International Council for
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C.M. 1971/E:33
Fisheries Improvement Committee

Mercury in marine fish. A preliminary report.

by

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The following report has been prepared in response to the relevant recommendation past by ICES Fisheries Improvement Committee at the Council meeting 1970.

Analyses on mercury content in marine organisms from Norwegian waters were first made by Raeder and Snekvik (1941, 1949 a and 1949 b). The levels in several species of marine fish, crustaceans and molluscs were recorded, and ranged mostly between 0.05 - 0.15 ppm total Hg (wet weight).

As a consequence of the world wide problem of mercury contaminated fish, some analyses were performed on commercial Norwegian cod (samples) in 1965. The recorded values were below 0.1 ppm in muscle. Over the last years a more intensive study of the mercury problem in the whole biota has been performed.

Different laboratories, identified by their initials in the text of the figures 1 to 8, have performed the analyses, the result of which are presented here. These laboratories are: Institutt for Næringsmiddelhygiene, Norges Veterinærhøyskole, Oslo, (NVH), Veterinærinstituttet, Oslo, (VI), Sentral-instituttet for Industriell Forskning, Oslo, (SI), Hermetikkindustriens Kontrollinstitutt, Stavanger, (HK). The values are given in ppm, wet weight.

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The results of a gradient study of mercury in the Trondheimsfjord waters are presented in Fig. 9. This fjord is an example of a fjord system shown to be contaminated by mercury from the pulp mill industry situated in the inner part of the fjord (Berge, Ljøen and Palmork 1970).

DISCUSSION

The commercial fisheries of Norway are based on coastal waters and high sea fishing, except for sprat which are also caught in the fjords. The results compiled demonstrate that the resources on which these fisheries are based are very low in mercury. For the different species of the offshore fish, there are no noticeable increase in the mean mercury levels since the time of the analyses reported by Raeder and Snekvik (1941, 1949 a and 1949 b).

Much of the analytical work has been conducted in areas of suspected contamination from industrial plants using mercury in their production.

Figures 1 to 8 show that five areas demonstrate a raised level of mercury in fish. These areas are: The inner Trondheimsfjord, the Sørfjorden branch of the Hardangerfjord, the Fedafjord, the Eidangerfjord area and the Drammsfjord. The sources of inputs are identified as pulp mill factories, zinc production, chlorine production and PVC production.

Due to the pollution problems, the pulp mill factories voluntarily stopped using mercury fungicides in their production by January 1970. The other factories in question have started research programmes to minimize their mercury pollution.

Comparing the levels of mercury in the different fish from the polluted areas, it is noticeable that levels are highest in cod, intermediate in flatfish and haddock and lowest in sprat. These differences are probably attributable to their feeding habits. Even in the most suspected areas, no sprat has been found to have any noteworthy levels of mercury, the maximum being 0.3 ppm and the overall mean 0.08 ppm. Cod, however, has in the Sørfjord been recorded with maximum 4 ppm mercury.

No commercial fisheries take place in these fjords, but some sports fishing and fishing for private consumption occur. The fact that the products of this fishing are not marketed and that they are of little overall importance in the household explains why it has not been found necessary to introduce restrictions.

Programmes have been carried out and others are under way to investigate the physical and biological transport from the input sources. The report by Berge, Ljøen and Palmork (1970) on the sediment and sea water analysis on mercury from the Trondheimfjord, showed that in spite of the input being stopped half a year earlier, great amounts of mercury were still present in the sediments outside a pulp mill factory. This contributed continously to the fjord water, and raised levels were recorded in the surface water within this basin. The impression from these results, as well as from other observations are that there is a retarded transport of mercury out of the fjord system.

REFERENCES

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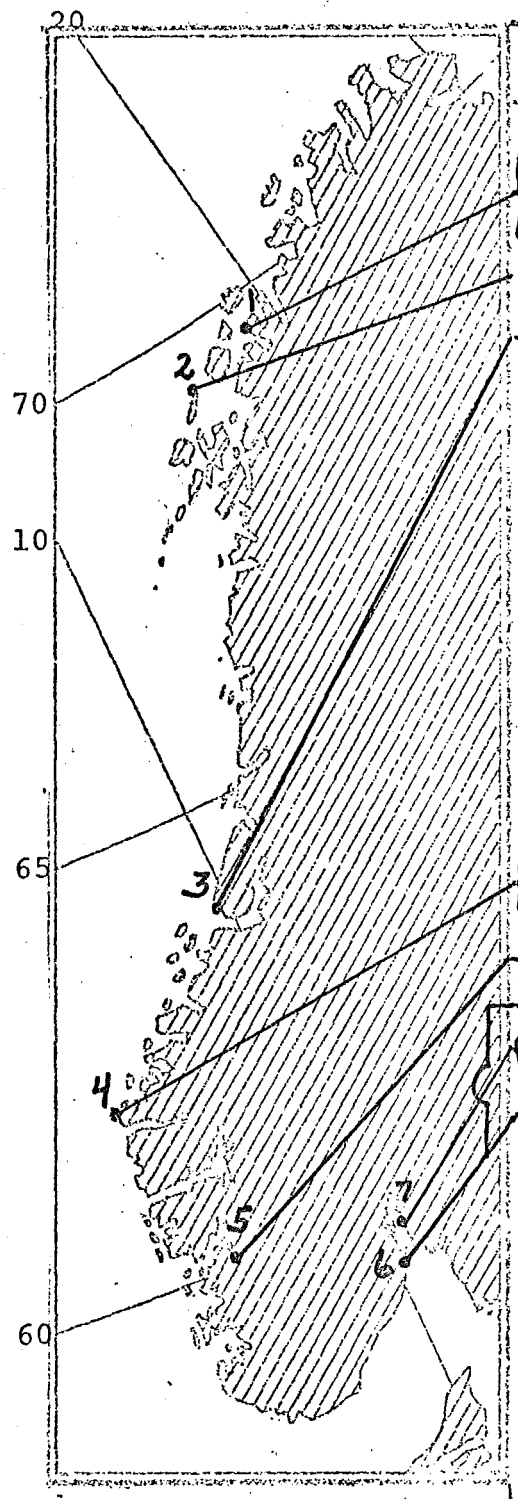
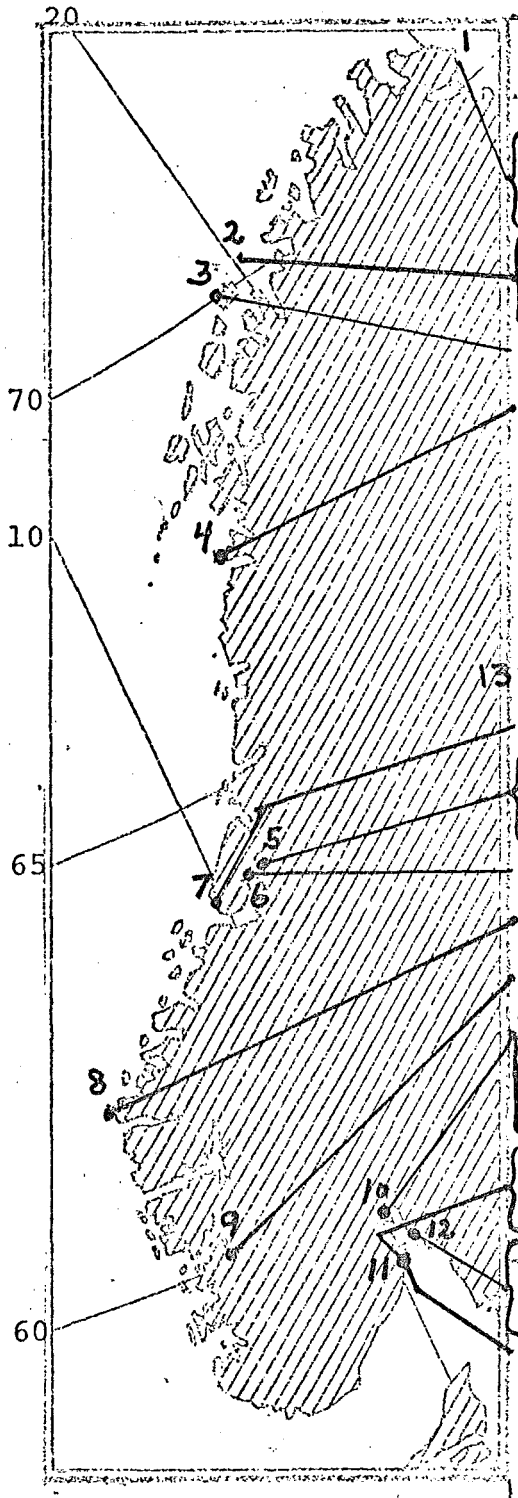
MERCURY in ppm Fig. 1



	MIN	MAX	MEAN	n	ANALYSED BY
Coalfish					
1. Fjordgård	0,220	0,360	0,249	10	NVH
	0,21	0,36	0,24	4	VI
2. Andøya	0,039	0,130	0,067	12	NVH
	0,040	0,050	0,045	2	NVH
	0,040	0,040	0,040	2	SI
3. Trøndelag	0,073	0,087	0,081	5	VI
		0,707[x]		1	
4. Tautra	0,06	0,06	0,06	1	VI
5. Sørfjorden	0,18	1,63	0,71	8	NVH
6. Frierfjord, Eidangerfjord	0,09	0,14	0,12	5	NVH
7. Fredrikstad-Hvaler	1,27	1,27	1,27	1	NVH

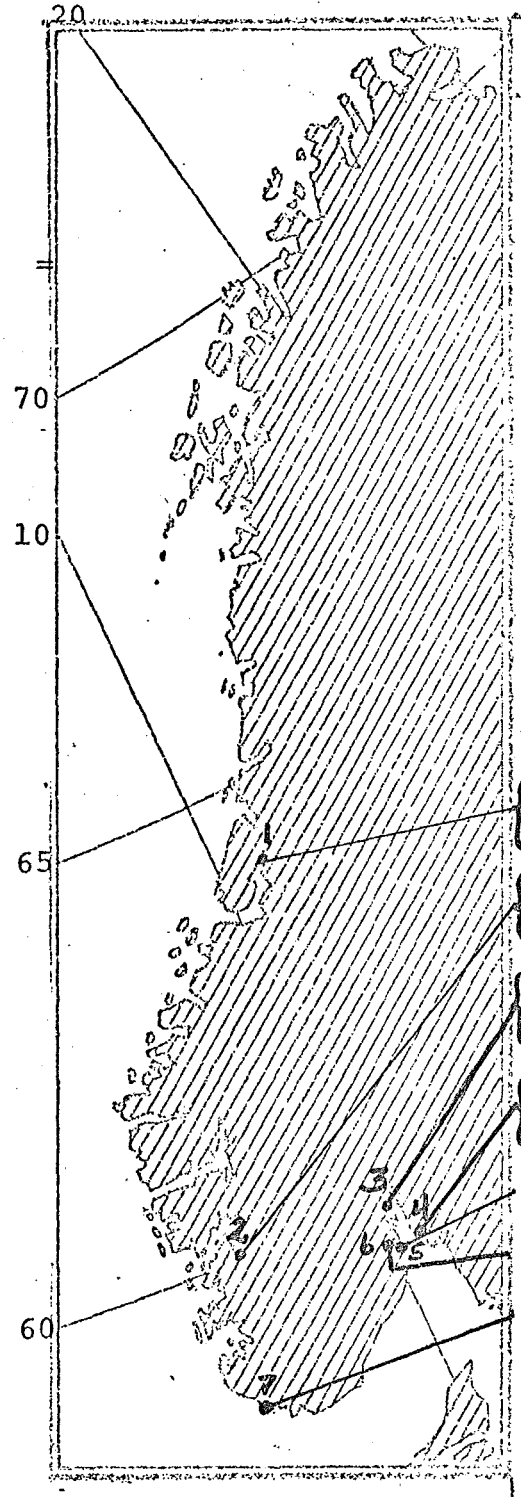
MERCURY in ppm Fig. 2



	MIN	MAX	MEAN	n	ANALYSED BY
Cod					
1. Øst-Finnmark	0, 050	0, 110	0, 080	2	NVH
	0, 04	0, 04	0, 04	2	SI
2. Ytre Troms	0, 130	0, 150	0, 13	2	NVH
	0, 05	0, 06	0, 055	2	SI
3. Løksfjord	0, 040	0, 110	0, 072	6	NVH
4. Mistfjord	0, 050	0, 150	0, 085	12	NVH
13. Midtre Fjord	0, 078	0, 086	0, 084	4	VI
	0, 043	0, 084	0, 059	6	VI
5. Steinkjær	0, 24	0, 24	0, 24	1	VI
6. Follafoss	0, 17	2, 05	0, 53	14	VI
7. Hennefjord	0, 08	0, 26	0, 16	5	VI
8. Tautra	0, 052	0, 220	0, 099	9	VI
9. Sørfjorden	0, 45	4, 70	1, 25	7	VI
10. Drammensfjord	1, 01	3, 27	1, 87	4	NVH
	1, 95	4, 66	3, 52	7	NVH
	0, 22	3, 11	1, 27	56	NVH
	0, 04	0, 55	0, 24	10	NVH
11. Frierfjord, Eidangerfjord	0, 11	0, 22	0, 14	5	NVH
12. Fredrikstad-Hvaler	0, 2			1	
	0, 10	0, 60	0, 25	13	NVH
	0, 31	3, 60	0, 84	47	NVH

MERCURY in ppm

Fig. 3



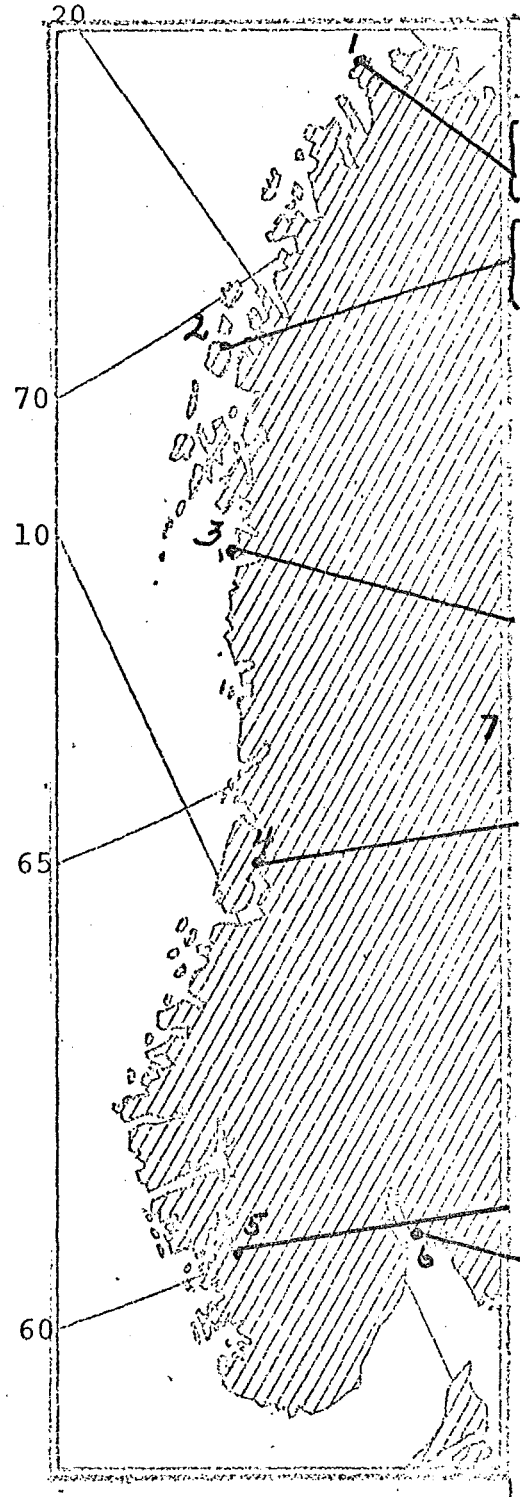
	MIN	MAX	MEAN	n	ANALYSED BY
1	0,10	0,38	0,26	5	VI
	0,41	0,50	0,46	2	VI
2	0,32	1,90	1,02	6	VI
	1,20	1,20	1,20	1	VI
3	0,38	1,08	0,65	10	NVH
	0,29	1,37	0,73	10	NVH
4	0,13	0,24	0,21	3	NVH
	0,09	0,21	0,17	4	NVH
5	0,63	1,16	0,96	3	NVH
6	0,11	0,34	0,20	8	NVH
7	0,54	0,54	0,54	1	VI

Flatfish

1. Trondheimsfjord
2. Sørfjorden
3. Drammensfjord
4. Fredrikstad-Hvaler
5. Sandefjord
6. Frierfjord, Eidangerfjord
7. Fedafjord

MERCURY in ppm

Fig. 4

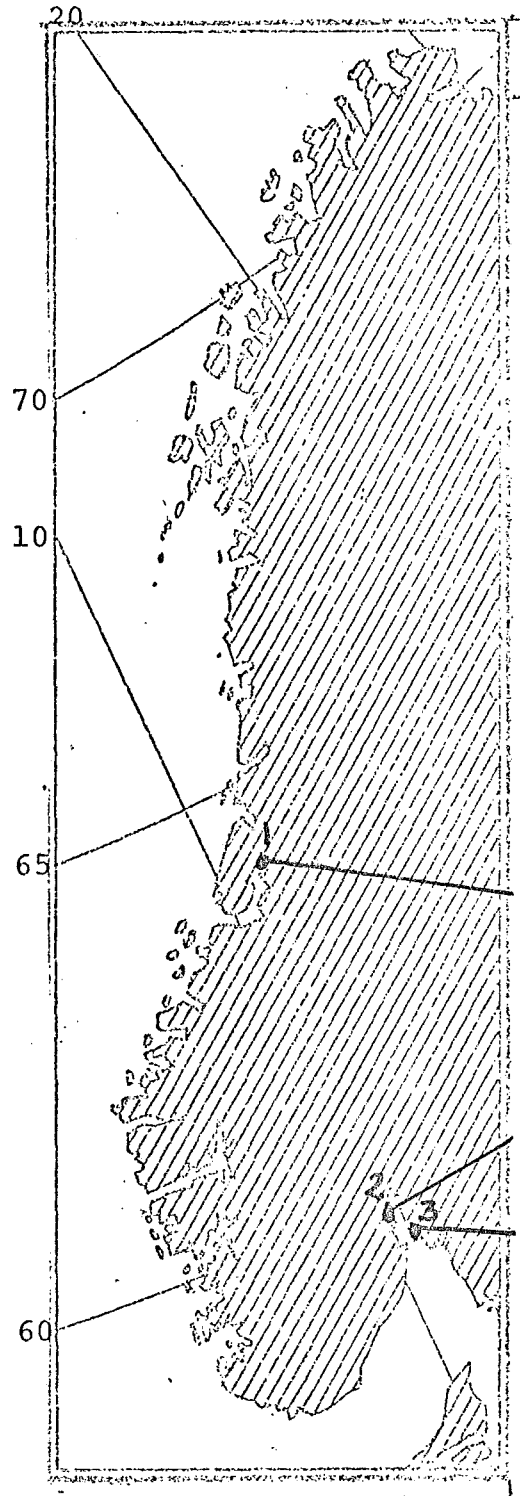


	MIN	MAX	MEAN	n	ANALYSED BY
1	0,030	0,070	0,050	2	NVH
	0,020	0,040	0,030	2	SI
2	0,04	0,04	0,04	2	SI
	0,04	0,05	0,045	2	NVH
3	0,14	0,14	0,14	0	VI
7	0,043	0,093	0,064	4	VI
4	0,08	0,50	0,22	5	VI
5	0,43	0,51	0,46	3	VI
6	0,06	0,22	0,11	9	NVH

Haddock

1. Vest Finnmark
2. Senja
3. Mistfjorden
4. Follafoss
5. Sørfjorden
6. Hvaler
7. Nord-Norge

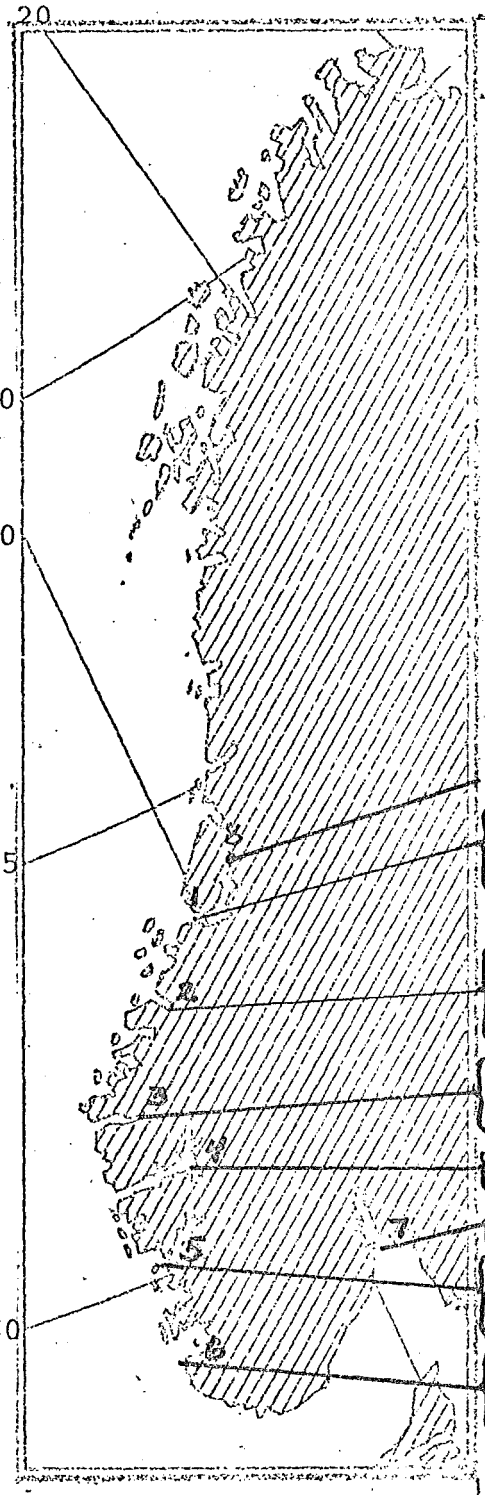
MERCURY in ppm Fig. 5



	MIN	MAX	MEAN	n	ANALYSED BY
Herring					
1. Borgenfjord	0, 03	0, 04	0, 04	5	VI
2. Drammensfjord	0, 05	0, 09	0, 07	4	NVH
3. Fredrikstad-Hvaler	0, 06	0, 76	0, 14	13	NVH

MERCURY in ppm

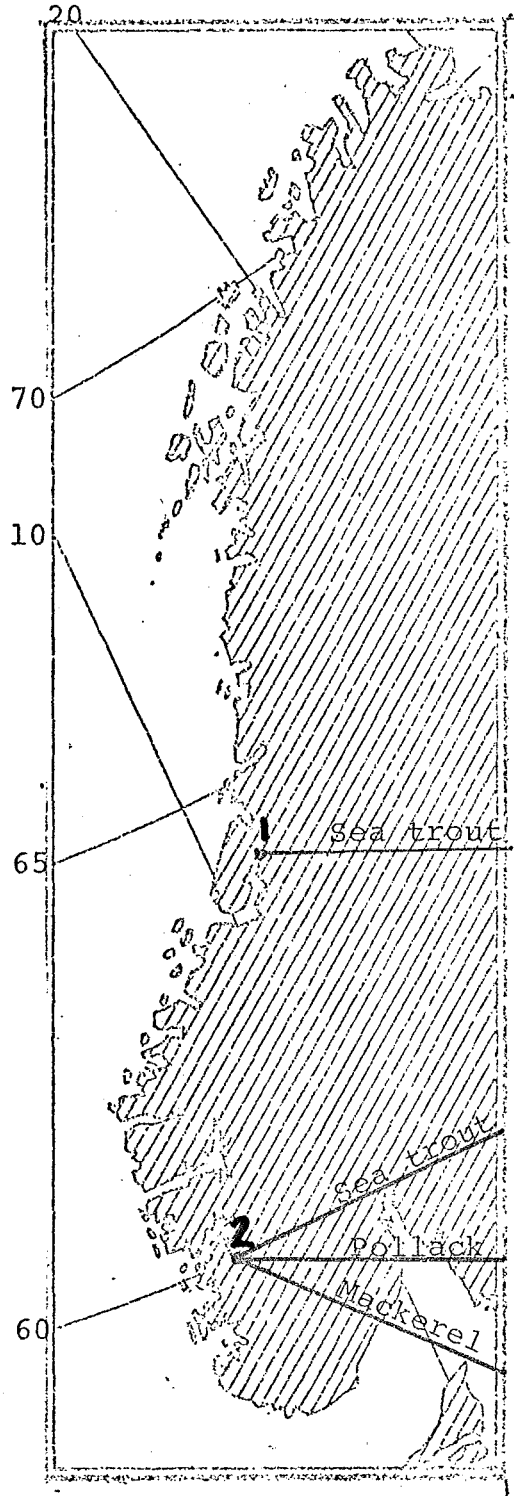
Fig. 6



Sprat

	MIN	MAX	MEAN	n	ANALYSED BY
1. Trondheimsfjorden	0,012	0,11	0,05	5	VI
2. Møre og Romsdal	0,05	0,15	0,11	16	HL
3. Nordfjord	0,04	0,04	0,04	12	HL
4. Sognefjord	0,02	0,06	0,04	4	HL
5. Ytre Hardanger	0,02	0,09	0,04	28	HL
6. Ryfylke	0,04	0,08	0,06	6	HL
7. Oslofjorden Sørlandet	0,02	0,05	0,04	4	HL
8. Borgenfjord	0,04	0,06	0,05	4	HL
	0,02	0,30	0,11	42	HL
	0,10	0,23	0,16	14	HL
	0,11	0,15	0,12	6	HL
	0,03	0,08	0,05	26	HL
	0,03	0,07	0,05	8	HL

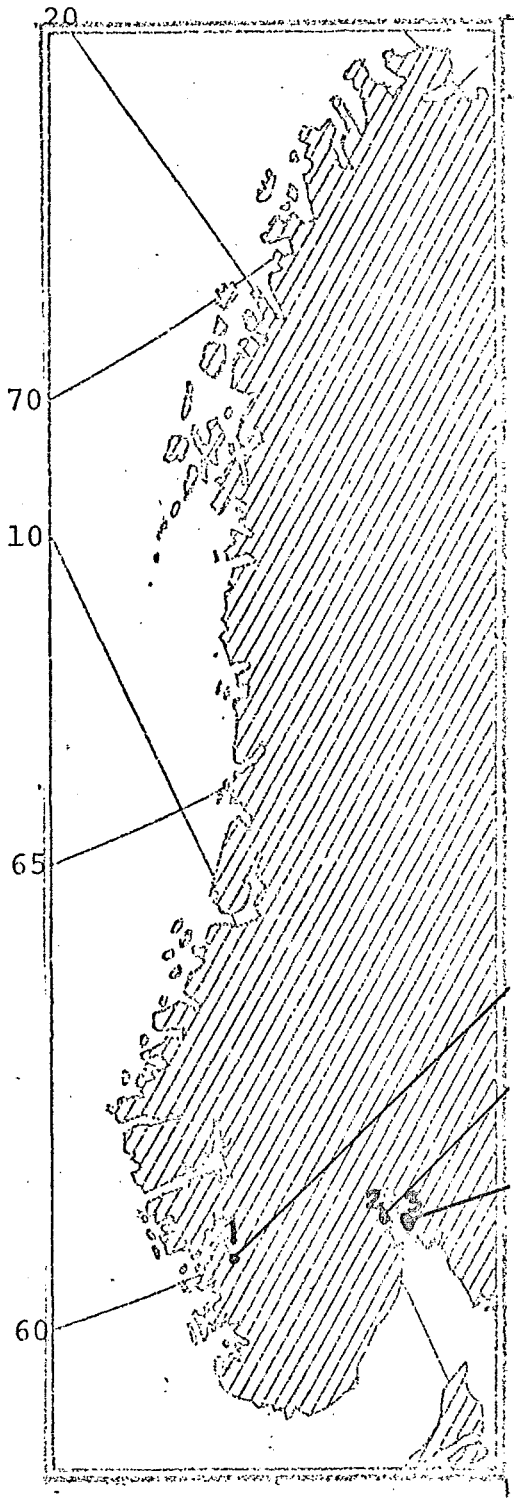
MERCURY in ppm Fig. 7



	MIN	MAX	MEAN	n	ANALYSED BY
Sea trout	0,12	0,22	0,16	9	VI
Sea trout	0,30	0,32	0,31	2	VI
Pollack	0,20	0,98	0,46	19	VI
Mackerel	0,08	0,12	0,10	1	VI

1. Ogna / Byaelva
2. Sørfjorden

MERCURY in ppm Fig. 8



	MIN	MAX	MEAN	n	ANALYSED BY
Whiting					
1. Sørfjorden	0,38	0,99	0,68	7	VI
2. Drammensfjord	0,74	1,88	1,52	9	NVH
3. Fredrikstad-Hvaler	0,13	0,30	0,22	2	NVH

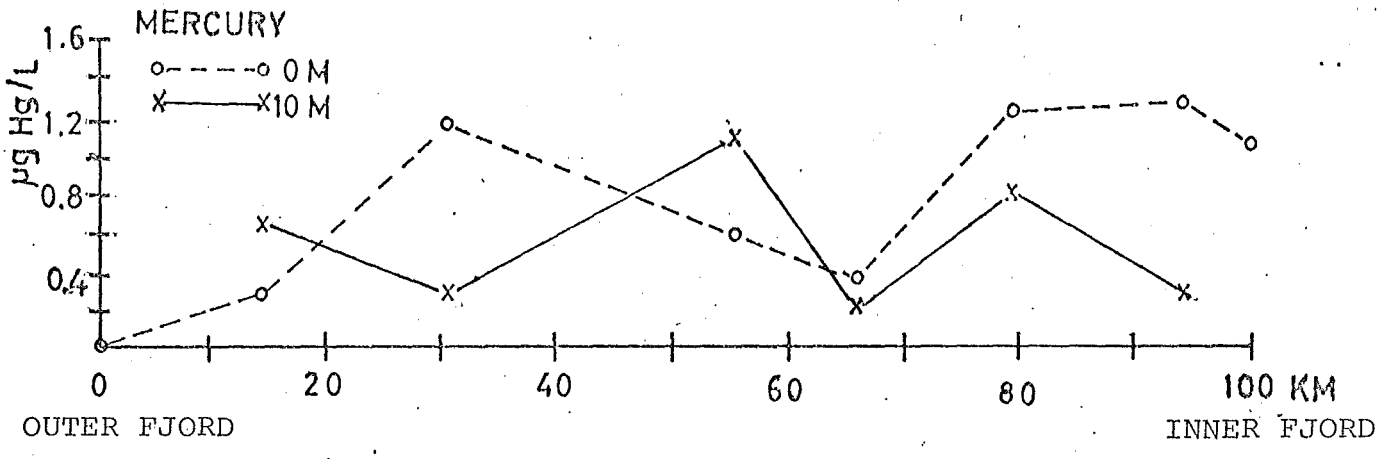


Fig. 9. Mercury content of the Trondheim fjord water May 1970. From Berge et el. (1970).