Compliments of

N. H. Cohen,

President Illinois Fish Commission.


HAVANA

FIELD OF BIOLOGICAL STATION OPERATIONS LOW WATER.

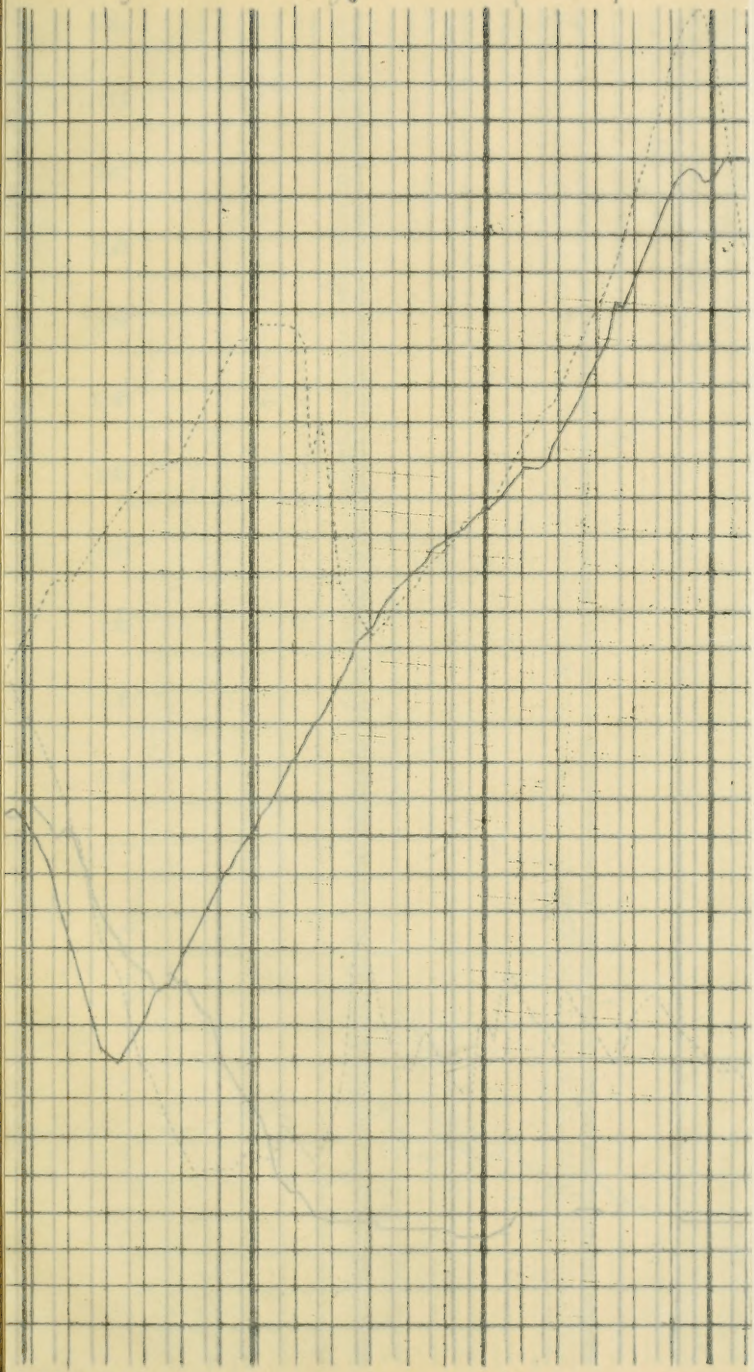
AFTER U. S. GOVERNMENT SURVEYS, REVISED BY MEMBERS OF THE STATION STAFF

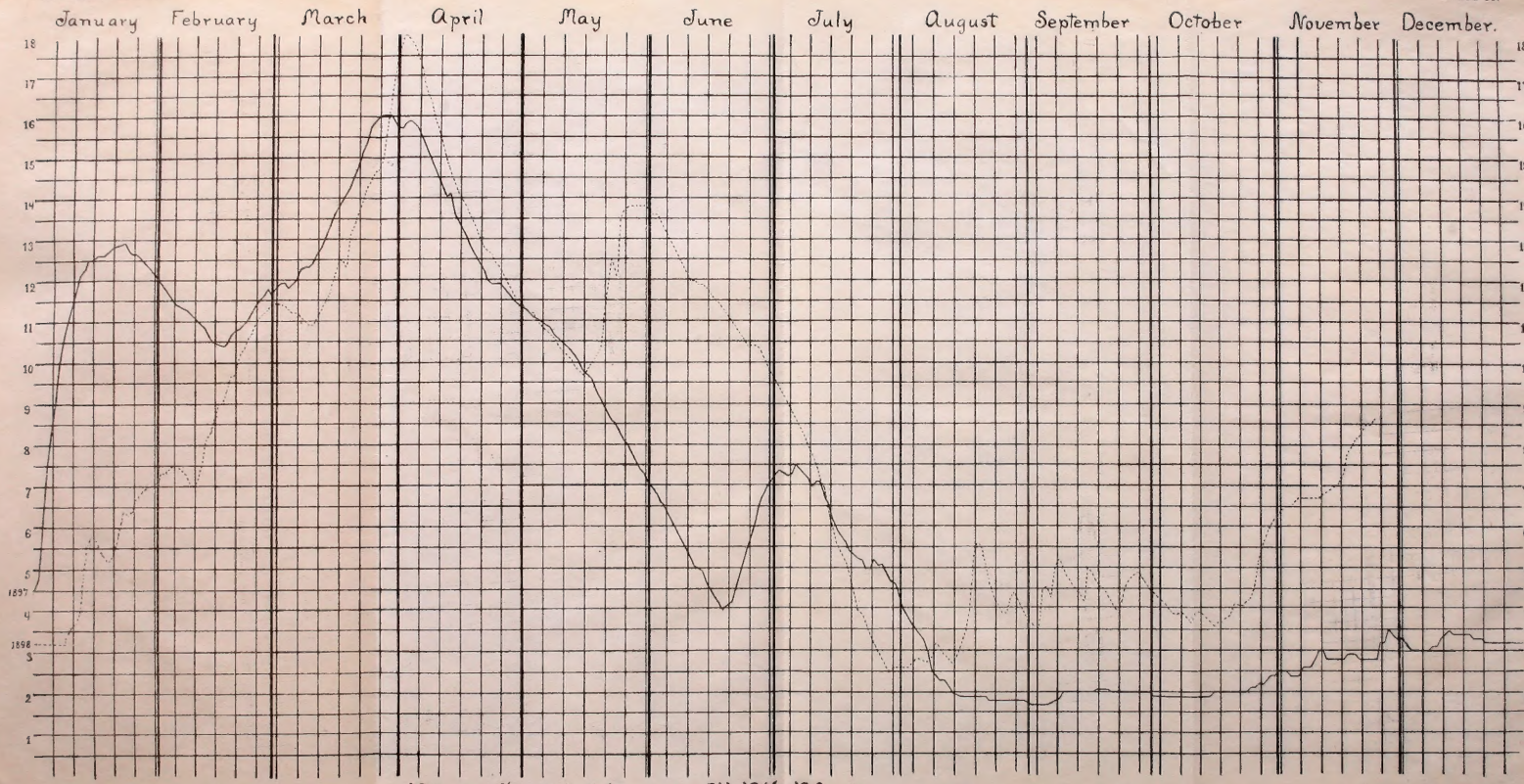
DRAWN BY LYDIA M. HART.

Wagon Road
Bluff.
Substation.

½ ¼ ½ 1 2
Scale of Miles

March
Forest.
Sandbar.





River Gauge, Havana, Ill. '97 & '98. Basis of Reference is Low Water Mark.

QUIVER LAKE, ILLINOIS RIVER, AND THE ILLINOIS BOTTOMS, LOW WATER.

QUIVER LAKE, ILLINOIS RIVER, AND THE ILLINOIS BOTTOMS, HIGH WATER.

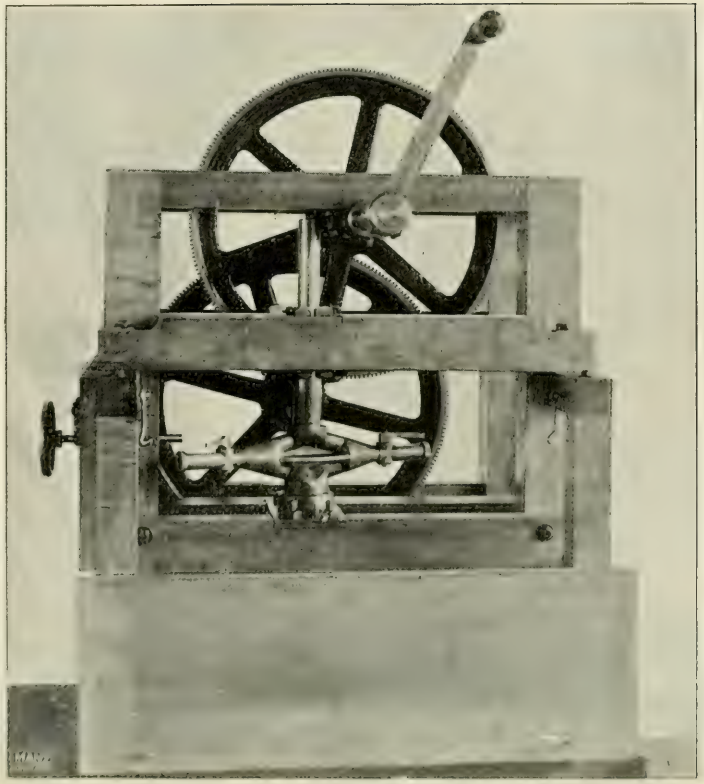
UP THE RIVER, FROM FOOT OF QUIVER LAKE, LOW WATER.

UP THE RIVER, FROM FOOT OF QUIVER LAKE, HIGH WATER.

QUIVER LAKE, WITH VEGETATION.

QUIVER LAKE, WITHOUT VEGETATION.

DOWN THE RIVER FROM STATION C.



THE PLANKTONKRIT.

REPORT

OF THE

ILLINOIS STATE FISH COMMISSIONER

FROM OCT. 1, 1896, TO SEPT. 30, 1898.

SPRINGFIELD, ILL.:
PHILLIPS BROS., STATE PRINTERS.
1899.

REPORT OF COMMISSIONERS.

To His Excellency, JOHN R. TANNER, *Governor:*

We beg leave to submit herewith our report as Board of Fish Commissioners for the two years ending September 30, 1898:

The work of the commission, so far as the collection and distribution of fishes is concerned, has been prosecuted along the same lines as in previous years. A decided increase is reported in the number of game or finer varieties of fishes found in the inland streams and lakes, while on the large rivers and lakes the increase in these varieties, as well as in the coarser varieties of food fishes have been very large. Heretofore, we have had no opportunity of arriving at any definite or accurate calculation as to just what increase there had been in the output of fish, from a commercial standpoint, except from general observation that fish were plentier. Now, we have an annual report from the Fisherman's Association giving us the amount of fish bought, taken and sold at twenty-two points on the Illinois river.

This association is composed of the fishermen and fish dealers along the Illinois river, and has a membership of over one thousand. A very large amount of capital is employed, and the business as a whole is one of great importance, particularly to the various towns along the river, many of them depending almost entirely on the fishing industry for their maintenance.

The report referred to is made to the secretary of the association, each individual or firm buying or catching fish for the market sending in an accurate statement of business done, and the whole showing exactly what amount of money fish bring to the people.

A glance at these reports will disclose some remarkable facts, probably known to comparatively few, or at least seldom given to the public. Eighty-five per cent of the whole number of fish taken is of the coarser varieties, such as carp, buffalo, catfish, suckers, white perch, etc., while the black bass represents only one-half of one per cent of the whole amount sold or offered for sale in 1898. This showing demonstrates a fact known to those who have followed up the life habits of fishes, viz: that under natural conditions in the rivers and lakes tributary to the Illinois river, eighty-five per cent of the whole number found must necessarily be of the coarser varieties in order to furnish the essential amount of food for the carnivorous varieties, as under such conditions this relative percentage always exists. The coarser fishes can not be taken with hook and line to

any considerable amount, their increase is naturally enormous, and if left unmolested nature would assert herself in some way to diminish the supply, either by disease or by freezing or drying up the waters, thus bringing about a proper balance. For instance, the German carp at full maturity will deposit from 100,000 to 300,000 eggs. Now, should any considerable percentage of these arrive at maturity the waters would soon become overstocked; but comparatively few, however, are productive of fry, and such as are being preyed upon by voracious fish, only a small percentage escape, still enough remain so that if left undisturbed they would soon fill the water to repletion, and these fish should be taken by some means and utilized for food. The product of the waters should be gathered for the use of the people as certainly as the grain is gathered from the fields, and to do this appliances must be used that will take them in quantities sufficient to make it a business, giving employment to both capital and labor. Such an industry is best seen in this State along the Illinois river, although good results are shown in various parts of the State elsewhere. This commercial interest is a large one and important, not only from a pecuniary standpoint, but from a hygienic one as well. Fish as food in some form or other finds its place on the tables of both rich and poor, almost every day of the week, the finer varieties as a delicacy for the rich, the cheaper and coarser as necessary food for the poor.

We submit herewith a statement of the association for the two years ending January 1, 1898, that of 1897 showing a very decided increase over that of 1896, and so far the year ending January 1, 1898, gives promise of an even greater increase if the present rate of catch is maintained.

Annual Report of the Illinois Fishermen's Association, Compiled from Reports Received from the Different Shipping Points on the Illinois River, giving the Estimated Amount and Kinds of Fish Caught, and Value of Same for the past Year, Ending February 15, 1897. By Alex Sargeant, Secretary:

Shipping Point on Illinois River.	German Carp.		Buffalo.		White Perch.		Catfish.		Bull Pouts.		Sunfish and Red Perch.		Strip'd Bass.		Croppie.		Black Bass.	
	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.	Lbs.	Val.
Hennepin	11,500	.02½	8,000	.02½	1,000	.02	220	.04	4,800	.03½	1,000	.02	.....	.....	1,200	.06	700	.09
Putnam	18,000	.03½	20,000	.03½	2,780	.03½	2,320	.04	5,480	.03½	3,700	.03	.....	.....	3,500	.06	800	.10
Henry	208,000	.03¼	21,000	.03¼	5,000	.02	.....	.....	2,000	.03½	2,000	.03½	1,000	.06½	5,000	.06	1,000	.10
Chillicothe	200,000	.02½	25,000	.02	10,000	.02	.....	.....	14,000	.03½	3,000	.03	1,000	.05	1,000	.07	1,500	.09
Lacon	100,000	.03	10,000	.03	3,000	.03	2,000	.03	20,000	.03	4,000	.04	4,000	.04	4,000	.05	3,000	.08
Peoria	575,000	.02½	320,000	.02½	8,000	.02½	5,700	.03½	11,000	.03	7,000	.03	.....	.....	3,000	.06	1,700	.09
Pekin	200,000	.04	100,000	.03	1,000	.04	40,000	.04	31,600	.04	10,000	.04	4,000	.06	20,000	.06	4,000	.10
Kingston	2,000	.02½	7,943	.02	.....	.....	.....	.....	616	.03½	343	.03	.....	.....	366	.06	100	.09
Liverpool	41,000	.03	19,400	.03	15,000	.02½	36,000	.03½	14,800	.03½	6,350	.02	650	.03	3,800	.05	515	.09
Havana	456,000	.02¾	273,500	.02½	561,500	.03	86,624	.04	123,800	.03½	37,965	.02	13,452	.03	12,805	.06	7,652	.09½
Bath	75,000	.02½	130,000	.02½	13,000	.02	19,000	.03	11,000	.03	10,000	.02	8,000	.05	3,000	.06	1,200	.08
Browning	268,000	.03	148,000	.03	7,000	.02	62,400	.04	.....	.....	16,000	.02½	8,000	.04	3,000	.04	8,100	.08
Beardstown	1,253,000	.02½	291,000	.02½	22,100	.02½	15,200	.04	62,600	.04	11,900	.02	17,000	.04	3,600	.05	1,880	.09
Meredosia	190,000	.02	60,000	.02	3,000	.02	4,000	.04	3,000	.04	5,000	.02	7,000	.04	2,000	.05	3,000	.08
Pearl	40,000	.02½	120,000	.02½	10,000	.02½	20,000	.05	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Kampville	9,000	.03	120,000	.03	75,000	.01½	25,000	.04	7,000	.03	50	.02	3,000	.07	500	.07½	500	.09½
Hardin	1,500	.02½	30,400	.03½	9,000	.02	14,400	.03½	600	.04	1,200	.02	300	.07	2,500	.07	1,500	.08
Grafton	30,000	.03	90,000	.02½	11,000	.02	50,000	.04	300	.03	8,000	.02	5,000	.07	.....	.....	2,000	.08
Total	3,678,000	.....	1,794,243	.....	777,380	.....	382,864	.....	311,996	.....	127,508	.....	72,402	.....	69,271	.....	39,147	.....

Kind of Fish.	Total Pounds.	Net Value.	Per Cent.
Carp	3,678,000	$99,059 50	49.49
Buffalo	1,794,000	48,139 00	24.79
White Perch	777,380	20,452 30	10.82
Catfish	382,864	15,024 06	5.94
Bull Pouts	311,996	11,259 36	4.41
Sunfish and Ring Perch	127,508	3,080 59	2.00
Striped Bass	72,492	3,234 06	1.02
Croppie	69,271	4,004 36	.99
Black Bass	39,147	3,433 99	.54
Totals	7,252,811	$207,687 22	100.00

All of which is respectfully submitted, February 25, 1897.

M. D. Hurley, *President.*

John A. Schulte, *Treasurer.*

Abe Hollingsworth, *Vice-President.*

The following is the Second Annual Report of the Illinois Fishermen's Association, Compiled from Reports Received from the Different Shipping Points on the Illinois River, giving the Estimated Amount and Kinds of Fish Caught and Value of same for the past Year, ending January 15, 1898, by Alex. Sargeant, Secretary, Bath, Illinois.

Shipping Point on Illinois River.	German Carp—Pounds.	Buffalo—Pounds.	Catfish—Pounds.	Bull Pouts—Pounds.	Sunfish and Ring Perch—Pounds.	Striped Bass—Pounds.	White Perch—Pounds.	Croppie—Pounds.	Black Bass—Pounds.	Value of catch By pounds.
Depue	40,000	119,000	1,000	4,000	1,200	900	4,100	1,000	625	$2,033 50
Spring Valley	40,000	13,500	600	1,100	700	575	4,100	400	415	1,735 45
Hennepin and Buren Creek	80,000	60,000	100	7,000	2,000	1,200	15,000	2,000	930	7,874 40
Henry and Putnam	700,000	200,000	1,000	21,000	3,000	2,000	6,000	3,000	2,000	27,610 00
Chillicothe and Lacon	350,000	120,000	100	16,000	3,500	2,000	70,000	2,000	1,050	21,523 00
Peoria	1,350,000	620,000	200	40,000	600	3,000	107,000	2,500	1,210	57,217 20
Pekin	120,000	61,000	.....	9,000	2,500	2,500	2,000	2,090	1,070	14,595 00
Liverpool	82,000	35,000	38,000	10,000	8,000	650	15,000	1,000	530	5,319 40
Havana	1,013,990	391,454	18,000	93,620	37,018	1,206	23,280	8,554	13,061	44,532 12
Bath	80,000	90,000	.....	16,000	3,000	3,000	2,500	2,000	11,000	5,632 50
Bluff City	80,000	60,000	1,000	5,000	5,000	100	2,000	200	400	3,987 00
Browning	475,000	548,000	45,000	.....	22,000	3,000	8,000	2,000	700	27,956 00
Beardstown	978,000	327,000	14,000	59,500	13,000	12,000	28,000	3,000	2,100	34,983 00
Meredosia	100,000	40,000	10,000	3,000	5,000	5,000	3,000	2,500	2,500	5,400 00
Valley City	30,000	90,000	8,000	.....	.....	.....	10,000	.....	.....	3,270 00
Pearl	10,000	120,000	20,000	.....	.....	.....	10,000	.....	.....	4,650 00
Kampsville	9,000	120,000	10,000	5,000	50	3,000	75,000	500	500	4,173 50
Hardin	2,000	46,500	9,000	5,000	1,500	300	700	1,500	1,000	1,875 00
Grafton	20,000	100,000	40,000	.....	7,000	5,000	11,000	2,000	1,500	5,085 00
Pounds of each species	5,489,990	3,061,454	235,000	285,000	120,468	35,431	394,680	40,654	40,621	
Value by species	$164,699 70	$61,229 08	$9,400 00	$8,550 00	$2,409 36	$1,771 55	$23,140 00	$2,032 70	$3,249 68	

Kinds of Fish.	Total pounds.	Net value.	Per cent.
Carp	5,489,990	$161,699 75	56.58
Buffalo	3,061,454	61,229 08	31.55
Catfish	235,000	9,400 00	2.36
Bull Pouts	285,000	8,550 00	2.45
Sunfish and Ring Perch	120,468	2,409 36	1.65
Striped Bass	35,431	1,771 55	.71
White Perch	394,680	23,140 00	4.17
Croppie	40,654	2,032 70	.42
Black Bass	40,621	3,249 68	.41
Total	9,703,298	$279,482 07	100 00

M. D. HURLEY, *President*,
JOHN A. SCHULTE, *Treasurer*.
ALEX. SARGEANT, *Secretary*, Bath, Ill.

As will be seen by the above figures from twenty points along the Illinois river, fish to the amount of $207,687.00 were taken out and sold in 1896, and $279,482.00 in 1897. This only represents the fishermen connected with the association, and does not fully represent all of the fish taken, as there are hundreds of men who are fishing for market that do not sell their fish to wholesale dealers and are members of the association, but find a market either locally, or ship in a smaller way on their own account. We have no doubt that their figures, if they could be accurately procured, would increase the output 25, perhaps 50 per cent, but this however, could only be an estimate.

Their figures represent only about two hundred miles frontage on one of the rivers of this State out of nearly or quite one thousand miles frontage of rivers productive of this great food product.

Organization will follow all over the State, in fact your commissioners are advocating it continually, and have tried to promote a good feeling between the fishermen and the commissioners. That certain laws must be enacted and enforced to protect the fish is self-evident, for although the greater part of the fishermen see the necessity of some protection, there are hundreds who do not, and who look upon each day's catch at any season of the year as a matter of profit, and without care as to what the future may or may not produce.

We advocate as great protection to those who fish for a living along lawful and legitimate lines as is given any other class of business, as it is equally as honorable as any and in importance much greater than some.

We have been very severely criticised by a great many, in that they claim we are neglecting proper protection for the game fish and are to a great extent overlooking the interests of the angler. Some going far enough to undertake to maintain the position that the use of the seip should be prohibited entirely in all the waters of the State. That it was the cause of great destruction and would in time wholly deplete the river. This position is true in part, but only when applied to the smaller streams and inland lakes of the State, and in that matter is fully covered by the laws upon our statute books now, but when applied to greater rivers is entirely at fault.

While the commission is doing its best to promote and encourage the production and protection of the coarse fish, and the business interests connected with it, we are certainly making it possible to increase, as it can be done in no other way, the game fishes.

Every responsible fisherman is now as firm an advocate for a proper close season as we are, and indeed some of the more vigorous laws proposed emanate from market fishermen.

We have frequently received severe criticism as to the practicability of the introduction of the German carp. Perhaps we dot not need to go to any greater length in the discussion of the subject than to give here letters from the largest fish dealers on the Illinois river. These letters will be found in their proper place in the appendix. Carp are accused of driving out all of the game fish, and destroying the young of all other fish. The best argument to refute that theory will be a plain statement of the conditions that exist this season (1898).

On Illinois river carp are more plentiful than ever, growing to immense size and the increase in numbers wonderful. While there are more black bass and croppie on the Illinois river this season than for many years before, and we cite many instances in lakes along the Illinois river where very large hauls of carp have been made, one in particular aggregating 30,000 pounds, and yet that lake has furnished the best bass fishing on the Illinois river. This instance is not an exception, but repeated many hundreds of times in greater or less degree along the whole length of the river. Here it may be well to note one very particular and unusual phase of the fish business this season to show the relative supply:

Carp at some times has brought a better price on the fish boats than the best table fish we have, viz: the black croppie or strawberry bass. Croppie were so plentiful that the local demand would not take them up. While carp, equally plentiful, found a quick market at 1 cent per pound higher price. Most of the carp being bought, however, for eastern markets.

DISTRIBUTION.

The methods of collecting are the same as used by the commission heretofore, viz: gathering fish from the drying ponds along the river bottoms, selecting such as are fit for distribution, and rescuing the remainder to be put into the nearest deep water.

Our distribution has been made mainly to public waters, although we have supplied a large number of private applicants who have made ponds or arranged lakes for their reception. Some of those applying for fish have expended large sums of money to prepare such ponds. Our distributions have consisted largely of large mouth black bass, black and white croppie, wall-eyed pike, red-eye perch, sun fish and channel cat fish.

Distribution for the season of 1897 was numerically not so large as 1898, but in our opinion was much the better in point of value.

For some cause difficult to explain satisfactorily the black bass spawn generally in the spring of 1897, or if so, spawn failed to hatch, consequently there was a very limited supply of fry; but on the other hand there was an abundant supply of yearling fish, that is, fish that were hatched the previous spring.

Under the circumstances we could not carry large numbers in distributing, but fewer and larger fish so far as the bass were concerned; but every black bass that was so deposited was in a condition as to age and size to reproduce the following year, which of course would not have been the case if fry alone had been used.

The spring of 1897 was very cold and a succession of cold rains followed each other until late in the spring, in fact into the summer, and it is possible the eggs of the bass failed to mature. Certain it is that very few small black bass were taken, when usually in favorable seasons they were abundant. The opposite condition of affairs existed in 1898. The spring was warmer and earlier, water quite high and out of its banks for a long period, and the bass fry was early and abundant, and as before stated, the growth was simply wonderful, so that in point of numbers the distribution has exceeded any previous year. The fish were carefully handled by competent men, care being taken to keep the temperature of water uniform in the can, and lake or pond when planted. Very few instances have been reported where dead fish have been found after our plants. In supplying private applicants we have endeavored to impress upon them the importance of providing food for the carniverous or so-called game fishes by the introduction of the coarser fishes into the pond or waters containing the finer varieties.

The exclusive cultivation of these latter has never been successful, and can not be, unless under extraordinary conditions. Under natural conditions, where ponds are not disturbed from year to year, and when black bass are found most plentiful, from eighty-five to ninety per cent of the fish supply will be found to consist of the coarser fishes which go to supply food for the carnivorous varieties, and there will also be found plenty of plant growth, and large quantities of *crustacia*. But as certainly as black bass and croppie are planted by themselves in ponds or lakes where their necessary food conditions are not supplied, just so surely will the hoped for increase prove a failure, for the stronger will prey upon the smaller and weaker, and only the stronger can survive. Many instances might be cited in corroboration of this statement, but none to show that any such experiment has ever been successful.

The best results can only be had with black bass and croppie, no matter when planted in land-locked ponds or lakes, where a very large proportion of all the fishes are of the coarse and more prolific varieties.

A list of fish distributed for seasons of 1897 and 1898, will be found in the proper place in appendix.

INTRODUCTION OF SMELT.

Your Commissioners have had under consideration the advisability of the introduction of the Anadromous Smelt into our rivers and lakes. This fish will make a valuable addition to the fish supply. As a table fish they are unexcelled, and are superior to any for producing food for the carnivorous fishes. The commissioners of New Jersey say, in their late report:

"Some years ago several successful attempts were made at land-locking the Anadromous Smelt, and the result showed that while transplanting the fish into fresh water did not deteriorate them in the least for the table, they materially increased in size."

We can, no doubt, obtain needed supply for introduction by an exchange with the New Jersey commission for some of our native fishes.

The commercial value of this fish is large and the consumption general. Chicago markets, during the proper season, distributing large quantities. As a production of food for other fishes the same authority says:

"The capacity of water to produce fish being graduated by the quantity of the food found by the fish, your commission in 1897 turned its attention to the supplying of streams and ponds with bait fish. In the water of the State of Maine there are two kinds of land-locked smelts, the large and the small. The large fish attain a growth of from five to six inches, the small fish of from three to four inches. Experience has shown that these fish are admirably adapted for food for other fish, and in Maine it has been a rule of some years' standing that no pond or stream will be stocked until there is a plentiful supply of smelts for the other fish to feed on."

This argument would hold good in our own land-locked waters. Plenty of vegetation and food should be introduced into ponds before carnivorous fish are planted.

FISH LAWS.

At the last session of the General Assembly (40th) all of the laws pertaining to fish and fishways were revised, and amendments made that have enabled the commissioners to bring about a better enforcement of them.

A limit of size of fish lawful to sell or offer for sale was incorporated, and has been the means of protecting, to a greater extent than before, the small fish. Heretofore, if a fisherman could, by use of a small mesh seine or net, take small fish and take them to market without being taken in the act, he escaped unpunished. After the enactment of the present law the commissioners undertook to stop their sale in the hands of dealers, warning them always for first offense, and if fish were found in their possession a second time, prosecution followed. It has resulted in most of the dealers refusing to receive or handle any except such fish as meet the requirement of the law.

As there is no market for them, shipper and dealer being alike responsible, fishermen do not catch them, or if they do, turn them back into the water, and by this means hundreds of thousands of pounds of good food is saved to the people.

A year's growth of the most of fishes in our waters is wonderful. Black bass this season (1898) spawned in May, will average in November six inches long, while a great many were taken while we were collecting for distribution that measured eight and one-half inches in length and weighed one-half a pound each. The growth of the coarser fish is much greater, and carp weighing one and one-half pounds not unusual at same age.

The low shallow lakes in the bottoms along the Illinois and Mississippi rivers are great breeding places, and it is not unusual during the hot months to find the temperature of the water ninety degrees, which causes not only a rapid growth in the fishes, but produces with equal rapidity the food necessary for their sustenance. These conditions do not exist everywhere, and the growth of fish is very much less rapid where the temperature of the water is lower.

For instance, Governor John R. Tanner and Col. J. R. B. Van Cleave, for a number of years have spent some of the summer months at Lake Miltona, Minn., and they have had metal tags, numbered, attached to small mouth black bass and other fish when caught, then liberating the fish after a record was made as to date of capture, the weight, etc. The following seasons a bounty or premium was paid for each fish taken with a tag, so that the increase made could be determined. Col. Van Cleave informs us that two or three ounces was the extent of the increase in weight noted in a year, and after careful investigation he found that a small mouth black bass called "tiger bass" and properly so, six inches in length would be four years of age. While as before stated we have taken plenty of large mouth bass weighing eight ounces and measuring eight and one-half inches in length six months old from our Illinois river, lakes and sloughs. So that there can be no doubt that if undersized fish were put back in the water when taken, and given a year's growth, hundreds of thousands of pounds of good food would be saved to the people, and the opportunity of making more money would be given to the fishermen.

Sec. 6 of our fish laws, published in appendix to this report, will show size lawful to sell or offer for sale. The penalties for violation of the fish laws have been increased and as a consequence, men who could afford to run the risk of being caught in violation of the law with a probable fine of $5 as a consequence, hesitate to do so when the fine is $25.

As a matter of fact, under the previous provision of our laws, it was frequently the case that fishermen deliberately used seine or net in violation of the law, and plead guilty, paying a nominal fine, and then as they expressed it, "made big money."

The law needs some further amendments, the principal one being the need of the protection of fish that congregate near the dams, a limit as to distance they should be permitted to be taken should be

named, during certain seasons of the year, covering the spawning period. During the spawning season the fish in their efforts to go up the streams are obstructed from doing so by the dams, and congregate there and are found to be an easy prey to the fishermen. The use of the trammel net is prohibited in any waters and we have found it difficult to enforce this provision, from the fact that some of the courts hold that the trammel net is a seine, or rather a combination of seines, as defined by best authorities. While this may be true, they are in no sense a seine, and never used as such. The trammel net as such should be clearly defined and its use prohibited. Just to what extent a net, (fyke or hoop) is an obstruction to the free passage of fish up, down or through the water, should also be clearly set forth, for if allowed to be used at all limit as to extent of leads attached should be stated While every opportunity should be given the fishermen to catch fish when lawful to do so, certain restrictions are necessary and the law should be explicit enough so that no misunderstanding or misapprehension could exist as to the use of the appliances.

TRAMMEL NETS.

Perhaps no device has done more to bring fishermen into disrepute than the trammel net. And certainly none has done no more mischief to the game fish. A lake covered with moss can not be seined. Such a lake is an ideal home for the black bass. Here, however, the trammel netter gets in his work, setting his net near the edge of the moss, and in their efforts to escape they are driven into the trammel net and caught. We have a law prohibiting its use, but it has been so construed as to make the trammel net a seine, and as a consequence we have failed to convict in several very plain cases of violation of the law.

We would suggest such changes in the law as would explicitly describe a trammel net and prohibit its use at all times.

FISHWAYS.

One of the most important parts of our work has been the enforcement of the fishway laws. Each succeeding season develops a greater necessity for properly constructed and protected fishways over the dams, and on this depends largely the equitable distribution of the breeding fish. That the dams across some of our rivers have been the principal causes for the partial depletion of our upper rivers, no one who has any knowledge of the habits of our native fish can doubt.

President Cohen has given the matter his special attention and has had placed twenty-seven fishways over dams in the State during the last two years, and was successful in doing so without litigation.

Fishways or fish ladders are devices for enabling fish to ascend a fall or go over a dam. They consist usually of a chute with a sinuous track for reducing the velocity of the water and assisting the passage of fish to the level above the dam. A number of devices are used in the several states, having laws compelling their use. That used in Illinois, is in our opinion, one of the simplest made, cheap as to con-

struction and entirely practical. The large dams over the Illinois river are not as well equipped in this particular as they should be, but in ordinary seasons the necessity for them is not so great as in the smaller streams. As when the spring rise is on, it is generally speaking sufficient to cover dams entirely and allow the passage of fish. When the spring opens the fish always start up streams to locate spawning beds, their progress is interrupted by the obstruction, and congregating there they continue their efforts to get over frequently until they have passed the spawning period. This gives an opportunity to take them in large quantities with the hook and line, and in fact the catches are so great that they amount to simply slaughter. At some of the dams more fish are destroyed during the season by anglers, than are taken by the seine in the same locality during the whole year.

At a meeting of the Fish and Game Commissions and the Fish and Game Associations of several states in Chicago, February 1898, this matter was taken up and after thorough discussion a resolution was passed asking the legislatures of the several states represented, to enact a law that would prohibit the taking of fish with any device, within 400 feet of a dam from April 14 to July 1 of the same year.

President Cohen of our Board introduced the resolution and his argument will explain itself. He said, "given a two and one half pound bass that has 12,000 to 15,000 eggs in its ovaries. If this fish is taken, as it can easily be, before it has a chance to spawn, and that period may be under certain circumstances June 1st, there has been destroyed every chance of that increase. If these are taken, as they are by the hundreds, how long can our water sustain that kind of a drain, only a short distance to almost total depletion. I, personally, know of one instance in this state where one rod killed 127 small mouth black bass below a dam on Kankakee river, more than one half being females and almost ripe. This is only a single instance of wholesale slaughter of this kind that commonly occurs. As fish are of a gregarious nature, at that time of the year particularly, they congregate below dams, seeking in vain a passage to the level above, and are at the mercy of the unsportsmanlike angler, who never leaves until the last of these poor starved ovaparous vertebrates have been taken, then, homeward bound, he displays his catch amid enthusiastic admirers who gloat over his mammoth slaughter."

We advocate an amendment covering the period named prohibiting taking and killing of fish within 400 feet of any dam, by any device, from April 1st to July 1st of the same year.

We have as yet several dams in the State that are unprovided with fishways, but all are in process of adjustment, some of them are in the nature of unsettled estates, and some where ownership is in litigation. But we hope to accomplish the purpose without recourse to litigation. Plans and specifications have been prepared and are always promptly furnished by the commission.

FISH WARDENS.

The enforcement of the law by Fish Wardens has not been as satisfactory in the main as we could have wished, although the Wardens have not been altogether to blame. After spending time and money to get cases ready for court, they have too frequently been unsuccessful in the prosecution of such cases, and in some instances where fines have been inflicted and collected, they have been witheld by the officials having charge. As the payments of Wardens for their services come solely from the fines collected, it can readily be seen how unsatisfactory such a condition of affairs must prove.

We have had a great deal of trouble in Chicago, and at times both the Wardens and ourselves have been placed in a very peculiar position, with positive evidence of violation of the law, and yet fully convinced that no intent of such violation existed. For instance, a fisherman at some of the rivers or lakes makes a catch or purchases fish, packs them in a box or barrel and ships them to the Chicago market. Of this shipment some of the fish will probably be under the prescribed size, and can not lawfully be sold or offered for sale. The commission merchant or wholesale dealer takes off the top of box or barrel and exposes them for sale, the retail dealer buys them in bulk, and removing them from their shipping case at his own place of business, openly offers them for sale, regardless of size. Now if a Warden comes along and inspects the fish, he finds the small fish, and the dealer is arrested and probably fined for offering undersized fish for sale, when so far as knoweledge and intention is concerned he may be innocent.

Your commissioners with their attorney have had several meetings with the wholesale dealers of Chicago, and have canvassed the matter with them very thoroughly, and while a large proportion of them seem to be perfectly willing, not only to obey the law but to assist us in enforcing it, there have been quite a number who have objected and given us a great deal of trouble, by getting the retail dealers into offering undersized fish for sale.

This would seem easy to overcome by reaching the wholesale dealers directly, but unfortunately we have found that, in the majority of cases, the retail dealer would rather fight a case against himself than to risk the enmity of the wholesale dealers and the possibility of cutting off the supply by appearing against them.

True, the class of wholesale dealers alluded to in such cases, is few in numbers, but there are enough to give considerable trouble. As before stated, the best known and responsible houses favor a vigorous enforcement of the law, and have assured the commissioners that they will refuse to receive or pay for fish of unlawful size, and that they will even have examination of each package made, if necessary. The argument has been used by some dealers that if they refused to take and sell the small fish shipped them, they would lose shippers. Possibly this may be true to some extent but the main purpose of the law is to destroy a market for fish under the lawful size, and thus discourage the taking of such fish by the fishermen, for they certain-

ly would not long continue the expense of catching and shipping fish that would be rejected by the dealer when received.

The theory of the law as it stands is, that to stop the sale of small fish is to stop the catching of them for market, and the enforcement of this law in the past two years has been productive of great good, and we believe it to be one of the best protective laws yet enacted.

We think that a warden system that would provide for a few paid wardens, rather than a larger number depending solely on the collection of fines for compensation, would be productive of a greater amount of good. As a warden with good judgment would warn dealers and show them their mistakes, rather than prosecute at first offense regardless of whether or not there was any intention of violation. On the other hand, it is a great temptation to a warden whose compensation depends solely on fines collected, to arrest whenever evidence is plain enough to make conviction probable, that is when fish under legal size are found in the possession of a dealer and offered for sale by him, although the offending party may be innocent in intent and purpose, and perfectly willing to rectify his mistake so far as possible by withdrawing such fish from sale or turning them over to the warden for disposition. The certainty of compensation for services, and the reimbursement of money expended in enforcing the law would make more efficient warden service, while the uncertainty of depending upon fines alone will not induce very effective work.

Few men care to incur the enmity of their neighbors, and spend their time and money to do so, unless there is some incentive back of it, either from an active public spirited interest in the cause or some pecuniary consideration which acts as the necessary inducement.

We call attention to wardens' reports, also their location, and the date of their appointments. All of which will be found in theproper place in the appendix.

OUR VISITING SPORTSMEN.

The fish interests in Illinois is not confined to the commercial phase of it alone, another and wider application should be made of its value. Illinois, particularly that portion lying along the Illinois River is beyond question the most prolific water in the country in its production of the gamey fish sought for by the angler. And the people who visit it each year for the sport of angling are numbered by the thousands. Many of them are from other states. Along the river are maintained a number of elaborate house boats for use of the clubs owning them, and in almost every instance other states furnish the larger part of the membership of the clubs.

The point we want to emphasize is, that a great deal of money is brought into the State by this means, and all classes of business men profit by it. Railroads, hotels, merchants, men as pushers, boats, etc. This is not overlooked by some of the railroads, whose management have given the matter investigation and offer inducements to the

sportsmen to take their outing on the Illinois or other fishing resorts in which the State abounds.

Statistics would be hard to make, showing even approximately just what the revenue from this source is, but that it is large there can be no doubt. Men come to fish and have an outing and spend their money. Our people get it, and both are satisfied.

The Commissioners of Fish and Game of the State of Maine made a computation of what Maine's game and fish preserves bring to that state yearly, and estimate the amount at $3,000,000 as money spent by visiting sportsmen in railroad fares, hotel bills, camp supplies, guides and the necessary expenses. This revenue is said to exceed the total receipts of the Maine summer resorts.

The fish sought by the men who come as anglers, the black bass, are only caught by the market fishermen to the extent of less than one per cent of all the fish taken.

In the northern portions of the State, at Fox Lake and lakes in Lake county, and in a number of places along the Mississippi, such resorts are well patronized.

REARING PONDS AT URBANA.

As the eastern portion of the State has not had as general attention as some of the other sections, it was thought advisable to establish a rearing or receiving pond somewhere centrally located on the eastern side of the State. After considerable investigation on the part of your commission, through the efforts of President Cohen, it was made possible to obtain the control and use of a beautiful pond at Urbana.

The pond is fed by springs and describes a complete circle, about 60 feet wide and 1,200 feet long, with an island in the center. The pond was carefully dredged, making it of good depth, and was filled with clear cold water, and complete, is an ideal home for such fish as would breed naturally there, and a storage or rearing pond for such collections as are intended for distribution along the eastern portion of the State. The advantage of this will be readily seen in time saved, in transportation and the expense attendant, besides the time saved as between Meredosia and the eastern portion of the State.

After the pond was placed in order it was thoroughly stocked and has produced for this season, 1898, a number of thousands of bass and croppie which have been planted in the rivers near by.

Just what would have been accomplished we can not say, as just at the time when the fry of the croppie and the bass began to show up in great quantities, a cloud-burst occurred which flooded the whole valley in which the pond is located, and our loss of fish was great, as thousands of the young must have been forced out.

STEAMER LOTUS.

While we have a fair code of fish laws, and they are as generally enforced as any of the protection laws, yet there is a tendency to take fish at times when it is unlawful to do so. For so many years it was considered almost a vested right by the man or men living along the rivers to take fish when and where they pleased, and it has taken very persistent work on our part to convince people in some localities that any law affects the right to take fish in that manner now. Scattered all along the whole length of both rivers are to be found small cabin boats, or perhaps rude cabins on the bank, the occupant a fisherman, dependent upon fishing for his support. They are away from the immediate supervision of the Warden and too often take advantage of that fact and use improper mesh or take fish at unlawful times. The most troublesome and one of the most destructive methods of taking fish is by means of what is known as a wing netting, or as expressed by the fishermen "shutting of a slough." This is accomplished in several ways. When the water is rising it backs up from the river through a slough into a lake or lakes. These lakes sometimes cover an area of thousands of acres before the river banks are submerged. Fish always go up through these sloughs into the shallow waters of the lakes on rising water early in the season to find spawning grounds and later during the season should the river take a "spurt" upwards, in search of food. As soon as the river begins to recede or come to a stand, the adult will undertake to go out into the river again. After the fish have gone in with the rising water, and before they have had a chance to get out, the wing net is used, and the slough or outlet is "shut off." This is accomplished by setting stakes, usually in a semicircle around the mouth of the slough, and hanging on them a piece of web, usually an old seine, after the manner of a fence. Now when the water commences to fall, fish undertake to go out, and they are simply forced into a funnel placed in the obstruction and every one of them can be taken. Frequently it is the case that fish so caught are in such plentiful numbers that they can not be used, and they are allowed to die there, as they do by the thousands, and are thrown out of the net into the river. On several occasions while going up the river we have met a continuous mass of dead and bloated fish floating down with the current extending for a mile or more, some wing-net fisherman having cleaned his nets, or thrown the dead fish out of live boxes, in which they are sometimes placed for market. The waste of fish in this way is very great, particularly after the weather has become warm. Fish crowded together as they are under circumstances given, soon perish.

The ordinary fyke net with long wings and leads is another destructive method of taking fish. They are frequently so placed by their proximity to each other and arrangement of the wings, that except in the channel of the river, the course of the fish is practically "shut off" and the instances are not rare when we have taken them from the channel itself. When we refer to the channel we mean that part of the river usually followed by the steamboat.

As will be readily understood these "shut offs" as a rule are along the river on either side at some distance from the towns, and not easily reached in any other way than by a boat of some kind. To meet this contingency we have used, for the past fifteen years, a boat of some kind, originally a very small propeller pushing a small barge. This was found to be altogether too small and a larger boat was purchased.

The steamer Lotus has been used now for the past eight years, and during the early season has patrolled the Illinois River removing such obstructions as mentioned, and given the enforcement of the law a general supervision. The demand, however, for a more extended service, brought about by the greatly increased interest in fish protection and propogation, will make it necessary to give that part of the rivers and water frontage not included on the Illinois River, a share of our attention, the Illinois River having nearly monopolized our work in the past. The Lotus, while giving good service on the Illinois River, can not be used successfully on the Mississippi River, as the current is swift and the power of the boat too light to give it proper speed. The Illinois River now has about two hundred and fifty miles of frontage out of over a thousand in the State. The Mississippi has four hundred miles and scattered all along are considerable fishing interests, its bottoms, wide in places, filled with great lakes, all preyed upon by the same class of men mentioned on the Illinois River, and this territory should have the oversight of the Commission and an effort be made to enforce there, as elsewhere, the protective laws.

As before stated, and for the reasons given, this can not be done unless we can use a larger, more powerful and swifter boat than the Lotus. We should be prepared to cover two hundred miles in twelve hours when necessary. Another and equally as important a reason for the use of a larger boat is that in collecting for distribution we can only carry a few thousand fish for any length of time with our present boat, as we are forced to place our tanks which are used in connection with our circulating apparatus on the outerguards of the boat and the space is quite limited.

On the Lotus every available space is utilized for some purpose, but with a boat of proper size and capacity it would be great enough to carry at one time the collections for a week or more.

This would enable us to work quickly the overflows which need immediate attention. As it is, we must collect for the day, and then run in and distribute our collection.

The Lotus now has lived the ordinary life of a steamboat, and while we have kept her up in good order, it has been at considerable yearly expense, which if it could be saved would go far towards paying for a larger boat. In the present condition of the boat we can work only the Illinois River.

The Lotus went into commission on March 1st 1897 and laid up at Havana, Illinois, December 3d 1897. In season of 1898, she went into commission March 16th. During the two years the boat has covered every portion of the river proper and every lake and slough

navigable. The crew have taken up hundreds of nets, warned hundreds of fishermen against illegal fishing and posted every part of the river. In the spring of 1898, the river rose very early, and reached an exceptionally high stage by the 1st of April. The rapid rise in the river caught a good many people unprepared who were living in the bottoms, in many instances without a boat or any way of getting to the main land from the bottoms or islands. Families were compelled to take refuge in upper stories of their houses or build log floats to get out of the way of the rising water. Corn in cribs and lots of it was in great danger of being lost. These people were mostly poor and dependent on what they had grown for a livelihood. Gov. Tanner, learning the situation, directed the Commission to have the crew and boats devote their time to the rescue of these people, their stock, etc. We engaged in this work for several weeks and did what we could to assist the unfortunate people. A number of families were removed to higher ground, and with the assistance of a barge their stock and grain were saved. With a boat large and swift enough, we think we can largely increase the value of the work, now assuming large proportions, and will ask the Legislature for money enough to buy, equip, and maintain such a craft.

The Lotus crew consists ot four men, as follows: Thos. Williams, Capt. and Pilot, Wm. V. McKinley, Engineer, J. D. Crompton, Fireman, A. T. Lorenz, Cook.

POLLUTION OF STREAMS.

One of the most frequent complaints reaching us is the pollution of streams by allowing the waste from gas factories, paper mills, etc., to escape into them. We have investigated the matter thoroughly and find we have no jurisdiction in the matter as a board.

The destruction of fish from this source is great, and some legislation touching on the subject should be enacted. Several times during the past seasons we have been called upon to investigate the great mortality among the fish, presumably from this cause. At several points on Fox river, particularly at Elgin, at Columbia Park on Desplaines river, and several points along the Illinois river, we have made personal investigation, and while we could not determine just what was the cause and definitely locate it enough was ascertained to leave no doubt in our minds that the fish were destroyed by those conditions.

Pollution of the waters to an extent sufficient to kill fish, must surely present a menace to the public health and some vigorous efforts should be put forth to arrest and prevent further danger from such causes. The ordinary sewage from towns emptying into the rivers is enough of itself to endanger life and health, but when to that is added acids and other poisonous matter, it would seem that such conditions would call for legislative interference.

LEGAL SERVICES.

Our work has been so extended and the complications so numerous in our efforts to enforce the fish and fishway laws, particularly in and about Chicago, that we have been compelled to employ legal help.

The State's attorney and his assistants have about all they can give attention to, and while willing to help in all they can, find it impossible to attend personally to the frequent cases brought in justices court. Attempts have been made to enjoin the Commissioners or their assistants from enforcing certain sections of our laws. This has been successfully resisted.

We will require such legal assistance as will enable us to promptly protect us in the enforcement of our laws.

TRANSPORTATION.

After our collections are made they must be taken to other waters, and the question of transportation has been one of the important features. If it had not been for the assistance and co-operation of the railroads of the State our distribution must have been exceedingly limited, for every move made with the heavy tanks in which our fish are transported costs money, they are of great inconvenience at times, in baggage cars, where they must be carried, particularly when baggage is running heavy. We have been treated with the utmost courtesy and liberality by the different railroad managements.

The fish are transported in the baggage cars accompanied by a messenger, whose duty it is to keep the water properly aerated; this is important when connections are made or lay overs from any cause occur.

Carrying live fish is a matter which is attended by a great deal of risk. As long as the water is kept thoroughly agitated and thus furnished with air, there will be no loss, but a few minutes only are required to lose them all if not given the required attention. Then it is necessary to carry fish so they will not be injured, as a slight injury, such as loss of a scale, or scratch on the eye will quickly result in a fungus condition and the fish will probably die. Fish must also be prepared for change in temperature of the water; ten degrees difference between the water they are taken from and that in tanks into which they are placed for transportation, would prove injurious. The same thing applies when planted. The water in the tanks must gradually be brought to nearly the same temperature as the lake or river into which they are to be placed. A great deal of expense and hard work can easily be wasted by not using proper precaution all along the line. The water in the lakes or sloughs from which the fish are rescued is frequently above 90 degrees, but to carry safely the temperature of the water in tanks should not be above 60 degrees and to put them directly into tanks or receiving ponds would be to almost instantly destroy them all. By a system of cooling down, involving 12 hours' time, the water is slowly brought down to requisite temperature. Without constant attention and good assistants money

and time would be thrown away. Fish may reach their destination in apparent good order, and be planted only to show up on the surface of the water dead soon afterwards. Now, we must have access to baggage cars on railroads and have more or less room and create more or less trouble, but with all of this we have had only the most courteous treatment from the railroad employés. We again repeat our statement, without the generous assistance of our railroads we could only have made a limited plant, while as it is, we have far exceeded our expectations with the limited amount of money at our disposal.

We are indebted to the following railroad companies for favors:

Chicago, Burlington & Quincy Railroad.	St. Louis, Keokuk & Northwestern Railway.
Wabash Railroad.	Chicago, Peoria & St. Louis Railroad.
Illinois Central Railroad	Indiana, Decatur & Western Railway.
Cleveland, Cincinnati, Chicago and St. Louis Railroad.	Indiana, Illinois & Iowa Railroad.
Chicago & Eastern Illinois Railroad.	Peoria, Decatur & Evansville Railway.
Wabash, Chester & Western Railroad.	Lake Erie & Western Railroad.
Toledo, Peoria & Western Railroad.	Jacksonville & St. Louis Railway.
Elgin, Joliet & Eastern Railroad.	Baltimore & Ohio.
Iowa Central Railroad.	Chicago & Texas Railroad.
Chicago, Burlington & Northern Railroad.	Diamond Joe Packet Co.
Fulton County Narrow Gauge Railway.	Illinois River Packet Co.

ACKNOWLEDGMENTS.

We can not close this report without acknowledging our indebtedness to those who have materially assisted us in our work.

Governor Tanner has taken a lively interest in the work and fully co-operated with us in giving his sanction and frequently his supervision.

The other State officers have placed us under obligations time and again in various ways. The railroad managements have not only been liberal, but have interested themselves in giving us facilities to do our work to an extent that has frequently been a matter of inconvenience to them.

They have added much to whatever success we may have attained and made it possible to cover with our plants a large amount of territory we could not otherwise have reached.

The employés too have cheerfully given us assistance at all times and anything else than courteous treatment would be an exception at their hands.

The press of the State has given us considerable attention, frequently criticising us or perhaps some part of our work, but as a rule as ready to correct any errors, and on the whole we are indebted to them for very favorable assistance.

We are indebted to the Illinois Fishermen's Association for valuable assistance in procuring the statistics we rendered and for general information from time to time. Their co-operation has been greatly appreciated.

SUMMARY.

Of all the large economical interests protected by the State, that of the fisheries industry is least appreciated, because less is known of it and its extent. Illinois is one of the best watered states in the Union, and its waters the most productive of them all. That the water is or can be made more productive than the land has been demonstrated. The shad industry in the east, running down to almost nothing in output, through the efforts of the U. S. Fish Commission in propagating and planting, was brought up to a point where it now represents a commercial value of millions of dollars.

The Illinois River at one time was a great producer of buffalo, a fish that was easily taken during the early months of spring, particularly during the rolling or spawning season. Farmers with gigs or pitch-forks caught them, and they were shipped by tons to St. Louis and other markets. Soft and unfit for food but they could be taken easily and in quantities.

They were sold by the commission merchants and the net proceeds remitted, frequently the shipper was asked to send money to pay charges, and one-half to three-fourths cents a pound was a fair average return on a good market. The result of this drain at this season of the year, was almost the total extinction of the buffalo.

The German Carp were introduced into the waters of this State by the Commission to overcome, if possible, the deficiency, and the result has been an increased supply yearly of a fish better than the buffalo, for shipping purposes, and much hardier and more prolific.

Aided by the efforts of the Legislature in giving us protective laws, the buffalo are again in good supply, and the output from the Illinois River alone, will aggregate nearly a half million dollars, yearly, and 90 per cent of these are the coarser fish, about 58 per cent being carp and 26 per cent buffalo. These fish brought an average price of nearly three cents a pound at shipping point. Each succeeding year shows an increase not only in the output but in the investment in the business as well.

The rescued fish from the overflows that are used for distribution into inland waters represent in a few years an enormous amount of food. We can not say just how much, but we do know that under favorable conditions every bass or croppie so planted means two or three pounds of food for somebody at the third year at latest.

The rescued fish that are taken from these overflows, and placed in nearest deep water, are numbered by the hundreds of thousands and comprise both coarse and fine fish and go a great way in swelling the volume of food produce each year when protected by the size limit of our law, keeping up the supply now yearly increasing.

This work requires the expenditure of money, and such appliances provided as are needed, of the best, to enable your Commissioners to get the full benefit of their work.

Our protective laws need amending, so far as to fully protect the fish and the fishermen, insuring an increase in output without doing an injustice to the business interest which is entitled to as much consideration as the producing of stock, fruit or grain. As the conditions surrounding it are peculiar and must be carefully guarded in this as in anything that is in a manner free to all to gather.

The commonwealth should insist on its ownership, and dictate terms as to how the crop should be gathered and when.

The need of a better and larger steamboat we have previously set forth. We can not do the work required, as it should be done without it. This is a large State and all its parts should have their share of attention. This can not be accomplished without proper means of reaching them by water.

As to results obtained, we can only ask careful investigation, feeling sure that it will not be unfavorable and fully justify the expenditures of the past and insure increased requests for the coming seasons.

Respectfully submitted,

NAT H. COHEN.
S. P. BARTLETT,
A. LENKE,
Commissioners.

THE AGE OF SMALL MOUTH BLACK BASS.

The following paper will explain itself and will throw light on a question of which little is known.

Colonel VanCleave has given the matter time and attention, and gives facts which are a matter of record.

SPRINGFIELD, ILL., January 12, 1898.

Col. S. P. Bartlett, Superintendent Illinois Fish Commissson, Quincy, Illinois.

MY DEAR COLONEL:—In answer to your letter under date of January 5th, I desire to say, that my investigation as to the habits of the black bass began in June 1889, at the Miltona Club, which is situated on Lake Miltona, twelve miles north of Alexandria, Douglas county, Minnesota. I had a desire to know something more about the black bass than the scientists give us, and was especially anxious to know whether the same fish could be caught and re-caught with the same lure, whether it was a migratory fish or lived continually in the same locality, and whether the probable age of a black bass could be ascertained.

During nine years I placed my german silver badge on nineteen hundred and thirty-five bass, sixteen hundred and seventy-six of which are of the small mouth, the rest being the large mouth variety. Of the whole number captured and recorded one hundred and nine have been retaken and re-recorded, a great many of them having been through my hands twice, many of them three times, while one was five times captured, three times in one season, being caught twice in one day by a guest who shared the boat with me.

I prepared german silver oblong plates one half inch long with a hole in one end. Upon one side my name was stamped and upon the other the serial number of the plate. Each plate was numbered consecutively, as were the pages of the book in which the record was kept. Immediately after catching and carefully weighing the bass it was placed in the large live box of my boat, and when convenient a small hole was made in the point of the heavy cheek piece or gill covering of the bass and the plate attached with a short copper wire, the ends of which were carefully clipped off and the fish returned to the water.

In the record book an entry would then be made according to the facts as follows:

Date.....
Locality.....
Bait used.....
Variety of bass.....
Weight in ounces.....
By whom caught.....

My investigations have been very interesting, and have added much to the enjoyment of my summer vacations. The members of the Miltona Club as well as the Monmouth (Illinois) Club and the Minnesouri Club on Lake Miltona have shown enough interest in my investigations to advise me when fish were recaptured that bore my plate, but have never kept the specimens for re-recording, and seldom ascertained their exact weight.

I find that from the peculiar construction of the bass that in being hooked it suffers neither nervous or bodily shock, unless the hook pierces the eye, stomach or gills, and therefore suffers no pain.

It can be retaken with the same lure again and again unless barbarously treated or carlessly handled by the oarsman. I have been so fortunate during the past ten years to have a true sportsman, John G. Olson, who as Isaac Walton says, "treats them as if he loved them." It is a very voracious fish when feeding, but there are many days, especially during the midsummer season when they will refuse bait of all kinds.

I find that bass are migratory in their habits and life, and range around a great deal, especially after the spawning season is over. I have retaken the same bass three and three-quarter miles from the locality of its first capture, and once took a two and a quarter pound bass in Lake Miltona that I had the season before taken in Lake Ida six miles away, the two lakes being connected by a large stream about two miles long. My research has been entirely confined to Lake Miltona and the contiguous waters in northern Minnesota, and therefore my record may not coincide with what might be established by proper investigations in Illinois waters.

In Lake Miltona the black bass are of very slow growth. They are a hibernating fish, and therefore in that far northern latitude can possibly have no more than six months of the year of active life in which to feed and grow.

Dr. Henshall in his work, "Book of the Black Bass," says that a bass at two years of age will be from eight to twelve inches long, and will weigh a pound and that it will grow about a pound a year thereafter, arriving at maturity in two or three years. My investigations do not show this to be the case. In Lake Miltona the May and June spawn do not grow to be exceeding two and a half inches in length before winter sets in, and when a year old will be about five inches long and very slim and flat—at two years old about nine inches long, beginning to grow thick, and will weigh about ten ounces. During his second year he changes food and begins to live on minnows. I have a bass mounted that I know to have been six years old and when last hooked was badly gilled. It weighed just twenty-nine ounces. I had caught this fish from my pier fly, casting with small trout flies, at two years of age when it was only nine inches long and weighed ten ounces. This was a small mouth bass. Possibly the fish referred to by Dr. Henshall is the large mouth variety.

My record certainly disputes Dr. Henshall's theory that a small mouth bass attains maturity at two or three years, as I know that bass continue growing for at least twelve years and increase in weight until they get to three and three quarters to four and a quarter pounds.

Young bass in their third summer, weighing from eight to twelve ounces, are always found in the shallow water along the shore attacking the schools of minnows and feeding constantly, which accounts for their great growth during the third and a few subsequent years.

The findings as shown by my record force me to the opinion that from the time a bass is three years old and weighs twelve ounces he grows very rapidly until he reaches six years of age, and weighs from twenty-eight to thirty-two ounces, being then a very tireless ranger and a voracious feeder, and that after that period he grows much less rapidly in weight.

I conclude that when a bass gets to weigh two pounds he does not gain to exceed three ounces a year, and that after he gets to weigh three pounds he does not gain more than an ounce a year, and almost ceases to gain in weight. A four pound bass in Lake Miltona does not gain perceptibly in weight, and consumes years of time to gain each additional ounce, having reached absolute maturity. I believe that a four and a half pound bass in Lake Miltona and its contiguous waters to be not less than twenty-five years old, and I believe that if I had sufficient time to properly digest the records I have made that I could conclusively prove that it is nearer fifty years old.

While fishing with Governor Tanner, of Illinois, in Vermont lake, two miles north of Lake Miltona in the summer of 1897, I caught with hook and line a small mouth bass that weighed four and a quarter pounds. When

baked and on the table it proved to be so old that the flesh, though fat, was absolutely strong, sinuous and unpalatable, and all its bones, especially the rib bones, instead of being round with square sides, were flat, heavy and strong, and resembled a sheep's ribs in shape and condition. I believe that bass was forty or fifty years of age.

I hope before the season of 1899 closes to be able to give you such additional proof of the truth of my theory—which theory is supported by living facts, as will enable you to set at rest all contention on the subject of the growth of the black bass.

I am, sir, very respectfully,

JAS. R. B. VANCLEAVE.

APPENDIX

Report of Fish Commissioners

From Oct. 1, 1896, to Sept. 30, 1898.

RECAPITULATION.

Recapitulation of Expenditures by Illinois State Fish Commission from October 1, 1896, to September 30, 1898. Bills of particulars and sub-vouchers on file with the State Auditor.

Amount to the credit of the Commission October 1, 1896	.....	$4,543 95
Amount of appropriation available July 1, 1897	.....	7,500 00
		$12,043 95
Amount paid for material for Fishery building	874 65	
" " work building Fishery building, as per contract	112 00	
By expenditures for October, 1896	850 57	
" " November, 1896	637 49	
" " December, 1896	422 46	
" " January, 1897	249 00	
" " February, 1897	197 60	
" " March, 1897	244 82	
" " April, 1897	300 25	
" " May, 1897	485 50	
" " June, 1897	532 00	
" " July, 1897	698 30	
" " August, 1897	891 51	
" " September, 1887	788 04	
		6,484 49
		$5,559 46
Appropriation available July 1, 1898	.....	7,500 00
		$13,059 46
By expenditures for October, 1897	$907 92	
" " November, 1897	898 35	
" " December, 1897	557 19	
" " January, 1898	327 40	
" " February, 1898	285 81	
" " March, 1898	329 80	
" " April, 1898	454 05	
" " May, 1898	642 95	
" " June, 1898	730 34	
" " July 1898	803 99	
" " August, 1898	681 87	
" " September, 1898	780 15	
Amount paid for stationery for the Commisssion	60 75	
		7,460 57
		$5,598 89

APPROPRIATIONS.

Appropriation for personal and traveling expenses of the Commission or such persons as may be authorized by them in enforcing the laws relative to fishways over dams and for protection of fish. Bills of particulars and sub-vouchers on file with the State Auditor.

Amount to credit of Commissioners October 1, 1896	.....	$2,582 46
Appropriation available July 1, 1897	.....	2,500 00
		$5,082 46
By expenditures for October, 1896	$87 01	
" " November, 1896	139 04	
" " December, 1896	307 48	
" " January, 1897	65 47	
" " February, 1897	62 79	
" " March, 1897	175 32	
" " April, 1897	242 04	
" " May, 1897	354 51	
" " June, 1897	482 85	
" " July, 1897	263 18	
" " August, 1897	189 82	
" " September, 1897	162 96	
Amount lapsed into State treasury September 30, 1897	212 95	
		2,745 42
		$2,337 04
Appropriation available July 1, 1898	.....	2,500 00
		$4,837 04
By expenditures for October, 1897	$252 61	
" " November, 1897	200 44	
" " December, 1897	277 42	
" " January, 1898	233 93	
" " February, 1898	217 32	
" " March, 1898	256 19	
" " April, 1898	281 64	
" " May, 1898	244 56	
" " June, 1898	250 70	
" " July, 1898	271 83	
" " August, 1898	211 38	
" " September, 1898	117 32	
		2,815 34
Amount to the credit of Commission October 1, 1898	.....	$2,021 70

DISTRIBUTION OF FISH.

Distribution 1897.

BLACK BASS.

The Black Bass distributed this season were mostly yearlings, for reasons given in report no fry were obtained.

Stream.	County.	Number.
Des Plaines River	Cook	500
Du Page "	Du Page	350
Henderson "	Henderson	250
Fox "	Kane, Aurora	500
Fox "	" Geneva	500
Fox "	" Batavia	500
Greene "	Lee	200
Spoon "	Stark	500
Crooked Creek	McDonough	700
Edwards River	Mercer	300
Sni Ecarte	Pike	500
Rock River	Rock Island	500
Apple Creek	Greene	250
Wood River	Madison	300
Macoupin Creek	Jersey	200
Kankakee River	Kankakee	1,000
" "	"	500
" "	"	500
Mackinaw River	McLean	250
Sangamon "	Sangamon	300
" "	Macon	250
" "	Menard C. Po. St. L. Ry	300
" "	Piatt	300
Long Lake	Madison	300
Vermilion River	Vermilion	1,000
Cuche "	Alexander	250
Saline "	Saline	200
Kaskaskia "	Fayette	300
Galena "	Jo Daviess	500
Embarass "	Coles	1,000
Wabash "	White	1,000
Pistaqua Lake	McHenry	500
Fox River	"	500
Lake Villa	Lake	500
Morgan Lake	Morgan	500
Soldiers' Home	Adams	1,000
Eagle Lake	Hancock	500
Carthage Lake	"	500
Chicago Park Lakes	Cook	1,000
Belleville Reservoirs	St. Clair	500
Waterloo Clubs	Monroe	500
Ponds at Galesburg	Knox	500

Distribution for 1897.

CROPPIE (FRY).

Stream.	County.	Number.
Des Plaines River	Cook	1,500
Du Page "	Du Page	1,000
Kankakee "	Kankakee, Kankakee	1,500
" "	" Momence	1,000
Macoupin Creek	Jersey	700
Wood River	Madison	1,200
Apple Creek	Greene	700
Rock River	Rock Island, Moline	1,500
Edwards River	Mercer	1,500
Crooked Creek	McDonough	1,200
Green River	Lee	700
Fox "	Kane	1,500
Mackinaw River	McLean	1,000
Sangamon "	Menard, C. P. St. L.	1,500
" "	Macon	1,000
Galena "	Jo Daviess, E. Dubuque	500
Kankakee "	Kankakee, Patoka	750
Vermilion "	Vermilion	2,000
Little Wabash River	Clay	1,500
Eagle Lake	Hancock	1,000
Carthage Lake	"	1,000
Belleville Ponds	St. Clair	2,000
Waterloo Clubs	Monroe	1,500
Morgan Lake	Morgan	500
Sni Ecarte	Adams	1,000
Ponds at Galesburg	Knox	1,500

Distribution of 1897.

RING PERCH FRY.

This fry only a few days old artificially propagated by the Commission.

Stream.	County.	Number.
Little Wabash River	Wayne	10,000
Wabash River	Wabash	10,000
Iriquois "	Kankakee	500
Big Muddy "	Richland	5,000
Kankakee "	Kankakee	5,000
Sni Ecarte "	Pike	5,000
Kaskaskia "	Clinton	5,000
Sangamon "	Macon	5,000
Quiver Lake	Mason	10,000
Mississippi River	Various points	100,000
Liberated in Illinois River		200,000

The above figures are estimated, as fry was but ten or twelve days old when liberated. We could not hold them any length of time, and were compelled to liberate the greater part of them in the Illinois and Mississippi Rivers.

Distribution for 1898.

BLACK BASS.

These fish would average from one and one-half to five inches in length, as season advanced and were taken from the overflows commencing in June and last shipments made in November.

Stream.	County.	Number.
Little Wabash River	Effingham	500
Little Muddy "	Clay	200
Sni Ecarte "	Pike	1,000
Macoupin Creek	Greene	600
Spoon River	Fulton	500
Edwards "	Mercer	600
Wood "	Madison	500
Rock "	Lee	1,000
Crooked Creek	McDonough	850
Clifton Bay	Madison	1,000
Long Lake	"	1,000
Calumet Lake	Cook	1,500
" River	"	750
Des Plaines River	Lake	500
Illinois and Michigan Canal	La Salle	1,000
Rock River	Lee	1,000
Sangamon River	Mason, Decatur	500
" "	Menard, C. Po. St. L.	1,500
Fox "	Kane, Aurora	500
" "	La Salle, Ottawa	500
" "	" St. Charles	500
" "	Kendall, Oswego	500
Vermilion "	Vermilion	750
Big Muddy "	Richland	500
Kaskaskia "	Clinton	.....
Galena "	Jo Daviess	500
Kankakee "	Kankakee, Momence	600
" "	" Waldron	1,000
" "	" Kankakee	1,000
" "	Seneca, La Salle	1,000
Fox "	Lovington	500
Iriquois "	Kankakee	1,500
West Henderson	Hancock	800
Galt Creek	Clinton	500
Sangamon River	Cass	300
Pistaqua Lake	McHenry	1,500
Fox River	"	1,500
Sangamon River	Decatur	500
" "	C. Po. St. L. Ry	1,500
Fox "	Kane, Aurora	500
" "	" Ottawa	500
" "	" St. Charles	500
" "	Kendall, Oswego	500
Vermilion "	Vermilion	750
Elm "	Wayne	500
Skillet Fork	"	500
North Fork Saline	Gallatin	300
Little Wabash River	"	300
Lake Fork	Douglass	300
Sni Ecarte River	Pike and Adams	750
Okaw "	Douglass	300
Little Wabash River	Effingham	500
Pesatonica "	Stephenia	500
Big Calumet "	Cook	500
Lakes in Lake county	Lake and McHenry Co., car lot	9,000
Lake Villa	" "	500
Points on Wabash Railroad	Sangamon, Logan, Dewitt, car lots	.....
Wabash River	Lovingston, Will and Cook	15,000
C., B. & Quincy R. R. ponds	Kane, McDonough, Stark, La Salle De Kalb.	12,500
Chicago Park lakes	Cook	2,500
Morgan Lake	Morgan	500
Reservoir, Paris	Edgar	500
North Fork, Vermilion	Vermilion	500

Distribution, 1898.

SUN FISH. (FRY.)

Stream.	County.	No.
Crooked Creek	McDonough	2,[illegible]
Sni Ecarte	Pike	2,[illegible]
Kankakee River	Kankakee	2,500
Fox "	Kane	2,500
Spoon "	Stark	1,500
Long Lake	Madison	2,500
Sangamon River	Menard C. Po. St. L.	2,500
Morgan Lake	Morgan	2,500
Sangamon River	Macon	2,500
Carthage Lake	Hancock	5,500
Ponds at Galesburg	Knox	2,500

Distribution for 1898.

CROPPIE. (FRY.)

Thirty thousand Black Croppie (strawberry bass) fry was planted late in the season as it was found impracticable to handle early owing to very warm weather and the liability to collapse in transit.

The plants were mainly in Kankankee, Sangamon, Fox and Calumet rivers and Calumet Lake. A number of applicants who had prepared ponds for them were supplied.

CHANNEL CAT FISH.

Ten thousand of these fish were distributed, 2,000 were placed in Sni Ecarte river, 2,000 in Spoon river, 1,000 in Sangamon river, near Decatur, 2,000 in Fox river, 3,000 in Rock river.

Illinois State Fish Distribution, 1898.

FISH SUPPLIED TO PRIVATE APPLICANTS.

Wm. Bender, Jr.	Bellville	H. D. Wyllbl	Hinsdale
T. L. Huffman	Decatur	Robt. Fleish	Springfield
W. A. Northcott	Greenville	Dr. Frank Stubblefield	El Paso
T. C. Mather	Springfield	A. J. Lynch	Beardy
W. P. Holiday	Cairo	M. L. Raftru	Chicago
O. A. Krebs	Belleville	Mt. Olive Coal Co	Mt. Olive
Judge Lindley	Greenville	A. B. Scott	Mt. Zion

Illinois State Fish Distribution, 1897.

FISH SUPPLIED TO PRIVATE APPLICANTS.

John Perch	O'Fallon
W. G. Willard	"
John Becker	"
Adam Bechloff	"
Albert M. Mentz	East St. Louis
J. P. Campbell	Chatham
L. W. Chambers	Jacksonville
Henry Byatt	Galesburg
R. J. Oglesby	Elkhart
Tom N. Donnelly	Lake Villa (public water)
W. W. Bird	Kankakee river " "
Hon. H. H. Evans	Fox river (Aurora) "
	DuPage " (Naperville) "
D. M. Eldgridge	Belvidere
Nick White	Lake Villa
M. S. Miller	" "
T. B. Chambers,	Danville
B. L. Talbot	Momence
Thos. McClintock	Philo
Prutsman Bros.	Hoopeston
Burrell Philips	Hillsboro, Ill
C. W. Bliss	" "
Geo. L. Zink	Litchfield, Ill
John F. Cramm	Philo, "
Chas. Allen	Alvan, "
Ills. Central R. R. (Reservoir)	Monee, "
Wabash R. R.	Springfield, "
" "	Lake Villa
" "	East Dubuque
K. Miller	Barrington
T. G. Fox	Antioch
F. W. Parker	Jacksonville
Jacob D. Ornelius	Danville
Vermilion Fish Club	Catlin
Wm. A. Church	Monee
Herman Sismer	Paxton
S. M. Wylhl	Metamora
John Schertz	Pocohantue
Samuel Weller	Carlinville
M. Cooney	"
O. P. Smith	Cornell
C. F. Morris	Farmingdale
J. M. Peck	"
J. S. Lyman	

CARTHAGE LAKE CLUB.

Situated on the western side of Hancock county are a number of lakes and bayous. They were formerly connected with the river and the height of water in them is affected by the rise and fall of the river. They are now mainly cut off by the railroad embankment and some changes in the course of the river.

They are and always have been good fishing grounds. The title to this marsh, in which these lakes are situated, has been acquired by several clubs, and these possessions cover several thousands of acres.

With a view to removing coarse or objectionable fish from these deep lakes and taking the fish out of the shallow places on these grounds and putting them into the deeper ones, a permit to use the seine for this purpose was requested.

This permit was issued under the conditions expressed, that the work must be done under the supervision of a warden and an officer of this club, making report to us of each day's work.

This they have done, and we submit herewith their report, which will be interesting in that it will show natural conditions existing in lakes of that kind.

O. H. Bell, *President.*

J. T. Smith, *Vice-President.*

J. C. Latham, *Secretary.*

The Carthage Lake Club.

Burlington, Iowa, October 12, 1897.

S. P. Bartlett, Esq., Supt. Fish Commission, Quincy, Ill.

Dear Sir:—As per your request for report on the seining of Palm lake, I submit the following: The lake was seined September 29, under the direction of our directors, and I was greatly surprised at the results. We placed in Carthage lake fully fifteen hundred fish, six or seven hundred large enough

for hook and line fishing. There were several black bass that usually weigh two and a half to three pounds and some of the finest croppies I have seen in a long time. The fish placed in the lake were bass, croppie and sunfish.

Yours respectfully.

J. C. LATHAM,
Secretary and Treasurer Fish.

RECORD OF SEINING DONE IN CARTHAGE LAKE AND RUNNING SLOUGH LAKE JANUARY, 1898.

January 9. A long haul was made from about the center lake towards the north, the catch landed consisted of about 1,500 pounds skips, gar and dogfish, and about 1,200 pounds carp and buffalo. Large quantity croppie, striped bass and two small black bass.

January 10. First haul was to the west end lake, snagged badly, compelling raising of the net, catch about 2,000 pounds; skips, dogfish, buffalo and carp. The worthless fish would probably run to 1,300 pounds. Several fine bass in this haul. Second haul was between the first haul of January 9th and the one above on the 10th. The catch was 5,000 pounds carp and buffalo, about 1,500 pounds skips, etc., and from 500 to 600 pounds game fish.

January 14. Four hauls made this date. First haul at the extreme upper end; catch small but nearly all game fish, bass, croppie and pike. Second haul adjoining No. 1 in upper end: catch was 700 to 800 pounds carp and buffalo. Estimate on worthless fish not given but pretty heavy. Third, adjoining No. 2, to the south and west, was a counterpart of haul No. 2. Fourth haul was in the same place as the second haul of January 10. Estimated there were 7,000 to 8,000 pounds skips alone taken, which were largely in majority. The cause arose from fact soft weather and rains sent Ellison creek water to the lake; water being fresh and warmer fish worked toward it and the seine landing was close to the mouth of the stream.

The figures for the four hauls are: Buffalo and carp, 3,000 pounds; skips, dogs, etc., 10,000 pounds; game fish, 700 pounds.

January 16. Running Slough Lake—First haul about center to the south, being deepest part lake, from three to four feet on sides and probably six feet in deepest center. We hadn't expected so much water. Catch was about 300 pounds carp and buffalo, about 500 pounds, mostly dogs. Very few skips, except very small ones which were all returned to the water for food. Some fine bass, seven to eight pounds in weight, many fine croppie and sun fish, one pike and three salmon. Second haul in upper end to the east from No. 1. This was as fine haul of game fish ever made, consisted of over 1,200 pounds, mostly bass and of fine size, many croppie, few pike, quite lot sunfish and several salmon, carp and buffalo about 700 pounds, about same of worthless fish, mostly dogfish. Total estimates, 1,700 to 1,800 pounds game fish, 1,000 pounds carp and buffalo, and 1,000 pounds worthless.

January 18. West of the railroad fill toward Harper's chute; only one haul made, showing about 400 pounds carp, buffalo and a few spoonbill cat, and 400 pounds skips, dogs, etc; game fish scarce, mostly croppie.

January 18. Carthage Lake—First haul, close to the fill on east side and across lake to north side; catch amounted to about 300 pounds carp and buffalo and 500 pounds skips, gar, dogs; only game fish were croppies. Second haul, center lake, landing near mouth small outlet from Ellison creek. There were taken 500 pounds carp and buffalo, some spoonbills and 3,000 pounds skips, etc. Fishermen claimed owing rising water body fish be in upper end lake. Didn't look for many game fish to be taken in Carthage, as their favorite places, along high bank, deep water, is so snaggy impossible to seine it. (Note the prediction and catch of January 19).

January 19. First haul at upper end lake, new set holes cut. This catch was nearly all game fish and amounted to 1,500 pounds, mostly bass, few pike and croppie of fine size. As predicted these fellows had gone ahead of the rise to the clear water. Second haul, made adjoining the upper end; consisted mostly worthless fish, estimated at 3,000 pounds; carps and buffalos

growing scarce; very few game fish. Third haul, made in the center, landing near the mouth of the overflow from Ellison, and they gathered in 7,000 pounds skips, small amount other worthless fish, few game fish, carp and buffalo. As estimated for three hauls the total is: Game fish, 1,500 pounds; carp and buffalo, 500 pounds; skips, etc., 10,000 pounds. It's evident from the last immense catch of skips that there had been a body of them laying on the west side of the fill, and feeling the rise from the overflow, had followed it up and fortunate for us the seine landed them. With the stage of water in the river it is impossible for fish to reach us from that water, and I feel satisfied that Carthage lake is pretty well cleared up of rough fish, and I wish it was possible to keep it so always. This is the record of last work done. I hope you will find it convenient to soon visit us. I want you to see our waters and have you express yourself as to the best methods keep them in good shape. My report to you is in detail, but not uninteresting I hope, and will enable to make a very satisfactory report. Hoping to see you soon, I am,

Very truly,

J. C. LATHAM, *Sec'y.*

BURLINGTON, IOWA, Nov. 25th, 1898.

S. P. Bartlett, Esq., Superintendent, Quincy, Illinois.

DEAR SIR:—I herewith send you report of the seining done at Carthage lake as per your permit. We have completed the work for this year and thank you kindly for favoring us.

WEST OF THE FILL.

July 28. Six short cross hauls; 1,000 pounds carp, buffalo and spoonbill cat; very few fine fish; not to exceed 50 pounds croppie, two large bass, one large pike, about 700 pounds dog fish, gar, skips and turtles.

CARTHAGE LAKE PROPER.

August 2. Start center lake, north side and up lake—Six hauls, 1,500 pounds carp, buffalo and spoonbill cat, good many gar and turtles, few dog fish, about 300 pounds croppie; very few bass.

August 4. Made eight hauls, all but one above the mud bar; catch, 800 poungs carp, very few buffalo, 600 pounds turtles, 300 pounds dog fish, 100 pounds skips and gar, about 200 pounds croppie and few bass, good ones, three to four pounds each, one five to six pounds.

August 8. Eight hauls, commencing near the bridge, up the lake; catch 1,700 pounds carp, buffalo and spoons, about 800 pounds turtle, dogs, gar and skips, 75 to 100 pounds croppie, two fine bass, two pike. Last haul, head of the lake, fourteen bass, running from one and a half to four pounds each, and 200 pounds croppie.

August 10. Eight hauls, five in the upper end lake close to the lillies, made with the shallow net, (2¼ inch mesh); catch, 1,200 pounds carp and buffalo, few spoonbills, 600 pounds turtles and dogs. One haul showed five large pike, several large bass. Last three hauls, made off mud flat, second haul about 400 croppie, five or six large bass.

August 12—One haul close to the fill inside. Catch very small.

WEST OF THE FILL.

August 12. Six hauls made. Catch, 1,800 pounds carp, buffalo and spoons, one weighing 75 pounds; 700 pounds turtle, gar and dogs; 1,200 pounds landed one haul; snagged twice, compelling raising the net, otherwise catch been heavier. Very few game fish, mostly croppie.

August 22. Seining postponed owing to high water. Heavy rains caused a rise of over four feet which held at that stage for two days, when dropped rapidly. Attempt made to seine Running Slough lake. Fishermen say its full of fish, but vegetation prevented successful work. Catch small, about twenty five carp.

August 22. Three hauls. Catch about 700 pounds carp and buffalo; 200 pounds skips and turtles.

CARTHAGE LAKE.

August 24. Seven hauls, about 1,200 pounds carp; 400 pounds buffalo and about 500 pounds skipjacks, dogs and turtles equally divided. This work over the usual ground.

August 26. Nine hauls, about 1,100 pounds carp and buffalo; 500 pounds turtles, dogs, etc.; about 700 pounds bass and croppie.

August 29. Seven hauls, about 1,000 pounds carp and buffalo; about 400 pounds turtles, dogs, etc. and 400 pounds game fish.

August 31. Eight hauls. 1,000 pounds carp and buffalo; 300 pounds turtles, dogs, etc.; 200 pounds large bass and 300 pounds other game fish.

September 2. Seven hauls. 450 to 500 pounds carp and buffalo; 300 pounds turtles and dogs. Not so many game fish as usual, but those taken very fine. Several nice pike, bass large size, also croppie.

November 4. Eleven hauls. Catch 1,200 to 1,300 pounds carp and buffalo; 200 pounds dog, gar and skips. Three hauls in upper end of lake showed 800 pounds game fish, nearly all bass and of fine size; not so many croppie.

I trust this report will be satisfactory to you as well as interesting. Carthage lake, some years ago was noted for its pike fishing. In the last five years nothing had been taken by hook and line, although I have often when hunting bait, before the lake became Club property, taken out of small holes in Running Slough, when it was almost dry, numerous small pike, 4 to 6 inches long, yet no one was taking any large fish, unless the fishermen had killed them off, as the place was seined to death previous to our securing it. This year has been taken by our members with the rod some ten or twelve pike, all good, big, fish, from which I am lead to believe the fish are beginning to use the lake again. Possibly it arises from the fact that the waters are protected.

The bass and croppie taken this fall have been very fine and some good catches have been made, although lately the fishing has been poor. You notice in my report that at the upper end of the lake is where the best catches of game fish are made. I attributed this to the fact, that since the country road opposite Crystal lake was opened, it gives us clear running water directly into the lake and the bass naturally drew to this new water as it probably brought down food for them. The water except in the center, where there's six to seven feet, is shallow with soft mud bottom. None of our boys seemingly ever tried the rod up above, but I imagine there could been some good strings made. My spare time I occupied hunting, but had intended trying up the lake, now I expect its frozen over.

Yours truly,

J. C. LATHAM, *Secretary.*

CORRESPONDENCE.

PEORIA, ILL., December 17, 1898.

Hon. S. P. Bartlett, Superintendent Fish Commission, Quincy, Ill.

DEAR SIR:—In answer to your question as to my opinion of carp, will say, as I have often said, that the carp is the bread-winner of the fishermen and is a cheap food fish in big demand in New York, Boston, Philadelphia and Chicago.

The prejudice against the carp here at home does not apply abroad. Instead of carp being unfit to eat, scavengers living off anything and everything, devouring the spawn of fine fish, etc., they are a fish of fair flavor for eating purposes, do not eat other than vegetable matter, such as grass, flag roots, moss, etc., and never eat the spawn of other fish as the black bass does. Often I heard it said that the carp are driving fine fish out of the river. This is also far from the truth as the carp lives in harmony with all kinds of fine fish. The only fish that does not seem to like the carp is the buffalo, and that is because carp are too lively for them and they can not stand the jumping about of the carp, but if the buffalo have become scarcer we have their cousin, the carp, to take its place.

In our dealings with our customers since the buffalo have become scarce, in filling our dressed fish orders, we have had to substitute carp for buffalo very often. At first there was great complaint and orders often read, "Don't send me carp if you have no buffalo." We kept on, however, substituting, and now many of the dealers who were so strongly prejudiced against carp order buffalo or carp, and many have written us to the effect that the people like them since they have given them a trial.

In summing up this carp question it can be truthfully said that the general opinion of the public on the question is purely imagination and has no foundation in fact and the best evidence of this is the wonderful demand for Illinois River carp from eastern markets where they are sold for Illinois River carp and not canned as "salmon," as many people believe.

Most respectfully yours,

M. D. HURLEY,

President Illinois Fishermen's Association.

ESTABLISHED 1893.

JOHN A. SCHULTE,

DEALER IN

FISH, GAME, TERRAPIN, ETC.

HAVANA, ILL., December 21, 1898.

S. P. Bartlett, Superintendent Fish Commission, Quincy, Ill.

DEAR SIR:—You ask me as to crop of German carp and my opinion of their value.

As to the crop of young carp this season, will say that there is an enormous lot of them, and by next August they will be good marketable fish, weighing from three to five pounds each.

The Fish Commission did a nice thing when they introduced the German carp in Illinois River. Carp are in great demand and a ready sale. There is more demand for German carp than for all other fish taken from our rivers combined.

From the information I get, as an official of the Illinois River Fishermen's Association, from all points along the river the carp have brought more money than the catch of all other of our fishes combined. Long live the carp.

Yours respectfully,

JOHN A. SCHULTE,

M. D. HURLEY, *President*, Peoria.

JOHN SCHULTE, *Treasurer*, Havana,

ALEX SARGEANT *Secretary*, Bath.

THE ILLINOIS FISHERMEN'S ASSOCIATION.

BATH, ILL., November 30, 1897.

Capt. S. P. Bartlett, Superintendent Fish Commission, Quincy, Ill.

DEAR SIR:—I have been quite frequently asked my opinion in regard to the closed law for seining on the Illinois River, and I have no hesitancy in

saying as for the commercial interest of the industry as well as to all well-meaning fishermen is concerned that an extension of the closed law for seining to cover the hot summer months, up to say the first of September, would be very beneficial owing to the large amount of small fish that are killed by landing in hot surface water during the months of July and August, at the time of year when markets are stagnant. There is too large a commercial interest at stake for honest minded men not to look forward to the protection and growth of our fish industry. It will be great if rightly protected.

Your obedient servant,

ALEX. SARGEANT,
Secretary Fish Association.

FISH WARDENS HOLDING COMMISSIONS IN 1898.

Name.	Date.	Residence.
William C. Loomis	Oct. 4, 1889	Richmond, Ill
Michael L. Kelly	Nov. 6, "	Wilmington, Ill
Joseph S. Juda	Jan. 28, 1890	Collinsville, Ill
William H. Healy	Jan. 28, "	Yorkville, Ill
M. D. Green	April 2, "	Momence, Ill
James Sampson	April 25, "	Calhoun County, Ill
John D. Trew	May 9, "	Colchester, Ill
Walter D. Hodson	May 19, "	New Boston, Ill
John Dickson	June 3, "	Sterling, Ill
Thomas Perry	June 6, "	Terre Haute, Ill
Thomas R. Mullens	July 8, "	Anna, Ill
James P. Campbell	July 8, "	Browning, Ill
Richard Harkness	Aug. 5, "	Macon County, Ill
Henry H. Turner	Sept. 18, "	Virginia, Ill
J. C. Stevens	Oct. 13, "	Noble, Ill
Dr. O. M. Fike	May 2, "	Waterloo, Ill
Fred Schanlin	May 2, "	Morris, Ill
George M. Berkley	May 22, "	Lee County, Ill
M. M. Benson	May 22, "	Magnor, Ill
David H. Law	June 13, "	Dixon, Ill
Wm. Rinesmith	June 13, 1891	Clinton County, Ill
J. H. Morse	June 13, "	DeWitt County, Ill
Edward E. Westcott	July 25, "	Ottawa, Ill
James D. Hamilton	Aug. 25, "	Morrison, Ill
T. Jeff Smith	Nov. 19, "	Antioch, Ill
J. C. Parks	Mar. 18, 1892	Jo Daviess County, Ill
Thomas R. Gale	Mar. 22, "	Tazewell County, Ill
G. W. Ward	May 24, "	Macoupin County, Ill
John P. Hook	May 27, "	Fulton, Ill
John F. Rittenhouse	July 11, "	Iroquois County, Ill
Chester Stiris	July 23, "	Byron, Ill
J. L. Howell	Oct. 5, 1893	Batavia, Ill
Edward Williams	Oct. 5, "	Pekin, Ill
Thomas Gill	Dec. 14, "	Bellview, Ill
George H. Westlake	Jan. 3, 1894	Virden, Ill
Wm. M. Wilkinson	Jan. 31, "	Gilead, Ill
S. G. Johnson	Feb. 13, "	Chandlerville, Ill
Robt. Wurtman	May 3, "	Newton, Ill
Chas. F. Schmidt	June 1, "	Elgin
John Lindee	June 1, "	Aurora, Ill
R. E. H. Westfall	June 5, "	Ficklin, Ill
Fred A. Snyder	July 10, "	Albany, Ill
Louis L. Moeschler	July 20, "	Lyons, Ill
P. M. Bledsoe	Oct. 2, "	Mt. Vernon, Ill
John Brenner	Oct. 26, "	New Athens, Ill
Thomas Williams	Jan. 5, 1895	Havana, Ill
C. H. Noel	Jan. 31, "	Cherry Valley, Ill
Frank Adams	April 2, "	Mt. Carmel, Ill
C. D. Crouse	April 20, "	Savana, Ill
Charles W. Babcock	April 20, "	Cook County, Ill
Philip Goeth	April 20, "	Chicago, Ill
Peter F. Lindmeyer	May 4, "	Fulton, Ill
George W. Webb	May 11, "	Lincoln, Ill
Henry H. Sweet	May 16, "	Glennwood, Ill
William J. Manning	May 20, "	Chicago, Ill
Thomas Gill	June 14, "	Carey Station, Ill
Abraham Mitchell	Sept. 5, "	Winnebago County, Ill
Anthony Ray	Sept. 19, "	Pike County, Ill
E. C. Howard	Feb. 5, "	Lake County, Ill
Henry Chappell	Feb. 5, 1896	Kendall County, Ill
W. H. Moore	April 1, "	Danville, Ill
Charles A. Miller	May 13, "	Alton, Ill

Name.	Date.	Residence.
M. M. Inman	June 1, 1896	Anna, Ill.
A. H. Ray	July 2, "	East St. Louis, Ill.
Robt. Rowe	July 20, "	DeKalb, Ill.
B. Fogli	Oct. 20, "	Hedgewick, Ill.
John W. Day, Jr.	May 22, 1897	Clinton, Ill.
J. D. Miller	May 22, "	Hoopestown, Ill.
Clemens S. Zeno	May 22, "	McHenry County, Ill.
John Kelley	June 2, "	Alvan, Ill.
John Savage	June 18, "	Kankakee, Ill.
George Woodruff	June 18, "	Banner, Ill.
E. J. Foreman	July 10, "	Roodhouse, Ill.
Jonas Stultz	July 10, "	Dixon, Ill.
Joseph McClarkey	July 10, "	Watseka, Ill.
T. M. Johns	July 10, "	Taylorville, Ill.
John Bulfeldt	July 16, "	Thornton, Ill.
L. B. Bartley	July 16, "	Monticello, Ill.
J. S. Brassfield	July 16, "	Henry, Ill.
C. W. Smith	July 16, "	La Moille, Ill.
Jonas Stultz	July 16, "	North Dixon, Ill.
S. Abraham	July 16, "	Geneo, Ill.
George W. Wertz	July 16, "	Potomac, Ill.
L. W. Potts	July 16, "	Lewistown, Ill.
John Kennedy	July 16, "	Atwood, Ill.
Charles Craine	July 16, "	Kankakee, Ill.
G. R. Ratto	July 16, "	Chicago, Ill.

REPORT OF SUPERINTENDENT OF ILLINOIS RIVER WARDENS.

To Hon. Nat H. Cohen, President Illinois State Fish Commissioners, Urbana, Ill.

DEAR SIR:—I respectfully submit herewith my report as superintendent of warden service on the Illinois river.

As master of Steamer Lotus, I have patrolled the Illinois river during the spring and close seasons from LaSalle to Grafton. I have posted a copy of the laws at every point and fishing outfit on the river. During the two years I have personally interviewed almost every fisherman on the river and had as thorough an understanding with them as possible. As instructed by you, I have made the first trip each season over the river, warning everybody against violations, and on the trip following removed without warning all nets in the water that I considered a violation of the law. When nets were removed they were as a rule, placed on the bank, care being used not to destroy property. In some of the most flagrant instances I have taken up the nets and brought them to headquarters, stored and advertised them with a view to prosecuting owners when property was claimed. I have caused to be removed by our crew during the seasons of 1897 and up to date in 1898, five hundred and sixty-four nets, and ordered owners to take out hundreds more themselves. As instructed by the Commission I have not interfered with the ordinary hook or fyke net, when of proper size mesh and not placed so as to form a serious obstruction, or rigged with long leads or wings. Wing nets have always been promptly removed or destroyed. In one instance I found a fence built of boards to shut off sloughs, and in another stakes driven to hold boards up lengthwise along the ledge at river's bank for almost a mile, to keep fish from coming out. This was near Grand Island. I removed the entire obstruction and have a case pending against the parties.

I have found a great many very serious obstructions in the large lakes. During high water of 1898, when the water was over the entire bottoms, I found, at what would have been the head of Woodyard Lake, a piece of web 600 yards in length which had forty-one nets attached. At another point I found one piece 400 yards long with 32 nets attached. These were promptly removed. The distance between points makes it almost impossible to do effective service, as the poachers have a system of notification and will take advantage of our absence to slip out into the large lakes away from the river and get their nets in for a few days. We should be able to cover greater distance in less time.

The most trouble we have had has been at Stewart Lake, Jack Lake, Anderson Lake, Flag and Thompson Lake, Meredosia Bay, Sni Ecarte, Mackinaw Lake, Sprig Lake and Lake De Pue.

Many of the sloughs leading from these lakes are miles in lengths, and it is frequently the case that with a view to evading the law, wings are so placed as to leave out a few feet from one shore open, and then at some distance above or below another wing is placed across the slough, reaching to within a few feet of the opposite bank, and so along the slough for miles. These obstructions can not be seen from the river but are reached either by steamboat or with small boats. They have been removed at once, as instructed by you.

The catch of carp has been very large, most of them during the open season, with proper appliances. But few game fish have been taken either by the seine or net from the river itself. The use of the trammel net has not been general, but I have found it in the spring lakes. It is most used at nights and the violations are difficult to detect.

As instructed by you, I have undertaken to promote a friendly feeling between those engaged with legitimate fishing industry and the Commission, and have given any assistance I could consistent with my duty as an officer. I have endeavored to enforce the laws without recourse to prosecution for every offense. I find the principal offenders to be those who have no fixed place of living or business, but "tramp" the entire length of the river and take advantage of every opportunity to use undersized mesh or unlawful rigging to catch fish.

Respectfully submitted,

THOS. WILLIAMS,
Warden.

REPORT OF FISH WARDENS

FOR

YEAR ENDING SEPTEMBER 30, 1897.

REPORT OF FISH WARDENS.

Report of Eugene Laverme, Sr., Alton, Madison County,
For Year ending September 30, 1897.

Number of arrests—None.

Streams in County—Pissia creek, Jersey county; Clifton bay, Madison county; Wood river, Madison county; Long lake, Madison county.

There are no dams in this county.

Report of G. R. Ratto, Chicago, Cook County,
For Year ending September 30, 1897.

Number of arrests	3
" " convictions	2
" " discharged	1
" " jail sentences	2

Streams in County—Calumet river, Calumet lake.

Number of dams in county—None.

Report of J. F. Powell, Waukegan, Lake County,
For Year ending September 30, 1897.

Number of arrests—None.

Streams in County—Des Plaines river. first, second and third lakes.

Number of dams in county—None.

Report of Peter Cantour, Ottawa, La Salle County,
For Year ending September 30, 1897.

Number of arrests	1
" " discharged	1

Streams in County—Illinois river, Fox river, Illinois and Michigan canal.

Number of dams in county—1 at Dalton on Fox river, 1 at Wedron on Fox river, 1 at Marseilles on Illinois river.

Number of dams provided with fishways—3.

Report of E. A. Sickels, Dixon, Lee County,
For Year ending September 30, 1897.

Number of arrests—None.

Streams in County—Rock river, Pine creek.

Number of dams in county—1 at Dixon.

Number of dams provided with fishways—1.

Report of Clemens S. Zens, McHenry, McHenry County,
For Year ending September 30, 1897.

Number of arrests—None.

Streams in County—Fox river, Nippersink creek, Pistaqua lake, McCullum's lake, Lily lake, Mudgets lake.

Number of dams in county—1 at Algoquin on Fox river, 1 at Barnette mill on Fox river, 1 at Richmont on Nippersink creek, 1 at Salem on Nippersink creek.

Number of dams provided with fishways—4.

Report of Ed. St. Claire, Streator, Livingston County,
For Year ending September 30, 1897.

Number of arrests	1
" " convictions	1
" discharged	3

Streams in County—Vermilion river, Illinois river, Fox river.

Number of dams in county—1 at Streator on Vermilion river, 1 at Pontiac on Vermilion river.

Number of dams put in during year—1 at Pontiac.

Report of John Savage, Kankakee, Kankakee County,
For Year ending September 30, 1897.

Number of arrests—None.

Streams in County—Kankakee river, Iroquois river.

Number of dams in county—1 at Kankakee on Kankakee river, 1 at Waldron on Kankakee river, 1 at Sugar Island on Iroquois river.

Number of dams provided with fishways	2
" " unprovided with fishways	1
" " put in during year	2

Report of Thomas Perry, Terre Haute, Hancock County,
For Year ending September 30, 1897.

Number of arrests—None.

Streams in County—North Henderson river, Ellison river.

There are no dams in this county.

Report of Henry Bender, Carlyle, Clinton County,
For Year ending September 30, 1897.

Number of arrests	2
" " convictions	2

Streams in County—Kaskaskia river.

Number of dams in county—1 at Carlyle.

Number of dams provided with fishways—1.

Report of John H. Waespe, Clay City, Clay County.
For year ending September 30, 1897.

Number of arrests—None.

Streams in County—Little Wabash river, Little Muddy creek, Big Muddy creek.

Number of dams in county—None.

Report of John W. Day, Jr., Clinton,
For year ending September 30, 1897.

Number of arrests—None.

Streams in County—Salt creek, North and South forks, Ten Mile creek.

Number of dams in county—Morrison dam on North fork, Morrison dam on South fork.

Number of dams provided with fishways, two; number of dams put in during year, one.

Number of fishways in process of construction—1.

Report of M. D. Green, Momence, Kankakee County,
For year ending September 30, 1897.

Number of arrests	1
" conviction	1
" jail sentence	1

Streams in County—Kankakee river.

Number of dams in county—One at Kankakee, on Kankakee river; one at Waldron, on Kankakee river.

Number of dams provided with fishways, two; number of dams put in during year, two.

Report of C. W. Smith, La Moille, Bureau County,
For year ending September 30, 1897.

Number of arrests	3
" convictions	3

Streams in County—Bureau creek, Pike creek.

Number of dams in county—One on Bureau creek, two miles of Illinois river.

Number of dams provided with fishways—1.

Report of Harry Hardin, Ripley, Brown County,
for year ending September 30, 1897.

Number of arrests—None.

No particular streams in county.

Number of dams in county—On Crooked creek, unprovided with fishways, four.

Report of M. L. Taylor, Noble, Richland County,
For year ending September 30, 1897.

Number of arrests	9
" convictions	9

Streams in County—Big Muddy, Richland county; Montery slough, Wayne county.

Dam in county—One near Olney, on Fox river.

Dam unprovided with fishways—1.

Report of D. B. O'Hair, Paris, Edgar County,
For year ending September 30, 1897.

Number of arrests—None.

Stream in county—Bruette creek.

Dam in county—One at Paris.

Dams unprovided with fishways—1.

Report of J. W. Shaffer, Charleston, Coles County,
For year ending September 30, 1897.

Number of arrests—None.

Streams in County—Embarrass river, Oakland river, Kickapoo creek, Whetstone creek.

Number of dams in county—Two, one at Oakland, one at Charleston.

Number of dams provided with fishways—2.

Report of John Kelly, Alvan, Vermilion County,
For year ending September 30, 1897.

Number of arrests	5
" discharged	5

Streams in county—North fork, East fork, Jordan creek.

Number of dams in county—One at Danville, one at Woods' Mill, one at Marysville, one at Alvan (Lake Front mill.)

One fishway in process of construction.

Report of H. H. Turner, Virginia, Cass County,
For year ending September 30, 1897.

Number of arrests	1
" convictions	1

Streams in County—Sangamon river and lakes along same; Illinois river and lakes along same.

Dams in county—One at La Grange.

Dams provided with fishways—1.

Report of J. E. Slocumb, Fairfield, Wayne County,
For Year Ending September 30, 1897.

Number of arrests	16
" " convictions	9
" discharged	7
" jail sentences	1

Streams in County—Little Wabash river, Elm river, Skillet Fork river, Montry slough.

Dams in county—One at Mills' Shoals, Skillet Fork river, White county.

Dams unprovided with fishways—1.

Report of Fred Smyth, Junction, Gallatin County,
For Year Ending September 30. 1897.

Number of arrests, none.

Streams in County—Saline river, (North Fork), Little Wabash river, fifteen lakes.

Number of dams in county—One on the North Fork.

Dams unprovided with fishways—1.

Report of Phillip Goetter, Chicago, Cook County.
For Year Ending September 30, 1897.

Number of arrests	23
" " convictions	19
" discharged	4

Streams in County—None.

Dams in county—None.

Report of John B. Boelfeldt, Thornton, Cook County.
For Year Ending September 30, 1897.

Number of arrests—None.

Streams in county—Calumet river, Thorn creek, Little and Grand.

Number of dams in county—None.

Report of Jno. Kennedy, Atwood, Douglas County,
For Year Ending September 30, 1897.

Number of arrests	4
" " convictions	3
" discharged	1

Streams in County—Lake Fork.

Number of dams in county—Three in Piatt county, one in Douglas county.

Number of dams unprovided with fishways—3.

Report of John D. Trew, Sni E Carte, Adams County,
For Year Ending September 30, 1897.

Number of arrests—None.

Streams in county—Sni E Carte.

Number of dams in county—None.

Report of W. H. Morse, Danville, Vermilion County,
For Year Ending September 30, 1897.

Number of arrests	20
" " convictions	7
" discharged	13

Streams in County—Vermilion river, North Fork, South Fork, Middle Fork.

Number of dams in county—Keyger dam on Vermilion river; Konkatown, on Salt Fork, Beard, Waterworks, Woods, and Myersville, on North Fork.

Number of dams provided with fishways, 4; number of dams unprovided with fishways, 2; number of dams put in during year, 6.

Report of A. Sites, Homer, Champaign County,
For Year Ending September 30, 1897.

Number of arrests	15
" " convictions	11
" discharged	4

Streams in County—Salt Fork, Sangamon, Lake Fork.

Number ot dams in county—One at old Homer on Salt Fork.

Number of dams provided with fishways—1.

Report of John R. Page, Springfield, Sangamon County,
For Year Ending September 30, 1897.

Number of arrests	12
" " discharged	12

Streams in County—Sangamon river, North and South fork of Sangamon river, Spring creek, Sugar creek, Lick creek, Horse Shoe lake, Clear lake, Kramier's lake, Mud lake.

Number of dams in county—One at Springfield waterworks on Sangamon river; one at Kalb's on South fork of Sangamon river; one at Torrence's on South fork of Sangamon river; one at Birds' on North fork of Sangamon river.

Number of dams unprovided with fishways—4.

Report of Geo. W. Wertz, Pontiac, Livingston County,
For Year Ending September 30, 1897.

Number of arrests, none.

Streams in County—Middle Fork, north of Higginsville.

Number of dams in county—None.

Report of J. S. Brasfield, Henry, Marshall County,
for the Year Ending September 30, 1897.

Number of arrests	6
" " convictions	6

Streams in county—Illinois river.

Number of dams in county—One at Henry on Illinois river.

Number of dams provided with fishways—1.

Report of Geo. Spaulding, Sadorus, Champaign County,
For the Year Ending September 30, 1897.

Number of arrests	1
" " convictions	1

Streams in county—Kaskaskia river.

Number of dams in county—none.

Report of W. P. Dolson, Arcola, Douglas County,
For the Year Ending September 30, 1897.

Number of arrests	2
" " convictions	1
" " discharged	1

Stream in county—Okaw river.

Number of dams in county—None.

Report of Geo. Woodruff, Bonner, Fulton County,
For the Year Ending September, 30, 1897.

Number of arrests—None.

Streams in county—Illinois river.

Number dams in county—One at Copperas Creek on Illinois river.

Number of dams provided with fishways—1. Number of dams put in during year—1.

Report of Chas. Caine, Kankakee, Kankakee County,
For the Year Ending September 30, 1897.

Number of arrests	1
" " discharges	1

Streams in county—Kankakee river; Iroquois river.

Number of dams in county—One at Kankakee, one at Waldron.

Number of dams provided with fishways—two. Number of dams put in during year—2.

Reports of Fish Wardens

FOR

YEAR ENDING SEPTEMBER 30, 1898.

REPORT OF WARDENS

Report of J. S. Brasfield, Henry, Marshall County,
For Year ending September 30, 1898.

Number of arrests	9
Number of convictions	9
Number of jail sentences	1

Streams in County—Illinois river.

Number of dams in county—One at Henry.

Dams provided with fishways—1.

Report of Henry Benders, Carlyle, Clinton County,
For Year ending September 30, 1898.

Number of arrests	6
Number of convictions	6

Streams in County—Kaskaskia river, Shoal creek, Beaver creek.

Number of dams in county—None.

Report of Geo. Kleinman, South Chicago, Cook County,
For Year ending September 30, 1898.

Number of arrests	33
Number of convictions	33
Number of discharged	8
Number of jail sentences	2

Streams in County—Lake Michigan, Calumet river, Little Calumet river, Grand Calumet river.

Dams in county—None.

Report of Peregrine White, Mason, Effingham County,
For Year ending September 30, 1898.

Number of arrests—None.

Streams in County—Little Wabash river, First and Second creeks, Big creek, Fulfer creek, Little and Big Salt creek, Bishop creek, Lucus creek.

Dams in county—One at Effingham Water Works, one at Tucker's Mill.

Unprovided with fishways—2.

Report of Peter Cantour, Ottawa, LaSalle County,
For Year ending September 30, 1898.

Number of arrests—None.

Streams in County—Illinois river, Fox river.

Number of dams in county, 5—One at Marseilles, one at Dayton, one at Yorkville, one at Sheridan, one at Montgomery.

Provided with fishways—1; unprovided with fishways—4.

Report of Charles Craine, Kankakee, Kankakee County,
For Year ending September 30, 1898.

Number of arrests	3
Number of discharged	3

Streams in County—Kankakee river, Iroquois river.

Number of dams in county—One at Kankakee, one at Aroma.

Number provided with fishways—2; number put in during year—2.

Report of J. C. Milton, Belle Rive, Jefferson County
For Year ending September 30, 1898.

Number of arrests—None.

Streams in County—O'Cier creek, Big Muddy creek.

Number of dams in county—None

Report of W. B. Ott, Freeport, Stephenson County,
For the Year Ending September 30, 1898.

Number of arrests—None.

Streams in County—Pecatonica river, Yellow creek.

Number of dams in county—one at Rockton, one at Pecatonica, one at Brown Mill, one at Freeport, one at Sciota, one at Pearl City.

Number of dams unprovided with fishways—7. Number of fishway notices served—5.

Report of G. R. Ratto, Chicago, Cook County,
For the Year Ending September 30, 1898.

Number of arrests	35
" " convictions	31
" " jail sentences	4

Streams in County—Lake Michigan, Lake Calumet, Calumet river.

Number of dams in county—None.

Report of C. W. Smith, LaMoille, Bureau County,
For the Year Ending September 30, 1898.

Number of arrests—None.

Streams in County—Green river, Bureau creek, Vermillion creek, Pike creek.

Number of dams in county—One on Bureau creek.

Number of dams provided with fishways—One.

Report of John B. Bielfelat, Thornton, Cook County,
For the Year Ending September 30, 1898.

Number of Arrests—None.

Streams in County—Big Calumet river, Little Calumet river, Thorn creek.

Number of dams in county—2.

Number of dams provided with fishways—2.

Report of John H. Walspi, Clay City, Clay County,
For the Year Ending September 30, 1898.

Number of arrests—None.

Streams in county—Little Wabash river.

Number of dams in county—None.

Report of L. B. Bartley, Monticello, Piatt County,
For the Year Ending September 30, 1898.

Number of arrests—None.

Streams in County—Sangamon river.

Dams in county—None.

Report of L. S. Carter, Hammond, Piatt County,
For Year Ending September 30, 1898.

Number of arrests—None.

Streams in County—Sangamon river, Lake Fork creek, Okaw creek.

Number of dams in county—2.

Number of dams provided with fishways—2. Number of fishway notices served—2.

FISH LAWS OF ILLINOIS.

AN ACT *to encourage the propagation and cultivation and to secure the protection of fishes in all waters under the jurisdiction of the State of Illinois.*

SECTION 1. *Be it enacted by the People of the State of Illinois, represented in the General Assembly:* That no person or persons shall place or cause to be placed or erected, any seine, weir, net, fish, dam or other obstruction in or across any of the rivers, creeks, ponds, streams, lakes, sloughs, bayous, or other water or water courses within the jurisdiction of this State, in such a manner as will obstruct the free passage of fish up and down and through such water or water courses, and it shall be unlawful for any person to catch or take fish, except minnows for bait, with any device or means other than a hook and a line, within one-half mile of any dam constructed across any of the rivers or creeks or other water courses within the jurisdiction of this State.

That it shall be unlawful for any person or persons, at any time, to catch or kill any fish in any of the rivers, creeks, ponds, lakes, sloughs, bayous or other water courses within the jurisdiction of this State, by the use of lime, spear, acid, medical or chemical compound or explosives.

That it shall be unlawful for any person to catch or kill any fish in or upon any of the lakes or rivers within the jurisdiction of this State with any device or means when such waters are covered with ice.

That it shall be unlawful for any person to catch or kill or attempt to catch or kill any fish with any trammel net, seine or other devices and as a seine in or upon any of the rivers, creeks, streams, ponds, lakes, sloughs, bayous or other water courses within the jurisdiction of this State. Nor shall the meshes of any weir, seine, basket or trap of any net or seine used for catching fish, except for catching minnows for bait, be less than two inches square:

Provided, however, that seining shall be lawful and allowed between the first day of July in each year, and the 15th day of April in the following year, with seines, the meshes of which shall not be less than two inches square, in such rivers or streams as are used for navigation within the jurisdiction of this State, and also in the navigable bays or lakes connected with such navigable streams within the jurisdiction of this State, and not extending beyond the overflowed bottom of such rivers or streams: *Provided, also*, that it shall be lawful for the fish commissioners or persons authorized by them to take fish in

any way, at any time and in any such places, as they deem best for the purpose of propagation, distribution or destroying of objectionable fish.

It shall be unlawful for any person to buy, sell or have in possession any fish at any time which shall have been caught, taken or killed contrary to the provisions of this act, and any person so offending shall be guilty of a misdemeanor and fined as provided in this act.

§ 2. NOT TO OBSTRUCT PASSAGE OF FISH.] That it shall be the duty of any person or persons who now own or control, or hereafter may erect or control any dam or other obstruction across any of the rivers, creeks, streams bayous or other water courses wholly within or running through this State, in such manner as shall obstruct the free passage of fish up and down or through such water or water courses, to place or cause to be erected in or in connection with such dam or dams, durable and efficient fishways, so that the free passage of fish up and down said water may not be obstructed. All such fishways shall be maintained and kept in good repair by the person or persons so owning or controlling such dam or other obstruction during the whole time for the existence of such dam or other obstruction, as aforesaid, so that said fishways shall at all times be open and free from obstruction for the passage of fish.

And in case the owner or person controlling, operating or using any dam or other obstruction, as aforesaid, shall fail or refuse, after ten days notice, in writing, by a majority of the fish commissioners of this State, to construct and keep in good repair durable and efficient fishways, as provided in this act, then the fish commissioners may construct, or cause to be constructed, durable and efficient fishways, or place the same in good repair, said work to be let by contract to the lowest responsible bidder, and may recover in an action of debt in the name of the People of the State of Illinois before any justice of the peace or any court of competent jurisdiction, the cost of constructing or repairing such fishway. Any person or persons or corporations owning or controlling any such dam or other constructions, who shall fail or refuse to comply with the provisions of this section with respect to the construction and maintenance in good repair of such fishways in any such dam, after having been notified in writing by the fish commissioners or a majority of them, to construct or repair the same, shall be deemed guilty of a misdemeanor, and for each and every twenty days after such notification that such person or persons shall neglect or refuse to comply with the provisions of this section in not erecting, maintaining and keeping in good repair such fishways, he or they shall be subject to a penalty of not less than twenty-five or more than two hundred dollars.

§ 3. SUITABLE FISH-WAYS—COMMISSIONERS—DAMAGES—PENALTY.] All fishways built as provided in this act, if constructed to the satisfaction and approval of a majority of the fish commissioners, then every owner or person controlling such dam or other obstruction, as provided in this act, may obtain from such fish commissioner, or a majority of them, a certificate that such fishway is constructed in compliance with this act, which certificate shall be a full protec-

tion against any prosecution for violation of this act for not providing a fishway. Such certificate may be suspended at any time by the fish commissioners, when such fishway is not maintained or repaired, as herein required. If such person or persons so owning or controlling any such dam or other obstruction, shall fail to construct or maintain such fishway to the satisfaction of the fish commissioners, or a majority thereof, then it shall be *prima facie* evidence of the violation of this act: *Provided*, that no owner or owners of any dam or dams shall be required by this act, or any other act, to construct or allow the construction of any fishway in such manner as to endanger the permanent durability of such dam or dams, or to impair their usefulness. Nor shall they be required to construct or repair such fishway by using some particular patent on which a patent fee is demanded, or to construct or repair such fishway when high water or climatic conditions may render such work impracticable. The fish commissioners, or a majority of them, to determine whether or not such fishway will endanger the permanent durability of such dam, or impair its usefulness as to such high water or climatic conditions, and in case the owner or owners of such dam dissent to the decision of such fish commissioners, or a majority of them, then a board of arbitration shall be chosen to determine such matters: One by the fish commissioners, or a majority of them, one by the owner or owners of such dam, and the two so chosen shall select a third within thirty (30) days after their selection, and if not so selected within thirty (30) days, then the third one shall be selected by the Governor of the State, and the decision of such arbitrators, so chosen, shall be final. If the owner or owners of such dam shall not choose the arbitrator, as aforesaid, within ten (10) days after notice in writing by the fish commissioners, or a majority of them, then the decision of the fish commissioners shall be final and conclusive. In case of the destruction or damage resulting to the dam by reason of the construction of a fishway, under the direction of the fish commissioners, such damage shall be repaired at the expense of the State.

§ 4. Appointment and duty of wardens.] The Governor, on request of the fish commissioners, shall appoint fish wardens, who shall enforce all laws relating to fishes, arrest all violators thereof, prosecute all offenses affainst same. They shall have power to serve processes against such offenders and shall be allowed the same fee as constables for like service, and shall have power to arrest, without warrant, any person for violating any of the provisions of this act; but such wardens shall receive no fees, except on cases where convictions are obtained. Such fish wardens may be removed at any time by the Governor.

§ 5. Persons violating act to be prosecuted.] It shall be the duty of all sheriffs, deputy sheriffs, constables, fish commissioners, and fish wardens to cause any person violating any of the sections of this act to be promptly prosecuted, and the several fish commissioners of this State shall have the power to arrest, without warrant, any person or persons for violation of sections two (2) and three (3) of this act.

§ 6. It shall be unlawful to sell, or offer for sale, any of the following named fishes mentioned below which are less than the length specified for each:

Black Bass	Eleven	Inches
White or Stripped Bass	Eight	"
Rock Bass	"	"
Black or River Croppie	"	"
White Croppie	Nine	"
Yellow or Ring Perch	Eight	"
Wall-eyed Pike or Pike Perch	Fifteen	"
Pike Pickerel	Eighteen	"
Buffalo	Fifteen	"
German Carp	Thirteen	"
Native Carp	Twelve	"
Sun Fish	Six	"
Red-eyed Pike	Six	"
Catfish	Thirteen	"
White Perch	Ten	"

And, provided further, that the possession of any of the above named species for the purpose of sale, or offering for sale, of less length than above designated, shall be *prima facie* evidence of violation, and subject the party or parties having them in their possession to the penalties of the law, hereinafter mentioned.

§ 7. FISHING WITHOUT CONSENT OF OWNER—PENALTY.] Any person or persons who shall, for the purpose of fishing, with seine or net, without the consent of the owner, trespass upon the lands of another, containing any fish pond or lake, whether natural or artificial, shall be deemed guilty of a misdemeanor, and on conviction shall be fined in any sum not less than twenty-five nor more than one hundred dollars, and cost of suit for first offense, and not less than fifty nor more than two hundred dollars for the second offense, and the same for each subsequent offense as for the second offense.

§ 8. HOW ENFORCED—COMPLAINT—AFFIDAVIT.] To enforce the provisions of this act, all suits brought under the same, shall be brought in the name of the people of the State of Illinois, and shall be brought on the complaint of any person or persons showing by affidavit that some section of this act has been violated, giving the names of the person or persons violating if known, and if unknown, such affidavit shall state by some person or persons whose name or names are unknown, and such complaint shall be made before any justice of the peace of the county in which such violation has been made.

§ 9. WHERE COMPLAINT TO BE MADE.] When such violation is alleged to have been committed upon that portion of a stream or water course which may be the dividing line between two counties, then the complaint may be made to any justice of the peace of either of such counties.

§ 10. WHEN WARRANT TO ISSUE.] If the justice of the peace, before whom such complaint shall be made, shall be satisfied that there is reasonable cause to justify the making of such complaint, he shall issue his warrant, directed to the sheriff or constable of such county, commanding him forthwith to arrest and bring before him, or in his

absence, before some other nearest justice of the peace within such county, the person or persons alleged to have been guilty of violating any of the sections of this act.

§ 11. HEARING—COMPLAINT—JUDGMENT—JUROR.] Whenever any person or persons shall be brought before any justice of the peace, in the manner provided in this act, it shall be the duty of such justice to hear and determine the complaint. The person or persons so charged may demand jury trial at any time before the commencement of the trial, and the case shall be tried as cases before justices in civil cases, and judgment shall be for conviction or acquittal of the defendant or defendants in the case. In case a jury is called, the form of the verdict shall be, if for conviction: "We, the jury, find the defendant guilty, and assess the fine at.....dollars;" and if for acquittal: "We, the jury, find the defendant not guilty." The justice shall pronounce judgment in accordance with the verdict.

§ 12. PENALTY—COLLECTION AND DISTRIBUTION OF.] Whenever any judgment of conviction shall be rendered against any defendant or defendants, as provided, execution shall issue forthwith on such judgment, and the sheriff or constable to whom the same shall be directed shall pay one-half of all penalties collected on such execution, in payment of such judgment, to the person or persons who shall have made the complaint, and the remaining one-half to the superintendent of schools of the county wherein such trial shall be had.

§ 13. WHEN EXECUTION RETURNS NO PROPERTY—ARREST.] Whenever any execution issued as above provided, shall be returned "No property found," the justice issuing the same, or in case of his death or absence, any other justice having possession of the docket in which said judgment was entered, shall issue his warrant to the sheriff or any constable of such county, commanding him to take and deliver the defendant or defendants in the execution to the jailer of such county, who shall receive such defendant or defendants into his custody and commit to the county jail of such county, whenever one exists, for a period of not less than ten nor more than sixty days, as the justice shall decide and direct in his warrant, but such defendant or defendants so arrested or committed shall be discharged at any time on payment of such fine and costs.

§ 14. APPEAL.] Any defendant or defendants against whom such judgment of conviction shall be rendered, and in case of acquital, the party making the complaint or any person who will give the necessary bond, shall have the right to appeal, on the same terms as in civil cases before justices, but no proceeding herein provided for shall be stayed until such appeal shall be fully perfected.

§ 15. PENALTY.] Any person or persons violating any of the provisions of the preceding sections of this act, when no other penalty is provided, shall be deemed guilty of a misdemeanor, and, upon a conviction, shall be fined not less than twenty-five nor more than two hundred dollars for each offense.

§ 16. REPEAL BOARD OF FISH COMMISSIONERS.] All acts and parts of acts in conflict with this act are hereby repealed; but such repeal shall not disturb the status of the present Board of Fish Commissioners.

ILLINOIS STATE LABORATORY OF NATURAL HISTORY

S. A. FORBES, Director.

BIENNIAL REPORT

OF THE

DIRECTOR

FOR

1897-98.

BIENNIAL REPORT OF THE ILLINOIS STATE LABORATORY OF NATURAL HISTORY.

To the Trustees of the University of Illinois.

GENTLEMEN: In pursuance of your general instructions as contained in your proceedings for 1892 (June meeting), I submit the following report of operations of the State Laboratory of Natural History for the past two years.

These operations have been connected almost wholly with the work of the State Entomologist or with that of the Biological Station. As the State Entomologist's operations will be reported, under the law, to the Governor previous to the next session of the Legislature, I will only say with regard to them here that they have been directed mainly to the study of the life histories of some of the insects injurious to corn, to an examination of the shade trees and other ornamental vegetation of several of the larger towns of central Illinois, and to work on the San José scale, distributed throughout the State.

Further investigation of the corn insects was undertaken with a view to preparing for my next biennial report a second installment of a monograph upon that subject. The study of the insects injurious to shade trees is the beginning of what I intend to make an exhaustive survey of that topic in this State; and the work on the San José scale has taken the form of a further examination of suspected premises with a view to the possible occurrence of hitherto undetected colonies of that insect in the State, a very thorough and careful spraying with insecticide solution of premises known to harbor the scale, the introduction of two fungus parasites of the scale obtained by me on a personal visit to Florida last spring, and several lines of experimental work undertaken in the hope of finding some cheaper and more effective insecticide than the one now generally in use. In this same connection I have provided for a general inspection of nurseries throughout the State, made at the expense of the nurserymen. Upon receipt of the report of the condition of these nurseries from my inspectors, I have given to nurserymen official certificates setting forth the facts as to the existence on their premises of insects likely to be conveyed in trade to the injury of their customers.

The operations of the Biological Station have been carried on during the past two years along lines practically the same as those previously reported upon, except that we have done much more during the last two years with fishes than previously, with the expectation of completing a formal report upon the fishes of Illinois on which considerable progress had been made by me long before the opening of the station.

This study of the fishes of the station field was taken up systematically in July, 1897, by Prof. Frank Smith, and continued by him without interruption until September 1 of that year. In the summer of 1898 this was passed over to Mr. Wallace Craig, assigned to the Biological Station as its resident naturalist, and he will make this his principal occupation during this entire year. He has been handsomely provided with various kinds of apparatus for the collection of fishes in all the station situations, including seines of all sorts, fish traps of various size and construction, set nets, and trammel nets. This work is being so conducted as to give us correct ideas not only of the

species occurring at the station, but of their relative abundance and local distribution, their haunts, their habits, their regular migrations and irregular movements, their breeding times and places, their rate of growth, their food, their diseases and their enemies, and, in short, the whole economy of each kind there represented and of the whole assemblage taken together as a community group.

Extensive studies of the aquatic entomology of the situation have also been made, and an elaborate paper on ephemerids and dragon-flies, the joint contribution of Messrs. Hart and Adams, of the laboratory staff, and of Professor J. G. Needham, who worked with us during a part of the summer of 1897, is now ready for the press.

The so-called plankton work, the systematic study, that is, of the minuter forms of plant and animal life suspended in the water, has gone steadily forward under Dr. Kofoid's immediate care. Refinements and improvements of method, new forms of apparatus, and a vast mass of material which has been largely identified and studied by him are some of the more obvious results of our recent work in this field. No part of the work of the station attracts more general attention among scientific men or is likely to lead to more interesting and important results.

By the Chemical Department of the University regular analyses of the waters of certain selected localities have been made during the entire two years, including one series of analyses of the gaseous contents of the water, made at Havana, one for each of twenty-four consecutive hours. This chemical work combined with the continuous biological work of the station will, when generalized, furnish a most substantial and authoritative body of knowledge of the conditions of the waters of the middle Illinois previous to the opening of the Chicago drainage canal which can scarcely fail to have a high utility for comparison with the results of similar studies made after that event.

Our main equipment—the cabin boat, the launch, and the smaller boats—has served our purpose perfectly, and the station property is in good order and condition in all respects.

The summer school of 1898, for whose expenses you voted a guarantee fund of $300, proved a disappointment only in the number in attendance, a deficiency easily accounted for in part by the lateness of the period at which we were able to announce our session, and in part by the fact that we could not offer last year certain local and personal inducements which may easily be provided for another session. Authority to advertise the school was not given until the March meeting of the board this year, too short an interval thus remaining before our opening in June. For want of any special building of our own we were obliged to resort to the village school building at Havana, generously placed at our disposal without compensation by the school trustees, and students of the school were thus compelled to live in the town. Vacation life in a village boarding house with work in a school room offers too little relief from the ordinary experience of the student or teacher to be especially attractive in itself. If the school is to be maintained—and I sincerely hope that it may be—we should have a plot of land on the banks of Quiver lake, two miles and a half above Havana, should have erected there a building suitable for summer use as a students' laboratory, should provide facilities for life in camp to those who prefer them, and should also make it possible for students to live either at that place or in town.

Fifteen students were in attendance throughout our term of four weeks. The only instructors regularly engaged were Assistant Professor Frank Smith, of the Department of Zoölogy, and Instructor C. F. Hottes, of the Department of Botany. The work was carefully planned and very thoroughly and efficiently done, and was received very cordially by all in attendance.

Publication of papers has been made by the State Laboratory to the full limit of our appropriation for this purpose, nine articles of our Laboratory Bulletin, comprising four hundred and thirty-eight pages of text and sixty plates, having been printed and distributed during the last two years. They set forth mainly the general results of our Biological Station work combined with the results of studies by advanced students and the station staff upon

other collections of the State Laboratory, but include also an article on scale insects of the State and one on insect disease. The influence of the State Laboratory upon the Department of Zoölogy is shown by the fact that three of the above papers, each a valuable contribution to science, have been prepared by university students in the course of their work for first and second degrees. Such work would have been entirely beyond their reach except for the materials, equipment, and literature provided by the Laboratory, which has also borne the expense of their publication and illustration.

With respect to the future of this work I am strongly of the opinion that a decided advance should be made in the Natural History Survey, for which the laboratory is responsible under the law of its establishment. The annual appropriations made of late have been too small to provide for more than the necessary operations of the entomologist's office, which they are made to cover, and those of the Biological Station, with some incidental general work naturally growing out of the operations of these two establishments. I see no reason why the State of Illinois should not provide in a suitable manner for the energetic prosecution of this survey work which it long ago authorized, and I propose, consequently, to ask of the next Legislature a suitable sum for this purpose and a separate sum for the economic investigations for which the State Entomologist is responsible. I think, also, that the Legislature might well be asked to enlarge the field of the State Laboratory of Natural History to include an economic geological survey, with such topographical work as this might require, and a biological survey of the water supplies of the State, conducted with special reference to sanitary interests, a subject which is certainly not less important in some of its aspects than that of their chemistry.

For details respecting the various departments of the work of the Biological Station you are respectfully referred to the appended reports of the Station Superintendent, Dr. C. A. Kofoid, of Prof. A. W. Palmer, Director of the Chemical Survey, of Mr. Chas. A. Hart, Entomologist of the station, and of Prof. Frank Smith, who served for a time as its Assistant Zoölogist and as principal instructor in the summer school.

Respectfully submitted,

S. A. Forbes,
Director.

REPORT OF THE SUPERINTENDENT OF THE BIOLOGICAL STATION.

To the Director of the Laboratory.

Sir:—The past two years have offered new and interesting conditions in the environment in which the work of the Illinois Biological Station has been prosecuted. The period of 1894 and 1895 was one of typical low water, without an extensive rise of the river during the spring and early summer, when such floods usually occur. On the other hand, these years were not marked by long uninterrupted periods of very low water. Under these conditions of two years of generally low water, without marked fluctuations, the lakes were thoroughly choked with vegetation, and even the banks of the river itself became fringed with a rank aquatic growth. A rise to 12.6 feet, culminating January 6, 1896, was succeeded by a series of minor floods at intervals of about two months throughout the year. The net result was an increase in the average height of the river for the year, which was 6.87 feet above the low-water mark—fully two feet above that of the average for the two years preceding. This was, then, a high-water year, without marked fluctuations, and the result was that the vegetation remained to a considerable extent in the lakes and the river. The year 1897 opened with rising water, which culminated January 23 at 12.9 feet, while a subsequent rise on March 27 reached a height of sixteen feet—the highest point attained since 1892. From this maximum the river fell slowly through the four months that followed, reaching a minimum early in August. From this time until the close of the year, in consequence of a general drought throughout the State, low water persisted, there being only a slight rise as evaporation was checked during the cooler weather of Autumn. In spite of the long-continued low

water the average height for the year was 6.9 feet—a slight increase over the preceding year. There was thus present the somewhat unusual condition of long-continued high water during the first half of the year followed by an uninterrupted period of unusually low water in the second half, the change from the one to the other being quite abrupt. Under these circumstances the vegetation was largely removed or its excessive growth prevented. The contrast between high- and low-water conditions in the station field is well shown by several of the plates appended to this report.* This long-continued low water worked marked changes in the topography of the bottomlands adjacent to Havana. Phelps Lake† dried up earlier than it did the preceding year, Thompson's Lake showed a marked diminution, principally at the northern and southern ends, long stretches of soft mud or matted vetetation in which dead fish were abundant being exposed. This mud, after a few weeks exposure, hardened and cracked open to a depth of a foot or eighteen inches, and a growth of shore grass began to spring up on it. Quiver lake, especially along the west shore and in the region known as Dogfish lake, was considerably reduced in area, and in the absence of any considerable amount of vegetation its depth was decreased more than usual. Flag lake, which in most years is a marsh with one to four feet of water filled with rushes, arrow leaves, water smartweed, water-lilies, and the lotus, dried up early and a wagon road was established across its bed. Havana lake, the expanse of the river above the mouth of Spoon river, presented the unusual appearance of a narrow river channel flanked on either side by a broad mud bank. The filling in and extension of these banks by the deposit of silt during recent years has been very marked, and is followed by an extension of the swamp willows over the rising banks.

In a general way the hydrological conditions of 1898 resembled those of 1897. The rise of the river began in January and continued through the winter, culminating April 2 at eighteen feet, a point equaled or exceeded but twice since 1879, at which time records were begun at the Government dam at Copperas Creek, eighteen miles above the location of the station. As in 1897, the high water continued during the early summer, dropping rapidly in August to the minimum stage. It did not, however, reach the extreme condition of the previous year, several minor fluctuations having occurred at frequent intervals during the fall months. The reduction in the aequatic vegetation begun in the previous year has continued. The increased activity in the fishing industry has also contributed largely to the removal of the vegetation from the lakes and the river on the fishing grounds, so that the river is now practically free from vegetation, as is also the main body of Quiver lake and almost the whole of Thompson's lake, only a restricted area at the southern end retaining its former condition.

In previous years the field headquarters of the station have been on Quiver, lake, either at Foster's Landing or at the Indian mounds. In the fall of 1896 the new laboratory boat was brought down to town and was stationed at the public landing along the river front. This location has been retained during the last two years with the exception of a week in August, 1898, when the boat was moved up to the Twin Mounds during some continued work upon the plankton and gas analyses in the Illinois river near that point. The advantages of a location at town are the saving of the time required for transit to and from headquarters in the field and the expense of running the launch on these trips, and the ready access to the station from living quarters at all times, while the distance from the collecting grounds is not greatly increased. Some disadvantages attend this location. The sheltered situation and the close proximity to the sand bluff increase the heat in the boat during the hot days in summer, and the nearness to the steamboat landing greatly increases the risk of damage to the boats and launch by the disturbance in the water caused by incoming and outgoing steamboats. Ropes and cavils are frequently broken, and boats are torn loose by the swells which follow in the wake of the larger steamers. On three separate occasions a steamboat in the

*For these localities see Plate I.

†Compare Plates III. and IV., and V. and VI. For differences with respect to mid-summer vegetation at similar stage of water, see Plates VII. and VIII.

hands of an old and experienced pilot collided with our flotilla, resulting in the crushing and sinking of the steam launch in one instance, and in the breakage of glassware aboard the laboratory boat at another time. With the considerable and now increasing number of river craft of all sorts seeking temporary or permanent anchorage on the river front, we have been gradually crowded to the least desirable location, where the shore is somewhat springy, and where at low water access to our boat is possible only by means of a dike of sand or a trestle-work of planking, owing to the soft mud which is rapidly filling in the river front at this point. At such times our location is neither inviting nor salubrious. The crowding of the boats and the lax care usually given to such property in this locality greatly increase our danger of loss by wreck or fire while we remain in our present location. The experience of the past two years has only emphasized the necessity of the location of the station at some suitable point—if at Havana, on Quiver lake—where we can control property which will afford us an abundance of room, freedom from disturbance, facilities for carrying on the shore operations that pertain to our work, and the location of breeding ponds.

The station was occupied by the station staff and in full operation in 1897 during the months of July, August, and September, and in 1898 from June 13 to October 1. In addition to this, monthly visits were made to it for plankton work during the winter and spring of 1897, and beginning with the autumn of 1897 visits were made for the same purpose until the full opening of the station in June, 1898. As a result of these visits a very full series of winter collections has been accumulated. Since September 1, 1898, Mr. Wallace Craig, resident assistant at the station, has been in charge during my absence. Previous to this time the property of the station was cared for at such times by Mr. Miles Newberry, who has been in our employ as general collector, janitor and engineer for the past four years. His service has been efficient and faithful in all the manifold and varied tasks which fall to his hands.

The work of the station has been in the main prosecuted along the lines established in previous years, with a few expansions in some directions and curtailments in others. The primary purpose of the station, that of investigation, has been carried on along three principal lines: entomology, ichthyology, and the quantitative investigation of the minute life of the water. The entomological work has been in the hands of Mr. C. A. Hart, who was at the station during considerable intervals in 1897 and 1898.

Investigation of the fishes was taken up July, 1897, by Prof. Frank Smith, and was continued by him until September 1 of that year. In the summer of 1898 this work was taken up by Mr. Craig, and additional equipment has been provided. The station was equipped with a hundred-yard river seine of an inch-and-a-half mesh, hung to fish eight feet; a forty-yard minnow seine of one-fourth-inch mesh, hung to fish five feet; a thirty-foot minnow seine, hung to fish four feet; a Baird seine of the same dimensions; and a trammel net thirty yards in length and five feet in depth. The additions to the equipment consist of two set nets, one of three-fourths-inch mesh and eighteen-inch hoops, the other of an inch-and-a-half mesh and four-foot hoops. Thirteen fish traps of quarter-inch galvanized wire netting were constructed especially for the work in deep water and in places where a minnow seine could not be used. They consist of a cylinder of netting ten inches in diameter, one end of which is closed by a circle of wood and the other by two successive funnels sloping inward, each with an opening three inches in diameter. For the capture of the smallest fish the nets are covered with fine wire cloth, and their efficiency is also increased by the use of wings of the same material or of minnow netting.

The plankton operations of the last two years have been carried on with increased regularity and greater attention to the correction of possible sources of error. The number of stations subject to regular examination at the beginning of the period covered by this report was seven; viz., the Illinois river two and a half miles above Havana, Quiver lake, Dogfish lake, Thompson's lake, Flag lake, Phelps lake, and Spoon river, the latter having been added to the list in August, 1896. The Illinois river station was visited at intervals of one month until July, 1896, in which month

a number of examinations were made at frequent intervals during a remarkable development of a filamentous diatom, *Melosira*, in the plankton, and in correlation with gas analyses conducted by Professor Palmer. Weekly collections upon Tuesdays were begun August 3, 1896, and have since been maintained except when the condition of the ice or sickness necessitated a slight shifting of the day of collection.

The station in Quiver lake was visited during intervals of one month during the first half of 1897, but during the latter part of July and the months of August and September the interval was reduced to a week. In October fortnightly visits were commenced, and have since been maintained. In the summer of 1895 a plankton station had been established in the west arm of Quiver lake, known as Dogfish lake. Examinations were continued in this locality for two years at intervals of a month or less, but were discontinued in July, 1897. During much of the year the conditions at this station differed but slightly from those in Quiver lake. Vegetation is a trifle more abundant and its duration is more extended. Except at times of high water there is no current passing through this arm of the lake. The difficulty of access to this station at times of low water—due to the dense mat of *Ceratophyllum* through which the plankton boat must be rowed—were increased by the erection of a fence of wire netting across the mouth of the lake in the construction of a fish pond. In view of the similarity to Quiver lake and the difficulty of access, it seemed desirable to drop this station from the regular list, especially as the two years' collections of its micro-flora and micro-fauna will suffice for detailed comparison with the plankton of the main body of the lake.

Monthly plankton collections were made in Thompson's lake during the first half of 1897, but in July of that year a fortnightly interval was adopted and has since been maintained. This station is, next to the river, the most important one on our list, being located in the largest permanent body of water within the field of our operations. During the period of high water (three to four months of the year), it is of easy access, as it is possible at such times to run the launch through the "cut road" across the bottom lands to the south end of the lake. As the water falls access may still be had for some time with a row boat through the "cut road;" or, at still lower water, through the "swale," a tortuous channel through the bottomland underbrush from the foot of Flag lake to Thompson's lake. When, however, the river falls below six feet, the only approach to this station is *via* Thompson's lake slough, a bayou connecting the lake with the river, leaving the latter at a point about six miles above Havana. Shallow water and a rank growth of aquatic vegetation found in some years at the northern end of the lake soon render it impossible to enter from the slough with the launch, and when the water falls below three feet a mud bar at the northern end of the slough necessitates making the remainder of the trip in a row boat. During the months of September, October, and the most of November, 1897, the river stood at the present low water mark, that is, about two feet by the guage, and the lake was drained to the lowest limit reached since our operations were commenced at Havana. Its bed at the north end, for a distance of about three quarters of a mile, was exposed, leaving an expanse of the softest black ooze, through which a narrow, winding channel several feet in width, containing several inches of water, was kept open by our boats and those of occasional sportsmen. When winds from the north prevailed, even this insignificant highway was left bare. Under these conditions ingress and egress over and through this bed of ooze became a task of no small difficulty.

Owing to these two routes of approach to the lake, two points of collection have been established; one off Sand Point, in the northern half, and one about half a mile below Prickett's Landing, in the southern half. Both are in open water and at a considerable distance from vegetation, and are equally typical locations. Access to one of these two places is always possible during the period of open water or when the lake is covered with thick ice, but when the ice is thin or rotten, it is at times only possible to work out a few rods from the shore with the aid of ax and ice-hook.

Plankton operations were not carried on in Phelps lake in 1895, owing to the failure of the river to overflow the bottomlands sufficiently to invade and fill the lake. During this year a heavy crop of corn was raised in its fertile bed, but before it was harvested the following winter the water asserted its claim to this territory and has since held possession. The rise which culmi-

nated January 1, 1896, filled the lake, and the water slowly decreased until November, when the few shallow pools that remained were frozen solid. Water again entered the lake January 6, 1897, and the last pool was dried up about September 1 the same year. Toward the last of February, 1898, rising waters again poured into the lake, and owing to the high water of the past spring continued to occupy it and the adjacent territory until the middle of July. Since that time the depth of the water has decreased rapidly and by the middle of September the lake was reduced to a few large pools. During the first half of 1896 monthly collections were made, and since that date the interval has been reduced to a fortnight.

During the past year a drainage district has been organized in the territory including and adjacent to Phelps lake. The object of this organization is the reclamation of the fertile bottom south of Spoon river. A large dike is being built along the north limit of the district, reaching the river a short distance above the north end of Phelps lake. From this point it passes southward along the river bank for several miles to a point some distance below the mouth of Phelps lake slough, and then turns westward to the west bluff. The drainage of the enclosed area will be accomplished by several large ditches leading to the southeast, where pumping works are planned to insure the removal of the water when the surrounding country is flooded. Owing to the drainage of this lake our operations in this locality must cease with the present season, which leaves us in possession of quantitative collections extending through three years, in each of which the water entered in the winter or spring overflow, and was slowly removed by evaporation and seepage throughout the summer months, the catastrophe culminating in the late fall. We have thus in our possession a basis for a tolerably complete record of the seasonal fluctuations and changes in the fauna and flora incident to the drying up of this ephemeral body of water.

Since September, 1896, collections have been made in Spoon river at intervals of a month or less, and during this time a number of qualitative towings have been taken for us by Mr. W. R. Deverman, of Topeka, Ill., from the waters of Quiver creek. We have thus a good series of collections from tributary streams of the river for a comparison with those of the river itself.

A plankton station was established in September, 1895, in Flag lake, a large marsh between Thompson's lake and the Illinois river. Collections have been made here from that time at intervals of a month or less and were continued in 1897 until July. Owing to the abundance of vegetation in Flag lake this station was extremely difficult of access during the summer months, and owing to the abundance of flocculent debris of vegetation it was at all times difficult to secure a satisfactory quantitative collection from this body of water. As it was necessary to reduce the amount of field work, it seemed best for these reasons to drop this station permanently from the list of places subject to regular visitation. During the summer of 1898 plankton collections have been made from time to time at the mouth of Flag lake slough in the hope of finding here *Trochosphæra*, as in former years. None, however, could be found in this locality or, indeed, in any other in our field of operations during the past summer.

As a rule the collections made at the plankton stations above enumerated included a vertical one, one from the surface, and one from the bottom water, all made with a pump and a net of No. 20 silk bolting cloth. In addition to these a catch from a liter of water from a vertical sample at each station was made with filter paper, and from five liters with the Berkefeld filter, the first method of filtration being introduced in September, 1896, and the second in November, 1897. The total number of bottles in the regular series for the years 1897 and 1898, each representing a different catch, is 1,075.

The collections above mentioned belong to the chronolgical series whose purpose is to afford a quantitative and qualitative representation of the changes through which the life in the water of the streams and the lakes examined passes during the course of a term of years. In addition to this series a considerable number of other catches have been made with a view to securing data upon certain allied and important phases of the plankton work.

The relation of the dissolved gases of the water to the amount and constitution of the life therein contained is an important problem, and an attempt to collect data has been made in connection with the chemical survey of the waters of the State. In July, 1897, Prof. A. W. Palmer, Director of this Survey, visited the station and made a number of analyses of the oxygen dissolved in the surface and bottom waters in the lakes and river. In 1898 this was repeated, with Mr. R. W. Stark, assistant on the survey, and a number of similar analyses were made, the carbon dioxide being also determined. A series of collections extending throughout twenty-four hours was made from the surface and bottom waters of the Illinois river with a view of determining the diurnal fluctuation in the amount of the dissolved gases. In all these operations parallel collections of the plankton have been made at the same time and from water collected in the same manner, the plankton pump being used for the collection both of the plankton and the water for gas analysis. The twenty-four-hour series collected in 1898 can be brought into correlation with the movements of the water-bloom, which is a marked feature of the plankton of the river during the warmer months of the year. About one hundred bottles are comprised in the collections belonging in this series.

The serial plankton work rests upon the supposition that a single catch made in a typical locality of a lake or river will give a fair sample of the microscopic life of the water, both as to its quantity and constituent organisms. With a view to testing the validity of this supposition, Thompson's, Quiver, and Mantanzas lakes and the river have in previous years been subject to extended examinations, collections being made on the same date at a considerable number of localities at regular intervals throughout the body of water examined. In 1897 Thompson's lake was re-examined on this plan and a biological cross-section of the river was made at Havana. This series of collections has been increased by twenty-five bottles during the period covered by this report.

The tests looking toward the detection and correction of sources of error in the plankton method and the justification of changes in it which we have made, have been continued during the past two years. Of the collections made in these tests about one hundred and fifty have been preserved. Tests have been made of the errors resulting from leakage, from the progressive clogging of the drawn net and the consequent variable coefficient, and from the active escape of the larger organisms of the plankton. Several types of funnels for the in-take of the plankton pump have also been devised and tested. Tests of the leakage through the silk and efforts to correct it by some form of micro-filter or precipitation method have also been continued. A variety of filters have been examined, including the Sedgwick-Rafter sand filter, using sharp Berkshire sand according to the directions of Calkins*, Jackson†, and Whipple‡. The loss by leakage from this filter was so great that we abandoned it and have been using filter paper as a supplementary method of collection since September, 1896, in all regular plankton examinations. For a short time ordinary filter paper was used, but owing to the looseness of its texture and consequent entanglement of the plankton and shedding of lint we rejected this paper and have since used the "hardened filter paper," No. 575, Schleicher & Schull. The water from which the sample for filtration is taken has been obtained by means of the pump. It was often necessary to take a much larger amount than was used for filtration in order to secure a vertical collection. To obviate this and also to secure greater accuracy in the collection of a vertical sample, a vertical water-trap was devised, which consists of a light brass tube three inches in diameter and eight feet long, at whose lower end is a sliding brass gate by which the bottom of the tube can be closed after it is lowered to the desired depth.

Although the filter-paper collections served to correct the loss by leakage in

*Calkins, G. N.—The Microscopical Examination of Water. Rep. Mass. State Board of Health, 1891, pp. 396-421. 2 folding tables.

†Jackson, D. D.—An improvement in the Sedgwick-Rafter Method for the Microscopical Examination of Water. Tech. Quart, Vol, ix, pp. 271-274. 1896.

‡Whipple, G. C.—Experience with the Sedgwick-Rafter Method at the Biological Laboratory of the Boston Water Works. Ibid., pp. 275-279. 1896.

an important degree, the method was defective in that a small portion of the catch, varying with the amount and character of the plankton, remained on the filter paper, entangled in the fibers of its surface. To obviate this difficulty and to secure, if possible, a method which would be effective and permit the handling of a large quantity of water, experiments were made with the centrifuge. The small machine described in the last report and adopted by us for use in the measurement of plankton collections was found to precipitate a large per cent of the organisms present in the water, accordingly a larger machine was devised and built at the mechanical shops of the University for this purpose It consisted of a hollow cylinder axis of gun-metal with two returning arms, each bearing at the elbow a detachable receptacle which receives the solid matter precipitated from the water, which last passed through the revolving axis and out to the tips of the elbows before it returns to the axis for discharge at the lower end. This machine is geared to give, with power, 8,000 revolutions per minute. When fitted with cranks for two men, four to five thousand revolutions can be obtained. This apparatus was tested with water from the river at a time when it was full of water bloom,—formed principally of *Carteria*,—and also with water from the lakes in varying kinds and amounts of plankton. It proved to be more effective in the removal of the plankton than any method previously tried, but the operation of the machine by hand was extremely laborious, and the precipitation of the plankton was very slow. Furthermore, a variable and oftentimes considerable amount of the plankton—especially that found in the water-bloom—is at times lighter than the water, and thus can not be removed by centrifugal force with the heavier constituents.

In November, 1897, a Berkefeld army filter (system Bruckner), was added to the plankton equipment. It is very efficient in removing all the solid matter from the water, and its operation with ordinary samples is quite rapid. It consists of a force-pump and a cylinder of diatomaceous earth, upon which the plankton and silt contained in the water are collected. This is removed by washing with a brush, but in the process a part of the substance of the cylinder is brushed off. This debris is added to the silt of the water and renders subsequent microscopic examination more difficult. The brushing is also disastrous to some of the more delicate organisms, but leaves by far the greater part of the minute forms which escape the silt intact and in suitable condition for enumeration.

During the past two years some progress has been made with an examination, measurement, and enumeration of the plankton of the regular series, though much of the time has been given to the preparation of plankton apparatus and the improvement of the method. In this work the examination of the the test collections by the enumeration method has been particularly time-consuming. The work of enumeration has been facilitated by the use of a set of six counting machines, which enable the observer to keep a record of six different species at once without the mental effort of carrying the count in the mind. An extended amount of this work remains to be done before we shall utilize to any considerable extent the collections now accumulated. This work will be necessary to the full confirmation of the results of our investigation, and will also be very valuable in suggesting new fields for development, especially along experimental lines. The present provision for this work is quite inadequate to a prompt return for our present investment in this department of the operations of the station. The enumeration of the smaller organisms, especially under the higher powers of the microscope, is particularly taxing upon the eyes, and long continued application is a severe strain upon the nerves of the plankton statistician. I believe it to be possible by the expenditure of a small amount of money to secure student aid for some of this work in such a way as to render promptly available a considerable portion of the now latent results of our plankton work.

The sanitary analyses of the water in connection with the chemical survey of the waters of the State have been continued. Weekly samples have been collected through the two years from the Illinois river and from Spoon river on days when plankton examinations have been made. Similar regular collections were commenced in Thompson's and Quiver lakes in September and October of 1897, and have been continued in connection with the fortnightly

plankton work. The total number of samples for sanitary analyses collected at the station and shipped to Champaign during the two years is two hundred and eighty. As these analyses include the determination of the free and albuminoid ammonia, the nitrites and nitrates, the chlorine, and the oxygen consumed, they will furnish data of great value for a comparison with those derived from the plankton work.

The shipment of samples to Champaign for an analysis of the gases dissolved in the water was begun July 23, 1897, samples being sent from the surface water of the river for the determination of the oxygen. In August fortnightly surface samples from Thompson's and Quiver lakes were added to the shipments, and in November additional samples were sent from each of these localities for an analysis of the carbon dioxide. With the beginning of 1898 samples were collected from both the surface and the bottom waters of the three localities above mentioned for the determination of both the oxygen and the carbon dioxide. This involves the collection and shipment of eight bottles of water from each of the three stations—a total of about nine hundred and fifty samples being shipped in 1897 and 1898. The water was collected with the plankton pump by means of a small pet cock inserted in the discharge pipe. A rubber tube is fastened upon this and inserted in the bottle and water sufficient to fill the bottle three times is pumped through it. The bottle is then closed, the sample being collected with a minimum contact with the air. If the change in the water between the time of collection and the time of analysis does not vitiate the results, we shall find these gas determinations of great importance in the discussion of the plankton data.

The equipment has been maintained in first-class condition so far as the wear and tear of property subject to the vicissitudes of an aquatic environment will permit. The hull of the laboratory boat has been provided with salt shelves and its bottom thoroughly salted to insure its preservation. The decks and guards have been painted repeatedly, and the canvas roof has received a heavy coat of paint. The floors have also been treated with several coats of oil. Three years' experience in our floating laboratory has only increased our satisfaction with its fitness and convenience for the work of a biological station.

The steam launch, with the new equipment of machinery described in the last report, has been of great service. A few repairs have been made from time to time upon the engine, and the boiler and stack have been provided with a shield to decrease heat in the launch. New tubes have also been placed in the boiler. In 1897 the steamer "Josie Sivley" collided with the "Illini" while she was at ancher on the river front, and crushing her against the guard of the laboratory boat opened a seam up the larboard side and broke several ribs and a staunchion. The launch sunk in shoal water and was easily raised, the damage being subsequently thoroughly repaired. In the spring of 1897 Mr. Newberry secured an engineer's license, and has since cared for the launch.

During the session of the summer school the carrying capacity of the launch is severely taxed in providing transit for the field excursions of the classes. At no time is the speed very great, seven miles an hour being the maximum maintained. Furthermore, the draught of the boat interferes with its greatest usefulness in the shoal waters in which at times our work compels us to go. It is only a question of time when extensive repairs will be necessary upon the hull. I would therefore recommend that an effort be made to secure a larger boat with more powerful machinery so as to carry more passengers and, if necessary, to tow a barge. Greater speed and less draught can be secured with such a boat. It would also enable us to considerably extend the field of our operations. Such a launch will be a prime necessity when the work of the station is extended to the Mississippi river.

The outfit of small boats, which consist of two lap-streak lake-boats, one lap-streak river-boat, and an Illinois river skiff, has been supplemented by the addition of a large flat-bottom seine boat twenty feet in length with five-foot beam for the plankton work. The increasing complexity of this work and the variety of apparatus necessary for its performance has made the load required

for a plankton trip too cumbersome for an ordinary boat. The total weight of the boat when manned and loaded with the outfit and water samples is not less than a thousand pounds. The increased attention given to winter work has necessitated the adaption of the boat to the exigencies of that season. The bow and sides are protected with a sheath of zinc, and while the ice prevails the bottom is shod with two steel runners. With the boat thus equipped it is usually possible by rocking the boat and skillful manipulation of the ice-hooks to beat a way through the thin and rotten ice which will not carry the weight of the load, while the runners allow the boat to slide easily over the surface of the smooth ice wherever this is strong enough to bear the weight. The greatest difficulty attending transit in the field in the winter occurs at times when the river is low and access to Thompson's lake must be had by portage across the bottomlands at the southern end of the lake. A pair of wheels has been rigged up for this work, but in wet weather or after heavy snows they are hardly adequate to the task.

In the fall of 1896 the rented quarters which the station had occupied in town were given up, and the property there accumulated was placed on board the laboratory boat. When the station was opened the following summer it was necessary to secure storage elsewhere for property of a bulky nature or that for which there was only occasional use, and by the courtesy of the Illinois State Fish Commission we utilized a corner of their warehouse on the river front until the burning of the building in September. We suffered no loss of consequence, and our property, some of it in a damaged condition, was then returned to the laboratory boat for the winter. In 1898 the problem of storage was temporarily solved by the purchase of a cheaply constructed cabin boat twelve by twenty feet.

Although no formal opening of the station to students was made during the summer of 1897 and no advertisements of its facilities was undertaken, a few applicants for places were accommodated under the conditions attending the opening of the station to such persons in previous years. The following is a list of those in attendance and the lines of work pursued.

H. C. Beardslee, A. B., Instructor in Science, University School, Cleveland, Ohio. Fleshy fungi and Mycetozoa.

Miss Bertha V. H. Forbes, B. S., Teacher of Biology, High School, Austin, Ill. General biology.

H. M. Kelly, A. M., Professor of Biology, Cornell College, Mt. Vernon, Iowa. Trematoda parasitic in Unionidæ.

S. D. Magers, B. S., Principal of High School, Houston, Texas. Algæ and general biology.

H. L. Roberts, Superintendent of Schools and Principal of High School, Farmington, Ill. General biology.

The following year a summer school of biology, with regular courses in botany and zoölogy and offerings of advanced work in zoölogy was planned, and authorized at the March meeting of the board of trustees. The school was well advertised in the educational journals, and preliminary and final circulars were distributed as far as possible among the teachers of the State. Extended advertising in the neighboring states was not attempted. The Station staff was mainly responsible for packing and shipping the equipment sent over by the University and the State Laboratory and for its return, for the registration of students, and for the financial management of the school. No effort was spared to make the equipment of the station of use to the school. The board of education of Havana placed the high school building at our disposal for the summer school, and the teachers' institute in session during the opening days was transferred to one of the churches by the county superintendent, Mr. M. Bolan.

The following is a list of the persons in attendance and their present positions.

Miss Anna L. Baldwin, Science Teacher, High School, Pittsfield Ill.

T. L. Cook, Superintendent of Schools, Mt. Pulaski, Ill.

Wallace Craig, B. L., Assistant of the Illinois State Laboratory of Natural History, Havana, Ill.

Miss Louise S. Dewey, B.S., Fellow in Physiology, University of Illinois, Urbana, Ill.

C. C. Faust, Superintendedt of Schools, Mansfield, Ill.

J. F. Garber, A.B., Instructor in Biology and Mathematics, High School, Houston, Texas.

J. T. Johnson, Teacher of Biology, High School, Galesburg, Ill.

Miss Nellie I. Kofoid, B. S., Science Teacher, High School, DeKalb, Ill.

J. E. Meharry, Student, University of Illinois, Tolono, Ill.

Mrs. Sara E. Pierce, Principal of High School, Havana, Ill.

W. E. Praeger, Student, University of Illinois, Keokuk, Ia.

L. H. Pratt, Teacher, Clear Creek, Ill.

F. W. Schacht, M.S., Principal of High School, Chicago Heights, Ill.

Otto Widmann, Student, University of Illinois, Old Orchard, Mo.

C. W. Youngs, B.S., Assistant in Botany, University of Illinois, Urbana, Ill.

The total number enrolled in the School was fifteen. Of these nine are teachers of natural science in this and other states. Three of those in attendance are now connected with the University as assistants or fellows. Nine of the fifteen students of the school have been or are connected with the University, three are now under graduates, and six have received their diplomas, two of them remaining as graduate students. This summer school of biology might be made a very efficient means of attracting attention to the facilities which the University offers for instruction in the sciences, since students availing themselves of the opportunities of the summer school are apt to be drawn to the University for further work.

Although the number in attendance was not so large as had been expected, still certain features of the enterprise are encouraging. Among these is the cordial response of the citizens of Havana to those needs of the school which can be supplied only by local support. There was no difficulty in securing pleasant and comfortable accommodations for all in attendance; and a much larger number would not have exhausted the facilities offered. From its beginning the station has received generous treatment at the hands of the business men of the town. Indeed, the granting of a site for a station building upon the public river front on the bluff overlooking the river has been urged in the local press. A second encouraging feature is the satisfaction expressed by those in attendance with the work they have been able to accomplish in Havana, and the frequently repeated desire to continue it when opportunity offers.

Very respectfully yours,

C. A. Kofoid.

Superintendent of Biological Station.

REPORT ON WATER ANALYSES.

To the Director of the Laboratory.

Sir: During the two years just passed the number of water samples, from the streams and lakes in the vicinity of Havana, Illinois, which were examined by the State Water Survey as conducted by the department of Chemistry of the University, were as follows: Illinois river and Spoon river 102 samples from each, these being regular weekly collections from each of these sources. The collections from Quiver lake number, all told, 28, and a like number has been taken from Thompson's lake. The waters from these different sources have been subjected to the regular sanitary analysis and

there has been in the different seasons of the year considerable variation in the quantities of organic matters contained, but it is to be noted that the quantities of organic matters in the water of the Illinois river and in the lakes adjacent thereto are ordinarily very high even for surface waters. During the last twelve months the average in the river and also in the lakes shows that the quantity of sewage contained has been considerably less than it was during the preceding twelve months, due of course to the fact that there have been repeated periods of high water and a more generally distributed rainfall during the year of '97–'98 than was the case during '96–'97.

Attempts have also been made during the last year to determine the quantity of dissolved oxygen and of dissolved or free carbonic acid gas in the waters of the Illinois river and the lakes at Havana. We have met with considerable difficulty in making these determinations because of the necessity of doing most of the work here at Champaign. The conditions are particularly unfavorable for work at a distance because of the large quantities of organic matters contained in the water, and, further, because these matters are in a state of putrefactive change, that is, are undergoing somewhat rapid decomposition. The determinations of dissolved oxygen, consequently, commonly give us figures somewhat too low. Tests made on the spot at the time of collection show that the quantity of dissolved oxygen is ordinarily diminished very quickly on standing a few hours, particularly when the vessels containing the water are exposed to the light. Our results, however, have been obtained under practically similar conditions throughout the season and they show considerable variation, at times the quantity of dissolved oxygen being exceedingly low, while at other times the quantity reached the approximate maximum figure. This is true not only of water contained in the river, but also of the water of the lakes. The data which we have in hand has not yet been digested and can not be until the work has been carried on somewhat more extensively. The free carbonic acid,—that is the carbonic acid which exists not in combination with the bases in the water, but as gas merely dissolved in the water—varies yet more greatly than does the dissolved oxygen. At times there seems to be none present; at other times the quantity present is quite considerable; but these determinations are even more greatly influenced by permitting the samples to stand, or by the time which elapses during their transportation to the laboratory, and we can not at present attach very great importance to the results which have hitherto been obtained.

We expect soon to be able to extract gases from water by means of an air pump, and then we shall be in a position to obtain results which will not be influenced by the conditions mentioned above, and, provided we shall be able to have collections carefully made at Havana, the work can very easily be continued and completed here at the University.

Since early in the summer of 1897 we have made regular determinations of dissolved oxygen and of carbon dioxide in samples taken from the Illinois river and from Thompson and Quiver lakes, but the earlier results are less reliable than those obtained during the last six months, and these later results are themselves not sufficiently reliable to be made at present the basis of any general conclusions.

Yours very respectfully,

ARTHUR W. PALMER,
Professor of Chemistry.

REPORT OF THE ENTOMOLOGICAL ASSISTANT.

To the Director of the Laboratory.

SIR:—During the season of 1897 I was in the field, primarily for entomological observation and collection, from June 29 to August 13, giving attention particularly to the gathering of information and material for use in completing our work on *Odonata* and *Mollusca*. In 1898 two visits to the field were made for work on *Odonata*, *Ephemerida* and *Mollusca*; a week in spring, from April 19 to 25, and two weeks in midsummer, from June 21 to July 7.

The accumulations of material and notes were already sufficiently large for group studies at the beginning of the two year period covered by this report. Every opportunity has been taken to make desirable additions to them, and they now stand as a superb basis for the study of any group of aquatic forms. The material is all arranged by orders, and consists of about 4,250 vials and bottles of specimens.

There are now in various stages of preparation four papers, mainly on the entomology of the biological station field, one each on the *Odonata*, the *Ephemerida*, the fresh-water *Mollusca* and the aquatic *Coleoptera*. The order of procedure which I have endeavored to pursue in the preparation of these papers, and which seems to lead to the most satisfactory and accurate results, is as follows: First, the collection of a large quantity of material and data under the greatest possible variety of conditions as to locality, surroundings, stage of water, season and time of day; then the careful study of these, in connection with the literature, and the making of copious notes and sketches preliminary to the preparation of manuscript, all evident deficiencies either in material or data being carefully noted down; next, a return to the field at times and places indicated by the previous collections for the special purpose of supplying, as far as possible, these deficiencies, and finally, after further study of the literature, the writing of the manuscript.

In the preparation of the paper on the *Odonata* I have had the valued assistance of Prof. J. G. Needham and Mr. C. C. Adams, who have furnished the systematic work on the nymphs and adults respectively, while it has been my part to discuss the biology and ecology of the group and its species and to combine the several manuscripts into a single paper—now nearly ready for the press. Under Mr. Adams' supervision the State Laboratory Artist, Miss Hart, has prepared a valuable series of 134 drawings illustrating the abdominal structures of nearly all our Illinois species, and a series of general drawings of the nymphs and their distinguishing structures is well under way.

For the article on Ephemerida, the station collections and notes have all been examined and the results are nearly ready to be put in manuscript form. It would add greatly to the usefulness of the paper, however, if a study of the large series of nymphs of this order in the general collections of the State Laboratory could be made before the article is completed.

Much time and labor have been spent on the *Mollusca* in the endeavor to place the study of this group on a truly scientific basis. Not merely the shell, but all parts of the animal were studied, full use being made of the unusual facilities at the station for work of this kind. The univalves of the station collection have been determined by Mr. H. A. Pilsbry, of the University of Pennsylvania, and the *Sphærium* and *Pisidium* by Dr. V. Sterki. More time could profitably be spent on the biology of the *Unionida*, but otherwise the notes are ready to go into manuscript form.

The collections of water beetles have been exhaustively studied and determined, but the systematic examination of the immature stages has not yet been reached.

Respectfully submitted,

C. A. HART,
Entomological Assistant.

REPORT ON THE SUMMER SCHOOL OF 1898.

To the Director of the Laboratory.

SIR:—Of the fifteen persons in regular attendance at the summer school twelve were either teachers or preparing to teach, in our public schools. Five of them had received training in the laboratories of the University of Illinois, but nearly all of them were without any considerable experience in fieldwork or in the methods of collecting and preserving aquatic organisms. On this account especial prominence was given to tri-weekly excursions for collecting and field observation, and these furnished probably the most important elements in the work of the session. With the steam launch, row boats, and

needful collecting equipment of the biological station the entire party made trips to Matanzas, Thompson's, and other lakes within reach of Havana. The use of the station launch made the excursion highly enjoyable, and by reducing to a minimum the time *en route* gave the party ample opportunity for observing, collecting, and preserving such animals and plants as would best repay further study, or would be useful in the laboratories or museums of the high schools in which the various teachers present were interested. The work done in the laboratory by the several members of the school was largely determined by their past experience and the application to be made of the knowledge acquired.

Soon after the opening of the session it became evident that the needs of the students would be best met by dividing their time equally between the zoölogy and botany; the forenoons were accordingly given to the former, and the afternoons to the latter.

In the department of zoölogy emphasis was given to the lines of work most useful to teachers. Material collected on excursions was used in various ways. For correct methods of dissection as well as a better knowledge of anatomical details some work in dissection was done. Time was also given to acquiring the best methods of preserving specimens of various kinds of animals, as *Hydra*, worms of various groups, mollusks, *Crustacea*, insects,—both larval and mature,—and fishes. The identification of annelid worms, insects, mollusks, and fishes received due attention, and was aided by named collections belonging to the State Laboratory, and also by literature and by a number of synoptic keys to these groups prepared by members of the State Laboratory staff. As a result of this part of the work, teachers were enabled to take home with them properly preserved and named collections of various kinds of animals. All persons not already familiar with the ordinary methods of section-cutting and the making of permanent microscopic preparations had practice in such work.

The work in botany consisted of as thorough a study of the aquatic and terrestrial flora of the surrounding region as the time would allow. The algæ of the Illinois river and connected waters were studied with special reference to their morphology and reproduction. The relation between land and water plants both as to their differences in morphology and distribution was observed and discussed on the field trips.

The phanerogams of the vicinity were treated with special reference to their adaptation for protection and cross fertilization. Instruction in the methods of the collection and perservation of herbarium material was given to those who desired it. The systematic work on the higher plants was in the nature of a study of the characteristics of orders from different representatives rather than by following an artificial key.

General plant physiology was illustrated by demonstrations with apparatus such as can be employed in laboratories of limited equipment. In the field special attention was paid to the movements of plant parts as influenced by light, temperature, and progress in seed development. Time at the end of the month was devoted to a discussion of the matter presented and its adaptation to the needs of the secondary schools, with which most of those present were connected.

Each student was provided with a first-class compound microscope for use in both botany and zoölogy and had also the use of a microtome and an abundance of apparatus, reagents, and general laboratory equipment from the zoölogical, botanical, and entomological laboratories of the University. An abundance of literature for general reading as well as for work for special groups was provided from the libraries of the University and the State Laboratory.

The instruction in field and laboratory was supplemented by lectures on special forms and groups of animals, and by others, of general biological interest on cell division, development, parasitism, cross-fertilization of plants, adaptive modifications for protection, etc.

Very respectfully yours,

FRANK SMITH,

Assistant Professor of Zoölogy.

TO THE HONORABLE BOARD OF FISH COMMISSIONERS OF THE STATE OF ILLINOIS

Fourth Annual Report of the Illinois Fishermen's Association

Compiled from reports received from the different shipping points on the Illinois River, giving the estimated amount and kinds of fish caught and value of same for the past year, ending January 1, 1900.

Shipping Point on Illinois River	*German Carp* POUNDS	*Buffalo* POUNDS	*Cat-fish* POUNDS	*Bull Pouts* POUNDS	*Sun-fish and R. Perch* POUNDS	*Striped Bass* POUNDS	*White Perch* POUNDS	*Croppie* POUNDS	*Black Bass* POUNDS	*No. of Turtles Caught*
Depue	50,000	100,000	1,000	4,000	1,200	900	4,000	1,000	525	2 000
Spring Valley	45,000	33,500	600	2 100	1,700	575	4,100	400	415	2 000
Hennepin & Bureau Cr'k	85,000	60,000	2 200	7,000	2,000	1,200	6,000	2,000	930	13,000
Henry and Putnam	300,000	130,000	2,000	31,000	15,000	6,000	25,000	12,000	9,000	17,000
Chillicothe and Lacon	700,000	220,000	2,200	60,000	14,500	6,000	70,000	14,000	6,000	17,000
PEORIA	1,350,000	500,000	1,200	110,000	30,000	8,000	81,000	15,500	9,240	25,000
Pekin & Copperas Creek	360,000	100,000	1,100	49,000	27,500	6,000	2,000	13.090	9,000	18,000
Liverpool	80,000	65,000	18,000	18,000	7,000	1,650	15,000	2,000	4,030	6,000
HAVANA	1,193,990	400,154	18,000	94,100	37,000	13,206	43,280	18,500	12,061	28,000
Bath	100,000	100,000	8,000	16,000	23,000	7,000	14,500	12,000	2,070	16,000
Bluff City	85,000	61,000	1,000	5,000	5,000	500	2,000	200	400	2,000
Browning	475,000	308,000	45,000	9,000	18,000	3,000	8,000	2,000	1,700	4,000
BEARDSTOWN	908,000	700,000	24,000	59,500	23,000	12,000	49,000	10,000	4,100	18,000
Meredosia	160,000	100,000	10,000	13,000	15,000	5,000	3,000	2,000	2,500	12,000
Naples	100,000	90,000	1,700	2,000	19,000	3,000	4,000	1,000	1,850	900
Valley City	60 000	90,000	8,000	2,000	2,000	2,100	10,000	1,500	1,000	1,000
Pearl	90,000	120,000	20,000	1,000	1,700	1,500	10,000	1,800	1,400	6,000
Kampsville	49,000	220,000	20,000	5,000	1,250	8,000	75,000	1,500	1,500	5,000
Hardin	22,000	146,500	19,000	5,000	1,500	1,300	15,700	2,000	1,000	4,000
Grafton	20,000	100,000	40,000	6,400	7,000	5,000	18,000	2,000	1,500	6,000
Pounds of each Species	6,332.990	3,143,154	241,000	499,100	252,050	92,931	459,580	114,490	70,221	202,900
Value by Species	$189,980.70	$94,294.62	$9,640.00	$19,964.00	$7,561.50	$4,646.55	$13,787.40	$6,869.40	$7,022.10	$8,471.50

	Pounds	*Value*
Carp	6,332,990	189,980.70
Buffalo	3,143,154	94,294.62
Cat-fish	241,000	9,640.00
Bull Pouts	499,100	19,964.00
Sun-fish and Ring Perch	252,050	7,561.50
Striped Bass	92,931	4,646,55
White Perch	459,580	13,787.40
Croppie	114,490	6,869.40
Black Bass	70,221	7,022.10
No. of Turtles, 202,900	.....	8,471.50
TOTAL	11,205,516	$362,246.77

GRAND TOTAL { Pounds, 11,205,516 / Value, $362,246.77

M. D. HURLEY, President,
JOHN A. SCHULTE, Treasurer,
ALEX SARGEANT, Secretary, Peoria, Ill.