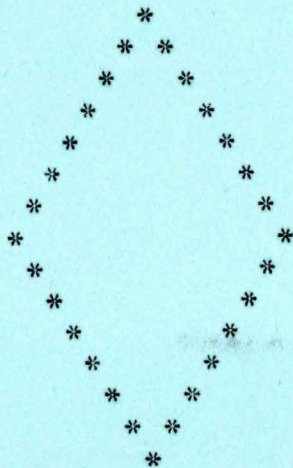


IOWA FISH MANAGEMENT

January, 1938



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FOREWORD

The writer feels that a chronological story of the progress made in the management of Iowa fish life since the time first attention was given to this phase of Iowa conservation would be of instructional interest and give helpful suggestions for the further improvement of fishing in a state that has at best a minimum amount of this kind of recreation.

The narration has been arbitrarily divided into three sections. The first portion deals with fisheries activities in Iowa from 1862 to 1931. The second part describes the work of the Fish and Game Commission which covers the period from April, 1931 to July, 1935. The third section covers the two and one-half years the State Conservation Commission has existed.

Respectfully submitted,

W. W. Aitken

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January 1, 1938

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IOWA FISH MANAGEMENT

Chapter I

In order to present a clear and factual statement of the management of fish in Iowa, it seems appropriate to review from the earliest records up to the present time some of the major efforts that have been made to conserve fish life.

Scarcely had the Iowa pioneer become established in Iowa before he saw the necessity of preserving, propagating, and regulating the take of fish in Iowa lakes and streams. From Page 29, Newhall's "Sketches of Iowa," we find this comment:

"Our rivers and creeks abound with excellent fish among which are speckled trout, white perch, black and rock bass, pike, catfish, shad, red-horse, sucker, white sucker, eels, sturgeon, shovel-nosed sturgeon and numerous other varieties."

Newhall continues to stress the importance of wildlife as food. It is apparent then, as we peruse such articles, that early Iowans recognized the need for some sort of fish management. In these early days those interested in the taking and the preservation of fish turned to the law-making bodies of the state as the most effective means to secure and insure a suitable population of fish in the state waters.

We find in Bennett's "Fish and Game Legislation in Iowa," that in 1858, the Senate of the 7th General Assembly considered a bill aiming to provide for a careful study of bird and animal life of Iowa, evidently with a view to making such a study the basis for determining a legislative program to perpetuate wildlife in Iowa.

Bennett has further disclosed that the first Iowa law enacted with respect to fish was in 1863 (Laws of Iowa, 1856-57, Chapter 164) which limited the taking of fish. Provision was made for ar-

tificial propagation and related expedients. These Acts were designed to increase the natural supply of fish in the state. So we see at the beginning, in the first instance of the act, a negative attitude and in the second instance we find the first positive attitude to promulgate fisheries activities and produce more fish for Iowa waters.

In January of 1870, the 13th General Assembly appointed a special committee on fish (Journal of the House of Representatives, Page 294).

During the 15th General Assembly in 1874 a law was enacted to provide for a State Board of Fish Commissioners. The duties of the Fish Commissioners were declared to be two-fold, "Fish Protection and Fish Propagation," which is evidence that the diminution of the fish supply in Iowa waters was already raised as a matter of concern.

Further, we learn, in substantiation, that the Act declared that it shall be the duty of the Commissioners,

"to forward the restoration of fish to the rivers and waters of this state and to stock the same with fish as they may be supplied with means for that purpose by the U. S. Fish Commissioner and by societies and individuals interested in the propagation of fish in the waters of the state."

The Fish Commission was of short duration as the 16th General Assembly in 1876 passed a new act which eliminated the Commission of three members and provided for one "competent person" to be known as a State Fish Commissioner.

An Act of the 18th General Assembly in 1880 provided for an Assistant Commissioner, whose specific and primary duty was fish culture and who was also required to enforce the fish laws. It was

further set out that he was to maintain a fish hatching house within easy access of Spirit Lake.

We find as we go through the records of each succeeding General Assembly that the people of the state interested in fish and their management submitted petitions to the Fish Commissioner and to their legislative assembly members to provide legislation regulating the fisheries activities of the state as they, as individuals, believed to be right. We see then, through the entire history of fish management, up to the formation of the Fish and Game Commission in 1931, that empirical methods shaped the policies of the Fish Commissioner, as it did later in many instances the policies of the State Game Warden.

The Fish Commissioner's title was changed to that of Fish and Game Warden in the extra session of the 26th General Assembly. This same Act authorized the appointment of deputies to assist in the enforcement of the violations of fish and game laws.

The first fish that was granted protection by the Legislature was the trout in 1862. The bill prescribed that the only lawful means of taking trout was by hook and line. The spawning time was also protected, as the law provided no trout were to be taken between September 15 and December 31 of each year.

Further management of fish by legislation was attempted and we find at an early date that fishways were urged; and that passages be embodied in dams to facilitate the movement of fish up and down the rivers. The 10th General Assembly, in 1864, received petitions asking for a law regulating mill-dams in such a way as to require provision for fishways. We find that through several General As-

semblies the fishway question received considerable attention.

Finally, in the 15th General Assembly, in 1874, a law was provided which reads in part:

"It shall be the duty of any person or persons or corporations hereafter erecting or constructing any dam in any of the rivers within the state-----to put in or upon the same, fishways."

The same Act prohibited the use of other obstructions, such as seines, nets, or weirs, that might hinder fish migration. It also prohibited the poisoning of fish and restricted fishing, except by hook and line, within certain distances of fishways.

It is apparent from the increasing number of acts passed by the successive Assemblies that the management of fish in Iowa was becoming more and more a problem of serious importance.

We find in these later laws restrictions were made on the taking of bass and pike-perch during their spawning seasons, as well as on the taking of salmon and trout during the winter months.

After fishway legislation seemed to have run its course we find the attention of the 20th General Assembly, in 1884, called to the limiting of spearing and selling of fish.

Further management practices were attempted by enacting a law in 1886 to construct dams across outlets on meandered lakes with the obvious purpose of preventing the escape of fish from the lake.

We find that, as time passed, closed seasons on trout and other species were lengthened and many types of taking fish were declared illegal, including the use of dynamite and other explosives.

In 1902, among other Acts of the Legislature regulating the

management of fish, the Warden was authorized to grant permits to whomsoever he might see fit in order that they might "take from certain designated portions of the waters of the state buffalo, carp, quillbacks, red-horse suckers, and gar."

It is apparent then that rough fish control was not a definite problem of fish management.

In a scrutiny of the biennial reports made by the Fish Commissioners, the Commission, and the State Game Warden, we find much of the legislation that was enacted was definitely recommended by these men charged with the management of fish. In a summation of their activities in actual fish management work we find their efforts were directed toward propagation, distribution and stocking of fish in the inland waters, collection of fish from the Mississippi River, control of rough fish, and stressed the regulation, take, and enforcement phases of fisheries work.

Propagation activities in an early day consisted of rearing fish at a hatchery a few miles north of Anamosa on a small tributary of the Wapsipinicon River in Jones County. From the first Commissioner's report we find that in 1874-5, 260,000 California Salmon were hatched and the fry distributed in many streams of the state which included some of the Missouri River tributaries. The Nishnabottany River, at Atlantic in Cass County, received 6,000 of these fish.

Further review of the early Fish Commission reports discloses that fish not native to the state were introduced in a vigorous attempt to get them established. These fish were California salmon; Atlantic salmon, sometimes called Penobscot salmon; land-locked

salmon; lake trout; whitefish; rainbow and Loch Leven trout. Environmental conditions in the state eliminated all of these foreign species. The introduction of foreign species was climaxed by the most successful emigrant that ever came to the United States-- Edelkarpfen, the German carp.

The introduction of carp was soon recognized as a mistake, as previously noted in the law passed in 1902 authorizing the control of rough fish.

The hatching of pike-perch at the Spirit Lake Hatchery is early evidence that wide-spread interest existed in the state in this fish as food and as sport for the angler.

Fish rescue was early practiced on the Mississippi River, obviously to secure fish for inland stocking. From the Second Commissioner's report a description of a fish car is given which was used to transport fish from Lansing, Iowa, to 51 counties in September and October of 1876. Aquarium tanks were used on a freight car that travelled 4,000 miles in the state.

In 1896, when the Fish Commissioner's office was abolished and a Fish and Game Warden was authorized by law, the division of duties did not lessen fisheries activities but rather it is noted that the responsibility of this office was becoming of greater magnitude due to the increased agricultural activities, the changing conditions of the physical characteristics of the lakes and streams in the state, coupled with an increased interest in the taking of fish for sport and for food.

From the records, up to 1931, the management of fish was dic-

tated by the expedience of the times and the changing ideas from all quarters of the state that created "pressure" on the State Game Warden which materially effected his plans and policies. The following illustrates how some fisheries activities were handled.

For a number of years goldfish were hatched at Spirit Lake and distributed to applicants in every part of the state; also, privately owned ponds were stocked. It is to be noted, however, that up to the time the Fish and Game Commission was authorized in 1931 that the State Fish and Game Warden had inaugurated approved fish management work of commendable proportions.

Fish hatcheries were established with substantial buildings at Orleans, Dickinson County; Clear Lake in Cerro Gordo County; a yellow pike-perch stripping station was erected at the inlet of West Okoboji Lake in Dickinson County; and a trout hatchery adequate in size for the trout waters of Iowa, operated in the Backbone Park in Delaware County.

Rescue stations, with excellent equipment, were located at Lansing, Iowa, in Allamakee County, and Sabula in Jackson County. From these points a fish car, "The Hawkeye," was used to transport the collected fish to points inland for stocking. In the last few years, prior to 1931, trucks were recognized as more economical and feasible for inland distribution.

Up to this time, the pond propagation of fish was of negligible moment, although ponds had been built at Lansing, Cedar Rapids, the Palisades Park, and at the Spirit Lake (Orleans) station. Pond propagation had been attempted with variable success in gravel pits,

improvised rearing areas, such as the Clear Lake Pond, and by using some of the small lakes in Dickinson County as "nursery lakes" for yellow pike-perch. These efforts to produce larger fish were commendable even though they were not highly successful and pointed to the possibility of producing fingerling fish for stocking purposes rather than by securing them from the rescue operations on the Mississippi River.

In 1930 the State Game Warden recognized the need for technical advice in the management of fish. He employed a research worker to study Iowa lakes and cooperated with research workers at the State University of Iowa. The new Fish and Game Commission, a few months later, felt the need for more extensive fisheries investigations. Studies were initiated on pollution of lakes, diseases of fish, and other related fisheries activities. A staff of scientists from the State University of Iowa made an initial survey of some of Iowa's lakes to determine types of pollution present and potential quantity of plankton forms. Dr. G. W. Prescott and Dr. G. W. Martin made some worthwhile contributions to the management of Iowa lakes.

One of the fundamental phases of fish and game work was the effort the State Game Warden made to acquaint the public with Iowa fish. This was accomplished by the construction of the present Fish and Game Building on the State Fair Grounds, which includes a fish aquarium for the display of Iowa's native fish. This building has enjoyed continuous use up to the present time for conservation displays.

Because of changing fish environment in the lakes and streams, the increased interest in taking fish, and various other pertinent

factors, the management of the fish in the state did not satisfy the general demands made upon this phase of wildlife. By an Act of the Legislature in 1931, a Fish and Game Commission was created to manage the wildlife of the state. They held their first meeting April 23, 1931.

Chapter II

The Commission first cooperated with the Board of Conservation in having a 2-year survey made of Iowa's natural resources to formulate a 25-Year Conservation Plan. This report was accepted and published in 1933.

The consultant of the 25-Year Plan, Mr. Jacob L. Crane, asked Dr. Carl L. Hubbs, Director of the Institute for Fisheries Research, to suggest a 25-Year fisheries program. In April, 1931, Dr. Hubbs submitted such a plan titled "Increasing the Fish Supply of Iowa." In this plan Dr. Hubbs says:

"Fish conservation and increase are intimately bound up with other conservation plans."

Under the heading "Methods for the Increase of Iowa's Fish Supply" he says:

"The program being proposed for the upbuilding of the fish supply in Iowa, while radical in a way, does not involve the casting aside of any of the existing means of fish conservation and development. It recognizes the need for protection against any lawless or uninformed elements which unfairly prey upon the fish supply.

It acknowledges the need for protective, restrictive, legislation, and calls for the obtaining and coordinating of data which will make such laws sounder and more effective.

"As a basis for sound fish laws for Iowa, I recommend that the State sponsor natural history investigations. These should be made and coordinated by a technically competent official trained in the methods of modern fisheries research and by assistants, and by institutes of fellowships at one or more of the colleges or universities of the state."

This plan includes some of the following items: growth of different game fish, age, the percentage of fish maturing at different ages, weights and lengths, the usual and extreme limits of spawning season, the relation between catch, carrying capacity, and present fish population in various waters, location of natural spawning grounds in the lakes and streams, and the relation of coarse and obnoxious fish to game fish.

Dr. Hubbs continues to point out the need for fish cultural investigations and observations in Iowa and points out the phases such an investigation should include. One of the phases of fish management particularly stressed by Dr. Hubbs is that of a creel census for Iowa.

The entire plan stresses the need first of surveys and investigations of the different areas so that the management of fish in state waters will be on a sound and fundamental basis.

Dr. Hubbs made the following outline:

"I would suggest that in the game fish survey attention be divided along five lines, namely:

1. A preliminary lake survey
2. A reconnaissance stream survey
3. A fish-hatchery inspection
4. A consideration of draining lands

and impounding water
5. A consideration of stream pollution."

Later in the year of 1931, in July and August, Dr. Hubbs directed some field investigations in the state. These investigations were quite extensive for the short period they were pursued and the volume of this report was materially enhanced by the information gained from the Iowa Fisheries Department. The survey was not state-wide because of limited funds and was confined primarily to the lakes region in northwest Iowa and the trout stream section of northeast Iowa.

The report on the Iowa 25-Year Plan, prepared by Crane, in Chapter 10 (15 pages), sets out the conservation of Iowa fisheries resources. This report is but a brief summary of Dr. Hubbs' management plan.

Destruction of fish life is pointed out, restoration is mentioned as might apply to lakes and streams, continued surveys and research are urged, fish culture, stocking policies, and environmental control are listed as subjects for attention in fish management and in addition to the four fishing areas mentioned by Dr. Hubbs, a general plan is submitted, urging the construction of a series of artificial lakes in southern Iowa.

Crane sums up the chapter by saying,

"Here then in brief is an outline of the program to bring Iowa's fishing back to a point equalling or exceeding its original richness."

Dr. Hubbs divided the state into four fishing areas: (1) a commercial fishing area, boundary waters, (2) the southwestern fishing areas, (3) north central area, and (4) the northeastern

area. He made suggestions for the management of these areas.

To further stress the importance of fish management in Iowa, Dr. Hubbs says,

"It strikes us as being vital to the effective development of Iowa's fish supply that a well-trained technical man be engaged on a full-time basis. The problems facing Iowa are so difficult, and are increasing so alarmingly in their seriousness, that technical help will continue to be needed, and will be increasingly important; more than that, of necessity. We refer to the problems of silting, of pollution, of algae nuisance and control, of diseases in nature and hatcheries and of over-fishing.

"We therefore suggest that a technically trained man be employed at the Commission's earliest convenience. This man:

1. should know the fish problems of the prairie regions from long experience;
2. should know fish thoroughly both as an angler and as a scientist;
3. should have primary interest in the conservation and upbuilding of the fish supply rather in purely scientific work; yet
4. should be capable of applying most approved and modern scientific methods in the solution of the problems confronting the state, and
5. capable of cooperating with other investigators at the State College, State University, and other institutions, and of coordinating their work with his own and of applying these combined results in practice; and
6. should be mature enough and of proper character to succeed in public relations.

"If the same man can serve in a similar capacity on the technical side of game research and game management, so much the better. If fitted for educational work as well, both among children and adults, he would be an ideal person for the position. It

is quite possible that a man of these many qualifications could be secured."

In all, many worthwhile recommendations were made which, to be applied, required expenditures of money, the employment of a trained supervisor, and the formulation of a workable field program.

The Fish and Game Commission selected several points emphasized by Dr. Hubbs as expedient in an attempt to secure fisheries improvement on a gradual basis over a prolonged period of time so that neither extra help or increased cost would be an issue. Some progress was made by this plan.

The most outstanding work of the Fish and Game Commission was stream improvement on some short stretches of the northeast Iowa trout streams, the expansion of pond propagation, and the construction of some of the new artificial lakes in southern Iowa for fishing areas. The first of these was started at Lake Wapello, Davis County, in September, 1932. The writer, as a fisheries technician, was employed to develop these lakes as fishing areas. Here in these new lakes brush, log, and rock shelters, tile and gravel spawning beds were installed to augment natural fish environment.

A large-mouth bass hatchery was constructed at Lake Wapello and other ponds were built at various places in the state to bring fingerling fish production on a par with other mid-western states practicing modern fish culture. (Reference is made to Aitken's report of September, 1934, Conservation Department files.)

The lake-dredging program was started at Lake Manawa, Council Bluffs.

A small-mouth bass hatchery and trout rearing raceways were built at Decorah. This was a definite step in the best fish cultural practices under the Hubbs' plan.

The newly established Federal work agencies accelerated the fisheries improvement program and several fairly large log and rock dams were placed in such rivers as the Cedar, the Shellrock, Upper Des Moines, Wapsipinicon, and some smaller streams.

Because of decentralized responsibility in fisheries activities, coordinated and concerted progress was slow. This was exhibited in stocking, collection and rescue from the Mississippi River, rough fish control, and fish census work.

One forward step in general management of stocking fish was the discontinuance of the old method of formal application for consignments of fish. A stocking program was set up by counties and no private waters were stocked.

For instance, all proposed fisheries activities were submitted to the five members of the Fish and Game Commission by their administrator for approval in seasonal appropriateness, or as the various emergencies arose. This method of procedure was used in passing regulations for the taking of fish, rough fish control, stocking policies, purchase of any type of equipment, etc., and was different in method over the State Game Warden system only in point of number of persons who must make the management decisions.

To sum up the situation briefly to the credit of all concerned, progress was made in improvement of streams and lakes and a demonstration made at the new bass hatchery at Lake Wapello that fingerling fish could be raised in large quantities very cheaply if

modern fish cultural practices were followed. The dredging program was started, the Decorah hatcheries at Twin Springs and Sievert Springs built, and several important sections of lake shore line secured. Notable was the acquisition of Pikes Point at West Okoboji where the public might enjoy free access to this finest and most valuable piece of state owned property.

A better stocking policy was adopted, the commercial take of rough fish in inland waters was discontinued, a trained fisheries worker was employed, and fish management took on new meaning.

Chapter III

When the consolidation of the Fish and Game Commission and the Board of Conservation was effected July 1, 1935, fundamental to success of a state organization, authority and responsibility was definitely placed on personnel.

This new Iowa State Conservation Commission, by the Director, Mr. M. L. Hutton, divided the conservation work into various sections, Fish and Game, Lands and Waters, and Administration, and experienced men were appointed to head the divisions.

A Superintendent of Fisheries was appointed and publicly recognized. The new Commission charged the Fisheries Technician, under the title of Biologist, with certain specific duties and requested the formulation of a fish management plan for the state. A summation of these duties is here given as taken from a memorandum by Fred T. Schwob, Chief of the Fish and Game Division, to all

employees of that division.

"He shall be biological consultant on all fisheries matters and make recommendations to the Chief of the Division and Superintendent of Fisheries for the proper development of the fisheries program. He shall make recommendations and be responsible for the making of development plans for the lakes and streams of the state so that maximum natural fish production can be realized. This will include all experimental work such as oxygenation of lakes and streams, aquatic plantings, elimination of pollution, and proper balance of animal life in lakes and streams which includes recommendations on rough fish removal or removal of other animals or life to bring proper biological balance so that the maximum desirable fishes may be produced to increase fishing in the state.

"In general, the Biologist's duties are to make proper recommendations for improvement and development of the fisheries program. All plans for fish nursery ponds, hatcheries, or other development for production of fish must be approved by the Biologist."

The Iowa Fish Management Plan is herewith set forth as it appears in the "Proceedings of the First American Wildlife Conference" held in Washington, D. C., February, 1936. This plan points to the practical application of modern piscicultural methods and latest research in fisheries fields as suggested in the Iowa 25-Year Plan.

"IOWA FISH MANAGEMENT PLAN: To successfully manage fish in any state, a plan is of first importance. Of second moment is a recognition and knowledge of field conditions including both physical and biological factors with an appreciation of the practical and scientific phases of fisheries work.

"Wide variants of fish ecology are exhibited in Iowa. A classification of the state waters reveals a gamut of gradations in stream and lake characters, cold trout waters of northeast Iowa, rock-bottomed bass rivers of the upper mid-state, and warm turbid catfish streams of the southwest. The lakes range from shallow bull-head areas, pan fish and bass sections, to the sport

fishing, pelagic Okoboji, each body of water demanding individual treatment in stocking, in improvement, and in management.

"These natural sequences establish a variety of propagation problems. Iowa fish culturists care for troughs of brook and rainbow trout, batteries of yellow pike-perch, raceways of artificially fed small-mouth bass, and pond units of bullhead, bluegill, crappie, and large-mouth bass, each group of fish requiring different methods of daily care and study.

"The various types of fishing areas, with their specific biotic factors, an increase in fishing interest, the lake building and restoration impetus of the 25-Year Conservation Plan, the probability of a diminishing supply of stock from the canalized Mississippi, the lower water levels in the state, the correlation of fisheries improvement with waterfowl management all coupled with limited faunal and ecological history necessitate the placing of a fish management plan on a fundamental basis.

"For these reasons the basic factors in such a plan as are here enumerated are fused into a working plan that is practical, scientific, and therefore reasonable.

"Propagation: The propagation of fish includes trout and pike-perch hatcheries, pan fish, bullhead, bass, and forage minnow ponds; nursery lakes that are certain small lakes where fry are introduced and fingerling periodically removed to regular fishing areas; sportsmen's ponds where local groups under State supervision produce fish for local waters.

"Collection: The collection of game fish from land-locked ponds in the flood plains of inland and border streams and their return to suitable fishing waters.

"Rescue: The wholesale rescue of fish by federal, state, and sportsmen's groups from land-locked pools in flooded districts and their return to mother waters or their use for stocking barren waters.

"Stocking: The stocking by state and U. S. Bureau of Fisheries of state owned lakes and privately owned areas, the stocking of rivers, smaller streams and reservoirs.

"Obnoxious Fish Control: The removal of carp, gar, dogfish, and other rough fish from game fish waters, by department crews, by contract, by relief labor under a state-wide WPA project, by gill-netting through the ice, and by sportsmen's groups.

"Winter Aeration: The mechanical and natural oxygenation of the shallow lakes that experience unusual oxygen depletion during the winter months. The work is pursued by the department, by WPA projects and by sportsmen.

"Improvement--Streams: Major activities are erosion control and reforestation of watersheds; tree planting of stream banks; elimination of pollution directed by the State Board of Health; the installation of devices and dams by state and federal government and sportsmen's groups. Lakes: The reconditioning of natural lakes by restoring natural shore lines by excluding cattle and all agricultural practices from the immediate lake area; the introduction of suitable aquatic vegetation; the stabilization of levels by controlled inlets and outlets, the control of rough fish; planned stocking correlated with creel limits; and a dredging program of distinctive proportions. Artificial lakes: The building of fishing lakes. Lake Wapello, a typical example of fish management, with its lake bed prepared with fish shelters of rock and brush, and spawning areas of tile, gravel, and sand, aquatic vegetation plantings for fish and waterfowl, scheduled stocking and service facilities provided for the recreator. City and leased reservoirs: An improvement program outlined for municipal execution that approximates artificial lake development.

"Acquisition: The securing of trespass waivers along privately owned streams, access agreement for public use of deserted railroad reservoirs; the purchase of riparian rights along state lakes and the acquisition of areas suitable for pond propagation units.

"Surveys: Physical surveys by engineers of lake bed contours, and watershed topos, including geological data and wind and precipitation phenomena; biological surveys of aquatic fauna including records of biotic and chemical conditions, creel census of water stocked and the reconnaissance of streams and lakes for future improvement.

"Biological: The initiation of fundamental ecological studies with emphasis on fish distribution and controlling increments, the correlation of private and state scientific research work with pertinent fish problems, and the dissemination of information to fish and game workers that are not scientifically trained.

"Administration: The field execution of the program, the budgeting of funds, the care and purchase of equipment, the establishment of a record system to preserve field history, and all such duties that apply to execution of plans.

"Each section of the plan dovetails into each other to make a composite whole. Each phase of this plan is for-

mulated in detail. All employees working in each particular section are apprised of the tentative plans made for their division. They are then asked for their criticism and suggestion.

"This method gives each fisheries worker a clear idea of the ultimate goal in view and tends to stimulate self interest, by giving each worker a picture of his part in the general plan. Fisheries progress cannot be made unless the fisheries worker adds to and uses to the best advantage the knowledge he possesses. To insure the consummation of this fisheries program, the unstinted cooperation and whole-hearted interest of all employees are necessary.

"If proper cognizance is taken of all factors herein set out and prudent attention paid to the attendant details, aquatic resources will be re-established on a plane that will approach a natural optimum."

The following brief review presents the progress made after the Iowa Fish Management Plan has been in operation two and one-half years. For clarity and brevity each phase of the work will be dealt with separately.

Propagation

The areas of the state owned hatchery ponds total 129.5 acres. The area of ponds under lease or agreement is 48.25 acres and the total area of small lakes used for pike-perch (Welch and Diamond in Dickinson County) is 200 acres. 65.5 acres of the state owned ponds have been added during the present period under discussion, while 14.5 acres of the total acreage of cooperative ponds now used were also added in the last two years. A series of bass ponds are now under construction at Chariton which will be ready for use the 1938 season. Other hatchery units are also under construction.

Fish produced in state owned ponds with a total of 102.75 acres:

	1936	1937
Large-mouth bass)		
Small-mouth bass)		
Rock bass)		
Warmouth bass)	456,870	415,611
Crappie)		
Bluegill)		
Yellow perch)		

Fish produced in the nursery lakes with a total of 200 acres:

Pike-perch	209,658	155,941
Bullheads	279,549	2,321,838

Young bullheads are a by-product of the pike-perch nursery lakes. In 1937 two and a quarter million bullheads were removed at the time the young pike-perch were seined from Diamond Lake. These bullheads are stocked in typical bullhead lakes that are heavily fished, such as Lost Island, Medium, and others.

There are several ponds in the state not included in this report that are privately owned and operated by local sportsmen.

Under the Fish Management Plan at present, as far as possible, fry are reared to fingerling size before liberating them in the fishing areas. (Trout are fed to legal size.) The Commission is making all effort to increase rearing pond acreage for pike-perch fry as the present areas used for this purpose take but a small percent of the fry hatched. The Biennial Report, ending 1934, shows a total of 124,887,000 pike-perch fry hatched at the two pike-perch hatcheries. The office records for 1936 and 1937 show this number has been increased to 180,500,000 for these two years. This increase in production has been accomplished at practically no increase in cost.

A radical change from the system used in trout management was inaugurated in the fall of 1935. Instead of keeping a surplus number of fingerling trout on hand to make monthly or stated interval stocking, which resulted in a steady supply of undersized fish being placed in the streams, a new plan was inaugurated to stock only legal size fish twice yearly; approximately 50,000 in number, combining brook, brown, and the rainbow species. This number proves to be more effective in providing a reasonable supply of takeable fish than by stocking a far greater number of fingerling fish. By this new system a saving in food was effected amounting to \$80.00 per week. This program is still in effect and plans are now started to increase the number of trout for stocking. We feel we can do this because better methods of pisciculture are being practiced and new rearing ponds are being built at the Backbone Hatchery; also, each culturist has an opportunity to learn from literature and other sources the latest work in this field. Our adult trout cost 10.7 cents each with a feeding cost of 3.5 cents.

Propagation of fish by sportsmen on a cooperative basis is encouraged and accomplished. At Manchester, Davenport, Burlington, Marshalltown, and other points, local groups are maintaining ponds and rearing fish for local stocking. Advice and help in rearing and distributing the fish is given by the Commission. By raising fish the sportsmen have a more tangible interest in the fish of the lakes and streams in such cases cited. This working interest builds fundamental conservation principals more surely.

The sportsmen must have a workable interest in his own sport if success attends the Commission's effort to improve state-wide

fishing.

Of fundamental importance to good fish management is need for hatcheries located in geographical convenience to the stocking places.

Because various species of fish are propagated in various sections of the state and because biological factors differ in each case each major hatchery has a more or less individual status. The methods for handling small-mouth bass in Decorah cannot be compared with pond propagation of yellow pike-perch at the Lanesboro Hatchery.

For these apparent reasons the propagation of fish in Iowa will always need continuous biological study if progress in this phase of fishery work is attained.

Hatchery records are kept that contain information on volume and cost of foods, weather conditions, chemical status of the water, weekly growth rate of the fish, mortality rates at various ages, and all information pertinent to modern fish culture.

Winter Aeration

During the winter months the lakes in northern Iowa are covered with 18 to 40 inches of ice. If the ice is covered with snow sunlight is excluded. This condition hinders plant activity which uses gases being produced by the decomposition of organic matter in the bottom of the lake. During this process the dissolved oxygen supply in the water is gradually depleted until there is not enough to sustain fish life.

Iowa and other states in the north-central lake region have

tried to devise a method to replenish the supply of oxygen necessary to sustain fish life under the ice.

In the winters of 1935 and 1936 every method was tried on various lakes. In some cases oxygen was forced under the ice by air compressors and blowers. Other machines were constructed and used to pump large volumes of water out of the lakes onto the ice to eliminate obnoxious gases and permit the addition of oxygen from the atmosphere. Large holes and channels were also cut in the ice. In some cases outboard motors were used to agitate the water in an attempt to trap oxygen in the water. However, little success came from these efforts.

During the biennium, ending June 30, 1936, dissolved oxygen samples were taken on the following lakes at regular intervals from the time the lakes were frozen over until the spring thaw:

Spirit Lake, Dickinson County
Silver Lake (Lake Park), Dickinson County
Diamond Lake, Dickinson County
Welch Lake, Dickinson County
Center Lake, Dickinson County
Upper Gar Lake, Dickinson County
Lower Gar Lake, Dickinson County
Minnewashta Lake, Dickinson County
East Okoboji Lake, Dickinson County
Swan Lake, Dickinson County
West Okoboji Lake, Dickinson County
Lost Island Lake, Palo Alto County
Trumbull Lake, Clay County
Pine Lake, Hardin County
Medium Lake, Palo Alto County
Crystal Lake, Hancock County
Silver Lake (Ayrshire), Palo Alto County
Cornelia Lake, Wright County
Clear Lake, Cerro Gordo County
Black Hawk Lake, Sac County
Blue Lake, Monona County
Brown's Lake, Woodbury County
Storm Lake, Buena Vista County
Twin Lake (Rockwell City), Calhoun County

Morse Lake, Wright County
Iowa Lake, Emmet County
Tuttle Lake, Emmet County
East Twin Lake, Wright County

During the winter of 1935, some fish died under the ice; however, the heaviest loss of fish occurred in 1936. For several months the temperatures ranged far below normal, and deep snow prevented natural aeration.

The Iowa State Conservation Commission allocated \$1,500.00 to carry on the work in 1936. In addition to the regular Fisheries Department employees, several governmental agencies, including the State Planning Board, Works Progress Administration, Civilian Conservation Corps, and others, cooperated in the work.

The services of two departmental employees were required to make the necessary oxygen tests to ascertain the condition of the various lakes.

In addition to these men, several other fisheries employees, Conservation Officers, and scores of interested sportsmen, spent a considerable amount of their time on the work. The Commission also authorized the employment of several men to operate the mechanical devices and to cut holes on several of the lakes.

The biological unit of the Planning Board rendered the following services:

12 men and supervisors on Lost Island Lake
3 to 4 men on Trumbull Lake
4 to 5 men on Silver Lake at Ayrshire
5 men on Storm Lake
13 men on Dickinson County Lakes

In addition to those listed above several groups of WPA men were used on North Twin and various other lakes.

The WPA carp crew on Medium Lake was used to keep holes open

on this lake.

In some instances long channels from 100 to 300 feet long by four to six feet in width were cut in the ice. Federal agencies responded promptly and willingly, but would not permit the men to work when the temperature went below zero. This seriously handicapped operations since there were but few days in January and early February when the temperature did not run from five to forty below zero.

Realizing the critical condition of nearly every lake in the state in 1936, the Conservation Commission opened a group of lakes to winter fishing. The purpose of this order was to encourage sportsmen to cut holes in the ice to allow the gases harmful to fish life to escape and aid in the aeration of the water. It was also thought best to allow fish to be taken in some of the extremely shallow lakes rather than to let them perish. The following lakes were opened to winter fishing:

East Okoboji (Narrows to Hatchery), Dickinson County
Swan Lake, Dickinson County
Lost Island Lake, Clay and Palo Alto Counties
Medium Lake, Palo Alto County
Lake Cornelia, Wright County
Black Hawk Lake, Sac County
North Twin Lake, Calhoun County
Morse Lake, Wright County
Mud Lake, Emmet County
Iowa Lake, Emmet County
Tuttle Lake, Emmet County
Big Lake, Allamakee County

Lower Pine Lake in Hardin County and Storm Lake in Buena Vista County were also opened to pole and line fishing from February 12 to March 31, 1936.

Although many fish died they were mostly carp, buffalo, and sheepshead whose loss was probably beneficial to the lakes.

Because mechanical methods by pumping air under the ice and by circulating water, and by opening long holes parallel to wind sweep, have had questionable value, the Commission decided to try some experimental work the winter of 1936-37 to see if better methods might be discovered.

Two types of equipment were used for comparative purposes. One method was a direct pressure pump system, the other a system of lifting water above the ice, mixing with the atmosphere, and then returning to the lake. The latter method proved more effective but neither seemed practical for aerating large lakes.

The only sure method to aerate lakes will be to get vegetation re-established in the lakes in sufficient quantities to produce a natural condition. Aquatic vegetation not only produces oxygen, but uses those gases that are deleterious to aquatic animal life.

Stocking Fish

One of the most important phases of fish management is to augment, where needed, natural fish population by artificial methods. The most feasible method is to stock the necessary species and numbers.

A stocking program is formulated by classifying all the waters of the state as to suitability for given species and numbers. The particular habitats are ever-changing which necessitates up-to-date information and continual revision of stocking quotas.

By adding available number anticipated from river collection and propagation sources, a reasonable quota is assigned to each potential stocking area. We have not reached the point where over-

stocking might be a problem. Each consignment serves as an activating nucleus necessary in much of our Iowa waters to compensate for the fisherman's take.

A total of 142,620,489 fish were stocked in the waters of the state during the biennium ending June 30, 1936. Of this number 3,925,489 were fingerlings, yearlings and adults and 139,695,000 were pike-perch fry.

A survey of the fishing areas has been made which enables the Commission to intelligently recommend the proper species and numbers of game fish for each individual body of public water in the state.

With the exception of the brown and rainbow trout, every species stocked is native to the waters of the state.

To assist the re-establishment of a biological balance the stocking of fish by the U. S. Bureau of Fisheries, upon application by private individuals, is first sanctioned by the Commission before the Federal Government forwards the fish to the applicant. By this cooperation with the U. S. Bureau of Fisheries, the State has knowledge of all fish stocked in Iowa. This method also assures the U. S. Bureau of Fisheries that the fish will go into suitable waters.

Fish used for stocking the inland waters are secured from the four fish hatcheries, the nursery pond units, and from fish salvaged from the overflow waters of the Mississippi River obtained in connection with the regular rescue operations. These fish are transplanted to the various streams and lakes by trucks equipped

with steel tanks especially constructed for hauling fish. When the fish are delivered the consignee signs the distribution report and the local Conservation Officer is notified that they have been stocked in his territory.

Without artificial propagation fish for stocking inland waters must be taken from rescue operations. However, taking fish from one place in the state to another is not production nor fundamental conservation. The justification of this system in the past has been the idea that these fish might be lost anyway; therefore, it was a matter of a tax on the principal for handling the rescue business.

It is true that the fish collected for inland stocking probably go into better fish environment and might be considered "the predator's take" if they were returned to the river.

Rescue

Inland Rescue: This work is accomplished by Department crews and by the aid of sportsmen's groups and Conservation Officers.

Five crews were operated by the Department the current year of 1937. These crews operated from centers where heaviest floods have occurred. They cooperated with the Conservation Officers who had informed the Department where the most urgent rescue work was needed. A "crew" consisted of local help secured by the departmental employee directing the work.

The volume of work on inland rescue is contingent largely upon weather conditions for the year. This condition makes yearly records of fish rescue fluctuate so much that comparison cannot be

drawn to illustrate progress. Rather, progress is measured by comparing methods and checking results that affect more efficient rescue of fish.

The present plan to more efficiently handle rescue operations consists of departmental rescue supervisor with "pick-up" truck and seines to service particular districts that need experienced seiners.

Mississippi River Rescue: This work is pursued as in previous years. At the present time conjecture is rife as to what effect canalization of the river will have on the fisheries operations on the Mississippi River--whether or not there will be more or less fish to rescue.

One step forward in rescue work that is now accomplished is a complete daily record of the operations at each place seined. This record contains number and species of fish rescued, size and weather conditions as well as such notes on environment, the non-technical fisheries worker can give.

Over a period of years such information will have value in determining population ratios, spawning information, and other pertinent facts concerning fish and their management.

Obnoxious Fish Removal

Many of the lakes and streams in Iowa are infested with carp, quillback, gar, and dogfish, which are undesirable because of species and numbers. If buffalo become too numerous they are removed.

The Commission believes that a definite rough fish removal program is necessary and that unceasing efforts should be made to

control these fish. It has been definitely proven that where heavy populations of "obnoxious" fish are present the natural environment for the desirable game fish, which were once abundant in these areas, is destroyed. For these reasons a supervisor is placed in charge of this work and departmental crews and equipment are used to do this type of work.

The carp is probably the most abundant "rough fish" found in the state. This fish is not native to Iowa, having been introduced into the state about 1880. Since that time carp have increased and are now universally found in nearly all state waters, infesting many of our lakes and streams.

The carp, because of its life habits, destroys aquatic vegetation which is a part of the environment needed by much of the aquatic life on which the game fish feed and which provides spawning places for the "pan" fish. The spawning habits of carp destroy large numbers of nests and eggs of the game fish and soon reduces a lake to a roily bullhead status.

The carp is a very prolific spawner. A five or six pound carp may scatter a half-million eggs in a single season in the shallows throughout the up-rooted vegetation. On the other hand, a black bass only deposits from two to five thousand eggs in a nest which must have parental care. This shows the difference in the habits and reproductive ability of these two fishes and demonstrates one reason why carp increase at a rapid rate and soon gain a preponderance in population.

The condition of Lower Gar Lake, in Dickinson County, illustrates the destructive habits of the carp. A few years ago this

lake contained heavy growths of aquatic vegetation which not only made this area a desirable place for game fish but also provided food for migratory waterfowl. Since the carp have infested this area the aquatic vegetation has almost completely disappeared and the area does not at this time have suitable environment for game fish nor food in sufficient quantity to attract migratory waterfowl in such numbers as in former years.

All pertinent factors were taken into consideration in the development of the obnoxious fish program. When conditions change in the areas under treatment the plans are made to conform to the new situations.

The old practice of drag seining the major lakes at the time of year when aquatic vegetation and the spawning areas of the game fish might be disturbed or destroyed has been discontinued.

During the past biennium where the problem has been to keep the rough fish population under control "spot" seining methods were used. Briefly, this system is where carp attempt to congregate in large numbers in certain bays or inlets previous to spawning, a short seine is used to quickly remove these undesirable species. By this method few game fish are disturbed and little harm done to aquatic vegetation and other life phases that belong to game fish environment.

In the natural lakes, where carp or starved buffalo have gained an over-population, as is seen in Silver Lake at Lake Park, long drag seines are used so that effective removal will be speedily accomplished. Often 5,000 feet of seine is pulled in a single haul.

Extensive work in rough fish control was also carried on during the biennium by sportsmen's groups, Conservation Officers, and WPA workers under the supervision of the Fisheries Department.

At West Okoboji, each winter for the past 20 years, residents of that locality are permitted to gill-net under the ice for carp and buffalo. These people are under contract with posted bonds and actually are designated agents of the Commission. By this method, 48,984 pounds of buffalo and 10,260 pounds of carp were removed in 1935-36; and 86,723 pounds of buffalo and 23,385 pounds of carp were taken in 1936-37.

Few game fish are taken in these nets--a total of 41 was taken in 1935-36 and a total of 86 was taken in 1936-37. The game fish were released as soon as they were found in the nets. Each fisherman is required to keep a daily record of take, species, size, and other pertinent information. All of the activities are daily supervised by Conservation Officers. The State received a percentage of the receipts from the sale of these fish to make the work self-supporting.

The rough fish removal work is carried on to improve conditions for fishing in the state and not as a commercial proposition. It is the policy of the Commission to eliminate all obnoxious fish possible irrespective of their sale value. On the major seining projects the rough fish that are saleable are sold to make the program as nearly self-supporting as possible. The fish are sold to the highest bidder; however, the Commission reserves the right to reject any or all bids. Many pounds of these obnoxious fish are given to relief agencies and needy people. 493,361 pounds were

given away in 1936 and 236,241 pounds in 1937.

River rough fish control is pursued in late fall and during the winter months in order that the least damage will be done to game fish environment and other aquatic life.

It would be far too optimistic to hope for total elimination of carp; however, the Commission has demonstrated that rough fish can be controlled if a definite program is followed.

Improvements

Streams: Stream improvement trends toward a goal where the work is of a permanent nature, mainly cross-dams of rock and logs. This provides improvement of long duration without heavy yearly up-keep. This work was made possible through Federal work agencies, although some stream improvement had been done by interested sportsmen.

Many of the streams in Iowa flow through fertile fields with watersheds or eroding hills. When heavy rains descend the streams are silt-laden.

The denuded hillsides permit virtually all the rainfall to become run-off water which quickly reaches the streams. The heavy suspensions of rich top soil in the water are deposited in the stream beds changing in drastic fashion the natural fish environment.

During the summer months stream flows are often decreased to a point which prohibits desirable fish life. During these periods of drought the fish migrate to the impounded waters above the power dams or to the deeper holes in the river bed.

The Commission has deemed it advisable to construct low-head dams in some of the streams to create a sufficient depth of water to carry fish through low-water stages.

Low-head dams are a satisfactory type of stream improvement in Iowa. There is a sufficient flow of water in normal years in many Iowa streams to support greater fish populations than now exist, and these numbers can be increased under proper management.

Silt and sand deposits caused by spring floods destroy a considerable amount of aquatic vegetation and often the eggs of nesting fish are covered or destroyed.

Silt also destroys the cover and hiding places of fish which is often extremely scarce in the streams. Adequate protection for the fish during flood periods is essential for proper habitats.

Brush shelters and logs not only furnish protection to game fish and their young but also furnish a place where enormous quantities of aquatic insect life such as caddis, stone, dragon, and midge fly larvae can exist which are an important part of fish diets.

Some of the early devices installed in many of the Iowa streams were ineffective. Although these devices were satisfactory in other states the nature of the streams in Iowa is somewhat different and it was found that many of these devices were not applicable to our streams. However, after experimentation and study devices were placed in the streams to meet the individual demands of each area.

To date sixteen streams in Iowa have been wholly or partially improved and public access has been secured on portions of forty-one non-meandered streams by agreements between the landowners and

the Commission.

In addition to the regular improvement work, sixteen low-head dams have been constructed, or are in the process of construction, to impound a sufficient depth of water to support fish life during the entire year. These dams vary in height from three to ten feet, the average being approximately six feet. Game fish are stocked in the backwaters behind these dams as part of the improvement plan.

In Bear Creek, Winneshiek County, near Highlandville, along with the stream improvement devices, trees have been planted along the stream banks in an effort to restore this stream to something like an ideal trout stream. In other sections tree planting is a part of stream improvement.

Lake Improvement: The continuance of the artificial lake program, initiated by the Fish and Game Commission, has been one of the major efforts in the past biennium.

With the impetus gained from the efforts of the Fish and Game Commission, new artificial lakes have been built; the first dredged lake has been completed and the machinery moved to Black Hawk Lake in Sac County.

The present Conservation Commission has plans to improve all of the lakes for fish life. Due to various causes many of the Iowa lakes, both natural and artificial, do not present ideal conditions for the fish life that should naturally abound in such areas.

To improve, in a measure, some of the situations, surveys were made of the particular areas to be improved, work that would prevent the immediate erosion of shore lines was outlined, spawning

areas were re-established by the introduction of vegetation, and suitable bottom for the nest-building fish was provided. Inlets and outlets were properly screened to prevent obnoxious fish from entering the areas and likewise to prevent fish in the lake from escaping through the same channel. Silt dams and other devices were used to minimize direct siltation. Erosion control methods were directed on the watershed of certain lake areas through cooperation from Federal agencies. In addition, the lakes were subjected to planned stocking, definite rough fish removal programs, and necessary regulation of the fish take.

Because of the stupendous amount of improvement work to be done and the limited amount of available labor and funds, a period of years must naturally elapse before all of the needed improvement work is accomplished.

The work on natural lakes here enumerated consists of bank protection and other types of immediate improvement on the areas listed:

- Silver Lake, Dickinson County, 900 feet of shore rip-rapped.
- Silver Lake, Palo Alto County, 3,000 feet of shore rip-rapped. Slab rock and glacial boulders were used.
- Spirit Lake, Dickinson County, dam at inlet repaired to prevent fish leaving the area.
- Medium Lake, Palo Alto County, 6,000 feet of rip-rap with glacial boulders.
- Crystal Lake, Hancock County, 500 feet of rip-rap with glacial boulders.
- Screens were replaced or repaired in Medium Lake and Rush Lake, Palo Alto County; and Spirit Lake, Dickinson County.

Aquatic vegetation has been planted to improve Lower Gar Lake in Dickinson County, East Twin Lake in Hancock County, and Lake Cornelia in Wright County. Plans have been made and are under

way to make wholesale plantings of suitable aquatic vegetation in certain of the natural lakes. The amount of vegetation to be planted will be dictated by availability of material, labor, and funds.

Artificial Lakes: A specific part of the artificial lake construction is the preparation of the lake bed for fish environment. This work consists of the installation of log and brush shelters that offer a harbor for small fish, furnish a sub-stratum for small, crawling forms of life that are used as food by the smaller fish, serve as wave barriers to cut down bank erosion, and fill other biological needs of such an artificial area.

In addition to these types of improvement devices, rock shelters, and tile and gravel spawning beds are placed in the shallower reaches of the artificial lakes. This work has been done by volunteer labor and by labor furnished through Federal agencies. The following lakes have been treated with lake bed improvement devices as described (part of this work was done previous to 1935):

Lake Wapello, Davis County; 1,244 log and rock devices
Lake Keomah, Mahaska County; 212 shelters
Backbone Lake, Delaware County; 92 brush shelters
Upper Pine Lake, Eldora, Hardin County; 36 brush shelters
Lake Macbride, Johnson County; 306 brush shelters
Beed's Lake, Franklin County; 112 brush shelters
Springbrook Lake, Guthrie County; 31 brush shelters
Lake Ahquabi, Warren County; 85 brush shelters
Bedford Lake, Taylor County; 120 brush shelters
Lacey-Keosauqua Lake, Van Buren County; 36 brush shelters

Except in Lake Wapello there is an average of about five rock shelters and spawning bed devices to each of the major log and brush devices in the above lakes here listed.

Aquatic vegetation planted in these areas is here listed.

This work was planned and supervised by the Conservation Commission.

Beed's Lake, Franklin County; 4 truck loads
Ahquabi Lake, Warren County; 2 truck loads
Lake Wapello, Davis County; 9 truck loads
Lake Keomah, Mahaska County; 2 truck loads
East Twin Lake, Hancock County; 3 truck loads
Lake Cornelia, Wright County; 2 truck loads

Before the water reaches the spillways of the artificial lakes, suitable fish screens are installed to prevent contamination of the area by obnoxious fish coming up-stream. These screens also restrict the fish stocked in the lake from leaving the area.

Because sections of the shore line of the artificial lakes are steep, log and rock rip-rap were installed along such sections before the area experienced maximum lake level. At the present time, the improvement of the artificial lakes has not been completed due to incomplete construction of other phases of development of the areas.

Further, the initial fish plantings were arranged in order that species, size and types of fish would be in harmonious cycles, and bring the area to a quicker biological balance than would be experienced if left to time, nature, and the elements.

A creel census has been kept at Lake Wapello since it was first opened to public fishing, June 15, 1936. Help in making this census was received from the National Park Service CCC Camp, located at Drakesville.

The following information was received from this census. In 1936, the average catch per fisherman was 7.4 fish per fishing effort. During the same period in 1937, the average catch per fisherman was 7.7 fish per fishing effort. 58 percent of the fish caught in 1937 were pan fish, the remainder were bullheads. 66,000 people

attended Lake Wapello during the fishing season of 1936.

Plants were taken from Big Wall Lake in Wright County by WPA workers by virtue of a State Planning Board Biological project and planted by CCC Camps.

The number of plants gathered are as follows:

Giant Bulrush - 13,140 stods
Round Bulrush - 49,608 stods
Cattails - 3,476 stods
Other cattails secured locally and planted at
Lake Wapello - 3,050 stods

(A stod is similar to a piece of sod and contains from 6 to 10 plants.)

Lakes where a planting program is proposed for the spring of 1938 are as follows:

Crystal Lake, Hancock County
Lower Gar Lake, Dickinson County
Silver Lake, Dickinson County

Where special types are to be introduced in limited quantity:

West Union Lake, Fayette County
Lake Manawa, Pottawattamie County
Macbride Lake, Johnson County
Bedford Lake, Taylor County
Beed's Lake, Franklin County
Storm Lake, Buena Vista County
Lacey-Keosauqua Lake, Van Buren County
Springbrook Lake, Guthrie County
Upper Pine Lake, Hardin County
Backbone Lake, Delaware County

All planting is contingent upon availability of labor. If labor can be secured additional areas will be included.

Sportsmen's groups have seen the value of such work and have taken an active interest in lake improvement by rip-rapping and installing shelters in city reservoirs, and by placing them on the ice to be scuttled later.

At Crystal Lake, Hancock County, with the financial help of sportsmen, material is on hand for fish shelter construction on the ice. This work has been planned, initiated and supervised by the Commission. Sportsmen at Spirit Lake bought vegetation and planted it in East Okoboji Lake.

Where the same species once thrived, vegetation has been introduced into other areas. At Lower Gar Lake, 15 truck loads were planted the spring of 1937 by the aid of WPA labor. All of these plants grew and thrived.

The chart here included was prepared to assist the field worker in planting material at the proper time, depth, etc.

<u>Name</u>	<u>Depth to plant in water</u>	<u>Material</u>	<u>Depth to plant in silt</u>	<u>Time to Plant</u>
Great River Bulrush (<i>Scirpus validus</i>)	18"-24"	Roots	6"	April & May
Great River Bulrush (<i>Scirpus occidentalis</i>)	18"-24"	Roots	6"	April & May
Giant Bulrush (<i>Scirpus fluviatilis</i>)	18"-24"	Roots	6"	April & May
Wide-leafed Cattail (<i>Typha latifolia</i>)	6"-12"	Roots	6"	April & May
Narrow-leaf Cattail (<i>Typha angustifolia</i>)	6"-12"	Roots	6"	April & May
Spatterdock (<i>Nymphae advena</i>)	18"-24"	Roots	6"	April & May
Spatterdock (<i>Castalia odorata</i>)	18"-24"	Roots	6"	April & May
Duckweed (<i>Lemna minor</i>)	Floating	Entire plant	Water surface	May-August
Arrowhead (<i>Sagittaria latifolia</i>)	6"	Roots	4"	April & May
Coontail (<i>Ceratophyllum</i>)	24"	Entire plant	3"	June to August
Water Milfoil (<i>Myriophyllum</i>)	24"	Entire plant	3"	June to August
Wild Celery (<i>Valisneria spiralis</i>)	5'	Seeds or tubers	Sow seed Mud Ball	Sept. or April
Sago Pondweed (<i>Potamogeton natans</i>)	12"	Tubers	Push in mud	April to June

<u>Name</u>	<u>Depth to plant in water</u>	<u>Material</u>	<u>Depth to plant in silt</u>	<u>Time to plant</u>
Sago Pondweed (Potamogeton amplifolius)	Muddy	Roots	Push in mud	April to June
Cane - Reed Grass (Phragmites communis)	Muddy banks	Roots	3"	April to June
Iris (Iris versicolor)	6"	Seed or roots	3"	April, May & June
Pickerel weed (Pontederia cordata)	18"	Roots	6"	April & May
Water plantain (Alisma p. aquatic)	6"	Seed or roots	3"	April to May
Wild Rice (Zizania aquatica)	6"-24"	Seed	Sow on sur- face	In October through ice

The many feet of natural lake shoreline that have been ripped with stone prevents direct erosion of the lake banks. This work was done by WPA labor under the sponsorship of the Conservation Commission. The product of these efforts is of tremendous importance to a restoration of Iowa's natural lakes.

Water levels were stabilized by dams, improved screening methods for controlling ingress and egress of fish, and spawning areas at Silver Lake, Palo Alto County; Tuttle Lake, Emmet County; and Spirit Lake, Dickinson County; have had natural spawning areas preserved by erection of low dams to hold the water in such areas until after the spawning seasons. Roads have been built to make fishing areas easily accessible.

Plans and help in improving city and railroad reservoirs have been a part of the Commission's work in improving fishing areas of the state.

A boat fish census was set up on some of the natural lakes this year. By this census we learn what the take per man fishing hour is at given times. At Lost Island 3.35 fish were caught per man fishing hour. If this work is carried along for several years we will secure fundamental information for managing our lakes.

Acquisition

Trespass waivers or easements to improve streams for fishing are taken as it is practicable to secure them. This will make more miles of fishing area for Iowa recreators.

Up to July 1, 1935, Iowa streams through 157 land sections were listed and preliminary surveys made on all but six sections. Since that time 129 stream miles have been listed for possible improvement.

An outstanding piece of this improvement work is seen in the Shellrock River from Plymouth to Rock Falls and in the Winnebago River from Fertile to the "Red Mill."

41 different streams in Iowa have had attention from preliminary surveys to actual completion of dams or devices.

The first requisite for improving Iowa streams is to have them accessible to the public. 800 miles of the streams flowing through Iowa are meandered. 15,000 miles of Iowa streams have been named, yet many miles of these streams flow only part of the year. Our recent stream survey records approximately 4,000 miles of potential fishing miles in the state, including the 800 miles of meandered streams. This shows that about 3,200 miles of the best fishing areas are privately owned.

To date we have secured 317 easements from landowners to permit stream improvement work.

Acquisition of lake shore has been secured on several lakes. Of the natural lakes Black Hawk Lake in Sac County has the greatest length of state owned shore line.

The excluding of cattle from the margins of our state lakes will be a great step forward in Iowa conservation. Cattle allowed to pasture lake and marsh areas destroy and permanently eliminate both fish and game environment. For these reasons all marginal lands belonging to the state should be fenced.

The major areas acquired during the two and one-half year period under discussion are the Lanesboro Hatchery pond of 30 acres in Carroll County, twenty-seven and one-half acres adjoining the Wapello Hatchery, that has the two new ponds (three and six acres each), the area for the Beed's Lake Hatchery at Hampton, and the pond areas at Bedford in Taylor County.

Surveys

A number of fish surveys have been made in Iowa covering certain sections or streams (Call's "Survey of the Des Moines River Basin," Iowa Academy of Science, 1887 and Larabee's survey of the Okoboji Region, Iowa Studies, 1926, are examples.), but no one has ever made a state wide survey to learn what species of fish exist in the state.

At least an inventory seems of prime importance in successfully operating any business; therefore, in order to better manage Iowa's fish fauna a state wide survey is being conducted that will take two or more years to complete if it is carried along "piece-meal" with other work.

Briefly, the plan is--certain stations are designated in each county where collections are made at regular and stated intervals. All pertinent biological data is noted at times fish are collected.

By this method comparisons can be made from year to year on abundance of given species in relation to changing environment.

Forbes of Illinois set the Illinois Natural History Survey to repeat every decade; however, a three-year interval is more desirable for Iowa.

At the present time 60 counties are represented in the collection which have yielded two new species for Iowa, one has been reported in "Some Common Iowa Fishes," Aitken, 1936, the other, Hybonathus placitus, is described in an unpublished paper "Iowa Minnows" (same author).

It is hoped that funds and help will be available the coming season to finish the remainder of the 99 counties as quickly as possible.

We now have 132 native fishes described for the state with 30 on the hypothetical list. These may be found at any time in the state as they have been noted in our neighboring waters.

A fish survey is basic to any state fish management plan.

Another technical survey is one made this past season of certain privately owned marsh areas adjacent to state lakes that are potential fish and game spawning and nesting areas.

When normal water levels exist many of these areas have sufficient water to be ideal for the above mentioned purposes, yet because they are privately owned are open to cattle and other livestock pollution and grazing depredations. These swamp areas are to our natural lakes what the bedroom and kitchen are to the house. Under the present riparian status in Iowa we have control of the living room, but strangers, or the "visiting relatives," have pos-

session of the other rooms, all of which is detrimental to domestic tranquillity.

In each of these areas approximate acreage, fauna, flora, and other factors helpful to a fish and game area are described and listed.

A survey of fish take (creel census) has been established on several of the natural lakes and at Lake Wapello. The following account of this work was presented to the Midwest Fish and Game Conference, November 11, 1937:

"The first requisite in the management of any business is to know how much stock you have on hand. It is a rather simple operation to secure an inventory of merchandise as it exists in the retail stores or warehouses. It is even a simple process to count live stock, poultry, etc., even wild animals can be counted and we know that the Biological Survey counts the ducks, geese, and other migratory waterfowl. I am sure the pheasants, quail, rabbits, and other land forms of wild life can be counted without much error, but the counting of fish as they exist in any stream or lake has long been considered next to impossible. At least, few people have attempted such an undertaking.

"However, the man who would manage fish must have some fairly definite knowledge of the number and species that live in the area under treatment. No person could operate a shoe store and stay in business very long if he took over a store without any knowledge of the kind and number of shoes on the shelves, and retailed his merchandise and bought from the wholesale houses without any idea of the number of pairs of shoes he was selling. Yet this method of doing business is exactly the way many states are handling their fisheries operations. No fisheries department does this with total indifference to the facts, but rather because they think a fish census is either impossible or presents too many complications for practical untanglement.

"In the management of fish in Iowa we realize that if we would intelligently do our work and improve fishing for the angler we must know, not only what numbers and species are stocked and are being taken by the public, but what fish exists in each body of water.

"To attack this problem we have set up several types of census that give us both general and detailed information on given areas. This may be considered as supplemental biological work of value for comparative studies of certain areas in checking results of stocking, natural reproduction, and take.

"Our comprehensive census, the results of which will be reported at some later opportunity, is conducted on Lake Wapello, Davis County. Lake Wapello is an artificial lake that has been fished two seasons. The census card used is similar to the one Eschmeyer uses on Fife Lake, Michigan. The CCC boys, with some departmental help, collect the cards. The next problem is to get the cards handled voluntarily by the fisherman for our experience shows that information gained in a whole-hearted cooperative spirit is much more dependable than information that comes from a request bordering on the nature of a demand.

"One of our more general types of census, used for the first time this year, was tried on Lost Island Lake, a bullhead fisherman's paradise. This census is called a "boat census." We use a card 3 x 5 inches, which only requests date, number fishing from boat, total hours fished, and species and number of fish taken. This gives us a take per man fishing hour. Over a period of years reliable comparative information will be obtained on success of stocking and extent of natural reproduction. As an example, if 500 fishermen caught 4.5 bullheads per fishing hour throughout the month of June this year and in 1939 500 fishermen, fishing the same month, caught 6.0 fish per fishing hour, it could be assumed that our stocking of over one and one-half million fingerling bullheads this year produced this increase providing natural reproduction was stable for this period.

"Each boat livery is asked to give these cards to their customers; one card to each boat. The success in getting these cards filled and returned seems to be due to their simplicity. We find that boat livery managers like this type much better than the more complicated form. I think part of the hesitancy in using the complicated form is due to the request for signature; for, after all, who wants to acknowledge in writing that he is a poor fisherman. Signatures on cards also have a tendency to give you cards with fine fishing results to prove the angler is a good fisherman.

"Advantage is taken during the winter rough fish gill-net operations on West Okoboji Lake and on the gill-net operations in the spring when the pike-perch are taken for stripping to secure data on fish populations, move-

ments under the ice, sex ratios on spawning beds, and other facts concerning fish and physical factors that might effect their behavior.

"Another type of census conducted by the Iowa Department, which is linked to our biological investigations in the big lakes, is an actual count of all fish taken in the seines in our rough fish removal operations. In this census we check number, species and size, as well as record acre feet of water seined. Weather data and other physical conditions are noted. Each haul is circumscribed on a map of the lake so that, as in the case of the complete seining of Silver Lake at Lake Park, we have a vivid picture of each haul at each location with all pertinent facts.

"With a boat census established at this lake next year and succeeding seasons we can formulate definite plans to best manage the fish and their take at this place.

"I believe the various fisheries departments of the country should first check their own activities to see where they may take advantage of their routine operations to secure information on fish populations and so collect and record this information that it may be used by the aquatic biologist in recommending improvement plans. It is my understanding that some work of this kind has been done by the Illinois Natural History Survey.

"In summarizing our census activities, we have at type areas the elaborate creel census card system; at several of the large natural fishing lakes we use the boat census method; on areas seined for rough fish we have our own departmental haul census; on the Mississippi River we have the commercial take reports which can stand a lot of improvement; and we have our own biological survey information to check against our layman's reports, which all brings us to conclude that census systems must be used which are simple to operate yet will give us accurate information.

"At this time I emphasize the need to improve census taking methods and to continually urge and point out to fisheries departments how much information will assist such departments in better supervising their work and help them to more efficiently manage their fisheries problems.

"After all, in Iowa a law has been passed which makes it compulsory for the Conservation Commission to know what the wildlife population is in any given area at seasonal periods. Therefore, in Iowa, at least, a fish census must be taken seriously by the fisheries worker and by the conservationist who is fish-minded."

The state wide fish survey, the marginal land survey adjacent to our lakes and streams and the creel census work, are the three major fish surveys under way at the present time.

Other biological investigations are those on "wall-eye" fingerling production, trout feeding experiments, bass propagation, inspection of new areas for suitability of fish producing areas, and year-round observations on areas that have been established for fisheries purposes. The coming year of 1938 will see studies made to determine best method or device for passing fish over dams or other similar stream barriers.

Further Research and Educational Work

To secure help in fisheries work based on scientific knowledge, the volunteer aid of the state schools and other colleges and Junior colleges of the state was urged.

This appeal was made and suggestions for pertinent research recommended in an address before the General Session of the Iowa Academy of Science, meeting in Iowa City in April, 1936. (See Proceedings of Iowa Academy of Science, 1936, "Research vs Conservation," Aitken).

Later suggestions were made to the National Youth Administration in Iowa which were readily accepted. All of these problems suggested had practical application to Iowa fish plans. A number of the Iowa schools were interested and some research was inaugurated on conservation projects by NYA students.

Several biology students of Iowa Wesleyan College, under the direction of Prof. H. E. Jacques, made a worthwhile contribution.

They studied the amount of insect food in a given length of Big Creek in Henry County.

Prof. C. C. Carter, at Parsons College, directed several NYA students on Iowa conservation problems relative to value of city water reservoirs as suitable for fishing areas.

The Lakeside Laboratory, formerly known as the Macbride Lakeside Laboratory, is open ten weeks each year on the west shores of West Okoboji Lake. Here graduate students, under the direction of Prof. J. H. Bodine, of the State University of Iowa, pursue problems concerning chemical status of the lake water, parasites of fish, effect of evaporation on vegetation, life histories of prairie plants and their relation to the Iowa natural lakes and other outdoor research. At this station the United States Biological Survey, in cooperation with the Conservation Commission, built a number of new stone buildings in 1936 and 1937 with modern equipped laboratories.

Educational work in fisheries fields has consisted of lectures to sportsmen and department groups and the preparation of fish questionnaires, radio talks, and printed and mimeographed reading material on fish management.

The success of improving the fishing for Iowa anglers will depend largely upon the support accorded this movement by the general public. To secure their unstinted cooperation we must face and recognize the fundamental principles that govern all life and educate the youth of Iowa to appreciate, preserve, and protect the heritage of our fathers.