

This project, which has been constructed, affords some of the best salt-water fishing on the Atlantic Coast.

Another project involving control of salinity, food availability, and related factors is our recommended reintroduction of fresh water from the Mississippi River into the subdelta marshes below New Orleans. The Corps of Engineers has approved the general design of this project, although further coordination will be required before agreement can be reached as to means of implementation.

Our preliminary examination report on the efforts of hydraulic dredging and filling in Boca Ciega Bay, Florida, in 1955, initiated a chain reaction culminating in widespread public interest in estuarine problems. Estuarine research by Federal and State agencies also was stimulated.

Due in part to our efforts in cooperation with other interests, plans for the diversion of flood waters from the St. Johns River into Indian River, Florida, were deferred. Fish and wildlife habitat afforded by Back Bay and Currituck Sound, were also protected against excessive drainage as would have resulted from the Princess Anne County Watershed project, Virginia. Assistance was also rendered the State of North Carolina in reporting upon the deleterious effects of shell dredging in Currituck Sound. To protect shellfish resources in the James River estuary, Virginia, and on water bottoms along the route of the Intracoastal Waterway, and the Gulf Outlet project, Louisiana, the Corps has taken special precautions in planning canal alignment and deposition of spoil.

The desirability of aligning the proposed Freshwater Bayou navigation canal to avoid dissection of valuable fish and wildlife habitat was reported upon by River Basin Studies at a coordination meeting held with local landowners. Subsequently, a survey of the Freshwater Bayou project was also undertaken by the Vermilion Bay Corporation and a report submitted to the Board of Engineers for Rivers and Harbors in opposition, August, 1959. Thus, industry joined hands with conservation forces in an effort to save valuable fish and wildlife habitat from this type destruction.

About the Future. In this review we have portrayed a part of the story of River Basin Studies, but it is more than that. It is the story of conservation forces everywhere who have worked toward a more balanced program of water-resource development.

Of the progress made, we believe that the demonstration of success obtainable through united effort is our greatest single accomplishment. Fish and wildlife conservation is now generally recognized as a purpose of water resource development programs.

We, therefore, look forward to a sustained River Basin Studies program future of fish and wildlife conservation will largely depend on how well we phasis on coordinated research, planning, education, and development. The by the States as well as the Fish and Wildlife Service with still more em-perform individually and as a team.

AN EVALUATION OF RIVER BASIN STUDIES IN THE SOUTHEAST

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The River Basin Studies Program in the Southeast is 14 years, 2 months and 12 days old as of this day, October 27, 1959.

It began as did the programs in other regions because there was a need for the conservation of fish and wildlife affected by water development projects constructed by the Federal Government or under Federal permit or license. The program has grown because it has contributed much toward meeting that need; and it will probably endure as long as the Federal Government is engaged in water-resource development.

This will be for an extended period of time. The Southeast is a frontier; its abundant water resources are virtually undeveloped. Land use is rapidly changing from row crops to forestry and improved pasture. Farms are being consolidated and methods employed require much less labor. Human populations, once largely rural, are shifting to the cities where new industries are being established and old ones are being expanded.

The principal water resource development agency in the Southeast is the U. S. Army Corps of Engineers. Within this 12-State region there are no less than 15 districts serving 5 division offices of that agency. Of rapidly increasing importance in this field is the Department of Agriculture, which, by means of its extensive activities and small watershed programs, is serving virtually every farm owner in this region.

Of special interest are the mosquito control and pollution abatement programs of the Department of Health, Education and Welfare. The Federal Power Commission and the Bureau of Public Roads also are exerting great influence in the field of water resource development, the former by the licensing of private power projects, the latter through the construction of major highways across the nation. There is also the Tennessee Valley Authority which initiated its comprehensive project in 1933.

A new arrival is the U. S. Study Commission, Southeast River Basins, which was established by Public Law 85-850 on August 28, 1958. The Commission has 11 members which were appointed by the President of the United States on December 16, 1958. It is composed of a member from each of the states, Georgia; Alabama; Florida; and South Carolina, and a member from each of the principal Federal Agencies concerned with lands and waters: Army; Commerce; Health, Education and Welfare; Agriculture; Interior, and Federal Power Commission. Its principal objective is to prepare a comprehensive plan for the conservation, utilization, and development of the land and water resources in the area designated as the Southeast River Basins. Fish and wildlife conservation is cited as a specific purpose in the legislation.

Collectively, the programs of these agencies will shape the use of land and water throughout the Southeast, and, consequently, greatly influence the future of fish and wildlife conservation.

River Basin Studies assumed official identity in the Southeast Region (Region 4) with the employment of 2 biologists on August 19, 1945. With little previous experience in this field and virtually no guidelines, this small crew was assigned the task of studying every Federal water-development project in a 10-State (now 12) area.

The first study undertaken was of the Corps of Engineers' comprehensive plan for the White River Basin, Missouri and Arkansas. Soon after, problems reported upon in widely separated areas were Cross Florida Barge Canal, Florida; Santee Hydroelectric Project, South Carolina; Yazoo Backwater area, Mississippi; Allatoona Dam and Reservoir project, Georgia; and Falmouth project, Kentucky.

To save travel time and encourage closer liaison with the planning and construction agencies, field offices were established as funds became available. These are located at Vicksburg, Mississippi; Vero Beach, Florida; Raleigh, North Carolina, and Decatur, Alabama.

The organization has grown from a two-man staff in 1945 to a complement of 22 technical men in the fields of wildlife, freshwater fishery, and marine biology. They are dedicated to carrying out, in cooperation with the State conservation agencies, the main objective of the Fish and Wildlife Coordination Act. That objective is the conservation and development of fish and wildlife resources in connection with water development projects.

In meeting this objective, the field survey and report are the basic means by which facts are obtained and recommendations coordinated with cooperating agencies. The job is not completed, however, until the measures recommended have been implemented and evaluated. This requires the adoption of an approach designed to overcome the many problems associated with each project.

The approach in the Southeast (Region 4 of the Bureau of Sport Fisheries and Wildlife), from the beginning, has been positive. Definite plans for fish

and wildlife conservation for almost every drainage and project area studied have been formulated. In this task, the capabilities of each area are appraised, related to man's most pressing needs, and a fish and wildlife plan fitted into the scheme of things.

We have sought management measures which are compatible with other project uses; but, where it has been necessary to push single-purpose fish and wildlife projects to achieve balance, we have done so.

The best illustration of the Region 4 approach is the Mississippi River and Tributaries project, a review of which was directed by Congress in a resolution dated June 12, 1954.

The first phase of this review consisted of a series of 12 public hearings conducted by the District Engineers, Corps of Engineers, with the assistance of the Regional Director, Bureau of Sport Fisheries and Wildlife. These hearings, which were well attended, provided local people an opportunity to express their views with respect to the need for fish and wildlife conservation, as well as for flood control and drainage.

The second phase involved surveys and planning by the Corps of Engineers and the Branch of River Basin Studies as the basis for determining any modifications in the overall project deemed necessary and justifiable.

The third phase involved a series of coordination meetings with the Corps of Engineers and with local interests as the basis for arriving at a mutually acceptable plan for each sub-basin. These meetings are in progress at the present time.

The fourth phase is review by higher authority, Congressional action, and construction of those projects authorized and for which funds are appropriated.

While the Corps of Engineers does not always fully concur in all of our recommendations, we are encouraged by the outcome of our jointly prepared plan for the White River Backwater area, a segment of the MRT project, which was authorized by the Congress in 1958. This was the first instance in Region 4 where fish and wildlife conservation was recognized as a collateral purpose to flood control with specific provision for project operation in conformance with a plan agreed upon by the Corps of Engineers, this Bureau, and local drainage interests.

The progress of the River Basin Studies program cannot be measured in strictly physical terms. Much that will be accomplished is now on the planning table, or in the minds of the field personnel.

Much has been accomplished, however, which may be charted by the discovery and application of effective conservation measures.

I should like to review briefly for you several conservation measures which River Basin Studies has recommended or included at water development projects in the Southeast.

One of the first measures to be applied that had popular appeal was the sub-impoundment. In theory it was generally assumed that reservoirs with widely fluctuating water levels could not afford good fishing. It was also assumed that the practical solution to this problem would be to build auxiliary dams on one or more arms of the main reservoir, whereby pools could be created with stable levels.

The Acworth Dam and Subimpoundment, erected in 1950 on Allatoona Creek, an arm of the Allatoona Reservoir, Georgia, is the first example of such a project recommended in our reports. It has proven very beneficial, although the fishing afforded in this stable-level pool is little better and in some ways not as good as in the main impoundment. Similar results, incidentally, were experienced with the construction of subimpoundments on TVA reservoirs.

There are virtually no stable-level reservoir projects in the Southeast. Furthermore, with alternate storage and drawdown for flood control, water supply, power, navigation, and other purposes, the degree and pattern of fluctuation varies from one impoundment to another, and, in the same impoundment, from year to year.

We were aware of the effectiveness of water level manipulations in waterfowl management and mosquito control and of the excellent fishing afforded by oxbow

lakes in the lower Mississippi River Valley which are overflowed each winter and spring. This gave us a valuable clue in fashioning a plan for fish and wildlife management in impounded waters through the manipulation of water levels. This plan and concept were first described at the annual meeting of the American Fisheries Society in Denver, September 11, 1947. Although the principles of water level management are incompletely known and while the application of this measure is still in the experimental stage, excellent results are being obtained in a number of instances. A good example from a fishery standpoint, is the management of water levels in Nimrod Reservoir, Arkansas, as reported by Hulsey. Here, fall and winter drawdown has been effective in bringing about favorable ratios between predatory and forage fish and game and rough fish. It has benefited both commercial and sport fishing.

In Conservation Area 1, Central and Southern Florida Flood Control Project, fishing has been greatly improved through the seasonal fluctuation of water levels between elevations 14 and 17 m.s.l. Similar operations are planned for Conservation Areas 2 and 3 which are being developed by the Florida Game and Fresh Water Fish Commission, cooperating with the Central and Southern Florida Flood Control District.

The bleak, monotonous shoreline of many reservoirs in the Southeast, as contrasted to the cypress-rimmed lakes of the Mississippi lowlands, prompted our biologists to seek some practical means of diversifying the habitat of large impoundments. One means which affords some promise of success is selective rather than complete clearing of timber from the impoundment areas.

Most of the reservoirs which were constructed by private interests for power purposes in the early 1900's were not cleared of timber. The first Corps of Engineers' projects in this region, however, were completely cleared. The Corps deviated from such rigid clearing specifications, however, at Allatoona Reservoir, Georgia, in 1949. The Corps was very cooperative and, with the assistance of the clearing contractors, erected over 90 fish attractors.

Since 1949, we have recommended that instead of felling trees and tying them with cable to hold them in place, that groups or stands of trees be left standing in selected sites. This was accomplished concurrently with the clearing of Clark Hill Reservoir on the Savannah River and Buford Reservoir on the Chattahoochee River. At Jim Woodruff Reservoir and Demopolis Reservoir in the lowlands of Alabama, Georgia, and Florida, selective clearing has involved leaving uncleared certain water-tolerant trees in the reservoir basin.

The result of selective clearing in reservoirs has been generally favorable. While we do not know exactly the effect of fish attractors on fish or upon fishing success, we do know that they have an appeal to the angler because certain fish concentrate in these areas. Also, savings in clearing costs are substantial.

The regulation of stream flows has been a much desired tool in fishery management, but under experienced conditions, it has not been as effective as we would like.

In the White River Basin, Missouri and Arkansas, for example, the pattern of flow and quality of water were radically changed with construction and operation of Bull Shoals and Norfolk Dam for flood control and power purposes. Flooding was reduced in the middle reaches of the river to the extent that the natural production of commercial fishes has sharply declined. Furthermore, minimum stream flow immediately below the dams was reduced almost to zero as a result of intermittent power generation. Of greater significance, the withdrawal of cold water from deep strata of the reservoirs virtually eliminated sport fishing for warm water species for a distance of almost 200 miles downstream.

In addition to favorable flow pattern in the upper as well as the lower portions of the valley, a trout hatchery was constructed below Norfolk Dam for the purpose of rearing fingerling stock for annual introduction into the cold waters of the upper White River. This has resulted in an outstanding trout fishery for a distance of 35 miles below Bull Shoals Dam.

Similar problems occurred in the Obey River below Dale Hollow Dam, Tennessee, and in the Cumberland River below Wolf Dam, Kentucky, by cooperative

studies by the Tennessee Game and Fish Commission, Kentucky Department of Fish and Wildlife Resources, and the Bureau of Sport Fisheries and Wildlife. An excellent trout fishery was established in the Obey River by annual stocking and by controlled release of cold water during the weekend periods.

Cooperative efforts in Kentucky, however, have failed to establish a trout fishery of importance in the Cumberland River. Similar failures have occurred in the Chattahoochee River below Buford Dam in Georgia, although water temperatures appear favorable.

In a few instances in the Southeast, fishways play an important role in conserving and improving sport and commercial fisheries. At Little Falls Dam on the Potomac River in Maryland and Virginia, a new fishway is nearly completed. This project is finally coming into being after many years of effort on the part of the Fish and Wildlife Service and Maryland fishery agencies.

At the Roanoke Rapids Dam and Reservoir on the Roanoke River, North Carolina, the Virginia Electric Power Company has attempted to control water quality through the construction of a curtainwall a short distance upstream from the power intake. The purpose of the curtainwall is to entrap cold and sometimes oxygen deficient water and to allow the draw of the oxygenated surface waters. Recently, the Corps of Engineers has favorably considered our recommendations that the dams to be located on Nolin River, Barren River, Little Sandy River and Little Tygarts Creek, in the Ohio River drainage be equipped with means of warm water discharge. The Nolin Dam, for example, will have a multi-vented intake which will permit the withdrawal of water from four levels. We hope to determine optimum conditions for either cold or warm water fishes and establish the effect which variable discharge may have upon the warm water fishery.

Acquisition of lands for fish and wildlife purposes in conjunction with water development projects is essential to providing maximum public benefits. This includes lands that are necessary for (1) public access and use, and (2) the preservation of existing or potential fish and wildlife values.

Availability of lands around the margins of reservoir projects, in the interest of public use and access, was no problem in the early years of the River Basin Studies program. This was because sufficient lands were purchased in fee title for these purposes. However, in many cases there has been insufficient lands for fish and wildlife purposes, but we are hopeful that the new Fish and Wildlife Coordination Act and recently formulated policies will favorably alter this situation.

Thus far I have touched mainly upon water development projects of the inland areas. Water development projects, however, can seriously affect our important coastal marshes and estuarine areas. There is, in preliminary planning stage, a proposal that surplus water stored in Lake Okeechobee, Florida, be discharged southward into the Everglades National Park by means of a floodway rather than into the Gulf of Mexico and the Atlantic Ocean as presently accomplished. Under the present conditions, water supplies of the Everglades are far from adequate. On the other hand, discharge into St. Lucie Estuary on the East Coast and the Caloosahatchee Estuary on the West Coast has aroused public indignation largely because of the deleterious effects on the fisheries. In addition to flood control, other of man's activities such as channel dredging for navigation and dredging and filling for construction of dwellings and industry can bring about drastic ecological changes. We have been successful in alleviating damages in some instances. Also, we have successfully promoted projects which are beneficial to estuarine life. It is encouraging to note that our work and reports have created widespread public interest in estuarine problems. Research by State and Federal agencies has been stimulated.

Since I will not be able to cover for you many of the details of River Basin Studies work in the Southeast, we are making available for your reference copies of a supplement entitled "A Portrait of River Basin Studies in the Southeast" which will help complete the picture for you. This was prepared with the generous assistance of our Regional Office in Atlanta, Georgia.

In this review we have portrayed a part of the story of River Basin Studies, but it is more than that. It is the story of fish and wildlife conservation forces

everywhere working toward a more balanced program of water resource development.

Of the progress made, we believe that the demonstration of success obtained through united effort is our greatest single accomplishment. Fish and wildlife conservation is now generally recognized as a purpose of water resource development programs.

We, therefore, look forward to a sustained River Basin Studies program by the States as well as the Fish and Wildlife Service with still more emphasis on coordinated research, planning, education, and development. The future of fish and wildlife conservation will largely depend on how well we perform individually and as a team.

ROUGH FISH REMOVAL FROM LAKE CATHERINE, ARKANSAS

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Little Rock, Arkansas

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ABSTRACT

Following the recommendations of a three-year comparative fishery study of Lakes Ouachita, Hamilton and Catherine near Hot Springs, Arkansas, a rough fish removal project was carried out on 3,000-acre Lake Catherine, October 25, 1958. The chemical (Pro-Noxfish) was applied at varying concentrations over approximately three-fourths of the drawn-down area of the lake. The water level was manipulated so that the treated water infiltrated the untreated portions. As a result, a selective shad and drum kill was obtained over the entire area of the lake. Bank counts failed to give an acceptable quantitative estimate of numbers and weights of fish killed. A more satisfactory estimate was obtained by the use of data obtained from previous rotenone population samples. As part of the management plan, the lake will be restocked with large numbers of yearling and fingerling game fishes. Evaluation of the management work will be carried out by continuing Dingell-Johnson Project F-5-R.

INTRODUCTION

Lake Catherine is the oldest of three lakes located in series on the Ouachita River near Malvern and Hot Springs, Arkansas. The dam was completed in 1923 by the Arkansas Power and Light Company, and the 3,000-acre lake filled the same year. The lake was impounded for hydroelectric power and recreational purposes.

Lake Catherine is not as well developed commercially as is Lake Hamilton located directly above it. However, along its shores are a number of permanent residences, summer cottages, youth camps, a state park, several public boat landings and a large steam generation plant which obtains its cooling water from the lake.

Because of its proximity to both Hot Springs and Malvern, Lake Catherine is of considerable economic importance to the region from a recreational and tourist viewpoint. However, use of the lake for fishing has been low in recent years due to the poor fishing success to be had.

In 1955, the Arkansas Game and Fish Commission inaugurated a Federal Aid (D-J) Investigations Project (F-5-R) which is a comparative fishery study of Lake Catherine, Lake Hamilton and Lake Ouachita, all located in series on the Ouachita River, and all within a radius of 20 miles of Hot Springs National Park, Arkansas. This study was designed to provide "new lake" data for comparison with "old lake" findings, and to seek preventive and corrective solutions to the problem of decreasing angling returns (Stevenson and Hulsey, 1958).