



Book of Abstracts of the
Fifth International Conference on

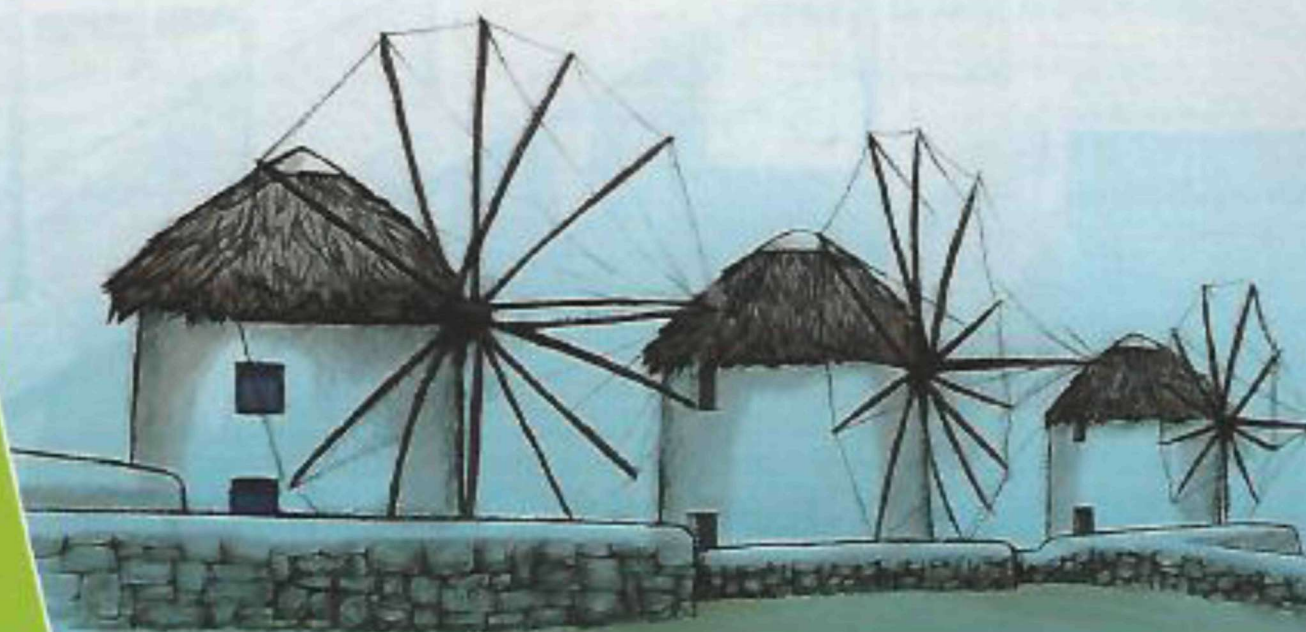
Environmental Management, Engineering, Planning and Economics

(CEMEPE 2015) and SECOTOX Conference

June 14-18, 2015,
Mykonos island, Greece

EDITORS

A. Kungolos / K. Aravossis / C. Laspidou / P. Samaras / K. - W. Schramm



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* The artwork was created by Rigas Kougolos



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Planning and Economics (CEMEPE 2015) and SECOTOX Conference**

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- Society of Ecotoxicology and Environmental Safety (SECOTOX)
- Department of Planning and Regional Development, University of Thessaly, Greece

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- German Research Center for Environmental Health, Germany
- Sector of Industrial Management and Operations Research, School of Mechanical Engineering, National Technical University of Athens, Greece
- Division of Hydraulics and Environmental Engineering, Department of Civil Engineering, Aristotle University of Thessaloniki
- Food Technology Department, Technological Education Institute of Thessaloniki, Greece

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Mercury bioaccumulation in two benthic sharks from the Ionian Sea and consumer health implications

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Abstract

This study examined total mercury (Hg) concentrations in muscle, liver, gills and gonad of two cartilaginous species from the Ionian Sea (along the Hellenic coast): the small-spotted catshark (*Scyliorhinus canicula*) and the longnose dogfish (*Squalus blainville*), by cold vapour atomic absorption spectrometry (CVAAS) with stannous chloride as reducing agent. In both species, the general tendency in Hg concentration among the different tissues was gonad < gills < liver < muscle. Sex, in contrast to the mature condition, did not seem to play an important role in differentiating Hg levels in any of the tissues or species. The between-species comparison showed a significantly higher Hg content, regardless of the tissue, in *S. blainville*, which was attributed to its higher longevity and lower growth rate. The analysis of covariance showed that for a given body length, *S. blainville* tends to accumulate higher Hg levels. From a human health perspective, in 80 and 96.8% individuals of *S. canicula* and *S. blainville*, respectively, Hg exceeded the European Commission regulatory threshold of 1 mg/kg w.w. The estimated weekly intake of Hg (EWI) exceeded the provisional tolerable weekly intake (PTWI) and the recommended reference dose (RfD) in both species. Hg hazard index (HI) exceeded the safe limit of 1 in both *S. canicula* and *S. blainville* (2.04 and 6.69, respectively). The maximum possible consumption of fish (MPCF) was 0.23 kg for *S. canicula* and 0.10 kg for *S. blainville*, per week for a mean body weight of 70 kg. Our findings indicated that frequent consumption of each of the species may adversely affect human health.

Keywords: mercury; sharks; risk assessment; Mediterranean Sea.

MERCURY BIOACCUMULATION IN TWO BENTHIC SHARKS FROM THE IONIAN SEA AND CONSUMER HEALTH IMPLICATIONS

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INTRODUCTION

Few studies exist on trace metal concentrations in sharks from the Mediterranean Sea [1]. This study examined Hg partitioning among four tissues of two cartilaginous species of moderate commercial value from the Ionian Sea: the small-spotted catshark (*Scyllorhinus canicula* L. 1758) and the longnose spurdog (*Squalus blainville* R. 1827).

MATERIALS AND METHODS

A total of 20 small-spotted catsharks, ranging from 300 to 492 mm in TL (mean=415±96.9) and 62 longnose spurdogs ranging from 268 to 790 mm in TL (mean=433±132) were sampled in the Ionian Sea along the Hellenic coast [Fig. 1].

Hg concentration was determined in the muscle, liver, gonad and gills by Cold Vapor Atomic Absorption Spectrometry (CVAAS) with stannous chloride as reducing agent. Analysis was validated with DORM-2 (NRC) and percentage recovery was calculated.



Figure 1. Sampling sites of *S. canicula* and *S. blainville* in the Ionian Sea.

Table 1. Hg concentrations in various tissues expressed in mg/kg ww.

| Tissue | <i>S. canicula</i> | | <i>S. blainville</i> | |
|--------|--------------------|-----------|----------------------|-----------|
| | Mean ±SD | Range | Mean ±SD | Range |
| Muscle | 1.50 ± 0.58 | 0.78–2.62 | 4.52 ± 2.70 | 0.72–15.7 |
| Liver | 0.59 ± 0.37 | 0.12–1.25 | 3.55 ± 2.53 | 0.10–27.9 |
| Gills | 0.42 ± 0.19 | 0.16–0.75 | 1.74 ± 1.54 | 0.15–7.71 |
| Gonads | 0.21 ± 0.09 | 0.09–0.33 | 1.48 ± 1.40 | 0.03–8.98 |

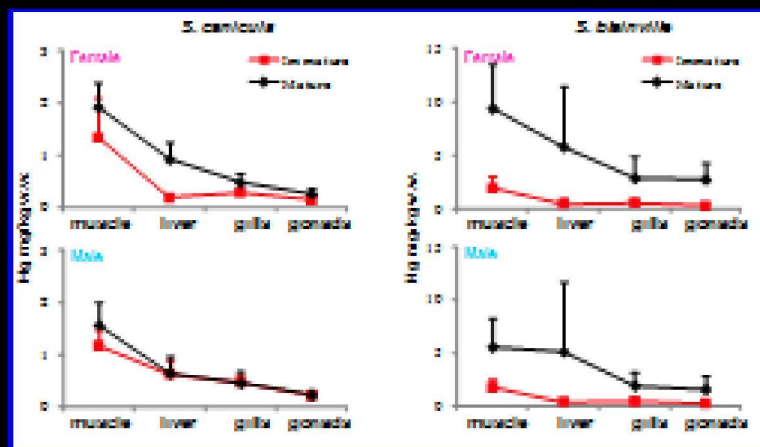


Figure 2. Mean Hg concentration in various tissues of immature and mature female and male *S. canicula* and *S. blainville* from the Ionian Sea.

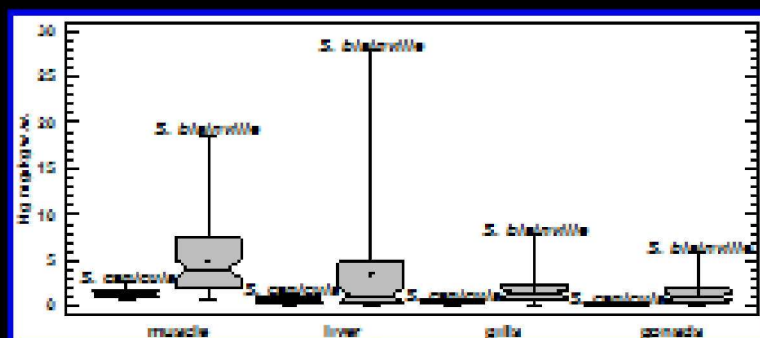


Figure 3. Mean Hg concentrations in various tissues of *S. canicula* and *S. blainville* from the Ionian Sea.

RESULTS

- > In both species, the general tendency in mean Hg concentration among the tissues was gonads < gills < liver < muscle [Table 1].
- > No sex-dependent Hg accumulation was observed ($P_{w} > 0.05$), while mature individuals accumulated significantly higher concentrations than immature ones in both species [Fig. 2].
- > Mean Hg concentration was statistically significantly higher in *S. blainville* than *S. canicula*, regardless of the tissue ($P_{w} < 0.05$) [Fig. 3].
- > In 80 and 96.8% samples of the edible tissue of *S. canicula* and *S. blainville*, respectively, Hg concentration exceeded the European Commission regulatory threshold of 1 mg/kg ww.
- > The estimated weekly intake of Hg (BWI) through the consumption of both species exceeded the provisional tolerable weekly intake (PTWI) and the recommended reference dose (RfD). Moreover, Hg hazard index (HI) exceeded the safe limit of 1 in *S. canicula* and *S. blainville* (2.04 and 6.69, respectively).
- > The maximum possible consumption of fish (MPCF) equaled 0.23 kg for *S. canicula* and 0.10 kg for *S. blainville* per week for a mean body weight of 70 kg.

CONCLUSIONS

- > Mercury was differentially distributed in the various tissues probably due to their different biochemical characteristics and function [1]. For example, the detoxifying role of liver could explain its lower Hg values as compared with muscle [2].
- > The higher longevity of *S. blainville* and its lower growth rate could explain the higher Hg levels found in its tissues.
- > Our findings indicated that the frequent consumption of each of the species may adversely affect human health. This phenomenon, common in shark species, needs further attention due to the high toxicity of Hg [1, 3, 4].

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REFERENCES

- [1] Scorrill et al., 2011. *Environmental Monitoring and Assessment*, 174: 271–281.
- [2] Corlito et al., 2010. *Marine Pollution Bulletin*, 60(6): 1372–1375.
- [3] Kouskourel et al., 2002. *Cyprus*, 30(1): 103–108.
- [4] Scorrill et al., 2002. *Bulletin of Environmental Contamination and Toxicology*, 68(3): 361–370.