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# AMMONIA TOXICITY TO WARM-WATER

## FISH OF THE LOWER FOX RIVER

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### INTRODUCTION

Ammonia is known to be toxic to fish. The toxicity of ammonia salts are pH dependent and are directly related to the concentration of undissociated ammonia. The undissociated or unionized ammonia (NH<sub>3</sub>-N) is the fraction of total ammonia which is toxic to fish. The ionized ammonia (NH<sub>4</sub><sup>+</sup>) fraction has little or no toxicity.

Calculations were made to determine the toxic fraction of the total ammonia (unionized) from water samples taken on the Lower Fox River in Brown County between April 8, 1986 and August 14, 1986. These values were calculated to determine if the unionized ammonia fraction ever exceeded the 0.04 mg/l criterion level that was set for Wisconsin water which are not classified as trout streams, such as the Fox River.

### METHODS & PROCEDURES

Ninety water samples were taken on the Fox River at forty-seven different sites. These samples were analyzed at the State Laboratory of Hygiene for total ammonia along with other parameters. Water pH and temperature was taken at the time the samples were collected. The procedures for calculating toxic ammonia are described below.

Using pH and water temperature, go to the "Total Ammonia vs Temperature at various pH values" chart (chart #1) to determine the total ammonia in mg/l containing 0.04 mg/l of unionized ammonia (NH<sub>3</sub>-N). Using this value, along with the critical ammonia level of 0.04 mg/l and the value of total ammonia from the lab slip, set up a ratio to obtain the desired unionized ammonia value.

Example: At a pH of 8 and a water temperature of 15 C Deg., there are 1.5 mg/l of total ammonia (from chart) which contains 0.04 mg/l of unionized ammonia. Therefore the ratio is:

$$\frac{0.04}{1.5} = \frac{X}{\text{total ammonia value from lab slip}}$$

If ammonia value from the lab slip equals 5, then

$$\frac{0.04}{1.5} = \frac{X}{5}$$

$$X = \frac{5(0.04)}{1.5}$$

$$X = 0.13 \text{ mg/l of unionized ammonia (NH}_3\text{-N)}$$

## RESULTS

From the 90 samples taken on the Fox River, at only three times during the sampling period did the ammonia toxicity level exceed the critical level of 0.04 mg/l. These sites and their toxic ammonia level are listed below.

- 1.) April 24, 1986. At the ski club, the level was above 0.04 mg/l. The exact level could not be calculated because lack of data. Calculations show that temperature could have been as low as -2 C Deg. and the ammonia level would still be considered toxic.
- 2.) June 17, 1986. At the mouth of the Fox River on the east shore. Unionized ammonia = 0.04 mg/l.
- 3.) July 22, 1986. At Highway 172 bridge in the center. Unionized ammonia = 0.04 mg/l.

All other unionized ammonia values calculated were considerably lower than the critical level.

(Total Ammonia vs Temperature at various pH values)  
**Ammonia Toxicity - Warm Water Fishery (Chart #1)**

