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Further Studies on the Mercury Contents in Some Species of Marine Fish and Molluscs

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Mercury pollution was first detected in Japan (IRUKAYAMA 1966) and then in many others countries including Sweden (JHONELS et al. 1967), the United States (ANON. 1970 a,b,c) and Canada (WOBESER et al. 1970; BLIGH MS 1970).

In the last few years studies have also been carried out in the Mediterranean (JUN UI 1971; D'AUBERT et al. 1974; AUBERT 1975; CUGURRA and MAURA 1976).

Mercury is present in contaminated fish and molluscs mostly in organic form (e.g. methyl mercury),(WESTÖÖ 1966, 1967; JHONELS et al. 1967; BACHE et al. 1971; KAMP et al. 1972). In fact it has been demonstrated that inorganic mercury, its salts and some organomercury compounds (coming from natural or man-made sources) can be biologically methylated by some microorganisms present in sea and lake bottom (JENSEN and JERNELÖV 1969). Methyl mercury thus enters the food chain and tends to accumulate because of its low excretion rates (JERNELÖV and LANN 1971).

Contaminated fish consumption can be dangerous to human health as documented in exceptional cases after repeated ingestion of polluted products, chiefly because many organic mercurials (e.g. methyl mercury) may produce irreversible damage to the central nervous system (BERGLUND et al. 1971; CURLEY et al. 1971).

This and other previous researches (CUGURRA and MAURA 1976). programmed since 1969 and realized starting from 1971 by our Ecological Research Group, were carried out to provide new data on the contamination level of alimentary ichthycal products, in particular of those coming from the Ligurian Sea.

This kind of research may contribute, althought indirectly,information on mercury pollution of the Ligurian Sea and, generally,of the Mediterranean.

MATERIALS and METHODS

The analyses were performed by five specialized

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government laboratories* on 365 samples of marine fish and molluscs belonging to 53 different species caught in the Ligurian Sea during 1974 and 1975.

Total mercury levels were determined by a variation of the flameless Atomic Absorption technique (HATCH and OTT 1968; LINDSTEDT 1970).

In short, 3 g of tissue were mineralized by heating them with sulphonitric mixture. Mercury (II) was reduced to elemental mercury with stannous chloride and then vaporized in an air current and swept into a quartz cell mounted in an Atomic Absorption unit. Absorption due to mercury was measured at 253.7 nm. The results were expressed in ppm (mg/kg wet wt).

RESULTS and DISCUSSION

The results are shown in Table 1. Data refering to a small sample number are also included because, even if not significant, they may be utilized to program future research projects on single species, expecially if they have revealed a high content of total mercury.

Samples partaining to 11 (Aristeomorpha foliacea; Arnoglossus, sp; Eledone, sp; Etmopterus spinax; Gaidropsarus, sp; Maena maena; Noephrops norvegicus; Pagrus pagrus; Penaeus keraturus; Serranus cabrilla; Trachurus, sp) of the 53 species showed a total mercury content higher than the legal admissable tollerance limit (0.7 ppm) in Italy. In 7 of the remainding species (Conger conger; Octopus vulgaris; Scomber scombrus; Scyllarus, sp; Serranus scriba; Solea vulgaris; Sphyrema sphyrema) total mercury levels higher than 0.5 ppm, the tollerance limit admitted in many countries, including the USA and Canada, were found.

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Laboratorio provinciale di igiene e profilassi di Imperia
Laboratorio provinciale di igiene e profilassi di La Spezia
Laboratorio provinciale di igiene e profilassi di Savona
Laboratorio zooprofilattico sperimentale del Piemonte e della Liguria (Torino).

TABLE 1

Species	n° of samples	total Hg ppm	
		mean ± S.D.	range
Aristeomorpha foliacea (Risso)	3	1.70*	1.20* – 2.50*
Arnoglossus, sp	1	1.15*	
Atherina mochon Valenciennes	7	0.11 ± 0.02	0.07 – 0.21
Boops boops (L.)	27	0.11 ± 0.04	0.03 – 0.25
Cepola rubescens L.	10	0.09 ± 0.06	trace – 0.20
Citharus linguatola (L.)	7	0.16 ± 0.08	0.03 – 0.28
Conger conger (L.)	13	0.18 ± 0.14	0.04 – 0.56**
Coris julis	1	0.13	
Dicentrarchus labrax (L.)	5	0.13 ± 0.06	0.05 – 0.23
Diplodus annularis (L.)	13	0.15 ± 0.07	0.08 – 0.26
Diplodus, sp	4	0.10	0.04 – 0.14
Eledone, sp	12	0.51** ± 0.41	0.08 – 1.33*

TABLE 1 (continued)

Engraulis encrasicholus Cuvier	13	0.11 ± 0.06	0.03 – 0.22
Etmopterus spinax (L.)	1	1.06*	
Eutrigla gurnardus (L.)	1	0.11	
Gadus merlangus L.	8	0.21 ± 0.06	0.10 – 0.30
Gaidropsarus, sp	4	0.50*	0.20 – 0.76*
Gogius cobitis Pallas	1	0.07	
Gobius, sp	13	0.10 ± 0.03	0.03 – 0.17
Lithognatus mormyrus (L.)	5	0.10 ± 0.05	0.03 – 0.19
Liza, sp	1	0.04	
Loligo vulgaris Lamk.	11	0.15 ± 0.04	0.08 – 0.24
Maena maena (L.)	11	0.30 ± 0.32	trace – 0.80*
Merluccius merluccius (L.)	26	0.15 ± 0.04	0.03 – 0.25
Micromesistius potassou (Risso)	2	0.29	0.18 – 0.40
Mugil cephalus L.	1	0.05	
Mullus, sp	25	0.13 ± 0.09	trace – 0.49
Mytilus galloprovincialis Lamk.	1	0.02	

TABLE 1 (continued)

Noephrops norvegicus L.	10	0.31 ± 0.30	0.04 - 0.90*
Octopus vulgaris Lamk.	11	0.20 ± 0.14	0.09 - 0.60**
Pagellus acarne (Risso)	1	0.18	
Pagellus erythrinus (L.)	2	0.12	0.11 - 0.13
Pagrus pagrus (L.)	8	0.17 ± 0.26	0.04 - 0.80*
Penaeus keraturus (Forssk.)	5	0.46 ± 0.36	0.27 - 1.10*
Saepia officinalis L.	13	0.15 ± 0.07	0.06 - 0.28
Sardina pilchardus (Walbaum)	8	0.16 ± 0.12	0.04 - 0.38
Sardinella aurita Valenciennes	1	0.10	
Sarpa salpa (L.)	2	0.05	0.05 - 0.05
Scorpaena porcus L.	9	0.12 ± 0.09	trace - 0.28
Scomber scombrus L.	2	0.45	0.19 - 0.70**
Scyliorhinus, sp	2	0.28	0.26 - 0.29
Scyllarus, sp	6	0.21 ± 0.20	0.07 - 0.60**
Serranus cabrilla (L.)	4	0.41 +	0.10 - 1.20*
Serranus scriba (L.)	4	0.30	0.14 - 0.62**

TABLE 1 (continued)

Solea vulgaris Quens.	6	0.17 ± 0.17	0.06 - 0.51**
Sphyrema sphyrema (L.)	1	0.70**	
Spicara, sp	10	0.10 ± 0.05	trace - 0.22
Spodyliostoma cantharus (L.)	1	0.05	
Trachinus, sp	7	0.12 ± 0.03	0.07 - 0.20
Trachurus, sp	12	0.19 ± 0.18	0.03 - 0.73*
Trigla lucerna (L.)	8	0.17 ± 0.06	0.10 - 0.28
Umbrina cirrosa (L.)	1	0.34	
Uranoscopus scaber (L.)	4	0.18	0.11 - 0.26

* Values > 0.7 ppm

** Values ≥ 0.5 ppm

D'Aubert (D'AUBERT et al. 1974) also found a low mercury content in some small fish (Engraulis encrasicholus; Sardina pilchardus; Boops boops; Mullus, sp).

The results of other researchers (CUGURRA and MAURA 1976; AUBERT 1975) are difficult to compare with ours for technical reasons (drawing of samples in very particular areas such as the docks of Genoa; difficulties in locating fishing areas or in singling out the species considered).

Several species that we analyzed revealed mercury levels higher than those found in fish caught in uncontaminated areas (0.01-0.1 ppm), (LOFROTH 1970).

It is a matter of course that, in order to have good information in this field, it is necessary to carry out periodical (e.g. annual) investigations, in order to clarify some major questions, such a :

1) are there species so contamined as to make some precautional measures necessary?
2) is mercury contamination increasing?
3) regarding the second question, are there mercury pollution sources that can be identified and eliminated?

The data presented here are preliminary and are intended to be evaluated in conjunction with other possible sources of information on mercury contamination levels of the Ligurian Sea and Mediterranean.

These studies will have minimal impact unless they are supported by data on the average fish consumption by the population in our area.

APPENDIX

It is also well known that the mercury contamination level in marine fish and molluscs depends on many factors: mercury pollution of the waters of their habitat, position they occupy in the food chain, size and age they have, etc.

The main causes of marine pollution are: naturally occuring mercury in the sea bottom, industrial and agricultural discharges, torrential regime of the rivers and sea currents that can carry mercurial compounds from area to area.

It stands to reason that, to tackle correctly the problem of high levels of mercury in marine fish and molluscs, it would be necessary to consider all the possible causes in order to prevent, rather than mitigate,

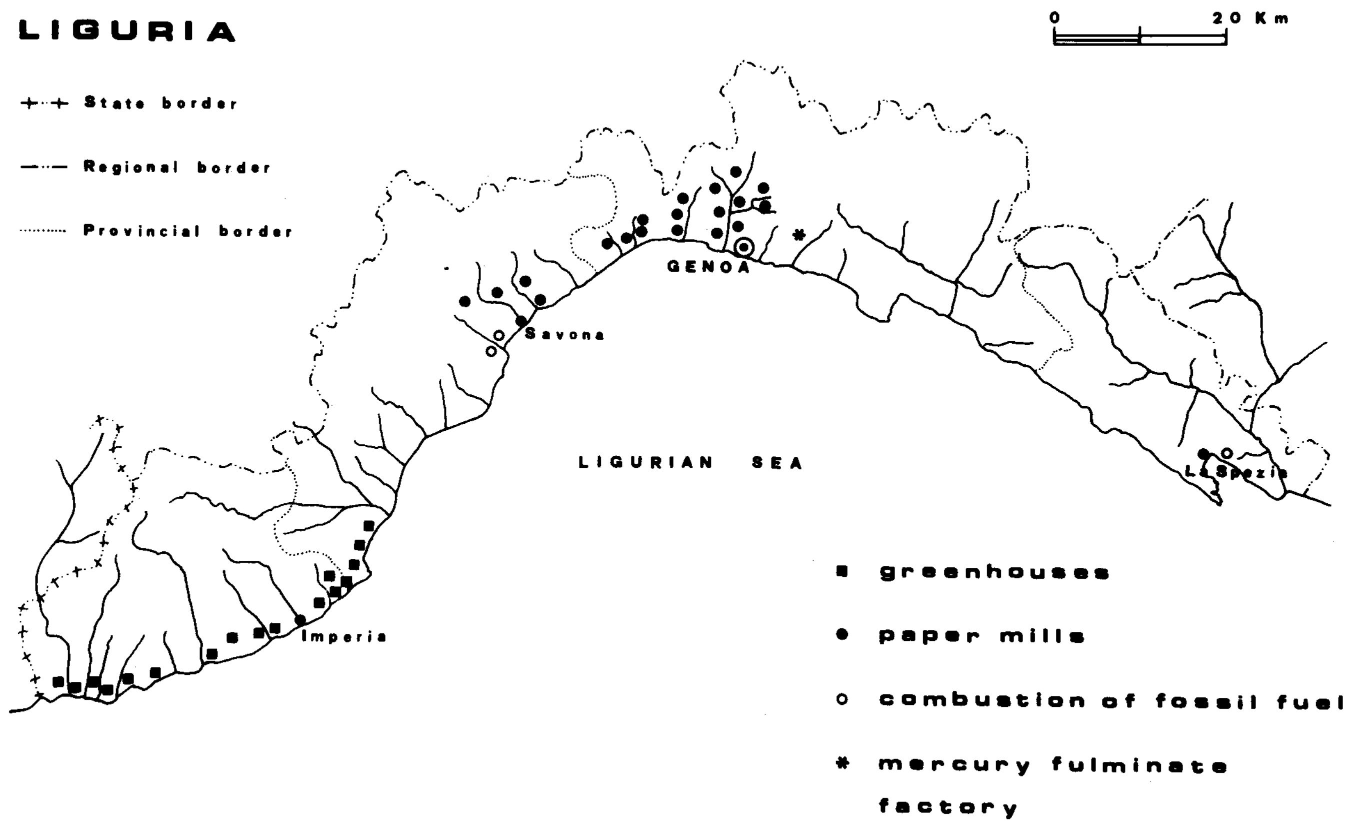

FIGURE 1. Some of the possible mercury pollution sources in Liguria.

their effects.

To this end, some of the possible pollution sources are indicated on the map of Liguria (Figure 1).

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