

being eligible under existing FCC rules is doubtful, but it is believed the rules may be altered in the near future.

It was pointed out that Civil Defense matching funds are available to those agencies desiring to install or expand their communications system. The steps necessary to apply for Civil Defense matching funds, in order of their necessity, are as follows:

1. Contact State Civil Defense Radio Officers at State Civil Defense Headquarters.
2. Justify application by becoming a part of State Civil Defense. Support plans (this is worked out with Civil Defense Radio Officer).
3. Equipment must be bought on bid basis, and this information furnished Civil Defense.
4. Purchase radio equipment, and then furnish State Civil Defense Office copies of paid invoices.
5. Civil Defense then reimburses State agency fifty percent of paid invoice amount.

The average cost of a mobile unit is approximately \$500.00. The approximate cost of a 60-watt base station is \$1,000.00. Approximate cost of a 250-watt station \$2,500.00. It is suggested that the State agency employ its own communications personnel. Not more than 60 mobile units nor more than five base stations should be assigned per communications maintenance technician. The average cost of maintenance per mobile unit is \$5.50 each, and the average cost of maintenance per base station is \$19.00 each.

It is highly recommended that vehicle bid specifications include 40-amp., 12-volt generators with coax generator filter, resistor spark plugs and/or suppressor ignition harness and 70 ampere-hour batteries.

Agencies considering the installation of a communications system are urged to employ their own communications engineer or the services of a consultant to assist in the planning of a system. Agencies now employing communications technicians are urged to allow such personnel to attend the Game and Fish conventions for the purpose of augmenting the Communications Committee, which is now being set up by the International Association of Game and Fish Commissioners.

SESSION ON WATER MANAGEMENT

WATER USE AND THE FUTURE OF FISH AND WILDLIFE CONSERVATION

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INTRODUCTION

In appointing this Committee, James Jenkins, President, Southeastern Section of The Wildlife Society, requested that we prepare a paper on water use with particular reference to a discussion of fish and wildlife management practices which have been found to be particularly effective or promising.

Having reviewed available data and analyzed the situation, this Committee was impressed by the urgency of the need for sound practices and information concerning their application. We were equally moved, however, by the realization that to be effective, many of the practices must be integrated with other land and water uses. We are not in this business by ourselves. Wildlife conservation is inextricably a part of the over-all problem.

Thus, the first part of this paper deals with a discussion of trends and changing concepts of water use as viewed at the national, state, and local levels. The second part reviews sound management practices involving water use with conclusion and recommendations as to action which should be taken to implement them.

TRENDS AND CHANGING CONCEPTS OF WATER USE

THE NATIONAL PICTURE

The sound development of water resources is one of the most important problems on the national horizon. Water is the subject of public and private action all the way from a casual letter to the editor of a local newspaper to major legislation by Congress. It is the chief topic for study this year by the League of Women Voters and the Chamber of Commerce, U. S. A.

Nationally, the Federal Government has become the largest single developer of water resources. As stated by Mr. Frank E. McCashin, Chairman of the Natural Resources Committee, Chamber of Commerce, U. S. A., the Federal Government not only spends the most money and hires the most people, but also establishes most of the policies which determine the activities of other agencies—private and public—in water development and conservation.

Historically, the interest of the Federal Government in water development began with navigation, was expanded to include flood control and irrigation, and later hydroelectric power, the so-called "big four" uses. In view of the national importance of these uses and immediate need for a solution of related problems, the "big four" have received primary considerations. *Moreover, it was logical that since the dominant planning agency was comprised of engineers, the approach to water resource development should have been structural measures rather than by land-use practices which involve more difficult problems of human relations.* This approach, of course, was encouraged by the pressure of special interests desiring that projects be built which required a minimum local contribution and maximum local benefits. In the absence of an over-all Federal policy requiring a balanced development of water resources, wildlife conservation naturally has received only incidental consideration.

With increased demands for water supply and competition for its use, it was inevitable that there would develop a *strong trend toward multiple use.* That this trend is well underway is evidenced by increased interest in water conservation for agricultural, industrial, domestic, municipal and recreational purposes.

With this trend toward multiple use, there arose need for new methods, and consequently emphasis began to shift from such practices as ditching, diking and the single-purpose impoundment to multiple-purpose impoundments, stream flow regulation, and ground water recharge. Thus it is not surprising that with this trend in need and method *a more comprehensive approach to river basin development* should have been undertaken with appropriate regard for the small watershed and the individual landowner; and that *a balanced development of water resources should become more of a reality.* The age-old argument of big dams versus small dams which seems never to have been settled at the conference table, is being decided by circumstances. It is true that small dams and associated watershed treatment cannot supplant the function of large dams, but it was inevitable as favorable sites for large impoundments became fewer and interest in water resource development increased, that the eyes of the Nation would be focused on the individual landowner and the watershed in which he resides.

With this trend toward balanced use, local interests have shown more interest in formulating plans and assuming responsibility for project operation and maintenance. The big impoundments which typify much of the water resource development in our major river basins have been financed entirely by Federal funds. Many of the drainage canals and levees of the lower Mississippi Valley were constructed by the Federal Government upon assurance that local interests would provide the rights-of-way and assume responsibility for maintenance. While projects of national interest will continue to be built on these terms, an increasing number of projects constructed by the Corps of Engineers and, more recently, by the Soil Conservation Service, are requiring local beneficiaries to

contribute a greater proportion of the cost. *A partnership, therefore, is in prospect.*

These trends translated into a water resource development program of the Federal Government are typified by the Arkansas-White-Red River Survey, Central and Southern Florida Flood Control Project, the small watersheds program being carried out by the Department of Agriculture under the provisions of Public Law 566, Mission 66 of the Park Service, and the pollution abatement and mosquito control programs of the U. S. Department of Health, Education and Welfare.

With these trends and associated programs, fish and wildlife conservation has assumed a more important role. For example, the Fish and Wildlife Service, working through its Office of River Basin Studies, is not only formulating plans for the preservation and development of wetland habitat, but is assisting the Corps of Engineers, the Soil Conservation Service, the State game and fish departments, and other Federal and State agencies in planning for water resource development.

We have a long way to go in achieving equal status in this field, and a truly comprehensive program is still only a dream. Nevertheless, we may be encouraged by a recent report on the White River backwater area approved by the Chief of Engineers. This is the first clear-cut example in the southeastern United States where fish and wildlife conservation has been specifically recognized as a collateral purpose to flood control.

THE STATE PICTURE

State Governments have become more aggressive in planning and participating in water resource development; where departments have been created with general planning responsibilities, close coordination with the major programs of the Federal Government and local government have been maintained. Some of the State game and fish departments have undertaken a vigorous program of water impoundment and development of wetland areas, although there is a wide divergence in the degree to which they have displayed interest in the programs of other State or Federal agencies.

Wetland acquisition and attention to water resources as indicated by approved Pittman-Robertson projects in the Southeastern States have been grossly neglected until the past few years. When the Pittman-Robertson Act was inaugurated in 1938, the various States began immediate implementation of the funds provided by this Act. The projects were primarily concerned with research and then development. Emphasis was placed on deer, turkey, and farm game. Extensive surveys were made of natural resources and justifiably so, for one must know one's assets in order to intelligently manage them.

From this phase to acquisition was a short step. But the step was made toward upland areas, not wetlands. More surveys were made in the late '40's and this time for waterfowl. Public lands, such as T. V. A. lands, received the most attention. In these years Arkansas awakened to the need for wetlands acquisition, and in a far-sighted gesture began the purchase of approximately 75,000 acres of bottomland hardwoods which ultimately would be developed for waterfowl and upland game. Other states followed the lead set by Arkansas with such measures as leasing flood control reservoirs from the Corps of Engineers and entering management agreements with T. V. A.

Now most of the states have become aware of the urgent need for obtaining wetlands and of assuring themselves of a voice in the proper distribution and control of the water so vital to the very life of wetlands, and to the wildlife inhabitants which they support. A few states are still hampered for various reasons in their wetlands acquisition programs; for example: legislation prevents Mississippi from acquiring the lands they need; and Louisiana is unable to purchase land because of a mineral-rights clause.

In Arkansas, the State Game and Fish Commission continues its program of acquiring and developing wildlife management areas with special emphasis on green-tree reservoirs which are of particular importance for waterfowl hunting. There is strong public support of this program.

In Maryland, the State Game and Inland Fish Commission has cooperated closely with the State Highway Department in designing highway fills and bridge crossings to serve as dams and control structures for water impoundments.

State-owned impoundment projects, managed for public hunting or fishing purposes, have probably become the most popular activity of the game and fish departments. Not only have they met with wide public favor, but they have engendered a real spirit of cooperation. In Alabama, for example, the Department of Conservation recently opened to fishing, Lake Tuscaloosa. This lake, comprising 250 acres on a tract of approximately 1,600 acres, is the product of coordinated effort between local citizenry who contributed \$50,000.00 for the purchase of the land; the Division of Wildlife, who constructed the dam and managed the waters for fish production; the Division of Parks, who is operating the concession; the County Highway Department, which constructed access roads and parking areas; and the Fish and Wildlife Service which extended assistance through the provisions of the Dingell-Johnson Act.

In a discussion of these programs remember that water is the key. It is a precious commodity and at the same time one of the most controversial resources with which the world has to deal. In the United States, the West's doctrine of appropriation and the East's riparian rights have been argued in their various ramifications to the Supreme Court not once, but many times. Yet, the legal question of who has the right to use what amount of how much water for what purpose continues to be lucrative for lawyers and onerous to organizations and individuals concerned. It is also about the most imminent problem confronting each state, to which the Governors all agree.

The issues are becoming increasingly clear: Industry and other big water consumers want priority rights in the event of conflict, and special investigators have been employed to collect basic data and to present them in public meetings; agricultural interests, whose requirements for irrigation are increasing at a greatly accelerated rate, have strongly organized throughout the Southeast and are systematically establishing and strengthening their position. Hunters and fishermen, although somewhat disorganized as a group, have been represented at committee meetings by enthusiastic leaders.

With vigorous and sometimes heated discussions on basic issues, it is inevitable that there be some clash. For instance, at a public hearing in Atlanta, Georgia, April 4, 1956, Walter Cates of the Georgia Chamber of Commerce, advised members of the Georgia Water Revision Commission that a choice would have to be made between "catfish and job-producing industry." While this reflects an extreme point of view, the fact remains that there prevails considerable misunderstanding as to conservation objectives and the importance of fish and wildlife resources to the local, state, and national economy. Thus, the need for sustained liaison with all groups concerned with water use and its regulation is clearly indicated.

In general, the position taken by conservation interests is that (1) fish and wildlife conservation should be recognized as a beneficial use of water on a par with other, except domestic, uses; and (2) in the event of conflict, each case should be judged on individual merit rather than on the basis of a pre-established order of priority.

Two incidents in fiscal year 1956 are particularly encouraging. On October 24, the Supreme Court (in rendering a decision involving conflicting use between irrigation and fish and wildlife conservation) recognized fishing, recreation, and irrigation as beneficial uses and ruled that when one lawful use of water is destroyed by another lawful use, the latter (irrigation in this case) must yield or be enjoined.

The other concerns the passage of an Act establishing a permanent seven-man board of water commissioners in the State of Mississippi for the purpose of regulating use of all public waters. This Act defines "beneficial use" as the application of water to a useful purpose . . . recognizes the need for sustaining minimum stream flows, acknowledges right of landowner to impound water on his property with proper regard for those downstream, and to issue permits for water use. In case of conflict, the board may establish rightful user or refer the matter for appropriate court action.

In the light of increasing controversy over diminishing water supplies, it was deemed wise to submit to the southeastern States a questionnaire designed to determine insofar as possible the correct status of water-rights legislation in each state. Particular information was desired as to the importance attributed game and fish in the legislation of water supplies. A study of the compiled answers indicates one thing if no other. Most of the states are just embarking on a water resources policy, and for the most part, have no definite answers. A very few of the states answered the questionnaire completely, some states answered partially, but still to the best of their ability in light of the current status of commission studies, legislative studies, and studies by private concerns which have not yet been completed.

Of the twelve states queried regarding the enactment of legislation, only two—Kentucky and Mississippi—replied affirmatively. Kentucky's new law is entitled "An Act Relating to Conservation, Development and Use of Water Resources," and Mississippi's is known as "House Bill 232," presumably without a title to date.

In response to a request concerning legislation providing for water policy study, five states indicated a commission had been appointed to make a study of water rights and basic laws, and were empowered to submit their recommendations to the General Assembly for consideration; four states said that a Legislative Research Service or Council was making a study of the water problem; two states had no answer; one state mentioned study was under way by both Commission and Legislature; and one state had employed a private concern to bolster legislative findings.

To the question dealing with the number of council or board members making the study and the interest represented, the answers varied from "all members of the Commonwealth so requested" to "seven." In two states proceedings had not yet progressed to the point where positive answers were available. From the scanty information at hand, it appears that legislators far exceed any other group represented. The interest they represent is anyone's guess. Municipalities, agriculture, industry, and recreation rated next in that order. Only in one State, Georgia, were fish and wildlife interests represented on the study board.

To the question regarding representation of fish and wildlife conservation interests on Citizen's Committees or Councils, only Louisiana replied, indicating that these interests were represented by the Louisiana Federation of Wildlife.

Three states indicated that new or proposed legislation provided for a priority establishment of water use; two indicated that it did not; and the remainder failed to reply.

To the question seeking to determine the order of priority of beneficial uses in new or proposed legislation, domestic use was predominant. Other uses were indicated as follows by the states that were able to reply: Mississippi—the date of filing application; Tennessee—municipal, health, industry, agriculture and fish and wildlife and recreation, ranked in that order; South Carolina—domestic, municipal, irrigation, industry, recreation, and water power in the order listed.

Four states replied to the question of whether their boards were empowered by the legislation to appropriate water on the basis of a balanced or multiple-use concept. The only affirmative reply was received from Maryland.

In the State of Maryland the Department of Geology, Mines and Water Resources was the principal group backing the new legislation; in Florida the Water Resources Study Commission was primarily interested.

Four states indicated that they felt that fish and wildlife would definitely be protected by the the new legislation; one that it would be partially protected; and one that it would not. Yet, of the four who indicated that these interests would be safeguarded, only one had legislation recognizing fish and wildlife interests equal to other beneficial uses.

In summarizing the results of these questionnaires, the following conclusions are inescapable: No one state seems to be following a path similar to that of a sister state; and few clear-cut answers are presently available. However, the fact that attempts are being made to survey water resources, to arrive at a proper and just method of conserving and appropriating water, and to establish basic needs for water, is heartening.

The importance of water conservation has become apparent to the various southeastern states only within the past few years to the extent that they are now trying to do something about the dwindling supplies of this precious natural resource. It is our duty as individuals, whose vocation is the proper management of fish and game, to exert every effort toward the recognition of game and fish in any legislative action relative to beneficial uses of water.

THE LOCAL PICTURE

Locally, people are keenly aware of the value of water, if not the merits of comprehensive planning and balanced use. Generally, they are in favor of more impoundments with secondary consideration to their size or purpose. Thus, most programs in the Southeast involving storage of water for any purpose have met with considerable support. In many instances the construction of a navigation, power, or flood-control project has depended upon the enthusiastic support of local groups more interested in the recreational aspects of the project than upon the so-called primary purposes for which it was designed. Ironically, maximum recreational benefits can never be derived without specific consideration for their requirements in project design and operation.

The rapid acceptance of the small watersheds program has been due in part to the aesthetic appeal and recreational value of the flood detention reservoir, one of the more important features in the Work Plans. It is difficult for the individual to comprehend flood control benefits which will be derived from these structures downstream; it is easy for him to envision the gains which he will personally derive from a lake impounded on his property. There is evidence that with provision for fish and wildlife management, the value of the flood detention reservoir could be greatly enhanced; it is equally true, however, that the landowner is either unaware of this opportunity, or the incentive for development of fish and wildlife resources is inadequate to arouse or sustain his enthusiasm. Here is a challenge to the wildlife biologist.

Broadly surveying the trend of water resource developments by local interests, we find local participation in a program of water-use for wildlife conservation when and where there is (1) opportunity, (2) means, and (3) incentive. As an outstanding example, individual landowners in the Grand Prairie region, Arkansas, have developed an extensive system of management areas for water-fowl, sport and commercial fishing purposes, and bait minnow production with minimum assistance from the State or Federal Governments. These developments, integrated with agricultural, industrial, and domestic use of water supplies have had a profound influence on the economic and social welfare of the region. Actually, a particular type of cultural progress has been achieved, and neighboring states are adopting many of the practices which have been proved to be good land use in every sense of the word.

The willingness of individual landowners to develop their lands and waters for wildlife purposes where there is a will and a way is further exemplified by the thousands of farm ponds which have been constructed throughout the Southeastern States.

WILDLIFE MANAGEMENT PRACTICES

In the opinion of this Committee, wildlife conservationists have never enjoyed the opportunities for participating in the development of the Nation's water resources as they do today. Not only can we pursue a program of our own design, but we are privileged to work with other agencies in determining the policies, formulating the plans, and sharing the costs and responsibilities of project construction, operation and maintenance.

It would be naive for us to state that wildlife conservation has been accepted as a full partner by the "big four" uses of water. The fact remains, however, that the "big four" uses now have need of the values, protection and support to be derived from the economic and social aspects of wildlife and recreational development.

The future of wildlife conservation and the role which it will assume in development of the Nation's water resources depends to a large extent on how well we take advantage of this opportunity.

One of the major tasks before us is the development of management practices for our particular use or for the use of other agencies and individuals. To be acceptable, these practices must be practical. In explanation, a practice should produce the results which justify the cost; it should be simple to apply; and it should fit into the general scheme of land and water use.

IMPOUNDMENTS

The impoundment of water and regulation of water levels in accordance with a seasonal pattern or "rule curve" is rapidly becoming one of the most practical tools available. The successful application of water-level management has brought about a variety of impoundment projects which have achieved individual distinction.

The "green-tree reservoir," for example, designed and operated especially for waterfowl hunting, has proved to be an outstanding type of development. Although in general use in the lower White River Valley for the last 20 years, its adoption by Federal or State conservation agencies is of recent occurrence. Encouraged by the successful application of this measure in the lower Mississippi alluvial valley, we have received word that the U. S. Forest Service contemplates an experimental installation in Illinois. The Fish and Wildlife Service also is contemplating the establishment of green-tree reservoirs on refuges other than those located in the alluvial valley. Last winter, for example, an 800-acre green-tree reservoir was placed on Noxubee National Wildlife Refuge in the uplands of northeastern Mississippi with phenomenal results. An estimated peak population of approximately 44,000 ducks, comprised primarily of mallards, with a considerable number of wood ducks and, strangely enough, canvasbacks, were attracted to this development. This was an increase of more than 35,000 birds over populations wintered in previous years.

"Seasonal pools" involving the construction of low contour dikes and levees across minor drainage ways within the flood pools of large impoundments are proving very practical. The Mississippi Game and Fish Commission has assumed the leadership in this type of development. Within the State waterfowl refuge on Sardis Reservoir, a series of seasonal pools ranging from three to thirty acres in size, and aggregating approximately 150 acres have been constructed; outside the refuge boundaries, 25 seasonal pools have been constructed which range from 2 to 65 acres in size, aggregating approximately 300 acres. These pools, which are dewatered by breaking the contour dikes following the winter season, are disked periodically to control undesirable shrubs and to promote growth of waterfowl foods such as smartweed and wild millet. To insure adequate water supplies for waterfowl, some of the seasonal pools have been irrigated with water withdrawn from nearby streams.

When levees are enclosed and drainage is intercepted, a "sump area" is often formed. The discharge of this drainage must be accomplished by means of a flood gate, a pumping plant, or by a combination. Because of the necessity of impounding water within the sump areas during flood control operations at least for brief periods, they often provide excellent wildlife habitat. With the regulation of water levels to consider wildlife production and use, their values can be greatly enhanced. There are a number of examples of this type of project which offer excellent opportunity, some of which are, at this time, being considered for development by state game and fish departments in the lower Mississippi Valley. These include the White River, St. Francis, Yazoo and Red River backwater areas.

"Flood control reservoirs," constructed on the headwaters of major streams and their tributaries, offer excellent opportunities for wildlife development. This is particularly true where a fish and wildlife pool is superimposed upon a conservation pool and water levels regulated to improve production and availability of foods. Although there are no distinct instances where this is being practiced with maximum benefit, some consideration is being given to water regulation for waterfowl purposes in Nimrod and Blue Mountain Lakes, Arkansas.

In the last year the Corps of Engineers has considered modifying the flood-control reservoirs to include a "flow regulation pool." This pool would be primarily for the purpose of storing waters in late spring, when flood expectancy is low, in order to regulate discharge downstream during periods of normal

low flow. By adjustment of the pattern of regulation within the impoundment and flow below the structure, fish and wildlife values may be greatly enhanced. Two reservoirs in particular are being planned with this in mind: North Wilkesboro Reservoir Project on the Yadkin River, North Carolina and Rough River Reservoir, Kentucky.

"Dewatering projects" were originally designed for mosquito control with wildlife benefits of secondary importance. A number were constructed on main-stream reservoirs of the T. V. A. system. The continued application of this practice, however, is questionable in view of the great expense of pumping operation. Experience shows that mosquito control benefits are questionable; and it is doubtful that waterfowl benefits alone will justify operation and maintenance costs.

The "drawdown" of large impoundments for fishery-management purposes as practiced on Nimrod and Blue Mountain Reservoirs, Arkansas, has been very effective and practical. Last year the Arkansas Game and Fish Commission removed from Nimrod Reservoir over 200,000 pounds of rough fish after the waters had been drawn down 12 feet below the conservation pool level. Marked improvement in fishing success is reported. Commission biologists are now attempting to determine the frequency with which impoundments of this type should be drawn down, the extent to which a reservoir should be dewatered, and the period and time of occurrence. Here is also an opportunity for wildlife biologists to work in cooperation with fishery biologists toward a plan which would yield mutual advantages.

Because of the growing popularity of water-level management as an effective tool in both fish and wildlife management, the North Carolina Wildlife Resources Commission has initiated a research project to work out in detail the mechanics for its use. The Florida Game and Fresh Water Fish Commission and the Fish and Wildlife Service are undertaking detailed ecological investigations in conservation areas of the Central and Southern Florida Flood Control project with a view toward determining the most favorable pattern of seasonal water fluctuations.

The "flood detention reservoir" as designed by the Soil Conservation Service for use in its small watershed program with minor modifications offers outstanding opportunities for wildlife development. Much progress in this direction has been made following joint conferences attended by representatives of the U. S. Fish and Wildlife Service, U. S. Soil Conservation Service, and State Game and Fish Departments of Georgia, Tennessee and Kentucky. In Georgia, for example, the Soil Conservation Service has included a vertical slot equipped with dam boards in the drop-inlet structure. This feature locally referred to as a "duck window" gives the project greater flexibility in managing water levels for shoreline conditioning, planting and flooding of waterfowl foods, and possible control of excessive fish populations.

It is interesting to note at this time that many of the benefits to be derived from a carefully conceived and executed plan for water-level management were reported over ten years ago and documented in what was popularly referred to as the "Eureka Plan." This plan involving management of water levels provided for a conservation pool upon which was super-imposed a fish and wildlife pool and, in turn, a flood control pool. The merits of this plan are that it not only affords opportunity for combining fish and wildlife management but that it is compatible with flood control, mosquito control and irrigation. Experience now demonstrates that this plan also is favorable to flow regulation, pollution abatement, municipal water supply and other related purposes.

RESERVOIR PREPARATION

Wildlife conservation has made a major contribution toward methods of reservoir preparation. In the last three years we have observed a definite trend from the removal of all timber from reservoir basins to a plan of "selective clearing." The Corps of Engineers is interested in such a plan since it reduces the cost of the clearing operation; fish and wildlife biologists are interested in view of its enhancement of fish and wildlife resources. An outstanding example of this selective clearing is Jim Woodruff Reservoir, Georgia, Alabama and Florida. Another example is Demopolis Dam and Reservoir project, Alabama.

Experience gained from these and other clearing operations in the reservoirs of the Southeast clearly reflects advantages to be derived from leaving carefully selected areas of timber in reservoirs. Wildlife use of dead or living timber in natural or artificially constructed impoundments generally exceeds that of open waters. Wood ducks, for example, find nesting sites in the trunks of deadened trees whereas herons, egrets, ibises and anhingas usually confine their nesting sites to trees and shrubs surrounded by water. That fisherman success and enjoyment is enhanced by standing timber and by rafted logs has become a generally accepted fact. Certain other intangible values should not be overlooked. A fisherman's enthusiasm is sustained as long as he remains optimistic. A lone cypress on a point ahead or a splintered oak dropped into the edge of a lake are eagerly approached by fishermen. In locations where water-tolerant cypress and tupelo gum trees have endured flooding, shade is afforded to fishermen and fish alike.

In reservoir preparation, consideration has been given to grading and conditioning of "seining areas" for removal of rough fish. There are no instances, however, of this having been accomplished to date. That it would be an effective and practical measure in at least some types of reservoirs is suggested by experience and the removal of rough fish by seining in Mattamuskeet Lake, North Carolina. By baiting the seining areas several hundred thousand pounds were removed in a single year. Great improvement in the production of aquatic plants has been observed following this operation.

STREAM IMPROVEMENT

The "regulation of stream flows" appears to be as practical a measure in the improvement of streams for fish and wildlife purposes as the regulation of water levels in an impoundment. Certainly one operation complements the other. With the construction of headwater reservoirs it is possible to provide for regulated discharge downstream whereby accumulated sediments may be flushed from stream channels, favorable water temperatures obtained, oxygen supplies replenished and pollution abated.

An outstanding example of effort being exerted in this direction is that of the North Carolina Wildlife Resources Commission working in cooperation with the Stream Sanitation Commission, the Department of Conservation and the U. S. Fish and Wildlife Service. To date the combined efforts of these agencies has resulted in establishment of a pattern of flow regulation below Kerr Reservoir for the express purpose of the improvement of habitat conditions for striped bass and abatement of pollution.

Another outstanding example is the work of the Tennessee Game and Fish Commission cooperating with the Corps of Engineers in respect to stream flow regulation below Dale Hollow and Center Hill Dams. With the construction of these reservoir projects, Caney Fork and Obey Rivers, tributaries of the Cumberland River, were converted from warm to cold water streams. Upon investigation it was found that although stream temperatures and oxygen supplies were favorable during sustained operation of the turbines, during periods of prolonged closure, waters in the pools downstream became too warm to sustain trout. Although it was first believed that a sustained discharge would be necessary to correct this situation, a more practical solution was found by "intermittent releases"; thus, it was possible to reduce loss of power to a minimum and at the same time provide favorable conditions downstream.

"Increased minimum flows" are having a pronounced effect upon deepening and widening existing stream channels and thereby restoring their former cross-section. For a long time we thought that flood flows were primarily responsible for scouring of holes and maintaining channel capacity. However, where runoff is from unstable watersheds, floods may be responsible for filling channels with sediment. On the other hand sustained minimum flows have been found responsible for cleansing shoal areas and scouring the holes below obstacles, increasing the production of food supplies, thereby providing cover for game fish.

By working closely with construction agencies we are demonstrating that the "channelization" and "clearing" and "snagging" of streams need not be detrimental to wildlife resources. Tensas Bayou in Louisiana, for example, was

improved not only for increased discharge capacity but for wildlife purposes by the removal of only those trees and shrubs less than 10" in diameter, breast high, as opposed to cutting and removal of all vegetation. The practical aspects of this practice are obvious. By leaving a canopy of timber to shade the understory, plant succession is retarded and cost of maintenance diminished. The park-like appearance given to these streams is not deleterious to hunting and fishing; on the contrary the landscape appears natural, and navigation by small craft may be facilitated.

Drainage channels also may be equipped with weirs to impound water to a depth of from 4 to 6 feet. In the Boeuf River Basin, Arkansas, weirs constructed of sheet piling and stone riprap have preserved several lakes and impounded waters in the ditches for as much as 13-20 miles upstream. Although constructed primarily to retard coppice, these weirs have contributed toward preservation of fish and wildlife resources.

Where "cutoffs" or "diversions" are necessary to reduce flood heights they may be equipped with weirs or control structures which will permit passing of flood flows down the new channel such as in the Yazoo City cutoff, Mississippi. Medium and low flows in the natural stream channel are thereby maintained. Where this is not practicable, the "bendways" may be dammed at either end and equipped with control structures. This permits impoundment and regulation of water levels.

MARSH IMPOUNDMENTS

In the development of coastal marshes for wildlife purposes, the impoundment of tidal guts and estuaries has proved to be an effective and practical measure. The Fish and Wildlife Service is employing such a procedure on Bulls Island within the Cape Romaine Refuge off the coast of South Carolina. The South Carolina Game and Fish Commission, in the development of the Bear Island Game Management area, also is employing this practice. With the impoundment of a saline or brackish area and gradual conversion to fresh water conditions, an abundance of desirable food plants such as widgeon grass are produced and made available to waterfowl. One distinct advantage of this type of development is that as desirable brackish water plants give way to fresh water species of less value, the manager need only to open his structures, emit salt water, and return the succession to a pioneer stage.

"Marsh impoundments" as a measure for waterfowl production also take on greater significance when related to the vast program of mosquito control, contemplated by the Federal Government working in cooperation with state and local agencies, for the marshes of our coastline. Investigations by mosquito control authorities reveal that the control of nuisance mosquitoes by impoundment is more practical in many instances than by drainage, larvaciding or filling.

On the Chassahowitzka National Wildlife Refuge, the Fish and Wildlife Service has developed what appears to be a practical measure for the conversion of needle rush (*juncus roemerianus*) marsh into productive habitat for waterfowl. This marsh has defied wildlife biologists for years. Experiments on Chassahowitzka Refuge, however, reveal that by mowing, spraying, burning and disking in various combinations, needle rush can be destroyed and in its place a desirable pioneer succession composed of such plants as salt grass, salt marsh, bullrush, three square and sand sedge may be established. Widespread adoption of this practice seems likely in view of its practical application, not only for waterfowl purposes but for pasture improvement. The importance of this discovery becomes evident when we realize that there are several million acres of this type of marsh from Maryland around the tip of Florida to the Texas coast.

ACCESS AND PUBLIC USE

The realization of recreational potentials afforded by streams and impoundments will demand adequate public access and provisions for reasonable use. In view of the abundance of water resources in the southeastern United States, this has not been a major problem in the past; it will be a major problem, however, in the future. In realization of this fact, projects to acquire access sites to streams and lakes have been encouraged and are meeting with wide-

spread approval. The North Carolina Wildlife Resources Commission is one of the outstanding departments of the Southeast in the advancement of this type of development.

There is increasing interest in development of access areas and facilities in connection with Federally constructed impoundments. This has become increasingly important with the change in land acquisition policy by the Federal Government. No longer is there a wide margin of lands acquired around the periphery of each impoundment. The Corps of Engineers is authorized to acquire only those lands essential for limited access and reasonable use. This does not provide adequate lands for wildlife conservation purposes. The problem has become even more serious with a trend toward revestment of lands in the previous landowners. Existing or potential wildlife development on many reservoirs in the Southeast is threatened by this action. In Florida the threat was successfully countered by recent passage of an Act by Congress transferring the right of managing certain lands on Jim Woodruff Reservoir to the Florida Game and Fresh Water Fish Commission. It is expected that participation of the State Game and Fish Departments in developing access areas on Federal lands will increase in the future. Not only is there need for this development since the Corps of Engineers is not financially equipped to undertake this job, but the advantages to be derived by establishing favorable public relations cannot be overlooked.

ZONING FOR WILDLIFE PURPOSES

The need for dedication of water and wetlands for wildlife purposes is of paramount importance. A considerable acreage has been dedicated by "land acquisition." With increased human populations and value of lands, the opportunity for acquiring lands is fast disappearing. Some means must be found whereby lands can be dedicated for wildlife purposes other than by acquisition in fee title.

"Comprehensive easements," which include the right of flowage for wildlife management are being considered. Recommendations have been made with respect to flood control and other projects being planned by the Corps of Engineers. The principle of easement, of course, is being employed by the Soil Conservation Service in the construction of floodwater detention reservoirs as well as by the Corps of Engineers in many new impoundment projects. It should be further explored by fish and wildlife interests.

"Flood plain zoning" as a means of prohibiting conflicting use has long been considered in lieu of levees, ditches, and reservoirs. The first evidence that this concept has practical application is a recent law enacted by the Florida legislature prohibiting further encroachment into a designated portion of the upper St. Johns River Valley. Benefits to be derived in terms of wetlands preservation and development from this practice are quite obvious.

EQUIPMENT

Fish and wildlife managers have adopted or developed equipment which best serves our needs. There are a number of items which deserve special mention: The "marsh digger," first developed along the Texas and Louisiana coast, has made its appearance in the Everglades of Florida. It is one of the most valuable tools available for the excavation of boat trails and the opening up of ponds, sloughs, and pot holes within the monotonous sawgrass marshes. The "air boat," developed by the frog hunters of the Everglades in Florida, has found widespread application as a means of rapid communication in the shallow marshes of our coastal areas; the "rotary mower," which was designed primarily as a means of cutting brush and shrubby vegetation from old pastures is proving to be an excellent means of setting back plant succession in the marshlands and inland wetland areas; the "lowhead pump," working on the principle of an open cylinder with impeller, has met with immediate popularity because of its simple design, low cost, and easy maintenance. The "ricefield trunk," developed by the first planters in the lowlands of South Carolina, has been found to be well suited as a means of water control and waterfowl development on the sites of old rice plantations. The principles of this trunk, which provides automatic egress or discharge of waters from an impoundment, have

been combined in a patented gate manufactured by Armco Drainage and Metal Products.

DISCUSSION AND CONCLUSIONS

In summary, the sound development of water resources is one of the Nation's most important problems. Water development for wildlife purposes is inextricably a part of this problem which involves many interests at national, state and local levels. If wildlife conservation is to keep pace with water resource development, we must be aware of changing concepts and trends in water use, the programs of other interests, and the rules and regulations which guide their efforts. We must be constantly on the alert and adequately equipped to take advantage of any opportunity or cope with any emergency.

As the trend of development proceeds toward more balanced use and wildlife conservation matures as a science and profession, there emerges from the tangle of frustrated efforts, clearly defined opportunities, practical means of accomplishment, and incentives.

The use we make of these opportunities will depend to a great extent upon our attitude, effort exerted, and team work accomplished.

RECOMMENDATIONS

This Committee, therefore, recommends that the Southeastern Section of the Wildlife Society, cooperating with the Southeastern Section of the American Fishery Society, (1) adopt as a basic physical objective the integration of wildlife conservation with other uses of water in accordance with each area's capabilities and in recognition of human needs; (2) compile a handbook of proven fish and wildlife management practices involving water use; (3) acquaint our members and associates with the policies, programs, and procedures concerning water resource development and their relationship to wildlife conservation; and (4) develop a procedure whereby fish and wildlife research, planning and development may be coordinated and each biologist may understand the role he is to play.

IN SUPPLEMENT

Since this report has been prepared, we have received copy of Civil Works Information Memorandum, Volume 2, No. 7, dated July, 1956, containing a message from the Acting Chief of Engineers which we think will be of particular interest to the members of the Wildlife Society:

MESSAGE FROM THE ACTING CHIEF OF ENGINEERS

FISH AND WILDLIFE

"Fish and Wildlife" is a magic phrase to millions in the United States. Whether their interest is primarily that of scientist, conservationist, sportsman, food provider, or just plain American vacationer, they are raising an increasingly louder voice in connection with the Nation's water resources development program.

This growing public interest in fish, wildlife and other outdoor recreation has a major bearing on Civil Works. In the past, Civil Works projects have provided more new fishing and hunting facilities than any other single program of resource development. Public recognition of the value of these opportunities is increasing. Last year, a new record of 62 million man days of recreational use of facilities made possible by these projects was achieved. In addition to considerations of personal satisfaction and health, that recreational use yielded major economic benefits in the areas immediately adjacent to the facilities.

Renewed emphasis on construction of flood control, navigation, water conservation and related projects indicates that in the future even more extensive opportunities for fish, wildlife and other outdoor recreational development will be presented in conjunction with Civil Works projects.

In view of the manifest desires of the public, it behooves the Corps of Engineers to give major attention to proper means of encouraging development of facilities, by those charged with that responsibility, whereby the public may realize fullest enjoyment of these opportunities. To that end responsible officers of the Corps of Engineers should take steps to:

Better acquaint the authorities concerned and the public with the outdoor recreational opportunities, already realized or potential, in connection with Civil Works projects.

Bring about better understanding of the Corps of Engineers' statutory requirements with respect to the development of such opportunities.

Stimulate better cooperation between groups interested primarily in outdoor recreational development and those interested primarily in flood control, navigation, water supply and other basic project benefits.

And encourage the state and local authorities to take the most vigorous and effective action possible, beginning with the planning phase, to discharge their responsibilities for making optimum use of the opportunities presented.

NEEDED: A STATE WATERSHED PROGRAM

By HAROLD E. WALLACE

Florida Game and Fresh Water Fish Commission

Tallahassee, Florida

What is a watershed program? The name itself imparts one meaning
Simply this:

W ise
A mericans
T hink
E very
R iver
S hould
H ave
E valuated
D evelopment

And to carry it further:

P eople
R ealize
O ur
G od-given
R esources
A re
M ortal

I hesitate to use the word "mortal" as it has a number of meanings. But to me it means "that which is capable of being destroyed," or "that which can be given the kiss of death." And there have certainly been some fateful osculatory antics taking place with each setting of the sun.

Each passing day sees the spawning of a new plan to harness a river, develop a watershed, or exploit a natural resource. And occasionally an unwise or unpopular plan of action will find its way into the obituary column. But there always seems to be many more births than deaths. Actually there is nothing wrong with this; it is a sign of progress. But it is up to us, we who are being paid to protect, develop, maintain, and otherwise manage our natural resources, to watch the birth announcements, and make the acquaintance of the responsible family. Learn the plans that the proud parents have for their new offspring. And, as the child grows, watch his development. If the youngster shows promise, help him; if he turns into a menace to society, first attempt to lead him into the paths of righteousness; if that fails, strive to remove him from circulation.

I see a number of pallbearers here today who have done commendable jobs in burying those watershed projects which had no earthly niche. I likewise see scars of battle on these same people resulting from corpses which refused to lie down. Instead of headstones, these corpses-which-got-away have other