COOPERATIVE RESEARCH REPORT
No. 98

THE ICES COORDINATED MONITORING PROGRAMME, 1977

https://doi.org/10.17895/ices.pub.7716

ISBN 978-87-7482-577-7

ISSN 2707-7144

International Council for the Exploration of the Sea
Palægade 2-4, 1261 Copenhagen K
Denmark

December, 1980

TABLE OF CONTENTS

- o - o -

INTRODUCTION

This report presents the results of the fourth year of the Coordinated Monitoring Programme. The programme began in 1974 after the 1972 baseline survey of contaminant levels in fish and shellfish of the North Sea (results reported in Coop.Res.Rep., No.39 (1974)) showed that, although most of the area studied was only lightly contaminated, certain areas, particularly coastal zones and the Southern and German Bights, should be monitored annually. Thus, it was agreed that the results of the studies conducted on a national basis in the identified areas should be reported to ICES for inclusion into an annual Coordinated Monitoring Report. The results of the first year of the programme, 1974, were published in Coop. Res.Rep., No.58 (1977) and those from 1975 and 1976 were printed in Coop.Res.Rep., No.72 (1977).

In 1975 another baseline survey of the levels of contaminants in selected fish and shellfish was conducted (see Coop.Res.Rep., No.69 (1977)). The area of study covered a large portion of the Oslo Commission Area, including the North Sea, and certain portions of the Northwest Atlantic off the coasts of Greenland and Canada. The levels of contaminants were mainly studied in food fish, particularly cod, but several species of shellfish were also sampled. The results showed that contaminant levels were low in the open sea areas, but that levels in organisms from certain coastal regions in addition to those identified earlier should be monitored and the data submitted to ICES annually for inclusion in the Coordinated Monitoring Report.

The areas identified as requiring monitoring were the Irish Sea, the German Bight and Southern Bight of the North Sea; the estuaries of the Thames, Forth, Rhine, Schelde and Clyde; the Skagerrak, Kattegat and Oslofjord; and certain parts of the Gulf of St Lawrence and the New York Bight.

It was agreed that the species to be studied should be the same as those used in the baseline survey. Additionally, certain procedures for the preparation of samples prior to analysis and for reporting results were developed. The procedures used in 1977 are published in Coop.Res.Rep., No.76 (1978) (pp.36-38); these procedures have subsequently been updated (see Annex II, Coop.Res.Rep., No.84 (1979)).

To ensure control over the quality of the data, only results from laboratories which have participated in recent ICES intercalibration exercises are included in the Coordinated Monitoring Report. The results of the intercalibrations applicable to this report are found in Coop.Res. Rep., No.80 (1978).

RESULTS

Data were received from Belgium, Canada, England/Wales, France, the Federal Republic of Germany, Ireland, the Netherlands and Scotland. Most of the data were for cod (*Gadus morhua*), but results were also presented on plaice (*Pleuronectes platessa*), flounder (*Pleuronectes flesus*), sole (*Solea solea*), herring (*Clupea harengus*), whiting (*Merlangius merlangus*), pilchard (*Sardina pilchardus*) and mackerel (*Scomber scombrus*). A few data were submitted on mussels (*Mytilus edulis*), shrimps (*Crangon crangon*) and scallops (*Pecten maximus*). The locations of sampling areas are shown in Figures 1 and 2.

Metals in Fish

The results submitted for the analyses of metals in fish muscle are presented in Table 1a and the results concerning fish liver are in Table 1b. The following discussion relates to mean values only.

In cod muscle, the range of mean mercury concentrations was reported from 0.02 - 0.33 mg/kg wet weight. This is nearly identical to the values reported the previous two years: the 1976 data ranged from 0.04 - 0.30 mg/kg and the 1975 data from 0.02 - 0.32 mg/kg. The highest concentrations of mercury were in cod caught in the Irish Sea in an area NNE of Dublin.

Mercury levels in plaice muscle were similar to those in cod, while sole muscle exhibited a narrower range of concentrations (0.16 - 0.23 mg/kg). On the other hand, the average levels in flounder muscle were higher, ranging from 0.21 - 0.49 mg/kg, depending on the age of the fish in the sample. These samples were collected from the Irish Sea and the Southern Bight and the largest flounder from the latter area appeared to contain the higher mercury concentrations, although the overall mean for the sample of one hundred fish was 0.30 mg/kg.

Mackerel, mostly taken off the southwestern tip of England, and pilchard from the English Channel contained mercury concentrations of less than 0.10 mg/kg in muscle tissue.

In the 1975 baseline survey and the 1975 and 1976 Coordinated Monitoring Reports, the levels of mercury in cod and plaice liver fell in the range of 0.01 - 0.09 mg/kg wet weight. The 1977 data show similar values for cod and plaice liver (0.02 - 0.12 mg/kg), with the exception of one sample of large plaice from the eastern Irish Sea which contained a much higher mean level of mercury (0.59 mg/kg).

Mercury levels in flounder liver ranged from 0.05 to 0.42 mg/kg, with an average around 0.26 mg/kg.

The data on cadmium and lead in fish muscle and liver must be regarded with great caution because ICES intercalibration exercises have shown that very few laboratories have adequately sensitive methods and clean enough procedures to obtain true values for these two metals (see Coop. Res.Rep., No.80 (1978)). This is reconfirmed by the data presented here, in which the results of most cadmium analyses in the muscle and liver tissues of the species studied showed levels below the detection limits of the analytical methods employed. However, the results obtained by laboratories using sufficiently sensitive methods (detection at 0.00X mg/kg) indicated cadmium levels in cod muscle in the range of 0.002 - 0.046 mg/kg, while levels in cod liver were higher (0.022 - 0.16 mg/kg). For plaice, data from the Federal Republic of Germany showed mean cadmium concentrations in muscle of 0.002 mg/kg and in liver, 0.037 mg/kg.

Similarly, the results of analyses for lead showed many levels below the detection limits of the methods used. Some of the data indicate, however, that mean lead levels in the muscle of cod and plaice from the German Bight of the North Sea are around 0.02 mg/kg, while the concentrations are slightly higher in liver, at 0.07 and 0.10 mg/kg for cod and plaice, respectively.

The levels of copper and zinc in the species studied are very similar to those reported earlier in the baseline survey and the Coordinating Monitoring Programme. The levels of both metals are higher in the liver

than in the muscle. Copper levels in the liver of the species studied were generally under 10 mg/kg, although several samples of flounder from the North Sea and one from the Irish Sea showed higher concentrations (up to 24 mg/kg). Corresponding copper concentrations in fish muscle are around one order of magnitude lower, generally under 1.0 mg/kg. In the data reported here, all mean copper levels in muscle were under 1.0 mg/kg, with the exception of one sample of herring from the Irish Sea and one sample of pilchard from the English Channel. The concentrations of zinc in fish liver are in tens of mg/kg, with cod showing the lowest levels (13-27 mg/kg) in the data reported here and plaice the highest levels (23 - 70 mg/kg). Muscle levels of zinc are generally below 10 mg/kg. In the data presented here, the overall range of mean zinc concentrations in fish muscle was between 3.3 and 14 mg/kg. There was little difference between species, although flounder, pilchard, and herring exhibited levels closer to the higher end of this range.

Overall, no changes can be observed in metal concentrations in fish in comparison with the results from earlier years.

Metals in Shellfish

In comparison with previous years, data were reported on only a few samples of shellfish in 1977: seven samples of mussels and one each of Crangon crangon and scallops. These data are given in Table 1c. The concentrations of mercury in mussels (0.02 - 0.09 mg/kg) were similar to those found in previous years (ranges 0.01 - 0.09 mg/kg in 1976 and 0.02 - 0.13 mg/kg in 1975). The one figure for mercury in Crangon (0.07 mg/kg) also fell in the range of values reported earlier. No data have been reported on scallops previously in this programme, but the data presented here indicate mercury levels (0.03 - 0.07 mg/kg) similar to those in mussels and Crangon. The cadmium levels reported in mussels ranged from 0.2 - 1.4 mg/kg, which is on the high end when compared with earlier figures (ranges of 0.16 - 1.1 mg/kg in 1976, 0.09 - 0.44 mg/kg in 1975 and 0.03 - 0.37 mg/kg in 1974). Similarly, the one figure reported for cadmium in Crangon was higher than the highest level reported in the three previous years. Of the three species of shellfish considered here, scallops exhibited the lowest concentrations of cadmium, 0.12 - 0.17 mg/kg.

The English data on lead concentrations in both mussels and Crangon (range 0.2 - 1.2 mg/kg) were within the respective ranges of this metal reported for these species in earlier years. The French data for mussels and scallops, however, indicated lead levels nearly one order of magnitude lower (range 0.02 - 0.35 mg/kg) than previously reported.

The copper concentrations reported for mussels (0.6 - 5.6 mg/kg) are similar to those found in previous years, e.g., 0.6 - 6.6 mg/kg in 1976 and 0.8 - 9.4 mg/kg in 1975. The one copper value obtained for Crangon (18 mg/kg) also fell within the previously reported ranges. For zinc, the reported concentrations in mussels ranged from 8.8 to 53 mg/kg, in line with ranges found in earlier years, while the one zinc concentration given here for Crangon fell at the lower end of previously reported values for this species.

Organochlorine Pesticide and PCB Residues in Fish

Table 2a summarises the results of analyses of fish muscle for organochlorine pesticide and PCB residues and Table 2b gives the results with regard to fish liver on a wet weight basis. Table 2b' provides several results for fish liver reported on a fat weight basis.

Analyses of pesticide residues in fish muscle showed that the levels of dieldrin were low in cod, whiting and plaice. All concentrations were below 0.007 mg/kg, with the exception of one sample of plaice in which a level of 0.013 mg/kg was detected. This plaice sample, which also contained higher levels of the other organochlorine residues under study, was taken from the Clyde area of the North Irish Sea, an area identified in the 1976 report as heavily contaminated with pesticide and PCB residues. With the exception of this sample of plaice, all dieldrin levels were similar to those reported in 1976. The concentrations of the DDT group residues were also low in the muscle of cod, whiting and plaice, with all levels below 0.010 mg/kg, except in the above-mentioned sample of plaice. Generally, the levels of DDE were higher than those of p,p'DDT, which were in turn either slightly higher than or nearly equivalent to the levels of TDE(= DDD). The levels of the DDT group were in the same range as those reported in 1976. However, in contrast to the 1976 data, in which more than half of the levels of TDE and pp'DDT were reported below the detection limit (0.001 mg/kg), in 1977 nearly all values were at or above this limit. The data reported for PCB concentrations in the muscle of cod, whiting and plaice were, with one exception, below 0.07 mg/kg.

As has been noted in earlier Coordinated Monitoring Reports and in the base-line study, herring contains higher amounts of organochlorine residues in its muscle tissue corresponding to the higher fat concentrations in this tissue (herring contains around 5% lipids in muscle versus less than 1% in cod and plaice). Of the two samples of herring studied in 1977, one contained a dieldrin concentration of 0.068 mg/kg which, with one exception, was higher than dieldrin concentrations reported in herring muscle in 1976 and 1975. This sample of herring was obtained from the Clyde area of the northern Irish Sea, the same area from which the plaice sample with elevated levels, mentioned above, was obtained. The levels of the DDT group residues in this sample were also higher than those generally found in herring in 1976, although they were lower than the upper range of values observed in 1975. The highest concentration was of DDE (0.025 mg/kg) while pp'DDT was nearly half this level. The PCB concentration was 0.21 mg/kg. In contrast, the second herring sample, taken from an offshore area to the west of Scotland, exhibited much lower levels of pesticide and PCB residues. DDT group residues in this sample averaged 0.011 mg/kg.

Table 2b presents the information submitted on the levels of pesticide and PCB residues in fish liver on a wet weight basis. Due to the significantly higher concentration of lipids in liver, the levels of these residues in liver are higher than those in muscle by nearly one order of magnitude.

The levels of pesticides in cod liver reported in 1977 were lower than those reported in 1976 and generally somewhat lower than those reported in 1975. The maximum level of dieldrin reported was 0.32 mg/kg, compared with 0.68 mg/kg in 1976 and 0.40 mg/kg in 1975. Levels of the DDT group residues in livers of cod from the North Sea were somewhat lower than those reported the previous year, with the highest total DDT level at 1.2 mg/kg (compare 3.3 mg/kg in 1976) and the highest level of the p,p'DDT residue at 0.27 mg/kg (1.53 mg/kg in 1976). The highest levels of DDT group residues were found in cod from the southern part of the North Sea, while cod from the central North Sea and the Clyde area of the northern Irish Sea showed slightly lower levels. Only the p,p'DDT residue was measured in cod from the Gulf of St Lawrence and the concentrations of this residue were somewhat higher in these cod livers (maximum 0.99 mg/kg) than in those from the North Sea. However, the Canadian data gave results from a spectrum of samples grouped according to age and the older cod (6 years and above) showed a sharp increase in liver levels of p,p'DDT.

The concentrations of PCBs in cod liver were considerably higher than those of the pesticide residues. Most samples contained concentrations of PCBs between 0.8 and 5.5 mg/kg, with most of these samples taken from the northern North Sea and the Gulf of St Lawrence, and no differences were apparent between these regions. However, two samples from the North Sea contained higher amounts of PCBs - one from the central North Sea contained 16 mg/kg and one from the southern North Sea had a level of 27 mg/kg. These latter data were submitted in a Dutch study (Kerkhoff and De Boer, 1979) which shows a clear pattern in the concentrations of PCBs and several pesticides in the livers of cod obtained from different parts of the North Sea. The concentrations were low in cod from the northern North Sea, higher in cod from the central North Sea and still higher in cod from the southern North Sea.

In whiting liver, with the exception of one sample with somewhat elevated levels, the concentrations of pesticides and PCB residues were in the same range as those found in cod (omitting the two high PCB values). The whiting sample with the elevated levels was caught in the Clyde area of the northern Irish Sea, the area in which elevated levels of contaminants were also observed in plaice and herring.

The two samples of herring liver studied contained lower levels than cod of all organochlorine residues examined. In comparison with previous years, the maximum level of dieldrin (0.19 mg/kg) was higher than the maximum concentration reported in herring liver in 1976 but lower than the 1975 maximum. Concentrations of DDT group residues were similar to those reported in 1976 and 1975 and the level of PCBs was also within the ranges found earlier.

The levels of pesticide residues in plaice and flounder liver were also lower than those reported in cod. The highest level of dieldrin was 0.13 mg/kg, while all residues in the DDT group were at a level of 0.05 mg/kg or less in plaice liver and 0.10 mg/kg or less in flounder liver. PCB levels were fairly low, with a maximum of 0.78 mg/kg in plaice liver and a concentration of 1.6 mg/kg in the one sample of flounder.

Table 2b' gives levels of organochlorines in fish liver in mg/kg fat weight for some of the samples reported in Table 2b on a wet weight basis.

Organochlorine Pesticide and PCB Residues in Shellfish

The data reported on the levels of organochlorines in mussels, Crangon and scallops are given in Table 2c. As mentioned previously, the amount of data reported on shellfish in 1977 is sparse in comparison with previous years and little can be inferred from such a small number of samples.

With the exception of a sample of mussels from the northern coast of Brittany, France, the levels of pesticide residues in all three species of shellfish were at or below 0.010 mg/kg wet weight; the maximum ΣDDT level was 0.015 mg/kg. These levels were similar to those reported in 1975 and 1976. The sample of mussels from northern Brittany contained higher levels of DDT residues, with a maximum ΣDDT concentration of 0.074 mg/kg. Higher levels of PCBs were also exhibited in this mussel sample (maximum 0.41 mg/kg) in comparison with PCB levels reported in the other samples of shellfish (range < 0.01 - 0.15 mg/kg). Comparing PCB levels reported in shellfish in 1977 with those from previous years, the levels are similar except for the French mussel sample, which contained a slightly higher level of PCBs than those previously reported in mussels (e.g., maximum PCB concentration of 0.31 mg/kg in 1976).

SUMMARY

The amount of data submitted from national monitoring programmes in 1977 was less than that submitted in previous years and it must be strongly emphasised that no real trends can be discerned due to the reduced data base, which has possibly not only reduced extreme values in the data, but also caused gaps in the sampling of certain areas which had been covered in previous years. On the other hand, a wider geographical area was covered in 1977 due to the submission of data from Canada.

On the basis of the information available, taking into account the samples collected, no changes can be observed in the concentrations of heavy metals and organochlorine residues compared with their levels in 1975 and 1976. In continuation of earlier observations, DDE concentrations were again found to exceed those of p,p'DDT in the muscle and liver of fish. PCB concentrations also continued to be considerably in excess of the levels of the DDT group residues. The areas identified in earlier reports as containing higher levels of contaminants, namely the Southern Bight of the North Sea and the Irish Sea (particularly the Clyde area), also exhibited higher contaminant levels in 1977.

As mentioned in the 1976 monitoring report, the Working Group on Marine Pollution Baseline and Monitoring Studies in the North Atlantic began a programme of study in 1977 designed to try to determine which factors affect the residue levels of particular pollutants in the various species of fish being monitored. The initial results of this programme have shown that there are many factors which affect the use of marine organisms in determining trends in the levels of pollutants in the marine environment. On the evidence available so far, it has been concluded that a thorough investigation must be conducted to determine the influence of physiological variables on the concentrations of each contaminant under study in each species to be monitored, using regression analysis techniques to establish the critical variable. Such a statistical study will probably have to be done separately for each contaminant in each species and also according to area or stock, as different variables appear to be significant in different cases.

When available, the results of these studies will be used to further develop and refine the coordinated monitoring programme according to the agreed objectives of this programme.

REFERENCE

Kerkhoff, M and De Boer, J. 1979. De Analyse van Kabeljaulever uit de Noordzee (1977/78). [Analyses of cod liver from the North Sea (in Dutch)]. Rijksinstituut voor Visserijonderzoek, Rep. No.CA 79-03.

Table 1a Metals in Fish Muscle.

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight)						
						Hg min max MEAN s.d.	Cd min max MEAN s.d.	Pb min max MEAN s.d.	Cu min max MEAN s.d.	Zn min max MEAN s.d.	Cr min max MEAN s.d.	As min max MEAN s.d.
COD (Gadus morhua)			1977									
	IVb F8 36	Germany, Fed.Rep.of	Sep	10	1975	0.07 0.20 0.12 0.03	0.001 0.003 0.002 0.001	0.01 0.03 0.02 0.009	0.12 0.21 0.17 0.03	3.2 4.6 3.9 0.4		
	IVb F7 40	Belgium	June	10	1974	0.13 0.23 0.17 0.03	0.01 0.02 0.01 0.003	0.20 0.23 0.21 0.01	0.30 0.59 0.42 0.11	4.9 21.9 9.2 5.1	<0.1 <0.1	
	VIIa E6 36	England/Wales	Nov	7	35-45cm	0.07 0.15 0.10 0.03	<0.2 <0.2	<0.2 <0.2	<0.2 0.3 0.2 0.4	2.8 3.8 3.3 0.4		
	"	"	"	6	47-73 cm	0.13 0.35 0.20 0.08	<0.2 <0.2	<0.2 <0.2	0.2 0.6 0.3 0.2	2.8 4.0 3.3 0.4		
	IVc F1 33	"	"	25	0-year class (1976)	0.02 0.09 0.04 0.02	<0.2 <0.2	<0.2 <0.2	0.3 0.8 0.42 0.11	2.0 4.4 3.4 0.48		
	"	"	"	25	1-year class	0.03 0.13 0.09 0.03	<0.2 <0.2	<0.2 <0.2	0.2 0.5 0.34 0.07	2.4 4.6 3.7 0.44		
	VIIa E3 36	Ireland	Mar-Sep	20	2 years old	0.06 0.28 0.15 0.08	0.002 0.71 0.12 0.19	0.16 1.45 0.60 0.49	0.03 0.52 0.27 0.14	3.1 12.5 4.8 2.1	0.01 0.45 0.17 0.16	
	VIIa E4 36	"	Nov	6	2 years old		0.006 0.126 0.046 0.055	0.06 1.50 0.40 0.55	0.17 0.42 0.26 0.09	3.2 4.8 4.2 0.6	0.01 0.08 0.04 0.03	
	VIIa E3 36	"	Mar-Sep	6	3 years old	0.16 0.66 0.33 -	0.009 0.072 0.040 0.26	0.07 1.92 0.71 -	0.33 0.40 0.37 0.03	3.5 7.3 5.0 1.4	0.02 0.15 0.09 0.05	

/Continued

Table 1a Metals in Fish Muscle (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight) Hg	Cd	Pb	Cu	Zn	Cr	As
						min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.
COD (Continued)			1977									
	4T	Canada	Sep	4	2 years old	0.010 0.022 0.016 -	0.007 0.015 0.010 -	0.15 0.29 0.24 -	0.5 1.2 0.8 -	3.9 5.7 4.4 -		0.95 2.48 1.66 -
	"	"	"	5	2 years old	0.018 0.022 0.019 0.002	0.007 0.011 0.009 0.002	0.16 0.29 0.22 0.05	0.6 0.8 0.6 0.09	3.7 4.5 4.0 0.3		1.12 1.70 1.51 0.22
	"	"	"	5	2 + 3 years old	0.012 0.030 0.022 0.007	0.005 0.031 0.020 0.013	0.04 0.18 0.07 0.06	0.4 0.5 0.4 0.04	3.4 4.1 3.6 0.3		0.73 1.62 1.29 0.35
	"	"	"	5	2 + 3 years old	0.024 0.048 0.033 0.010	0.017 0.021 0.019 0.002	0.17 0.27 0.22 0.04	0.4 0.6 0.5 0.08	3.7 4.9 4.2 0.5		1.51 4.03 2.73 0.89
	"	"	"	5	3 + 4 years old	0.028 0.050 0.037 0.011	0.003 0.006 0.005 0.002	0.14 0.33 0.24 0.07	0.4 0.5 0.4 0.05	3.6 4.3 4.0 0.3		1.32 4.22 2.46 1.14
	"	"	"	5	3 + 4 years old	0.014 0.040 0.029 0.010	0.006 0.012 0.008 0.002	0.08 0.33 0.22 0.11	0.4 0.7 0.6 0.1	3.9 4.4 4.2 0.3		1.22 2.80 2.16 0.67
	"	"	"	5	4 years old	0.030 0.050 0.043 0.008	0.005 0.011 0.009 0.003	0.09 0.46 0.22 0.14	0.5 0.9 0.7 0.2	4.6 5.6 5.1 0.4		1.91 3.81 3.00 0.75
	"	"	"	5	4 years old	0.014 0.050 0.029 0.15	0.004 0.013 0.007 0.003	0.03 0.14 0.08 0.04	0.4 0.7 0.6 0.1	3.8 5.6 4.2 0.8		0.70 2.25 1.51 0.55
	"	"	"	3	5 years old	0.039 0.081 0.054 -	0.001 0.015 0.010 -	0.07 0.16 0.11 -	0.5 0.6 0.5 -	3.7 3.9 3.8 -		0.80 4.54 2.36 -

/Continued

Table 1a Metals in Fish Muscle (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight) Hg min / max / MEAN / s.d.	Cd min / max / MEAN / s.d.	Pb min / max / MEAN / s.d.	Cu min / max / MEAN / s.d.	Zn min / max / MEAN / s.d.	Cr min / max / MEAN / s.d.	As min / max / MEAN / s.d.
COD (Continued)			1977									
	4T	Canada	Sep	5	4-6 years old	0.043 0.46 0.134 0.182	0.003 0.006 0.005 0.001	0.13 0.16 0.15 0.02	0.4 0.5 0.5 0.05	3.4 4.1 3.9 0.3		1.42 5.95 3.23 1.66
	"	"	"	3	6 + 7 years old	0.061 0.094 0.075 -	0.002 0.012 0.006 -	0.06 0.07 0.06 -	0.5 0.9 0.6 -	3.5 4.9 4.2 -		0.20 5.78 2.81 -
	"	"	"	2	7 + 8 years old	0.061 0.068 0.065 -	0.003 0.007 0.005 -	0.09 0.10 0.10 -	0.5 0.6 0.5 -	3.7 4.7 4.2 -		1.38 5.81 3.60 -
	3M	"	"	10	6 years old	0.032 0.098 0.056 0.019	0.006 0.042 0.013 0.010	0.06 0.20 0.10 0.04	<0.2 0.4 0.2 0.1	3.0 3.8 3.5 0.3		0.67 3.61 1.82 0.86
PLAICE (Pleuronectes platessa)												
	IVb F8 36	Germany, Fed.Rep.of	"	10	1975	0.03 0.06 0.05 0.01	0.001 0.004 0.002 0.001	0.01 0.03 0.02 0.007	0.14 0.20 0.16 0.02	3.3 4.7 3.9 0.4		
	IVc F2 31	Belgium	May	7	1975	0.08 0.17 0.11 0.04	0.02 0.02 0.02 0	0.23 0.38 0.28 0.05	0.67 1.03 0.86 0.13	6.2 9.2 7.8 1.0	0.23 0.55 0.37 0.10	
	"	"	"	3	1974	0.09 0.13 0.11 0.02	0.02 0.02 0.02 0	0.25 0.29 0.27 0.02	0.35 0.47 0.42 0.06	7.4 8.3 7.9 0.5	0.31 0.46 0.37 0.08	
	VIId	France				0.04	0.02	0.1	1.2	5.2		
	VIIa E6 36	England/Wales	Nov	8	27-32 cm	0.05 0.13 0.08 0.02	<0.2 <0.2	<0.2 0.2	<0.2 0.2 0.2 -	3.7 4.9 4.4 0.4		

/Continued

Table 1a Metals in Fish Muscle (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight)						
						Hg	Cd	Pb	Cu	Zn	Cr	As
						min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.
PLAICE (Continued)			1977									
	VIIa E6 36	England/Wales	Nov	5	34-40 cm	0.06 0.18 0.12 0.06	<0.2 <0.2	<0.2 <0.2	0.2 0.2 0.2 0	3.5 4.2 3.9 0.3		
	"	"	"	3	40-62 cm	0.06 0.52 0.31 0.23	<0.2 <0.2	0.2 0.2 0.2 0	<0.2 0.2	3.7 4.2 4.0 -		
FLOUNDER (Pleuronectes flesus)												
	IVc F1 32	England/Wales	June	25	14-19 cm	0.11 0.40 0.24 0.09	<0.2 <0.2	<0.2 <0.2	0.4 1.8 0.8 0.3	8 20 12 4		
	"	"	"	25	20-24 cm	0.06 0.56 0.21 0.13	<0.2 <0.2	<0.2 0.2 0.2 0	0.3 0.7 0.4 0.1	6.6 15.0 9.6 2.3		
	"	"	"	25	24-28.5 cm	0.07 0.72 0.25 0.17	<0.2 <0.2	<0.2 0.2 0.2	0.3 0.7 0.5 0.1	5.2 11.0 7.9 1.6		
	"	"	"	25	30-35.5 cm	0.13 1.1 0.49 0.24	<0.2 <0.2	<0.2 0.2	0.2 0.5 0.3 0.07	3.5 9.6 5.8 1.6		
	VIIa E6 36	"	Dec	20	22-39 cm	0.15 0.74 0.35 0.18	<0.2 <0.2	0.3 2.1 0.7 0.4	0.2 0.5 0.4 0.1	3.0 11.0 7.7 2.0		

/Continued

Table 1a Metals in Fish Muscle (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight) Hg	Cd	Pb	Cu	Zn	Cr	As
						min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.
SOLE (Solea solea)			1977									
	IVc F2 32	Belgium	Apr	7	1973	0.09 0.38 0.23 0.10	0.01 0.02 0.01 0.004	0.14 0.22 0.17 0.03	0.24 0.45 0.33 0.07	4.2 5.6 4.9 0.5	<0.1 <0.1	
	"	"	"	3	1974	0.13 0.18 0.16 0.03	0.01 0.01 0.01 -	0.17 0.19 0.18 0.01	0.31 0.36 0.33 0.03	5.1 5.8 5.5 0.4	<0.1 <0.1	
	VIIa E6 36 E7 36	"	Jan-Mar	10	1973	0.06 0.37 0.20 0.10	0.01 0.02 0.01 0.003	0.17 0.52 0.30 0.11	0.27 0.43 0.36 0.05	4.2 6.0 5.1 0.6	<0.10 0.32 0.10 -	
HERRING (Clupea harengus)												
	VIIa E4 36 E4 37	Ireland	Aug	7	3 years		0.016 0.071 0.028 0.020	0.03 0.30 0.19 0.12	0.27 1.15 0.79 0.35	4.4 14.2 7.6 3.4	0.03 0.10 0.06 0.03	
	"	"	"	5	4 years		0.008 0.164 0.062 0.074	0.04 0.30 0.18 -	0.36 2.35 1.19 0.83	5.3 22.8 14.4 7.5	0.04 0.13 0.08 0.04	
	VIIa E4 36 E4 37	Ireland	Aug	3	6 years		0.002 0.170 0.059 -	0.02 0.04 0.03 -	0.54 0.82 0.68 -	7.4 12.3 9.1 -	0.06 0.13 0.08 -	
PILCHARD (Sardina pilchardus)												
	VIIe E5 25	France	Mar	20	16-21 cm	0.02 0.05 0.04 -	<0.01 0.05 - -	<0.1 0.5 0.2 -	0.7 1.8 1.2 -	10.1 20.0 13.9 -		

/Continued

Table 1a Metals in Fish Muscle (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight) Hg	Cd	Pb	Cu	Zn	Cr	As
						min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.
MACKEREL (Scomber scombrus)			1977		Mean							
	VIIf E4 29	France	Dec	5*	32 cm	0.05	<0.01	0.7	0.5	5.4		
	"	"	"	5*	35 cm	0.05	<0.01	0.6	0.6	5.0		
	"	"	"	5*	34 cm	0.07	<0.01	0.5	0.6	4.0		
	"	"	"	5*	35 cm	0.09	0.01	0.5	0.7	4.8		
	VIId	"				0.03 0.08 - -	0.004 0.02 - -	0.03 0.08 - -	0.6 1.6 - -	4.6 6.5 - -		

Table 1b Metals in Fish Liver.

COD (Gadus morhua)												
	IVb F8 36	Germany, Fed.Rep.of	Sep	10	1975	0.04 0.11 0.08 0.02	0.016 0.035 0.022 0.007	0.03 0.10 0.07 0.02	8.0 10.3 9.0 0.7	9.8 16.4 13.3 2.1		
	IVc F1 33	England/Wales	Nov	25*	0 yr class	0.06	<0.2	<0.2	8.3	27.0		
	"	"	"	25*	1 yr class	0.06	<0.2	0.2	8.0	19.0		
	VIIa E6 36	"	"	7*	35-45 cm	0.03	<0.2	0.2	5.4	16.0		
	"	"	"	6*	49-73 cm	0.12	<0.2	<0.2	9.5	26.0		
	VIIa E4 36	Ireland	"	6	2 years		0.02 0.16 0.08 0.06	0.02 0.59 0.24 0.23	1.56 7.33 4.93 2.37	5.7 34.0 18.6 9.4	0.01 0.02 0.02 0.004	
	4T	Canada	Sep	4	2-3 years	0.019 0.031 0.025 0.007	0.022 0.106 0.051 0.037	0.10 0.22 0.15 0.06	1.8 3.5 2.8 0.8	13.6 23.2 16.5 4.5		1.80 2.46 1.99 0.31
	"	"	"	5	3-4 years	0.016 0.027 0.022 0.006	0.030 0.085 0.055 0.025	0.26 0.56 0.38 0.14	2.8 5.1 3.9 0.8	13.2 20.2 16.3 2.6		1.38 2.04 1.73 0.24

*analysis of homogenate

/Continued

Table 1b Metals in Fish Liver (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight)						
						Hg min max MEAN s.d.	Cd min max MEAN s.d.	Pb min max MEAN s.d.	Cu min max MEAN s.d.	Zn min max MEAN s.d.	Cr min max MEAN s.d.	As min max MEAN s.d.
COD (Continued)			1977									
	4T	Canada	Sep	5	3-4 years	0.008 0.031 0.018 0.008	0.027 0.077 0.052 0.018	0.04 0.42 0.16 0.16	3.0 5.3 4.1 0.9	13.2 18.0 15.2 1.8		1.33 1.84 1.59 0.21
	"	"	"	5	4 years	0.012 0.029 0.020 0.006	0.026 0.064 0.043 0.015	0.04 0.14 0.08 0.03	2.2 4.3 3.4 0.8	10.3 16.3 13.5 2.2		1.19 2.38 1.73 0.47
	"	"	"	5	4 years	0.023 0.043 0.030 0.009	0.028 0.265 0.107 0.096	0.14 1.37 0.57 0.50	2.6 7.0 4.6 1.8	12.7 19.0 16.1 3.2		1.38 2.37 1.89 0.35
	"	"	"	3	5 years	0.011 0.033 0.023 -	0.036 0.103 0.065 -	0.06 1.98 0.74 -	2.8 5.2 4.3 -	13.2 16.6 15.0 -		1.71 2.49 2.10 -
	"	"	"	5	5 years	0.023 0.030 0.028 0.003	0.042 0.218 0.123 0.076	0.01 1.19 0.34 0.49	3.6 12.7 6.8 3.5	14.6 18.9 16.1 1.7		2.21 2.78 2.55 0.22
	"	"	"	3	6-7 years	0.035 0.049 0.043 -	0.095 0.121 0.107 -	0.03 0.09 0.06 -	3.7 6.8 5.3 -	15.2 19.3 16.9 -		2.71 3.97 3.27 -
	"	"	"	2	7-8 years	0.032 0.036 0.034 -	0.089 0.227 0.158 -	0.03 0.04 0.03 -	4.1 4.2 4.2 -	14.0 19.0 16.5 -		2.64 4.24 3.44 -
	3M	"	"	10	6 years	0.021 0.094 0.039 0.024	0.94 3.36 1.34 0.66	0.08 0.78 0.20 0.19	2.7 14.8 6.1 3.7	17.6 44.0 22.5 8.0		1.79 5.35 3.06 1.29

/Continued

Table 1b Metals in Fish Liver (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	Concentration (mg/kg wet weight) Hg	Cd	Pb	Cu	Zn	Cr	As
						min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.
PLAICE (Pleuronectes platessa)			1977									
	IVb F8 36	Germany, Fed.Rep.of	Sep	10	1975	0.02 0.06 0.04 0.02	0.029 0.047 0.037 0.006	0.08 0.12 0.10 0.01	3.4 8.3 6.9 1.8	20.0 31.5 23.3 3.8		
	VIIa E6 36	England/Wales	Nov	8*	27-32 cm	0.07	<0.2	0.3	5.3	50.0		
	"	"	"	5*	34-40 cm	0.10	0.2	0.4	5.5	62.0		
	"	"	"	3*	40-62 cm	0.59	0.9	0.3	4.4	70.0		
FLOUNDER (Pleuronectes flesus)												
	IVc F1 32	England/Wales	Jun	25*	17.5-19 cm	0.06	<0.2	0.8	4.5	18		
	"	"	"	15*	20-22 cm	0.11	<0.2	0.6	7.0	32		
	"	"	"	20*	23-26 cm	0.07	<0.2	0.6	9.5	34		
	"	"	"	15*	26-28.5 cm	0.05	<0.2	0.6	13.0	36		
	"	"	"	10*	30-31 cm	0.22	0.6	0.6	13.0	30		
	"	"	"	15*	32-35.5 cm	0.42	0.5	0.3	24.0	38		
	VIIa E6 36	"	Dec	20*	23-39 cm	0.30	<0.2	2.0	18.0	50		

*) analysis of homogenate

Table 1c Metals in Shellfish.

Species	Source	Country	Date of Collection	Number Analysed	Size Range	Tissue	Concentration (mg/kg wet weight) Hg	Cd	Pb	Cu	Zn
							min	min	min	min	min
							max	max	max	max	max
							MEAN	MEAN	MEAN	MEAN	MEAN
							s.d.	s.d.	s.d.	s.d.	s.d.
MUSSELS (Mytilus edulis)			1977								
	IVc FO 34	England/Wales	Oct	62	823 g	whole*	0.02	0.3	0.5	0.8	8.8
	"	"	"	20	188 g	whole*	0.02	0.2	0.9	1.3	11.0
	VIIa E6 36	"	Aug	30	166 g	whole*	0.05	0.5	0.6	1.1	
	VIIa E6 35	"	Nov	20	201 g	whole*	0.04	0.3	1.2	1.2	16.0
	VIId	France	1977				0.02	0.02	0.04	0.8	11.0
							0.09	0.24	0.30	2.6	52.7
							-	-	-	-	-
							-	-	-	-	-
	VIIe E6 26	"					0.02	0.03	0.02	0.6	18.4
							0.09	0.49	0.35	5.6	52.7
							-	-	-	-	-
							-	-	-	-	-
	VIId E9 27	"					0.01	0.14	0.07	2.3	12.2
							0.07	1.40	0.18	4.4	43.5
							-	-	-	-	-
							-	-	-	-	-
SCALLOPS (Pecten maximus)											
	VIIe E6 26	France	1977				0.03	0.12	-	0.6	30.1
							0.07	0.17	-	1.7	38.7
							-	-	0.04	-	-
							-	-	-	-	-
BROWN SHRIMP (Crangon crangon)											
	IVc FO 32	England/Wales	Dec	50	102 g	whole*	0.07	0.4	0.2	18.0	20.0

*) Whole soft body.

Table 2a Organochlorines in Fish Muscle.

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) Dieldrin min max MEAN s.d.	ppDDE min max MEAN s.d.	ppTDE min max MEAN s.d.	ppDDT min max MEAN s.d.	Σ DDT min max MEAN s.d.	PCBs min max MEAN s.d.	HCB min max MEAN s.d.
COD (Gadus morhua)			1977										
	VIa E4 39	Scotland	Mar	10		0.3	0.004	0.002	0.001	0.003	0.006	0.03	
	"	"	July	10		0.8	0.001	0.002	<0.001	0.001	<0.004	0.03	
	IVa E6 44	Scotland	Mar	10		0.2	0.001	0.001	<0.001	0.001	<0.003	0.01	
	"	"	July	10		0.1	0.001	0.001	<0.001	0.001	<0.003	0.01	
	IVb E7 41	Scotland	Feb	4		0.2	0.001	0.002	0.001	0.001	0.004	0.02	
	"	"	Aug	10		0.3	0.002	0.004	0.001	0.002	0.007	0.05	
	IVa F2 45	Scotland	Mar	10		0.2	0.001	0.002	0.001	0.002	0.005	0.02	
	IVa F0 47	Scotland	Sep	10		0.5	0.001	0.001	0.001	0.001	0.003	0.03	
	4T	Canada	Sep	4	2 years old	0.61 1.17 0.87 -						0.009 0.020 0.015 -	<0.001 <0.001
	4T	Canada	Sep	5	2 years old	0.51 1.06 0.70 -						0.011 0.019 0.016 -	<0.001

/Continued

Table 2a Organochlorines in Fish Muscle (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) ppDDT min / max / MEAN / s.d.	PCBs min / max / MEAN / s.d.	HCB min / max / MEAN / s.d.	α -HCH min / max / MEAN / s.d.
COD (Continued)			1977							
	4T	Canada	Sep	5	2+3 years old	0.58 0.91 0.76 -		0.010 0.025 0.016 0.006	<0.001	
	"	"	"	5	2+3 years old	0.47 0.71 0.54 -		0.006 0.027 0.012 0.008	<0.001	
	"	"	"	5	3+4 years old	0.58 1.51 0.78 -		0.005 0.011 0.008 0.002	<0.001	
	"	"	"	5	3+4 years old	0.44 0.67 0.59 -		0.004 0.012 0.007 0.003	<0.001	
	"	"	"	5	3+4 years old	0.45 0.77 0.62 -		0.006 0.012 0.009 0.003	<0.001	
	"	"	"	5	3+4 years old	0.49 0.78 0.61 -		0.005 0.011 0.008 0.002	<0.001	
	"	"	"	3	5 years old	0.47 0.72 0.60 -		0.005 0.009 0.007 -	<0.001	
	"	"	"	5	4-6 years old	0.51 0.61 0.56 -		0.007 0.010 0.008 0.001	<0.001	
	"	"	"	3	6+7 years old	0.50 0.65 0.58 -		0.010 0.017 0.015 -	<0.001	
	"	"	"	2	7+8 years old	0.51 1.18 0.84 -		0.010 0.012 0.011 -	<0.001	
	3M	"		10	6 years old			<0.001 0.020 0.008 0.005	<0.001 <0.001	

/Continued

Table 2a Organochlorines in Fish Muscle (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) Dieldrin	ppDDE	ppTDE	ppDDT	Σ DDT	PCBs
							min	min	min	min	min	min
							max	max	max	max	max	max
							MEAN	MEAN	MEAN	MEAN	MEAN	MEAN
							s.d.	s.d.	s.d.	s.d.	s.d.	s.d.
WHITING (Merlangius merlangus)			1977									
	VIa E4 39	Scotland	Mar	10		1.0	0.007	0.006	0.006	0.004	0.016	0.06
	" "	"	July	10		0.3	0.004	0.004	0.003	0.003	0.010	0.03
	IVa E6 44	"	Mar	10		0.3	0.002	0.004	0.001	0.003	0.008	0.05
	"	"	July	10		0.3	0.001	0.002	<0.001	0.001	0.004	0.03
	IVb E7 41	"	Feb	10		0.4	0.002	0.003	0.002	0.003	0.008	0.02
	"	"	Aug	10		0.6	0.004	0.001	0.002	0.003	0.006	0.05
	IVa F2 45	"	Mar	10		0.6	0.002	0.005	0.002	0.005	0.012	0.06
	IVa F0 47	"	Aug	10		0.3	0.001	0.002	0.001	0.002	0.005	0.03
HERRING (Clupea harengus)												
	VIa E4 39	Scotland	June	10		4.9	0.068	0.025	0.021	0.013	0.059	0.21
	IVa F2 45	"	Jan	10		6.1	0.004	0.012	0.008	0.013	0.033	0.09
PLAICE (Pleuronectes platessa)												
	VIa E4 39	Scotland	Mar	10		0.9	0.013	0.010	0.009	0.010	0.029	0.12
	"	"	July	10		0.8	0.002	0.003	0.001	0.001	0.005	0.03
	IVa E6 44	"	Mar	10		0.5	0.001	0.001	0.001	0.001	0.003	0.01
	"	"	July	10		0.6	0.001	0.002	0.001	0.001	0.004	0.02
	IVb E7 41	"	Aug	10		0.4	0.001	0.002	0.001	0.001	0.004	0.02
	IVa F2 45	"	Mar	10		0.4	0.002	0.001	<0.001	0.001	0.003	0.02
	IVa F0 47	"	Sep	2		0.5	0.002	0.003	0.001	0.003	0.007	0.03
	VIId	France	-	-		-	-	0.002	0.002	0.003	0.007	0.07
MACKEREL (Scomber scombrus)												
	VIId	France						0.006	0.008	0.003		0.70
								0.010	0.012	0.013		0.76
								-	-	-		-
								-	-	-		-

Table 2b Organochlorines in Fish Liver.

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) Dieldrin	ppDDE	ppTDE	ppDDT	Σ DDT	PCBs
							min	min	min	min	min	min
							max	max	max	max	max	max
							MEAN	MEAN	MEAN	MEAN	MEAN	MEAN
							s.d.	s.d.	s.d.	s.d.	s.d.	s.d.
COD (Gadus morhua)			1977									
	IVc F1 33	England/Wales		10	0-year-class	6	0.03	0.10	0.05	0.03	0.18	1.5
						35	0.2	0.46	0.35	0.24	1.05	7.5
						22	0.08	0.17	0.11	0.10	0.38	2.7
						-	0.05	0.11	0.09	0.07		1.7
	"	"		10	1-year-class	35	0.05	0.1	0.05	<0.002	0.15	1.0
						96	0.4	0.6	0.6	0.07	1.27	10.0
						59	0.19	0.30	0.19	0.05	0.54	5.5
						-	0.11	0.18	0.17	0.03	-	3.2
	VIa E4 39	Scotland	Mar	10		15.6	0.320	0.39	0.35	0.07	0.81	4.28
	"	"	July	10		29.9	0.151	0.51	0.44	0.06	1.01	4.24
	IVa E6 44	"	Mar	10		39.4	0.034	0.23	0.11	0.23	0.57	1.52
	"	"	July	10		39.9	0.025	0.10	0.14	0.04	0.28	0.80
	IVb E7 41	"	Feb	4		45.7	0.180	0.34	0.19	0.21	0.74	2.56
	"	"	Aug	10		25.3	0.129	0.44	0.24	0.02	0.70	4.18
	IVa F2 45	"	Mar	10		49.8	0.026	0.23	0.07	0.22	0.52	1.67
	IVa F0 47	"	Sep	10		49.6	0.067	0.12	0.07	0.08	0.27	1.11

/Continued

Table 2b Organochlorines in Fish Liver (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) ppDDT	PCBs	HCB	α-HCH
							min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.
COD (Continued)			1977							
	4T	Canada	Sep	4	2 years old	4.4 22.9 14.2 -	0.024 0.224 0.088 -	0.32 1.12 0.72 -	0.003 0.021 0.010 -	<0.001 0.033
	"	"	"	5	2 years old	6.6 22.9 12.4 -	0.084 0.234 0.143 0.056	0.53 1.13 0.84 0.25	0.004 0.019 0.009 0.006	0.013 0.067 0.029 0.022
	"	"	"	5	2+3 years old	9.1 27.8 16.5 -	0.87 0.172 0.131 0.035	0.80 1.39 1.07 0.21	0.009 0.032 0.019 0.010	0.011 0.051 0.029 0.016
	"	"	"	5	2+3 years old	12.5 44.7 35.7 -	0.186 0.419 0.281 0.112	1.40 3.58 2.26 0.90	0.019 0.079 0.040 0.024	0.015 0.077 0.054 0.024
	"	"	"	5	3+4 years old	27.7 47.2 39.9 -	0.195 0.344 0.253 0.059	1.27 2.30 1.71 0.38	0.039 0.074 0.056 0.012	0.056 0.103 0.083 0.017
	"	"	"	5	3+4 years old	26.2 47.9 37.6 -	0.171 0.355 0.236 0.078	1.01 2.19 1.49 0.43	0.019 0.062 0.037 0.017	0.031 0.075 0.059 0.018
	"	"	"	5	3+4 years old	36.2 49.6 41.8 -	0.120 0.377 0.236 0.098	1.09 2.50 1.76 0.58	0.017 0.056 0.034 0.016	0.070 0.119 0.098 0.020

/Continued

Table 2b Organochlorine in Fish Liver (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) ppDDT	PCBs	HCB	α -HCH
							min	min	min	min
							max	max	max	max
							MEAN	MEAN	MEAN	MEAN
							s.d.	s.d.	s.d.	s.d.
COD (Continued)			1977							
	4T	Canada	Sep	5	3+4 years old	31.0	0.200	1.45	0.015	0.070
						51.9	0.413	1.85	0.063	0.094
						41.8	0.286	1.64	0.033	0.083
						-	0.078	0.17	0.021	0.010
	"	"	"	3	5 years old	41.4	0.237	1.63	0.040	0.077
						55.7	0.402	1.97	0.054	0.101
						47.6	0.377	1.79	0.047	0.088
						-	-	-	-	-
	"	"	"	5	4-6 years old	51.1	0.403	1.94	0.051	0.056
						58.6	0.722	2.79	0.065	0.070
						54.9	0.549	2.31	0.059	0.064
						-	0.160	0.37	0.005	0.006
	"	"	"	3	6+7 years old	45.7	0.654	2.55	0.050	0.048
						53.6	1.013	5.24	0.121	0.065
						48.3	0.843	3.98	0.089	0.057
						-	-	-	-	-

/Continued

Table 2b Organochlorines in Fish Liver (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) Dieldrin	ppDDE	ppTDE	ppDDT	Σ DDT	PCBs	HCB	α-HCH
COD (continued)			1977											
	4T	Canada	Sep	2	7+8 years old	53.6				0.862		4.16	0.115	0.059
						56.6				1.119		5.41	0.121	0.059
						55.1				0.990		4.78	0.118	0.058
						-				-		-	-	-
	3M	"		10	6 years old							0.13	0.003	
												1.61	0.040	
												1.07	0.022	
												0.82	0.011	
	IVa F2 50	Netherlands	Mar 1978	8	4.4 years (78 cm)	54.5	0.07	0.23	0.13	0.23	0.60	1.1	0.03	0.03
	IVb F5 40	"	Nov 1977	8	3.8 years (71 cm)	47.3	0.19	0.59	0.18	0.26	1.0	16.0	0.10	0.06
	IVc F4 33	"	Dec 1977	10	4.8 years (90 cm)	51.5	0.30	0.69	0.22	0.27	1.2	27.0	0.24	0.11
WHITING (Merlangius merlangus)														
	VIa E4 39	Scotland	Mar	10		35.5	0.83	0.74	0.57	0.60	1.91	6.14		
	"	"	July	10		40.1	0.20	0.50	0.40	0.27	1.17	4.10		
	IVa E6 44	"	Mar	10		42.8	0.12	0.25	0.09	0.22	0.56	3.44		
	"	"	July	10		49.8	0.06	0.26	0.26	0.09	0.61	2.19		
	IVb E7 41	"	Feb	10		38.0	0.18	0.02	0.17	0.08	0.27	2.05		
	"	"	Aug	10		51.7	0.21	0.36	0.19	0.21	0.76	4.41		
	IVa F2 45	"	Mar	10		46.1	0.20	0.31	0.16	0.31	0.78	2.80		
	IVa F0 47	"	Aug	10		52.6	0.06	0.15	0.11	0.16	0.42	1.04		

/Continued

Table 2b Organochlorines in Fish Liver (continued).

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight)							
							Dieldrin min max MEAN s.d.	ppDDE min max MEAN s.d.	ppTDE min max MEAN s.d.	ppDDT min max MEAN s.d.	Σ DDT min max MEAN s.d.	PCBs min max MEAN s.d.	HCB min max MEAN s.d.	∝-HCH min max MEAN s.d.
HERRING (Clupea harengus)			1977											
	VIa E4 39	Scotland	June	10		9.4	0.19	0.05	0.07	0.03	0.15	0.41		
	IVa F0 47	"	Jan	10		12.5	0.015	0.029	0.014	0.022	0.065	0.20		
PLAICE (Pleuronectes platessa)														
	VIa E4 39	Scotland	Mar	10		8.8	0.13	0.05	0.04	0.02	0.11	0.78		
	"	"	July	10		22.3	0.04	0.05	0.04	0.006	0.096	0.55		
	IVa E6 44	"	Mar	10		4.6	0.01	0.01	<0.01	0.01	0.03	0.04		
	"	"	July	10		21.8	0.016	0.037	0.017	0.024	0.078	0.37		
	IVb E7 41	"	Aug	10		3.1	0.020	0.026	0.011	0.009	0.046	0.41		
	IVa F2 45	"	Mar	10		7.0	0.01	0.01	0.01	0.01	0.03	0.08		
	IVa F0 47	"	Sep	2		10.9	0.022	0.033	0.016	0.009	0.058	0.43		
FLOUNDER (Platichthys flesus)														
	IVc F1 32	England/Wales		18	3-9 years (24-25.5 cm)	3 38 14 -	0.03 0.15 0.07 0.04	0.03 0.18 0.09 0.04	0.03 0.25 0.10 0.05	0.01 0.12 0.06 0.05	0.07 0.55 0.25	0.20 4.0 1.6 0.94		

Table 2b' Organochlorines in Fish Liver on a fat Weight Basis.

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight) Dieldrin	ppDDE	ppTDE	ppDDT	Σ DDT	PCBs	HCB	∝-HCH
							min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.	min max MEAN s.d.
COD (Gadus morhua)					Mean									
	IVa F2 50	Netherlands	Mar 1978	8	4.4 years (78 cm)	54.5	0.12	0.42	0.23	0.43	1.1	2	0.05	0.05
	IVb F5 40	"	Nov 1977	8	3.8 years (71 cm)	47.3	0.41	1.25	0.39	0.54	2.2	34	0.20	0.13
	IVc F4 33	"	Dec 1977	10	4.8 years (90 cm)	51.5	0.58	1.34	0.43	0.52	2.3	53	0.47	0.21
	IVc F1 33	England/Wales		10	0-year-class	6	0.16	0.30	0.16	0.08	0.60	5.5		
						35	0.70	1.9	1.60	1.5	5.0	33.0		
						22	0.37	0.96	0.65	0.59	2.19	15.5		
		"		10	1-year-class	35	0.09	0.18	<0.09	<0.05		2.0		
						96	0.5	1.6	1.0	0.3	2.4	28.0		
						59	0.30	0.52	0.30	-	-	9.7		
						-				-	-			
FLOUNDER (Pleuronectes flesus)														
	IVc F1 32	England/Wales		18	3-9 years (24-35.5 cm)	3	0.20	0.17	0.17	0.08	0.42	2.0		
						38	4.6	4.9	3.5	3.3	10.8	100.0		
						14	1.12	1.55	1.36	0.76	3.7	27.0		
						-								

Table 2c Organochlorines in Shellfish.

Species	Source	Country	Date of Collection	Number Analysed	Size/Age Year Class	% lipid	Concentration (mg/kg wet weight)					
							Dieldrin	ppDDE	ppTDE	ppDDT	Σ DDT	PCBs
							min	min	min	min	min	min
							max	max	max	max	max	max
							MEAN	MEAN	MEAN	MEAN	MEAN	MEAN
							s.d.	s.d.	s.d.	s.d.	s.d.	s.d.
MUSSELS (Mytilus edulis)			1977									
	IVc FO 34	England/Wales	Oct	62	828 g	0.4	0.002	<0.002	<0.002	0.003	<0.007	0.02
	IVc FO 34	"	"	20	188 g	0.8	0.005	0.004	0.006	0.005	0.015	0.07
	VIIa E6 36	"	Aug	30	166 g	0.4	0.007	<0.002	0.005	0.002	0.009	0.02
	VIIa E6 35	"	Nov	20	201 g	0.8	0.004	0.002	0.003	0.002	0.007	0.05
	VIIe E6 26	France						0.001	0.003	0.001	0.005	0.07
								0.042	0.012	0.030	0.074	0.41
								-	-	-	-	-
								-	-	-	-	-
BROWN SHRIMP (Crangon crangon)												
	IVc FO 32	England/Wales	Dec	50	102 g	0.6	0.002	<0.002	<0.002	<0.002	<0.006	<0.01
SCALLOPS (Pecten maximus)												
	VIIe E6 26	France						0.002	-	-		0.04
								0.010	-	-		0.15
								-	0.002	0.002		-
								-	-	-		-

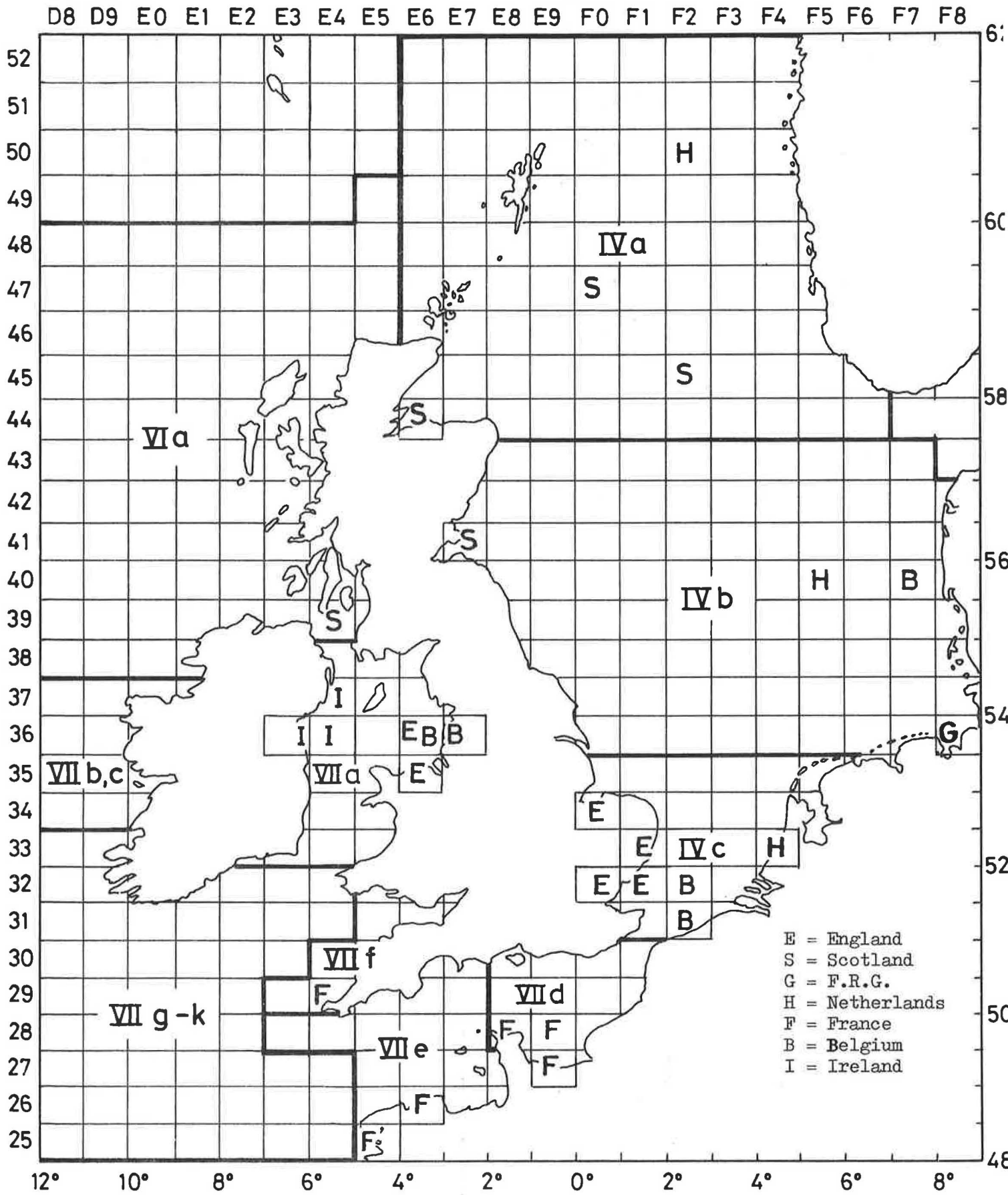

Figure 1. Localities in Northeast Atlantic sampled by named countries, 1977.

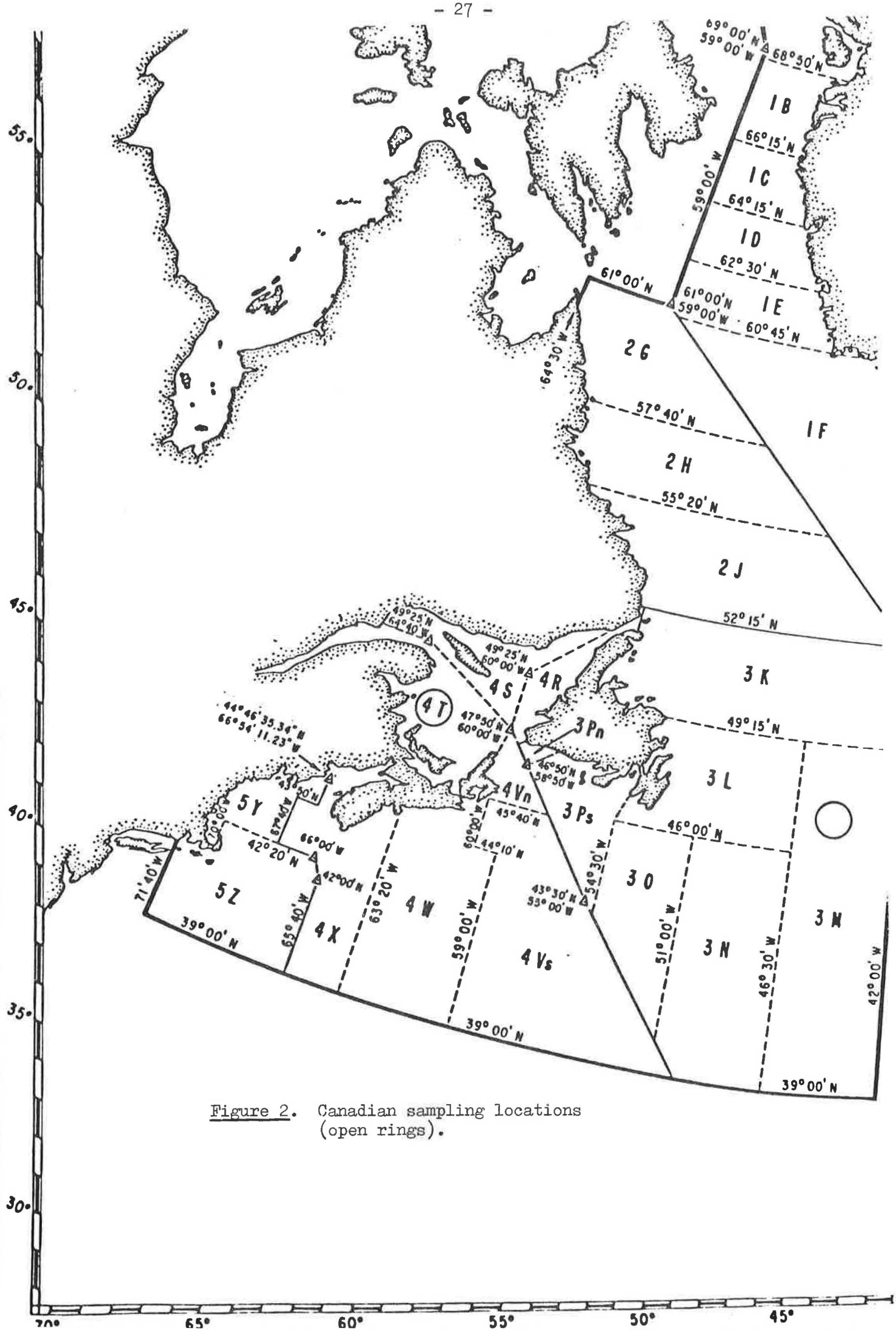

Figure 2. Canadian sampling locations (open rings).

Indication of spine colours

Reports of the Advisory Committee on Fishery Management	Red
Reports of the Advisory Committee on Marine Pollution	Yellow
Fish Assessment Reports	Grey
Pollution Studies	Green
Others	Black

-o-o-o-