ARE WARMWATER FISH DISEASES AN IMPORTANT PROBLEM?

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ABSTRACT

Although the literature shows several instances where warmwater fishes have been affected by recognizable disease organisms, the problem of warmwater fish diseases has received little notice by investigators.

Evidence collected in fish cultural activity at the Marion, Alabama, Station indicates that disease may be an important factor in the successful propagation of bluegill fingerlings and also to some extent in that of largemouth black bass.

A case of gill disease among bluegills is described and other evidence regarding unexplained mortality among both bluegills and largemouth black bass is discussed. The need for a comprehensive study of the problem of warmwater fish diseases is emphasized.

INTRODUCTION

Little work has been done in past years on the problem of warmwater fish diseases in this country. In 1953 only four disease or parasite control studies were being conducted by states according to a survey of Fisheries Research Activities (1953). Two of these studies dealt with coldwater fish diseases principally.

It is doubtful that interest has increased since this survey was made. In the symposium on fish diseases conducted by the American Fisheries Society in 1953 (Snieszko, *et al.*) practically all of the work reviewed related to diseases of trout and salmon. A review of the accomplishments of the Federal Aid in Fish Restoration Program for the latter half of 1954 listed only three projects in operation, all of which were concerned with trout and salmon diseases.

That diseases of parasitic and bacterial origin affect warmwater species of fishes is well illustrated by Davis' (1953) review of the literature on diseases of game fishes. He lists two important bacterial diseases and more than a dozen parasitic diseases that have been reported as being present in species of warmwater fishes. The extent of occurrence and the damage caused by these diseases has not been studied to any appreciable extent.

Several factors may be responsible for the apparent lack of concern about warmwater fish diseases by fish culturists. In many instances the presence of disease may go unnoticed. The dead fish often do not float and are not detected while the survivors recover without the condition being noticed. Too, where fish are cultured in ponds, few can be seen until harvest because of the presence of phytoplankton in many instances. Criteria for determining whether fish are "sick" or healthy are not too well established and usually if an individual fish can swim normally it is considered to be healthy. Finally, diseased fish may go unnoticed because of the large quantities of fish handled at one time. At warmwater fish cultural stations lots of 40,000 bass or 100,000 bluegill fingerlings are often handled in a single shipmment. Unless a considerable portion of the lot are affected, abnormalities may go unnoticed.

EVIDENCE OF DISEASE AT THE MARION STATION

The U. S. Fish Cultural Station located at Marion, Alabama, is the largest federal warmwater hatchery in operation at the present time. The production unit consists of 58 ponds covering approximately 110 surface acres. During the past five years the hatchery has produced between 3,500,000 and 6,000,000 bass and bluegill fingerlings annually. Observation of the results obtained in the ponds of this station where largemouth black bass (*Micropterus salmoides*, Lac.) and bluegills (*Lepomis macrochirus*, Raf.) were propagated has provided information which indicates that warmwater fish diseases are an important problem on this station at least. Contact with fish culturists from other stations where bass and bluegills are propagated indicate that unexplained fish losses take place at other hatcheries just as they do at Marion.

Occasional reports from owners of farm ponds about fish mortality in their waters points to the fact that unexplained mortality also affects fish production in other waters as well.

BLUEGILL DISEASE PROBLEMS

In the fall of 1954, bluegill fingerlings removed from a 10.9 acre pond located on the Marion Station suffered an abnormally high rate of mortality shortly after being removed from the pond. The small fish seemed to be suffering from a lack of oxygen, although an analysis of the water supply showed that an adequate amount of oxygen and a low concentration of carbon dioxide was present.

Mortality began after about 12 hours in the holding house and in some instances up to one-fourth of the fish in a tank died within 30 hours. The rate of mortality decreased after the first 24 hours of holding and the condition of the surviving fish gradually improved.

A sample of the affected fish was sent to the Microbiological Laboratory of the U. S. Fish and Wildlife Service at Leetown, West Virginia. The trouble was diagnosed as gill disease on the basis of the appearance of the gills. Necrosis of gill tissue was noted along with proliferation of gill filament epithelium and fusing of the gill lamellae. Mucus in excessive quantities was also present.

Treatment was begun for gill disease using a copper sulphate dip of 1:2,000 for 60 seconds initially. When this treatment failed to check the mortality, a prolonged treatment of two parts per million pyridylmercuric acetate (PMA) for one hour was tried. Use of this treatment reduced the rate of mortality as much as 75 percent over an untreated control lot and greatly improved the appearance of the treated fish. The long-time survival of the PMA treated fish was not studied. Diseased untreated fish failed to survive a three-month holding period when restocked in another pond on the station. Where the diseased fish were given a copper sulphate dip before stocking, survival in another pond after four weeks was about 25 percent.

This bluegill gill disease is not a new one at this hatchery as two previous instances of an outbreak having similar symptoms were recalled. However, the condition of the fish was not associated with that of gill disease at the time it was noted.

Another disease of bacterial or nutritional origin apparently occurs in the fall and winter months at Marion. The symptoms of the disease have not been observed and the assumption that the disease exists is based largely upon circumstantial evidence. In bluegill brood ponds the number and appearance of the fish crop is checked by seining samples of fish from the pond at approximately three-week intervals. Notes are made on the size and number of individuals in each sample. Study of these data for poor producing ponds indicates that in some instances heavy mortality takes place in the fall and early winter. Apparently the smaller and possibly weaker fish are the ones which die. Based on production estimates made from seine samples, losses may range from 20 to 80 percent of the total number of small fish in an affected pond. In two instances small numbers of dead fish were observed during the month of September, while the loss in another pond took place in October or November. The dead fish did not usually float, but were observed in most instances lying on the pond bottom in shallow water.

During the five-year period under study, pond failures [1] have risen from 13.1 percent in 1950 to 44.4 percent in 1954. It appears that bluegill disease and related causes are assuming a role of increasing importance at Marion.

Illustrating the susceptibility of bluegills to mortality during the winter months is the fact that survival of bluegill fingerlings in winter holding ponds is generally low at this station. The percentage surviving a 2-10 week holding period usually ranges from 30 to 90 percent. The survival rate of bluegill fingerlings stocked in farm ponds averaged about 75 percent for the first year

[1] All ponds producing less than 50,000 young per acre are tentatively classed as partial or complete failures, since an unfertilized and unmanaged pond should yield this many small bluegills.

according to Swingle (1950). If diseased fish are stocked the survival figure probably would be much lower.

EVIDENCE OF BASS DISEASE

Among largemouth black bass evidence regarding disease problems is more circumstantial, but it now appears that factors other than cold weather, inadequate feeding of brood stock and cannibalism are responsible for poor production in some instances.

In 1955 two bass brood ponds on the Marion Station were stocked from a common lot of brood fish on the same day. One pond received 45 brood fish per acre while the other was stocked with 50. Average weight of the fish stocked was 2.2 pounds and they appeared to be in satisfactory spawning condition. Spawning was normal in one of the ponds with 216,000 fry and 42,700 fingerlings being recovered from the 1.6 acre pond. Bass in the other pond failed to reproduce successfully, although several nests were observed and at least one large school of fry hatched. No fry could be harvested and no fingerling bass were present when the pond was drained. There were no physical reasons noted that could have accounted for the failure of the brood fish in the second pond to reproduce.

There is general agreement among fish culturists that an inverse relationship exists between the length of time bass fry are carried in a rearing pond (stocking rate 40-60,000 fry per acre) and the survival percentage of fish in the lot. The logical assumption is that cannibalism and lack of food decreases the survival rate as the holding time is increased. Undoubtedly this is true in ponds where the holding period lasts for three or four weeks. Mortality occurring before cannibalism or starvation normally begins may be attributed to other causes however.

At the risk of spoiling our fish cultural reputation the following data are presented to illustrate the amount of mortality sometimes occurring in bass rearing ponds which cannot be attributed to food supply or cannibalism:

TABLE I

SURVIVAL DATA ON BASS FRY FROM HOLDING PONDS

Pond No.	*Fry Stocked Per Acre*	*Date Stocked*	*Days in Pond*	*Percent Survival*	*Food Rating**
20	50,000	4/8	18	56.2	4.8
21	46,000	4/8	25	76.3	4.5
32	55,000	3/31	22	55.5	5.6
33	55,000	3/31	28	44.8	5.0
40	51,000	3/31	24	80.3	6.0
45	50,000	4/8	18	89.2	4.2
47	42,500	4/8	25	28.5	4.7

All ponds were fertilized and stocked following in general the technique described by Blosz (1952). Three forms of organic fertilizer were used in the different ponds but did not appear to materially differ as to rate of zooplankton production. A stocking rate of 50,000 fry per acre was desired but three of the ponds received more fry while two received less because of the supply of fry available. All fry were from a common source and were fairly uniform in size. All fish were held in a 1 p. p. m. acriflavine solution for a period of from 15 minutes to one hour during the stocking process. The variation in size was not considered to be great enough in any of the ponds at draining to indicate that cannibalism influenced survival rates.

The food supply appeared to be good in all ponds and numerous Cladocera and Copepods could be seen in all ponds upon casual examination. Two stocking dates were used, March 31 and April 8. The ponds were drained as rapidly as possible after the fish reached a size of about 1½ inches in length. The number of fish per pound varied from 233 in Pond 47 to 1,432 in Pond 32.

* A visual estimate was made of the amount of zooplankton present for bass food each week during the production cycle. Figures in this column are averages of five estimates where values ranging from 1-10 were given to ponds during the inspection period. The greater the numerical value, the more numerous the food organisms were estimated to be.

Examination of the survival percentages indicates that abnormally low survival was obtained in Ponds 47, 33, 32 and 20. Possibly Ponds 32 and 33 were overstocked. However, the fish remained uniform in size and food appeared adequate as the small bass were noted to be feeding normally throughout the production period.

The influence of disease is indicated by the usually low survival rate of 28.5 percent in Pond 47. Shortly before draining, a distressed fish was noted that had apparently lost its sense of equilibrum. Efforts to capture it were unsuccessful however due to the presence of a bloom of plankton and no more affected fish were noted in any of the ponds. As can be seen from the survival percentages and the days in the pond, high survival is not consistent with a short production period. Since cannibalism and food supply can tentatively be ruled out, disease or some other unknown influence is suggested.

Wide variation in survival between different ponds is the rule rather than the exception and has been noted in previous years results as well. Of course there are a number of reasons why the variations occur, but where all known influences are compensated for, it seems that results should be more uniform than are generally obtained.

CONCLUSIONS

In spite of the lack of interest in warmwater fish disease problems by fishery research agencies, observation of largemouth black bass and bluegill culture at the Marion Station over a five-year period indicate that the problem of disease may be a serious one in some locations at least.

This experience suggests more attention should be given to fish mortalities and the cause of death determined wherever possible. The establishment of an adequate diagnostic service by state and federal agencies to identify causative agents is needed.

Research programs to develop control methods for known diseases among warmwater fishes appear to be needed. The techniques used in treating diseases of coldwater species are not applicable in most instances to present methods of warmwater fish culture.

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