State Water Survey Division
WATER QUALITY SECTION
AT
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Illinois Department of
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The Behavior and Appearance of Stressed and Dead Fish Influenced by Six Common Toxicants

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INTRODUCTION

The Illinois State Water Survey has been conducting fish bioassays since 1974. The principal objective of the work is to determine the tolerance of some fishes native to Illinois, mainly bluegill, largemouth bass, and channel catfish, to aquatic toxicants. Thus far (1982) six toxicants* have been tested. These include:

- ammonia
- chlorine
- chlorides
- sulfates
- copper
- zinc

The studies have been performed in accordance with the protocol recommended by the *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, New York, New York. During the performance of the studies researchers recorded, in detail, the responses of the fishes to the various toxicants. These observations of stressed and dead fish have been condensed and presented here.

The behavior and appearance of fishes noted here may not be complete. It is quite probable that other response patterns may occur. Additionally, the observations recorded were made by different workers. It is quite likely that two or more observers reviewing a subject under stress at different time intervals may not record identical symptoms or appearance — particularly descriptive ones. And finally these observations were made in the laboratory under controlled conditions. Behavior and appearance of fishes under stress may differ in the field.

With knowledge of these shortcomings, and there are probably others, encouragement for compiling this information has been fostered by a single fact: *Too many fish kills occur in Illinois without the cause being resolved.*

In the belief that the behavior of fishes under stress and the appearance of dead ones might offer collateral clues for resolving fish kill episodes, this information is being offered. It is being offered also to encourage biologists in the field to marshal their expertise and experience into an assemblage of observations that will provide a more definitive set of guidelines than here proposed.

* Roseboom, Donald P. and Dorothy L. Richey. 1977. *Acute toxicity of residual chlorine and ammonia to some native Illinois fishes.* Illinois State Water Survey Report of Investigation 85, 42 p.

* Richey, Dorothy and Donald Roseboom. 1978. *Acute toxicity of copper to some fishes in high alkalinity water.* Illinois State Water Survey Circular 131, 24 p.

* Reed, Paula, Dorothy Richey, and Donald Roseboom. 1980. *Acute toxicity of zinc to some fishes in high alkalinity water.* Illinois State Water Survey Circular 142,21 p.

* Reed, Paula and Ralph Evans. 1981. *Acute toxicity of chlorides, sulfates, and total dissolved solids to some fishes in Illinois.* Illinois State Water Survey Contract Report 283. Prepared for Illinois Environmental Protection Agency, 50 p.

Bluegill (alive)

Swimming

- erratic . . . chlorine
- loss of equilibrium . . . chlorine chloride sulfate zinc
- jerking, spinnning, twisting at low concentrations . . . ammonia
- no schooling . . .
- floating at surface . . . copper zinc chloride
- sluggish when not aggressive . . . copper
- very sluggish . . .
- hovering near surface . . .
- tail chasing . . .
- motionless . . . sulfate
- upside down . . .
- aggressive at times . . . copper
- berserk immediately prior to death . . . ammonia
- barrel rolls . . . sulfate

Respiration

- erratic . . . chlorine
- increase . . .
- laborious . . . chlorine chloride sulfate zinc
- gulping air . . .
- coughing . . . chloride
- regurgitation . . .
- blowing bubbles . . . ammonia

Physical appearance and movement

- operculum flared . . . copper
- operculum open . . . chlorine
- mouth open . . . zinc
- eyes glazed . . .
- pigment faded . . .
- pigment darkened . . . zinc chloride
- muscle spasm . . .
- mucous film . . .
- pectoral fins beating rapidly . . . zinc
- operculum movement rapid and shallow . . .
- body sigmoid shaped . . .
- body L-shaped . . .
- body rigid . . .
- body vertical . . .
- lying on side . . . sulfate
- resting on bottom . . . sulfate zinc
- caudil fin hemorrhaging . . .

Bluegill (dead)

Hemorrhage

- gills . . . . . chloride sulfate zinc
- mouth . . . . .
- head . . . . . sulfate
- face . . . . . zinc
- brain . . . . .
- operculum . . . . .
- pectoral fins . . . . . chlorine chloride zinc
- caudal fins . . . . . chlorine chloride zinc

Position, shape, appearance

- vertical . . . . . chlorine chloride
- upside down . . . . . zinc
- sigmoid . . . . .
- curvature of spine . . . . . chloride sulfate
- dorsal side up . . . . .
- mouth open . . . . . ammonia
- pigment faded . . . . .
- pigment darkened . . . . . sulfate
- dorsal fin erect . . . . .
- operculum flared . . . . . ammonia chlorine chloride sulfate zinc

Largemouth Bass (alive)

Swimming

- erratic
- loss of equilibrium . . . chloride sulfate
- jerking, spinnning, twisting at low concentrations . . . ammonia zinc
- no schooling
- floating at surface
- sluggish when not aggressive
- very sluggish
- hovering near surface . . . chloride zinc
- tail chasing
- motionless
- upside down . . . sulfate
- aggressive at times
- berserk immediately prior to death . . . ammonia zinc
- barrel rolls

Respiration

- erratic
- increase
- laborious . . . sulfate zinc
- gulping air . . . chloride
- coughing . . . chloride
- regurgitation . . . chloride
- blowing bubbles . . . ammonia

Physical appearance and movement

- operculum flared
- operculum open
- mouth open
- eyes glazed
- pigment faded
- pigment darkened . . . sulfate
- muscle spasm . . . chloride
- mucous film
- pectoral fins beating rapidly
- operculum movement rapid and shallow
- body sigmoid shaped
- body L-shaped . . . chloride
- body rigid . . . zinc
- body vertical . . . zinc
- lying on side . . . chloride sulfate
- resting on bottom . . . zinc
- caudil fin hemorrhaging

Largemouth Bass (dead)

Hemorrhage
- gills . . . chloride sulfate
- mouth . . . chloride zinc
- head . . . chloride
- face . . . zinc
- brain . . .
- operculum . . . sulfate
- pectoral fins . . . chloride zinc
- caudal fins . . . chloride zinc

Position, shape, appearance
- vertical . . .
- upside down . . .
- sigmoid . . . zinc
- curvature of spine . . . sulfate
- dorsal side up . . .
- mouth open . . . ammonia zinc
- pigment faded . . . chloride
- pigment darkened . . .
- dorsal fin erect . . . sulfate
- operculum flared . . . ammonia chloride sulfate zinc

Channel Catfish (alive)

Swimming

- erratic . . . . . chloride
- loss of equilibrium . . . . . chloride sulfate zinc
- jerking, spinning, twisting at low concentrations . . . . . chloride
- no schooling . . . . . ammonia
- floating at surface . . . . .
- sluggish when not aggressive . . . . .
- very sluggish . . . . . copper
- hovering near surface . . . . . copper zinc
- tail chasing . . . . . chloride sulfate
- motionless . . . . . chloride
- upside down . . . . .
- aggressive at times . . . . .
- berserk immediately prior to death . . . . .
- barrel rolls . . . . .

Respiration

- erratic . . . . .
- increase . . . . . chlorine
- laborious . . . . . ammonia chloride sulfate
- gulping air . . . . . zinc
- coughing . . . . .
- regurgitation . . . . .
- blowing bubbles . . . . .

Physical appearance and movement

- operculum flared . . . . .
- operculum open . . . . . ammonia
- mouth open . . . . . ammonia
- eyes glazed . . . . . chloride
- pigment faded . . . . . ammonia
- pigment darkened . . . . .
- muscle spasm . . . . . chlorine copper
- mucous film . . . . . chlorine
- pectoral fins beating rapidly . . . . .
- operculum movement rapid and shallow . . . . . chloride sulfate
- body sigmoid shaped . . . . . copper
- body L-shaped . . . . .
- body rigid . . . . . zinc
- body vertical . . . . . zinc
- lying on side . . . . .
- resting on bottom . . . . . zinc
- caudil fin hemorrhaging . . . . . copper

Channel Catfish (dead)

Hemorrhage
- gills . . . chloride zinc
- mouth . . . zinc
- head . . .
- face . . .
- brain . . . chloride
- operculum . . .
- pectoral fins . . . ammonia chlorine chloride zinc
- caudal fins . . . chlorine chloride copper zinc

Position, shape, appearance
- vertical . . . chlorine
- upside down . . .
- sigmoid . . .
- curvature of spine . . . chloride sulfate
- dorsal side up . . . chlorine
- mouth open . . .
- pigment faded . . . ammonia
- pigment darkened . . .
- dorsal fin erect . . .
- operculum flared . . . sulfate

NOTES