

Norwegian State Pollution Monitoring Programme
Long-term monitoring of environmental quality in
Norwegian coastal waters

Report: 861/02

TA-number: 1918/2002

ISBN-number: 82-577-4259-7

Client: Norwegian Pollution Control Authority (SFT)

Executor: Norwegian Institute for Water Research (NIVA)

- Contaminant data for sediments
- 1986-1997

Report
861/02

NIVA report no. 4599-2002

Norwegian Institute for Water Research

REPORT

Main Office

P.O. Box 173, Kjelsås
N-0411 Oslo
Norway
Phone (47) 22 18 51 00
Telefax (47) 22 18 52 00

Regional Office, Sørlandet

Televeien 1
N-4890 Grimstad
Norway
Phone (47) 37 29 50 55
Telefax (47) 37 04 45 13

Regional Office, Østlandet

Sandvikaveien 41
N-2312 Ottestad
Norway
Phone (47) 62 57 64 00
Telefax (47) 62 57 66 53

Regional Office, Vestlandet

Nordnesboder 5
N-5008 Bergen
Norway
Phone (47) 55 30 22 50
Telefax (47) 55 30 22 51

Akvaplan-NIVA A/S

Søndre Tollbugate 3
N-9000 Tromsø
Norway
Phone (47) 77 68 52 80
Telefax (47) 77 68 05 09

Title Joint Assessment and Monitoring Programme (JAMP). Contaminant data for sediments 1986-1997 (Norwegian State Pollution Monitoring Programme Report no. 861/02. TA-no. 1918/2002)	Serial No. 4599-2002	Date 25.12.2002
	Report No. Sub-No. O-80106	Pages Price 230
Author(s) Norman W. Green Gunnar Severinsen Åse Kristine Rogne	Topic group Marine ecology	Distribution
	Geographical area Oslofjord to Varangerfjord	Printed NIVA

Client(s) Norwegian Pollution Control Authority (SFT)	Client ref.
--	-------------

Abstract

This report is a compilation of data on contaminant concentrations in sediment used in the Norwegian contribution to the Joint Assessment and Monitoring Programme (JAMP) and concerns mainly selected metals, organochlorines, polycyclic aromatic hydrocarbons that were collected during the period 1986-1997

4 keywords, Norwegian 1. Miljøgifter 2. Sedimenter 3. Marin 4. Norge	4 keywords, English 1. Contaminants 2. Sediments 3. Marine 4. Norway
--	--



Norman W. Green

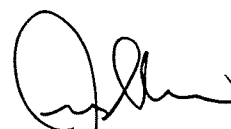
Project manager



Kristoffer Næs

Research manager

ISBN 82-577-4259-7



Jens Skei

Research director

Norwegian State Pollution Monitoring Programme
Long-term monitoring of environmental quality in
Norwegian coastal waters

Report: 861/02

TA-number: 1918/2002

ISBN-number: 82-577-4259-7

Client: Norwegian Pollution Control Authority (SFT)

Executor: Norwegian Institute for Water Research (NIVA)

- Contaminant data for sediments
- 1986-1997

Report
861/02

NIVA report no. 4599-2002

Norwegian Institute for Water Research

REPORT

Main Office

P.O. Box 173, Kjelsås
N-0411 Oslo
Norway
Phone (47) 22 18 51 00
Telefax (47) 22 18 52 00

Regional Office, Sørlandet

Televeien 1
N-4890 Grimstad
Norway
Phone (47) 37 29 50 55
Telefax (47) 37 04 45 13

Regional Office, Østlandet

Sandvikaveien 41
N-2312 Ottestad
Norway
Phone (47) 62 57 64 00
Telefax (47) 62 57 66 53

Regional Office, Vestlandet

Nordnesboder 5
N-5008 Bergen
Norway
Phone (47) 55 30 22 50
Telefax (47) 55 30 22 51

Akvaplan-NIVA A/S

Søndre Tollbugate 3
N-9000 Tromsø
Norway
Phone (47) 77 68 52 80
Telefax (47) 77 68 05 09

Title Joint Assessment and Monitoring Programme (JAMP). Contaminant data for sediments 1986-1997 (Norwegian State Pollution Monitoring Programme Report no. 861/02. TA-no. 1918/2002)	Serial No. 4599-2002	Date 25.12.2002
	Report No. Sub-No. O-80106	Pages Price 230
Author(s) Norman W. Green Gunnar Severinsen Åse Kristine Rogne	Topic group Marine ecology	Distribution
	Geographical area Oslofjord to Varangerfjord	Printed NIVA

Client(s) Norwegian Pollution Control Authority (SFT)	Client ref.
--	-------------

Abstract This report is a compilation of data on contaminant concentrations in sediment used in the Norwegian contribution to the Joint Assessment and Monitoring Programme (JAMP) and concerns mainly selected metals, organochlorines, polycyclic aromatic hydrocarbons that were collected during the period 1986-1997
--

4 keywords, Norwegian 1. Miljøgifter 2. Sedimenter 3. Marin 4. Norge	4 keywords, English 1. Contaminants 2. Sediments 3. Marine 4. Norway
--	--

Norman W. Green
Project manager

Kristoffer Næs
Research manager
ISBN 82-577-4259-7

Jens Skei
Research director

Norwegian Institute for Water Research

O-80106

**JOINT ASSESSMENT AND MONITORING PROGRAMME (JAMP)
CONTAMINANT DATA FOR SEDIMENTS 1986-1997**

Oslo, 25 December 2002

Project co-ordinator: Norman W. Green

Foreword

This report presents the Norwegian data for contaminants in sediment 1986-1997 compiled 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).

The Norwegian JMP was carried out by the Norwegian Institute for Water Research (NIVA) by contract from the Norwegian Pollution Control Authority (SFT, NIVA contract 80106). Institute for Marine Research (IMR), Norwegian Institute for Air Research (NILU) and FORCE Institutes (Denmark) have also contributed.

The Norwegian contribution to the JAMP was initiated by SFT in 1981 as part of the national monitoring programme. Three main areas have been investigated: the Oslofjord and adjacent areas (Hvaler-Singlefjord area and Langesundsford, 1981-), Sørffjord/Hardangerfjord (1983-84, 1987-) and Orkdalsfjord area (1984-89, 1991-93, 1995-96).

The report is one of four in a series of data reports:

- 1. Contaminant data for sediments 1986-1997
SFT report no.861/02, NIVA report no. 4599-2002*
- 2. Contaminant data for shellfish 1998-2001,
SFT report no.862/02, NIVA report no. 4600-2002*
- 3. Contaminant data for fish 1998-2001
SFT report no. 863/02, NIVA report no. 4601-2002*
- 4. Summary statistics for contaminants in shellfish and fish 1981-2001
SFT report no. 864/02, NIVA report no. 4602-2002*

Because of their similarity, appendices A, B, C (biota only), D (biota only) and E concerning abbreviations, analyses, station positions and maps are the same for all four reports.

Thanks are due to my colleagues at NIVA, IMR, NILU and FORCE institutes for helping to compile this data. These have been credited earlier in JAMP data reports and the annual JAMP National Comments.

Oslo, 25 December 2002

Project co-ordinator Norman W. Green

Contents

1. Background and aims	1
2. Sampling	1
3. Analyses	1
4. Comment on quality assurance and detection limit	2
5. References	3
Appendix A. Abbreviations	5
Appendix B. Participation in intercalibration exercises	23
Appendix C. Analytical overview	15
Appendix D. Overview of localities and samples 1986-1997	27
Appendix E. Map of stations	31
Appendix F. SEDIMENT 1986-1997 RAW DATA	47
Appendix G. SEDIMENT 1986-1997 MEAN CONCENRATIONS	143

1. Background and aims

The Oslo and Paris commissions were established in the seventies with the aim to protect the marine environment against anthropogenic contamination. The Oslo commission focuses on problems relating to dumping at sea in the Northeast Atlantic and Baltic areas. The Paris commission focuses on discharges from land based sources. Together, the commission (Oslo and Paris Commission - OSPAR), govern the "Joint Assessment and Monitoring Programme" (JAMP). JAMP commenced in 1995 as a continuation of the "Joint Monitoring Programme" (JMP). It receives guidance from the "International Council for the Exploration of the Sea" (ICES). Norway and other European countries, which are members of OSPAR have committed themselves to protection of the marine environment of the North East Atlantic for preventing and elimination pollution, protecting human health and ensuring sound and healthy marine ecosystems (OSPAR 1998).

The Norwegian contribution to JAMP focuses on two JAMP areas: Oslofjord-area (including the Hvaler area, Singlefjord and Langesundsfjord) and the Sjørfjord/Hardangerfjord area. Orkdalsfjord, a third JAMP area, was discontinued after 1996. During 1990-95 Norway has also included other areas, mostly remote from point sources of pollution, along the coast from the Swedish border in the South to the Russian border in the North. This was in connection with the Norwegian contribution to the investigation of the North Sea (*North Sea Task Force (NSTF) Monitoring Master Plan (MMP)*) in 1990 when JAMP expanded to cover the area from Oslofjorden og Bergen. The programme has since also included areas farther north. In 1992 and 1994 contaminants in marine sediments were investigated from Bergen to Varangerfjorden.

An overview of the analytical methods (1981-2001) has been presented (Green *et al.* 2001a). The raw data has been presented for sediment 1986-1992 (Green & Klungsøyr 1994; Green & Rønningen 1995). Part of the results have been previously evaluated, for 1986-1994 (Green *et al.* 1995), 1996-1997 (Green *et al.* 2000) and 1990-1997 (Green *et al.* 2001b). The results have also been incorporated in European JMG regional assessments of sediment (JMG 1993).

2. Sampling

Investigations of sediment have followed the OSPAR guidelines (1990, 1997) as far as practical. The results presented are for the total fraction of the sediment (<2000µm) and are not normalised because agreement on this issue within OSPAR has not been reached.

3. Analyses

JAMP (OSPAR 1990) agreed that the concentration of at least cadmium, copper, mercury, lead, zinc and polychlorinated hydrocarbons should be monitored in sediment. In these investigations many other contaminants have also been quantified. A complete list of variables, as well as other abbreviations, used is given in by Appendix A.

An overview of the contaminants and associated analytical method codes is shown in Appendix B. A brief description of the analytical methods is given by Green *et al.* (2001a). The Institute for Marine Research was responsible for all organic analyses of sediments collected in 1990. All sediment age determinations were done by FORCE institutes (DK). Arsenic analyses were done by SINTEF-SI. The remainder of analyses were performed at the Norwegian Institute for Water Research (NIVA).

4. Comment on quality assurance and detection limit

Analytical labs have been routinely involved in international and national intercalibration exercises for quality assurance (QA), including QUASIMEME since 1994 (cf. Appendix C.). In addition the laboratories have (more regularly in recent years) analysed standard reference material in connection with analyses of the samples used in monitoring. The results of intercalibration exercises and analyses of the standard reference material is discussed in part in the annual National Comments (cf. Green *et al.*2002).

The detection limits are approximations based on 3 times the standard deviation of the 'blank' or near zero concentration of a solution. Day-to-day variations in the analytical instrument may lead to minor variation in detection limits.

5. Comment on presentation of results

An overview of the samples collected is shown in Appendix D. Appendix F. Special attention should be paid to notes and comments preceding each Appendix.

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

6. References

Titles translated to English in square brackets [] are not official.

- Ahlborg, U.G., 1989. Nordic risk assessment of PCDDs and PCDFs. *Chemosphere* 19:603-608.
- 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., 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.
- Green, N.W., Klungsøyr, J., 1994. Norwegian 1990 sediment data for the North Sea Task Force (NSTF) and the Joint Monitoring Group (JMG). A joint report by Norwegian Institute for Water Research (NIVA) and Institute of Marine Research (IMR). NIVA project O-80106 (report number 3110), 17 pp + Annexes. ISBN-82-577-2585-4
- Green, N.W., Rønningen, A., 1995. Contaminants in sediment 1986-92. The Joint Monitoring Programme (JMP) NIVA samples. Norwegian biota data. Norwegian Pollution Control Authority, Monitoring report no. 599/95 TA no. 1180/1995. NIVA project O-80106/, (report number 3192), 97 pp.. ISBN number 82-577-2679-6.
- Green, N.W., Knutzen, J., Helland, A., Brevik, E.M., 1995. Overvåking av miljøgifter i sedimenter og organismer 1981-92. "Joint Monitoring Programme (JMP)". [Monitoring of contaminants in sediment and organisms 1981-92 "Joint Assessment and Monitoring Programme (JMP)".] Norwegian Pollution Control Authority, Monitoring report no. 593/95. Norwegian Institute for Water Research project 80106, report number 3184, 195 pp.. ISBN-82-577-2676-1.
- Green, N.W., Bjerkeng, B., Helland, A., Hylland, K., Knutzen, J., Walday, M., 2000. Joint Assessment and Monitoring Programme (JAMP) National Comments regarding the Norwegian Data for 1998 and supplementary investigations on cod (1996) and sediment (1996-1997). Norwegian Pollution Control Authority, Monitoring report no. 788/00 TA no. 1702/2000. Norwegian Institute for Water Research project 80106, report number 4171-2000, 206 pp.. ISBN number 82-577-3787-9. (Also presented as SIME 2000 document 00/3/6).
- Green, N.W., Følsvik, N., Oredalen, T.J., Prestbakmo, G., 2001a. Joint Assessment and Monitoring Programme (JAMP). Overview of analytical methods 1981-2000. SFT Statlig overvåkingsprogram rapport nr. 822/01, TA nr. 1800/2001. NIVA, rapport nr. 4353-2001, 68 s. ISBN nr. 82-577-3989-8.
- Green, N.W., Helland, A., Hylland, K., Knutzen, J., Walday, M., 2001b. Joint Assessment and Monitoring Programme (JAMP). Overvåking av miljøgifter i marine sedimenter og organismer 1981-1999. [Monitoring of contaminants in marine sediment and organisms 1981-1999] Norwegian Pollution Control Authority (SFT) no. 819/01, TA no. 1797/2001. NIVA, report no. 4358-2001, 191 pp. ISBN no. 82-577-3995-2.
- Green, N.W., Hylland, K., Ruus, A., Walday, M., 2002. Joint Assessment and Monitoring Programme (JAMP). National Comments regarding the Norwegian Data for 2000. Norwegian Pollution Control Authority, Monitoring report no. 842/02 TA no. 1854/2002. Norwegian Institute for Water Research project 80106, report number 4468-2002, 197 pp.. ISBN number 82-577-4115-9. (Also presentert som SIME 2002 document 02/2/info. 2).
- IARC (International Agency for Research on Cancer), 1987. Monographs on the evaluation of carcinogenic risks to humans. Overall evaluation of carcinogenicity: An updating of IARC Monographs volumes 1 to 42. Suppl. 7. Lyons, 440 pp.
- OSPAR, 1990. Oslo and Paris Conventions. Principles and methodology of the Joint Monitoring Programme. [Monitoring manual for participants of the Joint Monitoring Programme (JMP) and North Sea Monitoring Master Plan (NSMMP)]. March 1990.
- OSPAR, 1997. JAMP Guidelines. Oslo and Paris Commissions, Joint Assessment and Monitoring Programme (including chapter updates 1998-1999).
- OSPAR, 1998. JAMP [Joint Assessment and Monitoring Programme] Guidelines for Contaminant-specific Biological Effects Monitoring (version 23.2.98) Oslo and Paris Commissions 38 pp.
- 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 Health Perspect.* 106:775-792.

Appendix A. Abbreviations

Abbreviation¹	English	Norwegian
ELEMENTS		
Al	aluminium	<i>aluminium</i>
As	arsenic	<i>arsen</i>
Cd	cadmium	<i>kadmium</i>
Co	cobalt	<i>kobolt</i>
Cr	chromium	<i>krom</i>
Cu	copper	<i>kobber</i>
Fe	iron	<i>jern</i>
Hg	mercury	<i>kvikksølv</i>
Li	lithium	<i>litium</i>
Mn	manganese	<i>mangan</i>
Ni	nickel	<i>nikkel</i>
Pb	lead	<i>bly</i>
Pb210	lead-210	<i>bly-210</i>
Se	selenium	<i>selen</i>
Ti	titanium	<i>titan</i>
Zn	zinc	<i>sink</i>
PAHs		
PAH	polycyclic aromatic hydrocarbons	<i>polysykliske aromatiske hydrokarboner</i>
ACNE	acenaphthene	<i>acenaften</i>
ACNLE	acenaphthylene	<i>acenaftülen</i>
ANT	anthracene	<i>antracen</i>
BAA³	benzo[a]anthracene	<i>benzo[a]antracen</i>
BAP³	benzo[a]pyrene	<i>benzo[a]pyren</i>
BBF³	benzo[b]fluoranthene	<i>benzo[b]fluoranten</i>
BBJKF³	benzo[b,j,k]fluoranthene	<i>benzo[b,j,k]fluoranten</i>
BBJKF³	benzo[b+j,k]fluoranthene	<i>benzo[b+j,k]fluoranten</i>
BBKF³	benzo[b+k]fluoranthene	<i>benzo[b+k]fluoranten</i>
BEP	benzo[e]pyrene	<i>benzo[e]pyren</i>
BGHIP	benzo[ghi]perylene	<i>benzo[ghi]perylen</i>
BIPN²	biphenyl	<i>bifenyl</i>
BJKF³	benzo[j,k]fluoranthene	<i>benzo[j,k]fluorantren</i>
BKF³	benzo[k]fluoranthene	<i>benzo[k]fluorantren</i>
CHR	chrysene	<i>chrysen</i>
CHRTR	chrysene+triphenylene	<i>chrysen+trifenylen</i>
COR	coronene	<i>coronen</i>
DBAHA³	dibenz[a,h]anthracene	<i>dibenz[a,h]antracen</i>
DBA3A³	dibenz[a,c/a,h]anthracene	<i>dibenz[a,c/a,h]antracen</i>
DBP³	dibenzopyrenes	<i>dibenzopyren</i>
DBT	dibenzothiophene	<i>dibenzothiofen</i>
DBTC1	C ₁ -dibenzothiophenes	<i>C₁-dibenzotiofen</i>
DBTC2	C ₂ -dibenzothiophenes	<i>C₂-dibenzotiofen</i>
DBTC3	C ₃ -dibenzothiophenes	<i>C₃-dibenzotiofen</i>
FLE	fluorene	<i>fluoren</i>
FLU	fluoranthene	<i>fluoranten</i>

Abbreviation ¹	English	Norwegian
PAHs (cont.)		
ICDP ³	indeno[1,2,3-cd]pyrene	<i>indeno[1,2,3-cd]pyren</i>
NAP ²	naphthalene	<i>naftalen</i>
NAPC1 ²	C ₁ -naphthalenes	<i>C₁-naftalen</i>
NAPC2 ²	C ₂ -naphthalenes	<i>C₂-naftalen</i>
NAPC3 ²	C ₃ -naphthalenes	<i>C₃-naftalen</i>
NAP1M ²	1-methylnaphthalene	<i>1-metylnaftalen</i>
NAP2M ²	2-methylnaphthalene	<i>2-metylnaftalen</i>
NAPD2 ²	1,6-dimethylnaphthalene	<i>1,6-dimetylnaftalen</i>
NAPD3 ²	1,5-dimethylnaphthalene	<i>1,5-dimetylnaftalen</i>
NAPDI ²	2,6-dimethylnaphthalene	<i>2,6-dimetylnaftalen</i>
NAPT2 ²	2,3,6-trimethylnaphthalene	<i>2,3,6-trimetylnaftalen</i>
NAPT3 ²	1,2,4-trimethylnaphthalene	<i>1,2,4-trimetylnaftalen</i>
NAPT4 ²	1,2,3-trimethylnaphthalene	<i>1,2,3-trimetylnaftalen</i>
NAPTM ²	2,3,5-trimethylnaphthalene	<i>2,3,5-trimetylnaftalen</i>
NPD	Collective term for naphthalenes, phenanthrenes and dibenzothiophenes	<i>Samlebetegnelse for naftalen, fenantren og dibenzotiofens</i>
PA	phenanthrene	<i>fenantren</i>
PAC1	C ₁ -phenanthrenes	<i>C₁-fenantren</i>
PAC2	C ₂ -phenanthrenes	<i>C₂-fenantren</i>
PAM1	1-methylphenanthrene	<i>1-metylfenantren</i>
PAM2	2-methylphenanthrene	<i>2-metylfenantren</i>
PADM1	3,6-dimethylphenanthrene	<i>3,6-dimetylfenantren</i>
PADM2	9,10-dimethylphenanthrene	<i>9,10-dimetylfenantren</i>
PER	perylene	<i>perylen</i>
PYR	pyrene	<i>pyren</i>
DI-Σn	sum of "n" dicyclic "PAH"s (footnote 2)	<i>sum "n" disykliske "PAH" (fotnote 2)</i>
P-Σn	sum "n" PAH	<i>sum "n" PAH</i>
PK-Σn	sum carcinogen PAH's (footnote 3)	<i>sum kreftfremkallende PAH (fotnote 3)</i>
PAHΣΣ	DI-Σn + P-Σn etc.	<i>DI-Σn + P-Σn mm..</i>
SPAH	"total" PAH, specific compounds not quantified (outdated analytical method)	<i>"total" PAH, spesifikke forbindelser ikke kvantifisert (foreldet metode)</i>
BAP_P	% BAP av PAHΣΣ	<i>% BAP av PAHΣΣ</i>
BAPPP	% BAP of P-Σn	<i>% BAP av P-Σn</i>
BPK_P	% BAP of PK-Σn	<i>% BAP av PK-Σn</i>
PKn_P	% PK-Σn av PAHΣΣ	<i>% PK-Σn av PAHΣΣ</i>
PKnPP	% PK-Σn av P-Σn	<i>% PK-Σn av P-Σn</i>

Abbreviations (cont'd.)

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

Abbreviations (cont'd.)

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

Abbreviations (cont'd.)

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

Abbreviations (cont'd.)

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

- 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 PCB's and "dioxins" (ICES pers. comm.)
 - 2) Indicates "PAH" compounds that are dicyclic and not truly PAH's 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 ie., those that lack Cl in positions 1, 1', 5, and 5'
- *) The Pesticide Index, second edition. The Royal Society of Chemistry, 1991.

Other abbreviations andre forkortelser

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

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

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

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

Appendix B. Analytical overview

Sorted by:

- Contaminant, year, laboratory, intercalibration

Abbreviations are defined in Appendix A. and Appendix C.

Contamin.	Contaminant defined in Appendix A.
Mon. Year	Monitoring year
Lab.	Analytical laboratory (cf. Appendix A.)
Intercalibr. +basis	Intercalibration exercise (cf. Appendix C.) 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.

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
ACNE	1992-NIVA		D		369	~1	23	23
	1994-NIVA		D		369	1	24	23
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
ACNLE	1992-NIVA		D		369	~1	23	23
	1994-NIVA		D		369	1	24	23
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
AL	1987-NIVA		D		352	~0.001	28	
	1990-NIVA		D		352	~0.001	128	
ALD	1990-IMRN		D		760	~0.05	14	14
ANT	1990-IMRN		D		769	~1	14	14
	1992-NIVA		D		369	~1	24	24
	1994-NIVA		D		369	1	24	22
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
AS	1994-NIVA		D		354	500	12	
BAP	1990-IMRN		D		769	~1	14	14
	1992-NIVA		D		369	~1	23	23
	1994-NIVA		D		369	1	24	12
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
BBF	1992-NIVA		D		369	~1	23	23
	1994-NIVA		D		369	1	24	9
BBJKF	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
BBKF	1990-IMRN		D		769	~1	14	14
BEP	1990-IMRN		D		769	~1	14	14
	1992-NIVA		D		369	~1	23	23
	1994-NIVA		D		369	1	24	8
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
BGHIP	1990-IMRN		D		769	~1	14	14
	1992-NIVA		D		369	~1	24	24
	1994-NIVA		D		369	1	24	9
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
BIPN	1992-NIVA		D		369	~1	23	23
	1994-NIVA		D		369	1	24	21
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
BJKF	1992-NIVA		D		369	~1	14	14
	1994-NIVA		D		369	1	24	11
BAA	1990-IMRN		D		769	~1	14	14
	1992-NIVA		D		369	~1	24	24
	1994-NIVA		D		369	1	24	11
	1996-NIVA		D		369	1	10	
	1997-NIVA		D		369	1	18	
CB101	1990-IMRN	8B	D		760	~0.05	14	14
	1992-NIVA	8C	D		360	~0.05	24	24
	1994-NIVA	8Z	D		360	0.05	24	12
	1996-NIVA		D		360	0.2	10	
	1997-NIVA		D		360	0.2	18	
CB105	1990-IMRN		D		760	~0.05	14	14
	1992-NIVA	8C	D		360	~0.05	24	24
	1994-NIVA	8Z	D		360	0.05	24	24
	1996-NIVA		D		360	0.2	10	24

JAMP contaminants for sediments 1986-1997 - Norway

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1997-NIVA		D	360	0.2	18		
CB118	1990-IMRN	8B	D	760	~0.05	14	14	
	1992-NIVA	8C	D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		13
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	17		
CB128	1990-IMRN		D	760	~0.05	14	14	
CB138	1990-IMRN	8B	D	760	~0.05	14	14	
	1992-NIVA	8C	D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		12
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB149	1990-IMRN		D	760	~0.05	14	14	
CB153	1990-IMRN	8B	D	760	~0.05	14	14	
	1992-NIVA	8C	D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		12
	1996-NIVA		D	360	0.05	10		
	1997-NIVA		D	360	0.05	18		
CB156	1990-IMRN		D	760	~0.05	14	14	
	1992-NIVA		D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		22
	1996-NIVA		D	360	0.2	10	1	
	1997-NIVA		D	360	0.2	18	2	
CB170	1990-IMRN		D	760	~0.05	14	14	
CB180	1990-IMRN	8B	D	760	~0.05	14	14	
	1992-NIVA	8C	D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		13
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB209	1992-NIVA	8C	D	360	~0.05	24	24	
	1994-NIVA	8C	D	360	0.05	24		12
	1996-NIVA		D	360	0.2	10	1	
	1997-NIVA		D	360	0.2	18	1	
CB28	1990-IMRN	8B	D	760	~0.05	14	14	
	1992-NIVA	8C	D	360	~0.05	23	23	
	1994-NIVA	8Z	D	360	0.05	24		2
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CB31	1990-IMRN	8B	D	760	~0.05	14	14	
CB52	1990-IMRN	8B	D	760	~0.05	14	14	
	1992-NIVA	8C	D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		2
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
CD	1986-NIVA	7C	D	352	~0.001	24	24	
	1987-NIVA	7C	D	352	~0.001	25	25	
	1990-NIVA		D	353	~0.001	14	14	
	1990-NIVA	7E	D	353	~0.001	114	114	
	1992-NIVA	7E	D	353	~0.001	107	107	
	1994-NIVA	7Z	D	353	1	114		
	1996-NIVA		D	353	200	23	22	
	1997-NIVA		D	353	200	27	15	
CHR	1990-IMRN		D	769	~1	14	14	
	1992-NIVA		D	369	~1	24	24	
CHRTR	1994-NIVA		D	369	0.5	24		
	1996-NIVA		D	369	0.5	10		
	1997-NIVA		D	369	0.5	18		
COR	1992-NIVA		D	369	~1	24	24	

JAMP contaminants for sediments 1986-1997 - Norway

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (< above d.lim)
CORG	1986-NIVA		D	390	~1	18	18	
	1987-NIVA		D	390	~1	28	28	
	1990-NIVA		D	390	~0.2	128	128	
	1992-NIVA		D	390	~0.2	107	107	
	1994-NIVA		D	390	200000	114		
	1996-NIVA		D	390	200000	23		
	1997-NIVA		D	390	200000	27		
CR	1994-NIVA	7Z	D	353	5	12		
CTOT	1994-NIVA		D	390	1000000	12		
	1996-NIVA		D	390	1000000	23		
	1997-NIVA		D	390	1000000	27		
CU	1986-NIVA	7C	D	351	~0.01	24	24	
	1987-NIVA	7C	D	351	~0.01	28	28	
	1990-NIVA	7E	D	351	~0.01	128	128	
	1992-NIVA	7E	D	351	~0.01	107	107	
	1994-NIVA	7Z	D	351	10	114		
	1996-NIVA		D	351	10	23		
	1997-NIVA		D	351	10	27		
DBA3A	1992-NIVA		D	369	~1	24	24	
	1994-NIVA		D	369	1	23	11	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
DBAHA	1990-IMRN		D	769	~1	14	14	
DBP	1992-NIVA		D	369	~1	24	24	
DBT	1990-IMRN		D	769	~1	14	14	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
DBTC1	1990-IMRN		D	769	~1	14	14	
DBTC2	1990-IMRN		D	769	~1	14	14	
DBTC3	1990-IMRN		D	769	~1	14	14	
DDEOP	1990-IMRN		D	760	~0.05	14	14	
DDEPP	1990-IMRN		D	760	~0.05	14	14	
	1992-NIVA		D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		12
	1996-NIVA		D	360	0.05	10		
	1997-NIVA		D	360	0.05	18		
DDTOP	1990-IMRN		D	760	~0.05	14	14	
DDTPP	1990-IMRN		D	760	~0.05	14	14	
	1996-NIVA		D	999	0.7	10		5
	1997-NIVA		D	999	0.7	18		3
FLE	1990-IMRN		D	769	~1	14	14	
	1992-NIVA		D	369	~1	24	24	
	1994-NIVA		D	369	1	24	23	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
FLU	1990-IMRN		D	769	~1	14	14	
	1992-NIVA		D	369	~1	24	24	
	1994-NIVA		D	369	1	24	10	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
GSAMT	1996-NIVA		D	miss	miss	31		
	1996-VKID		D	miss	miss	35		
	1997-NIVA		D	miss	miss	45		
	1997-VKID		D	miss	miss	47		
HCB	1990-IMRN		D	760	~0.05	14	14	
	1992-NIVA		D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		10
	1996-NIVA		D	360	0.1	10		

JAMP contaminants for sediments 1986-1997 - Norway

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (<) above d.lim
	1997-NIVA		D	360	0.1	18		
HCHA	1990-IMRN		D	760	~0.05	14	14	
	1992-NIVA		D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		23
	1996-NIVA		D	360	0.2	10	2	
	1997-NIVA		D	360	0.2	18	1	
HCHB	1990-IMRN		D	760	~0.05	14	14	
HCHG	1990-IMRN		D	760	~0.05	14	14	
	1992-NIVA		D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		15
	1996-NIVA		D	360	0.2	10	1	
	1997-NIVA		D	360	0.2	18	1	
HG	1986-NIVA	7C	D	350	~0.01	24	24	
	1987-NIVA	7C	D	350	~0.01	28	28	
	1990-NIVA	7E	D	350	~0.01	128	128	
	1992-NIVA	7E	D	350	~0.01	107	107	
	1994-NIVA	7Z	D	350	10	114	2	
	1996-NIVA		D	350	10	23		
	1997-NIVA		D	350	10	27		
ICDP	1990-IMRN		D	769	~1	14	14	
	1992-NIVA		D	369	~1	24	24	
	1994-NIVA		D	369	1	24	12	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
LI	1990-NIVA	7E	D	353	~0.001	14	14	
	1992-NIVA	7E	D	353	~0.001	107	107	
	1994-NIVA	7E	D	353	1	114		
	1996-NIVA		D	353	1	23		
	1997-NIVA		D	353	1	27		
MOCON	1994-NIVA		D	340	~1	62		
	1996-NIVA		D	340	~1	31		
	1996-VKID		D	340	~1	35		
	1997-VKID		D	340	~1	47		
NAP	1990-IMRN		D	769	~1	14	14	
	1992-NIVA		D	369	~1	23	23	
	1994-NIVA		D	369	1	24	18	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAP1M	1992-NIVA		D	369	~1	23	23	
	1994-NIVA		D	369	1	24	19	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAP2M	1992-NIVA		D	369	~1	23	23	
	1994-NIVA		D	369	1	24	17	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPC1	1990-IMRN		D	769	~1	14	14	
NAPC2	1990-IMRN		D	769	~1	14	14	
NAPC3	1990-IMRN		D	769	~1	14	14	
NAPD2	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPD3	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPDI	1992-NIVA		D	369	~1	23	23	
	1994-NIVA		D	369	1	24	18	
	1996-NIVA		D	369	1	10		
	1997-NIVA		D	369	1	18		
NAPT2	1996-NIVA		D	369	1	10		

JAMP contaminants for sediments 1986-1997 - Norway

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (< above d.lim)
	1997-NIVA		D	369		1	18	
NAPT3	1996-NIVA		D	369		1	10	
	1997-NIVA		D	369		1	18	
NAPT4	1996-NIVA		D	369		1	10	
	1997-NIVA		D	369		1	18	
NAPTM	1992-NIVA		D	369		~1	23	23
	1994-NIVA		D	369		1	24	24
	1996-NIVA		D	369		1	10	
	1997-NIVA		D	369		1	18	
NI	1994-NIVA	7Z	D	353		50	12	
NTOT	1994-NIVA		D	390	1000000		114	
	1996-NIVA		D	390	1000000		23	
	1997-NIVA		D	390	1000000		27	
OCS	1992-NIVA		D	360	~0.05		24	24
	1994-NIVA		D	360	0.05		24	24
	1996-NIVA		D	360	0.1		10	
	1997-NIVA		D	360	0.1		18	1
PA	1990-IMRN		D	769	~1		14	14
	1992-NIVA		D	369	~1		24	24
	1994-NIVA		D	369	1		24	11
	1996-NIVA		D	369	1		10	
	1997-NIVA		D	369	1		18	
PAC1	1990-IMRN		D	769	~1		14	14
PAC2	1990-IMRN		D	769	~1		14	14
PAM1	1992-NIVA		D	369	~1		24	24
	1994-NIVA		D	369	1		24	17
	1996-NIVA		D	369	1		10	
	1997-NIVA		D	369	1		18	
PAM2	1996-NIVA		D	369	1		10	
	1997-NIVA		D	369	1		18	
PAMD1	1996-NIVA		D	369	1		10	
	1997-NIVA		D	369	1		18	
PAMD2	1996-NIVA		D	369	1		10	
	1997-NIVA		D	369	1		18	
PB	1986-NIVA	7C	D	352	~0.05		24	24
	1987-NIVA	7C	D	352	~0.05		28	28
	1990-NIVA		D	353	~0.05		14	14
	1990-NIVA	7E	D	353	~0.001		114	108
	1992-NIVA	7E	D	353	~0.001		107	107
	1994-NIVA	7Z	D	353	1		114	
	1996-NIVA		D	353	1		23	
	1997-NIVA		D	353	1		27	
PB210	1990-VKID		D	650	~1		70	26
	1992-VKID		D	650	~1		56	15
	1994-VKID		D	650	~1		62	25
	1996-VKID		D	650	~1		11	
	1997-VKID		D	650	~1		21	3
PER	1990-IMRN		D	769	~1		14	14
	1992-NIVA		D	369	~1		23	23
	1994-NIVA		D	369	1		24	3
	1996-NIVA		D	369	1		10	
	1997-NIVA		D	369	1		18	
PYR	1990-IMRN		D	769	~1		14	14
	1992-NIVA		D	369	~1		24	24
	1994-NIVA		D	369	1		24	12
	1996-NIVA		D	369	1		10	
	1997-NIVA		D	369	1		18	
QCB	1992-NIVA		D	360	~0.05		24	24

Contamin.	Mon. Year	Lab.	Inter-calibr. +basis	Analys method code	Detect limit (ppb)	Total value count	Count below d.lim	N (< above d.lim)
	1994-NIVA		D	360	0.05	24		22
	1996-NIVA		D	360	0.05	10		
	1997-NIVA		D	360	0.05	18		
SPA	1990-IMRN		D	769	~1	14	14	
TDEOP	1990-IMRN		D	760	~0.05	14	14	
TDEPP	1990-IMRN		D	760	~0.05	14	14	
	1992-NIVA		D	360	~0.05	24	24	
	1994-NIVA	8Z	D	360	0.05	24		21
	1996-NIVA		D	360	0.2	10		
	1997-NIVA		D	360	0.2	18		
ZN	1986-NIVA	7C	D	351	~0.1	24	24	
	1987-NIVA	7C	D	351	~0.1	28	28	
	1990-NIVA	7E	D	351	~0.01	128	128	
	1992-NIVA	7E	D	351	~0.1	107	107	
	1994-NIVA	7Z	D	351	100	114		
	1996-NIVA		D	351	100	23		
	1997-NIVA		D	351	100	27		
Sum of counts						8030	3986	260

~ > converting to ppb ignored, due to missing unit

Appendix C.

Participation in intercalibration exercises

Participation in intercalibration exercises

General: The main contributor to JAMP has been NIVA which has participated in nearly all QUASIMEME exercises relevant to the parameter and tissues monitored since 1994. The following lists other exercises.

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, VETN and SIIF 1986 (PCB (all labs), DDE, OCS, HCB and DCB (NACE and VETN)).

Appendix D.

Overview of localities and sample counts 1986-1997

Station positions are shown on maps in Appendix E. .

jmpco: JAMP area code (J99 = unclassified)

jmpst: station code (sorted geographically along the coast
from the Oslofjorden (in the south) to Varangerfjord
(Russian border))

stnam: station code

Lon: Longitude

Lat: Latitude

icear: ICES area

STATIONS AND SAMPLE COUNT FOR SEDIMENT

jmpco	jmpst	stnam	Lat	Lon	icear	1986	1987	1990	1992	1994	1996	1997
J26	30S	Steilene	59° 49.10'	10° 33.80'	48G05	8		34			5	
J26	35S	Holmestrand-Mølen	59° 28.96'	10° 31.74'	47G04	6					5	
J26	35S	Holmestrand-Mølen	59° 30.0'	10° 35.70'	48G06	2		3				
J26	36S	Færder area	59° 1.55'	10° 32.99'	47G06	6						
J26	36S	Færder area	59° 0.40'	10° 41.60'	47G09	2		40				
J26	36S	Færder area	59° 2.50'	10° 46.60'	47G09						56	
J99	77S	Arendal area	58° 24.20'	9° 1.80'	45F91			43				29
J99	15S	Lista area	58° 1.0'	6° 34.30'	45F66			32				5
J99	22S	Bømlo area	59° 25.90'	4° 50.20'	47F47			29				5
J99	24S	Sotra	60° 15.10'	4° 33.30'	49F45			3				
J99	27S	Stadtlandet (east of)	62° 9.30'	5° 21.30'	53F56				30			
J63	52S	Tyssedal	60° 6.90'	6° 32.90'	49F66			3				5
J63	56S	Kvalnes	60° 13.70'	6° 35.60'	49F65			29				5
J63	57S	Krossanes	60° 23.10'	6° 40.70'	49F67			3				5
J62	63S	Ranaskjær	60° 23.60'	6° 27.10'	49F64			3				5
J62	67S	Strandebarm	60° 13.50'	6° 5.10'	49F62			28				28
J62	69S	Kvinnheradsfjorden	60° 1.30'	5° 56.10'	49F59			3				5
J65	82S	Flakk	63° 27.5'	10° 11.8'	55G01		8					
J65	84S	Trossavika	63° 21.70'	9° 57.40'	55F97		8		3			
J65	89S	Thamshavn	63° 19.8'	9° 52.5'	55F98		4		3			
J65	90S	Outer Orkdalsfjord	63° 27.40'	10° 3.0'	55G01		8		30			
J99	93S	Raudøya (northeast of)	64° 22.70'	10° 27.80'	57G04				30			
J99	95S	Rodø (east of)	66° 41.80'	13° 9.90'	62G32				31			
J99	98S	Skrova (south of)	68° 7.0'	14° 41.0'	65G49				30			
J99	99S	Lundøy (north of)	68° 5.80'	15° 10.10'	65G53				30			
J99	41S	Vågsfjorden	68° 56.25'	17° 5.24'	66G71					34		
J99	42S	Malangen	69° 30.38'	18° 6.77'	68G83					3		
J99	43S	Kvænangen	70° 3.31'	21° 7.94'	69H13					34		
J99	44S	Sørøysund	70° 25.91'	22° 31.83'	69H24					3		
J99	45S	Revsbotn	70° 42.86'	24° 26.65'	70H45					34		
J99	46S	Porsangerfjorden	70° 52.93'	26° 11.89'	70H61					28		
J99	47S	Laksfjord	70° 54.96'	26° 55.11'	70H67					3		
J99	48S	Tanafjord	70° 52.54'	28° 38.53'	70H84					33		
J99	49S	Syltefjord	70° 33.94'	30° 19.91'	70J03					3		
J99	10S	Varangfjorden	69° 56.7'	30° 6.70'	68J01					29		

Appendix E. Map of stations

**Station positions 1986-1997
(cf. Appendix D.)**

Appendix E. (cont.) Map of stations

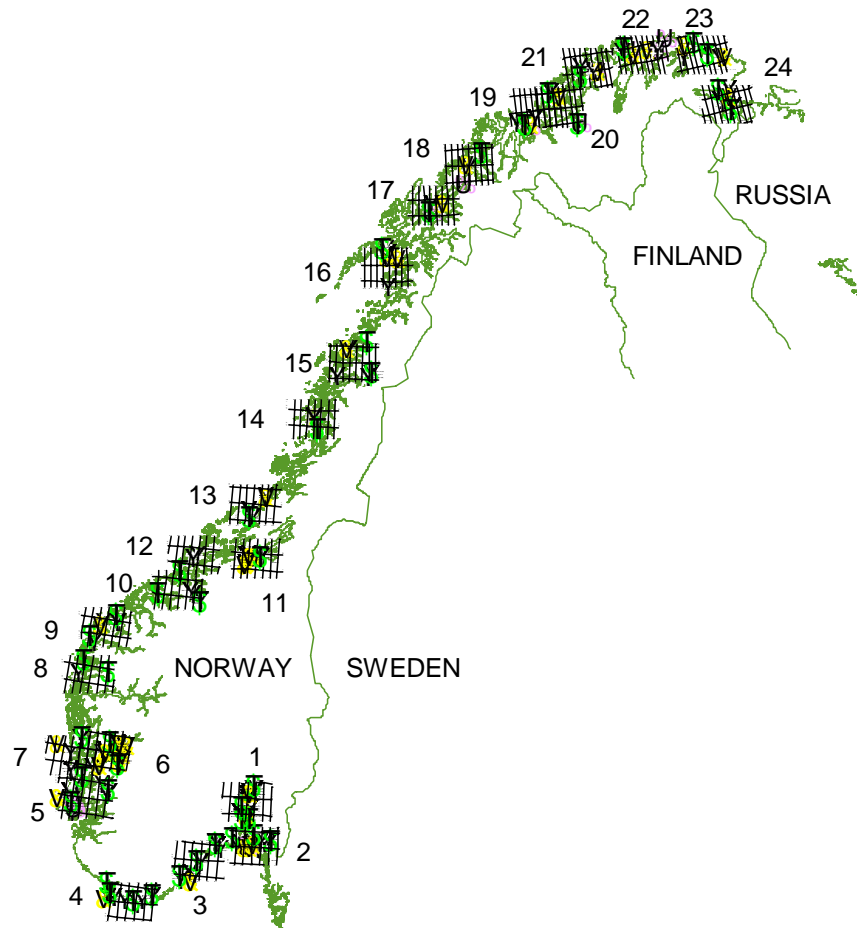
NOTES

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 Sjørfjord). Hence, the same station name may appear more than once on a map.

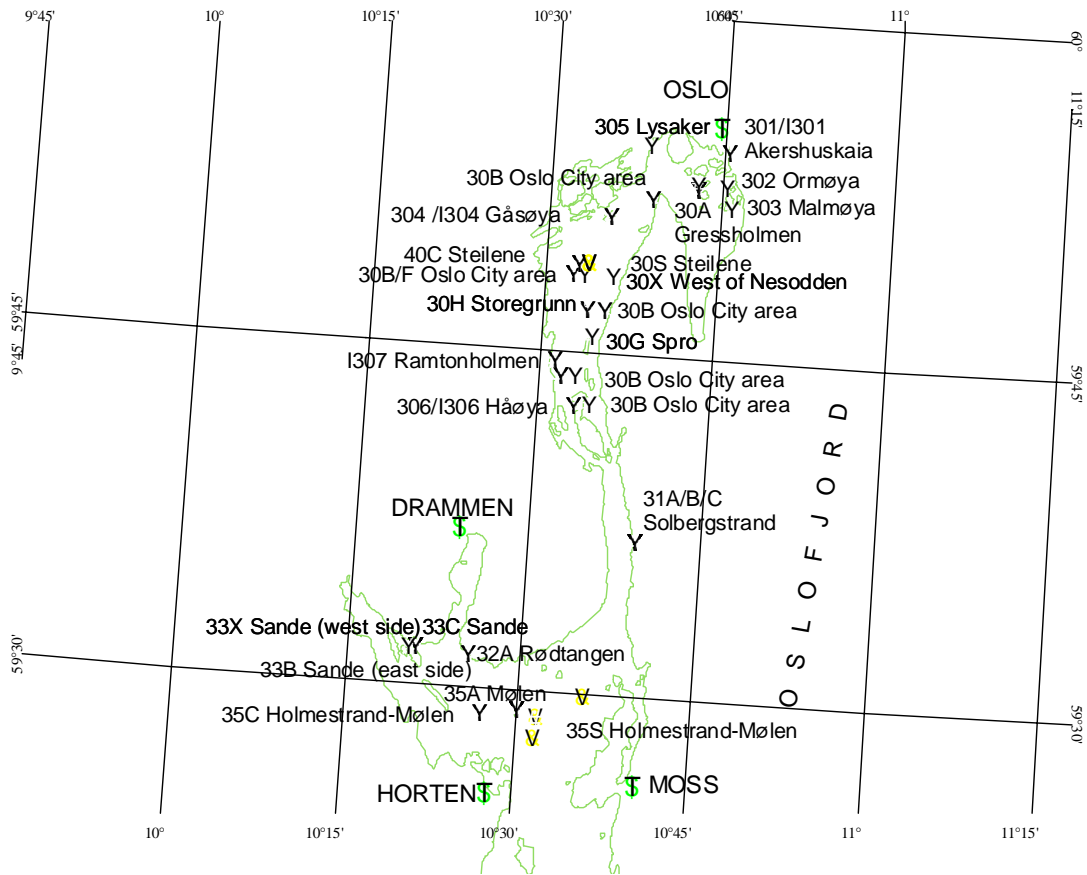
The letter A following the station identification number indicates that blue mussels were sampled. The letter B indicates sampling for cod and the letter F indicates sampling for flatfish. This system for fish is not consistent for some older stations (30, 33, 52 and 67) where only the letter B is used 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. A square and pentagon symbol indicates the position for sampling dog whelks or sediment, respectively.

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.* 2002).

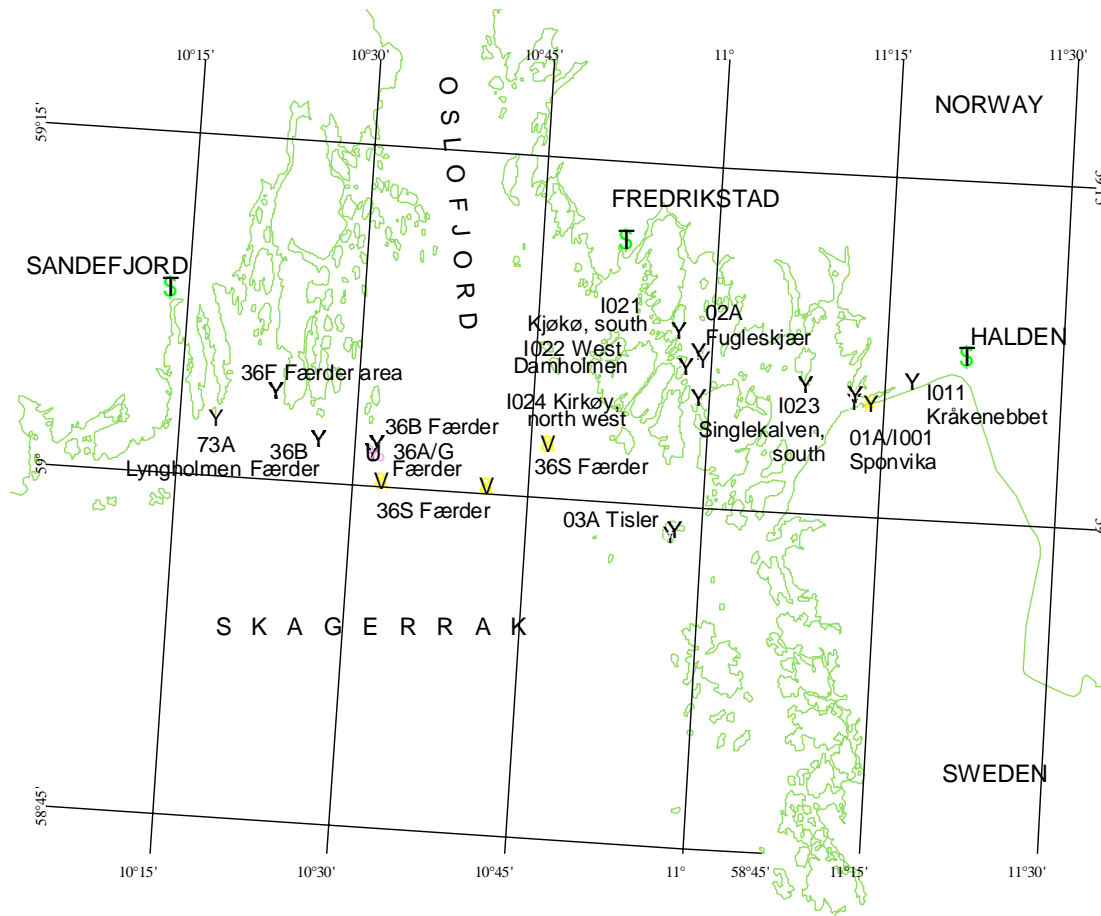
The maps are generated using ArcView GIS version 3.3.



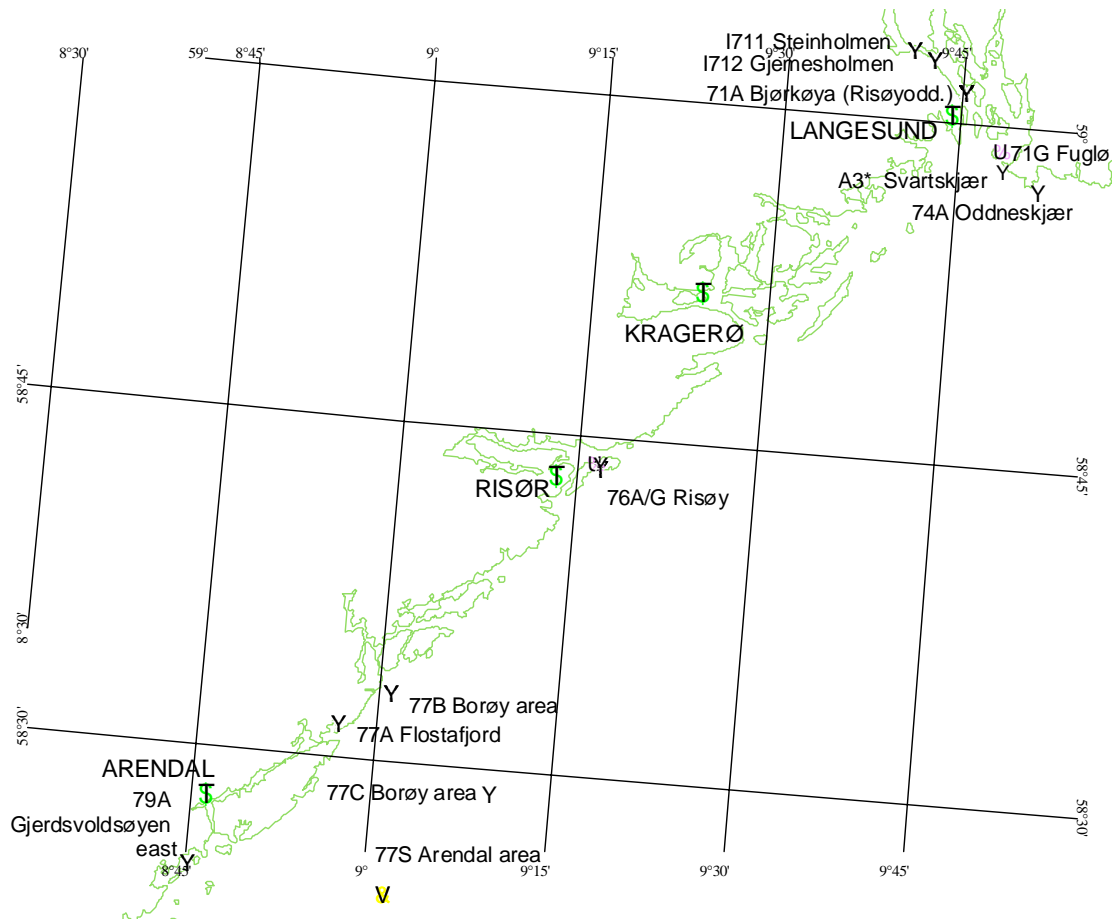
JAMP stations Norway. Numbers indicate map reference.



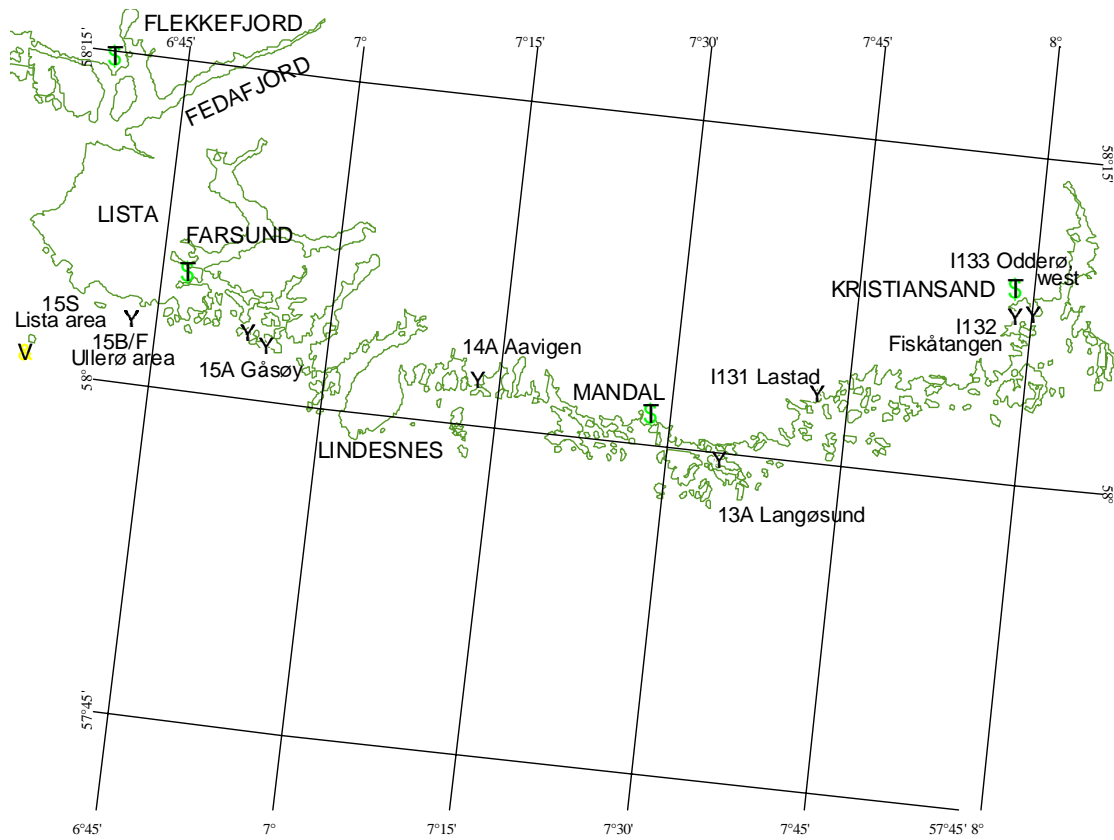
MAP 1



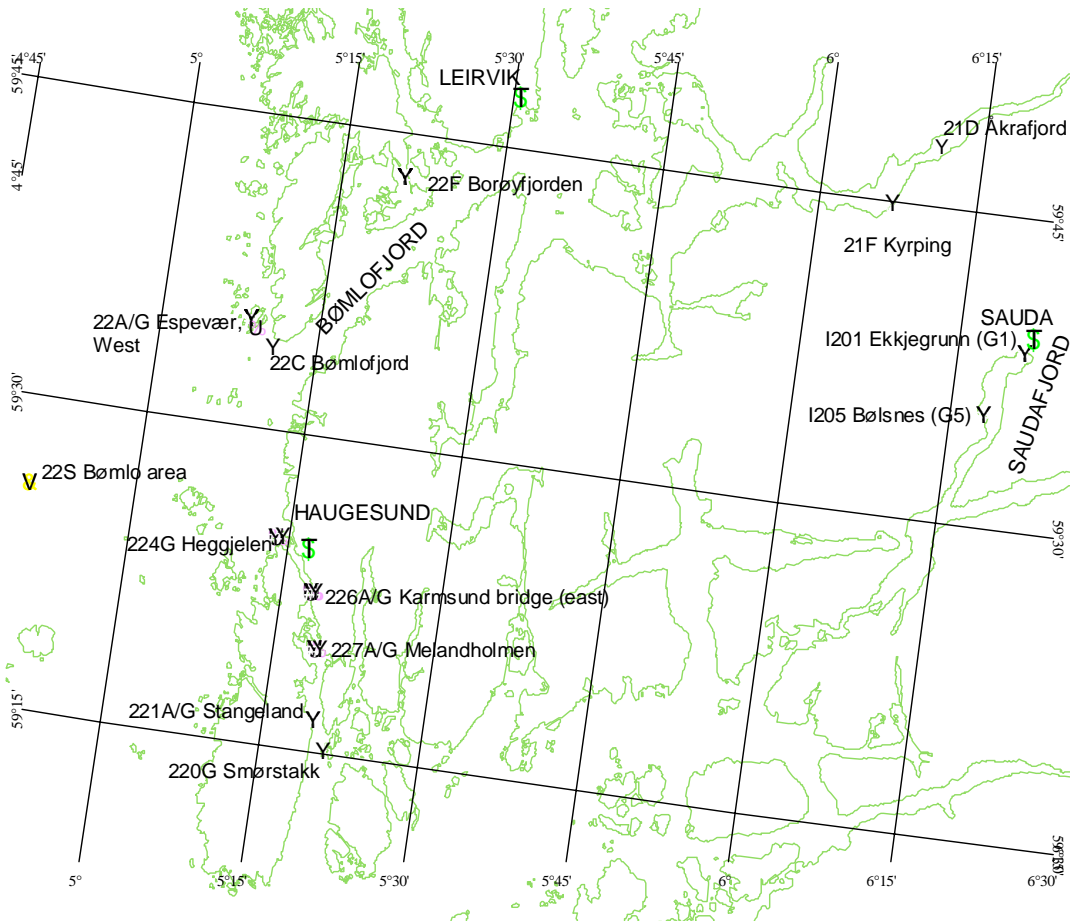
MAP 2



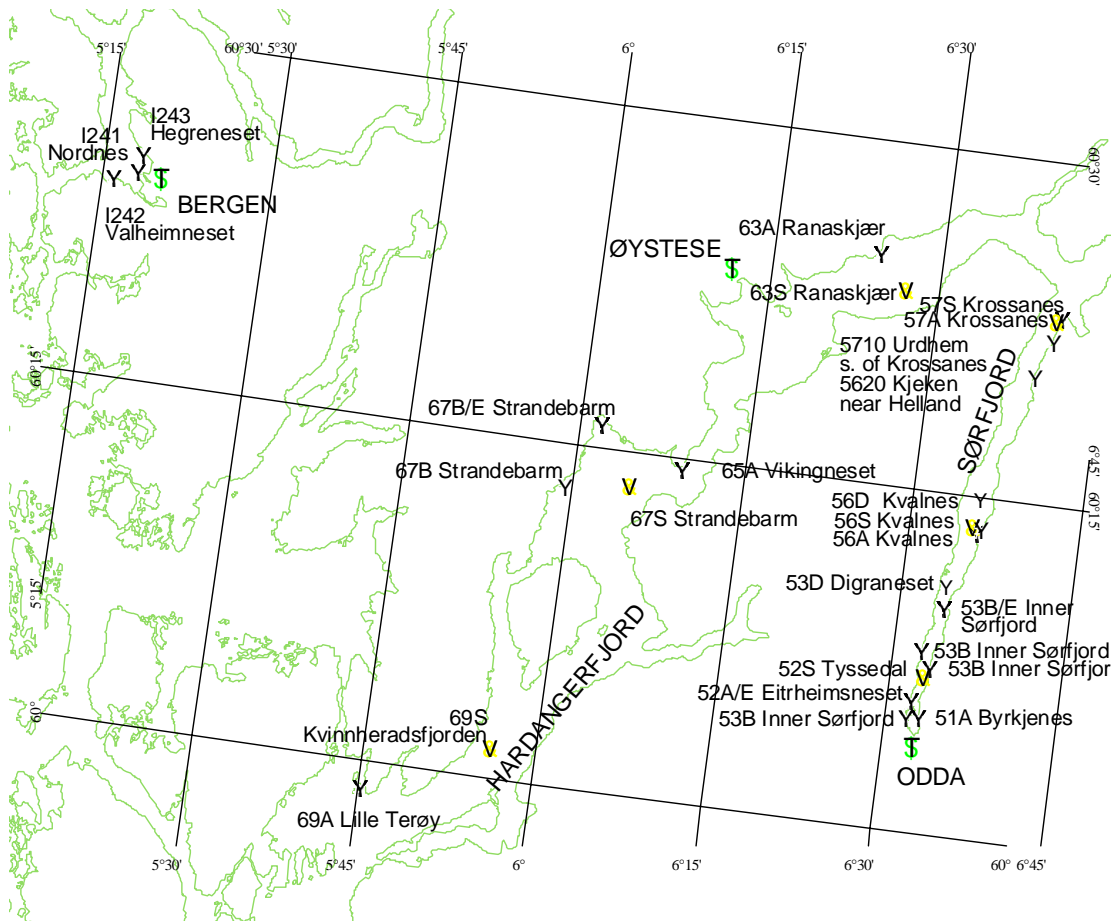
MAP 3



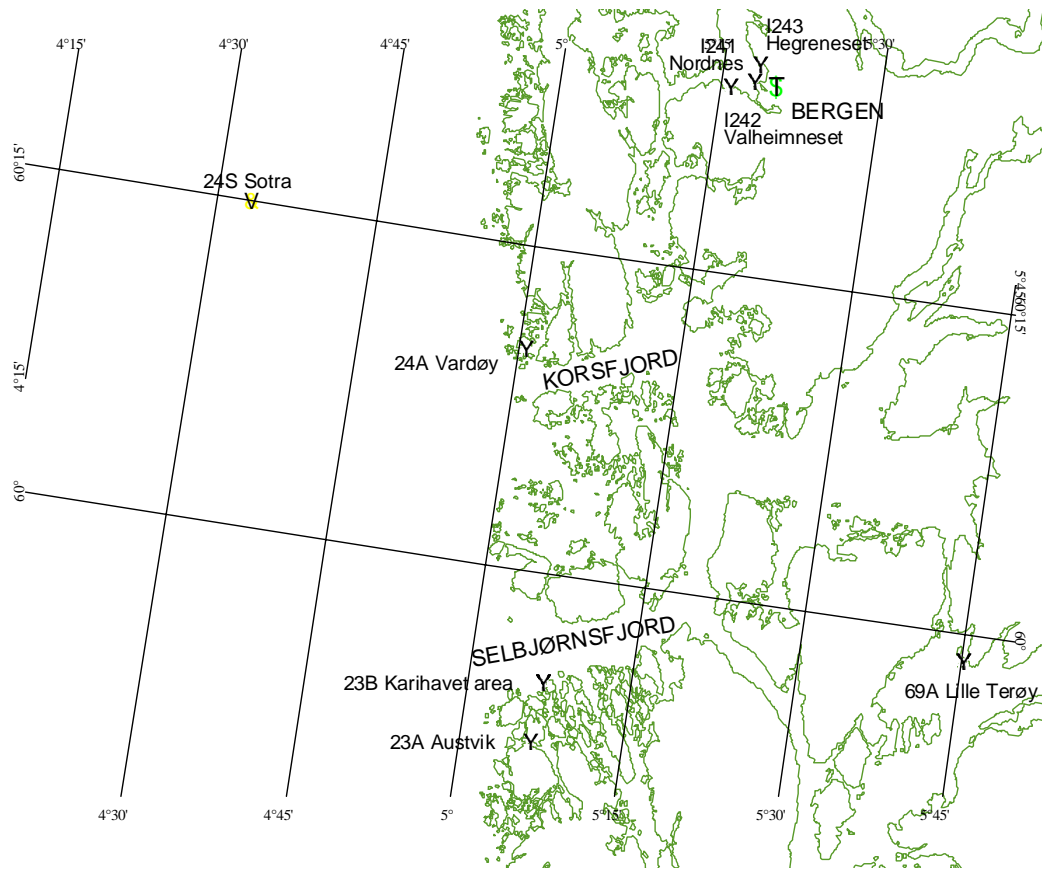
MAP 4



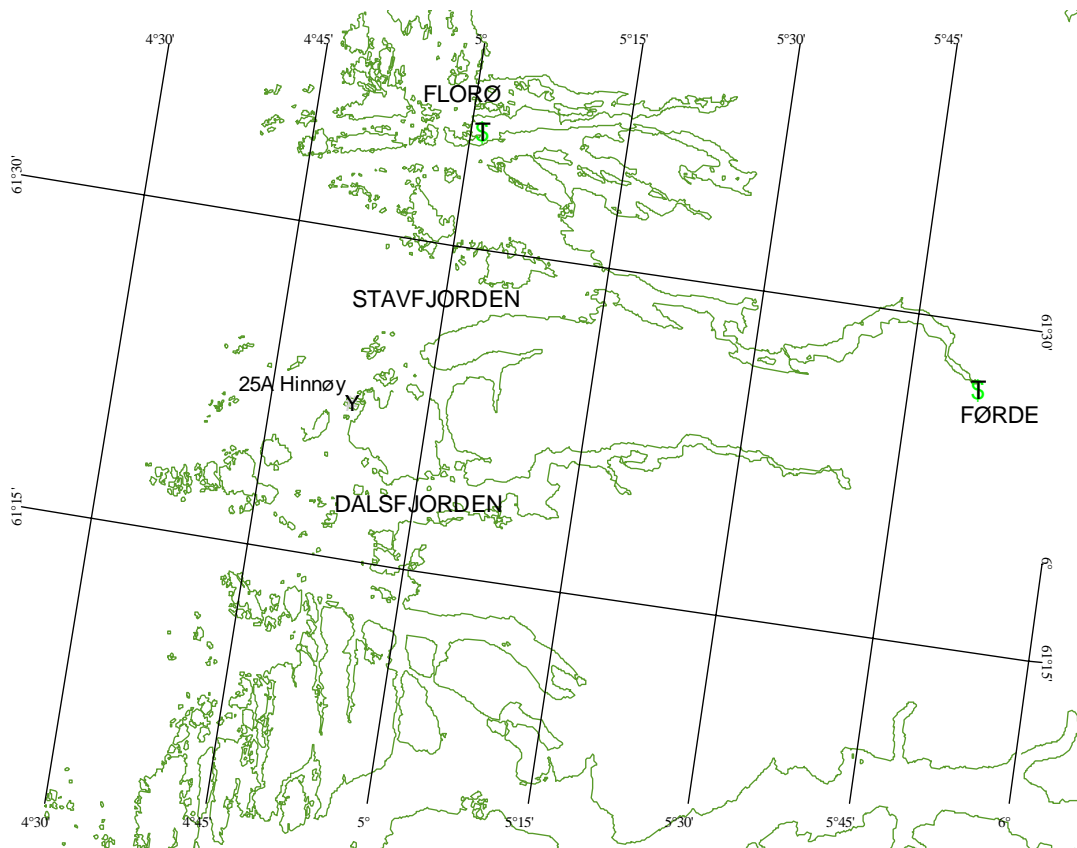
MAP 5



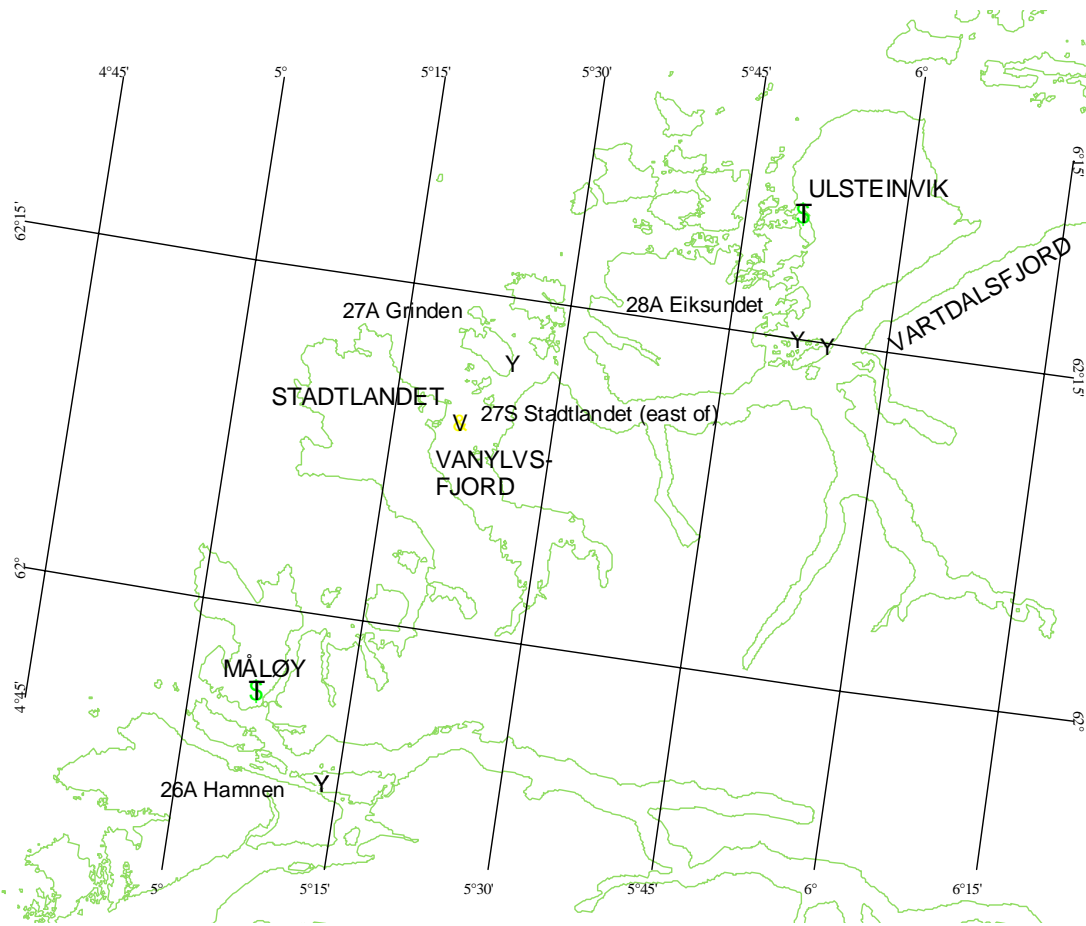
MAP 6



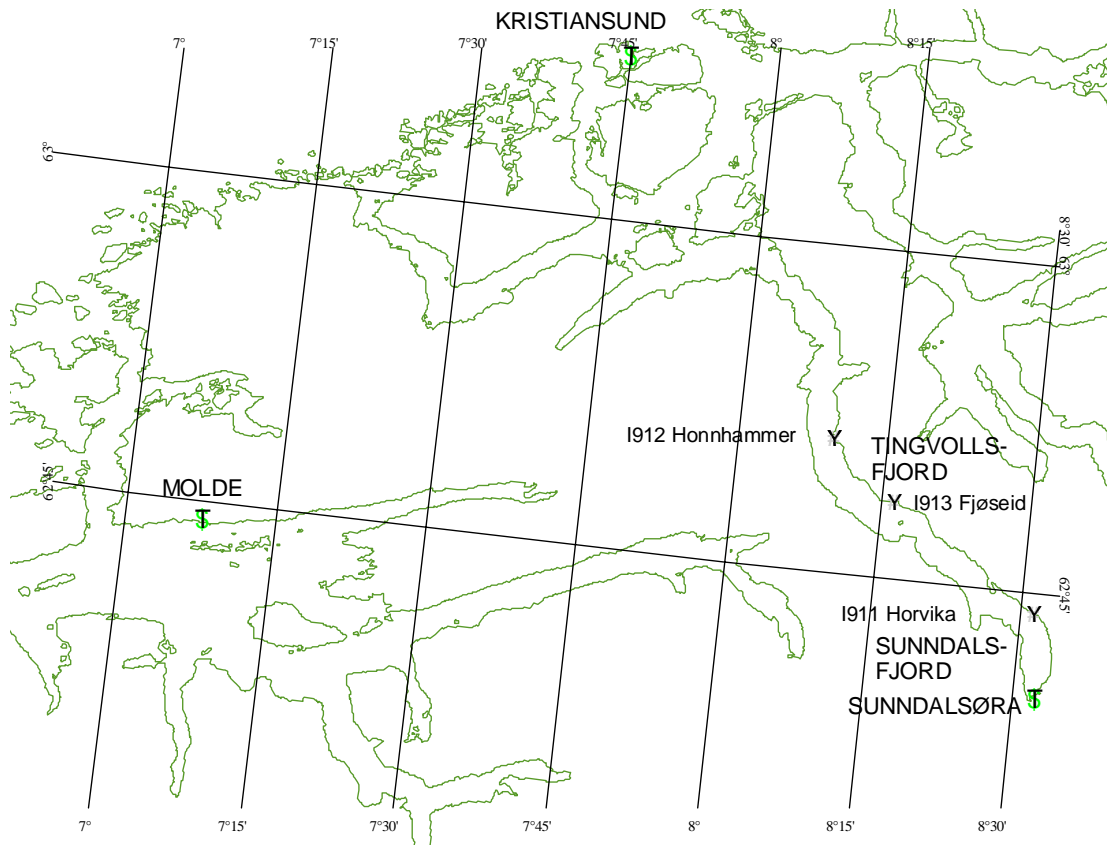
MAP 7



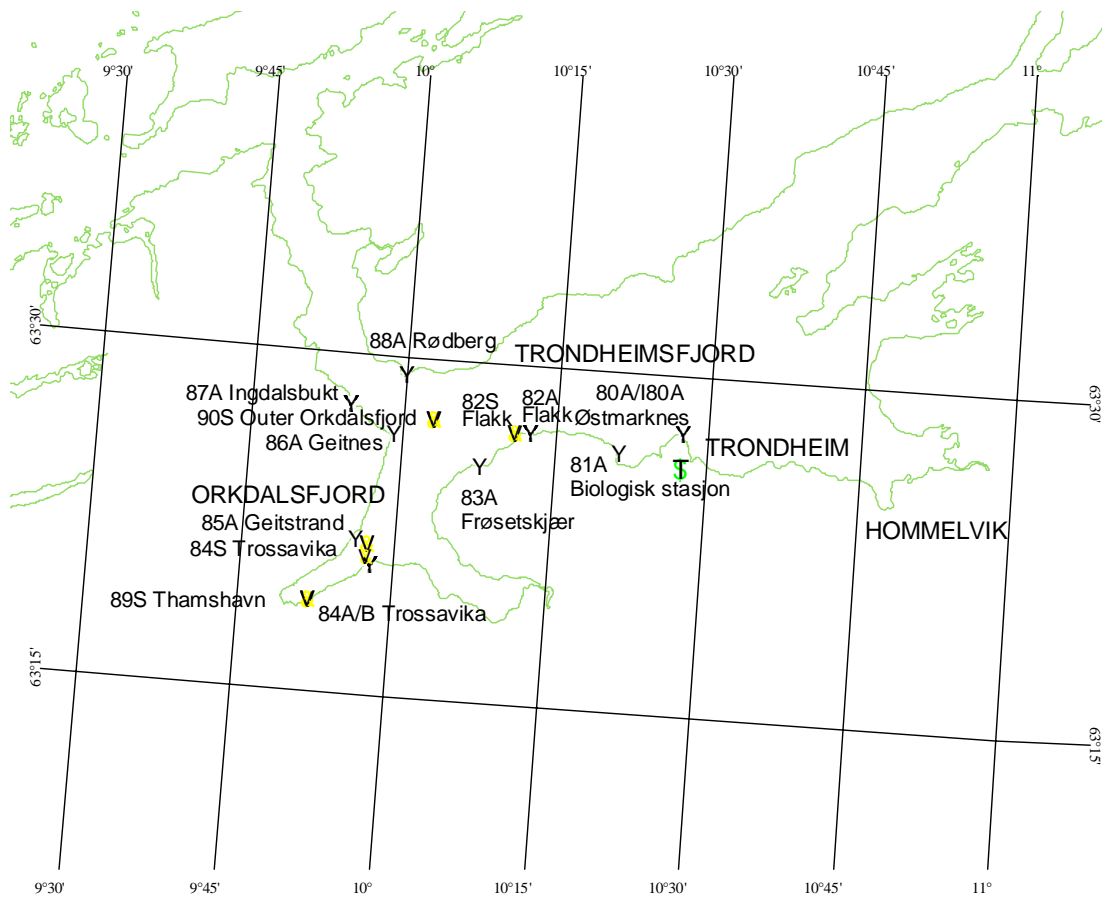
MAP 8



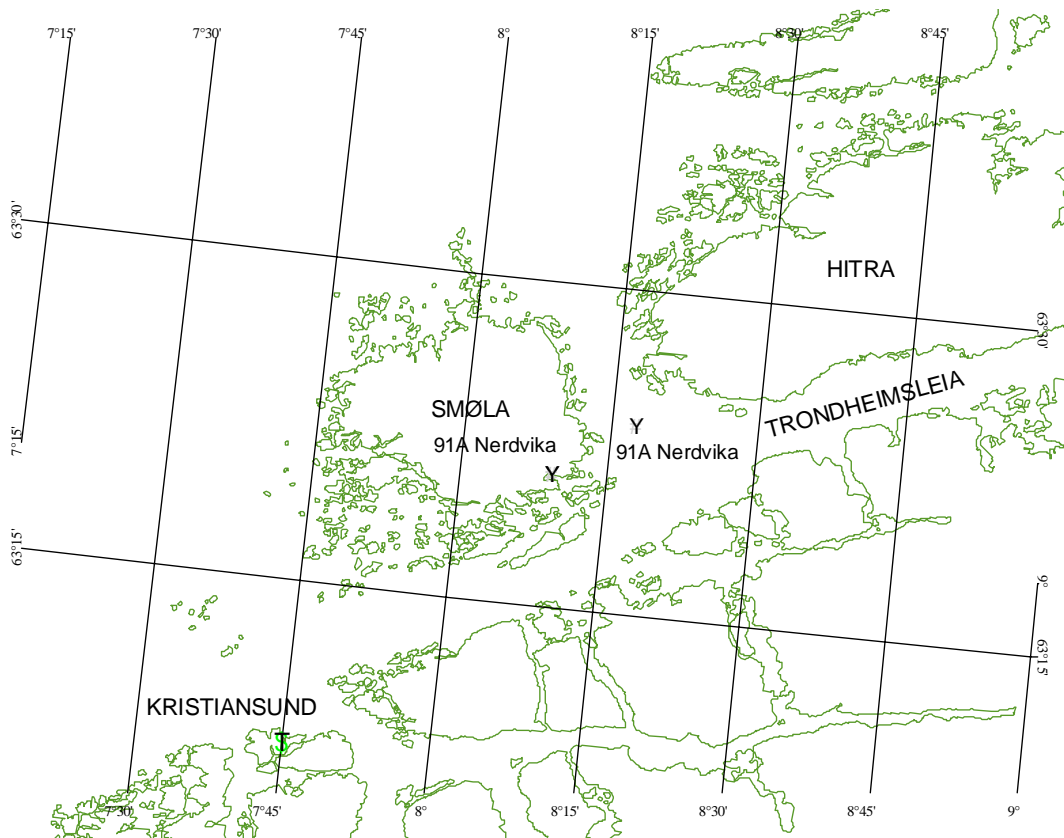
MAP 9



MAP 10



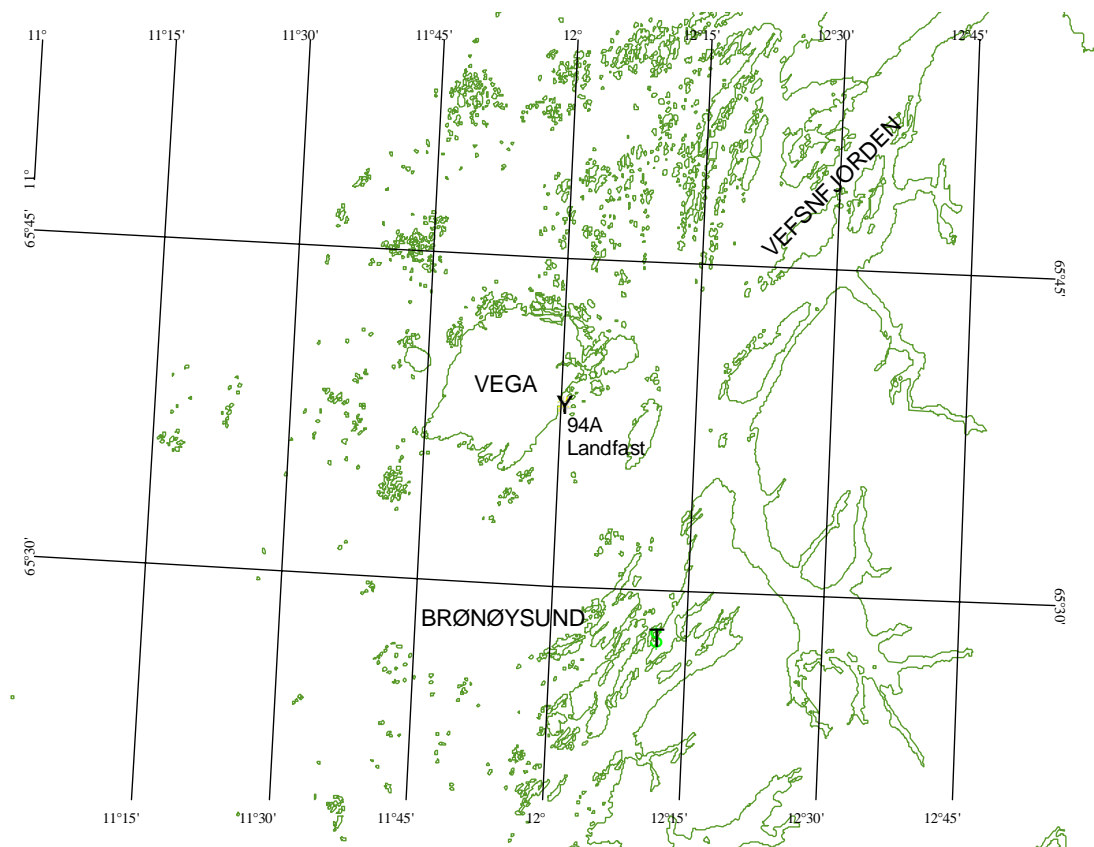
MAP 11



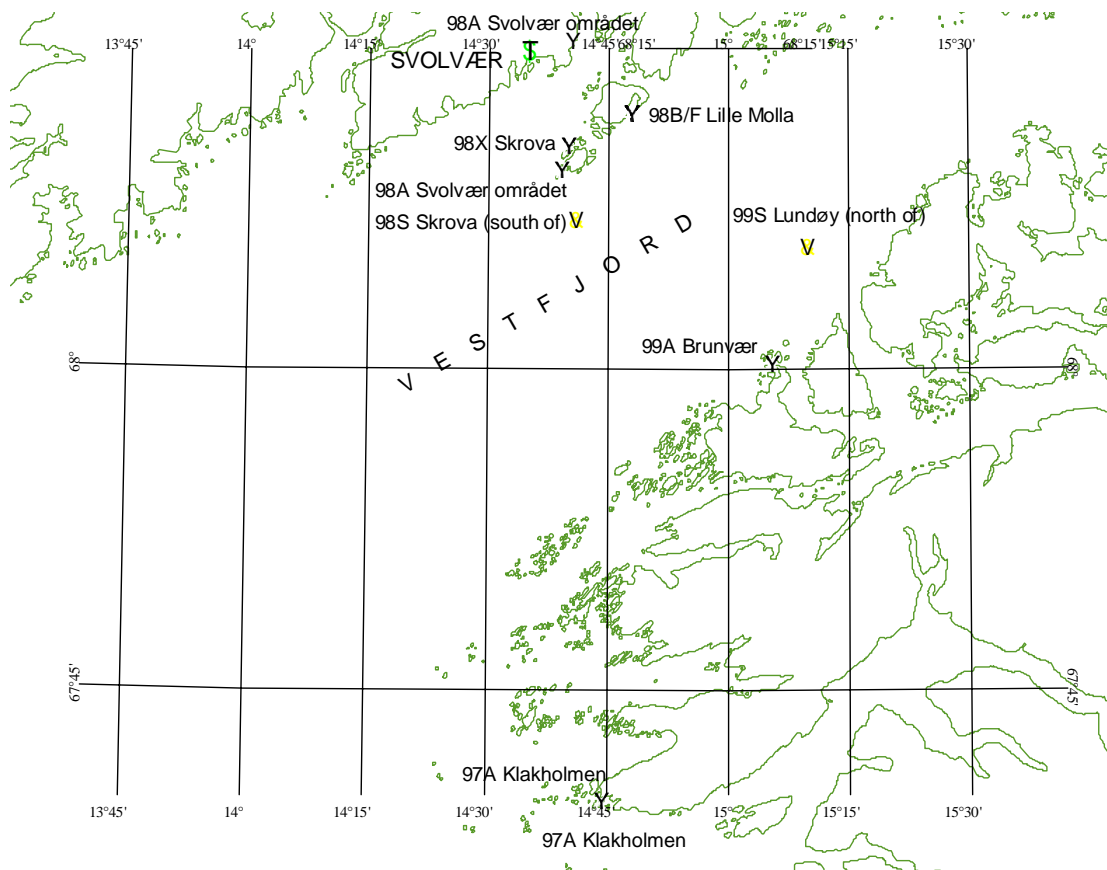
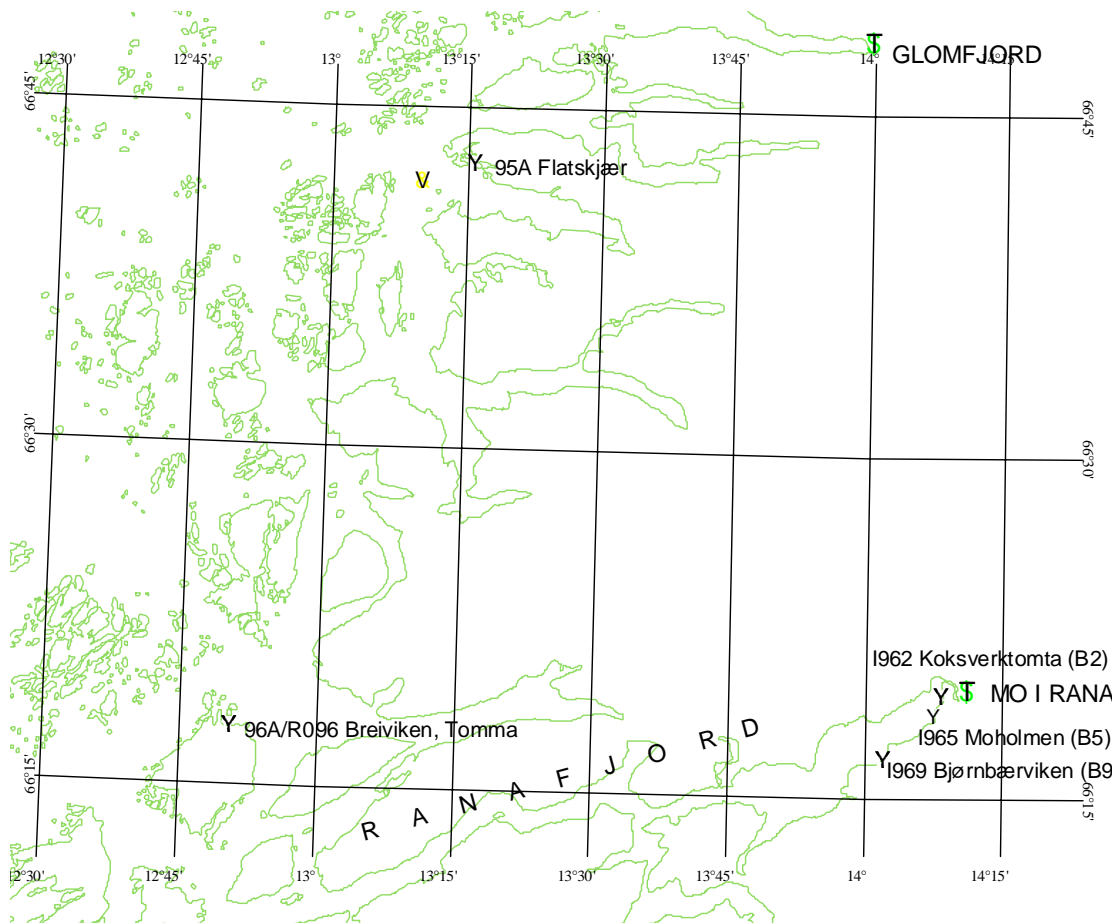
MAP 12

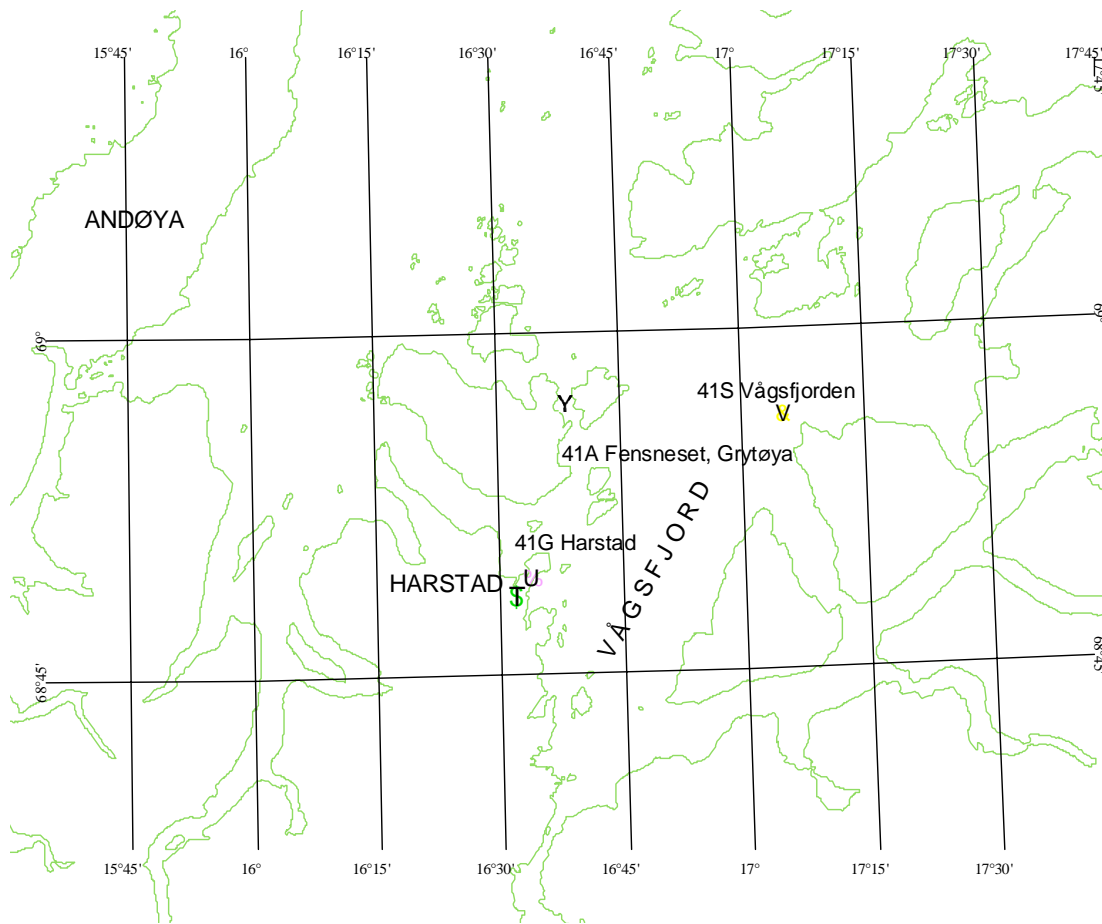


MAP 13

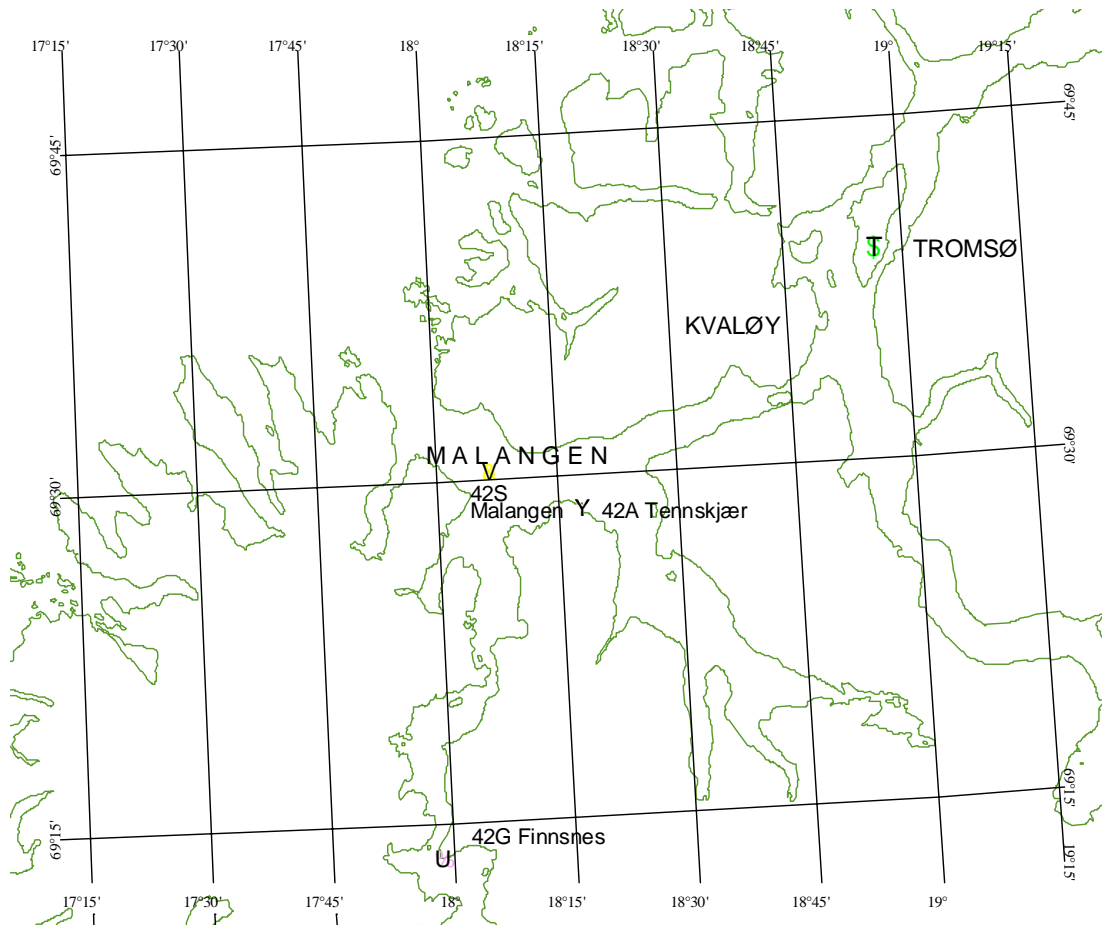


MAP 14

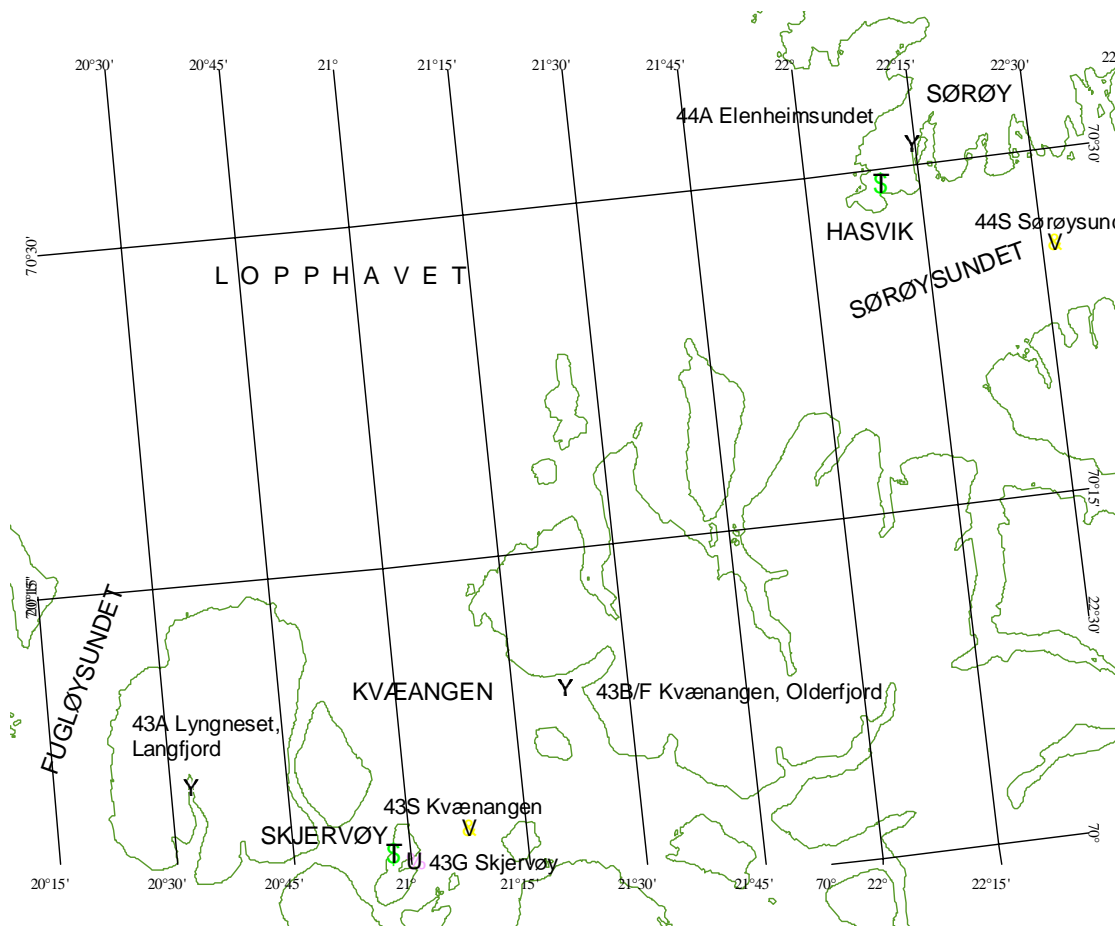




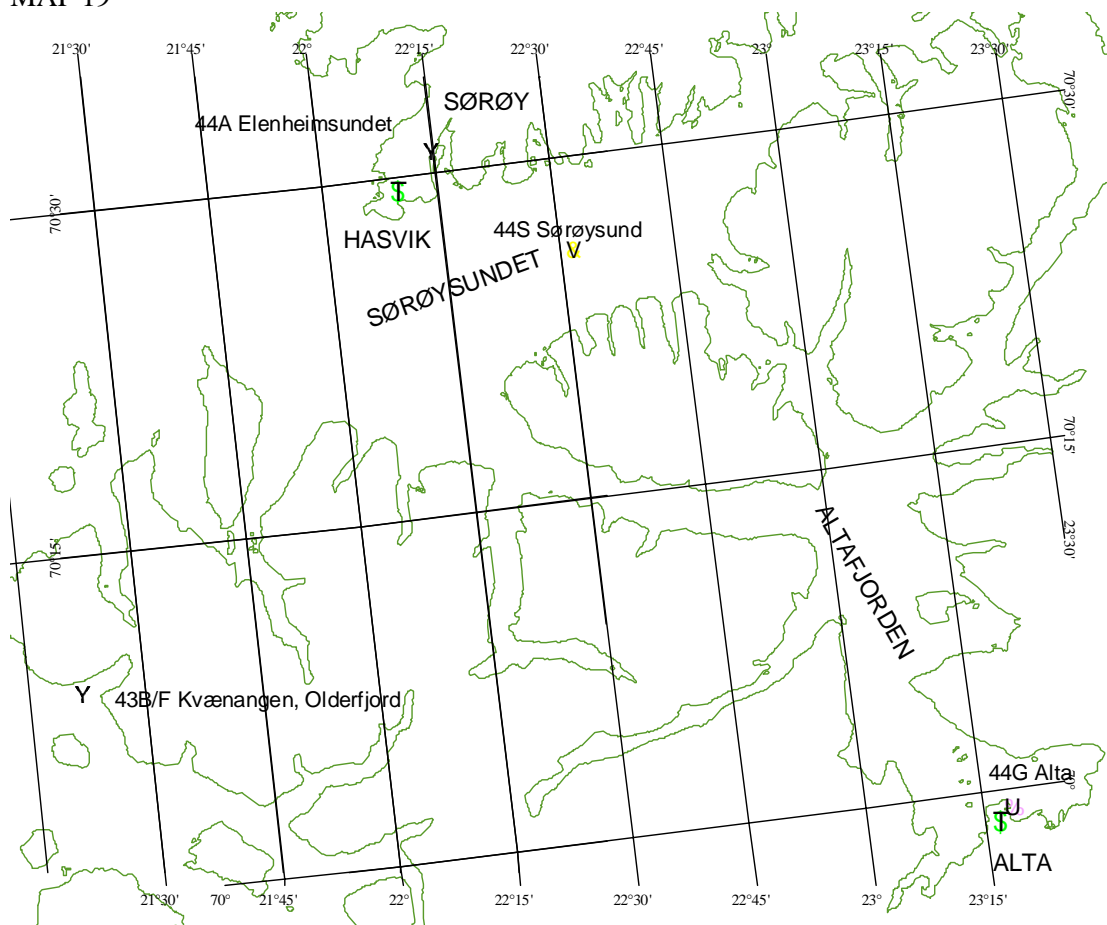
MAP 17



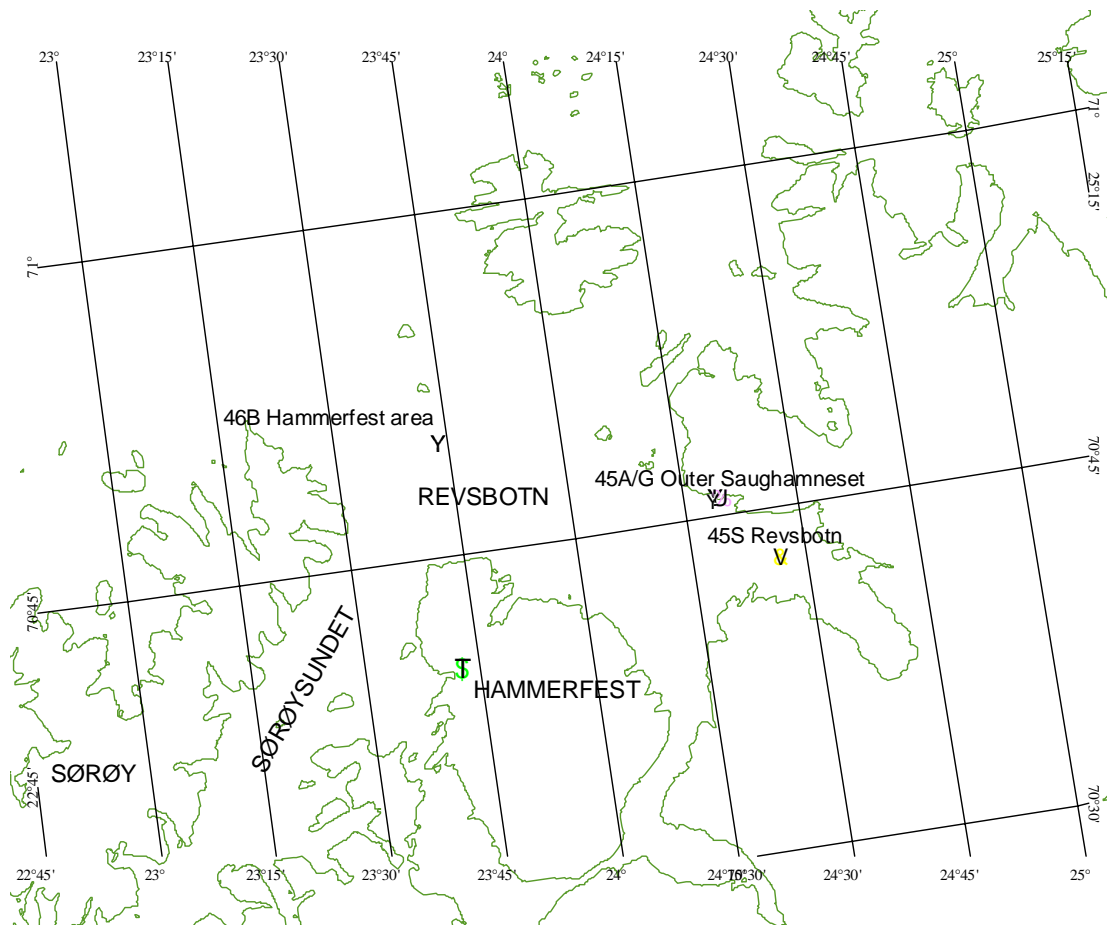
MAP 18



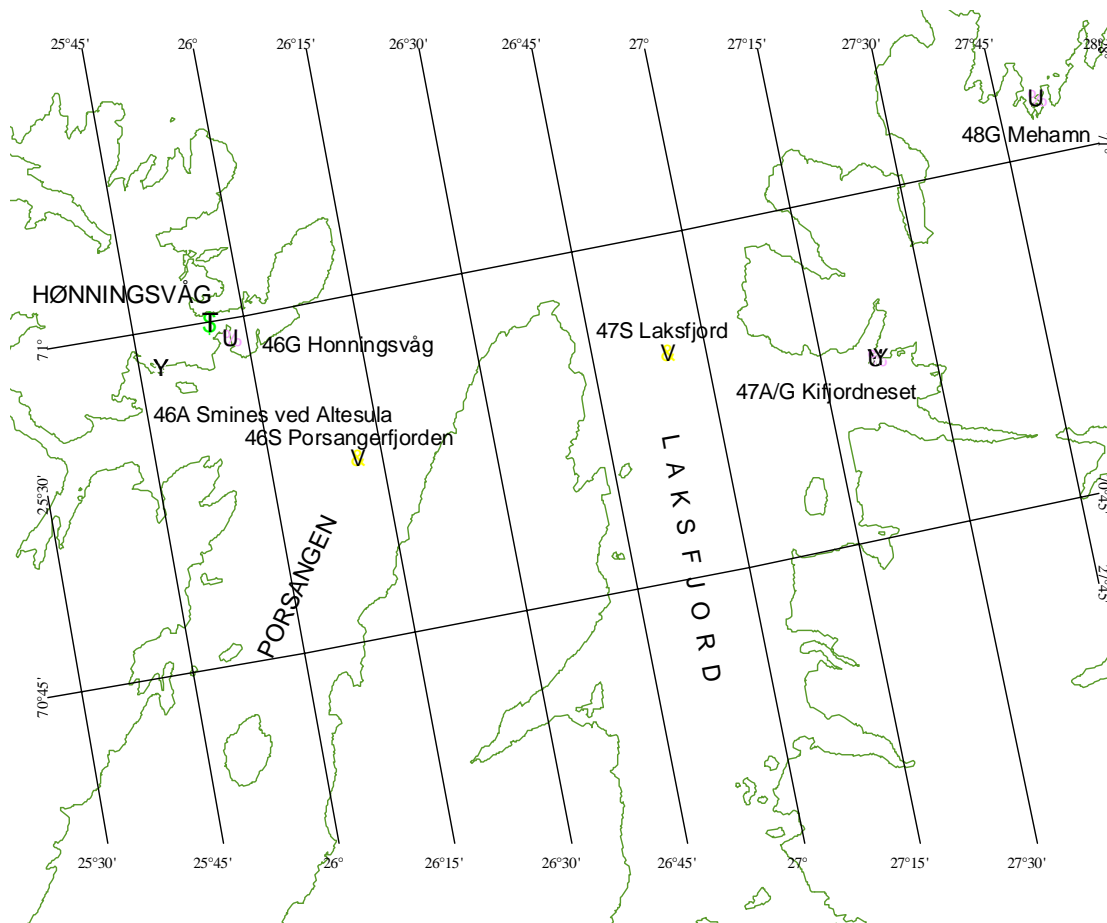
MAP 19



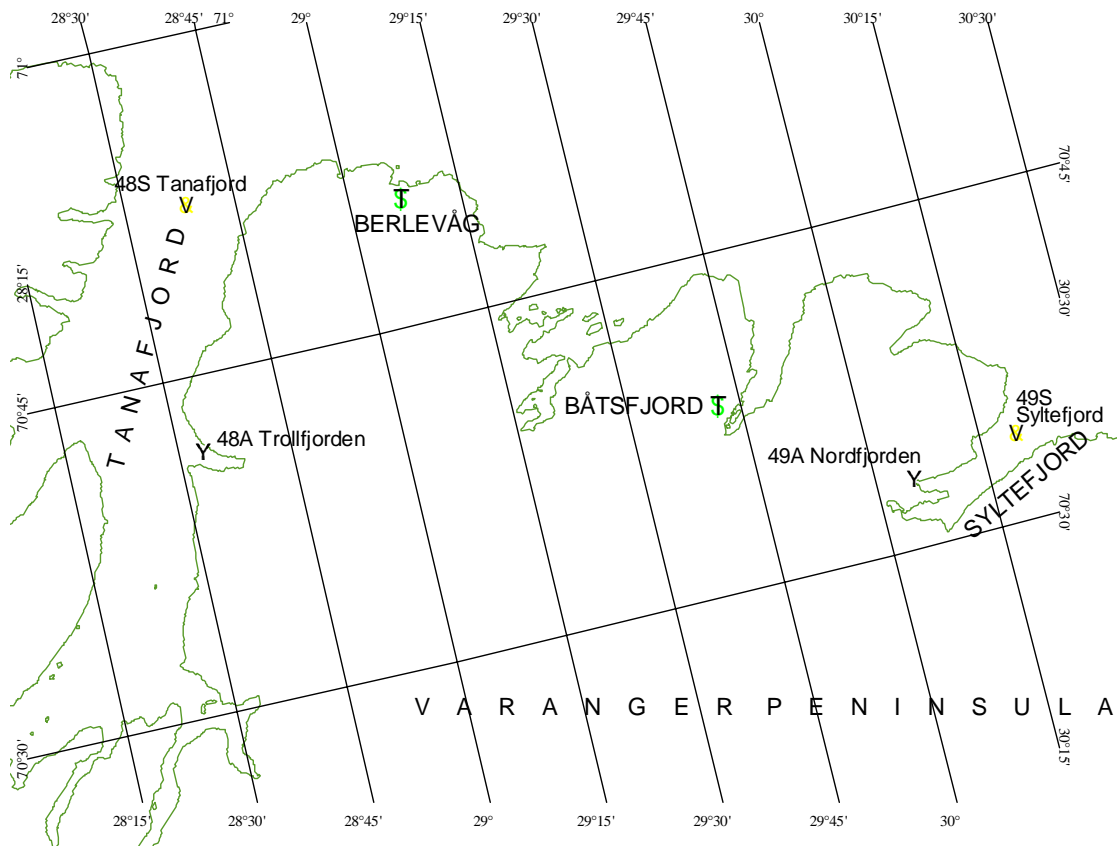
MAP 20



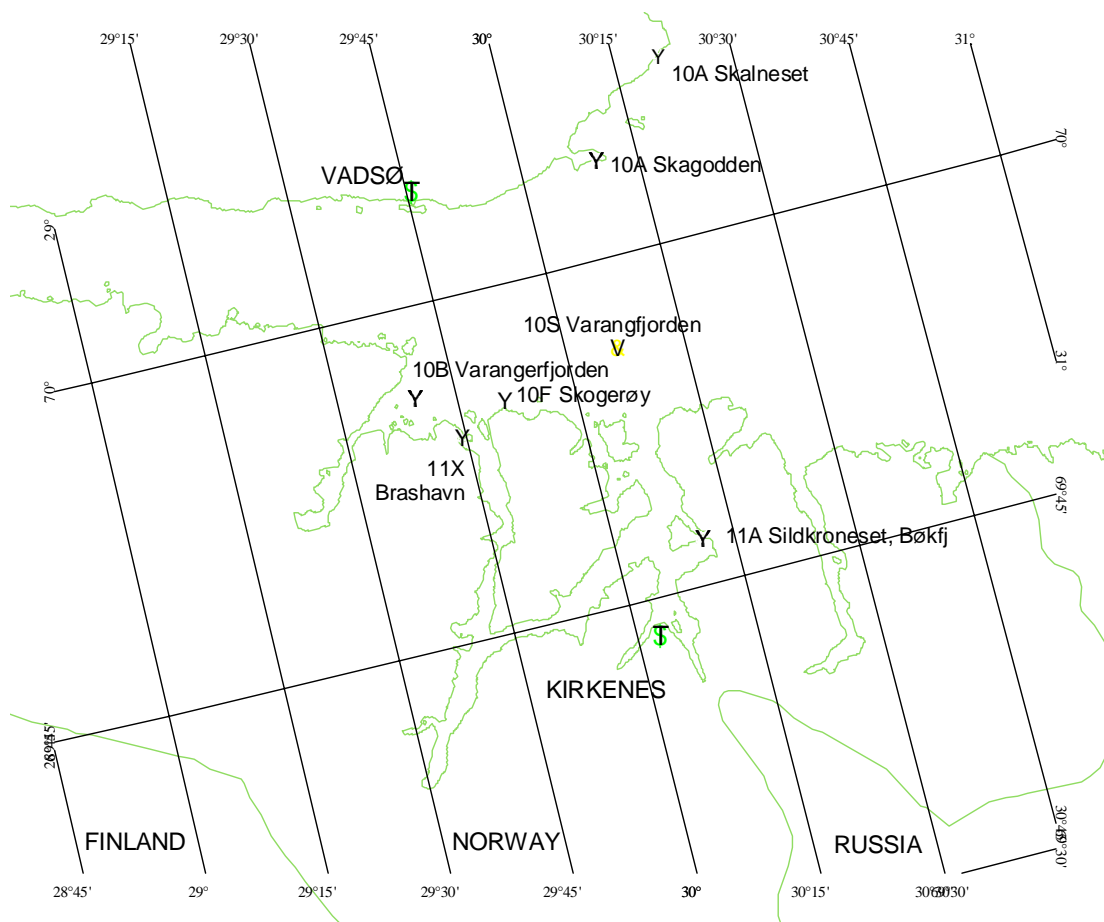
MAP 21



MAP 22



MAP 23



MAP 24

Appendix F. SEDIMENT 1986-1997 RAW DATA

NOTES

This appendix presents mean concentrations of the contaminants found in sediment. All data are on a dry weight basis. Three units of measure are used: **ppt** (parts per thousand), **ppm** (parts per million, mg/kg), and **ppb** (parts per billion, µg/kg). The numeric values shown have been printed with a fixed number of digits and do not necessarily indicate analytical precision. Refer also to the comments preceding the table.

The sample area code refers to the official JAMP designation and for some areas this may be undefined (J99).

- Sample area** Geographically beginning with those stations near the Swedish border and continuing around the coast to the Russian border (cf., maps, Appendix E). The sample area code refers to the official JAMP designation and for some areas this may be undefined (J99).
- Locality** Station name and position. The data are sorted geographically along the coast from the Swedish border in the south to the Russian border in the north *viz* (cf., maps, Appendix E): 30S, 35S, 36S, 77S, 15S, 22S, 24S, 52S, 56S, 57S, 63S, 67S, 69S, 27S, 89S, 84S, 82S, 90S, 93S, 95S, 99S, 98S, 41S, 42S, 43S, 44S, 45S, 46S, 47S, 48S, 49S, and 10S.
- Type** refers to sample method: where GC=gravity corer (used by NIVA).
- Diameter** refers to inner diameter (mm) of GC

The abbreviations for analytical laboratory and variable name are explained in Appendix A. Analysis codes have been described Green *et al.* (2001a). An overview of variables, detection limits and data count are given in recent JAMP annual reports (cf., Green *et al.* 2002).

K:\arkiv\Nivarapporter\4599-JAMP-nog-sediment_rawdata-summary_statistics-1986-1997\4599-Appendix F.xls

OSV for 94 sider !!

Appendix G.

SEDIMENT 1986-1997

MEAN CONCENTRATIONS

NOTES

This appendix presents mean concentrations of the contaminants found in sediment. All data are on a dry weight basis and include count, mean and standard deviation for parallel samples, if relevant. Three units of measure are used: **ppt** (parts per thousand), **ppm** (parts per million, mg/kg), and **ppb** (parts per billion, µg/kg). The numeric values shown have been printed with a fixed number of digits and do not necessarily indicate analytical precision. Refer also to the comments preceding the table.

The sample area code refers to the official JAMP designation and for some areas this may be undefined (J99).

- Sample area** Geographically beginning with those stations near the Swedish border and continuing around the coast to the Russian border (cf., maps, Appendix E). The sample area code refers to the official JAMP designation and for some areas this may be undefined (J99).
- Locality** Station name and position. The data are sorted geographically along the coast from the Swedish border in the south to the Russian border in the north *viz* (cf., maps, Appendix A): 30S, 35S, 36S, 77S, 15S, 22S, 24S, 52S, 56S, 57S, 63S, 67S, 69S, 27S, 89S, 84S, 82S, 90S, 92S, 95S, 99S, 98S, 41S, 42S, 43S, 44S, 45S, 46S, 47S, 48S, 49S, and 10S.
- Type** refers to sample method: where GC=gravity corer (used by NIVA).
- Diameter** refers to inner diameter (mm) of GC

The abbreviations for analytical laboratory and variable name are explained in Appendix A. Analysis codes have been described Green *et al.*(2001a). An overview of variables, detection limits and data count are given in recent JAMP annual reports (cf., Green *et al* 2002.).

K:\arkiv\Nivarapporter\4599-JAMP-nog-sediment_rawdata-summary_statistics-1986-1997\4599-Appendix G.xls

OSV for 84 sider !!