Acute Toxicological Response of the Crayfish *(Orconectes limosus)* to Mercury

Marianne Doyle, Stephen Koepp, and James Klaunig
Biology Department, Montclair State College
Upper Montclair, N.J. 07043

Recent detection of mercury residues in Canadian freshwater organisms (BLIGH 1970; FIMREITE et al 1971; VERMEER 1971; WOBESER et al 1970) has refocused attention to the harmful effects stemming from the uptake of this toxicant. Prior studies have been concerned primarily with fish and piscivorous bird subjects, both noted for rather lengthy migratory movements. The crayfish, an omnivorous bottom invertebrate with relatively restricted movements, has been suggested as a more reliable indicator of localized mercury contamination (VERMEER 1972). As yet, however, no comparable toxicological criteria have been established relative to crayfish response to acute levels of mercury. Such information is essential in properly assessing the impact of heavy metals in aquatic systems.

It was the purpose of this investigation to determine the dose-response of a single crayfish population (Orconectes limosus) to mercury as a preface to meaningful histopathological studies. Mercuric chloride was selected as the toxicant form in view of its prior use in investigations of this nature.

Methods and Materials

Crayfishes identified as Orconectes limosus were collected with hand nets during June 1975 from a small feeder stream in Bergen County, New Jersey. Only larger specimens (4-6 cm carapace length) were used in order to ensure a lengthy intermolt. These animals were acclimated in the laboratory for at least 7 days at 20°C in dechlorinated tap water prior to use in experiments. During the holding period crayfishes were fed daily a diet of earthworms. Feeding was suspended 24 hours prior to and during the test period.

Crayfishes were incubated singly in one of 5 different dosages of mercuric chloride ranging from 0.25 to 5.0 mg/liter. All exposures were conducted for 96 hours at 20°C in covered 2-liter glass aquaria containing 1.5 liters of aerated tap water. A total of

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4 repetitions (10 animals/each) were performed at each test concentration. Percent survival was subsequently determined at hours 12, 24, 36, 48, and 96. Controls consisted of 40 crayfishes incubated separately in aerated tap water under comparable conditions.

Results and Discussion

As shown in Table I, 100% survival was obtained at a dosage of 0.25 mg/liter. Crayfishes incubated at this dosage varied little in behavior from controls. Survivors of the calculated LD-60 (1.0 mg/liter) exhibited sluggish response to mechanical stimulation, whereas only occasional ventilative movements characterized crayfishes surviving higher dosages.

TABLE I

Percent survival of crayfishes following 96 hour exposure to mercuric chloride. Mean number (± Standard Deviation) of survivors based on 4 repetitions of 10 animals per concentration.

$HgCl_2$ (mg/l)	Total Surviving	Mean ± 1 S.D.	% Survival
0.00	40	10.0 ± 0	100
0.25	37	9.3 ± 0.8	93
1.00	16	4.0 ± 0.7	40
1.75	6	1.5 ± 0.9	15
2.50	3	0.8 ± 0.7	8
5.00	0	0.0 ± 0	0

The response of crayfishes to mercury was further investigated versus exposure time (Figure 1). In general the decrease in percent survival was proportional to both time and toxicant concentration, with the greatest mortality occurring between hours 24 and 72.

Using atomic absorption techniques, VERMEER (1972) has reported the accumulation of mercury residues as high as 2.0 mg/kg wet weight by natural crayfish populations (particularly among larger animals). It is likely that such populations exhibit even greater mortality than that encountered in this investigation, inasmuch as they include juvenile animals. The latter appear to be particularly susceptible in view of their relatively high frequency of molt.

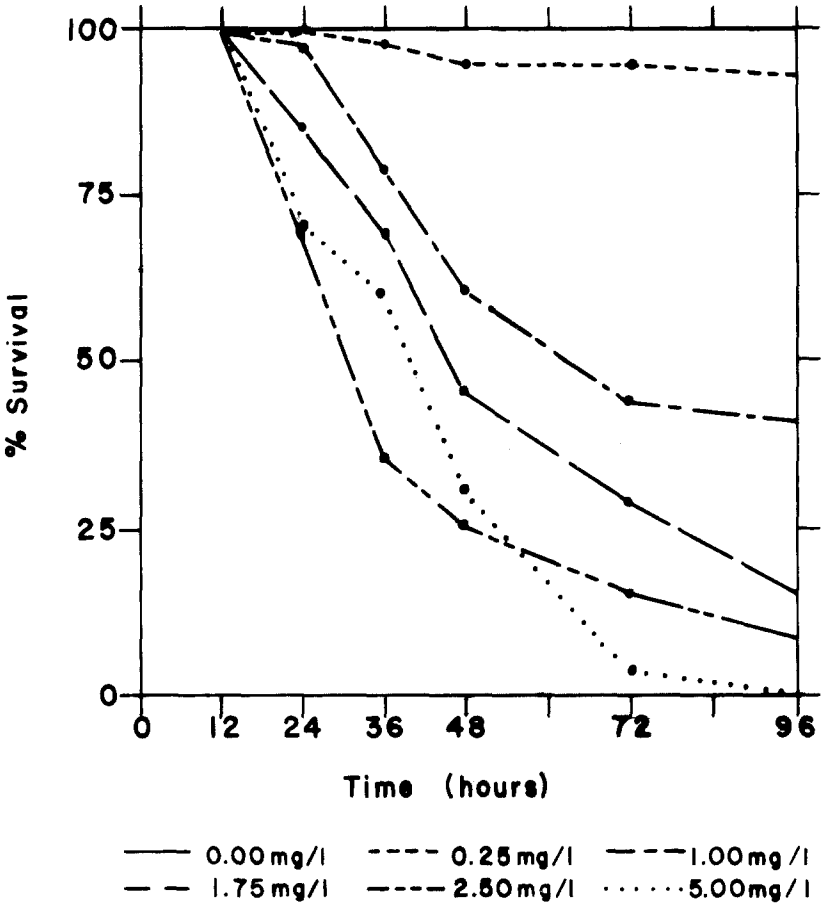

Figure 1. Percent survival versus time for crayfishes exposed to various concentrations of mercuric chloride.

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