A SUMMARY OF FISH DISEASE CASES RECEIVED OVER A FIVE-YEAR PERIOD AT THE SOUTHEASTERN COOPERATIVE FISH DISEASE LABORATORY

By WILMER A. ROGERS

Leader Southeastern Cooperative Fish Disease Project
Auburn University Agricultural Experiment Station
Auburn, Alabama

ABSTRACT

During the period July 1, 1964 to June 31, 1968, a total of 300 cases was received for diagnosis at the Southeastern Cooperative Fish Disease Laboratory at Auburn University. Ninety of the cases (30%) were determined to be caused by parasites, 104 cases (34.7%) were determined to be caused by bacteria or viruses. The remainder of the cases were routine prestocking checks, kills due to factors other than disease producing organisms, or undetermined cases due to unsuitable specimens for diagnosis or lack of data. A detailed breakdown of the cases is given including seasonal occurrence, prevalent organisms associated with epizootics, and environmental factors associated with epizootics when known.

INTRODUCTION

The Southeastern Cooperative Fish Disease Project was initiated July 1, 1964. Such a project was needed due to the ever increasing awareness of the aquatic habitat and the fish kills that occasionally occurred therein. What used to be considered "winter kills" resulting from low temperatures or low dissolved oxygen, are now known in most cases to be due to disease producing organisms and pollution. During the 5 years, July 1, 1964—June 30, 1969, the project has been in effect, 300 cases were received for diagnosis. In most cases a fish kill was involved, however, many cases consisted of routine examination of the fish to determine if disease producing organisms were present. Several cases were submitted merely to rule out disease producing organisms where pollution or some other factor was suspected of causing the mortalities. Poor water quality accounted for a number of mortalities and sometimes bacterial infections were associated with poor water quality conditions.

Drs. N. Fijan and G. Krantz and Mr. J. A. Plumb were mainly responsible for bacterial and viral diagnoses. Drs. R. Allison and W. A. Rogers and Messrs. H. Beckert, S. K. Johnson, and M. V. Rawson were responsible for parasitological diagnoses. Mr. Tom Wellborn, Bureau of Sport Fisheries and Wildlife Hatchery Biologist, cooperated on the project.

SEASONAL OCCURRENCE OF CASES

Total number of cases received (Figure 1) showed the greatest number of cases being received in April and June and the lowest number of cases being received in December. A breakdown of the cases showed that the cases due to bacteria (Figure 2) reached a peak in April and gradually declined throughout the summer months while the cases that were parasite caused (Figure 3) had distinct seasonal peaks in March and September. Snieszko (1958) believes that bacterial diseases cause heaviest losses in the spring when water temperature rises and the fish blood is deficient in antimicrobial components. Meyer (1964) reported major outbreaks of *Aeronmonas liquefaciens* in April and May and October and November. He thought these epizootics were brought on by rapid temperature changes. The cases due to parasites (Figure 3) showed peaks of occurrence in March and September indicating that parasite epizootics are also temperature correlated.

Snieszko (1958) stated that the Eastern Fish Disease Laboratory received large numbers of samples of sick fish during the spring and that

the first samples were received in February or March from States near the Gulf while samples from the more northern tier of States was received in April. A similar trend was observed at this laboratory. A peak number of cases was received from Florida in March and April while the peak number was received from Tennessee in May.

VIRAL DISEASES

One of the most significant contributions the project has made thus far is in isolating and determining the etiological agent of channel catfish virus disease. The symptoms of this disease had been observed and a virus had been suspected long before it was demonstrated. The virus seems only to affect fingerling channel catfish, *Ictalurus punctatus*, and then only when the water temperature is high during mid-and-late summer. In the cases involved, mortalities ranged from about 30-95% of the populations. Symptoms of the disease are as follows: the fish show distress and may hang vertically in the water near the surface and often swim in a spiralling manner, the body cavity generally is filled with a yellowish to bloody exudate and the eyes may be distended, and bloody areas are generally present at bases of fins and on the body. Often bacterial infections are present and they may mask the virus symptoms. Both *Chondrococcus columnaris* and *Aeromonas liquefaciens* have been associated with the virus disease but they are thought to be secondary and only invade the fish when they are weakened by the virus. The channel catfish virus disease is being described by Fijan, Wellborn, and Naftel (In Press).

Most known virus diseases of fish occur in salmonids and since our laboratory seldom receives cold-water fishes, lymphocystis was the only other virus disease encountered. In most cases where lymphocystis was sent to our laboratory, it was mainly to find out what was causing the characteristic growths (Wolf, 1964).

A virus was suspected as causing part of the massive fish-kill in the Tennessee River during early 1965 since other disease producing organisms were not found consistently, however, a virus was never demonstrated.

BACTERIAL DISEASES

A total of 104 (37.4%) cases received on the project during the five-year period was determined to have bacteria as the cause of the epizootic. Mortalities were not occurring in every case but lesions or other symptoms were usually present. Pathogenic bacteria were often isolated from the skin, fins, and gills and not the internal organs of apparently healthy fish but unless the infection was systemic the role the bacteria played in mortalities was often unclear.

In most cases, the presumptive tests of Bullock (1961) were used to identify bacteria. If known pathogenic bacteria were not isolated, and enteric or common water bacteria were, the latter were considered to be contaminants. In at least one case, however, it appeared that *Achromobacter* and *Alcaligenes* might have been causing mortalities. The fish in this case were lake chubsuckers, *Erimyzon sucetta*, the only species of fish affected in a mixed population, and they had large hemorrhagic areas on the body. The two named bacteria were the only ones isolated from the kidney and were the only organisms found. The possibility of a virus was not ruled out, however. Bullock and Snieszko (1969) quote Wharton as expressing a belief that *Achromobacter* infecting trout in very high numbers caused mortalities. The water or enteric bacteria isolated from fish at our laboratory were most frequently obtained from recently dead fish or those almost dead. Bullock and Snieszko (1969) report that bacteria may continuously enter tissues of healthy vertebrates, but are removed almost immediately by humoral and cellular defenses of the body. In weakened fish, it stands to reason that water bacteria present in large numbers could be a contributing cause of mortality.

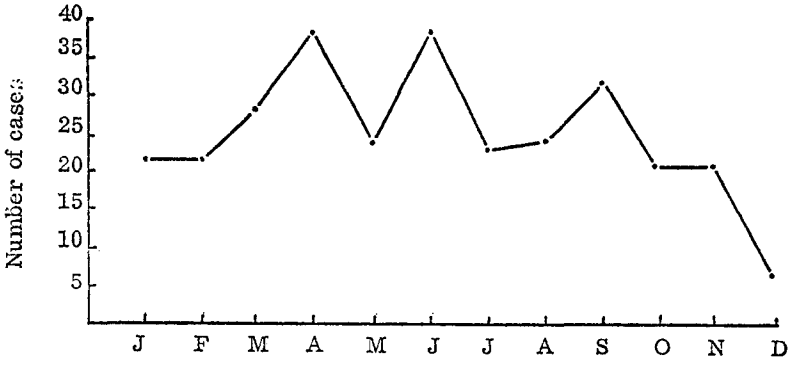

Figure 1 Total number of cases per month

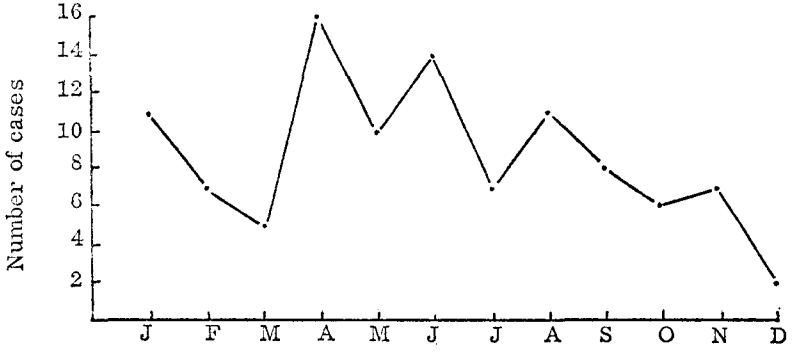

Figure 2 Total number of bacterial cases per month

Figure 3 Total number of parasitic cases per month

Apparently, occurrence of bacteria in fish that appear healthy can be considered normal. Van der Struik (1965) found that more than one-third of nearly 1,000 fish examined were infected with *Aeromonas*, and concluded that fish populations free of bacteria did not exist or hardly existed in the Netherlands. Evelyn and McDermott (1961) and Bullock and Snieszko (1969) found that apparently healthy fish populations in North America may also be infected.

Approximately 20% of the bacterial cases involved *C. columnaris* or closely related myxobacteria. *Columnaris* disease occurred mainly during the summer months when the temperature was high but occasionally was found throughout the year. Fijan (1968; 1969) and Fijan and Voorhees (In Press) conducted extensive research on columnaris disease during the two years Dr. Fijan was at our laboratory.

Aeromonas liquefaciens was identified from about 18% of the 104 bacterial cases. *Pseudomnas florescens* occurred in about 8% of the cases and *Pseudomonas* and *Aeromonas* occurred together occasionally. In most of the rest of the bacterial cases no specific identifications were made. Several samples of fish were received where the fish had apparently been frozen, thawed, and refrozen and no cultures could be made. In other cases bacteria were considered to be the etiological agent but no attempt at specific determination was made. In many of the cases involving bacterial infections, parasites were abundant but could not be considered as causing the mortalities and it appeared that the bacteria were secondary invaders.

PARASITIC DISEASES

Ninety (30%) of the 300 cases received were diagnosed as being caused by parasites. Although several thousand fish were examined for parasites, the majority of the cases involving mortalities were those caused by the protozoans.

Costia, Trichodina, Ichthyophthirius, Chilodonella, Trichophyra, Scyphidia and *Glossatella* most frequently caused mortailties. Most cases involving protozoans occurred in the spring or fall and appeared to be temperature related. Bacterial infections were often associated with the protozoan infestations but in almost every case the bacteria were considered to be secondary invaders.

A commonly encountered disease condition–"red sore disease"—was caused by the stalked ciliate *Epistylis*. Sometimes an estimated 60 to 80% of the fishes body would be covered by red sores and eroded scales caused by *Epistylis*. This parasite was associated with high organic content in the water and showed no occurrence correlation to season or temperature. *Scyphidia, Glossatella* and *Trichophyra* all appeared to be correlated to high organic content in the water.

Amoebas were found in 13 cases and in all but one case were associated with bacterial infections. Their association with mortalities was unknown. In one case, an amoeba was found in gill tissue and was extremely abundant in fluids in the body cavity. This was the only organism found consistently in all fish examined and it was concluded that the amoeba was causing the fish kill.

Dinoflagellates were associated with four fish kills. *Glenodinium* was abundant on the gills and body of channel catfish in two cases and bluegills, *Lepomis macrochirus*, in another case. *Aeromonas liquefaciens* was isolated from the channel catfish, but it appeared to be secondary to a stress factor, probably the dinoflagellate infestation. The pH was low (3.5 to 4.0) in one of the catfish ponds and in the bluegill pond. *Oodinium* was infesting channel catfish that had been held in a pond with pompano and apparently was obtained from the pompano.

In two cases Myxosporidia (*Myxosoma*) were the only organisms found that could have caused death.

Trematodes were present on or in most fish examined but only in a few of the cases were they ever a problem. *Gyrodactylus* was the worst

of these and was in most cases associated with a bacterial infection, either *C. columnaris* or *A. liquefaciens*, both of which were considered to be secondary. *Cleidodiscus pricei* on channel catfish gills was causing problems in a few cases. *Cleidodiscus robustus* on the gills of the bluegill caused considerable damage to tissues in two cases and was thought to have caused mortalities. *Urocleidus principalis* on the gills of largemouth bass, *Micropterus salmoides*, also was thought to have contributed to mortalities in two cases. Each of the above bass and bluegill cases came from large reservoirs. Yellow grubs, *Clinostomum marginatum*, in the flesh of young striped bass being reared in a hatchery were received a few times and white grubs, *Posthodiplostomum minimum*, in the internal organs of centrarchids were noted many times but no mortalities were associated with either parasite. A poor condition factor in bluegills in a few cases were thought to be due to white grubs.

The only cestodes that appeared to cause trouble were the larval forms of the bass tapeworm, *Proteocephalus ambloplites*. In one large lake where bluegills and largemouth bass were heavily infested, no bass reproduction had occurred in several years and the fish population was out of balance. The bass tapeworm was blamed for this condition. In two other cases, hatchery brood bass were infested and a recommendation was made to destroy all infested broodstock, sterilize the hatchery and water supply, and obtain uninfected broodstock.

Nematodes were often encountered in the samples examined and in several cases nematodes caused quite a problem. A species of *Philometra* occurred behind the eye and in the body cavity of bluegills, laregmouth bass and white bass. Larval *Centracaecum* encysted in viscera of fish were sent in for identification several times. A species of *Goezia* encysted in the stomach wall of striped bass, *Morone saxatilis*, was blamed for a rapid decline in condition factor. Bacteria of various types were present in the nodular cysts with the *Goezia* species.

Acanthocephalans were sent in for identification several times and in one case *Pomphorhynchus rocci* was thought to have caused mortality in striped bass being held at a hatchery for spawning. Antagonism was observed between *Neoechinorhynchus cylindratum* and a tapeworm, *Proteocephalus* sp. in largemouth bass. In bass having one or two tapeworm present in the gut, less than 2 dozen *N. cylindratum* were present, but in the same sample of fish, those not having a tapeworm in the gut would have 4 to 8 dozen *N. cylindratum* present.

Leeches were considered a problem in only two cases. No kills were involved but gill damage was observed in both cases.

The anchor worm, *Lernaea*, was the most damaging of the parasitic crustaceans encountered. Several samples of fish infested with anchor worms were sent to the lab and fungus, probably *Saprolegnia* sp., was generally associated with the lesions produced by *Lernaea*. *Ergasilus* was not considered a problem, although one species being studied produced some very pronounced pathology to the gills. The fish louse *Argulus* appears to have contributed to fish kills in at least two cases and may have been solely responsible in one case. *Achtheres* was encountered several times but was never considerd to be a problem.

MISCELLANEOUS DISEASES

Fungus was present on many of the fish sent in for diagnosis but it was always considered to be a secondary infection. In most of these cases the fungus was determined to belong to the genera *Saprolegnia* or *Achlya*. In one case an undescribed fungus which was systemic in channel catfish was found. The systemic mycosis was described by Fijan (1969).

Nutritional diseases were diagnosed several times. Most often this was in channel catfish receiving a pelleted food and not having access to any natural foods.

A number of samples were received in which the fish had cuts or fresh

lesions and no bacteria or other disease producing organisms could be found. Those cases were considered to be due to mechanical damage.

Three fish were received with tumors present. Dr. Fijan classified the tumors as a malignant neoplasm, a lipoma, and a sarcoma. Several abnormal growths were considered to be due to mechanical damage.

Gas bubble disease was encountered a few times. One case was after fertilization when a supersaturation of O_2 occurred, one involved a deep well that had high CO_2, and another case involved water being heated up in a holding facility and the change in temperature causing a supersaturation of gases in the water.

There were several fish kills where no causative agent could be determined. Chemicals (insecticides, herbicides, etc.) were suspected but could not be ascertained.

Hoffman's (1967) book on North American fish parasites proved to be invaluable in parasite diagnosis.

LITERATURE CITED

Bullock, G. L. 1961. A schematic outline for the presumptive identification of bacterial diseases of fish. Progressive Fish-Culturist. 23(4):147-151.

——— and S. F. Snieszko. 1969. Bacteria in blood and kidney of apparently healthy hatchery trout. Trans. Amer. Fish. Soc. 98(2):268-271.

Evelyn, T. P. T., and L. A. McDermott. 1961. Bacteriological studies of freshwater fish. I. Isolation of aerobic bacteria from several species of freshwater fish. Can. J. Microbiol. 7(3):375-382.

Fijan, N. 1968. The survival of *Chondrococcus columnaris* in waters of different quality. Bull. Off. Epiz., Vol. 69, No. 7-8, p. 1159-1166.

———. 1969a. Antibiotic additives for the isolation of *Chondrococcus columnaris* from fish. Applied Microbiology, Vol. 17, No. 2, p. 333-334.

———. 1969b. Systemic mycosis in channel catfish. Bulletin of Wildlife Disease Association, Vol. 5, No. 4. p. 109.

——— and Patricia Voorhees. In Press. Drug sensitivity of *Chondrococcus columnaris*. Veterinarski arhiv.

———, Thomas Wellborn and John Naftel. In press. An acute viral disease of channel catfish. Tech. paper FWS.

Hoffman, G. L. 1967. Parasites of North American freshwater fishes. Univ. Calif. Press, 486 pp.

Meyer, F. P. 1964. Field treatments of *Aeromonas liquefaciens* infections in golden shiners. Prog. Fish. Cult., 26:33-5.

Snieszko, S. F. 1958. Natural resistance and susceptibility to infecttions. Prog. Fish. Cult., 20:133-136.

van der Struik, A. 1965. EIFAC Technical Paper No. 2. Preliminary investigations on the occurrence of bacteria in fish-stocks. FAO, 1965. 21-35.

Wolf, K. 1964. Lymphocystis disease of fish. BSFW. Fishery Leaflet 565:1-4.