

<https://helda.helsinki.fi>

---

## Hair Mercury Contents and Fish Eating Habits of People Living Near a Finnish Man-made Lake

Lodenius, M.

Pergamon Press Ltd.

1982

---

Lodenius, M. and Seppänen, A. 1982. Hair Mercury Contents and Fish Eating Habits of People Living Near a Finnish Man-made Lake. *Chemosphere*, Vol. 11, no. 8, pp. 755-759.

---

<http://hdl.handle.net/1975/206>

---

*Downloaded from Helda, University of Helsinki institutional repository.*

*This is an electronic reprint of the original article.*

*This reprint may differ from the original in pagination and typographic detail.*

*Please cite the original version.*

## HAIR MERCURY CONTENTS AND FISH EATING HABITS OF PEOPLE LIVING NEAR A FINNISH MAN-MADE LAKE

Martin Lodenius and Ari Seppänen  
Department of Environmental Science  
University of Helsinki  
SF-00710 HELSINKI 71, Finland

Mercury contents in hair samples were determined from people who have eaten fish from a Finnish man-made lake, in which high mercury concentrations in fish have been found. The mercury contents in human hair (mean 6.6 mg/kg) was clearly higher than the normal level. Males had a higher concentration than females. The development of mercury contents in hair was followed.

### Introduction

The construction of man-made lakes is known to elevate the mercury concentrations in fish (1-4). In several Finnish man-made lakes elevated concentrations have been found and the highest values have been reported from Kalajärvi in western Finland (5).

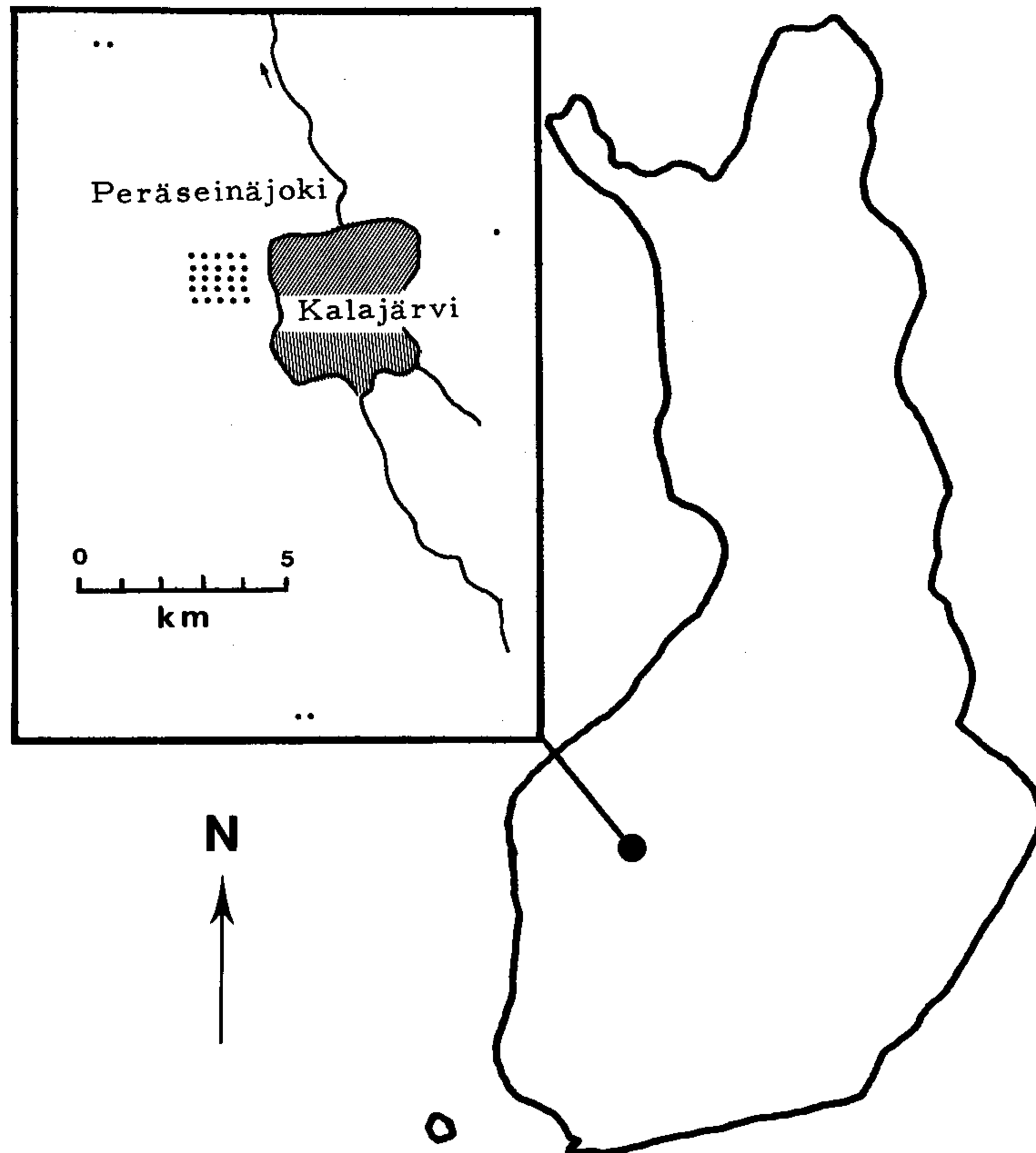
Fish with mercury concentrations exceeding 0.4-1 mg/kg is commonly considered unsuitable for human consumption. High mercury concentrations may thus cause a health risk for people eating fish from recently impounded reservoirs. Human hair is a good indicator of mercury exposure and there has been a good correlation between the consumption of polluted fish and the mercury content of hair (6-10). The purpose of this investigation was to estimate the rate of mercury contamination in people who eat fish from the Finnish reservoir having the highest mercury content in fish.

### Material and methods

Lake Kalajärvi is situated in western Finland (Fig. 1). The impoundment was constructed by enlarging the old Kalajärvi lake and it was completed in 1977. The old lake covers 20 % and agricultural land 15 % of the new bottom. The regulation amplitude is 6 m and at top water level the area is 11 km<sup>2</sup> and volume 43 x 10<sup>6</sup> m<sup>3</sup>. The calculated mercury content in a 1 kg pike was 1.9 and in a 0.5 kg burbot 1.3 mg/kg and the concentrations were higher in spring than in the autumn (5). The sale of fish from Kalajärvi was banned at the end of October 1980.

36 hair samples from people who eat fish from Kalajärvi were obtained in February 1981. Most of the people lived in the nearby town Peräseinäjoki. Data about age, sex and fish eating habits were also obtained from each subject. If possible, the samples were divided in 1.5 cm long segments starting from the scalp. They were digested in 5 ml of concentrated sulphuric and nitric acids (4 : 1) for 4 hours in a water bath (+60°C and analyzed for the mercury content using cold vapour atomic absorption spectrometry (Coleman MAS-50).

Fig. 1. The study area and living sites of the subjects (dots). Three subjects lived in Seinäjoki 25 km NW of Peräseinäjoki.



### Results and discussion

In the period spring 1980 - winter 1981 the mean fish consumption was 2.1 meals of fish per week among the people investigated. The fish consumption was highest in spring (mean 4.5 meals/week), decreased in the summer (2.3 meals/week) and it was low in the autumn and winter (1.1 meals/week) after it became known that the fish in Kalajärvi contained high amounts of mercury. Most of the people ate pike (92 %), burbot (86 %) and perch (56 %).

The mean mercury content in hair of people, who eat fish from Kalajärvi (Table 1) was at maximum 6.6 mg/kg or about four times higher than the corresponding value from unpolluted areas in northern Finland (11). The maximum value (34 mg/kg) was at the same level as the maximum values obtained from regulated waters in northern Finland. Considering the high mercury contents in fish and the high fish consumption, the hair mercury values seem to be quite low. In Finnish waters polluted by phenylmercury from the pulp industry with a comparable degree of mercury pollution considerably higher concentrations have been noted (6, 7, 12, Table 1).

Table 1. Mercury content in human hair (mg Hg / kg d.w.) from Kalajärvi and from some other areas.

	n	mean	range	cases exceeding 6 mg/kg (%)
<u>Kalajärvi, W. Finland</u> <sup>*</sup> )				
Males	21	7.6	0.77 - 34	43
Females	15	5.4	0.57 - 21	40
Whole material	36	6.6	0.57 - 34	42
<u>Water regulation areas, N. Finland (11)</u>				
Lokka	19	4.4	0.02 - 27	25
Porttipahta	16	5.6	0.37 - 35	27
Kemijärvi	33	4.7	0.16 - 32	19
<u>Unpolluted lakes, N. Finland (11)</u>				
Whole material	43	1.6	0.02 - 13	5
<u>Phenyl-mercury polluted waters, S. Finland (12, 6, 7)</u>				
Ahvenkoskenlahti	17	15	3.9 - 34	94
Kotka, Munapirtti	43	13	0.3 - 60	51
Hämeenkyrö	22	13	1.2 - 61	71

<sup>\*</sup>) at the time, when the highest values were recorded

Fig. 2. Hair mercury content and fish consumption in different age groups of the subjects in Kalajärvi.

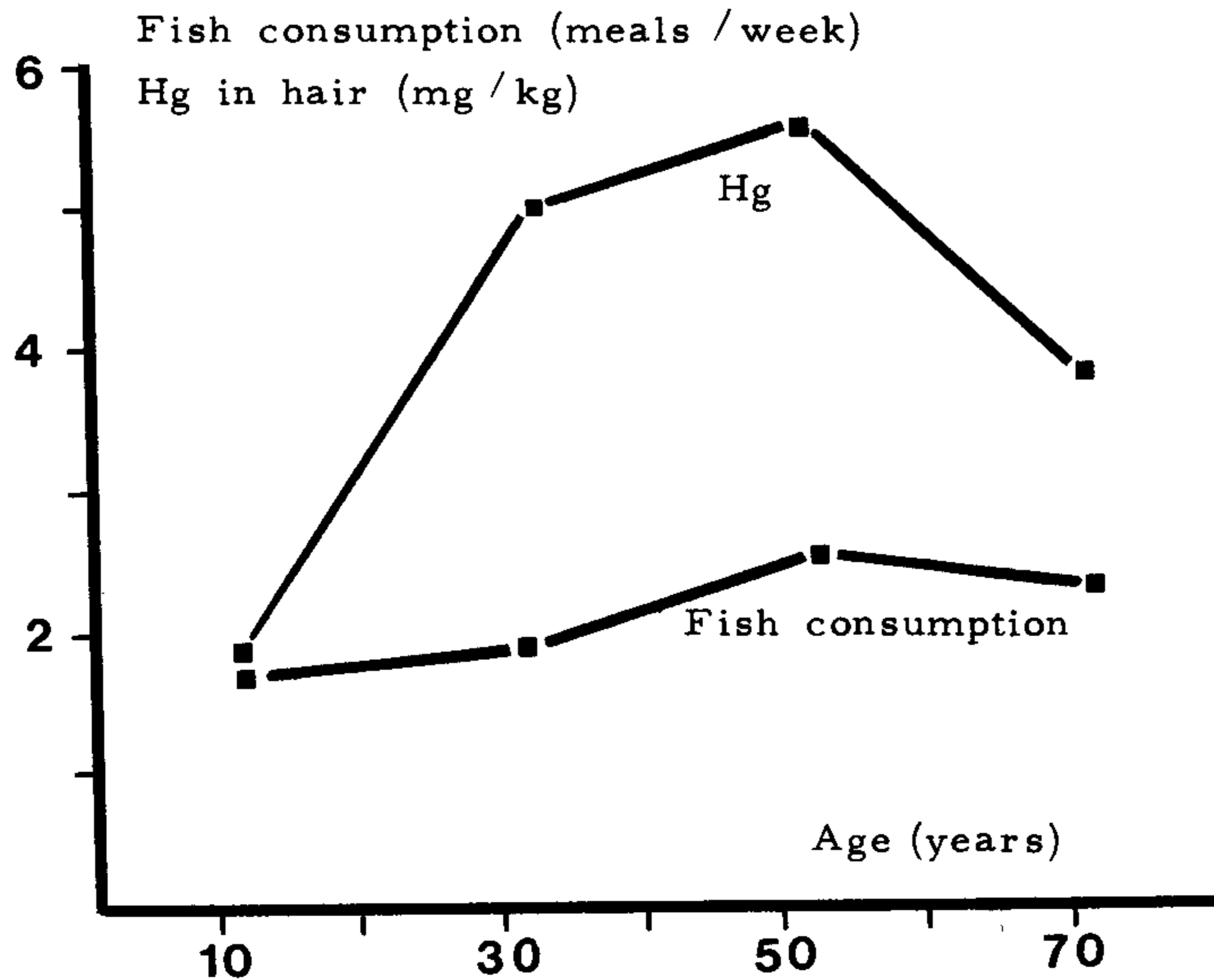
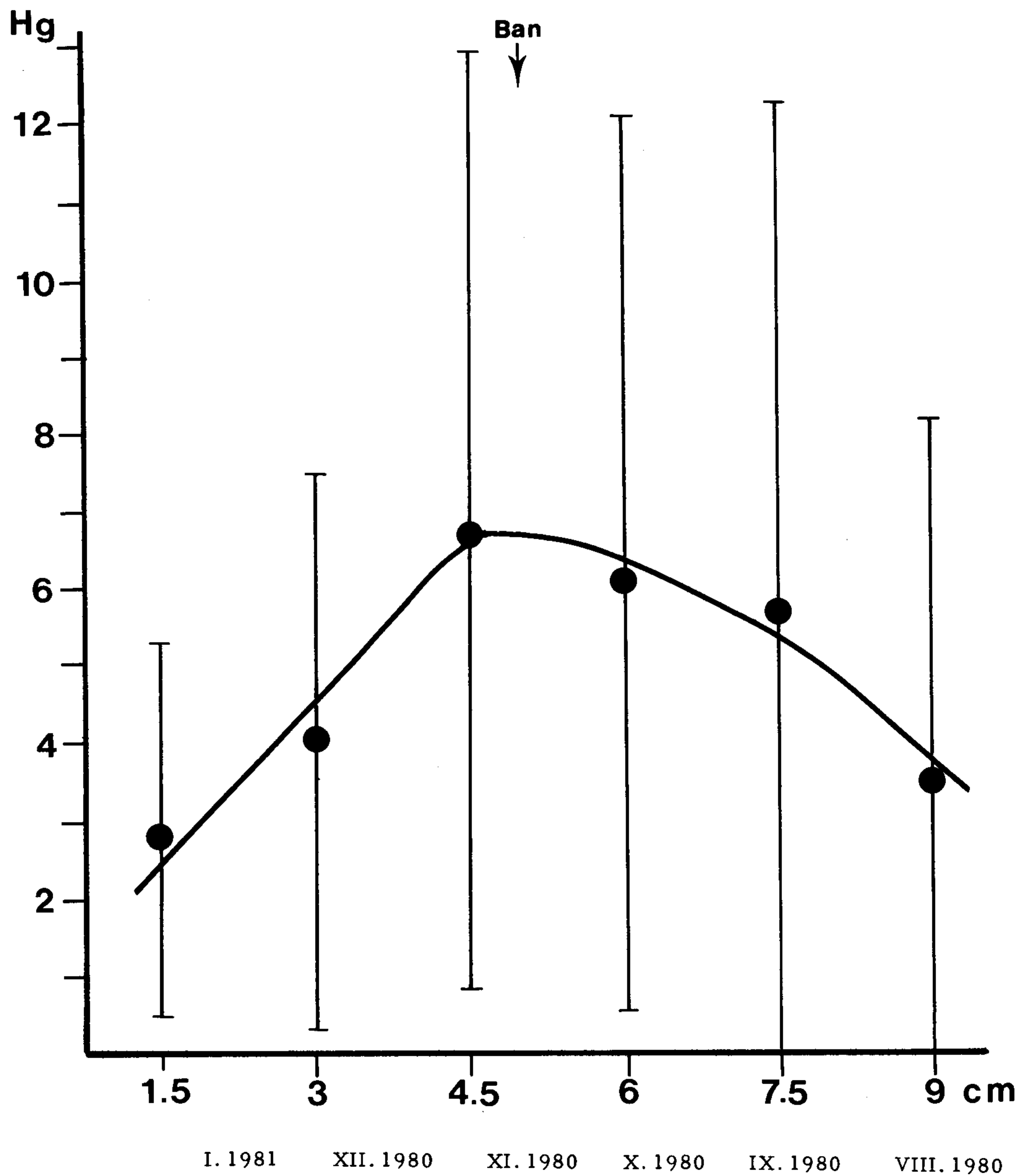


Fig. 3. Mercury content (mg/kg) in hair segments in relation to the distance from the scalp and the estimated time. Means and standard deviations are given.



The fish consumption was about the same for males and females but the mercury content in hair of males was higher than that of females. There was an almost significant positive correlation ( $r = 0.535$ ,  $n = 35$ ) between the fish consumption and the mercury content in hair. The mercury content was highest in middle-aged people as was the fish consumption (Fig. 2). Almost the same distribution was observed in northern Finland.

After the ban in October 1980 the people greatly reduced their consumption of fish from Kalajärvi. The analysis of the hair segments indicates, that the highest mercury concentrations have been in segments about 5 cm from the scalp or in October - November 1980 if the growth rate of hair is assumed to be 1.3 cm/week (13). After the peak a clear decrease in the mercury contents can be observed (Fig. 3).

Symptoms of methyl mercury poisoning (Minamata disease) may occur at hair mercury levels of 50 mg/kg or more (14) and a Swedish expert committee has recommended that mercury levels in the hair should not exceed 6 mg/kg (15). At Kalajärvi 44 % of the samples exceeded this limit at the time, when the highest concentrations were recorded.

#### Acknowledgements

We are indebted to Mr. Antti Kanto for collection of the samples and the Academy of Finland for economic support.

#### References

1. Abernathy, A.R. & Cumbie, P.M., Bull. Environ. Contam. Toxicol. 17, 595 (1977).