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The Iowa Cooperative Fisheries Research Program

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The Iowa State Conservation Commission and Iowa State College cooperate in a program of research, extension and education in the field of fishery management. This cooperative program, initiated in 1941, was patterned after that of the earlier established Cooperative Wildlife Research Unit (Scott, 1939). The research work is carried on by the permanent staff at the college and by graduate students some of whom are on fellowship appointments. The problems being investigated include those deemed most important in the management of Iowa's fishery resources and include work on streams, natural lakes, reservoirs, artificial inpoundments, and farm ponds.

For this presentation, it may be helpful to classify fishery research investigations into four categories: 1) inventory, 2) life history, 3) ecology and population dynamics, and 4) development and testing of management techniques. These are arranged in the order in which they must generally be investigated, but they usually cannot be separated nor can one phase be completed before starting the next. Fishery management would be impossible if it were necessary to wait until all the answers were secured through research. Because management must therefore be based upon inadequate information and incomplete understanding of population dynamics, it should be tested and critically evaluated at every opportunity and should be flexible enough to permit adjustment to new findings.

Inventory is necessary to determine the species of fish and other important aquatic organisms present, to estimate the abundance of resources which can be utilized, and to select the problems which must be investigated before management can be improved. It is thus an essential part of each of the unit projects. Inventory must be more or less continuous just as it is in any business. Fishery resources are not static quantities which once measured remain unchanged. One of the most recent inventories is a survey of the fish populations in farm ponds in several southern Iowa counties (Fessler, 1949). We found that many ponds had large numbers of small fish but very few fish that an angler would care to take home. Even in many of the ponds with good populations of larger fish, the fish

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are not being caught. One of the reasons for this is that many people do not know how to catch bass and bluegills. Another reason is that the owners are afraid of over-fishing the ponds. Research, however, indicates that the ponds should be fished regularly if they are to produce the most fish. When more fish are caught the remaining fish grow faster.

One of the first problems in connection with the pond survey was the development of a method of censusing the fish population (Carlander and Lewis, 1948). Satisfactory estimates have been made in several ponds by seining the pond, clipping a fin from each fish and returning the marked fish to the pond. The next day the pond was again seined and the population estimated on the assumption that the percentage of marked fish caught the second day is the same as the percentage of population caught at the same time. This method frequently gave estimates with standard errors of less than ten percent, but in other cases the errors were much larger. Particular difficulty was experienced in trying to census the adult largemouth bass *(Micropterus salmoides)* and the bullheads *(Ameiurus* spp.) which seemed to be able to avoid the seine.

One of the most important tools in the study of fish life histories is the scale method of age and growth analysis. The scales of most fishes have rings on them from which the age and past growth can be calculated. Comparisons of growth rates in different waters give clues as to where conditions are favorable for a species, and where improvements are needed. Knowledge of growth rates and ages is also valuable in the understanding of changes in fish populations and in the success of fishing. Members of the Research Unit have made growth studies of white bass *(Lepibema chrysops)*, yellow bass *(Morone interrupta)*, yellow pikeperch or walleye *(Stizostedion vitreum)*, and smallmouth black bass *(Micropterus dolomieu)* (Carlander, 1948; Lewis and Carlander, 1949; Cleary, 1949; Sigler, 1949; Tate, 1949). Other growth studies are now in progress, and an extensive study of the literature is being made preparatory to publishing a summary of the growth data on all freshwater fishes of the United States.

Bullheads, catfish, and a few other native species do not have scales and therefore cannot be aged in the same way as the scaled fishes. William Lewis (1949) demonstrated that the age of the bullheads could usually be determined by examining the rings on the centra of their vertebrae. If this method proves to be generally applicable to bullheads from various waters, it may help supply badly-needed information on these abundant Iowa fishes.

The food habits of the various species of fish are important factors to be considered in their management and conservation. Studies at Clear Lake in 1942-42 indicated that the diet of most of the predatory fish consisted primarily of young game and pan fishes (Bailey and Harrison, 1945). There appeared to be a definite shortage of forage fishes. The decreased abundance of small fish as the summer progressed may account for the increased success of fishing in the fall.

The channel catfish *(Ictalurus lacustris punctatus)* and several of the river minnows appear to be almost omnivorous and will modify their diet as the food supply changes (Bailey and Harrison, 1948; Starrett, 1948). Competition for food is thus kept at a minimum, except possibly during the winter months when most of the species feed upon aquatic insect larvae. Some of the minnows, on the other hand, are quite selective in their feeding habits. Four species in the Des Moines River *(Hyborhynchus notatus, Hybognathus hankinsoni, Campostoma anomalum pullum,* and *Pimephales promelas promelas)* feed almost exclusively on the bottom ooze which is composed largely of diatoms. Two species *(Extrarius aestivalis* and *Phenacobius mirabilis)* eat little except insect larvae.

The age and growth studies indicated pronounced differences in the success of reproduction and survival of young fish in different years. The white bass which hatched in 1941 in Spirit Lake were extremely abundant and practically all the white bass caught from 1942 to 1946 came from this one year class (Sigler, 1949). The survival of young white bass in the years 1942 to 1946 was negligible, and as the abundant 1941 year class disappeared, white bass fishing showed a marked decline. Similarly, practically all the yellow bass caught in Clear Lake in 1942 and 1943 were from the 1939 year class (Bailey and Harrison, 1945; Lewis and Carlander, 1948). By 1947 and 1948, the yellow bass population was composed of several age classes with little evidence of a dominant year class. The causes of dominant year classes are not yet known although their occurrence upon occasion have been correlated with weather and other factors. Other species of Iowa fishes show differences in the abundance of various year classes but not to the degree found in the white and yellow bass.

In an ecological study of the Des Moines River in Boone County, Starrett (1948) found the abundance of river minnows to be controlled to a considerable extent by floods and high water stages. Reproduction and survival of young were very poor during high water stages and the most successful species over a period of years

were those which have intermittent spawning seasons, extending over several weeks. Then, if high water reduced the success of the early spawning, the entire season's reproduction was not lost as in the case of species which spawn over a short period of time only. In those years when there is no high water in the spring and early summer, the species which have a short intensive spawning season have an advantage and their young have taken up most of the available space before the young from later-spawning species appear on the scene. Since the minnows are mostly short-lived species, with few exceeding three years of age, two or three years of unfavorable conditions for any one species may almost eliminate it from the population. The smaller tributary streams sometimes serve as reservoirs where a species may survive and repopulate the main river when conditions become favorable again.

These life history and ecological studies give many clues as to methods of better management of the fishery resources, but it is also necessary to test these methods and to examine the results to learn if the desired goals are being reached. On Clear Lake, an investigation of the value of planting walleye pike fry is being carried out. This year the hatchery is not being operated, no fish are being caught to supply eggs and milt and no fry will be planted. This year's reproduction of walleye or yellow pikeperch in Clear Lake will thus be derived entirely from natural propagation. Next year, the hatchery will be run as in the past, with the fry being planted in the lake soon after hatching. Then for several years the hatchery will be operated only in alternate years. If the hatchery contributes significantly to the production of walleyes in the lake, the subsequent catch of walleyes in Clear Lake should show more fish of the years when the hatchery was in operation than of years when there was only natural propagation. In some instances it has been found that the planting of fry has no appreciable affect on the fish production and the money used in hatchery operation can be diverted to other phases of fishery management (Hile, 1937; Van Oosten, 1937 and 1942; Carlander, 1945). We need to find whether this is true in Iowa lakes or whether further artificial propagation is justified.

Rather detailed programs of farm pond management for fish production have been developed in Alabama. These programs include proper pond construction, ratios for stocking fish, fertilization to increase food and to control aquatic plants, and recommendations for intensive fishing. Several of these recommendations have been tried in various Iowa farm ponds but their applicability has not yet been determined and successful fishing cannot be guaranteed. We

are now trying to evaluate some of these practices and to determine how they may be modified to bring satisfactory results. Although the work is still in a preliminary stage, stocking ratios do not appear to be too significant, although the species present in the pond may be very important. It is unlikely that the fertilizers and fertilizing program used in Alabama will prove to be the most satisfactory for ponds in the more productive Iowa soils. The farm ponds of Iowa provide a real challenge to fishery management. Ponds can be managed and their fish population studied and understood much more readily than can streams or larger lakes. Many of the things learned in pond management may help us in understanding fish population problems in the other more complex waters.

One of the difficulties in fishery management is the abundance of fishery resources which are not being utilized. During the war, much of the research effort of the unit was directed toward developing methods of preparation and utilization of the so-called rough fishes (Olsen, 1944; Olsen and Hendricksen, 1945). In addition to the increased supply of marketable food which these fish may provide, the removal of large numbers of these fish may materially promote the growth of the more desirable game and pan fishes. Excessive populations of rough fish destroy desirable habitat for other fish.

It is not only the rough fish which are not being sufficiently utilized, however. Our studies indicate that many Iowa waters have quantities of game fish which are never caught (Carlander, 1949). We believe that it is part of a wise management program to aid the fishermen so that they may harvest more of the annual crop. We are therefore preparing a number of articles on fishing to be published in the *Iowa Conservationist.*

One other phase of the cooperative program should be mentioned — *i. e.*, the training of biologists for fishery management and conservation jobs. The field is a new one and there are relatively small numbers of available, qualified technicians and biologists. Several of our former research fellows and students are now biologists for various state conservation commissions and private, state and federal research agencies and others are teaching wildlife and fishery management in colleges.

In addition to their research work, students in fishery management take courses in wildlife management, parasitology and other phases of zoology, statistics, and botany. The class work in fisheries includes a year's sequence, with limnology in the fall quarter, fish taxonomy and biology in winter, and fishery management in

the spring. Two advanced courses, given alternate winters, deal with fishery resources and commercial fishery problems, and with fish propagation and pond management.

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