Assessment of PCDD, PCDF and PCB Pollution in Lake Baikal using two species of Sculpins: *Comephorus baicalensis* and *Comephorus dybowskii*

A.A. Mamontov, E.A. Mamontova, E.N. Tarasova, M.S. McLachlan* and P.N. Anoshko**

Institute of Geochemistry, Siberian Branch of the Russian Academy of Sciences, 664033, Irkutsk, Box 4044, Russia
*Ecological Chemistry and Geochemistry, University of Bayreuth, D-95440 Bayreuth, Germany (Current address: Baltic Sea Research Institute, Seestrasse 15, D-18119 Rostock)
**Limnological Institute, Siberian Branch of the Russian Academy of Sciences, 664033, Irkutsk

Introduction

This work is part of an ongoing investigation of the distribution of PCDDs, PCDFs and PCBs in the biota of Lake Baikal. In the first stage, an initial screening of the levels of these contaminants in different species in the aquatic food web was conducted[1]. In the present study, an attempt was made to compare contaminant levels in biota from different regions of the lake. Two species of pelagic sculpin - *Comephorus baicalensis* and *Comephorus dybowskii* - were chosen for this purpose. They inhabit virtually all depths of the lake from 25 - 200 m below the surface down almost to the lake bottom (1637m). They do not form shoals, and their lateral movement is very restricted, making them suitable for an investigation of contaminant distribution. There are an estimated 150,000 t of these two species in Lake Baikal, as much as all other fish species taken together[2].

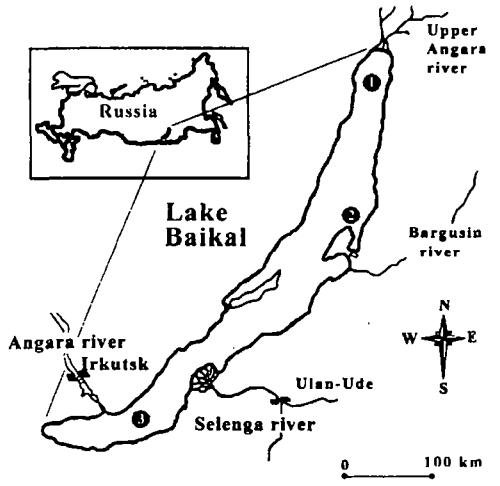

Figure 1: Map showing the sampling sites

Experimental Methods

Sculpin were collected at three stations (see Figure 1) in August 1997 from a depth of 200 m by trawl (2×2.5 m^2). The age of the fish was determined by external examination and they were sorted according to age and species (see Table 1). Samples were wrapped in aluminum foil, immediately frozen and stored at –20°C before being transported to Bayreuth for analysis.

Table 1: Description of the Samples

Nr	Species	Sampling station	Age (yr)	Lipids (%)
1	*Comephorus dybowskii*	North basin (1)	5	2
2	*Comephorus baicalensis*	1	3	13.3
3	*Comephorus baicalensis*	1	5	39.8
4	*Comephorus dybowskii*	North basin (2)	5	3.4
5	*Comephorus baicalensis*	2	3	12.1
6	*Comephorus baicalensis*	2	5	41.3
7	*Comephorus dybowskii*	South basin (3)	4-5	4.3
8	*Comephorus baicalensis*	3	5	40.3

Each sample consisted of a composite of 10-20 whole fish. The analyses were conducted using previously published methods [1]. Both the PCDD/Fs and the PCBs were measured using HRGC/HRMS at a mass resolution of 8,000-10,000. The 2,3,7,8-substituted PCDD/F congeners and PCB congeners 28, 52, 77, 99, 101, 105, 118, 126, 138, 153, 156, 169, 170, 180, 199, 202 and 209 were quantified. The toxicity equivalents (TEQs) were calculated using the TEFs for fish recently proposed by the WHO working group.

Results and Discussion

Note the difference in the lipid contents of the fish (Table 1). *Comephorus dybowskii* is a very lean fish while *Comephorus baicalensis* is fat, the lipid content of the latter increasing with age. On a fresh weight basis the concentration in the two species at a given location differed by an order of magnitude, but on a lipid weight basis the levels were similar (see Figures 2 and 3).

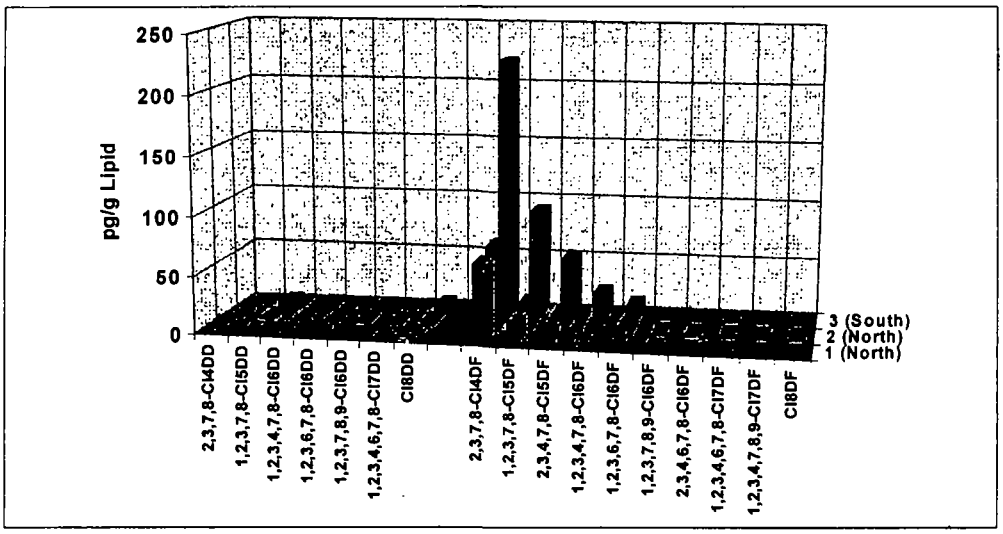

Figure 2: PCDD/F concentrations in *C. baicalensis* (age 5 years) from the 3 sites

Figure 2 shows the PCDD/F concentrations found in 5 year old *Commephorus baicalensis*. The congener pattern is characterized by a dominance of the lower chlorinated 2,3,7,8-substituted PCDFs. The PCDD levels are very low in comparison. This pattern was found in sculpin and in macrozooplankton in the first phase of this study[1)] and suggests that the input of lower chlorinated 2,3,7,8-substituted PCDFs into Lake Baikal is much higher than the input of lower chlorinated 2,3,7,8-substituted PCDDs.

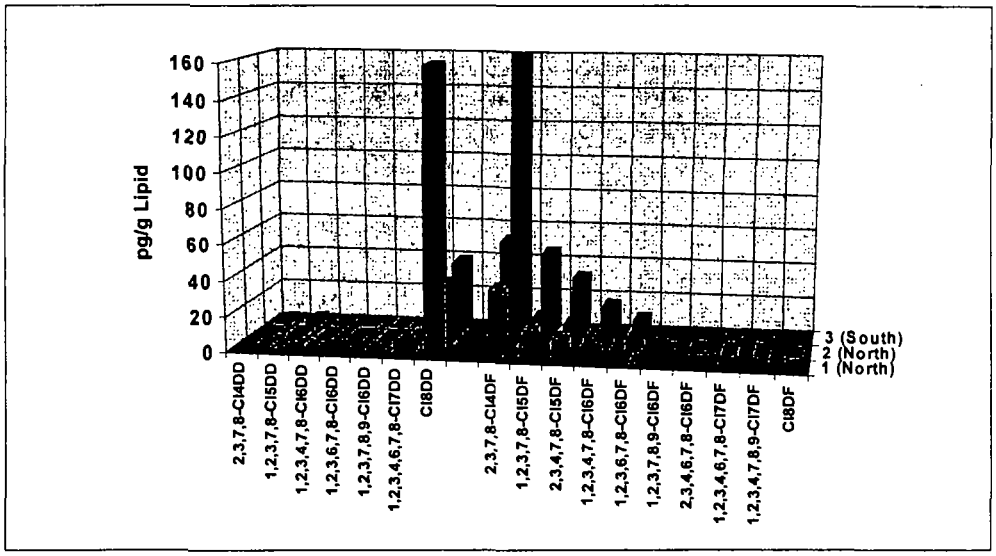

Figure 3: PCDD/F concentrations in *C. dybowskii* (age 5 years) from the 3 sites

Figure 3 shows the PCDD/F concentrations found in 5 year old *Comephorus dybowskii*. The PCDF congener pattern is similar to that in *C. baicalensis*. However, *C. dybowskii* also shows high levels of Cl_8DD and to a lesser extent 1,2,3,4,6,7,8-Cl_7DD. Given that the two fish were sampled at the same site, this cannot be attributed to differences in the levels of environmental contamination. Rather, it must be due to differences in feeding patterns or in the ability of these species to absorb very lipophilic compounds.

In both species the concentrations of the lower chlorinated PCDFs increase going from the north of Lake Baikal to the south. The PCDD/F TEQ increases from 11 to 32 pg/g lipid in *C. dybowskii* and from 15 to 50 pg/g lipid in *C. baikalensis*. This is an indication that the southern part of the lake is more contaminated with these compounds. Interestingly, the levels of Cl_8DD in *C. dybowskii* were highest at the northern most station.

In the first phase of this study a sample of *C. dybowskii* collected 10 km offshore of the Selenga River delta area was analyzed. The PCDD/F TEQs were 54 pg/g, which is higher than in the sample from the southwest end of the lake analyzed in this phase. This may be due to higher inputs in this region, perhaps from the Selenga River, however it could be linked to a general decrease in the level of pollution [3)].

Figure 4 compares the levels of the PCDD/F congeners in the 3 and 5 year old *C. baicalensis*, averaged for the samples from the two northern stations. The levels in the older fish

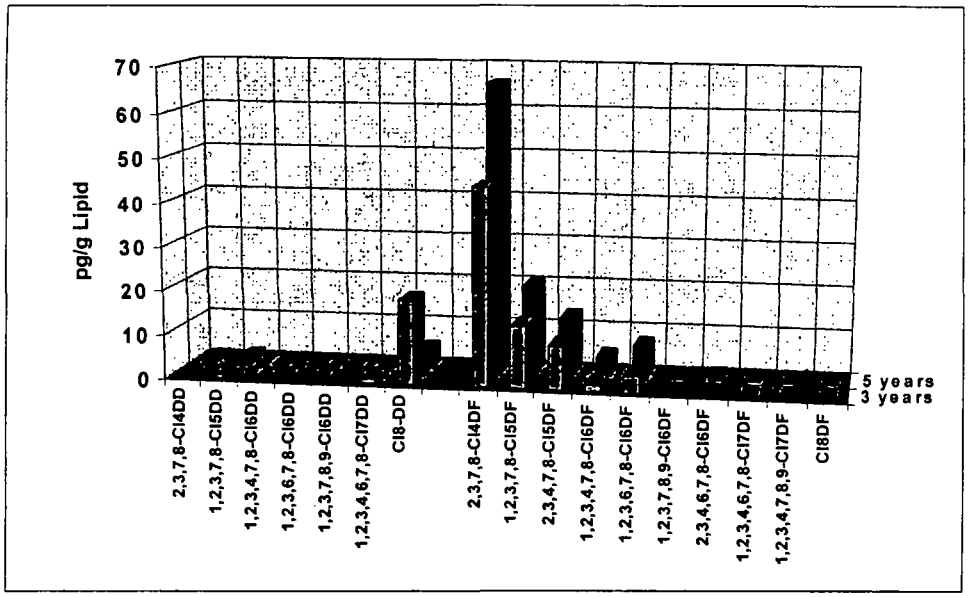

Figure 4: PCDD/F concentrations in 3 year old and 5 year old *C. baicalensis* (average of samples from sites 1 and 2)

are higher. Also, although the PCDF congener patterns are similar, the younger fish show considerably higher levels of Cl_8DD. This may be due to changes in feeding patterns with age.

The PCBs contributed only about 10 % of the total TEQs in the fish. The PCB congener pattern was very similar in all of the samples, but the absolute levels varied. The same regional trend was observed in *C. baicalensis* as with the PCDD/Fs, the PCB concentrations increasing by a factor of about 7 from the northern stations to the southern station . However, no trend was observed in the PCB concentrations in *C. dybowskii*.

Acknowledgement

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Literature Cited

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