Assessment Of Mercury Contents Of Tuna In East Indonesian Seas

SANTOSO, SUNARYA and EDDY P

National Center for Fishery Quality Control and Processing Development, Jakarta, Indonesia

Abstract

Samples of meat were taken from tuna landed at Ambon, Biak, Bitung and Denpasar between August 1989 and February 1990 at two month intervals. They were flown to Jakarta for assessment of their mercury content. It was found that the mercury content did not increase with size of tuna. The mercury content of tuna was generally well below 0.5 ppm, although samples from Ambon were higher than those from other three landing places.

Introduction

Tuna is an Indonesian export commodity that is exported in fresh and frozen forms. In 1987 tuna exports totalled 9,800 mt and the annual increase has been averaging 200%.

The maximum sustainable yield of tuna in Indonesian waters is 166,000 mt per year. Resources are mainly located in east Indonesia, including the waters off Makasar Strait, Arafura and other areas.

In most cases, tuna shipped for export should be accompanied by a certificate confirming that the fish does not contain mercury above the permitted level.

Most species of fish in oceanic waters contain 0.15 ppm mercury in muscle tissue. Much higher values are found in fish from contaminated water. Tuna (*Thunnus* spp.) and some other large fish normally contain high concentrations of mercury. It has been reported elsewhere that concentrations of 1 ppm in the muscle are common and may even reach 4.9 ppm (Clark, 1986).

Tunas are large carnivores at the end of food chains and their diets, therefore, contain high levels of mercury resulting from bioaccumulation and biomagnification. Much of this mercury is in the form of methyl mercury and because the fish cannot excrete it, its concentration in the tissues increases with the age of the fish (Clark, 1986).

The present assessment was performed between August 1989 and February 1990. Analysis of samples were done at National Centre for Fishery Quality Control and Processing Development, Jakarta (NCQC).

Materials And Methods

The samples consisted of flesh of fresh tuna landed at Denpasar (Bali), Biak (Irian Jaya), Ambon and Bitung (North Sulawesi). These samples were thought to originate in the waters off East Indonesia.

Based on the size, yellow fin tuna were grouped into three categories as follows:

1. Less than 5 kg in individual weight.
2. 5 - 20 kg in individual weight.
3. More than 20 kg in individual weight.

Preparation of tuna flesh was done at Provincial Laboratories of Fishery Quality Control. Frozen flesh was packed using styrofoam boxes. In the boxes, ice was added to maintain a low

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Note: This paper was presented at the Seminar by Dr Sunarya.

temperature. After boxing, samples were transported to NCQC by plane.

Sampling was carried out three times at intervals of two months. Mercury contents were determined using Atomic Absorption Spectrophotometer (Perkin Elmer, 2830 model) which was combined with Mercury Hydride System (MHS - 10, Perkin Elmer). For the method of analysis refer to AOAC 14th edition, 1984.

Results And Discussions

Results of the assessment of mercury content of tuna less than 5 kg in individual size is shown in Table 1.

Apparently the contents of mercury varied with the fishing period and the fishing grounds. It was difficult to conclude whether there were persistent differences between the periods of sampling. The lowest and the highest contents were found in tuna landed at Bitung - North Sulawesi (9.4 ppb) and Ambon (361 ppb) respectively.

Results of the assessment of the mercury content of tuna in the 5 to 20 kg range is shown in Table 2.

The mercury content of tuna with individual weights of 5 to 20 kg ranged from 45.7 (Bitung) to 467 ppb (Denpasar). The average mercury content in tuna of less than 5 kg was lower than those of 5 to 20 kg body weight.

The mercury content in tuna more than 20 kg body weight ranged from 34.6 ppb (Denpasar) to 544 ppb (Ambon) (Table 3).

Average content of mercury in tuna of more than 20 kg weight landed at Biak, Bitung and Denpasar were lower than those in tuna with 5 - 20 kg weight at the same places, while the contents in tuna landed at Ambon were higher.

According to data collected and depicted in Tables 1,2 and 3, we concluded that mercury contents on tuna varied with sampling periods and between the three landing places, and that the mercury content did not depend on the size of the tuna, but rather on individuals. To obtain better information regarding the mercury content of tuna, more frequent monitoring should be done.

Table 1. Mercury content of tuna less than 5 kg of individual weight.

Sampling period	Mercury content (ppb)			
	Tuna landed at			
	Biak	Bitung	Ambon	Denpasar
I	41.6	163.5	-	340.6
II	70.1	9.4	41.9	-
III	188.8	59.5	361.0	-

Table 2. Mercury content on tuna of 5 - 20 kg individual weight.

Sampling period	Mercury content (ppb)			
	Tuna landed at			
	Biak	Bitung	Ambon	Denpasar
I	161.8	171.3	103.5	467.0
II	122.9	45.7	249.7	-
III	307.9	388.0	458.0	-

Table 3. Mercury content of tuna over 20 kg of individual weight.

Sampling period	Mercury content (ppb)			
	Tuna landed at			
	Biak	Bitung	Ambon	Denpasar
I	199.0	175.9	130.1	377.0
II	181.0	63.5	442.6	34.6
III	43.0	348.0	544.0	337.0

In general, mercury content of tuna landed from the three landing places was less than 0.5 ppm, which is the maximum level mandated by Indonesian government. This means that in terms of mercury content, tuna caught from East Indonesian seas were safe for consumption.

Conclusion

The mercury content of tuna landed at Denpasar, Bitung and Biak was still below 0.5 ppm (maximum level permitted). The contents varied among the period of sampling and the size of tuna. This indicates that the mercury content depended on individual weight. We recommend more frequent monitoring of mercury on tuna landed in East Indonesian seas.

AOAC, 1984. Official methods of analysis of the Association of Official Analytical Chemists. 14th Ed. AOAC Inc. Virginia, USA.

Clark, R.B. 1986. Marine pollution. Oxford. Clarendon Press. 215pp.

Uktolseja, J.C.B. 1988. Potential resources of tuna in Indonesian seas. *Ikatan Sarjana Perikanan Indonesia*. Jakarta, Indonesia.

Discussion

A comment was made that in the paper, some tuna contained high concentration of mercury at 4.9 ppm. Asked whether the Indonesia government put a control on this as the USA mercury level guideline is only 0.5 ppm, the meeting was informed that this data was acquired not from Indonesian fish but from literature. However the Indonesian standard for mercury levels in tuna is 0.5 ppm.

Asked whether the mercury data reflected in the paper is for methyl mercury or total mercury, and whether data on methyl mercury were available, Mr Sunarya replied that the data related to total mercury and that there were no data for methyl mercury.

A comment was raised that less than 20 kg tuna may contain 0.5 ppm mercury, that 80-100 kg tuna may contain 1.0 - 1.5 ppm mercury, and that the USA has adopted a level of 1.0 ppm methyl mercury content for tuna. Mr Sunarya appreciated this informatin provided by Dr Watanabe.

It was suggested that regional surveys be conducted in order to better understand the distribution of mercury in tuna. Dr Sunarya reiterated that tuna stock migrates over great distances and sampling by region may not necessarily reflect the mercury level in each region. He agreed however, that such studies may contribute to greater understanding.