

FLOTATION OF FISHES FOLLOWING STUNNING BY ELECTRICAL SHOCK

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INTRODUCTION

When sampling fish populations by use of electrical shock, one encounters variations in the number of fishes taken. Variations in catch occur on different days in the same waters, and the catch of a species may be out of proportion to its abundance. The present study was undertaken with the objective of determining the cause of these variations in catch.

Preliminary work indicated that much of the difference in catch is associated with variation in flotation of the fish following their being stunned. Failure to capture non-floating stunned fish is particularly important in turbid waters. To understand the cause of differences in flotation, all environmental factors that were thought to be important in this regard were investigated. A consideration of each of these factors is given below.

POSSIBLE FACTORS

Salt content of water.—The first environmental variable investigated was salt content of the water. It was not possible to demonstrate that a variation in salt content, of the magnitude occurring in most mid-western situations, had any significant effect upon the flotation of fishes.

Barometric pressure.—The effect of atmospheric pressure was studied by utilizing a steel cylinder equipped with an air exhaust system. By this means an aquarium containing fish was subjected to lowered barometric pressures equal to any changes which might normally occur. Although it was possible to make a stunned fish float by dropping the barometric pressure the equivalent of two inches of mercury, such a drop of atmospheric pressure would be rare in nature. Hence, it was felt that a more effective variable must exist.

Temperature and temperature changes.—Since winter-time collecting with electrical equipment was observed to be poor, it was thought that stunned fishes might float more readily at higher temperatures. Fishes were held at various temperatures and shocked. No positive correlation was obtained from this work.

To determine the effect of temperature change upon flotation, a group of fishes that had been held for several hours at a particular temperature was divided into two groups, one of which was moved to water of the same temperature and the other to water varying from 3 to 23 degrees warmer; after 5 minutes they were shocked, using 110 volts alternating current. Forty-six

trials were conducted, with beginning water temperatures from 33° to 72° F. The sample in each trial consisted of one, two, or three fishes. The species utilized included: the green sunfish, *Lepomis cyanellus*; white crappie, *Pomoxis annularis*; goldfish, *Carassius auratus*; yellow bullhead, *Ictalurus natalis*; white sucker, *Catostomus commersonii*; largemouth bass, *Micropterus salmoides*; Creek chubsucker, *Erimyzon oblongus*; steel-colored minnow, *Notropis whipplei*; longear sunfish, *Lepomis megalotis*; and golden shiner, *Notemigonus crysoleucas*. The green sunfish floated if the increase in temperature amounted to as much as 8° F. The largemouth bass floated at an 8-degree increase but not at 6-degree increase. The goldfish and steel-colored minnow floated when the temperature was increased 10-degree. The creek chubsucker did not float with a 10-degree increase in temperature. The yellow bullhead could not be made to float, even with a maximum increase of 22 degrees, although observation on this species was somewhat limited. The crappie was not entirely predictable even with extremes of temperature change. It is evident that a variation in flotability exists between species. This is further confirmed by the findings given below which refer to the effect of changes in depth.

Changes in depth.—To determine the effect of depth changes upon flotation, fishes were held in cages suspended in steel drums at depths of 8 inches, 20 inches, and 34 inches. At the end of 24 hours the fish at 20 and 34 inches of depth were moved up to 8 inches

and all fishes were shocked, using 110 volts alternating current; in some instances they were shocked at 34 inches as a control procedure. A total of 77 trials was conducted, utilizing from 1 to 4 fish per trial. The trials were conducted at temperatures ranging from 36° to 75° F., but in all instances the temperature was constant during the experiment and precautions were taken to avoid thermal stratification within the holding tank. In practically all instances, when the fish were held at 20 inches or at 34 inches and then moved to 8 inches and shocked, immediate flotation occurred in the green sunfish, largemouth bass, creek chubsucker, longear sunfish, goldfish, steel-colored minnow, and some golden shiners, but not in the yellow bullhead. There were instances, particularly in the crappies, where fish that were held at eight inches floated.

DISCUSSION

It becomes apparent from our observations that changes in temperature and depth, of magnitudes to be found in nature, are important in determining whether or not a fish will float or sink following stunning by electrical shock. The magnitude of the change required to produce flotation is approximately 8 degrees in temperature or 12 inches in depth. It is also apparent that there may be considerable variation in the flotation of different species of fishes. For example, the yellow bullhead did not float when subjected to rather extreme changes in temperature and depth. A rather interesting situation did occur in regard to this species. In one instance, when the fish was

stunned, it sank and came to rest with its head directed toward the surface. As it commenced to recover, spasmodic fin action caused it to surface.

The variation between species requires a great deal of additional observation, but there may be an association between the fishes having a well-developed pneumatic duct and the more recent fishes that have lost this connection between the swim bladder and the esophagus. This is suggested by the fact that, in each instance when the bullheads were subjected to changes in temperature and depth, they would commence to release air bubbles from the operculum approximately five minutes after they were subjected to the change.

The green sunfish, the species most thoroughly studied in the present

work, apparently is able to adjust to the changes in temperature or depth in approximately 30 minutes.

The relationship between these findings and the electrical sampling of fish populations under field conditions is of significance. In a lake, one might commonly run into a situation where fishes would move from colder to warmer water, and in any habitat one might encounter fishes moving from a greater to a lesser depth. One is led to speculate as to the possibility of causing fish to move to shallow water prior to shocking.

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