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REPORT

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Abstract

This report is part of the Norwegian contribution to the SIME 2004 meeting administrated by OSPAR. JAMP 2002 included the monitoring of contaminants in blue mussels (50 stations) and cod or flatfish (18 stations) along the coast of Norway from Oslo to Bergen, Lofoten and Varangerfjord. The results indicated elevated levels of contaminants, i.e., poorer than Class I in SFT's classification system, or over provisional “high background”, in the inner Oslofjord (PCBs, mercury and lead in cod; PCBs in mussels), Langesundsfjord (HCB and lindane in mussels) and Sørfjord and Hardangerfjord (cadmium, lead, mercury and DDT (ppDDE) in mussels, and PCBs and mercury in cod). Significant upward trends were found for mercury in cod from the inner Oslofjord and a downward trend was found for HCB in mussels from Langesundsfjord (since 1990) and cadmium in mussels from Sørfjord/Hardangerfjord. The results from the remaining stations showed low or moderate levels of contamination. The “Pollution" and "Reference" indices for respective groups of fjords was classified as severely (Cl.IV and a class higher than 2001) and moderately (Cl.II and the same as 2001) polluted, respectively. Contamination of organotin in mussels and imposex in dogwhelks were still apparent, especially in the Haugesund area. The results from studies using biological effects methods in cod (4 stations) and imposex/intersex in dogwhelks (9 stations) and investigations of DDT at supplementary mussel stations in the Sørfjord are discussed.

4 keywords, Norwegian	4 keywords, English
1. Miljøgifter	1. Contaminants
2. Organismer	2. Organisms
3. Marin	3. Marine
4. Norge	4. Norway

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WORKING GROUP ON CONCENTRATIONS, TRENDS AND EFFECTS OF SUBSTANCES IN THE MARINE ENVIRONMENT (SIME)

LONDON 24-26 FEBRUARY 2004

O-80106

JOINT ASSESSMENT AND MONITORING PROGRAMME (JAMP)

NATIONAL COMMENTS REGARDING

THE NORWEGIAN DATA FOR 2002

Oslo, 23. December 2003

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Foreword

This report presents the Norwegian national comments on the 2002 investigations for the Joint Assessment and Monitoring Programme (JAMP). JAMP is administered by the Oslo and Paris Commissions (OSPAR) and their Environmental Assessment and Monitoring Committee (ASMO). JAMP receives guidance from the International Council for the Exploration of the Sea (ICES). ASMO has delegated implementation of part of the programme to the Working Group on Concentrations, Trends and Effects of Substances in the Marine Environment (SIME). The Norwegian 2002 investigations are directed to particular JAMP issues relating to contaminants and implemented by SIME. JAMP replaced Joint Monitoring Programme (JMP) in 1995.

The Norwegian JAMP for 2002 was carried out by the Norwegian Institute for Water Research (NIVA) by contract from the Norwegian Pollution Control Authority (SFT), (NIVA contract O-80106).

The Norwegian contribution to the JMP/JAMP was initiated by SFT in 1981 as part of the national monitoring programme. It now comprises three areas: the Oslofjord and adjacent areas (Hvaler-Singlefjord area and Langesundsfjord, 1981-), Sørfjord/Hardangerfjord (1983-84, 1987-) and Orkdalsfjord area (1984-89, 1991-93, 1995-96).

Since the North Sea Task Force Monitoring Master Plan was implemented in 1990, additional areas have also been monitored. These include: Arendal, Lista and Bømlo-Sotra areas. On the initiative of SFT and NIVA "reference" or merely diffusely contaminated areas from Bergen to Lofoten have been monitored since 1992 and from Lofoten to the Norwegian-Russian border from 1994.

The comments are presented in accordance with the agreed standardised format (ASMO 1997, Annex 12).

Thanks are due to many colleagues at NIVA, especially: Lise Tveiten, Merete Schøyen, Åse Kristine Rogne, Sigurd Øxnevad, Åse Bakketun, Tom Tellefsen for field work, sample preparations and data entry; Alfhild Kringstad, Merete Grung, Torgunn Sætre, and their colleagues for organic analyses; Bente Hiort Lauritzen and her colleagues for metal analyses; Randi Romstad and her colleagues for biological effects measurements, Gunnar Severinsen for data programme management and operation; and to the authors Ketil Hylland and Anders Ruus (biological effects methods), and Mats Walday (organotin). Thanks go also to the numerous fishermen and their boat crews for which we have had the pleasure of working with.

Oslo, 23 December 2003.

Norman W. Green
Project co-ordinator

Contents

1. General Details

1.1 Executive Summary / *Sammendrag*

The Norwegian JAMP 2002 included the monitoring of micropollutants (contaminants) in blue mussels (50 stations), dog whelks (9 stations) and fish (18 stations) from the border of Sweden in the south along the coast of Norway to the Bergen area, Lofoten and the Varangerfjord bordering Russia. The mussel sites include supplementary stations for the Norwegian Index programme, DDT investigations in the Sørfjorden, and for TBT analyses. The results showed several cases of levels of contaminants, higher than Class I in the Norwegian Pollution Control Authority's (SFT's) classification system, or over provisional “high background”). The major cases were found in:

- Part of JAMP area 26: Oslofjord (up to Cl.III for PCBs, and to a lesser extent lead and mercury), where cod liver from the inner Oslofjord was markedly polluted with PCB (Cl.III) even though the annual median concentration was the third lowest registered and a significant upward trend was found for mercury in cod fillet from both "large" and "small" individuals from the inner Oslofjord 1984-2002,
- Part of JAMP area 26: Langesundsfjord (Cl.V for lindane and Cl.III for HCB in mussels), where a downward trend for HCB since 1990 was found,
- JAMP areas 63 and 62: Sørfjord and Hardangerfjord (for mussels, up to Cl.V for mercury, Cl.IV for lead and DDE, Cl.III for cadmium, and for cod, Cl.III for mercury, Cl.II for PCB,) where a significant downward trend was found for cadmium in mussels at four stations in Sørfjord/Hardangerfjord 1987-2002.

Two environmental indices have been applied annually since 1995 to assess the levels of contamination in mussels from “polluted” and “reference” areas. The 2002 Pollution Index result was in the class "severely polluted" (Cl.IV) in the Norwegian Pollution Control Authority's (SFT's) classification system, a higher class than in 2001. The Reference Index was in the class "moderately polluted" (Cl.II), as in previous years.

The biological effects methods OH-pyrene (pyrene metabolite; marker for PAH exposure), δ-aminolevulinic acid dehydrase (ALA-D; marker for lead exposure), cytochrome P4501A activity (EROD; marker for planar hydrocarbons, such as certain PCBs/PCns, PAHs and dioxins) and metallothionein (MT; marker for metal exposure) were determined in cod from three to four stations along the coast from the Oslofjord to Hardanger. With respect to OH-pyrene metabolites in 2002, there were somewhat elevated levels at sites where fish are moderately exposed to PAH, and generally higher levels than in the previous year (except at Lista). Results for ALA-D indicated exposure to lead to cod from the inner Oslofjord and inner Sørfjord. EROD results for 2002, evaluated against PCB-data, indicated that moderate EROD activities do not disprove an environmental problem, at least with respect to contamination of specific PCB congeners. Variability in hepatic cod metallothionein concentrations appeared to reflect natural endogenous processes involving the two essential metals zinc and copper.

The presence of organotin (as TBT) in Norwegian waters was still a problem in 2002, most evident close to harbours. Concentrations of organotin in mussels and dogwhelks were elevated, and biological effects from TBT were found in dogwhelks from all of the investigated areas. No clear trend in imposex was found, but concentrations of TBT in mussels were lower than previous years. It is a cause for concern that the ban on the use of TBT in antifouling on vessels <25 m of length has not lead to a clear improvement in the investigated areas.

Concentrations of pp'-DDE in mussels from supplemental stations in the Sørfjord indicated two areas with higher levels, one just north of Kvalnes and the other near Urdheim, just south of Krossanes.

Sammendrag

JAMP (Joint Assessment and Monitoring Programme) er et internasjonalt program for miljøovervåking av kystfarvann. Norge er et av tolv land som gjennom Oslo-Pariskonvensjonen (OSPAR) har forpliktet seg til å delta i dette felles overvåkingsprogrammet. Programmet i Norge startet i 1981 og hovedmålsettingen er å overvåke utvikling av miljøgifter i påvirkede områder og ellers langs hele norskekysten. Resultatene fra de minst påvirkede områdene benyttes for å angi "bakgrunnsnivåer". Resultatene rapporteres årlig.

I 2002 omfattet JAMP undersøkelse av blåskjell (på 50 stasjoner, inkludert de til SFTs forurensningsindeks, stasjoner brukt til overvåking av TBT, og tilleggsstasjoner brukt til å kartlegge DDT omfang i Sørfjorden), purpursnegl (9 stasjoner) og torsk eller flatfisk (18 stasjoner) fra svenskegrensen i syd til Bergen, Lofoten og Varangerfjorden mot den russiske grensen. Resultatene tydet på forhøyede konsentrasjoner av miljøgifter, dvs. mer enn Klasse I i SFTs klassifiseringssystem, eller over antatt "høyt bakgrunnsnivå". Disse tilfellene ble registrert i:

- Oslofjorden med opp til Kl.III for PCB og i mindre grad bly og kvikksølv, hvor torskelever fra indre Oslofjord var markert forurenset med PCB (Kl.III) selv om median konsentrasjon for 2002 var den tredje laveste i hele undersøkelsesperioden, og det ble funnet signifikant økende trender for kvikksølv i torskefilet fra både "store" og "små" individer fra indre Oslofjord 1984-2002,
- Langesund for HCB (Kl.V for lindan og Kl.III for HCB i blåskjell) hvor det ble funnet en avtagende trend for HCB siden 1990,
- Sørfjorden og Hardangerfjorden for blåskjell med opp til Kl.V for kvikksølv, Kl.IV for bly og DDE, og Kl.III når det gjaldt kadmium, og for torsk med opp til Kl.III for kvikksølv og Kl.II når det gjaldt PCB, hvor det ble funnet en signifikant avtagende trend for kadmium i blåskjell på fire stasjoner i Sørfjorden/Hardangerfjorden 1987-2002.

SFTs blåskjell-forurensningsindeks og blåskjell-referanseindeks har blitt brukt årlig siden 1995 på en gruppe "forurensede-" og "referanse-" fjordområder. Forurensningsindeksen for 2002 betegnet sin gruppe som sterk forurenset (Kl.IV), en klasse høyere enn i 2001. Referanseindeksen har klassifisert sin gruppe som moderat forurenset (Kl.II) i hele perioden..

Følgende biologiske effekt-parametre ble undersøkt i torsk fra tre-fire stasjoner langs kysten fra indre Oslofjord til Hardanger: OH-pyren (pyren-metabolitt; markør for PAH-eksponering), δ-aminolevulinsyre dehydrase (ALA-D; markør for bly-eksponering), cytokrom P4501A aktivitet (EROD; markør for plane hydrokarboner, slik som spesifikke PCB/PCN, PAH og dioksiner) og metallotionein (MT; markør for metall-eksponering). Det var noe forhøyede konsentrasjoner av OH-pyren i fisk moderat eksponert for PAH, og generelt høyere konsentrasjoner enn foregående år (bortsett fra ved Lista). Resultatene for ALA-D indikerte bly-eksponering for torsk fra indre Oslofjord og indre Sørfjord. EROD-resultater for 2002, evaluert mot PCB-data, indikerte at moderate EROD-aktiviteter ikke avkrefter et miljøproblem, i det minste vedrørende forurensning av spesifikke PCB-kongenere. Videre ser det ut til at variasjon i MT konsentrajonene gjenspeiler naturlige endogene (kroppsegne) prosesser som involverer de essensielle metallene sink og kobber.

Effekter av organotin (bl.a. TBT) kunne fortsatt registreres i 2002, tydeligst i havner eller i områder med mye skipstrafikk. Konsentrasjoner av TBT i blåskjell og purpursnegl var forhøyet, og virkning av TBT (imposex) ble registrert på samtlige stasjoner. Ingen tydelig utvikling i imposex over tid ble registrert, men konsentrasjoner i blåskjell var lavere enn tidligere år. Forbud mot bruk av TBT som begroingshindrende middel på båter <25m i lengde har ikke ført til klar forbedring i de undersøkte områdene.

Konsentrasjoner av DDE i blåskjell fra supplerende stasjoner i Sørfjord tydet på to områder med høye nivåer, et like nord for Kvalnes og det andre nær Urdheim, like syd for Krossanes.

1.2 Introduction

The Norwegian contribution to the "Joint Assessment and Monitoring Programme (JAMP) was initiated by the Norwegian Pollution Control Authority (SFT) and is integrated with SFT's State Pollution Monitoring Programme. The procedures and practice of JAMP has also provided a basis for other investigations of interest to SFT but not necessarily requested by JAMP (e.g. SFT's Index Programme (Pollution and Reference Indices), chapter 1.3.8).

Data are submitted to ICES under three categories: for Purpose A (health assessment) on a voluntary basis, Purpose C (spatial distribution) on a voluntary basis and Purpose D (temporal trend assessment) on a mandatory basis. Where practical, data collection was in accordance to agreed procedures (OSPAR 1990, 1997). Data were screened and submitted to ICES in accordance with procedures outlined by ICES (1996).

This report focuses on issues and situations in Norway concerning contaminants and considered of interest to the implementation of JAMP (Table 1). It should be noted that these issues are being revised (cf., MON 2001). The Norwegian programme for JAMP 2002 has been outlined previously (Green 2002).

Table 1. Extract from list of JAMP issues, subjects and descriptions to which the Norwegian investigations for 2002 can be addressed (cf. ASMO 1997, Annex 30).

Issue	Subject	Description
1.2	Hg, Cd, and Pb	What are the concentrations and fluxes in sediments and biota?
1.3	TBT	To what extent do biological effects occur in the vicinity of major shipping routes, offshore installations, marinas and shipyards?
1.7	PCBs	Do high concentrations pose a risk to the marine ecosystem?
1.8	PCBs	Do high concentrations of non-ortho and mono-ortho CBs in seafood pose a risk to human health?
1.10	PAHs	What are the concentrations in the maritime area?
1.11	PAHs	Do PAHs affect fish and shellfish?
1.12	Other synthetic compounds	How widespread are synthetic organic compounds within the maritime area?
1.15	Chlorinated dioxins and dibenzofurans	What concentrations occur and have the policy goals (for the relevant parts of the maritime area) been met?
1.17	Biological effects of pollutants	Where do pollutants cause deleterious biological effects?
5.3	Chemical used [mariculture]	In which areas do pesticides and antibiotics affect marine biota?
6.1	Ecosystem health	How can ecosystem health be assessed in order to determine the extent of human impact?

The chapter structure of this report for the first and second level is according to agreed format (ASMO 1997, Annex 12) which *inter alia* presents results before methodology.

1.3 Information on measurements

An overview of JAMP stations in Norway is shown in the tables in Appendix E and maps in Appendix F. The stations and sample counts relevant to the 2002 investigations are noted in the tables in Appendix E. Data reports have been published recently for sediment 1986-1997 (Green *et al.* 2002a) and biota 1981-2001 (Green *et al.* 2002b-d).

Blue mussels were sampled at 50 stations (including supplementary stations for Index and TBT), dog whelks from 9 stations and fish from 18 stations from the border to Sweden in the south to the border to Russia in the north. Generally, mussels are not abundant on the exposed coastline from Lista (south Norway) to the North of Norway. A number of samples were collected from dock areas, buoys or anchor lines.

This chapter focuses on the principle cases where *median* concentrations exceeded provisional "high background" ("normal"). The median concentration can be derived from the tables in Appendix H or figures in Appendix I, depending on the year and concentration basis in question. Where possible, these medians are classified according to the Norwegian Pollution Control Authority's (SFT's) **environmental quality classification system** (cf. Molvær *et al.* 1997). An extract of the system that is applied in this report is shown in Table 6 and includes unofficial conversion to other bases. The system does not cover some contaminants for some species-tissues, however provisional "high background" concentrations have been determined and these are listed in Table 7. "High background" concentrations set the upper limit for Class I in SFT's system. The factor by which concentrations exceeded “high background” is termed **overconcentration**. "High background" concentration corresponds to the upper limit to Class I, or insignificantly polluted. Below the median concentrations are assessed according to the SFT system, but where this is not possible overconcentrations are used. The term "significant" refers to the results of a statistical analysis of linear trends shown in Appendix H. More details concerning these terms and methods can be found in chapter 2.1.2.

1.3.1 Oslofjord area

Mussels from the inner Oslofjord were moderately polluted with ΣPCB-7 (SFT's Cl.II, Figure 1A). Cod liver from the inner Oslofjord was markedly polluted with ΣPCB-7 (Cl.III, Figure 2A). The median concentration in cod liver was 2230 ppb w.w., third lowest recorded for the entire period (1990-2002). Cod liver from the outer Oslofjord was insignificantly polluted with regard to ΣPCB-7 (st.36B, Figure 2B).

In 1994, and renewed in 2002, the Norwegian Food Control Authority (SNT) advised not to consume liver of cod from the inner Oslofjord (north of st.31A, see Map 1 in Appendix F) due to concerns about PCB contamination (cf. Table 4).

A significant linear *downward* trend was detected (see method description in chapter 2.1.3) for ΣPCB-7 in mussels from the inner Oslofjord (30A and 31A, Figure 1A, B) for the period 1988 to 2002.

Power analyses (see chapter 2.1.3) indicated that a hypothetical trend of 10% change per year in ΣPCB-7 concentration in the blue mussel from the inner Oslofjord would take 10 to 13 years to be detected with 90% significance (Appendix H).

The fillet of "small" (41-46 cm[1]) and “large” cod (49-57 cm) from the inner Oslofjord was moderately polluted with mercury (Cl.II, Figure 3A, B). A significant *upward* trend was detected for the period 1984-2002 for both size groups, even though the concentrations in 2002 were lower than 2001. "Large" cod (53-59 cm) from the outer Oslofjord were also moderately polluted with mercury (Figure 3A, B). The power, indicated as number of years to detect a hypothetical 10% change per year for mercury in cod fillet from either station, was slightly better for “small” fish (10-11 years) than “large” fish (13 years) (cf. Appendix H). Concentrations of mercury when considering the entire period were significantly higher in "large" cod compared to "small" cod. Flounder fillet from mid Oslofjord was insignificantly polluted (Cl.I) (st.33B, Appendix H).

Median concentration of lead in cod liver from the inner Oslofjord (30B) was 0.51 ppm w.w. and just over 5 times "high background". The concentration was the second highest found during the entire period (1990-2002).

Median concentration of HCB in flounder liver from mid Oslofjord (33B) was 13 ppb w.w. and over twice estimated "high background" (5 ppb w.w.). The concentration was the highest ever registered at this station.

The SFT's environmental quality classification system does not include lead in cod liver or HCB in flounder liver.

It should be noted that the Index programme indicated severe concentrations of TBT in mussels from a station located in the inner Oslofjord (see chapter 1.3.8).

[1] The size of "small" and "large" cod depends on the station-year catch, and hence may vary (see section 2.1.3. The range given is the lower and upper quartile of the median lengths of the "small" or "large" fish.

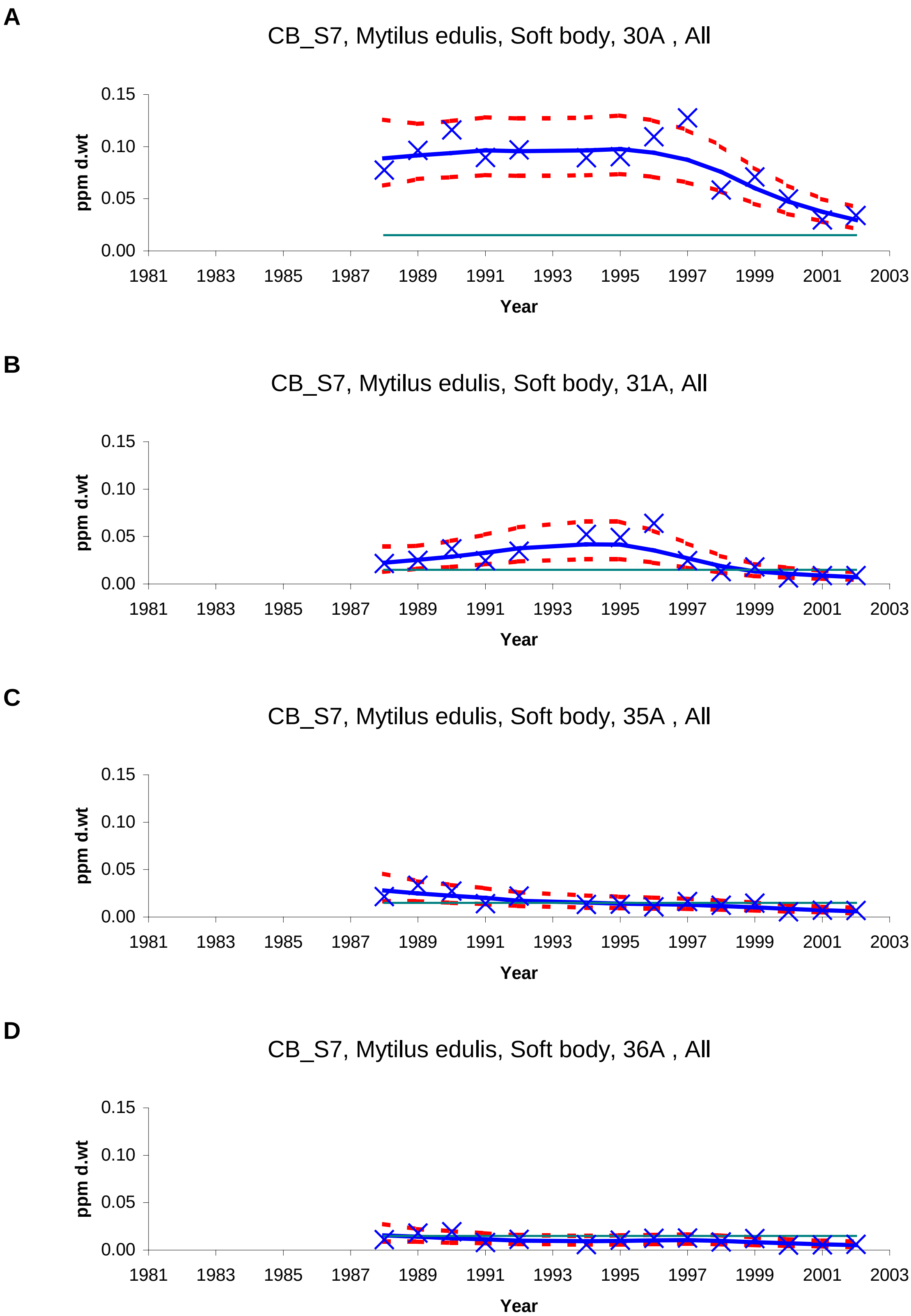


Figure 1. Median CB_S7 (=ΣPCB-7, sum of PCB 28, 52, 101, 118, 138, 153 and 180) concentration in blue mussel (*Mytilus edulis*) from inner (st.30A) to outer (st.36A) Oslofjord. (cf. Appendix F and key in Figure 22, page 42).

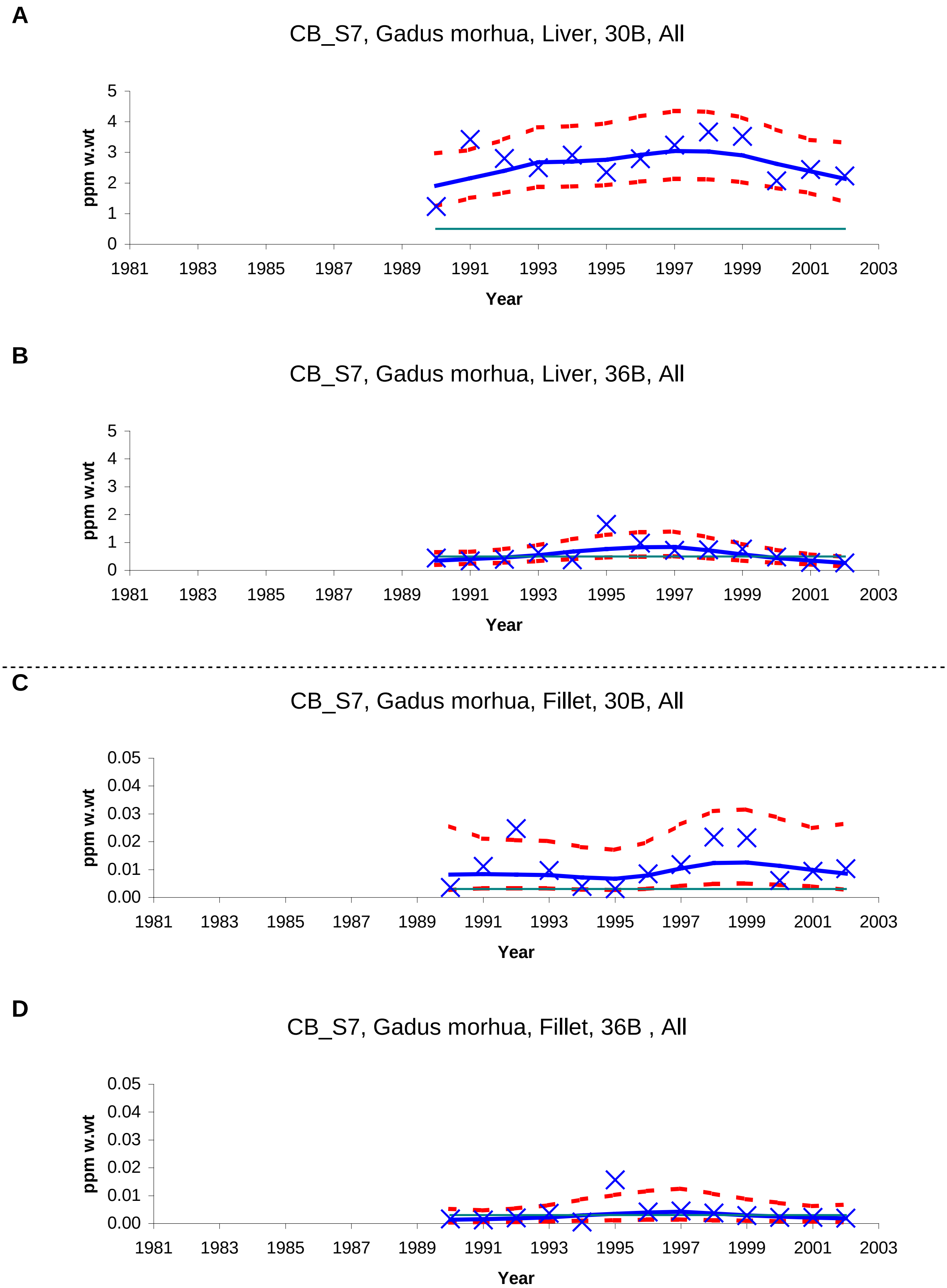


Figure 2. Median CB_S7 (=ΣPCB-7, sum of PCB 28, 52, 101, 118, 138, 153 and 180) concentration in liver and fillet of cod (*Gadus morhua*) from the inner (st.30B) to outer (st.36B) Oslofjord. (cf. Appendix F and key in Figure 22).

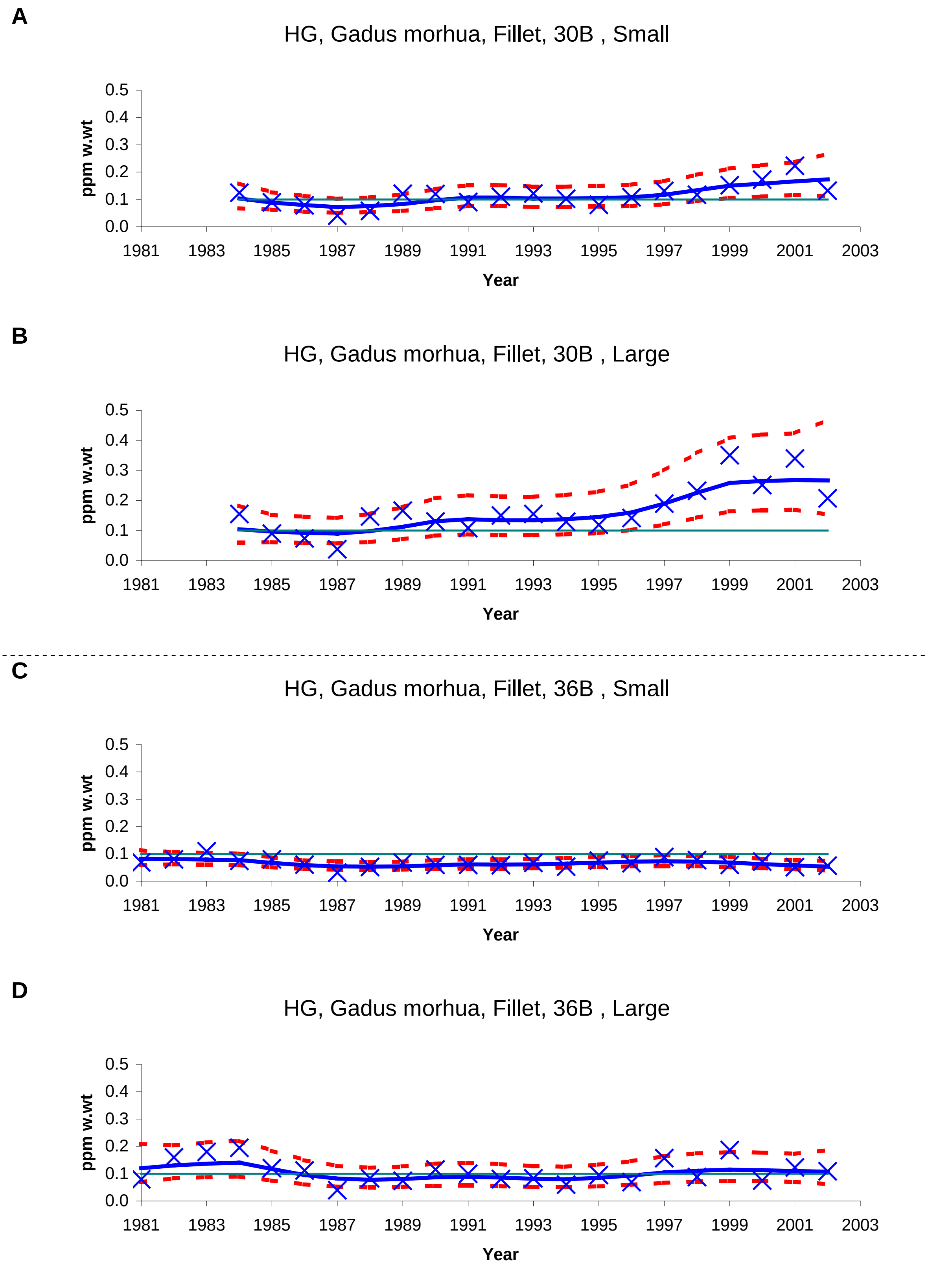


Figure 3. Median mercury (Hg) concentration in fillet of cod (*Gadus morhua*): for the inner Oslofjord (st.30B) “small” (**A**) and “large” (**B**) fish, and for the outer Oslofjord (st.36B) “small” (**C**) and “large” (**D**) fish. (cf. Appendix F and key in Figure 22).

Mussels from Langesundsfjord (st.71A) in 2002 were markedly polluted with HCB (Cl.III, Figure 4). Concentrations have varied greatly since 1983 but median value have decreased distinctly since 1989 (Figure 4) due to about 99% reduction in discharge of HCB and other organochlorines from a magnesium factory (cf. Knutzen *et al.* 2001).

The power of the monitoring programme was 15 years for the period 1990-2002 and more than 25 years for the entire period (cf. Appendix H). The 1983-2002 data indicated no significant trend, whereas the 1990-2002 period had a significant *downward* trend.

Extremely high lindane concentrations (Cl.V) were found in blue mussels from this station. The median value was 479 ppm dry wt. and over 80 times higher than any other value recorded in this programme. The concentrations in the three replicate samples ranged from 267 to 1287 ppm dry wt. Reanalyses confirmed these results. Concentrations in mussels collected the same day at nearby stations (I712 and I713) 3-5 km away and farther in the fjord were below the detection limit (<0.5 ppm dry wt.). As yet, no explanation has been found for this anomaly.

It should be noted that under the Index programme, concentrations of dioxins in mussels from nearby stations were extreme (Cl.V, see chapter 1.3.8).

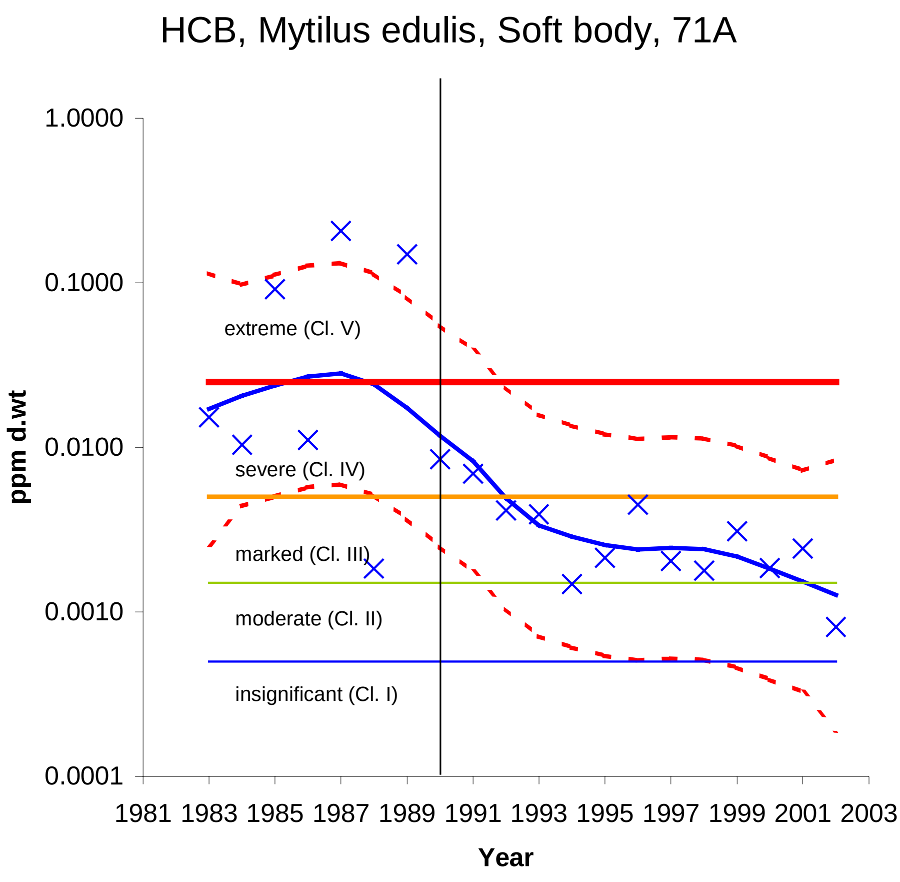


Figure 4. Median HCB concentration in blue mussel (*Mytilus edulis*) from Langesundsfjord (west of Oslofjord). (cf. Appendix F and key in Figure 22). Vertical line indicates when a magnesium factory reduced it's discharge by 99%. Horizontal lines indicate classes as defined in Table 6. **NB: log-scale.**

It should be noted that dioxin is one of the contaminants monitored to establish the Pollution Index (see section 1.3.8). Dioxin toxicity equivalents based on the Nordic model (TCDDN) in mussels from 71A were severe (SFT Cl.IV) and extreme values were found at nearby Index stations (I711, I712 and I713) (Figure 38). Since 1996 values have decreased at stations 71A and I712 but increased at I711.

1.3.2 Sørfjord and Hardangerfjord

The development of the contaminant conditions in these connected fjords and the main remedial actions that have been taken, have been outlined in the JAMP National comments for 1989 (Green 1991)) and in recent reports concerning Sørfjord in particular (Skei 2000, 2001, Skei & Knutzen 2000, Skei *et al.* 1998). The results from JAMP 2002 are coupled to other studies in this area (cf. Knutzen & Green 2001a, Ruus & Green 2002, 2003) and confirm that the Sørfjord, and in some cases also Hardangerfjord, continue to be contaminated especially with cadmium (Figure 5 and Figure 6), lead, mercury (Figure 7 and Figure 8), ppDDE (Figure 11, Figure 12 and Figure 13) and to a lesser extent PCB (Figure 10, Figure 13).

In 2002 the Norwegian Food Control Authority (SNT) extended their advice against the consumption of mussels to include all seafood in the Sørfjord including deep-water fish due to concerns about metal and PCB contamination (Table 4).

Results for mussels collected from the Sørfjord indicated that these were moderately (Cl.II) or markedly polluted (Cl.III) with cadmium in respect to SFT's classification system (Figure 5, Appendix H). Mussels as far as Lille Teløy in Hardangerfjorden (st.69A), over 100 km from the head of Sørfjorden, were markedly polluted with cadmium (Figure 6). A significant *downward* trend was found for cadmium at two stations in Sørfjord (st.56A and 57A) and two in Hardangerfjord (st.63A and 65A) (Appendix H). Also, lead concentrations at two stations (st.51A and 56A) were severe (Cl.IV). A *downward* trend was found for lead at st. 63A and 65A, 1987-2002. Mercury was extreme (Cl.V) at one station (st.51A).

Cod fillet from "large" individuals (46-56 cm) from the inner Sørfjord (st.53B) was markedly polluted with mercury (Cl.III). The median concentration in 2002 was 0.4 ppm w.w. compared to 0.7 ppm in 2001. Overconcentrations for mercury were found in fillet in flounder (4-6 times "background") and an *upward* trend was found also. Overconcentrations were found for cadmium in cod liver and flounder liver from inner Sørfjord (4 and 9 times, respectively). Overcentrations of lead in liver for these fish species were also registered (1 and 4 times, respectively).

The power of the sampling strategies for mussels was relatively poor for samples collected from Odda; the innermost part of Sørfjord (st.51A or 52A). For example for lead in mussels, it is estimated that it would take 20-24 years to detect a hypothetical trend of 10% per year with 90% significance (Appendix H). This reflects the large variability found in the data series from this area. The variability is mostly due to the irregular/accidental input of contaminated discharges. The power improved with distance from Odda, and at Ranaskjær (st.63A, ca.50km from Odda) it was only 10 years.

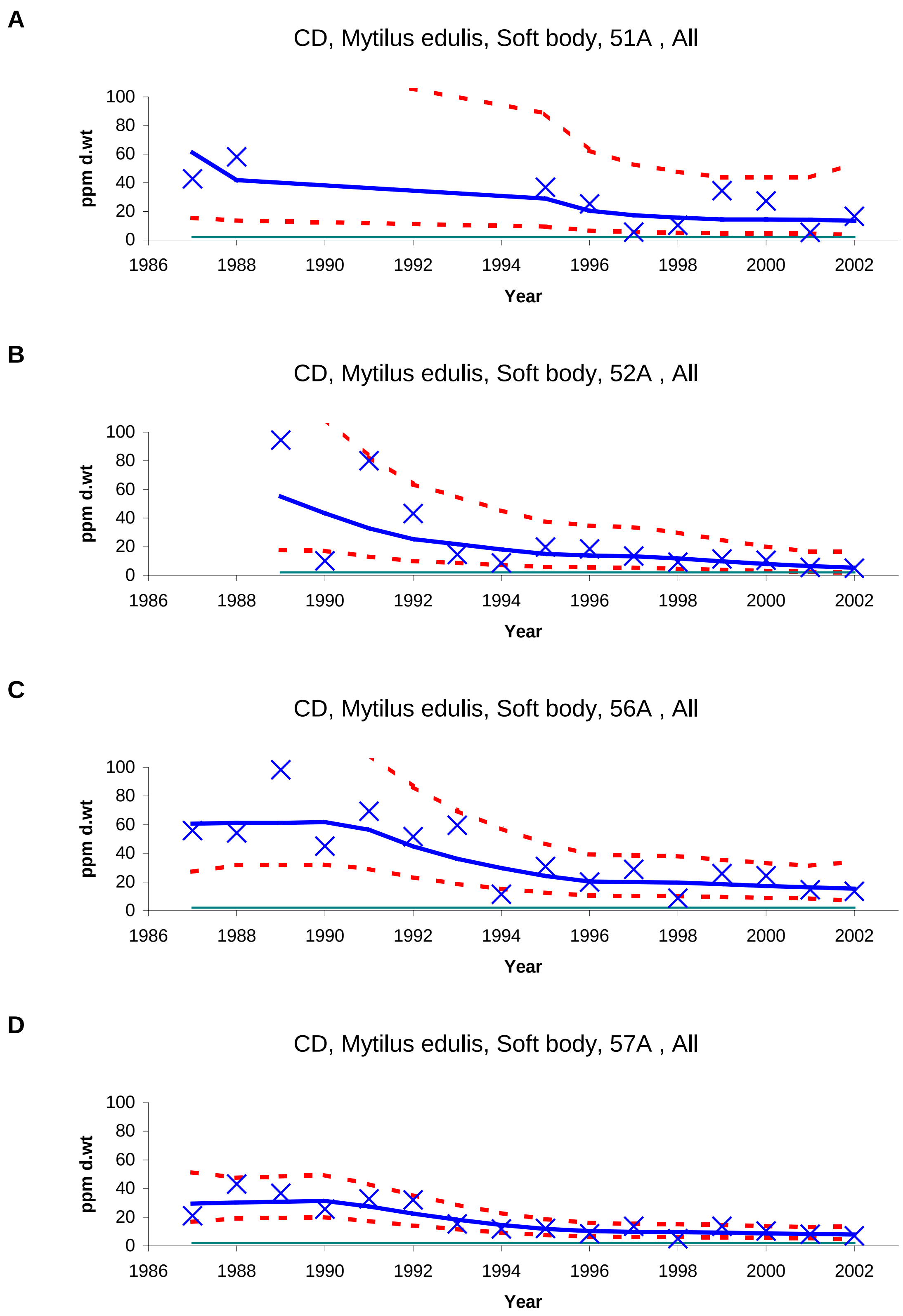


Figure 5. Median cadmium (Cd) concentration in blue mussel (*Mytilus edulis*) from inner (st.51A) to outer (st.57A) Sørfjord. NB: (cf. Appendix F and key in Figure 22). **Note: for some years the upper confidence interval line is off-scale in figures A and B. Note: horizontal line for "high background" near x-axis.**

A
B
C

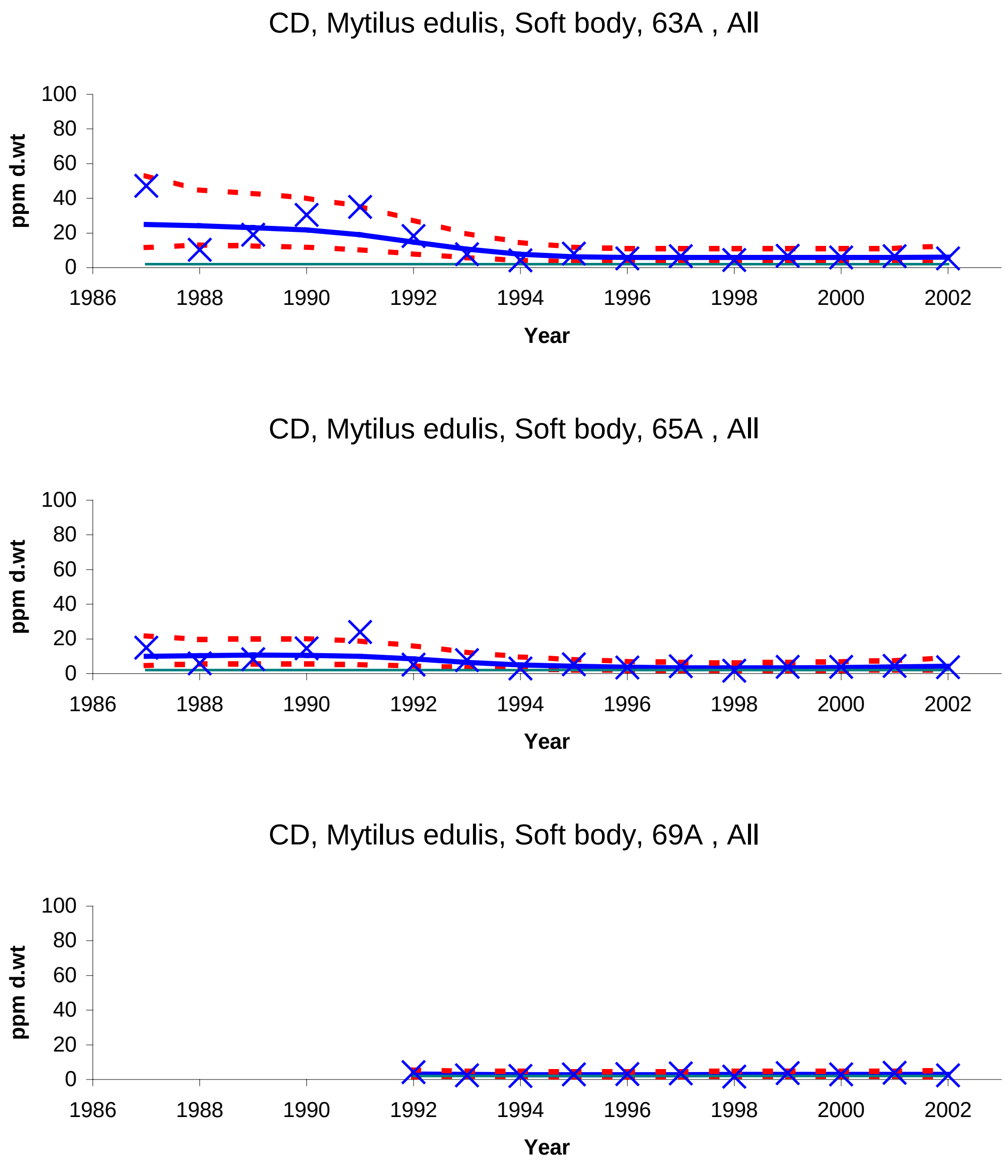


Figure 6. Median cadmium (Cd) concentration in blue mussel (*Mytilus edulis*) from Hardangerfjord (st. 63A, 65A and 69A). (cf. Appendix F and key in Figure 22). **Note: horizontal line for "high background" near x-axis.**

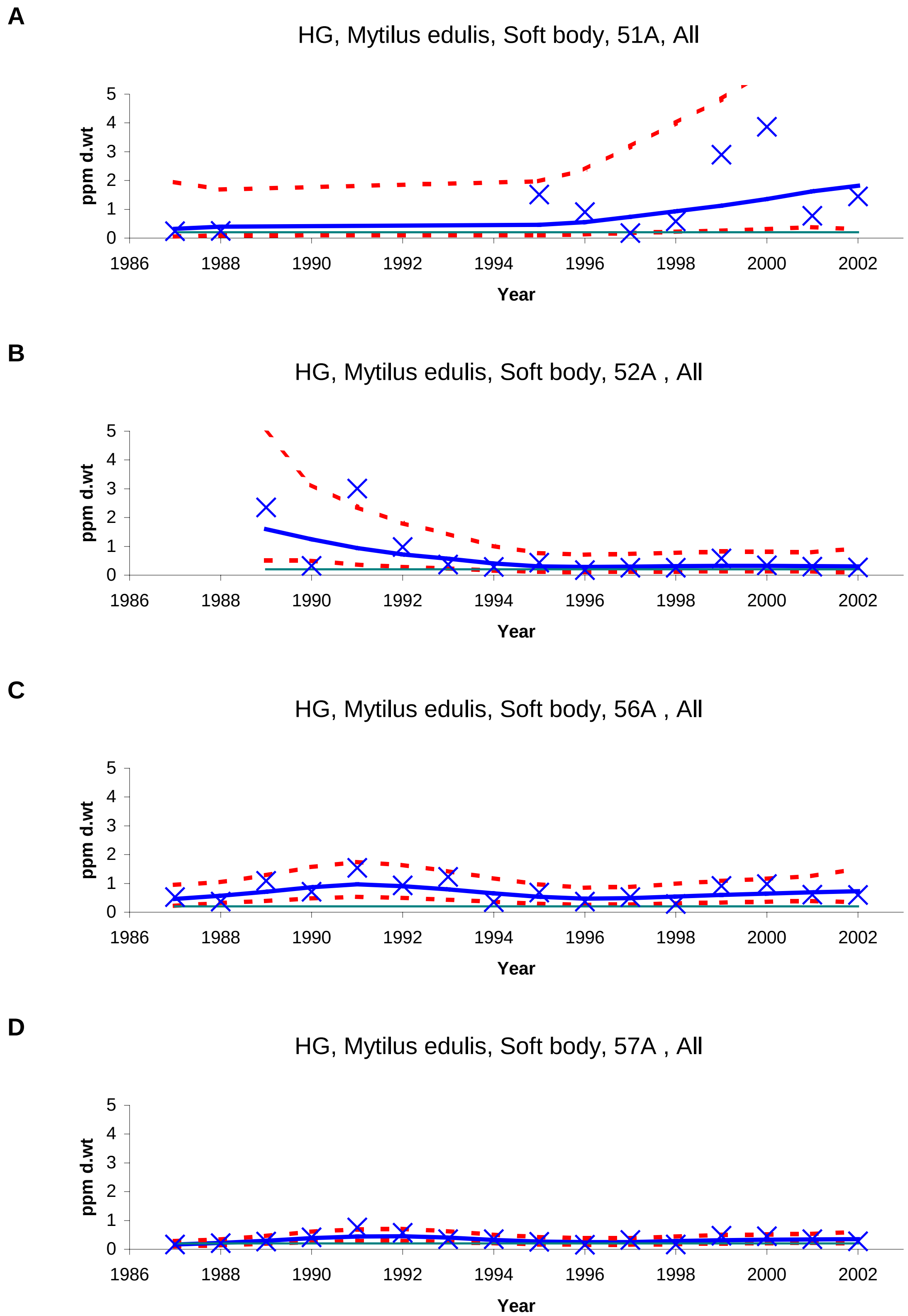


Figure 7. Median mercury (Hg) concentration in blue mussel (*Mytilus edulis*) from inner (st.51A) to outer (st.57A) Sørfjord. (cf. Appendix F and key in Figure 22). **Note: for some years the upper confidence interval line is off-scale in figures A and B. Note: horizontal line for "high background" near x-axis.**

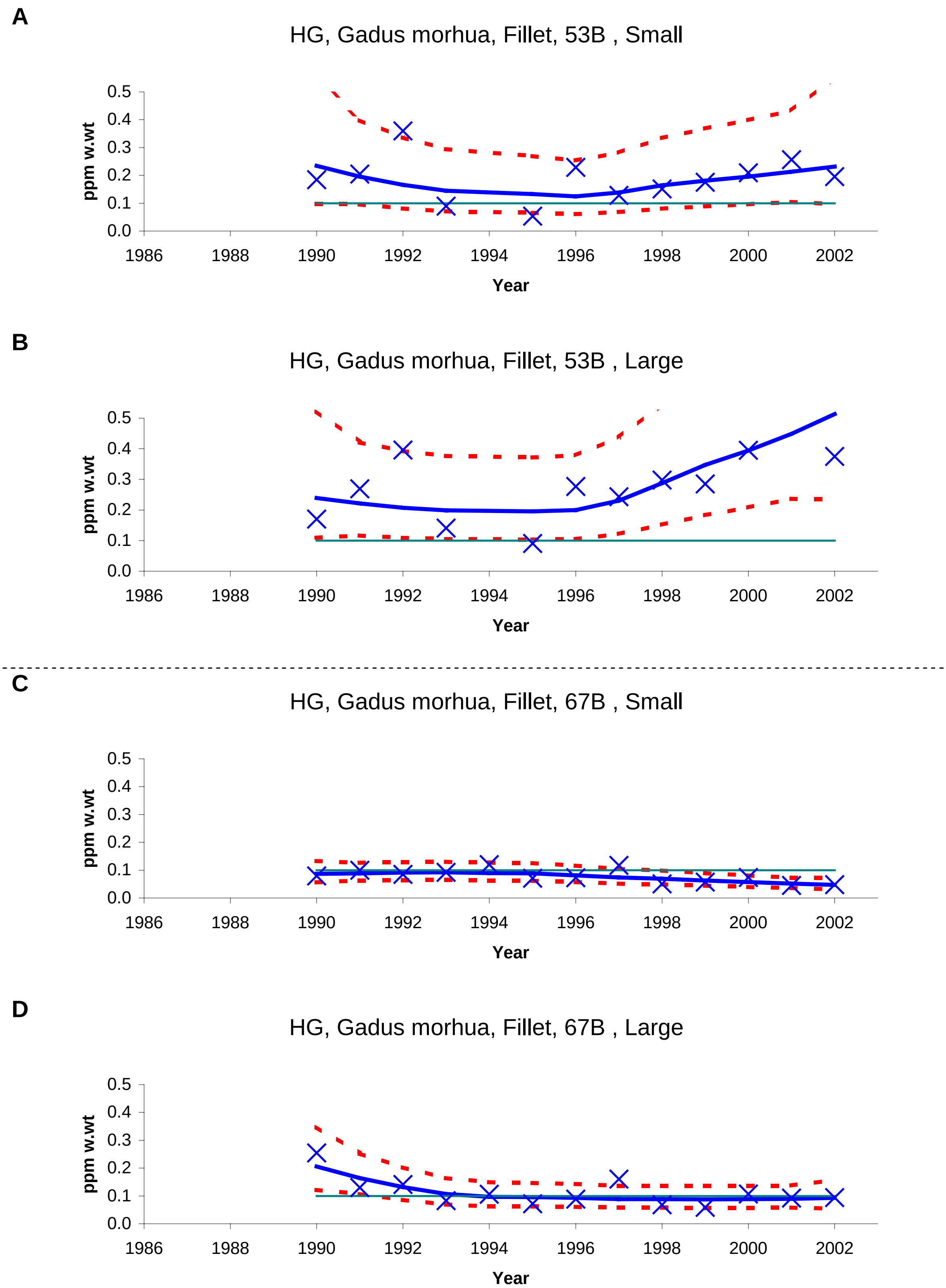


Figure 8. Median mercury (Hg) concentration in fillet of cod (*Gadus morhua*): from Sørfjord (st.53B) for "small" (**A**) and "large" (**B**) fish and Hardangerfjord (st.67B) for "small" (**C**) and "large" (**D**) fish (cf. Appendix F and key in Figure 22).

Mussels at one station (st.56A) near the outer Sørfjord were severely polluted with ppDDE (Cl.IV, Figure 11 and Figure 12). The highest median concentration here was 60 ppb d.w. Just 5-8 km away the mussels were insignificantly or only moderately polluted (Cl.I or II) (Figure 9). Cod fillet from the Sørfjord was only moderately polluted with ppDDE (Cl.II). Median concentration in cod liver was insignificant (Cl.I) in contrast to many previous years (Figure 13, Appendix H).

The source of ppDDE is uncertain. Analyses of supplementary stations between 56A and 57A indicated for 1999 that there may be several sources (cf., Green *et al.* 2001a, c). A more intensive investigation in 2002 with seven sampling points between 56A and 67A (56A1, 56A3, 56A4, 56A5, 56A2, 572 and 57A1) confirmed that there are two main areas with high concentrations (Figure 9). One area is near st.56A1, just north of Kvalnes and the other is near 57A1, Urdheim, just south of Krossanes. The Sørfjord and Hardangerfjord area has a considerable number of fruit orchards. Earlier use and persistence of DDT and leaching from contaminated soil is probably the main reason for the elevated levels found. DDT products have been prohibited in Norway since 1970 (excepting the dipping of spruce seedling until 1987).

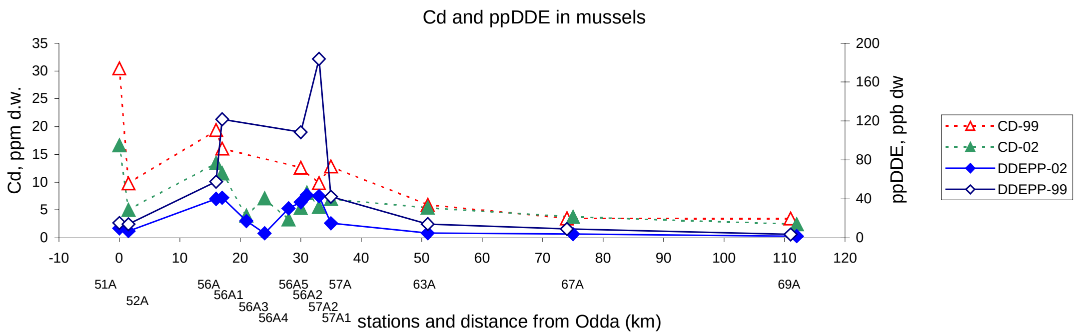


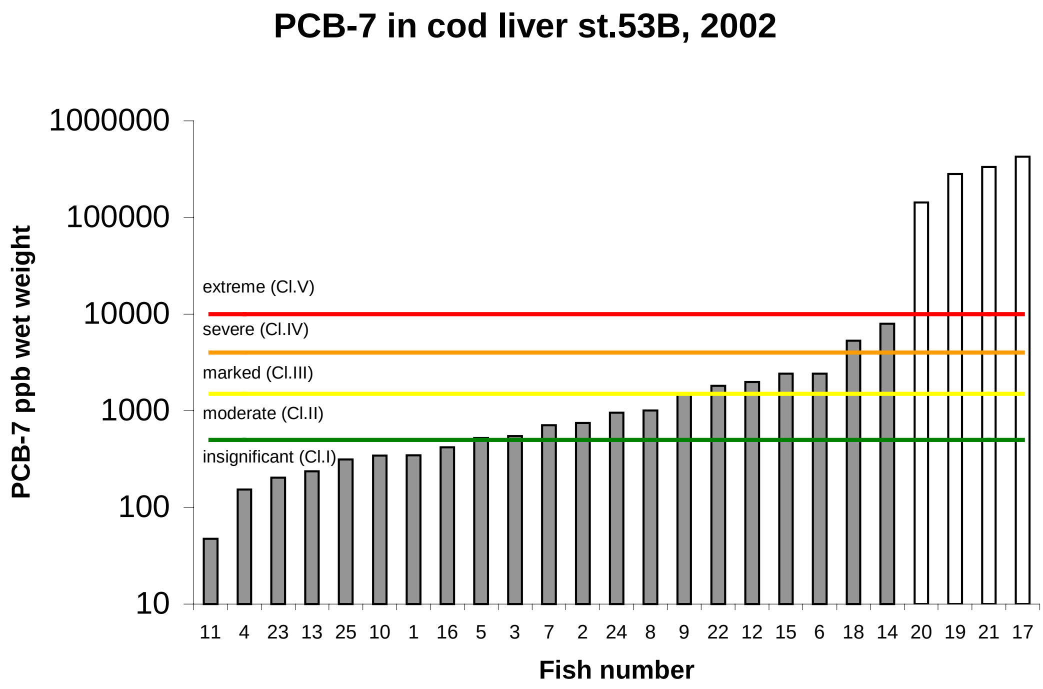
Figure 9. Median cadmium (Cd) and ppDDE concentration in blue mussel (*Mytilus edulis*) from the Sørfjord and Hardangerfjord region 1999 and 2002. Mussels from stations 56A, 57A, 63A, 67A and 69A were depurated which may influence comparisons to others stations (see chapter 2.1.4).

Median concentrations of ΣPCB-7 in mussels Sørfjord were insignificant (Cl.I) in contrast to 2001 when the concentrations varied from moderate (Cl.II) to severe (Cl.IV) (Green *et al.* 2003). Cod liver from inner Sørfjord (st.53B near Tyssedal) was moderately polluted with ΣPCB-7, but some fish had extremely high concentrations (Figure 10A). The four highest ranged from 143000 to 427000 ppb wet weight. The lower limit to Class V is 10000 ppb wet weight. These are the highest ever recorded in the JAMP programme. The high concentrations in mussels in 2001 are thought to be linked to wall paint/plaster from the Tyssedal power station (Ruus & Green 2002). This is probably also the reason for the high concentrations found in four cod from 2002 (Ruus & Green 2003). The PCB profile for these four cod were similar to the profile for the paint/plaster with higher fraction of CB-101, -105 and -118 and lower fractions of CB-153 and -180 compared to other profiles (cf. Figure 10B). A review of the profiles in cod-liver samples 1999-2001 did not indicate such similarity to the paint/plaster profile. The results from biological effects measurement EROD on these cod are discussed in section 1.4.3.

Median concentrations of ΣPCB-7 in liver of cod from Hardangerfjord for 2002 were insignificant. Since JAMP monitoring started in the Sørfjord and Hardangerfjord the median values have varied between 100 and 2400 ppb w.w. This indicated that cod is subject to a variable exposure from PCB, but the cause of this variation is not clear.

No trends were evident in these organisms for ppDDE and ΣPCB-7 during the period 1990-2002, with the exception for these substances in flounder fillet from inner Sørfjord.

A



B

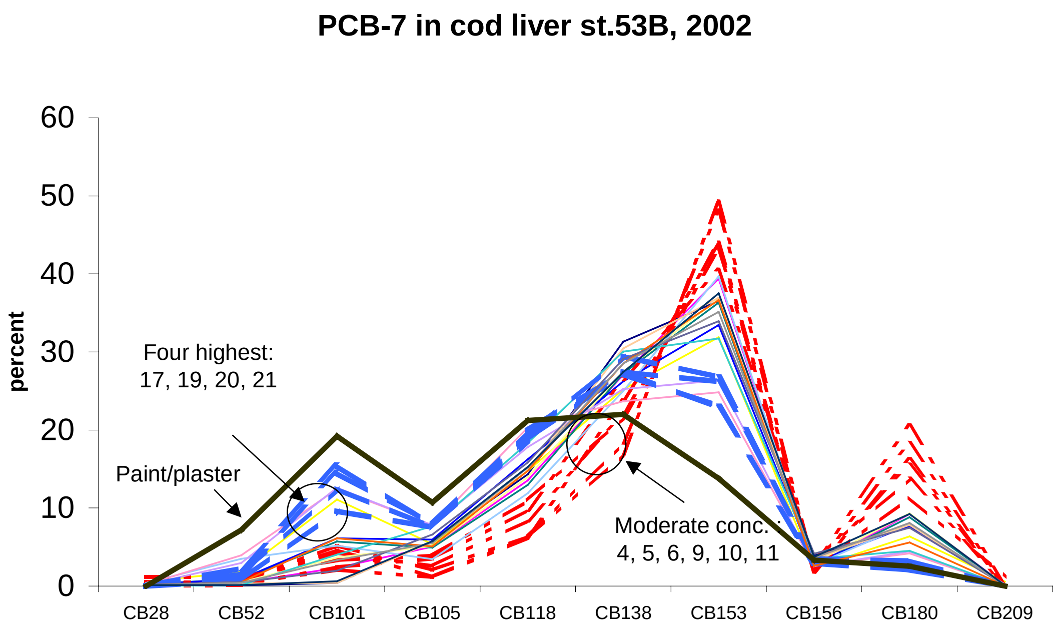


Figure 10. PCB in liver from 25 cod (*Gadus morhua*) from Sørfjord (st.53B) 2002, **A**) concentrations for PCB-7 (=ΣPCB-7) and **B**) percent contribution from 10 different PCB congeners. The profile for paint/plaster is also indicated figure in **B**. See text.

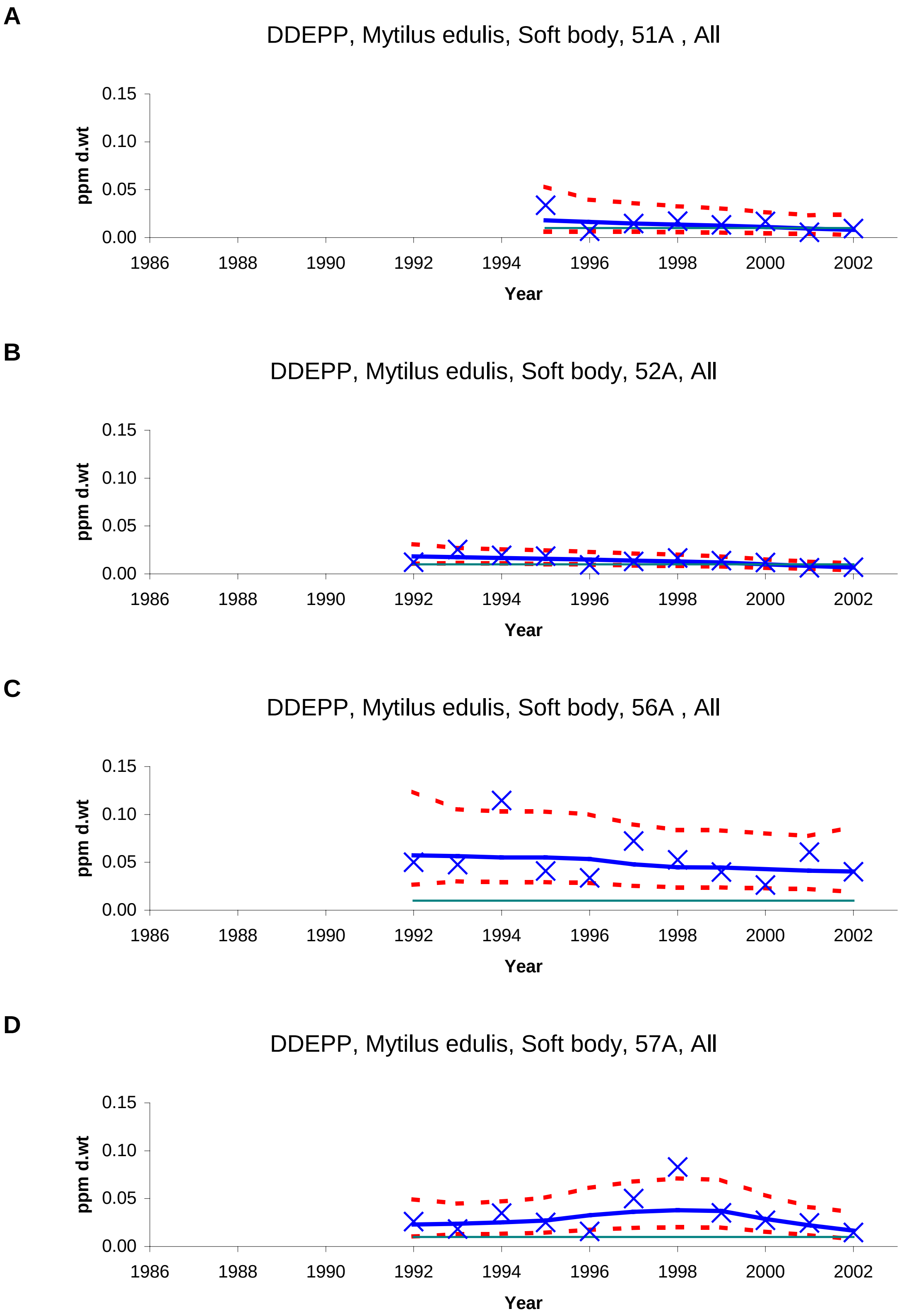
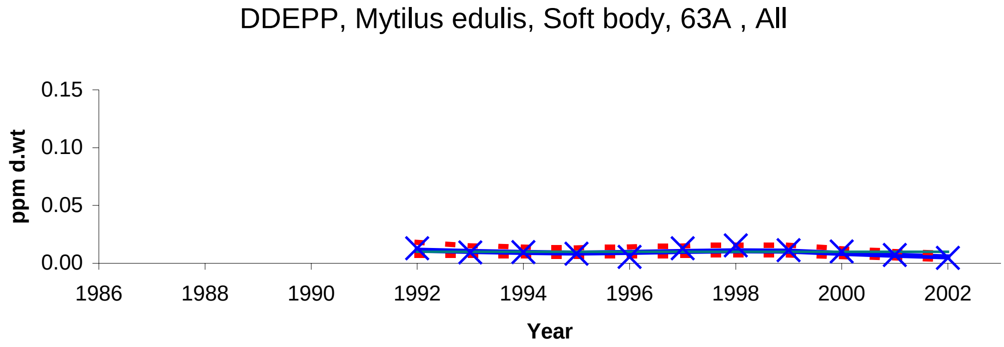
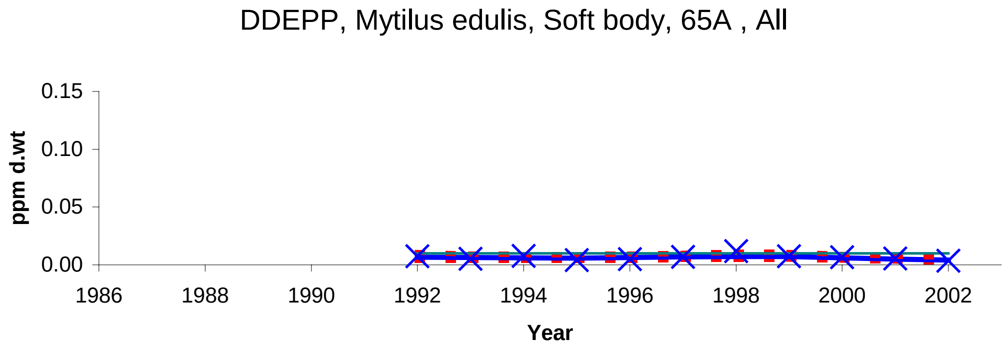


Figure 11. Median ppDDE (DDEPP) concentration in blue mussel (*Mytilus edulis*) from inner (st.51A) to outer (st.57A) Sørfjord. (cf. Appendix F and key in Figure 22). **Note: for some years the upper confidence interval line is off-scale in figure C. Note: horizontal line for "high background" near x-axis.**

A



B



C

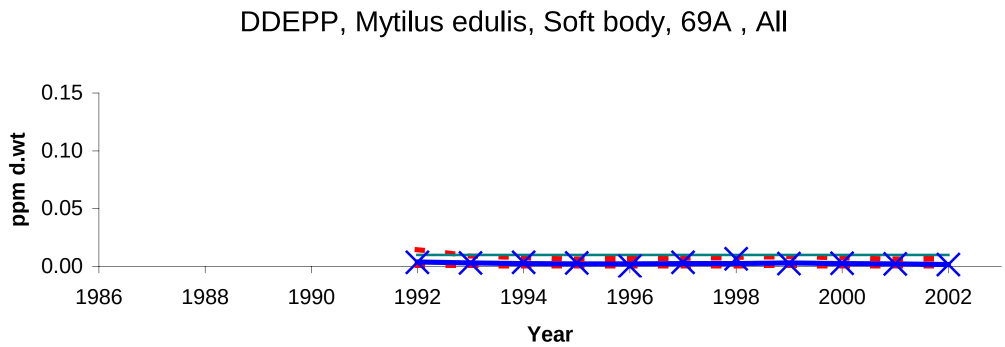


Figure 12. Median ppDDE (DDEPP) concentrations in blue mussel (*Mytilus edulis*) from Hardangerfjord (st. 63A, 65A and 69A). (cf. Appendix F and key in Figure 22). **Note: horizontal line for "high background" near x-axis.**

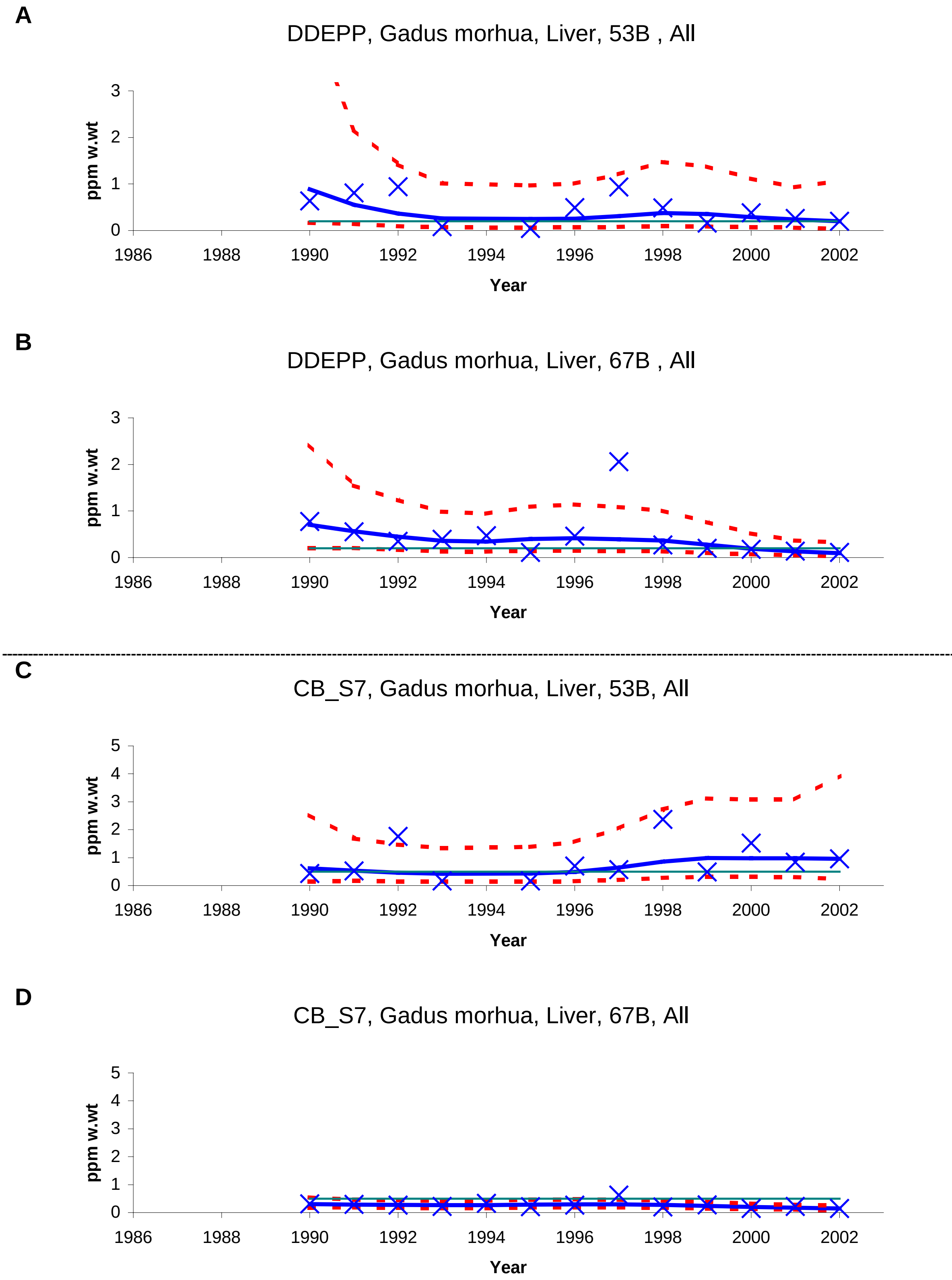


Figure 13. Median ppDDE (DDEPP) and CB_S7 (=ΣPCB-7) concentrations in liver of cod (*Gadus morhua*) from Sørfjord (st.53B) and Hardangerfjord (st.67B) (cf. Appendix F and key in Figure 22). **Note that for some years the upper confidence interval line is off-scale in Figure A.**

1.3.3 Lista area

Median concentrations of contaminants in mussels, cod and dab were insignificant and no upward trends were found (st.15, Appendix H and Appendix I).

1.3.4 Bømlo-Sotra area

It was impractical to continue sampling for flatfish at st.22F Borøyfjorden. Thus, a new station in Åkrafjorden, 21F Kyrping, was initiated in 2000. This station is about 82km south-east of 22F, but like 22F, is considered in a reference area.

Mussels, cod and flounder from this area (22A, 23B, 21F) were insignificantly polluted or showed no signs of overcentrations with respect to metals or organochlorines (Appendix H and Appendix I).

1.3.5 Orkdalsfjord area

Investigations in the area have been discontinued. Data for mussels is available for the period 1984-1996.

1.3.6 Open coast areas from Bergen to Lofoten

This stretch of coastline covers 7° of latitude to 68°N (Appendix F). Only one mussel station (st.98A) was investigated. Mussels were collected from 98A in 1992-1993. However, during the period 1994-1996 mussels were not found at this station but were collected from nearby Skrova harbour (98X). Since 1997 a "new" 98A location was found roughly 18 km north in a small fjord remote from any apparent point source of contamination.

In 2002, moderate overconcentrations (SFT's Cl.II) of cadmium were found in mussels and liver of plaice (st.98A/F) (Appendix H and Appendix I).

1.3.7 Exposed area of Varangerfjord near the Russian border

The remaining and northern area of JAMP in Norway stretches north of 68°N and a longitude from 17 to 29°E (Appendix F). In 2002 only two mussel stations, one for cod and one for plaice were investigated in the Varangerfjord (at approximately 70°N).

Slight overconcentrations (less than 2 times “high background”) of cadmium, ΣPCB-7 and ppDDE and higher overconcentrations of HCB (4.3 times) were found in liver of plaice (st.10F) (Appendix H and Appendix I).

1.3.8 Norwegian Pollution and Reference Indices (The Index Programme)

The Norwegian Pollution Control Authority (SFT) has requested a select and small group of indices to assess the quality of the environment with respect to contaminants - The Index Programme. One index is based on the levels and trends of contaminant concentrations in blue mussels collected annually from a selection of the more contaminated fjords in Norway (Appendix J). SFT has also requested the testing of this index against “reference” stations from selected areas and fjords.

The Index scale varies from 1, when all areas or fjords are insignificantly polluted and would fall into Class I in SFT's environmental quality classification system (Molvær *et al.* 1997), to 5, in which at least one sample from each area or fjord could be classified as extremely polluted or Class V in SFT's system.

Nine fjord areas were used to calculate the Pollution Index. On a comparable basis, the Index for 2002 was 3.2 compared to 2.7 in 2001. A value between 3 and 4 is severely polluted and corresponds to Cl.IV in SFT's system. One reason for this increase was exceptionally high values of lindane found at one station in the Grenlandsfjord area (st.71A), about 1000 times higher than previously registered in this area. The low concentrations found at nearby stations suggest a local influence. Taking the supplementary stations (Strømtangen and Toraneskaien) and analyses (TBT and dioxin) into consideration the Index was 3.4 (cf. Appendix J). This was due to the dioxin results for the Frierfjord area (Steinholmen) that were in Class V and TBT results for the Inner Oslofjord (Akershuskaia) in Class IV.

Only five fjord areas were included in Reference Index for 1998-2002 compared to seven to eight used in previous years. But only four of these provided a common basis because the Lofoten area must be excluded. The Index for 2002 is 1.3 and lower than 1.8 for 2001. A value between 1 and 2 would be classified as moderately polluted, or Cl.II in SFT's system. With the new calculation where supplementary analyses of TBT are included, the Reference Index was 1.5, and 1.6 if Lofoten is included, compared to 1.3. All five fjords/areas included TBT analyses. In the Bømlo-Sotra area the results for TBT caused an increase from Class I to Class II.

The use of the indices to assess the general level of pollution in contaminated or reference areas of coastal water for the period 1995 to 1999 has been reviewed (Green & Knutzen, 2001). The conclusions were mainly that the sample and analytical strategies lacked adequate coverage of the relevant contaminants and geographical areas. Furthermore, the report suggested supplementing the assessment of this type with relevant analyses of sediment. In 2002 the programme was improved by including more stations and parameters relevant to the blue mussel Pollution Index.

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 (1995-2002) showed some significant trends in mussels (cf. Appendix H). Four cases with significant trends are worth noting:

- St.I307, Ramtonholmen in inner Oslofjord (Map 1, Appendix F) where the median benzo[*a*]pyrene (BAP) was in Cl.I and an *upward* trend was detected,
- St.I024, Kirkøy in the Glomma estuary of the Hvaler area (Map 2, Appendix F) where the median cadmium was in Cl.II and an *upward* trend was detected,
- St.I201, Ekkjegrunn in the Saudafjord (Map 5, Appendix F) where cadmium and mercury were in Cl.II and *upward* trends were detected,

1.4 Biological effects methods for cod and flatfish

The JAMP-programme for 2002 included five biological effects methods (BEM): FAC, ALA-D, EROD, MT and TBT (Table 2). The first four are discussed in this chapter (Figure 14 to Figure 17) and TBT is discussed separately (cf., section 1.5). The results for the four BEM 1997-2001 have been published (Ruus *et al.*2003). For 2002 investigations OH-pyrene, ALA-D, EROD and MT were measured in Atlantic cod in the inner Oslofjord (30B), Sørfjord (st.53B), and Sotra-Bømlo area (23B). OH-pyrene was also measured in cod outside Lista (15B). It has become clear that cod caught in the open coastal area outside Lista are more strongly affected by PAHs than cod at the other stations, despite the large water exchange in that area (Ruus *et al.* 2003). Furthermore, samples from the inner Oslofjord and Sørfjord are considered to be more contaminated with metals and organochlorines than the other stations.

Table 2. Summary of biological methods employed by the JAMP-2002.

Code	Name	tissue sampled	Specificity
OH-pyrene	Pyrene metabolite	fish bile	PAH
ALA-D	δ-amino levulinic acid dehydrase inhibition	fish red blood cells	Pb
EROD	Cytochrome P4501A-activity (CYP1A/P4501A1, EROD)	fish liver	planar PCB/PCNs, PAHs, dioxins
MT	Metallothionein	fish liver	Cd Cu Zn (Hg)
TBT	Imposex/Intersex	snail soft tissue	organotin

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. 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 JAMP 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.

The measures derived from OH-pyrene, EROD and MT (cf. Table 3) 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 higher exposure.

As in most previous years, 25 individual cod were sampled for biological effects measurements at each station. However, in 2002 only three stations (four for OH-pyrene) were sampled, instead of eight stations as in previous years. Furthermore, no samples for BEM were taken from flatfish. All fish were collected by local fishermen and kept alive until sampling by NIVA staff within 5 days. There is an ongoing process to train and inform the fishermen that collect fish for JAMP to ensure the quality of the material.

Table 3. Summary statistics for results (ppb w.w.) from biological methods employed for cod from 4 stations 1997-2002 (2000-2003 for OH-pyrene). The upper quartile (Q75) and 90 percentiles (90 per.) are indicated.

Code	station	count	mean	st.dev.	median	Q75	90 per.	Maximum
OH-pyrene	15B	42	25.38	21.04	22.83	37.26	53.56	101.34
OH-pyrene	23B	73	4.24	5.12	3.14	4.67	5.71	33.84
OH-pyrene	30B	70	20.35	11.16	17.38	27.61	40.74	52.47
OH-pyrene	53B	71	13.22	13.13	9.23	16.50	28.54	65.55
ALA-D	15B	94	18.36	8.22	18.59	22.87	28.60	42.90
ALA-D	23B	148	21.01	8.52	19.91	23.79	27.44	74.52
ALA-D	30B	147	13.24	4.92	12.72	15.46	18.64	33.09
ALA-D	53B	144	11.79	20.33	9.85	12.98	17.80	245.41
EROD	15B	96	107.25	114.10	73.56	134.98	251.55	666.23
EROD	23B	146	95.51	123.98	76.78	109.06	143.03	1081.48
EROD	30B	141	137.93	102.24	117.35	194.97	283.96	632.08
EROD	53B	140	98.96	84.16	88.92	134.43	204.33	503.30
MT	15B	91	16.76	5.37	15.86	19.60	24.31	30.74
MT	23B	140	18.67	6.99	17.39	21.91	28.16	49.72
MT	30B	138	13.68	6.21	12.79	17.09	23.20	30.98
MT	53B	138	17.85	8.10	15.91	21.45	29.26	46.96

1.4.1 OH-pyrene metabolites in bile

Detection methods for OH-pyrene have been changed (improved) two times since the initiation of these analyses in the JAMP programme. In 1998 the support/normalisation parameter biliverdin was changed to measurement of light absorbance at 380 nm. Furthermore, in 2000, the use of single-wavelength fluorescence for quantification of OH-pyrene was discontinued and the use of HPLC separation with fluorescence detection was implemented. Although there is a good correlation between results from the two methods they can not be compared directly. The single wavelength fluorescence method is naturally more unspecific and will include fluorescence from more components than the HPLC method, which has extremely high specificity towards individual metabolites. The interpretation of OH-pyrene data is therefore primarily focused towards stations within each year.

The concentrations of OH-pyrene metabolites in bile were significantly higher in cod from station 15B in 1998 and 1999 than the other stations ($p<0.01$, ANOVA on $\log_e$ transformed data (MINITAB release 12.21)) (cf., results in Appendix H). There were no data from this station in 2000, but in 2001 the concentrations of OH-pyrene metabolites in bile from cod were again found highest on station 15B. In 2002, the median concentration of OH-pyrene in cod at 15B had decreased to a level below those at stations 23B, 30B and 53B (Figure 14; other stations not evaluated in 2002), although the variability was high (the highest individual concentration was over 100 µg/kg/ABS 380nm). The standard deviation of OH-pyrene concentrations (2000-2002) in cod liver at station 15B was higher than at the other stations (as were the mean and median concentrations, as well as the 75% and 90% percentiles and the maximum value, Table 3). However, OH-pyrene was not measured at station 15B in 2000, thus the number of observations is lower than at the other stations (Table 3). As mentioned, in 2002 the concentrations at 15B were lower than 30B and 53B. The cause of this is not apparent.

The levels in cod from station 15B are generally high. This is an area with a large discharge to water from an aluminium-smelter, the main source of PAH. The fish are collected on the open coast and the discharge from the smelter is a small bay about 2-3 km away.

Bile metabolites of PAH can be detected within a short period (hours) following exposure, and holding conditions prior to sampling may affect results. However, measures were taken in 1998 and 1999 to minimise or remove such exposure. Given the precautions taken, it is unlikely that the observed levels have been caused by storage of fish prior to sampling. The higher levels of pyrene metabolites at stations 53B and 30B compared to the other areas (1998 - 2000), and the increase in concentration at these stations from 2001 to 2002, presumably reflect the general contamination of the two areas (inner Sørfjord and inner Oslofjord).

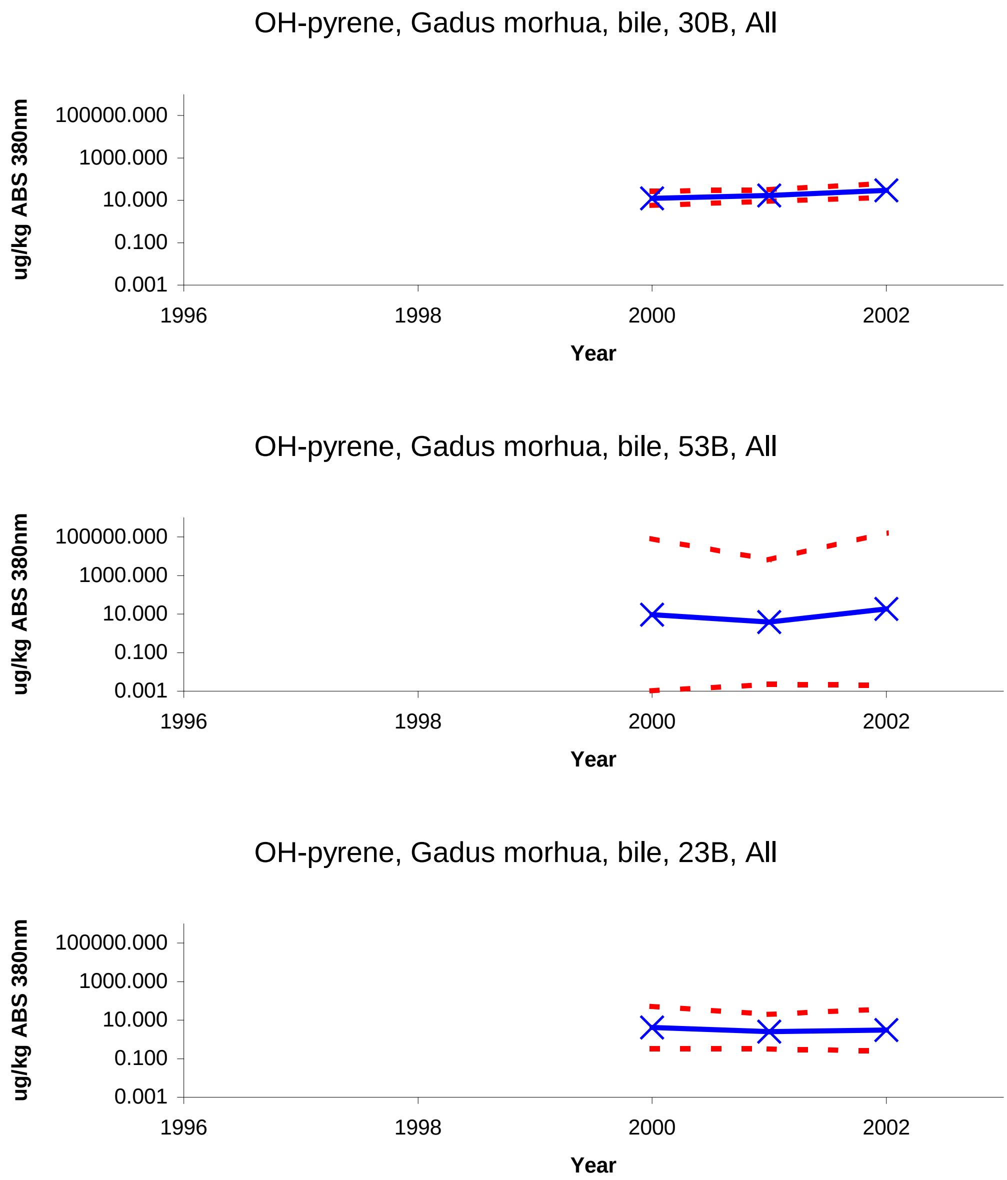


Figure 14. Concentration of OH-pyrene (µg/kg/ABS 380nm) in bile from Atlantic cod collected at the indicated stations 2002. There was insufficient data to present a time series from st. 15B. **NB: log-scale.**

1.4.2 ALA-D in blood cells

Most years the activity of ALA-D in cod was generally inhibited (indicating the influence of lead contamination) at the two most contaminated stations, i.e. 30B and 53B, compared to cleaner stations (i.e. 36B, 23B, and 10B). This was the case for 1997, 1998, and 2000-2002 (cf. Appendix H, results for stations 30B, 53B, and 23B in Figure 15). For the years 1997-2002 the activity of the enzyme at st.53B in Sørfjord was generally lower than the less contaminated station 23B on the open coast, about 130 km away.

In 2002, ALA-D was measured only in cod at stations 23B, 30B and 53B. At all stations the activity was lower compared to 2000-2001, indicating stronger inhibition. The inibition was greatest in the Sørfjord (53B), followed by the inner Oslofjord (30B) (Figure 15, Appendix H). This indicates that the pollution of metals is highest at 53B and decrease in the order 53B>30B>23B. The mean and median ALA-D activity, 1997-2002, was lowest at station 53B, while the standard deviation for this period was the highest at this station (Table 3).

The activity of ALA-D is known to be inhibited by exposure to lead. The results indicated that fish from the Sørfjord (st.53B/F) and inner Oslofjord (st.30B) are affected by the exposure to lead. During the period 1998-2002 slight overconcentrations of lead in cod liver have been found in the Sørfjord (1-1.4 times provisional "high background" concentrations) and for the period 1997-2002 in cod from the inner Oslofjord (1-8.5 times, cf. Appendix H). The results indicate that ALA-D in red blood cells is probably a better indicator of lead-exposure than lead concentration measurements in fish liver.

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 only 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 do not appear to affect the response.

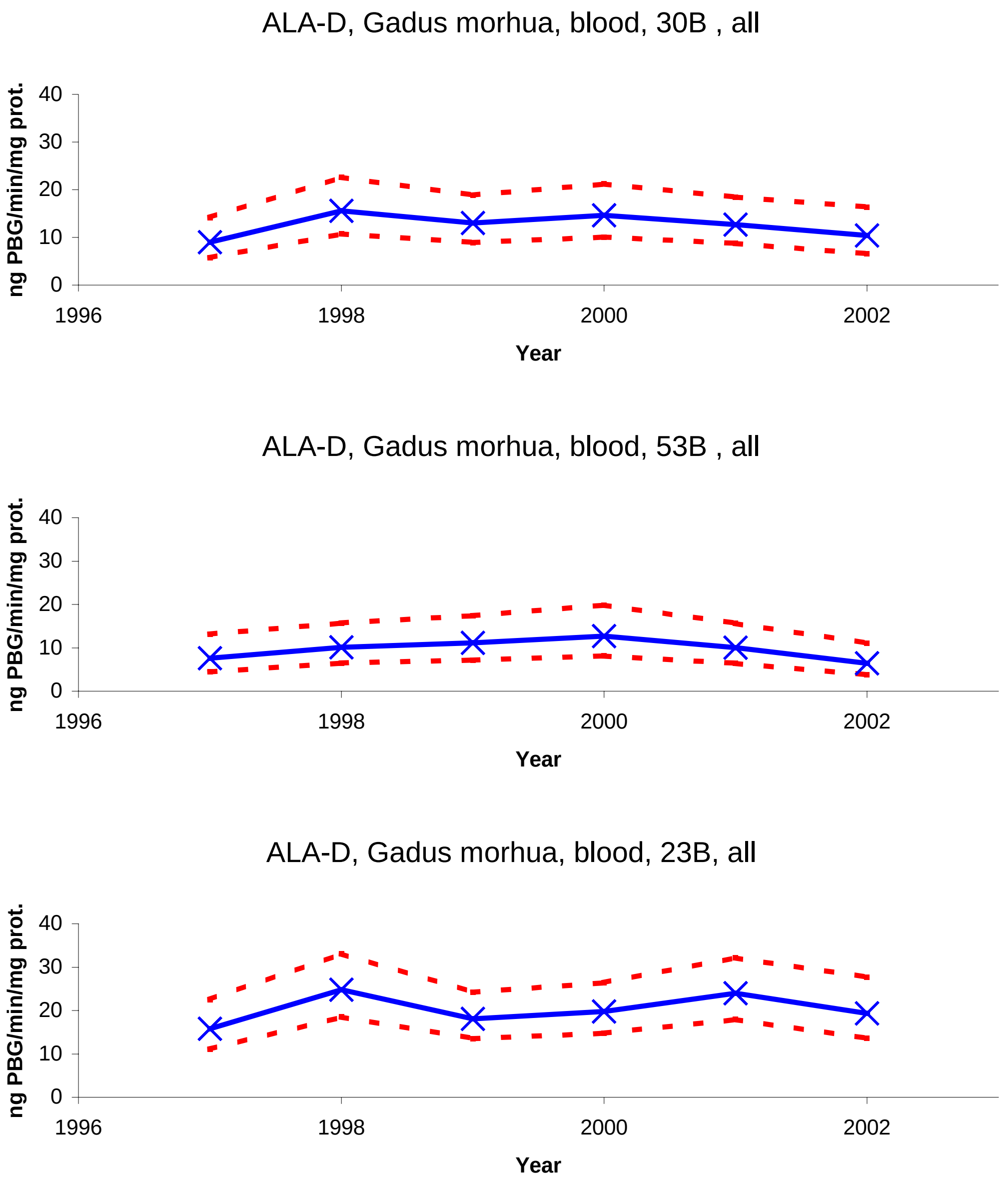


Figure 15. Activity of δ-aminolevulinic acid dehydrase (ALA-D, ng PBG/min/mg protein) in red blood cells from Atlantic cod collected at the indicated stations 2002.

1.4.3 EROD in liver

High activity of hepatic cytochrome P4501A activity (EROD) indicates a response to the contaminants indicated in Table 2. It was expected that higher activity would be found at the stations that were presumed to be most perturbed by planar PCBs, PCNs, PAHs or dioxins, which were st.30B (inner Oslofjord) and 53B/F (inner Sørfjord). However, EROD activity at 53B was lower than at 23B (Figure 16, Appendix H). Previous years have also shown that EROD in fish at stations 30B and 53B are not consistently higher than at other stations. At all three stations, EROD activities were higher in 2002 than in 2001.

Extreme concentrations of PCBs were found in four individuals of cod from the inner Sørfjord in 2002 (section 1.3.2), which should induce CYP 1A and thus increase EROD activity in these individuals. Two of these fish were those with the highest EROD-activities (although not much higher than some individuals with moderate PCB-concentrations). However, the other two extreme-PCB-concentration-fish had moderate hepatic EROD activities.

A plausible explanation for the finding is that there are other confounding factors present, which are determining EROD activity. It is shown that biological factors such as liver somatic index, as well as other contaminants (e.g. HCB in liver and Hg in muscle) are significant explanatory variables for EROD activity in cod (Ruus *et al.* 2003). The liver somatic index reflects the size and lipid content of the liver. These may be important factors for the induction of hepatic biotransformation enzymes such as CYP1A (and thus EROD). A second explanation is that the fish may have been exposed to (or have accumulated) the PCB for a long time and adapted to the exposure and thus the induction of EROD has stopped. Another but less likely explanation could be that the PCBs quantified in the fish are not the most planar, and thus not the most potent EROD inducers. However, exposure to high concentrations of PCBs would likely mean a high presence of the more co-planar PCBs (correlation). It can be concluded from this finding that moderate EROD activities do not disprove an environmental problem, at least with respect to the PCB congeners in question.

Regarding EROD activity at the other stations (not measured in 2002), it can be mentioned that in 2001 EROD activity in cod was fairly similar at all stations except 98B, where the activity was less than half of that at the other stations. EROD activity was low in cod from this station also in 2000 (cf. Appendix I and results for 2002 in Figure 16).

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). Generally, higher activity has been found at more contaminated stations, but the response was inconsistent. As mentioned, this inconsistency might indicate that populations with variable exposure history are sampled. Besides, there is evidence from other fish species that continuous exposure to e.g. PCBs may cause adaptation, i.e. decreased EROD response.

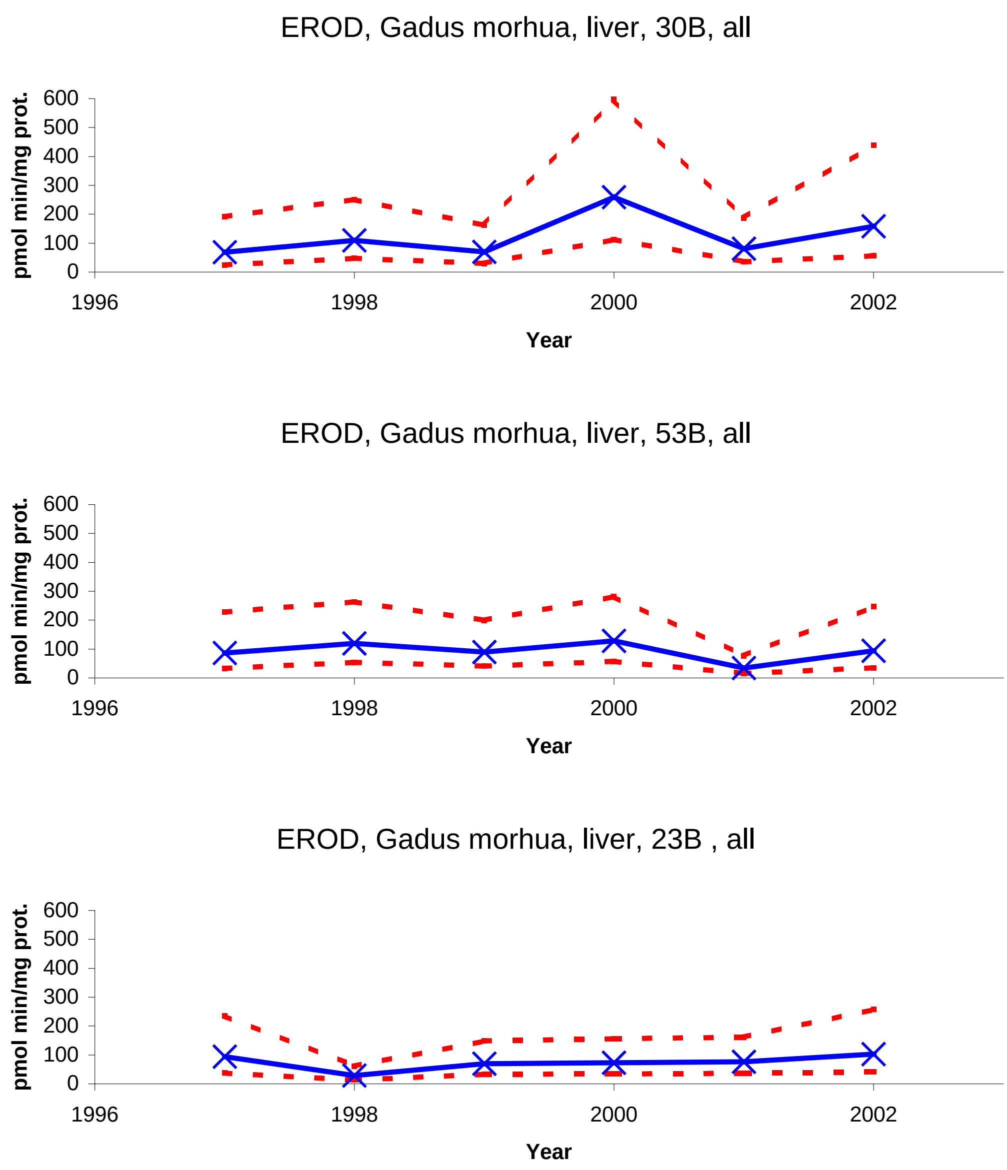


Figure 16. Activity of cytochrome P4501A (EROD, pmol/min/mg protein) in liver from Atlantic cod collected at the indicated stations 2002.

1.4.4 Metallothionein in liver

As indicated earlier (Green *et al.* 2002e), 1997-1999 samples have been reanalysed for metallothionein using differential pulse polarography (DPP). Thus, the same method has been used for all samples from all years and temporal comparisons can be made.

Results from previous years have shown that there were no clear trends in the hepatic concentrations of the metal-binding protein metallothionein (MT) in cod from the eight stations for the period 1997-2001 and in flounder from three stations 1999-2001. However, there were indications that metallothionein generally reflects metal concentrations in the liver of the fish (all species) studied (Ruus *et al.* 2003). Furthermore, a number of unexpected relations between MT-levels at different stations has been recorded. For example the MT concentrations in cod from station 23B were higher than in cod from the metal polluted Sørfjord (53B) in 2002 (Figure 17).

Metallothionein is a protein that is induced by and binds the metals cadmium, zinc, copper and mercury, and differences in median metal concentration should indicate differences in exposure. However, presumed gradient in metal exposures, such as decreasing from the inner Oslofjord to the outer Oslofjord and likewise from the Sørfjord to the Hardangerfjord (cf. Appendix I), did not correspond well with differences in metallothionein. More often than not the opposite was observed in cod and flounder during the last years of biological effects monitoring. The reason for this may require a more detailed analysis.

Ruus *et al.* (2003) have shown that the hepatic copper and zinc explain a large part of the variability observed in hepatic cod metallothionein. In addition, there are differences between years and stations. More surprising is the relationship between length and metallothionein. This has not been observed earlier. An apparent relationship between metallothionein and relative liver size is presumably only an inverse correlation between metallothionein (associated with water-soluble components) with fatty tissue in the liver (which increases with increasing relative liver size). In addition to copper and zinc, there were unknown differences between stations (showing up as highly significant), presumably due to other factors that modulate metallothionein (Ruus *et al.* 2003).

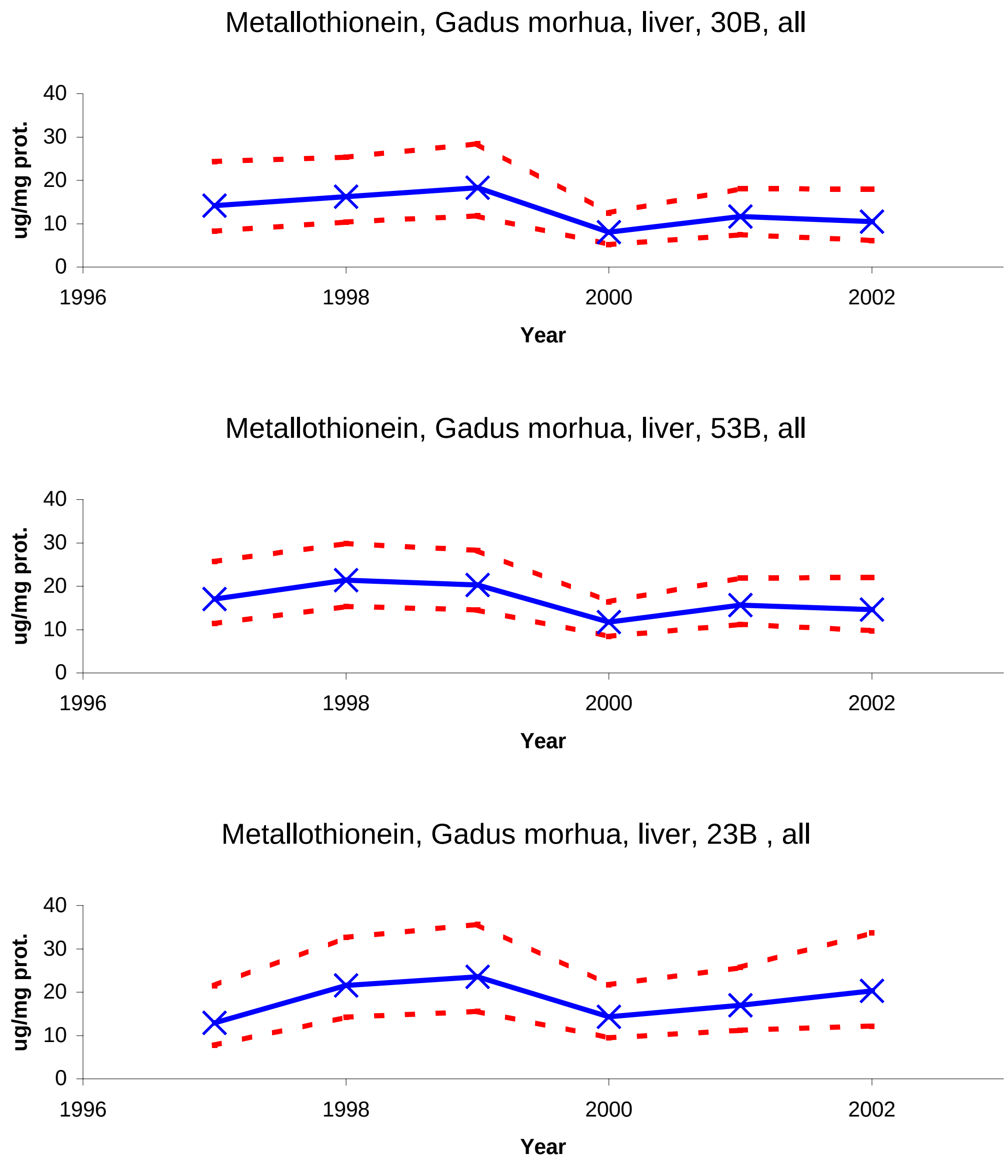


Figure 17. Activity of metallothionein (µg/mg protein) in fish liver from Atlantic cod collected at the indicated stations 2002.

1.4.5 Concluding remarks

The application of BEM methods within JAMP through the years 1997-2001 has indicated that the location 15B, previously regarded as only diffusely polluted, has an input of PAH which is sufficient to markedly affect fish in the area. In 2002, however, the median concentration of OH-pyrene in cod at 15B had decreased to a level below those at stations 23B, 30B and 53B, although the variability was high. Chronic exposure to PAHs may lead to liver lesions and reproductive disorders in fish, as shown through National Ocean and Atmospheric Administration's (NOAA (USA)) studies in Puget Sound. The highest levels of PAH metabolites observed in the bile of cod from station 15B are high compared to other studies, but it is not at present possible to infer population effects on cod in the area. It would be relevant to include DNA adduct analyses at some stage to clarify whether the cellular repair system of cod is sufficient to protect against damage from PAH radicals.

Results for the period 1997-2002 clearly indicated that there are lead effects, shown by decreased activity of the enzyme ALA-D in the two most strongly polluted areas, i.e. cod from the inner Oslofjord (30B) and cod from the inner Sørfjord (53B).

Extreme concentrations of PCBs were found in four individuals of cod from the inner Sørfjord (53B) in 2002. Two of these fish were those with the highest EROD-activities. However, the other two extreme-PCB-concentration-fish had moderate hepatic EROD activities. A likely explanation is that undetermined confounding factors, which affects EROD activity, are present. This finding shows that moderate EROD activities do not disprove an environmental problem, at least with respect to contamination of specific PCB congeners.

Results from previous years have shown that there were no clear trends in the hepatic concentrations of the metal-binding protein metallothionein (MT) in cod from the eight stations examined for the period 1997-2001 and in flounder from three stations 1999-2001. In the report presenting the results for application of biological effects methods in JAMP 1997-2001, indications that metallothionein generally reflects metal concentrations in the liver of the fish (all species) studied, are however presented. Furthermore, it is shown that variability in hepatic cod metallothionein concentrations appeared to reflect natural endogenous processes involving the two essential metals zinc and copper.

1.5 Effects and concentrations of organotin

Effects from organotin in dogwhelks (*Nucella lapillus*) and concentrations in dogwhelks and blue mussels (*Mytilus edulis*) were investigated in respectively nine and fourteen locations along the coast of Norway 2002.

Dogwhelks were sampled in outer Oslofjord (st. 36G), Langesundsfjord (71G), southern Norway (76G, 131G), south-west Norway (15G), Haugesund (227G), western Norway (22G) and northern Norway (98G, 11X) in September-October 2002. Blue mussels were sampled from inner Oslofjord (301, 30A), outer Oslofjord (st. 36A), Breviksfjord (712, 713), Langesundsfjord (71A), Risør (76A), southern Norway (I131, I132), Farsund (15A), Haugesund (227A), western Norway (22A), Svolvær, Lofoten (98A) and Varangerfjord (10A) in September - October 2002 (Appendix K and maps in Appendix F). TBT-induced development of male sex-characters in females, known as imposex (VDSI and RPSI), was analysed according to OSPAR-JAMP guidelines. Detailed information about the chemical analyses of the animals is given in Følsvik *et al*. (1999).

1.5.1 Dogwhelks

Evident effects from organotin was in 2002 observed at all stations, except for 11X in northern Norway. (Figure 18). Concentrations of organotin were relatively low (≤ 50 µg Sn/kg d.w.) at the coastal locations in Southwest of Norway, but lowest at the northern locations. Most heavily affected were snails from the Haugesund location (st. 227G, VDSI=4.5), and the highest organotin levels were also found in this area (182.7 µg Sn/kg d.w., cf. Appendix K). Concentrations of organotin in snails were generally elevated compared to 2001 (cf. Green *et al*. 2003).

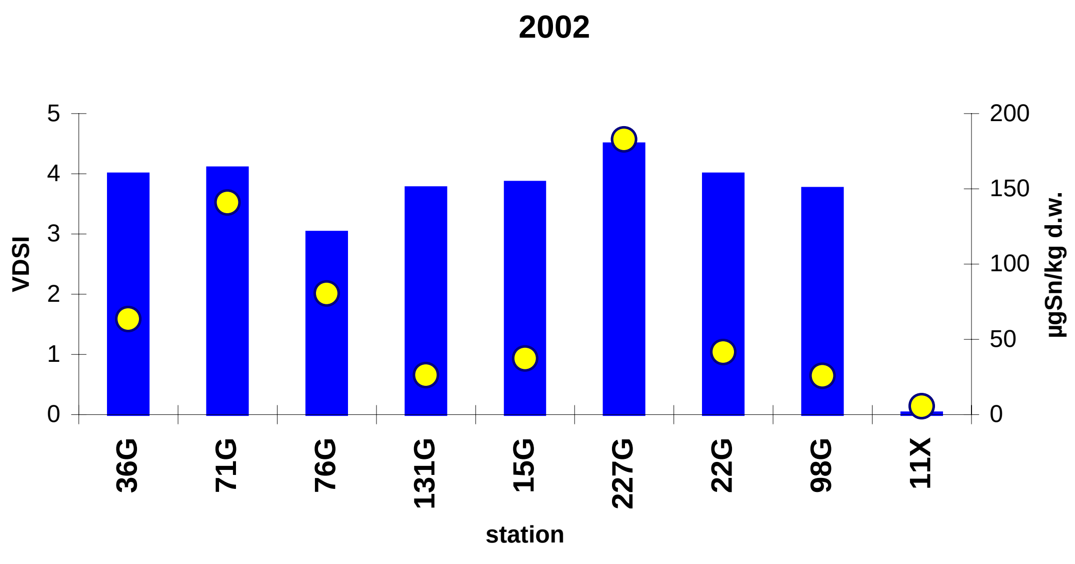


Figure 18. Concentrations of TBT (µg Sn/kg d.w.; circles) and imposex (VDSI; columns) in dogwhelks from 9 stations along the coast of Norway 2002.

At Færder (36G) the VDSI for 1993-2002 has been lower than 1991, while conditions in the Haugesund area (227G) has become slightly worse last years (Figure 19, Appendix K).

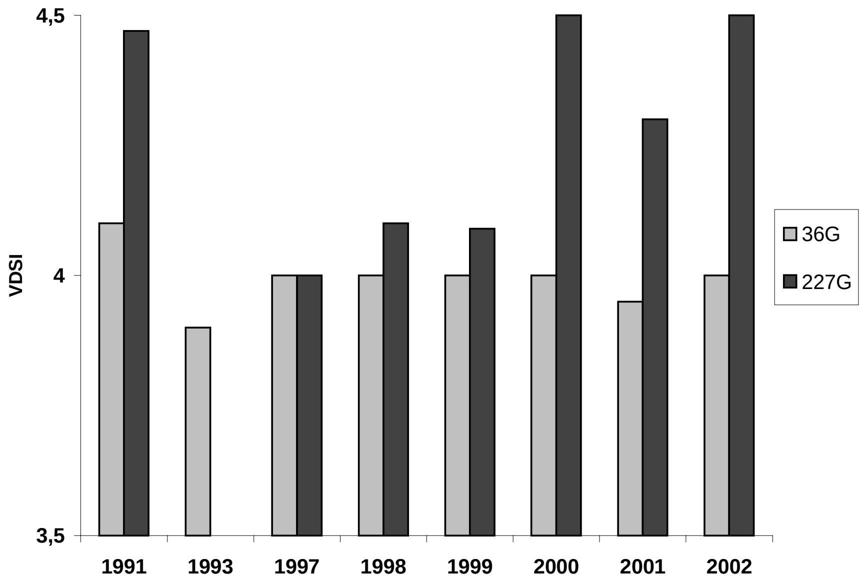


Figure 19. Imposex (VDSI) in dogwhelks (*Nucella lapillus*) at 2 stations in southern Norway; Færder (36G) and Haugesund (227G). Data from 1991 (Harding *et al*. (1992) and 1993 (Walday *et al*. 1997). (cf. Appendix F, Maps 2 and 5).

The development of the 'relative penis size index' (RPSI) is consistent with the VDSI for Færder (36G) over the years, but variation from year to year is somewhat higher. The Færder area has been clearly less affected than Haugesund (227G) through the period considering RPSI. No evident trends could be detected due to the large and in consistent between-year differences.

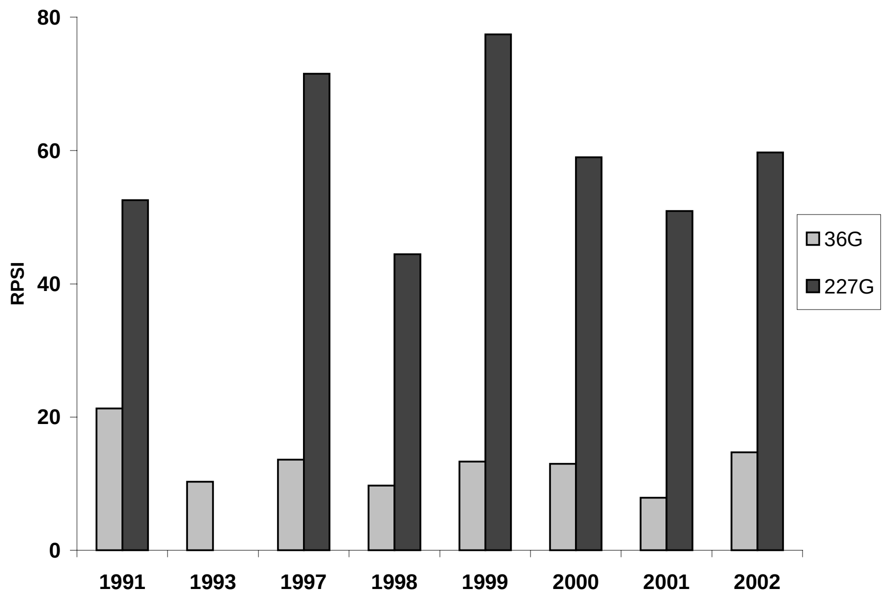


Figure 20. Imposex (RPSI) in dogwhelks (*Nucella lapillus*) at 2 stations in southern Norway; Færder (36G) and Haugesund (227G). Data from 1991 (Harding *et al*. (1992) and 1993 (Walday *et al*. 1997). (cf. Appendix F, Maps 2 and 5).

1.5.2 Mussels

Two replicate samples were analysed for stations 10A, 15A, 22A, 30A, 36A, 98A, 132, 301, 712 and 713, while one was analysed for 71A, 76A, I131 and 227A. Concentrations of organotin in mussels were high in the near harbour stations (301, 30A, 712, 713, 71A and 227A), while they were low in the northern station (10A). Levels ranged between 5 and 1063 µg Sn/kg d.w. (Table 2, Appendix A). According to the Norwegian classification of environmental quality (Molvær *et al*. 1997) the inner Oslofjord (301, and one of the replicates at 30A) was severely polluted from TBT, while the rest of the near harbour samples were markedly polluted. The northern station (10A) was slightly polluted. TBT-concentrations in the samples from Færder (36A), Gåsøy (15A) and Lofoten (98A) were Class I (slightly polluted) or just above Class I. Compared to previous years, most concentrations were lower in 2002, but an increase was observed at near harbour stations (Figure 21, Figure 39, Appendix K Table 12).

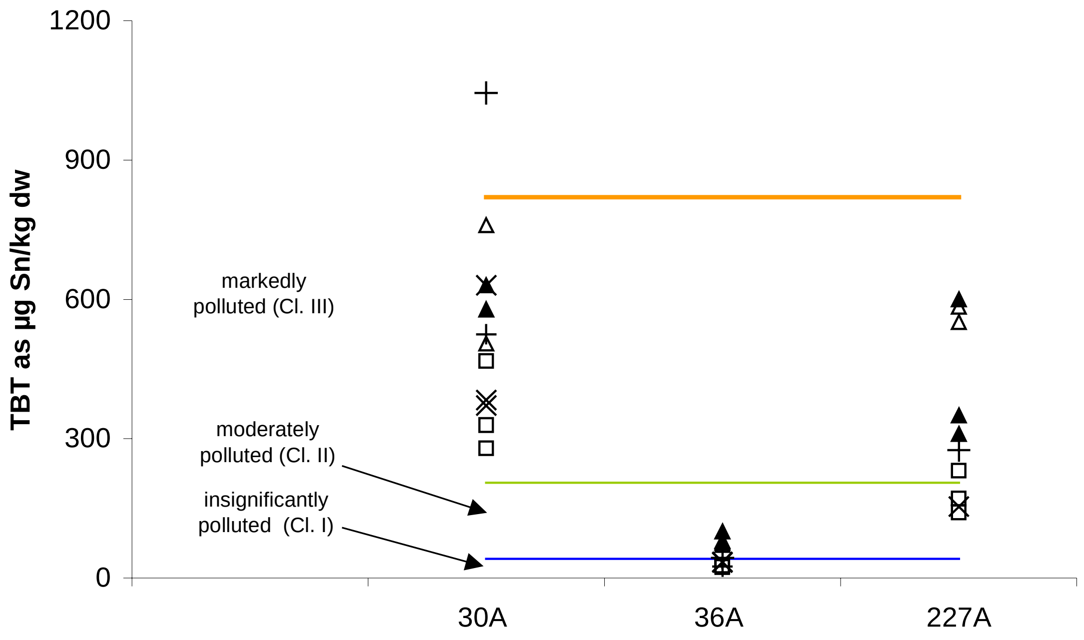


Figure 21. Levels of TBT (µg Sn/kg d.w.) in blue mussels (*Mytilus edulis*) from parallels at three stations in Southern Norway in 1998 (Δ), 1999 (▲), 2000 (x), 2001 (□) and 2002 (+), (cf. Appendix F, Maps 2 and 5).

1.5.3 Concluding remark

The presence of organotin (as TBT) in Norwegian waters still exceeded acceptable levels in 2002, in particular close to harbours. Concentrations of organotin in mussels and dogwhelks were elevated, and biological effects from TBT were found in dogwhelks from all of the investigated areas, except one northern station. There is no clear improvement through the years according to imposex, and concentrations of TBT in mussels were mostly higher than in 2001. It is a cause for concern that the ban on the use of TBT in antifouling on boats <25 m of length has not lead to a clear improvement in the investigated areas.

1.6 Overall conclusions

In regards to JMP/JAMP Purpose A (health assessment), attention should be called to the list from Norwegian Food Control Authority (SNT) which names the restrictions and recommendations concerning the sale and consumption in Norway for seafood taken from Norwegian fjord areas (Table 4).

In regards to JMP/JAMP Purpose C (spatial distribution assessment), the concentrations found in 2002 are indicated in the bar graphs shown in Appendix I. Provisional “high background" levels were used to identify elevated concentrations. This assessment revealed no new areas of concern that are not currently under surveillance.

In regards to JMP/JAMP Purpose D (temporal trend assessment) there is evidence that the median concentrations of:

- Mercury in fish fillet from the inner Oslofjord has increased since 1984,
- HCB in mussel from Langesundsfjorden has decreased since 1990,
- Cadmium in mussels from four stations in the Sørfjord/Hardangerfjord has decreased since 1987.

Study of the power of temporal trend monitoring was useful in assessing existing sampling strategies, however, modifications might be needed to account for local conditions (see Appendix O in Green *et al.* 2000).

The 2002 investigation also includes results on Norwegian Pollution Control Authority Pollution Indices (Appendix J), and discussion of the results of biological effects methods including imposex and intersex (chapters 1.4 and 1.5).

Table 4. Summary of action taken by the Norwegian Food Control Authority (SNT, http://www.snt.no/nytt/tema/kosthold/kyst.html; http://www.lovdata.no/for/sf/hd/td-19961129-1240-0.html) in co-operation with SFT (http://www.miljostatus.no/templates/PageWithRightListing____2701.aspx) concerning the consumption and sale of fish products along the Norwegian Coast. (Area designations from SFT, pers. comm. 2003) 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/ evaluation	Main fish/shellfish product of concerned	Recommendations or restrictions of concern:
Mid and Inner Oslofjord (498.9) (includes Drammensfjord)	PCB	2002	fish liver, eel	Consumption and sale
Tønsberg area (23.7)	PCB	2002	fish liver, eel, mussels	Consumption
Inner Sandefjordfjord (1.5)	PCB	1993	fish liver	Consumption and sale
Grenlandsfjords, Langesundsfjord (90.3)	Chl.org[2)]/ Dioxins	2002	fish, shellfish	Consumption and sale
Kragerø (3.2)	PAH Dioxins	2002	eel, mussels	Consumption
Tvedestrand (2.3)	PCB	2000	fish liver	Consumption and sale
Arendal (8.0)	PCB	2000	fish liver	Consumption and sale
Inner Kristiansandsfjord (33.3)	Chl.org[2)]/ Dioxins/PCB	2000	fish, shellfish	Consumption and sale
Farsund area (42.0)	PCB PAH	2000	fish liver, mussels	Consumption and sale
Fedafjord (11.2)	PAH	1995	mussels	Consumption and sale
Flekkefjord (4.2)	PCB	2000	fish liver	Consumption and sale
Stavanger (4.0)	PCB PAH	2001	fish liver, mussels	Consumption
Sandnes (1.7)	PAH	2001	mussels	Consumption
Karmsund-Eidsbotn (24.1)	PCB, PAH	2001	fish liver [1)], shellfish	Consumption and sale
Saudafjord (24.1)	PAH	1992	fish liver, mussels	Consumption and sale
Sørfjord (62.2)	Cd Pb Hg PCB	2002	fish, shellfish	Consumption and sale
Bergen area (169.9)	PCB	1998	fish, shellfish	Consumption and sale
Årdalsfjord (30.4)	PAH Pb Cd	2002	mussels	Consumption and sale
Sunndalsfjord (100.1)	PAH	2002	fish liver, mussels	Consumption and sale
Hommelvik (2.6)	PAH	1985	mussels	Consumption and sale
Inner Trondheimfjorden (1.2)	PAH PCB	2002	fish liver, mussels	Consumption
Brønnøysund (7.0)	PAH	2003	mussels	Consumption
Vefsnfjord (76.4)	PAH	2002	mussels	Consumption and sale
Sandnessjøen (0.4)	PAH	2003	mussels	Consumption
Inner Ranfjord (15.1)	PAH Pb Hg	1997	mussels	Consumption and sale
Narvik (11.6)	PCB	2003	fish	Consumption
Ramsund (5.4)	PCB	2000	fish, shellfish	Consumption and sale
Harstad (2.9)	PCB heavy metals	2003	fish liver, mussels	Consumption and sale
Tromsø (17.7)	PAH	2000	mussels	Consumption and sale
Hammerfest (4.1)	PAH	2003	mussels	Consumption and sale
Honningsvåg (3.3)	PAH	2000	mussels	Consumption and sale

[1)] Concerns only Eidsbotn
[2)] Organochlorine compounds

The JAMP issues to which these investigations are relevant are shown in Table 5.

Table 5. JAMP issues relating to the Norwegian JAMP (cf., SIME 2002).

Subject	JAMP issue	Question	Recent Norwegian contribution
Hg, Cd and Pb	JAMP issue 1.2.	What are the concentrations and fluxes in sediments and biota?	1996-1997: Levels in sediment (cf., Green *et al.* 2000) 2002: Levels and trends in biota (annual investigations since 1981, Chapter 1.3) 2002: INDEX for blue mussels from selected stations (annual investigations since 1995, cf. Chapter 1.3.8)
TBT	JAMP issue 1.3.	To what extent do biological effects occur in the vicinity of major shipping routes offshore installations, marinas and shipyards	2002: Levels and trends in mussels and snails (annual investigations since 1997, cf. Chapter 1.5)
PCBs	JAMP issue 1.7.	Do high concentrations pose a risk to the marine ecosystem	[as for JAMP issue 1.2]
PCBs	JAMP issue 1.8.	Do high concentrations of non-ortho and mono-ortho CBs in seafood pose a risk to human health?	1995: INDEX for blue mussels from selected stations (cf. Green 1997) 1996: Levels in cod (cf. Green *et al.* 2000)
PAHs	JAMP issue 1.10.	What are the concentrations in the maritime [1] area?	1992: Levels in shellfish (Green *et al.* 1995) 1992-1993: Levels in fish and mussels for selected stations (Knutzen & Green 1995) 1996-1997: Levels in sediment (cf., Green *et al.* 2000) 2002: INDEX for blue mussels from selected stations (annual investigations since 1995, Chapter 1.3.8)
PAHs	JAMP issue 1.11.	Do PAHs affect fish and shellfish?	1998: Biological effects methods in cod (cf. Chapter 1.4)
Other synthetic organic compounds	JAMP issue 1.12.	How widespread are synthetic organic compounds within the maritime [1] area?	2002: Levels and trends in biota (annual investigations since 1983 of selected organochlorines, cf. Chapter 1.3) 1996: Introductory investigation of organochlorines in cod livers (cf. Green *et al.* 2000)
Chlorinated dioxins and dibenzofurans	JAMP issue 1.15. [2]	What concentrations occur and have the policy goals (for the relevant parts of the maritime [1] area) been met?	1995: INDEX for blue mussels from selected stations (cf. Green 1997) 1996: Introductory investigation of organochlorines in cod livers (cf. Green *et al.* 2000)
Biological effects of pollutants	JAMP issue 1.17.	Where do pollutants cause deleterious biological effects?	2002: Southern Coast, planar PCBs, metals, PAHs in cod (annual investigations since 1997, cf. Chapter 1.4)
Chemicals used	JAMP issue 5.3.	In which areas do pesticides and antibiotics affect marine biota?	2002: Levels and trends in biota (cf. Chapter 1.3)
Ecosystem health	JAMP issue 6.1. [2]	How can ecosystem health be assessed in order to determine the extent of human impact?	Results for the other issues are also relevant here

[1]) Not defined in original text
[2]) See SIME 1997

2. Technical Details

2.1 Compliance with guidelines/procedures

2.1.1 JAMP programme

Samples were collected and analysed, where practical, according to OSPAR guidelines (OSPAR 1990, 1997) and screened and submitted to ICES by agreed procedures (ICES 1996). The most important point of concern are those stations where insufficient number of fish were collected (cf. Appendix G).

2.1.2 Overconcentrations and classification of environmental quality

This report focuses on the principle cases where *median* concentrations exceeded the upper limit to Class I in the Norwegian Pollution Control Authority's (SFT's) **environmental quality classification system** (cf. Molvær *et al.* 1997). The relevant extract from the system is shown in Table 6 and show five classes from Cl.I, Insignificantly polluted, to Cl.V, extremely polluted. However, the system does not cover all the contaminants in indicator species-tissues used in JAMP. To assess concentrations not included in the system provisional "high background" values were used (Table 7). The factor by which concentrations exceeded "high background" is termed **overconcentration**. 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 overconcentrations for years prior to 1997 made in this report may not correspond to figures and assessments made in previous national comments. The median concentration can be found in the tables in Appendix H or figures in Appendix I.

A review of provisional "high background" concentrations based on recent JAMP-data generally confirmed that the reference concentrations (i.e., upper limit for Class I) in SFT's classification system, but recommended the following revisions (Knutzen & Green 2001b, concentrations in µg/kg wet weight):

- Cod liver - ΣDDT: Either increase limit from 200 to 300 or preferably replace ΣDDT with p,p-DDE and keep the limit at 200
- Cod liver - ΣHCH: Decrease limit from 50 to 30.
- Cod liver - TEPCDD/PCDF: Decrease limit from 0.015 to 0.01
- Cod fillet - ΣPCB7: Decrease limit from 5 to 3
- Cod fillet - ΣHCH: Decrease limit from 0.5 to 0,3
- Blue mussel - ΣPCB7: Decrease limit from 4 to 3

Mostly based on data from other studies the review (Knutzen & Green 2001b, Green & Knutzen 2003) also suggested the following decreases for Class I in fillet of flounder (µg/kg w.w.):

- ΣPCB7: from 5 to 3.
- From 2 for ΣDDT to 1 for p,p-DDE

The review did not recommend changes in the Class I limits for mercury in fish fillet (1 mg/kg w.w.) or mercury, cadmium, lead, zinc and copper in mussels (in the same order 0.2; 2; 3; 200 and 10 mg/kg d.w.). However, for chromium and nickel in mussels limits should be decreased from 3 to 2 and from 5 to 3 mg/kg d.w., respectively. Further, reference values for organochlorines were indicated for fillet and liver of fish species that are not included in the classification system (dab, plaice, lemon sole) and for lead and cadmium in liver of cod.

These recommendations for changes have been taken into account in this report. However, corresponding adjustment of Classes II-V has not been done but should be considered once the above mentioned Class I revisions have been accepted by SFT. SFT 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 mussels 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 H). In regards to mussels, 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 Control Authority (SNT) is responsible for official commentary as to possible health risk due to consumption of seafood. Hence, the results of the JAMP pertaining to this purpose are presented only as a partial basis for evaluation.

Table 6. Extracts of the Norwegian Pollution Control Authority revised environmental classification system of contaminants in blue mussels and fish (from Molvær *et al.* 1997 and revised (shaded) Cl.I concentrations as suggested in this report).

Contaminant			**Classification (upper limit for classes I-IV)**				
			Degree of pollution				
			I	**II**	**III**	**IV**	**V**
			Insignificant	***Moderate***	***Marked***	***Severe***	***Extreme***
BLUE MUSSEL							
Lead	ppm	d.w.	3	15	40	100	>100
Cadmium	ppm	d.w.	2	5	20	40	>40
Copper	ppm	d.w.	10	30	100	200	>200
Mercury	ppm	d.w.	0.2	0.5	1.5	4	>4
Zinc	ppm	d.w.	200	400	1000	2500	>2500
TBT [1)]	ppm	d.w.	0.1	0.5	2	5	>5
ΣPCB-7	ppb	w.w.	3	15	40	100	>100
		d.w. [2)]	*15*	*75*	*200*	*500*	*>500*
ΣDDT	ppb	w.w.	2	5	10	30	>30
		d.w. [2)]	*10*	*25*	*50*	*150*	*>150*
ΣHCH	ppb	w.w.	1	3	10	30	>30
		d.w. [2)]	*5*	*15*	*50*	*150*	*>150*
HCB	ppb	w.w.	0.1	0.3	1	5	>5
HCB in d.w. [2)]		*d.w.* [2)]	*0.5*	*1.5*	*5*	*25*	*>25*
$\mathbf{TE}_{PCDF/D}$ [3)]	ppp [4)]	w.w.	0.2	0.5	1.5	3	>3
COD, fillet							
Mercury	ppm	w.w.	0.1	0.3	0.5	1	>1
ΣPCB-7	ppb	w.w.	3	20	50	150	>150
ΣDDT	ppb	w.w.	1	3	10	25	>25
ΣHCH	ppb	w.w.	0.3	2	5	15	>15
HCB	ppb	w.w.	0.2	0.5	2	5	>5
COD, liver							
ΣPCB-7	ppb	w.w.	500	1500	4000	10000	>10000
ΣDDT	ppb	w.w.	200	500	1500	3000	>3000
ΣHCH	ppb	w.w.	50	200	500	1000	>1000
HCB	ppb	w.w.	20	50	200	400	>400
$\mathbf{TE}_{PCDF/D}$ [2)]	ppp [4)]	w.w.	10	40	100	300	>300

[1]) Tributyltin on a formula basis
[2]) Conversion assuming 20% dry weight
[3]) TCDDN (Appendix B)
[4]) µg/1000 kg (Appendix B)

Table 7. Provisional "high background levels" of selected contaminants, in **ppm (mg/kg) dry weight** (blue mussel) and **ppm (mg/kg wet weight)** (blue mussel and fish). The respective "high background" limits are from Knutzen & Skei (1990) with mostly minor adjustments (Knutzen & Green 1995; Molvær *et al.* 1997), except for dab where the suggested limit is based on JAMP-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**
	ppm d.w.	ppm w.w.	ppm w.w.	ppm w.w.	ppm w.w.	ppm w.w.	ppm w.w.	ppm w.w.	ppm w.w.	ppm w.w.
Lead	3.0 [2)]	0.6 [3)]	0.1		0.3 ?		0.3 ?		0.2 ?	
Cadmium	2.0 [2)]	0.4 [3)]	0.1		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-7 [8)]	0.015[3,9)]	0.003[2 9)]	0.15 [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)]	0.003[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)]	0.0000002 [2)]	0.00001 [9)]							

[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]) With respect to revisions suggested by Knutzen & Green (2001b) and Green & Knutzen (2003), see text.

2.1.3 Comparison with previous data

A simple 3-model approach has been developed to study time trends for contaminants in biota based on *median* concentrations (ASMO 1994). A variation of this method was applied to mercury in fish fillet to distinguish trends in "small" and "large" individuals, the size of which may vary from year to year, station to station, depending on the catch. To determine the "small" fish, the sample is sorted by length and split into two groups of one or even numbers. The fish with median length in the smaller group is the "small" fish, and the median length in the larger group is the "large" fish. The concentration in these two fish (one per group) determine the concentrations in the two groups. The method was first used on a large-scale basis by the Ad Hoc Working Group on Monitoring that met in Copenhagen 8-12. November 1993 (MON 1993). At this meeting it was agreed to apply the method on contaminants in fish muscle and liver on a wet weight basis and contaminants in soft tissue of mussels on a dry weight basis. 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 G. The results can be presented as in Figure 22.

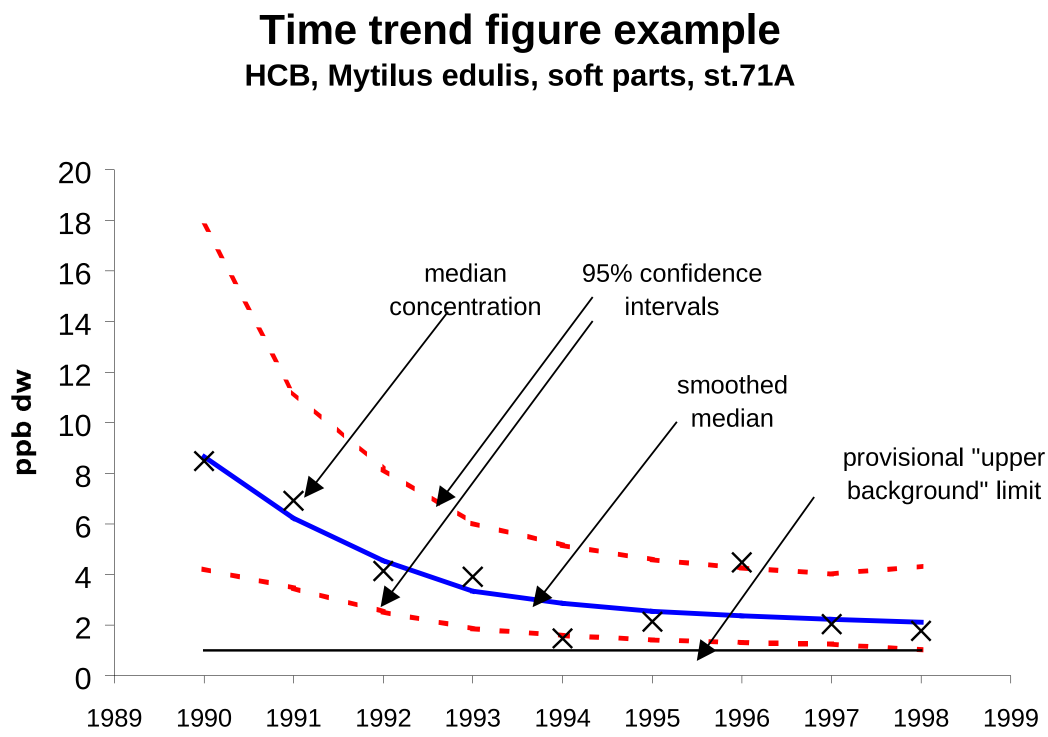


Figure 22. Example presentation and variation in contaminant concentration with time, indicating median concentrations, running mean of median values (Loess smoother), 95% confidence intervals. The provisional "high background level" is marked with a horizontal line and corresponds to values listed in Table 7 (see text).

The method of calculating the smoother is in accordance to the methods employed at Ad Hoc Working Group on Monitoring that met in Copenhagen 23-27. February 1998 (MON 1998). A Loess smoother is based on a running seven-year interval, a non-parametric curve fitted to median log-concentrations (Nicholson *et al.*1997). 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 lognormally distributed (cf. Nicholson *et al.* 1998).

The National Comments since 1994 have included two additional analyses. The first is that the smoothed median for the last three sampling years is linearly projected for the next three years. This deviates from previous reports where the upper 95 confidence interval was used to assess the likelihood of overconcentrations (Nicholson, *et al.* 1994). The projected estimate is based on the results for the temporal trend analyses of at least 6 years of data.

The second is 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 mussels from Langesundsfjord (Figure 4).

The statistical analysis was carried out on temporal trend data series for cadmium, copper, mercury, lead, zinc, the ΣPCB-7 (congeners: 28, 53, 101, 118, 138, 153, 180), ppDDE (ICES code DDEPP), γ-HCH (ICES code HCHG) and HCB. Except for ΣPCB-7 , assessment focused on individual compounds instead of "sum variables".

2.1.4 The effect of depuration and freezing on mussels

Based on samples collected in the Sørfjord and Hardangerfjord, the JAMP-method of pre-treatment of mussels (i.e., depuration and then cleaning) contrasted significantly to the Index-method (freezing then cleaning) (Green *et al.* 2001a). Using the JAMP-method and based on a dryweight basis, cadmium concentrations were significantly higher (24%), whereas significant lower concentrations were found for lead (45%), zinc (14%), PCBs (CB101, -118, -138, -153 27-52%) and DDTs (50-64%). Lower concentrations indicated that these contaminants are associated with the particle load.

The results were not consistent with a previous study from this region that indicated no significant difference between the methods for mercury, cadmium, copper, lead and zinc (Green 1989). A study on mussels from the mouth of the Glomma River in Southern Norway showed the lead and copper were significantly lower in depurated samples (Green *et al.* 1996); however, no differences were found for PCBs or DDTs (on a lipid basis). The PCB concentrations found in the Glomma study were 3-4 times higher than Sørfjord/Hardangerfjord.

Mercury was the only contaminant common to all three studies that had consistent results; that there is no significant difference between the two methods.

The difference in methods has indicated an effect on the concentration of contaminants in mussels. However, with the exception of mercury, the results for Sørfjord/Hardangerfjord 2002 are inconsistent with two other studies in Norway. Revision of JAMP guidelines and assessment of data should take these results into consideration.

2.2 Information on Quality Assurance

NIVA has participated in all the QUASIMEME international intercalibration exercises, including Round 32 (2003). These exercises have included nearly all the contaminants analysed for JAMP. Quality assurance programme for NIVA is similar to the 2001 programme (cf. Green *et al.* 2003). In addition, NIVA was accredited in 1993 in accordance with the EN45000 standard by the Norwegian Accreditation (reference P009). A summary of the quality assurance programme at NIVA is given in Appendix A. A summary of the intercalibrations exercises that NIVA has participated in is given in Appendix D.

Cadmium, lead, zinc, and copper were analysed using ICPMS instead of graphite furnace atomic absorption electrothermal spectrometry (GFAAS) or flame atomic absorption spectrometry (AAS) used before 2002. The results of 43-58 parallel analyses indicated no significant difference between the two methods for lead and only slight differences for cadmium, copper and zinc (4, 2 and 8%, respectively, 3.Appendix L). The only significant linear regression found between difference and average concentration was for zinc, but the explained variance (R^2) only 0.09. These difference were not considered sufficient to warrant special treatment when assessing data derived from the two methods.

2.3 Description of the Programme

The sampling for 2002 involved sampling of blue mussel at 50 stations and cod or at least one flatfish species was sampled at 18 stations (cf. Appendix E). The Norwegian JAMP has been expanded since 1989 to include monitoring in more diffusely polluted areas. Though new stations are initially intended for annual monitoring (temporal trends), there has not always been sufficient funds to do this for every station. Sample/station reduction measures have been taken to reduce costs. Furthermore, sufficient samples have not always been practical to obtain. When this applies to mussels, a new site in the vicinity is often chosen. As for fish, the quota of 25 individuals (±10%), indicated in Appendix E, as either 25 individuals or 5 bulked samples consisting of 5 fish per bulked sample, was met for all stations in 2002.

Concentrations of metals, organochlorines (including pesticides) and polycyclic aromatic hydrocarbons in mussels and fish were determined at the Norwegian Institute for Water Research (JAMP code NIVA).

An overview of the methods applied up to and including 2002 sample material has been presented by Green *et al*. (2001b). An overview of the samples collected from 1981 to 2002 is given in Appendix E. An overview of analyses applied from 1981 to 2002 for biological material is given in Appendix C. Parameter abbreviations are given in Appendix B.

The data is stored at NIVA in MS ACCESS 1997. The tables are generated using MS ACCESS 97 and MS EXCEL 97.

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Appendix A
Quality assurance programme

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. NIVA has reference number P009.

Summary of quality control results

A summary of the results for the analyses of the SRM biota are shown in Table A1.

Dogfish muscle (DORM-2) or dogfish liver (DOLT-2) was used as SRM for the control of the determination of metals (see Table A1). Mackerel oil (350) and mussel tissue (2978) was used as SRM for controls of PCBs and PAHs, respectively. (477) was used for tin organic compounds. In addition to SRM 2974, an internal standard was used for quality control.

The results were generally satisfactory, the mean was within 2 standard deviations of SRM-mean. Based on the results for **biota** SRM, lead, zinc, benzo[*k*]fluorenthrene and benzo[*e*]pyrene may have been overestimated and copper, CB101 and CB153 may have been underestimated. It should be noted that the SRM value for lead is close to the detection limit for this reporting lab.

See also results from intercalibrations exercises listed in Appendix D.

NIVA has participated in QUASIMEME exercises up to Round 32 (January – April 2003) which includes:
- QTM057BT and QTM058BT for metals in biota,
- QOR074BT and QOR075BT for organochlorines in biota.

The latest round would apply to the 2002 samples analysed in 2002-2003. The results from this round were generally acceptable (z-scores between -2 and 2), but the results for CB52 (both), CB101 (QOR075BT) , CB105 (both) and γ-HCH (QOR075BT) was not classified as satisfactory. All results for metals in biota are satisfactory.

NIVA has also participated in QUASIMEME exercises which includes:
- QTM062MS and QTM063MS for metals in sediments,
- QOR072MS and QOR073MS for organochlorines in sediments,
- QPH036MS and QPH037MS for PAH in sediments.

Summary of internal intercalibration exercise for ICP-MS and GFAAS

Cadmium, lead, zinc, and copper were analysed using ICP-MS instead of graphite furnace atomic absorption electrothermal spectrometry (GFAAS) or flame atomic absorption spectrometry (AAS) used before 2002. The results of 43-58 parallel analyses indicated no significant difference between the two methods for lead and only slight differences for cadmium, copper and zinc (4, 2 and 8%, respectively, Appendix L). The only significant linear regression found between difference and average concentration was for zinc, but the explained variance (R^2) only 0.09. These difference were not considered sufficient to warrant special treatment when assessing data derived from the two methods.

Table 8. Summary of the quality control results for the 2002 biota samples analysed 2001-2002. The Standard Reference Materials (SRM) were DORM-2* (dogfish muscle) for mussels and fish fillet, DOLT-2* (dogfish liver) for fish liver, 350** (mackerel oil) for mussels and fish liver and 2978** (mussel tissue) for mussels. SRM was analysed in series with the JAMP-samples for analyses of metals (mg/kg w.w.), organochlorines or PAH (µg/kg w.w.). 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
Cd	**cadmium**	SB	DORM	0.043 ± 0.008	19	21	0.0463	0.0057 x
		LI	DOLT	20.80 ± 0.5	10	21	21.1	1.1
Cu	**copper**	SB	DORM	2.34 ± 0.16	18	21	2.17	0.18 x
		LI	DOLT	25.80 ± 1.1	10	21	27.9	1.1 x
Pb	**lead**	SB	DORM	0.065 ± 0.007	18	21	0.0562	0.0075 x
		LI	DOLT	0.22 ± 0.02	10	21	0.259	0.079 x
Hg	**mercury**	SB	DORM	4.64 ± 0.26	20	17	4.66	0.15
Zn	**zinc**	SB	DORM	25.6 ± 2.3	19	21	26.1	1.5
		LI	DOLT	85.8 ± 2.5	6	21	94.4	4.1 x
CB-28	**PCB congener CB-28**	(all)	350	22.5 ± 4	6	3	18.4	0.8 x
CB-52	**PCB congener CB-52**	(all)	350	62. ± 9	6	3	54.8	7.2
CB-101	**PCB congener CB-101**	(all)	350	164 ± 9	6	3	143.0	2.5 x
CB-118	**PCB congener CB-118**	(all)	350	142 ± 20	6	3	120	4.7 x
CB-153	**PCB congener CB-153**	(all)	350	317 ± 20	6	3	287.3	8.4 x
CB-180	**PCB congener CB-180**	(all)	350	73. ± 13	6	3	66.7	4.1
BAA	benzo[*a*]anthracene[1)]	SB	2978	25. ± 7	2	5	62	22 X
BAP	benzo[*a*]pyrene[1)]	SB	2978	7. ± 3	2	5	8.8	0.1
BBF	benzo[*b*]fluoranthene[1)]	SB	2978	58. ± 15				
BEP	**benzo[*e*]pyrene**	SB	2978	89.3 ± 6.2	2	5	86	1
BGHIP	**benzo[*ghi*]perylene**	SB	2978	19.7 ± 4.4	2	5	22	4
BKF	**benzo[*k*]fluoranthene**	SB	2978	24.1 ± 3.4				
CHRTR	chrysene+triphenylene[1 2)]	SB	2978	122 ± 13.5	2	5	93	45 x
FLU	**fluoranthene**	SB	2978	166 ± 12	2	5	276	55 X
ICDP	**indeno[1,2,3-*cd*]pyrene**	SB	2978	12.2 ± 2.9	2	5	15	1 x
PER	**perylene**	SB	2978	4.09 ± 0.32	2	5	5.2	0.4 x
PYR	**pyrene**	SB	2978	256 ± 21	2	5	482	88 X
DBTIN	**Dibutyl-tin**	SB	477	1540 ± 120	2	1	1920	57 x
TBTIN	**Trybutyl-tin**	SB	477	2200 ± 190	2	1	2320	28

*) 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)
1) Not certified (see NIST certificate)
2) Calculated from separate values for chrysene and triphenylene; respectively, $(59+63) \pm \sqrt{(10^2 + 9^2)}$

Appendix B
Abbreviations

Abbreviation[1]	English	*Norwegian*
ELEMENTS		
Al	aluminium	*aluminium*
As	arsenic	*arsen*
Cd	cadmium	*kadmium*
Co	cobalt	*kobolt*
Cr	chromium	*krom*
Cu	copper	*kobber*
Fe	iron	*jern*
Hg	mercury	*kvikksølv*
Li	lithium	*litium*
Mn	manganese	*mangan*
Ni	nickel	*nikkel*
Pb	lead	*bly*
Pb210	lead-210	*bly-210*
Se	selenium	*selen*
Ti	titanium	*titan*
Zn	zinc	*sink*
PAHs		
PAH	polycyclic aromatic hydrocarbons	*polysykliske aromatiske hydrokarboner*
ACNE	acenaphthene	*acenaften*
ACNLE	acenaphthylene	*acenaftylen*
ANT	anthracene	*antracen*
BAA [3]	benzo[*a*]anthracene	*benzo[a]antracen*
BAP [3]	benzo[*a*]pyrene	*benzo[a]pyren*
BBF [3]	benzo[*b*]fluoranthene	*benzo[b]fluoranten*
BBJKF [3]	benzo[*b,j,k*]fluoranthene	*benzo[b,j,k]fluoranten*
BBJKF [3]	benzo[b+j,k]fluoranthene	*benzo[b+j,k]fluoranten*
BBKF [3]	benzo[*b+k*]fluoranthene	*benzo[b+k]fluoranten*
BEP	benzo[*e*]pyrene	*benzo[e]pyren*
BGHIP	benzo[*ghi*]perylene	*benzo[ghi]perylen*
BIPN [2]	biphenyl	*bifenyl*
BJKF [3]	benzo[*j,k*]fluoranthene	*benzo[j,k]fluorantren*
BKF [3]	benzo[*k*]fluoranthene	*benzo[k]fluorantren*
CHR	chrysene	*chrysen*
CHRTR	chrysene+triphenylene	*chrysen+trifenylen*
COR	coronene	*coronen*
DBAHA [3]	dibenz[*a,h*]anthracene	*dibenz[a,h]anthracen*
DBA3A [3]	dibenz[*a,c/a,h*]anthracene	*dibenz[a,c/a,h]antracen*
DBP [3]	dibenzopyrenes	*dibenzopyren*
DBT	dibenzothiophene	*dibenzothiofen*
DBTC1	C_1-dibenzothiophenes	*C_1-dibenzotiofen*
DBTC2	C_2-dibenzothiophenes	*C_2-dibenzotiofen*
DBTC3	C_3-dibenzothiophenes	*C_3-dibenzotiofen*
FLE	fluorene	*fluoren*
FLU	fluoranthene	*fluoranten*

Abbreviation[1]	English	*Norwegian*
PAHs (cont.)		
ICDP [3]	indeno[*1,2,3-cd*]pyrene	*indeno[1,2,3-cd]pyren*
NAP [2]	naphthalene	*naftalen*
NAPC1 [2]	C_1-naphthalenes	*C_1-naftalen*
NAPC2 [2]	C_2-naphthalenes	*C_2-naftalen*
NAPC3 [2]	C_3-naphthalenes	*C_3-naftalen*
NAP1M [2]	1-methylnaphthalene	*1-metylnaftalen*
NAP2M [2]	2-methylnaphthalene	*2-metylnaftalen*
NAPD2 [2]	1,6-dimethylnaphthalene	*1,6-dimetylnaftalen*
NAPD3 [2]	1,5-dimethylnaphthalene	*1,5-dimetylnaftalen*
NAPDI [2]	2,6-dimethylnaphthalene	*2,6-dimetylnaftalen*
NAPT2 [2]	2,3,6-trimethylnaphthalene	*2,3,6-trimetylnaftalen*
NAPT3 [2]	1,2,4-trimethylnaphthalene	*1,2,4-trimetylnaftalen*
NAPT4 [2]	1,2,3-trimethylnaphthalene	*1,2,3-trimetylnaftalen*
NAPTM [2]	2,3,5-trimethylnaphthalene	*2,3,5-trimetylnaftalen*
NPD	Collective term for naphthalenes, phenanthrenes and dibenzothiophenes	*Sammebetegnelse for naftalen, fenantren og dibenzotiofens*
PA	phenanthrene	*fenantren*
PAC1	C_1-phenanthrenes	*C_1-fenantren*
PAC2	C_2-phenanthrenes	*C_2-fenantren*
PAM1	1-methylphenanthrene	*1-metylfenantren*
PAM2	2-methylphenanthrene	*2-metylfenantren*
PADM1	3,6-dimethylphenanthrene	*3,6-dimetylfenantren*
PADM2	9,10-dimethylphenanthrene	*9,10-dimetylfenantren*
PER	perylene	*perylen*
PYR	pyrene	*pyren*
DI-Σn	sum of "n" dicyclic "PAH"s (footnote 2)	*sum "n" disykliske "PAH" (fotnote 2)*
P-Σn	sum "n" PAH	*sum "n" PAH*
PK-Σn	sum carcinogen PAHs (footnote 3)	*sum kreftfremkallende PAH (fotnote 3)*
PAHΣΣ	DI-Σn + P-Σn etc.	*DI-Σn + P-Σn mm..*
SPAH	"total" PAH, specific compounds not quantified (outdated analytical method)	*"total" PAH, spesifikk forbindelser ikke kvantifisert (foreldret metode)*
BAP_P	% BAP of PAHΣΣ	*% BAP av PAHΣΣ*
BAPPP	% BAP of P-Σn	*% BAP av P-Σn*
BPK_P	% BAP of PK-Σn	*% BAP av PK-Σn*
PKn_P	% PK-Σn of PAHΣΣ	*% PK-Σn av PAHΣΣ*
PKnPP	% PK-Σn of P-Σn	*% PK-Σn av P-Σn*

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
PCBs		
PCB	polychlorinated biphenyls	*polyklorerte bifenyler*
CB	individual chlorobiphenyls (CB)	*enkelte klorobifenyl*
CB28	CB28 (IUPAC)	*CB28 (IUPAC)*
CB31	CB31 (IUPAC)	*CB31 (IUPAC)*
CB44	CB44 (IUPAC)	*CB44 (IUPAC)*
CB52	CB52 (IUPAC)	*CB52 (IUPAC)*
CB77 [4]	CB77 (IUPAC)	*CB77 (IUPAC)*
CB81 [4]	CB81 (IUPAC)	*CB81 (IUPAC)*
CB95	CB95 (IUPAC)	*CB95 (IUPAC)*
CB101	CB101 (IUPAC)	*CB101 (IUPAC)*
CB105	CB105 (IUPAC)	*CB105 (IUPAC)*
CB110	CB110 (IUPAC)	*CB110 (IUPAC)*
CB118	CB118 (IUPAC)	*CB118 (IUPAC)*
CB126 [4]	CB126 (IUPAC)	*CB126 (IUPAC)*
CB128	CB128 (IUPAC)	*CB128 (IUPAC)*
CB138	CB138 (IUPAC)	*CB138 (IUPAC)*
CB149	CB149 (IUPAC)	*CB149 (IUPAC)*
CB153	CB153 (IUPAC)	*CB153 (IUPAC)*
CB156	CB156 (IUPAC)	*CB156 (IUPAC)*
CB169 [4]	CB169 (IUPAC)	*CB169 (IUPAC)*
CB170	CB170 (IUPAC)	*CB170 (IUPAC)*
CB180	CB180 (IUPAC)	*CB180 (IUPAC)*
CB194	CB194 (IUPAC)	*CB194 (IUPAC)*
CB209	CB209 (IUPAC)	*CB209 (IUPAC)*
CB-Σ7	CB: 28+52+101+118+138+153+180	*CB: 28+52+101+118+138+153+180*
CB-ΣΣ	sum of CBs, includes CB-Σ7	*sum CBer, inkluderer CB-Σ7*
TECBW	Sum of CB-toxicity equivalents after WHO model, see **TEQ**	*Sum CB- toksitets ekvivalenter etter WHO modell, se **TEQ***
TECBS	Sum of CB-toxicity equivalents after SAFE model, see **TEQ**	*Sum CB-toksitets ekvivalenter etter SAFE modell, se **TEQ***

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
DIOXINs		
TCDD	2, 3, 7, 8-tetrachloro-dibenzo dioxin	*2, 3, 7, 8-tetrakloro-dibenzo dioksin*
CDDST	Sum of tetrachloro-dibenzo dioxins	*Sum tetrakloro-dibenzo dioksiner*
CDD1N	1, 2, 3, 7, 8-pentachloro-dibenzo dioxin	*1, 2, 3, 7, 8-pentakloro-dibenzo dioksin*
CDDSN	Sum of pentachloro-dibenzo dioxins	*Sum pentakloro-dibenzo dioksiner*
CDD4X	1, 2, 3, 4, 7, 8-hexachloro-dibenzo dioxin	*1, 2, 3, 4, 7, 8-heksakloro-dibenzo dioksin*
CDD6X	1, 2, 3, 6, 7, 8-hexachloro-dibenzo dioxin	*1, 2, 3, 6, 7, 8-heksakloro-dibenzo dioksin*
CDD9X	1, 2, 3, 7, 8, 9-hexachloro-dibenzo dioxin	*1, 2, 3, 7, 8, 9-heksakloro-dibenzo dioksin*
CDDSX	Sum of hexachloro-dibenzo dioxins	*Sum heksakloro-dibenzo dioksiner*
CDD6P	1, 2, 3, 4, 6, 7, 8-heptachloro-dibenzo dioxin	*1, 2, 3, 4, 6, 7, 8-heptakloro-dibenzo dioksin*
CDDSH	Sum of heptachloro-dibenzo dioxins	*Sum heptakloro-dibenzo dioksiner*
CDDO	Octachloro-dibenzo dioxin	*Oktakloro-dibenzo dioksin*
PCDD	Sum of polychlorinated dibenzo-p-dioxins	*Sum polyklorinaterte-dibenzo-p-dioksiner*
CDF2T	2, 3, 7, 8-tetrachloro-dibenzofuran	*2, 3, 7, 8-tetrakloro-dibenzofuran*
CDFST	Sum of tetrachloro-dibenzofurans	*Sum tetrakloro-dibenzofuraner*
CDFDN	1, 2, 3, 7, 8/1, 2, 3, 4, 8-pentachloro-dibenzofuran	*1, 2, 3, 7, 8/1, 2, 3, 4, 8-pentakloro-dibenzofuran*
CDF2N	2, 3, 4, 7, 8-pentachloro-dibenzofurans	*2, 3, 4, 7, 8-pentakloro-dibenzofuran*
CDFSN	Sum of pentachloro-dibenzofurans	*Sum pentakloro-dibenzofuraner*
CDFDX	1, 2, 3, 4, 7, 8/1, 2, 3, 4, 7, 9-hexachloro-dibenzofuran	*1, 2, 3, 4, 7, 8/1, 2, 3, 4, 7, 9-heksakloro-dibenzofuran*
CDF6X	1, 2, 3, 6, 7, 8-hexachloro-dibenzofuran	*1, 2, 3, 6, 7, 8-heksakloro-dibenzofuran*
CDF9X	1, 2, 3, 7, 8, 9-hexachloro-dibenzofuran	*1, 2, 3, 7, 8, 9-heksakloro-dibenzofuran*
CDF4X	2, 3, 4, 6, 7, 8-hexachloro-dibenzofuran	*2, 3, 4, 6, 7, 8-heksakloro-dibenzofuran*
CDFSX	Sum of hexachloro-dibenzofurans	*Sum heksakloro-dibenzofuraner*
CDF6P	1, 2, 3, 4, 6, 7, 8-heptachloro-dibenzofuran	*1, 2, 3, 4, 6, 7, 8-heptakloro-dibenzofuran*
CDF9P	1, 2, 3, 4, 7, 8, 9-heptachloro-dibenzofuran	*1, 2, 3, 4, 7, 8, 9-heptakloro-dibenzofuran*
CDFSP	Sum of heptachloro-dibenzofurans	*Sum heptakloro-dibenzofuraner*
CDFO	Octachloro-dibenzofurans	*Octakloro-dibenzofuran*
PCDF	Sum of polychlorinated dibenzo-furans	*Sum polyklorinated dibenzo-furaner*
CDDFS	Sum of PCDD and PCDF	*Sum PCDD og PCDF*
TCDDN	Sum of TCDD-toxicity equivalents after Nordic model, see **TEQ**	*Sum TCDD- toksitets ekvivalenter etter Nordisk modell, se **TEQ***
TCDDI	Sum of TCDD-toxicity equivalents after international model, see **TEQ**	*Sum TCDD-toksitets ekvivalenter etter internasjonale modell, se **TEQ***

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
PESTICIDES		
ALD	aldrin	*aldrin*
DIELD	dieldrin	*dieldrin*
ENDA	endrin	*endrin*
CCDAN	cis-chlordane (=α-chlordane)	*cis-klordan (=α-klordan)*
TCDAN	trans-chlordane (=γ-chlordane)	*trans-klordan (=γ-klordan)*
OCDAN	oxy-chlordane	*oksy-klordan*
TNONC	trans-nonachlor	*trans-nonaklor*
TCDAN	trans-chlordane	*trans-klordan*
OCS	octachlorostyrene	*oktaklorstyren*
QCB	pentachlorobenzene	*pentaklorbenzen*
DDD	dichlorodiphenyldichloroethane 1,1-dichloro-2,2-bis- (4-chlorophenyl)ethane	*diklordifenyldikloretan* *1,1-dikloro-2,2-bis-(4-klorofenyl)etan*
DDE	dichlorodiphenyldichloroethylene (principle metabolite of DDT) 1,1-dichloro-2,2-bis- (4-chlorophenyl)ethylene*	*diklordifenyldikloretylen* *(hovedmetabolitt av DDT)* *1,1-dikloro-2,2-bis-* *(4-klorofenyl)etylen*
DDT	dichlorodiphenyltrichloroethane 1,1,1-trichloro-2,2-bis- (4-chlorophenyl)ethane	*diklordifenyltrikloretan* *1,1,1-trikloro-2,2-bis-(4-klorofenyl)etan*
DDEOP	o,p'-DDE	*o,p'-DDE*
DDEPP	p,p'-DDE	*p,p'-DDE*
DDTOP	o,p'-DDT	*o,p'-DDT*
DDTPP	p,p'-DDT	*p,p'-DDT*
TDEPP	p,p'-DDD	*p,p'-DDD*
DDTEP	p,p'-DDE + p,p'-DDT	*p,p'-DDE + p,p'-DDT*
DD-nΣ	sum of DDT and metabolites, n = number of compounds	*sum DDT og metabolitter,* *n = antall forbindelser*
HCB	hexachlorobenzene	*heksaklorbenzen*
HCHG	Lindane γ HCH = gamma hexachlorocyclohexane (γ BHC = gamma benzenehexachloride, outdated synonym)	*Lindan* *γ HCH = gamma heksaklorsykloheksan* *(γ BHC = gamma benzenheksaklorid,* *foreldret betegnelse)*
HCHA	α HCH = alpha HCH	*α HCH = alpha HCH*
HCHB	β HCH = beta HCH	*β HCH = beta HCH*
HC-nΣ	sum of HCHs, n = count	*sum av HCHs, n = antall*
EOCl	extractable organically bound chlorine	*ekstraherbart organisk bundet klor*
EPOCl	extractable persistent organically bound chlorine	*ekstraherbart persistent organisk bundet klor*
NTOT	total organic nitrogen	*total organisk nitrogen*
CTOT	total organic carbon	*total organisk karbon*
CORG	organic carbon	*organisk karbon*
GSAMT	grain size	*kornfordeling*
MOCON	moisture content	*vanninnhold*

Abbreviations (cont'd.)

Abbreviation[1]	English	*Norwegian*
INSTITUTES		
IFEN	Institute for Energy Technology	*Institutt for energiteknikk*
FIER	Institute for Nutrition, Fisheries Directorate	*Fiskeridirektoratets Ernæringsinstitutt*
FORC	FORCE Institutes, Div. for Isotope Technique and Analysis [DK]	*FORCE Institutterne, Div. for Isotopteknik og Analyse [DK]*
IMRN	Institute of Marine Research (IMR)	*Havforskningsinstituttet*
NACE	Nordic Analytical Center	*Nordisk Analyse Center*
NILU	Norwegian Institute for Air Research	*Norsk institutt forluftforskning*
NIVA	Norwegian Institute for Water Research	*Norsk institutt for vannforskning*
SERI	Swedish Environmental Research Institute	*Institutionen för vatten- och luftvårdsforskning*
VETN	Norwegian Veterinary Institute	*Veterinærinstituttet*
SIIF	Fondation for Scientific and Industrial Research at the Norwegian Institute of Technology - SINTEF (a division, previously: Center for Industrial Research SI)	*Stiftelsen for industriell og teknisk forskning ved Norges tekniske høgskole- SINTEF (en avdeling, tidligere: Senter for industriforskning SI)*

[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 PAH compounds potentially cancerogenic for humans according to IARC (1987), i.e., categories 2A+2B (possibly and probably carcinogenic).

[4]) 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: • 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 *et al.*, 1998) [2] • non-ortho and mono-ortho substituted chlorobiphenyls after WHO model (Ahlborg *et al.*, 1994) [3] or Safe (1994, cf. NILU pers. comm.)	*"Toxisitetsekvivalentfaktorer" for de giftigste forbindelsene innen følgende grupper.* • *polyklorerte dibenzo-p-dioksiner og dibenzofuraner (**PCDD/PCDF**). Ekvivalentberegning etter nordisk modell (Ahlborg 1989) [1] eller etter internasjonal modell (Int./EPA, cf. Van den Berg et al. 1998) [2]* • *non-orto og mono-orto substituerte klorobifenyler etter WHO modell (Ahlborg et al., 1994) [3] eller Safe (1994, cf. NILU pers. medd.)*
ppm	parts per million, mg/kg	*deler pr. milliondeler, mg/kg*
ppb	parts per billion, µg/kg	*deler pr. milliarddeler, µg/kg*
ppp	parts per trillion, ng/kg	*deler pr. tusen-milliarddeler, ng/kg*
d.w.	dry weight basis	*tørrvekt basis*
w.w.	wet weight or fresh weight basis	*våtvekt eller friskvekt basis*

[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 C
Analytical overview

Sorted by:
- Contaminant, year, laboratory, intercalibration

Abbreviations are defined in Appendix B and Appendix D

Contamin.	**Contaminant defined in Appendix B**
Mon. Year	**Monitoring year**
Lab.	**Analytical laboratory (cf. Appendix B)**
Intercalibr. +basis	**Intercalibration exercise (cf. Appendix D) and basis where W = wet weight and D = dry weight .**
Detect limit	**"Normal" detection limit**
Count below d.lim	**Number of analyses below normal detection limit**
N (<) above d.lim	**Number of analyses where detection limit was higher than normal.**

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
ACNE	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		20
	1996-NIVA		W						309	0.2	65		19
	1997-NIVA		W						309	0.5	34		
	1998-NIVA	CI	W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	38		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
ACNLE	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		49
	1996-NIVA		W						309	0.2	65		42
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	41		
	2002-NIVA		W						309	0.5	42		
AG	1996-NIVA		W						999	miss	3		
ANT	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		28
	1996-NIVA		W						309	0.2	65		30
	1997-NIVA		W						309	0.5	35		
	1998-NIVA	CI	W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
AS	1996-NIVA		W						999	miss	3		
BAP	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		21
	1996-NIVA		W						309	0.2	65		26
	1997-NIVA	AL	W						309	0.5	36		
	1998-NIVA	CI	W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
BBF	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	59		9
	1996-NIVA		W						309	0.2	57		6
BBJKF	1995-NIVA		W						309	0.2	12		
	1996-NIVA		W						309	0.2	8		
	1997-NIVA		W						309	0.2	36		1
	1998-NIVA		W						309	0.2	39		
	1999-NIVA		W						309	0.2	34		
	2000-NIVA		W						309	0.2	39		10
	2001-NIVA		W						309	0.2	42		
	2002-NIVA		W						309	0.2	43		9
BD100	2001-NILU		W		miss	6				miss	6		
	2002-NILU		W						843	0.02	2		
BD138	2001-NILU		W		miss	6		6		miss	6		6
BD153	1996-NILU		W		miss	4		4					
	2001-NILU		W		miss	6		4		miss	6		4
	2002-NILU		W						843	0.01	2		
BD154	2001-NILU		W		miss	6				miss	6		4
	2002-NILU		W						843	0.01	2		
BD183	2001-NILU		W		miss	6		3		miss	6		6
	2002-NILU		W						843	0.01	2		
BD209	2001-NILU		W		miss	6		5		miss	6		1
	2002-NILU		W						843	0.03	2		
BDE28	2001-NILU		W		miss	6				miss	6		1
	2002-NILU		W						843	0.01	2		
BDE47	1996-NILU		W		miss	4							
	2001-NILU		W		miss	6				miss	6		
	2002-NILU		W						843	0.11	2		
BDE99	1996-NILU		W		miss	4							
	2001-NILU		W		miss	6				miss	6		1
	2002-NILU		W						843	0.06	2		
BEP	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		5

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NIVA		W						309	0.2	65		6
	1997-NIVA		W						309	0.2	36		
	1998-NIVA	CI	W						309	0.2	38		
	1999-NIVA	EK	W						309	0.2	34		
	2000-NIVA		W						309	0.2	39		10
	2001-NIVA		W						309	0.2	42		
	2002-NIVA		W						309	0.2	43		9
BGHIP	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		20
	1996-NIVA		W						309	0.2	65		10
	1997-NIVA		W						309	0.5	36		
	1998-NIVA	CI	W						309	0.5	35		
	1999-NIVA	EK	W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
BIPN	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		52
	1996-NIVA		W						309	0.2	62		39
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39	1	
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	38		1
	2001-NIVA		W						309	0.5	41		
	2002-NIVA		W						309	0.5	42		
BJKF	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	24		21
	1996-NIVA		W						309	0.2	57		16
BAA	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	72		9
	1996-NIVA		W						309	0.2	65		8
	1997-NIVA		W						309	0.5	36		
	1998-NIVA	CI	W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
CB101	1987-SIIF		W						111	0.2	21	1	
	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169	1		341	0.05	58		
	1990-SIIF	2G	W						111	0.4	41	6	
	1991-NIVA	2H	W	340	1	179		8	341	0.05	62		
	1991-SIIF	2H	W						111	0.2	35		1
	1992-NIVA	2J	W	340	5	192	3		341	0.1	140		
	1993-NIVA	2K	W	340	4	212	12		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	3		341	0.05	165	39	
	1995-NIVA		W	340	3	318	10		341	0.05	225	10	
	1996-NIVA		W	340	3	332	14		341	0.05	237	9	
	1997-NIVA		W	340	3	260	24						
	1997-NIVA	AJ	W						341	0.05	221	4	
	1998-NIVA		W	340	3	284	19	1					
	1998-NIVA	CH	W						341	0.05	197	1	3
	1999-NIVA		W	340	3	249	6						
	1999-NIVA	EG	W						341	0.05	226		13
	2000-NIVA		W	340	3	230	24						
	2000-NIVA	GU	W						341	0.05	180	11	7
	2001-NIVA		W	340	3	250	19	4					
	2001-NIVA	IO	W						341	0.05	205		16
	2002-NIVA		W	340	3	241	13		341	0.05	204		17
CB105	1991-NIVA	2H	W	340	1	87		1	341	0.05	47		
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA	QM	W	340	4	212	21		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	8		341	0.05	165	53	
	1995-NIVA		W	340	3	318	13		341	0.05	224	34	
	1996-NIVA		W	340	3	332	22		341	0.05	231	23	
	1997-NIVA		W	340	3	260	24		341	0.05	221	3	1
	1998-NIVA		W	340	3	284	31	19					
	1998-NIVA	CH	W						341	0.05	201	11	16

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1999-NIVA		W	340	3	249	17						
	1999-NIVA	EG	W						341	0.05	226	4	61
	2000-NIVA		W	340	3	230	32						
	2000-NIVA	GU	W						341	0.05	180	21	37
	2001-NIVA		W	340	3	250	29	2					
	2001-NIVA	IO	W						341	0.05	205		76
	2002-NIVA		W	340	3	249	30		341	0.05	204		58
CB118	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.2	41	1	
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.2	35		1
	1992-NIVA	2J	W	340	5	192	2		341	0.1	140		
	1993-NIVA	2K	W	340	4	212	10		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	2		341	0.05	165	25	
	1995-NIVA		W	340	3	318	2		341	0.05	225	2	
	1996-NIVA		W	340	3	332	6		341	0.05	237	4	
	1997-NIVA		W	340	3	260	5						
	1997-NIVA	AJ	W						341	0.05	221		
	1998-NIVA		W	340	3	284	6	1					
	1998-NIVA	CH	W						341	0.05	203	3	1
	1999-NIVA		W	340	3	249	2						
	1999-NIVA	EG	W						341	0.05	226		7
	2000-NIVA		W	340	3	230	5						
	2000-NIVA	GU	W						341	0.05	180	6	7
	2001-NIVA		W	340	3	250	1	1					
	2001-NIVA	IO	W						341	0.05	205		21
	2002-NIVA		W	340	3	249	7		341	0.05	204		22
CB126	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	0.0001	4			841	0.0001	18		
	2002-NILU		W						841	0.0001	12		
CB138	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	21		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.3	41		
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.3	35		1
	1992-NIVA	2J	W	340	5	192			341	0.1	137		
	1993-NIVA	QM	W	340	4	212	3		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300			341	0.05	165	12	
	1995-NIVA		W	340	3	318	2		341	0.05	225		
	1996-NIVA		W	340	3	331	1		341	0.05	235		
	1997-NIVA		W	340	3	260	1						
	1997-NIVA	AJ	W						341	0.05	221		1
	1998-NIVA		W	340	3	284	3						
	1998-NIVA	CH	W						341	0.05	203		
	1999-NIVA		W	340	3	249							
	1999-NIVA	EG	W						341	0.05	226		1
	2000-NIVA		W	340	3	230	3						
	2000-NIVA	GU	W						341	0.05	180	3	
	2001-NIVA		W	340	3	250	1	1					
	2001-NIVA	IO	W						341	0.05	205		7
	2002-NIVA		W	340	3	249	3		341	0.05	204		6
CB153	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.3	41		
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.5	35		1
	1992-NIVA	2J	W	340	5	192			341	0.1	140		
	1993-NIVA	2K	W	340	4	212	3		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300			341	0.05	165	9	
	1995-NIVA		W	340	3	318	1		341	0.05	225		
	1996-NIVA		W	340	3	332	1		341	0.05	237		
	1997-NIVA		W	340	3	260							
	1997-NIVA	AJ	W						341	0.05	221		
	1998-NIVA		W	340	3	284	1						

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1998-NIVA	CH	W						341	0.05	203	1	1
	1999-NIVA		W	340	3	249							
	1999-NIVA	EG	W						341	0.05	226		1
	2000-NIVA		W	340	3	230	3						
	2000-NIVA	GU	W						341	0.05	180	1	
	2001-NIVA		W	340	3	250		1					
	2001-NIVA	IO	W						341	0.05	205		5
	2002-NIVA		W	340	3	249	1		341	0.05	204		4
CB156	1991-NIVA	2H	W	340	1	87		15	341	0.05	47		5
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA	QM	W	340	4	212	31		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	24	1	341	0.05	162	70	
	1995-NIVA		W	340	3	317	27		341	0.05	225	67	
	1996-NIVA		W	340	3	332	48		341	0.05	237	62	
	1997-NIVA		W	340	3	260	46						
	1997-NIVA	AJ	W						341	0.05	221	9	10
	1998-NIVA		W	340	3	284	52	70					
	1998-NIVA	CH	W						341	0.05	203	37	47
	1999-NIVA		W	340	3	249	39	2					
	1999-NIVA	EG	W						341	0.05	225	12	134
	2000-NIVA		W	340	3	230	71	5					
	2000-NIVA	GU	W						341	0.05	180	28	90
	2001-NIVA		W	340	3	250	82	3					
	2001-NIVA	IO	W						341	0.05	205	9	134
	2002-NIVA		W	340	3	249	99		341	0.05	204		97
CB169	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	0.0001	4			841	0.0001	18	2	
	2002-NILU		W						841	0.0001	12		
CB180	1987-SIIF		W						111	0.2	21	6	
	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93	1						
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169			341	0.05	58		
	1990-SIIF	2G	W						111	0.2	41	8	
	1991-NIVA	2H	W	340	1	179			341	0.05	62		
	1991-SIIF	2H	W						111	0.2	35		
	1992-NIVA	2J	W	340	5	192	3		341	0.1	140		
	1993-NIVA	2K	W	340	4	212	15		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	3		341	0.05	162	49	
	1995-NIVA		W	340	3	318	5		341	0.05	225	22	
	1996-NIVA		W	340	3	332	14		341	0.05	237	25	
	1997-NIVA		W	340	3	260	18						
	1997-NIVA	AJ	W						341	0.05	221	1	1
	1998-NIVA		W	340	3	284	20	14					
	1998-NIVA	CH	W						341	0.05	203	18	44
	1999-NIVA		W	340	3	249	7	1					
	1999-NIVA	EG	W						341	0.05	226	2	77
	2000-NIVA		W	340	3	230	15						
	2000-NIVA	GU	W						341	0.05	180	15	80
	2001-NIVA		W	340	3	250	17	1					
	2001-NIVA	IO	W						341	0.05	205		99
	2002-NIVA		W	340	3	249	24		341	0.05	204		99
CB209	1990-NIVA		W	340	2	169	24	11	341	0.05	58		
	1991-NIVA		W	340	2	179	11	88	341	0.05	62	5	7
	1992-NIVA		W	340	5	192	3		341	0.1	140		1
	1993-NIVA		W	340	4	212	46	14	341	0.1	133		
	1994-NIVA		W	340	3	300	29	24	341	0.05	165	91	
	1995-NIVA		W	340	3	318	36		341	0.05	225	92	5
	1996-NIVA		W	340	3	332	255		341	0.05	237	107	9
	1997-NIVA		W	340	3	260	196		341	0.05	221	30	14
	1998-NIVA		W	340	3	283	120	121	341	0.05	203	50	69
	1999-NIVA		W	340	3	243	163	17	341	0.05	224	19	172
	2000-NIVA		W	340	3	228	151	18	341	0.05	172	33	105
	2001-NIVA		W	340	3	250	184	10	341	0.05	205	21	179
	2002-NIVA		W	340	3	248	207	1	341	0.05	203		108
CB28	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		1
	1990-NIVA	2G	W	340	1	169	2	2	341	0.05	58		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1990-SIIF	2G	W						111	0.2	41	7	
	1991-NIVA	2H	W	340	1	179	2	52	341	0.05	62	5	1
	1991-SIIF	2H	W						111	0.3	35		
	1992-NIVA	2J	W	340	5	192	3		341	0.1	137		
	1993-NIVA	2K	W	340	4	212	44	5	341	0.1	133		
	1994-NIVA	2Z	W	340	3	282	18	4	341	0.05	163	73	
	1995-NIVA		W	340	3	313	27		341	0.05	225	75	
	1996-NIVA		W	340	3	332	107		341	0.05	236	70	
	1997-NIVA		W	340	3	260	81						
	1997-NIVA	AJ	W						341	0.05	221	22	14
	1998-NIVA		W	340	3	284	96	99					
	1998-NIVA	CH	W						341	0.05	201	33	46
	1999-NIVA		W	340	3	249	96	18					
	1999-NIVA	EG	W						341	0.05	226	14	143
	2000-NIVA		W	340	3	230	110	7					
	2000-NIVA	GU	W						341	0.05	180	26	60
	2001-NIVA		W	340	3	250	146	10					
	2001-NIVA	IO	W						341	0.05	205	17	145
	2002-NIVA		W	340	3	249	144	1	341	0.05	199		93
CB52	1987-SIIF		W						111	0.2	20	1	
	1988-SIIF		D						111	0.1	6		
	1988-SIIF		W						111	0.1	22		
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	0.1	36		
	1990-NIVA	2G	W	340	1	169	2	6	341	0.05	58		
	1990-SIIF	2G	W						111	0.4	41	7	
	1991-NIVA	2H	W	340	1	179	1	37	341	0.05	62	5	1
	1991-SIIF	2H	W						111	0.3	35		
	1992-NIVA	2J	W	340	5	192	3		341	0.1	137		
	1993-NIVA	2K	W	340	4	212	40		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	9		341	0.05	165	64	
	1995-NIVA		W	340	3	312	19		341	0.05	214	28	
	1996-NIVA		W	340	3	332	49		341	0.05	235	31	
	1997-NIVA		W	340	3	260	116						
	1997-NIVA	AJ	W						341	0.05	221	25	10
	1998-NIVA		W	340	3	281	47	44	341	0.05	168	12	17
	1999-NIVA		W	340	3	249	52	11					
	1999-NIVA	EG	W						341	0.05	216	7	71
	2000-NIVA		W	340	3	230	65	4					
	2000-NIVA	GU	W						341	0.05	177	22	20
	2001-NIVA		W	340	3	250	66	4					
	2001-NIVA	IO	W						341	0.05	180	7	58
	2002-NIVA		W	340	3	193	29		341	0.05	155		52
CB77	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	0.0001	4			841	0.0001	18		
	2002-NILU		W						841	0.0001	12		
CB81	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	0.0001	4			841	0.0001	18		
	2002-NILU		W						841	0.0001	12		
CD	1981-SIIF	1E	W	130	10	28			130	5	27		
	1981-SIIF	1F	W						130	10	7		
	1982-SIIF	1F	W						130	10	18		
	1982-VETN		W	230	10	54							
	1983-SIIF	1F	W						130	10	17		
	1983-VETN	1Z	W	230	10	46							
	1984-FIER	1H	W	402	1	23							
	1984-SIIF	1G	W						130	10	27		
	1984-VETN	1Z	W	230	10	66							
	1985-SIIF	1G	D						130	10	35		
	1985-VETN	1Z	W	230	10	45		3					
	1986-NIVA	1H	D	312	30	56	1		312	30	20		
	1987-FIER	1G	W	402	1	37							
	1987-NIVA	1H	D	312	30	57		4	312	30	37		
	1988-NIVA	1H	D	312	30	61	11	1	312	30	55		
	1989-NIVA	1H	D	312	30	135	11	8					
	1989-NIVA	1H	W						312	30	36		
	1990-NIVA	1H	W	312	10	189	9	2	312	30	77	5	
	1991-NIVA	1H	W	312	10	190	29	2	312	10	67		
	1992-NIVA	1H	W	312	10	191	4		312	10	111		
	1993-NIVA	1H	W	312	50	221	98		312	50	79		
	1994-NIVA	1Z	W	312	50	302	134		312	50	81		
	1995-NIVA		W	312	50	318	129		312	50	139	2	

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr. +basis		Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NIVA	V1	W						312	50	125		
	1996-NIVA	V2	W	312	50	368	128						
	1997-NIVA		W	312	50	287	90						
	1997-NIVA	AH	W						312	50	107		
	1998-NIVA		W	312	50	285	101		312	50	93		
	1999-NIVA		W	312	50	235	79						
	1999-NIVA	EF	W						312	50	132	15	
	2000-NIVA		W	312	50	227	82						
	2000-NIVA	GS	W						312	50	90		
	2001-NIVA		W	312	50	261	103						
	2001-NIVA	IM	W						312	50	93		
	2002-NIVA		W	315	50	230	126		315	50	110		
CDD1N	1995-NILU		W						841	2E-05	6	1	1
	1996-NILU		W	841	1E-05	4			841	1E-05	18		2
	2002-NILU		W						841	1E-05	12		2
CDD4X	1995-NILU		W						841	2E-05	6	3	1
	1996-NILU		W	841	2E-05	4			841	2E-05	18		1
	2002-NILU		W						841	2E-05	12		2
CDD6P	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	4E-05	4			841	4E-05	18		
	2002-NILU		W						841	4E-05	12	1	
CDD6X	1995-NILU		W						841	2E-05	6		1
	1996-NILU		W	841	2E-05	4			841	2E-05	18		1
	2002-NILU		W						841	2E-05	12	2	1
CDD9X	1995-NILU		W						841	2E-05	6	2	1
	1996-NILU		W	841	2E-05	3		1	841	2E-05	18		1
	2002-NILU		W						841	2E-05	12	2	2
CDDO	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	0.0001	4			841	0.0001	18		
	2002-NILU		W						841	0.0001	12		
CDDSN	1995-NILU		W						841	2E-05	5		
	1996-NILU		W	841	1E-05	3			841	1E-05	18		3
	2002-NILU		W						841	1E-05	10		
CDDSP	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	4E-05	4			841	4E-05	18		
	2002-NILU		W						841	4E-05	11	1	
CDDST	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	1E-05	4			841	1E-05	18		
	2002-NILU		W						841	1E-05	12		
CDDSX	1995-NILU		W						841	2E-05	5		
	1996-NILU		W	841	2E-05	3			841	2E-05	18		2
	2002-NILU		W						841	2E-05	11		
CDF2N	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	1E-05	4			841	1E-05	18		1
	2002-NILU		W						841	1E-05	12		
CDF2T	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	1E-05	4			841	1E-05	18		
	2002-NILU		W						841	1E-05	12		
CDF4X	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	2E-05	4			841	2E-05	18		1
	2002-NILU		W						841	2E-05	12	4	
CDF6P	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	4E-05	4			841	4E-05	18	2	1
	2002-NILU		W						841	4E-05	12	3	
CDF6X	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	2E-05	4			841	2E-05	18		1
	2002-NILU		W						841	2E-05	12		1
CDF9P	1995-NILU		W						841	2E-05	6	2	1
	1996-NILU		W	841	8E-05	4			841	8E-05	17	3	1
	2002-NILU		W						841	8E-05	12	2	2
CDF9X	1995-NILU		W						841	2E-05	6	3	1
	1996-NILU		W	841	2E-05	4			841	2E-05	18		1
	2002-NILU		W						841	2E-05	12		3
CDFDN	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	1E-05	4			841	1E-05	18		1
	2002-NILU		W						841	1E-05	12		
CDFDX	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	2E-05	4			841	2E-05	18		1
	2002-NILU		W						841	2E-05	12		1
CDFO	1995-NILU		W						841	2E-05	6		1

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NILU		W	841	0.0001	4			841	0.0001	18	3	1
	2002-NILU		W						841	0.0001	11	1	
CDFSN	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	1E-05	4			841	1E-05	18		1
	2002-NILU		W						841	1E-05	12		
CDFSP	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	8E-05	4			841	8E-05	18	6	1
	2002-NILU		W						841	8E-05	12	4	
CDFST	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	1E-05	4			841	1E-05	18		
	2002-NILU		W						841	1E-05	12		
CDFSX	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	2E-05	4			841	2E-05	18		1
	2002-NILU		W						841	2E-05	12	1	
CHR	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	56		
	1996-NIVA		W						309	0.2	65		3
CHRTR	1995-NIVA		W						309	0.2	15		2
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
CO	1996-NIVA		W						999	miss	3		
COR	1992-NIVA		W	309	0.2	8			309	0.2	46		
CR	1992-NIVA		W						312	10	6		
	1996-NIVA		W						999	miss	3		
CU	1983-SIIF	1G	W						130	10	12		
	1984-SIIF	1G	W						130	10	27		
	1986-NIVA	1H	D	311	150	56			311	150	20		
	1987-FIER	1G	W	404	50	37							
	1987-NIVA	1H	D	311	150	57			311	150	37		
	1988-NIVA	1H	D	311	150	61			311	150	55		
	1989-NIVA	1H	D	311	150	135							
	1989-NIVA	1H	W						311	150	36		
	1990-NIVA	1H	W	311	150	189			311	150	77		
	1991-NIVA	1H	W	311	50	193	2		311	50	67		
	1992-NIVA	1H	W	311	10	191			311	10	111		
	1993-NIVA	1H	W	311	10	221			311	10	79		
	1994-NIVA	1Z	W	311	10	302			311	10	81		
	1995-NIVA		W	311	10	318			311	10	124		
	1996-NIVA	V1	W						311	10	113		
	1996-NIVA	V2	W	311	10	368							
	1997-NIVA		W	311	5000a	287	1						
	1997-NIVA	AH	W						311	10	96		
	1998-NIVA		W	311	10	285							
	1998-NIVA	CF	W						311	10	51		
	1999-NIVA		W	311	10	235							
	1999-NIVA	EF	W						311	10	99		
	2000-NIVA		W	311	10	227							
	2000-NIVA	GS	W						311	10	51		
	2001-NIVA		W	311	10	261							
	2001-NIVA	IM	W						311	10	51		
	2002-NIVA		W	315	10	230			315	10	65		
DBA3A	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	71		48
	1996-NIVA		W						309	0.2	65		53
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
DBP	1992-NIVA		W	309	0.2	8			309	0.2	46		
DBT	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
DBTC1	1995-NIVA		W						309	0.2	57		14

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1996-NIVA		W						309	0.2	65		9
DBTC2	1995-NIVA		W						309	0.2	56		9
	1996-NIVA		W						309	0.2	62		11
DBTC3	1995-NIVA		W						309	0.2	57		4
	1996-NIVA		W						309	0.2	65		5
DBTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		
	1999-NIVA		D						320	5	13		
	1999-NIVA		W						320	5	6	2	
	2000-NIVA		W						320	0.5	23		
	2001-GALG		W						520	0.15	11		
	2001-NIVA		W						320	0.5	16		1
	2002-EFDH		W						720	2	33	5	
DBTIO	1997-NIVA		W						309	0.5	34		
DDEPP	1982-VETN		W	210	50	53							
	1983-VETN	2E	W	210	50	48			211a	50	48		
	1984-VETN	2E	W	210	50	66							
	1985-VETN	2E	W	210	50	45							
	1986-NACE	2Z	W	510	20	56							
	1987-NACE	2Z	W	510	40	53							
	1988-NACE	2Z	W	510	40	61							
	1989-NACE	2Z	W	510	20	93							
	1990-NIVA		W	340	1	169			341	0.05	58		
	1991-NIVA		W	340	1	179			341	0.05	62		
	1992-NIVA		W	340	5	192	2		341	0.1	140		
	1993-NIVA		W	340	4	212	3		341	0.1	133		
	1994-NIVA	2Z	W	340	4	300			341	0.1	165	27	
	1995-NIVA		W	340	4	318	2		341	0.1	225	30	
	1996-NIVA		W	340	4	332	2		341	0.1	237	47	
	1997-NIVA		W	340	4	260	3		341	0.1	221	1	
	1998-NIVA		W	340	4	284	6						
	1998-NIVA	CH	W						341	0.1	203	4	
	1999-NIVA		W	340	4	249							
	1999-NIVA	EG	W						341	0.1	226	2	
	2000-NIVA		W	340	4	230	7						
	2000-NIVA	GU	W						341	0.1	179	6	
	2001-NIVA		W	340	4	250		1					
	2001-NIVA	IO	W						341	0.1	205	1	7
	2002-NIVA		W	340	4	249	4		341	0.1	204	5	
DDTEP	1983-SIIF		W						111	0.5	12		
	1984-SIIF		W						111	0.5	24		1
	1985-SIIF		W						111	0.5	27	1	5
	1986-SIIF		W						111	0.5	21		
	1987-SIIF		W						111	0.5	21	1	
	1988-SIIF		D						111	0.5	6		
	1988-SIIF		W						111	0.5	22	1	
	1989-SIIF		W						111	0.5	36	1	
	1990-SIIF		W						111	0.2	41	1	
	1991-SIIF		W						111	0.3	35		
DDTPP	1986-NACE		W	510	40	56							
	1987-NACE		W	510	40	53							
	1988-NACE		W	510	40	61							
	1989-NACE		W	510	20	93							
	1995-NIVA		W						340	0.05	72		
	1996-NIVA		W	340	0.05	55		4	340	0.05	45		
	1997-NIVA		W	340	2	32							
	1997-NIVA	AJ	W						340	0.05	48		
	1998-NIVA		W	340	2	37	1	8	340	0.05	68		24
	1999-NIVA		W	340	2	29		4	340	0.05	93		7
	2000-NIVA		W	340	2	22			340	0.05	48		6
	2001-NIVA		W	340	2	46		2	340	0.05	48		11
	2002-NIVA		W	340	2	32		10	340	0.05	62		21
DPTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15	9	
	1999-NIVA		D						320	5	13	12	
	1999-NIVA		W						320	5	6	6	
	2000-NIVA		W						320	0.5	23	1	1
	2001-NIVA		W						320	0.5	16		16
EOCL	1989-SIIF		W						605	170	5		
EPOCL	1986-NACE		W	610	800	56							
	1986-SIIF		W						605	5000	21	21	

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1987-NACE		W	610	800	53							
	1987-SIIF		W						605	40	20		
	1988-NACE		W	610	800	60							
	1988-SIIF		W						605	40	27		
	1989-NACE		W	610	800	89	1						
	1989-SIIF		W						605	40	35		
	1990-NIVA		W	615	40	117		3					
	1990-SIIF		W						605	40	41		
	1991-NIVA		W	615	40	116		12					
	1991-SIIF		W						605	130	35		
	1997-IFEN		W						607	50	6		
	1998-IFEN		W						607	1	6		
	2000-SINT		W						607	1	6		
	2001-SINT		W						607	1	6		
FLE	1992-NIVA		W	309	0.2	8			309	0.2	45		
	1995-NIVA		W						309	0.2	72		22
	1996-NIVA		W						309	0.2	65		6
	1997-NIVA	AL	W						309	0.5	34		
	1998-NIVA	CI	W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
FLU	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	72		
	1996-NIVA		W						309	0.2	65		
	1997-NIVA	AL	W						309	0.2	36		
	1998-NIVA	CI	W						309	0.2	39		
	1999-NIVA	EK	W						309	0.2	34		
	2000-NIVA		W						309	0.2	39		
	2001-NIVA		W						309	0.2	42		
	2002-NIVA		W						309	0.2	43		3
HBCDA	2001-NILU		W		miss	4				miss	5		2
HBCDB	2001-NILU		W		miss	4		4		miss	5		5
HBCDG	2001-NILU		W		miss	5		4		miss	4		4
HCB	1983-SIIF		W						111	0.5	12		
	1983-VETN	2Z	W	210	10	48			211a	10	48		
	1984-SIIF		W						111	0.2	24		1
	1984-VETN	2Z	W	210	10	66							
	1985-SIIF		W						111	0.2	30	6	2
	1985-VETN	2Z	W	210	10	45		4					
	1986-NACE	2Z	W	510	10	56							
	1986-SIIF	2Z	W						111	0.2	21	3	
	1987-NACE	2Z	W	510	40	53							
	1987-SIIF	2Z	W						111	0.2	21	4	
	1988-NACE	2Z	W	510	40	61							
	1988-SIIF	2Z	D						111	0.2	6		
	1988-SIIF	2Z	W						111	0.2	22	2	
	1989-NACE	2Z	W	510	20	93							
	1989-SIIF	2Z	W						111	0.05	36		
	1990-NIVA		W	340	1	169	2		341	0.05	58		
	1990-SIIF	2Z	W						111	0.05	41	3	
	1991-NIVA		W	340	1	179	4	13	341	0.05	62	5	
	1991-SIIF	2Z	W						111	0.1	35		
	1992-NIVA		W	340	5	189	3		341	0.1	140		
	1993-NIVA		W	340	4	212	31		341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	24	1	341	0.05	165	33	
	1995-NIVA		W	340	3	317	37		341	0.05	225	30	
	1996-NIVA		W	340	3	332	52		341	0.05	237	37	
	1997-NIVA		W	340	2	260	39						
	1997-NIVA	AJ	W						341	0.05	221	7	
	1998-NIVA		W	340	2	284	48	13	341	0.05	203	67	2
	1999-NIVA		W	340	2	249	18						
	1999-NIVA	EG	W						341	0.05	226	18	8
	2000-NIVA		W	340	2	230	40						
	2000-NIVA	GU	W						341	0.05	180	43	1
	2001-NIVA		W	340	2	250	36	1	341	0.05	205	36	2
	2002-NIVA		W	340	2	249	36		341	0.05	204	29	
HCHA	1990-NIVA		W	340	1	168			341	0.05	58		
	1991-NIVA		W	340	1	179	2	111	341	0.05	62	5	10
	1992-NIVA		W	340	5	192	3		341	0.1	140		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1993-NIVA		W	340	4	212	45	22	341	0.1	133		
	1994-NIVA	2Z	W	340	3	296	32	3	341	0.05	165	85	
	1995-NIVA		W	340	3	318	45		341	0.05	225	98	
	1996-NIVA		W	340	3	332	111		341	0.05	231	100	
	1997-NIVA		W	340	0.5	260	2	10	341	0.05	221	20	11
	1998-NIVA		W	340	0.5	284	8	208	341	0.05	202	25	121
	1999-NIVA		W	340	0.5	249	17	78	341	0.05	226	23	150
	2000-NIVA		W	340	0.5	230	31	62	341	0.05	180	42	78
	2001-NIVA		W	340	0.5	250	25	50	341	0.05	205	20	179
	2002-NIVA		W	340	0.5	249	23	149	341	0.05	204		115
HCHG	1986-NACE		W	510	30	56	1						
	1986-SIIF		W						111	3	21		
	1987-NACE		W	510	40	53							
	1987-SIIF		W						111	5	21		1
	1988-NACE		W	510	40	61							
	1989-NACE		W	510	20	93							
	1989-SIIF		W						111	50	36		
	1990-NIVA		W	340	1	169	1	9	341	0.05	58		
	1990-SIIF		W						111	0.1	41		
	1991-NIVA		W	340	1	179	3	18	341	0.05	62	5	1
	1991-SIIF		W						111	0.3	35		
	1992-NIVA		W	340	5	192	3		341	0.1	140		
	1993-NIVA		W	340	4	212	42	17	341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	24	1	341	0.05	165	46	
	1995-NIVA		W	340	3	313	31		341	0.05	213	29	
	1996-NIVA		W	340	3	330	68		341	0.05	220	8	
	1997-NIVA		W	340	2	260	47						
	1997-NIVA	AJ	W						341	0.05	221	3	9
	1998-NIVA		W	340	2	284	25	63					
	1998-NIVA	AJ	W						341	0.05	203	10	23
	1999-NIVA		W	340	2	249	52	3	341	0.05	226	19	62
	2000-NIVA		W	340	2	230	65	29	341	0.05	180	27	9
	2001-NIVA		W	340	2	250	96	20	341	0.05	205	21	154
	2002-NIVA		W	340	2	249	147	13	341	0.05	204		78
HG	1981-SIIF	1E	W	120	10	15		1	120	10	35		
	1982-SIIF	1E	W						120	10	18		
	1982-VETN		W	220	10	51			220	10	54		
	1983-SIIF	1E	W						120	10	17		
	1983-VETN	1Z	W						220	10	48		
	1984-FIER	1G	W						401	10	39		
	1984-SIIF	1G	W						120	10	27	6	
	1984-VETN	1Z	W						220	10	66		
	1985-SIIF	1G	D						120	10	30		
	1985-VETN	1Z	W						220	10	90		
	1986-NIVA	1H	D						310	10	74		
	1987-FIER	1G	W						401	10	38		
	1987-NIVA	1H	D						310	10	93		14
	1988-NIVA	1H	D						310	10	116		
	1989-NIVA	1H	D						310	100	134		
	1989-NIVA	1H	W						310	10	36	5	
	1990-NIVA	1H	W						310	10	266		
	1991-NIVA	1H	W						310	100a	264	126	
	1992-NIVA	1H	W						310	100a	303	122	
	1993-NIVA	1H	W						310	5	300		
	1994-NIVA	1Z	W						310	5	381		
	1995-NIVA		W						310	5	442	1	
	1996-NIVA	V1	W						310	5	481		
	1997-NIVA	AH	W						310	5	383		
	1998-NIVA	CF	W						310	5	381		
	1999-NIVA		W	310	5	3							
	1999-NIVA	EF	W						310	5	386		
	2000-NIVA	GS	W						310	5	330		
	2001-NIVA	IM	W						310	5	356		
	2002-NIVA		W						310	5	366		
ICDP	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		29
	1996-NIVA		W						309	0.2	65		23
	1997-NIVA		W						309	0.5	36		
	1998-NIVA	CI	W						309	0.5	37	2	
	1999-NIVA	EK	W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
MBTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		
	1999-NIVA		D						320	5	13		
	1999-NIVA		W						320	5	6	6	
	2000-NIVA		W						320	0.5	23		
	2001-GALG		W						520	0.2	11		
	2001-NIVA		W						320	0.5	16		5
	2002-EFDH		W						720	0.8	33		15
MN	1984-SIIF		W						132	40	27		
	1985-SIIF		D						132	40	35		
MPTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15	9	
	1999-NIVA		D						320	5	13	13	
	1999-NIVA		W						320	5	6	6	
	2000-NIVA		W						320	0.5	23	3	
	2001-NIVA		W						320	0.5	16		15
	2002-EFDH		W						720	4	1		
NAP	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	70		21
	1996-NIVA		W						309	0.2	61		11
	1997-NIVA		W						309	0.2	34		1
	1998-NIVA	CI	W						309	0.2	37		
	1999-NIVA		W						309	0.2	34		1
	2000-NIVA		W						309	0.2	37		7
	2001-NIVA		W						309	0.2	41		4
	2002-NIVA		W						309	0.2	42		19
NAP1M	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	15		13
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	37		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	41		
	2002-NIVA		W						309	0.5	42		9
NAP2M	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	15		13
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	37		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	41		
	2002-NIVA		W						309	0.5	42		9
NAPC1	1995-NIVA		W						309	0.2	55		6
	1996-NIVA		W						309	0.2	61		
NAPC2	1995-NIVA		W						309	0.2	57		6
	1996-NIVA		W						309	0.2	60		
NAPC3	1995-NIVA		W						309	0.2	57		5
	1996-NIVA		W						309	0.2	60		
NAPD2	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	41		
	2002-NIVA		W						309	0.5	42		
NAPD3	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	41		
	2002-NIVA		W						309	0.5	42		
NAPDI	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	15		6
	1997-NIVA		W						309	0.5	34		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	41		
	2002-NIVA		W						309	0.5	42		
NAPT2	1997-NIVA		W						309	0.5	34		

Tissue			Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1998-NIVA	W						309	0.5	39		
	1999-NIVA	W						309	0.5	34		
	2000-NIVA	W						309	0.5	39		
	2001-NIVA	W						309	0.5	42		
	2002-NIVA	W						309	0.5	43		
NAPT3	1997-NIVA	W						309	0.5	34		
	1998-NIVA	W						309	0.5	39		
	1999-NIVA	W						309	0.5	34		
	2000-NIVA	W						309	0.5	39		
	2001-NIVA	W						309	0.5	42		
	2002-NIVA	W						309	0.5	43		
NAPT4	1997-NIVA	W						309	0.5	34		
	1998-NIVA	W						309	0.5	39		
	1999-NIVA	W						309	0.5	34		
	2000-NIVA	W						309	0.5	39		
	2001-NIVA	W						309	0.5	42		
	2002-NIVA	W						309	0.5	43		
NAPTM	1992-NIVA	W	309	0.2	8			309	0.2	46		
	1995-NIVA	W						309	0.2	15		11
	1997-NIVA	W						309	0.5	34		
	1998-NIVA	W						309	0.5	39		
	1999-NIVA	W						309	0.5	34		
	2000-NIVA	W						309	0.5	39		
	2001-NIVA	W						309	0.5	42		
	2002-NIVA	W						309	0.5	43		
NI	1983-SIIF	1G W						130	20	12		
	1992-NIVA	W						312	10	6		
	1996-NIVA	W						999	miss	3		
OCS	1990-NIVA	W	340	2	169	31	24	341	0.05	58		1
	1991-NIVA	W	340	2	179	14	81	341	0.05	62	5	8
	1992-NIVA	W	340	5	192	3		341	0.1	140		
	1993-NIVA	W	340	4	212	51	16	341	0.1	133		
	1994-NIVA	W	340	3	300	39	22	341	0.05	165	96	
	1995-NIVA	W	340	3	318	44		341	0.05	225	102	
	1996-NIVA	W	340	3	332	287		341	0.05	237	114	
	1997-NIVA	W	340	2	260	100		341	0.05	221	30	14
	1998-NIVA	W	340	2	277	132	101	341	0.05	203	182	1
	1999-NIVA	W	340	2	249	148	2	341	0.05	226	80	26
	2000-NIVA	W	340	2	230	140	21	341	0.05	180	103	58
	2001-NIVA	W	340	2	250	189	2	341	0.05	205	94	64
	2002-NIVA	W	340	2	218	183		341	0.05	195	96	
PA	1992-NIVA	W	309	0.2	8			309	0.2	45		
	1995-NIVA	W						309	0.2	72		
	1996-NIVA	W						309	0.2	65		
	1997-NIVA	AL W						309	0.2	36		
	1998-NIVA	CI W						309	0.2	39		
	1999-NIVA	EK W						309	0.2	34		
	2000-NIVA	W						309	0.2	39		
	2001-NIVA	W						309	0.2	42		
	2002-NIVA	W						309	0.2	43		
PAC1	1995-NIVA	W						309	0.2	57		1
	1996-NIVA	W						309	0.2	65		
PAC2	1995-NIVA	W						309	0.2	56		
	1996-NIVA	W						309	0.2	65		2
PADM1	1997-NIVA	W						309	0.5	36		
	1998-NIVA	W						309	0.5	39		
	1999-NIVA	W						309	0.5	34		
	2000-NIVA	W						309	0.5	39		
	2001-NIVA	W						309	0.5	42		
	2002-NIVA	W						309	0.5	43		
PADM2	1997-NIVA	W						309	0.5	36		
	1998-NIVA	W						309	0.5	39		
	1999-NIVA	W						309	0.5	34		
	2000-NIVA	W						309	0.5	39		1
	2001-NIVA	W						309	0.5	42		
	2002-NIVA	W						309	0.5	43		
PAH	1987-NIVA	W	309	0.02	1							
PAM1	1992-NIVA	W	309	0.2	8			309	0.2	45		
	1995-NIVA	W						309	0.2	15		2
	1997-NIVA	W						309	0.5	36		
	1998-NIVA	W						309	0.5	39		

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
PAM2	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA		W						309	0.5	34		
	2000-NIVA		W						309	0.5	38		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
PB	1983-SIIF	1G	W						130	20	12		
	1984-SIIF	1G	W						130	20	27		2
	1985-SIIF	1G	D						130	20	35		
	1986-NIVA	1Z	D	312	150	56	4		312	150	20		
	1987-FIER	1G	W	403	10	37	1						
	1987-NIVA	1Z	D	312	150	57		12	312	150	37		
	1988-NIVA	1Z	D	312	150	61	17	3	312	150	55		
	1989-NIVA	1Z	D	312	150	135	9	9					
	1989-NIVA	1Z	W						312	150	36		
	1990-NIVA	1Z	W	312	50	187	3	1	312	150	77	3	
	1991-NIVA	1Z	W	312	50	193	14		312	50	67		
	1992-NIVA	1Z	W	312	50	191	119		312	50	111	2	
	1993-NIVA	1H	W	312	30	221	40		312	30	79		
	1994-NIVA	1Z	W	312	30	302	3		312	30	81		
	1995-NIVA		W	312	30	318	162	30	312	30	124		
	1996-NIVA	V1	W						312	30	110		
	1996-NIVA	V2	W	312	30	368		109					
	1997-NIVA		W	312	40	287	10	28	312	40	92		
	1998-NIVA		W	312	40	285	126	2					
	1998-NIVA	CF	W						312	40	90		
	1999-NIVA		W	312	40	235	118	11					
	1999-NIVA	EF	W						312	40	129	10	
	2000-NIVA		W	312	40	227	67	4					
	2000-NIVA	GS	W						312	40	87		
	2001-NIVA		W	312	40	261	156	6					
	2001-NIVA	IM	W						312	40	90		
	2002-NIVA		W	315	40	230	164		315	40	107		
PBB15	1996-NILU		W		miss	4		3					
	2001-NILU		W		miss	6		6		miss	6		3
	2002-NILU		W						843	0.01	2		
PBB49	2001-NILU		W		miss	6		1		miss	6		3
	2002-NILU		W						843	0.01	2		
PBB52	1996-NILU		W		miss	4							
	2001-NILU		W		miss	6		1		miss	6		5
	2002-NILU		W						843	0.01	2		
PCB	1981-SIIF	2D	W	110	10	27			110	10	35		
	1982-SIIF	2D	W						111	5	17		
	1982-VETN		W	210	50	53			211	50	54		
	1983-SIIF	2E	W						111	5	14		
	1983-VETN	2E	W						211	50	48		
	1983-VETN	2Z	W	210	50	48							
	1984-SIIF	2E	W						111	5	24		
	1984-VETN	2E	W						211	50	66		
	1984-VETN	2Z	W	210	50	66							
	1985-SIIF	2E	W						111	5	32		6
	1985-VETN	2E	W						211	50	90		1
	1985-VETN	2Z	W	210	50	45							
	1986-NACE	2Z	W	511a	40a	56			511	20	56		
	1986-SIIF	2E	W						111	5	21		
	1987-NACE	2Z	W	510	40	53			511	20	54		
	1987-NIVA		W	340	0.1	2							
	1987-SIIF	2E	W						111	5	21		
	1988-NACE	2Z	W	510	40	61			511	20	13		
	1988-SIIF	2E	D						111	5	6		
	1988-SIIF	2E	W						111	5	22	4	
	1989-NACE	2Z	W	510	20	93			511	20	17		
	1989-SIIF	2E	W						111	5	36	6	
	1990-SIIF	2E	W						111	5	41		
	1991-SIIF	2E	W						111	5	35		
PCC26	1996-NILU		W						842	0.001	6		
PCC32	1996-NILU		W						842	0.003	6		4

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
PCC50	1996-NILU		W						842	0.001	6		
PCC62	1996-NILU		W						842	0.025	6		6
PCDD	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	0.0001	4			841	0.0001	18		
	2002-NILU		W						841	0.0001	12		
PCDF	1995-NILU		W						841	2E-05	6		
	1996-NILU		W	841	0.0001	4			841	0.0001	18		
	2002-NILU		W						841	0.0001	11		
PER	1992-NIVA		W	309	0.2	8			309	0.2	46		
	1995-NIVA		W						309	0.2	72		32
	1996-NIVA		W						309	0.2	65		40
	1997-NIVA		W						309	0.5	36		
	1998-NIVA		W						309	0.5	39		
	1999-NIVA	EK	W						309	0.5	34		
	2000-NIVA		W						309	0.5	39		
	2001-NIVA		W						309	0.5	42		
	2002-NIVA		W						309	0.5	43		
PYR	1992-NIVA		W	309	0.2	8			309	0.2	44		
	1995-NIVA		W						309	0.2	72		4
	1996-NIVA		W						309	0.2	65		1
	1997-NIVA	AL	W						309	0.2	36		
	1998-NIVA	CI	W						309	0.2	39		
	1999-NIVA	EK	W						309	0.2	34		
	2000-NIVA		W						309	0.2	39		
	2001-NIVA		W						309	0.2	42		
	2002-NIVA		W						309	0.2	43		3
QCB	1990-NIVA		W	340	2	169	33	39	341	0.05	58		
	1991-NIVA		W	340	2	178	13	97	341	0.05	57	5	7
	1992-NIVA		W	340	5	192	3		341	0.1	125		
	1993-NIVA		W	340	4	212	52	24	341	0.1	133		
	1994-NIVA		W	340	3	299	38	23	341	0.05	165	93	
	1995-NIVA		W	340	3	318	45		341	0.05	225	103	
	1996-NIVA		W	340	3	332	306		341	0.05	237	109	
	1997-NIVA		W	340	2	260	79		341	0.05	221	27	10
	1998-NIVA		W	340	2	284	121	101	341	0.05	203	171	1
	1999-NIVA		W	340	2	242	185	2	341	0.05	226	84	14
	2000-NIVA		W	340	2	230	198	1	341	0.05	180	123	1
	2001-NIVA		W	340	2	232	216	1	341	0.05	205	95	62
	2002-NIVA		W	340	2	248	235		341	0.05	204	99	
SCCP	2001-NILU		W		miss	4				miss	3		
SE	1982-VETN		W	240	10	46			240	10	54		
TBA	2001-NILU		W		miss	6				miss	6		
	2002-NILU		W						843	0.35	1		
TBBPA	2001-NILU		W		miss	6				miss	6		
TBTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		
	1999-NIVA		D						320	5	13		
	1999-NIVA		W						320	5	6		
	2000-NIVA		W						320	0.5	23		
	2001-GALG		W						520	0.12	11		
	2001-NIVA		W						320	0.5	16		
	2002-EFDH		W						720	0.2	32		
TCDD	1995-NILU		W						841	2E-05	6	1	
	1996-NILU		W	841	1E-05	4			841	1E-05	18		
	2002-NILU		W						841	1E-05	12		
TDEPP	1991-NIVA		W	340	1	138		1	341	0.05	62		
	1992-NIVA		W	340	5	191	3		341	0.1	140		
	1993-NIVA		W	340	4	212	24	3	341	0.1	133		
	1994-NIVA	2Z	W	340	3	300	17	5	341	0.05	165	47	
	1995-NIVA		W	340	3	318	36		341	0.05	222	51	
	1996-NIVA		W	340	3	332	23		341	0.05	237	16	
	1997-NIVA		W	340	3	260	23						
	1997-NIVA	AJ	W						341	0.05	221	11	
	1998-NIVA		W	340	3	278	19	26					
	1998-NIVA	CH	W						341	0.05	203	1	44
	1999-NIVA		W	340	3	249	6	1					
	1999-NIVA	EG	W						341	0.05	226	2	71
	2000-NIVA		W	340	3	230	35	4					
	2000-NIVA	GU	W						341	0.05	179	11	67
	2001-NIVA		W	340	3	250	24	3	341	0.05	205	1	101
	2002-NIVA		W	340	3	248	24	3	341	0.05	204		124

Tissue				Fish liver					Fish fillet, Shrimp tail, Mussel, Other				
Contamin.	Mon. Year Lab.	Inter-calibr.	+basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
TPTIN	1997-NIVA		D						320	5	8		
	1998-NIVA		D						320	5	15		5
	1999-NIVA		D						320	5	13		
	1999-NIVA		W						320	5	6	4	
	2000-NIVA		W						320	0.5	23		
	2001-GALG		W						520	0.1	11		1
	2001-NIVA		W						320	0.5	16		9
	2002-EFDH		W						720	2	24	13	
V	1996-NIVA		W						999	miss	3		
ZN	1983-SIIF	1G	W						131	400	12		
	1984-SIIF	1G	W						132	400	27		
	1985-SIIF	1G	D						132	400	35		
	1986-NIVA	1H	D	311	3000	56			311	3000	20		
	1987-FIER	1G	W	405	20	37							
	1987-NIVA	1H	D	311	3000	57			311	3000	37		
	1988-NIVA	1H	D	311	3000	61			311	3000	55		
	1989-NIVA	1H	D	311	3000	135		1					
	1989-NIVA	1H	W						311	3000	36		
	1990-NIVA	1H	W	311	3000	189			311	3000	77		
	1991-NIVA	1H	W	311	1000	193			311	1000	67		
	1992-NIVA	1H	W	311	1000	191			311	1000	111		
	1993-NIVA	1H	W	311	1000	221			311	1000	79		
	1994-NIVA	1Z	W	311	1000	302			311	1000	81		
	1995-NIVA		W	311	1000	318			311	1000	142		
	1996-NIVA	V1	W						311	1000	131		
	1996-NIVA	V2	W	311	1000	368							
	1997-NIVA		W	311	1000	287							
	1997-NIVA	AH	W						311	1000	110		
	1998-NIVA		W	311	1000	285							
	1998-NIVA	CF	W						311	1000	51		
	1999-NIVA		W	311	1000	235							
	1999-NIVA	EF	W						311	1000	99		
	2000-NIVA		W	311	1000	227							
	2000-NIVA	GS	W						311	1000	51		
	2001-NIVA		W	311	1000	261							
	2001-NIVA	IM	W						311	1000	51		
	2002-NIVA		W	315	1000	230			315	1000	65		
Sum of counts						72635	10536	2583			66484	5193	5618

a(7) > ambigous value (Maximum value displayed)

Appendix D
Participation in intercalibration exercises

Participation in intercalibration exercises other than QUASIMEME

Sea water:

4H ICES/JMG Fifth Round Intercalibration on Trace Metals in Sea Water - Section 4, analysis for Hg - 1983 - (5/TM/SW:4).

4I JMG Sixth Intercalibration on Trace Metals in Estuarine Waters - 1986 - (6/TM/SW).

4Z Intercalibration exercise for SIIF/SERI (Cd) and NIVA/IAMK (IAMK=Chalmers Inst., Göteborg) - 1985.

Seabed sediment:

7E ICES, First Intercalibration Exercise on Trace metals in Marine Sediments - 1984 - (1/TM/MS).

8B ICES/OSPAR, First Intercomparison Exercise on Organochlorines (individual chlorobiphenyl congeners) in Marine Sediments - Phase 1, analysis of standard solutions - 1989 - (1/OC/MS:1).

8C ICES/OSPAR, First Intercomparison Exercise on Organochlorines (individual chlorobiphenyl congeners) in Marine Sediments - Phase 2, analysis of standard solutions - 1991 - (1/OC/MS:2).

8B ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 1 - (analysis of standard solutions) - 1989 - (1/OC/MS-1).

8C ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 2 - 1990 - (1/OC/MS-2).

8D ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3a (1/OC/MS-3a) 1991.

8E ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3b - (1/OC/MS-3b) 1992.

8F ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 4 - (1/OC/MS-4) 1993.

Marine biota:

1E ICES, Fifth Intercalibration Exercise on Trace Metals in Biological Tissues - 1978 - (5/TM/BT).

1F ICES, Sixth Intercalibration Exercise on Trace Metals (Cadmium and Lead only) in Biological Tissues - 1979 - (6/TM/BT).

1G ICES, Seventh Intercalibration Exercise on Trace Metals in Biological Tissues - Part A - 1983 - (7/TM/BT).

1H ICES, Seventh Intercalibration Exercise on Trace Metals in Biological Tissues - Part B - 1985 - (7/TM/BT) (preliminary report 1987).

1Z VETN Interlabcalibration exercise with VETN and SIIF 1983, mercury and cadmium in cod filet and liver.

1Z NIVA	Interlabcalibration exercise with VETN, NACE and NIVA 1986 (Hg, Cd, Cu, Pb and Zn in 6 samples).
2D	ICES Fourth Intercalibration Exercise on Organochlorines (mainly PCBs) in Biological Tissues (Sample No.5) - 1979 - (4/OC/BT).
2E	ICES Fifth Intercalibration Exercise on Organochlorines (PCBs only) in Biological Tissues - 1982 - (5/OC/BT).
2G	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 1 - (analysis of standard solutions) - 1989 - (7/OC/BT-1).
2H	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 2 - 1990 - (7/OC/BT-2).
2I	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3a - (7/OC/BT-3a) 1991.
2J	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 3b - (7/OC/BT-3b) 1992.
2K	ICES/IOC/OSPAR Intercomparison Programme on the Analysis of Chlorobiphenyls in Marine Media - Step 4 - (7/OC/BT-4) 1993.
2Z VETN	Interlabcalibration exercise with VETN among others, 1983, PCB and HCB in cod liver.
2Z NACE	Interlabcalibration exercise with NACE, VETNand SIIF 1986 (PCB (all labs), DDE, OCS, HCB and DCB (NACE and VETN).

Participation in QUASIMEME intercalibration exercises

IC	Code	Year	No.	Group	Matrix
QM	QOR002BT	1993	80	BT-2	CB's in standard solution and biota - Fish oil
V1	QTM028BT	1996	280	BT-1	Trace metals in cod muscle and cod liver
V2	QTM029BT	1996	280	BT-1	Trace metals in cod muscle and cod liver
AJ	QOR054BT	1997	347	BT-2	Chlorobiphenyls and organochlorine pesticides in biota
AL	QPH008BT	1997	348	BT-4	PAHs in biota
AH	QTM036BT	1997	346	BT-1	Metals in biota
CI	QPH010BT	1998	394	BT-4	Polyaromatic hydrocarbons in biota
CH	QOR059BT	1998	393	BT-2	Chlorobiphenyls and organochlorine pesticides in Biota
CF	QTM042BT	1998	392	BT-1	Trace metals in Biota
EF	QTM046BT	1999	433	BT-1	Trace metals in biota
EG	QOR062BT	1999	434	BT-2	Chlorobiphenyls and organochlorine pesticides in biota
EK	QPH012BT	1999	435	BT-4	Polyaromatic hydrocarbons in biota
GU	QOR066BT	2000	473	BT-2	Chlorobiphenyls and organochlorine pesticides in biota
GS	QTM049BT	2000	472	BT-1	Trace metals in biota
IO	QOR070BT	2001	510	BT-2	Chlorobiphenyls and organochlorine pesticides in biota
IM	QTM053BT	2001	509	BT-1	Trace metals in biota
	QTM057BT	2003	549	BT-1	Trace metals in biota
	QOR074BT	2003	550	BT-2	Chlorobiphenyls and organochlorine pesticides in biota

Appendix E
Overview of localities and sample counts 1981-2002

Station positions are shown on maps in Appendix F

jmpco: JAMP area code (J99 = unclassified)
jmpst: station code
stnam: station code
Lon: Longitude
Lat: Latitude
icear: ICES area
speci: species code (English, Norwegian (Latin))
MYTI EDU - blue mussel, blåskjell (*Mytilus edulis*)
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 whiff-iagonis*)
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

jmpco	jmpst	stnam	lat	lon	icear	speci	tissu	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
J26	01A	Sponvika	59° 5.10	11° 13.90	47G13	MYTI EDU	SB		3			3					3												
J26	02A	Fugleskjær	59° 6.90	10° 59.0	47G09	MYTI EDU	SB		3			3					3												
J26	03A	Tisler	58° 58.80	10° 57.50	46G07	MYTI EDU	SB		2			3					3												
J26	301	Akershuskaia	59° 54.23	10° 45.47	48G07	MYTI EDU	SB												2										
J26	302	Ormøya	59° 52.69	10° 45.46	48G07	MYTI EDU	SB												2										
J26	303	Malmøya	59° 51.78	10° 45.95	48G07	MYTI EDU	SB												2										
J26	304	Gåsøya	59° 51.11	10° 35.51	48G04	MYTI EDU	SB												3										
J26	305	Lysaker	59° 54.36	10° 38.60	48G04	MYTI EDU	SB												2										
J26	306	Håøya	59° 42.69	10° 33.35	48G05	MYTI EDU	SB												3										
J26	30A	Gressholmen	59° 53.20	10° 42.658	48G07	MYTI EDU	SB				3	3	3	4	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3
J26	30G	Spro	59° 45.80	10° 34.50	48G05	PAND BOR	TM															1							
J26	30B	Oslo City area	59° 49.0	10° 33.0	48G05	GADU MOR	BI																		27	23	23	25	25
J26	30B	Oslo City area	59° 49.0	10° 33.0	48G05	GADU MOR	BL																	20	30	25	25	25	25
J26	30B	Oslo City area	59° 49.0	10° 33.0	48G05	GADU MOR	LI				29	25	25	25	25	25	25	24	21	24	25	25	50	50	50	25	25	28	30
J26	30B	Oslo City area	59° 49.0	10° 33.0	48G05	GADU MOR	MU				29	25	25	25	26	26	30	30	21	29	30	30	60	60	60	30	30	30	30
J26	30F	Oslo City area	59° 47.0	10° 34.0	48G05	PLEU PLA	LI												2		5	5							
J26	30F	Oslo City area	59° 47.0	10° 34.0	48G05	PLEU PLA	MU												2		5	5							
J26	30H	Storegrunn	59° 48.50	10° 33.50	48G05	PAND BOR	TM															1							
J26	30X	West of Nesodden	59° 48.50	10° 36.0	48G05	GADU MOR	LI												22										
J26	30X	West of Nesodden	59° 48.50	10° 36.0	48G05	GADU MOR	MU												22										
J26	40C	Steilene	59° 49.0	10° 33.0	48G05	PAND BOR	TM				1								2										
J26	31A	Solbergstrand	59° 36.90	10° 39.40	48G06	MYTI EDU	SB	2		6	3	3	3	3	3	3	3	3	3	3	3	2	4	3	3	3	3	3	3
J26	31B	Solbergstrand	59° 36.90	10° 39.40	48G06	GADU MOR	LI	10	27																				
J26	31B	Solbergstrand	59° 36.90	10° 39.40	48G06	GADU MOR	MU	10	27																				
J26	31B	Solbergstrand	59° 36.90	10° 39.40	48G06	PLAT FLE	LI	8																					
J26	31B	Solbergstrand	59° 36.90	10° 39.40	48G06	PLAT FLE	MU	8																					
J26	31C	Solbergstrand	59° 36.90	10° 39.40	48G06	PAND BOR	TM				1																		
J26	32A	Rødtangen	59° 31.50	10° 25.60	48G06	MYTI EDU	SB	1	3			3																	
J26	33B	Sande (east side)	59° 31.70	10° 21.0	48G06	PLAT FLE	LI			25		1	23	1	26	1	5	5	5	5	5	5	15	15	13	5	5	30	30
J26	33B	Sande (east side)	59° 31.70	10° 21.0	48G06	PLAT FLE	MU			25		25	1	1	26	1	5	5	5	5	5	5	15	15	13	5	5	30	30
J26	33C	Sande	59° 31.70	10° 21.0	48G06	PAND BOR	TM						1																
J26	33X	Sande (west side)	59° 31.70	10° 20.40	48G06	PLAT FLE	LI										3												
J26	33X	Sande (west side)	59° 31.70	10° 20.40	48G06	PLAT FLE	MU										3												
J26	35A	Mølen	59° 29.20	10° 30.10	47G04	MYTI EDU	SB	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
J26	35C	Holmestrand-Mølen	59° 29.20	10° 30.10	47G04	PAND BOR	TM		1						1		2												
J26	35C	Holmestrand-Mølen	59° 29.20	10° 30.10	47G04	PAND BOR	XX								1														
J26	36A	Færder	59° 1.60	10° 31.70	47G06	MYTI EDU	SB	1		5	3	3	3	3	3	3	3	3	3	3	3	3	5	3	3	3	3	3	3
J26	36G	Færder	59° 1.60	10° 31.70	47G06	NUCE LAP	SB																			1	1	1	1
J26	36G	Færder	59° 1.60	10° 31.70	47G06	NUCE LAP	WO																		1				
J26	36B	Færder	59° 2.0	10° 32.0	47G06	GADU MOR	BI																	21	25	25	23	25	
J26	36B	Færder	59° 2.0	10° 32.0	47G06	GADU MOR	BL																	20	25	25	23	25	
J26	36B	Færder	59° 2.0	10° 32.0	47G06	GADU MOR	LI	10	27	23	24	14	25	25	25	25	24	25	25	25	25	25	26	25	25	25	23	28	30
J26	36B	Færder	59° 2.0	10° 32.0	47G06	GADU MOR	MU	10	27	23	24	14	25	25	26	26	29	30	30	30	30	30	30	30	30	30	27	30	30
J26	36F	Færder area	59° 4.0	10° 23.0	47G06	LIMA LIM	BI																			11	9	20	
J26	36F	Færder area	59° 4.0	10° 23.0	47G06	LIMA LIM	BL																			20	9	20	
J26	36F	Færder area	59° 4.0	10° 23.0	47G06	LIMA LIM	LI										5	5	5	5	5	5	5	5	5	30	30	30	30

jmpco	jmpst	stnam	lat	lon	icear	speci	tissu	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
J26	36F	Færder area	59° 4.0	10° 23.0	47G06	LIMA LIM	MU										5	5	5	5	5	5	5	5	5	30	30	30	30
J26	73A	Lyngholmen	59° 2.60	10° 18.10	47G03	MYTI EDU	SB										3												
J26	74A	Oddneskjær	58° 57.30	9° 52.10	46F97	MYTI EDU	SB										3												
J26	71A	Bjørkøya (Risøyodd.)	59° 1.40	9° 45.40	47F99	MYTI EDU	SB	1	3	3	3	2	3	3	3	3	3	3	3	3	3	3	4	3	3	3	3	3	3
J26	71G	Bjørkøya	58° 58.95	9° 48.50	46F97	NUCE LAP	SB																					1	1
J99	76A	Risøy	58° 43.60	9° 17.0	46F92	MYTI EDU	SB										3	3	3	3			3	3	3	3	3	3	3
J99	76G	Risøy	58° 43.6	9° 17.0	46F92	NUCE LAP	SB																					1	1
J99	77A	Flostafjord	58° 31.50	8° 56.90	46F89	MYTI EDU	SB										3	3											
J99	77B	Borøy area	58° 33.0	9° 1.0	45F93	GADU MOR	LI										14	25											
J99	77B	Borøy area	58° 33.0	9° 1.0	45F93	GADU MOR	MU										17	30											
J99	77B	Borøy area	58° 33.0	9° 1.0	45F93	LIMA LIM	LI											3											
J99	77C	Borøy area	58° 29.0	9° 10.0	45F91	PAND BOR	TM										2												
J99	79A	Gjerdsvoldsøyen east	58° 24.80	8° 45.30	45F87	MYTI EDU	SB										3	3											
J99	13A	Langøsund	57° 59.80	7° 34.60	45F74	MYTI EDU	SB										1	4											
J99	14A	Aavigen	58° 2.20	7° 13.20	45F73	MYTI EDU	SB										3	4											
J99	15A	Gåsøy (Ullerø)	58° 3.7	6° 53.16	45F69	MYTI EDU	SB										4	4		3	3	4	4	3	3	3	3	3	3
J99	15G	Gåøy	58° 3.1	6° 43.3	45F69	NUCE LAP	SB																					1	1
J99	15B	Ullerø area	58° 3.0	6° 43.0	45F69	GADU MOR	BI																	10	25	25		24	25
J99	15B	Ullerø area	58° 3.0	6° 43.0	45F69	GADU MOR	BL																	24	25	25		23	
J99	15B	Ullerø area	58° 3.0	6° 43.0	45F69	GADU MOR	LI										25	24	23	30	23	25	26	25	25	25	25	25	25
J99	15B	Ullerø area	58° 3.0	6° 43.0	45F69	GADU MOR	MU										30	29	27	30	28	29	30	30	30	30	30	30	30
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	LIMA LIM	BI																			20		22	
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	LIMA LIM	BL																			25		25	
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	LIMA LIM	LI											3		2	4	5	5	5	5	30	5	30	30
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	LIMA LIM	MU											3		2	4	5	5	5	5	30	5	30	30
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	PLEU PLA	LI												3	2									
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	PLEU PLA	MU												3	2									
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	MICR KIT	LI														1								
J99	15F	Ullerø area	58° 3.0	6° 43.0	45F69	MICR KIT	MU														1								
J63	51A	Byrkjenes	60° 5.10	6° 33.10	49F66	MYTI EDU	SB							3	3							1	3	3	3	6	3	3	3
J63	52A	Eitrheimsneset	60° 5.80	6° 32.20	49F66	MYTI EDU	SB									3	3	3	3	2	3	3	3	3	3	6	3	3	3
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	GADU MOR	BI																	15	28	24	25	25	25
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	GADU MOR	BL																	15	30	25	25	25	25
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	GADU MOR	LI							13	26	12	25	25	22	25	25	25	50	30	30	25	25	25	25
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	GADU MOR	MU							12	26	15	30	30	26	30	30	30	56	36	36	30	30	30	30
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	PLAT FLE	BI																			25	11	12	
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	PLAT FLE	BL																			23	11	12	
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	PLAT FLE	LI				22				22	30	5	5	5	5	4	4	11	15	11	30	13	30	30
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	PLAT FLE	MU				22				22	30	5	5	5	5	4	4	11	15	11	30	13	30	30
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	GLYP CYN	LI							3															
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	GLYP CYN	MU							3															
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	SALM TRU	LI										12												
J63	53B	Inner Sørfjord	60° 10.0	6° 34.0	49F65	SALM TRU	MU										12												
J63	53D	Digraneset	60° 11.0	6° 34.5	49F65	BROS BRO	LI																					24	
J63	53D	Digraneset	60° 11.0	6° 34.5	49F65	BROS BRO	MU																					24	
J63	53D	Digraneset	60° 11.0	6° 34.5	49F65	MOLV MOL	LI																					30	
J63	53D	Digraneset	60° 11.0	6° 34.5	49F65	MOLV MOL	MU																					30	
J63	53D	Digraneset	60° 11.0	6° 34.5	49F65	CHIM MON	LI																					12	
J63	53D	Digraneset	60° 11.0	6° 34.5	49F65	CHIM MON	MU																					12	

jmpco	jmpst	stnam	lat	lon	icear	speci	tissu	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
J63	56D	Kvalnes	60° 15.0	6° 36.0	49F65	BROS BRO	LI																			3			
J63	56D	Kvalnes	60° 15.0	6° 36.0	49F65	BROS BRO	MU																			3			
J63	56D	Kvalnes	60° 15.0	6° 36.0	49F65	MOLV MOL	LI																			1			
J63	56D	Kvalnes	60° 15.0	6° 36.0	49F65	MOLV MOL	MU																			1			
J63	56D	Kvalnes	60° 15.0	6° 36.0	49F65	CHIM MON	LI																			1			
J63	56D	Kvalnes	60° 15.0	6° 36.0	49F65	CHIM MON	MU																			1			
J99	227X	Høievarde	59° 19.43	5° 19.11	47F52	MYTI EDU	SB																				3	3	3
J99	226X	Karmsund bridge (east)	59° 22.68	5° 17.91	47F51	MYTI EDU	SB																		1	3	3		
J99	222A	Kopervik harbour	59° 17.2	5° 18.94	47F52	MYTI EDU	SB																				3		
J99	220G	Smørstakk	59° 15.21	5° 21.14	47F55	NUCE LAP	SB																			1			
J99	220G	Smørstakk	59° 15.21	5° 21.14	47F55	NUCE LAP	WO																		1				
J99	221A	Stangeland	59° 16.62	5° 19.70	47F52	MYTI EDU	SB																		3	3			
J99	221G	Stangeland	59° 16.2	5° 19.70	47F52	NUCE LAP	SB																			1			
J99	221G	Stangeland	59° 16.2	5° 19.70	47F52	NUCE LAP	WO																		1				
J99	227A	Melandholmen	59° 20.4	5° 18.90	47F51	MYTI EDU	SB																		3	3			
J99	227G	Melandholmen	59° 20.4	5° 18.90	47F51	NUCE LAP	SB																			1	1	1	1
J99	227G	Melandholmen	59° 20.4	5° 18.90	47F51	NUCE LAP	WO																		1				
J99	226A	Karmsund bridge (west)	59° 22.68	5° 17.70	47F51	NUCE LAP	SB																				1		
J99	226G	Karmsund bridge (east)	59° 22.68	5° 17.91	47F51	NUCE LAP	SB																			1	1		
J99	226G	Karmsund bridge (east)	59° 22.68	5° 17.91	47F51	NUCE LAP	WO																		1				
J99	224G	Heggjelen	59° 25.0	5° 13.90	47F51	NUCE LAP	SB																			1	1		
J99	224G	Heggjelen	59° 25.0	5° 13.90	47F51	NUCE LAP	WO																		1				
J63	56A	Kvalnes	60° 13.231	6° 36.120	49F65	MYTI EDU	SB							3	15	3	3	3	3	3	3	3	3	3	3	6	3	3	3
J63	56A1	Kvalnes, north	60° 13.514	6° 36.255	49F65	MYTI EDU	SB																			3			3
J63	56A3	Sekse	60° 15.683	6° 37.396	49F65	MYTI EDU	SB																						3
J63	56A4	Rosstadnes	60° 17.219	6° 37.428	49F65	MYTI EDU	SB																						3
J63	56A5	Lofthus, south	60° 19.351	6° 39.121	49F65	MYTI EDU	SB																						3
J63	56A2	Kjeken	60° 20.329	6° 39.274	49F64	MYTI EDU	SB																			3			3
J63	57A2	Ernes	60° 21.188	6° 39.738	49F64	MYTI EDU	SB																						3
J63	57A1	Urdheim	60° 22.346	6° 40.689	49F67	MYTI EDU	SB																			3			3
J63	57A	Krossanes	60° 23.225	6° 41.353	49F67	MYTI EDU	SB							3	3	3	3	3	3	3	3	3	3	3	3	6	3	3	3
J62	63A	Ranaskjær	60° 25.10	6° 24.50	49F64	MYTI EDU	SB							3	3	3	3	3	3	3	3	3	3	3	3	6	3	3	3
J62	65A	Vikingneset	60° 14.50	6° 9.60	49F62	MYTI EDU	SB							3	15	3	3	3	3	3	3	3	3	3	3	6	3	3	3
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	GADU MOR	BI																	25	24	25	15	25	
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	GADU MOR	BL																	25	25	25	13	24	
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	GADU MOR	LI							22	26	22	16	19	8	12	18	25	35	25	25	25	25	25	25
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	GADU MOR	MU							22	26	23	16	24	9	14	22	30	40	30	30	30	30	30	30
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	PLAT FLE	BI																			25	22	25	
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	PLAT FLE	BL																			25	23	23	
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	PLAT FLE	LI															3		4	30	30	30	30
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	PLAT FLE	MU															3		4	30	30	30	30
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	LIMA LIM	LI																		5				
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	LIMA LIM	MU																		5				
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	LEPI WHI	LI				19			1	26	30	5	5	3	5	5	5	5	5	5	5	5	30	30
J62	67B	Strandebarm	60° 16.0	6° 2.0	49F62	LEPI WHI	MU				19			1	26	30	5	5	3	5	5	5	5	5	5	5	5	30	30
J62	69A	Lille Terøy	59° 58.79	5° 45.35	48F57	MYTI EDU	SB												3	1	3	3	3	3	3	6	3	3	3
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	PLAT FLE	BI																			11			
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	PLAT FLE	BL																			11	25		
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	PLAT FLE	LI																			14	30	30	30

jmpco	jmpst	stnam	lat	lon	icear	speci	tissu	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	PLAT FLE	MU																			14	30	30	30
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	LIMA LIM	LI																						30
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	LIMA LIM	MU																						30
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	LEPI WHI	LI																			5			
J99	21F	Åkrefjord	59° 45.0	6° 7.0	48F62	LEPI WHI	MU																			5			
J99	21D	Åkrafjord	59° 48.0	6° 11.0	48F62	BROS BRO	LI																			1		24	
J99	21D	Åkrafjord	59° 48.0	6° 11.0	48F62	BROS BRO	MU																			1		24	
J99	21D	Åkrafjord	59° 48.0	6° 11.0	48F62	MOLV MOL	LI																			1		24	
J99	21D	Åkrafjord	59° 48.0	6° 11.0	48F62	MOLV MOL	MU																			1		24	
J99	21D	Åkrafjord	59° 48.0	6° 11.0	48F62	CHIM MON	LI																			1		12	
J99	21D	Åkrafjord	59° 48.0	6° 11.0	48F62	CHIM MON	MU																			1		12	
J99	22A	Espevær, west	59° 35.20	5° 8.50	48F53	MYTI EDU	SB										3	3	3	3	3	3	5	3	3	3	3	3	3
J99	22G	Espevær vest	58° 34.75	5° 8.90	46F53	NUCE LAP	SB																					1	1
J99	22C	Bømlofjord	59° 34.0	5° 11.0	48F53	PAND BOR	TM										2												
J99	22F	Borøyfjorden	59° 43.0	5° 21.0	48F55	LIMA LIM	LI										5	5	4		5	2							
J99	22F	Borøyfjorden	59° 43.0	5° 21.0	48F55	LIMA LIM	MU										5	5	4		5	2							
J99	22F	Borøyfjorden	59° 43.0	5° 21.0	48F55	PLEU PLA	LI																5	5	5				
J99	22F	Borøyfjorden	59° 43.0	5° 21.0	48F55	PLEU PLA	MU																5	5	5				
J99	22F	Borøyfjorden	59° 43.0	5° 21.0	48F55	MICR KIT	LI													5									
J99	22F	Borøyfjorden	59° 43.0	5° 21.0	48F55	MICR KIT	MU													5									
J99	23A	Austvik	59° 52.20	5° 6.60	48F51	MYTI EDU	SB										3	3											
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	GADU MOR	BI																	22	23	24	23	25	25
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	GADU MOR	BL																	25	25	25	24	25	25
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	GADU MOR	LI										25	25	25	25	26	25	26	25	25	25	25	25	25
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	GADU MOR	MU										30	30	30	30	30	30	30	30	30	30	30	30	30
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	PLAT FLE	LI														1								
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	PLAT FLE	MU														1								
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	PLEU PLA	LI														3								
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	PLEU PLA	MU														3								
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	MICR KIT	LI														1	4							
J99	23B	Karihavet area	59° 54.0	5° 8.0	48F51	MICR KIT	MU														1	4							
J99	24A	Vardøy	60° 10.20	5° 0.80	49F52	MYTI EDU	SB										3	3											
J65	80A	Østmarknes	63° 27.50	10° 27.50	55G04	MYTI EDU	SB				1	2																	
J65	81A	Biologisk Stasjon	63° 26.50	10° 21.40	55G04	MYTI EDU	SB				1																		
J65	82A	Flakk	63° 27.10	10° 12.60	55G01	MYTI EDU	SB				1	2	2	3	1	2		3	2	2		3	3						
J65	83A	Frøsetskjær	63° 25.50	10° 7.80	55G01	MYTI EDU	SB				1																		
J65	84A	Trossavika	63° 20.80	9° 57.80	55F97	MYTI EDU	SB				2	3	3	3	3	3		3	3	3		3	3						
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	GADU MOR	LI				13	1	1	1	5														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	GADU MOR	MU				13	10	1	1	5														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	MICR KIT	LI								3														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	MICR KIT	MU								3														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	MELA AEG	LI						14	1	4														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	MELA AEG	MU						1	1	5														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	MERL MNG	LI							1	7														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	MERL MNG	MU							1	7														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	POLL POL	LI					1	1		8														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	POLL POL	MU					16	1		8														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	POLL VIR	LI								4														
J65	84B	Trossavika	63° 20.80	9° 57.80	55F97	POLL VIR	MU								4														

jmpco	jmpst	stnam	lat	lon	icear	speci	tissu	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
J65	85A	Geitstrand	63° 21.90	9° 56.30	55F97	MYTI EDU	SB				1																		
J65	86A	Geitnes	63° 26.60	9° 59.20	55F97	MYTI EDU	SB				1																		
J65	87A	Ingdalsbukt	63° 27.80	9° 54.80	55F97	MYTI EDU	SB				1	1	1	1	1	1		1	2	1		2	2						
J65	88A	Rødberg	63° 29.20	10° 0.0	55G01	MYTI EDU	SB				1	1																	
J99	25A	Hinnøy	61° 22.20	4° 52.80	51F47	MYTI EDU	SB												3	3									
J99	26A	Hamnen	61° 52.70	5° 13.60	52F51	MYTI EDU	SB												6	3									
J99	27A	Grinden	62° 12.20	5° 25.40	53F55	MYTI EDU	SB												2										
J99	28A	Eiksundet	62° 15.0	5° 51.60	53F58	MYTI EDU	SB												6	3									
J99	91A	Nerdvika	63° 21.20	8° 9.60	55F81	MYTI EDU	SB												4	3	3								
J99	92A	Stokken	64° 2.21	10° 1.10	57G03	MYTI EDU	SB												7	3	3	3	3	3					
J99	92B	Stokken area	64° 9.85	9° 53.0	57F99	GADU MOR	LI													25	24	25	25						
J99	92B	Stokken area	64° 9.85	9° 53.0	57F99	GADU MOR	MU													30	29	30	30						
J99	92B	Stokken area	64° 9.85	9° 53.0	57F99	LIMA LIM	LI															1							
J99	92B	Stokken area	64° 9.85	9° 53.0	57F99	LIMA LIM	MU															1							
J99	92B	Stokken area	64° 9.85	9° 53.0	57F99	PLEU PLA	LI															1							
J99	92B	Stokken area	64° 9.85	9° 53.0	57F99	PLEU PLA	MU															1							
J99	93A	Sætervik	64° 23.68	10° 29.0	57G04	MYTI EDU	SB												7	3									
J99	94A	Landfast	65° 38.40	12° 0.50	60G23	MYTI EDU	SB												3	3									
J99	95A	Flatskjær	66° 42.60	13° 15.80	62G32	MYTI EDU	SB												3	3									
J99	96A	Breiviken	66° 17.60	12° 50.50	61G28	MYTI EDU	SB												6	3									
J99	97A	Klakholmen	67° 39.90	14° 44.60	64G49	MYTI EDU	SB												4	3									
J99	98A	Svolvær området	68° 14.942	14° 39.752	65G45	MYTI EDU	SB												4	3				3	3	3	3	3	3
J99	98G	svolvær området	68° 15.4	14° 40.6	65G48	NUCE LAP	SB																					1	1
J99	98B	Lille Molla	68° 12.0	14° 48.0	65G48	GADU MOR	BI																				14	22	
J99	98B	Lille Molla	68° 12.0	14° 48.0	65G48	GADU MOR	BL																				5	25	
J99	98B	Lille Molla	68° 12.0	14° 48.0	65G48	GADU MOR	LI												25	29	25	24	26	25	25	25	25	25	25
J99	98B	Lille Molla	68° 12.0	14° 48.0	65G48	GADU MOR	MU												30	29	30	29	30	30	30	30	30	30	30
J99	98B	Lille Molla	68° 12.0	14° 48.0	65G48	LIMA LIM	LI													4									
J99	98B	Lille Molla	68° 12.0	14° 48.0	65G48	LIMA LIM	MU													4									
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	LIMA LIM	LI														1	1	5						
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	LIMA LIM	MU														1	1	5						
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	PLEU PLA	BI																				18	24	
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	PLEU PLA	BL																				13	19	
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	PLEU PLA	LI													3		5		4	5	1	25	30	24
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	PLEU PLA	MU													3		5		4	5	1	25	30	24
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	MICR KIT	LI														1	1							
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	MICR KIT	MU														1	1							
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	GLYP CYN	LI															1							
J99	98F	Lille Molla	68° 12.0	14° 48.0	65G48	GLYP CYN	MU															1							
J99	98X	Skrova	68° 10.50	14° 40.15	65G48	MYTI EDU	SB														3	4	4						
J99	99A	Brunvær	68° 0.30	15° 5.60	65G53	MYTI EDU	SB												7	3									
J99	41A	Fensneset,Grytøya	68° 56.90	16° 38.47	66G64	MYTI EDU	SB														3	3	4	3					
J99	41G	Harstad,Trondenes	68° 49.30	16° 33.92	66G65	NUCE LAP	SB																				1		
J99	42A	Tennskjær,Malangen	69° 28.60	18° 18.0	67G81	MYTI EDU	SB														3	3							
J99	42G	Finnsnes,	69° 13.55	17° 58.50	67G78	NUCE LAP	SB																				1		
J99	43A	Lyngneset,Langfjord	70° 6.20	20° 32.79	69H06	MYTI EDU	SB														3	3		3					
J99	43G	Skjervøy	70° 2.16	20° 59.71	69H09	NUCE LAP	SB																				1		
J99	43B	Kvænangen	70° 9.0	21° 22.0	69H16	GADU MOR	LI														25	25	25						
J99	43B	Kvænangen	70° 9.0	21° 22.0	69H16	GADU MOR	MU														30	30	30						

jmpco	jmpst	stnam	lat	lon	icear	speci	tissu	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
J99	43F	Kvænangen,Olderfjord	70° 9.0	21° 22.0	69H16	LIMA LIM	LI																3						
J99	43F	Kvænangen,Olderfjord	70° 9.0	21° 22.0	69H16	LIMA LIM	MU																3						
J99	43F	Kvænangen,Olderfjord	70° 9.0	21° 22.0	69H16	MICR KIT	LI																1						
J99	43F	Kvænangen,Olderfjord	70° 9.0	21° 22.0	69H16	MICR KIT	MU																1						
J99	44A	Elenheimsundet	70° 30.97	22° 14.80	70H23	MYTI EDU	SB														3	3	4	3					
J99	44G	Alta	69° 59.40	23° 18.70	68H31	NUCE LAP	SB																				1		
J99	45A	Yttre Sauhamnneset	70° 45.81	24° 19.22	70H42	MYTI EDU	SB														3	3							
J99	45G	Sauhamneset	70° 45.80	24° 19.80	70H42	NUCE LAP	SB																				1		
J99	46A	Smines ved Altesula	70° 58.38	25° 48.14	70H57	MYTI EDU	SB														3	3	5						
J99	46G	Honningsvåg	70° 59.12	25° 57.77	70H57	NUCE LAP	SB																				1		
J99	46B	Hammerfest area	70° 50.0	23° 44.0	70H37	GADU MOR	LI														24	25							
J99	46B	Hammerfest area	70° 50.0	23° 44.0	70H37	GADU MOR	MU														29	30							
J99	47A	Kifjordneset	70° 52.89	27° 22.17	70H74	MYTI EDU	SB														3	3							
J99	47G	Kifjordneset	70° 52.86	27° 22.20	70H74	NUCE LAP	SB																				1		
J99	48A	Trollfjorden i Tanafjord	70° 41.61	28° 33.28	70H85	MYTI EDU	SB														3	3	3						
J99	48G	Mehamn	71° 2.55	27° 50.35	71H79	NUCE LAP	SB																				1		
J99	49A	Nordfjorden,Syltefj.	70° 33.10	30° 5.17	70J03	MYTI EDU	SB														3	3							
J99	10A	Skallneset	70° 6.650	30° 21.50	69J06	MYTI EDU	SB														3	3	4	3	3	3	3	3	3
J99	10B	Varangerfjorden	69° 56.0	29° 40.0	68H97	GADU MOR	BI																				22	21	
J99	10B	Varangerfjorden	69° 56.0	29° 40.0	68H97	GADU MOR	BL																				25	25	
J99	10B	Varangerfjorden	69° 56.0	29° 40.0	68H97	GADU MOR	LI														21	25	25	23	25	25	25	25	25
J99	10B	Varangerfjorden	69° 56.0	29° 40.0	68H97	GADU MOR	MU														25	30	30	27	30	30	30	30	30
J99	10B	Varangerfjorden	69° 56.0	29° 40.0	68H97	BROS BRO	LI														1								
J99	10B	Varangerfjorden	69° 56.0	29° 40.0	68H97	BROS BRO	MU														1								
J99	10F	Skogerøy	69° 55.0	29° 51.0	68H97	PLEU PLA	BI																				15	25	
J99	10F	Skogerøy	69° 55.0	29° 51.0	68H97	PLEU PLA	BL																				11	24	
J99	10F	Skogerøy	69° 55.0	29° 51.0	68H97	PLEU PLA	LI																	5		4	18	30	30
J99	10F	Skogerøy	69° 55.0	29° 51.0	68H97	PLEU PLA	MU																	5		4	18	30	30
J99	11A	Sildkroneset,Bøkfj	69° 47.2	30° 11.10	68J02	MYTI EDU	SB														3	3	4	3					
J99	11G	Brashavn	69° 53.92	29° 44.65	68H97	NUCE LAP	SB																						1
J99	11X	Brashavn	69° 53.92	29° 44.65	68H97	MYTI EDU	SB																	3	3	3	3	3	3
J26	I001	Sponvikskansen	59° 5.40	11° 12.50	47G13	MYTI EDU	SB															3	3						
J26	I011	Kråkenebbet	59° 6.10	11° 17.30	47G13	MYTI EDU	SB															3	3						
J26	I021	Kjøkø,south	59° 7.79	10° 57.11	47G09	MYTI EDU	SB															3	3	3	3		3	3	3
J26	I022	West Damholmen	59° 6.20	10° 57.90	47G09	MYTI EDU	SB															3	3	3	3	3	3	3	3
J26	I023	Singlekalven, south	59° 5.70	11° 8.20	47G13	MYTI EDU	SB															3	3	3	3	3	3	3	3
J26	I024	Kirkøy, north west	59° 4.90	10° 59.20	47G09	MYTI EDU	SB															3	3	3	3	3	3	3	3
J26	I301	Akershuskaia	59° 54.23	10° 45.47	48G07	MYTI EDU	SB															3	3	3	3	3	3	3	3
J26	I304	Gåsøya	59° 51.11	10° 35.51	48G04	MYTI EDU	SB															3	3	3	3	3	3	3	3
J26	I306	Håøya	59° 42.69	10° 33.35	48G05	MYTI EDU	SB															3	3	3	3	3	3	3	3
J26	I307	Ramtonholmen	59° 44.70	10° 31.40	48G05	MYTI EDU	SB															3	3	3	3	3	3	3	3
J99	I711	Steinholmen	59° 3.15	9° 40.70	47F99	MYTI EDU	SB															3	4	3	3	3	3		3
J99	I713	Strømtangen	59° 3.22	9° 41.500	47F99	MYTI EDU	SB																						3
J99	I712	Gjemesholmen	59° 2.75	9° 42.47	47F99	MYTI EDU	SB															3	4	3	3	3	3	3	3
J99	I131	Lastad	58° 3.30	7° 42.40	45F79	MYTI EDU	SB															3	3	3	3	3	3	3	3
J99	131G	Lastad	58° 3.30	7° 42.40	45F79	NUCE LAP	SB																					1	1
J99	I132	Fiskåtangen	58° 7.75	7° 58.60	45F79	MYTI EDU	SB															4	4	3	3	3	3	3	3
J99	I133	Odderø,west	58° 7.90	8° 0.15	45F83	MYTI EDU	SB															4	4	3	3	3	3	3	3
J99	I201	Ekkjegrunn (G1)	59° 38.65	6° 21.38	48F66	MYTI EDU	SB															3	3	3	3	3	3	3	3

jmpco	jmpst	stnam	lat	lon	icear	speci	tissu	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01	02
J99	I205	Bølsnes (G5)	59° 35.50	6° 18.30	48F63	MYTI EDU	SB															3		3	3	3	3	3	3
J99	I241	Nordnes	60° 24.10	5° 18.20	49F51	MYTI EDU	SB															3	3	3	3	3	3	3	3
J99	I242	Valheimneset	60° 23.70	5° 16.10	49F51	MYTI EDU	SB															3	3	3	3	3	3	3	3
J99	I243	Hegreneset	60° 24.90	5° 18.50	49F51	MYTI EDU	SB															3	3	3	3	3	3	3	3
J99	I911	Horvika	62° 44.10	8° 31.40	54F85	MYTI EDU	SB															3	3						
J99	I913	Fjøseid	62° 48.59	8° 16.48	54F82	MYTI EDU	SB																			3	3	3	3
J99	I912	Honnhammer	62° 51.20	8° 9.70	54F81	MYTI EDU	SB															3	3	3	3	3	3	3	3
J65	I080	Østmerknes	63° 27.50	10° 27.50	55G04	MYTI EDU	SB															3	3						
J99	I962	Koksverktomta (B2)	66° 19.57	14° 8.38	61G42	MYTI EDU	SB															3	3	2	3				
J99	I964	Toraneskaien	66° 19.30	14° 7.97	61G42	MYTI EDU	SB																						3
J99	I965	Moholmen (B5)	66° 18.72	14° 7.62	61G42	MYTI EDU	SB																					3	3
J99	I969	Bjørnbærviken (B9)	66° 16.79	14° 2.13	61G42	MYTI EDU	SB															3	3	3	3	3	3	3	3
J99	R096	Breiviken, Tomma	66° 17.60	12° 50.50	61G28	MYTI EDU	SB															3	3						
J26	A3*	Svartskjær	58° 58.90	9° 49.90	46F97	MYTI EDU	SB	1																					

Appendix F
Map of stations

Station positions 1981-2002
(cf. Appendix G and Appendix J)

Appendix F (cont.) Map of stations

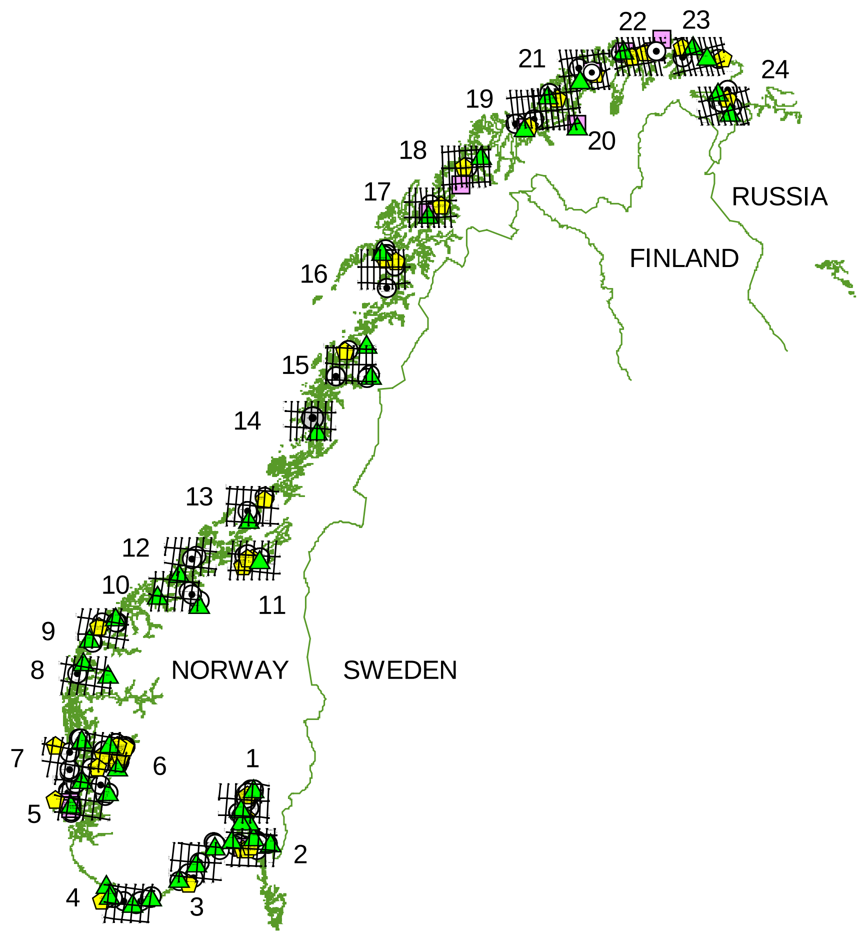
NOTES

For a few stations the geolocation has varied somewhat in order to collect sufficient material (e.g., st. 36B and 98A) or investigate local geographical variations (e.g., in the inner Oslofjord and Sørfjord). Hence, the same station name may appear more than once on a map.

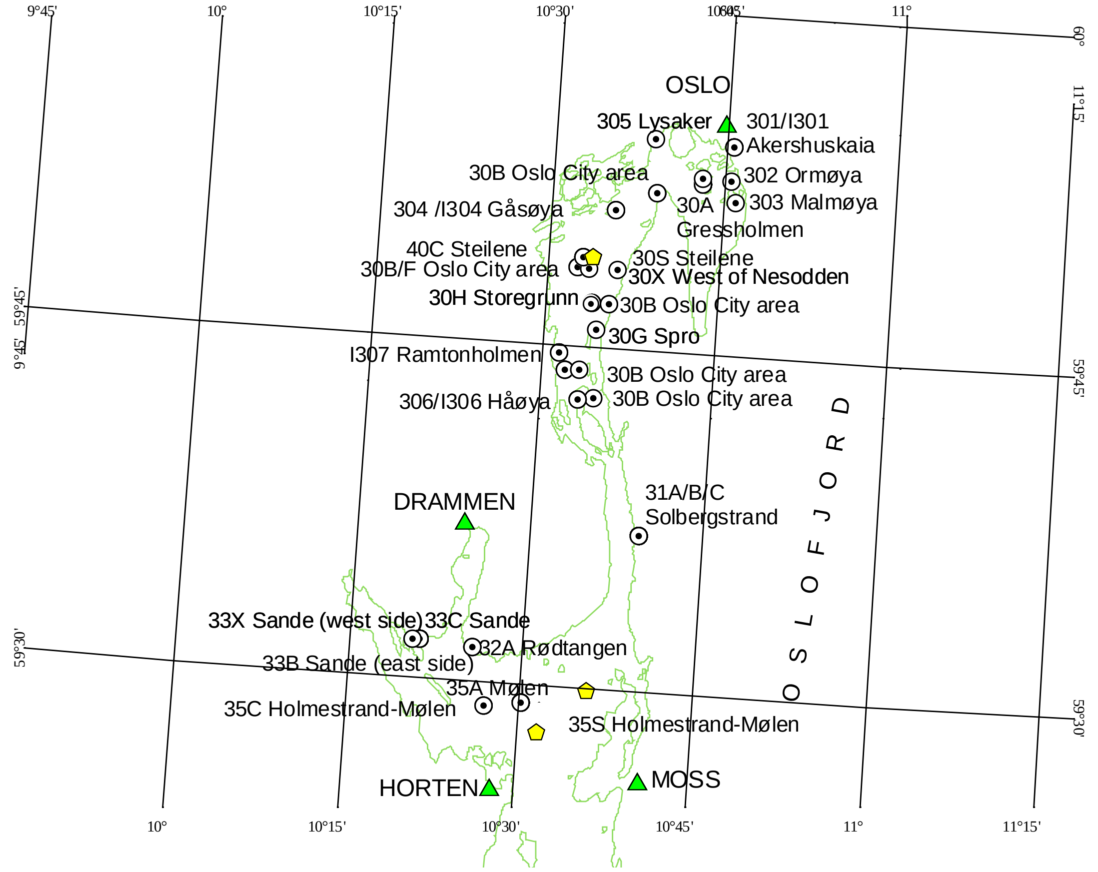
The letter A following the station identification number indicates that blue mussels were sampled. The letter B indicates sampling for cod and the letter F indicates sampling for flatfish. This system for fish is not consistent for some older stations (30, 33, 52 and 67) where only the letter B is used indicating that either cod or flatfish or both were sampled. An encircled dot indicates a mussel, shrimp or fish station. The letter G indicates sampling for dog whelks and S indicates sampling for sediment. An encircled dot indicates the position for sampling mussels, shrimp or fish. A square and pentagon symbol indicates the position for sampling dog whelks or sediment, respectively. A triangle indicates the position of a town or city.

The letter "I" preceding the station identification number indicates an INDEX station for determining a "pollution" index. The letter R indicates a station for evaluating a "reference" index. Only blue mussels are used for these indices. The indices are based on a selection of JAMP and INDEX stations (cf. Green *et al.* 2001).

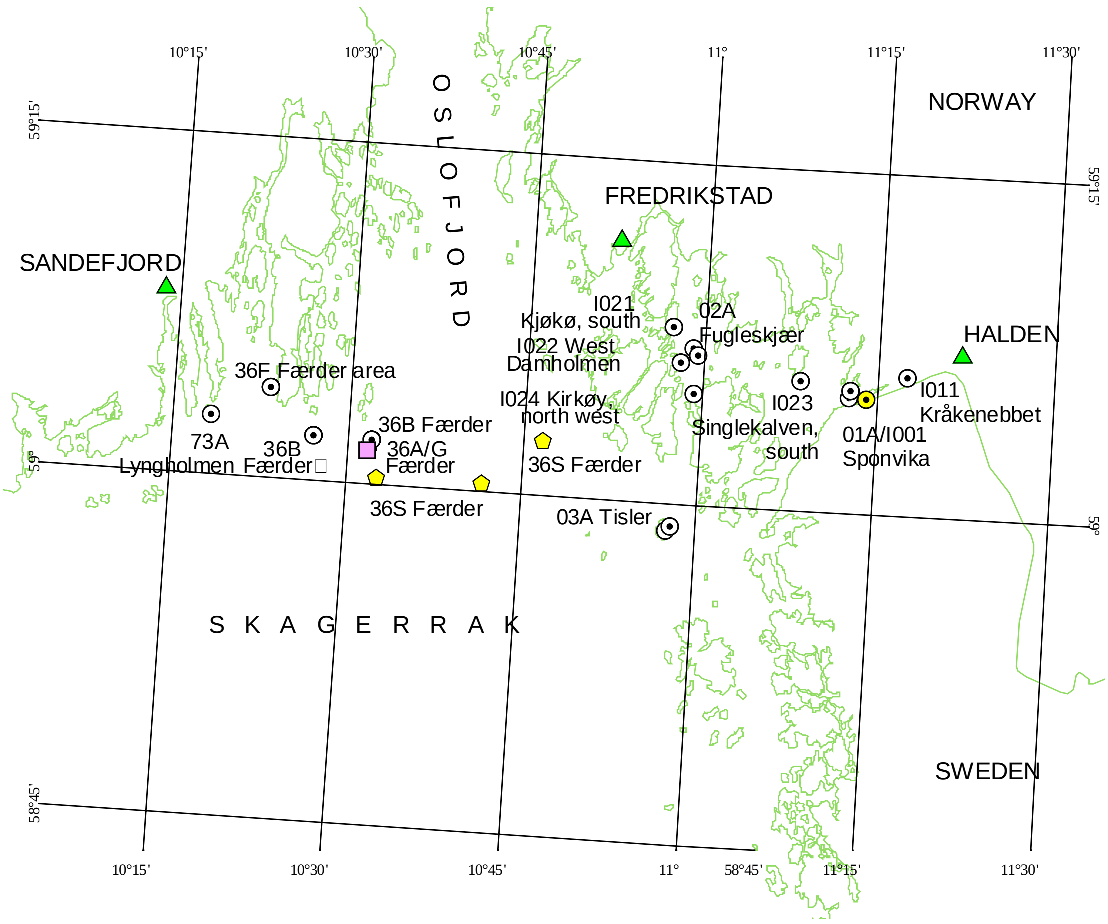
The maps are generated using ArcView GIS version 3.3.



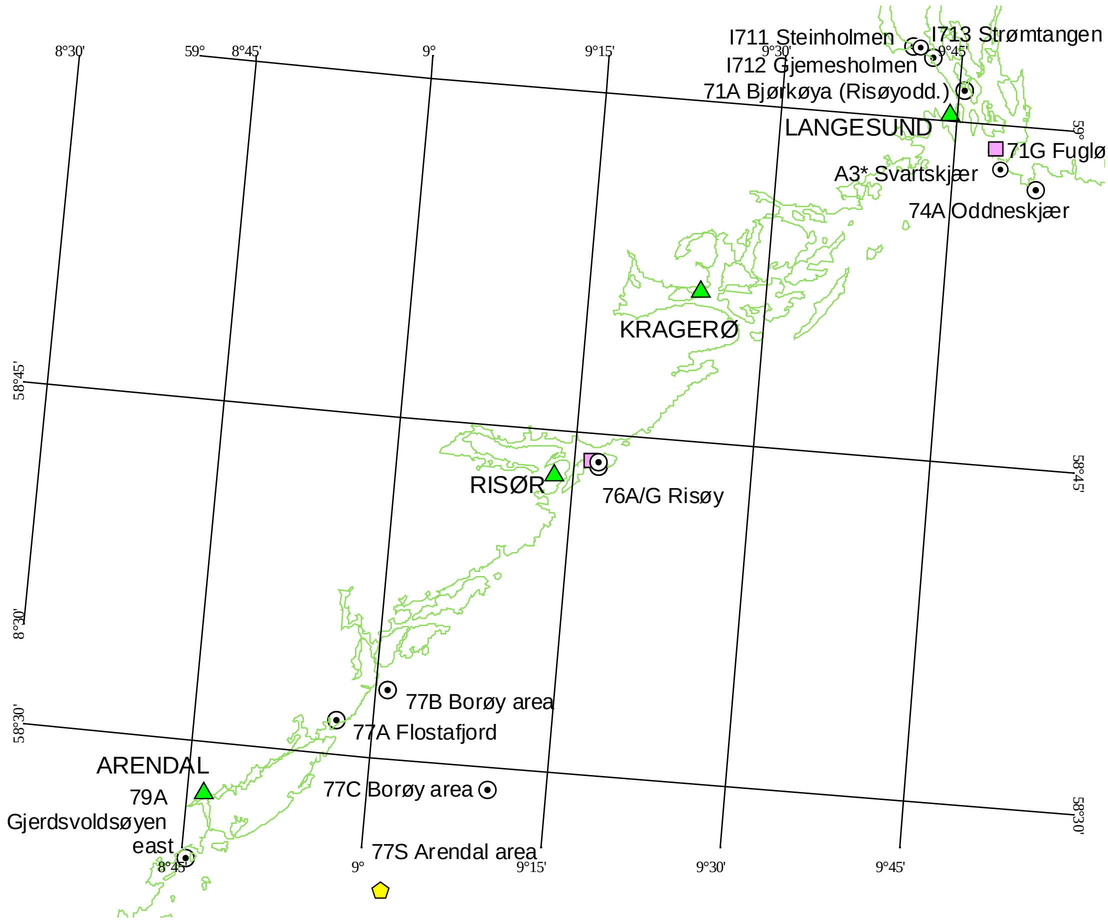
JAMP stations Norway. Numbers indicate map reference


OSLO
305 Lysaker
301/I301
Akershuskaia
30B Oslo City area
302 Ormøya
304 /I304 Gåsøya
30A
303 Malmøya
Gressholmen
40C Steilene
30S Steilene
30B/F Oslo City area
30X West of Nesodden
30H Storegrunn
30B Oslo City area
30G Spro
I307 Ramtonholmen
30B Oslo City area
306/I306 Håøya
30B Oslo City area
DRAMMEN
31A/B/C
Solbergstrand
O S L O F J O R D
33X Sande (west side)
33C Sande
32A Rødtangen
33B Sande (east side)
35A Mølen
35C Holmestrand-Mølen
35S Holmestrand-Mølen
HORTEN
MOSS

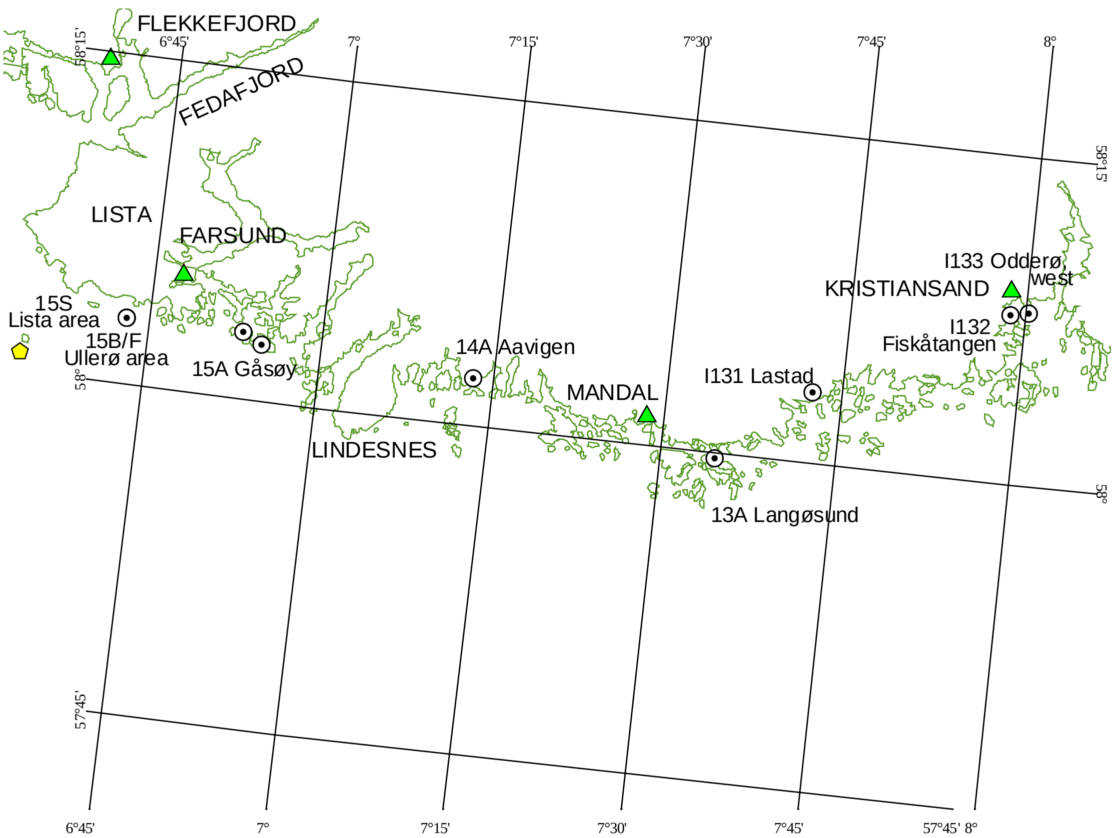
MAP 1


NORWAY
O S L O F J O R D
FREDRIKSTAD
SANDEFJORD
I021
Kjøkø, south
02A
Fugleskjær
I022 West
Damholmen
HALDEN
36F Færder area
I023
I011
Kråkenebbet
I024 Kirkøy,
north west
Singlekalven,
south
73A
36B Færder
36B
36A/G
Færder
01A/I001
Sponvika
Lyngholmen
Færder
36S Færder
36S Færder
03A Tisler
S K A G E R R A K
SWEDEN

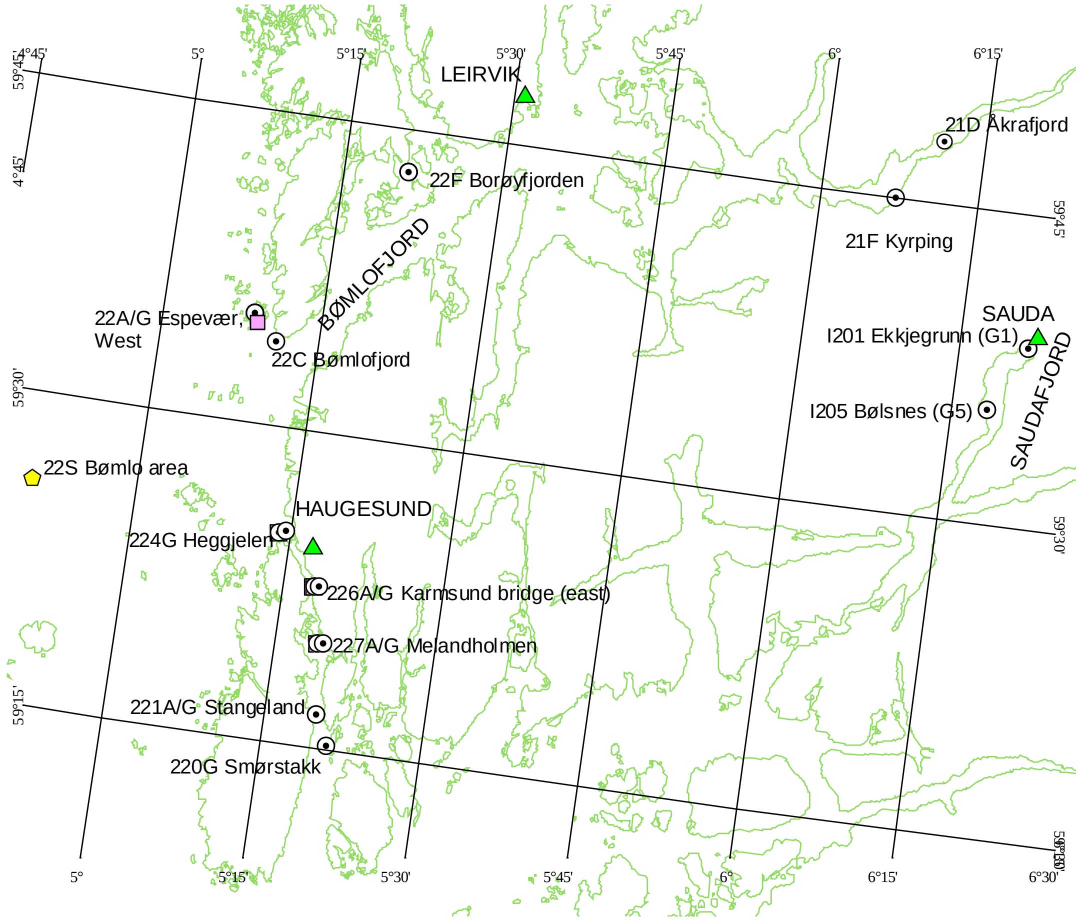
MAP 2


I711 Steinholmen
I713 Strømtangen
I712 Gjemesholmen
71A Bjørkøya (Risøyodd.)
LANGESUND
71G Fuglø
A3* Svartskjær
74A Oddneskjær
KRAGERØ
RISØR
76A/G Risøy
77B Borøy area
77A Flostafjord
ARENDAL
79A
Gjerdsvoldsøyen
east
77C Borøy area
77S Arendal area
8°30'
59°
8°45'
9°
9°15'
9°30'
9°45'
58°45'
58°30'

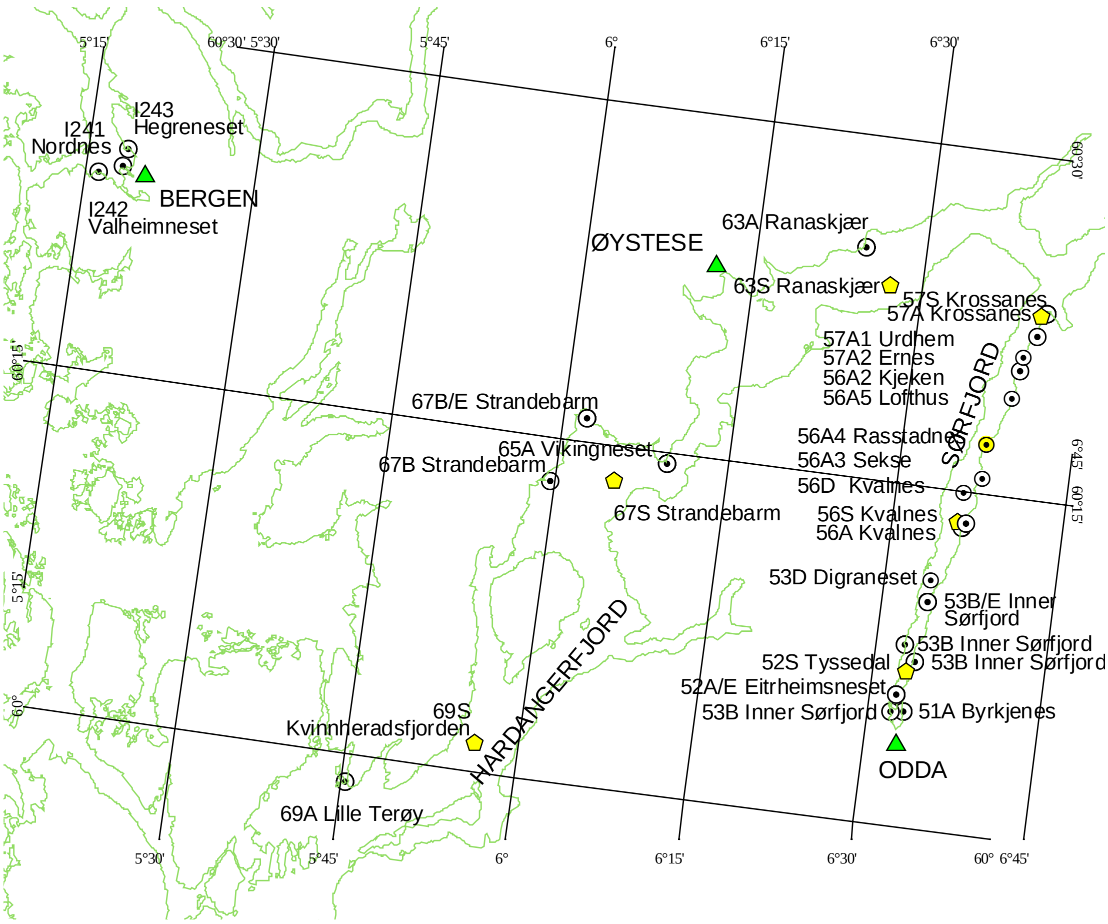
MAP 3


FLEKKEFJORD
FEDAFJORD
LISTA
FARSUND
15S
Lista area
15B/F
Ullerø area
15A Gåsøy
14A Aavigen
LINDESNES
MANDAL
I131 Lastad
13A Langøsund
I133 Odderø,
west
KRISTIANSAND
I132
Fiskåtangen
6°45'
7°
7°15'
7°30'
7°45'
8°
58°15'
58°
57°45'

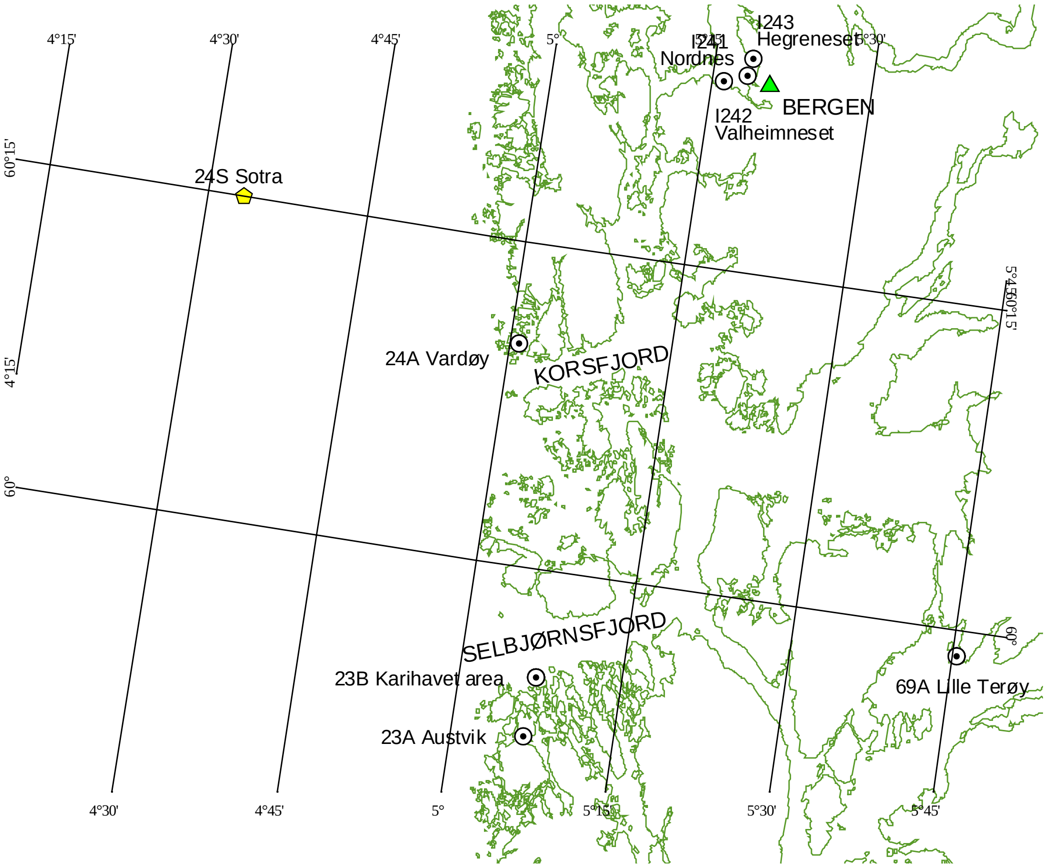
MAP 4


LEIRVIK
21D Åkrafjord
22F Borøyfjorden
21F Kyrping
BØMLOFJORD
22A/G Espevær,
West
22C Bømlofjord
SAUDA
I201 Ekkjegrunn (G1)
I205 Bølsnes (G5)
SAUDAFJORD
22S Bømlo area
HAUGESUND
224G Heggjelen
226A/G Karmsund bridge (east)
227A/G Melandholmen
221A/G Stangeland
220G Smørstakk

MAP 5

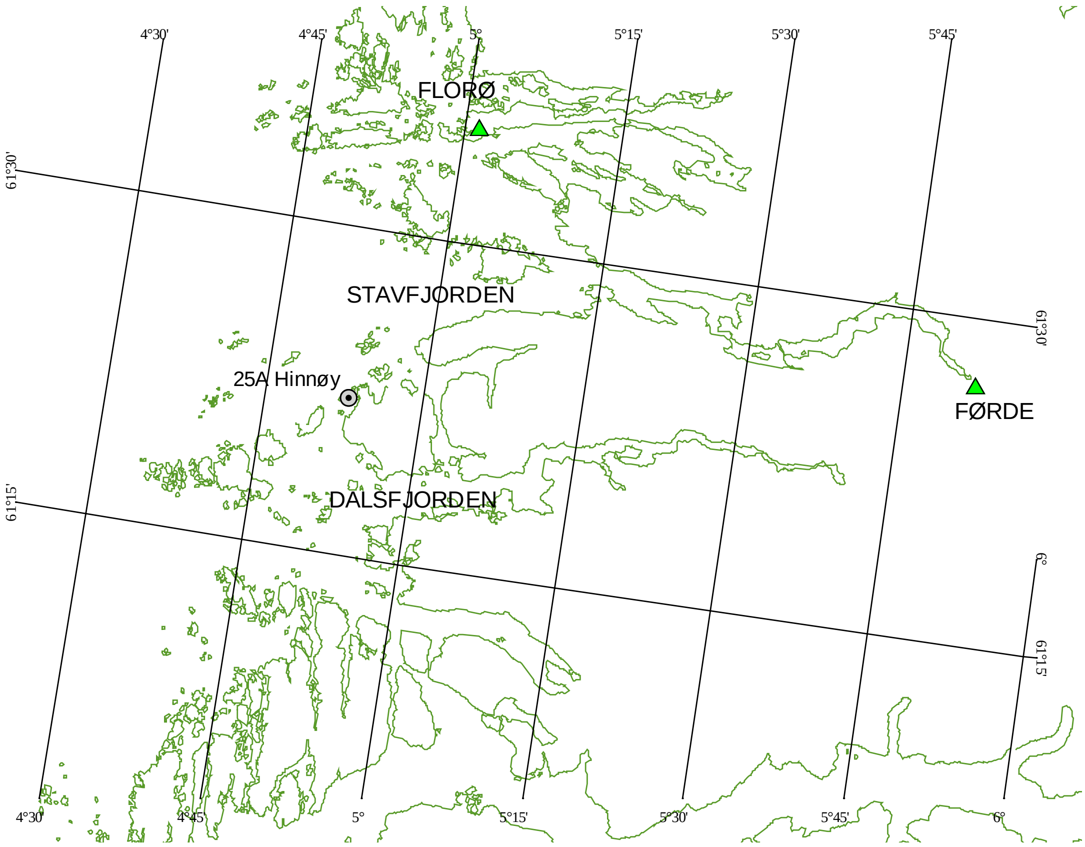

I243
Hegreneset
I241
Nordnes
BERGEN
I242
Valheimneset
63A Ranaskjær
ØYSTESE
63S Ranaskjær
57S Krossanes
57A Krossanes
57A1 Urdhem
57A2 Ernes
56A2 Kjeken
56A5 Lofthus
SØRFJORD
67B/E Strandebarm
56A4 Rasstadnes
65A Vikingneset
67B Strandebarm
56A3 Sekse
56D Kvalnes
67S Strandebarm
56S Kvalnes
56A Kvalnes
53D Digraneset
53B/E Inner
Sørfjord
53B Inner Sørfjord
52S Tyssedal
53B Inner Sørfjord
52A/E Eitrheimsneset
53B Inner Sørfjord
51A Byrkjenes
69S
Kvinnheradsfjorden
HARDANGERFJORD
ODDA
69A Lille Terøy

MAP 6



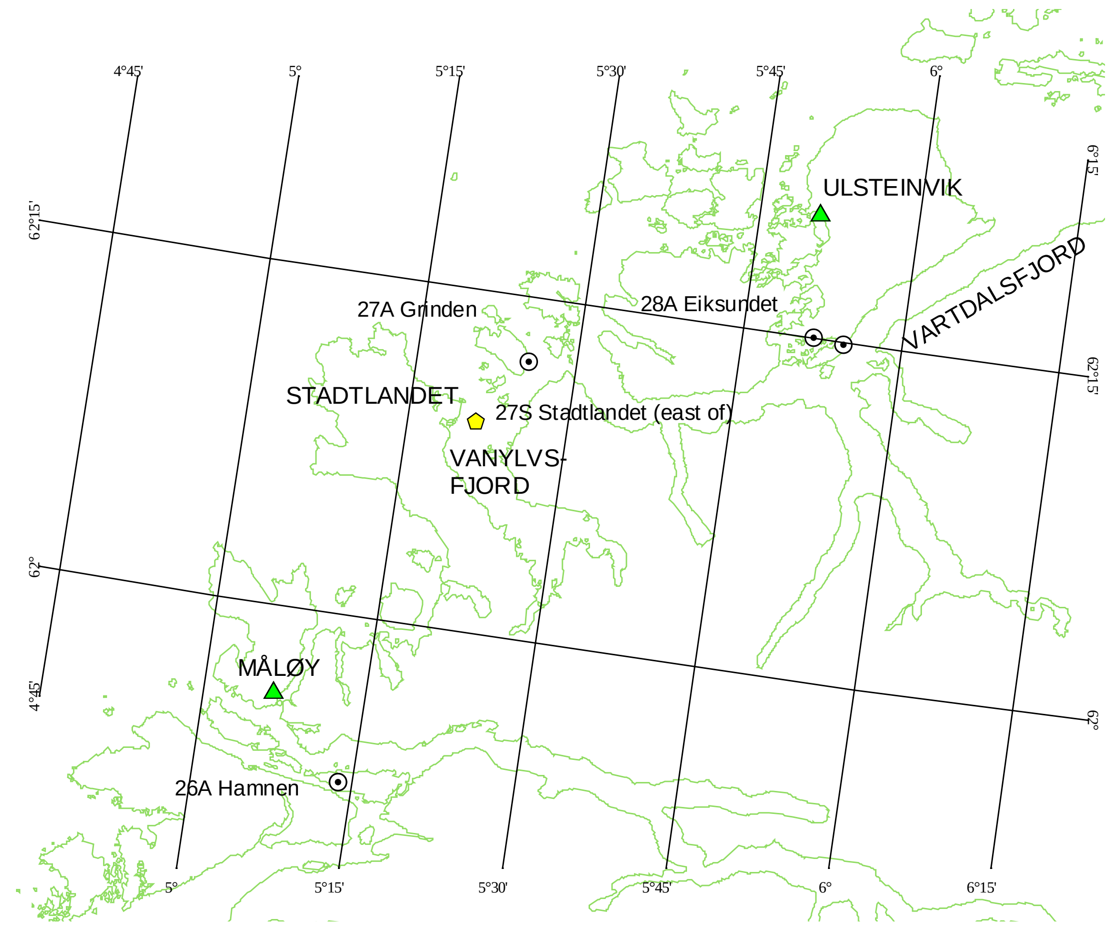
24S Sotra
I241
Nordnes
I243
Hegreneset
I242
Valheimneset
BERGEN
24A Vardøy
KORSFJORD
SELBJØRNSFJORD
23B Karihavet area
23A Austvik
69A Lille Terøy
60°15'
60°
4°15'
4°30'
4°45'
5°
5°15'
5°30'
5°45'

MAP 7

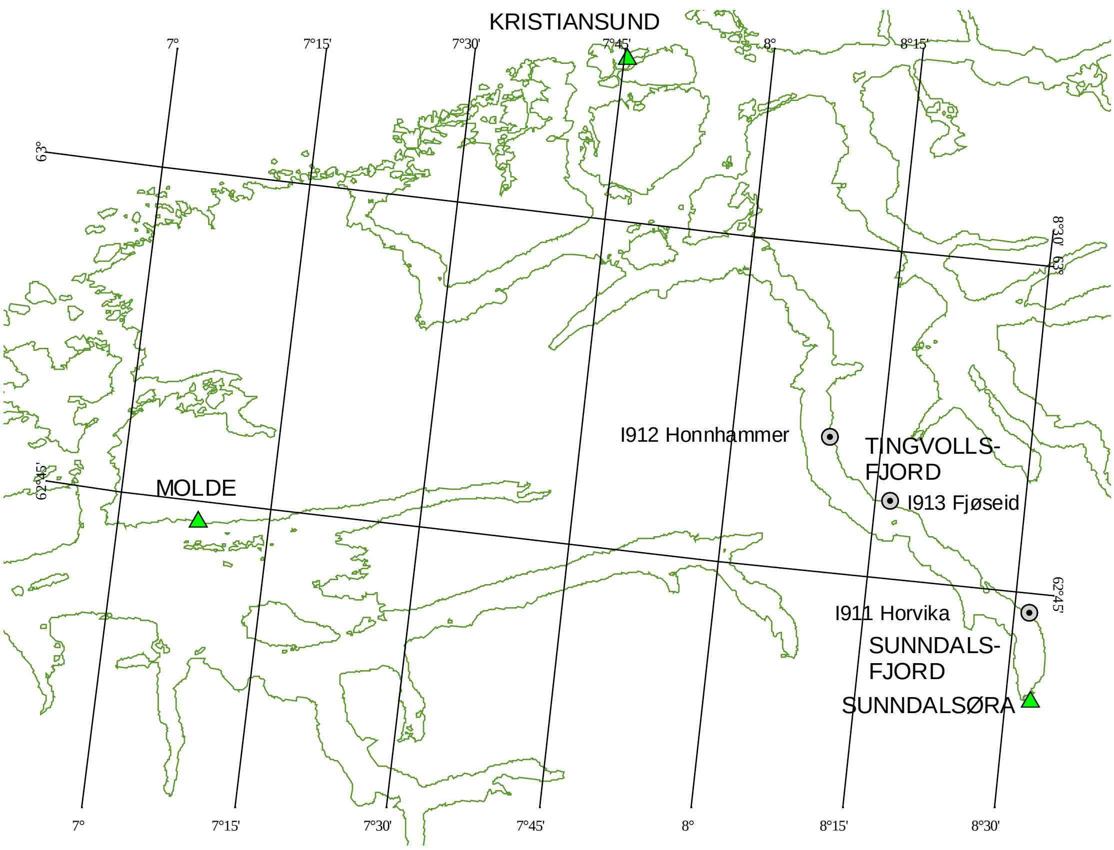


FLORØ
STAVFJORDEN
25A Hinnøy
DALSFJORDEN
FØRDE
61°30'
61°15'
4°30'
4°45'
5°
5°15'
5°30'
5°45'
6°

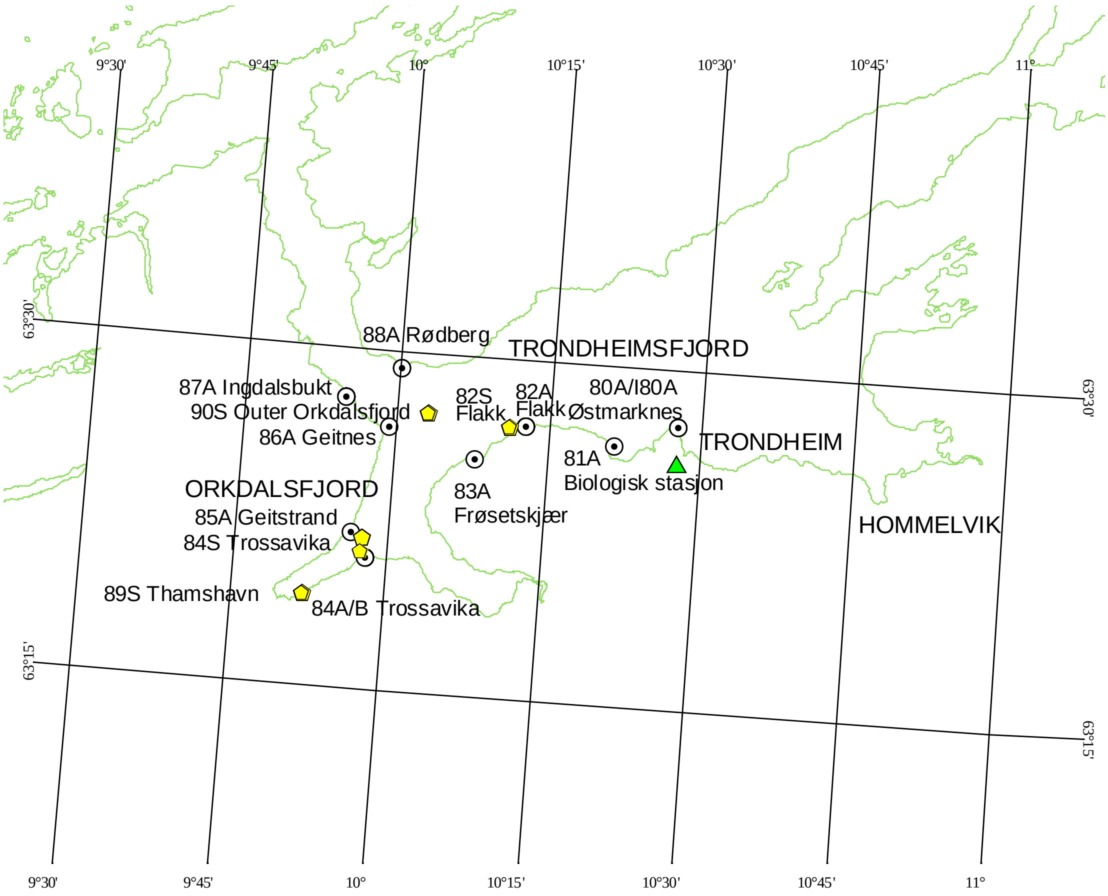
MAP 8


ULSTEINVIK
VARTDALSFJORD
28A Eiksundet
27A Grinden
STADTLANDET
27S Stadtlandet (east of)
VANYLVS-
FJORD
MÅLØY
26A Hamnen
4°45'
5°
5°15'
5°30'
5°45'
6°
6°15'
62°15'
62°
4°45'

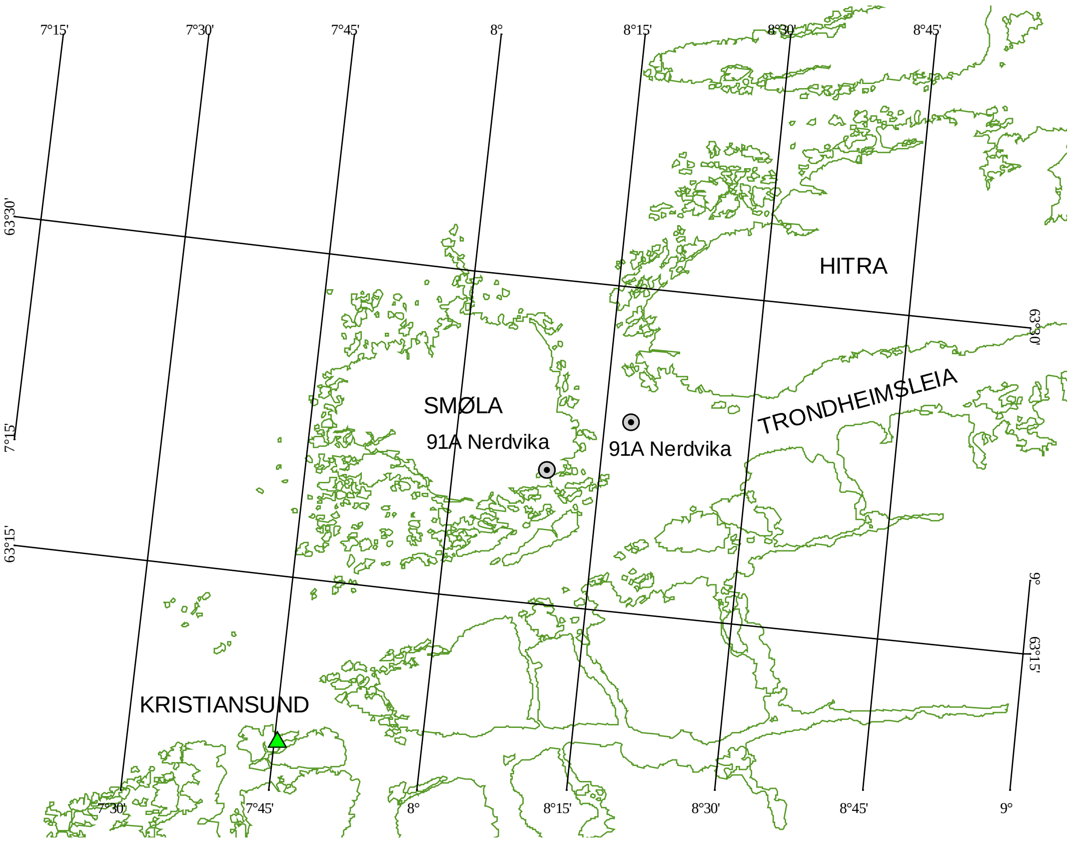
MAP 9


KRISTIANSUND
MOLDE
I912 Honnhammer
TINGVOLLS-
FJORD
I913 Fjøseid
I911 Horvika
SUNNDALS-
FJORD
SUNNDALSØRA
7°
7°15'
7°30'
7°45'
8°
8°15'
8°30'
63°
62°45'

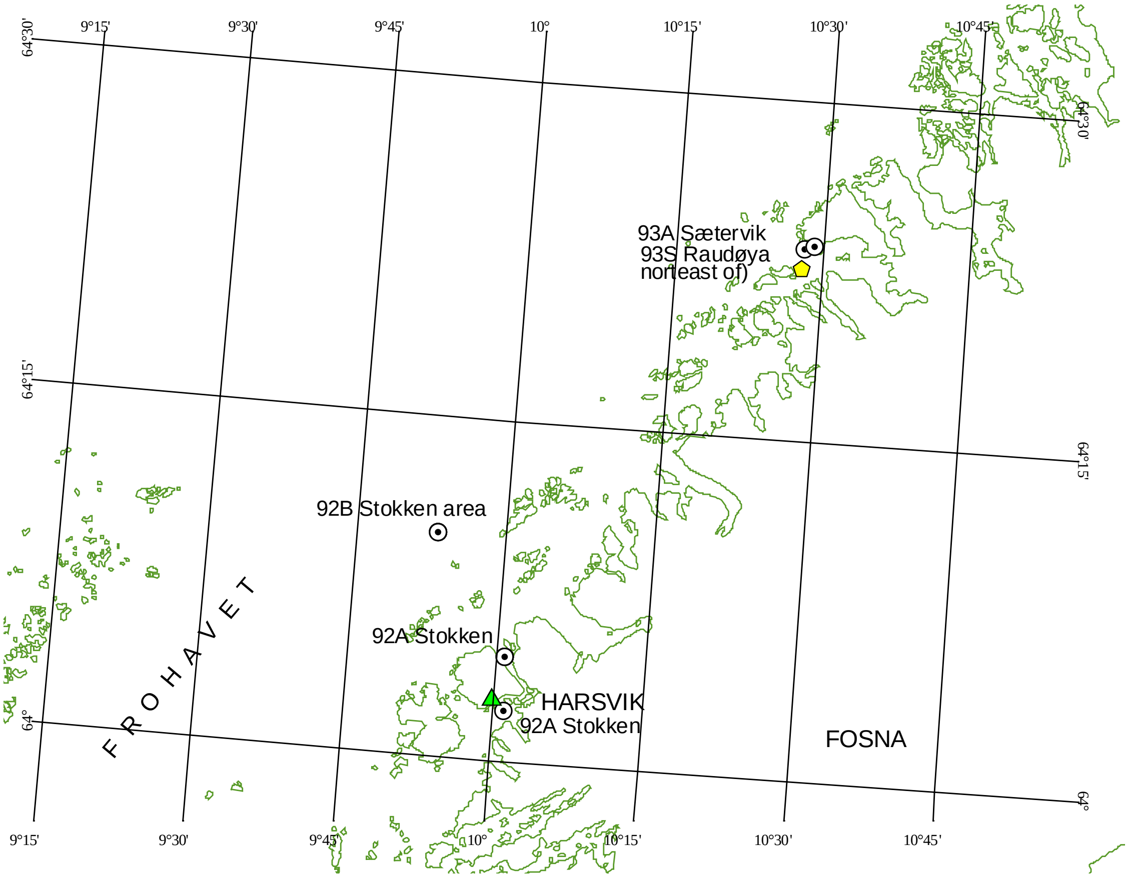
MAP 10


9°30'
9°45'
10°
10°15'
10°30'
10°45'
11°
63°30'
63°15'
88A Rødberg
TRONDHEIMSFJORD
87A Ingdalsbukt
90S Outer Orkdalsfjord
86A Geitnes
82S
Flakk
82A
Flakk
80A/I80A
Østmarknes
TRONDHEIM
81A
Biologisk stasjon
83A
Frøsetskjær
ORKDALSFJORD
85A Geitstrand
84S Trossavika
89S Thamshavn
84A/B Trossavika
HOMMELVIK

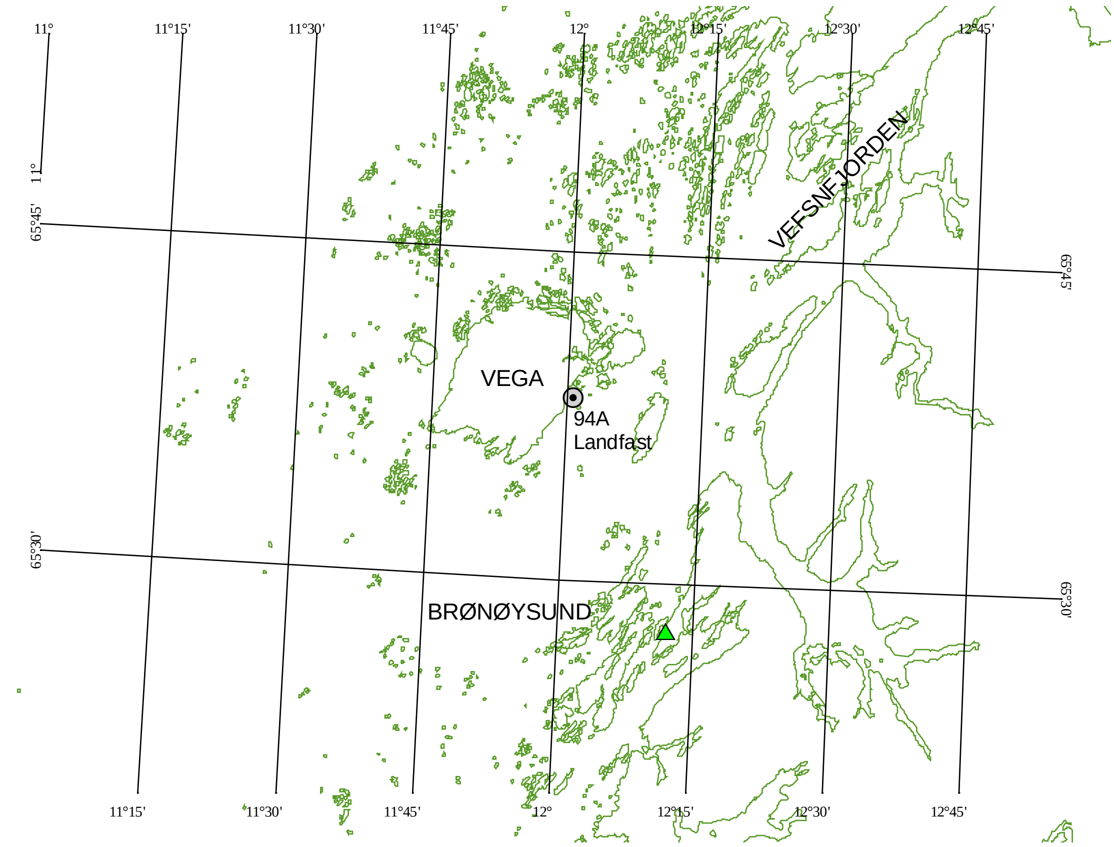
MAP 11


7°15'
7°30'
7°45'
8°
8°15'
8°30'
8°45'
9°
63°30'
63°15'
HITRA
SMØLA
91A Nerdvika
91A Nerdvika
TRONDHEIMSLEIA
KRISTIANSUND

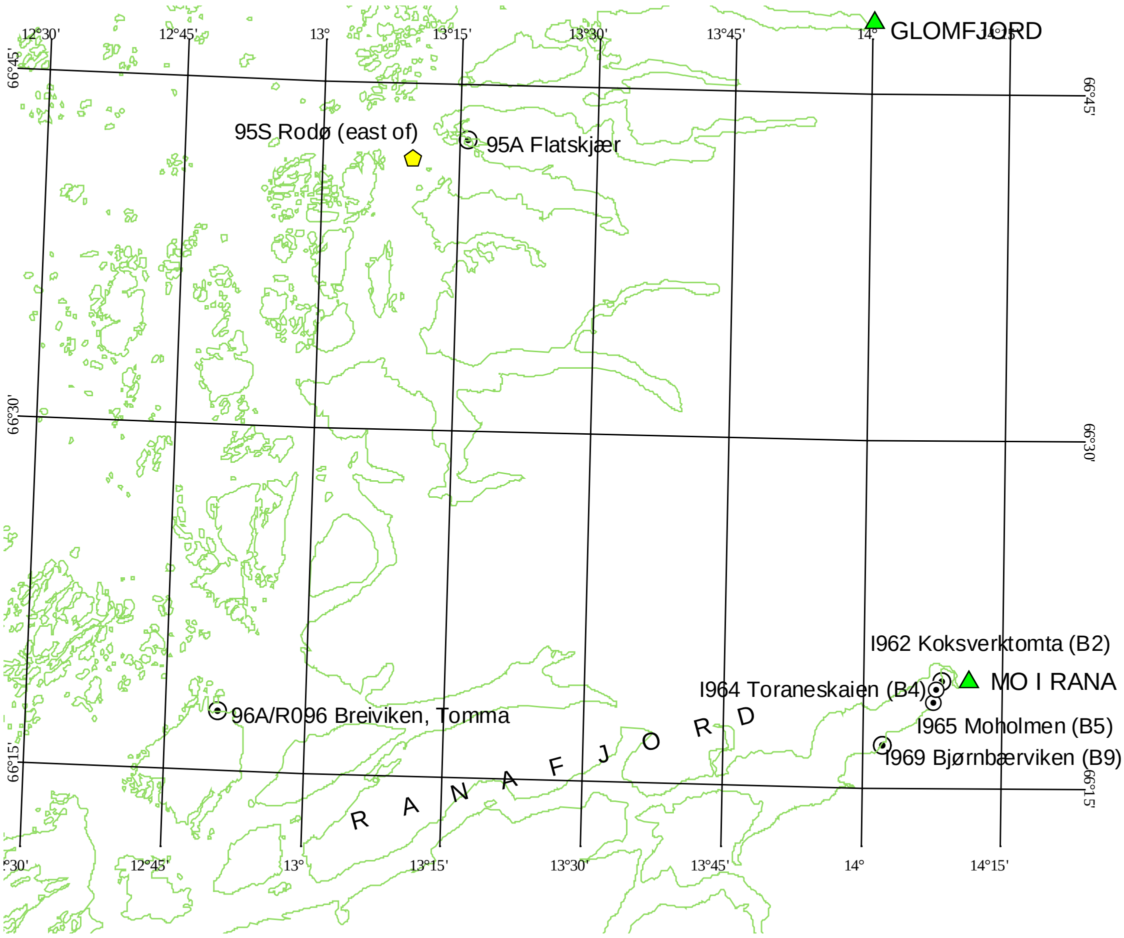
MAP 12


93A Sætervik
93S Raudøya
northeast of)
92B Stokken area
92A Stokken
HARSVIK
92A Stokken
FOSNA
FROHAVET
9°15'
9°30'
9°45'
10°
10°15'
10°30'
10°45'
64°30'
64°15'
64°

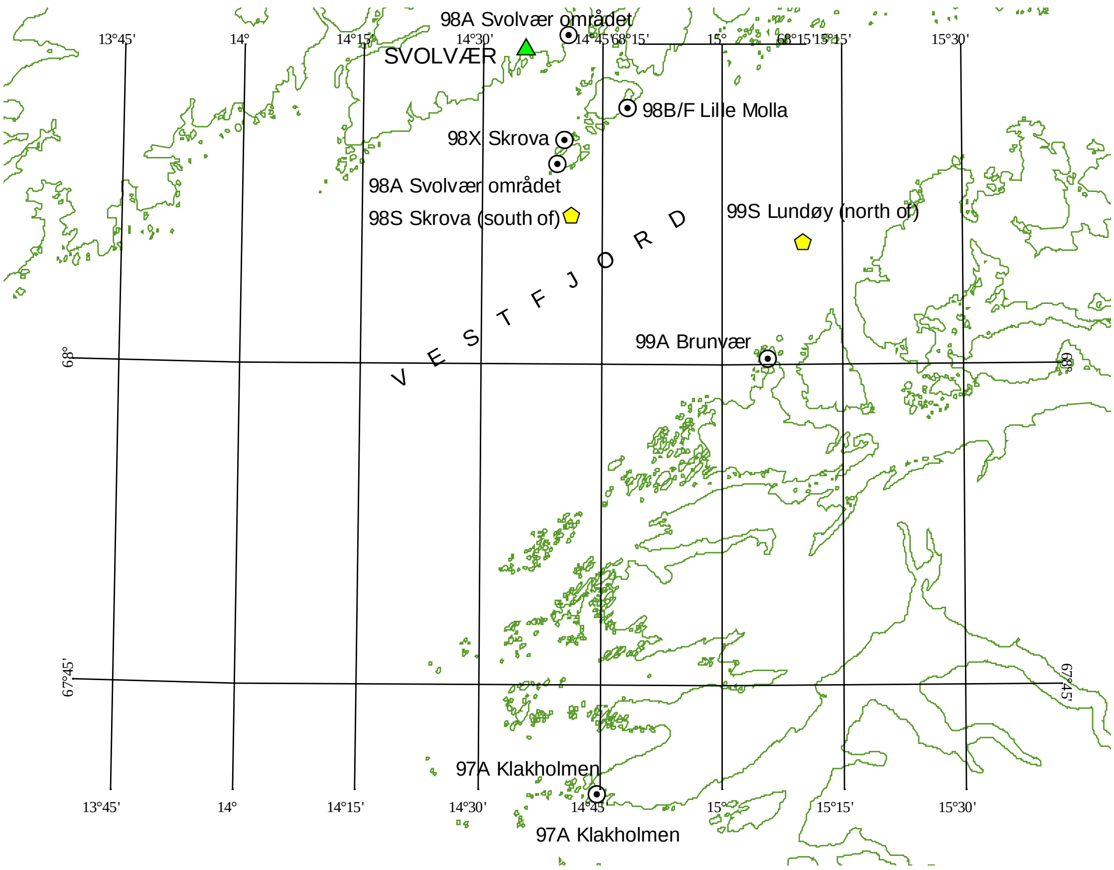
MAP 13


VEFSNFJORDEN
VEGA
94A
Landfast
BRØNØYSUND
11°
11°15'
11°30'
11°45'
12°
12°15'
12°30'
12°45'
65°45'
65°30'

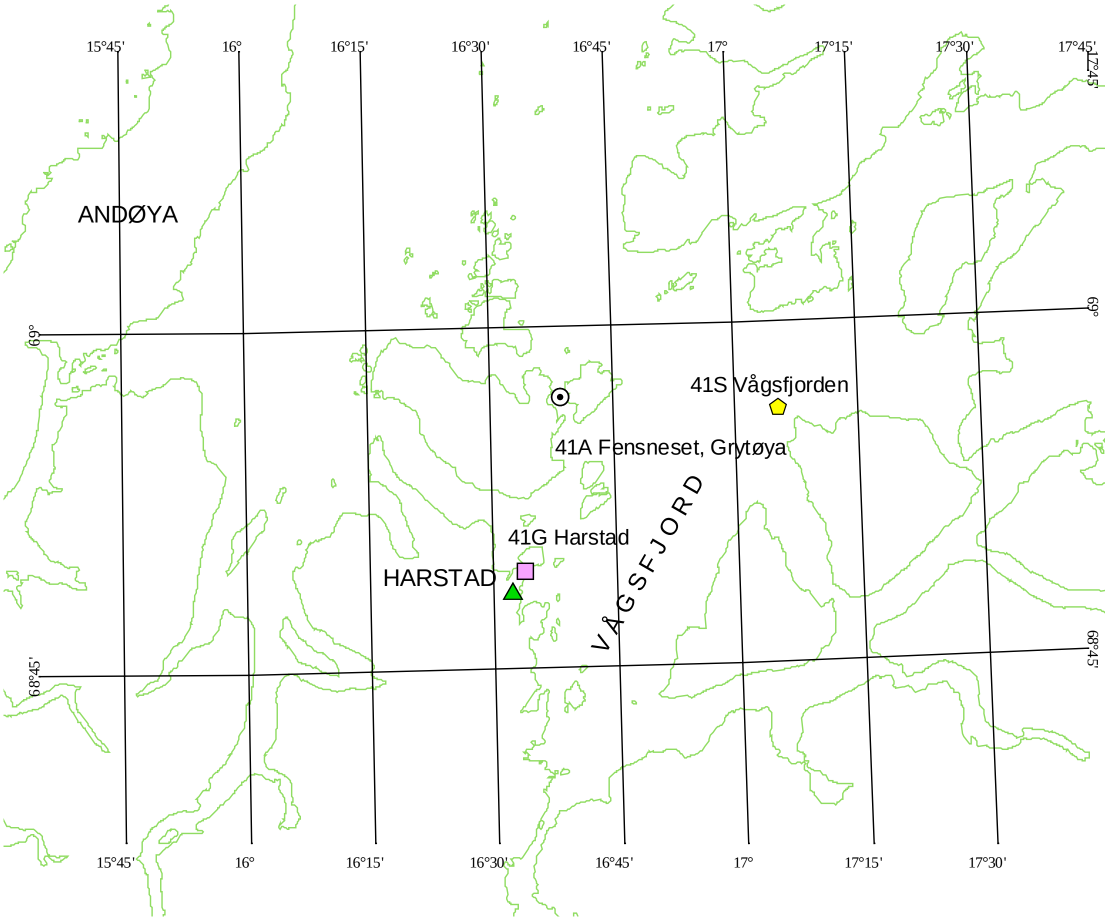
MAP 14


GLOMFJORD
95S Rodø (east of)
95A Flatskjær
I962 Koksverktomta (B2)
MO I RANA
I964 Toraneskaien (B4)
I965 Moholmen (B5)
I969 Bjørnbærviken (B9)
96A/R096 Breiviken, Tomma
R A N A F J O R D
12°30'
12°45'
13°
13°15'
13°30'
13°45'
14°
14°15'
66°45'
66°30'
66°15'

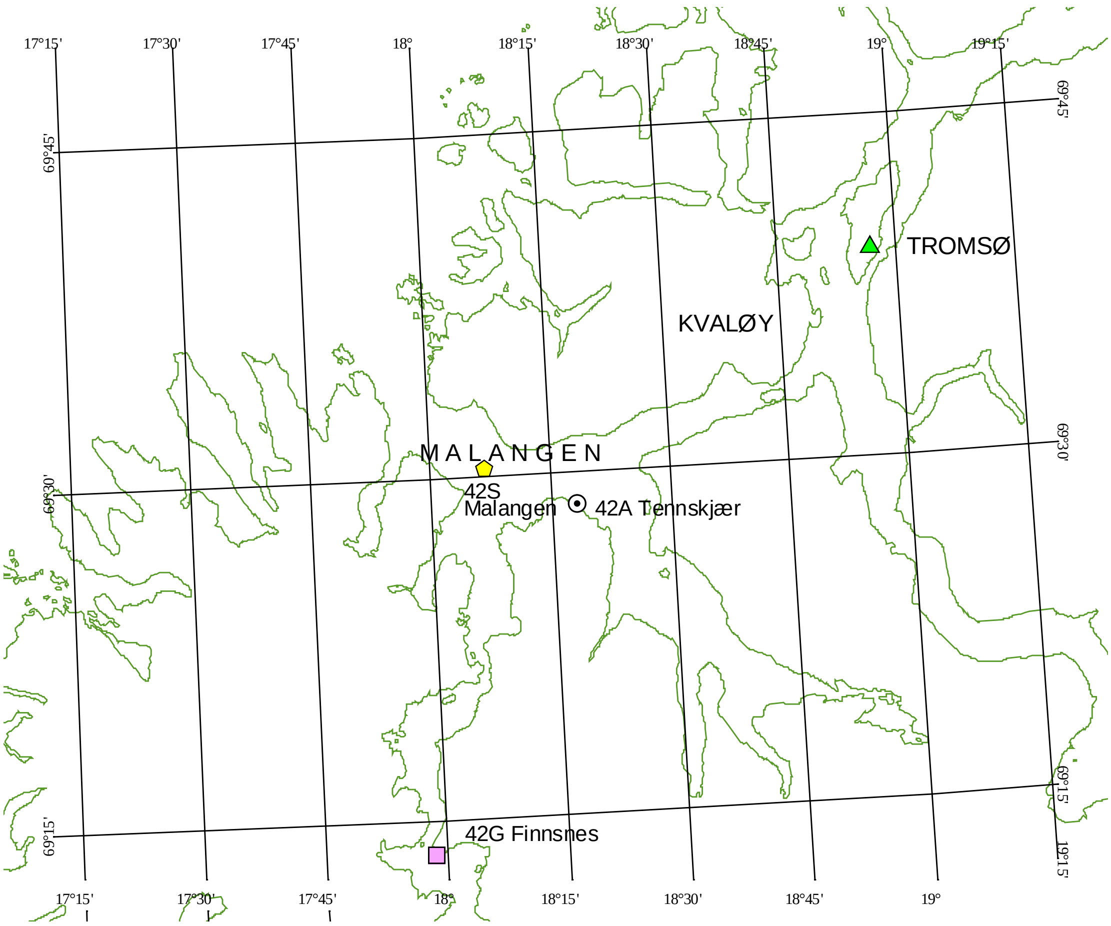
MAP 15


98A Svolvær området
SVOLVÆR
98B/F Lille Molla
98X Skrova
98A Svolvær området
98S Skrova (south of)
99S Lundøy (north of)
V E S T F J O R D
99A Brunvær
97A Klakholmen
97A Klakholmen
13°45'
14°
14°15'
14°30'
14°45'
15°
15°15'
15°30'
68°
67°45'

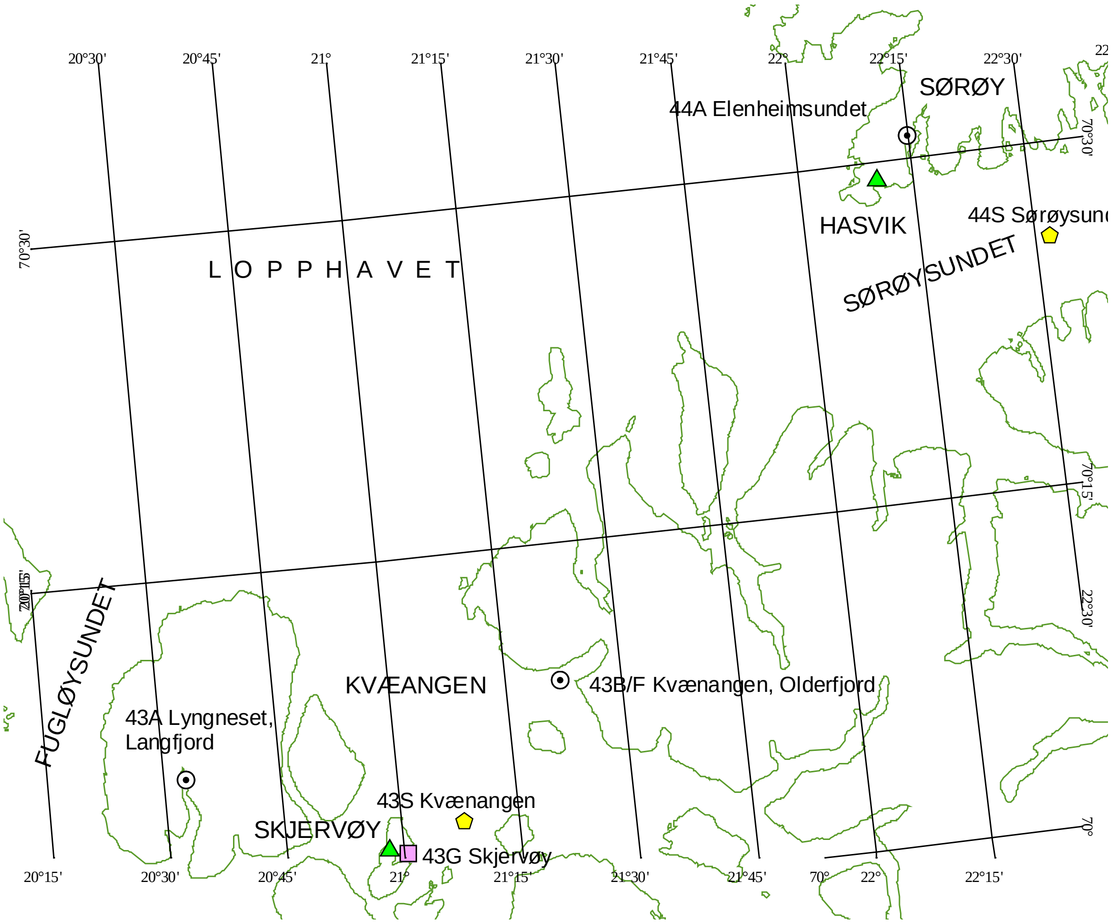
MAP 16


ANDØYA
41S Vågsfjorden
41A Fensneset, Grytøya
41G Harstad
HARSTAD
VÅGSFJORD
15°45'
16°
16°15'
16°30'
16°45'
17°
17°15'
17°30'
17°45'
69°
68°45'

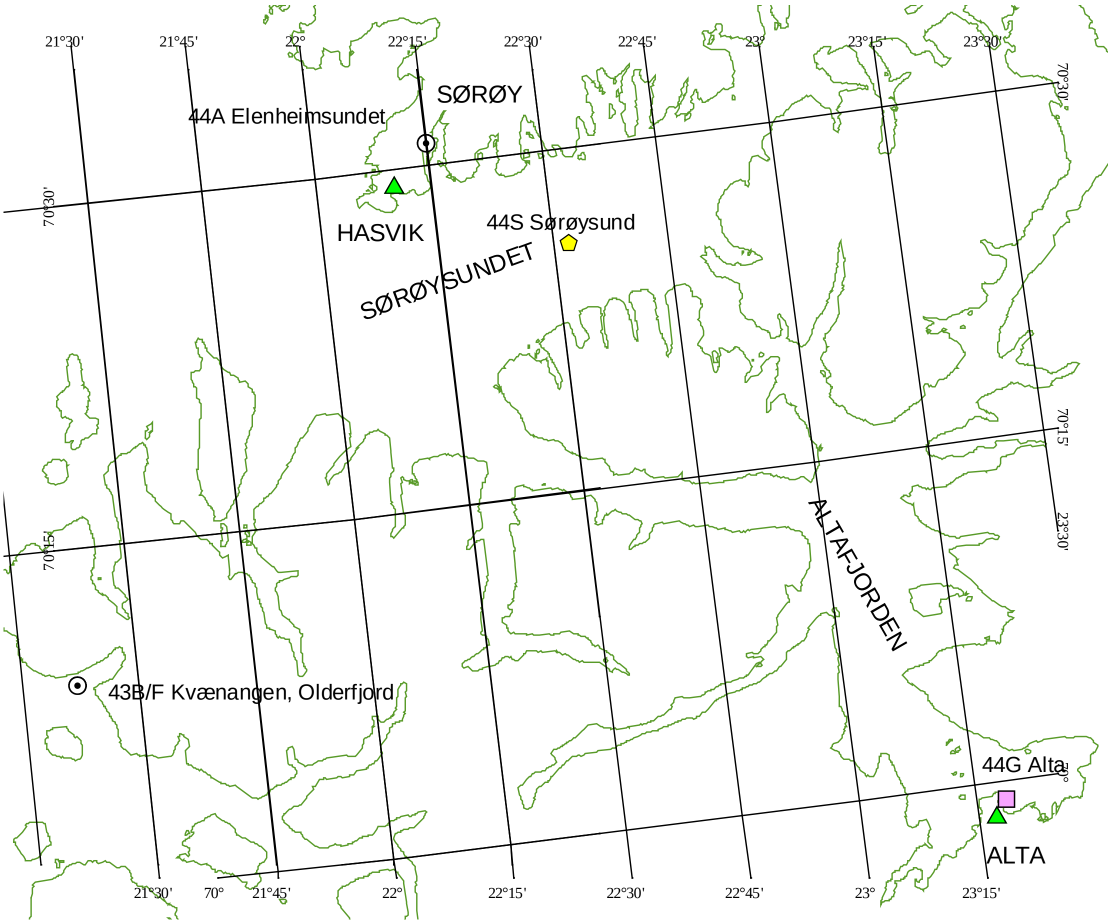
MAP 17


TROMSØ
KVALØY
MALANGEN
42S
Malangen
42A Tennskjær
42G Finnsnes
17°15'
17°30'
17°45'
18°
18°15'
18°30'
18°45'
19°
19°15'
69°45'
69°30'
69°15'

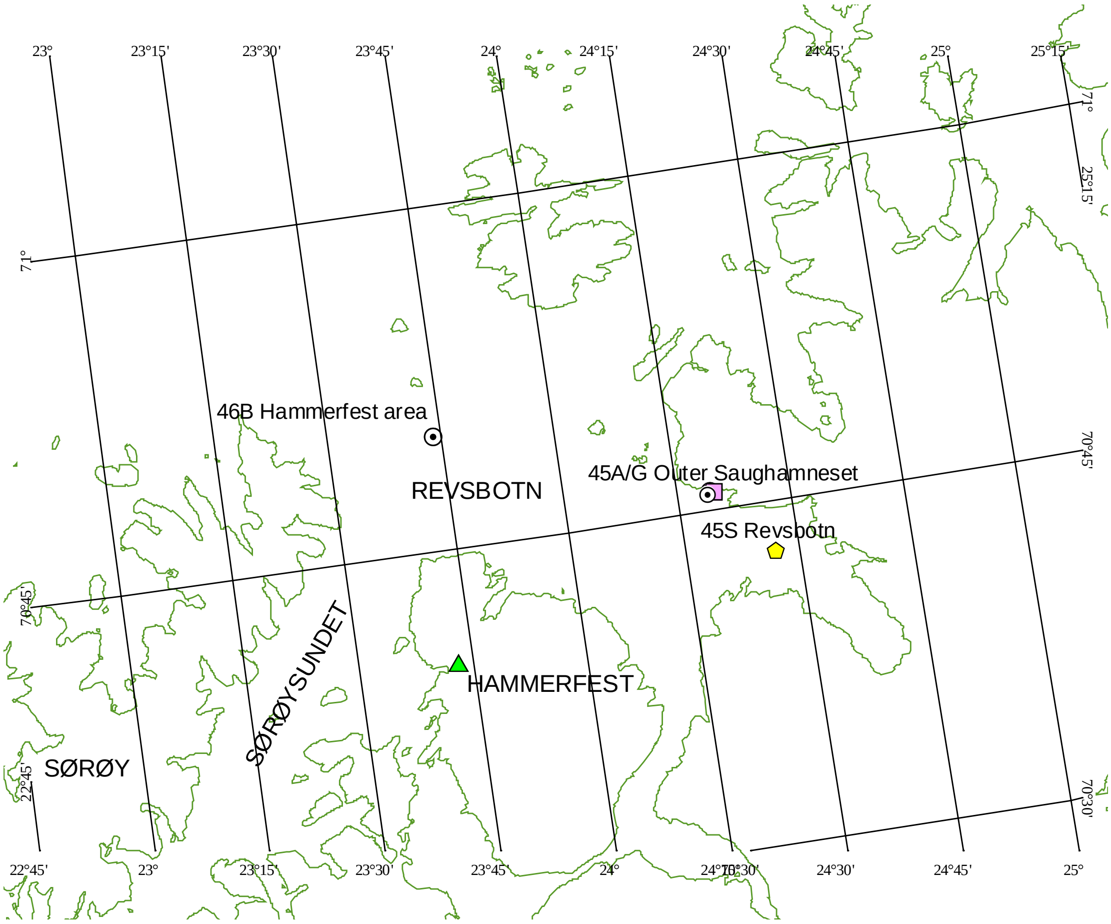
MAP 18


SØRØY
44A Elenheimsundet
HASVIK
44S Sørøysund
SØRØYSUNDET
L O P P H A V E T
FUGLØYSUNDET
KVÆANGEN
43B/F Kvænangen, Olderfjord
43A Lyngneset,
Langfjord
43S Kvænangen
SKJERVØY
43G Skjervøy
20°30'
20°45'
21°
21°15'
21°30'
21°45'
22°
22°15'
22°30'
70°30'
70°15'
70°
20°15'

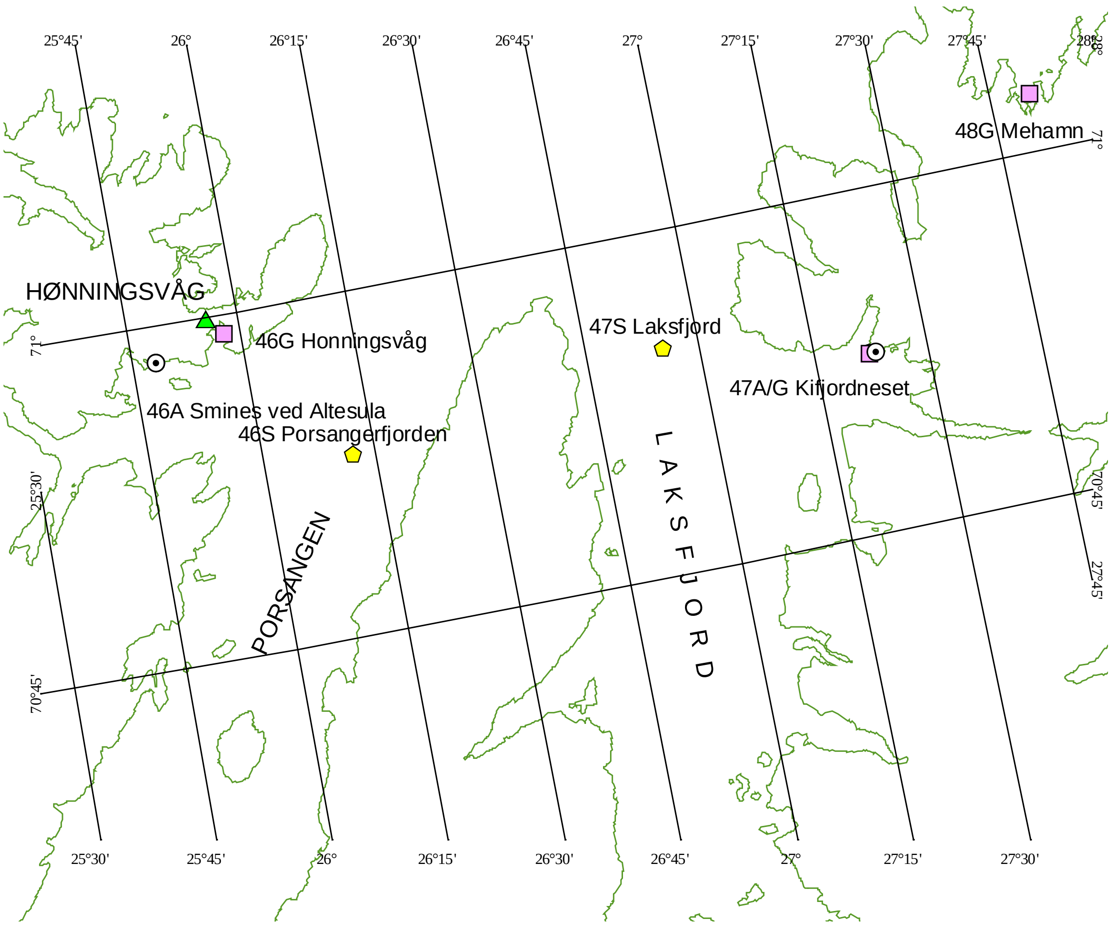
MAP 19


SØRØY
44A Elenheimsundet
HASVIK
44S Sørøysund
SØRØYSUNDET
ALTAFJORDEN
43B/F Kvænangen, Olderfjord
44G Alta
ALTA
21°30'
21°45'
22°
22°15'
22°30'
22°45'
23°
23°15'
23°30'
70°30'
70°15'
70°

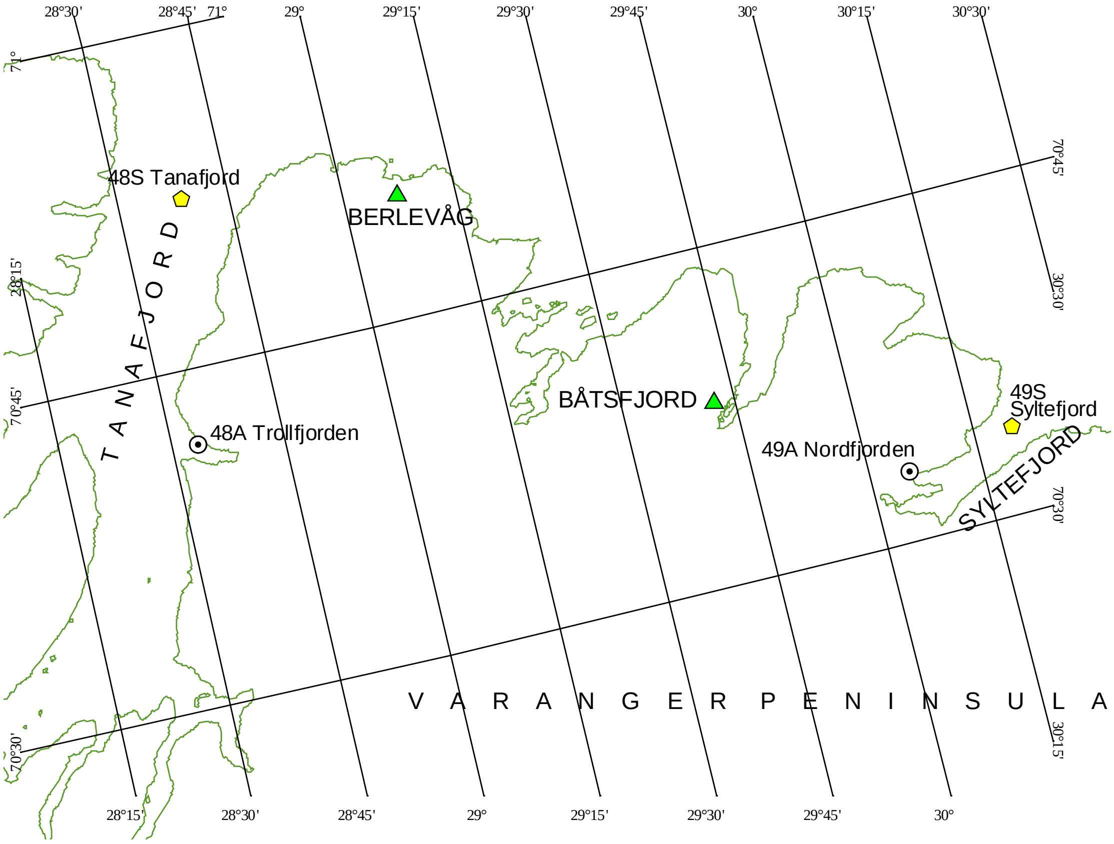
MAP 20


46B Hammerfest area
REVSBOTN
45A/G Outer Saughamneset
45S Revsbotn
HAMMERFEST
SØRØYSUNDET
SØRØY
23°
23°15'
23°30'
23°45'
24°
24°15'
24°30'
24°45'
25°
25°15'
71°
70°45'
70°30'
22°45'
25°

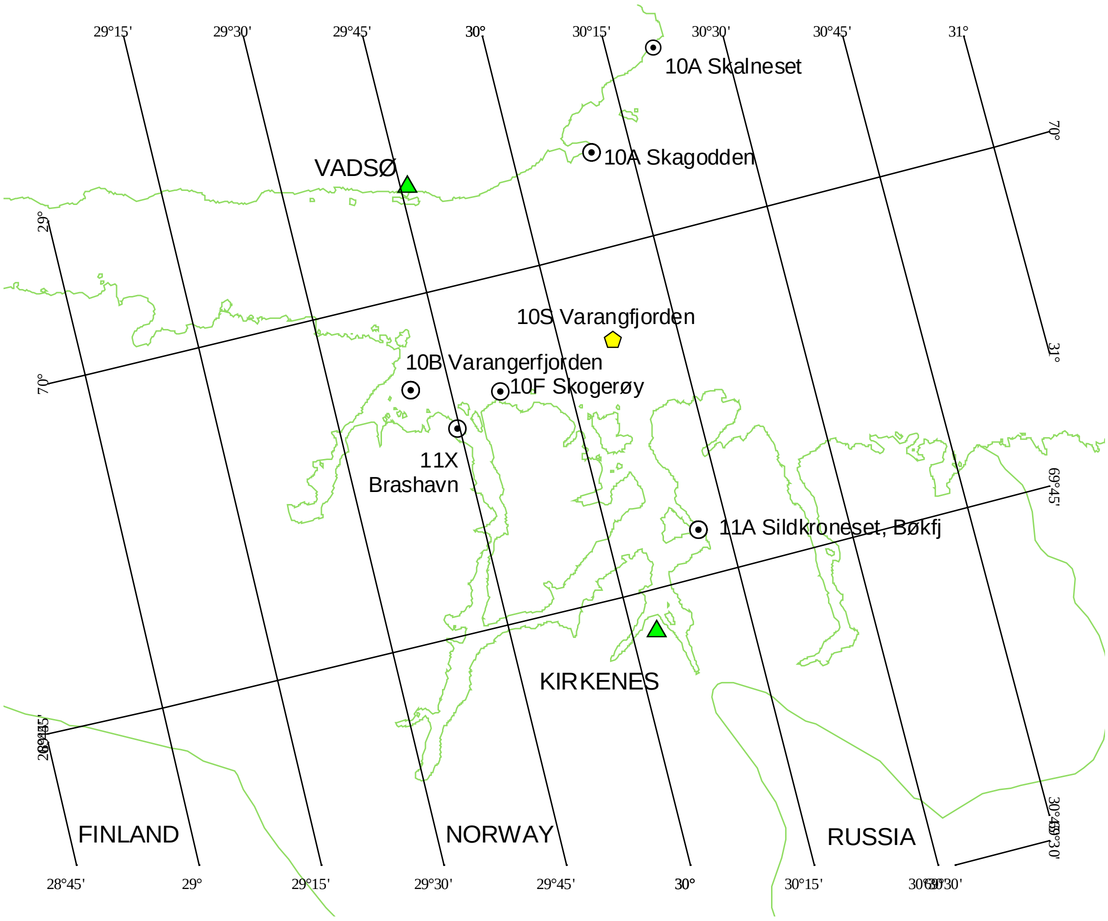
MAP 21


48G Mehamn
HØNNINGSVÅG
46G Honningsvåg
46A Smines ved Altesula
46S Porsangerfjorden
47S Laksfjord
47A/G Kifjordneset
PORSANGEN
LAKSFJORD
25°45'
26°
26°15'
26°30'
26°45'
27°
27°15'
27°30'
27°45'
28°
71°
70°45'
25°30'
27°45'

MAP 22


48S Tanafjord
BERLEVÅG
TANAFJORD
48A Trollfjorden
BÅTSFJORD
49S
Syltefjord
49A Nordfjorden
SYLTEFJORD
VARANGERPENINSULA

MAP 23


10A Skalneset
10A Skagodden
VADSØ
10S Varangfjorden
10B Varangerfjorden
10F Skogerøy
11X
Brashavn
11A Sildkroneset, Bøkfj
KIRKENES
FINLAND
NORWAY
RUSSIA

MAP 24

Appendix G
Overview of materials and analyses 2002

Station positions are shown on maps in Appendix F

Appendix G1. Sampling and analyses for 2002, L-liver, F-fillet. (See Appendix G2 for descriptions of codes for analysis (M0, M1, M3, M4, M5, C2, C4, A1, G1), fish (P, F, D, L, M, C) and counts). Analytical overview for liver (-L) or fillet (-F) tissue is distinguished.

JAMP area		STATION	WATER	SEDIMENT				MUSSEL/			OTHER		FISH FLAT- (P,F,D,M)				COD- (C)			
													-L	M4	C2	A1	-L	M4	C2	A1
			M0	M1	C4	A1	G1	M3	C2	A1	M3	C2	-F	M5	C2	A1	-F	M5	C2	A1
26		**OSLOFJORD AREA CENTRAL**, Oslofjord proper																		
26	30A	Gressholmen	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
26	30B	Oslo city Area / Håøya	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-L	25	25	.
			.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-F	25	5B	.
26	31A	Solbergstrand	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
26	33B	Sande, east side	.	.	.	.	.	.	.	.	.	.	F-L	5B	5B	.	.	.	.	.
			.	.	.	.	.	.	.	.	.	.	F-F	5B	5B	.	.	.	.	.
26	35A	Mølen	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
26	36A	Færder	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
26	36B	Færder area	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-L	25	25	.
			.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-F	25	5B	.
20	36F	Færder area	.	.	.	.	.	.	.	.	.	.	D-L	5B	5B	.	.	.	.	.
			.	.	.	.	.	.	.	.	.	.	D-F	5B	5B	.	.	.	.	.
26		**OSLOFJORD AREA WEST**, outer Sandefjord-Langesundsfjord																		
26	71A	Bjørkøya	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
		ARENDAL AREA																		
	76A	Risøy	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
		LISTA AREA																		
	15A	Ullerø area	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
	15B	Ullerø area	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-L	25	25	.
			.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-F	25	5B	.
	15F	Ullerø area	.	.	.	.	.	.	.	.	.	.	D-L	5B	5B	.	.	.	.	.
			.	.	.	.	.	.	.	.	.	.	D-F	5B	5B	.	.	.	.	.
		BØMLO-SOTRA AREA																		
	21F	Kyrping (Åkrafjord 2000)	.	.	.	.	.	.	.	.	.	.	D-L	5B	5B	.	.	.	.	.
			.	.	.	.	.	.	.	.	.	.	D-F	5B	5B	.	.	.	.	.
			.	.	.	.	.	.	.	.	.	.	F-L	5B	5B	.	.	.	.	.
			.	.	.	.	.	.	.	.	.	.	F-F	5B	5B	.	.	.	.	.
	22A	Espevær, west	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
	23B	Karihavet	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-L	25	25	.
			.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-F	25	5B	.
62		**HARDANGERFJORDEN**																		
62	69A	Lille Terøy	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
62	67B	Strandebarm	.	.	.	.	.	.	.	.	.	.	ML	5B	5B	.	C-L	25	25	.
			.	.	.	.	.	.	.	.	.	.	MF	5B	5B	.	C-F	25	5B	.
			.	.	.	.	.	.	.	.	.	.	F-L	5B	5B	.	.	.	.	.
			.	.	.	.	.	.	.	.	.	.	F-F	5B	5B	.	.	.	.	.
62	65A	Vikingneset	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
62	63A	Ranaskjær	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
63		**SØRFJORDEN**																		
63	52A	Eitrheimsneset	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
63	53B	Inner Sørfjord	.	.	.	.	.	.	.	.	.	.	P-L	5B	5B	.	C-L	25	25	.
			.	.	.	.	.	.	.	.	.	.	P-F	5B	5B	.	C-F	25	5B	.
63	56A	Kvalnes	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
63	57A	Krossanes	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.

Appendix G1 (cont.)

JAMP area	STATION	WATER M0	SEDIMENT M1	SEDIMENT C4	SEDIMENT A1	SEDIMENT G1	MUSSEL/ M3	MUSSEL/ C2	MUSSEL/ A1	OTHER	OTHER	FISH FLAT- (P,F,D,M) -L / -F	FISH FLAT- M4 / M5	FISH FLAT- C2 / C2	FISH FLAT- A1 / A1	FISH COD- (C) -L / -F	FISH COD- M4 / M5	FISH COD- C2 / C2	FISH COD- A1 / A1
	LOFOTEN AREA																		
98A	Husvågen (1997)	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
98B	Lille Molla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-L	25	25	.
		.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-F	25	5B	.
98F	Lille Molla	.	.	.	.	.	.	.	.	.	.	P-L	5B	5B	.	.	.	.	.
		.	.	.	.	.	.	.	.	.	.	P-F	5B	5B	.	.	.	.	.
	VARANGER PENINSULA AREA																		
10A	Skalneset	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.
10B	Varangerfjorden	.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-L	25	25	.
		.	.	.	.	.	.	.	.	.	.	.	.	.	.	C-F	25	5B	.
		.	.	.	.	.	.	.	.	.	.	P-L	5B	5B	.	.	.	.	.
		.	.	.	.	.	.	.	.	.	.	P-F	5B	5B	.	.	.	.	.
10F	Varangerfjorden	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
		.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
11X	Brashavn (1997)	1	.	.	.	.	3	3	.	.	.	.	.	.	.	.	.	.	.

Appendix G2: Key to analysis codes and sample counts used in Appendix G1.

ANALYSIS CODES:

Code	Analyses
M0	suspended matter
M1	Hg, Cd, Cu, Pb, Zn, Li (normalising element) total organic carbon (TOC)
M3	Hg, Cd, Cu, Pb, Zn
M4	Cd Cu Pb Zn (for fish liver)
M5	Hg (for fish fillet)
C1	CB-28,-52,-101,-105,-118,-138,-153,-156,-180, 209, 5-CB, OCS, a+gHCH, HCB, DDE, DDD, EPOCl (optional), dry weight percent
C2	CB-28,-52,-101,-105,-118,-138,-153,-156,-180, 209, 5-CB, OCS, a+gHCH, HCB, DDE, DDD, EPOCl (optional), fat and dry weight percent
A1	PAH
G1	Sediment core geological dating

SAMPLE COUNT CODES:

Medium	Count	Explanation
SEAWATER	1	sample for suspended matter determination
SEDIMENT	17	17 samples for metal analyses; two cores each with samples from 0-1, 1-2, 2-4, 4-6, 6-10, 10-15, 15-20 cm and deepest 5 cm slice plus one core with sample from 0-1 cm.
	4	4 samples for PCB or PAH analyses; two each cores with samples from 0-1cm and deepest 5cm slice.
	3	3 samples for metal analyses; three cores each with samples from 0-1cm.
MUSSEL	3/6	3 size groups (2-3, 3-4, 4-5 cm) each a bulk of ca.50 individuals and/or 1 size group (3-4 or 4-5 cm), 3 parallel samples each a bulk of 20 individuals.
	1/2	1 size group (2-3 or 3-4 cm), 2 parallel samples each a bulk of 50 individuals.
SHRIMP	2	2 samples of 100 individuals (edible size)
FISH		The number of individual fish or bulk samples of fish (-B) for analyses is shown. Bulk samples of fish consist of 5 fish. The five longest fish make up one bulk sample, the next five longest fish make up the another bulk sample and so on. The letter following the number indicates the fish type: D=dab, F=flounder, L=lemon sole, M=megrim, P=plaice, W=witch, C=cod, T=tusk, R=Rat fish, and N=Ling.

Appendix H
Temporal trend analyses of contaminants and biomarkers in biota 1981-2002

Sorted by contaminant, species and area/station:

Cadmium (Cd)
Mercury (Hg)
Lead (Pb)
Sum PCB-7 (CB: 28+52+101+118+138+153+180)
DDEPP (ppDDE)
γHCH (HCHG)
HCB
OH-pyrene
ALA-D (δ-amino levulinic acid dehydrase inhibition)
EROD (Cytochrome P4501A-activity)
MT (Metallothionein)

MYTI EDU - Blue Mussel (*Mytilus edulis*)
JAMP-stations
"Index"-stations
GADU MOR - Atlantic cod (*Gadus morhua*)
LEPI WHI - Megrim (*Lepidorhombus whiff-iagonis*)
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 "high background" ("?" missing background value)

TRD trend
- **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 (<6 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

Annual median concentration of CD
(ppm)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt				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	no	--	no	11
31A	MYTI EDU	SB	d.wt			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	no	--	no	13
35A	MYTI EDU	SB	d.wt			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	no	UY	no	10
36A	MYTI EDU	SB	d.wt			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	no	--	no	13
71A	MYTI EDU	SB	d.wt			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	no	--	no	12
76A	MYTI EDU	SB	d.wt										0.638	0.86	0.957	1.1			1.17	1.19	1.2	1.28	0.823	1.82	1.45	no	--	no	10
15A	MYTI EDU	SB	d.wt										0.505	0.831		1.18	0.794	1.44	1.22	1.07	1.03	0.841	1.44	4.4	1.31	no	--	1.6	15
51A	MYTI EDU	SB	d.wt							42.8	58.2							36.8	25.3	5.45	10.3	34.6	27.3	5.35	16.6	8.3	--	6.3	21
52A	MYTI EDU	SB	d.wt									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	2.5	--	no	20
56A	MYTI EDU	SB	d.wt							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	6.7	D-	6.2	16
57A	MYTI EDU	SB	d.wt							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	3.5	D-	3.3	13
63A	MYTI EDU	SB	d.wt							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	2.7	D-	3.1	16
65A	MYTI EDU	SB	d.wt							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	1.9	D-	2.6	16
69A	MYTI EDU	SB	d.wt												4.26	2.37	2.08	2.91	3.2	3.53	1.58	3.76	2.87	3.8	2.41	1.2	--	1.6	13
22A	MYTI EDU	SB	d.wt										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	no	--	no	14
82A	MYTI EDU	SB	d.wt				1.41	1.15	2.31	0.99	0.4	1.26		1.2	1.21	1.15		0.981	1.22							no	--	no	15
84A	MYTI EDU	SB	d.wt				1.39	1.86	2.38	2.1	0.96	1.19		1.82	2.11	1.6		1.64	1.29							no	--	no	12
87A	MYTI EDU	SB	d.wt				0.968	1.02	1.93	0.77	0.69	0.756		0.872	0.978	0.927		1.15	1.27							no	--	no	12
91A	MYTI EDU	SB	d.wt												1.68	1.27	1.82									no	-?	?	11
92A	MYTI EDU	SB	d.wt												1.08	0.544	0.939	0.743	0.691	0.716						no	--	no	11
98A	MYTI EDU	SB	d.wt												1.08	1.09				0.854	1.58	2.17	1.68	2.38	2.13	1.1	U-	1.6	10
98X	MYTI EDU	SB	d.wt														0.712	0.688	0.781							no	-?	?	6
41A	MYTI EDU	SB	d.wt														1.89	2.95	1.63	1.88						no	-?	?	12
43A	MYTI EDU	SB	d.wt														3.47	4.32		3.85						1.9	-?	?	8
44A	MYTI EDU	SB	d.wt														1.69	2.74	1.95	1.51						no	-?	?	12
46A	MYTI EDU	SB	d.wt														2.7	2.06	2.72							1.4	-?	?	10
48A	MYTI EDU	SB	d.wt														1.35	1.31	1.38							no	-?	?	<=5
10A	MYTI EDU	SB	d.wt														1.74	1.71	2.34	1.06	2.32	1.61	1.53	1.23	1.41	no	--	no	11
11A	MYTI EDU	SB	d.wt														1.31	1.28	1.07	1.59						no	-?	?	9
11X	MYTI EDU	SB	d.wt																	1.65	0.67	1.13	1.07	1.32	1.36	no	--	no	13

Annual median concentration of CD (ppm)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
I021	MYTI EDU	SB	d.wt															1.73	2.26	2.48	3.31		1.83	2.53	2.41	1.2	--	1.1	10
I022	MYTI EDU	SB	d.wt															1.43	1.36	1.26	2.09	1.94	1.33	1.7	2.69	1.3	--	1.3	11
I023	MYTI EDU	SB	d.wt															1.61	1.4	1.77	2.04	1.45	0.948	0.873	1.55	no	--	no	12
I024	MYTI EDU	SB	d.wt															1.31	1.63	2.04	2.56	2.45	1.83	2.53	2.7	1.4	U-	1.4	8
30A	MYTI EDU	SB	d.wt				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	no	--	no	11
I301	MYTI EDU	SB	d.wt															0.824	0.795	0.817	1.03	1.29	0.716	0.902	0.888	no	--	no	9
I304	MYTI EDU	SB	d.wt															1.33	0.719	0.784	1.05	0.994	0.921	1.16	1.3	no	--	no	10
I306	MYTI EDU	SB	d.wt															0.81	0.779	0.646	0.707	0.842	0.592	0.734	0.872	no	--	no	8
I307	MYTI EDU	SB	d.wt															0.94	0.815	0.687	0.72	0.826	0.719	0.899	1.46	no	--	no	9
I131	MYTI EDU	SB	d.wt															1.24	0.875	1.14	1.31	1.18	1.98	2.48	1.13	no	--	no	12
I201	MYTI EDU	SB	d.wt															0.801	0.856	1.06	0.927	1.27	1.42	1.49	2.8	1.4	U-	1.7	8
I205	MYTI EDU	SB	d.wt															0.819		1.37	0.858	1.49	1.99	1.42	2.43	1.2	--	1.5	11
51A	MYTI EDU	SB	d.wt							42.8	58.2							36.8	25.3	5.45	10.3	34.6	27.3	5.35	16.6	8.3	--	6.3	21
52A	MYTI EDU	SB	d.wt									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	2.5	--	no	20
I962	MYTI EDU	SB	d.wt															0.746	0.606	0.645	0.518					no	-?	?	6
I969	MYTI EDU	SB	d.wt															0.502	0.599	0.318	0.611	0.588	0.827	0.76	0.8	no	--	no	11
10A	MYTI EDU	SB	d.wt														1.74	1.71	2.34	1.06	2.32	1.61	1.53	1.23	1.41	no	--	no	11

Annual median concentration of CD
(ppm)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt				0.01	0.05	0.0619	0.0711	0.0218	0.0267	0.035	0.027	0.1	0.0645	0.063	0.049	0.045	0.045	0.107	0.165	0.078	0.111	0.106	1.1	--	1.3	17
36B	GADU MOR	LI	w.wt	0.078	0.06	0.22	0.07	0.05	0.137	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	no	DY	no	16
15B	GADU MOR	LI	w.wt										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	no	--	no	13
53B	GADU MOR	LI	w.wt						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	4.3	--	8.9	>25
67B	GADU MOR	LI	w.wt							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	no	--	no	21
23B	GADU MOR	LI	w.wt										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	no	--	no	11
84B	GADU MOR	LI	w.wt				0.13	0.0949	0.0688		0.0291															no	D?	?	6
92B	GADU MOR	LI	w.wt													0.036	0.029	0.022	0.066							no	-?	?	16
98B	GADU MOR	LI	w.wt												0.069	0.15	0.025	0.113	0.33	0.064	0.047	0.039	0.14	0.279	0.0291	no	--	no	25
43B	GADU MOR	LI	w.wt														0.168	0.183	0.097							no	-?	?	12
10B	GADU MOR	LI	w.wt														0.23	0.188	0.095	0.128	0.119	0.137	0.125	0.129	0.059	no	--	no	12

Annual median concentration of CD
(ppm)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
33B	PLAT FLE	LI	w.wt			0.19		0.195	0.176	0.251	0.061	0.106	0.234	0.196	0.16	0.184	0.087	0.091	0.11	0.107	0.108	0.126	0.071	0.091	0.0569	no	--	no	13
53B	PLAT FLE	LI	w.wt								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	9.1	--	13.3	21
67B	PLAT FLE	LI	w.wt																2.48		0.187	0.185	0.148	0.059	0.065	no	D-	no	18
36F	LIMA LIM	LI	w.wt										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	no	--	no	13
15F	LIMA LIM	LI	w.wt													0.0992	0.136	0.125	0.153	0.076	0.181	0.167		0.313	0.129	no	--	no	14
22F	LIMA LIM	LI	w.wt										0.095	0.091	0.128		0.169	0.125								no	-?	?	9
98F	LIMA LIM	LI	w.wt														0.98	0.182	0.225							no	-?	?	21
30F	PLEU PLA	LI	w.wt												0.11		0.101	0.222								1.1	-?	?	15
22F	PLEU PLA	LI	w.wt																0.23	0.231	0.244					1.2	-?	?	<=5
98F	PLEU PLA	LI	w.wt													0.1		0.747		0.324	0.203	0.214	0.821	0.521	0.217	1.1	--	2.0	22
10F	PLEU PLA	LI	w.wt																	0.571		0.141	0.248	0.302	0.204	1.0	-?	?	16
67B	LEPI WHI	LI	w.wt			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	m	DY	m	15

Annual median concentration of HG
(ppm)

																										ANALYSIS		
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt				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	no	--	no	13
31A	MYTI EDU	SB	d.wt			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	no	--	no	14
35A	MYTI EDU	SB	d.wt			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	no	--	no	15
36A	MYTI EDU	SB	d.wt			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	no	--	no	14
71A	MYTI EDU	SB	d.wt			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	no	--	no	12
76A	MYTI EDU	SB	d.wt										0.0709	0.0682	0.0498	0.0205			0.057	0.0824	0.0632	0.101	0.0328	0.0634	0.0585	no	--	no	15
15A	MYTI EDU	SB	d.wt										0.0561	0.0522		0.0244	0.0503	0.0217	0.0488	0.0558	0.0529	0.0437	0.163	0.0354	0.0452	no	--	no	17
51A	MYTI EDU	SB	d.wt							0.24	0.25							1.51	0.901	0.175	0.577	2.89	3.86	0.774	1.45	7.3	--	12.7	25
52A	MYTI EDU	SB	d.wt									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	1.3	--	1.3	20
56A	MYTI EDU	SB	d.wt							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	3.0	--	4.3	15
57A	MYTI EDU	SB	d.wt							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	1.4	--	1.9	13
63A	MYTI EDU	SB	d.wt							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	1.4	--	2.1	13
65A	MYTI EDU	SB	d.wt							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	no	--	no	13
69A	MYTI EDU	SB	d.wt												0.106	0.0263	0.0829	0.0704	0.104	0.111	0.0773	0.161	0.107	0.146	0.106	no	--	no	15
22A	MYTI EDU	SB	d.wt										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	no	--	no	13
82A	MYTI EDU	SB	d.wt				0.0508	0.11	0.17	0.08	0.12	0.0668		0.0743	0.0519	0.0787		0.0493	0.0691							no	--	no	13
84A	MYTI EDU	SB	d.wt				0.0766	0.112	0.15	0.08	0.24	0.0571		0.0657	0.0902	0.0568		0.0542	0.0433							no	--	no	15
87A	MYTI EDU	SB	d.wt				0.178		0.15	0.05	0.26	0.0462		0.0564	0.0543	0.0488		0.0439	0.0623							no	--	no	17
91A	MYTI EDU	SB	d.wt												0.0539	0.0758	0.0943									no	-?	?	<=5
92A	MYTI EDU	SB	d.wt												0.0548	0.0335	0.0521	0.0407	0.0234	0.067						no	--	no	14
98A	MYTI EDU	SB	d.wt												0.0865	0.0857				0.104	0.155	0.246	0.109	0.109	0.115	no	--	no	12
98X	MYTI EDU	SB	d.wt														0.335	0.34	0.328							1.6	-?	?	<=5
41A	MYTI EDU	SB	d.wt														0.0686	0.0635	0.064	0.0848						no	-?	?	8
43A	MYTI EDU	SB	d.wt														0.0844	0.0946		0.104						no	-?	?	<=5
44A	MYTI EDU	SB	d.wt														0.0552	0.05	0.0517	0.0592						no	-?	?	6
46A	MYTI EDU	SB	d.wt														0.0387	0.0618	0.0564							no	-?	?	10
48A	MYTI EDU	SB	d.wt														0.0726	0.0599	0.0524							no	-?	?	<=5
10A	MYTI EDU	SB	d.wt														0.0526	0.0488	0.0588	0.0617	0.0581	0.0625	0.0503	0.052	0.0494	no	--	no	6
11A	MYTI EDU	SB	d.wt														0.182	0.145	0.0859	0.146						no	-?	?	13
11X	MYTI EDU	SB	d.wt																	0.0811	0.0366	0.0564	0.0667	0.065	0.0372	no	--	no	13

Annual median concentration of HG
(ppm)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
I021	MYTI EDU	SB	d.wt															0.212	0.397	0.496	0.859		0.356	0.436	0.319	1.6	--	1.2	13
I022	MYTI EDU	SB	d.wt															0.13	0.134	0.321	0.404	0.415	0.182	0.238	0.289	1.4	--	no	14
I023	MYTI EDU	SB	d.wt															0.14	0.143	0.295	0.31	0.263	0.0944	0.0959	0.15	no	--	no	15
I024	MYTI EDU	SB	d.wt															0.107	0.18	0.45	0.543	0.425	0.12	0.295	0.238	1.2	--	no	17
30A	MYTI EDU	SB	d.wt										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	no	--	no	11
I301	MYTI EDU	SB	d.wt															0.0656	0.0682	0.0582	0.0675	0.0625	0.0408	0.0677	0.05	no	--	no	9
I304	MYTI EDU	SB	d.wt															0.047	0.0694	0.0395	0.0541	0.0503	0.0294	0.0513	0.0462	no	--	no	11
I306	MYTI EDU	SB	d.wt															0.0447	0.0617	0.0387	0.061	0.0508	0.0355	0.0353	0.0403	no	--	no	10
I307	MYTI EDU	SB	d.wt															0.0383	0.0705	0.0337	0.0465	0.0542	0.0327	0.0488	0.0541	no	--	no	12
I711	MYTI EDU	SB	d.wt																		0.382	0.287	0.198		0.2	no	-?	?	9
I712	MYTI EDU	SB	d.wt																		0.181	0.257	0.214	0.218	0.211	1.1	-?	?	8
I131	MYTI EDU	SB	d.wt															0.127	0.0691	0.0601	0.144	0.0635	0.0337	0.0784	0.0503	no	--	no	16
51A	MYTI EDU	SB	d.wt															1.51	0.901	0.175	0.577	2.89	3.86	0.774	1.45	7.3	--	12.7	>25
52A	MYTI EDU	SB	d.wt										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	1.3	--	1.3	20
I201	MYTI EDU	SB	d.wt																		0.101	0.132	0.157	0.169	0.313	1.6	U?	?	8
I205	MYTI EDU	SB	d.wt																		0.0974	0.171	0.205	0.167	0.218	1.1	-?	?	10
10A	MYTI EDU	SB	d.wt														0.0526	0.0488	0.0588	0.0617	0.0581	0.0625	0.0503	0.052	0.0494	no	--	no	6

Annual median concentration of HG
(ppm)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30B	GADU MOR (s)	MU	w.wt				0.125	0.0894	0.0788	0.0402	0.0585	0.121	0.12	0.09	0.11	0.122	0.102	0.08	0.108	0.131	0.117	0.153	0.173	0.224	0.131	1.3	U-L	2.0	11
30B	GADU MOR (l)	MU	w.wt				0.155	0.09	0.0735	0.0379	0.147	0.166	0.13	0.108	0.15	0.155	0.129	0.119	0.142	0.19	0.232	0.351	0.252	0.34	0.207	2.1	U-L	2.7	13
36B	GADU MOR (s)	MU	w.wt	0.069	0.08	0.11	0.0748	0.08	0.0612	0.0317	0.0529	0.0685	0.06	0.06	0.0592	0.0674	0.0535	0.0759	0.0665	0.0885	0.0778	0.06	0.072	0.0515	0.0569	no	--L	no	10
36B	GADU MOR (l)	MU	w.wt	0.079	0.16	0.18	0.195	0.12	0.112	0.0393	0.083	0.0739	0.115	0.1	0.08	0.0829	0.0599	0.0946	0.0695	0.157	0.088	0.186	0.075	0.123	0.108	1.1	--L	no	13
15B	GADU MOR (s)	MU	w.wt										0.0648	0.04	0.026	0.018	0.045	0.0435	0.0585	0.0761	0.0435	0.023	0.0377	0.064	0.0375	no	--L	no	14
15B	GADU MOR (l)	MU	w.wt										0.12	0.07	0.063	0.0394	0.081	0.0455	0.0874	0.108	0.09	0.0265	0.0465	0.0865	0.048	no	--L	no	15
53B	GADU MOR (s)	MU	w.wt						0.223		0.105	0.16	0.184	0.204	0.36	0.0896		0.0535	0.229	0.128	0.151	0.175	0.209	0.257	0.196	2.0	--L	2.8	16
53B	GADU MOR (l)	MU	w.wt						0.196		0.105	0.203	0.17	0.269	0.396	0.141		0.0904	0.277	0.243	0.298	0.285	0.395	0.715	0.375	3.7	--L	6.9	15
67B	GADU MOR (s)	MU	w.wt							0.1	0.0847	0.0902	0.0794	0.1	0.0847	0.0925	0.12	0.0712	0.073	0.117	0.0505	0.0575	0.0735	0.045	0.048	no	--L	no	10
67B	GADU MOR (l)	MU	w.wt							0.17	0.0847	0.102	0.255	0.13	0.141	0.0828	0.106	0.072	0.089	0.16	0.068	0.0595	0.107	0.092	0.0939	no	--L	no	14
23B	GADU MOR (s)	MU	w.wt										0.0648	0.07	0.06	0.0415	0.0515	0.069	0.0595	0.073	0.075	0.0605	0.0833	0.0725	0.0634	no	--L	no	8
23B	GADU MOR (l)	MU	w.wt										0.17	0.11	0.0837	0.0981	0.0735	0.109	0.057	0.105	0.116	0.113	0.107	0.097	0.102	1.0	--L	no	10
84B	GADU MOR (s)	MU	w.wt				0.0346	0.04	0.0246		0.0439															no	-?-	?	12
84B	GADU MOR (l)	MU	w.wt				0.06	0.04	0.0246		0.0439															no	-?-	?	14
92B	GADU MOR (s)	MU	w.wt													0.0464	0.0785	0.0795	0.077							no	-?-	?	10
92B	GADU MOR (l)	MU	w.wt													0.058	0.091	0.074	0.117							1.2	-?-	?	10
98B	GADU MOR (s)	MU	w.wt												0.0665	0.0543	0.069	0.0685	0.0395	0.095	0.0664	0.0465	0.0953	0.047	0.047	no	---	no	13
98B	GADU MOR (l)	MU	w.wt												0.065	0.064	0.069	0.0863	0.037	0.128	0.0895	0.043	0.09	0.0716	0.0593	no	---	no	14
43B	GADU MOR (s)	MU	w.wt														0.065	0.054	0.047							no	-?-	?	<=5
43B	GADU MOR (l)	MU	w.wt														0.05	0.059	0.0568							no	-?-	?	6
10B	GADU MOR (s)	MU	w.wt														0.044	0.0339	0.0285	0.011	0.0135	0.0165	0.0105	0.009	0.00949	no	D-L	no	11
10B	GADU MOR (l)	MU	w.wt														0.0555	0.0525	0.0395	0.02	0.019	0.032	0.015	0.0105	0.012	no	D-L	no	12

Annual median concentration of HG
(ppm)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
33B	PLAT FLE (s)	MU	w.wt			0.11		0.09	0.0769	0.019	0.0694		0.175	0.0877	0.116	0.0918	0.0694	0.053	0.048	0.076	0.0384	0.0455	0.0495	0.0293	0.067	no	---	no	16
33B	PLAT FLE (l)	MU	w.wt			0.139		0.1	0.0769	0.0238	0.0694		0.195	0.135	0.196	0.103	0.088	0.049	0.06	0.087	0.0699	0.119	0.0778	0.059	0.0281	no	---	no	15
53B	PLAT FLE (s)	MU	w.wt								0.111	0.0738	0.139	0.154	0.141	0.0712		0.0352	0.165	0.13	0.165	0.249	0.289	0.333	0.553	5.5	U--	8.0	15
53B	PLAT FLE (l)	MU	w.wt								0.111	0.128	0.09	0.124	0.1	0.116		0.0356	0.208	0.221	0.257	0.157	0.233	0.438	0.45	4.5	U--	6.3	16
67B	PLAT FLE (s)	MU	w.wt																0.1		0.0426	0.0363	0.0638	0.0442	0.0505	no	---	no	13
67B	PLAT FLE (l)	MU	w.wt																0.246		0.0608	0.0337	0.082	0.0678	0.0712	no	---	no	18
36F	LIMA LIM (s)	MU	w.wt										0.0447	0.0707	0.066	0.0703	0.0495	0.0539	0.0487	0.0306	0.0615	0.0375	0.0563	0.041	0.0617	no	--L	no	11
36F	LIMA LIM (l)	MU	w.wt										0.098	0.0742	0.133	0.101	0.0756	0.0997	0.0659	0.0906	0.0915	0.0676	0.102	0.0989	0.114	1.1	--L	1.3	10
15F	LIMA LIM (s)	MU	w.wt											0.09		0.038	0.0368	0.0245	0.0374	0.0475	0.042	0.036		0.0548	0.0559	no	--L	no	12
15F	LIMA LIM (l)	MU	w.wt											0.15		0.034	0.036	0.0564	0.108	0.0727	0.0884	0.059		0.165	0.105	1.0	--L	1.5	17
22F	LIMA LIM (s)	MU	w.wt										0.0837	0.04	0.207		0.045	0.063								no	-?-	?	20
22F	LIMA LIM (l)	MU	w.wt										0.174	0.152	0.282		0.223	0.372								3.7	-?-	?	11
30F	PLEU PLA (s)	MU	w.wt												0.058		0.0275	0.0372								no	-?-	?	13
30F	PLEU PLA (l)	MU	w.wt												0.035		0.0559	0.0476								no	-?-	?	10
22F	PLEU PLA (s)	MU	w.wt																0.0287	0.0431	0.0495					no	-?-	?	7
22F	PLEU PLA (l)	MU	w.wt																0.0506	0.0505	0.0827					no	-?-	?	9
98F	PLEU PLA (s)	MU	w.wt													0.017		0.0475		0.0384	0.0292	0.049	0.0579	0.0588	0.0334	no	---	no	14
98F	PLEU PLA (l)	MU	w.wt													0.025		0.0751		0.0259	0.0588	0.049	0.164	0.0896	0.0309	no	---	no	20
10F	PLEU PLA (s)	MU	w.wt																	0.032		0.014	0.029	0.019	0.0189	no	-?-	?	13
10F	PLEU PLA (l)	MU	w.wt																	0.0415		0.0339	0.031	0.024	0.0349	no	-?-	?	9
67B	LEPI WHI (s)	MU	w.wt															0.364	0.398	0.172	0.0663	0.11	0.104	0.0936	0.208	m	--D	m	15
67B	LEPI WHI (l)	MU	w.wt															0.341	0.372	0.331	0.275	0.392	0.33	0.237	0.0914	m	--D	m	12

Annual median concentration of PB
(ppm)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt										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	no	--	no	23
31A	MYTI EDU	SB	d.wt										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	no	--	no	14
35A	MYTI EDU	SB	d.wt										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	no	D-	no	11
36A	MYTI EDU	SB	d.wt										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	no	DY	no	9
71A	MYTI EDU	SB	d.wt										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	no	--	no	14
76A	MYTI EDU	SB	d.wt										1.77	0.968	1.5	0.913			0.796	1.84	1.23	1.99	0.602	0.829	0.766	no	--	no	14
15A	MYTI EDU	SB	d.wt										1.46	0.777		0.976	1.05	0.522	0.671	1.12	1.28	1.66	2.2	0.96	0.714	no	--	no	13
51A	MYTI EDU	SB	d.wt															149	60.3	17.2	29.6	37.1	91.7	32.4	98.4	32.8	--	40.7	20
52A	MYTI EDU	SB	d.wt										12.1	313	189	65.5	16.4	17.5	9.84	20.6	14.7	11.6	11	21.8	21.8	7.3	--	8.5	24
56A	MYTI EDU	SB	d.wt										20.7	23.4	121	109	24.7	46.4	27.8	37.5	15.7	30.3	28.5	30.5	42.9	14.3	--	16.5	18
57A	MYTI EDU	SB	d.wt										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	3.2	--	4.0	14
63A	MYTI EDU	SB	d.wt										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	2.2	D-	2.3	10
65A	MYTI EDU	SB	d.wt										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	1.0	D-	1.2	11
69A	MYTI EDU	SB	d.wt												4.62	3.42	2.8	3.17	4.02	3.66	1.98	3.4	2.27	3.91	2.76	no	--	1.1	11
22A	MYTI EDU	SB	d.wt										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	no	--	no	10
82A	MYTI EDU	SB	d.wt											1.28	0.933	0.916		0.622	0.674							no	D?	?	7
84A	MYTI EDU	SB	d.wt											1.01	1.15	1.38		1.38	0.833							no	-?	?	11
87A	MYTI EDU	SB	d.wt											0.974	0.87	0.634		1.4	2.47							no	-?	?	14
91A	MYTI EDU	SB	d.wt												0.898	1.46	2.01									no	-?	?	6
92A	MYTI EDU	SB	d.wt												0.933	0.628	1.09	0.664	0.654	2.18						no	--	1.4	16
98A	MYTI EDU	SB	d.wt												1.87	1.85				1.54	2.36	1.59	1.49	1.34	0.892	no	D-	no	9
98X	MYTI EDU	SB	d.wt														4.34	3.12	4.11							1.4	-?	?	11
41A	MYTI EDU	SB	d.wt														1.29	0.9	0.793	0.651						no	D?	?	6
43A	MYTI EDU	SB	d.wt														1.56	1.51		0.855						no	-?	?	8
44A	MYTI EDU	SB	d.wt														2.81	2.57	1.66	1.15						no	D?	?	7
46A	MYTI EDU	SB	d.wt														1.26	1.57	1.38							no	-?	?	8
48A	MYTI EDU	SB	d.wt														0.682	1.08	0.333							no	-?	?	19
10A	MYTI EDU	SB	d.wt														1.94	2.78	0.735	0.807	2.34	1.57	1.44	1.39	1.8	no	--	no	16
11A	MYTI EDU	SB	d.wt														1.54	1.48	0.336	0.367						no	-?	?	16
11X	MYTI EDU	SB	d.wt																	0.743	0.521	0.314	1.09	2.32	0.74	no	--	no	19

Annual median concentration of PB
(ppm)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
I021	MYTI EDU	SB	d.wt															1.06	2.29	1.65	2.12		0.99	1.65	1.19	no	--	no	13
I022	MYTI EDU	SB	d.wt															1	0.599	1.18	1.31	1.94	1.05	0.952	1.27	no	--	no	12
I023	MYTI EDU	SB	d.wt															0.774	1.27	1.38	1.7	1.38	0.636	0.616	0.754	no	--	no	12
I024	MYTI EDU	SB	d.wt															0.971	1.1	1.16	1.7	1.79	0.617	1.33	1.1	no	--	no	13
30A	MYTI EDU	SB	d.wt										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	no	--	no	23
I301	MYTI EDU	SB	d.wt																		2.47	2.11	1.32	3.16	1.98	no	-?	?	13
I304	MYTI EDU	SB	d.wt																		2.23	1.19	0.765	1.88	1.3	no	-?	?	15
I306	MYTI EDU	SB	d.wt																		1.34	0.678	0.542	1.03	0.658	no	-?	?	14
I307	MYTI EDU	SB	d.wt																		1.05	0.798	0.513	1.01	1.26	no	-?	?	14
I201	MYTI EDU	SB	d.wt															3.54	4.39	4.77	4.67	4.43	6.41	3.78	8.21	2.7	--	2.6	11
I205	MYTI EDU	SB	d.wt															4.77		6.96	4	5.97	7.09	6.15	9.27	3.1	--	3.6	10
51A	MYTI EDU	SB	d.wt															149	60.3	17.2	29.6	37.1	91.7	32.4	98.4	32.8	--	40.7	20
52A	MYTI EDU	SB	d.wt										12.1	313	189	65.5	16.4	17.5	9.84	20.6	14.7	11.6	11	21.8	21.8	7.3	--	8.5	24
I962	MYTI EDU	SB	d.wt															4.44	5.34	3.55	2.99					no	-?	?	9
I969	MYTI EDU	SB	d.wt															2.47	2.08	1.62	2.91	5.13	3	2.57	2.58	no	--	no	13
10A	MYTI EDU	SB	d.wt														1.94	2.78	0.735	0.807	2.34	1.57	1.44	1.39	1.8	no	--	no	16

Annual median concentration of PB
(ppm)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt										0.2	0.115	0.249	0.105	0.12	0.11	0.06	0.1	0.163	0.85	0.24	0.22	0.513	5.1	--	6.0	18
36B	GADU MOR	LI	w.wt										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	no	D-	no	15
15B	GADU MOR	LI	w.wt										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	no	D-	no	14
53B	GADU MOR	LI	w.wt										0.19	0.26	0.14	0.03		0.02	0.0748	0.07	0.105	0.115	0.13	0.13	0.142	1.4	--	1.9	17
67B	GADU MOR	LI	w.wt										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	no	--	no	17
23B	GADU MOR	LI	w.wt										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	no	D-	no	14
92B	GADU MOR	LI	w.wt													0.02	0.03	0.03	0.04							no	-?	?	7
98B	GADU MOR	LI	w.wt												0.03	0.03	0.03	0.04	0.04	0.05	0.03	0.03	0.04	0.03	0.01	no	--	no	12
43B	GADU MOR	LI	w.wt														0.03	0.03	0.03							no	-?	?	<=5
10B	GADU MOR	LI	w.wt														0.03	0.02	0.04	0.04	0.04	0.03	0.04	0.03	0.02	no	--	no	11

Annual median concentration of PB
(ppm)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
33B	PLAT FLE	LI	w.wt										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	no	DY	no	14
53B	PLAT FLE	LI	w.wt										0.71	0.81	0.41	0.23		0.0245	0.46	0.35	0.52	0.46	0.357	0.57	1.29	4.3	--	4.4	23
67B	PLAT FLE	LI	w.wt																0.35		0.03	0.03	0.03	0.03	0.0078	no	D-	no	19
36F	LIMA LIM	LI	w.wt										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	no	DY	no	17
15F	LIMA LIM	LI	w.wt											0.07		0.0408	0.03	0.02	0.03	0.05	0.04	0.0346		0.05	0.0212	no	--	no	13
22F	LIMA LIM	LI	w.wt										0.25	0.16	0.0424		0.06	0.07								no	-?	?	18
98F	LIMA LIM	LI	w.wt														0.02	0.04	0.03							no	-?	?	14
30F	PLEU PLA	LI	w.wt												0.739		0.54	0.57								2.8	-?	?	7
22F	PLEU PLA	LI	w.wt																0.28	0.28	0.46					2.3	-?	?	9
98F	PLEU PLA	LI	w.wt													0.03		0.31		0.05	0.04	0.22	0.104	0.04	0.0682	no	--	no	25
10F	PLEU PLA	LI	w.wt																	0.15		0.0648	0.08	0.05	0.0583	no	-?	?	11
67B	LEPI WHI	LI	w.wt										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	m	D-	m	12

Annual median concentration of CB_S7
(ppb)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt								77.5	96.5	116	89.6	97		89.3	90.4	110	128	58.5	71.1	49.9	29.6	33.9	2.3	DY	no	10
31A	MYTI EDU	SB	d.wt								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	no	DY	no	13
35A	MYTI EDU	SB	d.wt								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	no	D-	no	12
36A	MYTI EDU	SB	d.wt								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	no	--	no	13
71A	MYTI EDU	SB	d.wt								17	34.4	25	14.2	15.3		16.5	10.5		9.27	11.8	13.6	8.52	12.7	7.55	no	D-	no	12
76A	MYTI EDU	SB	d.wt										16.6	6.49	7.21				16.3	19.1	14.4	16.4	6.34	6.78	5.12	no	--	no	15
15A	MYTI EDU	SB	d.wt										11.8				6.29	3.06	2.41	3.88	4.72	5.28	2.56	4.19	3.15	no	--	no	14
51A	MYTI EDU	SB	d.wt															26.2	9.69	14.7	10.5	11.5	12	28	16.9	1.1	--	1.4	14
52A	MYTI EDU	SB	d.wt									40.2	14.9		11.3	11.3	17.1	16.9	10	19	10.6	11.2	7.19	74.2	12.5	no	--	1.5	19
56A	MYTI EDU	SB	d.wt								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	no	--	2.6	24
57A	MYTI EDU	SB	d.wt									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	no	--	no	21
63A	MYTI EDU	SB	d.wt									21.8		9.71	6.45	3.68	5.7	5.72		4.15	7.95	7.26	4.09	13.8	3.54	no	--	no	16
65A	MYTI EDU	SB	d.wt								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	no	--	no	17
69A	MYTI EDU	SB	d.wt												4.82		4.97	4.51	2.77	5.41	12.6	5.83	2.53	5.7	3.18	no	--	no	16
22A	MYTI EDU	SB	d.wt										18.9	8.23	8.61		7.97	6.84	5.19	4.69	11.5	6.01	5.14	4.69	3.24	no	D-	no	12
84A	MYTI EDU	SB	d.wt								5.25	20.5		5.05	8.44			3.6	6.37							no	--	no	18
92A	MYTI EDU	SB	d.wt												4.46	2.49	5.83	4.05	2.89	7.74						no	--	no	15
98A	MYTI EDU	SB	d.wt												20.5	5.68				10.7	8.4	4.14	3.54	4.56	3.23	no	--	no	14
98X	MYTI EDU	SB	d.wt														87.3	78.4	46.4							3.1	-?	?	9
41A	MYTI EDU	SB	d.wt														3.49	4.26	2.39	2.58						no	-?	?	10
43A	MYTI EDU	SB	d.wt														2.92	3.1		3.02						no	-?	?	<=5
44A	MYTI EDU	SB	d.wt															7.31	8.46	29.4						2	-?	?	15
46A	MYTI EDU	SB	d.wt														5.74	4.16	3.11							no	D?	?	<=5
48A	MYTI EDU	SB	d.wt														6.22	4.04	3.1							no	-?	?	6
10A	MYTI EDU	SB	d.wt														6.03	4.29	4.66	6.29		5.11	4.33	3.03	2.13	no	D-	no	9
11A	MYTI EDU	SB	d.wt														7.48	6.92	4.32	5.75						no	-?	?	10
11X	MYTI EDU	SB	d.wt																	3.34	3.56	4.48	2.79	3.1	1.93	no	--	no	10

Annual median concentration of CB_S7
(ppb)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
I021	MYTI EDU	SB	d.wt															43.1	31.8	32.2	24.1		22.2	20	25.1	1.7	D-	no	8
I022	MYTI EDU	SB	d.wt															32.1	25.9	41.2	22.4	28.9	19.2	22.4	20.8	1.4	--	no	10
I023	MYTI EDU	SB	d.wt															19.6	20.9	26	15	22.2	10.8	17.4	15.9	1.1	--	no	11
I024	MYTI EDU	SB	d.wt															31.8	36.1	45.6	36.6	28.7	16.8	17.7	26	1.7	--	no	12
30A	MYTI EDU	SB	d.wt								77.5	96.5	116	89.6	97		89.3	90.4	110	128	58.5	71.1	49.9	29.6	33.9	2.3	DY	no	10
I301	MYTI EDU	SB	d.wt															118	113	182	86.5	125	58.7	64.6	62.6	4.2	--	1.2	12
I304	MYTI EDU	SB	d.wt															35.2	23.8	44.4	35.9		19.9	25	24.4	1.6	--	no	12
I306	MYTI EDU	SB	d.wt															16.4	15.7	54.2	26.1		21.8	17.2	15.7	no	--	no	15
I307	MYTI EDU	SB	d.wt															20.6	28.5	40.2	17.3		20.3	16.9	17.5	1.2	--	no	12
I711	MYTI EDU	SB	d.wt															24.8	13.3	13.3	20.6	21.6	18.4		13.4	no	--	no	12
I712	MYTI EDU	SB	d.wt															33.3	31.2	25.3	22.4	24.9	13.9	12.5	10.9	no	D-	no	8
I131	MYTI EDU	SB	d.wt															7.94	11.7	13.1	22.4	12.7	10.1	14	29.4	2	--	1.2	14
I132	MYTI EDU	SB	d.wt															27.5	33.7	32	31.1	22.5	10.2	15.8	11.8	no	D-	no	12
I133	MYTI EDU	SB	d.wt															22.8	22.3	21.5	24.7	23	10.4	11.7	9.24	no	D-	no	10
51A	MYTI EDU	SB	d.wt															26.2	9.69	14.7	10.5	11.5	12	28	16.9	1.1	--	1.4	14
52A	MYTI EDU	SB	d.wt									40.2	14.9		11.3	11.3	17.1	16.9	10	19	10.6	11.2	7.19	74.2	12.5	no	--	1.5	19
I242	MYTI EDU	SB	d.wt															63	81.6	29.6	45.6	59.5	36.6	26.2	44.6	3	--	1.5	14
I243	MYTI EDU	SB	d.wt															115	169	122	78.2	92.4	47.9	29.3	52.5	3.5	D-	no	13
10A	MYTI EDU	SB	d.wt														6.03	4.29	4.66	6.29		5.11	4.33	3.03	2.13	no	D-	no	9

Annual median concentration of CB_S7
(ppb)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt										1240	3430	2800	2500	2910	2350	2790	3240	3660	3520	2080	2440	2230	4.5	--	2.8	11
36B	GADU MOR	LI	w.wt										441	344	396	636	376	1650	974	720	735	766	482	288	269	no	--	no	14
15B	GADU MOR	LI	w.wt										182	349	266	182	295	307	274	399	279	257	153	377	244	no	--	no	12
53B	GADU MOR	LI	w.wt										435	524	1760	166		162	701	576	2370	487	1520	842	956	1.9	--	1.9	22
67B	GADU MOR	LI	w.wt										316	293	268	226	329	209	269	627	206	273	148	225	145	no	--	no	13
23B	GADU MOR	LI	w.wt										222	244	228	208	128	193	196	125	179	229	207	167	111	no	--	no	10
92B	GADU MOR	LI	w.wt													135	152	311	369							no	U?	?	9
98B	GADU MOR	LI	w.wt												239	183	114	197	278	372	165	147	131	114	62.6	no	--	no	13
43B	GADU MOR	LI	w.wt														325	329	140							no	-?	?	13
10B	GADU MOR	LI	w.wt														645	485	210	189	168	255	99.4	109	151	no	D-	no	13
30B	GADU MOR	MU	w.wt										3.58	11.1	24.7	9.65	3.94	3.12	8.46	11.8	21.7	21.4	6.05	9.4	10.3	3.4	--	1.5	20
36B	GADU MOR	MU	w.wt										1.61	1.28	2	3.65	0.525	15.6	4.14	4.53	3.77	2.86	2.26	2.19	1.9	no	--	no	22
15B	GADU MOR	MU	w.wt										1.35	1.22	1.38	0.65	0.38	1.02	1.13	1.44	1.41	0.81	1.42	1.88	0.655	no	--	no	15
53B	GADU MOR	MU	w.wt										8.2	2.23	15	1.1		0.37	21.9	3.76	138	6.61	36.3	1.08	23.6	7.9	--	no	>25
67B	GADU MOR	MU	w.wt										0.835	1.43	1.1	0.624	1.15	0.605	3.49	7.07	0.73	1.72	1.18	9.98	0.61	no	--	no	25
23B	GADU MOR	MU	w.wt										0.64	2.25	0.75	0.85	0.18	0.625	0.46	0.81	1.49	0.95	0.45	0.62	0.38	no	--	no	18
92B	GADU MOR	MU	w.wt													0.55	0.225	0.36	0.905							no	-?	?	19
98B	GADU MOR	MU	w.wt												0.9	0.9	0.135	0.34	0.475	1.4	0.44	0.585	2.02	1.48	0.24	no	--	no	23
43B	GADU MOR	MU	w.wt														0.515	0.815	0.39							no	-?	?	16
10B	GADU MOR	MU	w.wt														1.76	2.48	0.367	0.9	0.79	1.39	0.5	0.55	0.635	no	--	no	18

Annual median concentration of CB_S7
(ppb)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
33B	PLAT FLE	LI	w.wt										36	31.1	97.5	69	57	86	38.3	40.4	30.5	47.2	90.7	158	53	no	--	1.4	16
53B	PLAT FLE	LI	w.wt										509	517	309	36		22.8	115	113	111	156	95.8	95.1	158	1.6	--	1.4	19
67B	PLAT FLE	LI	w.wt																70		96.9	45.8	44	36.2	32	no	D-	no	11
33B	PLAT FLE	MU	w.wt										2.04	3.96	1.8	0.95	0.51	1.37	1.37	0.995	0.85	5.32	1.14	1.76	1.53	no	--	no	18
53B	PLAT FLE	MU	w.wt										27.4	33.2	14.2	1.45		0.757	3.19	2.74	2.19	2.73	3	2.67	2.02	no	DY	no	20
67B	PLAT FLE	MU	w.wt																0.775		1.8	1.66	1.48	0.95	0.845	no	--	no	14
36F	LIMA LIM	LI	w.wt										301	217	339	418	404	433	386	387	236	412	838	527	297	no	--	no	13
15F	LIMA LIM	LI	w.wt											124		58.2	77	74	62.5	64.4	51.1	69.6		106	50.2	no	--	no	12
22F	LIMA LIM	LI	w.wt										170	127	140		60	88.7								no	-?	?	11
36F	LIMA LIM	MU	w.wt										2.76	7.05	5.6	7.8	5.9	8.18	9.62	5.18	9.41	3.88	8.38	7.73	6.56	1.3	--	no	13
15F	LIMA LIM	MU	w.wt											3.72		0.806	0.369	1.13	1.81	1.28	1.41	0.959		1.21	0.665	no	--	no	19
22F	LIMA LIM	MU	w.wt										1.97	5	3.82		1.24	5.14								1	-?	?	20
98F	LIMA LIM	MU	w.wt														0.845	1.34	3.3							no	-?	?	9
30F	PLEU PLA	LI	w.wt												313		207	216								4.3	-?	?	8
22F	PLEU PLA	LI	w.wt																21	20.1	14.5					no	-?	?	7
98F	PLEU PLA	LI	w.wt													9.38		37.5		27.8	24.1	24.7	40.8	25.5	10.3	no	--	no	17
10F	PLEU PLA	LI	w.wt																	42.1		62.8	45	24.9	86.2	1.7	-?	?	16
30F	PLEU PLA	MU	w.wt												6.82		3.01	1.45								no	-?	?	9
22F	PLEU PLA	MU	w.wt																1.39	0.95	3.33					1.7	-?	?	19
98F	PLEU PLA	MU	w.wt													0.45		2.51		0.581	0.83	0.435	1.54	0.6	0.291	no	--	no	21
10F	PLEU PLA	MU	w.wt																	0.97		2.58	1.78	1.12	1	no	-?	?	16
67B	LEPI WHI	LI	w.wt										111	100	143	101	172	166	97.2	91.5	118	82.3	83.8	63.8	105	m	--	m	11
67B	LEPI WHI	MU	w.wt										0.84	0.935	1.4	0.55	0.48	1.45	0.445	0.68	0.42	1.03	0.82	0.673	0.37	m	--	m	16

Annual median concentration of DDEPP
(ppb)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt												5.24	3.86	7.08	5.7	2.56	5.88	3.87	5.91	3.47	1.99	1.97	no	--	no	13
31A	MYTI EDU	SB	d.wt												3.3	1.89	3.45	1.84	0.505	3.37	3.49	5.47	1.19	2.1	1.79	no	--	no	20
35A	MYTI EDU	SB	d.wt												4.91	2.08	3.13	2.84	0.57	3.91	3.73	5.93	1.61	3.29	2.17	no	--	no	20
36A	MYTI EDU	SB	d.wt												2.76	1.06	1.03	1.76	0.442	2.11	1.79	2.98	1.48	1.51	1.34	no	--	no	17
71A	MYTI EDU	SB	d.wt												2.61	1.58	3.21	1.29	0.736	1.02	2.2	2.41	2.26	3.58	1.1	no	--	no	16
76A	MYTI EDU	SB	d.wt												1.4	0.794			0.355	1.21	2.29	2.49	0.779	0.829	0.746	no	--	no	19
15A	MYTI EDU	SB	d.wt													0.976	1.72	0.735	0.294	1.02	1.41	2.05	0.536	0.622	0.854	no	--	no	19
51A	MYTI EDU	SB	d.wt															33.9	6.67	14.7	17.1	13.2	16.9	5.48	9.52	no	--	no	18
52A	MYTI EDU	SB	d.wt												12.3	25.5	19.4	18.5	9.53	13.1	16.7	13.7	11.9	6.47	6.82	no	--	no	12
56A	MYTI EDU	SB	d.wt												50	47.5	115	40.8	33.9	72.3	52.6	39.8	26.2	60.6	40	4.0	--	3.7	15
57A	MYTI EDU	SB	d.wt												25.9	18.3	35	25.3	15.8	50	82.9	35.2	27.5	24.7	14.7	1.5	--	no	15
63A	MYTI EDU	SB	d.wt												12.9	9.29	9.68	8.36	5.53	13	15.5	11.4	10.2	7.09	4.76	no	--	no	12
65A	MYTI EDU	SB	d.wt												7.6	5.19	7.79	4.12	5	6.9	11.9	7.38	6.76	5.43	3.61	no	--	no	12
69A	MYTI EDU	SB	d.wt												3.55	3.16	3.54	2.91	0.4	3.69	6.52	2.61	2.7	2.25	1.61	no	--	no	21
22A	MYTI EDU	SB	d.wt												2.22	1.31	1.88	1.45	0.387	1.37	5.11	1.96	1.49	0.909	0.725	no	--	no	19
84A	MYTI EDU	SB	d.wt												3.12	2.23		0.985	0.736							no	D?	?	<=5
92A	MYTI EDU	SB	d.wt												0.68	2.09	1.41	0.766	0.275	1.93						no	--	no	22
98A	MYTI EDU	SB	d.wt												5.81	2.29				1.59	1.87	0.87	0.575	1.31	0.625	no	D-	no	14
98X	MYTI EDU	SB	d.wt														31.6	22.9	5.16							no	-?	?	15
41A	MYTI EDU	SB	d.wt														0.621	0.423	0.291	0.61						no	-?	?	15
44A	MYTI EDU	SB	d.wt															0.486	0.343	1.41						no	-?	?	20
46A	MYTI EDU	SB	d.wt														1.05	0.756	0.273							no	-?	?	11
48A	MYTI EDU	SB	d.wt														1.71	1.13	0.286							no	-?	?	14
10A	MYTI EDU	SB	d.wt														0.848	0.78	0.439	1.49		1.45	0.611	0.867	0.61	no	--	no	15
11A	MYTI EDU	SB	d.wt														1.3	1.88	0.408	1.23						no	-?	?	21
11X	MYTI EDU	SB	d.wt																	0.811	1.04	1.04	0.769	0.758	0.472	no	--	no	10

Annual median concentration of DDEPP
(ppb)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
I021	MYTI EDU	SB	d.wt															4.6	1.45	4.8	3.25		5.19	2.73	4.73	no	--	no	17
I022	MYTI EDU	SB	d.wt															3.95	1.38	7.13	4.58	7.96	4.92	3.73	4.51	no	--	no	17
I023	MYTI EDU	SB	d.wt															1.81	1.32	3.79	2.32	6.1	2.39	2.91	3.31	no	--	no	15
I024	MYTI EDU	SB	d.wt															3.5	3.52	8.91	7.17	8.96	4.94	2.52	5.15	no	--	no	15
30A	MYTI EDU	SB	d.wt												5.24	3.86	7.08	5.7	2.56	5.88	3.87	5.91	3.47	1.99	1.97	no	--	no	13
I301	MYTI EDU	SB	d.wt															2.59	3.75	17.8	5.96	7.45	5.58	4.51	5.06	no	--	no	17
I304	MYTI EDU	SB	d.wt															2.14	0.751	3.42	3.89		1.95	2.71	2.62	no	--	no	18
I306	MYTI EDU	SB	d.wt															1.84	0.455	4.25	3.31		2.37	1.88	1.92	no	--	no	21
I307	MYTI EDU	SB	d.wt															2.18	1.03	3.42	2.74		2.12	4.13	2.28	no	--	no	15
I711	MYTI EDU	SB	d.wt															3.46	0.719	1.49	2.19	2.18	3.85		1.26	no	--	no	19
I712	MYTI EDU	SB	d.wt															2.43	1.34	3.14	3.09	3.49	3.46	2.48	1.6	no	--	no	12
I131	MYTI EDU	SB	d.wt															1.46	0.691	1.89	2.06	1.67	1.11	0.915	1.11	no	--	no	14
I132	MYTI EDU	SB	d.wt															1.88	1.36	2.15	2.02	2.06	1.19	1.15	1.26	no	--	no	10
I133	MYTI EDU	SB	d.wt															2.16	0.879	1.62	1.93	2.73	1.16	1.11	1.03	no	--	no	14
51A	MYTI EDU	SB	d.wt															33.9	6.67	14.7	17.1	13.2	16.9	5.48	9.52	no	--	no	18
52A	MYTI EDU	SB	d.wt												12.3	25.5	19.4	18.5	9.53	13.1	16.7	13.7	11.9	6.47	6.82	no	--	no	12
I242	MYTI EDU	SB	d.wt															6.52	9.74	1.58	3.53	9.47	3.52	2.22	2.88	no	--	no	20
I243	MYTI EDU	SB	d.wt															7.47	6.12	1.72	5.43	5.11	4.01	1.99	3.32	no	--	no	17
10A	MYTI EDU	SB	d.wt														0.848	0.78	0.439	1.49		1.45	0.611	0.867	0.61	no	--	no	15

Annual median concentration of DDEPP
(ppb)

																										ANALYSIS		
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt										163	440	182	159	191	194	312	383	260	230	160	180	180	no	--	no	13
36B	GADU MOR	LI	w.wt										91.9	51	50	75	55	105	141	129	45	86	47	46	39	no	--	no	13
15B	GADU MOR	LI	w.wt										50	136	48	57	86	33.5	75	140	72.5	76	46	60	78	no	--	no	16
53B	GADU MOR	LI	w.wt										637	806	939	85		42	491	936	490	160	380	260	200	no	--	no	25
67B	GADU MOR	LI	w.wt										776	554	347	392	471	109	460	2060	270	200	177	140	110	no	--	no	21
23B	GADU MOR	LI	w.wt										68	85.4	42	41	35	31	49	33	49	48	59	52.9	24	no	--	no	11
92B	GADU MOR	LI	w.wt													53	50.5	50	196							no	-?	?	17
98B	GADU MOR	LI	w.wt												73	83.4	43	49	138	198	78	41	58	28	29	no	--	no	16
43B	GADU MOR	LI	w.wt														126	69	60							no	-?	?	9
10B	GADU MOR	LI	w.wt														211	71	75	99	65	90	32	38.5	54	no	--	no	15
30B	GADU MOR	MU	w.wt										0.45	1.21	2	1	0.32	0.29	0.97	1.04	1.5	1.5	0.44	0.67	0.73	no	--	no	19
36B	GADU MOR	MU	w.wt										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	no	--	no	19
15B	GADU MOR	MU	w.wt										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	no	--	no	13
53B	GADU MOR	MU	w.wt										2.36	2.16	6.75	1.8		0.08	4.09	4.59	4.64	3.2	2.5	0.6	1.79	1.8	--	no	>25
67B	GADU MOR	MU	w.wt										2.25	3.03	1.4	1	2.46	1.08	6.96	19	1	1.1	1.1	1.8	0.44	no	--	no	24
23B	GADU MOR	MU	w.wt										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	no	--	no	18
92B	GADU MOR	MU	w.wt													0.1	0.09	0.17	0.49							no	-?	?	14
98B	GADU MOR	MU	w.wt												0.4	0.4	0.06	0.05	0.24	0.6	0.18	0.15	0.4	0.38	0.09	no	--	no	24
43B	GADU MOR	MU	w.wt														0.23	0.23	0.14							no	-?	?	9
10B	GADU MOR	MU	w.wt														0.74	0.68	0.12	0.4	0.26	0.41	0.15	0.18	0.23	no	--	no	18

Annual median concentration of DDEPP
(ppb)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
33B	PLAT FLE	LI	w.wt										13	9.1	24	14	13	7	10.2	9.7	8.6	6.8	27	27	17	no	--	1.2	15
53B	PLAT FLE	LI	w.wt										94	70.1	32	41		8	25	45	38	44	17.5	39	42	1.4	--	1.2	17
67B	PLAT FLE	LI	w.wt																27		84.5	40	35	25	24	no	--	no	16
33B	PLAT FLE	MU	w.wt										0.9	1.93	0.6	0.2	0.15	0.25	0.43	0.28	0.24	1.5	0.3	0.56	0.43	no	--	no	19
53B	PLAT FLE	MU	w.wt										4.67	5.3	3.8	1.3		0.373	1.79	1.36	0.96	0.93	0.61	0.88	0.66	no	D-	no	17
67B	PLAT FLE	MU	w.wt																0.85		1.31	1.4	1.2	0.54	0.63	no	--	no	14
36F	LIMA LIM	LI	w.wt										28	34.4	28	21	50	40	40	22	18	52	45	27	31	no	--	no	14
15F	LIMA LIM	LI	w.wt											39		13.4	23.5	9	20.7	20	13	32		41	15	no	--	no	17
22F	LIMA LIM	LI	w.wt										68.9	48	39.9		21	9.17								no	D?	?	10
36F	LIMA LIM	MU	w.wt										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	no	--	no	13
15F	LIMA LIM	MU	w.wt											1.21		0.173	0.143	0.3	0.55	0.42	0.38	0.324		0.55	0.18	no	--	no	20
22F	LIMA LIM	MU	w.wt										1.1	2	1.18		0.56	0.83								no	-?	?	14
98F	LIMA LIM	MU	w.wt														0.57	0.31	1.63							no	-?	?	23
30F	PLEU PLA	LI	w.wt												21.2		13	12								1.2	-?	?	6
22F	PLEU PLA	LI	w.wt																7.8	12	2.8					no	-?	?	21
98F	PLEU PLA	LI	w.wt													3		8		15.5	6.2	7.8	10.8	8	5.1	no	--	no	16
10F	PLEU PLA	LI	w.wt																	15		34.7	28	8.9	19	1.9	-?	?	18
30F	PLEU PLA	MU	w.wt												0.693		0.32	0.17								no	-?	?	8
22F	PLEU PLA	MU	w.wt																0.47	0.34	0.76					no	-?	?	15
98F	PLEU PLA	MU	w.wt													0.1		0.46		0.302	0.21	0.14	0.465	0.24	0.135	no	--	no	19
10F	PLEU PLA	MU	w.wt																	0.4		0.859	1.1	0.3	0.4	no	-?	?	18
67B	LEPI WHI	LI	w.wt										294	240	183	163	250	145	143	167	160	160	130	58	64	m	D-	m	10
67B	LEPI WHI	MU	w.wt										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	m	--	m	17

Annual median concentration of HCB
(ppb)

																										ANALYSIS		
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt				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	no	D-	no	14
31A	MYTI EDU	SB	d.wt			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	no	DY	no	15
35A	MYTI EDU	SB	d.wt			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	no	D-	no	17
36A	MYTI EDU	SB	d.wt			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	no	D-	no	18
71A	MYTI EDU	SB	d.wt			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	1.6	--	no	>25
													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*	*1.6*	*D-*	*no*	*15*
76A	MYTI EDU	SB	d.wt										0.378	0.568	0.498	0.794			0.254	0.289	0.4	0.256	0.216	0.244	0.299	no	--	no	13
15A	MYTI EDU	SB	d.wt										0.203			0.488	0.253	0.217	0.294	0.254	0.159	0.224	0.179	0.253	0.296	no	--	no	12
51A	MYTI EDU	SB	d.wt															0.612	0.333	0.313	0.4	0.4	0.385	0.196	0.476	no	--	no	13
52A	MYTI EDU	SB	d.wt									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	no	--	no	14
56A	MYTI EDU	SB	d.wt								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	no	--	no	16
57A	MYTI EDU	SB	d.wt									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	no	D-	no	12
63A	MYTI EDU	SB	d.wt									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	no	D-	no	11
65A	MYTI EDU	SB	d.wt								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	no	--	no	13
69A	MYTI EDU	SB	d.wt												0.532	0.526	0.286	0.251	0.286	0.5	0.483	0.361	0.207	0.331	0.311	no	--	no	12
22A	MYTI EDU	SB	d.wt										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	no	--	no	13
82A	MYTI EDU	SB	d.wt				2.26	10.7	0.656	0.617	0.8	0.535														1.1	--	no	24
84A	MYTI EDU	SB	d.wt				3.41	8.79	3.33	2.04	1.23	0.476		0.505	0.625	0.532		0.246	0.215							no	D-	no	15
92A	MYTI EDU	SB	d.wt												0.68	0.418	0.244	0.225	0.23	0.254						no	D-	no	12
98A	MYTI EDU	SB	d.wt												0.619	0.571				0.336	0.311	0.435	0.286	0.291	0.313	no	--	no	10
98X	MYTI EDU	SB	d.wt														0.559	0.318	0.26							no	-?	?	8
41A	MYTI EDU	SB	d.wt														0.292	0.263	0.291	0.303						no	-?	?	6
43A	MYTI EDU	SB	d.wt														0.325	0.338		0.45						no	-?	?	<=5
44A	MYTI EDU	SB	d.wt															0.273	0.286	0.329						no	-?	?	<=5
46A	MYTI EDU	SB	d.wt														0.263	0.291	0.273							no	-?	?	6
48A	MYTI EDU	SB	d.wt														0.279	0.294	0.238							no	-?	?	7
10A	MYTI EDU	SB	d.wt														0.292	0.266	0.245	0.309		0.284	0.278	0.289	0.305	no	--	no	6
11A	MYTI EDU	SB	d.wt														0.35	0.427	0.336	0.459						no	-?	?	8
11X	MYTI EDU	SB	d.wt																	0.34	0.208	0.249	0.242	0.253	0.236	no	--	no	8

Annual median concentration of HCB
(ppb)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
I021	MYTI EDU	SB	d.wt															0.833	0.916	0.48	0.375		0.481	0.636	0.549	1.1	--	1.1	11
I022	MYTI EDU	SB	d.wt															0.421	0.479	0.97	0.312	0.783	0.455	0.543	0.549	1.1	--	1.0	14
I023	MYTI EDU	SB	d.wt															0.482	0.424	0.431	0.259	0.615	0.347	0.342	0.417	no	--	no	12
I024	MYTI EDU	SB	d.wt															0.488	0.602	1.16	0.426	0.66	0.556	0.536	0.495	no	--	no	13
30A	MYTI EDU	SB	d.wt				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	no	D-	no	14
I301	MYTI EDU	SB	d.wt															0.294	0.284	0.695	0.818	1.55	0.508	0.677	0.423	no	--	no	14
I304	MYTI EDU	SB	d.wt															0.336	0.281	0.719	0.486		0.294	0.526	0.385	no	--	no	14
I306	MYTI EDU	SB	d.wt															0.299	0.307	0.774	0.253		0.296	0.294	0.336	no	--	no	15
I307	MYTI EDU	SB	d.wt															0.273	0.318	0.674	0.174		0.327	0.336	0.45	no	--	no	16
I711	MYTI EDU	SB	d.wt															4.45	5.54	0.575	4.46	6.96	2.56		4	8.0	--	11.3	24
I712	MYTI EDU	SB	d.wt															3.43	16.4	7.9	4.83	5	3.31	1.78	2.75	5.5	--	no	17
I131	MYTI EDU	SB	d.wt															0.316	0.298	0.273	0.196	0.582	0.288	0.327	0.292	no	--	no	13
I132	MYTI EDU	SB	d.wt															52.8	89.7	40.2	44.2	1.89	4.73	3.11	2.36	4.7	D-	no	23
I133	MYTI EDU	SB	d.wt															18.1	43.5	8.12	28	1.7	6.18	2.3	1.62	3.2	--	no	23
51A	MYTI EDU	SB	d.wt															0.612	0.333	0.313	0.4	0.4	0.385	0.196	0.476	no	--	no	13
52A	MYTI EDU	SB	d.wt									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	no	--	no	14
I242	MYTI EDU	SB	d.wt															1.2	0.923	0.562	0.604	0.651	0.552	0.241	0.5	no	--	no	13
I243	MYTI EDU	SB	d.wt															1.03	0.663	0.516	1.24	0.662	0.67	0.262	0.444	no	--	no	15
10A	MYTI EDU	SB	d.wt														0.292	0.266	0.245	0.309		0.284	0.278	0.289	0.305	no	--	no	6

Annual median concentration of HCB
(ppb)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt										10	17	7.48	16	11	11	12	7	5.3	5.1	9.1	8.9	6.7	no	--	no	12
36B	GADU MOR	LI	w.wt										7	9	9	10	9	5	9	6	4.4	6.5	5.4	4.6	3.1	no	D-	no	11
15B	GADU MOR	LI	w.wt										5	20.5	10	14	14	9	11	13	11.5	11	6.2	6.6	8.2	no	--	no	13
53B	GADU MOR	LI	w.wt										10	10	16.5	7		5	7	7	5	4.7	12	2.1	3	no	--	no	16
67B	GADU MOR	LI	w.wt										14	8	7.94	8	8.49	10	8	15.5	9.9	4.6	5.63	4.9	4.6	no	--	no	12
23B	GADU MOR	LI	w.wt										6	9.49	12	9	8	6	10	6	8.4	7.8	7.6	9.25	4.7	no	--	no	11
92B	GADU MOR	LI	w.wt													17	11	14	13							no	-?	?	9
98B	GADU MOR	LI	w.wt												20	9.95	12	18	35	20.5	16	13	3.1	2.6	10	no	--	no	19
43B	GADU MOR	LI	w.wt														15	16.5	13							no	-?	?	8
10B	GADU MOR	LI	w.wt														13	11	16	17	17	25	9	9.9	11	no	--	no	12
30B	GADU MOR	MU	w.wt										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	no	--	no	11
36B	GADU MOR	MU	w.wt										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	no	D-	no	11
15B	GADU MOR	MU	w.wt										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	no	--	no	11
53B	GADU MOR	MU	w.wt										0.1	0.03	0.1	0.1		0.03	0.0648	0.06	0.05	0.05	0.09	0.04	0.05	no	--	no	16
67B	GADU MOR	MU	w.wt										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	no	D-	no	8
23B	GADU MOR	MU	w.wt										0.08	0.08	0.1	0.1	0.04	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.04	no	--	no	11
92B	GADU MOR	MU	w.wt													0.1	0.07	0.05	0.09							no	-?	?	13
98B	GADU MOR	MU	w.wt												0.2	0.2	0.07	0.1	0.11	0.1	0.1	0.08	0.1	0.06	0.07	no	--	no	11
43B	GADU MOR	MU	w.wt														0.09	0.13	0.06							no	-?	?	15
10B	GADU MOR	MU	w.wt														0.16	0.11	0.09	0.2	0.17	0.26	0.09	0.11	0.13	no	--	no	14

Annual median concentration of
HCB (ppb)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
33B	PLAT FLE	LI	w.wt										1	0.5	5	2	1	1	0.6	0.8	0.59	0.54	1.6	1.6	13	2.6	--	2.4	20
53B	PLAT FLE	LI	w.wt										6	4.47	5	2		1	2	3	1.8	2.5	2.39	2	2.9	no	--	no	13
67B	PLAT FLE	LI	w.wt																3		6.39	3.6	4.2	4.3	3.5	no	--	no	12
33B	PLAT FLE	MU	w.wt										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	no	--	no	14
53B	PLAT FLE	MU	w.wt										0.45	0.3	0.2	0.1		0.0837	0.05	0.1	0.06	0.06	0.09	0.06	0.05	no	DY	no	11
67B	PLAT FLE	MU	w.wt																0.05		0.098	0.19	0.16	0.12	0.14	no	--	no	13
36F	LIMA LIM	LI	w.wt										5.48	3	5	2	3	2	2.3	3	1.1	2.5	3	2.6	2	no	--	no	13
15F	LIMA LIM	LI	w.wt											4		4	4	2	3	3.2	3	3.64		5.9	2.5	no	--	no	12
22F	LIMA LIM	LI	w.wt										6	3	5		1	1.41								no	-?	?	15
36F	LIMA LIM	MU	w.wt										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	no	D-	no	8
15F	LIMA LIM	MU	w.wt											0.2		0.1	0.0447	0.07	0.09	0.07	0.09	0.08		0.15	0.04	no	--	no	16
22F	LIMA LIM	MU	w.wt										0.12	0.2	0.1		0.05	0.0742								no	-?	?	14
98F	LIMA LIM	MU	w.wt														0.07	0.13	0.16							no	-?	?	9
30F	PLEU PLA	LI	w.wt												5		2	2								no	-?	?	11
22F	PLEU PLA	LI	w.wt																0.5	0.9	0.3					no	-?	?	19
98F	PLEU PLA	LI	w.wt													1		1		1.74	1	2.5	1.3	1.8	0.955	no	--	no	13
10F	PLEU PLA	LI	w.wt																	6.1		8.77	6.4	2.4	1.6	no	-?	?	16
30F	PLEU PLA	MU	w.wt												0.141		0.05	0.03								no	D?	?	<=5
22F	PLEU PLA	MU	w.wt																0.03	0.03	0.04					no	-?	?	7
98F	PLEU PLA	MU	w.wt													0.1		0.13		0.0548	0.04	0.07	0.07	0.04	0.0447	no	--	no	13
10F	PLEU PLA	MU	w.wt																	0.22		0.303	0.49	0.15	0.43	2.2	-?	?	17
67B	LEPI WHI	LI	w.wt										9	4	5	4	5	2	4.6	4	5	2.8	4.8	3.4	3.8	m	--	m	13
67B	LEPI WHI	MU	w.wt										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	m	--	m	14

Annual median concentration of
BAP (ppb)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt												2.53			3.35	3.52	4.95	3.57	2.99	2.99	3.29	3.4	no	--	no	9
I301	MYTI EDU	SB	d.wt															4.44	19.3	18.8	6.02	13.1	2.55	9.77	3.12	no	--	no	22
I304	MYTI EDU	SB	d.wt															3.36	2.81	3.29	3.38	2.76	2.94	3.76	3.85	no	--	no	7
I306	MYTI EDU	SB	d.wt															2.99	3.07	2.87	3.05	3.07	2.96	2.94	3.36	no	--	no	<=5
I307	MYTI EDU	SB	d.wt															2.73	3.21	2.75	2.91	3.01	3.27	3.36	4.5	no	U-	1.0	6
I131	MYTI EDU	SB	d.wt															3.25	2.66	2.73	3.6	5.02	2.4	3.27	2.79	no	--	no	11
I132	MYTI EDU	SB	d.wt															71.8	89	18.6	22.6	300	10.8	32.7	49.6	9.9	--	6.9	>25
I133	MYTI EDU	SB	d.wt															80.6	13.7	51.7	18.6		8.47	19	23.7	4.7	--	2.7	20
I201	MYTI EDU	SB	d.wt															93.2	207	679	10.5	83.8	47.4	31.7	188	37.5	--	20.2	>25
I205	MYTI EDU	SB	d.wt															7.39		23.1	64.5	7.51	5.59	7.55	33	6.6	--	2.3	>25
I912	MYTI EDU	SB	d.wt															7.02		9.46	5.35	16.4	135	4.17	20	4.0	--	4.8	>25
I962	MYTI EDU	SB	d.wt															246	33.5		87					17.4	-?	?	>25
I969	MYTI EDU	SB	d.wt															14.2	10.7	17.6	8.42	10.3	17.1	23.5	3.68	no	--	no	18

Annual median concentration of
PK_S (ppb)

																										ANALYSIS			
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt												38.1			27.5	132	46	40	21.9	19.5	39.4	13.3	no	--	no	18
I301	MYTI EDU	SB	d.wt															125	959	197	106	183	43.4	114	50	1.0	--	no	23
I304	MYTI EDU	SB	d.wt															21.1	77.4	13.7	38.4	38.4	9.15	23.3	11.5	no	--	no	20
I306	MYTI EDU	SB	d.wt															22.2	172	34.8	32.8	32.2	8.88	29.6	16	no	--	no	22
I307	MYTI EDU	SB	d.wt															18.2	106	19.9	29.3	48.5	13.4	28.9	33.8	no	--	no	21
I131	MYTI EDU	SB	d.wt															70.8	50.9	35.4	63.1	60.3	40.9	29.8	17	no	D-	no	12
I132	MYTI EDU	SB	d.wt															759	855	281	593	2730	258	390	787	15.7	--	9.6	23
I133	MYTI EDU	SB	d.wt															1950	335	647	292		161	341	488	9.8	--	6.2	19
I201	MYTI EDU	SB	d.wt															768	1650	7970	284	1020	938	640		12.8	--	1.4	>25
I205	MYTI EDU	SB	d.wt															124		470	1390	205	197	190	1700	34.0	--	14.6	>25
I912	MYTI EDU	SB	d.wt															237		342	208	210	1590	72.6	427	8.5	--	6.1	>25
I962	MYTI EDU	SB	d.wt															2420	479		682					13.6	-?	?	24
I969	MYTI EDU	SB	d.wt															221	169	230	139	287	198	171	41.1	no	--	no	15

Annual median concentration of PAHSS
(ppb)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30A	MYTI EDU	SB	d.wt												248			236	616	524	324	262	162	150	66	no	DY	no	13
I301	MYTI EDU	SB	d.wt															726	3420	2100	830	1250	571	795	412	1.6	--	no	18
I304	MYTI EDU	SB	d.wt															103	256	208	267	405	77.1	201	66.5	no	--	no	18
I306	MYTI EDU	SB	d.wt															100	507	228	205	296	73.1	139	146	no	--	no	19
I307	MYTI EDU	SB	d.wt															83.7	275	177	182	421	82.4	168	279	1.1	--	no	19
I131	MYTI EDU	SB	d.wt															207	255	191	265	360	282	118	133	no	--	no	12
I132	MYTI EDU	SB	d.wt															2760	2810	1390	1730	7270	1380	1170	1920	7.7	--	4.1	19
I133	MYTI EDU	SB	d.wt															5690	1770	1960	1150		1080	964	1440	5.8	D-	3.1	13
I201	MYTI EDU	SB	d.wt															2660	5210	17100	861	3720	2560	1300		5.2	--	no	25
I205	MYTI EDU	SB	d.wt															614		1770	3540	891	658	509		2.0	--	no	21
I912	MYTI EDU	SB	d.wt															1100		1530	963	1970	7300	832	2220	8.9	--	9.9	22
I962	MYTI EDU	SB	d.wt															6340	1690		1850					7.4	-?	?	20
I969	MYTI EDU	SB	d.wt															1060	986	747	629	917	1160	824	170	no	--	no	17

Annual median concentration of OH-PYRENE (ug/kg/ABS 380 nm)
Shaded area indicates older and not directly comparable method.

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt																		115	130	12.3	17	29.2	m	-?	m	6
36B	GADU MOR	LI	w.wt																		42.9	28.9	5.14	3.72					
15B	GADU MOR	LI	w.wt																		3770	253		29.7	6.32				
53B	GADU MOR	LI	w.wt																		83	58.6	9.23	3.81	18.8	m	-?	m	25
67B	GADU MOR	LI	w.wt																		19.8	16.5	1.62	1.66					
23B	GADU MOR	LI	w.wt																		12.7	11.2	4.15	2.55	3.1	m	-?	m	11
53B	PLAT FLE	BI	w.wt																			74.6	9.75	3.64					
67B	PLAT FLE	BI	w.wt																			41	1.71	5.42					
36F	LIMA LIM	BI	w.wt																			48.8	4.18	3.48					

Annual median concentration of ALAD (ng PBG/min/mg prot.)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt																	8.98	15.6	13	14.6	12.7	10.4	m	--	m	10
36B	GADU MOR	LI	w.wt																	13	26.2	9.93	22	19.4		m	-?	m	15
15B	GADU MOR	LI	w.wt																	17.2	23.4	8.45		18.9		m	-?	m	17
53B	GADU MOR	LI	w.wt																	7.64	10.1	11.1	12.7	10	6.44	m	--	m	11
67B	GADU MOR	LI	w.wt																	7.17	28.2	16.9	22.4	19		m	-?	m	16
23B	GADU MOR	LI	w.wt																	15.8	24.8	18.1	19.8	24	19.4	m	--	m	9
53B	PLAT FLE	BI	w.wt																			10.4	8.82	7.61		m	D?	m	<=5
67B	PLAT FLE	BI	w.wt																			15.9	17.6	23.6		m	-?	m	6
36F	LIMA LIM	BI	w.wt																			7.89	17.6	15		m	-?	m	14

Annual median concentration of EROD
(pmol/min/mg prot.)

																										ANALYSIS		
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt																	68.8	109	70	260	81.2	158	m	--	m	16
36B	GADU MOR	LI	w.wt																	95.1	11.4	60.2	64.9	76.2		m	-?	m	24
15B	GADU MOR	LI	w.wt																	49.9	52.3	184		61		m	-?	m	20
53B	GADU MOR	LI	w.wt																	86.5	119	90.1	128	34.7	93.9	m	--	m	16
67B	GADU MOR	LI	w.wt																	103	76.2	84.5	103	72.9		m	-?	m	9
23B	GADU MOR	LI	w.wt																	94.1	28.6	70	73.5	76.5	103	m	--	m	15
53B	PLAT FLE	BI	w.wt																			24.6	6.22	33.8		m	-?	m	>25
67B	PLAT FLE	BI	w.wt																			16.1	6.34	3.29		m	-?	m	7
36F	LIMA LIM	BI	w.wt																			471	336	149		m	-?	m	9

Annual median concentration of MT (ug/kg
prot.)

																										ANALYSIS		
St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	OC	TRD	SM3	PWR
30B	GADU MOR	LI	w.wt																	14.2	16.2	18.3	8.02	11.6	10.5	m	--	m	11
36B	GADU MOR	LI	w.wt																	17.9	16.8	26.3	11.6	9.82		m	-?	m	13
15B	GADU MOR	LI	w.wt																	13.3	19.5	17.8		15		m	-?	m	10
53B	GADU MOR	LI	w.wt																	17.1	21.4	20.3	11.7	15.7	14.6	m	--	m	10
67B	GADU MOR	LI	w.wt																	16.9	21.5	16.8	16.3	12.8		m	-?	m	8
23B	GADU MOR	LI	w.wt																	12.9	21.5	23.5	14.3	17	20.3	m	--	m	11
53B	PLAT FLE	BI	w.wt																			15	8.33	18.3		m	-?	m	17
67B	PLAT FLE	BI	w.wt																			34.1	27.3	29		m	-?	m	7
36F	LIMA LIM	BI	w.wt																			13.7	9.83	8.13		m	-?	m	<=5

Annual median concentration of TBT
(ug/kg)

St	Species	Tsu	Base	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	ANALYSIS OC	TRD	SM3	PWR
30A	MYTI EDU	SB	w.wt																	205	103	102	72	71	109	5.5	--	7.9	12
36A	MYTI EDU	SB	w.wt																	3.29	15.1	17.7	5.7	6.1	7.28	no	--	no	20
71A	MYTI EDU	SB	w.wt																	44.4				25.6	42	2.1	-?	?	14
76A	MYTI EDU	SB	w.wt																	13.1				4.1	6.9	no	-?	?	16
227X	MYTI EDU	SB	w.wt																				35	55	38	1.9	-?	?	13

Appendix I
Geographical distribution of contaminants and biomarkers in biota 2001-2002

Sorted by contaminant and species:

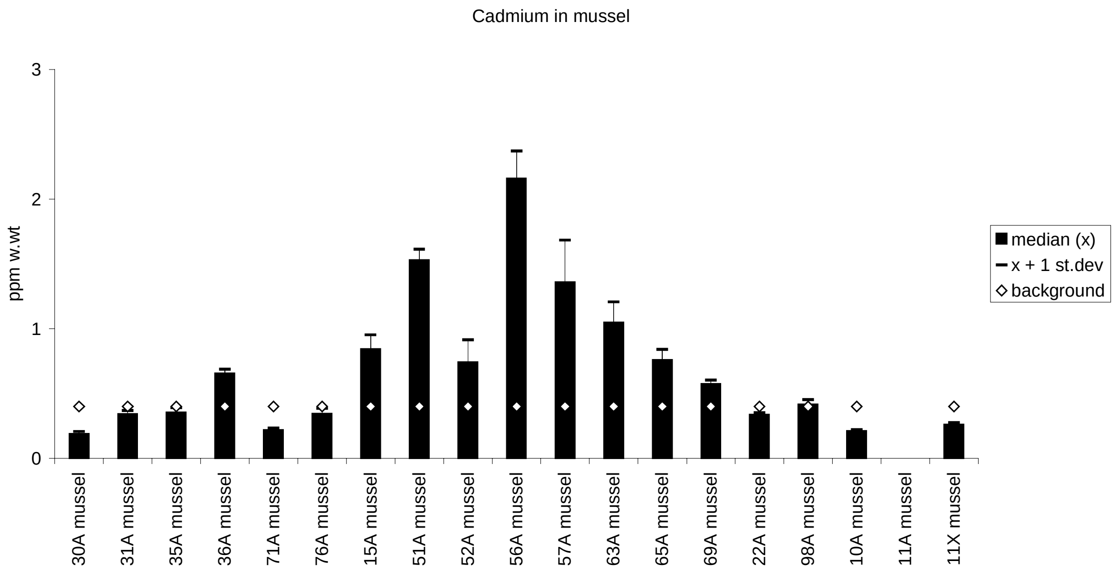
Cadmium (Cd)
Mercury (Hg)
Lead (Pb)
Sum of 7 CBs (CB-28, -52, 101, -118, -138, -153 and -180)
DDEPP (ppDDE)
HCB
CB77
CB126
CB169
TCDDN
TBT
OH-pyrene
ALA-D (δ-amino levulinic acid dehydrase inhibition)
EROD (Cytochrome P4501A-activity)
MT (Metallothionein)

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-iagonis***)**

Station positions are shown on maps in Appendix F

Appendix I
Geographical distribution of contaminants and biomarkers in biota 2001-2002
(cont.)

A



B

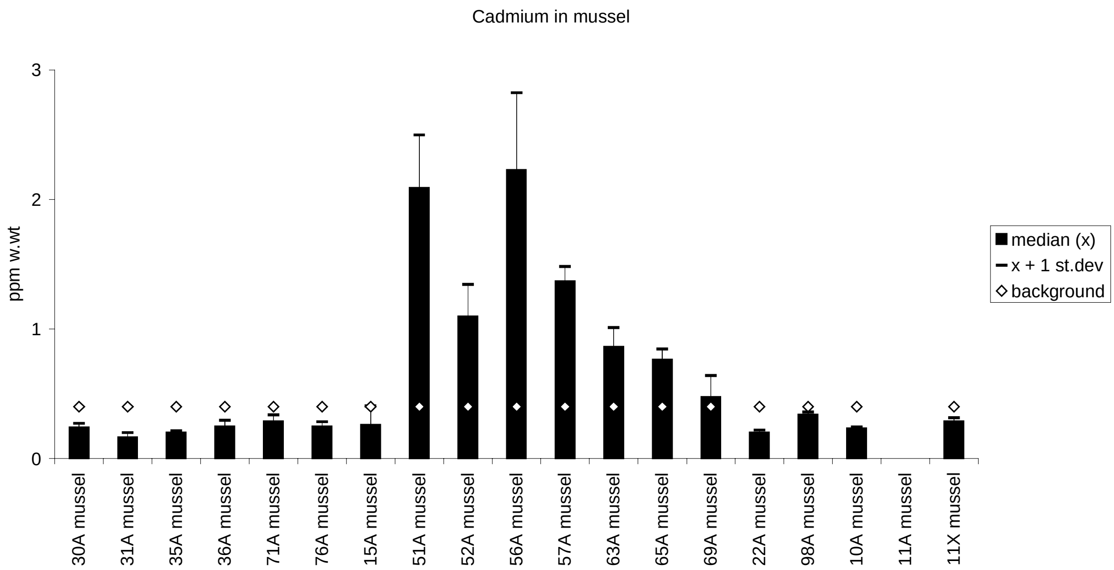
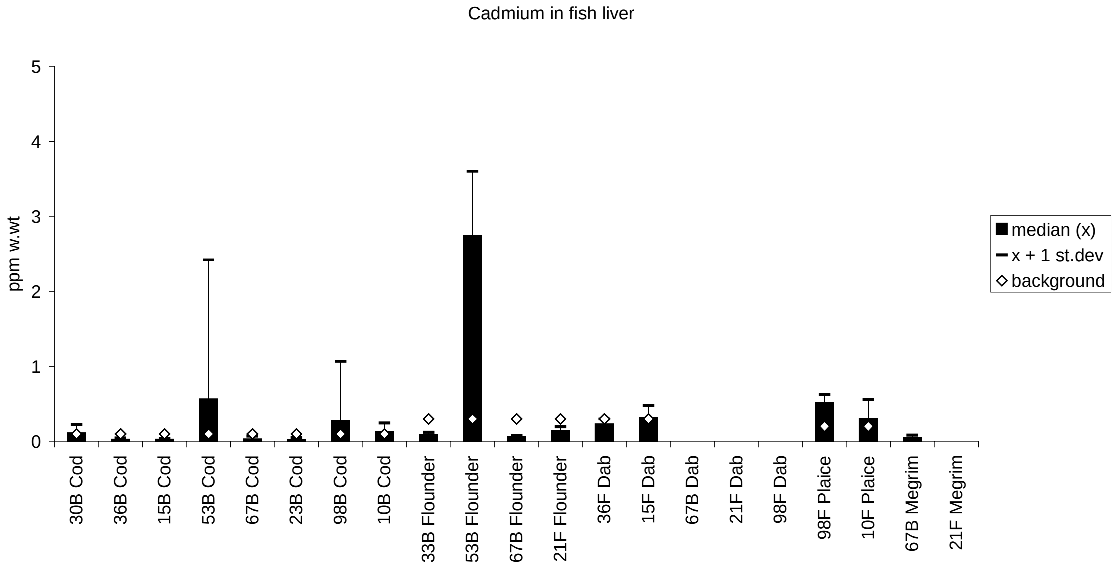


Figure 23. Median, standard deviation and provisional "high background" concentration for cadmium in mussels (*Mytilus edulis*) 2001 (**A**) and 2002 (**B**), ppm wet weight (see maps in Appendix F).

A



B

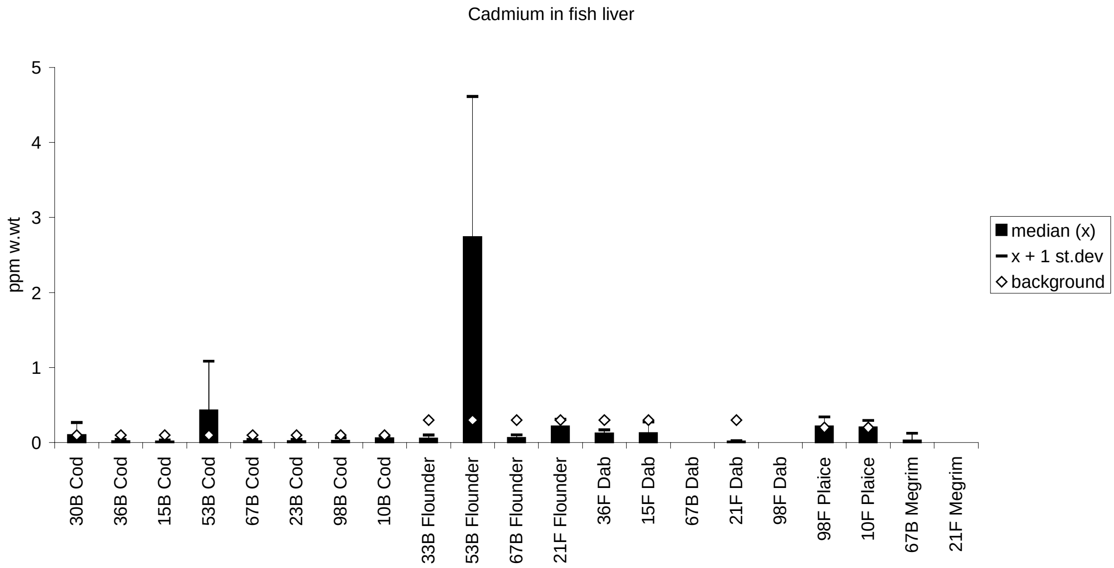


Figure 24. Median, standard deviation and provisional "high background" concentration for cadmium in fish liver 2001 (**A**) and 2002 (**B**), ppm wet weight (see maps in Appendix F).

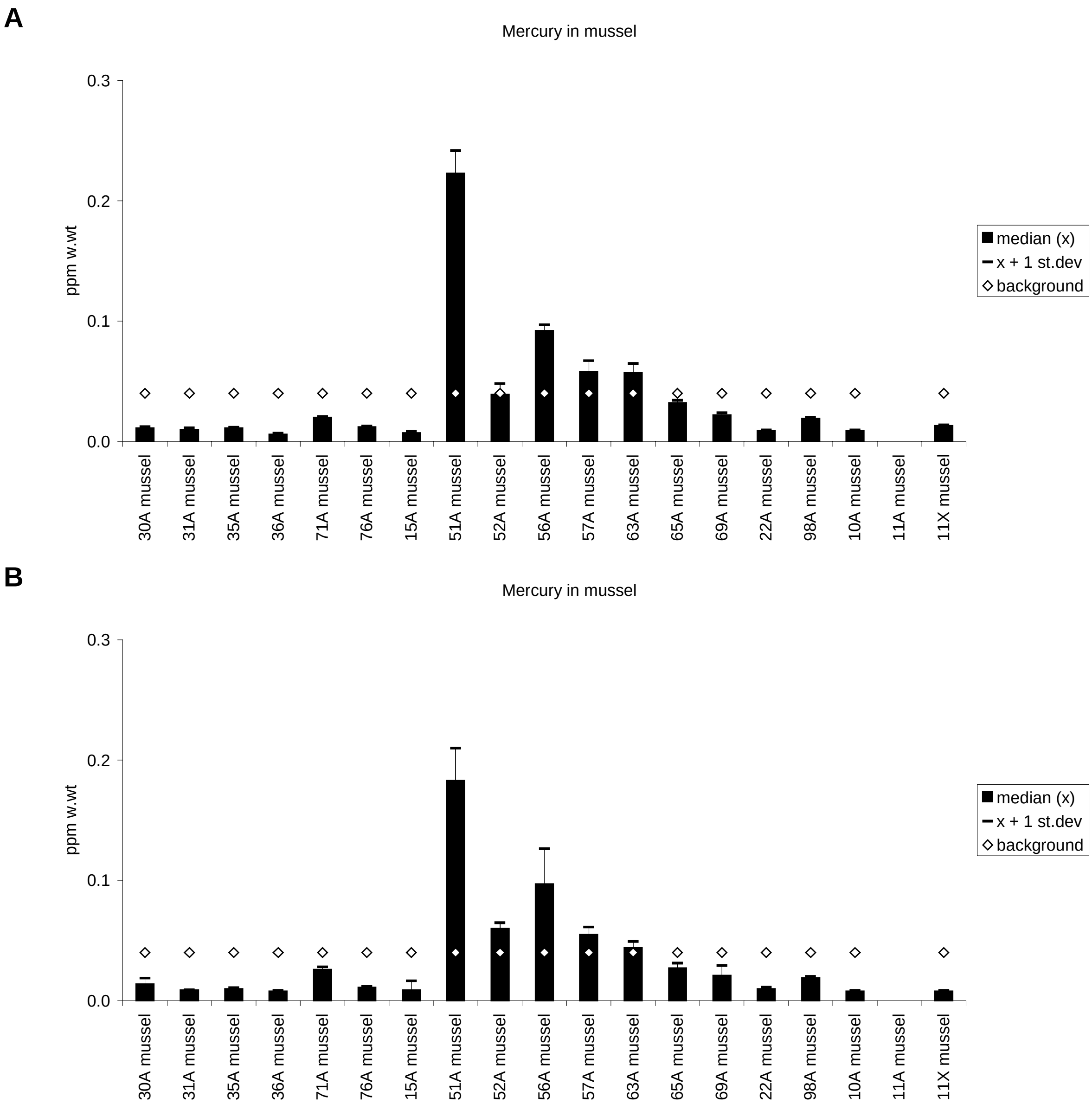
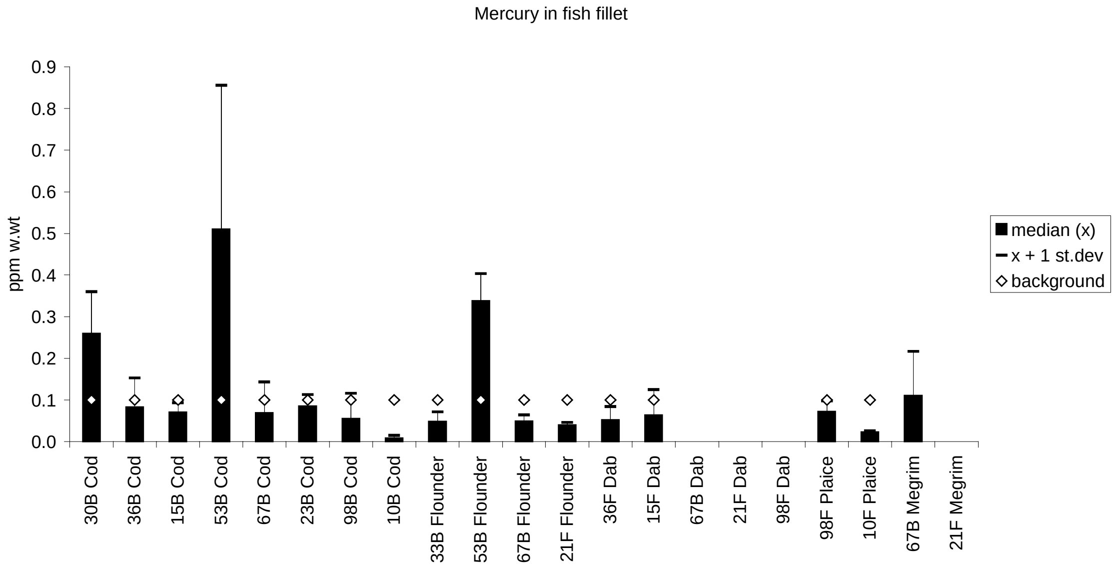


Figure 25. Median, standard deviation and provisional "high background" concentration for mercury in mussels (*Mytilus edulis*) 2001 (**A**) and 2002 (**B**), ppm wet weight (see maps in Appendix F).

A



B

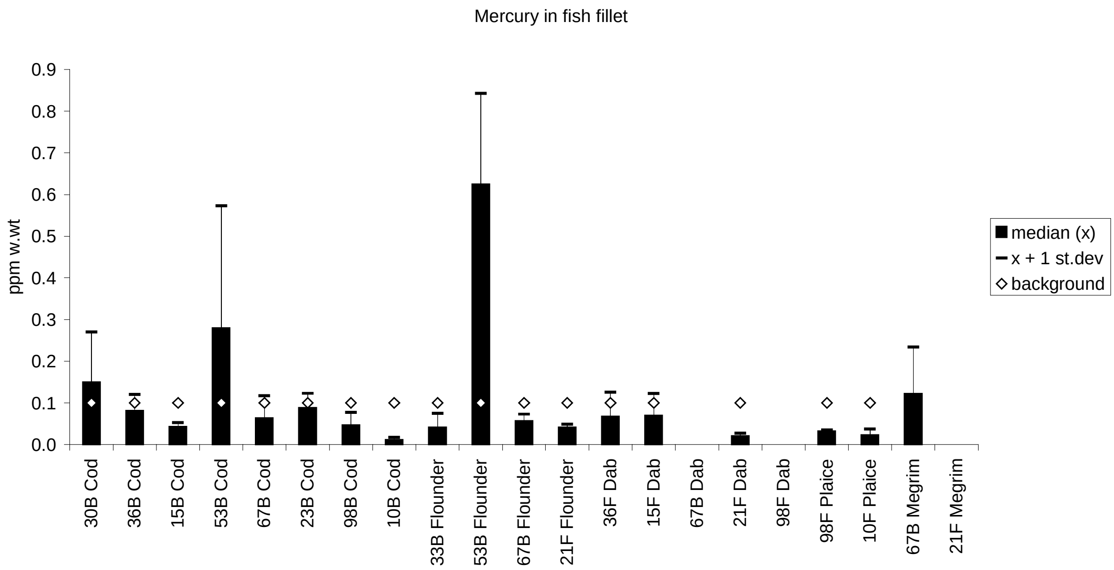
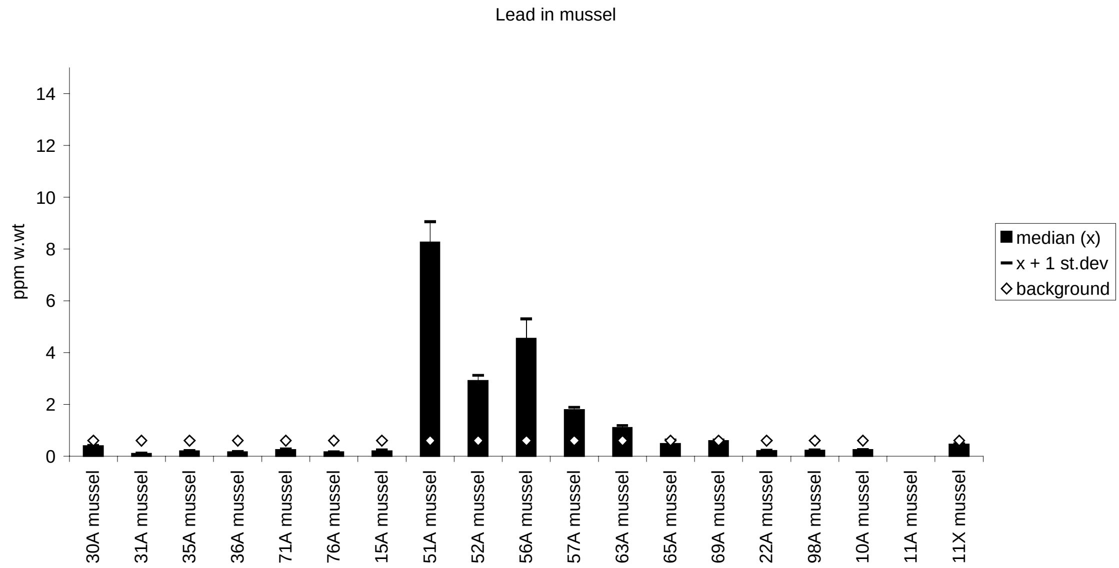


Figure 26. Median, standard deviation and provisional "high background" concentration for mercury in fish fillet 2001 (**A**) and 2002 (**B**), ppm wet weight (see maps in Appendix F).

A



B

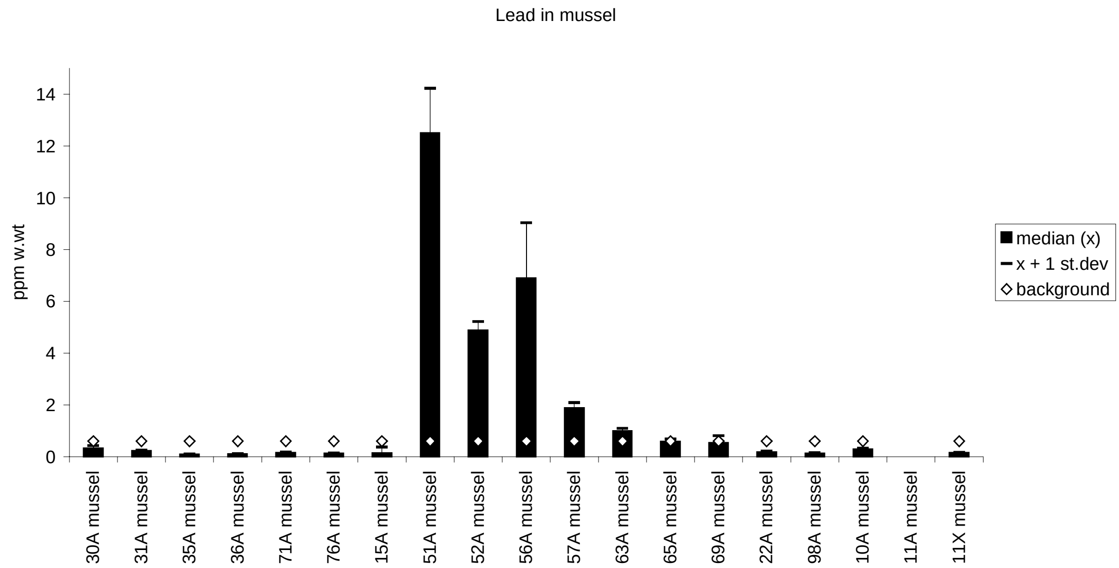
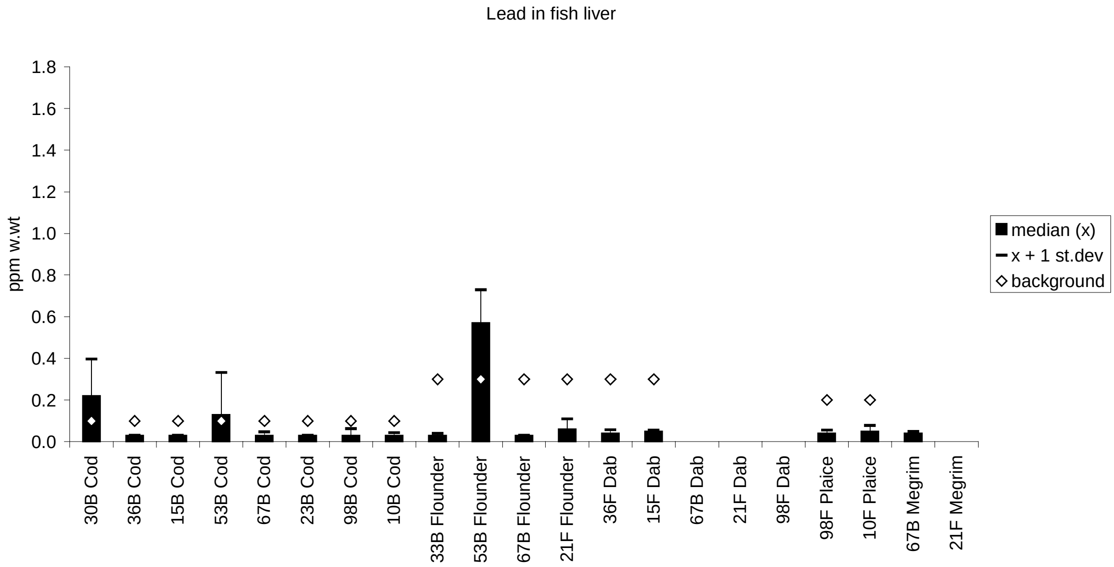


Figure 27. Median, standard deviation and provisional "high background" concentration for lead in mussels (*Mytilus edulis*) 2001 (**A**) and 2002 (**B**), ppm wet weight (see maps in Appendix F).

A



B

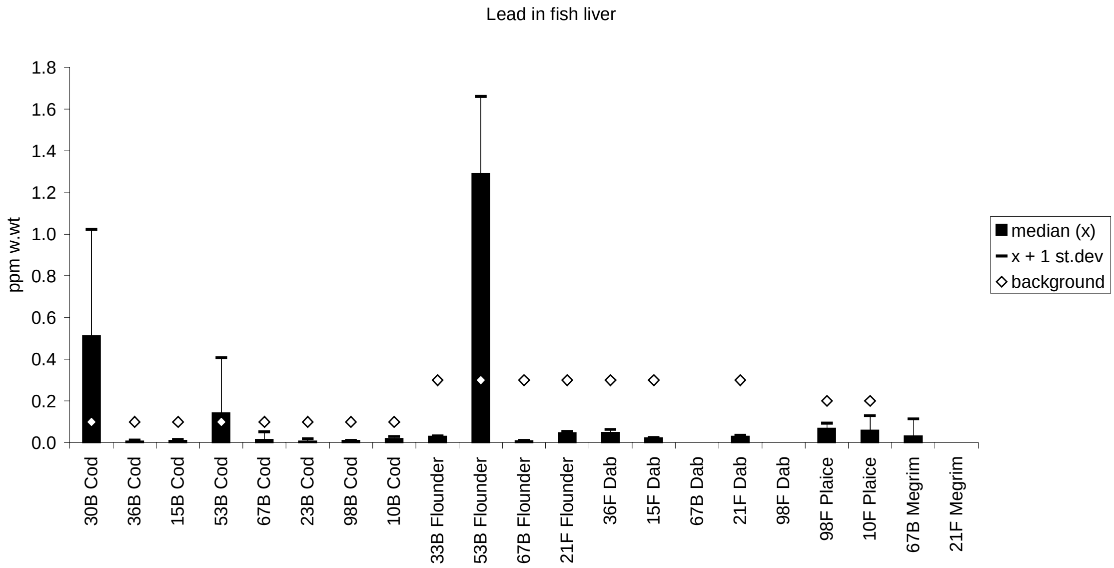


Figure 28. Median, standard deviation and provisional "high background" concentration for lead in fish liver 2001 (**A**) and 2002 (**B**), ppm wet weight (see maps in Appendix F).

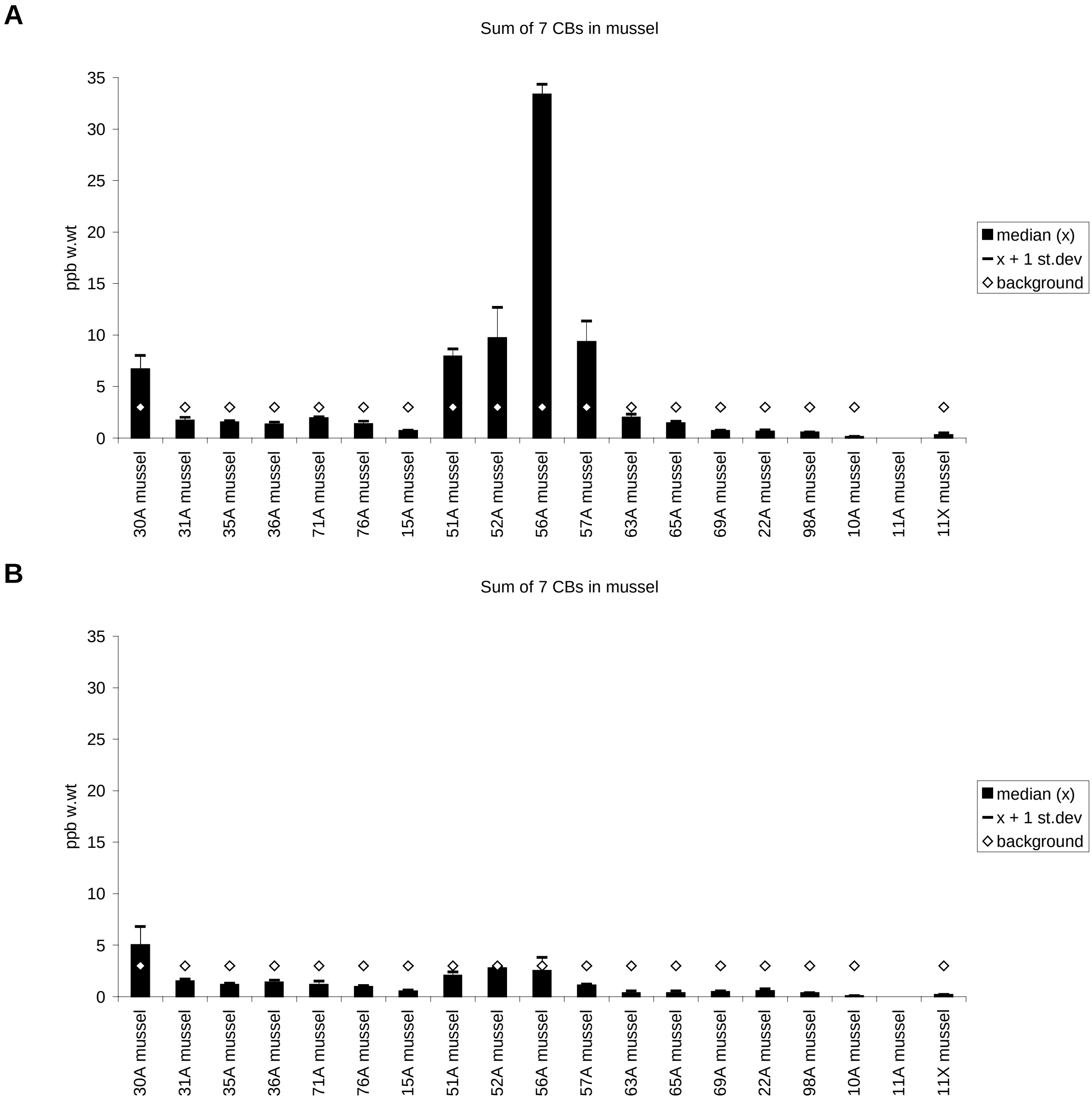
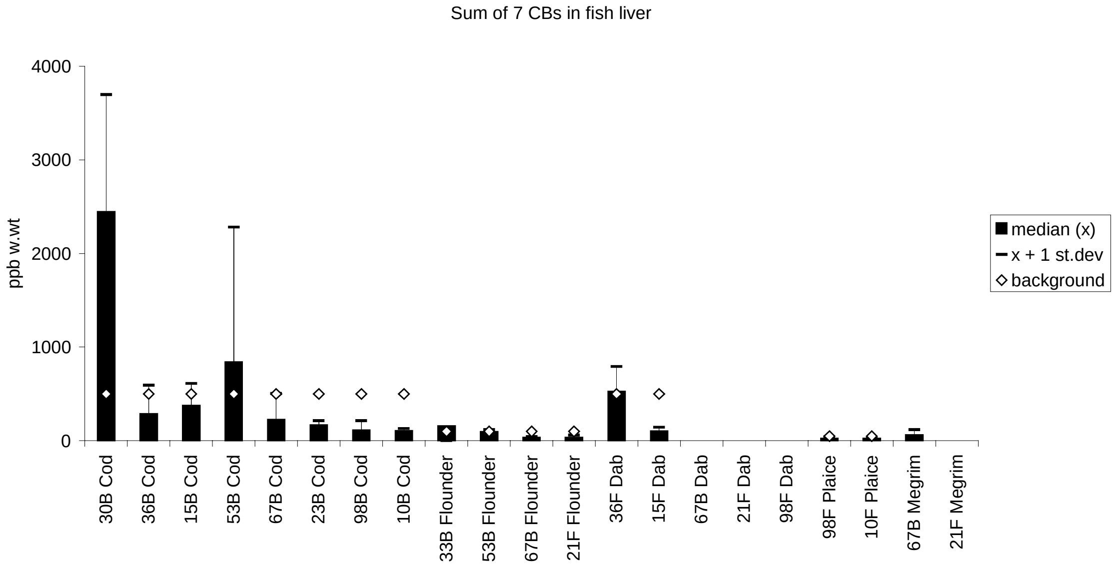


Figure 29. Median, standard deviation and provisional "high background" concentration for sum of 7 PCBs (CB-28, -52, 101, -118, -138, -153 and -180) in mussels (*Mytilus edulis*) 2001 (**A**) and 2002 (**B**), ppb wet weight (see maps in Appendix F).

A



B

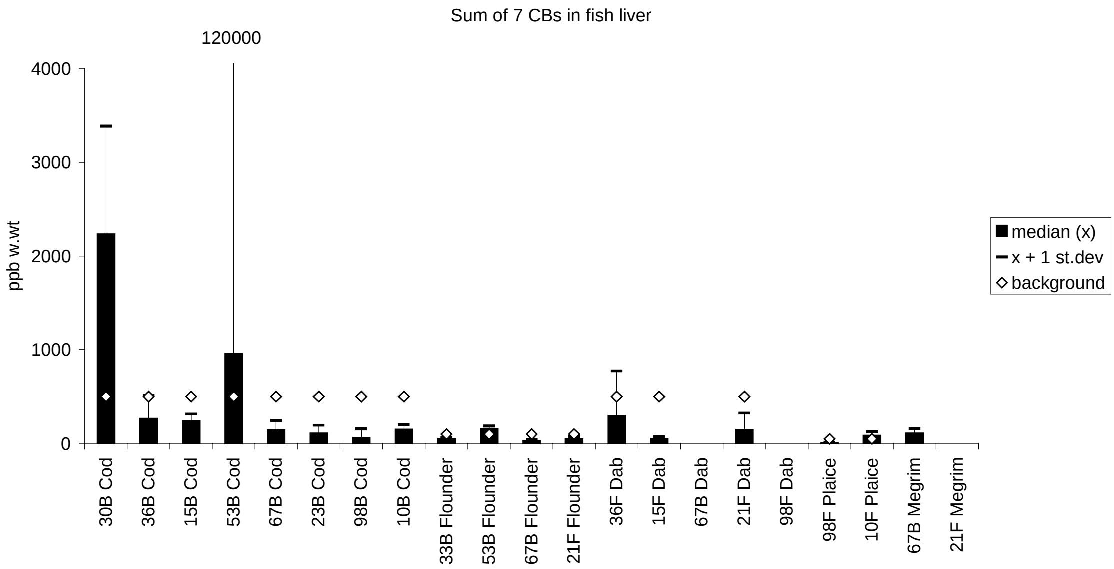


Figure 30. Median, standard deviation and provisional "high background" concentration for sum of 7 PCBs (CB-28, -52, 101, -118, -138, -153 and -180) in fish liver 2001 (**A**) and 2002 (**B**), ppb wet weight (see maps in Appendix F).

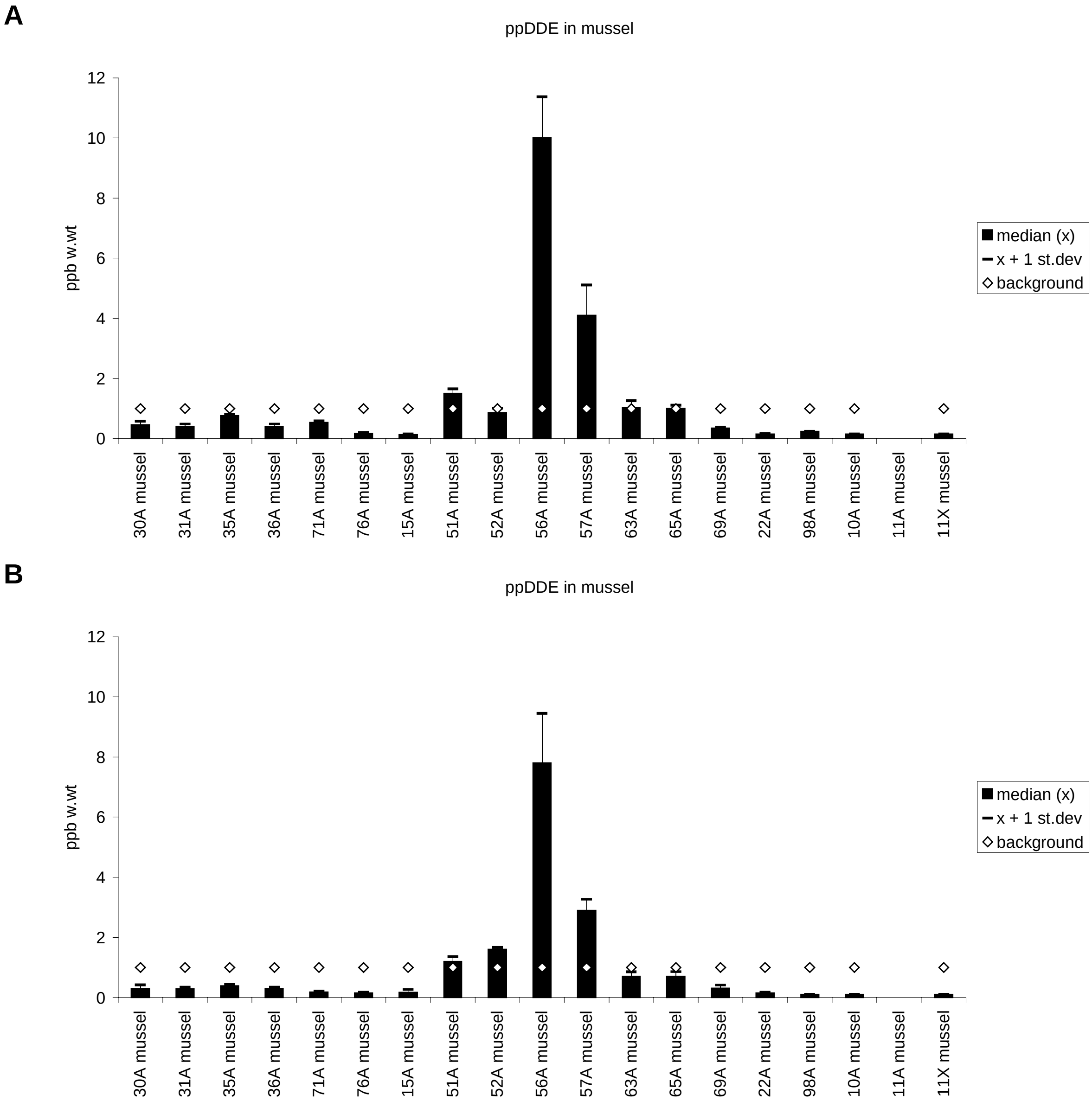


Figure 31. Median, standard deviation and provisional "high background" concentration for ppDDE (DDEPP) in mussels (*Mytilus edulis*) 2001 (**A**) and 2002 (**B**), ppb wet weight (see maps in Appendix F). (See also footnote in Table 7).

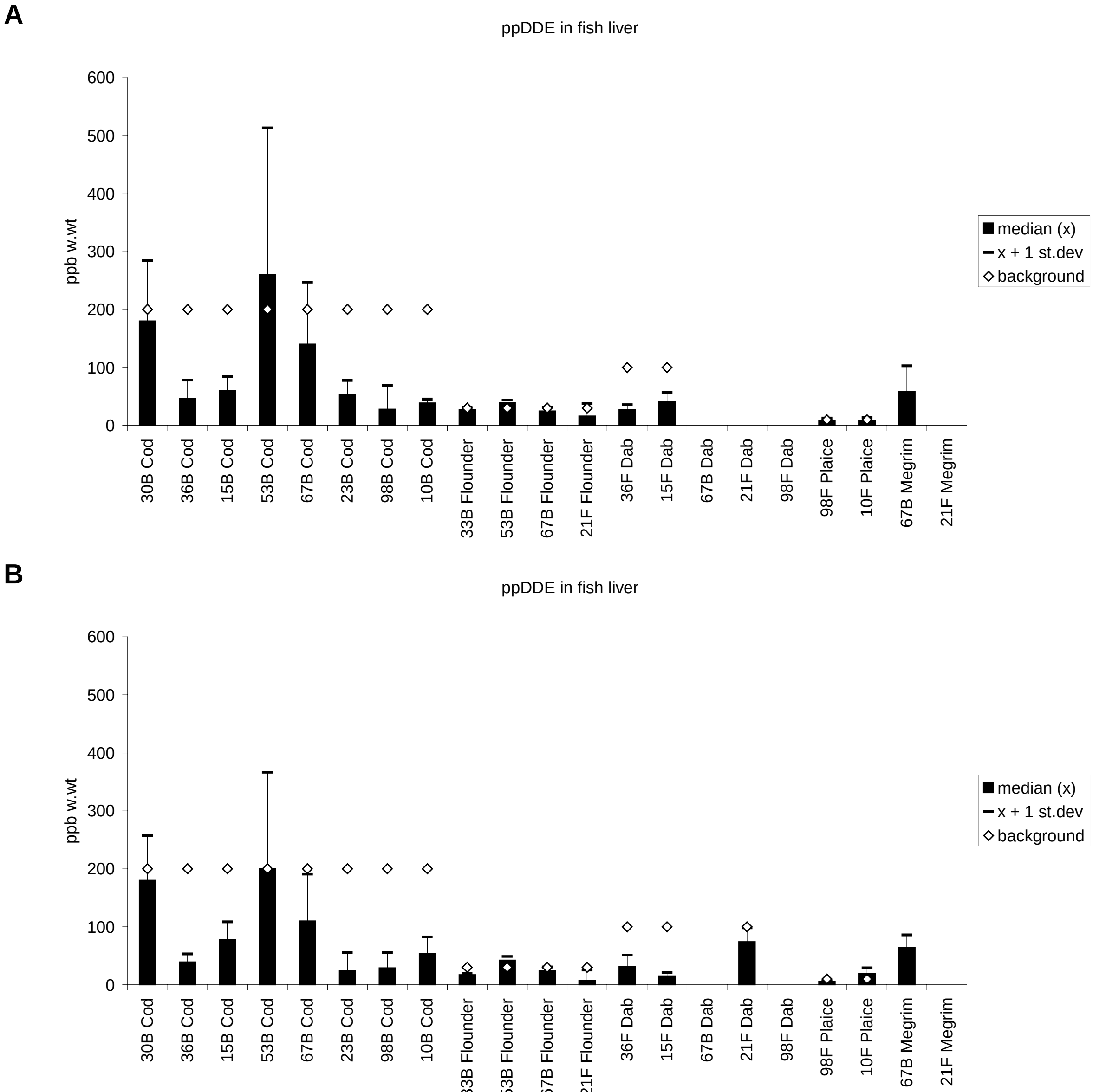
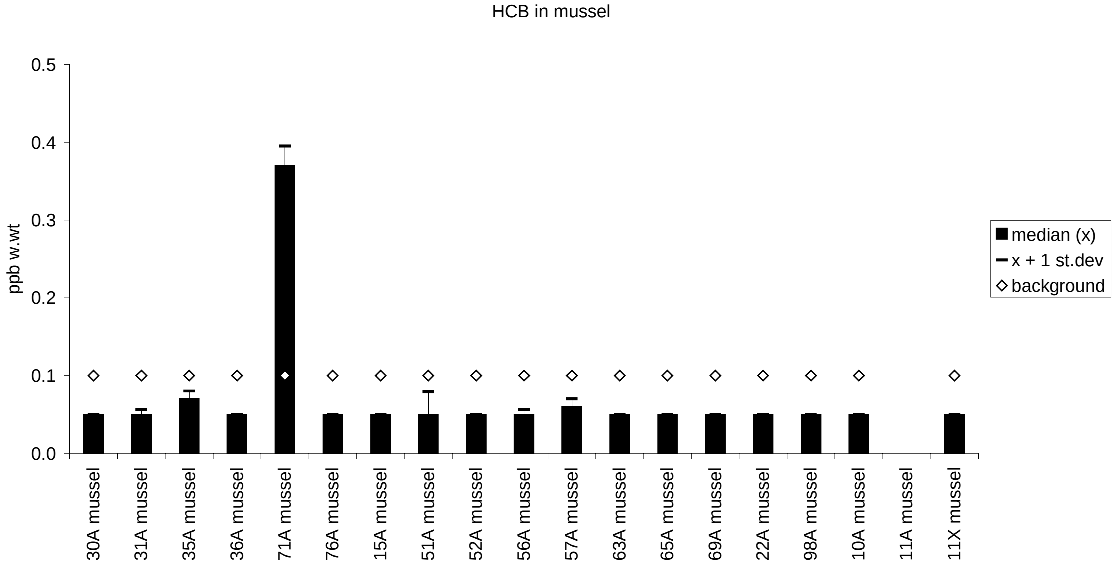


Figure 32. Median, standard deviation and provisional "high background" concentration for ppDDE (DDEPP) in fish liver 2001 (**A**) and 2002 (**B**), ppb wet weight (see maps in Appendix F). (See also footnote in Table 7).

A



B

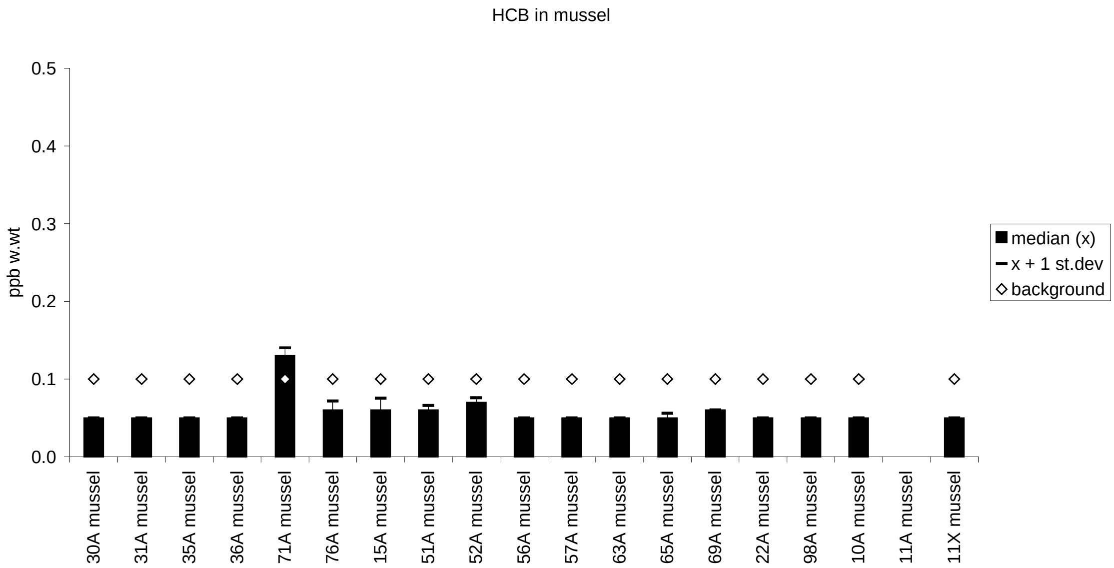
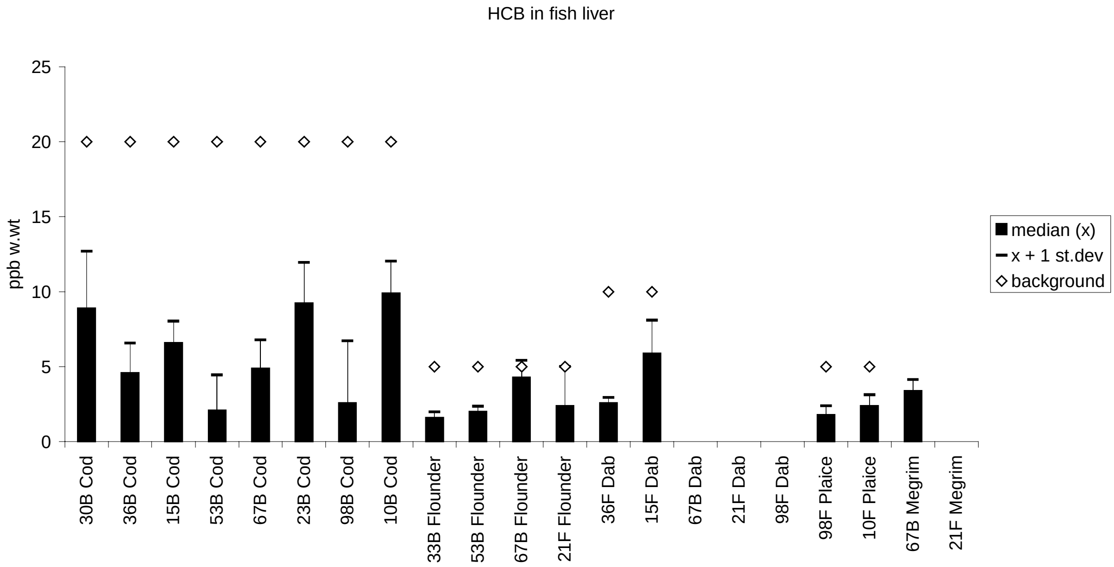


Figure 33. Median, standard deviation and provisional "high background" concentration for HCB in mussels (*Mytilus edulis*) 2001 (**A**) and 2002 (**B**), ppb wet weight (see maps in Appendix F).

A



B

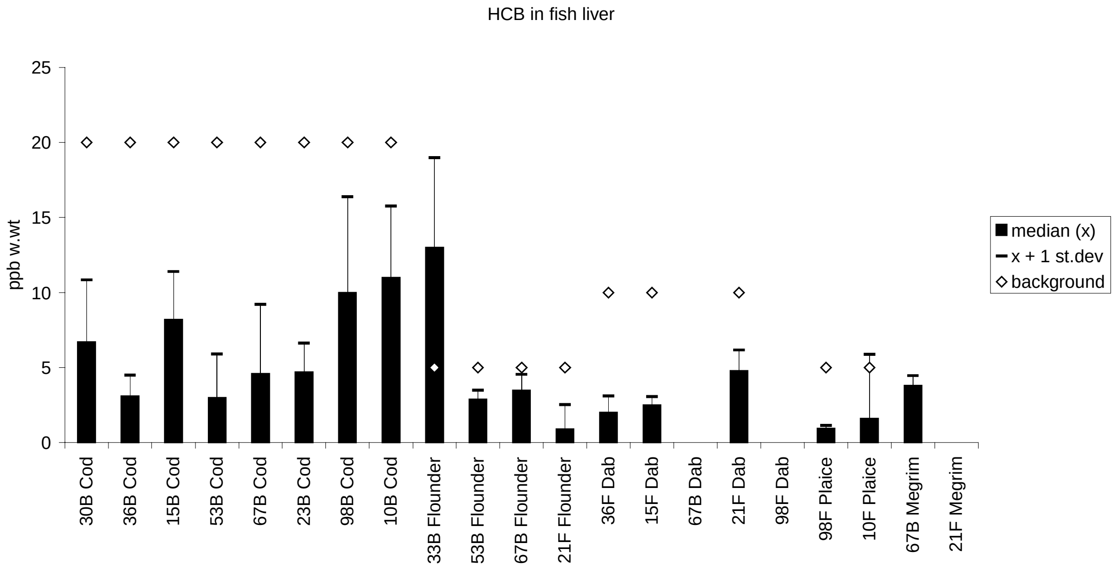


Figure 34. Median, standard deviation and provisional "high background" concentration for HCB in fish liver 2001 (**A**) and 2002 (**B**), ppb wet weight (see maps in Appendix F).

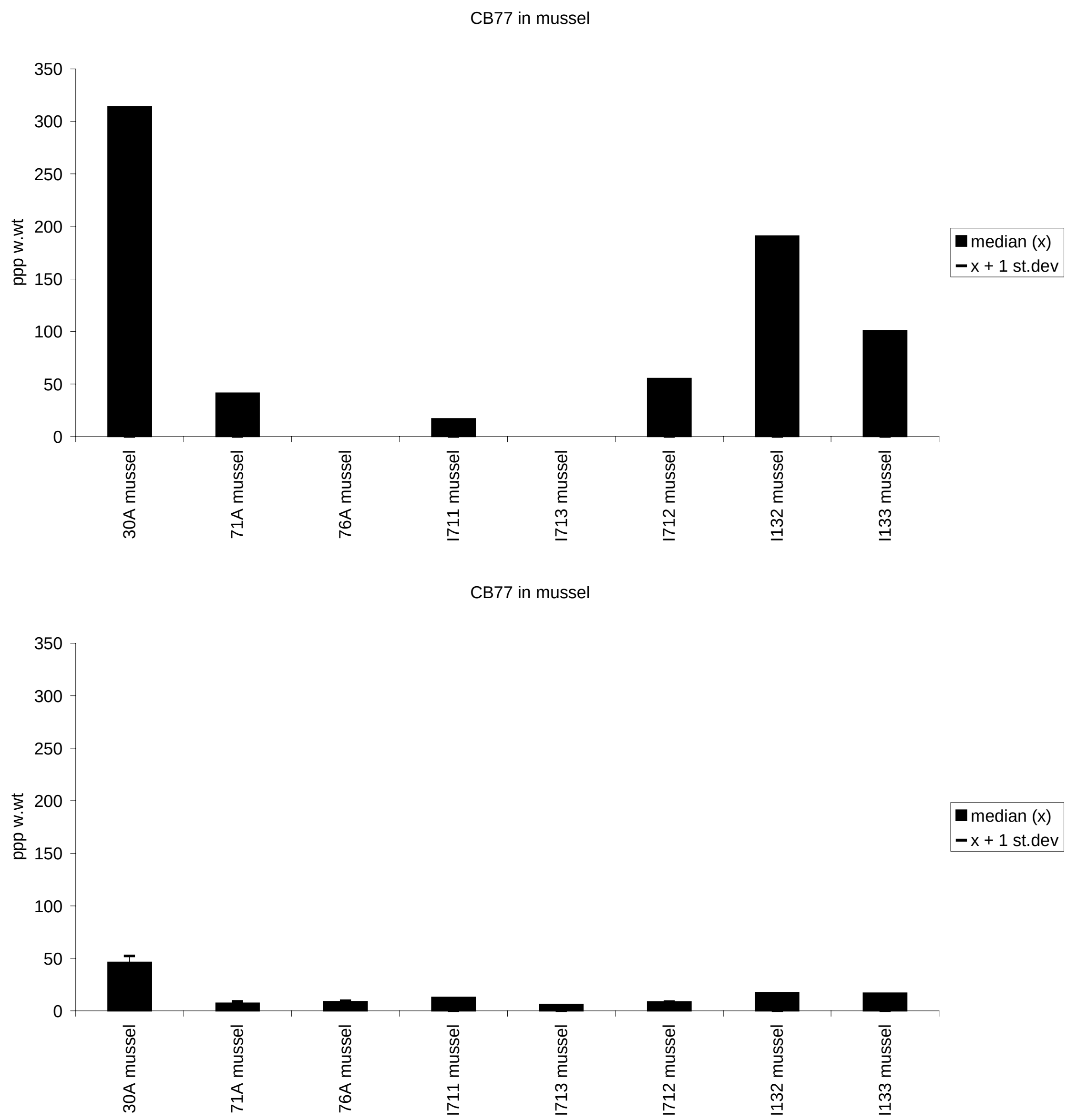
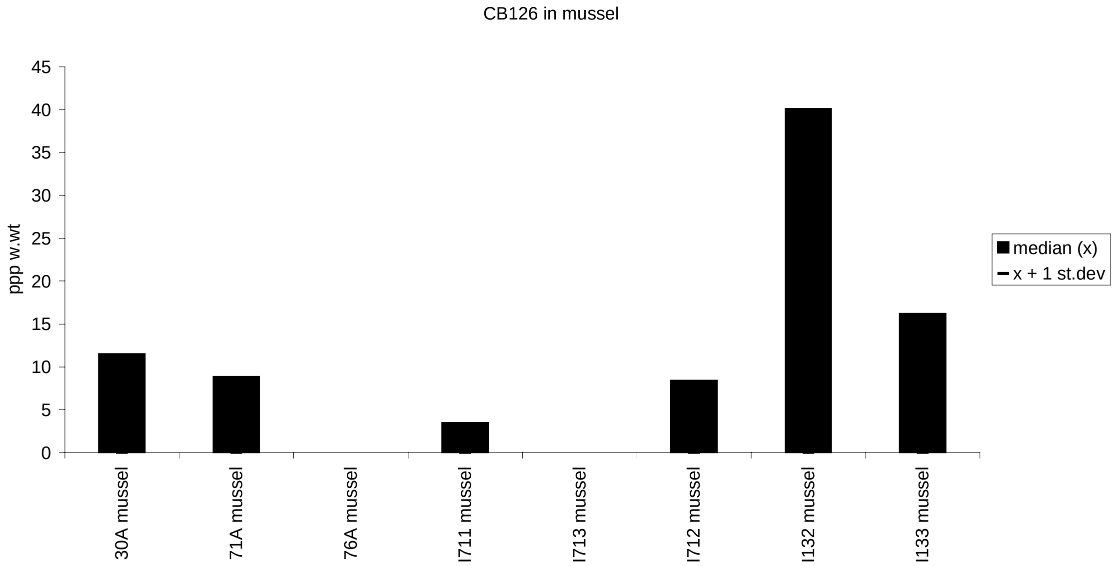


Figure 35. Median and standard deviation concentration for non-ortho co-planar PCB CB77 in mussels 1996 (**A**) and 2002 (**B**), ppp (ng/kg) wet weight (see maps in Appendix F).

A



B

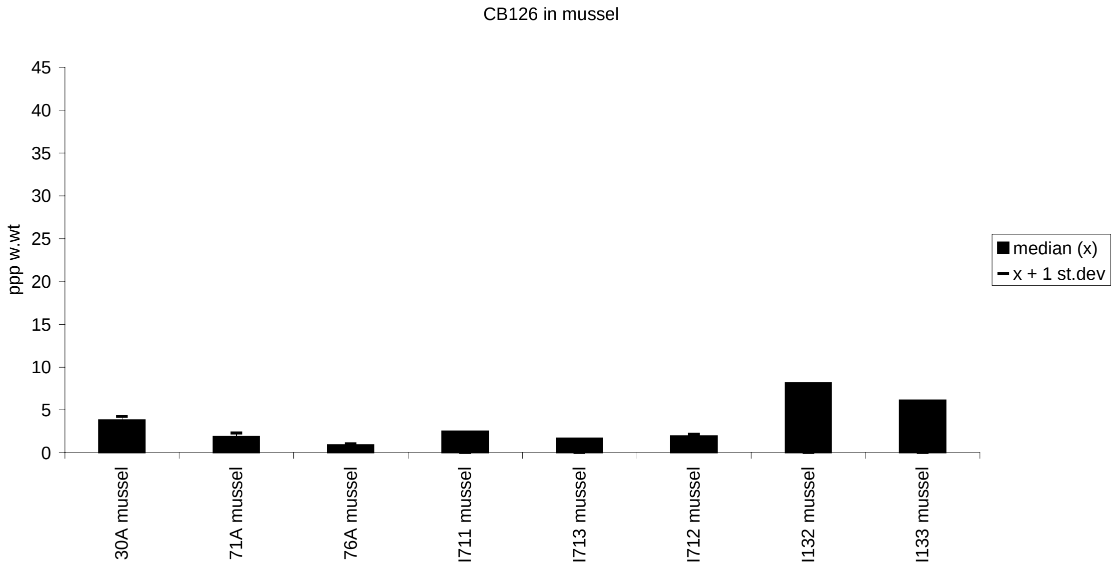
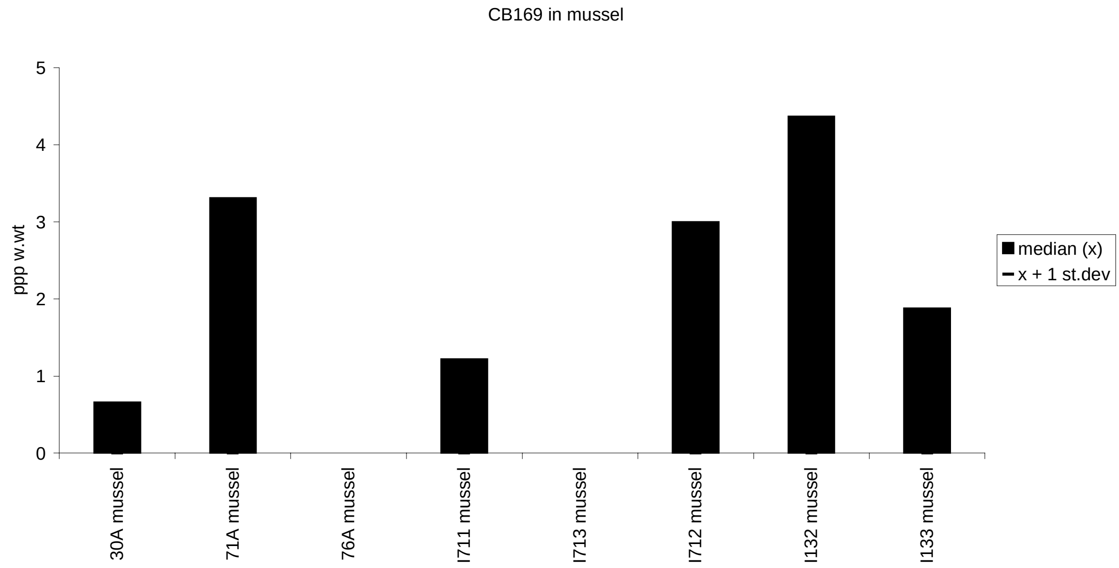


Figure 36. Median and standard deviation concentration for non-ortho co-planar PCB CB126 in mussels 1996 (**A**) and 2002 (**B**), ppp (ng/kg) wet weight (see maps in Appendix F).

A



B

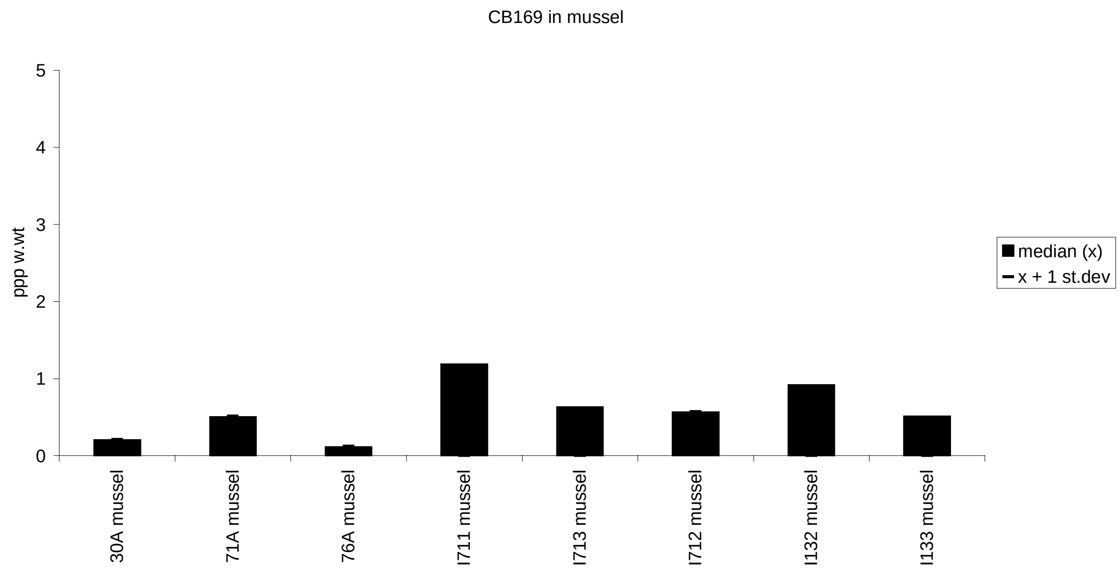
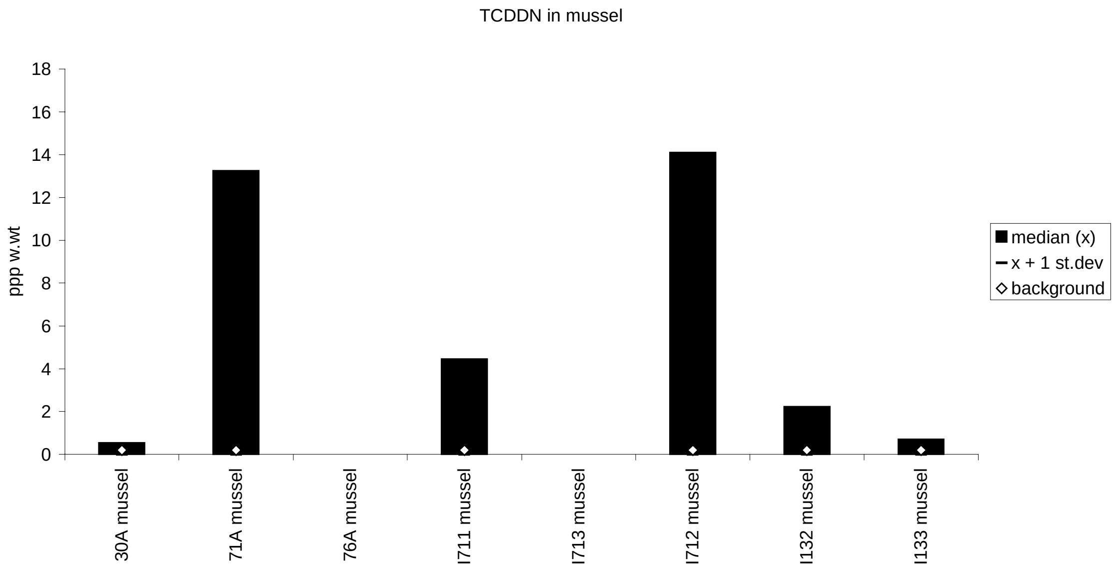


Figure 37. Median and standard deviation concentration for non-ortho co-planar PCB CB69 in mussels 1996 (**A**) and 2002 (**B**), ppp (ng/kg) wet weight (see maps in Appendix F).

A



B

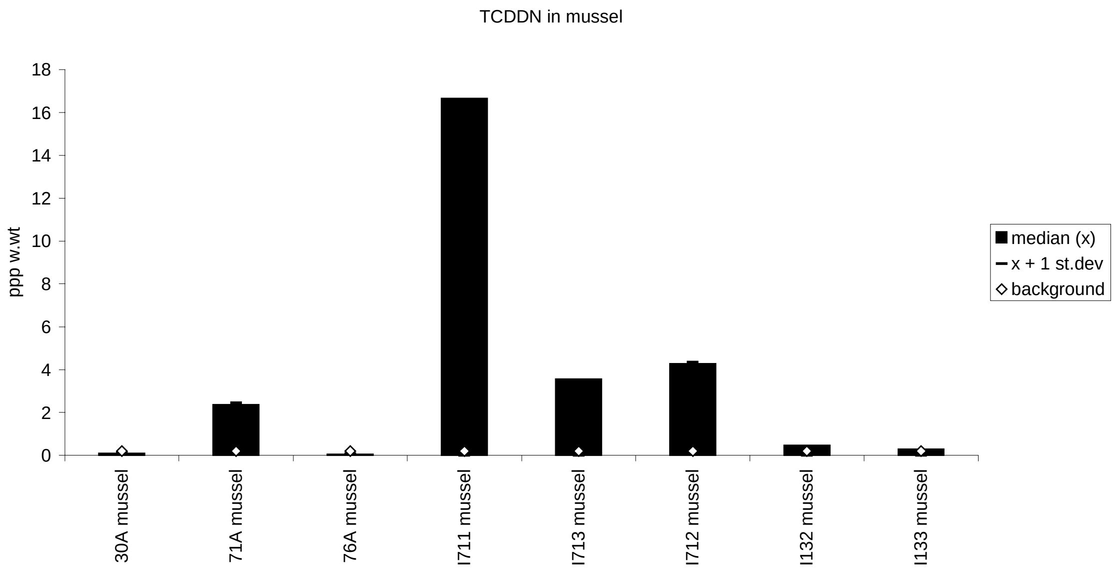
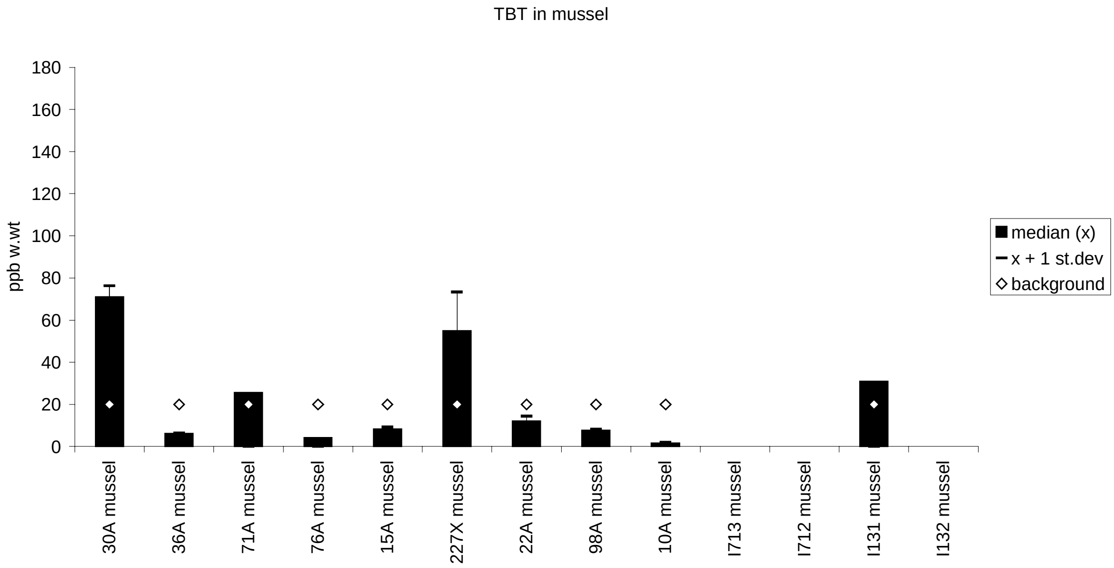


Figure 38. Median, standard deviation and provisional "high background" concentration for dioxin TCDD-toxicity equivalents after nordic model (TCDDN) in mussels 1996 (**A**) and 2002 (**B**), ppp (ng/kg) wet weight (see maps in Appendix F).

A



B

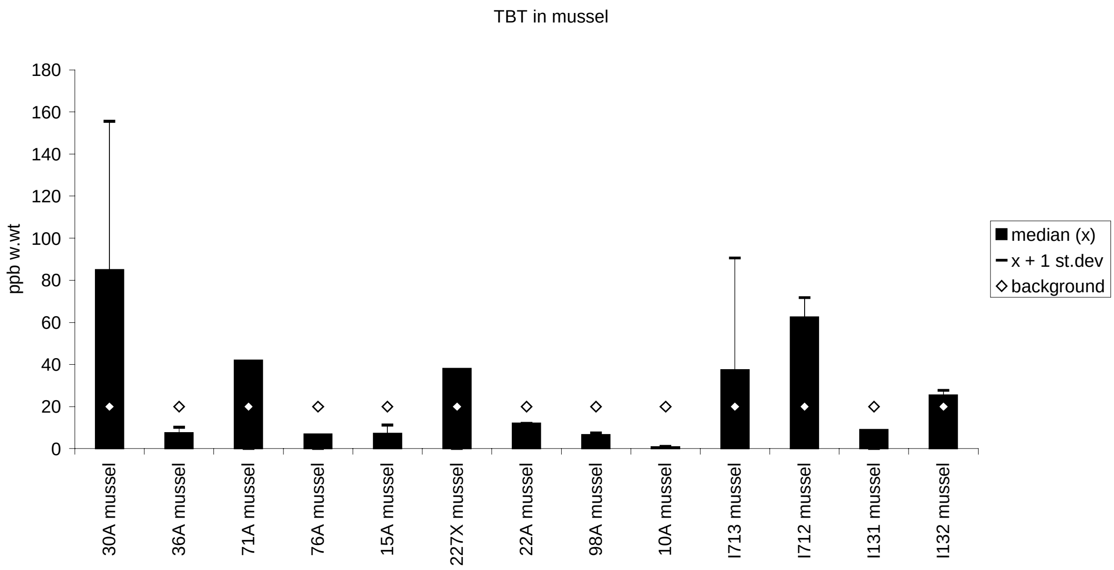


Figure 39. Median, standard deviation and provisional "high background" concentration for tributyl tin (TBT) in mussels 2001 (**A**) and 2002 (**B**), ppb (µg Sn/kg) wet weight (see maps in Appendix F).

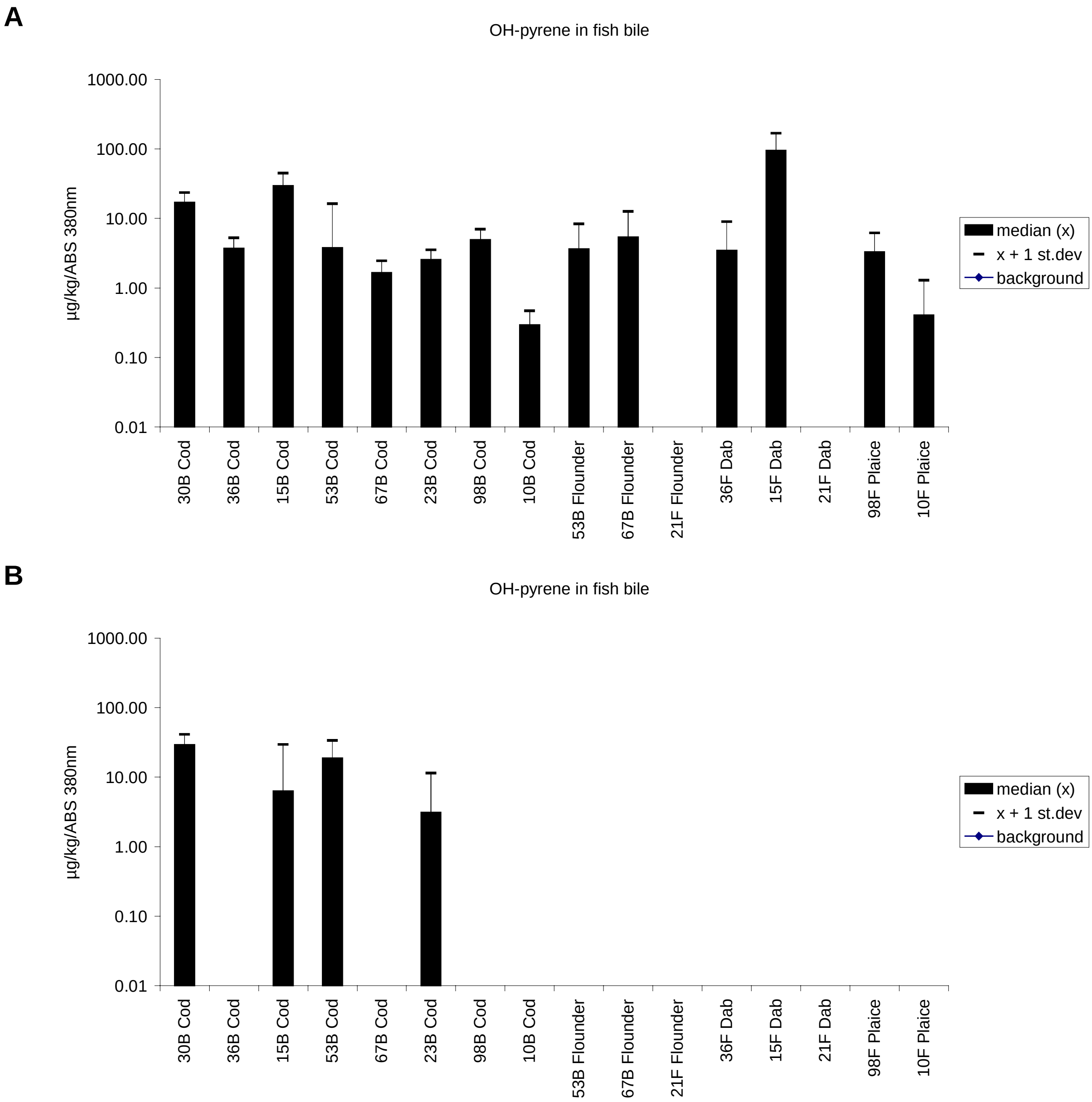
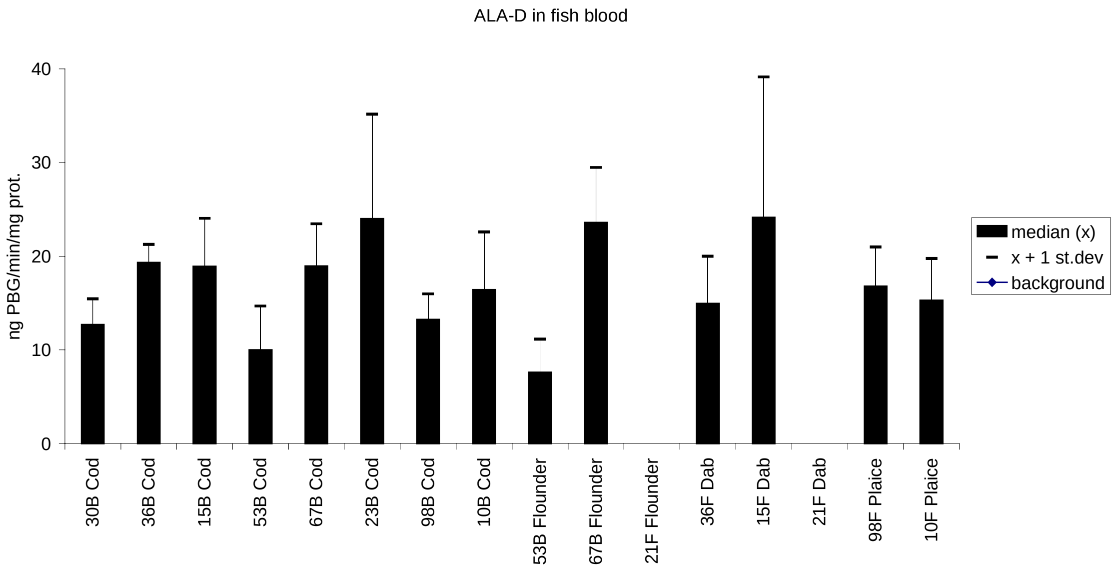


Figure 40. Median and standard deviation concentration for OH-pyrene (Pyrene metabolite) in fish bile 2001 (**A**) and 2002 (**B**), µg/kg/ABS (absorbance) 380 nm (see maps in Appendix F).

A



B

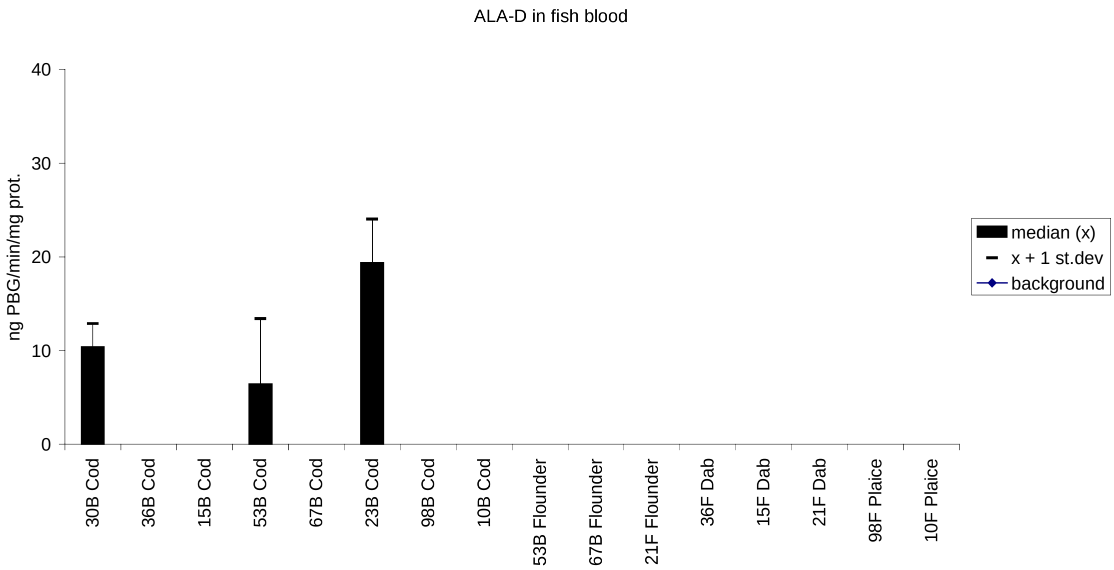


Figure 41. Median and standard deviation concentration for ALA-D (δ-amino levulinic acid dehydrase inhibition) in fish liver 2001 (**A**) and 2002 (**B**), ng PBG (porphobilinogen)/min/mg protein (see maps in Appendix F).

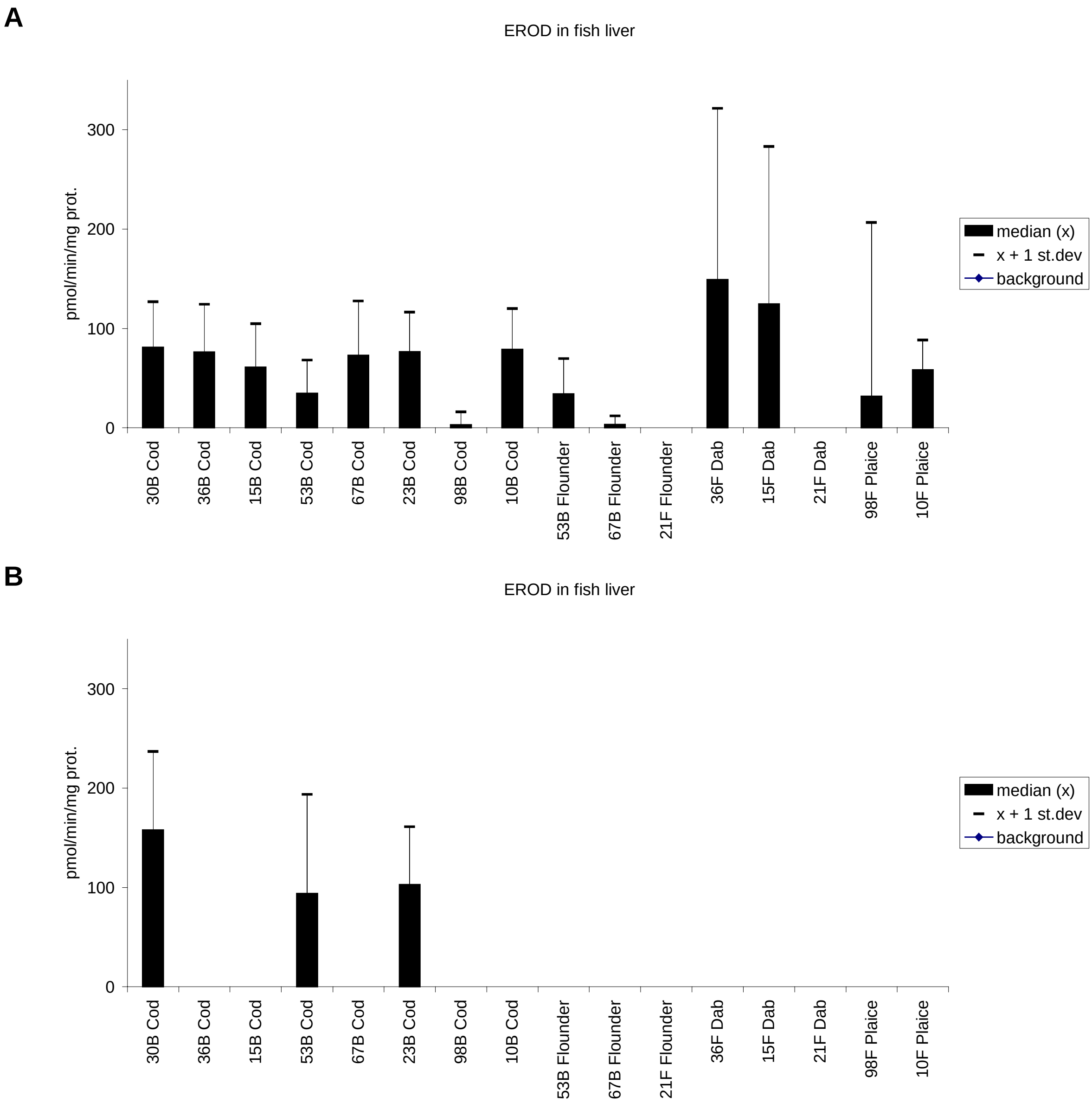
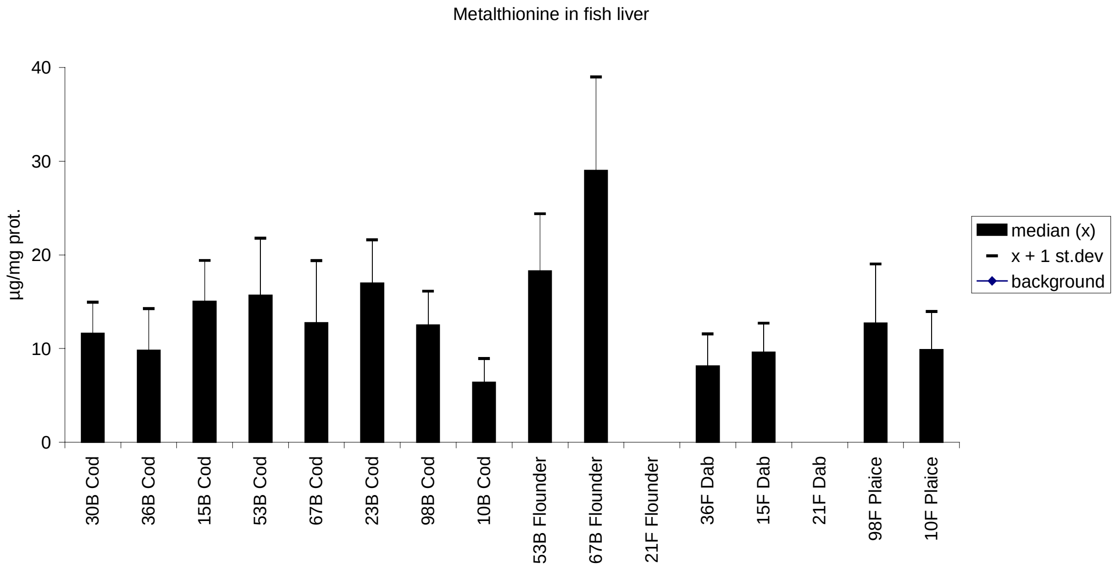


Figure 42. Median and standard deviation concentration for EROD (Cytochrome P4501A-activity) in fish liver 2001 (**A**) and 2002 (**B**), pmol/min/mg protein (see maps in Appendix F).

A



B

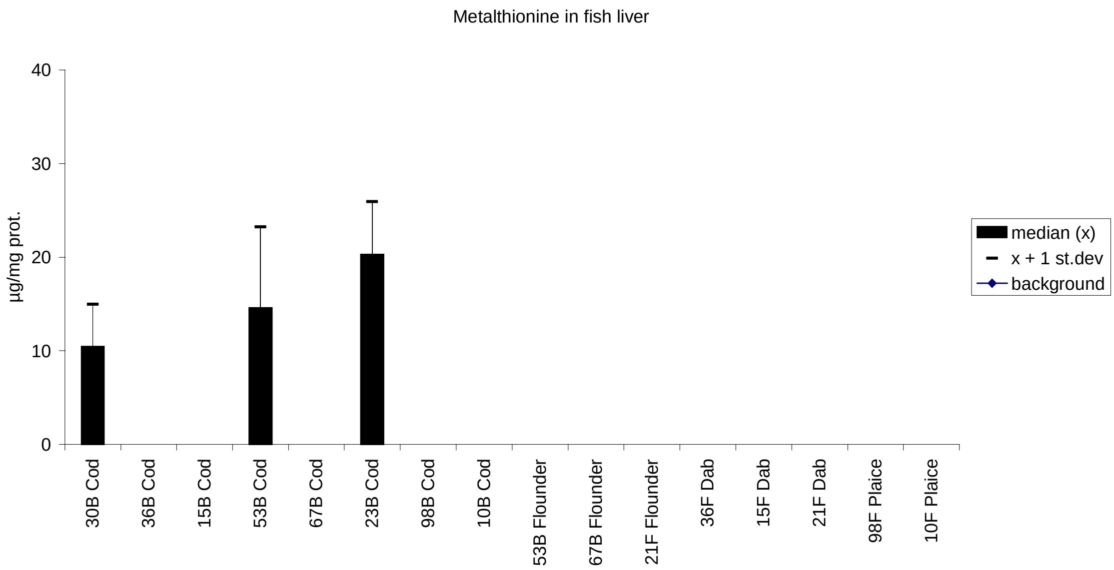


Figure 43. Median and standard deviation concentration for MT (Metallothionein) in fish blood 2001 (**A**) and 2002 (**B**), µg/mg protein (see maps in Appendix F).

Appendix J
Results from INDEX determinations 1995-2002

Introduction

The Norwegian Pollution Control Authority (SFT) has requested that a small group of indices be established to assess the quality of the environment with respect to contaminants. The target medium for both indices may vary depending on the purpose, however sediment, cod and mussels are considered to be the most likely choices. Blue mussels were selected for this investigation (Appendix J1 and Appendix J2).

Two indices are calculated. One index is based on the contaminant concentrations in the blue mussel collected annually from 9 of the more contaminated fjords in Norway (Walday *et al*. 1995), herein designated “Pollution Index”. This index was initiated in 1995. Initially there were 11 fjords but sampling from Orkdalsfjord and Iddefjord was discontinued in 1997. It was practical to organise sampling within JAMP. Some JAMP results could be used to calculate the index value.

In addition, a “Reference Index” was initiated in 1995 based on annual contaminant concentrations in the blue mussel. The mussels were collect at JAMP stations along the entire coast where there is presumably low levels of contamination. The importance of “reference” stations for monitoring of contaminants has been discussed earlier (cf. Green 1987). One of the main reasons for this work is to establish points of reference for contaminated fjords. Initially 8 areas were involved but since 1998 only 5 have been sampled.

Calculation of the index

Sampling strategy and a detailed discussion of calculation of the Pollution Index has been given earlier (cf. Walday *et al.* 1995) and only a brief summary will be given here. The relevant contaminants for each of the Pollution Index fjords are summarised in Appendix J2 and 3. Their selection is based on earlier investigations. Two to five stations were sampled from each area. Three parallels of 20 individuals from 3-5 cm are collected from each station. Each sample was analysed for the contaminants according to the scheme in Appendix J3. "Dioxins" were only investigated in 1995-96.

One to three stations were sampled from selected areas for the determination of the Reference Index. Each station included three parallels which were analysed for the usual JAMP contaminants (cf. analysis code A, Appendix J3). Some samples were also analysed for PAHs and dioxins.

The strategy for sampling mussels differed depending on whether the mussels were to be used for the Index or for JAMP and Index in that stations that were exclusively to be used for Index calculations allowed a slightly greater size range (3-5 cm) compared to JAMP and that the mussels were frozen directly and not depurated.

The maximum median for each contaminant for all the stations in an area was determined. These concentrations were classified according to SFT's classification system for contaminants in the marine environment (Appendix J4). The highest class found for any contaminant measured in an area determined the index value for that area.

The SFT 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 (CBΣΣe) 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 the calculation of sum-PAH included the dicyclic PAHs. For this report PAH_Σ was calculated for previous years and hence, the classification may vary a class from what has been previously reported. "Dioxins" were assessed based on toxicity equivalency factors (TEQ) according to a Nordic model (Ahlborg 1989) which differs insignificantly from the recently revised WHO-model (van den Berg *et al.* 1998). Note that EPOCl is considered a relevant contaminant for one area but is not included in the part of the classification system based on levels in mussels. Likewise, there are contaminants which are included in the classification system but have not been measured in any area (e.g., tributyltin (TBT), arsenic, fluoride, nickel, silver).

The maximum class found for any contaminant determined the Class (I-V) of the area. The average Class for all the contaminated sub areas and all the reference localities determined the Pollution or Reference Index, respectively. The lowest Index value is 1 and means that all median values were in Class I (insignificantly polluted). The highest Index value is 5 and means that at least one median value from each of the areas was in Class V (extremely polluted).

Conclusion from application of the indices

The indices have been in use since 1995 based on contaminant concentrations in mussels from 14-19 areas (cf. Green *et al.* 2003). 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 SFT classification system for environmental quality (Molvær *et al.* 1997). SFT provided funds to improve the index in 2002. Two additional stations were established: one in the Frierfjord area (I713 Strømtangen, about 800 m east of I711 Steinsholmen) and one in the inner Ranfjord (I964 Toraneskaien, about 500 m north of I965 Moholmen). An additional station in the Sunndalsfjord area has been found in 2003. 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. The differences are discussed below.

It should also be noted that the SFT 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).

To compare the 2002 results with results from previous years the calculations were done on a common basis with respect to areas and contaminants. Nine fjord areas were used to calculate the Pollution Index for 1998-2002 compared to eight for 1995-1997. As before, 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. I911 Horvika in the Sunndalsfjord since 1999, st. I021 in the Hvaler area 1999, st.I962 in the Inner Ranfjord since 1999, and st. I711 Steinholmen in the Frierfjord 2001). Because insufficient amount of mussels were found at station Horvika, a new station (I913 Fjøseid) was introduced in 1999 between Horvika and I912 Honnhammer, about 15 km farther out the fjord from Horvika. Because sufficient amount of mussels were not found at station I962 Koksverktomta since 1999, a new station (I965 - Moholmen) was introduced in 2001 about 2 km south of Koksverktomta. The Pollution Index for 2002 based on this common basis is 3.2 compared to 2.7 in 2001 (Table 1, Annex). A value between 3 and 4 would be termed by the SFT system as “Severe” and between 2 and 3 "Marked". One reason for the increase was exceptionally high values of lindane found at one station in the Grenlandsfjord area (st.71A), about 1000 times higher than previously registered in this area. Reanalyses confirmed the results. The median lindane concentrations in this area never exceeded SFT Class I before. The reason for the high lindane concentrations are unknown, but low concentrations found at nearby stations indicate a local influence. Not taking into account the lindane results, the Frierfjord area would be Class III (because of HCB) and the Pollution Index would then have been 3.0.

With the new calculation where supplementary stations and dioxin and TBT analyses are included, the Pollution Index for 2002 was 3.4 compared to 3.2 using the older method (Table 1, Annex). The new stations (Strømtangen and Toraneskaien) did not affect the index but the supplementary analyses did due to the dioxin results for the Frierfjord area (Steinholmen) that were in Class V and TBT results for the Inner Oslofjord (Akershuskaia) in Class IV.

Only 5 fjords/areas were monitored for the Reference Index for 1998-2002 compared to 7 for 1997 and 8 for 1995-1996 (Table 2, Annex). However, only four of these provided a common basis (cf., Table 10), because Lofoten had to be omitted. Similar to the application of the Pollution Index, the

Reference Index made no special considerations when one but not all the stations within an area were sampled. This has occurred several times and all in the Varangerfjord area (st.48A since 1997 and st.11A since 1998). The value for 2002 is 1.3, lower than 1.8 for 2001, and within the range of 1.3-1.5 for 1995-2000. A value between 1 and 2 would be termed by the SFT system as “Moderate”.

With the new calculation where supplementary analyses of TBT are included, the Reference Index was 1.5 for the four common areas, and 1.6 if Lofoten is included, compared to 1.3 using the older method (Table 2, Annex). All five fjords/areas included the TBT analyses. In the Bømlo-Sotra area the results for TBT caused an increase from Class I to Class II.

Table 9. Maximum environmental classification for fjords selected for Pollution INDEX. (See text and Appendix J5).

Index Area [1]	1995	1996	1997 [2]	1998	1999	2000	2001	2002	2002 new [7]
Hvaler/Singlefjord	2	2	2	3	2	2	2	2	2
Iddefjord	-	-	-	-	-	-	-	-	-
Inner Oslofjord	3	3	4	2	3	2	2	2	4
Frierfjord, Grenlandsfjords	3	4	3	3	3	3	3	5 [6]	5
Inner Kristiansandsfjord	5	5	5	5	5	4	3	3	3
Saudafjord	4	5	5	3	4	3	3	4	4
Sørfjord	5	4	3	3	4	4	3	4	4
Byfjorden, Bergen [3]	3	3	3	2	2	2	2	3	3
Sunndalsfjord	3	3	3 [4]	2	3	4	2	3	3
Orkdalsfjord	-	-	-	-	-	-	-	-	-
Inner Ranfjord	5	3	3 [5]	4	2	2	3	3 [6]	3
AVERAGE (Pollution INDEX)	**3.7**	**3.6**	**3.4**	**3.0**	**3.1**	**2.9**	**2.7**	**3.2**	**3.4**

[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 (DDTΣ, HCB, HCHΣΣ and CBΣΣ) 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 in 2002 did not influence outcome of classification

[7] Inclusion of supplementary station in Frierfjord, Grenlandsfjord and Inner Ranfjord, and supplementary dioxin and TBT analyses for Inner Oslofjord, Frierfjord, Grenlandsfjord and Inner Kristiansandfjord.

Table 10. Maximum environmental classification for fjords selected for Reference INDEX. (See text and Appendix J6).

Index Area	1995	1996	1997	1998	1999	2000	2001	2002	2002 new [5]
Mid and outer Oslofjord [1]	2	2	2	1	1	1	2	1	1
Lista	1	1	1	1	2	2	2	2	2
Bømlo-Sotra	1	1	1	1	1	2	2	1	2
Outer Ranfjord, Helgeland [2]	(1)	(1)	-	-	-	-	-	-	-
Lofoten [3]	(2)	(2)	(1)	(2)	(2)	(1)	(2)	(2)	2
Finnsnes-Skjervøy [2]	(2)	(1)	(1)	-	-	-	-	-	-
Hammerfest-Honningsvåg [2]	(2)	(3) [4]	(2)	-	-	-	-	-	-
Varanger Peninsula	1	2	1	2	1	1	1	1	1
AVERAGE (Reference INDEX)	**1.3**	**1.5**	**1.3**	**1.3**	**1.3**	**1.5**	**1.8**	**1.3**	**1.6**

[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.

Appendix J1
INDEX - Stations and programme 1995-2002

Appendix J1. INDEX station positions and sampling overview for blue mussels 1995-2002, where P = “Pollution Index” and R = “Reference Index” (contaminated and assumed “background” stations, respectively). Mussels were sampled from rock surfaces unless otherwise noted. See Walday *et al.* (1995) for discussion of station selection and analyses.

Station		Locality name	North latitude	East longitude	ICES position	INDEX type P/R	notes
HVALER/SINGLEFJORDEN, east of outer OSLOFJORD							
	I021	Kjøkø, south	59°07.8'	10°57.1'	47G13	P	
	I024	Kirkø, north west	59°04.9'	10°59.2'	47G09	P	
	I022	West Damholmen	59°06.2'	10°57.9'	47G09	P	
	I023	Kirkø, north west	59°05.7'	11°08.2'	47G09	P	
IDDEFJORD, east of outer OSLOFJORD							
	I001	Sponvikskansen	59°05.4'	11°12.5'	47G09	P	
	I011	Kråkenebbet	59°06.1'	11°17.3'	47G09	P	
INNER OSLOFJORD							
JAMP	30A	Gressholmen	59°52.5'	10°43.0'	48G07	P	
	I301	Akershuskaia	59°54.2'	10°45.5'	48G07	P	
	I304	Gåsøya	59°51.0'	10°35.5'	48G04	P	
	I307	Ramtonholmen	59°44.7'	10°31.4'	48G05	P	
	I306	Håøya	59°24.7'	10°33.4'	48G04	P	
MID and OUTER OSLOFJORD							
JAMP	31A	Solbergstrand	59°36.9'	10°39.4'	48G06	R	
JAMP	35A	Mølen	59°29.2'	10°30.1'	47G04	R	
JAMP	36A	Færder	59°01.6'	10°31.7'	47G06	R	
FRIERFJORD AREA, west of outer Oslofjord							
	I711	Steinholmen	59°03.2'	09°40.7'	48F99	P	
	I712	Gjermundsholmen	59°02.8'	09°42.5'	47F99	P	
	I713	Strømtangen	59°03.2'	09°41.5'	47F99	P	
JAMP	71A	Bjørkøya (Risøyodden)	59°01.4'	09°45.4'	47F99	P	
INNER KRISTIANSANDSFJORD							
	I132	Fiskåtangen	57°07.7'	07°59.2'	43F79	P	
	I133	Odderø, west	57°07.9'	08°00.3'	43F83	P	
LISTA AREA							
JAMP	15A	Gåsøy (Ullerø area)	58°03.1'	06°53.3'	45F69	R	
	I131	Lastad	58°03.3'	07°42.4'	45F79	R	7
SAUDAFJORD							
	I201	Ekkjegrunn (G1)	59°38.7'	06°21.4'	48F66	P	
**	I205	Bølsnes (G5)	59°35.5'	06°18.3'	48F63	P	
BØMLO AREA							
JAMP	22A	Espevær, west	59°35.2'	05°58.5'	48F59	R	C, 1
SØRFJORD							
*	51A	Byrkjenes	60°05.1'	06°33.1'	49F66	P	
JAMP	52A	Eitrheimsneset	60°05.8'	06°32.2'	49F66	P	3

Appendix J1 (cont'd)

Station		Locality name	North latitude	East longitude	ICES position	INDEX type P/R	notes
BYFJORDEN, Bergen							
	I242	Valheimneset	60°23.7'	05°16.1'	49F51	P	
	I241	Nordnes	60°24.1'	05°18.2'	49F51	P	
	I243	Hagreneset	60°24.9'	05°18.3'	49F51	P	
SUNNDALSFJORDen							
	I912	Honnhammer	62°51.2'	08°09.7'	54F81	P	
	I911	Horvika	62°44.1'	08°31.4'	54F85	P	
	I913	Fjøseid	62°49.0'	08°16.48'	54F85	P	
[TRONDHEIM AREA - not related to INDEX investigation**]**							
*	80A	Østmerknes	63°27.5'	10°27.5'	56G04	P	
ORKDALSFJORD AREA, supplementary area (cf. Walday *et al*. 1995)							
JAMP	82A	Flakk	63°27.1'	10°12.6'	56G01	P	
JAMP	84A	Trossavika	63°20.8'	09°57.8'	55F97	P	
JAMP	87A	Ingdalsbukt	63°27.8'	09°54.8'	55F97	P	
INNER RANFJORD							
	I969	Bjørnbærviken (B9)	66°16.8'	14°02.1'	61G42	P	
	I965	Moholmen (B5)	66°19.0'	14°07.5'	61G42	P	
	I964	Toraneskaien	66°19.3'	14°08.0'	61G42	P	
	I962	Koksverkkaien (B2)	66°19.4'	14°08.0'	61G42	P	3
OUTER RANFJORD, Helgeland area							
*	96A	Breiviken	66°17.6'	12°50.5'	61G28	R	1
LOFOTEN AREA							
JAMP	98A	Husvågen (1997)	68°15.4'	14°40.6'	65G46	R	5
JAMP	98A	Husvågen (1998)	68°16.9'	14°40.1'	65G46	R	
FINNSNES-SKJERVØY AREA							
JAMP	41A	Fensneset, Grytøya	68°56.9'	16°38.5'	66G64	R	3
HAMMERFEST-HONNINGSVÅG AREA							
JAMP	44A	Elenheimsundet	70°30.8'	22°14.8'	70H23	R	1, 6
JAMP	46A	Smineset in Altesula	70°58.4'	25°48.1'	70H57	R	3, 6
VARANGER PENINSULA AREA							
JAMP	48A	Trollfjorden i Tanafjord	70°41.6'	28°33.3'	70H85	R	
JAMP	10A	Skagoodden	70°04.2'	30°09.8'	69J03	R	2
JAMP	11A	Sildkroneset, Bøkfjorden	69°47.0'	30°11.1'	68J02	R	
JAMP	11X	Brashavn	69°53.9'	29°44.7'	68H97	R	

notes:

* - JAMP station but not sampled in accordance to JAMP guidelines, see Annex text.
** - Sufficient mussel-sample not found in 1996.
1 - mussels collected from buoy and/or buoy anchor lines
2 - mussels collected from sand/gravel bottom
3 - mussels collected from iron/cement pilings
4 - mussels collected from metal navigation buoys
5 - mussels collected from floating dock
6 - mussels collected from wooden docks
7 - mussels collected from tire on jetty

Appendix J2
INDEX - Sampling and analyses for 1995-2002

Appendix J2. Blue mussel samples planned or used in INDEX 1995-2002, where P = “Pollution Index” and R = “Reference Index” (contaminated and assumed “background” stations, respectively). + indicates JAMP 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 J3. See Walday *et al.* (1995) for discussion of selection of stations and analyses.

JAMP st.	STATION	INDEX	ANALYSIS CODE +	A	B	C	D	E	F	G	H	I	J
	HVALER/SINGLEFJORD AREA												
021	Kjøkø, south	P	.	3	.	.	.	.	.	.	.	.	.
024	Kirøy, north west	P	.	3	.	.	.	.	.	.	.	.	.
022	West Damholmen	P	.	3	.	.	.	.	.	.	.	.	.
023	Singlekalven, south	P	.	3	.	.	.	.	.	.	.	.	.
	IDDEFJORD												
01A	Sponvikskansen	P	.	.	3	.	.	.	.	.	.	.	.
011	Kråkenebbet	P	.	.	3	.	.	.	.	.	.	.	.
	OSLOFJORD, inner												
30A	Gressholmen	P	+	.	.	.	.	.	.	.	3	.	1
301	Akershuskaia	P	.	.	.	3	.	.	.	.	.	.	.
304	Gåsøya	P	.	.	.	3	.	.	.	.	.	.	.
307	Ramtonholmen	P	.	.	.	3	.	.	.	.	.	.	.
306	Håøya	P	.	.	.	3	.	.	.	.	.	.	.
	OSLOFJORD, mid and outer												
31A	Solbergstrand	R	+	.	.	.	.	.	.	.	.	.	1
35A	Mølen	R	+	.	.	.	.	.	.	.	.	.	.
36A	Færder	R	+	.	.	.	.	.	.	.	.	.	2*
	FRIERFJORD AREA, west of outer Oslofjord												
711	Steinholmen	P	.	.	.	.	3	.	.	.	.	.	1
712	Gjermundsholmen	P	.	.	.	.	3	.	.	.	.	.	1
713	Strømtangen	P	.	.	.	.	3	.	.	.	.	.	1
71A	Bjørkøya	P	+	.	.	.	.	.	.	.	.	.	1
	INNER KRISTRIANSANDSFJORD												
132	Fiskåtangen	P	.	.	.	.	.	3	.	.	.	.	1
133	Odderø, west	P	.	.	.	.	.	3	.	.	.	.	1
	LISTA AREA												
15A	Gåsøya	R	+	.	.	.	.	.	.	.	.	.	1
131	Lastad	R	.	.	.	3.	.	.	.	.	.	.	.
	SAUDAFJORD												
201	Ekkjegrunn (G1)	P	.	.	.	.	.	.	3	.	.	.	.
205	Bølsnes (G5)	P	.	.	.	.	.	.	3	.	.	.	.
	BØMLO-SOTRA AREA												
22A	Espevær, west	R	+	.	.	.	.	.	.	.	.	.	2*
	SØRFJORD												
51A	Byrkjeneset	P	.	3	.	.	.	.	.	.	.	.	.
52A	Eirtrheimsneset	P	+	.	.	.	.	.	.	.	.	.	.

*) indicates Toxaphene included

Appendix J2 (cont'd)

JAMP st.	STATION	INDEX					ANALYSIS CODE +	A	B	C	D	E	F	G	H	I	J
	BYFJORDEN, BERGEN																
242	Valheimsneset	P	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.
241	Nordnes	P	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.
243	Hagreneset	P	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.
	SUNNDALSFJORD																
912	Honnhammer	P	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.
913	Fjøseid	P	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.
	[TRONDHEIM AREA - not related to index investigation]																
80A	Østmarknes	-	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
	ORKDALSFJORD AREA (not suggested in Walday *et al.* 1995)																
82A	Flakk	P	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
84A	Trossavika	P	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
87A	Ingdalsbukta	P	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.
	INNER RANFJORD																
964	Toraneskaien	P	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
965	Moholmen (B5)	P	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
969	Bjørnbærvikenn (B9)	P	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.
	OUTER RANFJORD, HELGELAND AREA																
96A	Breivika, Tomma	R	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.
	LOFOTEN AREA																
98A	Husvågen	R	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1
	FINNSNES-SKJERVØY AREA																
41A	Fensneset, Grytøya	R	.	.	.	.	+	.	.	.	.	.	.	.	3	.	1
	HAMMERFEST-HONNINGSVÅG AREA																
44A	Elenheimsundet	R	.	.	.	.	+	.	.	.	.	.	.	.	3	.	2*
46A	Smineset in Altesula	R	.	.	.	.	+	.	.	.	.	.	.	.	3	.	1*
	VARANGER PENINSULA AREA																
48A	Trollfjorden i Tanafjord	R	.	.	.	.	+	.	.	.	.	.	.	.	3	.	.
10A	Skagoodden	R	.	.	.	.	+	.	.	.	.	.	.	.	3	.	1
11A	Sildkroneset	R	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1

*) indicates Toxaphene included

Appendix J3
INDEX - Key to analysis codes and sample counts

(Used in Appendix J2)

ANALYSIS CODES[1)] See Walday *et al.* (1995) for discussion of selection of analyses.

Contaminant	Analysis code									
	A	B	C	D	E	F	G	H	I	J
Lead	x	x	.	.	.	x	.	.	x	.
Cadmium	x	x	x	.	.	x	.	.	x	.
Copper [2])	x	x	x	.	.	.	.	.	.	.
Mercury	x	x	x	.	.	.	.	.	.	.
Zinc [2])	x	x	x	.	.	.	x	.	x	.
EPOCl	.	.	.	.	x	.	.	.	.	.
PAHs	.	.	x	.	x	x	.	x	x	.
PCBs	x	.	x	x	x	.	x	.	.	.
"Dioxin" [3])	.	.	.	.	.	.	.	.	.	x

[1]) Concerns MUSSEL - 1 size group (3-5 cm), 3 parallel 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

Appendix J4
INDEX - SFT 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
PAH_S	total PAH excluding dicyclic (=PAH_Σ)*
BAP	benzo[*a*]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 B for definitions.

Basis: D = dry weight, W = wet weight
Units: M = ppm (mg/kg), U = ppb (µg/kg), P = ppp (ng/kg)

SFT's Environmental quality classes for blue mussels (Molvær *et al.* 1997).

Contaminant	basis	unit	Class 1	Class 2	Class 3	Class 4	Class 5
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
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 J5
INDEX - Summary table "Pollution index" 1995-2002

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 3.7

Index areaname (Pollution area) 1995	n	N	As ppm d.wt	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	Max E.C I:V
Hvaler/Singlefjorden	4	4	i	1.06	i	1.73	i	i	0.2	i	i	i	i	i	0.93	0.1	0.53	6.73	i	II
Iddefjord	1	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	i	1.33	i	i	0.1	i	i	i	<132.90	0.8	1.95	<0.05	0.41	20.6	i	III
Frierfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	0.85	0.6	0.27	4.74	i	III
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	1088.5	15	0.65	9.6	0.76	5.08	i	V
Saudafjord	2	2	i	4.77	i	0.82	i	i	i	i	i	i	<428.80	15	i	i	i	i	i	IV
Sørfjord	2	2	i	149	i	36.8	i	i	1.5	i	i	i	i	i	6.01	0.1	0.28	2.67	i	V
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	3.76	0.2	0.74	19	i	III
Sunndalsfjord	2	2	i	i	i	i	i	i	i	i	i	i	809.8	8	i	i	i	i	i	III
Orkdalsfjord area	3	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	2	2	i	4.44	i	0.75	i	i	i	i	i	i	785.7	31	i	i	i	i	i	V

I	20
II	10
III	9
IV	4
V	3

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 3.6

Index areaname (Pollution area) 1996	n	N	As ppm d.wt	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	Max E.C I:V
Hvaler/Singlefjorden	4	4	i	2.29	i	2.26	i	i	0.4	i	i	i	i	i	<0.56	0.1	0.27	4.83	i	II
Iddefjord	1	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	i	0.82	i	i	0.1	i	i	i	<644.80	3.3	1.08	<0.05	0.3	20.86	i	III
Frierfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	0.26	2.2	0.19	4.18	i	IV
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<542.40	17	0.61	18	1.32	6.64	i	V
Saudafjord	1	2	i	4.39	i	0.86	i	i	i	i	i	i	891.4	35	i	i	i	i	i	V
Sørfjord	2	2	i	60.3	i	25.3	i	i	0.9	i	i	i	i	i	4.08	<0.05	0.6	1.92	i	IV
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	7.8	0.2	1.03	30.72	i	III
Sunndalsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<290.00	3.8	i	i	i	i	i	III
Orkdalsfjord area	3	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	2	2	i	5.34	i	0.61	i	i	i	i	i	i	301.9	6.2	i	i	i	i	i	III

I	16
II	12
III	12
IV	4
V	2

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 3.4

Index areaname (Pollution area) 1997	n	N	As ppm d.wt	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	Max E.C I:V
Hvaler/Singlefjorden	4	4	i	1.65	i	2.48	i	i	0.5	i	i	i	i	i	1.14	0.1	0.42	5.61	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	i	0.86	i	i	0.1	i	i	i	<409.10	3.5	12.08	0.1	0.79	33.81	i	IV
Frierfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	0.65	0.8	0.26	<2.68	i	III
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	356	9.1	1.22	7.6	0.81	<6.00	i	V
Saudafjord	2	2	i	6.96	i	1.37	i	i	i	i	i	i	2726.5	108	i	i	i	i	i	V
Sørfjord	2	2	i	20.6	i	13.4	i	i	0.3	i	i	i	i	i	5.07	<0.05	0.29	<2.71	i	III
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	2.94	0.1	0.4	24.54	i	III
Sunndalsfjord	1	2	i	i	i	i	i	i	i	i	i	i	<238.90	1.4	i	i	i	i	i	III
Orkdalsfjord area	0	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	2	2	i	3.55	i	0.64	i	i	i	i	i	i	<132.90	3.1	i	i	i	i	i	III

I	17
II	13
III	12
IV	2
V	2

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 3.0

Index areaname (Pollution area) 1998	n	N	As ppm d.wt	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	Max E.C I:V
Hvaler/Singlefjorden	4	4	i	2.12	i	3.31	i	i	0.9	i	i	i	i	i	1.13	0.1	<0.23	<4.42	i	III
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	i	1.27	i	i	0.1	i	i	i	<149.20	1	2.34	0.1	0.59	13.75	i	II
Frierfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	<0.63	0.7	0.41	3.18	i	III
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<279.00	3.8	0.53	7.2	<0.65	<5.09	i	V
Saudafjord	2	2	i	4.67	i	0.93	i	i	i	i	i	i	<550.50	9.8	i	i	i	i	i	III
Sørfjord	2	2	i	29.6	i	10.3	i	i	0.6	i	i	i	i	i	w	0.1	0.51	2.04	i	III
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	<2.83	0.2	0.79	10.87	i	II
Sunndalsfjord	1	2	i	i	i	i	i	i	i	i	i	i	<180.00	1	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	2	2	i	2.99	i	0.61	i	i	i	i	i	i	257.5	12	i	i	i	i	i	IV

I	19
II	14
III	10
IV	1
V	1

Max(median). Statistics for alle areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 3.1

Index areaname (Pollution area) 1999	n	N	As ppm d.wt	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	Max E.C I:V
Hvaler/Singlefjorden	3	4	i	1.94	i	2.45	i	i	0.42	i	i	i	i	i	<1.15	0.09	<0.26	3.27	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	i	1.29	i	i	0.11	i	i	i	223.9	2.1	2.2	0.25	<0.34	20.01	i	III
Frierfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	0.76	0.6	<0.28	<2.64	i	III
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<1172.40	48	0.73	0.3	0.29	<4.10	i	V
Saudafjord	2	2	i	5.97	i	1.49	i	i	i	i	i	i	622.8	14	i	i	i	i	i	IV
Sørfjord	2	2	i	37.14	i	34.71	i	i	2.89	i	i	i	i	i	6.21	0.07	0.35	<2.42	i	IV
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	4.5	0.12	0.28	13.88	i	II
Sunndalsfjord	2	3	i	i	i	i	i	i	i	i	i	i	384.2	3	i	i	i	i	i	III
Orkdalsfjord area	0	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	1	2	i	5.13	i	0.59	i	i	i	i	i	i	<173.60	1.95	i	i	i	i	i	II

I	19
II	13
III	10
IV	3
V	1

Max(median). Statistics for alle areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 2.9

Index areaname (Pollution area) 2000	n	N	As ppm d.wt	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	Max E.C I:V
Hvaler/Singlefjorden	4	4	i	1.05	i	1.83	i	i	0.36	i	i	i	i	i	<0.93	0.09	<0.32	<2.77	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	i	1.13	i	i	0.06	i	i	i	<118.80	0.5	3.2	0.1	<0.31	11.45	i	II
Frierfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	0.56	0.43	0.21	<2.15	i	III
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<246.60	1.8	0.33	1.1	<0.26	1.9	i	IV
Saudafjord	2	2	i	7.09	i	1.99	i	i	i	i	i	i	<383.00	7.2	i	i	i	i	i	III
Sørfjord	2	2	i	91.67	i	27.33	i	i	3.86	i	i	i	i	i	4.27	0.05	0.29	<1.75	i	IV
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	2.85	0.12	<0.26	9.88	i	II
Sunndalsfjord	2	3	i	i	i	i	i	i	i	i	i	i	1287.8	23	i	i	i	i	i	IV
Orkdalsfjord area	0	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	1	2	i	3	i	0.83	i	i	i	i	i	i	<192.50	2.8	i	i	i	i	i	II

I	23
II	13
III	5
IV	5
V	0

Max(median). Statistics for alle areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 2.7

Index areaname (Pollution area) 2001	n	N	As ppm d.wt	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	Max E.C I:V
Hvaler/Singlefjorden	4	4	i	1.65	i	2.53	i	i	0.44	i	i	i	i	i	<0.62	<0.10	<0.15	<2.82	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	i	1.16	i	i	0.07	i	i	i	<110.40	1.3	<0.99	0.1	<0.23	8.59	i	II
Frierfjorden	2	3	i	i	i	i	i	i	i	i	i	i	i	i	0.7	0.37	<0.15	<1.96	i	III
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<182.90	5	0.28	0.48	<0.10	<2.44	i	III
Saudafjord	2	2	i	6.15	i	1.49	i	i	i	i	i	i	<186.10	4.5	i	i	i	i	i	III
Sørfjord	2	3	i	32.35	i	5.59	i	i	0.77	i	i	i	i	i	3.41	<0.10	<0.15	<9.72	i	III
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	4.01	0.09	<0.20	11.33	i	II
Sunndalsfjord	2	3	i	i	i	i	i	i	i	i	i	i	<141.55	0.7	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	2	3	i	20	i	2.02	i	i	i	i	i	i	<362.60	27	i	i	i	i	i	IV

I	22
II	14
III	9
IV	1
V	0

Pollution index 2002 (as calculated prior to 2002)

Average of Max E.C is 3.2

Index areaname (Pollution area) 2002	n	N	As ppm d.wt	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	4	4	i	1.27	i	2.7	i	i	0.32	i	i	i	i	i	<0.68	<0.05	<0.10	<2.73	i	i	II
Iddefjord	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Oslofjord	5	5	i	i	i	1.75	i	i	0.1	i	i	i	<68.90	<0.50	1.21	0.06	<0.10	9.74	i	i	II
Frierfjorden	4	4	i	i	i	i	i	i	i	i	i	i	i	i	<0.35	0.49	<78.10	<1.71	i	i	V
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<252.50	6.5	<0.31	0.31	<0.10	<1.49	i	i	III
Saudafjord	2	2	i	9.27	i	2.8	i	i	i	i	i	i	w	21	i	i	i	i	i	i	IV
Sørfjord	2	3	i	98.43	i	16.59	i	i	1.45	i	i	i	i	i	3.37	0.07	<0.21	<2.80	i	i	IV
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	4.28	0.11	<0.23	19.11	i	i	III
Sunndalsfjord	1	3	i	i	i	i	i	i	i	i	i	i	<330.60	2	i	i	i	i	i	i	III
Orkdalsfjord area	0	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	3	4	i	12.69	i	2.15	i	i	i	i	i	i	<112.30	4.1	i	i	i	i	i	i	III

I	20
II	13
III	9
IV	2
V	1

Pollution index 2002-new (with supplementary analyses and stations)

Average of Max E.C is 3.4

Index areaname (Pollution area) 2002	n	N	As ppm d.wt	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	4	4	i	1.27	i	2.7	i	i	0.32	i	i	i	i	i	<0.68	<0.05	<0.10	<2.73	i	i	II
Iddefjord	0	2	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Oslofjord	5	5	i	i	i	1.75	i	i	0.1	i	i	i	<68.90	0.5	1.21	0.06	<0.10	9.74	<0.10	2.59	IV
Frierfjorden	4	4	i	i	i	i	i	i	i	i	i	i	i	i	<0.35	0.49	<78.10	<1.71	16.65	1.37	V
Inner Kristiandsfjord	2	2	i	i	i	i	i	i	i	i	i	i	<252.50	6.5	<0.31	0.31	<0.10	<1.49	<0.48	0.47	III
Saudafjord	2	2	i	9.27	i	2.8	i	i	i	i	i	i	w	21	i	i	i	i	i	i	IV
Sørfjord	2	3	i	98.43	i	16.59	i	i	1.45	i	i	i	i	i	3.37	0.07	<0.21	<2.80	i	i	IV
Byfjorden	3	3	i	i	i	i	i	i	i	i	i	i	i	i	4.28	0.11	<0.23	19.11	i	i	III
Sunndalsfjord	1	3	i	i	i	i	i	i	i	i	i	i	<330.60	2	i	i	i	i	i	i	III
Orkdalsfjord area	0	3	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	miss
Inner Ranfjord	3	4	i	12.69	i	2.15	i	i	i	i	i	i	<112.30	4.1	i	i	i	i	i	i	III

I	21
II	15
III	10
IV	3
V	2

Appendix J6
INDEX - Summary table “Reference Index” 1995-2002

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 1.5

Index areaname (Reference area) **1995**	n	N	As ppm d.wt	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	Max E.C I:V
Mid and outer Oslofjord	3	3	w	1.68	w	1.32	i	w	0.1	w	i	w	w	w	<0.95	0.1	0.4	7.86	i	II
Lista area	2	2	w	0.52	w	1.44	i	w	0.1	w	i	w	<31.60	0.5	<0.34	<0.05	0.38	<1.28	i	I
Bømlo-Sotra area	1	1	w	1.18	w	1.41	i	w	0.1	w	i	w	w	w	<0.46	<0.05	0.31	<1.38	i	I
Outer Ranfjord, Helgeland area	1	2	w	1.12	w	0.96	i	w	0.1	w	i	w	<37.70	<0.50	0.21	<0.05	0.38	<0.90	i	I
Lofoten area	1	2	w	3.12	w	0.69	i	w	0.3	w	i	w	w	w	4.42	0.1	0.15	12.31	i	II
Finnsnes- Skjervøy area	1	1	w	0.9	w	2.95	i	w	0.1	w	i	w	w	w	<0.18	<0.05	0.16	<0.81	i	II
Hammerfest-Honningsvåg area	2	2	w	2.57	w	2.74	i	w	0.1	w	i	w	<129.90	0.7	<0.23	<0.05	<0.15	<1.34	i	II
Varanger peninsula area	3	3	w	2.78	w	1.71	i	w	0.2	w	i	w	<6.90	<0.50	<0.36	<0.05	0.16	<0.88	i	I

I	56
II	8
III	0
IV	0
V	0

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 1.6

Index areaname (Reference area) **1996**	n	N	As ppm d.wt	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	Max E.C I:V
Mid and outer Oslofjord	3	3	7	2.04	w	1.6	i	0.5	0	0.9	i	0.1	w	w	<0.25	<0.05	0.25	13.95	i	II
Lista area	2	2	w	0.67	w	1.22	i	w	0.1	w	i	w	<44.60	<0.50	<0.20	<0.05	0.29	<2.14	i	I
Bømlo-Sotra area	1	1	w	1.51	w	1.14	i	w	0.1	w	i	w	w	w	<0.11	<0.05	<0.14	<0.78	i	I
Outer Ranfjord, Helgeland area	1	2	w	0.9	w	0.78	i	w	0.1	w	i	w	w	w	<0.12	<0.05	0.21	<0.62	i	I
Lofoten area	1	2	w	4.11	w	0.78	i	w	0.3	w	i	w	w	w	<1.15	<0.05	<0.13	8.9	i	II
Finnsnes- Skjervøy area	1	1	w	0.79	w	1.63	i	w	0.1	w	i	w	<24.25	<0.50	<0.05	<0.05	<0.05	<0.40	i	I
Hammerfest-Honningsvåg area	2	2	w	1.66	w	2.72	i	w	0.1	w	i	w	<212.50	0.8	<0.11	<0.05	<0.11	<1.59	i	III
Varanger peninsula area	3	3	w	0.74	w	2.34	i	w	0.1	w	i	w	<21.30	<0.50	<0.14	<0.05	0.14	<0.98	i	II

I	61
II	6
III	1
IV	0
V	0

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 1.3

Index areaname (Reference area) **1997**	n	N	As ppm d.wt	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	Max E.C I:V
Mid and outer Oslofjord	3	3	w	2.17	w	1.84	i	w	0.1	w	i	w	w	w	2.75	0.1	1.16	4.9	i	II
Lista area	2	2	w	1.12	w	1.14	i	w	0.1	w	i	w	<36.70	<0.50	0.58	<0.05	0.53	2.43	i	I
Bømlo-Sotra area	1	1	w	1.37	w	1.01	i	w	0.1	w	i	w	w	w	<0.39	<0.05	0.26	<0.73	i	I
Outer Ranfjord, Helgeland area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Lofoten area	1	2	w	1.54	w	0.85	i	w	0.1	w	i	w	w	w	0.61	<0.05	0.14	<1.57	i	I
Finnsnes- Skjervøy area	1	1	w	0.65	w	1.88	i	w	0.1	w	i	w	w	w	<0.15	<0.05	0.12	<0.40	i	I
Hammerfest-Honningsvåg area	1	2	w	1.15	w	1.51	i	w	0.1	w	i	w	w	w	0.27	<0.05	0.18	<4.49	i	II
Varanger peninsula area	2	3	w	0.81	w	1.59	i	w	0.2	w	i	w	w	w	0.33	0.1	0.13	<1.07	i	I

I	46
II	5
III	0
IV	0
V	0

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 1.4

Index areaname (Reference area) **1998**	n	N	As ppm d.wt	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	Max E.C I:V
Mid and outer Oslofjord	3	3	w	1.57	w	1.14	i	w	0.1	w	i	w	w	w	<1.30	<0.03	<0.52	<2.01	i	I
Lista area	2	2	w	1.28	w	1.31	i	w	0.1	w	i	w	<42.70	<0.50	0.6	<0.03	<0.53	3.58	i	I
Bømlo-Sotra area	1	1	w	1.21	w	0.85	i	w	0.1	w	i	w	w	w	<1.61	<0.03	<0.51	<2.05	i	I
Outer Ranfjord, Helgeland area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Lofoten area	1	2	w	2.36	w	1.58	i	w	0.2	w	i	w	w	w	<2.28	<0.05	<0.20	<1.21	i	II
Finnsnes- Skjervøy area	0	1	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Hammerfest-Honningsvåg area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Varanger peninsula area	1	3	w	2.34	w	2.32	i	w	0.1	w	i	w	w	w	w	w	w	w	i	II

I	31
II	2
III	0
IV	0
V	0

Max(median). Statistics for all areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 1.4

Index areaname (Reference area) **1999**	n	N	As ppm d.wt	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	Max E.C I:V
Mid and outer Oslofjord	3	3	w	1	w	1.53	i	w	0.1	w	i	w	w	w	1.83	<0.05	<0.44	2.88	i	I
Lista area	2	2	w	1.66	w	1.18	i	w	0.1	w	i	w	<68.05	1	<0.67	0.1	<0.40	<2.49	i	II
Bømlo-Sotra area	1	1	w	1.7	w	1.32	i	w	0.1	w	i	w	w	w	<0.54	<0.05	<0.23	<0.93	i	I
Outer Ranfjord, Helgeland area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Lofoten area	1	2	w	1.59	w	2.17	i	w	0.3	w	i	w	w	w	<0.52	<0.06	<0.20	<0.43	i	II
Finnsnes- Skjervøy area	0	1	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Hammerfest-Honningsvåg area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Varanger peninsula area	1	3	w	1.57	w	1.61	i	w	0.1	w	i	w	w	w	<0.47	<0.05	<0.30	<0.90	i	I

I	33
II	4
III	0
IV	0
V	0

Max(median). Statistics for alle areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 1.4

Index areaname (Reference area) **2000**	n	N	As ppm d.wt	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	Max E.C I:V
Mid and outer Oslofjord	3	3	w	0.94	w	1.65	i	w	0.05	w	i	w	w	w	0.77	0.09	0.41	<1.31	i	I
Lista area	2	2	w	2.2	w	1.98	i	w	0.16	w	i	w	<66.40	<0.50	<0.36	0.06	<0.32	<2.20	i	II
Bømlo-Sotra area	1	1	w	1.3	w	2.69	i	w	0.03	w	i	w	w	w	0.51	0.04	0.29	<1.07	i	II
Outer Ranfjord, Helgeland area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Lofoten area	1	2	w	1.49	w	1.68	i	w	0.11	w	i	w	w	w	<0.20	<0.05	<0.19	<0.53	i	I
Finnsnes- Skjervøy area	0	1	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Hammerfest-Honningsvåg area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Varanger peninsula area	1	3	w	1.44	w	1.53	i	w	0.05	w	i	w	w	w	<0.18	<0.05	<0.16	<0.75	i	I

I	35
II	2
III	0
IV	0
V	0

Max(median). Statistics for alle areas: (n = Index-station measured, N = Station programmed for index)

Average of Max E.C is 1.8

Index areaname (Reference area) **2001**	n	N	As ppm d.wt	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	Max E.C I:V
Mid and outer Oslofjord	3	3	w	0.87	w	2.59	i	w	0.05	w	i	w	w	w	1.5	<0.10	<0.32	<1.73	i	II
Lista area	2	2	w	0.96	w	4.4	i	w	0.08	w	i	w	<17.60	<0.50	<0.28	<0.10	<0.15	<2.14	i	II
Bømlo-Sotra area	1	1	w	1.21	w	2.01	i	w	0.05	w	i	w	w	w	<0.45	<0.10	<0.15	<0.66	i	II
Outer Ranfjord, Helgeland area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Lofoten area	1	2	w	1.34	w	2.38	i	w	0.11	w	i	w	w	w	<0.53	<0.10	<0.15	<0.56	i	II
Finnsnes- Skjervøy area	0	1	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Hammerfest-Honningsvåg area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	miss
Varanger peninsula area	1	3	w	1.39	w	1.23	i	w	0.05	w	i	w	w	w	<0.15	<0.10	<0.15	<0.15	i	I

I	33
II	4
III	0
IV	0
V	0

Reference index 2002 (as calculated prior to 2002)

Average of Max E.C is 1.4

Index areaname (Reference area) 2002	n	N	As ppm d.wt	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	3	3	w	1.43	w	1.16	i	w	0.06	w	i	w	w	w	<0.68	<0.05	<0.24	<1.52	i	i	I
Lista area	2	2	w	0.71	w	1.31	i	w	0.05	w	i	w	<23.90	<0.50	<0.34	0.06	<0.22	<5.27	i	i	II
Bømlo-Sotra area	1	1	w	0.88	w	0.98	i	w	0.05	w	i	w	w	w	<0.45	<0.05	<0.10	<0.57	i	i	I
Outer Ranfjord, Helgeland area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	i	miss
Lofoten area	1	2	w	0.89	w	2.13	i	w	0.11	w	i	w	w	w	<0.30	<0.05	<0.10	<0.37	i	i	II
Finnsnes- Skjervøy area	0	1	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	i	miss
Hammerfest-Honningsvåg area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	i	i	miss
Varanger peninsula area	1	3	w	1.8	w	1.41	i	w	0.05	w	i	w	w	w	<0.15	<0.05	<0.10	<0.10	i	i	I

I	35
II	2
III	0
IV	0
V	0

Reference index 2002-new (with supplementary analyses and stations)

Average of Max E.C is 1.6

Index areaname (Reference area) 2002	n	N	As ppm d.wt	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	3	3	w	1.43	w	1.16	i	w	0.06	w	i	w	w	w	<0.68	<0.05	<0.24	<1.52	w	0.08	I
Lista area	2	2	w	0.71	w	1.31	i	w	0.05	w	i	w	<23.90	<0.50	<0.34	0.06	<0.22	<5.27	w	0.12	II
Bømlo-Sotra area	1	1	w	0.88	w	0.98	i	w	0.05	w	i	w	w	w	<0.45	<0.05	<0.10	<0.57	w	0.14	II
Outer Ranfjord, Helgeland area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	w	w	miss
Lofoten area	1	2	w	0.89	w	2.13	i	w	0.11	w	i	w	w	w	<0.30	<0.05	<0.10	<0.37	w	0.11	II
Finnsnes- Skjervøy area	0	1	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	w	w	miss
Hammerfest-Honningsvåg area	0	2	w	w	w	w	i	w	w	w	i	w	w	w	w	w	w	w	w	w	miss
Varanger peninsula area	1	3	w	1.8	w	1.41	i	w	0.05	w	i	w	w	w	<0.15	<0.05	<0.10	<0.10	w	0.01	I

I	37
II	5
III	0
IV	0
V	0

Appendix K
Effects and concentrations of organotin 2002

Table 11. Imposex (VDSI, RPSI) and levels of TBT (µg Sn/kg d.w.) in dogwhelks (*Nucella lapillus*) from outer Oslofjord (st. 36G), Langesundsfjord (71G), southern Norway (76G, 131G), south-west Norway (15G), Haugesund (227G), western Norway (22G) and northern Norway (98G, 11X), in 2002. SH = avg. shell height in mm. (cf. Appendix F, Maps 2-5, 16 and 24).

St.	Area	SH	VDSI	RPSI	TBT	n
36G	Færder	29.5	4.0	0.15	63.4	26
71G	Langesund, Fuglø	24.2	4.1	0.23	140.9	29
76G	Risør, Risø	23.9	3.0	0.02	80.5	30
131G	Mandal, Lastad - Y. Notevikhlm	22.5	3.8	0.03	26.2	26
15G	Farsund, Ullerøya	24.3	3.9	0.07	37.3	28
227G	Melandholmen	28.2	4.5	0.60	182.7	24
22G	Espevær	28.6	4.0	0.30	41.6	29
98G	Husvågen	29.9	3.8	0.03	25.8	25
11x	Brashavn	25.5	0.03	0	5.4	30

Table 12. Levels of TBT (µg Sn/kg d.w.) in bulk samples (n=50) of mussels (*Mytilus edulis*) from inner Oslofjord (301, 30A), outer Oslofjord (36A), Langesundsfjord (71A, 712, 713), Risør (76A), southern Norway (I131, I132), south-west Norway (15A), Haugesund (227A), western Norway (22A), Svolvær, Lofoten (98A) and northern Norway (10A) in 2002. Sh.length = avg. shell length in mm. Class condition for TBT (formula based) on a dry weight basis in the Norwegian classification system for environmental quality. (cf. Table 6) (cf. Appendix F, Maps 1-5, 16 and 24).

St.	Area	Sh. length	TBT	TBT* (ppm)	Class
301	Akershuskaia	42.3	1062.5	2.59	severely polluted
301	Akershuskaia	41.9	1062.5	2.59	severely polluted
30A	Gressholmen	25.7	1044.8	2.54	severely polluted
30A	Gressholmen	36.1	m	m	
30A	Gressholmen	45.0	524.7	1.28	markedly polluted
36A	Færder	34.5	43.3	0.11	moderately polluted
36A	Færder	45.2	24.4	0.06	slightly polluted
712	Gjemesholmen	41.7	526.7	1.29	markedly polluted
712	Gjemesholmen	41.8	459.0	1.12	markedly polluted
713	Strømtangen	33.9	m	m	
713	Strømtangen	33.1	559.7	1.37	markedly polluted
71A	Langesund. Bjørkøy	44.3	287.7	0.70	markedly polluted
76A	Risør. Risø	44.7	37.7	0.09	slightly polluted
I132	Fiskåtangen	40.9	189.0	0.46	moderately polluted
I132	Fiskåtangen	41.5	200.0	0.49	moderately polluted
I131	Lastad	40.4	49.2	0.12	moderately polluted
15A	Farsund. Gåsøy	34.8	51.0	0.12	moderately polluted
15A	Farsund. Gåsøy	41.6	21.7	0.05	slightly polluted
227A	Haugesund	40.6	275.4	0.67	markedly polluted
22A	Espevær	34.1	58.0	0.14	moderately polluted
22A	Espevær	44.3	55.3	0.13	moderately polluted
98A	Husvågen	44.4	48.0	0.12	moderately polluted
98A	Husvågen	43.8	38.8	0.09	slightly polluted
10A	Skallneset	31.5	5.5	0.01	slightly polluted
10A	Skallneset	31.4	4.7	0.01	slightly polluted

*) TBT ppb dw converted to formulation basis ppm dw by a factor of 2.44/1000.

Appendix L
Comparison between ICP-MS and GFAAS

Background and methods
NIVA's laboratory has changed their JAMP analytical method for quantification of copper, zinc, cadmium and lead for quantification of the 2002 samples. Detection/quantification by atomic absorption spectroscopy in flame or graphite oven (GFAAS) has been replaced by Inductive Coupled Plasma – Mass Spectrometry (ICP-MS). To insure that this change does not produce any artefacts in time-trend studies on these contaminants, a parallel analysis on JAMP-samples from 2001 and 2002 was performed. Both blue mussel and cod liver samples (n=58) were analysed. Samples with (expected) high and low concentrations of the elements in question were chosen. In addition samples of certified reference materials (DOLT-2 and DORM-2) were incorporated in the test.

Differences between the concentrations in the JAMP-samples deduced from the two methods were evaluated by the use of paired t-test. A significance level of $\alpha=0.05$ was chosen. To normalise (reduce skewness of) distributions all concentrations were natural log-transformed prior to the paired t-test. In addition, linear regression was performed on the difference between methods vs. average (between methods) concentration, to see whether any differences between the methods changed with the element concentrations in the samples. The results from these tests are discussed below.

Results
There were no significant differences in the ln-transformed concentrations of lead deduced from the two analytical methods (Table 13 and Table 14). However, for copper, zinc and cadmium, ICP-MS gave slightly higher concentrations than GFAAS. More specifically, ICP-MS gave concentrations 4%, 2% and 8%, respectively, higher than the average concentrations (not transformed) deduced from the two methods. In addition a significant linear trend for zinc was observed (Table 15 and Figure 44). As average concentrations decreased, the GFAAS method gave lower concentrations compared to the ICP-MS method. This may be partly explained by the ICP-MS method being a more sensitive method, which also gives better (lower) detection limits.

NIVA's analytical laboratory is accredited by the Norwegian Accreditation as a testing laboratory according to the requirements of NS-EN ISO/IEC 17025 (2000). Analytical standards are also certified by the participation in international calibration tests, including QUASIMEME twice per year. As part of their quality assurance system, the above mentioned certified materials (DOLT-2 and DORM-2) are routinely analysed and a result of ±20% certified value is generally accepted. Apart from a few cases this requirement was fulfilled in the present test (for both methods).

Conclusion
Noting that the no significant difference was found for lead, significant differences for copper, zinc and cadmium were low (1-8%) and for zinc where the only significant linear regression was found, the explained variance (R^2) for the change with concentration was only 0.09, it was not considered that these were sufficiently large to warrant special treatment when assessing data derived from the two methods.

Table 13. Results from ICP-MS and GFAAS intercalibration for cadmium (Cd), lead (Pb), copper (Cu) and zinc (Zn): raw data. Samples are from mussels (*Mytilus edulis* - MYTI EDU) and liver of cod (*Gadus morhua* - GADU MOR) 2001 and 2002. Stations (St.) are shown in maps in Appendix F. In addition the results from analyses of Standard Reference Materials (SRM) DORM-2 (dogfish muscle) for mussels and DOLT-2 (dogfish liver) for cod liver are shown.

Sample	year	St.	Sp/tissue	cm	Cd (µg/g)		Pb (µg/g)		Cu (µg/g)		Zn (µg/g)	
					ICP-MS	GFAAS	ICP-MS	GFAAS	ICP-MS	GFAAS	ICP-MS	GFAAS
2001-2982-2 re	2001	30A	MYTI EDU	3-4	0.19	0.169	0.332	0.35	1.38	1.27	19.07	17.50
2001-2982-5 re	2001	31A	MYTI EDU	3-4	0.365	0.344	0.0924	0.09	1.14	1.11	18.63	16.20
2001-2982-21 re	2001	15A	MYTI EDU	4-5	1.10	1.02	0.155	0.18	2.31	1.98	17.33	16.40
2001-2982-24 re	2001	69A	MYTI EDU	3-5	0.619	0.574	0.574	0.59	1.10	1.03	30.64	28.70
2001-2982-27 re	2001	65A	MYTI EDU	4-5	0.939	0.873	0.621	0.63	1.19	1.05	33.23	32.50
2001-2982-30 re	2001	63A	MYTI EDU	4-5	1.257	1.16	1.03	1.12	0.86	0.77	23.31	22.10
2001-2982-34 re	2001	56A	MYTI EDU	2-3	2.325	2.16	3.95	4.02	1.20	0.99	24.15	22.70
2001-2982-36 re	2001	56A	MYTI EDU	4-5	2.543	2.41	5.65	5.52	1.00	0.87	30.74	29.10
2001-2982-39 re	2001	52A	MYTI EDU	3-4	1.068	1.03	3.08	3.05	0.79	0.66	24.92	23.80
2001-2982-45 re	2001	98A	MYTI EDU	4-5	0.481	0.465	0.213	0.24	1.32	1.05	17.89	17.20
2001-2982-51 re	2001	11A	MYTI EDU	3-4	0.268	0.247	0.395	0.45	1.36	1.01	23.10	22.70
2001-2983-40 re	2001	I205	MYTI EDU	3-5	0.222	0.206	0.853	1.03				
2001-2983-43 re	2001	I051	MYTI EDU	3-5a	1.764	1.53	8.44	8.25				
2001-2983-45 re	2001	I051	MYTI EDU	3-5c	1.813	1.51	9.41	9.61				
2002-269-1 re	2001	53B	GADU MOR, L		9.85	8.97	0.130	0.11	39.21	37.20	64.86	64.50
2002-269-4 re	2001	53B	GADU MOR, L		0.0771	0.074	0.0340	0.04	2.45	2.70	15.84	12.90
2002-269-9 re	2001	53B	GADU MOR, L		3.31	3.02	0.780	0.80	52.38	48.80	46.95	46.70
2002-295-3 re	2001	67B	GADU MOR, L		0.0292	0.028	0.0277	0.04	9.21	8.53	35.14	32.90
2002-295-10 re	2001	67B	GADU MOR, L		0.177	0.169	0.0946	0.09	48.18	53.10	57.84	56.80
2002-295-17 re	2001	67B	GADU MOR, L		0.0497	0.046	0.0923	0.09	9.70	9.41	37.91	36.20
2002-303-17 re	2001	30B	GADU MOR, L		0.196	0.172			16.66	16.00	35.93	34.30
2002-429-2 re	2001	98B	GADU MOR, L		1.75	1.69	0.0652	0.06	8.16	8.16	39.28	39.00
2002-429-8 re	2001	98B	GADU MOR, L		3.85	3.49	0.0908	0.10	10.19	9.86	57.48	56.60
2002-429-14 re	2001	98B	GADU MOR, L		0.684	0.643	0.0451	0.05	6.29	5.62	30.64	30.30
2002-589-2 re	2001	15B	GADU MOR, L		0.0282	0.027			20.54	20.30	39.05	39.50
2002-690-10 re	2001	36B	GADU MOR, L		0.0132	0.014			5.01	5.18	23.78	22.90
2002-690-22 re	2001	36B	GADU MOR, L		0.0131	0.012			1.65	1.51	25.02	26.40
2002-699-2 re	2001	10B	GADU MOR, L		0.101	0.091			4.08	3.71	21.26	20.70
2002-699-21 re	2001	10B	GADU MOR, L		0.333	0.308	0.0530	0.05	8.01	8.12	47.70	48.90
2002-2433-3	2002	65A	MYTI EDU	4-5	0.766	0.667	0.699	0.64	1.34	1.31	36.3	35.9
2002-2433-6	2002	63A	MYTI EDU	4-5	1.09	1.06	1.12	1.15	0.980	1.00	16.5	17.3
2002-2433-10	2002	56A	MYTI EDU	2-3	1.25	1.17	3.53	3.48	1.17	1.19	19.9	20.5
2002-2433-12	2002	56A	MYTI EDU	4-5	2.23	2.18	7.48	8.00	0.984	1.13	27.9	30.3
2002-2433-15	2002	52A	MYTI EDU	4-5	1.06	0.952	5.33	5.15	1.75	1.63	20.7	20.1
2002-2433-21	2002	98A	MYTI EDU	4-5	0.341	0.329	0.151	0.13	1.14	1.14	13.6	13.5
2002-2433-26	2002	11X	MYTI EDU	3-4	0.288	0.277	0.163	0.15	1.38	1.32	19.0	19.7
2002-2504-2	2002	30A	MYTI EDU	3-4	0.228	0.22	0.33	0.31	0.925	1.03	17.0	17.4
2002-2504-5	2002	31A	MYTI EDU	3-4	0.161	0.149	0.223	0.20	0.854	0.93	14.5	14.7
2002-2504-21	2002	15A	MYTI EDU	4-5	0.212	0.208	0.099	0.08	0.959	1.02	17.3	17.7
2002-2504-24	2002	69A	MYTI EDU	4-5	0.478	0.432	0.546	0.52	1.15	1.19	26.9	25.2
2002-2827-11	2002	I205	MYTI EDU	3-5	0.274	0.260	0.896	0.89	0.63	0.67	18.2	18.1
2002-2827-13	2002	I051	MYTI EDU	3-5b	1.47	1.36	9.57	9.89	0.88	0.92	15.5	16.2
2002-2827-14	2002	I051	MYTI EDU	3-5c	2.24	2.10	12.5	13.0	0.89	0.93	17.8	18.2
2003-81-7	2002	53B	GADU MOR, L		0.802	0.719	0.568	0.56	11.6	12.0	30.3	30.4
2003-81-14	2002	53B	GADU MOR, L		0.413	0.451	0.133	0.13	8.50	8.47	36.1	41.8
2003-81-21	2002	53B	GADU MOR, L		0.190	0.208	0.190	0.19	16.0	17.1	48.6	57.9

Sample	year	St.	Sp/tissue	cm	Cd (µg/g)		Pb (µg/g)		Cu (µg/g)		Zn (µg/g)	
					ICP-MS	GFAAS	ICP-MS	GFAAS	ICP-MS	GFAAS	ICP-MS	GFAAS
2003-191-1	2002	67B	GADU MOR, L		0.049	0.045			14.6	14.3	30.0	29.0
2003-191-10	2002	67B	GADU MOR, L		0.014	0.011			8.56	8.22	25.4	22.3
2003-191-25	2002	67B	GADU MOR, L		0.065	0.060	0.070	0.07	7.89	7.18	29.8	30.1
2003-56-11	2002	30B	GADU MOR, L		0.162	0.147	0.195	0.17	10.8	9.67	26.7	23.3
2003-497-3	2002	98B	GADU MOR, L		0.031	0.027			4.91	4.94	15.0	14.2
2003-497-14	2002	98B	GADU MOR, L		0.041	0.033			11.5	10.4	26.4	22.9
2003-497-23	2002	98B	GADU MOR, L		0.017	0.014			6.55	5.98	13.0	11.0
2003-494-6	2002	15B	GADU MOR, L		0.021	0.021			4.04	5.24	23.1	25.3
2003-79-3	2002	36B	GADU MOR, L		0.021	0.017			4.63	4.38	24.2	23.5
2003-79-11	2002	36B	GADU MOR, L		0.074	0.072			9.05	8.53	34.4	35.1
2003-492-15	2002	10B	GADU MOR, L		0.0590	0.053			3.43	3.59	17.0	18.0
2003-492-19	2002	10B	GADU MOR, L		0.054	0.046			2.97	2.91	18.1	17.3
DORM-2 20020207					0.050	0.05	0.0984	0.063	3.37	2.85	28.79	23.90
DORM-2 20020214					0.050	0.048	0.0507	0.058	2.25	1.86	28.02	25.10
DORM-2 20020215					0.048	0.046	0.0618	0.065	2.39	1.88	27.41	24.20
DORM-2 20020301					0.047	0.044	0.0457	0.101	2.24		28.85	
DOLT-2 20020313					21.7	21.1	0.185	0.18	27.74	26.30	100.41	95.10
DOLT-2 20020404					21.8	21.3	0.190	0.22	27.90	26.00	99.21	96.30
DOLT-2 20020409					22.0	20.8	0.221	0.19	28.78	28.00	100.40	95.90
DOLT-2 20020515					21.5	21.1	0.185	0.18	27.68	25.60	97.62	96.60
DOLT-2 20020516					21.8	20	0.306	0.27	27.91	25.10	99.84	100.60
DOLT-2 20020530					21.8	19.9	3.25	3.17	27.64	26.70	103.86	100.70
DOLT-2 20020604					21.9	20.8	0.254	0.21	28.27	22.90	101.03	101.40
DORM 20030124					0.047	0.034	0.048	0.018	2.00	2.19	26.0	24.6
DORM 20030212					0.044	0.037	0.049	0.020	2.17	2.23	24.8	25.1
DOLT 20030212					19.5	21.6	0.239	0.20	28.1	25.3	89.7	92.9
DOLT 20030129					20.5		0.222	0.17	26.6	28.1	94.7	93.7

Table 14. Results from ICP-MS and GFAAS intercalibration for cadmium (Cd), lead (Pb), copper (Cu) and zinc (Zn): paired-t analyses on ln-transformed data (cf. Table 13).

Cd (ln-transformed data)	**Cd** (ln-transformed data)		**Pb** (ln-transformed data)	
	ICP-MS	*GFAAS*	*ICP-MS*	*GFAAS*
Mean	-1.293960443	-1.37125571	-0.78932	-0.782776581
Variance	2.829144652	2.86190308	3.032877	3.032786817
Observations	58	58	43	43
Pearson Correlation	0.999345524		0.998227	
Hypothesized Mean Difference	0		0	
df	57		42	
t Stat	9.52575302		-0.41354	
P(T<=t) one-tail	1.0818E-13		0.340658	
t Critical one-tail	1.672028702		1.681951	
P(T<=t) two-tail	**2.1636E-13**		**0.6813**	
t Critical two-tail	2.002466317		2.018082	

	Cu (ln-transformed data)		**Zn** (ln-transformed data)	
	ICP-MS	*GFAAS*	*ICP-MS*	*GFAAS*
Mean	1.219957545	1.18960056	3.239869	3.220344433
Variance	1.452496751	1.47108864	0.155676	0.172223281
Observations	55	55	55	55
Pearson Correlation	0.996912904		0.986582	
Hypothesized Mean Difference	0		0	
df	54		54	
t Stat	2.362075081		2.087388	
P(T<=t) one-tail	0.010903846		0.020793	
t Critical one-tail	1.673565748		1.673566	
P(T<=t) two-tail	**0.02180769**		**0.0416**	
t Critical two-tail	2.004881026		2.004881	

Table 15. Results from ICP-MS and GFAAS intercalibration for zinc (Zn): linear regression analyses for difference against average concentration (on ln-transformed data). No significant regression was found for cadmium, copper or lead. (cf. Table 13).

Regression Statistics	
Multiple R	0.29564159
R Square	**0.087404**
Adjusted R Square	0.07018516
Standard Error	0.38900445
Observations	55

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.768134862	0.768135	5.076079	**0.0284215**
Residual	53	8.020196304	0.151324		
Total	54	8.788331166			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	3.2636762	0.054528496	59.85267	2.4E-50	3.154305935	3.37304646
difference	-1.71933005	0.763123943	-2.25302	**0.0284**	-3.249962115	-0.188698

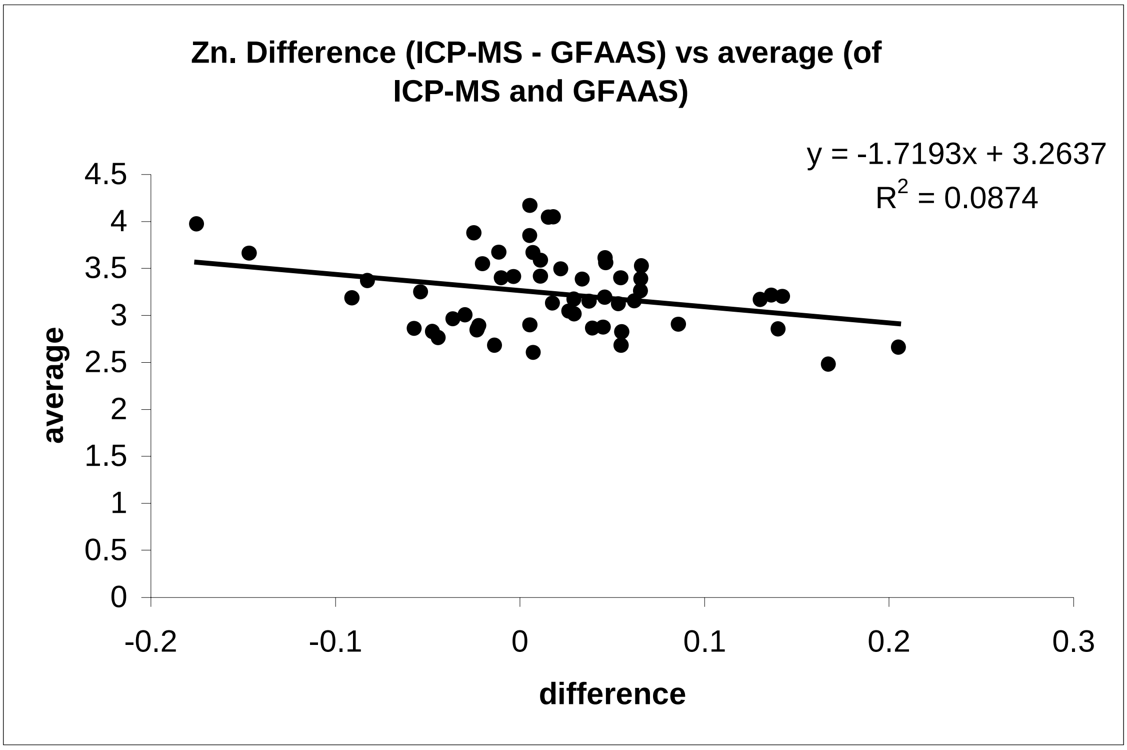


Figure 44. Results from ICP-MS and GFAAS intercalibration for zinc (Zn): linear regression analyses for difference against average concentration (on ln-transformed data). No significant regression was found for cadmium, copper or lead. (cf. Table 13 and Table 15).