TRACE METAL CONCENTRATIONS IN EDIBLE FISHES FROM IZMIR BAY, EASTERN AEGEAN

F. Kucuksezgin*, A. Kontas, O. Altay, E. Uluturhan

Dokuz Eylul University, Institute of Marine Sciences and Technology. Inciralti, Izmir, Turkey - kucuksez@imst.deu.edu.tr

Abstract

The levels of Hg, Cd, Pb were determined in edible fish of Izmir Bay in the framework of a 'Izmir Bay Marine Research Project' during 1996-1998 supported by Izmir Metropolitan Municipality. The concentrations of trace metals found in fish varied for Hg: 5.2-829, Cd: 0.10-10 and Pb: 7.1-918 $\mu g\ kg^{-1}$ fresh weight in Izmir Bay. There was no significant seasonal variation in trace metal concentrations. The relationships between Hg concentration and fork length were significant in *Mullus barbatus, Pagellus erythrinus* and *Merluccius merluccius* in the Bay. Trace metal levels were lower than the results in fish tissues reported from polluted areas of the Mediterranean Sea.

Key words: Mercury, cadmium, lead, fish, Eastern Aegean

Introduction

Izmir Bay is located in the western part of Turkey and surrounded by a densely populated community. This bay has been divided into three sections (Outer, Middle and Inner) according to its physical characteristics as they relate to the different water masses. Monitoring of Hg, Cd and Pb levels in edible fishes (*Mullus barbatus, Pagellus erythrinus, Merluccius merluccius, Diplodus annularis, Solea vulgaris*) was conducted in Izmir Bay during 1996-1998. A number of studies have been carried out on the concentrations of trace metals in the Bay during a year with a few different species (1-3) but no long-term data are available on trace metal concentrations in the Bay during a 3 year period. The main aim of this study was to monitor levels, temporal variability and distribution of trace metals in edible fishes of Izmir Bay.

Material and Methods

The locations of sampling areas are given in Figure 1. Biota samples were collected by trawling and approximately 5-7g of fish muscle was digested with HNO_3:$HClO_4$ in microwave digestion system (4). All the analyses were performed by Varian AAS. Hg concentration was measured by cold vapor technique and Cd, Pb were determined by graphite furnace and background corrections were used as required. The detection limits were Hg:0.05 μgl^{-1}, Cd:0.10 μgl^{-1}, Pb:0.10 μgl^{-1}. Intercalibration fish homogenate samples (from IAEA, Monaco) were used as a control for the analytical methods. The values obtained (in $\mu g\ g^{-1}$ dry wt.) for the analysis of six replicates of this sample were as follows: Hg (certified 2.69±0.17; measured 2.77), Cd (certified 0.015±0.012; measured 0.018), Pb (certified 0.074±0.015; measured 0.064).

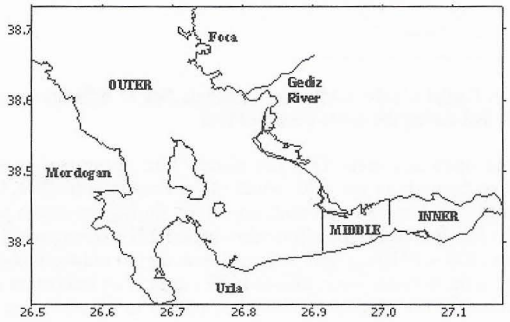

Fig. 1. The location of sampling sites.

Results and discussion

The concentrations of trace metals found in biota varied, with Hg ranging from 12-829 and 5-315, Cd from 0.10-10 and 0.44-3.1 and Pb from 14-918 and 7-713 $\mu g\ kg^{-1}$ fresh weight in the Outer and Middle Bays, respectively (Table 1). High levels of trace metals were measured in *Pagellus erythrinus* for Hg and Cd, and in *Mullus barbatus* for Pb in the outer part of the Bay. Minimum values were found in *Merluccius merluccius* (Hg), *Mullus barbatus* (Cd) and *Diplodus annularis* (Pb) in the Outer Bay. The levels were significantly lower in *Solea vulgaris* than the other species from the Middle and Inner Bays. There was no significant seasonal variation in trace metal concentrations. The relationship between Hg concentration and fork length was significant in *Mullus barbatus* (R=0.491), *Pagellus erythrinus* (R=0.673) and *Merluccius merluccius* (0.440). Cd and Pb concentrations in muscle tissue showed no relation to fork length. A person consuming 2, 150 and 10 meals per week of edible fishes in the human diet would reach the tolerable weekly intake of Hg, Cd and Pb, respectively (5,6). As a general conclusion, the values are higher than the reported mean concentration of trace metals in marine organisms from the Aegean and Mediterranean Sea (7-9). However, the levels of trace metals determined in the different fish from Izmir Bay are considerably lower than those in polluted areas of the Mediterranean Sea (10).

Table 1. Trace metal concentrations in fish from Izmir Bay (mg kg-1 fresh wt.)

Sampling location	Organism	Length (mm)	Number of sample	Hg	Cd	Pb
06/96	Mullus barbatus	125-153	20	259	2.4	918
Outer	Pagellus erythrinus	250-280	4	829	2.6	83
	Merluccius merluccius	260-295	2	65	1.9	155
	Diplodus annularis	130-170	10	220	2.1	14
	Solea vulgaris	159-230	4	159	1.6	203
Middle	Merluccius merluccius	190-386	2	92	2.4	713
	Diplodus annularis	105-142	8	315	1.9	7.1
	Solea vulgaris	199-210	3	68	1.8	388
Inner	Solea vulgaris	156-171	3	17	2.2	97
10/96 Outer	Mullus barbatus	118-153	10	182	0.13	125
	Diplodus annularis	118-129	10	162	0.16	205
	Solea vulgaris	158-182	3	17	0.41	46
Middle	Solea vulgaris	157-188	4	22	0.44	115
01/97 Outer	Mullus barbatus	110-150	19	94	0.93	209
	Mullus barbatus	150-165	6	77	0.53	39
	Pagellus erythrinus	150-230	6	263	0.21	150
	Merluccius merluccius	260-295	2	53	0.25	17
	Diplodus annularis	135-170	10	370	1.0	30
04/97 Outer	Mullus barbatus	144-175	4	66	1.9	29
	Pagellus erythrinus	141-197	6	181	3.2	146
	Merluccius merluccius	387	1	96	4.0	455
	Diplodus annularis	126-160	10	91	4.5	175
Inner	Solea vulgaris	170-205	3	7.7	2.3	270
07/97 Outer	Mullus barbatus	111-143	10	87	3.5	780
	Mullus barbatus	206	1	399	5.7	943
	Pagellus erythrinus	245-270	2	316	10	376
	Merluccius merluccius	365-384	4	27	1.5	431
	Diplodus annularis	118-145	20	92	1.7	697
Middle	Diplodus annularis	101-143	9	74	1.9	169
	Solea vulgaris	161-246	12	5.2	1.2	364
10/97 Outer	Mullus barbatus	163-184	10	345	1.5	120
	Mullus barbatus	128-162	8	75	2.0	349
	Pagellus erythrinus	151-218	6	369	1.2	58
	Merluccius merluccius	346-444	5	53	2.0	120
	Merluccius merluccius	221-285	10	12	1.6	315
	Diplodus annularis	106-143	10	285	1.0	428
Middle	Solea vulgaris	157-173	4	5.2	1.3	110
Inner	Solea vulgaris	159-224	4	9.5	1.1	217
01/98 Outer	Mullus barbatus	150-160	10	84	0.93	16
	Pagellus erythrinus	127	1	144	5.4	89
	Pagellus erythrinus	207	1	419	0.66	28
	Merluccius merluccius	313-361	9	17	0.48	240
	Diplodus annularis	109-134	20	164	0.90	175
	Solea vulgaris	220	1	46	1.2	78
Inner	Solea vulgaris	130-140	2	11	3.2	341
04/98 Outer	Mullus barbatus	130-161	8	83	1.2	359
	Mullus barbatus	114-139	10	27	0.53	256
	Pagellus erythrinus	268	1	175	0.77	88
	Merluccius merluccius	284-320	3	37	1.1	375
	Diplodus annularis	127-153	10	184	0.58	326
10/98 Outer	Mullus barbatus	140-157	10	41	0.10	44
	Mullus barbatus	168-186	9	285	0.88	478
	Pagellus erythrinus	147-152	3	279	2.2	203
	Pagellus erythrinus	186-201	2	342	0.61	48
	Merluccius merluccius	251-273	2	34	0.58	116
	Diplodus annularis	117-144	10	174	1.2	594
	Solea vulgaris	250	1	212	5.2	220

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