The Southeastern Cooperative Fish Disease Project: 40 Years of Service to the Southeastern United States

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Abstract: In 2004, the Southeastern Cooperative Fish Disease Project completed 40 years of research, education, and disease diagnosis in support of the fisheries management goals of the members of the Southeastern Association of Fish and Wildlife Agencies (SEAFWA). This project has been possible because of the cooperation of biologists and support from the Southeastern states. Major areas of research included parasites of warmwater sport fish, bacterial and viral diseases of fish, and environmental effects on fish health. These research topics arose from problems identified because of the disease diagnostic activities of this cooperative project. Continuing education courses provided basic instruction about fish diseases and also transferred new research information to biologists in the SEAFWA states. In addition, the training of fish disease specialists increased the availability of personnel to assist SEAFWA members.

Key words: fish diseases, disease diagnosis, continuing education, cooperative project

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The Southeastern Association of Game and Fish Commissioners (SAGFC), known since 1975 as the Southeastern Association of Fish and Wildlife Agencies (SEAFWA), initiated a study, now known as the Southeastern Cooperative Fish Disease Project (FDP), on 1 July 1964. The project was developed because management of fisheries resources in the Southeast required better information about fish diseases, both in wild fish and in state hatcheries (Swingle and Allison 1963). By 2004, SEAFWA had continued to support the FDP for 40 years with funding provided by 13 agencies that have been members of SEAFWA (Table 1). Equally essential to the success of the study has been the cooperation of biologists employed by the members of SEAFWA.

This overview of the FDP includes background information and examples of accomplishments. For the members of SEAFWA, this will provide a historical perspective for future activities related to fish diseases. Fish dying from disease are a highly variable portion of the overall mortality of wild fish populations; improved methods for diagnosis of diseases, understanding and predicting the effects of disease on fish populations, and communication of disease risks to the public are all important for management of fisheries resources.

Table 1. States of the Southeastern Association of Fish and Wildlife Agencies that have been members of the Southeastern Cooperative Fish Disease Project.

State	Founding member	Member at some time	Member during 40th year (2004)
Alabama	X	X	X
Arkansas	X	X	
Florida	X	X	
Georgia	X	X	X
Kentucky		X	
Louisiana	X	X	X
Maryland		X	
Missouri		X	X
North Carolina		X	X
South Carolina		X	X
Tennessee	X	X	X
Texas		X	X
Virginia	X	X	

Objectives of the Fish Disease Project

As originally proposed (Swingle and Allison 1963), the objectives of the FDP were (1) to assist in the solution of fisheries management problems involving the control of fish diseases, (2) to conduct research on parasitic and bacterial diseases affecting fish populations, (3) to conduct training programs for fishery biologists of cooperating states, and (4) to publish research results and make information about fish diseases available to cooperating states. These objectives have continued to be relevant to members of SEAFWA throughout the history of the project. Additional research areas, such as viral diseases and the effects of environmental factors on fish health, became important and were added to project activities. Specific objectives were established by the Cooperative Fish Disease Study Committee appointed by SEAFWA, were reviewed annually, and were modified as new problems were recognized and agency priorities changed.

Formation and Staffing of the Project

Homer S. Swingle, a professor of Fisheries at Auburn University, presented a proposal to the state agencies "charged with the responsibility for the management of freshwater fisheries in public waters in the Southeast" (Swingle and Allison 1963). This proposal led to the formation of the Cooperative Fish Parasite and Disease Project on 1 July 1964. A committee was appointed by the SAGFA to advise and direct the project and to keep the states advised of project activities. Seven member states initially funded the project (Table 1), which was led by Swingle (Table 2).

As indicated by the original name of the project (Cooperative Fish Parasite and

Table 2. Faculty of the Southeastern Cooperative Fish Disease Project.

Name	Role	Years
Homer S. Swingle	Project leader	1964–1969
Ray Allison	Parasitologist	1964–1969
W. A. (Bill) Rogers	Parasitologist; Project leader[a]	1964–1995
George Krantz	Microbiologist	1965–1966
Tom L. Wellborn Jr.	Cooperator, Bureau of Sport Fisheries and Wildlife	1966–1969
Nikola Fijan	Visiting scientist	1966–1968
John A. Plumb	Microbiologist; Project leader[b]	1969–1998
John L. Gaines	Pathologist	1972–1974
John M. Grizzle	Pathologist; Project leader[c]	1976–present
Teruo Miyazaki	Visiting scientist	1982–1983
Yolanda J. Brady	Microbiologist	1984–present
Jeffery S. Terhune	Epidemiologist	2003–present

a. 1969–1994
b. 1994–1998
c. 1998–present

Disease Project), parasitology was a major area of emphasis during the first few years. There was little information about parasites of warmwater fish, and rapid progress was made in describing many species of parasites of fishes in the Southeast. As more was learned about fish parasites, they became recognized as an important category of disease-causing agents. In addition, interest and expertise in other aspects of fish pathology increased, leading to a change in the name of the project in 1968 to the Southeastern Cooperative Fish Disease Project.

Personnel of the FDP have all been affiliated with Auburn University (Table 2). In addition to permanent faculty, visiting scientists were important in meeting project goals. For example, Nikola Fijan from Yugoslavia was a visiting professor soon after the project was initiated and provided expertise in microbiology and pathology. In addition to the faculty listed in Table 2, numerous students, technicians, research associates, and postdoctoral fellows were essential for all phases of the project's activities.

Relationships Among Diagnosis, Research, and Continuing Education

Fish received by the FDP for disease diagnosis provide opportunities for discovery. Many of the major areas of research, including channel catfish virus disease, enteric septicemia of catfish, tumors of fish exposed to wastewater, and largemouth bass virus disease, grew out of the obvious need for additional information when fish with these diseases were submitted to the diagnostic laboratory. Diagnostic activities not only led to the discovery of previously unrecognized diseases, but also provided a source of "real-world" scenarios for research. Continuing education courses presented to biologists of agencies belonging to SEAFWA were an opportunity for sharing diagnostic-laboratory discoveries and subsequent research findings.

The integration of the diagnostic, research, and education functions of the proj-

ect encouraged a rapid response to new problems. Funding provided by SEAFWA members allowed research and dissemination of information to begin immediately when new problems arose rather than having to wait for new funding to be obtained. For example, ability to respond immediately allowed rapid progress in understanding channel catfish virus (Wellborn et al. 1970), *Edwardsiella ictaluri* (Hawke 1979), golden shiner virus (Plumb et al. 1979), and largemouth bass virus (Plumb et al. 1996) when these pathogens were first recognized as potential threats to fish populations.

Collaboration Between Agency Biologists and Project Personnel

Biologists working in states belonging to SEAFWA were essential to the success of the FDP. It was not possible for project personnel to visit the site of each fish disease problem in the Southeast, so collaboration with state biologists was essential for identifying and investigating fish diseases. Some examples of collaboration between the FDP and biologists working for state agencies are presented below.

William Keys, a fishery biologist with the Arkansas Game and Fish Commission, contacted the FDP in 1965 because of diseased fish in Lake Ouachita, Arkansas. Keys and personnel from the FDP collected fish from Lake Ouachita, and a protozoan parasite, *Epistylis* sp., was found in all external lesions. This observation lead to additional field and laboratory research establishing *Epistylis* sp. as a common cause of skin ulcers on freshwater fish throughout the southeastern United States (Rogers 1972).

Rearing striped bass *(Morone saxatilis)* and striped bass hybrids is a common activity in many SEAFWA member states. Initially, success was often poor, but it improved as better methods were developed for spawning and rearing these fish (Harrell et al. 1990). However, in some regions where natural waters have low hardness, losses of young *Morone* spp. continued. During harvest of ponds at Georgia's McDuffie and Walton hatcheries in 1983, one-month-old striped bass were dying while being transferred to holding vats. After consultation with FDP personnel, the severity of the problem was reduced by adding soluble calcium to the ponds and transport water (Grizzle et al. 1985; Mauldin et al. 1988). The importance of an adequate concentration of calcium in the water when young *Morone* spp. were harvested from hatchery ponds and the relationship between this requirement and fish age were documented because of the initial recognition of the problem by biologists working for a SEAFWA member state. Additional research on this topic continued to involve personnel from both the FDP and the Georgia Department of Natural Resources (Grizzle and Mauldin 1994, 1999).

Investigation of fish kills has always been a central part of FDP activities, but the timely discovery of a fish kill, obtaining vital field information, and collection of specimens for examination depend on well-trained biologists working for the member agency. An example of a cooperative effort to determine the cause of a fish kill occurred in 1995 when dead largemouth bass *(Micropterus salmoides)* were observed in Santee-Cooper Reservoir, South Carolina. This fish kill was unusual because only the larger size largemouth bass were dying. The most important aspects of this investigation were field observations by biologists with the South Carolina De-

partment of Natural Resources related to the dying fish and the collection of sick fish for examination by the FDP. This investigation lead to the initial association of largemouth bass virus with fish kills (Plumb et al. 1996).

Selected Research Accomplishments

Research conducted by the FDP has addressed many topics including the study of disease agents, development of diagnostic methods, evaluation of vaccines and drugs, and studies of the effects of environmental factors, both as direct causes of disease and as predisposing conditions (Table 3). By 2004, this research produced more than 300 publications in scientific journals and books. In many cases, additional funding from federal agencies or other sources was used to supplement project funds so that SEAFWA members received "more bang for their bucks" from these research activities.

Most research related to fish diseases is a continuing process of discovery leading to additional questions. An exception to this is the process of obtaining approval from the U.S. Food and Drug Administration for use of drugs on fish. In 1999, research by the FDP led to the approval of human chorionic gonadotropin as a drug for inducing spawning.

Education Provided by the Project

The FDP has provided two types of continuing education opportunities for SEAFWA biologists. More than 60 short courses, usually one to two days in duration, were presented in member states to provide basic information about fish diseases or about new information resulting from FDP research. A five-day course about fish diseases, taught at Auburn University, was presented 19 times over the years to SEAFWA biologists and allowed a more comprehensive coverage of topics.

In addition to benefits directly related to FDP objectives, an opportunity for training graduate students was created by this project. Master's or doctoral degrees were awarded to 133 students, and the research conducted by these students was important for achieving the objectives of this project. Graduates of the FDP have worked in 15 of the states or territories that are members of SEAFWA.

Conclusion

The support from SEAFWA members provided a mechanism for investigation of fish diseases, both diagnosis of isolated problems and long-term research, and for information transfer to fishery biologists. The importance of this project to the Southeast was recognized in 1998 when W. A. Rogers, who worked with the FDP for 31 years, was presented the Clarence W. Watson Award by SEAFWA, the Southeastern Section of The Wildlife Society, and the Southern Division of the American Fisheries Society for his contributions to the conservation of natural resources.

During the 40 years of this project, the information available about the causes, control, and fisheries management implications of fish diseases has increased, but

Table 3. Selected research accomplishments of the Southeastern Cooperative Fish Disease Project.

Topic	Literature cited
Characterization of pathogens	
Monogenetic trematodes	Rogers and Wellborn 1965
Crustacean parasites	Rogers 1969
Channel catfish virus	Wellborn et al. 1970
Cestodes	Williams and Rogers 1972
Edwardsiella ictaluri	Hawke 1979
Golden shiner virus	Plumb et al. 1979, Brady and Plumb 1988
Acanthocephala	Williams and Rogers 1984
Largemouth bass virus	Plumb et al. 1996
Mechanisms of disease	
Ichthyophthirius multifiliis	Beckert and Allison 1967
Epistylis sp.	Rogers 1972
Channel catfish virus	Plumb et al. 1974
Edwardsiella ictaluri	Miyazaki and Plumb 1985
Aeromonas hydrophila	Ventura and Grizzle 1988
Largemouth bass virus	Zilberg et al. 2000
Methods for detection and identification of pathogens	
Development of cell lines	Bowser and Plumb 1980
Edwardsiella ictaluri	Rogers 1981
Yersinia ruckeri	Altinok et al. 2001
Largemouth bass virus	Grizzle et al. 2003
Environmental factors affecting fish health	
Low concentration of oxygen	Plumb et al. 1976, Mqolomba and Plumb 1992
Hypolimnetic release from dams	Grizzle 1979
Chemical carcinogens	Grizzle et al. 1984
Nitrite	Hanson and Grizzle 1985
Chlorinated wastewater	Grizzle et al. 1988
Calcium requirements of *Morone* spp.	Mauldin et al. 1988 Grizzle and Mauldin 1999
Salinity	Altinok and Grizzle 2001a, 2001b
Electrofishing	Henry et al. 2003, Henry and Grizzle 2004
Vaccination	
Columnaris and *Aeromonas*	Schachte 1978
Vibrio	Rogers and Xu 1992
Edwardsiella ictaluri	Plumb and Vinitnantharat 1993
Pharmaceuticals	
Potassium permanganate	Phelps et al. 1977
Etomidate	Limsuwan et al. 1983
Mebendazol	Boonyaratpalin and Rogers 1984
Formalin	Xu and Rogers 1993a
Oxytetracycline	Xu and Rogers 1993b
Salt	Plumb and Shoemaker 1995
Human chorionic gonadotropin	Grizzle et al. 1997, Grizzle and Xu 1998
Publication of books and reviews	
Catfish anatomy	Grizzle and Rogers 1976
Diseases of sport fish	Rogers and Plumb 1977
Catfish diseases	Plumb 1985
Tumors	Grizzle and Goodwin 1998
Microbial diseases	Plumb 1999
Largemouth bass virus	Grizzle and Brunner 2003

many problems remain. The continued support of SEAFWA for the FDP will ensure that additional progress is made in understanding the role of diseases in fisheries management.

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