

over-estimations of population size were those for the number of 1960-stocked channel catfish in Pond S-8. These slight over-estimations probably resulted from designating some of the 1961-stocked channel catfish as those stocked in 1960 (Fig. 1). This mistaken designation apparently occurred during the latter part of the 1961 fishing season, when recruitment of the young channel catfish was greatest and when there was a probable overlap in the sizes of the channel catfish from each stocking. It was therefore concluded that the assumption of either constant fishing pressure and/or no competition between units of fishing gear did not have to be fully satisfied in this study during the period from which the data was taken to obtain a regression line to achieve accurate estimates of population size.

CONCLUSIONS

It was concluded that the Delury Method may be used with reasonable accuracy to estimate the number of channel catfish in farm ponds providing the following assumptions are met:

- (1) A significant proportion of the population must be taken by the anglers before an estimate is initiated.
- (2) Recruitment and natural mortality must be negligible, and the entire population must be available to the fishery.
- (3) The "catchability" of the fish must remain relatively constant during the sampling period.

The assumption of non-competing units of fishing gear and constant fishing pressure appears to influence estimation of size of channel catfish populations to a lesser degree than do the above assumptions.

It was concluded that estimates based upon the different intervals of effort of this study did not give significantly different estimates.

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THE COOPERATIVE FISHERY UNITS

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ABSTRACT

The purpose of the cooperative fishery and wildlife units, as stated by Congress, is "to facilitate cooperation between the Federal Government, colleges and universities, the States, and private organizations for cooperative unit programs of research and education relating to fish and wildlife and for other purposes." This paper describes only the fishery phase of the program which is now getting underway. The training of fishery biologists for professional employment is considered the primary objective at this stage. The conduct of research is also recongized as

having high importance. Limited attention is given to extension-type programs involving preparation of literature, short courses in fishery methods, preparation of exhibits and demonstrations.

Each fishery unit is a cooperative venture involving the Bureau of Sport Fisheries and Wildlife, a university, and usually a State fish and game department. A coordinating committee, representing the participating agencies, gives general guidance to each unit by reviewing annual budgets and proposals for research studies. The Bureau pays the salaries and expenses of a leader and assistant leader and supplies limited funds for employment of students and for graduate research projects. The university provides housing, office and laboratory space, utilities, access to libraries, other special facilities, and stenographic services. The State fish and game department makes its facilities available wherever feasible and contributes a stated amount of money to the university. These things are spelled out in a cooperative agreement.

The Bureau plans a total of approximately 15 units for the United States. As of the date of this report, funds have been provided for seven of these.

THE INCREASING NEED FOR FISHERY BIOLOGISTS

Fishery science as a profession has grown rapidly since World War II. This is largely due to the public demand for more places to fish and the need to improve production of sport fishes in hatcheries, in natural waters, and impoundments. Federal and State agencies have required new information to guide them in managing the fishery resources under their jurisdiction. This situation has led to greatly increased employment opportunities for trained fishery biologists. The inauguration of the Federal Aid in Fish Restoration program in 1951 greatly increased the requirements for fishery biologists for employment by the States. Universities have found their graduates in high demand, and many positions have remained unfilled. In recent years, the availability of funds for research grants has encouraged many fishery biologists to stay on at the university after graduation rather than to seek employment outside. Private industry is also competing for trained aquatic biologists. As a result, the opportunities for employment have grown while the number of graduates seeking positions has increased only slightly.

Opportunity to alleviate this situation came with the passage of the Cooperative Unit Act, PL 86-686 (16 USC 753 a-b) which was approved September 2, 1960. This Act authorized cooperative programs of research, education, and extension related to fish and wildlife resources. This paper deals with the steps taken to implement the above Act as related to sport fisheries. Copy of the Act is appended to this report.

OBJECTIVES OF THE PROGRAM

The cooperative fishery units are designed to serve several functions:

- (1) Training is considered the most important, particularly in the early stages of the program. The units will strive to increase the number of fishery biologists available for employment with State, Federal, and private agencies. The units will provide experienced and skilled persons to advise students interested in careers in fishery science, to direct research by graduate students, and to give courses of instruction in special subjects related to the fisheries.
- (2) Research by unit personnel is also a major objective of the program. This will involve individual research projects, chosen in respect to the interests and capabilities of the personnel, the facilities that are available, other research programs of the Bureau, and in response to regional and national needs.
- (3) Extension-type activities will be a part of the program, depending upon the workload in teaching and research, the requirements of the participating States and other interests. The units can make a very valuable contribution through preparation of fishery literature relating research findings to practical situations, and by cooperation in demonstrations of fishery management methods.

- (4) Other assignments may fall to the unit leaders, such as participation in national surveys, the preparation of inventories of aquatic resources, or other fishery subjects requiring a high level of professional competence. In some areas, field studies on large Federal land and water areas may be carried on, particularly those of an ecological nature and where students can be used to advantage.

HOW A UNIT IS ESTABLISHED

A general pattern for the location of fishery units has been drawn, indicating about 15 likely locations. Twelve of these are in the coterminous States, distributed fairly evenly on a geographical basis. As of fiscal year 1963, funds have been provided for seven units located at Utah State University, Colorado State University, University of Missouri, Louisiana State University, University of Georgia, North Carolina State College, and the University of Maine. Future locations will depend upon the fulfillment of several criteria which have been stated as follows:

- (1) A demonstrated need for training fishery biologists to serve State and Federal agencies in that State and in adjoining States having similar natural resources and management problems.
- (2) Location of the university in an area where research and management-type investigations can be profitably directed to fishery resources and related to Bureau programs on Federally-owned or controlled waters, such as the national parks, national forests, Indian reservations, and national wildlife refuges, or on waters of interstate importance.
- (3) An expressed desire on the part of the university and the State fish and game department for a fishery unit. The need for assistance on the part of the university to expand its fishery training at the graduate level is important.
- (4) Existence of adequate facilities at the university for teaching and research. Adequate laboratory and office space must be available for the work of unit staff members, as well as for graduate students in fisheries.

In the units established to date, the initiative was taken by the universities. This began with a letter to some responsible official of the Department of the Interior. The initial request sought information on the program and advice as to what the university might do to obtain a cooperative fishery unit. Several universities prepared statements describing their facilities and interests and listing the faculty engaged in teaching subjects related to the fisheries. Special equipment and laboratories which were available and the waters nearby where research and training activities could be conducted were described briefly. These proposals were answered by the Bureau.

Universities seeking information are provided copy of a sample cooperative agreement, which may be modified to meet local situations. Copies of the university catalogue, covering both graduate and undergraduate curricula, are very helpful to the Bureau. The attitude of the State fish and game department toward the proposed unit is also very important. A preliminary visit to the university and the State fish and game office is usually in order to examine facilities, determine the extent of interest and availability of State funds to support the program. These early meetings help the State agencies to become better acquainted with the objectives of the program and to determine whether they wish to pursue the matter to completion.

If decision is made to work together toward the establishment of a unit, arrangements for financing the Federal participation must be initiated. This step, by the Bureau, involves a request for funds in connection with the preparation of an annual Departmental budget. New programs and additions to old ones receive close scrutiny at several stages in the budget process and the competition for funds is very real. Projects that are included in the President's annual budget are reviewed and acted upon by the Congress. Members of Congress have shown special interest in the unit program and have aided in securing appropriations for several of the units.

Once Federal funds are provided, negotiations proceed looking toward early establishment of the unit. The next important step is the approval of a cooperative agreement involving the university, the Bureau, and usually the State fish and game department. The agreement sets forth the interests of each agency, the responsibilities each is willing to assume, and the contribution each will make to the undertaking. Ordinarily, the university will agree to provide housing for the unit, including space for the necessary offices, laboratories and storage, and use of special facilities, libraries, and other features that will contribute to success in the research and teaching efforts. The university is also expected to provide stenographic services.

The Bureau provides full-time technical personnel in the form of a unit leader and, generally, an assistant leader. It also agrees to support graduate projects and provide temporary employment to students as funds are available. Any facilities it may have in the area, such as fish hatcheries, research laboratories, natural or impounded waters, will ordinarily be made available for project use. The Bureau also agrees to give general supervision and provide administrative services to the Federal employees assigned to the unit.

The State fish and game department stipulates the cash contribution it expects to make to the university to help defray the latter's expenses and to provide funds for graduate projects. The State may also offer the use of nearby facilities, such as State lakes, hatcheries, boats, marinas, etc. If the State department declines to participate in the program, a two-way agreement is possible, though not generally favored.

When terms governing the above items and others are agreed upon, the cooperative agreement is signed and the unit formally established. The agreement remains in effect until modified on the request of any member and with the acceptance of changes by all parties.

The next step is the selection of the unit leader and, generally, an assistant leader. Both are Bureau employees, chosen under civil service rules and procedures. They are classified as fishery biologists (general) indicating abilities in both research and management fields. The leader is expected to be a man of recognized abilities, with substantial experience in the fields of teaching, research, or management-type activities. He must be qualified as a writer, a speaker, a scholar, a diplomat, and a public information specialist. The assistant leader should be of only slightly less stature but with similar abilities. A combination of two men, we believe, will provide greater flexibility and more complete coverage in the field than could be achieved in a single person. The assistant leader may sometimes be in training, looking toward advancement in the program. The qualifications of applicants for unit positions will be reviewed with university and State officials and concurrence of all parties sought when final selection is made. With the appointment of these men, the unit program is underway.

OPERATION OF THE UNITS

The units function under the guidance of a coordinating committee. Each committee is composed of a representative of the university (ordinarily the head of the department housing the unit, or a professor of aquatic biology); a representative of the State fish and game department (usually the chief of the fish division or director of fishery research); the unit leader; and a representative of the Regional Director, Bureau of Sport Fisheries and Wildlife (usually the Regional Chief, Division of Sport Fisheries). The Committee will elect its own chairman annually. It will meet at the call of the unit leader and act on proposals for research, review budgets, consider needs for major equipment items and means of procuring them, and review policy matters pertaining to the functioning of the units. In the event the State fish and game department is not a participant in the cooperative agreement, it will not be represented on the coordinating committee.

The fishery units function as a part of the Bureau's regional program and receive general supervision and administrative services from the office of the regional director of the region in which the unit is located. This places the fishery units in a pattern similar to most other Bureau

programs and assures a close working relationship between the State and Federal agencies.

The program will give opportunities to students for part-time and summer employment on fishery research and management projects. Some of these projects may be those carried out by the Bureau's research laboratories or management biologists. Students obtaining such employment will gain first-hand knowledge of actual methods and will be able to decide whether they wish to continue in fisheries as a career. While the funds contributed by the participating State and Federal agencies will be limited, financial support to graduate students will be provided. Also, funds from private agencies, including industries, utility companies, sportsmen's organizations, and national conservation agencies, such as the Sport Fishing Institute, may be provided for special studies. Other sources of funds remain to be explored. It is hoped that, as the program develops, funds available for graduate student projects may be increased.

One aspect of the program proposed includes the development of short or refresher courses on subjects of special interest to State and Federal fishery biologists. These courses may present information and instruction in new methods of aquatic weed control, the use of electrical gear in fish population studies, methods of pollution abatement, radiation biology, and other timely subjects. This type of refresher course is presently not available to Federal and State employees in most parts of the country.

A further function which it is hoped the units will eventually provide is the development of nationwide standards in fishery training. Achievement of this will contribute materially to the recognition of fishery biologists professionally and is one of the goals of the American Fisheries Society. This will take time, careful planning, and coordination.

RELATIONSHIP TO THE COOPERATIVE WILDLIFE RESEARCH UNITS

The legislation referred to above applies equally to the cooperative wildlife research unit program, which was started in 1935. Wildlife units are now established at 17 universities. The general objectives of the wildlife units are very similar to those given for the fishery units. As evident in the title, emphasis is placed on research activities although the training of wildlife personnel has been given almost equal attention. The wildlife units are operated under cooperative agreements which formed the basic pattern for those used in the fishery program. Likewise, general direction is provided by a coordinating committee composed of the State and Federal agencies represented. The Wildlife Management Institute also participates in the program through financial contributions. The wildlife units are supervised from the Washington office, as is true for all wildlife research activities.

The wildlife units have included a number of courses in aquatic biology in the programs which have been carried out at several of the universities. Wildlife students are encouraged to obtain some background in fishery subjects which are taught by regular university staff members. In the past, however, there has been no formal program or financial support provided by the Fish and Wildlife Service to students in fishery science except for a short period at Colorado State University, where support was given from 1948 to 1953.

Wildlife and fishery units may be located at the same institution, or they may be entirely separated. Wherever possible, they will cooperate closely, and the efforts of the Bureau in connection with the two programs will be closely coordinated. From the standpoint of supervision and curriculum, it has been found expedient to conduct the two unit programs as separate entities.

One of the valuable characteristics of the fishery and wildlife units is their continuity. This was considered by Congress and suitable language incorporated into the enabling legislation. It is for as long as the participating agencies recognize the need for the program, agree on the general objectives, and give their financial support. The benefits will result first to the student seeking a career in fisheries or wildlife; second, to the employing agency having responsibility for resource management; and third,

to the public who seek recreation through sport fishing, hunting, or other enjoyment of our natural resources.

PUBLIC LAW 86-686, 74 STAT. 733

AN ACT

To facilitate cooperation between the Federal Government, colleges and universities, the States, and private organizations for cooperative unit programs of research and education relating to fish and wildlife, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That, for the purpose of developing adequate, coordinated, cooperative research and training programs for fish and wildlife resources, the Secretary of the Interior is authorized to continue to enter into cooperative agreements with colleges and universities, with game and fish departments of the several States, and with nonprofit organizations relating to cooperative research units: Provided, That Federal participation in the conduct of such cooperative unit programs shall be limited to the assignment of Department of the Interior technical personnel by the Secretary to serve at the respective units, to supply for the use of the particular units' operations such equipment as may be available to the Secretary for such purposes, and the payment of incidental expenses of Federal personnel and employees of cooperating agencies assigned to the units.

Sec. 2. There is authorized to be appropriated such sums as may be necessary to carry out the purposes of this Act.

Approved September 2, 1960.

SELF CONTAINED UNDERWATER BREATHING APPARATUS (SCUBA) AS AN AID IN FISHERIES WORK

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ABSTRACT

The development of self-contained underwater breathing apparatus (SCUBA) in recent years has opened an entirely new world to those who are physically able to enjoy it.

SCUBA is now used extensively in marine biology and is beginning to find its place in fresh water fisheries research and management. More aquatic biologists would probably utilize SCUBA if they were more familiar with its possibilities and its limitations. It is the purpose of this paper to present information which will assist fisheries administrators and biologists in determining whether or not diving techniques could be used in their programs.

USE OF SCUBA IN FLORIDA'S FRESH WATER FISHERIES

In Florida's fresh waters many areas are suitable for underwater work. As a result, skin and SCUBA diving has been used by the Florida Game and Fresh Water Fish Commission personnel in both research and management for the past few years.

At first, diving equipment was used to recover fish from the bottom after rotenone samples. This began on a very small scale, but it soon proved so effective that it is now used state-wide when conditions are suitable and divers available.

Other sample techniques such as various types of nets and electrical gear have been used while divers observed and noted the fishes' reaction.