

marshes of its upper reaches. This will provide more effective and less expensive flood control than diversion. While the biological studies did not swing the solution in this instance they are in no sense a wasted effort. We will have the results of those studies to influence planning on other future projects. Also, if diversion had not been eliminated for engineering reasons, the biological reasons would have been given their proper major consideration and would likely have had sufficient weight to cause a change of plan. I would like to emphasize that the Corps is not forced into those decisions because of opinions or pressure. Rather, we very strongly desire to make the decisions on the basis of economic merit, engineering soundness, and the results of expert research of all of the other factors that enter in to the project justification. When the scientific evidence and cold facts are present, we have every desire to go along with them. We are also quite willing to change our tentative plans when we can find a better way. It is fundamentally the engineer's job to find a better way to do something for less money.

I hope that my remarks have shown some measure of the very real desire and interest that the Corps of Engineers has, not only in preserving fisheries values, but in enhancing them. The Corps is also interested in continuing to improve the harbors and channels necessary for enabling the salt water fishing industry to operate around the Florida coastline.

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**The Activities of the U. S. Fish and Wildlife Service,  
Office of River Basin Studies, in Relation to Federal  
Water-use Projects and the Marine Fishery Resources  
of Florida**

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MR. RAWLS OF THE CORPS OF ENGINEERS in his excellent presentation has relieved me of much descriptive detail regarding the plans for water-use development in Florida.

In this paper, it is intended to stress the problems of conservation connected with projects of the Corps of Engineers in Florida. The effects of Federal projects on marine resources are, however, certainly not confined to any one State.

Since many persons are not familiar with the aims of the Office of River Basin Studies, it is appropriate to describe these briefly. Since World War II the rate of development of the nation's water resources has been accelerated, largely owing to increased Federal participation. Federal agencies participate in water-resource management programs for the purposes of irrigation, flood control, navigation, and power. Many state, municipal, and private organizations also take an active role in such development. Conservationists have long recognized the impact of water-use programs on the fish and wildlife resources. The need has been apparent for incorporation into these construction programs of measures for conservation of fish and wildlife.

In response to this concern, there was enacted, on August 14, 1946, the

"Coordination Act," Public Law 732, 79th Congress. This law authorizes the Fish and Wildlife Service to provide assistance to, and cooperate with, Federal, State, and public or private agencies in planning for fish and wildlife conservation. It also decrees that, whenever the waters of any stream or body of water are authorized to be impounded, diverted, or otherwise controlled for any purpose whatever, by any agency of the United States or by any public or private agency under Federal permit, such agency shall first consult with the Fish and Wildlife Service and the State conservation department concerned, with a view to preventing losses to fish and wildlife resources.

In order to meet more fully the obligations imposed by Congress and to keep abreast of the increasing number of projects, the Service established the Office of River Basin Studies in April, 1945. The major objective of this organization is the determination of the effects of Federal water-use projects on fish and wildlife resources and the formulation of recommendations for the preservation, rehabilitation, and development of fish and wildlife resources affected by these projects.

A number of State conservation departments have attempted to keep abreast of public and private water developments by establishing river basins sections within their own organizations.

Since the establishment of the River Basin Studies organization in the Service, some 2100 investigations and reports on water-use projects have been prepared. At scores of projects throughout the United States, conservation measures have been incorporated in project design and operation as a result of the recommendations in these reports. Conservation, through these activities, is a living reality at these projects, where otherwise severe destruction of fish and wildlife resources would have resulted.

A River Basins field office was established at Vero Beach, Florida, in February, 1955. Its principal mission has been the study of the far-flung Central and Southern Florida Flood Control Project. This project, most of which has been authorized by the Congress, is likely to have a profound effect on fish and wildlife resources of nearly all of the eastern half of Florida. It may cause major changes in the habitat for commercial and sports fishery resources in the fresh and saline waters in and adjacent to the Florida mainland. It is the conservation and protection of these resources to which the efforts of the Vero Beach office have been addressed. The methods by which this investigation is being conducted will be of interest.

At this point the cooperative nature of the River Basin investigations in Florida with the State agencies, should be emphasized. The program has been developed in conjunction with the Florida State Board of Conservation and the Florida Game and Fresh Water Fish Commission, both of which are actively engaged in investigations of this project. These agencies, particularly the Board of Conservation, together with the universities in the State, are carrying the major load in biological research, which is a necessary basis for the investigations. We have developed joint procedures with the two State agencies so that the work of each of the three agencies complements the other two, and so that the information developed by each cooperator can be fitted into the need for data by the others. Duplication of effort is thus avoided.

Fundamental to the investigations by all three agencies are the biological analyses of the effect of dams, dikes, and canals on the habitat of the fish

and wildlife species involved. Trained biologists make estimates of the changes in salinity, for example, and the probable effect of such changes on the welfare and abundance of various fish and wildlife species.

The first step in this type of analysis is the evaluation and appraisal of biological conditions as they exist prior to the construction of one of these water control structures. Following this, an estimate is made of the biological conditions as they might exist after construction of the project. On the basis of differences between these two analyses, conservation measures are developed for recommendation as part of the project plans.

In rare cases a recommendation is made that a project, or a unit of a project, not be constructed at all. The basis for such a recommendation is that the benefits to be derived from leaving the fish and wildlife habitat as nature made it exceed those which are likely to be derived from the construction. More commonly the recommendations are for modifications in the design or operation plan of the water-control project for the benefit of fish and wildlife conservation. These modifications may include, for example, sustained minimum flows below dams to maintain fish life, the construction of sub-impoundment areas on reservoirs to provide controlled water levels for the benefit of waterfowl and other water-related species of wildlife, and the construction of fish-attracting devices for placement in reservoirs.

The economic effects of a proposed water-development project on fish and wildlife are determined largely by comparing human utilization of these species expected to occur with and without the project.

The anticipated economic effects of a project on harvested fish and wildlife resources are expressed, to a large extent, in monetary terms. In the case of commercial fish and fur animals, annual harvests are evaluated in terms of market prices at the point where the products are first sold in the market. Expected annual sportfish and game harvests, or day-use by sportsmen, are evaluated on the basis of money spent by sportsmen in connection with their fishing and hunting trips. Unharvested species are not evaluated in monetary terms, but their importance is presented in River Basin reports by appropriate description.

By evaluating the commercial and game species in a project area without and with the project, it is possible to show monetary gains or losses to fish and wildlife resources. These dollar values give some indication of the relation of fish and wildlife resources to the agricultural and other resources which are considered in the economic analysis of a project by the construction agency. The monetary gains or losses to fish and wildlife may be included by the construction agency in the project benefit-cost ratio which is used to determine economic justification for project construction.

As I have noted, the Central and Southern Florida Flood Control Project is the principal water control project in Florida with which the Service is concerned. The purpose of this project is to provide some measure of control over the extremes of flood and drought which Florida historically has experienced in the St. Johns and Kissimmee River valleys, in the Everglades, and on the lower east coast.

In addition to large interior water-storage reservoirs, this project will include several canals which will be used as routes for discharge of excess water to the sea. One of these, the St. Lucie Canal, which discharges into the St. Lucie River at Stuart, is presently in operation at project capacity. Canals such as this cause considerable changes in the physical and chemical aspects of

the receiving estuaries, and, therefore, create a part of the problem of conservation of the estuarine resources. Another major Federal water-use project in Florida with which we are concerned, is the Intracoastal Waterway, a portion of which traverses the bays and lagoons of the east coast from Jacksonville to Miami.

One of the major difficulties in the investigations of Florida's estuarine resources is the lack of requisite biological knowledge of estuaries. This problem is a knotty one and considerable research will be required for its solution. We first need to know more of the mechanics of estuarine productivity. For example, we want to find out what organisms utilize estuaries for breeding, nursery grounds, and feeding, and to learn the character of their nutritional relationships. We need also a more complete understanding of the reliance of the non-estuarine coastal fauna on the estuaries.

In addition to these basic matters, there are certain specific questions which appear repeatedly in our investigations. One is the matter of salinity tolerances, and here we need to know not only minimum tolerances, but also tolerances to differing rates, duration, and frequency of change. Another frequent problem is that of the materials which are brought in suspension into the estuaries by fresh water discharges. While we recognize that repeated blanketing of a bottom can cause damages to the biota, we think it important to know whether plant detritus, which may settle out into thick blankets, does or does not contribute eventually to production of a richer fauna as the result of nutrient enrichment.

Other recurring questions are: What effects does channelization of a lagoon have on its biota? If there are harmful effects, can they be lessened by selection of some particular route through the lagoon? Further, what is the least harmful method of disposing of spoil resulting from dredging?

With the answers to these questions provided by research, managerial and planning efforts will be far more effective.

This problem which we have encountered is a part of the total problem confronting those concerned with maintenance of Florida's estuarine resources. No observer can fail to be impressed with the great use to which these resources are put. Sport and commercial fishing, recreational boating and bathing, in the coastal bays and lagoons, are all very extensive. On the other hand, an observer must also be impressed with the considerable losses that these same resources seem to be undergoing as a result of Florida's phenomenal growth.

Dr. F. G. Walton Smith, Director of the University of Miami Marine Laboratory, puts it this way:

"In the first place I consider that the effects of clearing and filling mangrove swamps, building sea walls, and otherwise changing the natural drainage patterns have a very considerable effect upon the natural conditions of the estuaries and inland waterways of the state. Probably this is more important in its effects than human sewage pollution, except to the extent that the latter renders shellfish unfit for consumption. Industrial pollution may be far more harmful, depending upon its nature. All of these factors, however, are probably more effective in altering ecological patterns and interfering with the natural production of fish than the effects of commercial fishing or angling themselves.

"These factors have been particularly serious in the more heavily

populated areas of Florida and promise to become even more serious in the future, with the ever-increasing scope of real estate development throughout the state.

"Since estuarine waters, including the inland waterways form a considerable part of the angling and recreational area of the state, the above matters should, in my opinion, be ranked high in order of priority for investigation."

Mr. Ernest Mitts, Director of the Florida State Board of Conservation, shares Dr. Smith's views. Mr. Mitts says:

"First, we feel that many of the habitats of Florida's coastal areas have declined from the standpoint of marine and estuarine animal populations. Our feeling is that much of the decline has been due to the fact that the habitat and its role in fish and invertebrate abundance has been overlooked.

"Second, we feel that the gradual abuse and elimination of the natural habitat constitutes one of the most acute of the many problems facing us at this time."

Dredging and filling operations have been conducted in many estuarine areas for various developmental purposes. Two prime examples of this have occurred in Biscayne Bay in Miami, and in the north end of Boca Ciega Bay at St. Petersburg. In each case, substantial acreages of estuarine bottom has become dry land. If for no reason other than reduction of water acreage, this procedure is obviously harmful to fish and their habitat.

Of course, the growth of population and industry brings increased possibilities for the introduction of pollutant materials into estuarine waters, as has occurred in other states. While many agencies (federal, state, local, and industrial) are working on this aspect, much remains to be done, if the receiving estuaries are not to be overtaxed.

Projects for flood control, drainage, and navigation have also contributed in certain instances to the deterioration of the estuarine environment. Certainly the discharges of the St. Lucie Canal into the river at Stuart have had some adverse effect, even though unmeasured, on the biota of that body of water. Alterations of salinity and sedimentation which accompany such projects can have serious effects.

There are available few actual measures of the present fishery values of estuarine waters. These values are needed before appropriate decisions can be made in project planning. Several current surveys of the Florida State Board of Conservation, in addition to our studies, are designed to determine these values, in terms of human utilization and business generated.

We do know, from a qualitative point of view, that the estuarine resources contribute in large measure to Florida's economy. Many individuals and concerns derive some or all of their income from the extensive utilization of these resources. Undoubtedly Florida's estuaries play a significant role in attracting visitors to the state, and in contributing to its phenomenal growth.

In considering opportunities for conservation of Florida's estuarine resources, a first advantage we have is that the problem of estuarine deterioration is generally recognized by professional and lay people alike, and public interest is high. Such interest is essential. It is obviously far more effective to recognize and combat potential damaging influences as they confront you than it is to attempt to rectify their harm after it is done.

A second factor that can contribute to success is that there are in Florida

a number of organizations and facilities which are capable of coping with some part or all of the problem, and which have common interests. These include the State Board of Conservation, the Game and Fresh Water Fish Commission, the public health agencies, the Corps of Engineers, and certain municipal and industrial elements, in addition to the Fish and Wildlife Service. Certainly the state agencies are active and progressive groups, with clearly demonstrated abilities and interest, as we know from our associations with them in cooperative studies of water-use development projects.

In the way of research facilities, there are the Oceanographic Institute at Florida State University, the St. Petersburg Laboratory of the Board of Conservation, The Marine Laboratory at the University of Miami, and graduate student research programs in the biology departments of the colleges and universities.

It should be emphasized that the Corps of Engineers, which is constructing the Central and Southern Florida Flood Control Project and other projects, is cooperative in the field of fish and wildlife conservation. The Corps not only has its own staff biologist, Mr. Gordon Hall, at the Jacksonville office, but also has enlisted the assistance of marine scientist Gordon Gunter.

Florida's estuarine resources appear to be at a cross-roads, and an unfavorable balance can come in the near future if persons interested in these resources do not continue actively to represent their case. Opportunity still remains to retain these resources, and to regain some of those portions which have been lost. It is not possible to predict what the total effect of the water-use programs on the estuaries will be. We can be sure, however, that the total effect will be unfavorable unless these resources are given every reasonable consideration in project planning. We realize that much needs to be done to further the effectiveness of our activities and the activities of those concerned with the total problem of estuarine conservation.

We are vitally interested, along with you, in the preservation of these resources, which are so outstanding a characteristic of the unique Florida scene. We are disturbed at the deterioration which seems to have occurred, and we shall work with you and for you toward lessening their attrition, within the area of our authority.

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## **DISCUSSION**

### **Caribbean and General Session**

Discussion Leader: L. S. MOWBRAY

Discussion Panel: ORIS RUSSELL, FRANK J. MATHER III, HECTOR FERREIRA

### **The Present Situation in the Fishing Industry of Cuba**

JOSE A. SUAREZ CAABRO

- Q. Mowbray: How are the tuna and grouper caught in Cuba?  
A. Suarez: In Cuba we catch tuna using the Japanese method of pole