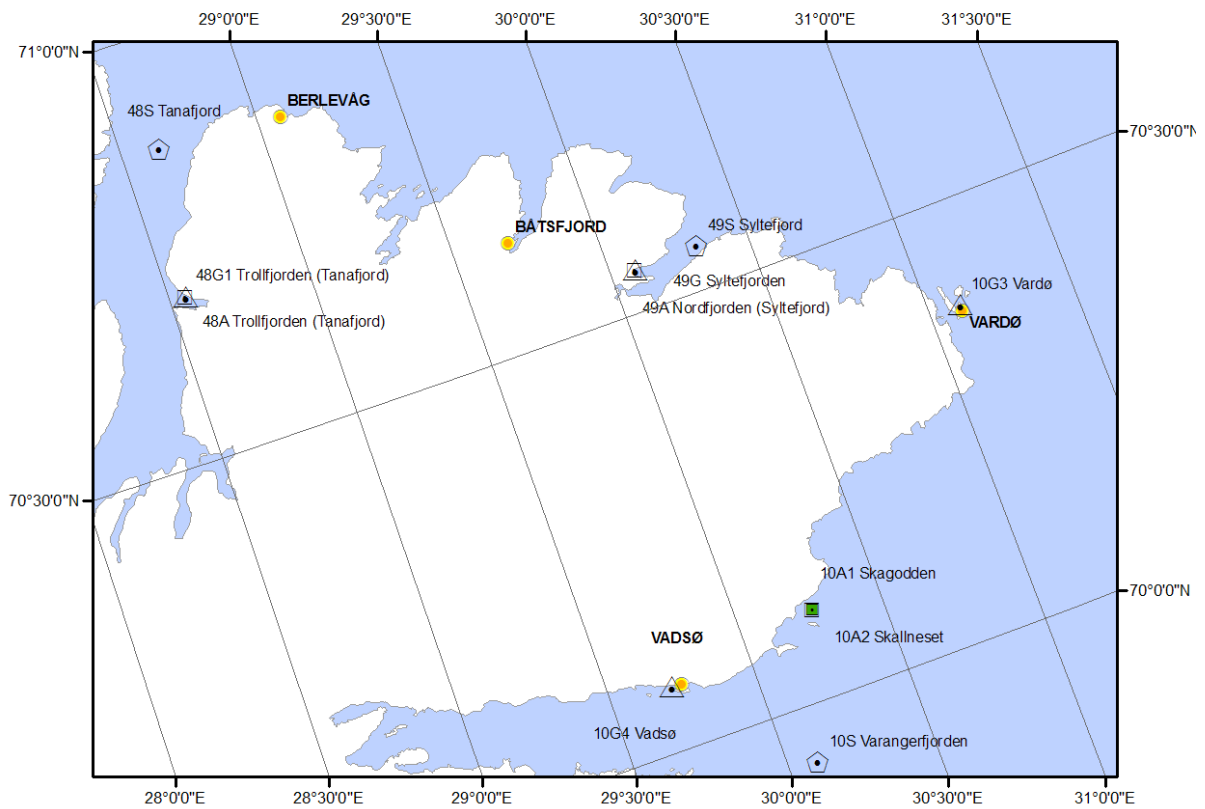
MAP 19



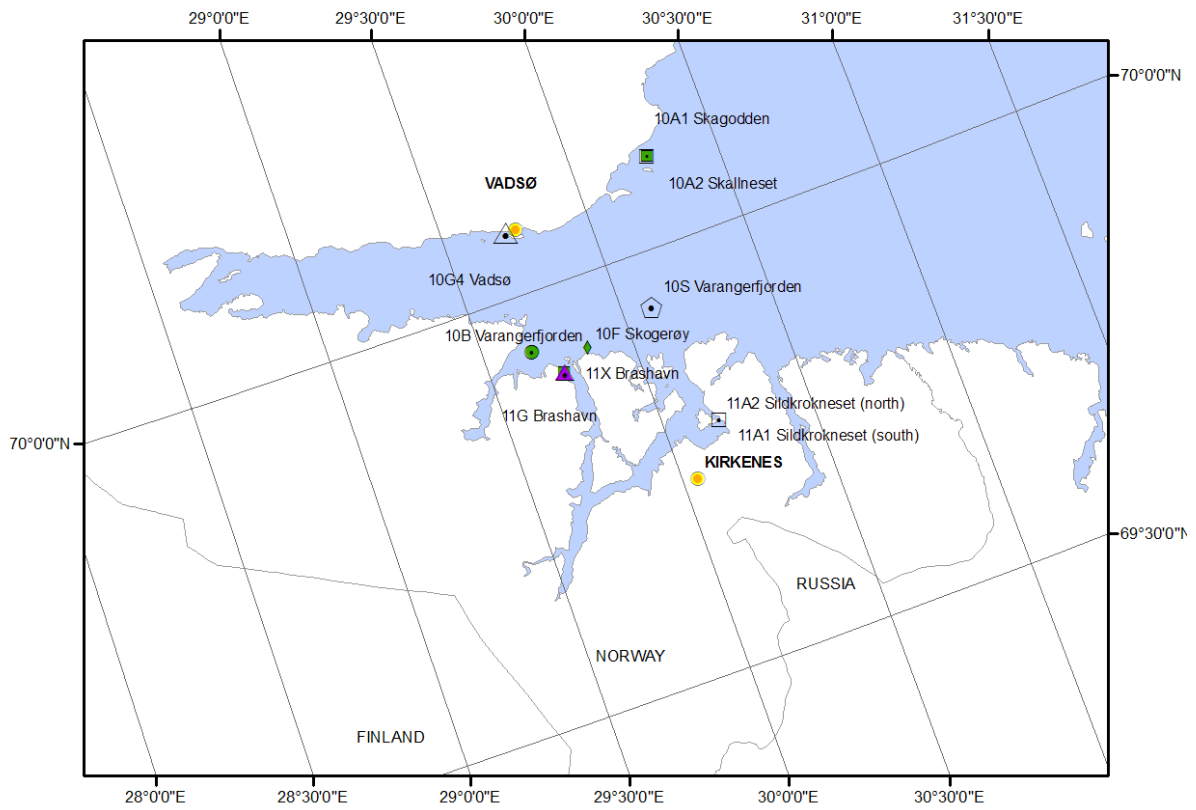
MAP 20



MAP 21



MAP 22



MAP 23

Appendix H

Overview of materials and analyses 2009

Nominal station positions are shown on maps in Appendix G

Me - Blue Mussel (*Mytilus edulis*)
NI - Dog whelk (*Nucella lapillus*)
Gm - Atlantic cod (*Gadus morhua*)
FI - flat fish:
Megrim (*Lepidorhombus whiffiagonis*)
Dab (*Limanda limanda*)
Flounder (*Platichthys flesus*)

Tissue:
SB - Soft body tissue
LI - Liver tissue, in fish
MU - Muscle tissue, in fish
BL - Blood, in fish
BI - Bile, fish

ICES-parameter-group codes (See Appendix C for descriptions of codes):

ICES code	Description	Me-SB	NI-SB	Gm-BI	Gm-BL	Gm/Ff-LI	Gm/Ff-MU
I-MET	Cd, Cu, Pb, Zn	x				x	
I-MET	Hg	x					x
O-MET	TBT ¹⁾	x	x			x ³⁾	
OC-CB	PCBs ²⁾	x				x	x
OC-CL	HCB	x				x	x
OC-DD	DDT, DDE, DDD	x				x	x
OC-HC	α -, γ -HCH	x				x	x
OC-DX	Dioxins ³⁾	x					
OC-BB	PBDE ⁴⁾					x ³⁾	
OC-PF	PFC ⁵⁾					x ³⁾	
PAH	PAHs ⁶⁾	x					
BEM ⁷⁾	Biological effects met.		Impo-sex	OH-pyrene	ALA-D	EROD-activity, CYP1A ⁸⁾	

1) Includes: DBTIN, DPTIN, MBTIN, MPTIN, TBTIN, TPTIN

2) Includes the congeners: CB-28,-52,-101,-105,-118,-138,-153,-156,-180, 209, 5-CB, OCS and, when dioxins are analysed, the non-orto-PCBs, i.e. CB-77, -81, -126, -169

3) Includes: CDD1N, CDD4X, CDD6P, CDD6X, CDD9X, CDDO, CDF2N, CDF2T, CDF4X, CDF6P, CDF6X, CDF9P, CDF9X, CDFDN, CDFDX, CDFO, TCDD

4) Polybrominated diphenyl ethers (PBDE), including brominated flame retardants and includes: BDE28, BDE47, BDE49, BDE66, BDE71, BDE77, BDE85, BDE99, BDE100, BDE119, BDE138, BDE153, BDE154, BDE183, BDE205

5) Includes: PFNA, PFOA, PFHpA, PFHxA, PFOS, PFBS, PFOSA

6) Includes (with NPDs): ACNE, ACNLE, ANT, BAP, BBJF, BEP, BGHIP, BKF, BAA, CHR, DBA3A, DBT, DBTC1, DBTC2, DBTC3, FLE, FLU, ICDP, NAP, NAPC1, NAPC2, NAPC3, PA, PAC1, PAC2, PAC3, PER, PYR.

7) Biological effects methods

8) Cod only

Appendix H. Sampling and analyses for 2009 –biota.

impost	station	nom lon	nom lat	speci	tissu	N	LMET	O-BR	OC-CB	OC-CL	OC-DD	OC-DX	OC-HC	O-FL	O-MET	O-PAH
01A	Sponvika	11.226	59.088	MYTI EDU	SB	3	3		3	3	3		3			
02A	Fugleskjær	10.983	59.115	MYTI EDU	SB	3	3		3	3	3					
03A	Tisler	10.958	58.98	MYTI EDU	SB	3	3		3	3	3					
10A2	Skallneset	30.262	70.104	MYTI EDU	SB	3	3		3	3	3					
10B	Varangerfjorden	29.667	69.933	GADU MOR	LI	25	25		25	25	25		25			
10B	Varangerfjorden	29.667	69.933	GADU MOR	MU	30	25		5	5	5		5			
10F	Skogerøy	29.85	69.917	PLEU PLA	LI	3	3		3	3	3					
10F	Skogerøy	29.85	69.917	PLEU PLA	MU	2	2		2	2	2		2			
11G	Brashavn	29.744	69.899	NUCE LAP	SB	1									1	
11X	Brashavn	29.744	69.899	MYTI EDU	SB	3	3		3	3	3		3		2	
131G	Lastad	7.709	58.056	NUCE LAP	SB	1										1
13A	Langøysund	7.577	57.998	MYTI EDU	SB	3	3		3	3	3		3			
13BH	Kristiansand harbour	7.988	58.135	GADU MOR	LI	25	25	25	25	25	25		25	25		
13BH	Kristiansand harbour	7.988	58.135	GADU MOR	MU	30	25		5	5	5		5			
14A	Avigen	7.216	58.033	MYTI EDU	SB	3	3		3	3	3					
15A	Gåsøy (Ullerø)	6.895	58.048	MYTI EDU	SB	3	3		3	3	3		3		2	
15B	Ullerø area	6.717	58.05	GADU MOR	LI	25	19		25	25	25		25			
15B	Ullerø area	6.717	58.05	GADU MOR	MU	30	25		5	5	5		5			
15F	Ullerø area	6.717	58.05	LIMA LIM	LI	5	5		5	5	5		5			
15F	Ullerø area	6.717	58.05	LIMA LIM	MU	5	5		5	5	5		5			
15G	Gåsøy (Ullerø)	6.896	58.05	NUCE LAP	SB	1									1	
21F	Akra fjord	6.117	59.75	LEPI WHI	LI	5	5		5	5	5		5			
21F	Akra fjord	6.117	59.75	LIMA LIM	LI	3	3		3	3	3		3			
21F	Akra fjord	6.117	59.75	LEPI WHI	MU	5	5		5	5	5		5			
21F	Akra fjord	6.117	59.75	LIMA LIM	MU	3	3		3	3	3		3			
227A2	Høgevarde	5.318	59.326	MYTI EDU	SB	1	1		1	1	1		1		1	
227G2	Flatskjær	5.312	59.337	NUCE LAP	SB	1									1	
22A	Espevær (west)	5.144	59.584	MYTI EDU	SB	3	3		3	3	3		3		2	
22G	Espevær (west)	5.144	59.584	NUCE LAP	SB	1									1	
23B	Karihavet area	5.133	59.9	GADU MOR	LI	25	25	25	25	25	25		25	25		
23B	Karihavet area	5.133	59.9	GADU MOR	MU	30	25		5	5	5		5			
30A	Gressholmen	10.712	59.882	MYTI EDU	SB	3	3		3	3	3	2	3		2	3
30B	Oslo City area	10.56	59.799	GADU MOR	LI	25	25	25	25	25	25		25	25		
30B	Oslo City area	10.56	59.799	GADU MOR	MU	30	25		5	5	5		5			
31A	Solbergstrand	10.65	59.619	MYTI EDU	SB	3	3		3	3	3		3			
33F	Sande (east side)	10.35	59.528	PLAT FLE	LI	5	5		5	5	5		5			
33F	Sande (east side)	10.35	59.528	PLAT FLE	MU	5	5		5	5	5		5			
35A	Mølen	10.498	59.488	MYTI EDU	SB	3	3		3	3	3	1	3		1	1
36B	Færder area	10.436	59.04	GADU MOR	LI	21	21	21	21	21	21		21	21		
36B	Færder area	10.436	59.04	GADU MOR	MU	25	21		4	4	4		4			
36F	Færder area	10.383	59.067	LIMA LIM	LI	5	5		5	5	5		5			
36F	Færder area	10.383	59.067	LIMA LIM	MU	5	5		5	5	5		5			
36G	Færder	10.526	59.027	NUCE LAP	SB	1									1	
43B	Kvænangen (Olderfjord)	21.397	70.226	GADU MOR	LI	21	21	21	21	21	21		21	21		
43B	Kvænangen (Olderfjord)	21.397	70.226	GADU MOR	MU	21	21									
43BH	Tromsø harbour	18.974	69.653	GADU MOR	LI	25	25	25	25	25	25		25	25		
43BH	Tromsø harbour	18.974	69.653	GADU MOR	MU	30	25		5	5	5		5			
51A	Byrkjenes	6.55	60.084	MYTI EDU	SB	3	3		3	3	3		3			
52A	Eitrheimsneset	6.533	60.097	MYTI EDU	SB	3	3		3	3	3		3			
53B	Inner Sørfjord	6.567	60.167	GADU MOR	LI	19	19	19	19	19	19		19	19		
53B	Inner Sørfjord	6.567	60.167	GADU MOR	MU	23	19		4	4	4		4			
53F	Inner Sørfjord	6.567	60.167	PLAT FLE	LI	2	2		2	2	2		2			
53F	Inner Sørfjord	6.567	60.167	PLAT FLE	MU	2	2		2	2	2		2			
56A	Kvalnes	6.602	60.22	MYTI EDU	SB	3	3		3	3	3		3			
57A	Krossanes	6.689	60.387	MYTI EDU	SB	3	3		3	3	3		3			
63A	Ranaskjær	6.405	60.421	MYTI EDU	SB	3	3		3	3	3		3			
65A	Vikingneset	6.153	60.242	MYTI EDU	SB	3	3		3	3	3		3			
67B	Strandebarm area	6.033	60.267	GADU MOR	LI	29	25		25	25	25		25			
67B	Strandebarm area	6.033	60.267	GADU MOR	MU	30	25		5	5	5		5			
67F	Strandebarm area	6.033	60.267	LEPI WHI	LI	5	5		5	5	5		5			
67F	Strandebarm area	6.033	60.267	PLAT FLE	LI	5	5		5	5	5		5			
67F	Strandebarm area	6.033	60.267	LEPI WHI	MU	5	5		5	5	5		5			
67F	Strandebarm area	6.033	60.267	PLAT FLE	MU	5	5		5	5	5		5			
69A	Lille Terøy	5.752	59.982	MYTI EDU	SB	3	3		3	3	3		3			
71A	Bjørkøya (Risøyodden)	9.754	59.023	MYTI EDU	SB	3	3		3	3	3	2	3		1	
71g	Fugløyskjær	9.808	58.981	LITT LIT	SB	1									1	
71G	Fugløyskjær	9.808	58.981	NUCE LAP	SB	1									1	
73A	Lyngholmen	10.295	59.045	MYTI EDU	SB	5	5		5	5	5		5			
74G	Langholmmane	9.868	58.955	NUCE LAP	SB	1									1	
76A	Risey	9.272	58.731	MYTI EDU	SB	3	3		3	3	3	2	3		1	
76G	Risey	9.276	58.728	NUCE LAP	SB	1									1	
77A	Nordstrand	8.942	58.524	MYTI EDU	SB	5	5		5	5	5		5			
77B	Borøy area	9.017	58.55	GADU MOR	LI	25	25	25	25	25	25		25			
77B	Borøy area	9.017	58.55	GADU MOR	MU	30	25		5	5	5		5			
77F	Borøy area	9.017	58.55	LIMA LIM	LI	5	5		5	5	5		5			
77F	Borøy area	9.017	58.55	LIMA LIM	MU	5	5		5	5	5		5			
79A	Gjerdsvoldsøyen (east)	8.742	58.413	MYTI EDU	SB	3	3		3	3	3		3			
80BH	Munkholmen	10.392	63.442	GADU MOR	LI	21	21	21	21	21	21		21	21		
80BH	Munkholmen	10.392	63.442	GADU MOR	MU	25	21		4	4	4		4			
92B	Stokken area	9.887	64.171	GADU MOR	LI	25	25	25	25	25	25		25	25		
92B	Stokken area	9.887	64.171	GADU MOR	MU	25	25									
98A2	Husvaagen area	14.664	68.258	MYTI EDU	SB	3	3		3	3	3		3		2	
98B1	Bjørnerøya (east)	14.803	68.247	GADU MOR	LI	25	25	25	25	25	25		25	25		
98B1	Bjørnerøya (east)	14.803	68.247	GADU MOR	MU	30	25		5	5	5		5			
98F2	Husholmen	14.808	68.219	PLEU PLA	LI	5	5		5	5	5		5			
98F2	Husholmen	14.808	68.219	PLEU PLA	MU	5	5		5	5	5		5			
98G	Svolvær area	14.663	68.249	NUCE LAP	SB	1									1	
1022	West Damholmen	11.045	59.102	MYTI EDU	SB	3	3		3	3	3		3			
1023	Singlekalven (south)	11.137	59.095	MYTI EDU	SB	3	3		3	3	3		3			
1024	Kirkøy (north west)	10.986	59.08	MYTI EDU	SB	3	3		3	3	3		3			
1131A	Lastad	7.709	58.056	MYTI EDU	SB	3	3		3	3	3		3			3
1132	Svensholmen	7.989	58.125	MYTI EDU	SB	3	3		3	3	3	1	3		1	3
1133	Odderø (west)	8.002	58.132	MYTI EDU	SB	3	3		3	3	3	1	3		2	3
1201	Ekkjegrunn (G1)	6.357	59.643	MYTI EDU	SB	3	3								3	3
1205	Bølsnes (G5)	6.3	59.592	MYTI EDU	SB	3	3									3
1241	Nordnes	5.302	60.401	MYTI EDU	SB	3	3		3	3	3		3			
1242	Gravdalsneset	5.267	60.395	MYTI EDU	SB	3	3		3	3	3		3			
1243	Hegreneset	5.305	60.415	MYTI EDU	SB	3	3		3	3	3		3			
1301	Akershuskaia	10.736	59.905	MYTI EDU	SB	3	3		3	3	3		3		2	3
1304	Gåsøya	10.589	59.851	MYTI EDU	SB	3	3		3	3	3		3			3
1306	Håøya	10.555	59.713	MYTI EDU	SB	3	3		3	3	3		3			3
1307	Ramtonholmen	10.523	59.744	MYTI EDU	SB	3	3		3	3	3		3			3
1712	Gjemsholmen	9.707	59.045	MYTI EDU	SB	4	4		4	4	4	2	4		3	
1713	Strømtangen	9.692	59.05	MYTI EDU	SB	3	3		3	3	3	1	3		2	
1912	Honnhammer	8.162	62.853	MYTI EDU	SB	3										3
1913	Fjøsøid	8.275	62													

Appendix I

Concentrations and temporal trend analyses of contaminants and biomarkers in biota 2009

Sorted by contaminant, species and area/station:

Ag - silver
ALA-D (δ -amino levulinic acid dehydrase inhibition)
As - arsenic
Ba - barium
BAP (benzo[*a*]pyrene)
BDESS (Sum brominated flame retardants)
CB_S7 (CB: 28+52+101+118+138+153+180)
Cd - cadmium
Co - cobalt
Cr - chromium
Cu - copper
CYP1A (relative amount of Cytochrome P4501A protein)
DD_S4 (sum of pp'DDE, pp'DDD, and pp'DDT)
EROD-activity (Cytochrome P4501A-activity)
HCB
Hg - mercury
HCHG (gamma-hexachlorocyclohexane)
Mo - molybdenum
Ni - nickel
PAH (sum of PAHs, excluding the dicyclic forms, cf. Appendix B)
PK_S (sum carcinogen PAHs, cf. Appendix B)
Pb - lead
PFOS
PYR10 (Pyrene metabolite)
QCB
Sn - tin
TBT (Tributyltin)
TCDDN (Dioxin toxicity equivalents – Nordic model)
Vanadium (V)
VDSI (measurement of Imposex)
Zinc (Zn)

CEMP-stations
"Index"-stations
MYTI EDU - Blue Mussel (*Mytilus edulis*)
NUCE LAP - Dog whelk (*Nucella lapillus*)
GADU MOR - Atlantic cod (*Gadus morhua*)
LEPI WHI - Megrin (*Lepidorhombus whiffiagonis*)
LIMA LIM - Dab (*Limanda limanda*)
PLAT FLE - Flounder (*Platichthys flesus*)

Tissue:
SB - Soft body tissue
LI - Liver tissue
MU - Muscle tissue
BL - Blood
BI - Bile

Unit:
M – mg/kg
U - µg/kg
N – ng/kg
ng – ng/min/mg protein (for ALAD)
pm – pmol/min/mg protein (for EROD)
380 – µg/kg/ABS 380 nm (for PYR10)
ABS – ABS (for CYP1A)

Base:
W – wet weight
D – dry weight

OC	Overconcentration expressed as quotient of median of last year and upper limit to presumed “high background” (“m” missing background value)
Class	Classification system is used for sediment (Bakke <i>et al.</i> 2007c) and biota (Molvær <i>et al.</i> 1997) for Classes: I (blue), II (green), III (yellow), IV (orange) and V (red). Dark grey indicates concentration higher than estimated high background levels. Light grey indicates concentration lower than high background levels. Note: Class limits for ΣDDT are used for ppDDE. Class limits for ΣHCH are used for HCHG.
TRND	trend for all time series with 3 or more years data. D- Significant linear trend, downward U- Significant linear trend, upward -- No significant trend -? No significant linear trend, systematic non-linear trend can not be tested because of insufficient data (<7 years) -Y No significant linear trend, but a systematic non-linear trend DY or UY Significant linear trend (downward or upward) and a significant non-linear trend. This is considered the same as "-Y"

Note on detection limit: for values designated below detection limit, half of this limit is used.

Symbol trend analyses were done on time series with three or more years and the results are indicated by an upward or downward arrow where significant trends were found, or a zero if no trend was detected. A small filled square (◻) indicates that chemical analysis has been performed, but the data were insufficient to do a trend analysis.

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
10B	Varangerfjorden	GADU MOR	Cod	Ag	LI	M	W	0.15				▪
13BH	Kristiansand havn	GADU MOR	Cod	Ag	LI	M	W	2.11				▪
15B	Ullerø area	GADU MOR	Cod	Ag	LI	M	W	0.33				▪
23B	Karihavet area	GADU MOR	Cod	Ag	LI	M	W	3.77				▪
30B	Oslo City area	GADU MOR	Cod	Ag	LI	M	W	10.70				▪
36B	Færder area	GADU MOR	Cod	Ag	LI	M	W	0.61				▪
43BH	Tromsø havn	GADU MOR	Cod	Ag	LI	M	W	0.19				▪
53B	Inner Sør fjord	GADU MOR	Cod	Ag	LI	M	W	0.24				▪
67B	Strandebarm area	GADU MOR	Cod	Ag	LI	M	W	0.11				▪
77B	Borøy area	GADU MOR	Cod	Ag	LI	M	W	0.40				▪
80BH	Munkholmen	GADU MOR	Cod	Ag	LI	M	W	0.19				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Ag	LI	M	W	0.07				▪
21F	Åkrafjord	LEPI WHI	Megrim	Ag	LI	M	W	0.08				▪
67F	Strandebarm area	LEPI WHI	Megrim	Ag	LI	M	W	0.06				▪
15F	Ullerø area	LIMA LIM	Dab	Ag	LI	M	W	0.06				▪
21F	Åkrafjord	LIMA LIM	Dab	Ag	LI	M	W	0.04				▪
36F	Færder area	LIMA LIM	Dab	Ag	LI	M	W	0.03				▪
77F	Borøy area	LIMA LIM	Dab	Ag	LI	M	W	0.01				▪
01A	Sponvika	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
03A	Tisler	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Ag	SB	M	D	0.12		I		▪
11X	Brashavn	MYTI EDU	Blue mussel	Ag	SB	M	D	0.14		I		▪
13A	Langøysund	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.06		I		▪
227A2	Høgevarde	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.02		I		▪
30A	Gressholmen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.16		I		▪
31A	Solbergstrand	MYTI EDU	Blue mussel	Ag	SB	M	D	0.06		I		▪
35A	Mølen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.06		I		▪
51A	Byrkjenes	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Ag	SB	M	D	0.05		I		▪
56A	Kvalnes	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
57A	Krossanes	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
63A	Ranaskjær	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
65A	Vikingsneset	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
69A	Lille Terøy	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
73A	Lyngholmen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.02		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
77A	Nordstrand	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.05		I		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1022	West Damholmen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.05		I		▪
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.05		I		▪
1131A	Lastad	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1132	Svensholmen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.06		I		▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
1241	Nordnes	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
1242	Gravdalsneset	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1243	Hegreneset	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
1301	Akershuskaia	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
1304	Gåsøya	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1306	Håøya	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
1307	Ramtonholmen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.05		I		▪
1712	Gjemesholmen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
1713	Strømtangen	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.05		I		▪
1965	Moholmen (B5)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.04		I		▪
1969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Ag	SB	M	D	0.03		I		▪
33F	Sande (east side)	PLAT FLE	Flounder	Ag	LI	M	W	0.09				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	Ag	LI	M	W	0.02				▪
67F	Strandebarm area	PLAT FLE	Flounder	Ag	LI	M	W	0.01				▪
10F	Skogerøy	PLEU PLA	Plaice	Ag	LI	M	W	0.18				▪
98F2	Husholmen	PLEU PLA	Plaice	Ag	LI	M	W	0.05				▪
23B	Karihavet area	GADU MOR	Cod	ALAD	BL	np	W	34.4	m		--	○
30B	Oslo City area	GADU MOR	Cod	ALAD	BL	np	W	28.6	m		--	○
53B	Inner Sørfjord	GADU MOR	Cod	ALAD	BL	np	W	19.6	m		--	○
10B	Varangerfjorden	GADU MOR	Cod	As	LI	M	W	4.64				▪
13BH	Kristiansand havn	GADU MOR	Cod	As	LI	M	W	5.10				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
15B	Ullerø area	GADU MOR	Cod	As	LI	M	W	4.69				▪
23B	Karihavet area	GADU MOR	Cod	As	LI	M	W	48.50				▪
30B	Oslo City area	GADU MOR	Cod	As	LI	M	W	43.50				▪
36B	Færder area	GADU MOR	Cod	As	LI	M	W	4.18				▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	As	LI	M	W	5.03				▪
43BH	Tromsø havn	GADU MOR	Cod	As	LI	M	W	6.17				▪
53B	Inner Sørfjord	GADU MOR	Cod	As	LI	M	W	4.21				▪
67B	Strandebarm area	GADU MOR	Cod	As	LI	M	W	3.04				▪
77B	Borøy area	GADU MOR	Cod	As	LI	M	W	4.44				▪
80BH	Munkholmen	GADU MOR	Cod	As	LI	M	W	2.40				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	As	LI	M	W	3.49				▪
21F	Åkra fjord	LEPI WHI	Megrim	As	LI	M	W	9.91				▪
67F	Strandebarm area	LEPI WHI	Megrim	As	LI	M	W	3.52				▪
15F	Ullerø area	LIMA LIM	Dab	As	LI	M	W	5.81				▪
21F	Åkra fjord	LIMA LIM	Dab	As	LI	M	W	24.00				▪
36F	Færder area	LIMA LIM	Dab	As	LI	M	W	9.61				▪
77F	Borøy area	LIMA LIM	Dab	As	LI	M	W	13.50				▪
01A	Sponvika	MYTI EDU	Blue mussel	As	SB	M	D	8.58		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	As	SB	M	D	13.31		II		▪
03A	Tisler	MYTI EDU	Blue mussel	As	SB	M	D	17.00		II		▪
10A2	Skallneset	MYTI EDU	Blue mussel	As	SB	M	D	14.76		II		▪
11X	Brashavn	MYTI EDU	Blue mussel	As	SB	M	D	10.57		II		▪
13A	Langøysund	MYTI EDU	Blue mussel	As	SB	M	D	20.63		II		▪
14A	Aavigen	MYTI EDU	Blue mussel	As	SB	M	D	22.94		II		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	As	SB	M	D	20.24		II		▪
227A2	Høgevarde	MYTI EDU	Blue mussel	As	SB	M	D	31.60		III		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	As	SB	M	D	16.76		II		▪
30A	Gressholmen	MYTI EDU	Blue mussel	As	SB	M	D	13.39		II		▪
31A	Solbergstrand	MYTI EDU	Blue mussel	As	SB	M	D	15.73		II		▪
35A	Mølen	MYTI EDU	Blue mussel	As	SB	M	D	14.87		II		▪
51A	Byrkjenes	MYTI EDU	Blue mussel	As	SB	M	D	13.29		II		▪
52A	Eitrheimsneset	MYTI EDU	Blue mussel	As	SB	M	D	18.24		II		▪
56A	Kvalnes	MYTI EDU	Blue mussel	As	SB	M	D	25.00		II		▪
57A	Krossanes	MYTI EDU	Blue mussel	As	SB	M	D	19.10		II		▪
63A	Ranaskjær	MYTI EDU	Blue mussel	As	SB	M	D	21.47		II		▪
65A	Vikingneset	MYTI EDU	Blue mussel	As	SB	M	D	21.55		II		▪
69A	Lille Terøy	MYTI EDU	Blue mussel	As	SB	M	D	17.65		II		▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	As	SB	M	D	10.41		II		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
73A	Lyngholmen	MYTI EDU	Blue mussel	As	SB	M	D	12.60		II		▪
76A	Risøy	MYTI EDU	Blue mussel	As	SB	M	D	23.65		II		▪
77A	Nordstrand	MYTI EDU	Blue mussel	As	SB	M	D	33.89		III		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	As	SB	M	D	17.80		II		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	As	SB	M	D	15.68		II		▪
I022	West Damholmen	MYTI EDU	Blue mussel	As	SB	M	D	12.30		II		▪
I023	Singlekalven (south)	MYTI EDU	Blue mussel	As	SB	M	D	8.54		I		▪
I024	Kirkøy (north west)	MYTI EDU	Blue mussel	As	SB	M	D	12.90		II		▪
I131A	Lastad	MYTI EDU	Blue mussel	As	SB	M	D	14.77		II		▪
I132	Svensholmen	MYTI EDU	Blue mussel	As	SB	M	D	18.40		II		▪
I133	Odderø (west)	MYTI EDU	Blue mussel	As	SB	M	D	15.87		II		▪
I201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	As	SB	M	D	6.35		I		▪
I205	Bølsnes (G5)	MYTI EDU	Blue mussel	As	SB	M	D	8.38		I		▪
I241	Nordnes	MYTI EDU	Blue mussel	As	SB	M	D	12.39		II		▪
I242	Gravdalsneset	MYTI EDU	Blue mussel	As	SB	M	D	13.86		II		▪
I243	Hegreneset	MYTI EDU	Blue mussel	As	SB	M	D	11.50		II		▪
I301	Akershuskaia	MYTI EDU	Blue mussel	As	SB	M	D	10.27		II		▪
I304	Gåsøya	MYTI EDU	Blue mussel	As	SB	M	D	13.14		II		▪
I306	Håøya	MYTI EDU	Blue mussel	As	SB	M	D	14.71		II		▪
I307	Ramtonholmen	MYTI EDU	Blue mussel	As	SB	M	D	13.63		II		▪
I712	Gjemesholmen	MYTI EDU	Blue mussel	As	SB	M	D	12.29		II		▪
I713	Strømtangen	MYTI EDU	Blue mussel	As	SB	M	D	15.23		II		▪
I964	Toraneskaia (B4)	MYTI EDU	Blue mussel	As	SB	M	D	13.80		II		▪
I965	Moholmen (B5)	MYTI EDU	Blue mussel	As	SB	M	D	13.83		II		▪
I969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	As	SB	M	D	9.17		I		▪
33F	Sande (east side)	PLAT FLE	Flounder	As	LI	M	W	15.70				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	As	LI	M	W	9.56				▪
67F	Strandebarm area	PLAT FLE	Flounder	As	LI	M	W	1.10				▪
10F	Skogerøy	PLEU PLA	Plaice	As	LI	M	W	11.40				▪
98F2	Husholmen	PLEU PLA	Plaice	As	LI	M	W	3.75				▪
35A	Mølen	MYTI EDU	Blue mussel	Ba	SB	M	D	1.64				▪
30A	Gressholmen	MYTI EDU	Blue mussel	BaP	SB	U	D	2.78	no	I	--	○
I131A	Lastad	MYTI EDU	Blue mussel	BaP	SB	U	D	3.85	no	I	--	○
I132	Svensholmen	MYTI EDU	Blue mussel	BaP	SB	U	D	24.70	4.9	III	--	○
I133	Odderø (west)	MYTI EDU	Blue mussel	BaP	SB	U	D	112.00	22.4	IV	--	○
I201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	BaP	SB	U	D	5.41	1.1	II	D-	↓
I205	Bølsnes (G5)	MYTI EDU	Blue mussel	BaP	SB	U	D	3.13	no	I	--	○
I301	Akershuskaia	MYTI EDU	Blue mussel	BaP	SB	U	D	3.86	no	I	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
1304	Gåsøya	MYTI EDU	Blue mussel	BaP	SB	U	D	3.57	no	I	--	○
1306	Håøya	MYTI EDU	Blue mussel	BaP	SB	U	D	3.33	no	I	U-	↑
1307	Ramtonholmen	MYTI EDU	Blue mussel	BaP	SB	U	D	2.94	no	I	UY	↑
1912	Honnhammer	MYTI EDU	Blue mussel	BaP	SB	U	D	2.78	no	I	--	○
1913	Fjøseid	MYTI EDU	Blue mussel	BaP	SB	U	D	2.78	no	I	--	○
1964	Toraneskaaien (B4)	MYTI EDU	Blue mussel	BaP	SB	U	D	397.00	79.3	V	--	○
1965	Moholmen (B5)	MYTI EDU	Blue mussel	BaP	SB	U	D	233.00	46.7	V	--	○
1969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	BaP	SB	U	D	14.90	3	II	--	○
13BH	Kristiansand havn	GADU MOR	Cod	BDESS	LI	U	W	573				▪
23B	Karihavet area	GADU MOR	Cod	BDESS	LI	U	W	10	m		-?	▪
30B	Oslo City area	GADU MOR	Cod	BDESS	LI	U	W	61	m		-?	▪
36B	Færder area	GADU MOR	Cod	BDESS	LI	U	W	68				▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	BDESS	LI	U	W	222				▪
43BH	Tromsø havn	GADU MOR	Cod	BDESS	LI	U	W	897				▪
53B	Inner Sørffjord	GADU MOR	Cod	BDESS	LI	U	W	33	m		-?	▪
80BH	Munkholmen	GADU MOR	Cod	BDESS	LI	U	W	867				▪
92B	Stokken area	GADU MOR	Cod	BDESS	LI	U	W	148				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	BDESS	LI	U	W	92				▪
10B	Varangerfjorden	GADU MOR	Cod	CB_S7	LI	U	W	131	no	I	DY	↓
13BH	Kristiansand havn	GADU MOR	Cod	CB_S7	LI	U	W	34340.90		V		▪
23B	Karihavet area	GADU MOR	Cod	CB_S7	LI	U	W	78	no	I	D-	↓
30B	Oslo City area	GADU MOR	Cod	CB_S7	LI	U	W	3600	3.6	III	--	○
36B	Færder area	GADU MOR	Cod	CB_S7	LI	U	W	181	no	I	DY	↓
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	CB_S7	LI	U	W	121	no	I	-?	▪
43BH	Tromsø havn	GADU MOR	Cod	CB_S7	LI	U	W	8515.40		IV		▪
53B	Inner Sørffjord	GADU MOR	Cod	CB_S7	LI	U	W	449	no	I	--	○
67B	Strandebarm area	GADU MOR	Cod	CB_S7	LI	U	W	89	no	I	D-	↓
77B	Borøy area	GADU MOR	Cod	CB_S7	LI	U	W	197	no	I	-?	▪
80BH	Munkholmen	GADU MOR	Cod	CB_S7	LI	U	W	27540.80		V		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	CB_S7	LI	U	W	15	no	I	D-	↓
10B	Varangerfjorden	GADU MOR	Cod	CB_S7	MU	U	W	0.71	no	I	--	○
13BH	Kristiansand havn	GADU MOR	Cod	CB_S7	MU	U	W	33.86		III		▪
15B	Ullerø area	GADU MOR	Cod	CB_S7	MU	U	W	0.48	no	I	--	○
23B	Karihavet area	GADU MOR	Cod	CB_S7	MU	U	W	0.84	no	I	--	○
30B	Oslo City area	GADU MOR	Cod	CB_S7	MU	U	W	21.20	7.1	III	--	○
36B	Færder area	GADU MOR	Cod	CB_S7	MU	U	W	2.53	no	I	--	○
43BH	Tromsø havn	GADU MOR	Cod	CB_S7	MU	U	W	7.84		II		▪
53B	Inner Sørffjord	GADU MOR	Cod	CB_S7	MU	U	W	4.44	1.5	II	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
67B	Strandebarm area	GADU MOR	Cod	CB_S7	MU	U	W	0.43	no	I	--	○
77B	Borøy area	GADU MOR	Cod	CB_S7	MU	U	W	0.98	no	I	-?	▪
80BH	Munkholmen	GADU MOR	Cod	CB_S7	MU	U	W	19.84		II		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	CB_S7	MU	U	W	0.18	no	I	--	○
21F	Åkrafjord	LEPI WHI	Megrim	CB_S7	LI	U	W	66	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	CB_S7	LI	U	W	27	m		DY	↓
21F	Åkrafjord	LEPI WHI	Megrim	CB_S7	MU	U	W	2.81				▪
67F	Strandebarm area	LEPI WHI	Megrim	CB_S7	MU	U	W	0.52	m		--	○
15F	Ullerø area	LIMA LIM	Dab	CB_S7	LI	U	W	48	no	B.B.	--	○
21F	Åkrafjord	LIMA LIM	Dab	CB_S7	LI	U	W	34	no	B.B.	Dm	↓
36F	Færder area	LIMA LIM	Dab	CB_S7	LI	U	W	313	no	B.B.	--	○
77F	Borøy area	LIMA LIM	Dab	CB_S7	LI	U	W	80	no	B.B.	-?	▪
15F	Ullerø area	LIMA LIM	Dab	CB_S7	MU	U	W	0.66	no	B.B.	--	○
21F	Åkrafjord	LIMA LIM	Dab	CB_S7	MU	U	W	1.20	no	B.B.	--	○
36F	Færder area	LIMA LIM	Dab	CB_S7	MU	U	W	10.10	2	O.B.	UY	↑
77F	Borøy area	LIMA LIM	Dab	CB_S7	MU	U	W	6.33		O.B.		▪
01A	Sponvika	MYTI EDU	Blue mussel	CB_S7	SB	U	D	32.68		II		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	CB_S7	SB	U	D	26.54		II		▪
03A	Tisler	MYTI EDU	Blue mussel	CB_S7	SB	U	D	12.18		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	CB_S7	SB	U	D	2.06	no	I	D-	↓
11X	Brashavn	MYTI EDU	Blue mussel	CB_S7	SB	U	D	2.64	no	I	--	○
13A	Langøysund	MYTI EDU	Blue mussel	CB_S7	SB	U	D	13.93		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	35.68		II		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	CB_S7	SB	U	D	4.50	no	I	DY	↓
227A2	Høgevarde	MYTI EDU	Blue mussel	CB_S7	SB	U	D	25.57		II		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	CB_S7	SB	U	D	4.84	no	I	--	○
30A	Gressholmen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	38.30	1.5	II	D-	↓
31A	Solbergstrand	MYTI EDU	Blue mussel	CB_S7	SB	U	D	11.00	no	I	DY	↓
35A	Mølen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	6.96	no	I	D-	↓
51A	Byrkjenes	MYTI EDU	Blue mussel	CB_S7	SB	U	D	9.93	no	I	--	○
52A	Eitrheimsneset	MYTI EDU	Blue mussel	CB_S7	SB	U	D	6.78	no	I	--	○
56A	Kvalnes	MYTI EDU	Blue mussel	CB_S7	SB	U	D	5.81	no	I	--	○
57A	Krossanes	MYTI EDU	Blue mussel	CB_S7	SB	U	D	4.88	no	I	--	○
69A	Lille Terøy	MYTI EDU	Blue mussel	CB_S7	SB	U	D	2.73	no	I	--	○
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	CB_S7	SB	U	D	9.71	no	I	D-	↓
73A	Lyngholmen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	31.10		II		▪
76A	Risøy	MYTI EDU	Blue mussel	CB_S7	SB	U	D	5.24	no	I	DY	↓
77A	Nordstrand	MYTI EDU	Blue mussel	CB_S7	SB	U	D	151.13		III		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	CB_S7	SB	U	D	19.44		II		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	CB_S7	SB	U	D	3.25	no	I	--	○
1023	Singlekalven (south)	MYTI EDU	Blue mussel	CB_S7	SB	U	D	9.62	no	I	D-	↓
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	CB_S7	SB	U	D	8.36	no	I	D-	↓
1131A	Lastad	MYTI EDU	Blue mussel	CB_S7	SB	U	D	8.18	no	I	--	○
1132	Svensholmen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	29.10	1.2	II	--	○
1241	Nordnes	MYTI EDU	Blue mussel	CB_S7	SB	U	D	51.50	2.1	II	--	○
1242	Gravdalsneset	MYTI EDU	Blue mussel	CB_S7	SB	U	D	35.10	1.4	II	--	○
1243	Hegreneset	MYTI EDU	Blue mussel	CB_S7	SB	U	D	35.90	1.4	II	--	○
1301	Akershuskaia	MYTI EDU	Blue mussel	CB_S7	SB	U	D	45.90	1.8	II	D-	↓
1304	Gåsøya	MYTI EDU	Blue mussel	CB_S7	SB	U	D	17.70	no	II	--	○
1306	Håøya	MYTI EDU	Blue mussel	CB_S7	SB	U	D	12.30	no	I	--	○
1307	Ramtonholmen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	16.50	no	II	D-	↓
1712	Gjemesholmen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	9.47	no	I	D-	↓
1713	Strømtangen	MYTI EDU	Blue mussel	CB_S7	SB	U	D	13.10	no	I	--	○
33F	Sande (east side)	PLAT FLE	Flounder	CB_S7	LI	U	W	75	no	B.B.	--	○
53F	Inner Sørfjord	PLAT FLE	Flounder	CB_S7	LI	U	W	19	no	B.B.	DY	↓
67F	Strandebarm area	PLAT FLE	Flounder	CB_S7	LI	U	W	23	no	B.B.	D-	↓
33F	Sande (east side)	PLAT FLE	Flounder	CB_S7	MU	U	W	1.28	no	B.B.	--	○
53F	Inner Sørfjord	PLAT FLE	Flounder	CB_S7	MU	U	W	0.59	no	B.B.	DY	↓
67F	Strandebarm area	PLAT FLE	Flounder	CB_S7	MU	U	W	1.13	no	B.B.	DY	↓
10F	Skogerøy	PLEU PLA	Plaice	CB_S7	LI	U	W	11	no	B.B.	--	○
10F	Skogerøy	PLEU PLA	Plaice	CB_S7	MU	U	W	0.33	no	B.B.	--	○
10B	Varangerfjorden	GADU MOR	Cod	Cd	LI	M	W	0.06	no	B.B.	D-	↓
13BH	Kristiansand havn	GADU MOR	Cod	Cd	LI	M	W	0.04		B.B.		▪
23B	Karihavet area	GADU MOR	Cod	Cd	LI	M	W	0.02	no	B.B.	--	○
30B	Oslo City area	GADU MOR	Cod	Cd	LI	M	W	0.16	1.6	O.B.	U-	↑
36B	Færder area	GADU MOR	Cod	Cd	LI	M	W	0.03	no	B.B.	DY	↓
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	Cd	LI	M	W	0.11	1.1	O.B.	-?	▪
43BH	Tromsø havn	GADU MOR	Cod	Cd	LI	M	W	0.17		O.B.		▪
53B	Inner Sørfjord	GADU MOR	Cod	Cd	LI	M	W	0.20	2	O.B.	UY	↑
67B	Strandebarm area	GADU MOR	Cod	Cd	LI	M	W	0.01	no	B.B.	D-	↓
77B	Borøy area	GADU MOR	Cod	Cd	LI	M	W	0.02	no	B.B.	-?	▪
80BH	Munkholmen	GADU MOR	Cod	Cd	LI	M	W	0.02		B.B.		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Cd	LI	M	W	0.02	no	B.B.	--	○
21F	Åkrafjord	LEPI WHI	Megrim	Cd	LI	M	W	0.11	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	Cd	LI	M	W	0.02	m		DY	↓
15F	Ullerø area	LIMA LIM	Dab	Cd	LI	M	W	0.18	no	B.B.	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
21F	Åkråfjord	LIMA LIM	Dab	Cd	LI	M	W	0.17	no	B.B.	--	○
36F	Færder area	LIMA LIM	Dab	Cd	LI	M	W	0.15	no	B.B.	--	○
77F	Borøy area	LIMA LIM	Dab	Cd	LI	M	W	0.08	no	B.B.	-?	▪
01A	Sponvika	MYTI EDU	Blue mussel	Cd	SB	M	D	0.87		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Cd	SB	M	D	3.23		II		▪
03A	Tisler	MYTI EDU	Blue mussel	Cd	SB	M	D	1.28		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Cd	SB	M	D	1.55	no	I	--	○
11X	Brashavn	MYTI EDU	Blue mussel	Cd	SB	M	D	1.02	no	I	--	○
13A	Langøysund	MYTI EDU	Blue mussel	Cd	SB	M	D	0.75		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Cd	SB	M	D	1.16		I		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Cd	SB	M	D	0.84	no	I	--	○
227A2	Høgevarde	MYTI EDU	Blue mussel	Cd	SB	M	D	0.85		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Cd	SB	M	D	0.87	no	I	--	○
30A	Gressholmen	MYTI EDU	Blue mussel	Cd	SB	M	D	1.21	no	I	UY	↑
31A	Solbergstrand	MYTI EDU	Blue mussel	Cd	SB	M	D	1.16	no	I	UY	↑
35A	Mølen	MYTI EDU	Blue mussel	Cd	SB	M	D	0.73	no	I	UY	↑
51A	Byrkjenes	MYTI EDU	Blue mussel	Cd	SB	M	D	2.29	1.1	II	D-	↓
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Cd	SB	M	D	2.25	1.1	II	D-	↓
56A	Kvalnes	MYTI EDU	Blue mussel	Cd	SB	M	D	4.89	2.4	II	D-	↓
57A	Krossanes	MYTI EDU	Blue mussel	Cd	SB	M	D	1.83	no	I	D-	↓
63A	Ranaskjær	MYTI EDU	Blue mussel	Cd	SB	M	D	2.04	1	II	D-	↓
65A	Vikingneset	MYTI EDU	Blue mussel	Cd	SB	M	D	1.43	no	I	D-	↓
69A	Lille Terøy	MYTI EDU	Blue mussel	Cd	SB	M	D	1.09	no	I	D-	↓
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Cd	SB	M	D	0.92	no	I	D-	↓
73A	Lyngholmen	MYTI EDU	Blue mussel	Cd	SB	M	D	0.74		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Cd	SB	M	D	1.01	no	I	--	○
77A	Nordstrand	MYTI EDU	Blue mussel	Cd	SB	M	D	1.33		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Cd	SB	M	D	2.03		II		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Cd	SB	M	D	1.24	no	I	DY	↓
1022	West Damholmen	MYTI EDU	Blue mussel	Cd	SB	M	D	1.65	no	I	--	○
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Cd	SB	M	D	0.98	no	I	--	○
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Cd	SB	M	D	1.91	no	I	--	○
1131A	Lastad	MYTI EDU	Blue mussel	Cd	SB	M	D	1.51	no	I	--	○
1132	Svensholmen	MYTI EDU	Blue mussel	Cd	SB	M	D	1.22		I		▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Cd	SB	M	D	1.85		I		▪
1201	Ekkjegrund (G1)	MYTI EDU	Blue mussel	Cd	SB	M	D	0.92	no	I	--	○
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Cd	SB	M	D	1.14	no	I	--	○
1241	Nordnes	MYTI EDU	Blue mussel	Cd	SB	M	D	1.33		I		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
I242	Gravdalsneset	MYTI EDU	Blue mussel	Cd	SB	M	D	1.17		I		▪
I243	Hegreneset	MYTI EDU	Blue mussel	Cd	SB	M	D	1.24		I		▪
I301	Akershuskaia	MYTI EDU	Blue mussel	Cd	SB	M	D	1.23	no	I	--	○
I304	Gåsøya	MYTI EDU	Blue mussel	Cd	SB	M	D	1.16	no	I	--	○
I306	Håøya	MYTI EDU	Blue mussel	Cd	SB	M	D	0.77	no	I	--	○
I307	Ramtonholmen	MYTI EDU	Blue mussel	Cd	SB	M	D	0.82	no	I	UY	↑
I712	Gjemesholmen	MYTI EDU	Blue mussel	Cd	SB	M	D	1.44		I		▪
I713	Strømtangen	MYTI EDU	Blue mussel	Cd	SB	M	D	1.03		I		▪
I964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Cd	SB	M	D	1.55	no	I	--	○
I965	Moholmen (B5)	MYTI EDU	Blue mussel	Cd	SB	M	D	1.74	no	I	--	○
I969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Cd	SB	M	D	0.50	no	I	--	○
33F	Sande (east side)	PLAT FLE	Flounder	Cd	LI	M	W	0.06	no	B.B.	D-	↓
53F	Inner Sørfjord	PLAT FLE	Flounder	Cd	LI	M	W	0.15	no	B.B.	--	○
67F	Strandebarm area	PLAT FLE	Flounder	Cd	LI	M	W	0.13	no	B.B.	DY	↓
10F	Skogerøy	PLEU PLA	Plaice	Cd	LI	M	W	0.62	3.1	O.B.	--	○
10B	Varangerfjorden	GADU MOR	Cod	Co	LI	M	W	0.02				▪
13BH	Kristiansand havn	GADU MOR	Cod	Co	LI	M	W	0.08				▪
15B	Ullerø area	GADU MOR	Cod	Co	LI	M	W	0.04				▪
23B	Karihavet area	GADU MOR	Cod	Co	LI	M	W	0.29				▪
30B	Oslo City area	GADU MOR	Cod	Co	LI	M	W	0.10				▪
36B	Færder area	GADU MOR	Cod	Co	LI	M	W	0.05				▪
43BH	Tromsø havn	GADU MOR	Cod	Co	LI	M	W	0.01				▪
53B	Inner Sørfjord	GADU MOR	Cod	Co	LI	M	W	0.06				▪
67B	Strandebarm area	GADU MOR	Cod	Co	LI	M	W	0.03				▪
77B	Borøy area	GADU MOR	Cod	Co	LI	M	W	0.04				▪
80BH	Munkholmen	GADU MOR	Cod	Co	LI	M	W	0.03				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Co	LI	M	W	0.02				▪
21F	Åkra fjord	LEPI WHI	Megrim	Co	LI	M	W	0.08				▪
67F	Strandebarm area	LEPI WHI	Megrim	Co	LI	M	W	0.06				▪
15F	Ullerø area	LIMA LIM	Dab	Co	LI	M	W	0.21				▪
21F	Åkra fjord	LIMA LIM	Dab	Co	LI	M	W	0.53				▪
36F	Færder area	LIMA LIM	Dab	Co	LI	M	W	0.21				▪
77F	Borøy area	LIMA LIM	Dab	Co	LI	M	W	0.42				▪
01A	Sponvika	MYTI EDU	Blue mussel	Co	SB	M	D	0.28				▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Co	SB	M	D	1.02				▪
03A	Tisler	MYTI EDU	Blue mussel	Co	SB	M	D	0.55				▪
10A2	Skallneset	MYTI EDU	Blue mussel	Co	SB	M	D	0.28				▪
11X	Brashavn	MYTI EDU	Blue mussel	Co	SB	M	D	0.30				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
13A	Langø Sund	MYTI EDU	Blue mussel	Co	SB	M	D	0.40				▪
14A	Aavigen	MYTI EDU	Blue mussel	Co	SB	M	D	0.51				▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Co	SB	M	D	0.56				▪
227A2	Høgevarde	MYTI EDU	Blue mussel	Co	SB	M	D	0.62				▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Co	SB	M	D	0.44				▪
30A	Gressholmen	MYTI EDU	Blue mussel	Co	SB	M	D	0.38				▪
31A	Solbergstrand	MYTI EDU	Blue mussel	Co	SB	M	D	0.41				▪
35A	Mølen	MYTI EDU	Blue mussel	Co	SB	M	D	0.26				▪
51A	Byrkjenes	MYTI EDU	Blue mussel	Co	SB	M	D	0.46				▪
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Co	SB	M	D	0.35				▪
56A	Kvalnes	MYTI EDU	Blue mussel	Co	SB	M	D	0.55				▪
57A	Krossanes	MYTI EDU	Blue mussel	Co	SB	M	D	0.36				▪
63A	Ranaskjær	MYTI EDU	Blue mussel	Co	SB	M	D	0.47				▪
65A	Vikingneset	MYTI EDU	Blue mussel	Co	SB	M	D	0.40				▪
69A	Lille Terøy	MYTI EDU	Blue mussel	Co	SB	M	D	0.46				▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Co	SB	M	D	0.35				▪
73A	Lyngholmen	MYTI EDU	Blue mussel	Co	SB	M	D	0.48				▪
76A	Risøy	MYTI EDU	Blue mussel	Co	SB	M	D	0.56				▪
77A	Nordstrand	MYTI EDU	Blue mussel	Co	SB	M	D	0.57				▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Co	SB	M	D	0.70				▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Co	SB	M	D	0.35				▪
1022	West Damholmen	MYTI EDU	Blue mussel	Co	SB	M	D	0.89				▪
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Co	SB	M	D	0.51				▪
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Co	SB	M	D	1.09				▪
1131A	Lastad	MYTI EDU	Blue mussel	Co	SB	M	D	0.63				▪
1132	Svensholmen	MYTI EDU	Blue mussel	Co	SB	M	D	1.01				▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Co	SB	M	D	1.50				▪
1201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Co	SB	M	D	0.32				▪
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Co	SB	M	D	0.30				▪
1241	Nordnes	MYTI EDU	Blue mussel	Co	SB	M	D	0.47				▪
1242	Gravdalsneset	MYTI EDU	Blue mussel	Co	SB	M	D	0.46				▪
1243	Hegreneset	MYTI EDU	Blue mussel	Co	SB	M	D	0.36				▪
1301	Akershuskaia	MYTI EDU	Blue mussel	Co	SB	M	D	0.38				▪
1304	Gåsøya	MYTI EDU	Blue mussel	Co	SB	M	D	0.47				▪
1306	Håøya	MYTI EDU	Blue mussel	Co	SB	M	D	0.37				▪
1307	Ramtonholmen	MYTI EDU	Blue mussel	Co	SB	M	D	0.54				▪
1712	Gjemesholmen	MYTI EDU	Blue mussel	Co	SB	M	D	0.51				▪
1713	Strømtangen	MYTI EDU	Blue mussel	Co	SB	M	D	0.68				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
1964	Toraneskaaien (B4)	MYTI EDU	Blue mussel	Co	SB	M	D	1.12				▪
1965	Moholmen (B5)	MYTI EDU	Blue mussel	Co	SB	M	D	1.11				▪
1969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Co	SB	M	D	0.35				▪
33F	Sande (east side)	PLAT FLE	Flounder	Co	LI	M	W	0.83				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	Co	LI	M	W	0.19				▪
67F	Strandebarm area	PLAT FLE	Flounder	Co	LI	M	W	0.02				▪
10F	Skogerøy	PLEU PLA	Plaice	Co	LI	M	W	0.27				▪
98F2	Husholmen	PLEU PLA	Plaice	Co	LI	M	W	0.07				▪
10B	Varangerfjorden	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
13BH	Kristiansand havn	GADU MOR	Cod	Cr	LI	M	W	0.40				▪
15B	Ullerø area	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
23B	Karihavet area	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
30B	Oslo City area	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
36B	Færder area	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
43BH	Tromsø havn	GADU MOR	Cod	Cr	LI	M	W	0.10				▪
53B	Inner Sørfjord	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
67B	Strandebarm area	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
77B	Borøy area	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
80BH	Munkholmen	GADU MOR	Cod	Cr	LI	M	W	0.30				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Cr	LI	M	W	0.20				▪
21F	Åkrafjord	LEPI WHI	Megrim	Cr	LI	M	W	0.20				▪
67F	Strandebarm area	LEPI WHI	Megrim	Cr	LI	M	W	0.20				▪
15F	Ullerø area	LIMA LIM	Dab	Cr	LI	M	W	0.20				▪
21F	Åkrafjord	LIMA LIM	Dab	Cr	LI	M	W	0.20				▪
36F	Færder area	LIMA LIM	Dab	Cr	LI	M	W	0.20				▪
77F	Borøy area	LIMA LIM	Dab	Cr	LI	M	W	0.20				▪
01A	Sponvika	MYTI EDU	Blue mussel	Cr	SB	M	D	1.28		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Cr	SB	M	D	2.23		I		▪
03A	Tisler	MYTI EDU	Blue mussel	Cr	SB	M	D	1.13		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Cr	SB	M	D	1.00		I		▪
11X	Brashavn	MYTI EDU	Blue mussel	Cr	SB	M	D	0.67		I		▪
13A	Langøysund	MYTI EDU	Blue mussel	Cr	SB	M	D	1.00		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Cr	SB	M	D	0.92		I		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Cr	SB	M	D	0.47		I		▪
227A2	Høgevarde	MYTI EDU	Blue mussel	Cr	SB	M	D	1.33		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Cr	SB	M	D	0.57		I		▪
30A	Gressholmen	MYTI EDU	Blue mussel	Cr	SB	M	D	0.82		I		▪
31A	Solbergstrand	MYTI EDU	Blue mussel	Cr	SB	M	D	1.53		I		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
35A	Mølen	MYTI EDU	Blue mussel	Cr	SB	M	D	0.96		I		▪
51A	Byrkjenes	MYTI EDU	Blue mussel	Cr	SB	M	D	1.50		I		▪
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Cr	SB	M	D	0.41		I		▪
56A	Kvalnes	MYTI EDU	Blue mussel	Cr	SB	M	D	1.50		I		▪
57A	Krossanes	MYTI EDU	Blue mussel	Cr	SB	M	D	0.95		I		▪
63A	Ranaskjær	MYTI EDU	Blue mussel	Cr	SB	M	D	1.76		I		▪
65A	Vikingneset	MYTI EDU	Blue mussel	Cr	SB	M	D	1.00		I		▪
69A	Lille Terøy	MYTI EDU	Blue mussel	Cr	SB	M	D	0.67		I		▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Cr	SB	M	D	0.67		I		▪
73A	Lyngholmen	MYTI EDU	Blue mussel	Cr	SB	M	D	0.40		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Cr	SB	M	D	0.82		I		▪
77A	Nordstrand	MYTI EDU	Blue mussel	Cr	SB	M	D	1.07		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Cr	SB	M	D	1.62		I		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Cr	SB	M	D	1.13		I		▪
1022	West Damholmen	MYTI EDU	Blue mussel	Cr	SB	M	D	2.20		I		▪
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Cr	SB	M	D	2.08		I		▪
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Cr	SB	M	D	5.36		II		▪
1131A	Lastad	MYTI EDU	Blue mussel	Cr	SB	M	D	1.18		I		▪
1132	Svensholmen	MYTI EDU	Blue mussel	Cr	SB	M	D	2.06		I		▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Cr	SB	M	D	3.02		II		▪
1201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Cr	SB	M	D	0.82		I		▪
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Cr	SB	M	D	1.20		I		▪
1241	Nordnes	MYTI EDU	Blue mussel	Cr	SB	M	D	1.73		I		▪
1242	Gravdalsneset	MYTI EDU	Blue mussel	Cr	SB	M	D	1.64		I		▪
1243	Hegreneset	MYTI EDU	Blue mussel	Cr	SB	M	D	1.89		I		▪
1301	Akershuskaia	MYTI EDU	Blue mussel	Cr	SB	M	D	1.40		I		▪
1304	Gåsøya	MYTI EDU	Blue mussel	Cr	SB	M	D	1.07		I		▪
1306	Håøya	MYTI EDU	Blue mussel	Cr	SB	M	D	0.93		I		▪
1307	Ramtonholmen	MYTI EDU	Blue mussel	Cr	SB	M	D	1.24		I		▪
1712	Gjemesholmen	MYTI EDU	Blue mussel	Cr	SB	M	D	3.52		II		▪
1713	Strømtangen	MYTI EDU	Blue mussel	Cr	SB	M	D	1.69		I		▪
1964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Cr	SB	M	D	47.29		IV		▪
1965	Moholmen (B5)	MYTI EDU	Blue mussel	Cr	SB	M	D	36.73		IV		▪
1969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Cr	SB	M	D	2.30		I		▪
33F	Sande (east side)	PLAT FLE	Flounder	Cr	LI	M	W	0.20				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	Cr	LI	M	W	0.20				▪
67F	Strandebarm area	PLAT FLE	Flounder	Cr	LI	M	W	0.20				▪
10F	Skogerøy	PLEU PLA	Plaice	Cr	LI	M	W	0.20				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
98F2	Husholmen	PLEU PLA	Plaice	Cr	LI	M	W	0.20				▪
10B	Varangerfjorden	GADU MOR	Cod	Cu	LI	M	W	3.66		B.B.		▪
13BH	Kristiansand havn	GADU MOR	Cod	Cu	LI	M	W	7.44		B.B.		▪
15B	Ullerø area	GADU MOR	Cod	Cu	LI	M	W	5.04		B.B.		▪
23B	Karihavet area	GADU MOR	Cod	Cu	LI	M	W	7.46		B.B.		▪
30B	Oslo City area	GADU MOR	Cod	Cu	LI	M	W	6.54		B.B.		▪
36B	Færder area	GADU MOR	Cod	Cu	LI	M	W	6.14		B.B.		▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	Cu	LI	M	W	8.09		B.B.		▪
43BH	Tromsø havn	GADU MOR	Cod	Cu	LI	M	W	3.59		B.B.		▪
53B	Inner Sørfjord	GADU MOR	Cod	Cu	LI	M	W	7.94		B.B.		▪
67B	Strandebarm area	GADU MOR	Cod	Cu	LI	M	W	7.80		B.B.		▪
77B	Borøy area	GADU MOR	Cod	Cu	LI	M	W	6.46		B.B.		▪
80BH	Munkholmen	GADU MOR	Cod	Cu	LI	M	W	4.45		B.B.		▪
92B	Stokken area	GADU MOR	Cod	Cu	LI	M	W	5.77		B.B.		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Cu	LI	M	W	1.94		B.B.		▪
21F	Åkrafjord	LEPI WHI	Megrim	Cu	LI	M	W	0.02	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	Cu	LI	M	W	7.46				▪
15F	Ullerø area	LIMA LIM	Dab	Cu	LI	M	W	9.82		B.B.		▪
21F	Åkrafjord	LIMA LIM	Dab	Cu	LI	M	W	9.94		B.B.		▪
36F	Færder area	LIMA LIM	Dab	Cu	LI	M	W	7.23		B.B.		▪
77F	Borøy area	LIMA LIM	Dab	Cu	LI	M	W	3.25		B.B.		▪
01A	Sponvika	MYTI EDU	Blue mussel	Cu	SB	M	D	8.01		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Cu	SB	M	D	8.46		I		▪
03A	Tisler	MYTI EDU	Blue mussel	Cu	SB	M	D	7.07		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Cu	SB	M	D	6.24	no	I	--	○
11X	Brashavn	MYTI EDU	Blue mussel	Cu	SB	M	D	5.90	no	I	--	○
13A	Langøysund	MYTI EDU	Blue mussel	Cu	SB	M	D	5.93		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Cu	SB	M	D	8.71		I		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Cu	SB	M	D	6.24	no	I	--	○
227A2	Høgevarde	MYTI EDU	Blue mussel	Cu	SB	M	D	6.93		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Cu	SB	M	D	6.39	no	I	--	○
30A	Gressholmen	MYTI EDU	Blue mussel	Cu	SB	M	D	8.44	no	I	--	○
31A	Solbergstrand	MYTI EDU	Blue mussel	Cu	SB	M	D	6.23	no	I	--	○
35A	Mølen	MYTI EDU	Blue mussel	Cu	SB	M	D	6.48	no	I	--	○
51A	Byrkjenes	MYTI EDU	Blue mussel	Cu	SB	M	D	4.86	no	I	--	○
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Cu	SB	M	D	6.94	no	I	--	○
56A	Kvalnes	MYTI EDU	Blue mussel	Cu	SB	M	D	6.56	no	I	--	○
57A	Krossanes	MYTI EDU	Blue mussel	Cu	SB	M	D	4.75	no	I	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
63A	Ranaskjær	MYTI EDU	Blue mussel	Cu	SB	M	D	5.82	no	I	--	○
65A	Vikingneset	MYTI EDU	Blue mussel	Cu	SB	M	D	5.37	no	I	--	○
69A	Lille Terøy	MYTI EDU	Blue mussel	Cu	SB	M	D	5.61	no	I	--	○
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Cu	SB	M	D	6.22	no	I	--	○
73A	Lyngholmen	MYTI EDU	Blue mussel	Cu	SB	M	D	6.88		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Cu	SB	M	D	6.76	no	I	--	○
77A	Nordstrand	MYTI EDU	Blue mussel	Cu	SB	M	D	7.53		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Cu	SB	M	D	10.00		II		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Cu	SB	M	D	6.68	no	I	--	○
1022	West Damholmen	MYTI EDU	Blue mussel	Cu	SB	M	D	7.70		I		▪
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Cu	SB	M	D	6.77		I		▪
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Cu	SB	M	D	10.10		II		▪
1131A	Lastad	MYTI EDU	Blue mussel	Cu	SB	M	D	8.23		I		▪
1132	Svensholmen	MYTI EDU	Blue mussel	Cu	SB	M	D	12.20		II		▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Cu	SB	M	D	10.99		II		▪
1201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Cu	SB	M	D	4.41		I		▪
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Cu	SB	M	D	3.93		I		▪
1241	Nordnes	MYTI EDU	Blue mussel	Cu	SB	M	D	8.40		I		▪
1242	Gravdalsneset	MYTI EDU	Blue mussel	Cu	SB	M	D	7.14		I		▪
1243	Hegreneset	MYTI EDU	Blue mussel	Cu	SB	M	D	7.21		I		▪
1301	Akershuskaia	MYTI EDU	Blue mussel	Cu	SB	M	D	7.53		I		▪
1304	Gåsøya	MYTI EDU	Blue mussel	Cu	SB	M	D	6.57		I		▪
1306	Håøya	MYTI EDU	Blue mussel	Cu	SB	M	D	5.73		I		▪
1307	Ramtonholmen	MYTI EDU	Blue mussel	Cu	SB	M	D	6.47		I		▪
1712	Gjemesholmen	MYTI EDU	Blue mussel	Cu	SB	M	D	5.62		I		▪
1713	Strømtangen	MYTI EDU	Blue mussel	Cu	SB	M	D	6.85		I		▪
1964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Cu	SB	M	D	11.22		II		▪
1965	Moholmen (B5)	MYTI EDU	Blue mussel	Cu	SB	M	D	10.20		II		▪
1969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Cu	SB	M	D	5.45		I		▪
33F	Sande (east side)	PLAT FLE	Flounder	Cu	LI	M	W	15.00		O.B.		▪
53F	Inner Sørfjord	PLAT FLE	Flounder	Cu	LI	M	W	11.62		O.B.		▪
67F	Strandebarm area	PLAT FLE	Flounder	Cu	LI	M	W	11.20		O.B.		▪
10F	Skogerøy	PLEU PLA	Plaice	Cu	LI	M	W	4.22		B.B.		▪
98F2	Husholmen	PLEU PLA	Plaice	Cu	LI	M	W	2.15		B.B.		▪
23B	Karihavet area	GADU MOR	Cod	CYP1A	LI	ABS	W	0.175	m		-?	▪
30B	Oslo City area	GADU MOR	Cod	CYP1A	LI	ABS	W	0.513	m		--	○
53B	Inner Sørfjord	GADU MOR	Cod	CYP1A	LI	ABS	W	0.380	m		--	○
10B	Varangerfjorden	GADU MOR	Cod	DD_S4	LI	U	W	51	no	I	D-	↓

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
13BH	Kristiansand havn	GADU MOR	Cod	DD_S4	LI	U	W	58.00		I		▪
23B	Karihavet area	GADU MOR	Cod	DD_S4	LI	U	W	27	no	I	D-	↓
30B	Oslo City area	GADU MOR	Cod	DD_S4	LI	U	W	150	no	I	--	○
36B	Færder area	GADU MOR	Cod	DD_S4	LI	U	W	26	no	I	D-	↓
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	DD_S4	LI	U	W	48	no	I	-?	▪
43BH	Tromsø havn	GADU MOR	Cod	DD_S4	LI	U	W	33.00		I		▪
53B	Inner Sør fjord	GADU MOR	Cod	DD_S4	LI	U	W	268	1.3	II	--	○
67B	Strandebarm area	GADU MOR	Cod	DD_S4	LI	U	W	100	no	I	D-	↓
80BH	Munkholmen	GADU MOR	Cod	DD_S4	LI	U	W	60.00		I		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	DD_S4	LI	U	W	6	no	I	D-	↓
13BH	Kristiansand havn	GADU MOR	Cod	DD_S4	MU	U	W	0.31		I		▪
23B	Karihavet area	GADU MOR	Cod	DD_S4	MU	U	W	0.09	no	I	--	○
30B	Oslo City area	GADU MOR	Cod	DD_S4	MU	U	W	1.10	1.1	II	--	○
36B	Færder area	GADU MOR	Cod	DD_S4	MU	U	W	0.22	no	I	--	○
43BH	Tromsø havn	GADU MOR	Cod	DD_S4	MU	U	W	0.14		I		▪
53B	Inner Sør fjord	GADU MOR	Cod	DD_S4	MU	U	W	1.30	1.3	II	--	○
67B	Strandebarm area	GADU MOR	Cod	DD_S4	MU	U	W	0.47	no	I	D-	↓
77B	Borøy area	GADU MOR	Cod	DD_S4	MU	U	W	0.14	no	I	-?	▪
80BH	Munkholmen	GADU MOR	Cod	DD_S4	MU	U	W	0.21		I		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	DD_S4	MU	U	W	0.05	no	I	--	○
21F	Åkrafjord	LEPI WHI	Megrim	DD_S4	LI	U	W	43	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	DD_S4	LI	U	W	46	m		D-	↓
21F	Åkrafjord	LEPI WHI	Megrim	DD_S4	MU	U	W	0.59	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	DD_S4	MU	U	W	0.66	m		D-	↓
15F	Ullerø area	LIMA LIM	Dab	DD_S4	LI	U	W	16	no	B.B.	--	○
21F	Åkrafjord	LIMA LIM	Dab	DD_S4	LI	U	W	18	no	B.B.	Dm	↓
36F	Færder area	LIMA LIM	Dab	DD_S4	LI	U	W	18	no	B.B.	--	○
77F	Borøy area	LIMA LIM	Dab	DD_S4	LI	U	W	20	no	B.B.	-?	▪
21F	Åkrafjord	LIMA LIM	Dab	DD_S4	MU	U	W	0.69	no	B.B.	--	○
36F	Færder area	LIMA LIM	Dab	DD_S4	MU	U	W	0.41	no	B.B.	--	○
77F	Borøy area	LIMA LIM	Dab	DD_S4	MU	U	W	0.29		B.B.		▪
01A	Sponvika	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.37		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.83		I		▪
03A	Tisler	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.67		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.35	no	I	--	○
11X	Brashavn	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.45	no	I	--	○
13A	Langøysund	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.29		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.15		I		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.77	no	I	--	○
227A2	Høgevarde	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.93		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.90	no	I	--	○
30A	Gressholmen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.11	no	I	D-	↓
31A	Solbergstrand	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.94	no	I	--	○
35A	Mølen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	3.13	no	I	--	○
51A	Byrkjenes	MYTI EDU	Blue mussel	DD_S4	SB	U	D	12.90	1.3	II	--	○
52A	Eitrheimsneset	MYTI EDU	Blue mussel	DD_S4	SB	U	D	6.11	no	I	--	○
56A	Kvalnes	MYTI EDU	Blue mussel	DD_S4	SB	U	D	44.00	4.4	III	--	○
57A	Krossanes	MYTI EDU	Blue mussel	DD_S4	SB	U	D	25.50	2.6	III	--	○
63A	Ranaskjær	MYTI EDU	Blue mussel	DD_S4	SB	U	D	7.50	no	I	--	○
65A	Vikingneset	MYTI EDU	Blue mussel	DD_S4	SB	U	D	5.50	no	I	--	○
69A	Lille Terøy	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.12	no	I	--	○
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.71	no	I	--	○
73A	Lyngholmen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.52		I		▪
76A	Risøy	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.73	no	I	--	○
77A	Nordstrand	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.40		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	DD_S4	SB	U	D	3.27		I		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	DD_S4	SB	U	D	0.61	no	I	--	○
1022	West Damholmen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.40	no	I	DY	↓
1023	Singlekalven (south)	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.77	no	I	D-	↓
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.20	no	I	DY	↓
1131A	Lastad	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.46	no	I	--	○
1132	Svensholmen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.87	no	I	--	○
1133	Odderø (west)	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.00	no	I	--	○
1241	Nordnes	MYTI EDU	Blue mussel	DD_S4	SB	U	D	5.56	no	I	--	○
1242	Gravdalsneset	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.71	no	I	--	○
1243	Hegreneset	MYTI EDU	Blue mussel	DD_S4	SB	U	D	3.16	no	I	--	○
1301	Akershuskaia	MYTI EDU	Blue mussel	DD_S4	SB	U	D	3.00	no	I	--	○
1304	Gåsøya	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.93	no	I	--	○
1306	Håøya	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.71	no	I	--	○
1307	Ramtonholmen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	2.31	no	I	--	○
1712	Gjemesholmen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.05	no	I	--	○
1713	Strømtangen	MYTI EDU	Blue mussel	DD_S4	SB	U	D	1.62	no	I	--	○
33F	Sande (east side)	PLAT FLE	Flounder	DD_S4	LI	U	W	24	no	B.B.	--	○
53F	Inner Sørfjord	PLAT FLE	Flounder	DD_S4	LI	U	W	9	no	B.B.	--	○
67F	Strandebarm area	PLAT FLE	Flounder	DD_S4	LI	U	W	19	no	B.B.	--	○
33F	Sande (east side)	PLAT FLE	Flounder	DD_S4	MU	U	W	0.39	no	B.B.	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
53F	Inner Sør fjord	PLAT FLE	Flounder	DD_S4	MU	U	W	0.27	no	B.B.	D-	↓
67F	Strandebarm area	PLAT FLE	Flounder	DD_S4	MU	U	W	0.87	no	B.B.	DY	↓
10F	Skogerøy	PLEU PLA	Plaice	DD_S4	LI	U	W	4	no	B.B.	D-	↓
10F	Skogerøy	PLEU PLA	Plaice	DD_S4	MU	U	W	0.11	no	B.B.	D-	↓
23B	Karihavet area	GADU MOR	Cod	EROD	LI	pm	W	27.8	m		--	○
30B	Oslo City area	GADU MOR	Cod	EROD	LI	pm	W	57.8	m		--	○
53B	Inner Sør fjord	GADU MOR	Cod	EROD	LI	pm	W	41.4	m		--	○
10B	Varangerfjorden	GADU MOR	Cod	HCB	LI	U	W	8	no	I	D-	↓
13BH	Kristiansand havn	GADU MOR	Cod	HCB	LI	U	W	110.00		III		▪
23B	Karihavet area	GADU MOR	Cod	HCB	LI	U	W	5	no	I	--	○
30B	Oslo City area	GADU MOR	Cod	HCB	LI	U	W	4	no	I	D-	↓
36B	Færder area	GADU MOR	Cod	HCB	LI	U	W	3	no	I	D-	↓
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	HCB	LI	U	W	8	no	I	-?	▪
43BH	Tromsø havn	GADU MOR	Cod	HCB	LI	U	W	7.70		I		▪
53B	Inner Sør fjord	GADU MOR	Cod	HCB	LI	U	W	4	no	I	--	○
67B	Strandebarm area	GADU MOR	Cod	HCB	LI	U	W	4	no	I	D-	↓
80BH	Munkholmen	GADU MOR	Cod	HCB	LI	U	W	22.00		II		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	HCB	LI	U	W	4	no	I	D-	↓
13BH	Kristiansand havn	GADU MOR	Cod	HCB	MU	U	W	1.40		III		▪
23B	Karihavet area	GADU MOR	Cod	HCB	MU	U	W	0.17	no	I	--	○
30B	Oslo City area	GADU MOR	Cod	HCB	MU	U	W	0.06	no	I	DY	↓
36B	Færder area	GADU MOR	Cod	HCB	MU	U	W	0.04	no	I	D-	↓
43BH	Tromsø havn	GADU MOR	Cod	HCB	MU	U	W	0.08		I		▪
53B	Inner Sør fjord	GADU MOR	Cod	HCB	MU	U	W	0.04	no	I	--	○
67B	Strandebarm area	GADU MOR	Cod	HCB	MU	U	W	0.05	no	I	D-	↓
77B	Borøy area	GADU MOR	Cod	HCB	MU	U	W	0.05	no	I	-?	▪
80BH	Munkholmen	GADU MOR	Cod	HCB	MU	U	W	0.16		I		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	HCB	MU	U	W	0.05	no	I	D-	↓
21F	Åkra fjord	LEPI WHI	Megrim	HCB	LI	U	W	4	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	HCB	LI	U	W	2	m		D-	↓
21F	Åkra fjord	LEPI WHI	Megrim	HCB	MU	U	W	0.32	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	HCB	MU	U	W	0.06	m		D-	↓
15F	Ullerø area	LIMA LIM	Dab	HCB	LI	U	W	3	no	B.B.	--	○
21F	Åkra fjord	LIMA LIM	Dab	HCB	LI	U	W	1	no	B.B.	--	○
36F	Færder area	LIMA LIM	Dab	HCB	LI	U	W	1	no	B.B.	D-	↓
77F	Borøy area	LIMA LIM	Dab	HCB	LI	U	W	3	no	B.B.	-?	▪
21F	Åkra fjord	LIMA LIM	Dab	HCB	MU	U	W	0.06	no	B.B.	--	○
36F	Færder area	LIMA LIM	Dab	HCB	MU	U	W	0.07	no	B.B.	DY	↓

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
77F	Borøy area	LIMA LIM	Dab	HCB	MU	U	W	0.07		B.B.		▪
01A	Sponvika	MYTI EDU	Blue mussel	HCB	SB	U	D	0.61		II		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	HCB	SB	U	D	0.23		I		▪
03A	Tisler	MYTI EDU	Blue mussel	HCB	SB	U	D	0.18		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	HCB	SB	U	D	0.35	no	I	--	○
11X	Brashavn	MYTI EDU	Blue mussel	HCB	SB	U	D	0.91	1.8	II	--	○
13A	Langøsund	MYTI EDU	Blue mussel	HCB	SB	U	D	0.94		II		▪
14A	Aavigen	MYTI EDU	Blue mussel	HCB	SB	U	D	1.07		II		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	HCB	SB	U	D	0.18	no	I	--	○
227A2	Høgevarde	MYTI EDU	Blue mussel	HCB	SB	U	D	0.27		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	HCB	SB	U	D	0.21	no	I	D-	↓
30A	Gressholmen	MYTI EDU	Blue mussel	HCB	SB	U	D	0.22	no	I	D-	↓
31A	Solbergstrand	MYTI EDU	Blue mussel	HCB	SB	U	D	0.94	1.9	II	DY	↓
35A	Mølen	MYTI EDU	Blue mussel	HCB	SB	U	D	0.26	no	I	DY	↓
51A	Byrkjenes	MYTI EDU	Blue mussel	HCB	SB	U	D	0.58	1.2	II	--	○
52A	Eitrheimsneset	MYTI EDU	Blue mussel	HCB	SB	U	D	0.17	no	I	--	○
56A	Kvalnes	MYTI EDU	Blue mussel	HCB	SB	U	D	0.27	no	I	--	○
57A	Krossanes	MYTI EDU	Blue mussel	HCB	SB	U	D	0.75	1.5	II	--	○
63A	Ranaskjær	MYTI EDU	Blue mussel	HCB	SB	U	D	0.63	1.3	II	--	○
65A	Vikingneset	MYTI EDU	Blue mussel	HCB	SB	U	D	0.95	1.9	II	--	○
69A	Lille Terøy	MYTI EDU	Blue mussel	HCB	SB	U	D	0.67	1.3	II	--	○
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	HCB	SB	U	D	1.38	2.8	II	D-	↓
73A	Lyngholmen	MYTI EDU	Blue mussel	HCB	SB	U	D	0.16		I		▪
76A	Risøy	MYTI EDU	Blue mussel	HCB	SB	U	D	0.18	no	I	--	○
77A	Nordstrand	MYTI EDU	Blue mussel	HCB	SB	U	D	0.88		II		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	HCB	SB	U	D	1.25		II		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	HCB	SB	U	D	0.38	no	I	--	○
1022	West Damholmen	MYTI EDU	Blue mussel	HCB	SB	U	D	0.50	1	II	--	○
1023	Singlekalven (south)	MYTI EDU	Blue mussel	HCB	SB	U	D	0.42	no	I	--	○
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	HCB	SB	U	D	0.50	1	II	--	○
1131A	Lastad	MYTI EDU	Blue mussel	HCB	SB	U	D	0.77	1.5	II	U-	↑
1132	Svensholmen	MYTI EDU	Blue mussel	HCB	SB	U	D	0.67	1.3	II	--	○
1133	Odderø (west)	MYTI EDU	Blue mussel	HCB	SB	U	D	1.87	3.7	III	D-	↓
1241	Nordnes	MYTI EDU	Blue mussel	HCB	SB	U	D	0.56	1.1	II	UY	↑
1242	Gravdalsneset	MYTI EDU	Blue mussel	HCB	SB	U	D	0.77	1.5	II	DY	↓
1243	Hegreneset	MYTI EDU	Blue mussel	HCB	SB	U	D	0.53	1.1	II	--	○
1301	Akershuskaia	MYTI EDU	Blue mussel	HCB	SB	U	D	0.53	1.1	II	--	○
1304	Gåsøya	MYTI EDU	Blue mussel	HCB	SB	U	D	0.36	no	I	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
I306	Håøya	MYTI EDU	Blue mussel	HCB	SB	U	D	0.36	no	I	--	○
I307	Ramtonholmen	MYTI EDU	Blue mussel	HCB	SB	U	D	0.44	no	I	--	○
I712	Gjemesholmen	MYTI EDU	Blue mussel	HCB	SB	U	D	1.43	2.9	II	--	○
I713	Strømtangen	MYTI EDU	Blue mussel	HCB	SB	U	D	2.83	5.7	III	--	○
33F	Sande (east side)	PLAT FLE	Flounder	HCB	LI	U	W	2	no	B.B.	--	○
53F	Inner Sørfjord	PLAT FLE	Flounder	HCB	LI	U	W	1	no	B.B.	D-	↓
67F	Strandebarm area	PLAT FLE	Flounder	HCB	LI	U	W	3	no	B.B.	--	○
33F	Sande (east side)	PLAT FLE	Flounder	HCB	MU	U	W	0.05	no	B.B.	--	○
53F	Inner Sørfjord	PLAT FLE	Flounder	HCB	MU	U	W	0.05	no	B.B.	DY	↓
67F	Strandebarm area	PLAT FLE	Flounder	HCB	MU	U	W	0.15	1.5	O.B.	--	○
10F	Skogerøy	PLEU PLA	Plaice	HCB	LI	U	W	2	no	B.B.	D-	↓
10F	Skogerøy	PLEU PLA	Plaice	HCB	MU	U	W	0.07	no	B.B.	D-	↓
10B	Varangerfjorden	GADU MOR	Cod	Hg	MU	M	W	0.030	no	I	DY	↓
13BH	Kristiansand havn	GADU MOR	Cod	Hg	MU	M	W	0.073		I		▪
15B	Ullerø area	GADU MOR	Cod	Hg	MU	M	W	0.049	no	I	--	○
23B	Karihavet area	GADU MOR	Cod	Hg	MU	M	W	0.057	no	I	--	○
30B	Oslo City area	GADU MOR	Cod	Hg	MU	M	W	0.260	2.6	II	U-	↑
36B	Færder area	GADU MOR	Cod	Hg	MU	M	W	0.086	no	I	--	○
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	Hg	MU	M	W	0.044	no	I	-?	▪
43BH	Tromsø havn	GADU MOR	Cod	Hg	MU	M	W	0.028		I		▪
53B	Inner Sørfjord	GADU MOR	Cod	Hg	MU	M	W	0.194	1.9	II	--	○
67B	Strandebarm area	GADU MOR	Cod	Hg	MU	M	W	0.065	no	I	D-	↓
77B	Borøy area	GADU MOR	Cod	Hg	MU	M	W	0.080	no	I	-?	▪
80BH	Munkholmen	GADU MOR	Cod	Hg	MU	M	W	0.060		I		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Hg	MU	M	W	0.025	no	I	--	○
21F	Åkra fjord	LEPI WHI	Megrim	Hg	MU	M	W	0.173	m		--	○
67F	Strandebarm area	LEPI WHI	Megrim	Hg	MU	M	W	0.090	m		D-	↓
15F	Ullerø area	LIMA LIM	Dab	Hg	MU	M	W	0.068	no	B.B.	U-	↑
21F	Åkra fjord	LIMA LIM	Dab	Hg	MU	M	W	0.139	1.4	O.B.	--	○
36F	Færder area	LIMA LIM	Dab	Hg	MU	M	W	0.118	1.2	O.B.	--	○
77F	Borøy area	LIMA LIM	Dab	Hg	MU	M	W	0.050		B.B.		▪
01A	Sponvika	MYTI EDU	Blue mussel	Hg	SB	M	D	0.143		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Hg	SB	M	D	0.308		II		▪
03A	Tisler	MYTI EDU	Blue mussel	Hg	SB	M	D	0.094		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Hg	SB	M	D	0.041	no	I	D-	↓
11X	Brashavn	MYTI EDU	Blue mussel	Hg	SB	M	D	0.043	no	I	--	○
13A	Langøysund	MYTI EDU	Blue mussel	Hg	SB	M	D	0.081		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.143		I		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.077	no	I	--	○
227A2	Høgevarde	MYTI EDU	Blue mussel	Hg	SB	M	D	0.200		II		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.063	no	I	UY	↑
30A	Gressholmen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.078	no	I	--	○
31A	Solbergstrand	MYTI EDU	Blue mussel	Hg	SB	M	D	0.088	no	I	UY	↑
35A	Mølen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.057	no	I	--	○
51A	Byrkjenes	MYTI EDU	Blue mussel	Hg	SB	M	D	0.264	1.3	II	--	○
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Hg	SB	M	D	0.129	no	I	D-	↓
56A	Kvalnes	MYTI EDU	Blue mussel	Hg	SB	M	D	0.313	1.6	II	D-	↓
57A	Krossanes	MYTI EDU	Blue mussel	Hg	SB	M	D	0.150	no	I	DY	↓
63A	Ranaskjær	MYTI EDU	Blue mussel	Hg	SB	M	D	0.150	no	I	--	○
65A	Vikingneset	MYTI EDU	Blue mussel	Hg	SB	M	D	0.110	no	I	--	○
69A	Lille Terøy	MYTI EDU	Blue mussel	Hg	SB	M	D	0.100	no	I	--	○
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.124	no	I	D-	↓
73A	Lyngholmen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.038		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Hg	SB	M	D	0.100	no	I	--	○
77A	Nordstrand	MYTI EDU	Blue mussel	Hg	SB	M	D	0.139		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.318		II		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Hg	SB	M	D	0.072	no	I	--	○
1022	West Damholmen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.280	1.4	II	--	○
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.131	no	I	--	○
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.240	1.2	II	--	○
1131A	Lastad	MYTI EDU	Blue mussel	Hg	SB	M	D	0.123	no	I	--	○
1132	Svensholmen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.143		I		▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.177		I		▪
1201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.129	no	I	--	○
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.180	no	I	--	○
1241	Nordnes	MYTI EDU	Blue mussel	Hg	SB	M	D	0.178		I		▪
1242	Gravdalsneset	MYTI EDU	Blue mussel	Hg	SB	M	D	0.129		I		▪
1243	Hegreneset	MYTI EDU	Blue mussel	Hg	SB	M	D	0.116		I		▪
1301	Akershuskaia	MYTI EDU	Blue mussel	Hg	SB	M	D	0.073	no	I	U-	↑
1304	Gåsøya	MYTI EDU	Blue mussel	Hg	SB	M	D	0.057	no	I	--	○
1306	Håøya	MYTI EDU	Blue mussel	Hg	SB	M	D	0.053	no	I	--	○
1307	Ramtonholmen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.047	no	I	--	○
1712	Gjemesholmen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.197	no	I	--	○
1713	Strømtangen	MYTI EDU	Blue mussel	Hg	SB	M	D	0.131	no	I	--	○
1964	Toraneskaiaen (B4)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.116	no	I	--	○
1965	Moholmen (B5)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.086	no	I	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
1969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Hg	SB	M	D	0.040	no	I	--	○
33F	Sande (east side)	PLAT FLE	Flounder	Hg	MU	M	W	0.049	no	B.B.	DY	↓
53F	Inner Sørfjord	PLAT FLE	Flounder	Hg	MU	M	W	0.074	no	B.B.	UY	↑
67F	Strandebarm area	PLAT FLE	Flounder	Hg	MU	M	W	0.065	no	B.B.	DY	↓
10F	Skogerøy	PLEU PLA	Plaice	Hg	MU	M	W	0.017	no	B.B.	--	○
10B	Varangerfjorden	GADU MOR	Cod	HS_S2	LI	U	W	0.50				▪
13BH	Kristiansand havn	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
15B	Ullerø area	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
23B	Karihavet area	GADU MOR	Cod	HS_S2	LI	U	W	0.50				▪
30B	Oslo City area	GADU MOR	Cod	HS_S2	LI	U	W	0.60				▪
36B	Færder area	GADU MOR	Cod	HS_S2	LI	U	W	0.50				▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
43BH	Tromsø havn	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
53B	Inner Sørfjord	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
67B	Strandebarm area	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
77B	Borøy area	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
80BH	Munkholmen	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
92B	Stokken area	GADU MOR	Cod	HS_S2	LI	U	W	1.00				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	HS_S2	LI	U	W	2.00				▪
10B	Varangerfjorden	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
13BH	Kristiansand havn	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
15B	Ullerø area	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
23B	Karihavet area	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
30B	Oslo City area	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
36B	Færder area	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
43BH	Tromsø havn	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
53B	Inner Sørfjord	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
67B	Strandebarm area	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
77B	Borøy area	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
80BH	Munkholmen	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	HS_S2	MU	U	W	0.05				▪
21F	Åkra fjord	LEPI WHI	Megrim	HS_S2	LI	U	W	1.00				▪
67F	Strandebarm area	LEPI WHI	Megrim	HS_S2	LI	U	W	0.50				▪
21F	Åkra fjord	LEPI WHI	Megrim	HS_S2	MU	U	W	0.05				▪
67F	Strandebarm area	LEPI WHI	Megrim	HS_S2	MU	U	W	0.05				▪
15F	Ullerø area	LIMA LIM	Dab	HS_S2	LI	U	W	1.00				▪
21F	Åkra fjord	LIMA LIM	Dab	HS_S2	LI	U	W	0.20				▪
36F	Færder area	LIMA LIM	Dab	HS_S2	LI	U	W	0.50				▪

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77F	Borøy area	LIMA LIM	Dab	HS_S2	LI	U	W	0.50				▪
15F	Ullerø area	LIMA LIM	Dab	HS_S2	MU	U	W	0.05				▪
21F	Åkrafjord	LIMA LIM	Dab	HS_S2	MU	U	W	0.05				▪
36F	Færder area	LIMA LIM	Dab	HS_S2	MU	U	W	0.05				▪
77F	Borøy area	LIMA LIM	Dab	HS_S2	MU	U	W	0.05				▪
01A	Sponvika	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.30				▪
02A	Fugleskjær	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.38				▪
03A	Tisler	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.29				▪
10A2	Skallneset	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.29				▪
11X	Brashavn	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.24				▪
13A	Langø Sund	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.31				▪
14A	Aavigen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.36				▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.29				▪
227A2	Høgevarde	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.33				▪
22A	Espevær (west)	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.24				▪
30A	Gressholmen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.28				▪
31A	Solbergstrand	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.31				▪
35A	Mølen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.23				▪
51A	Byrkjenes	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.71				▪
52A	Eitrheimsneset	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.28				▪
56A	Kvalnes	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.33				▪
57A	Krossanes	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.25				▪
63A	Ranaskjær	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.31				▪
65A	Vikingneset	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.25				▪
69A	Lille Terøy	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.28				▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.24				▪
73A	Lyngholmen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.21				▪
76A	Risøy	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.29				▪
77A	Nordstrand	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.29				▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.42				▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.28				▪
1022	West Damholmen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	1.00				▪
1023	Singlekalven (south)	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.77				▪
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	HS_S2	SB	U	D	1.00				▪
1131A	Lastad	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.38				▪
1132	Svensholmen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.33				▪
1133	Odderø (west)	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.40				▪
1241	Nordnes	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.28				▪

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I242	Gravdalsneset	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.36				▪
I243	Hegreneset	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.26				▪
I301	Akershuskaia	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.67				▪
I304	Gåsøya	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.71				▪
I306	Håøya	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.67				▪
I307	Ramtonholmen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.59				▪
I712	Gjemesholmen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.35				▪
I713	Strømtangen	MYTI EDU	Blue mussel	HS_S2	SB	U	D	0.38				▪
33F	Sande (east side)	PLAT FLE	Flounder	HS_S2	LI	U	W	1.00				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	HS_S2	LI	U	W	0.71				▪
67F	Strandebarm area	PLAT FLE	Flounder	HS_S2	LI	U	W	1.00				▪
33F	Sande (east side)	PLAT FLE	Flounder	HS_S2	MU	U	W	0.05				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	HS_S2	MU	U	W	0.05				▪
67F	Strandebarm area	PLAT FLE	Flounder	HS_S2	MU	U	W	0.05				▪
10F	Skogerøy	PLEU PLA	Plaice	HS_S2	LI	U	W	0.20				▪
98F2	Husholmen	PLEU PLA	Plaice	HS_S2	LI	U	W	0.10				▪
10F	Skogerøy	PLEU PLA	Plaice	HS_S2	MU	U	W	0.05				▪
98F2	Husholmen	PLEU PLA	Plaice	HS_S2	MU	U	W	0.05				▪
30A	Gressholmen	MYTI EDU	Blue mussel	PK_S	SB	U	D	11.1	no	I	--	○
35A	Mølen	MYTI EDU	Blue mussel	PK_S	SB	U	D	8.0		I	--	▪
I131A	Lastad	MYTI EDU	Blue mussel	PK_S	SB	U	D	9.6	no	I	--	○
I132	Svensholmen	MYTI EDU	Blue mussel	PK_S	SB	U	D	162.0	3.2	III	--	○
I133	Odderø (west)	MYTI EDU	Blue mussel	PK_S	SB	U	D	568.0	11.4	IV	--	○
I201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	PK_S	SB	U	D	52.6	1.1	II	D-	↓
I205	Bølsnes (G5)	MYTI EDU	Blue mussel	PK_S	SB	U	D	27.9	no	I	--	○
I301	Akershuskaia	MYTI EDU	Blue mussel	PK_S	SB	U	D	35.9	no	I	--	○
I304	Gåsøya	MYTI EDU	Blue mussel	PK_S	SB	U	D	8.9	no	I	--	○
I306	Håøya	MYTI EDU	Blue mussel	PK_S	SB	U	D	8.9	no	I	--	○
I307	Ramtonholmen	MYTI EDU	Blue mussel	PK_S	SB	U	D	7.4	no	I	--	○
I912	Honnhammer	MYTI EDU	Blue mussel	PK_S	SB	U	D	8.9	no	I	D-	↓
I913	Fjøseid	MYTI EDU	Blue mussel	PK_S	SB	U	D	11.6	no	I	D-	↓
I915	Flåøya (northwest)	MYTI EDU	Blue mussel	PK_S	SB	U	D	112.6		II	--	▪
I964	Toraneskaia (B4)	MYTI EDU	Blue mussel	PK_S	SB	U	D	1610.0	32.1	V	--	○
I965	Moholmen (B5)	MYTI EDU	Blue mussel	PK_S	SB	U	D	990.0	19.8	IV	--	○
I969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	PK_S	SB	U	D	90.0	1.8	II	--	○
35A	Mølen	MYTI EDU	Blue mussel	MO	SB	M	D	0.76				▪
10B	Varangerfjorden	GADU MOR	Cod	Ni	LI	M	W	0.11				▪
13BH	Kristiansand havn	GADU MOR	Cod	Ni	LI	M	W	0.39				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
15B	Ullerø area	GADU MOR	Cod	Ni	LI	M	W	0.06				▪
23B	Karihavet area	GADU MOR	Cod	Ni	LI	M	W	0.50				▪
30B	Oslo City area	GADU MOR	Cod	Ni	LI	M	W	0.17				▪
36B	Færder area	GADU MOR	Cod	Ni	LI	M	W	0.07				▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	Ni	LI	M	W	0.04				▪
43BH	Tromsø havn	GADU MOR	Cod	Ni	LI	M	W	0.06				▪
53B	Inner Sør fjord	GADU MOR	Cod	Ni	LI	M	W	0.15				▪
67B	Strandebarm area	GADU MOR	Cod	Ni	LI	M	W	0.04				▪
77B	Borøy area	GADU MOR	Cod	Ni	LI	M	W	0.04				▪
80BH	Munkholmen	GADU MOR	Cod	Ni	LI	M	W	0.10				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Ni	LI	M	W	0.03				▪
21F	Åkra fjord	LEPI WHI	Megrim	Ni	LI	M	W	0.02				▪
67F	Strandebarm area	LEPI WHI	Megrim	Ni	LI	M	W	0.02				▪
15F	Ullerø area	LIMA LIM	Dab	Ni	LI	M	W	0.11				▪
21F	Åkra fjord	LIMA LIM	Dab	Ni	LI	M	W	0.20				▪
36F	Færder area	LIMA LIM	Dab	Ni	LI	M	W	0.09				▪
77F	Borøy area	LIMA LIM	Dab	Ni	LI	M	W	0.23				▪
01A	Sponvika	MYTI EDU	Blue mussel	Ni	SB	M	D	0.78		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Ni	SB	M	D	2.58		I		▪
03A	Tisler	MYTI EDU	Blue mussel	Ni	SB	M	D	1.94		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Ni	SB	M	D	1.29		I		▪
11X	Brashavn	MYTI EDU	Blue mussel	Ni	SB	M	D	1.14		I		▪
13A	Langøysund	MYTI EDU	Blue mussel	Ni	SB	M	D	1.14		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Ni	SB	M	D	1.38		I		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Ni	SB	M	D	1.29		I		▪
227A2	Høgevarde	MYTI EDU	Blue mussel	Ni	SB	M	D	2.53		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Ni	SB	M	D	1.00		I		▪
30A	Gressholmen	MYTI EDU	Blue mussel	Ni	SB	M	D	1.00		I		▪
31A	Solbergstrand	MYTI EDU	Blue mussel	Ni	SB	M	D	1.67		I		▪
35A	Mølen	MYTI EDU	Blue mussel	Ni	SB	M	D	1.13		I		▪
51A	Byrkjenes	MYTI EDU	Blue mussel	Ni	SB	M	D	1.29		I		▪
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Ni	SB	M	D	0.94		I		▪
56A	Kvalnes	MYTI EDU	Blue mussel	Ni	SB	M	D	1.38		I		▪
57A	Krossanes	MYTI EDU	Blue mussel	Ni	SB	M	D	1.00		I		▪
63A	Ranaskjær	MYTI EDU	Blue mussel	Ni	SB	M	D	1.53		I		▪
65A	Vikingneset	MYTI EDU	Blue mussel	Ni	SB	M	D	1.25		I		▪
69A	Lille Terøy	MYTI EDU	Blue mussel	Ni	SB	M	D	1.00		I		▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Ni	SB	M	D	0.86		I		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
73A	Lyngholmen	MYTI EDU	Blue mussel	Ni	SB	M	D	0.80		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Ni	SB	M	D	1.80		I		▪
77A	Nordstrand	MYTI EDU	Blue mussel	Ni	SB	M	D	1.83		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Ni	SB	M	D	2.08		I		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Ni	SB	M	D	1.19		I		▪
I022	West Damholmen	MYTI EDU	Blue mussel	Ni	SB	M	D	2.50		I		▪
I023	Singlekalven (south)	MYTI EDU	Blue mussel	Ni	SB	M	D	2.25		I		▪
I024	Kirkøy (north west)	MYTI EDU	Blue mussel	Ni	SB	M	D	5.20		II		▪
I131A	Lastad	MYTI EDU	Blue mussel	Ni	SB	M	D	1.69		I		▪
I132	Svensholmen	MYTI EDU	Blue mussel	Ni	SB	M	D	6.63		II		▪
I133	Odderø (west)	MYTI EDU	Blue mussel	Ni	SB	M	D	5.18		II		▪
I201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Ni	SB	M	D	0.71		I		▪
I205	Bølsnes (G5)	MYTI EDU	Blue mussel	Ni	SB	M	D	0.73		I		▪
I241	Nordnes	MYTI EDU	Blue mussel	Ni	SB	M	D	1.40		I		▪
I242	Gravdalsneset	MYTI EDU	Blue mussel	Ni	SB	M	D	1.21		I		▪
I243	Hegreneset	MYTI EDU	Blue mussel	Ni	SB	M	D	1.40		I		▪
I301	Akershuskaia	MYTI EDU	Blue mussel	Ni	SB	M	D	1.13		I		▪
I304	Gåsøya	MYTI EDU	Blue mussel	Ni	SB	M	D	1.36		I		▪
I306	Håøya	MYTI EDU	Blue mussel	Ni	SB	M	D	1.40		I		▪
I307	Ramtonholmen	MYTI EDU	Blue mussel	Ni	SB	M	D	1.53		I		▪
I712	Gjemesholmen	MYTI EDU	Blue mussel	Ni	SB	M	D	2.72		I		▪
I713	Strømtangen	MYTI EDU	Blue mussel	Ni	SB	M	D	2.08		I		▪
I964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Ni	SB	M	D	28.33		III		▪
I965	Moholmen (B5)	MYTI EDU	Blue mussel	Ni	SB	M	D	22.56		III		▪
I969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Ni	SB	M	D	1.75		I		▪
33F	Sande (east side)	PLAT FLE	Flounder	Ni	LI	M	W	0.44				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	Ni	LI	M	W	0.06				▪
67F	Strandebarm area	PLAT FLE	Flounder	Ni	LI	M	W	0.03				▪
10F	Skogerøy	PLEU PLA	Plaice	Ni	LI	M	W	0.10				▪
98F2	Husholmen	PLEU PLA	Plaice	Ni	LI	M	W	0.05				▪
30A	Gressholmen	MYTI EDU	Blue mussel	PAH	SB	U	D	98.9	no	I	--	○
35A	Mølen	MYTI EDU	Blue mussel	PAH	SB	U	D	120.1		I		▪
I131A	Lastad	MYTI EDU	Blue mussel	PAH	SB	U	D	43.8	no	I	--	○
I132	Svensholmen	MYTI EDU	Blue mussel	PAH	SB	U	D	513.0	2.1	II	--	○
I133	Odderø (west)	MYTI EDU	Blue mussel	PAH	SB	U	D	1630.0	6.5	III	--	○
I201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	PAH	SB	U	D	137.0	no	I	D-	↓
I205	Bølsnes (G5)	MYTI EDU	Blue mussel	PAH	SB	U	D	101.0	no	I	D-	↓
I301	Akershuskaia	MYTI EDU	Blue mussel	PAH	SB	U	D	308.0	1.2	II	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
I304	Gåsøya	MYTI EDU	Blue mussel	PAH	SB	U	D	52.5	no	I	--	○
I306	Håøya	MYTI EDU	Blue mussel	PAH	SB	U	D	43.5	no	I	--	○
I307	Ramtonholmen	MYTI EDU	Blue mussel	PAH	SB	U	D	48.3	no	I	--	○
I912	Honnhammer	MYTI EDU	Blue mussel	PAH	SB	U	D	61.7	no	I	DY	↓
I913	Fjøseid	MYTI EDU	Blue mussel	PAH	SB	U	D	73.6	no	I	D-	↓
I915	Flåøya (northwest)	MYTI EDU	Blue mussel	PAH	SB	U	D	731.0		II		▪
I964	Toraneskaaien (B4)	MYTI EDU	Blue mussel	PAH	SB	U	D	3510.0	14.1	III	--	○
I965	Moholmen (B5)	MYTI EDU	Blue mussel	PAH	SB	U	D	2580.0	10.3	III	--	○
I969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	PAH	SB	U	D	641.0	2.6	II	--	○
10B	Varangerfjorden	GADU MOR	Cod	Pb	LI	M	W	0.02	no	B.B.	DY	↓
13BH	Kristiansand havn	GADU MOR	Cod	Pb	LI	M	W	0.04		B.B.		▪
23B	Karihavet area	GADU MOR	Cod	Pb	LI	M	W	0.02	no	B.B.	D-	↓
30B	Oslo City area	GADU MOR	Cod	Pb	LI	M	W	0.13	1.3	O.B.	--	○
36B	Færder area	GADU MOR	Cod	Pb	LI	M	W	0.02	no	B.B.	D-	↓
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	Pb	LI	M	W	0.02	no	B.B.	D?	↓
43BH	Tromsø havn	GADU MOR	Cod	Pb	LI	M	W	0.02		B.B.		▪
53B	Inner Sørfjord	GADU MOR	Cod	Pb	LI	M	W	0.17	1.7	O.B.	UY	↑
67B	Strandebarm area	GADU MOR	Cod	Pb	LI	M	W	0.02	no	B.B.	D-	↓
77B	Borøy area	GADU MOR	Cod	Pb	LI	M	W	0.02	no	B.B.	D?	↓
80BH	Munkholmen	GADU MOR	Cod	Pb	LI	M	W	0.03		B.B.		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Pb	LI	M	W	0.02	no	B.B.	DY	↓
21F	Åkrafjord	LEPI WHI	Megrim	Pb	LI	M	W	0.02				▪
67F	Strandebarm area	LEPI WHI	Megrim	Pb	LI	M	W	0.02	m		D-	↓
15F	Ullerø area	LIMA LIM	Dab	Pb	LI	M	W	0.02	no	B.B.	--	○
21F	Åkrafjord	LIMA LIM	Dab	Pb	LI	M	W	0.24	no	B.B.	Um	↑
36F	Færder area	LIMA LIM	Dab	Pb	LI	M	W	0.04	no	B.B.	DY	↓
77F	Borøy area	LIMA LIM	Dab	Pb	LI	M	W	0.09	no	B.B.	-?	▪
01A	Sponvika	MYTI EDU	Blue mussel	Pb	SB	M	D	1.43		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Pb	SB	M	D	1.00		I		▪
03A	Tisler	MYTI EDU	Blue mussel	Pb	SB	M	D	0.35		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Pb	SB	M	D	0.82	no	I	--	○
11X	Brashavn	MYTI EDU	Blue mussel	Pb	SB	M	D	0.30	no	I	--	○
13A	Langøysund	MYTI EDU	Blue mussel	Pb	SB	M	D	1.25		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Pb	SB	M	D	1.93		I		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Pb	SB	M	D	0.94	no	I	--	○
227A2	Høgevarde	MYTI EDU	Blue mussel	Pb	SB	M	D	3.53		II		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Pb	SB	M	D	0.74	no	I	--	○
30A	Gressholmen	MYTI EDU	Blue mussel	Pb	SB	M	D	2.54	no	I	--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
31A	Solbergstrand	MYTI EDU	Blue mussel	Pb	SB	M	D	0.78	no	I	--	○
35A	Mølen	MYTI EDU	Blue mussel	Pb	SB	M	D	1.00	no	I	DY	↓
51A	Byrkjenes	MYTI EDU	Blue mussel	Pb	SB	M	D	21.20	7.1	III	--	○
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Pb	SB	M	D	5.50	1.8	II	D-	↓
56A	Kvalnes	MYTI EDU	Blue mussel	Pb	SB	M	D	15.00	5	III	--	○
57A	Krossanes	MYTI EDU	Blue mussel	Pb	SB	M	D	4.28	1.4	II	D-	↓
63A	Ranaskjær	MYTI EDU	Blue mussel	Pb	SB	M	D	3.19	1.1	II	D-	↓
65A	Vikingneset	MYTI EDU	Blue mussel	Pb	SB	M	D	3.10	1	II	D-	↓
69A	Lille Terøy	MYTI EDU	Blue mussel	Pb	SB	M	D	1.20	no	I	D-	↓
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Pb	SB	M	D	0.81	no	I	D-	↓
73A	Lyngholmen	MYTI EDU	Blue mussel	Pb	SB	M	D	0.54		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Pb	SB	M	D	1.35	no	I	--	○
77A	Nordstrand	MYTI EDU	Blue mussel	Pb	SB	M	D	2.20		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Pb	SB	M	D	2.73		I		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Pb	SB	M	D	0.83	no	I	D-	↓
1022	West Damholmen	MYTI EDU	Blue mussel	Pb	SB	M	D	1.50	no	I	--	○
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Pb	SB	M	D	0.77	no	I	--	○
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Pb	SB	M	D	1.40	no	I	--	○
1131A	Lastad	MYTI EDU	Blue mussel	Pb	SB	M	D	1.54		I		▪
1132	Svensholmen	MYTI EDU	Blue mussel	Pb	SB	M	D	3.83		II		▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Pb	SB	M	D	12.80		II		▪
1201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Pb	SB	M	D	1.88	no	I	--	○
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Pb	SB	M	D	2.80	no	I	--	○
1241	Nordnes	MYTI EDU	Blue mussel	Pb	SB	M	D	18.67		III		▪
1242	Gravdalsneset	MYTI EDU	Blue mussel	Pb	SB	M	D	5.21		II		▪
1243	Hegreneset	MYTI EDU	Blue mussel	Pb	SB	M	D	8.89		II		▪
1301	Akershuskaia	MYTI EDU	Blue mussel	Pb	SB	M	D	2.00	no	I	--	○
1304	Gåsøya	MYTI EDU	Blue mussel	Pb	SB	M	D	1.50	no	I	--	○
1306	Håøya	MYTI EDU	Blue mussel	Pb	SB	M	D	0.71	no	I	--	○
1307	Ramtonholmen	MYTI EDU	Blue mussel	Pb	SB	M	D	0.88	no	I	--	○
1712	Gjemesholmen	MYTI EDU	Blue mussel	Pb	SB	M	D	3.29		II		▪
1713	Strømtangen	MYTI EDU	Blue mussel	Pb	SB	M	D	1.83		I		▪
1964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Pb	SB	M	D	10.70	3.6	II	--	○
1965	Moholmen (B5)	MYTI EDU	Blue mussel	Pb	SB	M	D	18.40	6.1	III	--	○
1969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Pb	SB	M	D	2.13	no	I	--	○
33F	Sande (east side)	PLAT FLE	Flounder	Pb	LI	M	W	0.03	no	B.B.	DY	↓
53F	Inner Sørfjord	PLAT FLE	Flounder	Pb	LI	M	W	0.04	no	B.B.	--	○
67F	Strandebarm area	PLAT FLE	Flounder	Pb	LI	M	W	0.02	no	B.B.	DY	↓

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
10F	Skogerøy	PLEU PLA	Plaice	Pb	LI	M	W	0.03	no	B.B.	D-	↓
13BH	Kristiansand havn	GADU MOR	Cod	PFOS	LI	U	W	9				▪
23B	Karihavet area	GADU MOR	Cod	PFOS	LI	U	W	9	m		-?	▪
30B	Oslo City area	GADU MOR	Cod	PFOS	LI	U	W	48	m		-?	▪
36B	Færder area	GADU MOR	Cod	PFOS	LI	U	W	29				▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	PFOS	LI	U	W	5.5				▪
43BH	Tromsø havn	GADU MOR	Cod	PFOS	LI	U	W	6.3				▪
53B	Inner Sør fjord	GADU MOR	Cod	PFOS	LI	U	W	3	m		-?	▪
80BH	Munkholmen	GADU MOR	Cod	PFOS	LI	U	W	4.3				▪
92B	Stokken area	GADU MOR	Cod	PFOS	LI	U	W	9.1				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	PFOS	LI	U	W	6.8				▪
15B	Ullerø area	GADU MOR	Cod	PYR10	BI	380	W	2.69	m		--	○
23B	Karihavet area	GADU MOR	Cod	PYR10	BI	380	W	1.02	m		--	○
30B	Oslo City area	GADU MOR	Cod	PYR10	BI	380	W	15.60	m		--	○
53B	Inner Sør fjord	GADU MOR	Cod	PYR10	BI	380	W	10.90	m		--	○
10B	Varangerfjorden	GADU MOR	Cod	QCB	LI	U	W	1.90				▪
13BH	Kristiansand havn	GADU MOR	Cod	QCB	LI	U	W	5.50				▪
15B	Ullerø area	GADU MOR	Cod	QCB	LI	U	W	1.60				▪
23B	Karihavet area	GADU MOR	Cod	QCB	LI	U	W	0.89				▪
30B	Oslo City area	GADU MOR	Cod	QCB	LI	U	W	1.10				▪
36B	Færder area	GADU MOR	Cod	QCB	LI	U	W	0.50				▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	QCB	LI	U	W	2.00				▪
43BH	Tromsø havn	GADU MOR	Cod	QCB	LI	U	W	1.00				▪
67B	Strandebarm area	GADU MOR	Cod	QCB	LI	U	W	1.10				▪
77B	Borøy area	GADU MOR	Cod	QCB	LI	U	W	5.50				▪
80BH	Munkholmen	GADU MOR	Cod	QCB	LI	U	W	1.20				▪
92B	Stokken area	GADU MOR	Cod	QCB	LI	U	W	0.53				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	QCB	LI	U	W	1.60				▪
10B	Varangerfjorden	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
13BH	Kristiansand havn	GADU MOR	Cod	QCB	MU	U	W	0.08				▪
15B	Ullerø area	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
23B	Karihavet area	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
30B	Oslo City area	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
36B	Færder area	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
43BH	Tromsø havn	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
53B	Inner Sør fjord	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
67B	Strandebarm area	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
77B	Borøy area	GADU MOR	Cod	QCB	MU	U	W	0.03				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
80BH	Munkholmen	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	QCB	MU	U	W	0.03				▪
21F	Åkrafjord	LEPI WHI	Megrim	QCB	LI	U	W	1.90				▪
67F	Strandebarm area	LEPI WHI	Megrim	QCB	LI	U	W	0.93				▪
21F	Åkrafjord	LEPI WHI	Megrim	QCB	MU	U	W	0.03				▪
67F	Strandebarm area	LEPI WHI	Megrim	QCB	MU	U	W	0.03				▪
15F	Ullerø area	LIMA LIM	Dab	QCB	LI	U	W	0.79				▪
21F	Åkrafjord	LIMA LIM	Dab	QCB	LI	U	W	0.30				▪
36F	Færder area	LIMA LIM	Dab	QCB	LI	U	W	0.30				▪
77F	Borøy area	LIMA LIM	Dab	QCB	LI	U	W	0.46				▪
15F	Ullerø area	LIMA LIM	Dab	QCB	MU	U	W	0.03				▪
21F	Åkrafjord	LIMA LIM	Dab	QCB	MU	U	W	0.03				▪
36F	Færder area	LIMA LIM	Dab	QCB	MU	U	W	0.03				▪
77F	Borøy area	LIMA LIM	Dab	QCB	MU	U	W	0.03				▪
01A	Sponvika	MYTI EDU	Blue mussel	QCB	SB	U	D	0.18				▪
02A	Fugleskjær	MYTI EDU	Blue mussel	QCB	SB	U	D	0.23				▪
03A	Tisler	MYTI EDU	Blue mussel	QCB	SB	U	D	0.18				▪
10A2	Skallneset	MYTI EDU	Blue mussel	QCB	SB	U	D	0.18				▪
11X	Brashavn	MYTI EDU	Blue mussel	QCB	SB	U	D	0.14				▪
13A	Langø Sund	MYTI EDU	Blue mussel	QCB	SB	U	D	0.19				▪
14A	Aavigen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.21				▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	QCB	SB	U	D	0.59				▪
227A2	Høgevarde	MYTI EDU	Blue mussel	QCB	SB	U	D	0.20				▪
22A	Espevær (west)	MYTI EDU	Blue mussel	QCB	SB	U	D	0.14				▪
30A	Gressholmen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.17				▪
31A	Solbergstrand	MYTI EDU	Blue mussel	QCB	SB	U	D	0.19				▪
35A	Mølen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.13				▪
51A	Byrkjenes	MYTI EDU	Blue mussel	QCB	SB	U	D	0.43				▪
52A	Eittheimsneset	MYTI EDU	Blue mussel	QCB	SB	U	D	0.17				▪
56A	Kvalnes	MYTI EDU	Blue mussel	QCB	SB	U	D	0.20				▪
57A	Krossanes	MYTI EDU	Blue mussel	QCB	SB	U	D	0.15				▪
63A	Ranaskjær	MYTI EDU	Blue mussel	QCB	SB	U	D	0.19				▪
65A	Vikingneset	MYTI EDU	Blue mussel	QCB	SB	U	D	0.24				▪
69A	Lille Terøy	MYTI EDU	Blue mussel	QCB	SB	U	D	0.18				▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	QCB	SB	U	D	0.33				▪
73A	Lyngholmen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.13				▪
76A	Risøy	MYTI EDU	Blue mussel	QCB	SB	U	D	0.18				▪
77A	Nordstrand	MYTI EDU	Blue mussel	QCB	SB	U	D	0.18				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	QCB	SB	U	D	0.25				▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	QCB	SB	U	D	0.17				▪
I022	West Damholmen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.50				▪
I023	Singlekalven (south)	MYTI EDU	Blue mussel	QCB	SB	U	D	0.38				▪
I024	Kirkøy (north west)	MYTI EDU	Blue mussel	QCB	SB	U	D	0.50				▪
I131A	Lastad	MYTI EDU	Blue mussel	QCB	SB	U	D	0.23				▪
I132	Svensholmen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.20				▪
I133	Odderø (west)	MYTI EDU	Blue mussel	QCB	SB	U	D	0.24				▪
I241	Nordnes	MYTI EDU	Blue mussel	QCB	SB	U	D	0.17				▪
I242	Gravdalsneset	MYTI EDU	Blue mussel	QCB	SB	U	D	0.21				▪
I243	Hegreneset	MYTI EDU	Blue mussel	QCB	SB	U	D	0.16				▪
I301	Akershuskaia	MYTI EDU	Blue mussel	QCB	SB	U	D	0.33				▪
I304	Gåsøya	MYTI EDU	Blue mussel	QCB	SB	U	D	0.36				▪
I306	Håøya	MYTI EDU	Blue mussel	QCB	SB	U	D	0.33				▪
I307	Ramtonholmen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.29				▪
I712	Gjemesholmen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.33				▪
I713	Strømtangen	MYTI EDU	Blue mussel	QCB	SB	U	D	0.75				▪
33F	Sande (east side)	PLAT FLE	Flounder	QCB	LI	U	W	0.50				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	QCB	LI	U	W	0.49				▪
67F	Strandebarm area	PLAT FLE	Flounder	QCB	LI	U	W	0.64				▪
33F	Sande (east side)	PLAT FLE	Flounder	QCB	MU	U	W	0.03				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	QCB	MU	U	W	0.03				▪
67F	Strandebarm area	PLAT FLE	Flounder	QCB	MU	U	W	0.03				▪
10F	Skogerøy	PLEU PLA	Plaice	QCB	LI	U	W	0.37				▪
98F2	Husholmen	PLEU PLA	Plaice	QCB	LI	U	W	0.25				▪
10F	Skogerøy	PLEU PLA	Plaice	QCB	MU	U	W	0.03				▪
98F2	Husholmen	PLEU PLA	Plaice	QCB	MU	U	W	0.03				▪
10B	Varangerfjorden	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
13BH	Kristiansand havn	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
15B	Ullerø area	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
23B	Karihavet area	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
30B	Oslo City area	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
36B	Færder area	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
43BH	Tromsø havn	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
53B	Inner Sørfjord	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
67B	Strandebarm area	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
77B	Borøy area	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
80BH	Munkholmen	GADU MOR	Cod	Sn	LI	M	W	0.30				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
98B1	Bjørnerøya (east)	GADU MOR	Cod	Sn	LI	M	W	0.30				▪
21F	Åkrafjord	LEPI WHI	Megrim	Sn	LI	M	W	0.30				▪
67F	Strandebarn area	LEPI WHI	Megrim	Sn	LI	M	W	0.30				▪
15F	Ullerø area	LIMA LIM	Dab	Sn	LI	M	W	0.30				▪
21F	Åkrafjord	LIMA LIM	Dab	Sn	LI	M	W	0.30				▪
36F	Færder area	LIMA LIM	Dab	Sn	LI	M	W	0.30				▪
77F	Borøy area	LIMA LIM	Dab	Sn	LI	M	W	0.30				▪
01A	Sponvika	MYTI EDU	Blue mussel	Sn	SB	M	D	1.83				▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Sn	SB	M	D	2.31				▪
03A	Tisler	MYTI EDU	Blue mussel	Sn	SB	M	D	1.76				▪
10A2	Skallneset	MYTI EDU	Blue mussel	Sn	SB	M	D	1.76				▪
11X	Brashavn	MYTI EDU	Blue mussel	Sn	SB	M	D	1.43				▪
13A	Langøysund	MYTI EDU	Blue mussel	Sn	SB	M	D	1.88				▪
14A	Aavigen	MYTI EDU	Blue mussel	Sn	SB	M	D	2.14				▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Sn	SB	M	D	1.76				▪
227A2	Høgevarde	MYTI EDU	Blue mussel	Sn	SB	M	D	2.00				▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Sn	SB	M	D	1.43				▪
30A	Gressholmen	MYTI EDU	Blue mussel	Sn	SB	M	D	1.67				▪
31A	Solbergstrand	MYTI EDU	Blue mussel	Sn	SB	M	D	1.88				▪
35A	Mølen	MYTI EDU	Blue mussel	Sn	SB	M	D	1.30				▪
51A	Byrkjenes	MYTI EDU	Blue mussel	Sn	SB	M	D	2.14				▪
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Sn	SB	M	D	1.67				▪
56A	Kvalnes	MYTI EDU	Blue mussel	Sn	SB	M	D	2.00				▪
57A	Krossanes	MYTI EDU	Blue mussel	Sn	SB	M	D	1.50				▪
63A	Ranaskjær	MYTI EDU	Blue mussel	Sn	SB	M	D	1.88				▪
65A	Vikingneset	MYTI EDU	Blue mussel	Sn	SB	M	D	1.50				▪
69A	Lille Terøy	MYTI EDU	Blue mussel	Sn	SB	M	D	1.67				▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Sn	SB	M	D	1.43				▪
73A	Lyngholmen	MYTI EDU	Blue mussel	Sn	SB	M	D	1.25				▪
76A	Risøy	MYTI EDU	Blue mussel	Sn	SB	M	D	1.76				▪
77A	Nordstrand	MYTI EDU	Blue mussel	Sn	SB	M	D	1.76				▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Sn	SB	M	D	2.50				▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Sn	SB	M	D	1.67				▪
1022	West Damholmen	MYTI EDU	Blue mussel	Sn	SB	M	D	3.00				▪
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Sn	SB	M	D	2.31				▪
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Sn	SB	M	D	3.00				▪
1131A	Lastad	MYTI EDU	Blue mussel	Sn	SB	M	D	2.31				▪
1132	Svensholmen	MYTI EDU	Blue mussel	Sn	SB	M	D	2.00				▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
I133	Odderø (west)	MYTI EDU	Blue mussel	Sn	SB	M	D	2.60				▪
I201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Sn	SB	M	D	1.76				▪
I205	Bølsnes (G5)	MYTI EDU	Blue mussel	Sn	SB	M	D	1.88				▪
I241	Nordnes	MYTI EDU	Blue mussel	Sn	SB	M	D	1.67				▪
I242	Gravdalsneset	MYTI EDU	Blue mussel	Sn	SB	M	D	2.14				▪
I243	Hegreneset	MYTI EDU	Blue mussel	Sn	SB	M	D	1.58				▪
I301	Akershuskaia	MYTI EDU	Blue mussel	Sn	SB	M	D	2.00				▪
I304	Gåsøya	MYTI EDU	Blue mussel	Sn	SB	M	D	2.14				▪
I306	Håøya	MYTI EDU	Blue mussel	Sn	SB	M	D	2.00				▪
I307	Ramtonholmen	MYTI EDU	Blue mussel	Sn	SB	M	D	1.76				▪
I712	Gjemesholmen	MYTI EDU	Blue mussel	Sn	SB	M	D	2.07				▪
I713	Strømtangen	MYTI EDU	Blue mussel	Sn	SB	M	D	2.31				▪
I964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Sn	SB	M	D	2.90				▪
I965	Moholmen (B5)	MYTI EDU	Blue mussel	Sn	SB	M	D	2.59				▪
I969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Sn	SB	M	D	1.54				▪
33F	Sande (east side)	PLAT FLE	Flounder	Sn	LI	M	W	0.10				▪
53F	Inner Sørfjord	PLAT FLE	Flounder	Sn	LI	M	W	0.30				▪
67F	Strandebarm area	PLAT FLE	Flounder	Sn	LI	M	W	0.30				▪
10F	Skogerøy	PLEU PLA	Plaice	Sn	LI	M	W	0.30				▪
98F2	Husholmen	PLEU PLA	Plaice	Sn	LI	M	W	0.30				▪
11X	Brashavn	MYTI EDU	Blue mussel	TBT	SB	U	D	0.003	no	I	DY	↓
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	TBT	SB	U	D	0.007	no	I	D-	↓
227A2	Høgevarde	MYTI EDU	Blue mussel	TBT	SB	U	D	0.106	1.1	II	D-	↓
22A	Espevær (west)	MYTI EDU	Blue mussel	TBT	SB	U	D	0.053	no	I	--	○
30A	Gressholmen	MYTI EDU	Blue mussel	TBT	SB	U	D	0.187	1.9	II	D-	↓
35A	Mølen	MYTI EDU	Blue mussel	TBT	SB	U	D	13.636		V		▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	TBT	SB	U	D	0.039	no	I	D-	↓
76A	Risøy	MYTI EDU	Blue mussel	TBT	SB	U	D	0.020	no	I	D-	↓
98A2	Husvaagen area	MYTI EDU	Blue mussel	TBT	SB	U	D	0.021	no	I	D-	↓
I132	Svensholmen	MYTI EDU	Blue mussel	TBT	SB	U	D	84.667		V		▪
I133	Odderø (west)	MYTI EDU	Blue mussel	TBT	SB	U	D	85.976		V		▪
I301	Akershuskaia	MYTI EDU	Blue mussel	TBT	SB	U	D	0.364	3.6	II	DY	↓
I712	Gjemesholmen	MYTI EDU	Blue mussel	TBT	SB	U	D	0.148	1.5	II	DY	↓
I713	Strømtangen	MYTI EDU	Blue mussel	TBT	SB	U	D	0.085	no	I	DY	↓
11G	Brashavn	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.002	m		D-	↓
131G	Lastad	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.005	m		D-	↓
15G	Gåsøy (Ullerø)	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.007	m		D-	↓
227G1	Melandholmen	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.032	m		--	○

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
22G	Espevær (west)	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.010	m		--	○
36G	Færder	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.012	m		D-	↓
71G	Fugløyskjær	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.032	m		--	○
74G	Langholmane	NUCE LAP	Dogwhelk	TBT	SB	U	W	2.300				▪
76G	Risøy	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.009	m		--	○
98G	Svolvær området	NUCE LAP	Dogwhelk	TBT	SB	U	D	0.002	m		D-	↓
30A	Gressholmen	MYTI EDU	Blue mussel	TCdDN	SB	N	W	0.106	m	I	--	○
35A	Mølen	MYTI EDU	Blue mussel	TCdDN	SB	N	W	0.745		III		▪
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	TCdDN	SB	N	W	3.050	m	V	--	○
76A	Risøy	MYTI EDU	Blue mussel	TCdDN	SB	N	W	0.081	m	I	--	○
I132	Svensholmen	MYTI EDU	Blue mussel	TCdDN	SB	N	W	0.425	m	II	--	○
I133	Odderø (west)	MYTI EDU	Blue mussel	TCdDN	SB	N	W	0.635	m	III	--	○
I712	Gjemesholmen	MYTI EDU	Blue mussel	TCdDN	SB	N	W	5.920	m	V	--	○
I713	Strømtangen	MYTI EDU	Blue mussel	TCdDN	SB	N	W	3.850	m	V	--	○
35A	Mølen	MYTI EDU	Blue mussel	V	SB	M	D	2.60				▪
227G1	Melandholmen	NUCE LAP	Dogwhelk	VDSI	WO		W	2.32	m		DY	↓
22G	Espevær (west)	NUCE LAP	Dogwhelk	VDSI	WO		W	1.58	m		DY	↓
36G	Færder	NUCE LAP	Dogwhelk	VDSI	WO		W	0.22	m		DY	↓
71G	Fugløyskjær	NUCE LAP	Dogwhelk	VDSI	WO		W	1.25	m		D-	↓
98G	Svolvær området	NUCE LAP	Dogwhelk	VDSI	WO		W	3.03	m		--	○
10B	Varangerfjorden	GADU MOR	Cod	Zn	LI	M	W	13.9		B.B.		▪
13BH	Kristiansand havn	GADU MOR	Cod	Zn	LI	M	W	29.6		B.B.		▪
15B	Ullerø area	GADU MOR	Cod	Zn	LI	M	W	20.4		B.B.		▪
23B	Karihavet area	GADU MOR	Cod	Zn	LI	M	W	25.5		B.B.		▪
30B	Oslo City area	GADU MOR	Cod	Zn	LI	M	W	30.6		O.B.		▪
36B	Færder area	GADU MOR	Cod	Zn	LI	M	W	27.2		B.B.		▪
43B	Kvænangen (Olderfjord)	GADU MOR	Cod	Zn	LI	M	W	21.4		B.B.		▪
43BH	Tromsø havn	GADU MOR	Cod	Zn	LI	M	W	23.8		B.B.		▪
53B	Inner Sørfjord	GADU MOR	Cod	Zn	LI	M	W	28.7		B.B.		▪
67B	Strandebarm area	GADU MOR	Cod	Zn	LI	M	W	21.3		B.B.		▪
77B	Borøy area	GADU MOR	Cod	Zn	LI	M	W	23.1		B.B.		▪
80BH	Munkholmen	GADU MOR	Cod	Zn	LI	M	W	23.0		B.B.		▪
92B	Stokken area	GADU MOR	Cod	Zn	LI	M	W	23.1		B.B.		▪
98B1	Bjørnerøya (east)	GADU MOR	Cod	Zn	LI	M	W	13.0		B.B.		▪
21F	Åkrafjord	LEPI WHI	Megrim	Zn	LI	M	W	86.2				▪
67F	Strandebarm area	LEPI WHI	Megrim	Zn	LI	M	W	38.6				▪
15F	Ullerø area	LIMA LIM	Dab	Zn	LI	M	W	38.8		B.B.		▪
21F	Åkrafjord	LIMA LIM	Dab	Zn	LI	M	W	39.9		B.B.		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
36F	Færder area	LIMA LIM	Dab	Zn	LI	M	W	27.1		B.B.		▪
77F	Borøy area	LIMA LIM	Dab	Zn	LI	M	W	20.8		B.B.		▪
01A	Sponvika	MYTI EDU	Blue mussel	Zn	SB	M	D	99.5		I		▪
02A	Fugleskjær	MYTI EDU	Blue mussel	Zn	SB	M	D	169.2		I		▪
03A	Tisler	MYTI EDU	Blue mussel	Zn	SB	M	D	100.0		I		▪
10A2	Skallneset	MYTI EDU	Blue mussel	Zn	SB	M	D	111.0	no	I	--	○
11X	Brashavn	MYTI EDU	Blue mussel	Zn	SB	M	D	73.0	no	I	--	○
13A	Langøsund	MYTI EDU	Blue mussel	Zn	SB	M	D	108.8		I		▪
14A	Aavigen	MYTI EDU	Blue mussel	Zn	SB	M	D	135.7		I		▪
15A	Gåsøy (Ullerø)	MYTI EDU	Blue mussel	Zn	SB	M	D	107.0	no	I	--	○
227A2	Høgevarde	MYTI EDU	Blue mussel	Zn	SB	M	D	139.3		I		▪
22A	Espevær (west)	MYTI EDU	Blue mussel	Zn	SB	M	D	103.0	no	I	--	○
30A	Gressholmen	MYTI EDU	Blue mussel	Zn	SB	M	D	117.0	no	I	--	○
31A	Solbergstrand	MYTI EDU	Blue mussel	Zn	SB	M	D	110.0	no	I	--	○
35A	Mølen	MYTI EDU	Blue mussel	Zn	SB	M	D	80.4	no	I	UY	↑
51A	Byrkjenes	MYTI EDU	Blue mussel	Zn	SB	M	D	83.3	no	I	--	○
52A	Eitrheimsneset	MYTI EDU	Blue mussel	Zn	SB	M	D	94.1	no	I	D-	↓
56A	Kvalnes	MYTI EDU	Blue mussel	Zn	SB	M	D	101.0	no	I	D-	↓
57A	Krossanes	MYTI EDU	Blue mussel	Zn	SB	M	D	67.0	no	I	D-	↓
63A	Ranaskjær	MYTI EDU	Blue mussel	Zn	SB	M	D	82.5	no	I	D-	↓
65A	Vikingneset	MYTI EDU	Blue mussel	Zn	SB	M	D	92.9	no	I	D-	↓
69A	Lille Terøy	MYTI EDU	Blue mussel	Zn	SB	M	D	98.0	no	I	DY	↓
71A	Bjørkøya (Risøyodden)	MYTI EDU	Blue mussel	Zn	SB	M	D	86.1	no	I	DY	↓
73A	Lyngholmen	MYTI EDU	Blue mussel	Zn	SB	M	D	80.4		I		▪
76A	Risøy	MYTI EDU	Blue mussel	Zn	SB	M	D	114.0	no	I	--	○
77A	Nordstrand	MYTI EDU	Blue mussel	Zn	SB	M	D	124.0		I		▪
79A	Gjerdsvoldsøyen (east)	MYTI EDU	Blue mussel	Zn	SB	M	D	153.6		I		▪
98A2	Husvaagen area	MYTI EDU	Blue mussel	Zn	SB	M	D	92.6	no	I	--	○
1022	West Damholmen	MYTI EDU	Blue mussel	Zn	SB	M	D	171.0		I		▪
1023	Singlekalven (south)	MYTI EDU	Blue mussel	Zn	SB	M	D	105.4		I		▪
1024	Kirkøy (north west)	MYTI EDU	Blue mussel	Zn	SB	M	D	181.0		I		▪
1131A	Lastad	MYTI EDU	Blue mussel	Zn	SB	M	D	123.8		I		▪
1132	Svensholmen	MYTI EDU	Blue mussel	Zn	SB	M	D	102.4		I		▪
1133	Odderø (west)	MYTI EDU	Blue mussel	Zn	SB	M	D	151.8		I		▪
1201	Ekkjegrunn (G1)	MYTI EDU	Blue mussel	Zn	SB	M	D	118.2		I		▪
1205	Bølsnes (G5)	MYTI EDU	Blue mussel	Zn	SB	M	D	106.7		I		▪
1241	Nordnes	MYTI EDU	Blue mussel	Zn	SB	M	D	134.0		I		▪
1242	Gravdalsneset	MYTI EDU	Blue mussel	Zn	SB	M	D	175.7		I		▪

St	Station_Name	Species code	Common name	Contaminant	Tissue	Unit	Base	Concentration	OC	Class	TRND	Symbol
I243	Hegreneset	MYTI EDU	Blue mussel	Zn	SB	M	D	130.0		I		▪
I301	Akershuskaia	MYTI EDU	Blue mussel	Zn	SB	M	D	145.0		I		▪
I304	Gåsøya	MYTI EDU	Blue mussel	Zn	SB	M	D	130.0		I		▪
I306	Håøya	MYTI EDU	Blue mussel	Zn	SB	M	D	94.7		I		▪
I307	Ramtonholmen	MYTI EDU	Blue mussel	Zn	SB	M	D	95.9		I		▪
I712	Gjemesholmen	MYTI EDU	Blue mussel	Zn	SB	M	D	118.3		I		▪
I713	Strømtangen	MYTI EDU	Blue mussel	Zn	SB	M	D	96.2		I		▪
I964	Toraneskaia (B4)	MYTI EDU	Blue mussel	Zn	SB	M	D	233.1		II		▪
I965	Moholmen (B5)	MYTI EDU	Blue mussel	Zn	SB	M	D	377.7		II		▪
I969	Bjørnbærviken (B9)	MYTI EDU	Blue mussel	Zn	SB	M	D	90.9		I		▪
33F	Sande (east side)	PLAT FLE	Flounder	Zn	LI	M	W	45.2		B.B.		▪
53F	Inner Sør fjord	PLAT FLE	Flounder	Zn	LI	M	W	38.1		B.B.		▪
67F	Strandebarm area	PLAT FLE	Flounder	Zn	LI	M	W	43.8		B.B.		▪
10F	Skogerøy	PLEU PLA	Plaice	Zn	LI	M	W	38.6		B.B.		▪
98F2	Husholmen	PLEU PLA	Plaice	Zn	LI	M	W	25.3		B.B.		▪

Appendix J

Temporal trend analyses of contaminants and biomarkers in biota 1981-2009

Sorted by contaminant, species and area/station:

Cadmium (Cd)
Mercury (Hg)
Lead (Pb)
Copper (Cu)
Zinc (Zn)
Silver (Ag)
Arsenic (As)
Nickel (Ni)
Sum PCB-7 or CB_S7 (CB: 28+52+101+118+138+153+180)
DDEPP (ppDDE)
HCB
HCHG (gamma-hexachlorocyclohexane)
BAP (benzo[*a*]pyrene)
PK_Sn or PK_S (sum carcinogen PAHs, cf. Appendix B)
P-Sn or P_S (sum of PAHs, dicyclic "PAHs" not included, cf. Appendix B)
PFOS (perfluorooctanoic sulphonate)
TBT (Tributyltin)
TCDDN (Dioxin toxicity equivalents – Nordic model)
BDESS (Sum brominated flame retardants)
ALA-D (δ-amino levulinic acid dehydrase inhibition)
EROD-activity (Cytochrome P4501A-activity)
CYP1A (relative amount of Cytochrome P4501A protein)
OH-pyrene or PYR10 (Pyrene metabolite)
VDSI (measurement of Imposex)

CEMP-stations

"Index"-stations

MYTI EDU - Blue Mussel (*Mytilus edulis*)
NUCE LAP – Dog whelk (*Nucella lapillus*)
GADU MOR - Atlantic cod (*Gadus morhua*)
LEPI WHI - Megrin (*Lepidorhombus whiff-iaonis*)
LIMA LIM - Dab (*Limanda limanda*)
PLAT FLE - Flounder (*Platichthys flesus*)
(s) - Small fish
(l) - Large fish

Tsu -tissue:

SB - Soft body tissue
LI - Liver tissue
MU - Muscle tissue
BL - Blood
BI - Bile

OC	Overconcentration expressed as quotient of median of last year and upper limit to presumed "high background" ("m" missing background value)
TRD	trend for all time series with 3 or more years data. NB. The result shown in parentheses, e.g. "(D-)" for selected time series refers to trend analysis for the last 10-year period.
	D- Significant linear trend, downward
	U- Significant linear trend, upward
	-- No significant trend
	-? No significant linear trend, systematic non-linear trend can not be tested because of insufficient data (<7 years)
	-Y No significant linear trend, but a systematic non-linear trend
	DY or UY Significant linear trend (downward or upward) and a significant non-linear trend. This is considered the same as "-Y"
	SIZE length effect (mercury in fillet)
	L Significant difference in concentration levels but pattern of variation same
	D As "L" but pattern of variation significantly different
	- No significant difference between "small" and "large" fish

SM3	Projected smoothed median for three years expressed as quotient of value and “high background” (“?” if missing background or if number of years is less than seven)
PWR	POWER; estimated number of years to detect a hypothetical situation of 10% trend a year with a 90% power

Note on detection limit: for values designated below detection limit, half of this limit is used.

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Annual median concentration of Cd (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Cd (mg/kg d. wt.)																							ANALYSIS									
			1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER		
30A	MYTI EDU	SB		1.07	0.81	1.41	0.6	0.61	0.736	0.769	0.769	1.12	1.26	1.17	0.776	0.8	0.857	1.27	1.16	1.13	0.914	1.75	1.56	2.16	1.7	1.72	1.42	1.79	1.21	no	UY	no	10		
31A	MYTI EDU	SB	1.39	1.31	0.89	1.93	0.4	0.43	0.412	0.719	0.727	0.914	0.933	0.781	1.32	0.789	0.854	1.07	1.25	1	1.76	1.14	1.33	1.4	1.28	1.11	1.16	1.21	1.16	no	UY	no	12		
35A	MYTI EDU	SB	1.35	0.952	1.17	1.3	0.52	0.66	0.647	0.926	1.05	1.35	1.11	0.958	0.894	0.766	0.965	1.14	1.53	1.33	1.53	1.16	1.06	1.23	1.33	0.86	0.855	1.01	0.726	no	UY	no	9		
36A	MYTI EDU	SB	0.845	1.19	0.84	1.38	0.59	0.56	0.502	0.407	1.22	1.06	0.899	1.22	1.17	1.6	1.84	0.965	1.01	1.65	2.59	1	0.848	0.956	0.9	0.586	0.633	0.735	no	UY	no	12			
71A	MYTI EDU	SB	2.52	1.98	1.42	2	0.98	2.11	2.02	0.968	1.09	1.66	1.89	1.97	2.25	1.5	2.44	1.53	1.76	1.99	1.43	1.69	1.44	1.57	1.48	1.43	1.17	1.07	0.924	no	D-(D-)	no	10		
76A	MYTI EDU	SB								0.638	0.86	0.957	1.1			1.17	1.19	1.2	1.28	0.823	1.82	1.45	1.05	1.01	0.829	0.816	1.03	0.953	1.01	no	--	no	9		
15A	MYTI EDU	SB								0.505	0.831		1.18	0.794	1.44	1.22	1.07	1.03	0.841	1.44	4.4	1.31	0.737	0.926	0.788	1.01	0.718	0.622	0.835	no	--	no	14		
51A	MYTI EDU	SB				42.8	58.2								36.8	25.3	5.45	10.3	34.6	27.3	5.35	16.6	14.7	5.21	13.8	2.35	3.42	2.84	2.29	1.1	D(-)	no	20		
52A	MYTI EDU	SB						94.4	10.2	80.1	43.1	14.7	8.71	19.8	18.4	13.4	9.14	11.4	10.5	5.59	5	7.38	5.37	7	2.88	4.41	2.22	2.25	1.1	D-(D-)	no	18			
56A	MYTI EDU	SB				55.9	54.2	98.4	45	69.4	51.7	59.7	11.4	30.8	20	28.8	8.71	25.9	24.4	14.5	13.4	11.4	6.18	11.7	8.4	5.29	6.21	4.89	2.4	D-(D-)	1.3	15			
57A	MYTI EDU	SB				21.1	43.2	36.7	25.7	32.8	32.1	15.4	11.8	12.2	8.48	13.6	5.02	13.6	10.3	8.19	6.96	6.32	3.12	5.94	6.21	2.34	2.43	1.83	no	D-(D-)	no	13			
63A	MYTI EDU	SB				47.2	10.3	19	30.4	35.1	18.2	7.81	4.23	8.16	5.4	6.62	4.43	6.87	5.97	6.73	5.38	5.69	1.3	4	3.98	3.07	1.81	2.04	1.0	D(-)	no	16			
65A	MYTI EDU	SB				15	5.96	8.29	14.6	24	5.09	7.73	3.01	5.37	3.53	4.28	1.72	3.82	3.85	4.5	3.74	3.4	1.31	3.42	3.98	1.87	1.47	1.43	no	D(-)	no	15			
69A	MYTI EDU	SB				4.26	2.37	2.08	14.6	24	5.09	7.73	3.01	5.37	3.53	4.28	1.72	3.82	3.85	4.5	3.74	3.4	1.31	3.42	3.98	1.87	1.47	1.43	no	D-	no	12			
22A	MYTI EDU	SB							0.532	1.14	1.12	0.844	1.02	1.41	1.14	1.01	0.851	1.32	2.69	2.01	0.976	1.04	1.18	0.912	0.844	1.24	1.02	0.874	no	--	no	12			
23A	MYTI EDU	SB							0.406	0.994													0.832	1.11					no	-?	?	15			
24A	MYTI EDU	SB							0.52	0.816														0.958	0.944				no	-?	?	10			
82A	MYTI EDU	SB		1.41	1.15	2.31	0.99	0.4	1.26		1.2	1.21	1.15		0.981	1.22							0.944	1.51					no	--	no	15			
84A	MYTI EDU	SB		1.39	1.86	2.38	2.1	0.96	1.19		1.82	2.11	1.6		1.64	1.29							1.54	2.05				1.0	--	1.5	11				
87A	MYTI EDU	SB		0.968	1.02	1.93	0.77	0.69	0.756		0.872	0.978	0.927		1.15	1.27							1	1.08				no	--	no	11				
25A	MYTI EDU	SB										1.38	1.05										1.25	1.46				no	-?	?	8				
26A	MYTI EDU	SB										1.07	1										1.24	1.13				no	-?	?	<=5				
27A	MYTI EDU	SB										1.1											0.856	0.894				no	-?	?	<=5				
28A	MYTI EDU	SB										1.12	0.841										0.947	1.04				no	-?	?	8				
91A	MYTI EDU	SB										1.68	1.27	1.82											1.16			no	-?	?	9				
92A1	MYTI EDU	SB										1.08	0.544	0.939	0.743	0.691	0.716											no	--	no	11				
93A	MYTI EDU	SB										1.23	0.645											0.888	0.68			no	-?	?	13				
94A	MYTI EDU	SB										0.87	0.846											1.13	1.2			no	U?	?	<=5				
95A	MYTI EDU	SB										1.21	1.47										1	1.11			no	-?	?	7					
96A	MYTI EDU	SB										0.963	0.782											0.718	1.03			no	-?	?	10				
97A	MYTI EDU	SB										1.31	1.55											1.44	1.44			no	-?	?	6				
98A2	MYTI EDU	SB														0.854					2.17	1.68	2.38	2.13	2.27	1.07	1.29	1.18	1.05	1.42	1.24	no	DY	no	10
98X	MYTI EDU	SB												0.712	0.688	0.781													no	-?	?	6			
99A	MYTI EDU	SB										1.43	1.28											1.35	1.27			no	-?	?	<=5				
41A	MYTI EDU	SB												1.89	2.95	1.63	1.88									2.67	1.68	no	--	1.0	11				
42A	MYTI EDU	SB												1.05	1.59										0.952	1.2	no	-?	?	11					
43A	MYTI EDU	SB												3.47	4.32										2.53	3.26	1.6	-?	?	8					
44A	MYTI EDU	SB												1.69	2.74	1.95	1.51								1.86	1.15	no	--	no	11					
45A	MYTI EDU	SB												1.81	1.61										1.88	2.02	1.0	-?	?	6					
46A	MYTI EDU	SB												2.7	2.06	2.72									2.53	1.63	no	-?	?	10					
47A	MYTI EDU	SB												4.55	3.01										2.29	2.51	1.3	-?	?	9					
48A	MYTI EDU	SB												1.35	1.31	1.38									2.64	1.97	no	U?	?	8					
49A	MYTI EDU	SB												1.57	1.16										4.07	2.33	1.2	-?	?	13					
10A2	MYTI EDU	SB														2.34	1.06	2.32	1.61	1.53	1.23	1.41	1.98	1.59	1.12	1.74	2.28	2.07	1.55	no	--	1.1	12		
11X	MYTI EDU	SB															1.65	0.67	1.13	1.07	1.32	1.36	1.36	0.911	0.981	0.933	1.16	1.14	1.02	no	--	no	10		

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Annual median concentration of Cd (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Cd (mg/kg d. wt.)																											ANALYSIS					
			1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER		
30A	MYTI	EDU	SB		1.07	0.81	1.41		0.6	0.61	0.736	0.769	0.769	1.12	1.26	1.17	0.776	0.8	0.857	1.27	1.16	1.13	0.914	1.75	1.56	2.16	1.7	1.72	1.42	1.79	1.21	no	UY	no	10
71A	MYTI	EDU	SB	2.52	1.98	1.42	2	0.98	2.11	2.02	0.968	1.09	1.66	1.89	1.97	2.25	1.5	2.44	1.53	1.76	1.99	1.43	1.69	1.44	1.57	1.48	1.43	1.17	1.07	0.924	no	D-	no	10	
51A	MYTI	EDU	SB					42.8	58.2								36.8	25.3	5.45	10.3	34.6	27.3	5.35	16.6	14.7	5.21	13.8	2.35	3.42	2.84	2.29	1.1	D(-)	no	20
52A	MYTI	EDU	SB							94.4	10.2	80.1	43.1	14.7	8.71	19.8	18.4	13.4	9.14	11.4	10.5	5.59	5	7.38	5.37	7	2.88	4.41	2.22	2.25	1.1	D(-D-)	no	18	
10A2	MYTI	EDU	SB													2.34	1.06	2.32	1.61	1.53	1.23	1.41	1.98	1.59	1.12	1.74	2.28	2.07	1.55	no	--	1.1	12		
I021	MYTI	EDU	SB													1.73	2.26	2.48	3.31			1.83	2.53	2.41						1.2	--	1.0	10		
I022	MYTI	EDU	SB													1.43	1.36	1.26	2.09	1.94	1.33	1.7	2.69	1.61	1.25	1.42	1.74	2	2.37	1.65	no	--	1.2	11	
I023	MYTI	EDU	SB													1.61	1.4	1.77	2.04	1.45	0.948	0.873	1.55	1.48	1.03	1.39	1.79	1.15	1.28	0.983	no	--	no	11	
I024	MYTI	EDU	SB													1.31	1.63	2.04	2.56	2.45	1.83	2.53	2.7	2.03	1.57	1.46	1.97	1.39	2.04	1.91	no	--	1.1	9	
I301	MYTI	EDU	SB									1.26				0.824	0.795	0.817	1.03	1.29	0.716	0.902	0.888	1.15	1.32	1.03	1.49	1.18	1.45	1.23	no	--	no	9	
I304	MYTI	EDU	SB													1.33	0.719	0.784	1.05	0.994	0.921	1.16	1.3	1.37	1.1	1.34	1.35	0.889	1.11	1.16	no	--	no	9	
I306	MYTI	EDU	SB													0.81	0.779	0.646	0.707	0.842	0.592	0.734	0.872	1.28	0.992	1.11	0.806	0.65	1.16	0.773	no	--	no	9	
I307	MYTI	EDU	SB													0.94	0.815	0.687	0.72	0.826	0.719	0.899	1.46	1.44	1.14	1.26	0.933	0.876	1.33	0.818	no	UY	no	9	
I131A	MYTI	EDU	SB													1.24	0.875	1.14	1.31	1.18	1.98	2.48	1.13	0.862	1.34	0.965	0.831	0.787	1	1.51	no	--	no	11	
I201	MYTI	EDU	SB													0.801	0.856	1.06	0.927	1.27	1.42	1.49	2.8	0.707	0.957	1.47	1.55	1.44	1.48	0.924	no	--	no	13	
I205	MYTI	EDU	SB													0.819		1.37	0.858	1.49	1.99	1.42	2.43	1.25	1.02	2.02	1.91	1.28	2.41	1.14	no	--	no	13	
I965	MYTI	EDU	SB																		2.02	2.15	0.813	1.9	1.8	1.78	2.08	2.91	1.74	no	--	1.3	13		
I962	MYTI	EDU	SB													0.746	0.606	0.645	0.518												no	-?	?	6	
I964	MYTI	EDU	SB																				1.57	0.652	0.92	2.15	2.11	2.04	2.06	1.55	no	--	1.0	14	
I969	MYTI	EDU	SB													0.502	0.599	0.318	0.611	0.588	0.827	0.76	0.8	0.557	0.615	1.19	0.432	0.461	0.564	0.503	no	--	no	12	

Annual median concentration of Cd (mg/kg w. wt.)

St	Species	Tissue	Annual median concentration of Cd (mg/kg w. wt.)																											ANALYSIS						
			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER	
30B	GADU	MOR	LI				0.01	0.05	0.0619	0.0711	0.0218	0.0267	0.035	0.027	0.1	0.0645	0.063	0.049	0.055	0.0485	0.107	0.165	0.078	0.111	0.106	0.114	0.1	0.0734	0.115	0.19	0.174	0.163	1.6	U-	2.6	15
36B	GADU	MOR	LI	0.078	0.06	0.22	0.07	0.05	0.143	0.0611	0.0314	0.028	0.0235	0.01	0.021	0.034	0.021	0.042	0.033	0.0741	0.036	0.065	0.041	0.029	0.0247	0.0088	0.0067	0.029	0.025	0.034	0.034	0.025	no	DY	no	16
77B	GADU	MOR	LI										0.0375	0.018																	0.017	0.015	no	-?	?	13
15B	GADU	MOR	LI										0.026	0.009	0.025	0.016	0.014	0.016	0.024	0.031	0.03	0.026	0.033	0.026	0.0183	0.0374	0.0097	0.019	0.0058	0.023	0.018	0.02	no	--	no	16
53B	GADU	MOR	LI					0.658		0.058	0.0929	0.045	0.149	0.215	0.038		0.007	0.18	0.143	0.228	0.726	0.829	0.565	0.431	0.253	0.368	0.414	0.2	0.279	0.494	0.2	2.0	UY(-)	2.3	21	
67B	GADU	MOR	LI					0.145	0.0519	0.0467	0.069	0.077	0.0514	0.115	0.0989	0.033	0.111	0.277	0.0185	0.0715	0.059	0.032	0.0203	0.01	0.016	0.0252	0.0092	0.015	0.009	0.012	no	D-	no	19		
23B	GADU	MOR	LI								0.022	0.024	0.02	0.025	0.015	0.026	0.014	0.029	0.025	0.033	0.019	0.025	0.0206	0.0163	0.0228	0.024	0.0379	0.022	0.012	0.018	no	--	no	11		
84B	GADU	MOR	LI		0.13	0.1	0.0688		0.0291																						no	D?	?	6		
92B	GADU	MOR	LI											0.036	0.029	0.022	0.066									0.0229	0.024			0.031	0.049	no	--	no	14	
98B1	GADU	MOR	LI										0.069	0.15	0.025	0.113	0.33	0.064	0.047	0.039					0.0291	0.0254	0.0332	0.051	0.0379	0.0686	0.024	0.018	no	--	no	19
43B	GADU	MOR	LI											0.168	0.183	0.097														0.0765	0.112	1.1	-?	?	12	
10B	GADU	MOR	LI											0.23	0.188	0.095	0.128	0.119	0.137	0.125	0.129	0.059	0.099	0.103	0.079	0.0779	0.0815	0.092	0.06	no	D-	no	11			

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Cd (mg/kg w. wt.)

St	Species	Tissue	Annual median concentration of Cd (mg/kg w. wt.)																											ANALYSIS								
			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER			
33F	PLAT FLE	LI			0.19		0.2	0.176	0.257	0.061	0.106	0.234	0.196	0.16	0.184	0.087	0.091	0.114	0.119	0.0952	0.126	0.071	0.091	0.0569	0.0627	0.0313	0.025	0.0677	0.039	0.067	0.064	no	D-	no	13			
53F	PLAT FLE	LI								2.24	1.53	1.54	1.72	1.79	0.789		0.135	2.53	0.892	1.47	2.55	1.77	2.74	2.74	4.56	1.46	1.31		0.765	1.34	0.152	no	--	no	20			
67F	PLAT FLE	LI																		2.48		0.187	0.185	0.148	0.059	0.065	0.0802	0.0605	0.124	0.14	0.093	0.126	0.13	no	DY	no	14	
21F	PLAT FLE	LI																			0.052	0.0979	0.141	0.22		0.0473	0.125	0.129					no	--	no	18		
36F	LIMA LIM	LI									0.106	0.112	0.23	0.295	0.135	0.147	0.139	0.123	0.202	0.227	0.139	0.232	0.127	0.142	0.188	0.144	0.128	0.208	0.139	0.151	no	--	no	11				
77F	LIMA LIM	LI									0.181																						0.226	0.083	no	-?	?	20
15F	LIMA LIM	LI										0.0992	0.136	0.125	0.153	0.076	0.181	0.167			0.313	0.129	0.11	0.189	0.225	0.377	0.153	0.284	0.176	no	--	no	14					
22F	LIMA LIM	LI									0.095	0.091	0.128		0.169	0.125																		no	-?	?	9	
21F	LIMA LIM	LI																						0.0166	0.0085	0.0747	0.014		0.029		0.17	no	--	no	23			
30F	PLEU PLA	LI												0.11		0.101	0.222																	1.1	-?	?	15	
22F	PLEU PLA	LI															0.23	0.231	0.244															1.2	-?	?	<=5	
98F2	PLEU PLA	LI																				0.821	0.521	0.217	0.218	0.0726	1.01	0.593	0.287	0.205	0.051	no	--	no	22			
10F	PLEU PLA	LI																	0.571			0.141	0.248	0.302	0.204	0.316	0.307	0.271		0.627	0.409	0.617	3.1	--	4.1	14		
67F	LEPI WHI	LI			0.181				0.18	0.109	0.066	0.197	0.085	0.1	0.12	0.304	0.259	0.2	0.097	0.033	0.051	0.037	0.049	0.0342	0.0543	0.0485	0.0609	0.0449	0.028	0.026	0.023	m	DY	m	13			
21F	LEPI WHI	LI																							0.0592	0.0812	0.112	0.186	0.049	0.041	0.108	m	--	m	18			

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Hg (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Hg (mg/kg d. wt.)																							ANALYSIS								
			1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER	
30A	MYTI	EDU	SB		0.118	0.073	0.147	0.05	0.13	0.0437	0.0641	0.0533	0.0508	0.0703	0.0865	0.0574	0.07	0.0604	0.0778	0.114	0.0599	0.0586	0.0952	0.071	0.153	0.113	0.1	0.0765	0.106	0.0778	no	--	no	12
31A	MYTI	EDU	SB	0.0757	0.164	0.086	0.12	0.05	0.09	0.0225	0.0599	0.0485	0.0508	0.0446	0.0502	0.0623	0.0435	0.0515	0.0699	0.0881	0.0464	0.051	0.0577	0.0577	0.0935	0.11	0.18	0.159	0.0867	0.0875	no	UY	no	13
35A	MYTI	EDU	SB	0.0933	0.0741	0.084	0.17	0.05	0.18	0.05	0.0617	0.0585	0.0578	0.0537	0.0607	0.0369	0.0383	0.0354	0.0667	0.101	0.028	0.0472	0.0575	0.0574	0.0938	0.12	0.045	0.045	0.0667	0.0565	no	--	no	14
36A	MYTI	EDU	SB	0.0516	0.0427	0.084	0.14	0.05	0.14	0.034	0.0452	0.0476	0.0394	0.0321	0.0481	0.0333	0.0442	0.0743	0.0299	0.0455	0.0377	0.0245	0.0342	0.0526	0.108	0.05	0.0364	0.0267	0.0353	no	--	no	14	
71A	MYTI	EDU	SB	0.393	0.242	0.218	0.247	0.12	0.34	0.249	0.182	0.145	0.178	0.14	0.212	0.201	0.222	0.312	0.11	0.155	0.132	0.123	0.15	0.154	0.189	0.177	0.18	0.133	0.122	0.124	no	D-	no	11
76A	MYTI	EDU	SB								0.0709	0.0682	0.0498	0.0205			0.057	0.0824	0.0632	0.101	0.0328	0.0634	0.0585	0.0843	0.101	0.0824	0.0579	0.0824	0.0933	0.1	no	--	no	12
15A	MYTI	EDU	SB								0.0561	0.0522		0.0244	0.0503	0.0217	0.0488	0.0558	0.0529	0.0437	0.163	0.0354	0.0452	0.0596	0.0946	0.075	0.0632	0.0471	0.0526	0.0765	no	--	no	15
51A	MYTI	EDU	SB				0.24	0.25								1.51	0.901	0.175	0.577	2.89	3.86	0.774	1.45	1.47	0.304	0.607	0.231	0.292	0.257	0.264	1.3	-(D-)	no	21
52A	MYTI	EDU	SB						2.35	0.321	3.01	0.976	0.372	0.282	0.437	0.178	0.26	0.258	0.58	0.34	0.298	0.264	0.195	0.228	0.163	0.135	0.244	0.143	0.129	no	D-(D-)	no	17	
56A	MYTI	EDU	SB				0.53	0.37	1.09	0.71	1.54	0.935	1.22	0.352	0.679	0.365	0.526	0.282	0.917	0.982	0.611	0.602	0.346	0.235	0.358	0.336	0.294	0.307	0.313	1.6	D-(DY)	1.5	14	
57A	MYTI	EDU	SB				0.17	0.21	0.269	0.411	0.758	0.576	0.349	0.35	0.26	0.155	0.319	0.166	0.467	0.451	0.349	0.277	0.193	0.115	0.229	0.229	0.139	0.133	0.15	no	DY(D-)	no	12	
63A	MYTI	EDU	SB				0.31	0.14	0.177	0.394	0.468	0.294	0.143	0.19	0.252	0.172	0.203	0.226	0.268	0.299	0.365	0.289	0.213	0.0695	0.18	0.187	0.194	0.116	0.15	no	--	no	14	
65A	MYTI	EDU	SB				0.1	0.15	0.104	0.312	0.328	0.124	0.119	0.134	0.148	0.118	0.136	0.0792	0.142	0.155	0.189	0.132	0.135	0.0638	0.133	0.156	0.114	0.09	0.11	no	--	no	13	
69A	MYTI	EDU	SB								0.106	0.0263	0.0829	0.0704	0.104	0.111	0.0773	0.161	0.107	0.146	0.106	0.0989	0.0586	0.1	0.0778	0.0882	0.0789	0.1	no	--	no	13		
22A	MYTI	EDU	SB							0.0529	0.0732	0.112	0.0476	0.0673	0.0657	0.0723	0.0683	0.046	0.0736	0.0288	0.0545	0.0461	0.126	0.161	0.125	0.106	0.127	0.119	0.0632	no	UY	no	13	
23A	MYTI	EDU	SB							0.0543	0.0759													0.0855	0.107					no	-?	?	9	
24A	MYTI	EDU	SB							0.0578	0.0748													0.0903	0.075					no	-?	?	8	
82A	MYTI	EDU	SB	0.0508	0.11	0.17	0.08	0.12	0.0668		0.0743	0.0519	0.0787		0.0493	0.0691								0.0508	0.0941					no	--	no	13	
84A	MYTI	EDU	SB	0.0766	0.112	0.15	0.08	0.24	0.0571		0.0657	0.0902	0.0568		0.0542	0.0433								0.0511	0.0824					no	--	no	15	
87A	MYTI	EDU	SB	0.178		0.15	0.05	0.26	0.0462		0.0564	0.0543	0.0488		0.0439	0.0623								0.0467	0.045					no	--	no	18	
25A	MYTI	EDU	SB									0.141	0.0368											0.0952	0.0727					no	-?	?	19	
26A	MYTI	EDU	SB									0.0959	0.0459											0.0843	0.0789					no	-?	?	14	
27A	MYTI	EDU	SB									0.107												0.0824	0.0722					no	-?	?	6	
28A	MYTI	EDU	SB									0.0765	0.0619											0.0851	0.125					no	-?	?	10	
91A	MYTI	EDU	SB									0.0539	0.0758	0.0943											0.0647					no	-?	?	12	
92A1	MYTI	EDU	SB									0.0548	0.0335	0.0521	0.0407	0.0234	0.067													no	--	no	14	
93A	MYTI	EDU	SB									0.0679	0.118													0.202	0.126			no	-?	?	13	
94A	MYTI	EDU	SB									0.082	0.0631											0.0508	0.0591					no	-?	?	8	
95A	MYTI	EDU	SB									0.0765	0.0598											0.0526	0.0667					no	-?	?	9	
96A	MYTI	EDU	SB									0.0481	0.0304											0.039	0.04					no	-?	?	10	
97A	MYTI	EDU	SB									0.0765	0.0703											0.0594	0.0619					no	-?	?	<=5	
98A2	MYTI	EDU	SB													0.104		0.246	0.109	0.109	0.109	0.115	0.14	0.0817	0.08	0.0889	0.075	0.0765	0.0722	no	--	no	12	
98X	MYTI	EDU	SB										0.335	0.34	0.328															1.6	-?	?	<=5	
99A	MYTI	EDU	SB							0.0881	0.0487													0.0552	0.0588					no	-?	?	12	
41A	MYTI	EDU	SB									0.0686	0.0635	0.064	0.0848											0.05	0.0471			no	--	no	8	
42A	MYTI	EDU	SB									0.0449	0.0492													0.0348	0.0333			no	D?	?	<=5	
43A	MYTI	EDU	SB									0.0844	0.0946		0.104										0.075	0.0733			no	-?	?	7		
44A	MYTI	EDU	SB									0.0552	0.05	0.0517	0.0592											0.0444	0.045			no	--	no	6	
45A	MYTI	EDU	SB									0.0819	0.0667													0.0474	0.05			no	D?	?	7	
46A	MYTI	EDU	SB									0.0387	0.0618	0.0564											0.04	0.0227			no	-?	?	12		
47A	MYTI	EDU	SB									0.064	0.0425												0.0579	0.0368			no	-?	?	12		
48A	MYTI	EDU	SB									0.0726	0.0599	0.0524											0.125	0.1			no	-?	?	10		
49A	MYTI	EDU	SB									0.0651	0.0543													0.0474	0.0389			no	-?	?	7	
10A2	MYTI	EDU	SB												0.0588	0.0617	0.0581	0.0625	0.0503	0.052	0.0494	0.0549	0.0503	0.0368	0.0412	0.0391	0.0412	0.0412	no	D-	no	6		
11X	MYTI	EDU	SB													0.0811	0.0366	0.0564	0.0667	0.065	0.0372	0.0372	0.037	0.0429	0.0389	0.0421	0.0471	0.0429	no	--	no	10		

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Hg (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Hg (mg/kg d. wt.)																											ANALYSIS								
			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER			
30A	MYTI	EDU	SB				0.118	0.073	0.147	0.05	0.13	0.0437	0.0641	0.0533	0.0508	0.0703	0.0865	0.0574	0.07	0.0604	0.0778	0.114	0.0599	0.0586	0.0952	0.071	0.153	0.113	0.1	0.0765	0.106	0.0778	no	--	no	12		
71A	MYTI	EDU	SB			0.393	0.242	0.218	0.247	0.12	0.34	0.249	0.182	0.145	0.178	0.14	0.212	0.201	0.222	0.312	0.11	0.155	0.132	0.123	0.15	0.154	0.189	0.177	0.18	0.133	0.122	0.124	no	D-	no	11		
51A	MYTI	EDU	SB						0.24	0.25								1.51	0.901	0.175	0.577	2.89	3.86	0.774	1.45	1.47	0.304	0.607	0.231	0.292	0.257	0.264	1.3	--(D-)	no	21		
52A	MYTI	EDU	SB										2.35	0.321	3.01	0.976	0.372	0.282	0.437	0.178	0.26	0.258	0.58	0.34	0.298	0.264	0.195	0.228	0.163	0.135	0.244	0.143	0.129	no	D-(D-)	no	17	
10A2	MYTI	EDU	SB															0.0588	0.0617	0.0581	0.0625	0.0503	0.052	0.0494	0.0549	0.0503	0.0368	0.0412	0.0391	0.0412	0.0412	no	D-	no	6			
1021	MYTI	EDU	SB															0.212	0.397	0.496	0.859		0.356	0.436	0.319								1.6	--	no	13		
1022	MYTI	EDU	SB															0.13	0.134	0.321	0.404	0.415	0.182	0.238	0.289	0.197	0.155	0.243	0.215	0.242	0.264	0.28	1.4	--	1.7	12		
1023	MYTI	EDU	SB															0.14	0.143	0.295	0.31	0.263	0.0944	0.0959	0.15	0.142	0.129	0.164	0.177	0.138	0.131	0.131	no	--	no	12		
1024	MYTI	EDU	SB															0.107	0.18	0.45	0.543	0.425	0.12	0.295	0.238	0.233	0.21	0.291	0.275	0.225	0.245	0.24	1.2	--	1.1	14		
1301	MYTI	EDU	SB											0.0466				0.0656	0.0682	0.0582	0.0675	0.0625	0.0408	0.0677	0.05	0.0732	0.114	0.125	0.0929	0.0778	0.0857	0.0733	no	U-	no	9		
1304	MYTI	EDU	SB															0.047	0.0694	0.0395	0.0541	0.0503	0.0294	0.0513	0.0462	0.0491	0.063	0.0702	0.0615	0.0471	0.0467	0.0571	no	--	no	10		
1306	MYTI	EDU	SB															0.0447	0.0617	0.0387	0.061	0.0508	0.0355	0.0353	0.0403	0.0507	0.0744	0.069	0.05	0.05	0.0692	0.0533	no	--	no	10		
1307	MYTI	EDU	SB															0.0383	0.0705	0.0337	0.0465	0.0542	0.0327	0.0488	0.0541	0.062	0.0893	0.0952	0.0438	0.0438	0.0714	0.0471	no	--	no	12		
1711	MYTI	EDU	SB																															no	-?	?	9	
1712	MYTI	EDU	SB																															no	--	1.1	8	
1713	MYTI	EDU	SB																															no	--	no	11	
1131A	MYTI	EDU	SB															0.127	0.0691	0.0601		0.144	0.0635	0.0337	0.0784	0.0503	0.0652	0.1	0.0634	0.0786	0.0533	0.0667	0.123	no	--	no	14	
1201	MYTI	EDU	SB																																no	--	no	14
1205	MYTI	EDU	SB																																no	--	1.1	11
1965	MYTI	EDU	SB																																no	--	no	12
1964	MYTI	EDU	SB																																no	--	no	16
1969	MYTI	EDU	SB																																no	--	no	14

Annual median concentration of Hg (mg/kg w. wt.)

St	Species	Tissue	Annual median concentration of Hg (mg/kg w. wt.)																											ANALYSIS								
			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER			
30B	GADU	MOR	MU				0.14	0.09	0.0732	0.0382	0.112	0.13	0.12	0.09	0.12	0.133	0.123	0.105	0.134	0.155	0.195	0.201	0.217	0.26	0.15	0.163	0.134	0.147	0.225	0.17	0.255	0.26	2.6	U(-)	3.5	11		
36B	GADU	MOR	MU			0.0729	0.09	0.12	0.134	0.0995	0.0905	0.0352	0.0644	0.0708	0.1	0.08	0.07	0.079	0.056	0.081	0.068	0.113	0.089	0.094	0.072	0.083	0.082	0.043	0.053	0.085	0.094	0.081	0.108	0.086	no	--	1.2	11
77B	GADU	MOR	MU																																no	-?	?	14
15B	GADU	MOR	MU																																no	--	no	13
53B	GADU	MOR	MU																																no	--	no	13
53B	GADU	MOR	MU																																no	--	no	13
67B	GADU	MOR	MU																																no	--	no	13
67B	GADU	MOR	MU																																no	D-	no	11
23B	GADU	MOR	MU																																no	--	no	9
84B	GADU	MOR	MU																																no	--	no	9
84B	GADU	MOR	MU																																no	-?	?	13
92B	GADU	MOR	MU																																no	--	no	8
92B	GADU	MOR	MU																																no	--	no	8
98B1	GADU	MOR	MU																																no	--	no	14
43B	GADU	MOR	MU																																no	-?	?	6
10B	GADU	MOR	MU																																no	DY	no	10

Annual median concentration of Hg (mg/kg w. wt.)

St	Species	Tissue	Annual median concentration of Hg (mg/kg w. wt.)																											ANALYSIS					
			1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
33F	PLAT FLE	MU			0.12		0.09	0.0769	0.019	0.0694		0.18	0.11	0.126	0.081	0.074	0.051	0.052	0.0795	0.049	0.078	0.05	0.049	0.042	0.038	0.036	0.045	0.031	0.071	0.04	0.049	no	DY	no	13
53F	PLAT FLE	MU								0.111	0.107	0.12	0.14	0.124	0.104		0.0352	0.207	0.185	0.201	0.159	0.259	0.338	0.625	0.5	0.328	0.845		0.231	0.224	0.0741	no	UY	no	15
67F	PLAT FLE	MU																0.18		0.0555	0.037	0.069	0.05	0.057	0.066	0.064	0.061	0.041	0.045	0.071	0.065	no	DY	no	11
21F	PLAT FLE	MU																		0.075	0.078	0.04	0.042		0.021	0.046	0.043					no	--	no	13
36F	LIMA LIM	MU							0.07	0.06	0.086	0.078	0.056	0.058	0.073	0.038	0.09	0.054	0.066	0.053	0.068	0.061	0.074	0.12	0.1	0.111	0.054	0.118			1.2	--	no	11	
15F	LIMA LIM	MU								0.09		0.0359	0.036	0.034	0.056	0.055	0.049	0.0459		0.064	0.07	0.045	0.082	0.115	0.074	0.076	0.13	0.068			no	U-	no	11	
22F	LIMA LIM	MU							0.13	0.08	0.257		0.082	0.153																	1.5	-?	?	17	
21F	LIMA LIM	MU																					0.021	0.006	0.084	0.009		0.137		0.139	1.4	--	3.2	>25	
30F	PLEU PLA	MU										0.0451		0.038	0.039																no	-?	?	<=5	
22F	PLEU PLA	MU															0.045	0.051	0.074												no	-?	?	7	
98F2	PLEU PLA	MU																				0.115	0.072	0.032	0.041	0.016	0.0732	0.045	0.044	0.02	0.019	no	--	no	16
10F	PLEU PLA	MU																	0.038		0.0216	0.029	0.023	0.023	0.0155	0.0273	0.024		0.0364	0.0272	0.017	no	--	no	11
67F	LEPI WHI	MU			0.39				0.35	0.329	0.253	0.52	0.07	0.174	0.205	0.477	0.379	0.418	0.284	0.11	0.154	0.114	0.111	0.123	0.131	0.199	0.096	0.108	0.09	0.098	0.09	m	D-	m	14
21F	LEPI WHI	MU																							0.122	0.19	0.192	0.215	0.203	0.13	0.173	m	--	m	10

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Pb (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Pb (mg/kg d. wt.)																			ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		1.86	1.36	3.95	2.27	2.54	1.58	2.12	2.69	36.7	2.13	1.74	1.76	2.24	2.58	3.74	3.38	4.12	3.06	3.87	2.54	no	--	no	20
31A	MYTI EDU	SB		1.38	1.21	1.26	1.03	1.37	1.68	1.79	0.732	1.54	0.629	0.629	0.51	1.43	0.805	0.781	0.869	0.855	0.647	0.667	0.778	no	--	no	12
35A	MYTI EDU	SB		1.44	1.07	1.68	1.2	1.28	0.507	0.628	0.664	0.759	0.714	0.522	0.866	0.571	0.574	0.813	1.21	0.805	0.571	1.11	1	no	DY	no	11
36A	MYTI EDU	SB		1.01	0.847	0.787	1.12	1.39	1.24	2.04	2.17	1.57	0.995	0.943	0.618	0.449	0.585	0.956	0.578	0.559	1.13	0.471		no	DY	no	12
71A	MYTI EDU	SB		1.16	0.745	1.72	1.42	1.92	1.49	2.21	2.83	0.867	0.903	0.774	1.45	0.919	0.915	0.866	0.962	0.98	0.797	1	0.81	no	D-	no	12
76A	MYTI EDU	SB		1.77	0.968	1.5	0.913			0.796	1.84	1.23	1.99	0.602	0.829	0.766	0.938	1.48	0.778	1.19	1.06	1.76	1.35	no	--	no	13
15A	MYTI EDU	SB		1.46	0.777		0.976	1.05	0.522	0.671	1.12	1.28	1.66	2.2	0.96	0.714	0.76	0.857	1.66	0.781	1.06	0.545	0.941	no	--	no	13
51A	MYTI EDU	SB						149	60.3	17.2	29.6	37.1	91.7	32.4	98.4	108	42.2	77.5	17.6	29.8	23.4	21.2	7.1	--(-)		2.0	18
52A	MYTI EDU	SB		12.1	313	189	65.5	16.4	17.5	9.84	20.6	14.7	11.6	11	21.8	21.8	16.9	16.3	9.27	8.44	15.8	9.86	5.5	1.8	D-(-)	1.3	21
56A	MYTI EDU	SB		20.7	23.4	121	109	24.7	46.4	27.8	37.5	15.7	30.3	28.5	30.5	42.9	27.8	24.7	32	28.9	21.4	19.6	15	5.0	--(D-)	2.6	15
57A	MYTI EDU	SB		10.5	12.1	33.3	19.2	15.1	13.2	5.6	13.7	6.15	10.4	10.3	11.9	9.59	7.02	5.79	11.3	10.4	4.57	4.78	4.28	1.4	D-(-)	no	13
63A	MYTI EDU	SB		12.1	10.1	15.4	10.9	7.22	12.1	7.6	6.1	6.39	4.84	4.52	7.05	6.57	6.3	1.92	4.53	5.36	4.05	2.63	3.19	1.1	D-(-)	no	12
65A	MYTI EDU	SB		5.61	3.78	5.19	6.53	3.28	4.73	2.41	3	1.77	1.63	2.45	2.84	3.05	2.82	1.25	3	4.01	1.56	1.75	3.1	1.0	D-(-)	no	13
69A	MYTI EDU	SB				4.62	3.42	2.8	3.17	4.02	3.66	1.98	3.4	2.27	3.91	2.76	2.53	0.957	1.74	2.01	1.65	1.84	1.2	no	D-	no	12
22A	MYTI EDU	SB		1.37	1.46	2.78	1.87	1.39	1.18	1.51	1.37	1.21	1.7	1.3	1.21	0.884	1.46	1.79	1.88	1.31	2.6	2.29	0.739	no	--	no	12
23A	MYTI EDU	SB		1.42	1.47													0.878	2.13					no	-?	?	15
24A	MYTI EDU	SB		1.42	1.21													2.01	1.44					no	-?	?	9
82A	MYTI EDU	SB			1.28	0.933	0.916			0.622	0.674							0.558	0.529					no	--	no	7
84A	MYTI EDU	SB			1.01	1.15	1.38			1.38	0.833							1.11	1					no	--	no	9
87A	MYTI EDU	SB			0.974	0.87	0.634			1.4	2.47							0.421	0.3					no	--	no	13
25A	MYTI EDU	SB				2.68	1.77											2.01	1.09					no	-?	?	13
26A	MYTI EDU	SB				1.42	1.38											1.87	1.4					no	-?	?	8
27A	MYTI EDU	SB				1.83												0.941	0.833					no	D?	?	<=5
28A	MYTI EDU	SB				1.39	1.87											0.957	1.29					no	-?	?	10
91A	MYTI EDU	SB				0.898	1.46	2.01											0.778					no	-?	?	15
92A1	MYTI EDU	SB				0.933	0.628	1.09	0.664	0.654	2.18													no	--	no	16
93A	MYTI EDU	SB				1.14	1.62											2.13	1.05					no	-?	?	14
94A	MYTI EDU	SB				0.765	1.18											0.305	0.482					no	-?	?	13
95A	MYTI EDU	SB				1.04	2.16											0.585	0.463					no	-?	?	14
96A	MYTI EDU	SB				1.13	0.988											0.488	0.835					no	-?	?	12
97A	MYTI EDU	SB				1.37	1.26											0.495	0.47					no	D?	?	<=5
98A2	MYTI EDU	SB									1.54	1.59	1.49	1.34	0.892	1.16	1.09	0.54	0.667	0.699	0.706	0.833	no	D-	no	9	
98X	MYTI EDU	SB					4.34	3.12	4.11															1.4	-?	?	11
99A	MYTI EDU	SB				1.2	0.752											0.697	0.529					no	-?	?	11
41A	MYTI EDU	SB						1.29	0.9	0.793	0.651								0.63	0.356				no	Dm	no	11
42A	MYTI EDU	SB						1.54	0.761										0.557	0.384				no	-?	?	13
43A	MYTI EDU	SB						1.56	1.51			0.855							0.713	0.572				no	D?	?	10
44A	MYTI EDU	SB						2.81	2.57	1.66	1.15								0.82	1.81				no	--	no	14
45A	MYTI EDU	SB						1.1	1.99										0.69	0.639				no	-?	?	12
46A	MYTI EDU	SB						1.26	1.57	1.38									0.87	0.681				no	D?	?	8
47A	MYTI EDU	SB						1.09	1.18										0.603	0.675				no	D?	?	7
48A	MYTI EDU	SB						0.682	1.08	0.333									0.451	0.448				no	-?	?	15
49A	MYTI EDU	SB						2.38	7.65											2.73	1.87			no	-?	?	18
10A2	MYTI EDU	SB								0.735	0.807	2.34	1.57	1.44	1.39	1.8	1.65	1.02	0.674	0.988	1.63	1.06	0.824	no	--	no	13
11X	MYTI EDU	SB									0.743	0.521	0.314	1.09	2.32	0.74	0.279	0.37	0.323	0.539	0.331	0.389	0.3	no	--	no	17

Annual median concentration of Pb (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Pb (mg/kg d. wt.)																			ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		1.86	1.36	3.95	2.27	2.54	1.58	2.12	2.69	36.7	2.13	1.74	1.76	2.24	2.58	3.74	3.38	4.12	3.06	3.87	2.54	no	--	no	20
71A	MYTI EDU	SB		1.16	0.745	1.72	1.42	1.92	1.49	2.21	2.83	0.867	0.903	0.774	1.45	0.919	0.915	0.866	0.962	0.98	0.797	1	0.81	no	D-	no	12
51A	MYTI EDU	SB							149	60.3	17.2	29.6	37.1	91.7	32.4	98.4	108	42.2	77.5	17.6	29.8	23.4	21.2	7.1	--(-)	2.0	18
52A	MYTI EDU	SB		12.1	313	189	65.5	16.4	17.5	9.84	20.6	14.7	11.6	11	21.8	21.8	16.9	16.3	9.27	8.44	15.8	9.86	5.5	1.8	D(-)	1.3	21
10A2	MYTI EDU	SB								0.735	0.807	2.34	1.57	1.44	1.39	1.8	1.65	1.02	0.674	0.988	1.63	1.06	0.824	no	--	no	13
I021	MYTI EDU	SB							1.06	2.29	1.65	2.12		0.99	1.65	1.19								no	--	no	13
I022	MYTI EDU	SB							1	0.599	1.18	1.31	1.94	1.05	0.952	1.27	1.36	3.51	1.26	1.34	1.67	1.55	1.5	no	--	no	13
I023	MYTI EDU	SB							0.774	1.27	1.38	1.7	1.38	0.636	0.616	0.754	1.28	2.34	0.901	1.05	0.846	0.769	0.769	no	--	no	13
I024	MYTI EDU	SB							0.971	1.1	1.16	1.7	1.79	0.617	1.33	1.1	1.73	2.68	1.06	1.18	0.917	1.45	1.4	no	--	no	13
I301	MYTI EDU	SB				4.38						2.47	2.11	1.32	3.16	1.98	1.77	3.07	2.15	5.38	2.94	2.63	2	no	--	no	13
I304	MYTI EDU	SB										2.23	1.19	0.765	1.88	1.3	1.16	1.73	1.95	2.16	1.59	1.47	1.5	no	--	no	12
I306	MYTI EDU	SB										1.34	0.678	0.542	1.03	0.658	0.704	1.08	1.09	0.938	0.867	1.15	0.714	no	--	no	11
I307	MYTI EDU	SB										1.05	0.798	0.513	1.01	1.26	1.01	1.07	1.39	1.04	0.875	1.21	0.875	no	--	no	11
I201	MYTI EDU	SB							3.54	4.39	4.77	4.67	4.43	6.41	3.78	8.21	1.87	3.33	4.31	3.41	4.75	4.44	1.88	no	--	no	14
I205	MYTI EDU	SB							4.77		6.96	4	5.97	7.09	6.15	9.27	3.4	2.76	6.3	5.26	3.33	7.29	2.8	no	--	1.1	14
I965	MYTI EDU	SB													20	12.7	6.45	13.1	12.5	13.7	16.6	29.4	18.4	6.1	--	10.6	13
I962	MYTI EDU	SB							4.44	5.34	3.55	2.99												no	-?	?	9
I964	MYTI EDU	SB														8.75	3.49	6.57	13	13.3	13.7	15.4	10.7	3.6	--	5.3	14
I969	MYTI EDU	SB							2.47	2.08	1.62	2.91	5.13	3	2.57	2.58	1.85	1.59	3.92	2.11	1.94	1.93	2.13	no	--	no	12

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Pb (mg/kg w. wt.)

St	Species	Tissue	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																								OC	TRND	SM+3	POWER
30B	GADU MOR	LI		0.2	0.115	0.249	0.105	0.12	0.11	0.06	0.0949	0.163	0.85	0.24	0.22	0.513	0.24	0.17	0.138	0.101	0.29	0.3	0.13	1.3	--	2.3	17
36B	GADU MOR	LI		0.115	0.05	0.03	0.02	0.03	0.02	0.03	0.04	0.03	0.04	0.04	0.03	0.0061	0.02	0.02	0.02	0.02	0.02	0.02	0.02	no	D-	no	14
77B	GADU MOR	LI		0.135	0.195																	0.02	0.02	no	D?	?	11
15B	GADU MOR	LI		0.17	0.06	0.03	0.03	0.03	0.02	0.03	0.04	0.03	0.03	0.04	0.03	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	no	DY	no	12
53B	GADU MOR	LI		0.19	0.26	0.14	0.03		0.02	0.0748	0.07	0.105	0.115	0.13	0.13	0.142	0.04	0.09	0.082	0.0453	0.1	0.16	0.17	1.7	UY(-)	2.6	16
67B	GADU MOR	LI		0.13	0.18	0.03	0.0748	0.09	0.04	0.04	0.09	0.03	0.04	0.04	0.03	0.0149	0.02	0.02	0.0075	0.02	0.02	0.02	0.02	no	D(-)	no	16
23B	GADU MOR	LI		0.06	0.08	0.03	0.03	0.03	0.02	0.03	0.04	0.03	0.04	0.03	0.03	0.0061	0.02	0.02	0.02	0.0423	0.02	0.02	0.02	no	D-	no	14
92B	GADU MOR	LI					0.02	0.03	0.03	0.04							0.02	0.02				0.02	0.02	no	--	no	6
98B1	GADU MOR	LI				0.03	0.03	0.03	0.04	0.04	0.05	0.03	0.03			0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	no	DY	no	10
43B	GADU MOR	LI					0.03	0.03	0.03	0.03												0.02	0.02	no	D?	?	<=5
10B	GADU MOR	LI					0.03	0.02	0.04	0.04	0.04	0.04	0.03	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	no	DY	no	9

Annual median concentration of Pb (mg/kg w. wt.)

St	Species	Tissue	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																								OC	TRND	SM+3	POWER
33F	PLAT FLE	LI		0.24	0.35	0.06	0.03	0.03	0.02	0.03	0.04	0.04	0.04	0.04	0.03	0.0295	0.03	0.02	0.03	0.0439	0.02	0.03	0.03	no	DY	no	13
53F	PLAT FLE	LI		0.71	0.81	0.41	0.23		0.0245	0.46	0.35	0.52	0.46	0.357	0.57	1.29	0.73	0.44	1.35		0.56	0.7	0.0447	no	--	no	22
67F	PLAT FLE	LI								0.35		0.03	0.03	0.03	0.0078	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	no	DY	no	15
21F	PLAT FLE	LI											0.04	0.0447	0.06	0.0461		0.04	0.1	0.11			no	--	no	12	
36F	LIMA LIM	LI		0.6	0.07	0.04	0.07	0.03	0.02	0.03	0.05	0.05	0.05	0.06	0.04	0.0477	0.03	0.05	0.05	0.0473	0.05	0.06	0.04	no	DY	no	15
77F	LIMA LIM	LI			0.23																	0.06	0.09	no	-?	?	13
15F	LIMA LIM	LI			0.07		0.0408	0.03	0.02	0.03	0.05	0.04	0.0346		0.05	0.0212	0.02	0.03	0.03	0.037	0.02	0.03	0.02	no	--	no	12
22F	LIMA LIM	LI		0.25	0.16	0.0424		0.06	0.07															no	-?	?	18
21F	LIMA LIM	LI													0.0293	0.02	0.05	0.02			0.08		0.24	no	Um	1.1	17
30F	PLEU PLA	LI				0.739	0.54	0.57																2.9	-?	?	7
22F	PLEU PLA	LI								0.28	0.28	0.46												2.3	-?	?	9
98F2	PLEU PLA	LI											0.104	0.04	0.0682	0.04	0.02	0.204	0.15	0.06	0.02	0.02	no	--	no	21	
10F	PLEU PLA	LI								0.15		0.0648	0.08	0.05	0.0583	0.0447	0.0447	0.03		0.0346	0.0592	0.03	0.03	no	D-	no	11
67F	LEPI WHI	LI		0.19	0.07	0.06	0.07	0.04	0.07	0.03	0.04	0.04	0.03	0.03	0.04	0.0312	0.02	0.0245	0.02	0.02	0.02	0.02	0.02	m	D-	m	11
21F	LEPI WHI	LI															0.02	0.02	0.02	0.031	0.02	0.02	0.02	m	--	m	9

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Cu (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Cu (mg/kg d. wt.)																											ANALYSIS				
			1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30A	MYTI	EDU			4.57		7.45	4.96	5.48	5.97	10.3	10.5	5.84	6.67	8.56	6.94	7.69	9.47	7.72	8.01	6.49	5.81	6.29	7.68	8.55	9.31	8.2	7.35	7.44	8.44	no	--	no	9
31A	MYTI	EDU		7.03	6.57			4.44	4.52	4.51	9.04	11	5.49	5.67	6.21	7.26	6.61	6.08	8.08	7.55	5.54	5.82	5.47	6.31	6.73	6.86	8.4	6.38	5.87	6.23	no	--	no	9
35A	MYTI	EDU		6.32	3.62		8.06	4.89	4.58	5.26	8.02	10.1	6.56	6.34	6.61	6.41	6.94	6.81	7.23	7.14	5.49	6.19	6.51	7.38	8.31	7.94	6.55	5.57	6.58	6.48	no	--	no	9
36A	MYTI	EDU		6.29	3.57		6.08	4.47	4.87	4.3	5.5	9.23	5.16	5.51	5.63	7.67	9.06	6.86	6.83	6.2	5.52	5.83	5.21	6.32	6.96	6.24	6.27	6.19	6.29	no	--	no	9	
71A	MYTI	EDU		8.47	5.24		6.08	8.43	6.99		8.33	10.3	7.4	7.88	7.18	8.11	7.66	9.44	7.5	7.57	8.81	7.53	7.12	11.2	8.81	8.93	10.1	8.13	7.72	6.22	no	--	no	8
76A	MYTI	EDU									8.51	10.8	5.65	5.57			6.65	7.8	9.14	10.2	6.93	7.67	6.39	9.76	7.99	7.76	7	6.29	6.86	6.76	no	--	no	9
15A	MYTI	EDU									5.72	7.21		5.5	5.25	5.26	7.32	6.14	7.62	7.34	7.62	9.47	5.68	8.07	6.47	6.81	6.81	7.59	5.89	6.24	no	--	no	8
51A	MYTI	EDU					7.14	6.14							10.2	10.2	7.44		8.21											4.86	no	--	no	8
52A	MYTI	EDU							8.4	7.49	72.1	9.35	8.45	6.98	7.03	6.28	7.73	6.47	5.53	6.97	5.88	7.45	9.19	6.21	7.47	5.56	8.11	5.27	6.94	no	--	no	16	
56A	MYTI	EDU					8.07	7.87	8.82	5.37	7.54	7.4	9.15	6.36	7.71	6.59	7.79	7.18	8.17	8.72	5.77	6	9.1	5.36	8	7.47	5.61	7	6.56	no	--	no	9	
57A	MYTI	EDU					8.21	6.33	6.01	6.16	7.27	6.59	6.77	6.43	5.62	5.54	6.98	6.91	6.39	5.13	5.81	7.21	5.98	3.26	6.88	8.29	4.33	5.22	4.75	no	--	no	10	
63A	MYTI	EDU					9.84	6.16	5.11	6.84	11.1	6.32	6.11	6.71	6.84	6.56	6.12	5.61	5.13	5.69	5.46	6.67	7.95	2.39	6.27	7	5.57	4.11	5.82	no	--	no	12	
65A	MYTI	EDU					7.98	4.94	5.19	12.2	8.14	5.51	6	5.12	5.66	5.82	5.59	5.14	5.05	5.27	5.93	6.54	7.71	2.81	6.94	6.76	4.62	6.75	5.37	no	--	no	12	
69A	MYTI	EDU										6.19	5.32	5.41	6.26	7.28	5.56	5.22	7.22	8.51	6.82	5.81	12.6	3.06	5.84	5.55	6.06	6.39	5.61	no	--	no	12	
22A	MYTI	EDU									6.35	6.69	5.38	5.76	6.28	6.81	9.29	4.16	8.56	7.47	8.54	5.27	5.86	7.81	14.9	6.82	8.72	145	9.82	6.39	no	--	1.1	20
23A	MYTI	EDU									5.58	6.52													6.64	6.93				no	-?	?	6	
24A	MYTI	EDU									5.78	7.01													6.78	5.91				no	-?	?	7	
82A	MYTI	EDU		6.38				4.69	5.77	7.49		11.8	6.87	9.61		7.44	7.93								5.52	6.94				no	--	no	10	
84A	MYTI	EDU		10.3			96.8	56.8	39.3	26.8		17.1	22.2	24		9.51	7.21								8.07	8.39				no	--	1.1	17	
87A	MYTI	EDU		4.57				20.1	8.35	5.88		7.28	6.3	6.88		7.63	7.52								6.92	5.95				no	--	no	13	
25A	MYTI	EDU										6.48	5.77												6.48	6.05				no	-?	?	6	
26A	MYTI	EDU										6.98	6.28												6.41	6.75				no	-?	?	<=5	
27A	MYTI	EDU										6.92													5.89	5.52				no	-?	?	<=5	
28A	MYTI	EDU										5.36	5.18												5.69	8.12				no	-?	?	9	
91A	MYTI	EDU										6.59	6.36	8.36												7.33			no	-?	?	8		
92A1	MYTI	EDU										6.65	6.03	7.56	6.26	7.48	6.4												no	--	no	7		
93A	MYTI	EDU										6.46	6.79												7.93	8.11				no	U?	?	<=5	
94A	MYTI	EDU										6.81	6.72												6.72	5.77				no	-?	?	6	
95A	MYTI	EDU										7.84	6.44												7.95	7.28				no	-?	?	7	
96A	MYTI	EDU										7.22	6.2												6.46	6.68				no	-?	?	6	
97A	MYTI	EDU										8.12	7.01												6.77	7.35				no	-?	?	6	
98A2	MYTI	EDU																5.5		5.94	6.84	6.1	6.58	7.22	8.34	7.13	8.2	5.94	7.12	6.68	no	--	no	7
98X	MYTI	EDU												8.99	8.91	7.74														no	-?	?	<=5	
99A	MYTI	EDU										8.65	7.29												6.72	7.11				no	-?	?	6	
41A	MYTI	EDU												6.83	8.16	7.64	4.76										7.5	7.29		no	--	no	10	
42A	MYTI	EDU												7.4	7.61												7.09	6.33		no	-?	?	<=5	
43A	MYTI	EDU												7.79	9.32		6.32									9.38	5.84		no	-?	?	11		
44A	MYTI	EDU												6.56	9.56	7.78	6.86									9.1	5.81		no	--	no	10		
45A	MYTI	EDU												6.22	7.39											5.95	5.89		no	-?	?	6		
46A	MYTI	EDU												6.63	7.43	8										8.15	6.61		no	-?	?	7		
47A	MYTI	EDU												5.7	5.84											6.5	6.32		no	U?	?	<=5		
48A	MYTI	EDU												6.57	7.74	7.1										5.76	5.26		no	D?	?	6		
49A	MYTI	EDU												7.36	9.68											8	6.17		no	-?	?	9		
10A2	MYTI	EDU														7.84	5.71	7.9	6.93	6.17	5.43	6.4	7.42	6.95	6.79	8	6.26	6.41	6.24	no	--	no	7	
11X	MYTI	EDU																5.51	5.45	6.49	5.27	5.45	6.51	7.07	6.54	6.1	8.61	5.9	5.82	5.9	no	--	no	7

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Zn (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of Zn (mg/kg d. wt.)																											ANALYSIS								
			1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER				
30A	MYTI	EDU	SB			138	90.5	140	120	93.1	76.2	161	116	147	104	117	109	114	126	173	106	93.4	92.3	116	123	141	118	125	106	134	117	no	--	no	9			
31A	MYTI	EDU	SB		88.1	132	76.9	106	66.3	67.7	58.1	181	128	125	96.4	96.8	151	103	128	120	112	84	83.1	92.9	127	128	116	108	100	104	110	no	--	no	10			
35A	MYTI	EDU	SB		91.9	79.6	75.9	89.8	68.4	81.5	83.2	166	139	131	119	97.6	82.9	94.3	103	112	111	66.1	72.3	84.6	106	131	118	80.5	83.5	92.6	80.4	no	UY	no	9			
36A	MYTI	EDU	SB		66.5	85.8	66.1	57.7	61.5	73.6	65.3	126	127	104	84	121	115	137	145	105	95.5	125	100	102	125	98.6	90.6	83.6	91.9	90.6		no	UY	no	9			
71A	MYTI	EDU	SB		124	125	77	115	101	169	128	162	143	166	120	157	150	122	192	114	114	99.4	97.9	134	121	117	105	95.3	85.6	104	86.1	no	DY	no	9			
76A	MYTI	EDU	SB									158	127	124	57.6			112	135	137	132	83.1	116	123	127	128	107	92.6	121	116	114	no	--	no	9			
15A	MYTI	EDU	SB									157	144		71.4	88.9	62.6	232	107	127	105	127	83.3	110	101	114	103	112	102	92.6	107	no	--	no	11			
51A	MYTI	EDU	SB					378	253							386	223	120														83.3	no	--	no	13		
52A	MYTI	EDU	SB							824	272	453	408	218	141	196	183	247	160	143	134	180	90.6	137	106	104	90.6	106	95	94.1	no	D-	no	11				
56A	MYTI	EDU	SB				869	410	1170	572	479	418	388	211	290	246	377	143	271	225	158	146	151	178	171	140	99.3	125	101		no	D-	no	12				
57A	MYTI	EDU	SB				378	263	441	520	292	256	147	173	182	115	223	121	207	167	124	108	98.8	84.4	112	105	63.8	78.9	67		no	D-	no	11				
63A	MYTI	EDU	SB				579	216	241	509	392	207	122	122	189	147	170	129	115	115	127	106	119	54.6	110	113	98.2	77.9	82.5		no	D-	no	12				
65A	MYTI	EDU	SB				191	156	199	424	308	131	139	118	166	147	184	121	152	154	155	145	151	69.6	139	147	94.8	128	92.9		no	D-	no	12				
69A	MYTI	EDU	SB																																no	DY	no	10
22A	MYTI	EDU	SB									172	162	135	116	98	144	221	110	128	122	72.1	117	90.3	134	142	121	88.8	147	118	103	no	--	no	10			
23A	MYTI	EDU	SB									136	133																					no	D?	?	<=5	
24A	MYTI	EDU	SB									175	133																					no	-?	?	9	
82A	MYTI	EDU	SB		127	106	132	109	76.1	129				145	123	112		109	87.6															no	--	no	9	
84A	MYTI	EDU	SB		118	160	163	133	132	142				185	180	113			121	85.8														no	--	no	9	
87A	MYTI	EDU	SB		100	92.8	97.7	102	105	96.6				117	114	90.2		109	97.2																no	--	no	6
25A	MYTI	EDU	SB																																no	-?	?	10
26A	MYTI	EDU	SB																																no	-?	?	8
27A	MYTI	EDU	SB																																no	-?	?	<=5
28A	MYTI	EDU	SB																																no	-?	?	12
91A	MYTI	EDU	SB																																no	-?	?	7
92A1	MYTI	EDU	SB																																no	--	no	10
93A	MYTI	EDU	SB																																no	-?	?	6
94A	MYTI	EDU	SB																																no	-?	?	6
95A	MYTI	EDU	SB																																no	-?	?	6
96A	MYTI	EDU	SB																																no	-?	?	9
97A	MYTI	EDU	SB																																no	-?	?	<=5
98A2	MYTI	EDU	SB																																no	--	no	6
98X	MYTI	EDU	SB																																no	-?	?	6
99A	MYTI	EDU	SB																																no	-?	?	10
41A	MYTI	EDU	SB																																no	--	no	<=5
42A	MYTI	EDU	SB																																no	D?	?	<=5
43A	MYTI	EDU	SB																																no	D?	?	<=5
44A	MYTI	EDU	SB																																no	--	no	7
45A	MYTI	EDU	SB																																no	D?	?	<=5
46A	MYTI	EDU	SB																																no	-?	?	7
47A	MYTI	EDU	SB																																no	-?	?	9
48A	MYTI	EDU	SB																																no	-?	?	7
49A	MYTI	EDU	SB																																no	D?	?	<=5
10A2	MYTI	EDU	SB																																no	--	no	8
11X	MYTI	EDU	SB																																no	--	no	9

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Σ PCB-7 (mg/kg d. wt)

St	Species	Tissue																					ANALYSIS							
			1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER	
30A	MYTI EDU	SB		77.5	96.5	116	89.6	97		89.3	90.4	110	128	58.5	71.1	49.9	29.6	33.9	43.4	20.7	67.9	28.8	47.7	49.4	38.3	2.6	D(-)	3.2	12	
31A	MYTI EDU	SB		21.7	24.9	37.1	24.7	34.6		52.2	49	63.8	24.6	12.9	18	6.49	8.87	8.97	7.58	3.79	13.8	9.3	5.83	11.5	11	no	DY	no	13	
35A	MYTI EDU	SB		21.5	33.6	27.5	14.2	22.1		13.4	13.6	10.7	16.5	12.5	14.6	5.52	7.32	6.97	8.2		12.3	4.91	5.06	9.45	6.96	no	D-	no	12	
36A	MYTI EDU	SB		11	17.9	19.3	7.94	11.2		5.69	10.5	12.3	12.7	8.62	12.1	5.28	5.54	6.03	5.75	5.58	6.92	3.61	2.94	5.56		no	D-	no	12	
71A	MYTI EDU	SB		17	34.4	25	14.2	15.3		16.5	10.5		9.27	11.8	13.6	8.52	12.7	7.55	9.74		14.3	9.33	9.3	10.5	9.71	no	D-	no	11	
76A	MYTI EDU	SB				16.6	6.49	7.21					16.3	19.1	14.4	16.4	6.34	6.78	5.12	5.06		3.29	4.59	4.68	5.91	5.24	no	DY	no	11
15A	MYTI EDU	SB				11.8				6.29	3.06		2.41	3.88	4.72	5.28	2.56	4.19	3.15	2.73	2.74	3.34	2.56	4.38	4.18	4.5	no	DY	no	11
51A	MYTI EDU	SB										26.2	9.69	14.7	10.5	11.5	12	28	16.9	16	10.6	14.5	11.2	11.2	9.89	9.93	no	--	no	12
52A	MYTI EDU	SB			40.2	14.9		11.3	11.3	17.1	16.9	10	19	10.6	11.2	7.19	74.2	12.5	12	10.3	9.97	11.1	15.4	10.7	6.78	no	--	no	17	
56A	MYTI EDU	SB	12.5	45.8	37.7	12.1	12	9.41	13.8	11.9		16.8	9.55	11.2	5.98	216	13	13.1	6.73	9.33	6.04	9.53	6.5	5.81		no	--	no	21	
57A	MYTI EDU	SB		28		7.63	7.55	4.74	8.38	6.54	4.18	8.41	10.3	8.16	3.89	55.9	5.89	6.16	2.89	7.47	4.28	3.74	4.65	4.88		no	--	no	19	
63A	MYTI EDU	SB			21.8		9.71	6.45	3.68	5.7	5.72		4.15	7.95	7.26	4.09	13.8	3.54	6.05	1.25	5.3	4.09	5.07	3.3		no	--	no	16	
65A	MYTI EDU	SB	6.05	11.1	33.4	9.29	5.59	3.69	5.55	3.37	5.19	3.76	7.62	6.44	3	8.31	2.73	3.73	1.24	4.75	3.28	3.9	1.73			no	D-	no	17	
69A	MYTI EDU	SB					4.82		4.97	4.51	2.77	5.41	12.6	5.83	2.53	5.7	3.18	4.01	1.27	4.03	2.48	2.18	1.28	2.73		no	--	no	16	
22A	MYTI EDU	SB			18.9	8.23	8.61		7.97	6.84	5.19	4.69	11.5	6.01	5.14	4.69	3.24	8.5	5.51	8.74	5.76	6.43	8.68	4.84		no	--	no	12	
82A	MYTI EDU	SB		8.4	15.6																2.39	3.09				no	-?	?	14	
84A	MYTI EDU	SB		5.25	20.5		5.05	8.44			3.6	6.37									0.852	5.11				no	--	no	21	
87A	MYTI EDU	SB		3.9	12.8																	3.38				no	-?	?	23	
91A	MYTI EDU	SB					2.81		7.64													3.14				no	-?	?	20	
92A1	MYTI EDU	SB					4.46	2.49	5.83	4.05	2.89	7.74														no	--	no	15	
96A	MYTI EDU	SB					3.35	1.52												0.785	2.83					no	-?	?	21	
98A2	MYTI EDU	SB										10.7		4.14	3.54	4.56	3.23	3.62	1.85	2.72	3.27	2.7	1.09	3.25		no	--	no	14	
98X	MYTI EDU	SB							87.3	78.4	46.4															3.1	-?	?	9	
99A	MYTI EDU	SB					3.42	1.97													0.871	1.29				no	-?	?	13	
41A	MYTI EDU	SB							3.49	4.26	2.39	2.58										2.35	1.78			no	--	no	10	
43A	MYTI EDU	SB							2.92	3.1		3.02										2.5	1.57			no	-?	?	9	
44A	MYTI EDU	SB								7.31	8.46	29.4										15.7	11.1			no	-?	?	18	
45A	MYTI EDU	SB							6.45	5.31												4.25	2.7			no	-?	?	10	
46A	MYTI EDU	SB							5.74	4.16	3.11											5.53	2.86			no	-?	?	13	
48A	MYTI EDU	SB							6.22	4.04	3.1											5.16	2.21			no	-?	?	15	
10A2	MYTI EDU	SB									4.66	6.29		5.11	4.33	3.03	2.13	2.58	1.28	2.29	4.59	1.89	1.65	2.06		no	D-	no	13	
11X	MYTI EDU	SB										3.34	3.56	4.48	2.79	3.1	1.93	1.93	1.28	3.02	2.11	1.9	2.25	2.64		no	--	no	11	

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Σ PCB-7 (mg/kg d. wt)

St	Species	Tissue																								ANALYSIS						
			1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER		
30A	MYTI EDU	SB		34.9	77.5	96.5	116	89.6	97		89.3	90.4	110	128	58.5	71.1	49.9	29.6	33.9	43.4	20.7	67.9	28.8	47.7	49.4	38.3	2.6	DY(-)	3.2	12		
71A	MYTI EDU	SB		13.9	17	34.4	25	14.2	15.3		16.5	10.5	9.27	11.8	13.6	8.52	12.7	7.55	9.74			14.3	9.33	9.3	10.5	9.71	no	D-	no	11		
51A	MYTI EDU	SB										26.2	9.69	14.7	10.5	11.5	12	28	16.9	16	10.6	14.5	11.2	11.2	9.89	9.93	no	--	no	12		
52A	MYTI EDU	SB				40.2	14.9		11.3	11.3	17.1	16.9	10	19	10.6	11.2	7.19	74.2	12.5	12	10.3	9.97	11.1	15.4	10.7	6.78	no	--	no	17		
10A2	MYTI EDU	SB										4.66	6.29		5.11	4.33	3.03	2.13	2.58	1.28	2.29	4.59	1.89	1.65	2.06	no	D-	no	13			
I021	MYTI EDU	SB										43.1	31.8	32.2	24.1		22.2	20	25.1								1.7	D-	1.3	7		
I022	MYTI EDU	SB										32.1	25.9	41.2	22.4	28.9	19.2	22.4	20.8	15.2	17.1	11	11.1	5.79	8.13		no	D-	no	10		
I023	MYTI EDU	SB										19.6	20.9	26	15	22.2	10.8	17.4	15.9	12.3	12.6	9.73	8.91		5.04	9.62	no	D-	no	11		
I024	MYTI EDU	SB										31.8	36.1	45.6	36.6	28.7	16.8	17.7	26	15	15.8	11.3	10.6	3.54	6.14	8.36	no	D-	no	13		
I301	MYTI EDU	SB						231				118	113	182	86.5	125	58.7	64.6	62.6	70.4	57.9	84.7	75.4	63.2	104	45.9	3.1	D(-)	3.5	11		
I304	MYTI EDU	SB										35.2	23.8	44.4	35.9		19.9	25	24.4	27.5	30	21.4	23.4	23.9	33.1	17.7	1.2	--	1.3	11		
I306	MYTI EDU	SB										16.4	15.7	54.2	26.1		21.8	17.2	15.7	15.4	17.9	12.9	20.1	20.7		12.3	no	--	no	13		
I307	MYTI EDU	SB										20.6	28.5	40.2	17.3		20.3	16.9	17.5	15.4	13	11.7		15.4	16.5	16.5	1.1	D-	1.3	10		
I711	MYTI EDU	SB										24.8	13.3	13.3	20.6	21.6	18.4			13.4							no	--	no	11		
I712	MYTI EDU	SB										33.3	31.2	25.3	22.4	24.9	13.9	12.5	10.9	16.9		16.2	14.2		19.4	9.47	no	D-	no	10		
I713	MYTI EDU	SB																			12.5	15	21.4	18.1	15.7		13.7	13.1	no	--	no	8
I131A	MYTI EDU	SB										7.94	11.7	13.1	22.4	12.7	10.1	14	29.4	8.13	3.98	9.65	4.65	3.53	12.3	8.18	no	--	no	16		
I132	MYTI EDU	SB													31.1	22.5	10.2	15.8	11.8	13.3		11.5	10.9	6.19	5.92	29.1	1.9	--	1.3	16		
I133	MYTI EDU	SB										22.8	22.3	21.5	24.7	23	10.4	11.7	9.24	9.23	12.5	10	9.68	9.58	6.42		no	D-	no	9		
I241	MYTI EDU	SB										54.3	78.9	47.2	55.2	80.8	55.5	36.3	96.4	125	118	61.8	48.5	46.4	55	51.5	3.4	--(-)	2.2	13		
I242	MYTI EDU	SB										63	81.6	29.6	45.6	59.5	36.6	26.2	44.6	81.9	55.9	36.8	31.7	29.4		35.1	2.3	--	1.6	13		
I243	MYTI EDU	SB										115	169	122	78.2	92.4	47.9	29.3	52.5	326	288	217	75.2	48.9		35.9	2.4	--	no	17		

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Σ PCB-7 (mg/kg w. wt)

St	Species	Tissue																				ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30B	GADU MOR	LI		1240	3430	2800	2500	2910	2350	2930	3090	3660	3520	2080	2440	2230	2140	2620	4160	3550	2160	3780	3600	3.6	--(-)	3.6	11
36B	GADU MOR	LI		441	344	396	636	376	1650	974	720	736	766	482	288	269	425	535	542	591	210	261	181	no	DY	no	13
77B	GADU MOR	LI		305	386																134	197	no	-?	?	11	
15B	GADU MOR	LI		182	349	266	182	295	307	274	399	279	257	153	377	244	213	154	186	131	166	135	121	no	D-	no	11
53B	GADU MOR	LI		435	524	1760	166		162	701	576	2370	487	1520	842	956	317	463	422	340	742	136	449	no	--(-)	no	20
67B	GADU MOR	LI		316	293	268	226	329	210	269	627	206	273	148	225	145	92.6	94.4	134	56.1	109	77.1	89.3	no	D-	no	13
23B	GADU MOR	LI		222	244	228	208	128	193	196	125	179	229	207	167	111	114	202	210	141	146	72.9	78.1	no	D-	no	11
92B	GADU MOR	LI					135	152	311	369							119	42.8			78	82.7	no	--	no	13	
98B1	GADU MOR	LI				239	183	114	197	278	372	165	147			62.6	110	183	91.6	102	132	41.2	14.9	no	D-	no	12
43B	GADU MOR	LI						325	329	140											94.1	121	no	-?	?	13	
10B	GADU MOR	LI					645	485	210	189	168	255	99.4	109	151	146	127	104	96.6	116	82.4	131	no	DY	no	11	

Annual median concentration of Σ PCB-7 (mg/kg w. wt)

St	Species	Tissue																				ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30B	GADU MOR	MU		3.58	11.1	24.7	9.65	3.94	3.12	8.9	10.5	21.7	21.4	6.06	9.4	10.3	9.31	7.91	9.01	11.9	10.6	16.6	21.2	7.1	--(U-)	9.6	17
36B	GADU MOR	MU		1.62	1.29	2	3.65	0.525	15.6	4.14	4.54	3.78	2.86	2.26	2.19	1.9	2.52	2.88	2.71	9.34	0.63	1.36	2.53	no	--	no	21
77B	GADU MOR	MU		0.88	3.05																0.9	0.98	no	-?	?	19	
15B	GADU MOR	MU		1.35	1.22	1.38	0.65	0.38	1.03	1.14	1.44	1.41	0.81	1.42	1.88	0.655	1.23	0.2	0.675	0.575	0.421	0.575	0.475	no	--	no	15
53B	GADU MOR	MU		8.2	2.23	15	1.1		0.37	21.9	3.76	138	6.61	36.3	1.08	23.6	4.84	3.09	2.2	1.12	5.72	6.02	4.44	1.5	--(-)	2.8	>25
67B	GADU MOR	MU		0.835	1.43	1.1	0.624	1.15	0.605	3.5	7.07	0.73	1.72	1.18	9.98	0.61	0.35	0.407	0.865	0.235	0.255	0.557	0.43	no	--	no	23
23B	GADU MOR	MU		0.64	2.26	0.75	0.85	0.18	0.625	0.46	0.81	1.49	0.95	0.45	0.62	0.38	0.495	0.325	0.7	1.01	0.53	0.515	0.835	no	--	no	16
92B	GADU MOR	MU					0.55	0.225	0.36	0.905							0.225	0.255			0.365		no	--	no	17	
98B1	GADU MOR	MU				0.9	0.9	0.135	0.34	0.475	1.4	0.44	0.585			0.24	0.385	0.32	0.435	0.385	0.307	0.25	0.175	no	--	no	17
43B	GADU MOR	MU						0.515	0.815	0.39											0.362		no	-?	?	13	
10B	GADU MOR	MU					1.77	2.49	0.367	0.9	0.79	1.39	0.5	0.55	0.635	0.555	1.15	0.535	0.609	0.804	0.495	0.71	no	--	no	16	

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of Σ PCB-7 (mg/kg w. wt)

St	Species	Tissue	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																								OC	TRND	SM+3	POWER
33F	PLAT FLE	LI		36	31.1	97.5	69	57	86	54.9	30.3	35.3	47.2	90.7	158	53	60.1	62.8	63.4	68.9	67.3	72.8	74.6	no	--	no	13
53F	PLAT FLE	LI		509	517	309	36		22.8	115	113	111	156	95.8	95.1	158	165	108	363		119	80.7	19.4	no	DY	no	18
67F	PLAT FLE	LI								70		96.9	45.8	44	36.3	32	27.6	33.1	39	42.7	42.5	34.4	23.3	no	D-	no	10
21F	PLAT FLE	LI										22.9	6.97	33.6	48.9		121	15.5	20.1					no	--	no	23
33F	PLAT FLE	MU		2.04	3.96	1.8	0.95	0.51	1.37	1.91	0.935	1.14	5.32	1.14	1.76	1.53	1.25	0.675	0.48	0.805	0.675	1.38	1.28	no	--	no	16
53F	PLAT FLE	MU		27.4	33.2	14.2	1.45		0.757	3.19	2.74	2.19	2.73	3	2.67	2.02	1.13	1.96	6.73		1.76	2.19	0.588	no	DY	no	19
67F	PLAT FLE	MU								0.775		1.8	1.66	1.48	0.95	0.845	0.82	0.295	0.565	0.47	1.1	1.56	1.13	no	DY	no	13
21F	PLAT FLE	MU										0.76	0.2	0.61	1.33		1.56	0.957	1.19					no	--	no	18
36F	LIMA LIM	LI		301	217	339	418	404	433	386	387	236	412	838	527	297	272	538	511	620	650	721	313	no	--	no	13
77F	LIMA LIM	LI			75																	31.3	79.7	no	-?	?	19
15F	LIMA LIM	LI			124		58.2	77	74	62.5	64.5	51.1	69.6		106	50.2	49.8	66.8	105	47.1	55.5	74.9	47.7	no	--	no	12
22F	LIMA LIM	LI		170	127	140		60	88.7															no	-?	?	11
21F	LIMA LIM	LI													149	115	136	123			115		34.1	no	Dm	no	13
36F	LIMA LIM	MU		2.76	7.05	5.6	7.8	5.9	8.18	9.62	5.19	9.41	3.88	8.38	7.73	6.56	3.73	4.34	4.47	7.18	10.4	12.1	10.1	2.0	UY	3.8	12
15F	LIMA LIM	MU			3.72		0.806	0.369	1.14	1.81	1.28	1.42	0.959		1.21	0.665	0.94	0.349	1.25	0.695	0.575	0.98	0.66	no	--	no	16
22F	LIMA LIM	MU		1.97	5	3.82		1.24	5.14															1.0	-?	?	20
21F	LIMA LIM	MU													1.54	1.12	1.12	1.62			1.82		1.2	no	--	no	10
30F	PLEU PLA	LI				313		207	216															4.3	-?	?	8
22F	PLEU PLA	LI								21	20.1	14.5												no	-?	?	7
98F2	PLEU PLA	LI												40.8	25.5	10.3	10.5	8.4	24.1	13.8	5.53	3.49	2.56	no	D-	no	15
10F	PLEU PLA	LI									42.1		62.8	45	24.9	86.2	16.6	22.3	25.7		14.9	23.8	10.5	no	--	no	16
30F	PLEU PLA	MU				6.82		3.01	1.46															no	-?	?	9
22F	PLEU PLA	MU								1.39	0.95	3.33												1.7	-?	?	19
98F2	PLEU PLA	MU												1.54	0.6	0.291	0.25	0.175	0.862	0.74	0.285	0.225	0.175	no	--	no	18
10F	PLEU PLA	MU									0.97		2.58	1.78	1.12	1	0.457	0.175	0.435			0.986	0.333	no	--	no	17
67F	LEPI WHI	LI		111	100	143	101	172	166	97.2	91.5	118	82.3	83.9	63.8	105	85.2	73.3	58	52.5	50.4	40.4	27.3	m	DY	m	9
21F	LEPI WHI	LI															101	78.5	101	112	87.6	59.7	65.9	m	--	m	9
67F	LEPI WHI	MU		0.84	0.935	1.4	0.55	0.48	1.46	0.445	0.68	0.42	1.03	0.82	0.673	0.37	0.43	0.464	0.639	0.428	0.22	0.64	0.52	m	--	m	15
21F	LEPI WHI	MU															0.45	0.345	1.11	0.93	0.855	0.63	0.59	m	--	m	13

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of ppDDE (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of ppDDE (mg/kg d. wt.)																		ANALYSIS					
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER	
30A	MYTI EDU	SB		5.24	3.86	7.08	5.7	2.56	5.88	3.87	5.91	3.47	1.99	1.97	2.08	1.22	2.56	1.77	3.29	3	2.11	no	D(--)	no	13	
31A	MYTI EDU	SB		3.3	1.89	3.45	1.84	0.505	3.37	3.49	5.47	1.19	2.1	1.79	1.01	1.25	3.17	6.32	3.94	3.47	2.94	no	--	no	18	
35A	MYTI EDU	SB		4.91	2.08	3.13	2.84	0.57	3.91	3.73	5.93	1.61	3.29	2.17	1.8	2.94	5.47	2.4	2.86	3.95	3.13	no	--	no	17	
36A	MYTI EDU	SB		2.76	1.06	1.03	1.76	0.442	2.11	1.79	2.98	1.48	1.51	1.34	0.76	1.47	1.56	1.41	0.733	1.24		no	--	no	15	
71A	MYTI EDU	SB		2.61	1.58	3.21	1.29	0.736	1.02	2.2	2.41	2.26	3.58	1.1	1.67	0.763	1.8	2.17	1.8	1.56	1.71	no	--	no	14	
76A	MYTI EDU	SB		1.4	0.794			0.355	1.21	2.29	2.49	0.779	0.829	0.746	0.621	1.1	0.611	1.38	0.588	0.824	0.733	no	--	no	15	
15A	MYTI EDU	SB			0.976	1.72	0.735	0.294	1.02	1.41	2.05	0.536	0.622	0.854	0.667	0.857	0.688	0.722	0.706	1.17	0.765	no	--	no	16	
51A	MYTI EDU	SB					33.9	6.67	14.7	17.1	13.2	16.9	5.48	9.52	10	10.5	14.7	7.5	11.7	13.3	12.9	1.3	--	1.4	15	
52A	MYTI EDU	SB		12.3	25.5	19.4	18.5	9.53	13.1	16.7	13.7	11.9	6.47	6.82	8.86	10.5	12.5	4.71	12.2	12.7	6.11	no	--	no	13	
56A	MYTI EDU	SB		50	47.5	115	40.8	33.9	72.3	52.6	39.8	26.2	60.6	40	55.1	49.3	550	186	117	180	44	4.4	--	no	18	
57A	MYTI EDU	SB		25.9	18.3	35	25.3	15.8	50	82.9	35.2	27.5	24.7	14.7	27.8	16.6	53.3	12.1	23	26.7	25.5	2.6	--	2.5	16	
63A	MYTI EDU	SB		12.9	9.29	9.68	8.36	5.53	13	15.5	11.4	10.2	7.09	4.76	11.3	3.82	14	5.67	13.6	12.1	7.5	no	--	1.1	14	
65A	MYTI EDU	SB		7.6	5.19	7.79	4.12	5	6.9	11.9	7.38	6.76	5.43	3.61	6.47	2.55	8.33	3.63	6.67	7	5.5	no	--	no	13	
69A	MYTI EDU	SB		3.55	3.16	3.54	2.91	0.4	3.69	6.52	2.61	2.7	2.25	1.61	2.62	0.909	3	0.85	3.29	0.778	2.12	no	--	no	20	
22A	MYTI EDU	SB		2.22	1.31	1.88	1.45	0.387	1.37	5.11	1.96	1.49	0.909	0.725	1.46	0.861	1.65	4.78	0.933	0.938	0.895	no	--	no	18	
84A	MYTI EDU	SB		3.13	2.23		0.985	0.736								0.509	0.889					no	--	no	16	
25A	MYTI EDU	SB		1.29	1.03										0.879	1.05						no	-?	?	8	
26A	MYTI EDU	SB		2.74											1.35	1.84						no	-?	?	11	
27A	MYTI EDU	SB		1.8											0.442	0.833						no	-?	?	16	
28A	MYTI EDU	SB		1.11	0.858										0.378	0.765						no	-?	?	14	
91A	MYTI EDU	SB		0.625		1.32										0.667						no	-?	?	17	
92A1	MYTI EDU	SB		0.68	2.09	1.41	0.766	0.275	1.93													no	--	no	22	
96A	MYTI EDU	SB		1.03	0.435																	no	-?	?	19	
98A2	MYTI EDU	SB							1.59		0.87	0.575	1.31	0.625	0.725	0.415	0.778	0.867	0.5	0.438	0.611	no	--	no	13	
98X	MYTI EDU	SB				31.6	22.9	5.16														no	-?	?	15	
99A	MYTI EDU	SB		0.621	0.873											0.254	0.294					no	-?	?	10	
41A	MYTI EDU	SB				0.621	0.423	0.291	0.61									0.35	0.333				no	--	no	12
43A	MYTI EDU	SB					0.608		0.855									0.313	0.357				no	-?	?	11
44A	MYTI EDU	SB					0.486	0.343	1.41									3.3	1.35				no	-?	?	19
45A	MYTI EDU	SB				1.74	2											0.8	0.889				no	D?	?	8
46A	MYTI EDU	SB				1.05	0.756	0.273										0.6	0.524				no	-?	?	17
48A	MYTI EDU	SB				1.71	1.13	0.286										1.24	0.438				no	-?	?	22
10A2	MYTI EDU	SB						0.439	1.49		1.45	0.611	0.867	0.61	0.576	0.267	0.474	0.588	0.318	0.412	0.353	no	--	no	14	
11X	MYTI EDU	SB							0.811	1.04	1.04	0.769	0.758	0.472	0.465	0.317	0.524	0.389	0.286	1.17	0.45	no	--	no	14	

Annual median concentration of ppDDE (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of ppDDE (mg/kg d. wt.)																		ANALYSIS				
			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		5.24	3.86	7.08	5.7	2.56	5.88	3.87	5.91	3.47	1.99	1.97	2.08	1.22	2.56	1.77	3.29	3	2.11	no	D(-)	no	13
71A	MYTI EDU	SB		2.61	1.58	3.21	1.29	0.736	1.02	2.2	2.41	2.26	3.58	1.1	1.67	0.763	1.8	2.17	1.8	1.56	1.71	no	--	no	14
51A	MYTI EDU	SB					33.9	6.67	14.7	17.1	13.2	16.9	5.48	9.52	10	10.5	14.7	7.5	11.7	13.3	12.9	1.3	--	1.4	15
52A	MYTI EDU	SB		12.3	25.5	19.4	18.5	9.53	13.1	16.7	13.7	11.9	6.47	6.82	8.86	10.5	12.5	4.71	12.2	12.7	6.11	no	--	no	13
10A2	MYTI EDU	SB						0.439	1.49		1.45	0.611	0.867	0.61	0.576	0.267	0.474	0.588	0.318	0.412	0.353	no	--	no	14
I021	MYTI EDU	SB					4.6	1.45	4.8	3.25		5.19	2.73	4.73								no	--	no	16
I022	MYTI EDU	SB					3.95	1.38	7.13	4.58	7.96	4.92	3.73	4.51	2.54	2.7	1.43	1.31	0.75	1.09	1.4	no	DY(D-)	no	15
I023	MYTI EDU	SB					1.81	1.32	3.79	2.32	6.1	2.39	2.91	3.31	1.42	1.29	1.47	1.45	0.923	1	1.77	no	D(-)	no	14
I024	MYTI EDU	SB					3.5	3.52	8.91	7.17	8.96	4.94	2.52	5.15	2.4	2.32	1.7	1.33	0.615	1.09	1.2	no	DY(D-)	no	13
I301	MYTI EDU	SB		6.76			2.59	3.75	17.8	5.96	7.45	5.58	4.51	5.06	3.54	4.47	5.17	3.57	4.06	6.53	3	no	--	no	15
I304	MYTI EDU	SB					2.14	0.751	3.42	3.89		1.95	2.71	2.62	1.73	2.71	1.43	1.85	3.17	3.07	1.93	no	--	no	15
I306	MYTI EDU	SB					1.84	0.455	4.25	3.31		2.37	1.88	1.92	1.12	1.74	1.09	2.47	1.86	2.46	1.71	no	--	no	17
I307	MYTI EDU	SB					2.18	1.03	3.42	2.74		2.12	4.13	2.28	1.09	1.34	0.873	2.5	2.31	2.07	2.31	no	--	no	15
I711	MYTI EDU	SB					3.46	0.719	1.49	2.19	2.18	3.85		1.26								no	--	no	19
I712	MYTI EDU	SB					2.43	1.34	3.14	3.09	3.49	3.46	2.48	1.6	2.65	2.94	1.36	2.36	1.75	2.38	1.05	no	--	no	13
I713	MYTI EDU	SB											1.61	2.26	2.96	0.676	2.19	2.17	1.69	1.62	no	--	no	16	
I131A	MYTI EDU	SB					1.46	0.691	1.89	2.06	1.67	1.11	0.915	1.11	0.942	1.37	2.39	0.846	0.733	2.07	1.46	no	--	no	15
I132	MYTI EDU	SB								2.02	2.06	1.19	1.15	1.26	1.17	0.917	1.83	1.13	0.5	0.548	1.87	no	--	no	15
I133	MYTI EDU	SB					2.16	0.879	1.62	1.93	2.73	1.16	1.11	1.03	0.925	0.94	1.55	1.35	0.643	0.692	2	no	--	no	15
I241	MYTI EDU	SB					6.4	6.21	2.3	6.49	5.59	4.45	2.93	4.4	4.37	5.49	6.17	3	3.88	11.9	5.56	no	--	no	15
I242	MYTI EDU	SB					6.52	9.74	1.58	3.53	9.47	3.52	2.22	2.88	3.38	4.41	2.57	1.93	3.06	2.43	2.71	no	--	no	17
I243	MYTI EDU	SB					7.47	6.12	1.72	5.43	5.11	4.01	1.99	3.32	3.88	6.41	19.5	5.88	4.41	6.23	3.16	no	--	no	17

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of ppDDE (µg/kg w. wt.)

St	Species	Tissue	Annual median concentration of ppDDE (µg/kg w. wt.)																			ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30B	GADU MOR	LI	163	440	182	159	191	194	321	380	260	230	160	180	180	240	210	260	190	130	180	150	no	--	no	11	
36B	GADU MOR	LI	91.9	51	50	75	55	105	141	129	45	86	47	46	39	32	34	40	59	26	34	26	no	D-	no	12	
77B	GADU MOR	LI	46	63.4																	20	30	no	-?	?	12	
15B	GADU MOR	LI	50	136	48	57	86	33.5	75	140	72.5	76	46	60	78	74	50	58	51	55	48	37	no	--	no	13	
53B	GADU MOR	LI	637	806	939	85	42	491	936	490	160	380	260	200	145	300	199	220	360	87	268	1.3	--	no	21		
67B	GADU MOR	LI	776	554	347	392	471	109	460	2060	270	200	177	140	110	89	74	110	34	130	96.5	100	no	D(-)	no	19	
23B	GADU MOR	LI	68	85.4	42	41	35	31	49	33	49	48	59	52.9	24	37	52	46	33	40	21.4	26	no	D-	no	11	
92B	GADU MOR	LI				53	50.5	50	196								50	22			38	34	no	--	no	15	
98B1	GADU MOR	LI				73	83.4	43	49	138	198	78	41		29	64	73	22	37	52.2	17	5.6	no	D-	no	18	
43B	GADU MOR	LI						126	69	60											39.5	48	no	-?	?	12	
10B	GADU MOR	LI						211	71	75	99	65	90	32	38.5	54	51.5	50	37	34	35	30	51	no	D-	no	12

Annual median concentration of ppDDE (µg/kg w. wt.)

St	Species	Tissue	Annual median concentration of ppDDE (µg/kg w. wt.)																			ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30B	GADU MOR	MU	0.45	1.21	2	1	0.32	0.29	1.01	0.989	1.5	1.5	0.44	0.67	0.73	0.7	0.66	0.73	0.65	0.58	0.82	1.1	1.1	--	1.2	16	
36B	GADU MOR	MU	0.34	0.29	0.2	0.5	0.09	0.93	0.58	0.88	0.31	0.32	0.171	0.24	0.22	0.21	0.26	0.41	0.38	0.08	0.22	0.221	no	--	no	18	
77B	GADU MOR	MU	0.14	0.7																	0.13	0.14	no	-?	?	22	
15B	GADU MOR	MU	0.47	0.36	0.346	0.2	0.12	0.26	0.35	0.514	0.23	0.32	0.31	0.19	0.22	0.39	0.07	0.21	0.18	0.15	0.15	0.12	no	--	no	14	
53B	GADU MOR	MU	2.36	2.16	6.75	1.8		0.08	4.09	4.59	4.64	3.2	2.5	0.6	1.79	2.4	1.9	4.2	0.63	1.9	1.8	1.3	1.3	--	1.0	25	
67B	GADU MOR	MU	2.25	3.03	1.4	1	2.46	1.08	6.96	19	1	1.1	1.1	1.8	0.44	0.24	0.31	0.66	0.12	0.34	0.554	0.47	no	D-	no	22	
23B	GADU MOR	MU	0.21	0.59	0.1	0.2	0.04	0.16	0.14	0.18	0.14	0.18	0.12	0.16	0.1	0.13	0.08	0.17	0.29	0.15	0.07	0.09	no	--	no	17	
92B	GADU MOR	MU				0.1	0.09	0.17	0.49								0.11	0.1			0.14		no	--	no	13	
98B1	GADU MOR	MU				0.4	0.4	0.06	0.05	0.24	0.6	0.18	0.15		0.09	0.12	0.21	0.14	0.09	0.148	0.05	0.05	no	--	no	20	
43B	GADU MOR	MU						0.23	0.23	0.14											0.0949		no	-?	?	10	
10B	GADU MOR	MU						0.74	0.68	0.12	0.4	0.26	0.41	0.15	0.18	0.23	0.18	0.41	0.17	0.175	0.26	0.19	0.27	no	--	no	16

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of ppDDE (µg/kg w. wt.)

St	Species	Tissue	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																								OC	TRND	SM+3	POWER
33F	PLAT FLE	LI		13	9.1	24	14	13	7	12.7	9.29	8.99	6.8	27	27	17	22	19	16	20	16	18	24	no	--	no	13
53F	PLAT FLE	LI		94	70.1	32	41		8	25	45	38	44	17.5	39	42	40	29	45		51	30	9.44	no	--	no	16
67F	PLAT FLE	LI								27		84.5	40	35	25	24	20	21	22	26	26	33	19	no	--	no	12
21F	PLAT FLE	LI											11	2.6	16	7.4		90	7.7	4.8				no	--	no	>25
33F	PLAT FLE	MU		0.9	1.93	0.6	0.2	0.15	0.25	0.495	0.299	0.26	1.5	0.3	0.56	0.43	0.53	0.25	0.16	0.25	0.22	0.29	0.39	no	--	no	17
53F	PLAT FLE	MU		4.67	5.3	3.8	1.3		0.373	1.79	1.36	0.96	0.93	0.61	0.88	0.66	0.81	0.57	1.3		0.67	0.73	0.273	no	D-	no	15
67F	PLAT FLE	MU								0.85		1.31	1.4	1.2	0.54	0.63	0.68	0.11	0.33	0.26	0.7	1	0.87	no	DY	1.9	16
21F	PLAT FLE	MU											0.32	0.1	0.43	0.16		1.2	0.61	0.3				no	--	no	22
36F	LIMA LIM	LI		28	34.4	28	21	50	40	40	22	18	52	45	27	31	36	17	21	35	19	22	18	no	--	no	13
77F	LIMA LIM	LI			17																	7.3	20	no	-?	?	20
15F	LIMA LIM	LI			39		13.4	23.5	9	20.7	20	13	32		41	15	17	23	26	15	16	22	16	no	--	no	14
22F	LIMA LIM	LI		68.9	48	39.9		21	9.17															no	D?	?	10
21F	LIMA LIM	LI													74	82	56	69			40		18	no	Dm	no	11
36F	LIMA LIM	MU		0.41	1.15	0.7	0.5	0.96	0.91	0.91	0.46	0.67	0.49	0.52	0.51	0.61	0.53	0.13	0.31	0.38	0.46	0.35	0.41	no	--	no	14
15F	LIMA LIM	MU			1.21		0.173	0.143	0.3	0.55	0.42	0.38	0.324		0.55	0.18	0.28	0.1	0.46	0.24	0.16	0.35	0.23	no	--	no	17
22F	LIMA LIM	MU		1.1	2	1.18		0.56	0.83															no	-?	?	14
21F	LIMA LIM	MU													1.4	0.82	0.51	1.1			0.79		0.69	no	--	no	13
30F	PLEU PLA	LI				21.2		13	12															1.2	-?	?	6
22F	PLEU PLA	LI								7.8	12	2.8												no	-?	?	21
98F2	PLEU PLA	LI												10.8	8	5.1	3.6	2.8	9.19	4.6	1.7	1.2	1.2	no	D-	no	15
10F	PLEU PLA	LI									15		34.7	28	8.9	19	4.74	5.79	10		3.9	5.02	3.7	no	D-	no	16
30F	PLEU PLA	MU				0.693		0.32	0.17															no	-?	?	8
22F	PLEU PLA	MU								0.47	0.34	0.76												no	-?	?	15
98F2	PLEU PLA	MU												0.465	0.24	0.135	0.09	0.05	0.434	0.34	0.08	0.05	0.05	no	--	no	21
10F	PLEU PLA	MU									0.4		0.859	1.1	0.3	0.4	0.134	0.0671	0.18		0.2	0.139	0.11	no	D-	no	16
67F	LEPI WHI	LI		294	240	183	163	250	145	143	167	160	160	130	58	64	73	71.1	55	61.6	48	61	46	m	D-	m	10
21F	LEPI WHI	LI															44	27.9	48	45	36	38	43	m	--	m	10
67F	LEPI WHI	MU		2.56	1.51	2.5	0.8	0.8	3.04	0.78	1.27	0.56	1.4	1.1	0.54	0.39	0.59	0.483	0.57	0.37	0.28	0.76	0.66	m	D-	m	16
21F	LEPI WHI	MU															0.27	0.15	0.6	0.38	0.46	0.43	0.35	m	--	m	15

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of HCB (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of HCB (mg/kg d. wt.)																							ANALYSIS									
			1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER	
30A	MYTI	EDU			1.18	0.877	2.06	0.917	1.15	0.866	0.35	0.592	0.952	0.541	0.27	0.239	0.251	0.275	0.298		0.361	0.225	0.34	0.323	0.242	0.188	0.25	0.353	0.25	0.222	no	D-	no	13	
31A	MYTI	EDU		13.4	1.38	3.83	1.89	0.93	0.893	0.361	0.317	0.606	0.549	0.446	0.243	0.312	0.219	0.258	0.21		0.226	0.265	0.321	0.327	0.216	0.207	0.421	0.5	0.2	0.938	1.9	DY	1.7	15	
35A	MYTI	EDU		12.8	0.952	3.33	0.793	0.976	1.12	0.474	0.42	0.585	0.578	0.505	0.234	0.276	0.219	0.522	0.2	0.336	0.36	0.3	0.287	0.273	0.313	0.533	0.35	0.381	0.333	0.261	no	DY	no	15	
36A	MYTI	EDU		15	0.948	3.83	2.9	2.37	0.957	0.426	0.33	0.546	0.394	0.529	0.24	0.333	0.276	0.311	0.149		0.252	0.197	0.214	0.292	0.216	0.353	0.182	0.2	0.294	no	DY	no	16		
71A	MYTI	EDU		15.3	10.4	91.4	11.1	207	1.83	149	8.48	6.91	4.14	3.91	1.47	2.13	4.48	2.04	1.78	3.1	1.85	2.42	0.809	0.327	0.606	4.47	1.27	1.33	1.21	1.38	2.8	D(-)	2.3	>25	
76A	MYTI	EDU									0.378	0.568	0.498	0.794			0.254	0.289	0.4	0.256	0.216	0.244	0.299	0.311	0.974	0.294	0.188	0.235	0.353	0.176	no	--	no	14	
15A	MYTI	EDU									0.203			0.488	0.253	0.217	0.294	0.254	0.159	0.224	0.179	0.253	0.296	0.331	0.291	0.313	0.167	0.353	0.222	0.176	no	--	no	11	
51A	MYTI	EDU														0.612	0.333	0.313	0.4	0.4	0.385	0.196	0.476	0.403	0.49	0.575	0.5	0.769	0.467	0.583	1.2	--	1.2	11	
52A	MYTI	EDU									0.855	0.378		0.813	0.811	0.276	0.316	0.262	0.333	0.214	0.334	0.199	0.376	0.318		0.458	0.313	0.5	0.667	0.467	0.167	no	--	no	14
56A	MYTI	EDU							0.2	0.787	0.413	0.794	0.935	1.04	0.309	0.382	0.309	0.442	0.348	0.704	0.183	0.336	0.301	0.451	0.526	0.333	0.6	0.722	0.286	0.267	no	--	no	15	
57A	MYTI	EDU								0.769		0.763	0.719	0.794	0.357	0.301	0.262	0.431	0.576	0.625	0.262	0.361	0.254	0.397	0.237	0.533	0.538	0.696	0.278	0.75	1.5	--	1.4	13	
63A	MYTI	EDU								1.05		0.971	0.74	0.625	0.316	0.329	0.333	0.407	0.452	0.51	0.23	0.321	0.329	0.352	0.154	0.533	0.235	0.882	0.263	0.625	1.3	--	1.4	14	
65A	MYTI	EDU							0.2	0.427	0.516	0.862	0.621	0.667	0.284	0.296	0.294	0.345	0.377	0.524	0.15	0.272	0.258	0.294	0.179	0.556	0.188	1.1	0.2	0.947	1.9	--	1.8	16	
69A	MYTI	EDU												0.532	0.526	0.286	0.251	0.286	0.5	0.483	0.361	0.207	0.331	0.311	0.266	0.247	0.368	0.158	1.3	0.167	0.667	1.3	--	1.3	17
22A	MYTI	EDU									0.265	0.61	0.559	0.444	0.248	0.253	0.301	0.311	0.172	0.316	0.202	0.298	0.242	0.329	0.219	0.176	0.167	0.2	0.2	0.211	no	D-	no	11	
82A	MYTI	EDU			2.26	10.7	0.656	0.617	0.8	0.535																0.181	0.235					no	--	no	25
84A	MYTI	EDU			3.41	8.79	3.33	2.04	1.23	0.476		0.505	0.625	0.532		0.246	0.215									0.292	0.188					no	DY	no	15
87A	MYTI	EDU							0.917	0.42																0.14	0.19					no	-?	?	14
25A	MYTI	EDU												0.704	0.513											0.35	0.364					no	-?	?	8
26A	MYTI	EDU												0.614												0.318	0.474					no	-?	?	12
27A	MYTI	EDU												0.599												0.188	0.222					no	-?	?	9
28A	MYTI	EDU												0.556	0.429											0.16	0.353					no	-?	?	15
91A	MYTI	EDU												0.625		0.314											0.278				no	-?	?	14	
92A1	MYTI	EDU												0.68	0.418	0.244	0.225	0.23	0.254								0.146	0.3			no	Dm	no	12	
96A	MYTI	EDU												0.525	0.422																no	-?	?	14	
98A2	MYTI	EDU																0.336			0.435	0.286	0.291	0.313	0.362	0.433	0.294	0.167	0.4	0.176	0.375	no	--	no	13
98X	MYTI	EDU														0.559	0.318	0.26													no	-?	?	8	
99A	MYTI	EDU												0.621	0.442										0.152	0.176					no	D?	?	9	
41A	MYTI	EDU														0.292	0.263	0.291	0.303								0.15	0.444			no	--	no	14	
43A	MYTI	EDU														0.325	0.338		0.45								0.188	0.286			no	-?	?	11	
44A	MYTI	EDU															0.273	0.286	0.329								0.25	0.381			no	-?	?	9	
45A	MYTI	EDU														0.292	0.278										0.263	0.222			no	-?	?	6	
46A	MYTI	EDU														0.263	0.291	0.273									0.15	0.391			no	-?	?	14	
48A	MYTI	EDU														0.279	0.294	0.238									0.188	0.25			no	-?	?	8	
10A2	MYTI	EDU															0.245	0.309			0.284	0.278	0.289	0.305	0.275	0.279	0.263	0.188	0.227	0.176	0.353	no	--	no	9
11X	MYTI	EDU																0.34	0.208	0.249	0.242	0.253	0.236		0.279	0.381	0.167	0.571	0.176	0.905	1.8	--	1.5	16	

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of HCB (mg/kg d. wt.)

St	Species	Tissue	Annual median concentration of HCB (mg/kg d. wt.)																							ANALYSIS											
			1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER			
30A	MYTI	EDU	SB			1.18	0.877	2.06	0.917	1.15	0.866	0.35	0.592	0.952	0.541	0.27	0.239	0.251	0.275	0.298		0.361	0.225	0.34	0.323	0.242	0.188	0.25	0.353	0.25	0.222	no	D-	no	13		
71A	MYTI	EDU	SB	15.3	10.4	91.4	11.1	207	1.83	149	8.48	6.91	4.14	3.91	1.47	2.13	4.48	2.04	1.78	3.1	1.85	2.42	0.809	0.327	0.606	4.47	1.27	1.33	1.21	1.38	2.8	D-	2.3	>25			
51A	MYTI	EDU	SB													0.612	0.333	0.313	0.4	0.4	0.385	0.196	0.476	0.403	0.49	0.575	0.5	0.769	0.467	0.583	1.2	--	1.2	11			
52A	MYTI	EDU	SB							0.855	0.378					0.813	0.811	0.276	0.316	0.262	0.333	0.214	0.334	0.199	0.376	0.318		0.458	0.313	0.5	0.667	0.467	0.167	no	--	no	14
10A2	MYTI	EDU	SB														0.245	0.309		0.284	0.278	0.289	0.305	0.275	0.279	0.263	0.188	0.227	0.176	0.353	no	--	no	9			
I021	MYTI	EDU	SB													0.833	0.916	0.48	0.375		0.481	0.636	0.549								1.1	--	1.3	10			
I022	MYTI	EDU	SB													0.421	0.479	0.97	0.312	0.783	0.455	0.543	0.549	0.379	0.513	0.476	0.692	0.667	0.545	0.5	1.0	--	1.1	12			
I023	MYTI	EDU	SB													0.482	0.424	0.431	0.259	0.615	0.347	0.342	0.417	0.394	0.446	0.541	0.545	0.615	0.538	0.417	no	--	no	10			
I024	MYTI	EDU	SB													0.488	0.602	1.16	0.426	0.66	0.556	0.536	0.495	0.388	0.404	0.532	0.615	0.308	0.636	0.5	1.0	--	1.1	12			
I301	MYTI	EDU	SB										1.4			0.294	0.284	0.695	0.818	1.55	0.508	0.677	0.423	0.318	0.965	0.735	0.357	0.667	1.36	0.533	1.1	--	1.7	16			
I304	MYTI	EDU	SB													0.336	0.281	0.719	0.486		0.294	0.526	0.385	0.307	0.5	0.439	0.286	0.333	0.733	0.357	no	--	no	13			
I306	MYTI	EDU	SB													0.299	0.307	0.774	0.253		0.296	0.294	0.336	0.352	0.462	0.431	0.438	0.357	0.462	0.357	no	--	no	12			
I307	MYTI	EDU	SB													0.273	0.318	0.674	0.174		0.327	0.336	0.45	0.365	0.357	0.238	0.5	0.471	0.571	0.438	no	--	1.3	13			
I711	MYTI	EDU	SB													4.45	5.54	0.575	4.46	6.96	2.56		4								8.0	--	11.2	24			
I712	MYTI	EDU	SB													3.43	16.4	7.9	4.83	5	3.31	1.78	2.75	3.27	2.9	6.72	2.09	1.64	2.77	1.43	2.9	--	no	16			
I713	MYTI	EDU	SB																				3.49	2.64	4.17	11.1	3.56	2.44	2.83	2.83	5.7	--	1.7	16			
I131A	MYTI	EDU	SB													0.316	0.298	0.273	0.196	0.582	0.288	0.327	0.292	0.373	1.4	0.724	0.643	0.625	0.643	0.769	1.5	U-	1.2	14			
I132	MYTI	EDU	SB															44.2	1.89	4.73	3.11	2.36	1.56	1.94	6.42	4.93	0.625	3.55	0.667	1.3	--	no	24				
I133	MYTI	EDU	SB													18.1	43.5	8.12	28	1.7	6.18	2.3	1.62	2.45	3.76	7.18	4.09	0.615	4.31	1.87	3.7	D-	1.3	22			
I241	MYTI	EDU	SB													1.28	0.706	0.69	0.753	0.698	0.618	0.293	0.55	0.299	1.14	1.33	1.55	1.65	0.688	0.556	1.1	UY	no	14			
I242	MYTI	EDU	SB													1.2	0.923	0.562	0.604	0.651	0.552	0.241	0.5	0.463	0.593	0.857	1.07	0.778	0.571	0.769	1.5	DY	1.3	11			
I243	MYTI	EDU	SB													1.03	0.663	0.516	1.24	0.662	0.67	0.262	0.444	0.34	0.611	0.92	1.19	0.889	0.5	0.526	1.1	--	no	13			

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of HCB (µg/kg w. wt.)

St	Species	Tissue																				ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30B	GADU MOR	LI		10	17	7.48	16	11	11	12	7	5.3	5.1	9.1	8.9	6.7	6	8.9	6.3	5.5	7.9	6.2	3.7	no	D-	no	12
36B	GADU MOR	LI		7	9	9	10	9	5	9	6	4.4	6.5	5.4	4.6	3.1	3.3	4	3.3	3.5	3.7	4.1	2.8	no	D-	no	10
77B	GADU MOR	LI		9.49	8																	3.7	4.5	no	D?	?	8
15B	GADU MOR	LI		5	20.5	10	14	14	9	11	13	11.5	11	6.2	6.6	8.2	6.4	9.7	9.1	13	9.9	6.2	6.0	no	--	no	12
53B	GADU MOR	LI		10	10	16.5	7		5	7	7	5	4.7	12	2.1	3	2.25	2.6	1.3	3.9	6.3	0.5	4.2	no	--	no	20
67B	GADU MOR	LI		14	8	7.94	8	8.49	10	8	15.5	9.9	4.6	5.63	4.9	4.6	5.1	5.3	7.7	5.3	8	3.7	4	no	D-	no	11
23B	GADU MOR	LI		6	9.49	12	9	8	6	10	6	8.4	7.8	7.6	9.25	4.7	7.9	5.8	6.9	5.5	8.5	4.3	5.1	no	--	no	11
92B	GADU MOR	LI					17	11	14	13								9.8	6			7.3		no	--	no	10
98B1	GADU MOR	LI				20	9.95	12	18	35	20.5	16	13			10	13	11	10	13	12.5	7.4	4.1	no	D(-)	no	12
43B	GADU MOR	LI						15	16.5	13												12.5	8.4	no	-?	?	9
10B	GADU MOR	LI						13	11	16	17	17	25	9	9.9	11	9.43	5.1	7.7	6.8	8.5	4.3	7.9	no	D-	no	12

Annual median concentration of HCB (µg/kg w. wt.)

St	Species	Tissue																				ANALYSIS						
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER	
30B	GADU MOR	MU		0.09	0.09	0.1	0.1	0.04	0.03	0.05	0.05	0.06	0.06	0.06	0.05	0.06	0.05	0.06	0.06	0.05	0.04	0.05	0.06	0.06	no	DY	no	10
36B	GADU MOR	MU		0.11	0.07	0.1	0.1	0.04	0.05	0.06	0.06	0.05	0.06	0.04	0.05	0.03	0.03	0.04	0.04	0.04	0.03	0.04	0.0447	no	D-	no	10	
77B	GADU MOR	MU		0.12	0.1																	0.03	0.05	no	-?	?	12	
15B	GADU MOR	MU		0.11	0.11	0.1	0.1	0.06	0.07	0.08	0.0748	0.1	0.06	0.1	0.04	0.06	0.07	0.05	0.06	0.07	0.06	0.06	0.05	no	D-	no	10	
53B	GADU MOR	MU		0.1	0.03	0.1	0.1		0.03	0.0648	0.06	0.05	0.05	0.09	0.04	0.05	0.08	0.03	0.04	0.03	0.04	0.03	0.04	no	--	no	15	
67B	GADU MOR	MU		0.1	0.0849	0.1	0.1	0.0748	0.06	0.05	0.07	0.06	0.05	0.05	0.04	0.05	0.05	0.04	0.07	0.04	0.05	0.05	0.05	no	D-	no	9	
23B	GADU MOR	MU		0.08	0.08	0.1	0.1	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.04	0.05	0.03	0.07	0.08	0.05	0.04	0.17	no	--	no	13		
92B	GADU MOR	MU					0.1	0.07	0.05	0.09						0.07	0.07					0.08	no	--	no	12		
98B1	GADU MOR	MU				0.2	0.2	0.07	0.1	0.11	0.1	0.1	0.08			0.07	0.09	0.08	0.11	0.08	0.0949	0.07	0.05	no	D-	no	11	
43B	GADU MOR	MU						0.09	0.13	0.06												0.124	no	-?	?	14		
10B	GADU MOR	MU						0.16	0.11	0.09	0.2	0.17	0.26	0.09	0.11	0.13	0.09	0.09	0.1	0.0849	0.09	0.08	0.1	no	--	no	12	

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of HCB (µg/kg w. wt.)

St	Species	Tissue	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																								OC	TRND	SM+3	POWER
33F	PLAT FLE	LI		1	0.5	5	2	1	1	0.648	0.693	0.643	0.54	1.6	1.6	1.6	1.9	1.2	1.3	1.8	1.7	1.5	1.8	no	--	no	16
53F	PLAT FLE	LI		6	4.47	5	2		1	2	3	1.8	2.5	2.39	2	2.9	1.4	1	1.2	1.6	1.1	1.32	no	D-	no	12	
67F	PLAT FLE	LI								3		6.39	3.6	4.2	4.3	3.5	3.7	3.1	4.3	3.8	4.5	2.9	2.8	no	--	no	10
21F	PLAT FLE	LI											3.1	1.1	2.4	0.9		3.6	2.1	1.2			no	--	no	18	
33F	PLAT FLE	MU		0.06	0.07	0.1	0.1	0.03	0.03	0.03	0.05	0.03	0.06	0.04	0.04	0.05	0.06	0.03	0.03	0.04	0.04	0.04	0.05	no	--	no	12
53F	PLAT FLE	MU		0.45	0.3	0.2	0.1		0.0837	0.05	0.1	0.06	0.06	0.09	0.06	0.05	0.13	0.03	0.07		0.04	0.08	0.049	no	DY	no	14
67F	PLAT FLE	MU								0.05		0.098	0.19	0.16	0.12	0.14	0.12	0.03	0.08	0.07	0.07	0.11	0.15	1.5	--	2.0	14
21F	PLAT FLE	MU											0.1	0.03	0.06	0.04		0.09	0.08	0.06			no	--	no	15	
36F	LIMA LIM	LI		5.48	3	5	2	3	2	2.3	3	1.1	2.5	3	2.6	2	2.5	1.8	1.6	2.2	1.5	1.6	1.4	no	D-	no	12
77F	LIMA LIM	LI			1																	0.9	2.9	no	-?	?	21
15F	LIMA LIM	LI			4		4	4	2	3	3.2	3	3.64		5.9	2.5	4.3	3.1	4	2.6	3.7	2.5	3.3	no	--	no	11
22F	LIMA LIM	LI		6	3	5		1	1.41															no	-?	?	15
21F	LIMA LIM	LI														4.8	9.1	3.1	8		2.6		0.93	no	--	no	17
36F	LIMA LIM	MU		0.1	0.09	0.1	0.1	0.06	0.06	0.07	0.05	0.05	0.05	0.05	0.06	0.06	0.05	0.03	0.03	0.04	0.04	0.04	0.07	no	DY	no	9
15F	LIMA LIM	MU			0.2		0.1	0.0447	0.07	0.09	0.07	0.09	0.08		0.15	0.04	0.09	0.03	0.09	0.05	0.06	0.07	0.06	no	--	no	14
22F	LIMA LIM	MU		0.12	0.2	0.1		0.05	0.0742															no	-?	?	14
21F	LIMA LIM	MU														0.13	0.13	0.06	0.15		0.08		0.06	no	--	no	13
30F	PLEU PLA	LI				5		2	2															no	-?	?	11
22F	PLEU PLA	LI								0.5	0.9	0.3												no	-?	?	19
98F2	PLEU PLA	LI												1.3	1.8	0.955	0.68	1.2	1.09	0.45	0.43	0.48	0.61	no	--	no	13
10F	PLEU PLA	LI									6.1		8.77	6.4	2.4	1.6	2.15	1.99	2.9		1.35	1.59	1.7	no	D-	no	13
30F	PLEU PLA	MU				0.141		0.05	0.03															no	D?	?	<=5
22F	PLEU PLA	MU								0.03	0.03	0.04												no	-?	?	7
98F2	PLEU PLA	MU											0.07	0.04	0.0447	0.04	0.03	0.0648	0.04	0.04	0.04	0.04	0.03	no	--	no	11
10F	PLEU PLA	MU									0.22		0.303	0.49	0.15	0.43	0.0648	0.0346	0.07		0.06	0.0648	0.07	no	D-	no	17
67F	LEPI WHI	LI		9	4	5	4	5	2	4.6	4	5	2.8	4.8	3.4	3.8	3.9	3.45	2	2.2	2.3	2	1.9	m	D-	m	11
21F	LEPI WHI	LI															4.8	1	2.9	4.2	3.2	2.7	4.4	m	--	m	18
67F	LEPI WHI	MU		0.09	0.07	0.1	0.1	0.03	0.04	0.03	0.07	0.03	0.04	0.05	0.03	0.04	0.04	0.0346	0.04	0.03	0.03	0.05	0.06	m	D-	m	12
21F	LEPI WHI	MU															0.04	0.03	0.07	0.06	0.03	0.04	0.04	m	--	m	13

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of HCHG (mg/kg d.wt.)

St	Species	Tissue	Annual median concentration of HCHG (mg/kg d.wt.)																			ANALYSIS									
			1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		15.5	23.5		216	2.05	3.55	1.52	1.62	1.73	1.48	0.653	1.6	1.79	1.2	0.838	0.676	0.68	0.645	0.403	0.313	0.333	0.294	0.313	0.278	no	D-	no	20
31A	MYTI EDU	SB		16.4	23.3		181	2.04	3.66	2.2	1.42	1.37	0.779	0.658	2.73	1.23	0.938	0.686	0.769	0.753	0.654	0.36	0.338	0.263	0.313	0.333	0.313	no	D-	no	20
35A	MYTI EDU	SB		16.8	24.4		227	2.65	4.09	2.31	1.52	1.61	1.13	0.837	4.51	1	0.671	1.3	0.687	0.575	0.515	0.305	0.333	0.238	0.25	0.263	0.227	no	D-	no	21
36A	MYTI EDU	SB		12.4	23.7		209	3.63	5.46	2.76	1.59	0.769	1.25	0.556	2.88	2	1.74	0.909	0.656	0.651	0.585	0.36	0.278	0.227	0.333	0.294	no	D-	no	19	
71A	MYTI EDU	SB		15.9	28.7		276	2.08	4.85	1.96	2.11	0.964	0.793	0.478	1.02	1.91	1.08	0.943	0.926	479	0.641	0.394	0.357	0.333	0.333	0.278	0.238	no	-	no	>25
76A	MYTI EDU	SB						1.59	2.15	1.4	2.35			0.609	1.68	2.4	1.19	0.943	0.732	1.19	0.621	0.336	0.294	0.313	0.294	0.333	0.294	no	D-	no	14
15A	MYTI EDU	SB						1.68			1.95	1.11	1.06	0.366	1.99	2.32	1.38	0.595	0.758	0.591	0.662	0.338	0.294	0.278	0.294	0.263	0.294	no	D-	no	15
51A	MYTI EDU	SB									1.73	1.13	1.22	2.29	1.1	0.923	0.347	0.787	0.806	0.345	0.562	0.313	0.417	0.333	0.714	no	D-	no	14		
52A	MYTI EDU	SB				400	1.04		0.943	1.15	1.3	1.27	2.57	1.22	2.2	1.08	0.995	1.13	0.5	0.671	0.327	0.313	0.313	0.313	1.07	0.278	no	D-	no	25	
56A	MYTI EDU	SB				394	1.75	2.38	0.935	1.04	1.21	1.22	1.74	1.25	2.29	1.04	0.732	1.01	0.602	0.746	0.329	0.417	0.357	0.313	0.357	0.333	no	DY	no	22	
57A	MYTI EDU	SB				350		2.29	1.44	0.794	0.857	1.01	2.46	1.03	3.56	1.04	0.733	0.938	0.508	0.592	0.237	0.333	0.357	0.217	0.278	0.25	no	DY	no	18	
63A	MYTI EDU	SB				276		2.91	1.48	0.714	0.982	0.859	1.27	0.776	2.84	1.11	0.773	0.962	0.658	0.787	0.166	0.357	0.313	0.357	0.263	0.313	no	DY	no	17	
65A	MYTI EDU	SB				214	2.16	2.59	1.27	0.741	1.22	0.651	2.88	1	2.92	1.14	0.821	0.815	0.515	0.588	0.128	0.333	0.313	0.238	0.25	0.25	no	DY	no	21	
69A	MYTI EDU	SB							1.6	1.05	0.939	0.653	0.355	1.31	3.1	0.794	0.889	0.993	0.57	0.532	0.154	0.316	0.263	0.294	0.278	0.278	no	D-	no	16	
22A	MYTI EDU	SB						0.798	1.9	1.67	1.33	1.07	1.03	0.581	1.19	2.33	0.798	1.06	0.893	0.483	0.658	0.365	0.294	0.278	0.333	0.313	0.238	no	D-	no	13
82A	MYTI EDU	SB		19.7	30.9		267														0.254	0.313					no	-?	?	>25	
84A	MYTI EDU	SB		20	43.1		238		1.52	0.625	1.06		0.788	0.519							0.284	0.294					no	-	no	>25	
87A	MYTI EDU	SB			27.8		210														0.234	0.25					no	-?	?	>25	
25A	MYTI EDU	SB							1.45	1.03											0.265	0.273					no	D?	?	8	
26A	MYTI EDU	SB							1.5												0.318	0.263					no	D?	?	<=5	
27A	MYTI EDU	SB							0.599												0.294	0.278					no	D?	?	<=5	
28A	MYTI EDU	SB							1.64	1.29											0.266	0.294					no	D?	?	8	
91A	MYTI EDU	SB							0.884		0.818											0.278					no	-?	?	6	
92A1	MYTI EDU	SB							0.68	0.837	0.99	0.769	0.413	0.861								0.244	0.294				no	-	no	13	
96A	MYTI EDU	SB							0.535	0.844												0.244	0.294				no	-?	?	12	
98A2	MYTI EDU	SB													0.596		0.746	0.575	0.872	0.625	0.725	0.256	0.294	0.278	0.333	0.294	0.278	no	D-	no	11
98X	MYTI EDU	SB									1.45	0.637	0.417														no	-?	?	8	
99A	MYTI EDU	SB							0.621	0.442											0.254	0.263					no	D?	?	8	
41A	MYTI EDU	SB									0.683	0.526	0.291	0.427									0.25	0.278			no	-	no	11	
43A	MYTI EDU	SB									0.519	0.405		0.45									0.313	0.357			no	-?	?	7	
44A	MYTI EDU	SB										0.541	0.286	0.641								0.25	0.25				no	-?	?	13	
45A	MYTI EDU	SB									0.409	0.524											0.263	0.278			no	-?	?	8	
46A	MYTI EDU	SB									0.442	0.465	0.328										0.25	0.227			no	D?	?	7	
48A	MYTI EDU	SB									0.335	0.479	0.333										0.313	0.313			no	-?	?	9	
10A2	MYTI EDU	SB										0.439	0.402			1.08	0.503	0.867	0.61	0.549	0.267	0.263	0.313	0.227	0.294	0.294	no	DY	no	12	
11X	MYTI EDU	SB											0.34	0.99	1.15	0.727	0.758	0.472	0.465	0.265	0.238	0.278	0.238	0.278	0.238	0.238	no	D-	no	12	

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Annual median concentration of HCHG (mg/kg d.wt.)

St	Species	Tissue	Annual median concentration of HCHG (mg/kg d.wt.)																							ANALYSIS					
			1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		15.5	23.5		216	2.05	3.55	1.52	1.62	1.73	1.48	0.653	1.6	1.79	1.2	0.838	0.676	0.68	0.645	0.403	0.313	0.333	0.294	0.313	0.278	no	D-	no	22
71A	MYTI EDU	SB		15.9	28.7		276	2.08	4.85	1.96	2.11	0.964	0.793	0.478	1.02	1.91	1.08	0.943	0.926	0.479	0.641	0.394	0.357	0.333	0.333	0.278	0.238	no	D-	no	>25
51A	MYTI EDU	SB											1.73	1.13	1.22	2.29	1.1	0.923	0.347	0.787	0.806	0.345	0.562	0.313	0.417	0.333	0.714	no	D-	no	14
52A	MYTI EDU	SB					400	1.04		0.943	1.15	1.3	1.27	2.57	1.22	2.2	1.08	0.995	1.13	0.5	0.671	0.327	0.313	0.313	0.313	1.07	0.278	no	D-	no	25
10A2	MYTI EDU	SB											0.439	0.402			1.08	0.503	0.867	0.61	0.549	0.267	0.263	0.313	0.227	0.294	0.294	no	DY	no	12
I021	MYTI EDU	SB											1.47	0.916	1.12	1.22		0.962	1.36	1.1								no	--	no	9
I022	MYTI EDU	SB											1.58	1.05	2.28	1.04	0.932	0.873	1.17	1.1	0.758	0.455	0.467	0.385	0.417	0.455	1	no	D-	no	12
I023	MYTI EDU	SB											1.2	0.956	2.33	0.862	1.27	1.22	1.03	0.833	0.787	0.431	0.431	0.385	0.385	0.385	0.769	no	D-	no	12
I024	MYTI EDU	SB											1.66	1.38	1.88	1.08	0.943	0.926	0.893	0.99	0.775	0.505	0.485	0.583	0.417	0.455	1	no	D-	no	10
I301	MYTI EDU	SB								1.86			0.984	1.25	2.42	2.58	1.86	1.07	0.827	0.625	0.637	0.439	0.347	0.357	0.278	0.333	0.667	no	DY	no	11
I304	MYTI EDU	SB											1.14	0.867	2.48	2.5		0.941	0.752	0.769	0.613	0.394	0.439	0.385	0.294	0.333	0.714	no	D-	no	13
I306	MYTI EDU	SB											1.44	0.679	3.27	2.28		0.888	0.747	0.671	0.704	0.391	0.431	0.313	0.643	0.385	0.667	no	D-	no	15
I307	MYTI EDU	SB											1.61	1.02	2.83	2.2		0.85	0.872	0.901	0.73	0.42	0.397	0.333	0.313	0.357	0.588	no	D-	no	12
I711	MYTI EDU	SB											1.46	0.719	0.879	1.04	1.15	1.03		0.976								no	--	no	11
I712	MYTI EDU	SB											1	1.04	1.81	1.73	1.13	0.846	0.99	0.813	0.68	0.459	0.4	0.455	0.313	0.357	0.345	no	D-	no	10
I713	MYTI EDU	SB																	0.738	0.787	0.435	0.352	0.685	0.278	0.385	0.385		no	--	no	12
I131A	MYTI EDU	SB											0.909	1.12	2.3	2.19	0.729	1.06	0.654	0.559	0.725	0.333	0.34	0.385	0.333	0.333	0.385	no	D-	no	13
I132	MYTI EDU	SB																	0.676	0.764	0.69	0.485	2.33	0.333	0.333	0.323	0.333	no	--	no	17
I133	MYTI EDU	SB											2.9	4.4	1.45	1.86	1.02	1.01	0.794	0.791	0.845	0.431	0.455	0.521	0.385	0.385	0.404	no	D-	no	11
I241	MYTI EDU	SB											2.73	3.16	1.15	1.19	1.05	0.879	0.323	0.667	0.599	0.439	0.583	0.385	0.313	0.313	0.278	no	D-	no	12
I242	MYTI EDU	SB											2.23	2.41	1.12	1.47	0.947	0.852	0.359	0.611	0.704	0.413	0.357	0.357	0.294	0.357	0.357	no	D-	no	11
I243	MYTI EDU	SB											2.18	2.03	0.882	1.65	0.882	0.92	0.369	0.588	0.637	0.382	0.92	0.313	0.294	0.385	0.263	no	D-	no	13

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Annual median concentration of HCHG (µg/kg w. wt.)

St	Species	Tissue	Annual median concentration of HCHG (µg/kg w. wt.)																			ANALYSIS					
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30B	GADU MOR	LI		3	15	5	5	10	7	11	12	4	2.55	4	2.8	2	1.5	2	2	1	0.47	0.56	0.6	no	D-	no	15
36B	GADU MOR	LI	6.48	14	9	9	17	3	11	6	8.1	6.9	6.4	2.8	1.5	2	1.3	0.92	1	0.6	0.8	0.5	no	D-	no	14	
77B	GADU MOR	LI	28	6																	1	1	no	-?	?	20	
15B	GADU MOR	LI	11	37.5	7	9	10	6	13	10	8.15	6.5	3.4	2.7	1.7	1	1.5	1.5	2	1	0.8	1	no	D-	no	14	
53B	GADU MOR	LI	12	8.49	5	6		6	7	8	10	3.5	3.1	1.1	0.64	1	1	1	0.77	0.5	0.2	1	no	DY	no	15	
67B	GADU MOR	LI	12	7	10	7	6.32	5	10	11	21	4.8	4	2.6	2.3	3	2	1.5	2	1	1	1	no	DY	no	13	
23B	GADU MOR	LI	13	5.92	11	5	8	5	13	8	9.4	5.5	5	2.88	2.6	3	2	1.5	1	2	1	0.5	no	DY	no	13	
92B	GADU MOR	LI				6	6	4	6									2	0.8			1	1	no	D-	no	11
98B1	GADU MOR	LI			5		8	3	6	3	8	5			2.2	3	3	1.5	2	1	1	2	no	D-	no	14	
43B	GADU MOR	LI					3	3	4													1	1	no	D?	?	9
10B	GADU MOR	LI					3	3	4	3	8	4.2	3	2.85	1.6	2	1	1	2	0.6	1	0.5	no	D-	no	13	

Annual median concentration of HCHG (µg/kg w. wt.)

St	Species	Tissue	Annual median concentration of HCHG (µg/kg w. wt.)																			ANALYSIS				
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30B	GADU MOR	MU	0.08	0.05	0.1		0.06	0.04	0.05	0.05	0.07	0.06	0.05	0.04	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	11
36B	GADU MOR	MU	0.15	0.1	0.1	0.1	0.08	0.19	0.09	0.06	0.1	0.06	0.03	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	D-	no	12
77B	GADU MOR	MU	0.08	0.1																	0.05	0.05	no	D?	?	7
15B	GADU MOR	MU	0.09	0.06	0.1		0.04	0.06	0.09	0.06	0.09	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	10
53B	GADU MOR	MU	0.12	0.02	0.1	0.1		0.03	0.0812	0.05	0.07	0.06	0.05	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	16
67B	GADU MOR	MU	0.11	0.07	0.1		0.0447	0.22	0.16	0.06	0.09	0.06	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	14
23B	GADU MOR	MU	0.11	0.09	0.1	0.1	0.03	0.06	0.08	0.07	0.07	0.06	0.03	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	12
92B	GADU MOR	MU					0.03	0.03	0.05								0.05	0.05				0.05	no	--	no	9
98B1	GADU MOR	MU			0.1	0.1	0.05	0.03	0.03	0.1	0.04	0.05			0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	13
43B	GADU MOR	MU					0.03	0.06	0.06												0.05	0.05	no	-?	?	15
10B	GADU MOR	MU					0.03	0.15	0.03	0.1	0.04	0.03	0.04	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	15

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Annual median concentration of HCHG (µg/kg w. wt.)

St	Species	Tissue	Annual median concentration of HCHG (µg/kg w. wt.)																			ANALYSIS								
			1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER			
33F	PLAT FLE	LI		2	0.5	5	2	2		1	2.45	1.74	1.15	0.69		1.9	1.4	1.2	1.1	1	1	1	0.5	0.5	1	no	--	no	17	
53F	PLAT FLE	LI		3	2	5	2			1.41		2	3	2	2.4	0.941	0.86	1	0.5	1	0.21		0.5	0.5	0.707	no	D-	no	15	
67F	PLAT FLE	LI										2			6.19	3.3	3.1	1.7	1.1	2	2	1.2	1.2	0.5	0.5	1	no	D-	no	15
21F	PLAT FLE	LI													3.3	0.85	0.78	0.6		1	0.2	0.2				no	--	no	18	
33F	PLAT FLE	MU		0.19	0.05	0.1	0.1	0.05		0.13	0.155	0.0949	0.09	0.1	0.06	0.06	0.05	0.05	0.05	0.05	0.08	0.05	0.05	0.05	0.05	no	D-	no	13	
53F	PLAT FLE	MU		0.2	0.2	0.1	0.1			0.125	0.0837	0.1	0.13	0.1	0.05	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	D-	no	10	
67F	PLAT FLE	MU									0.06		0.122	0.19	0.13	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	DY	no	11	
21F	PLAT FLE	MU											0.11	0.04	0.06	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	--	no	12	
36F	LIMA LIM	LI		8.94	3	5	1	4	3	8	5	2	3.8	4	1.8	1.6	2	1	1	0.5	0.6	0.5	0.5	0.5	0.5	no	D-	no	16	
77F	LIMA LIM	LI			2																			0.4	0.5	no	-?	?	10	
15F	LIMA LIM	LI			3		4	3.46	3	5.1	5.6	4.1	3.25		2.6	1	1	1	1	1	0.5	0.5	1	no	DY	no	12			
22F	LIMA LIM	LI		6.93	3	5		1	1																no	D?	?	14		
21F	LIMA LIM	LI														1.6	2	2	0.6			0.5			0.2	no	Dm	no	14	
36F	LIMA LIM	MU		0.24	0.07	0.1	0.1	0.16	0.21	0.33	0.15	0.15	0.09	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	DY	no	12	
15F	LIMA LIM	MU			0.14		0.1	0.0548	0.26	0.29	0.14	0.15	0.06		0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	no	D-	no	14	
22F	LIMA LIM	MU		0.25	0.2	0.2		0.08	0.0458																	no	D?	?	10	
21F	LIMA LIM	MU														0.05	0.05	0.05	0.05			0.05			0.05	no	--	no	?	
30F	PLEU PLA	LI				5		1	1																	no	-?	?	15	
22F	PLEU PLA	LI								0.9	0.7	0.6														no	-?	?	<=5	
98F2	PLEU PLA	LI												0.71	0.67	0.219	0.22	1	0.2	0.2	0.1	0.6	0.1	0.1	no	--	no	22		
10F	PLEU PLA	LI									0.8		1.1	1.3	0.6	1.2	0.5	0.5	1			0.3	0.224	0.2	no	D-	no	14		
30F	PLEU PLA	MU				0.1		0.06	0.0346																no	-?	?	8		
22F	PLEU PLA	MU								0.0995	0.06	0.07													no	-?	?	11		
98F2	PLEU PLA	MU												0.0548	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.05	no	--	no	10	
10F	PLEU PLA	MU									0.05		0.06	0.07	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.1	0.05	no	--	no	10		

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Annual median concentration of PBDE ((µg/kg w. wt.))

St	Species	Tissue	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	ANALYSIS			
															TRND	SM+3	POWER	
30B	GADU MOR	LI								84.6	100	108	98.2	61	m	-?	m	10
53B	GADU MOR	LI								32.3	14.4	50.5	31.2	33.2	m	-?	m	16
23B	GADU MOR	LI								9.06	8.22	8.31	10.9	9.52	m	-?	m	7

Annual median concentration of PFOS (µg/kg w. wt.)

St	Species	Tissue	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	ANALYSIS			
															TRND	SM+3	POWER	
30B	GADU MOR	LI								38	49	11	42	48	m	-?	m	20
53B	GADU MOR	LI								6.48	10	2	10	3.2	m	-?	m	21
23B	GADU MOR	LI								5.48	16.5	3	6.9	8.9	m	-?	m	20

Annual median concentration of B[a]P (µg/kg d. wt.)

St	Species	Tissue	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	ANALYSIS		
																				TRND	SM+3	POWER
30A	MYTI EDU	SB		3.35	3.52		3.57	2.99	2.99	3.29	3.4	3.23	4.26	3.85	6.07	2.94	3.13	2.78	no	--	no	9
I301	MYTI EDU	SB		4.44	19.3	18.8	6.02	13.1	2.55	9.77	3.13	3.18	34.2	3.47	42.1	14.4	12	3.86	no	--	no	23
I304	MYTI EDU	SB		3.36	2.81	3.29	3.38	2.76	2.94	3.76	3.85	3.07	5.33	4.39	3.85	2.94	3.33	3.57	no	--	no	8
I306	MYTI EDU	SB		2.99	3.07	2.87	3.05	3.07	2.96	2.94	3.36	3.52	4.79	4.31	3.13	3.57	3.85	3.33	no	U-	no	7
I307	MYTI EDU	SB		2.73	3.21	2.75	2.91	3.01	3.27	3.36	4.5	3.65	5.27	3.97	3.13	3.13	3.57	2.94	no	UY	no	8
I131A	MYTI EDU	SB		3.25	2.66	2.73	3.6	5.02	2.4	3.27	2.79	3.73	8	3.4	3.85	3.33	3.33	3.85	no	--	no	12
I132	MYTI EDU	SB					22.6	300	10.8	32.7	49.6	89.7	52.4	150	61.3	80	93.8	24.7	4.9	--	1.6	24
I133	MYTI EDU	SB		80.6	13.7	51.7	18.6	8.47	19	23.7	39.3	135	67.3	50	22.3	123	112	22.4	--(U-)	22.9	20	
I201	MYTI EDU	SB		93.2	207	679	10.5	83.8	47.4	31.7	188	7.23	3.79	8.55	5	6.08	5.2	5.41	1.1	D(-)	no	>25
I205	MYTI EDU	SB		7.39		23.1	64.5	7.51	5.59	7.55	33	3.16	48.2	4.5	3.85	4.17	3.57	3.13	no	--	no	24
I913	MYTI EDU	SB					5.85	15.6	2.96	13.3	3.65	1.36	3.29	2.78	3.85	5.42	2.78	no	--	no	19	
I912	MYTI EDU	SB		7.02		9.46	5.35	16.4	135	4.17	20	3.97	1.46	3.65	3.33	3.38	9.29	2.78	no	--	1.2	25
I965	MYTI EDU	SB							233	30.8	43.6	87.7	19.3	58	115	66.5	233	46.7	--	56.9	21	
I962	MYTI EDU	SB		246	33.5		87											17.4	-?	?	>25	
I964	MYTI EDU	SB								37.3	289	251	55.4	200	232	200	397	79.3	--	100.6	22	
I969	MYTI EDU	SB		14.2	10.7	17.6	8.42	10.3	17.1	23.5	3.68	46.7	34.7	7.27	24.2	23.9	25	14.9	3.0	--	3.8	20

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Annual median concentration of Σ PK_S ($\mu\text{g}/\text{kg}$ d. wt.)

St	Species	Tissue	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																						OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		38.1			27.5	28.3		38.5	20.4	16.5	38.3	11.6	17.6	45.7	14.2	45.1	18.2	14.7	11.1	no	--	no	16
I301	MYTI EDU	SB		118			73	257	197	100	175	32.4	112	43.7	38.4	313	40.9	269	109		35.9	no	--	no	22
I304	MYTI EDU	SB					14.4	16.7	13.7	36.8	33.2	7.62	21.4	9.62	8.01	69.9	15.5	27.7	10.1	10.5	8.93	no	--	no	19
I306	MYTI EDU	SB					12.8	15.1	34.8	31.3	27.9	7.4	28.2	12.1	8.8	52.7	12.6	18.2	10.1	11.9	8.93	no	--	no	18
I307	MYTI EDU	SB					11.8	18.9	19.9	27.7	41.7	11.6	27.2	29.3	9.69	74	13.6	16.8	9.65	11.4	7.35	no	--	no	18
I131A	MYTI EDU	SB					48.4	17.9	35.4	61.4	57.1	26.9	28	15.5	26.6	127	20.1	9.62	8.33	14.5	9.62	no	--	no	19
I132	MYTI EDU	SB								581	2730	243	389	783	1520	570	813	401	405		162	3.2	--	no	21
I133	MYTI EDU	SB					602	121	647	287		150	339	476	580	1200	451	345	197	646	568	11.4	--	9.5	19
I201	MYTI EDU	SB					705	1590	7970	281	999	903	638		189	111	212	119	149		52.6	1.1	D-	no	23
I205	MYTI EDU	SB					96.4		470	1380	197	187	189	1650	97.5	808	98.2	57.2	56.3	34.5	27.9	no	--	no	24
I913	MYTI EDU	SB								107	604	76.7	405	28.8	20.9	8.22	8.67	14.3	20.6	11.6	no	D-	no	23	
I912	MYTI EDU	SB					109		342	195	187	1560	58.9	412	27.9	10.6	9.12	8.33	30.1	36.3	8.94	no	D-	no	25
I965	MYTI EDU	SB											1330	431	468	854	181	357	612	398	990	19.8	--	21.2	17
I962	MYTI EDU	SB					1450	265		665												13.3	-?	?	>25
I964	MYTI EDU	SB												368	2370	2090	501	915	1070	993	1610	32.1	--	32.0	20
I969	MYTI EDU	SB					139	108	230	131	285	192	169	39.7	625	361	73.6	188	170		90	1.8	--	no	21

Annual median concentration of Σ PAH ($\mu\text{g}/\text{kg}$ d. wt.)

St	Species	Tissue	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																						OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		215			179	219		268	216	140	124	54.9	126	163	74.6	292	107	78.4	98.9	no	--	no	15
I301	MYTI EDU	SB		878			486	1810	1880	657	1050	438	645	312	216	1040	271	1730	647		308	1.2	--	no	19
I304	MYTI EDU	SB					75.5	111	182	228	326	60.4	136	51.5	66.1	215	53.6	179	68.8	63.7	52.5	no	--	no	17
I306	MYTI EDU	SB					73.7	87	188	172	225	53.8	115	121	45.9	147	53.9	155	51.5	49.9	43.5	no	--	no	16
I307	MYTI EDU	SB					59.6	90.4	153	155	325	64.4	112	244	64.8	178	40.6	170	50.3	50.5	48.3	no	--	no	18
I131A	MYTI EDU	SB					120	98.4	140	213	240	181	91.8	95	133	344	109	80.6	70		43.8	no	--	no	14
I132	MYTI EDU	SB								1590	6470	1270	1000	1750	2440	1060	2800	1760	1380		513	2.1	--	no	18
I133	MYTI EDU	SB					1940	715	1710	1000	908	863	1120	1070	2530	1410	1320	709	3450	1630		6.5	--	8.6	16
I201	MYTI EDU	SB					2170	4450	15500	793	3400	2300	1130		579	381	569	303	358		137	no	D-	no	21
I205	MYTI EDU	SB					476		1630	3210	801	603	457		384	2170	309	221	204	124	101	no	D-	no	19
I913	MYTI EDU	SB								559	2200	578	2000	128	98.1	55.1	75.7	103	84.9	73.6		no	D-	no	21
I912	MYTI EDU	SB					648		1390	873	1510	5990	735	1970	164	42.3	32.9	42.9	305	185	61.7	no	DY	no	24
I965	MYTI EDU	SB											2770	720	1320	2930	587	1500	2620	1350	2580	10.3	--(-)	12.1	19
I962	MYTI EDU	SB					3400	982		1600												6.4	-?	?	21
I964	MYTI EDU	SB												643	6270	7960	1010	2590	2990	2500	3510	14.1	--	13.7	24
I969	MYTI EDU	SB					695	803	673	551	807	988	675	136	2340	1540	283	660	832		641	2.6	--	2.5	22

Hazardous substances in Norwegian fjords and coastal waters - 2009 TA-2716/2010

Annual median concentration of TBT (mg/kg d. wt.)

St	Species	Tissue														ANALYSIS				
			1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER
30A	MYTI EDU	SB		2.71	1.51	1.47	0.935	0.802	1.81	1.08	0.723	0.282	0.36	0.543	0.455	0.187	1.9	D-	1.4	14
36A	MYTI EDU	SB		0.0336	0.179	0.217	0.0831	0.0591	0.0792	0.103	0.0603	0.0224	0.0172	0.0283	0.0257		no	--	no	18
71A	MYTI EDU	SB		1.02				0.431	0.702	0.375	0.119	0.136	0.0567	0.0934	0.0765	0.0393	no	D-	no	14
76A	MYTI EDU	SB		0.188				0.0529	0.092	0.106	0.034	0.0318	0.0206	0.0135	0.03	0.0195	no	D-	no	14
15A	MYTI EDU	SB						0.098	0.0811	0.0622	0.0179	0.0179	0.0078	0.0137	0.00853	0.00681	no	D-	no	13
22A	MYTI EDU	SB						0.17	0.138	0.587	0.291	0.249	0.1	0.297	0.103	0.053	no	--	no	18
226X	MYTI EDU	SB			1.61	0.854	0.555										5.6	-?	?	6
227A2	MYTI EDU	SB			1.38	0.854	0.375	0.417	0.672	0.709	0.314	0.277	0.134	0.193	0.135	0.106	1.1	D-	no	13
98A2	MYTI EDU	SB						0.108	0.105	0.114	0.0468	0.0252	0.0165	0.0268	0.0153	0.0208	no	D-	no	13
10A2	MYTI EDU	SB						0.0224	0.0123	0.0067							no	D?	?	<=5
11X	MYTI EDU	SB							0.0348	0.0201	0.00401	0.00233	0.00278	0.00238	0.00286	0.0029	no	DY	no	15
1301	MYTI EDU	SB							2.59	2.11	2.83	2.94	1.27	1.42	0.561	0.364	3.6	DY	no	12
1712	MYTI EDU	SB							1.2	0.912	0.3	0.268	0.219	0.18	0.204	0.148	1.5	DY	no	11
1713	MYTI EDU	SB							1.37	0.668	0.22	0.213	0.13	0.0795	0.0686	0.0852	no	DY	no	12
1132	MYTI EDU	SB							0.474		0.458	0.128	0.21	0.0807	0.184	0.207	2.1	--	1.5	16
1133	MYTI EDU	SB								0.885	0.232	0.222	0.286	0.124	0.25	0.21	2.1	--	1.7	16
36G	NUCE LAP	SB		0.105	0.203	0.142	0.0951	0.0496	0.155	0.0846	0.0412	0.0344	0.00625	0.0293	0.0377	0.0118	m	D-	m	19
71G	NUCE LAP	SB						0.133	0.344	0.235	0.115	0.0429	0.0563		0.0315		m	--	m	16
76G	NUCE LAP	SB						0.0409	0.196		0.0679	0.0467	0.0165	0.0294	0.0139	0.00945	m	--	m	18
131G	NUCE LAP	SB						0.0326	0.064	0.075	0.0507	0.022		0.00629	0.0189	0.00534	m	D-	m	18
15G	NUCE LAP	SB						0.0706	0.091	0.0652	0.0264	0.0215	0.00641	0.00897	0.0132	0.00651	m	D-	m	15
224G	NUCE LAP	SB		0.0769	0.295		0.12										m	-?	m	24
22G	NUCE LAP	SB						0.0699	0.101	0.322	0.2	0.13	0.0262	0.0611	0.0581	0.00976	m	--	m	21
220G	NUCE LAP	SB		0.0815	0.1	0.0851					0.113						m	-?	m	7
226G	NUCE LAP	SB			0.844	0.225	0.21										m	-?	m	16
227G1	NUCE LAP	SB		0.0891	0.625	0.267	0.387	0.135	0.446	0.878	0.258	0.239	0.065	0.16	0.165	0.0323	m	--	m	21
98G	NUCE LAP	SB						0.026	0.0629	0.0612	0.0492	0.0394	0.014	0.0253	0.0178	0.00231	m	D-	m	18
11G	NUCE LAP	SB							0.0133	0.0261	0.0103	0.0184	0.00862	0.0111	0.00145	0.00225	m	D-	m	18

Annual median concentration of TCDDN (ng/kg w. wt.)

St	Species	Tissue										ANALYSIS					
			2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	TRND	SM+3	POWER	
30A	MYTI EDU	SB			0.11	0.108	0.127	0.169	0.153	0.143	0.107	0.106		m	--	m	7
71A	MYTI EDU	SB			2.37	2.36	2.02	2.64	2.76	2.2	4.62	3.05		m	--	m	10
76A	MYTI EDU	SB			0.0566	0.078	0.133	0.142	0.111	0.106	0.119	0.0812		m	--	m	10
1712	MYTI EDU	SB			4.31	4.29	3.26	1.51	3.24	4.02	5.77	5.92		m	--	m	12
1713	MYTI EDU	SB			3.59	4.16	2.98	4.77	1.41	6.14	3.61	3.85		m	--	m	16
1132	MYTI EDU	SB			0.479	0.611	0.211	1.53	0.303	0.373	0.593	0.425		m	--	m	19
1133	MYTI EDU	SB			0.277	0.24	0.371	0.249	0.227	0.256	0.178	0.635		m	--	m	14

Annual median concentration of CYP1A (ABS)

St	Species	Tissue	1995	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																OC	TRND	SM+3	POWER
30B	GADU MOR	LI							2.24	1.2	1.22	0.822	0.902	1.49	0.513	m	--	m	14
53B	GADU MOR	LI							0.132	0.207	0.201	0.0655	0.428		0.38	m	--	m	19
23B	GADU MOR	LI							0.113	0.212	0.199	0.0795			0.175	m	-?	m	16

Annual median concentration of ALAD (ng/min/mg protein)

St	Species	Tissue	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																	OC	TRND	SM+3	POWER
30B	GADU MOR	BL		8.98	14.7	13	14.6	12.7	10.4	6.91	14.2	15	32.3	14.1	11.7	28.6	m	--	m	14
36B	GADU MOR	BL		13	26.2	9.93	22	19.4									m	-?	m	15
15B	GADU MOR	BL		17.2	23.4	8.45		18.9									m	-?	m	17
53B	GADU MOR	BL		7.64	10.1	11.1	12.7	10	6.44	9.32	9.95	10.4	33.7	7.98		19.6	m	--	m	15
67B	GADU MOR	BL		7.17	28.2	16.9	22.4	19									m	-?	m	16
23B	GADU MOR	BL		15.8	24.8	18.1	19.8	24	19.4	16.8	19.7	25.8	38			34.4	m	--	m	9

Annual median concentration of EROD (pmol/min/mg protein)

St	Species	Tissue	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	ANALYSIS			
																	OC	TRND	SM+3	POWER
30B	GADU MOR	LI		68.8	124	70	260	81.2	158	88.3	69	50.9	98.7	29.7	6.12	57.8	m	--	m	21
36B	GADU MOR	LI		95.1	11.4	60.2	64.9	76.2									m	-?	m	24
15B	GADU MOR	LI		49.9	52.3	184		61									m	-?	m	20
53B	GADU MOR	LI		86.5	119	90.1	128	34.7	93.9	11.7	20	53.9	54.2	14.3		41.4	m	--	m	20
67B	GADU MOR	LI		103	76.2	84.6	103	72.9									m	-?	m	9
23B	GADU MOR	LI		94.1	28.6	70.1	73.5	76.5	103	41.9	45.9	50.8	57.2			27.8	m	--	m	15

Annual median concentration of PYR10 (µg/kg/ABS 380 nm)

St	Species	Tissue	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	ANALYSIS		
																		TRND	SM+3	POWER
30B	GADU MOR	BI					12.3	17	29.2	20.3	43.5	15.1	13.9	4.95	17.1	15.6	m	--	m	17
15B	GADU MOR	BI						29.7	6.32	5.66	16.7	1.1	2.61	1.14	1.7	2.69	m	--	m	22
53B	GADU MOR	BI					9.23	3.81	18.8	3.65	3.39	3.04	2.18	4.84	3.19	10.9	m	--	m	18
23B	GADU MOR	BI					4.15	2.55	3.1	5.32	1.62	3.46	1.34	1.72	1.67	1.02	m	--	m	14

Annual median VDSI

St	Species	Tissue	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	OC	ANALYSIS		
																								TRND	SM+3	POWER
36G	NUCE LAP	WO		4.1		3.9				4	4	4	4	3.95	4	3.96	3.65	0.96	0.125	0.583	0.24	0.217	m	DY	m	18
71G	NUCE LAP	WO												4	4.1	4	4	4	4	1.61		1.25	m	D-	m	18
76G	NUCE LAP	WO												3.41	3.03		3.28	0.643	0.778	0.0667	0.13	0	m	D-	m	20
131G	NUCE LAP	WO												3.89	3.77	3.47	3.63	1.86	1.08	0.118	0	0	m	D-	m	16
15G	NUCE LAP	WO												3.69	3.86	3.42	3.43	1.28	0.125	0	0.129	0	m	D-	m	19
22G	NUCE LAP	WO												4	4	3.95	4	4	2.96	2.41	1.41	1.58	m	DY	m	13
220G	NUCE LAP	WO								4.05	4	4			4								m	-?	m	<=5
227G1	NUCE LAP	WO		4.1						4	4.15	4.09	4.5	4.3	4.5	4.13	3.92	3.65	3.66	3.52	3.67	2.32	m	DY	m	12
98G	NUCE LAP	WO												3.5	3.76	3.8	4	3.43	2.97	2.95	1.88	3.03	m	--	m	15
11G	NUCE LAP	WO													0.0333	0	0.289	0	0	0.0345	0	0	m	--	m	7

Appendix K

Geographical distribution of contaminants and biomarkers in biota 1990-2009

Sorted by contaminant and species:

Cadmium (Cd)
Mercury (Hg)
Lead (Pb)
Sum of 7 CBs (CB-28, -52, 101, -118, -138, -153 and -180)
DDEPP (ppDDE)
HCB
TCDDN
PBDE
OH-pyrene
ALA-D (δ -amino levulinic acid dehydrase inhibition)
EROD-activity (Cytochrome P4501A-activity)
CYP1A (relative amount of cytochrome P4501A-protein)
TBT
VDSI

MYTI EDU - Blue Mussel (*Mytilus edulis*)
GADU MOR - Atlantic cod (*Gadus morhua*)
PLAT FLE - Flounder (*Platichthys flesus*)
LIMA LIM - Dab (*Limanda limanda*)
PLEU PLA - Plaice (*Pleuronectes platessa*)
MICR KIT - Lemon sole (*Microstomus kitt*)
LEPI WHI - Megrim (*Lepidorhombus whiff-iaconis*)

Station positions are shown on maps in Appendix G

Results are presented for three periods as noted in figure text
The average of the median concentrations was used for each period.
Cf. Appendix F. sample overview

Appendix K
Geographical distribution of contaminants and biomarkers in
biota 1990-2009
(cont.)

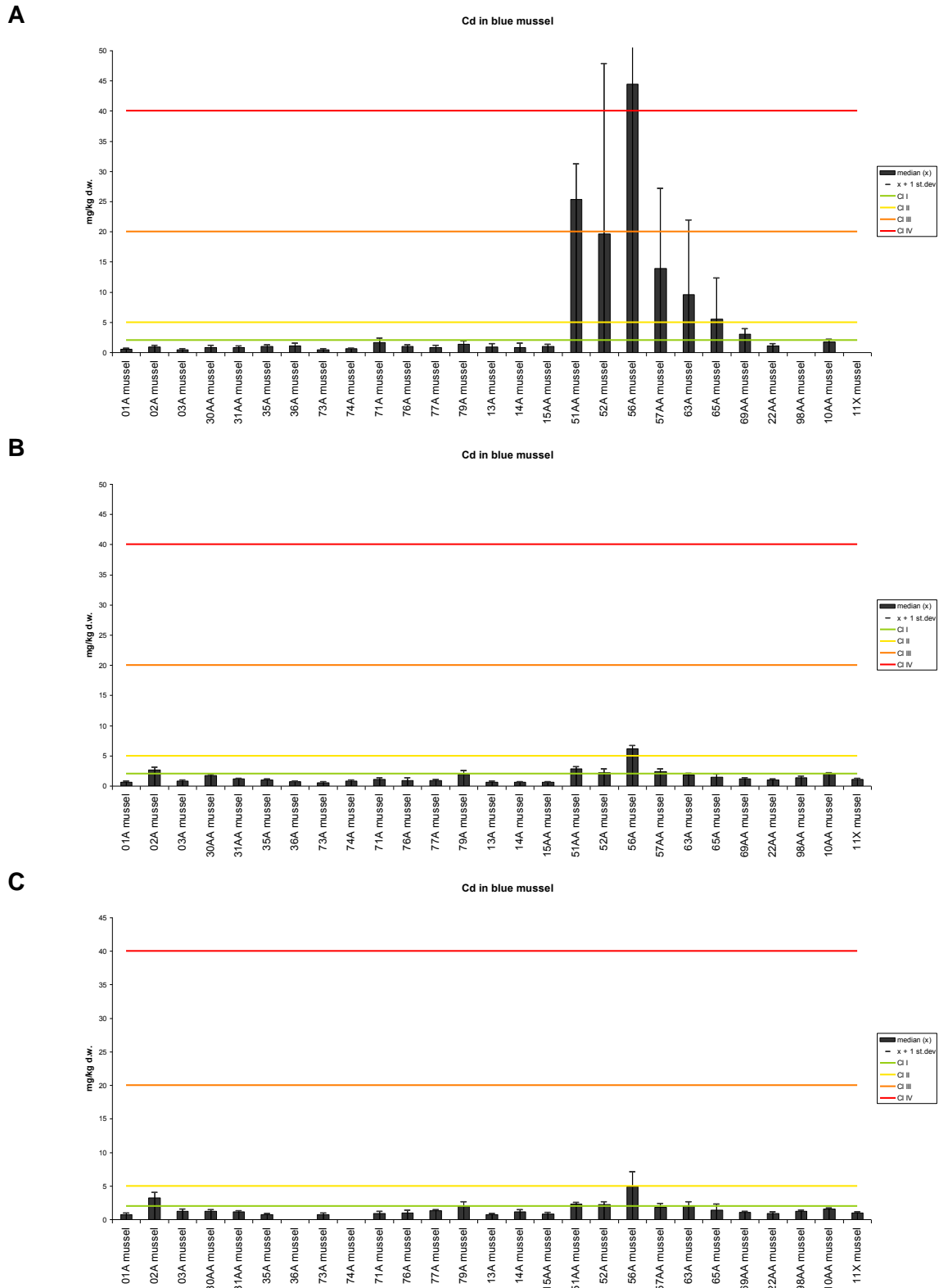


Figure 41. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for cadmium in blue mussel 1990-1996 (A), 2008 (B) and 2009 (C), ppm (mg/kg) dry weight (see maps in Appendix G). Note: for one station, the standard deviation is off-scale in figure A.

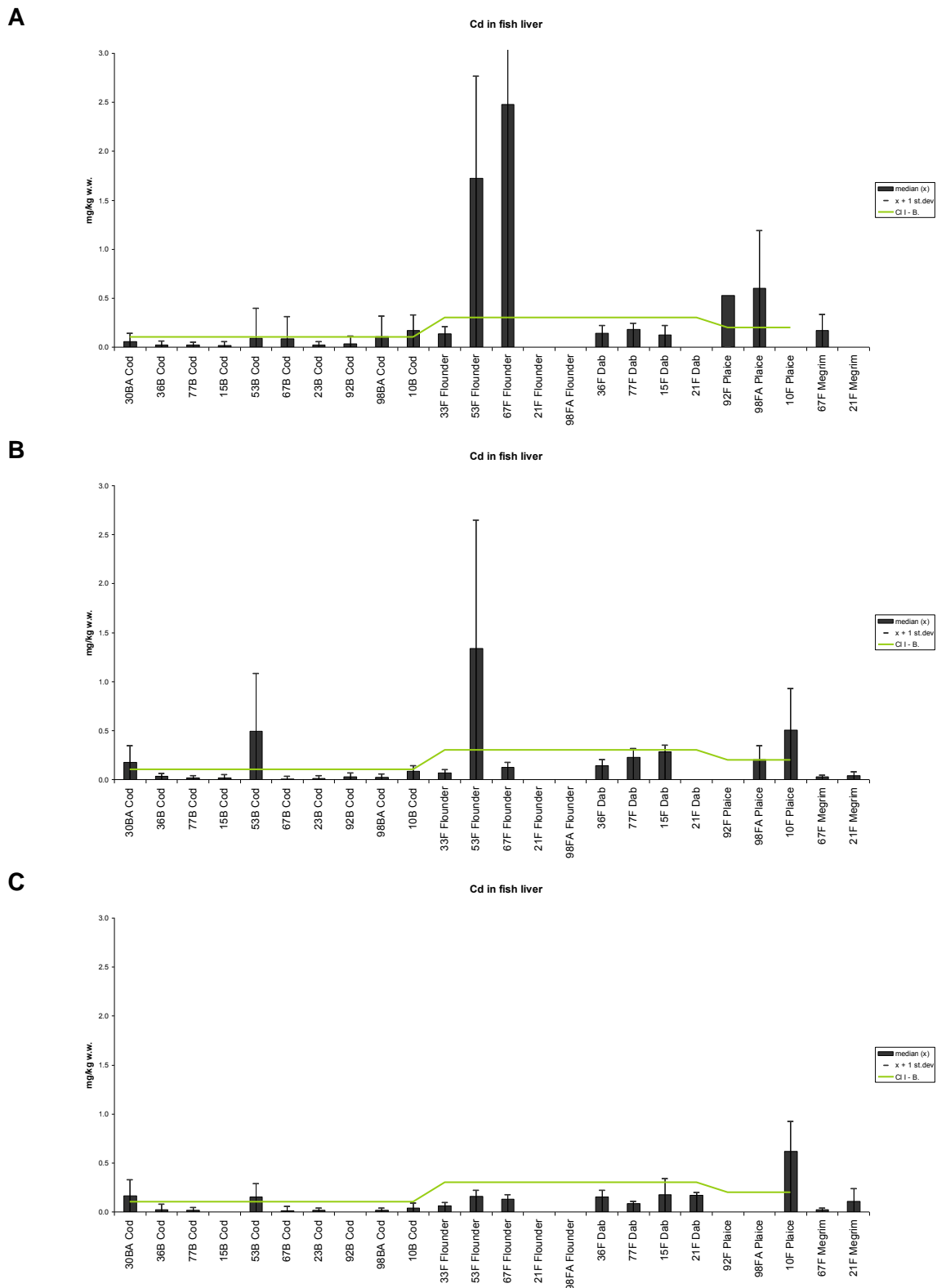


Figure 42. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for cadmium in fish liver 1990-1996 (A), 2008 (B) and 2009 (C), ppm (mg/kg) wet weight. "Cl. – B" indicates that only upper limit to Klif Classes or provisional high background concentration is indicated for all fish, (see maps in Appendix G). **Note: for one station, the standard deviation is off-scale in figure A.**

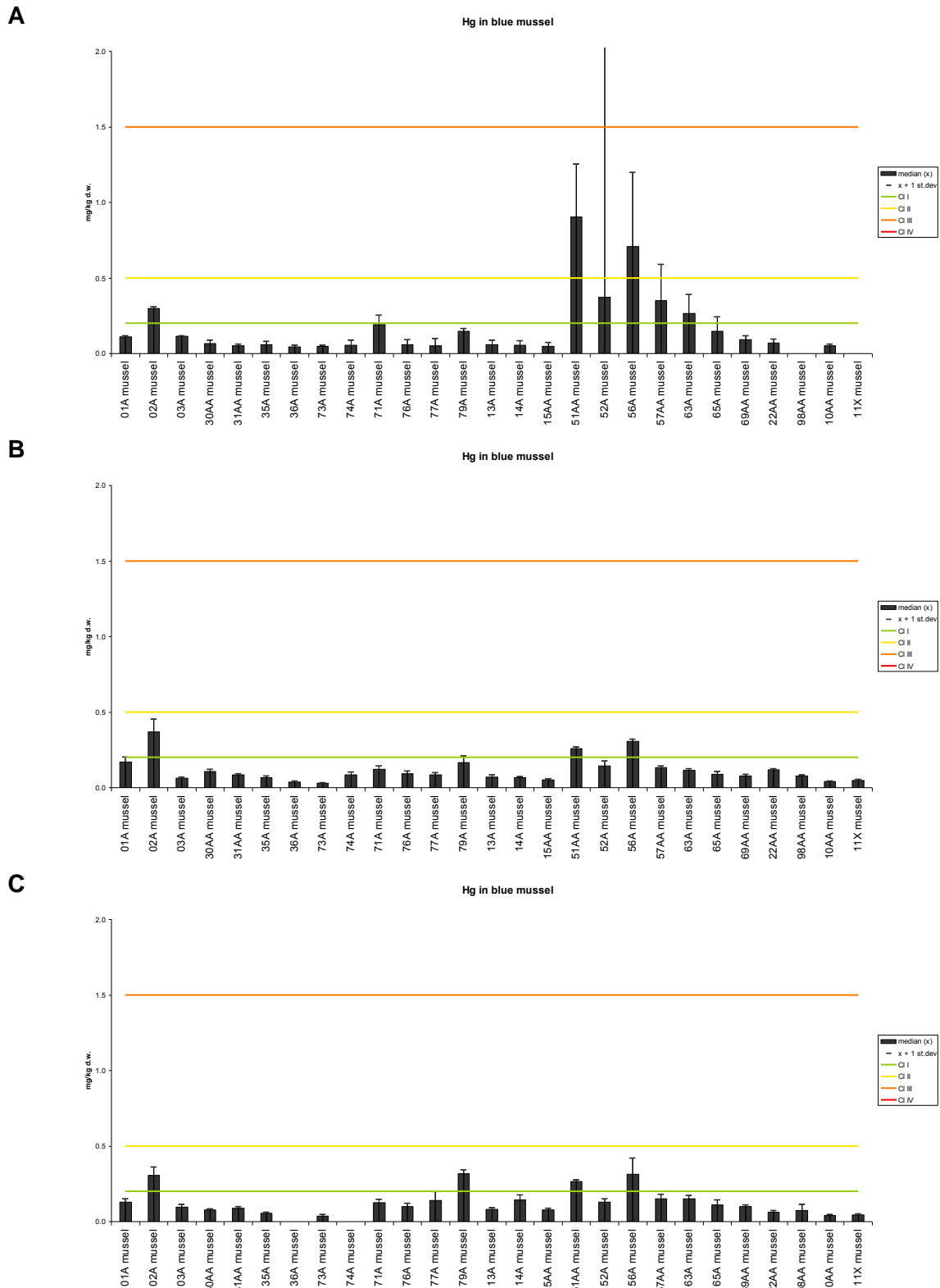


Figure 43. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for mercury in blue mussel 1990-1996 (A), 2008 (B) and 2009 (C), ppm (mg/kg) dry weight (see maps in Appendix G). **Note: for one station, the standard deviation is off-scale in figure A.**

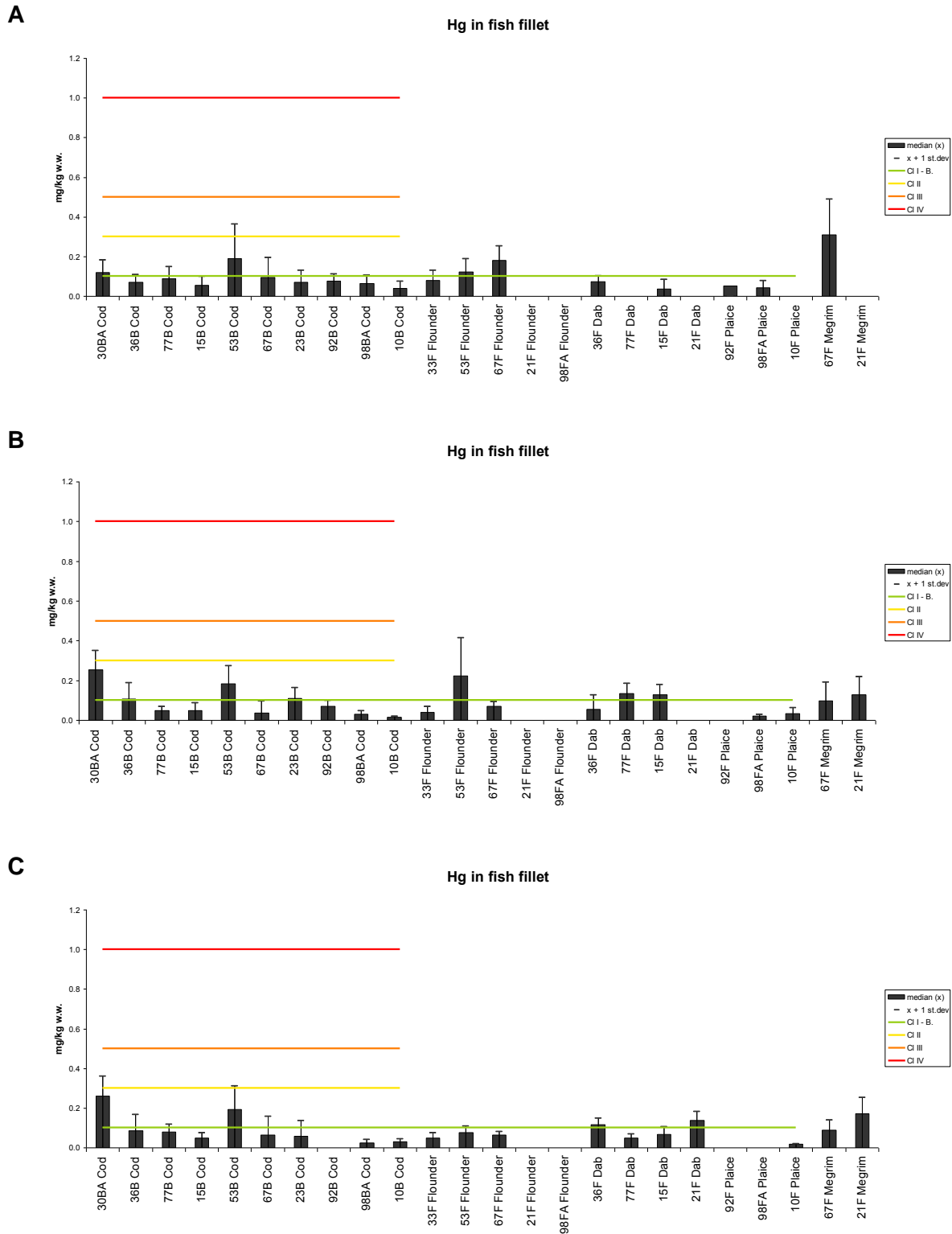


Figure 44. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for mercury in fish fillet 1990-1996 (A), 2008 (B) and 2009 (C), ppm (mg/kg) wet weight, "CI. – B" indicates that only upper limit to Klif Classes or provisional high background concentration is indicated for flatfish, (see maps in Appendix G).

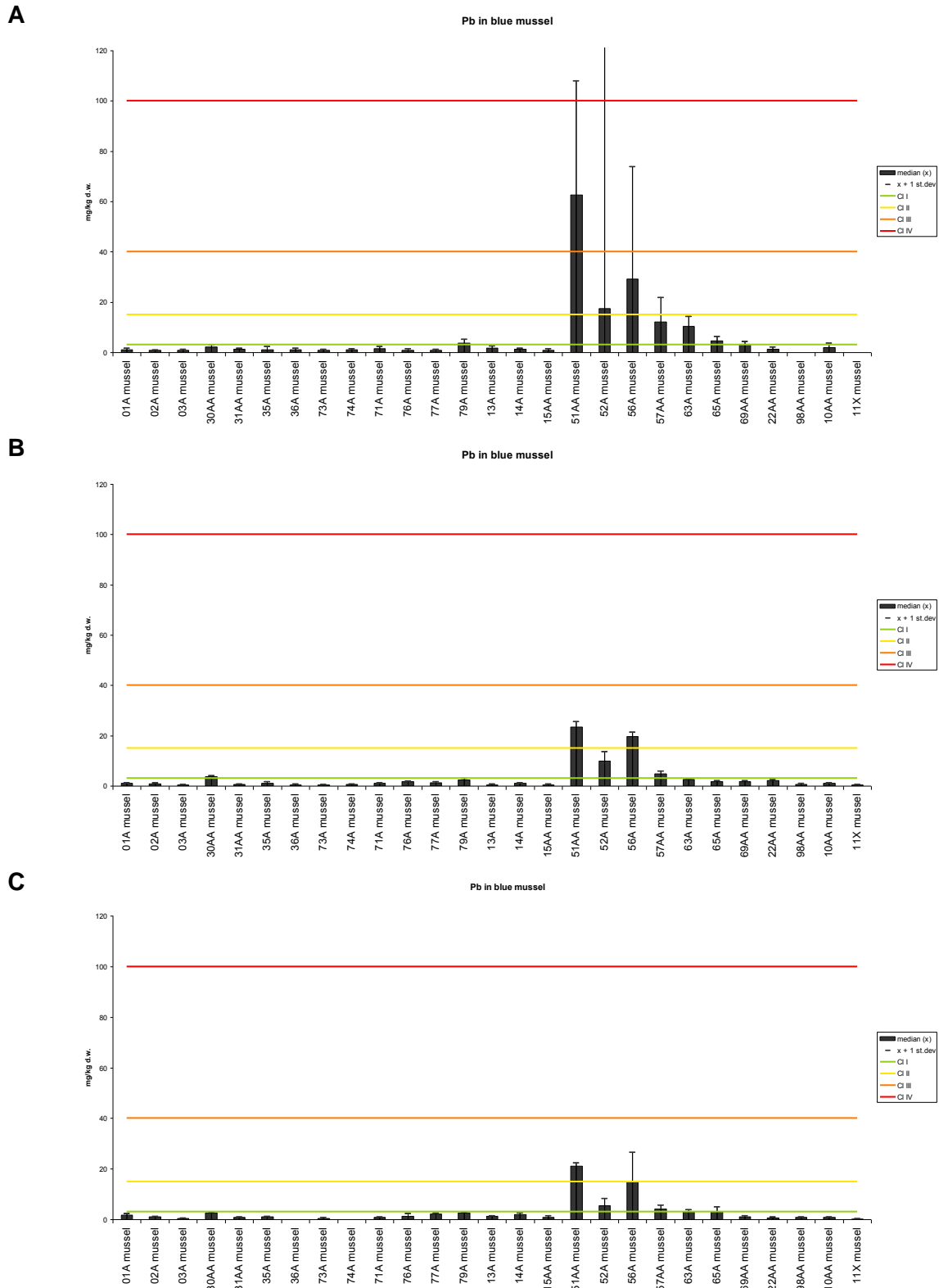


Figure 45. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for lead in blue mussel 1990-1996 (A), 2008 (B) and 2009 (C), ppm (mg/kg) dry weight (see maps in Appendix G). Note: for one station, the standard deviation is off-scale in figure A.

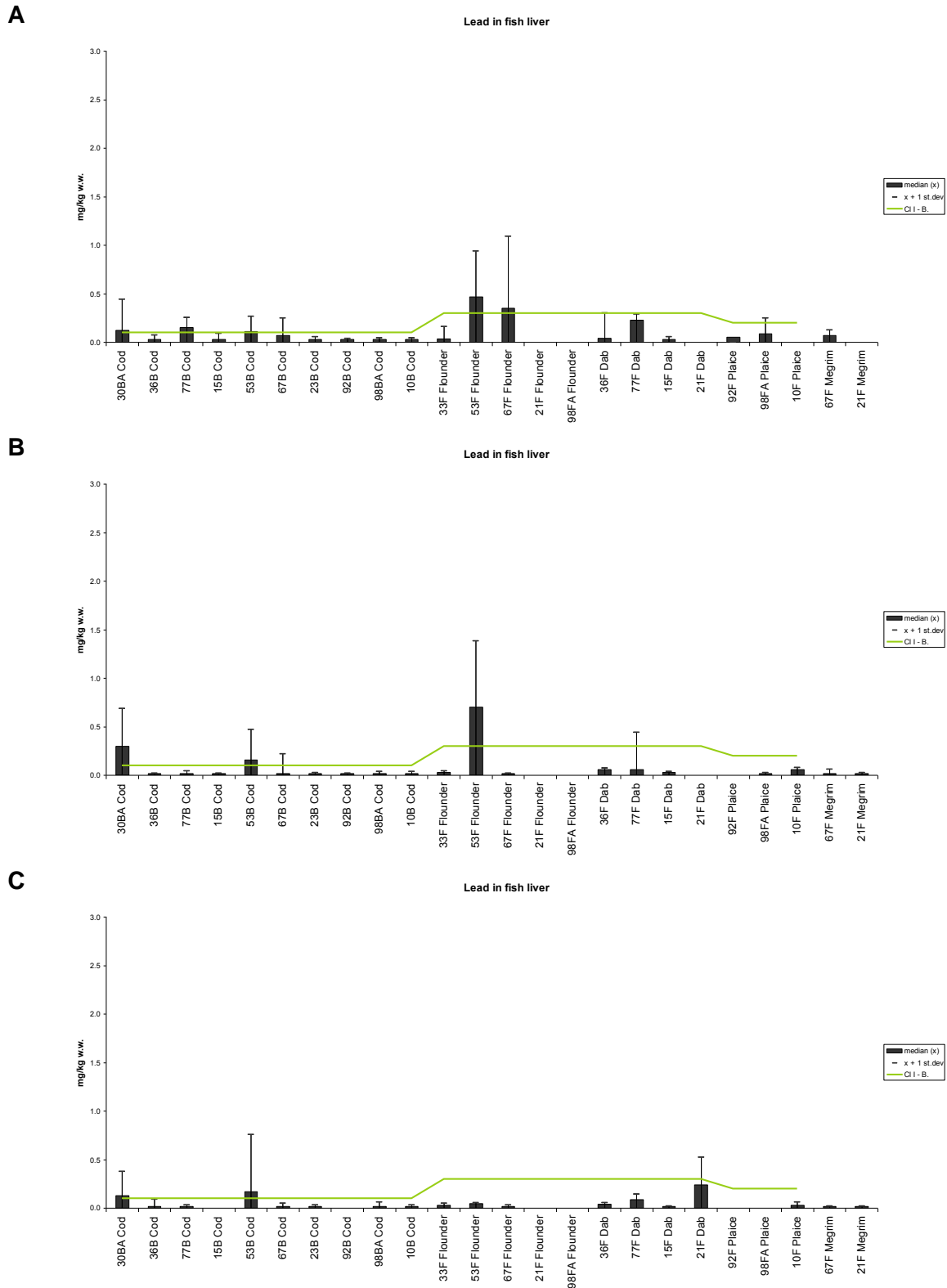


Figure 46. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for lead in fish liver 1990-1996 (A), 2008 (B) and 2009 (C), ppm (mg/kg) wet weight, "Cl. – B" indicates that only upper limit to Klif Classes or provisional high background concentration is indicated for all fish, (see maps in Appendix G).

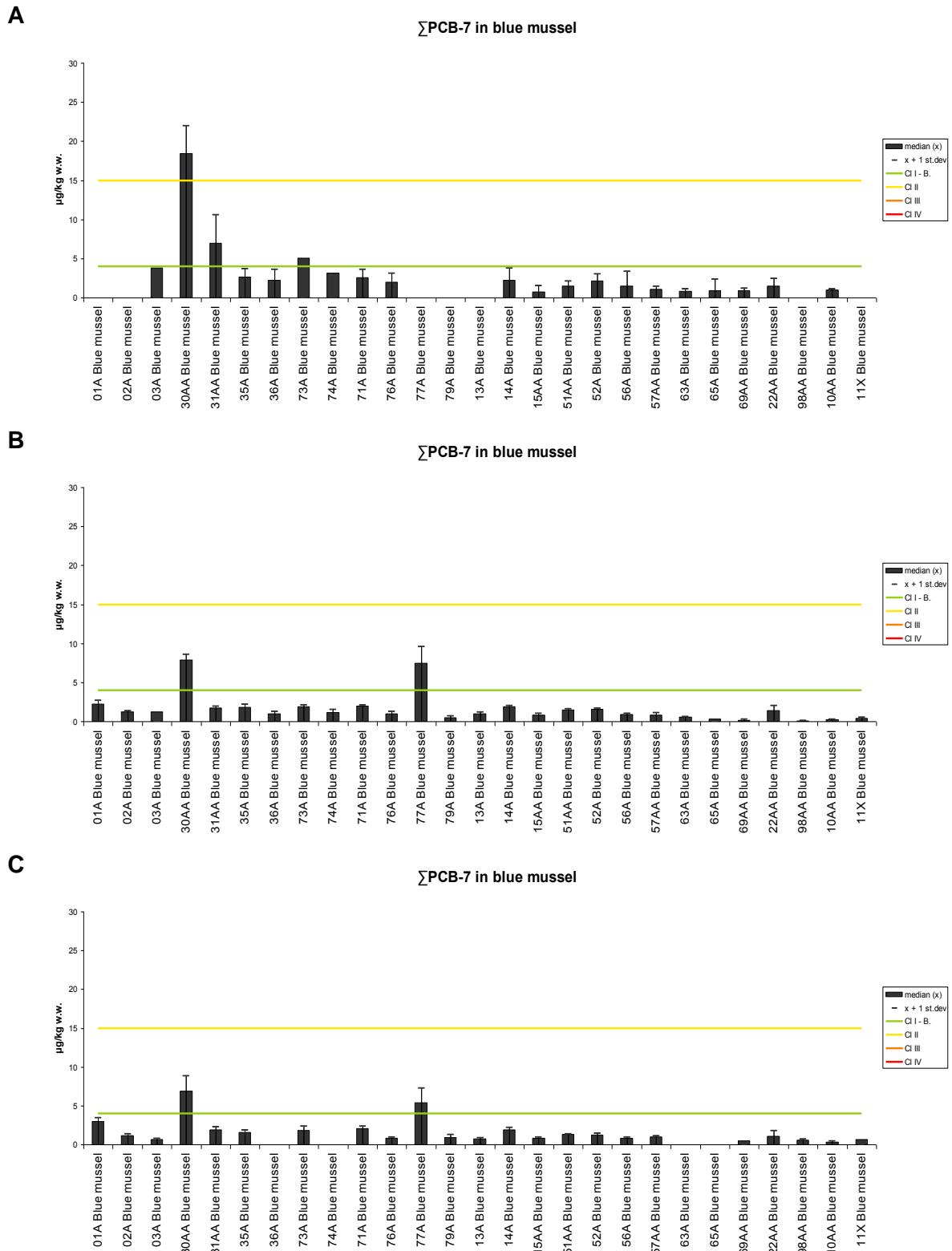


Figure 47. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for sum of 7 PCBs (CB-28, -52, 101, -118, -138, -153 and -180) in blue mussel 1990-1996 (A), 2008 (B) and 2009 (C), ppb ($\mu\text{g/kg}$) wet weight (see maps in Appendix G).

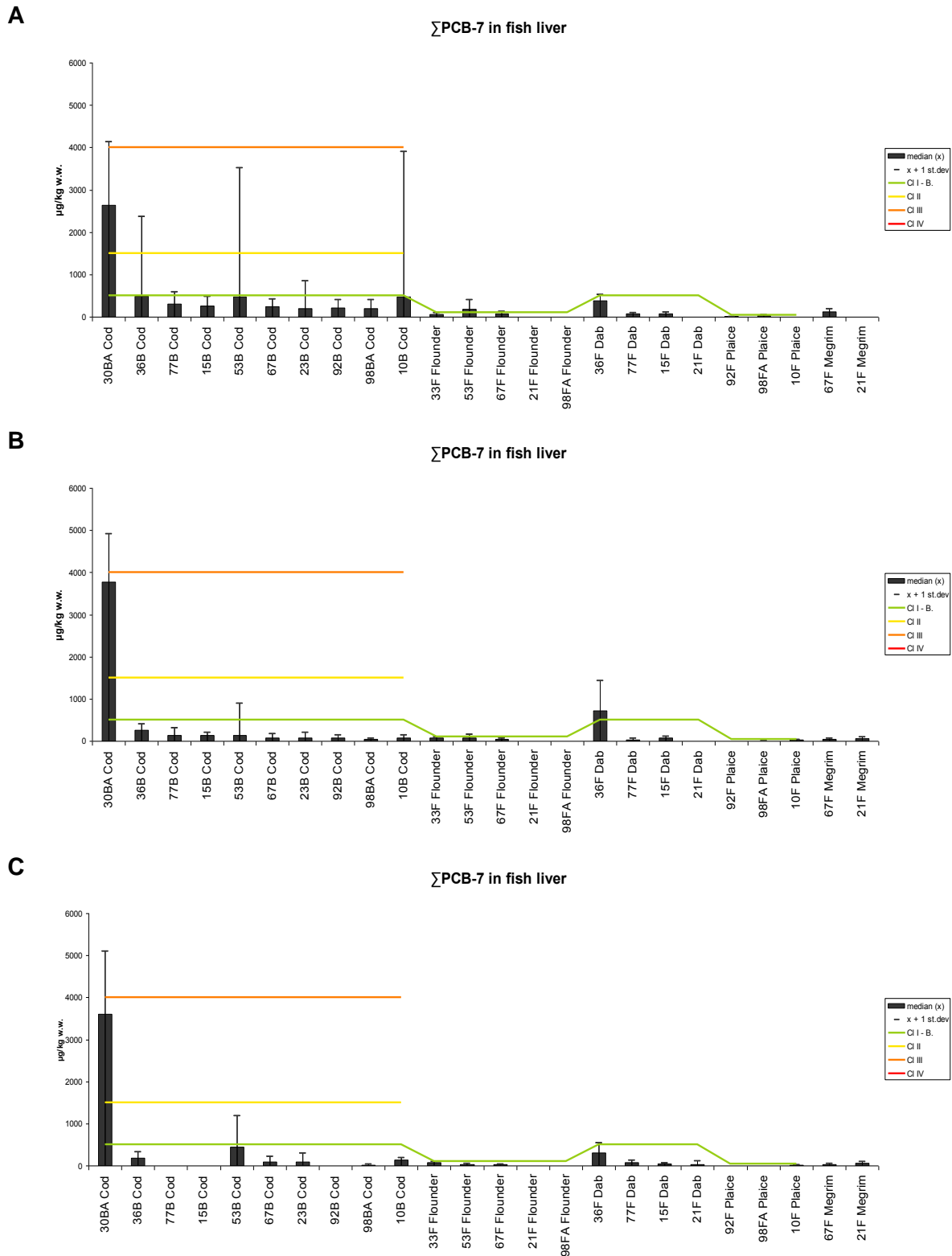


Figure 48. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for sum of 7 PCBs (CB-28, -52, 101, -118, -138, -153 and -180) in fish liver 1990-1996 (A), 2008 (B) and 2009 (C), ppb (µg/kg) wet weight, "CI. I – B" indicates that only upper limit to Klif Classes or provisional high background concentration is indicated for flatfish, (see maps in Appendix G).

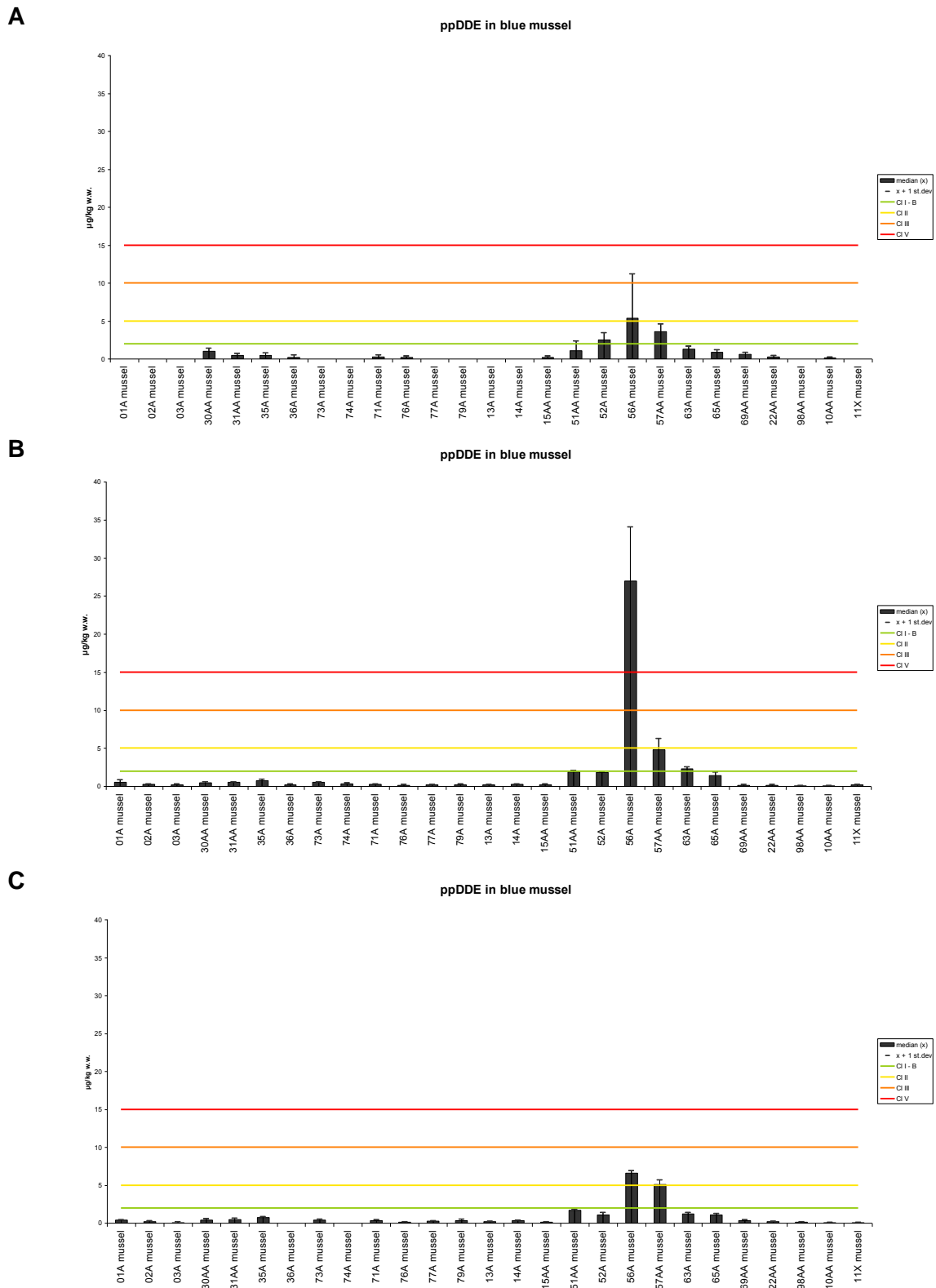


Figure 49. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for ppDDE (DDEPP) in blue mussel 1990-1996 (A), 2008 (B) and 2009 (C), ppb (µg/kg) wet weight (see maps in Appendix G). (See also footnote in Table 13). **Note:** Class limits for ΣDDT used.

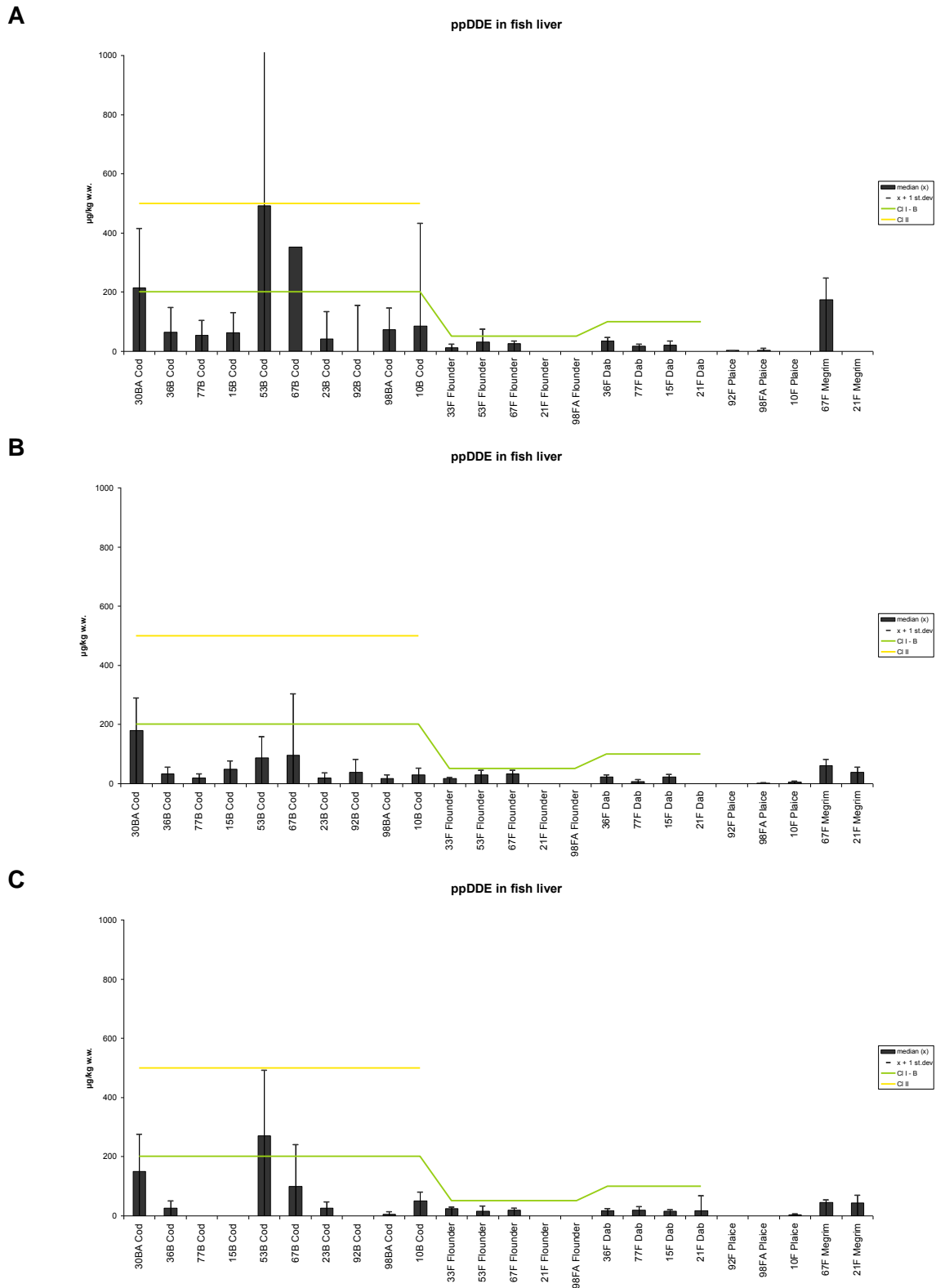


Figure 50. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for ppDDE (DDEPP) in fish liver 1990-1996 (A), 2008 (B) and 2009 (C), ppb (µg/kg) wet weight, "Cl. – B" indicates that only upper limit to Klif Classes or provisional high background concentration is indicated for flatfish, (see maps in Appendix G). (See also footnote in Table 13). **Note: Class limits for ΣDDT used.**

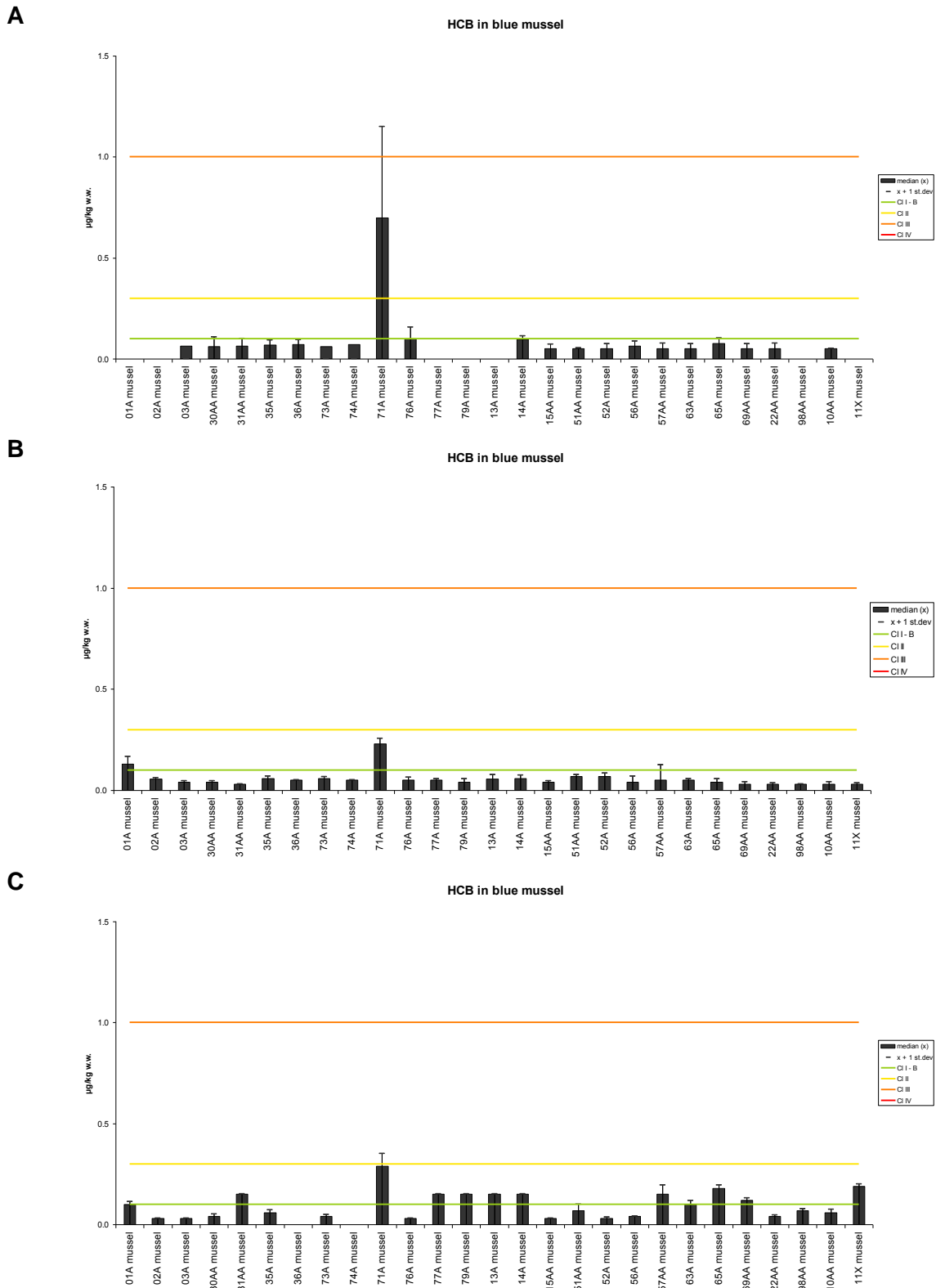


Figure 51. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for HCB in blue mussel 1990-1996 (A), 2008 (B) and 2009 (C), ppb (µg/kg) wet weight (see maps in Appendix G).

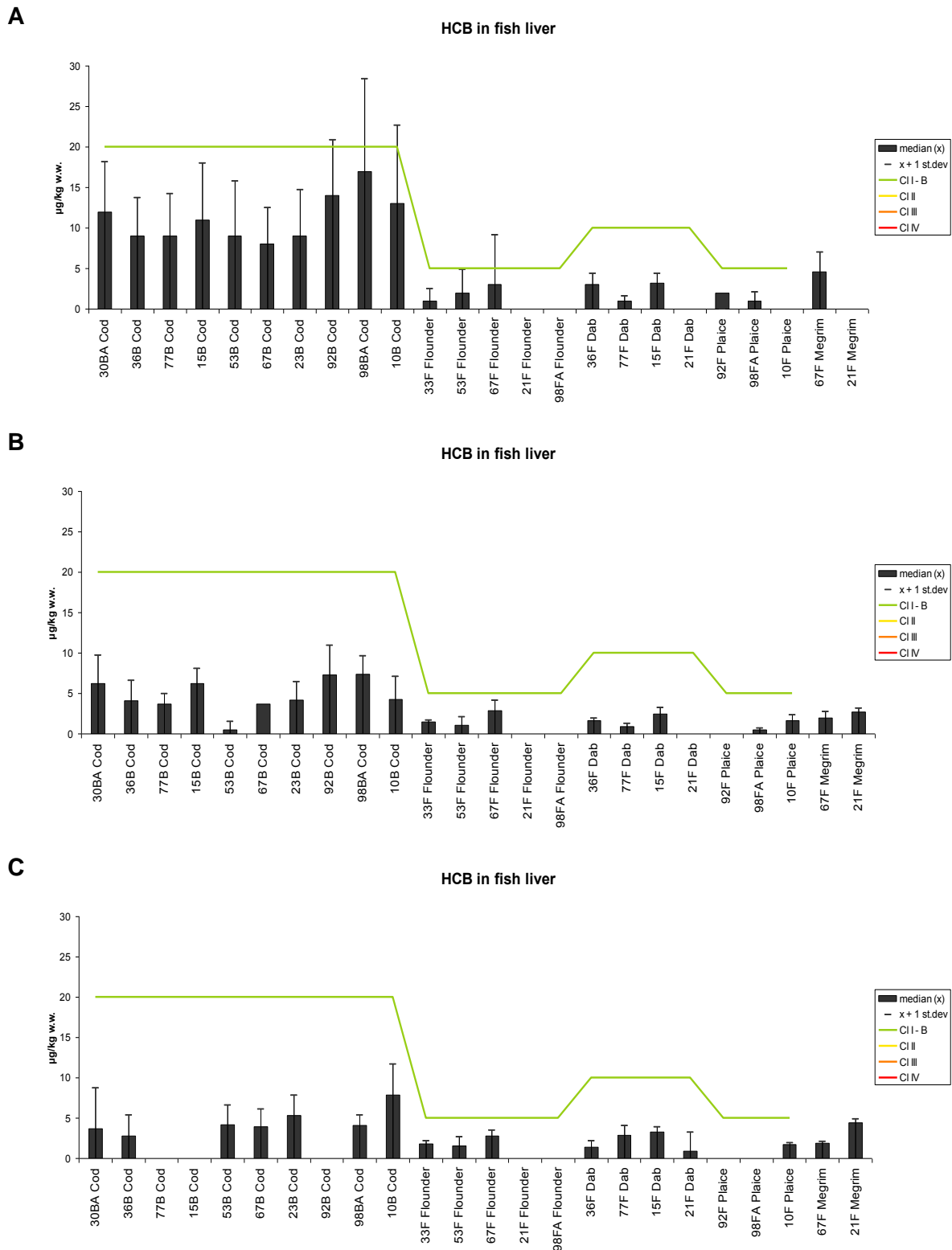


Figure 52. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for HCB in fish liver 1990-1996 (A), 2008 (B) and 2009 (C), ppb (µg/kg) wet weight, "CI - B" indicates that only upper limit to Klif Classes or provisional high background concentration is indicated for all fish, (see maps in Appendix G).

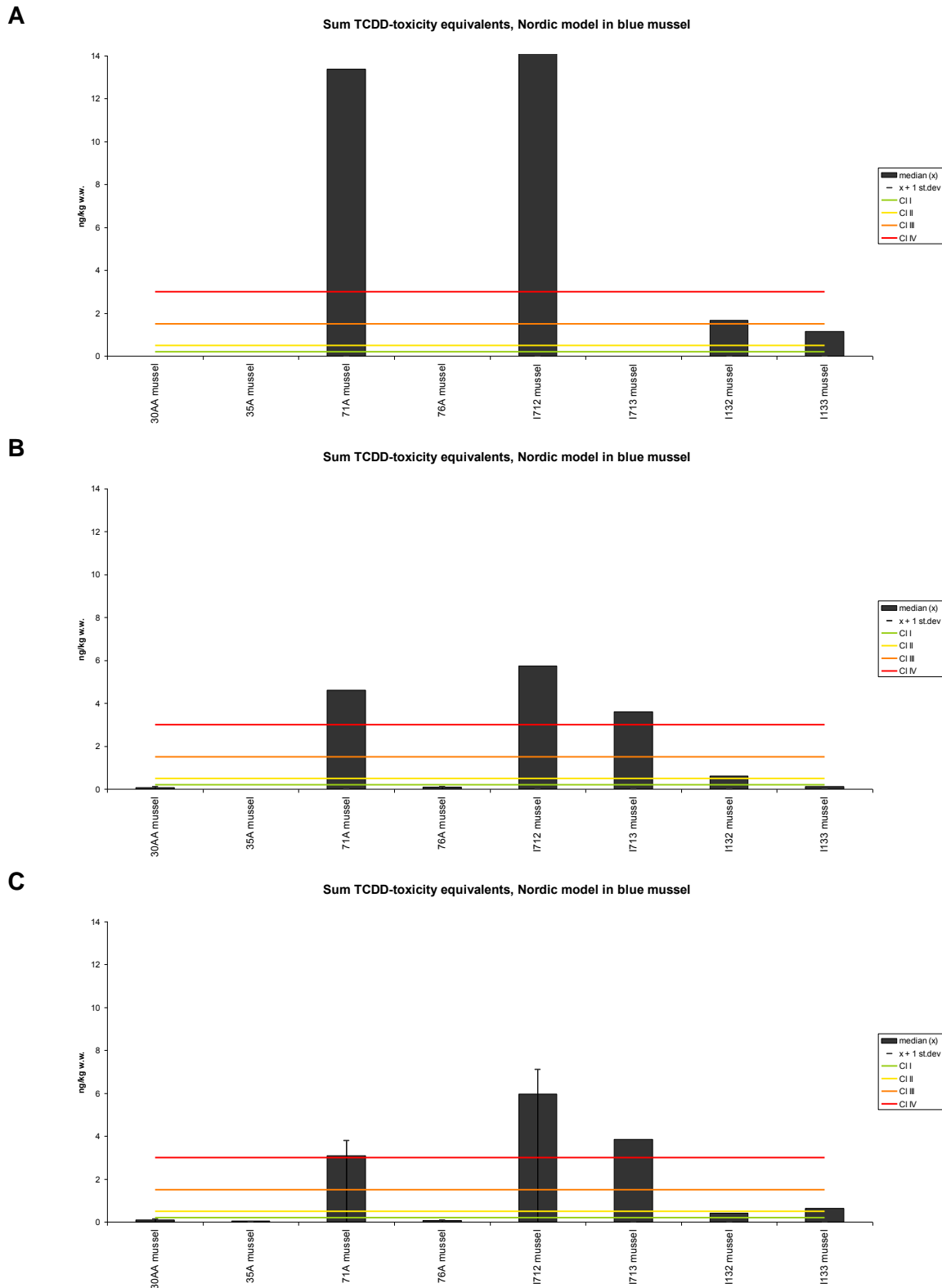


Figure 53. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for dioxin TCDD-toxicity equivalents after nordic model (TCDDN) in blue mussel 1990-1996 (A), 2008 (B) and 2009 (C), ppp (ng/kg) wet weight (see maps in Appendix G). NB: TCDDN is a sum of specific dioxin compounds of which may include compounds of uncertain quantification.

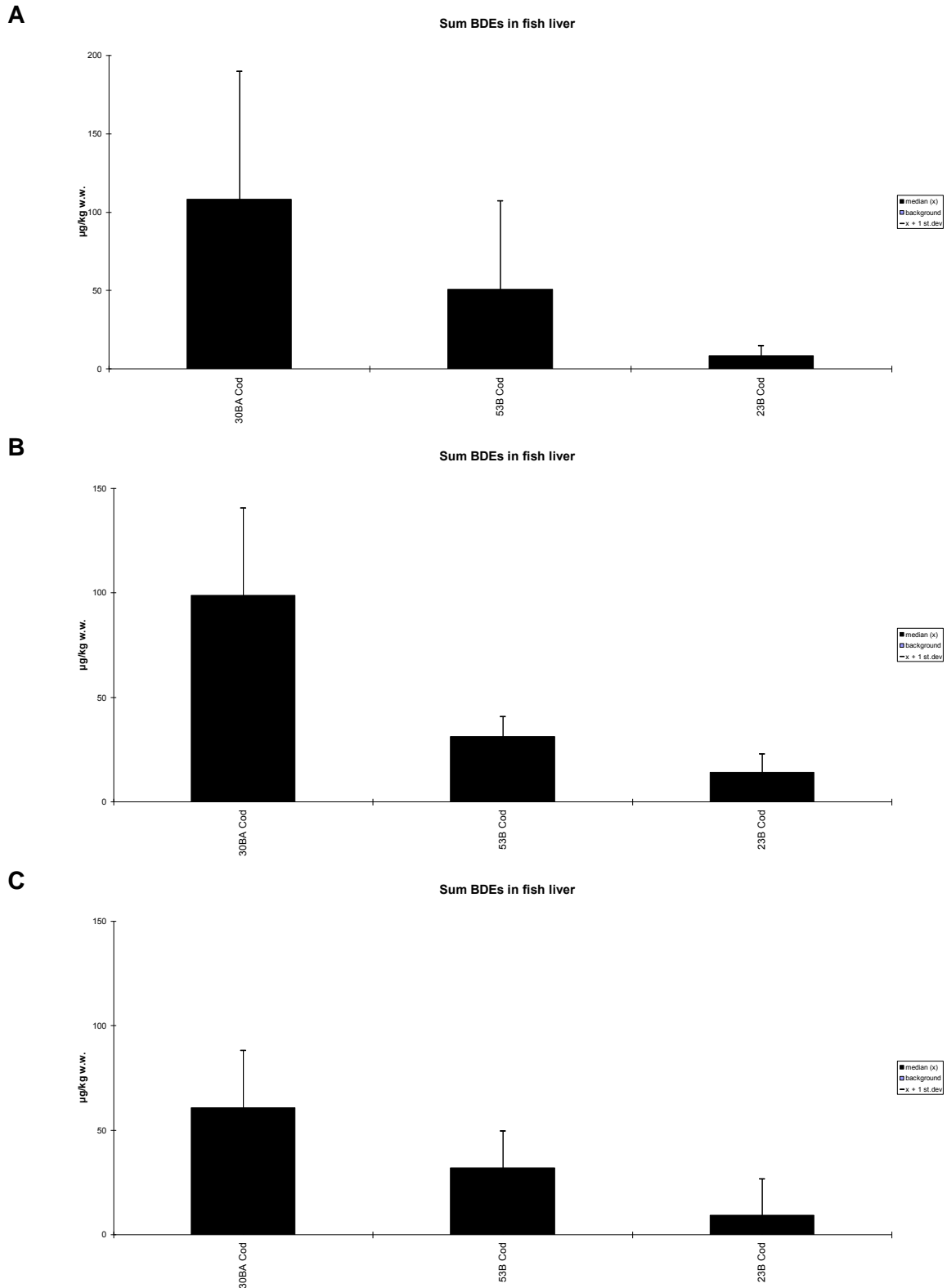


Figure 54. Median concentration for brominated flame retardant in cod liver 2007 (A), 2008 (B) and 2009 (C) ppb (µg/kg) wet weight for three CEMP stations (Inner Oslofjord - st. 30B, Inner Sør fjord - st. 53B and Karihavet - st. 23B) (see maps in Appendix G), and from two other investigations (see text).

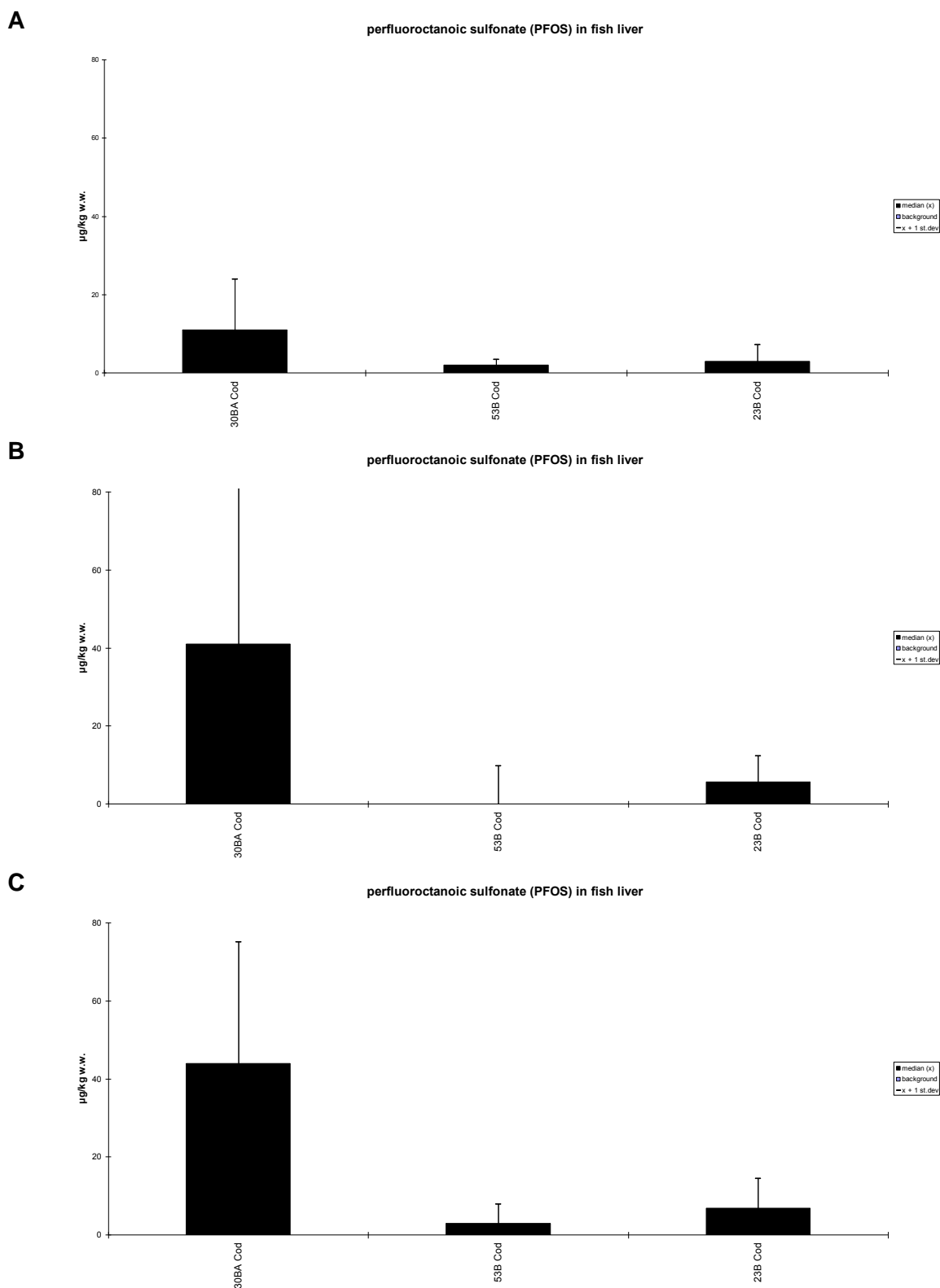


Figure 55. Median concentration for perfluorooctanoic sulfonate (PFOS) in cod liver 2007 (A), 2008 (B) and 2009 (C) ppb (µg/kg) wet weight for three CEMP stations (Inner Oslofjord - st. 30B, Inner Sør fjord - st. 53B and Karihavet - st. 23B) (see maps in Appendix G), and from two other investigations (see text).

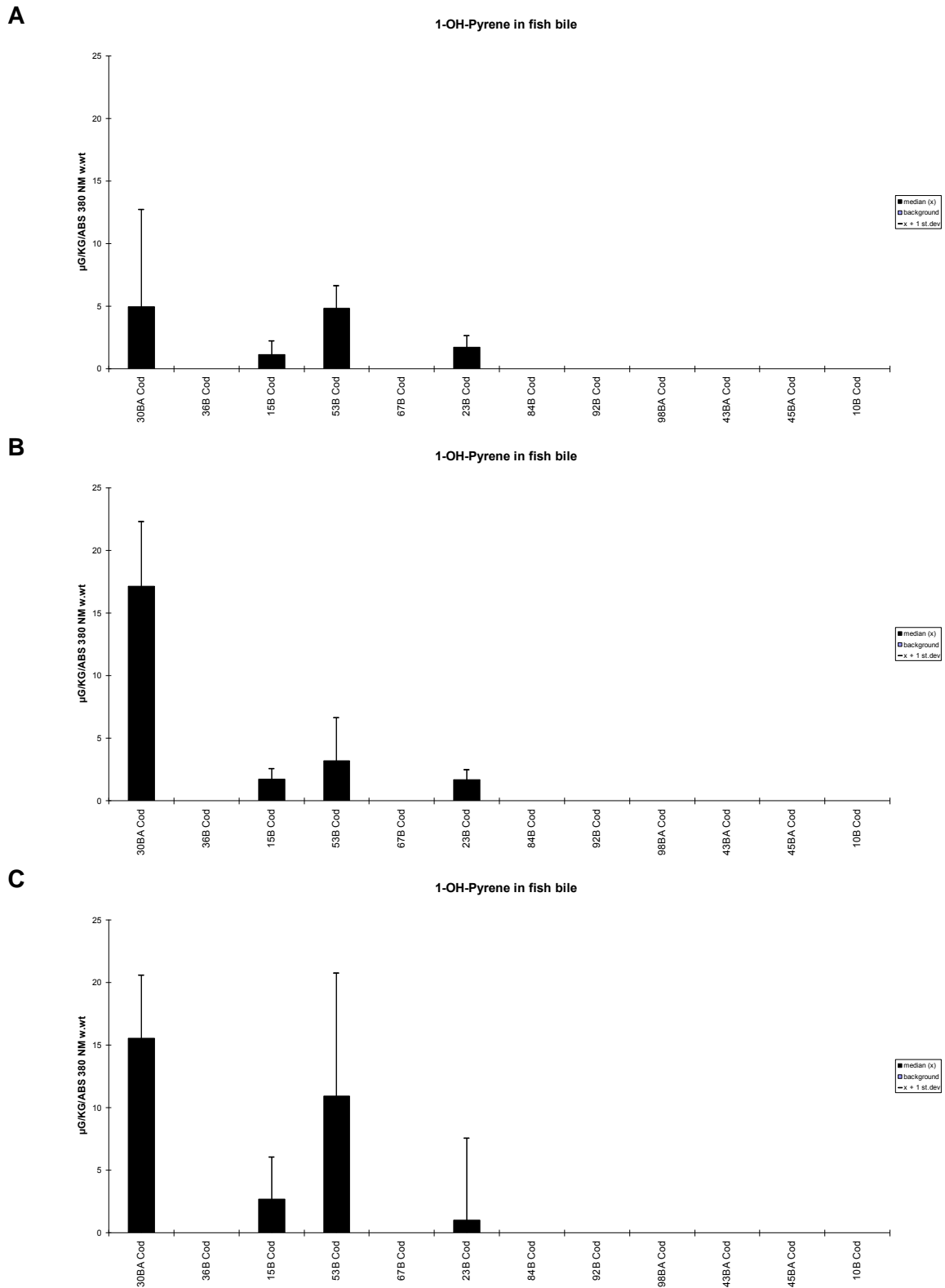


Figure 56. Median and standard deviation concentration for OH-pyrene (Pyrene metabolite) in fish bile 2007 (A), 2008 (B) and 2009 (C), µg/kg/ABS (absorbance) 380 nm (see maps in Appendix G).

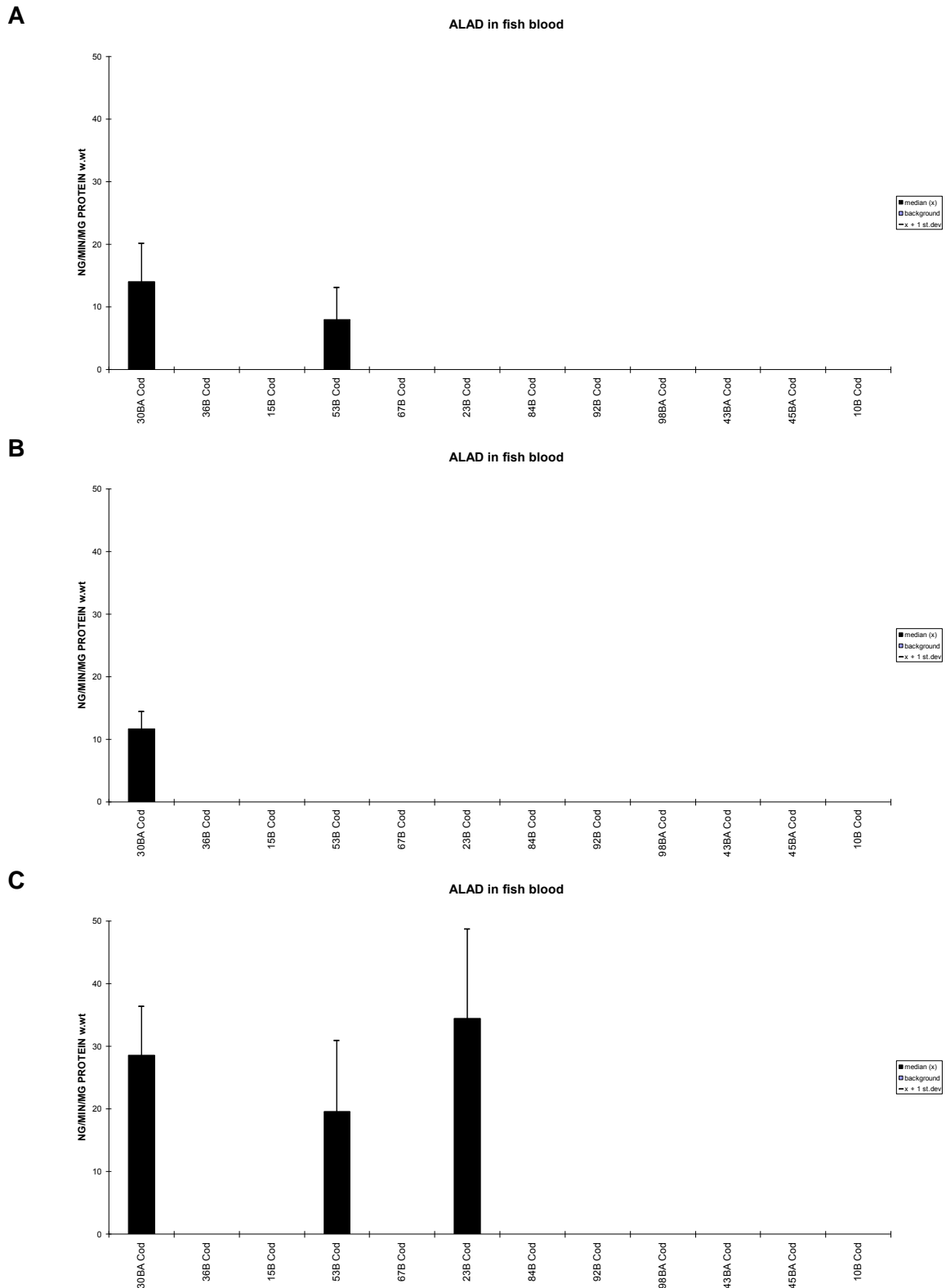


Figure 57. Median and standard deviation activity for ALA-D (δ -amino levulinic acid dehydrase inhibition) in fish blood 2007 (A), 2008 (B) and 2009 (C), ng PBG (porphobilinogen)/min/mg protein (see maps in Appendix G).

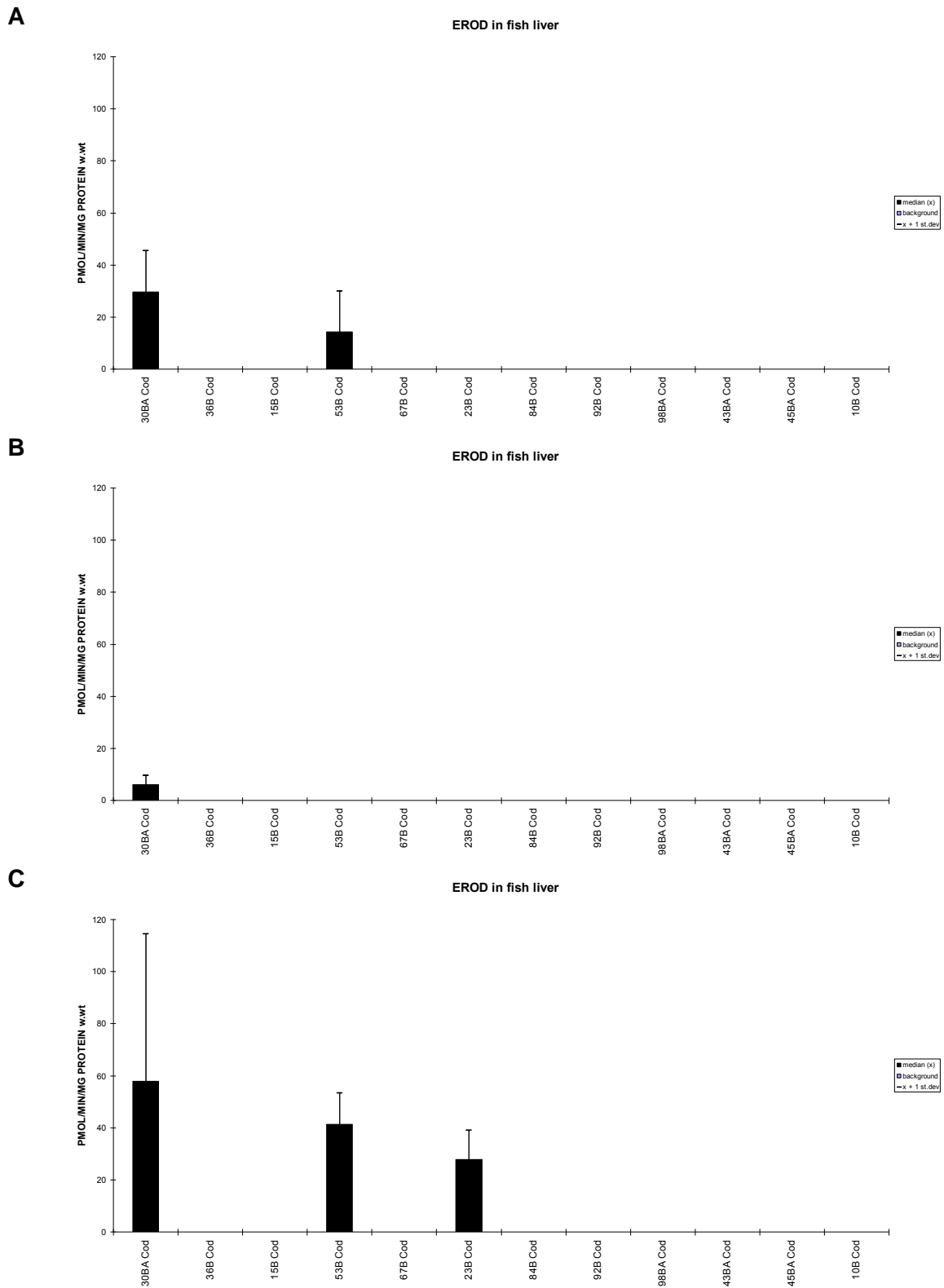


Figure 58. Median and standard deviation activity for EROD (Cytochrome P4501A-activity) in fish liver 2007 (A), 2008 (B) and 2009 (C), pmol/min/mg protein (see maps in Appendix G).

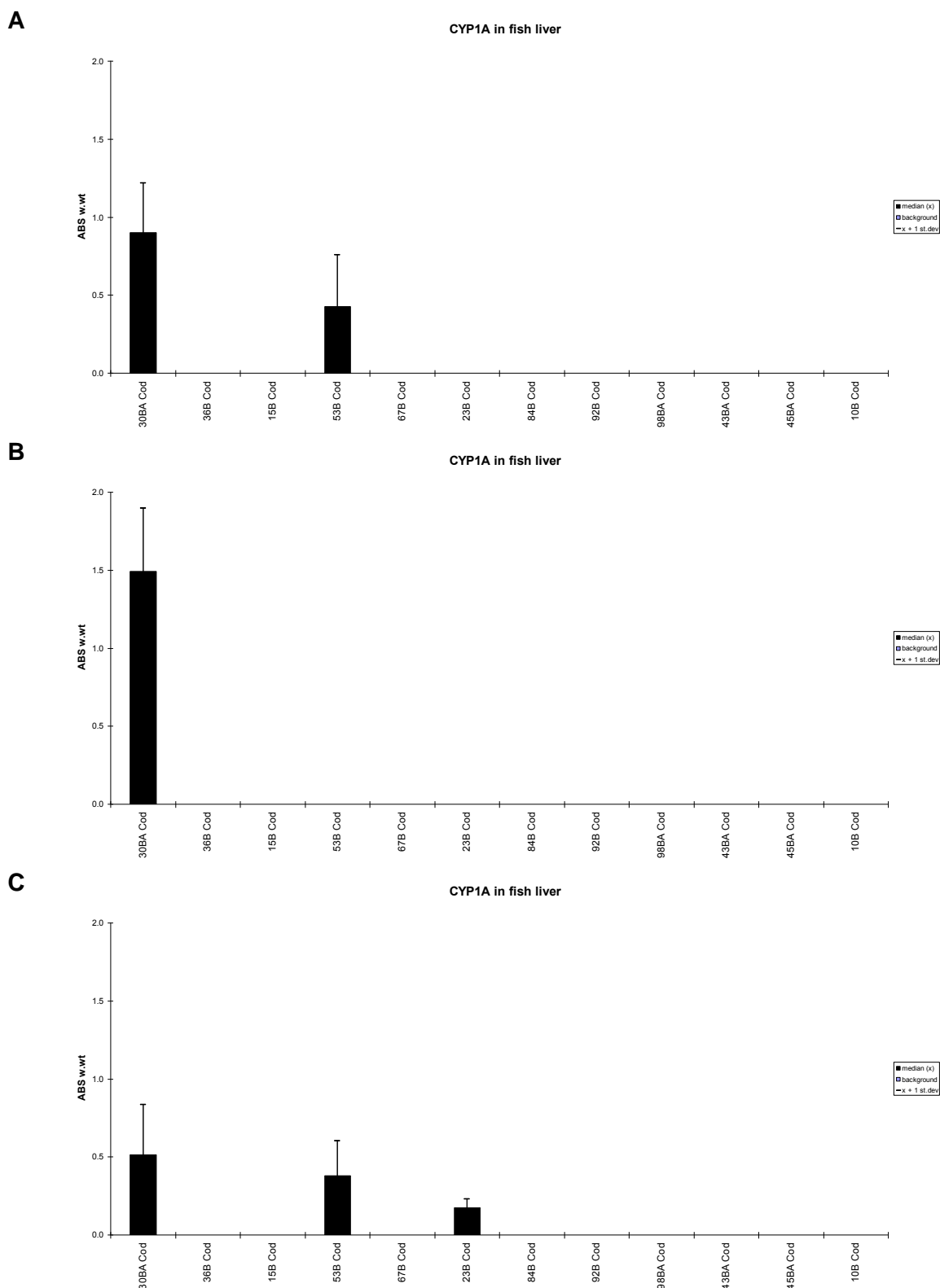


Figure 59. Median and standard deviation activity for CYP1A (relative amount of Cytochrome P4501A-protein) in fish liver 2007 (A), 2008 (B) and 2009 (C), pmol/min/mg protein (see maps in Appendix G).

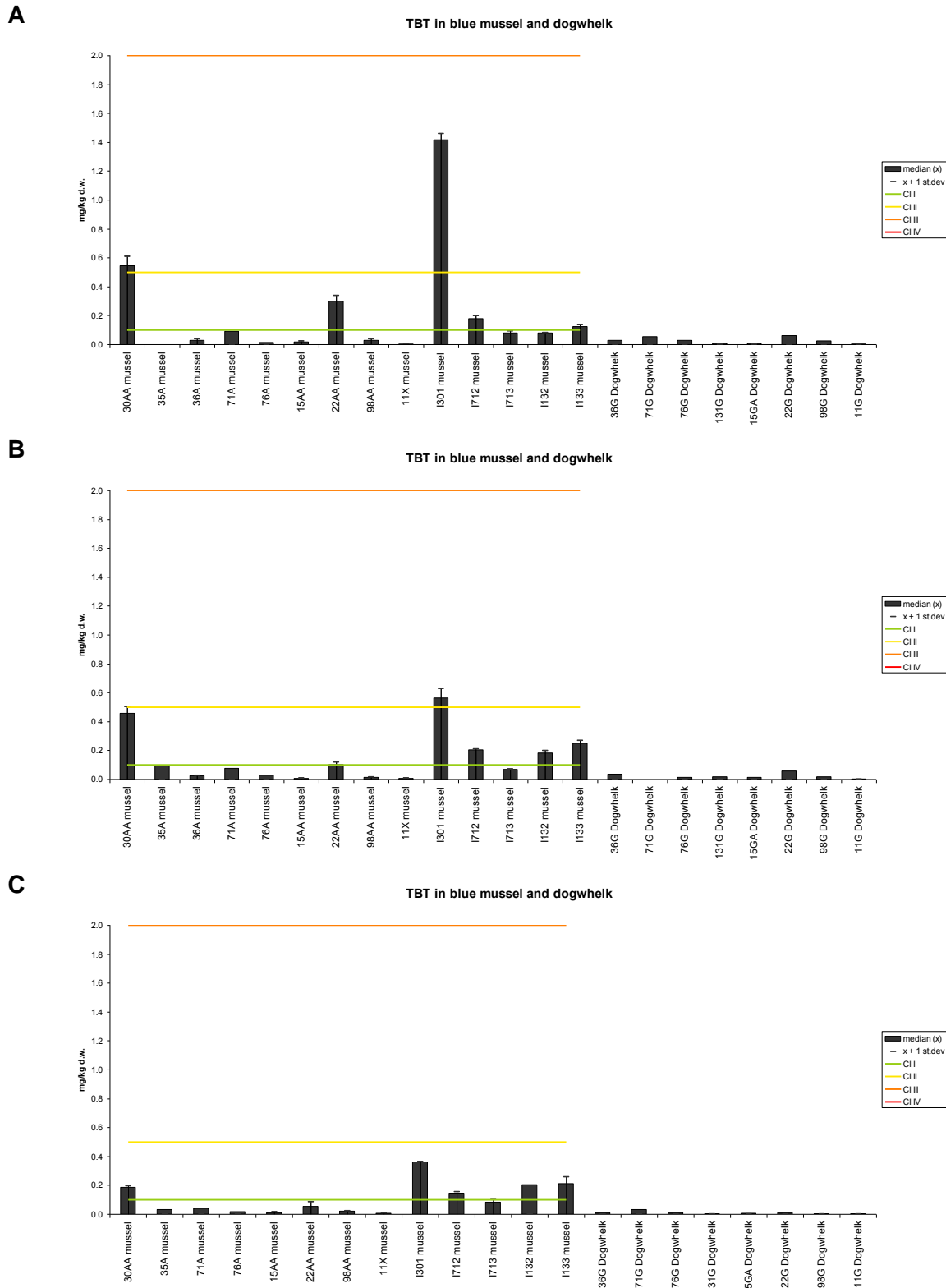


Figure 60. Median, standard deviation and upper limit to Klif Classes or provisional "high background" concentration for tributyltin (TBT-concentration on a formulation basis) in blue mussel and dogwhelk 2007 (A), 2008 (B) and 2009 (C), ppm (2.44* mg Sn/kg) dry weight (see maps in Appendix G).]

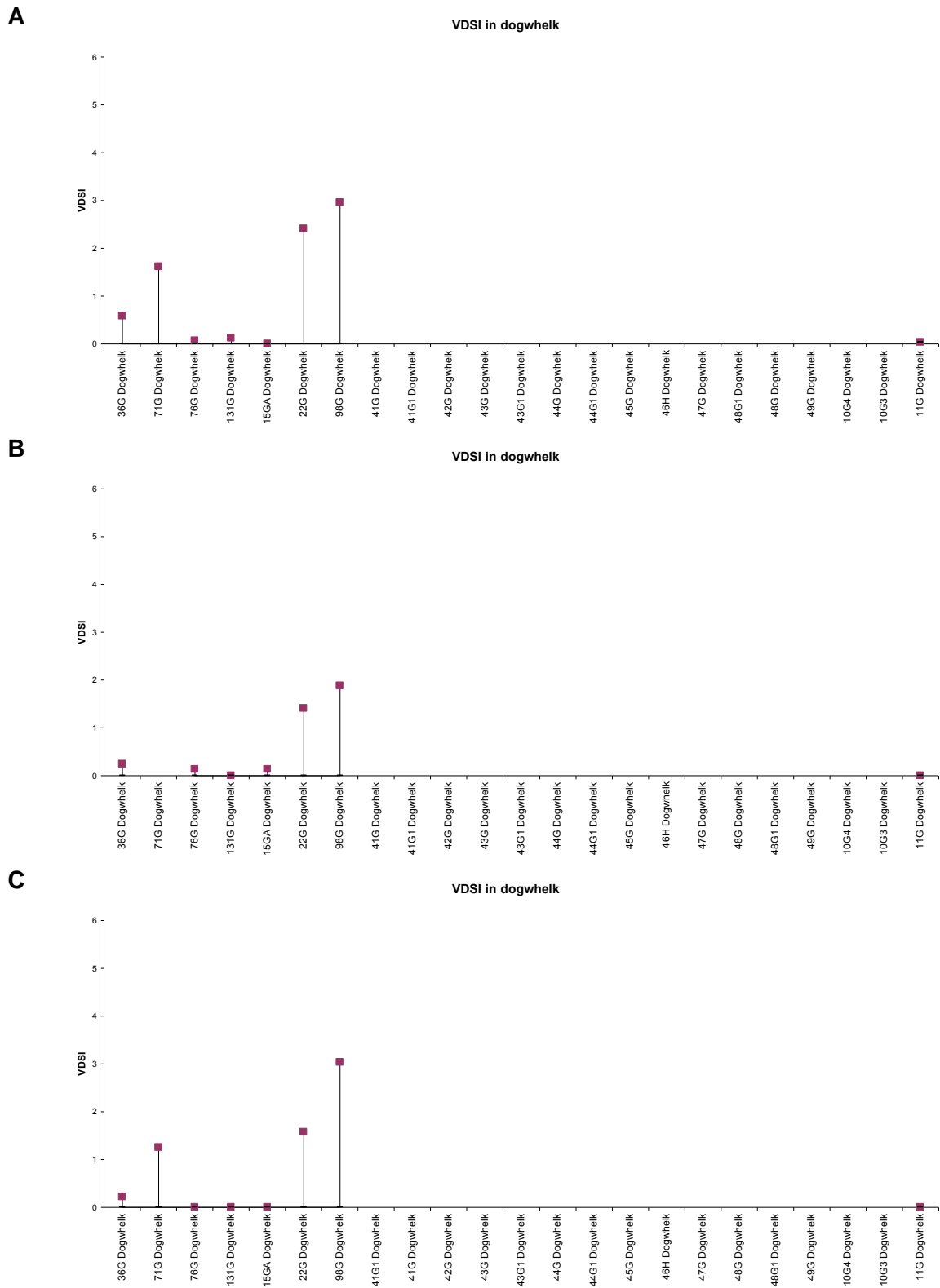


Figure 61. Average VDSI in dogwhelk 2007 (A), 2008 (B) and 2009 (C) (see maps in Appendix G).

Appendix L

Results from INDEX determinations 1995-2009

Introduction

The blue mussel pollution and reference indices are two indices used to evaluate levels of certain hazardous substances in blue mussel from a selection of fjord areas in Norway (Figure 62). The pollution index is based on 26 stations from nine fjord areas regarded as polluted. The reference index is based on results from 8 stations remote from point sources of pollution in five fjord areas.

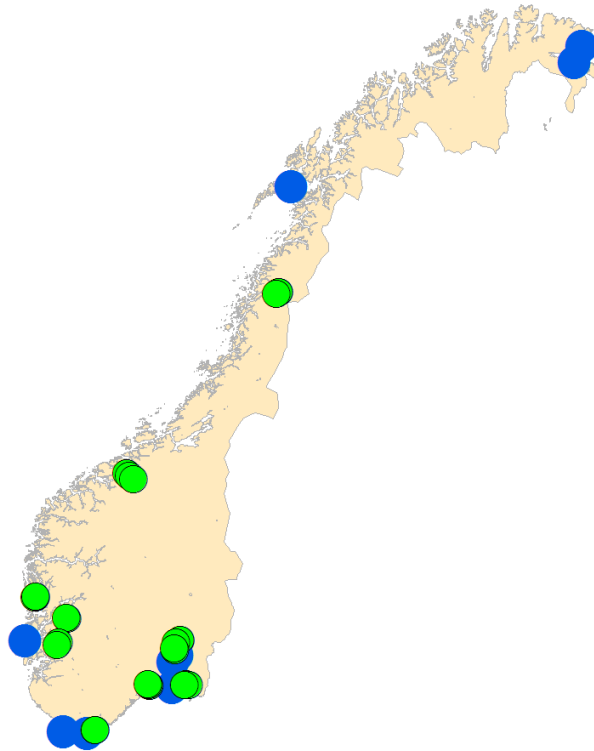


Figure 62. Blue mussel Index stations sampled in 2009; pollution (green circles), reference (blue circles).

The index scale varies from 1 to 5. Based on the analyses each station is classified according to Klif's classification system. Each area or fjord is given a class according to the highest classification registered, e.g. if one station within an area is classified as Class IV, the area is would designated with Maximum Environmental Class (Max.E.C.) of IV, provided that this is the highest classification found for all the stations in that area. A Max.E.C. of 1 means that all stations within an area are insignificantly polluted (Class I in Klif's classification system). There is one Max. E.C. determined for each fjord or fjord area and the average of these is the index. An index of 5 would mean that all the fjords or fjord areas have a Max.E.C. of V or "Extreme" in Klif's classification system.

The indices have been used since 1995 based on contaminant concentrations in blue mussel from 14-19 areas (cf. Green *et al.* 2004). An assessment of their application suggested that the pollution index needed mainly two improvements (Green & Knutzen 2001): 1) more stations to avoid the consequences of insufficient sample size and 2) inclusion of more relevant contaminant analyses with respect to the pollution load expected and in relation to the Klif classification system for environmental quality (Molvær *et al.* 1997). Klif provided funds to improve the index in 2002. Three additional stations have since been established: one in the Frierfjord area (I713 Strømtangen, about 800 m east of I711 Steinsholmen), one in the inner Ranfjord (I964 Toraneskaien, about 500 m north

of 1965 Moholmen) and one in the Sunndalsfjord area (1915 Flåøya, northwest, about halfway between 1913 and the inner most part of the fjord). Dioxin and TBT analyses were added to the programme for samples collected in the Frierfjord area, inner Oslofjord and the inner Kristiansandsfjord TBT-analyses were also included for some of the reference stations (see Annex). These changes affect the outcome of the index and comparison to previous years should be cautioned. For results up to and including 2001 Klif has presented only the results using the old method of calculation, for 2002 the results for both the old and new methods are presented, and for 2003 and since then only the results for the new method are presented. Comparison of the two methods for 2002 and 2003 has been done earlier (Green *et al.*, 2004 a, b).

The Klif Classes are based on the provisional “high background” levels. This system has been revised (Molvær *et al.* 1997); where among other changes the sum of CB-28, -52, -101, -118, -138, -153, and -180 (CBΣ7) is now a distinct parameter for classification. The sum of all PAHs excluding the dicyclic PAHs (PAH_Σ) was compared to the system’s “sum-PAH”. Previously this was the calculation of sum-PAH that included the dicyclic PAHs. As analytical methods improved through the years more non-dicyclic PAHs could be quantified, and included the C1-, C2-, and C3-dibenzophthiophenes, and C1-, C2-, C3- and methylated phenathrenes. These were included in the sum of all non-dicyclic PAHs, and comparison between years could be misleading. For the *National Comments* 2006 (Green *et al.*, 2008a), PAH_Σ was re-calculated, also for previous years, using only the 15 non-dicyclic PAH listed in the EPA protocol 8310¹. The recalculation revealed only one difference from previously reported index values, and that was for the Reference Index 2006 reported to Klif as 1.6 in June of 2007, but the recalculation was 1.4 because PAH_Σ at Lista dropped into Cl.I from Cl.II.

It should also be noted that the Klif classification system is under revision and may affect calculations of the indices in the future. One likely change will be the lowering of limits to the classes for PCBs taking into consideration a lower background from 4 to 3 ppb wet weight suggested by Green & Knutzen (2003).

No special considerations were made when one but not all the stations within an area were sampled. The lack of sufficient samples has occurred several times for the Pollution Index: (st. I205 Bølsnes from Saudafjord 1996, st. 1911 Horvika in the Sunndalsfjord since 1999, st. I021 in the Hvaler area 1999, st.1962 in the Inner Ranfjord since 1999, and st. 1711 Steinholmen in the Frierfjord 2001).

Because insufficient amount of blue mussel were found at station Horvika in the Sunndalsfjord, two new stations were introduced; Fjøseid (1913) in 1999 and Flåøya, northwest (1915), in 2003, about 15 and 5 km farther out the fjord from Horvika, respectively. It can be noted that inclusion of supplementary analyse of blue mussel from the “Hydro kai” (1916), innermost in Sunndalsfjord, would have increased the index. Because sufficient amount of blue mussel was not found at station 1962 Koksverktomta in the Ranfjord since 1999, a new station (1965 - Moholmen) was introduced in 2001 about 2 km south of Koksverktomta.

The Index scale varies from 1 to 5. Index 1 means that all areas or fjords are insignificantly polluted (Class I in Klif's classification system), Index 5 means that at least one sample from each area or fjord is extremely polluted or Class V in Klif's system. A value between 3 and 4 would be between “Marked” and “Severe” (Class III and IV) in the Klif system. A value between 2 and 3 would be between “Moderate” and “Marked” (Class II and III). A value between 1 and 2 would be between “Slight” and “Moderate” (Class I and II).

¹ Acenaphthene, acenaphthylene, anthracene, benzo[*a*]anthracene, benzo[*a*]pyrene, benzo[*b*]fluoranthene, benzo[*ghi*]perylene, benzo[*k*]fluoranthene, chrysene, dibenzo[*a,h*]anthracene, fluoranthene, indeno[*1,2,3-cd*]pyrene, phenanthrene and pyrene. NB. for NIVA's PAH_Σ, a where these cannot be distinguished but included in a group, such as benzo[*b*]fluoranthene benzo[*b,b,f*]fluoranthene, the value for the group is used. A single compound can not be included in more than one group.

Based on nine fjord areas and on the new calculation with the mentioned supplementary stations and supplementary analyses of dioxin and TBT, the Pollution Index for 2009 was 2.8, 0.2 lower than in 2008 (Table 15, Appendix M4, Green *et al.* 2010). A value between 2 and 3 would be termed by the Klif system as "Marked" and between 3 and 4 "Severe".

Only 5 fjords/areas were monitored for the Reference Index for 1998-2009 compared to 7 for 1997 and 8 for 1995-1996 (Table 2, Annex). However, only four of these provided a common basis (cf., Table 16). Similar to the application Pollution Index, the Reference Index made no special considerations when one but not all the stations within an area were sampled. For the four common areas, this has occurred several times, all in the Varangerfjord area (st.48A since 1997 and st.11A since 1998). With Lofoten and the supplementary analyses of TBT included, the Reference Index for 2009 was 1.2, 0.4 lower than in 2008 (Table 2, Annex. Note that 1.4 was erroneously reported for 2008 earlier). Four of the fjords/areas included the TBT analyses. The index decreased one class for the Bømlo-Sotra area because of lower concentration of TBT, and also decreased one class for the Varanger peninsula area because of lower concentration of cadmium. An index value between 1 and 2 would be termed by the Klif system as "Moderate".

Table 15. Maximum environmental classification for fjords selected for Pollution Index. (See text).

Index Area ¹⁾	1995	1996	1997 ²⁾	1998	1999	2000	2001	2002	2002 new ⁷⁾	2003	2003 new ⁷⁾	2004 new ⁷⁾	2005 new ⁷⁾	2006 new ⁷⁾	2007 new ⁷⁾	2008 new ⁷⁾	2009 new ⁷⁾
Hvaler/Singlefjord	2	2	2	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Iddefjord	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inner Oslofjord	3	3	4	2	3	2	2	2	4	2	4	4	4	3	3	3	2
Frierfjord, Grenlandsfjords	3	4	3	3	3	3	3	5 ⁶⁾	5	3 ⁶⁾	5	5	5	5	5	5	5
Inner Kristiansandsfjord	5	5	5	5	5	4	3	3	3	4	4	4	4	3	4	4	4
Saudafjord	4	5	5	3	4	3	3	4	4	2	2	3	2	2	2	2	1
Sørfjord	5	4	3	3	4	4	3	4	4	5	5	4	4	3	3	3	3
Byfjorden, Bergen ³⁾	3	3	3	2	2	2	2	3	3	4	4	3	3	3	2	2	2
Sunnalsfjord	3	3	3 ⁴⁾	2	3	4	2	3	3	1 ⁶⁾	1	1	1	1	2	2	1
Orkdalsfjord	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Inner Ranfjord	5	3	3 ⁵⁾	4	2	2	3	3 ⁶⁾	3	3 ⁸⁾	5	5	3	4	4	4	5
AVERAGE (Pollution INDEX)	3.7	3.6	3.4	3.0	3.1	2.9	2.7	3.2	3.4	2.9	3.6	3.4	3.1	2.9	3.0	3.0	2.8

¹⁾ Iddefjord and Orkdalsfjord not sampled since 1997, hence the indices 1995-96 do not include the local indices from these fjords

²⁾ Copper, zinc and TCDDN excluded since 1997, hence indices for 1995-96 excludes these contaminants

³⁾ PCB (DDT Σ , HCB, HCH $\Sigma\Sigma$ and CB $\Sigma\Sigma$) analysed in stored samples for 1995-1996

⁴⁾ Change in classification (cf. Green *et al.* 1999) due to recalculation of PAHs that excluded the dicyclic compounds

⁵⁾ Change in classification (cf. Green *et al.* 1999) due to calculation error

⁶⁾ Results from supplementary station would not influence the outcome of classification

⁷⁾ Inclusion of supplementary a station in Frierfjord, Inner Ranfjord, and Sunndalsfjord (2003), and supplementary dioxin and TBT analyses for Inner Oslofjord, Frierfjord, and Inner Kristiansandsfjord.

⁸⁾ Results from supplementary station would influence the outcome of classification.

Table 16. Maximum environmental classification for fjords selected for Reference Index. (See text).

Index Area	1995	1996	1997	1998	1999	2000	2001	2002	2002 new ⁵⁾	2003	2003 new ⁵⁾	2004 new ⁵⁾	2005 new ⁵⁾	2006 new ⁵⁾	2007 new ⁵⁾	2008 new ⁵⁾	2009 new ⁵⁾
Mid and outer Oslofjord ¹⁾	2	2	2	1	1	1	2	1	1	1	2	1	1	2	1	2	2
Lista	1	1	1	1	2	2	2	2	2	1	1	2	2	1	1	1	1
Bømlo-Sotra	1	1	1	1	1	2	2	1	2	1	3	2	2	2	2	2	1
Outer Ranfjord, Helgeland ²⁾	(1)	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lofoten ³⁾	(2)	(2)	(1)	(2)	(2)	(1)	(2)	(2)	2	(2)	2	1	1	1	1	1	1
Finnsnes-Skjervøy ²⁾	(2)	(1)	(1)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hammerfest-Honningsvåg ²⁾	(2)	(3) ⁴⁾	(2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Varanger Peninsula	1	2	1	2	1	1	1	1	1	1	1	1	1	1	2	2	1
AVERAGE (Reference INDEX)	1.3	1.5	1.3	1.3	1.3	1.5	1.8	1.3	1.6	1.2	1.8	1.4	1.4	1.4	1.4	1.6⁶⁾	1.2

¹⁾ Inclusion of results for arsenic, nickel and silver in 1996 did not affect the classification

²⁾ Outer Ranfjord, Finnsnes-Skjervøy and Hammerfest-Honningsvåg stations were not sampled in 1998, hence, the index for 1995-97 did not take these results into account. See cf., Green *et al.* 2000 for more details for outer Ranfjord.

³⁾ Inconsistency in sampling site, st.98X in 1995-96 and st.98A in 1997, hence, results from Lofoten excluded. See cf., Green *et al.* 2000 for more details for st 98X.

⁴⁾ Change in classification (cf. Green *et al.* 1999) due to recalculation of PAHs that excluded the dicyclic compounds.

⁵⁾ Inclusion of supplementary TBT analyses for Mid and outer Oslofjord, Lista, Bømlo-Sotra, Lofoten and Varangerfjord Peninsula.

⁶⁾ 1.4 reported earlier.

Appendix L1

INDEX - Sampling and analyses for 1995-2009

Appendix L1. Blue mussel samples planned or used in INDEX and other purposes besides CEMP 1995-2006, where P = "Pollution Index" and R = "Reference Index" (contaminated and assumed "background" stations, respectively). + indicates CEMP sampling and analyses (i.e. equivalent to analysis code A). The number indicates the number samples analysed. Codes for analysis (A, B etc.) are defined in Appendix L2. See Walday *et al.* (1995) for discussion of selection of stations and analyses.

st.	STATION	INDEX	ANALYSIS CODE											CM					
			+	A	B	C	D	E	F	G	H	I	J		K				
HVALER/SINGLEFJORD AREA																			
I021	Kjøkkø, south	P	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
I024	Kirøy, north west	P	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
I022	West Damholmen	P	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
I023	Singlekalven, south	P	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
IDDEFJORD																			
I001	Sponvikskansen	P	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
I011	Kråkenebbet	P	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.
OSLOFJORD, inner																			
30A	Gressholmen	P	.	.	.	.	.	+	3	.	.	.	.	.	3	.	2	2
I301	Akershuskaia	P	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	2
I304	Gåsøya	P	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
I307	Ramtonholmen	P	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
I306	Håøya	P	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.
OSLOFJORD, mid and outer																			
31A	Solbergstrand	R	.	.	.	.	.	.	+	3	.	.	.	.	.	.	.	.
35A	Mølen	R	.	.	.	.	.	.	+	3	.	.	.	.	.	.	.	.
36A	Færder	R	.	.	.	.	.	.	+	3	.	.	.	.	.	.	.	2
FRIERFJORD AREA, west of outer Oslofjord																			
I712	Gjermundsholmen	P	.	.	.	.	.	.	.	.	.	3	.	.	.	.	2	2
I713	Strømtangen	P	.	.	.	.	.	.	.	.	.	3	.	.	.	.	1	2
71A	Bjørkøya	P	.	.	.	.	.	.	+	3	.	.	.	.	.	.	2	1
76A	Risøy	R	.	.	.	.	.	.	+	3	.	.	.	.	.	.	2	1
INNER KRISTRIANSANDSFJORD																			
I1321	Fiskåtangen	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	2	2
I133	Odderø, west	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	1	2
LISTA AREA																			
15A	Gåsøya	R	.	.	.	.	.	.	+	3	.	.	.	.	.	.	.	2
I131A	Lastad	R	.	.	.	.	.	.	.	.	.	3.	.	.	.	.	.	g
SAUDAFJORD																			
I201	Ekkjegrunn (G1)	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
** I205	Bølsnes (G5)	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.
[HAUGESUND AREA not related to INDEX investigation]																			
227A1	Melandsholmen	O	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1
BØMLO-SOTRA AREA																			
22A	Espevær, west	R	+	3	2	c,a
SØRFJORD																			
* 51A	Byrkjeneset	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
52A	Eirtheimsneset	P	.	.	.	.	.	.	+	3	.	.	.	.	.	.	.	c

Appendix L1 (cont'd)

st.	STATION	INDEX	ANALYSIS CODE											CM			
			+	A	B	C	D	E	F	G	H	I	J		K		
BYFJORDEN, BERGEN																	
I242	Valheimsneset	P	.	.	.	.	.	.	.	.	.	3	.	.	.	.
I241	Nordnes	P	.	.	.	.	.	.	.	.	.	3	.	.	.	.
I243	Hagreneset	P	.	.	.	.	.	.	.	.	.	3	.	.	.	.
SUNNDALSFJORD																	
I912	Honnhammer	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
I913	Fjøseid	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
I914	Flåøya, southeast	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
I915	Flåøya, northwest	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
[TRONDHEIM AREA - not related to index investigation]																	
* 80A	Østmarknes	-	.	.	.	.	.	.	.	.	.	.	.	3	.	.	
ORKDALSFJORD AREA (not suggested in Walday et al. 1995)																	
82A	Flakk	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
84A	Trossavika	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
87A	Ingdalsbukta	P	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
INNER RANFJORD																	
I962	Koksverkkaien (B2)	P	.	.	.	.	.	.	.	.	.	.	.	3	.	.	c
I964	Toraneskaien	P	.	.	.	.	.	.	.	.	.	.	.	3	.	.	
I965	Moholmen (B5)	P	.	.	.	.	.	.	.	.	.	.	.	3	.	.	
I969	Bjørnbærviken (B9)	P	.	.	.	.	.	.	.	.	.	.	.	3	.	.	
OUTER RANFJORD, HELGELAND AREA																	
* R096	Breivika, Tomma	R	.	.	.	.	.	.	.	.	.	.	3	.	.	.	a
96A	Breivika, Tomma	R	.	.	.	.	.	.	.	.	.	.	3	.	.	.	a
LOFOTEN AREA																	
98A	Husvågen	R	.	.	.	.	.	.	.	.	.	.	3	.	.	.	2 e
FINNSNES-SKJERVØY AREA																	
41A	Fensneset, Grytøya	R	.	.	.	.	.	.	.	.	.	.	3	.	.	.	c
HAMMERFEST-HONNINGSVÅG AREA																	
44A	Elenheimsundet	R	.	.	.	.	.	.	.	.	.	.	3	.	.	.	a,f
46A	Smineset in Altesula	R	.	.	.	.	.	.	.	.	.	.	3	.	.	.	c,f
VARANGER PENINSULA AREA																	
48A	Trollfjorden i Tanafjord	R	.	.	.	.	.	.	.	.	.	.	3	.	.	.	
10A1	Skagoodden	R	.	.	.	.	.	.	.	.	.	.	+	3	.	.	b
11X	Brashavn	R	.	.	.	.	.	.	.	.	.	.	+	3	.	.	2

* - CEMP station but not sampled in accordance to CEMP guidelines, see Appendix text.

** - Sufficient mussel-sample not found in 1996.

Notes (CM):

- a - blue mussel collected from buoy and/or buoy anchor lines
- b - blue mussel collected from sand/gravel bottom
- c - blue mussel collected from iron/cement pilings
- d - blue mussel collected from metal navigation buoys
- e - blue mussel collected from floating dock
- f - blue mussel collected from wooden docks
- g - blue mussel collected from tire on jetty

Appendix L2

INDEX - Key to analysis codes and sample counts

(Used in Appendix L1)

ANALYSIS CODES¹⁾ See Walday *et al.* (1995) for discussion of selection of analyses.

Contaminant	Analysis code													
	A	B	C	D	E	F	G	H	I	J	K			
Lead	X	X	.	.	.	X	.	.
Cadmium	X	X	X	.	.	X	.	.
Copper ²⁾	X	X	X	.	.	.	.	.
Mercury	X	X	X	.	.	.	.	.
Zinc ²⁾	X	X	X	.	.	X	.	.
EPOCl	X	.	.	.	.	.
PAHs	X	X	.	X	.	.
PCBs	X	.	X	X	.	.	.	.
"Dioxin" ³⁾	X	.
TBT ⁴⁾	X

¹⁾ Concerns MUSSEL - 1 size group (3-5 cm), 3 replicate samples each a bulk of 20 individuals (see text)

²⁾ Concerns MUSSEL - discontinued since 1996

³⁾ Concerns MUSSEL - discontinued since 1995, but reinstated 2002 for st.30A, 71A, I711, I712, I713, 76A, I132 and I133

⁴⁾ Concerns MUSSEL – not included in Walday *et al.* (1995).

Appendix L3

INDEX - Klif Environmental quality classes

(Molvær *et al.* 1997)

As	Arsenic
Pb	Lead
F	Fluoride
Cd	Cadmium
Cu	Copper
Cr	Chromium
Hg	Mercury
Ni	Nickel
Zn	Zinc
Ag	Silver
TBT	Tributyltin
PAH_S	total PAH excluding dicyclic (=PAH_Σ)*
BAP	benzo[<i>a</i>]pyrene
DDTSS	DDTPP+DDEPP+TDEPP (=DDTΣΣ)*
HCB	hexachlorobenzene
HCHSS	HCHG+HCHA+HCHB (=HCHΣΣ)*
CBSSe	sum of CB: 28+52+101+118+138+153+180 *
TCDDN	Sum of TCDD-toxicity equivalents *

*) See also **Appendix C** for definitions.

Basis: D = dry weight, W = wet weight

Units: M = ppm (mg/kg), U = ppb (µg/kg), P = ppp (ng/kg)

Klif's Environmental quality classes for blue mussel (Molvær *et al.* 1997).

Contaminant	basis	unit	Class I	Class II	Class III	Class IV	Class V
As	D	M	<10	10-30	30-100	100-200	>200
Pb	D	M	<3	3-15	15-40	40-100	>100
F	D	M	<15	15-50	50-150	150-300	>300
Cd	D	M	<2	2-5	5-20	20-40	>40
Cu	D	M	<10	10-30	30-100	100-200	>200
Cr	D	M	<3	3-10	10-30	30-60	>60
Hg	D	M	<0.2	0.2-0.5	0.5-1.5	1.5-4	>4
Ni	D	M	<5	5-20	20-50	50-100	>100
Zn	D	M	<200	200-400	400-1000	1000-2500	>2500
Ag	D	M	<0.3	0.3-1	1-2	2-5	>5
TBT	D	M	<0.1	0.1-0.5	0.5-2	2-5	>5
PAH_S	W	U	<50	50-200	200-2000	2000-5000	>5000
BAP	W	U	<1	1-3	3-10	10-30	>30
DDTSS	W	U	<2	2-5	5-10	10-30	>30
HCb	W	U	<0.1	0.1-0.3	0.3-1	1-5	>5
HCHSS	W	U	<1	1-3	3-10	10-30	>30
CBSSe	W	U	<4	4-15	15-40	40-100	>100
TCDDN	W	P	<0.2	0.2-0.5	0.5-1.5	1.5-3	>3

Appendix L4
INDEX - Summary table "Pollution index"
2008-2009

Pollution index 2008-new (with supplementary analyses and stations)

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index, "i" = not investigated)

Average of Max E.C is 3.0

Index area name (Pollution area) 2008	n	N	Pb ppm d.wt	F ppm d.wt	Cd ppm d.wt	Cu ppm d.wt	Cr ppm d.wt	Hg ppm d.wt	Ni ppm d.wt	Zn ppm d.wt	Ag ppm d.wt	PAH_S ppb w.wt	BAP ppb w.wt	DDTSS ppb w.wt	HCb ppb w.wt	HCHSS ppb w.wt	CBSse ppb w.wt	TCDDN ppb w.wt	TBT ppm d.wt	Max E.C I:V
Hvaler/Singlefjorden	3	4	1.55	i	2.37	i	i	0.26	i	i	i	i	i	<0.33	0.07	<0.05	<1.00	i	i	II
Iddefjord	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Oslofjord	5	5	i	i	1.79	i	i	0.11	i	i	i	<10.20	1.8	2.49	0.19	<0.05	15.57	<0.08	0.56	III
Frierfjorden	3	4	i	i	i	i	i	i	i	i	i	i	i	1.49	0.36	<0.10	<2.65	5.76	0.2	V
Inner Kristiansandsfjord	2	3	i	i	i	i	i	i	i	i	i	<466.00	16	<0.30	0.56	<0.15	<0.95	<0.61	0.25	IV
Saudafjord	2	2	7.29	i	2.41	i	i	i	i	i	i	<16.07	0.8	i	i	i	i	i	i	II
Sørfjord	2	2	23.43	i	2.84	i	i	0.26	i	i	i	i	i	3.56	0.07	<0.21	<1.59	i	i	III
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	2.91	0.11	<0.05	8.8	i	i	II
Sunndalsfjord	3	4	i	i	i	i	i	i	i	i	i	<21.23	1.8	i	i	i	i	i	i	II
Orkdalsfjord area	0	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	3	4	24.57	i	2.8	i	i	i	i	i	i	<215.50	16	i	i	i	i	i	i	IV

Pollution index 2009-new (with supplementary analyses and stations)

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index, "i" = not investigated)

Average of Max E.C is 2.8

Index area name (Pollution area) 2009	n	N	Pb ppm d.wt	F ppm d.wt	Cd ppm d.wt	Cu ppm d.wt	Cr ppm d.wt	Hg ppm d.wt	Ni ppm d.wt	Zn ppm d.wt	Ag ppm d.wt	PAH_S ppb w.wt	BAP ppb w.wt	DDTSS ppb w.wt	HCb ppb w.wt	HCHSS ppb w.wt	CBSSe ppb w.wt	TCDDN ppp w.wt	TBT ppm d.wt	Max E.C I:V
Hvaler/Singlefjorden	3	4	1.5	i	1.91	i	i	0.28	i	i	i	i	i	<0.62	<0.05	<0.10	<1.40	i	i	II
Iddefjord	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Oslofjord	5	5	i	i	1.23	i	i	0.08	i	i	i	<46.26	0.54	1.53	0.08	<0.10	6.9	<0.11	0.36	II
Frierfjorden	3	4	i	i	i	i	i	i	i	i	i	i	i	<0.58	0.34	<0.05	2.04	5.97	0.15	V
Inner Kristiansandsfjord	2	3	i	i	i	i	i	i	i	i	i	<191.00	13	<0.58	0.2	<0.05	3.81	<0.64	0.21	IV
Saudafjord	2	2	2.8	i	1.14	i	i	i	i	i	i	<22.83	0.83	i	i	i	i	i	i	I
Sørfjord	2	2	21.21	i	2.29	i	i	0.26	i	i	i	i	i	2.94	0.07	<0.10	<1.34	i	i	III
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	1.79	<0.10	<0.05	8.31	i	i	II
Sunnalsfjord	3	4	i	i	i	i	i	i	i	i	i	<16.84	0.71	i	i	i	i	i	i	I
Orkdalsfjord area	0	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	3	4	18.38	i	1.74	i	i	i	i	i	i	<363.50	41	i	i	i	i	i	i	V

Appendix L5
INDEX - Summary table "Reference Index"
2008-2009

Reference index 2008-new (with supplementary analyses and stations)

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index, "i" = not investigated)

Average of Max E.C is 1.6

Index area name (Reference area)	n	N	Pb ppm d.wt	F ppm d.wt	Cd ppm d.wt	Cu ppm d.wt	Cr ppm d.wt	Hg ppm d.wt	Ni ppm d.wt	Zn ppm d.wt	Ag ppm d.wt	PAH_S ppb w.wt	BAP ppb w.wt	DDTSS ppb w.wt	HCb ppb w.wt	HCHSS ppb w.wt	CBSSe ppb w.wt	TCDDN ppb w.wt	TBT ppm d.wt	Max E.C I:V
2008																				
Mid and outer Oslofjord	2	3	1.11	i	1.21	i	1.58	0.09	0.89	i	0.04	i	0.96	<1.11	0.06	<0.05	<1.82	i	0.1	II
Lista area	1	3	0.55	i	1	i	i	0.07	i	i	i	i	<0.50	0.58	0.09	<0.05	<1.80	i	0.01	I
Bømlo-Sotra area	2	1	2.29	i	1.02	i	0.71	0.12	1.06	i	0.02	i	i	<0.53	<0.03	<0.05	<1.45	i	0.1	II
Outer Ranfjord, Helgeland area	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Lofoten area	1	3	0.71	i	1.42	i	0.71	0.08	0.76	i	0.05	i	i	<0.27	<0.03	<0.05	<0.05	i	0.02	I
Finnsnes- Skjervøy area	0	1	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Hammerfest-Honningsvåg area	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Varanger peninsula area	2	5	1.06	i	2.07	i	2.76	0.04	1.88	i	0.11	i	i	<0.27	<0.03	<0.05	<0.22	i	i	II

Reference index 2009-new (with supplementary analyses and stations)

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index, "i" = not investigated)

Average of Max E.C is 1.2

Index area name (Reference area) 2009	n	N	Pb ppm d.wt	F ppm d.wt	Cd ppm d.wt	Cu ppm d.wt	Cr ppm d.wt	Hg ppm d.wt	Ni ppm d.wt	Zn ppm d.wt	Ag ppm d.wt	PAH_S ppb w.wt	BAP ppb w.wt	DDTSS ppb w.wt	HCB ppb w.wt	HCHSS ppb w.wt	CBSSe ppb w.wt	TCDDN ppp w.wt	TBT ppm d.wt	Max E.C I:V
Mid and outer Oslofjord	2	3	1	i	1.2	i	1.5	0.09	1.67	i	0.1	<6.67	<0.50	1.1	<0.15	<0.05	<1.89	<0.04	0.03	II
Lista area	2	3	2	i	1.5	i	0.5	0.12	1.69	i	0.1	<4.72	<0.50	<0.55	<0.10	<0.05	<1.11	i	0.01	I
Bømlo-Sotra area	1	1	1	i	0.9	i	0.6	0.06	1	i	<0.02	i	i	<1.02	0.04	<0.05	<1.06	i	0.06	I
Outer Ranfjord, Helgeland area	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Lofoten area	1	3	1	i	1.2	i	1.1	0.07	1.19	i	0	i	i	<0.31	0.07	<0.05	<0.58	i	0.02	I
Finnsnes- Skjervøy area	0	1	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Hammerfest-Honningsvåg area	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
Varanger peninsula area	1	5	1	i	1.6	i	1	0.04	1.29	i	0.1	i	i	<0.26	0.06	<0.05	<0.35	i	i	I



Long-term monitoring of environmental quality in Norwegian coastal waters



CLIMATE AND POLLUTION AGENCY

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Contractor Norwegian Institute for Water Research		ISBN-number 978-82-5783-0	
Contracting project manager Norman W. Green		Klif project manager Jon L. Fuglestad	
		TA-number 2716/2010	
		Year 2010	Pages 287
		Klif's contract number 5010007	
Publisher Norwegian Institute for Water Research (NIVA), NIVA-report 6048		Project financed by Climate and Pollution Agency, Klif Klima- og forurensningsdirektoratet, Klif	
Author(s) Norman W. Green Merete Schøyen Sigurd Øxnevad Anders Ruus		Tore Høgåsen Bjørnar Beylich Jarle Håvardstun Åse K. Gudmundson Rogne Lise Tveiten	
Title Hazardous substances in fjords and coastal waters-2009. Levels, trends and effects. Long-term monitoring of environmental quality in Norwegian coastal waters.			
Summary This report is part of the Norwegian contribution to OSPAR's Coordinated Environmental Monitoring Programme (CEMP). CEMP 2009 included the monitoring of contaminants in blue mussel, dogwhelk, cod, and flatfish along the coast of Norway from the Oslofjord to the Varangerfjord. Time trend analyses were performed on a selection of representative contaminants of totalled 859 data series. Of the 538 time series evaluated for the 2009 investigations, 211 were statistically significant trends, 189 of these were downward trends and 22 were upwards. There were 186 of the 538 cases where concentrations in 2009 exceeded the upper limit to presumed background or the upper limit to Class I (insignificantly polluted). The dominance of downward trends indicates that contamination is decreasing.			

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SFPO-nr 1079/2010

Statlig program for forurensningsovervåking omfatter
overvåking av forurensningsforholdene i luft og nedbør,
skog, vassdrag, fjorder og havområder.

Overvåkingsprogrammet dekker langsiktige undersøkelser av:

- overgjødsling
- forsuring (sur nedbør)
- ozon (ved bakken og i stratosfæren)
- klimagasser
- miljøgifter

Overvåkingsprogrammet skal gi informasjon om
tilstanden og utviklingen av forurensningssituasjonen, og
påvise eventuell uheldig utvikling på et tidlig tidspunkt.
Programmet skal dekke myndighetenes
informasjonsbehov om forurensningsforholdene, registrere
virkningen av iverksatte tiltak for å redusere
forurensningen, og danne grunnlag for vurdering av nye
tiltak. Klif er ansvarlig for gjennomføringen av
overvåkningsprogrammet.

TA-2716/2010

ISBN 978-82-577-5783-0