REPORT ON THE PROPAGATION AND DISTRIBUTION OF FOOD-FISHES.

By TARLETON H. BEAN, *Assistant in Charge.*

The important features of the work of the division of fish culture at the numerous stations are shown in the abstracts of the annual reports of the superintendents. Certain experiments in the treatment of eggs and fish are grouped in a chapter of notes on the habits, diseases, fatalities, enemies, treatment, transportation, etc., of the species under observation.

The resources of the division were tested to their utmost by its duties in connection with the World's Columbian Exposition. It was called upon to provide and maintain a great aquarium of marine as well as fresh-water animals and plants, a hatchery for the eggs of shad, pike, perch, salmon, trout, and other fishes, together with a general exhibit of its methods and results, and, at the same time, to continue its usual work of hatching and distribution to meet the increasing demands of applicants in all parts of the United States.

The exhibit of the Fish Commission is made the subject of a separate report by its representative on the Government Board of Management and Control, Dr. Tarleton H. Bean. During his absence from Washington Mr. S. G. Worth performed the duties of acting assistant, serving from January 14, 1393, until February 20, 1894, when the assignment to World's Fair duty was completed.

Superintendent Page was detailed for special duty in the summer of 1893, to collect fishes from overflow ponds in the lowlands of St. Francis River, Arkansas, and has made a report upon the experimental work of the season.

The duties of the Commission at the World's Fair, combined with the regular work of distribution, entailed much additional labor upon the car and messenger service. The necessity of continuing the transportation of many kinds of fish during almost the entire year makes the natural difficulties of transportation very great.

A great burden was removed from the division near the close of 1893, when the Commissioner ordered the discontinuance of the general distribution of gold fish to individuals after the close of that season.

STATION OPERATIONS.

The number of active stations was the same as during the last fiscal year. The World's Fair having been made a temporary base of operations, offset the closed landlocked salmon station on Grand Lake Stream, Maine. A new station, located at St. Johnsbury, Vt., was nearly completed at the time of closing this report. Mr. John W. Titcomb was appointed inspector of construction September 1, 1893, and superintendent March 1, 1894. This is intended as a hatching and rearing station for landlocked salmon and various kinds of trout. Its water supply is obtained from Sleeper River and from springs.

The following is a list of stations:

Craig Brook Station, Me.
Green Lake Station, Me.
Gloucester Station, Mass.
Woods Hole Station, Mass.
Delaware River Station (steamer *Fish Hawk*).
Battery Island Station, Md.
Bryan Point Station, Md.
Central Station, Washington, D. C.
Fish Ponds, Washington, D. C.
Wytheville Station, Va.
Put in Bay Station, Ohio.
Northville Station, Mich.
Alpena Station, Mich.
Duluth Station, Minn.
Quincy Station, Ill.
World's Fair Station, Chicago, Ill.
Neosho Station, Mo.
Leadville Station, Colo.
Baird Station, Cal.
Fort Gaston Station, Cal.
Clackamas Station, Oreg.

Craig Brook Station, Maine (Charles G. Atkins, Superintendent).

The fish on hand at the station, July 1, 1893, were as follows:

Species.	Hatched in the year—							Total.
	1893.	1892.	1891.	1890.	1889.	1888.	1888 and 1889 mixed.	
Atlantic salmon	257,775	.....	.....	34	.....	33	.....	257,842
Atlantic salmon, domestic	1,700	156	.....	.....	.....	.....	.....	1,856
Landlocked salmon	6,764	.....	.....	29	.....	.....	26	6,819
Brook trout	9,013	14	.....	.....	28	.....	.....	9,055
Rainbow trout	1,012	.....	.....	.....	13	.....	.....	1,025
Loch Leven trout	.....	.....	.....	49	.....	.....	.....	49
Saibling	.....	.....	.....	1	.....	.....	.....	1
Swiss lake trout	.....	.....	.....	29	.....	.....	.....	29
Scotch sea trout	.....	.....	63	.....	.....	.....	.....	63
Von Behr trout	.....	.....	47	.....	.....	.....	.....	47
Whitefish	.....	1	.....	.....	.....	.....	.....	1
Total	276,264	171	110	142	41	33	26	276,787

The Atlantic salmon were fed through the summer in troughs on chopped liver and other meat and on maggots. In November it was found that 234,367 of them had survived. Of these, 231,367 were liberated in local waters, 2,000 were transferred to other parties, and 1,000 were reserved for wintering. Of the fish wintered over, 867 were alive June 30, 1894.

Eggs of the Atlantic salmon were collected at the Penobscot Station in May and June, 1893, with the cooperation of the State of Maine. From 146 fish—51 males and 95 females—806,000 eggs were obtained. On March 1, 1894, after the ordinary losses and the rejection of the

unfertilized eggs, there remained 745,300 eggs, 435,000 of which were given to the United States Fish Commission and 310,300 to the Maine Commission. From the United States Fish Commission's share 170,000 eggs of the Atlantic salmon were shipped to the following parties in accordance with instructions:

Date.	Consignee.	Number.
Jan. 30	Fred Mather, Cold Spring Harbor, N. Y	60,000
30	J. P. Creveling, Allentown, Pa	60,000
Mar. 7	D. C. McLine, Plymouth, N. H	25,000
7	R. E. Follett, Lime Rock, Conn	25,000
	Total	170,000

There were reserved for hatching at the station 265,000. The number of fish actually hatched from these eggs was 264,612, and of these there were on hand June 30, 1894, 214,000. Of the 33 fish hatched in 1888 only 11 were left at the end of the year; and 31 of those hatched in 1890 were liberated in November, 1893.

The year began with two lots of domesticated salmon; 156 fish hatched in 1892, and 1,700 in 1893. The former were kept through the year in two troughs, and grew slowly, and fell off in numbers to 131; the latter were also kept in troughs, and 1,348 of them were left at the end of the year. Domesticated salmon eggs were obtained in October, 1893, from the Atlantic salmon that had been in confinement since 1888, to the number of 4,800 eggs; but the parent fish being of inferior quality, the 1,677 fish hatched from the eggs declined to 600 on June 30, 1894.

Indications of the presence of an epidemic were observed on April 23, and it continued to ravage the Atlantic salmon for several weeks, causing a loss of about 15,000. No other species was attacked, though the fry of some other kinds suffered seriously from a disease of a different character.

Of the 26 landlocked salmon hatched in 1888 and 1889 only 17 remained on June 30, 1894. The 29 hatched in 1890 were reduced to 20 in November, 1893, when they were liberated. The 6,764 hatched in 1893 received in September an addition of 1,500 fish of the same age from Green Lake; making a total of 8,264. Of these, 7,050 were transferred to other parties during the summer, and the remainder were liberated in the fall.

From the oldest lot of landlocked salmon there was taken in the fall a lot of spawn estimated at 8,500, from which were hatched 6,330 very weak fish, of which the last one died June 1, 1894.

The 9,013 brook trout on hand June 30, 1893, were fed until fall, when 2,825 were transferred to Green Lake Station and 4,476 liberated in Craig Pond. The 14 hatched in 1892 were kept until November 27, and then put in Craig Pond. Of the 28 hatched in 1889, a count on November 27 showed but 14 remaining, and these were placed in Craig Pond.

A few eggs were taken from brook trout in the fall of 1893:

From fish of 1889	4,600
From wild fish caught from time to time and held in confinement at station (taken at station)	4,600
Total	9,200
Received from Green Lake, February 20, 1894	10,000
Total	19,200

From these eggs 17,190 fish were hatched, of which 9,000 were on hand June 30, 1894.

The rainbow trout were fed in troughs during the summer. On September 21st, 500 were transferred to Green Lake, and November 15th, 471 were delivered to the agent of the Maine commissioners. Of the 13 fish hatched in 1889, only 6 remained at the end of the year.

The Loch Leven, Swiss Lake, and Von Behr trout on hand at the beginning of the year had become intermixed by dislocated partitions in the ponds, and, in accordance with instructions, were all liberated together in Heart Pond, 2 miles from the station.

Of the 63 Scotch sea trout on hand July 1, 1893, only 27 were left in November, by reason of mink having gained access to the pond. The fish spawned in the autumn of 1893, and yielded, November 2, 1893, about 6,000 eggs, from which 3,178 very weak fish were hatched, the last of which died June 11, 1894.

The fish have been fed during the year, as formerly, on chopped material derived from butcher's offal, and on maggots produced at the station. Considerable attention has been given to the production of natural food—live food in the station ponds—one man being kept nearly the entire time from April to July in the collection of material, its distribution in the ponds, observations on the pond temperatures, and the growth and multiplication of the entomostraca, etc., of which the collections mainly consisted.

The maximum and minimum temperatures of the air and water during the year were as follows:

Month.	Air temperature.		Water temperature.	
	Maximum.	Minimum.	Maximum.	Minimum.
1893.	° F	° F	° F	° F
July	90	56	68	56
August	92½	55	70	58
September	75	38	64	53
October	72	27	63	46
November	55	11	53	34
December	37½	*a* 14	44	32
1894.				
January	40	*a* 24	38	32
February	39	*a* 22	37½	32
March	52	14	43	33
April	70	16	51½	38½
May	82	43	60	42
June	87½	50	71	52

a Below zero.

GREEN LAKE STATION, MAINE.

On July 1, 1893, the affairs of this station were temporarily put under the direction of the foreman, William H. Munson.

On July 5, Richard Dana reported at the station for the purpose of keeping the records and attending to the correspondence.

On August 2, 1893, in accordance with instructions from the Commissioner, E. M. Robinson took charge as acting superintendent and received a probationary appointment (under civil-service rules) as superintendent September 16, 1893.

Mr. Robinson reported the fish on hand at the station August 21, 1893, as follows:

Kind.	Hatching of the year—		
	1893.	1892.	1891.
Landlocked salmon	157,839	4,056	3,676
Sea salmon	3,420	.....	.....
Loch Leven trout	27,373	1,788	.....
Lake trout	5,000	.....	.....
Von Behr trout	45,494	1,142	.....
Brook trout	4,004	.....	.....
Total	243,130	7,586	3,676

One of the first subjects that received the attention of the superintendent was the collection of salmon and trout eggs in localities not too far removed from the station. A thorough reconnoissance was made of all the neighboring brooks, and Mann and Winkenpaugh brooks were selected as being the most suitable. In addition to the traps at those streams a net trap was put in at the outlet of Green Lake for the capture of landlocked salmon and the one at Great Brook was repaired.

During the season 133 landlocked salmon were taken. Of these, 90 were females and 43 males. The yield of eggs from the 90 females was 311,000, or an average of 3,477 to each fish. The first salmon was caught on September 26 at Mann Brook and the last on November 22 at Great Brook. After these fish were through spawning they were released in the lake.

On October 6 a trap was built at the head of Branch Pond, some 10 miles west of the hatchery; and on the 14th, after a heavy rain, 59 trout were taken. The season's catch of brook trout is as follows: Winkenpaugh Brook, 110; Great Brook, 14; Mann Brook, 1; total, 125. Of these 37 were males and 88 females. Eleven of the females were spent before being captured and only 15 of the males were found to be of any use.

The first eggs of the season were taken October 26; total for the season, 105,146.

During the season there were distributed from the station: Landlocked salmon, 143,481; sea salmon, 3,908; Loch Leven trout, 21,468; lake trout, 25,000; Von Behr trout, 36,803; brook trout, 5,500; rainbow trout, 400; total, 236,560.

Nearly all of these were planted in New England waters and principally in Maine.

Landlocked-salmon and brook-trout eggs were distributed from the station during the season, as follows:

Date.	Consignee.	Variety.	Number.	Remarks.
1894.				
Jan. 23	J. J. Armistead, Scotland	Brook trout	20,000	Received in good order.
24	W. H. Van Sickle, Bevans, N. J	do	10,000	Do.
31	Lieut. H. R. Lemly, South America	do	3,000	Did not sail; eggs opened at Central Station.
Feb. 10	do	Landlocked salmon	3,000	Nothing heard from shipment.
15	W. Hamlin, Tuxedo Park Association, New York.	do	3,000	Received in good order.
15	R. C. Alexander, Adirondack League Club, New York.	do	5,000	Do.
19	Caleb Gilman, Calais, Me	do	5,000	Received in bad order.
20	C. G. Atkins, Craig Brook Station, Me.	Brook trout	10,000	Received in good order.
20	Edmund Hayes, president Wilmurt Club, Buffalo, N. Y.	Landlocked salmon	5,000	Do.
20	A. E. Adams, Boston, Mass	do	5,000	
20	W. L. Gilbert, Plymouth, Mass	do	1,000	Do.
26	Gardner Smith, Ragged Lake, N. Y	do	5,000	Do.
26	E. R. Hewett, Ringwood, N. J	do	5,000	
26	W. T. Haynes, Oakland, Me	do	5,000	Do.
28	Henry Studor, White Corners, N. Y	do	5,000	Do.
28	John G. Roberts, superintendent Saranac Inn Station, N. Y.	do	30,000	Do.

The receipt of eggs at the station during the season was as follows:

Date.	Consignor.	Variety.	Number.	Remarks.
1894.				
Jan. 19	F. N. Clark, Northville, Mich	Von Behr trout	25,000	Fair condition.
19	do	Loch Leven trout	20,000	Do.
20	do	Lake trout	50,000	Good condition.
23	W. F. Page, Neosho, Mo	Rainbow trout	50,000	Bad condition.
Mar. 1	J. J. Armistead, Killywhan Station, Scotland.	Loch Leven trout	20,000	All dead on arrival.

Early in May the larva of the caddis fly was seen in the hatching troughs, and during the month 31,745 landlocked salmon fry were destroyed thereby. Other losses from the same cause were: Von Behr trout, 553; Loch Leven trout, 731; lake trout, 1,686.

The fry and other stock on hand for month ending June 30, 1894, at the station was as follows:

Varieties.	Fry.	Hatching of—			Hatching of 1890 or older.
		1893.	1892.	1891.	
Landlocked salmon	149,941	.....	4,656	3,376	2
Lake trout	16,012	.....	.....	.....	.....
Von Behr trout	11,674	.....	1,140	.....	.....
Loch Leven trout	15,678	.....	1,788	.....	.....
Brook trout	.....	263	.....	.....	90
Total	193,305	263	7,584	3,376	92

The temperatures during the year were as follows:

Month.	Air.		Water.	
	Max.	Min.	Max.	Min.
	° F.	° F.	° F.	° F.
July	95	60	76	67
August	98	59	78	63
September	78	46	68	50
October	70	39	66	47
November	55	12	48	34
December	40	*a* 8	38	33½
January	39	*a* 28	34	32½
February	42	*a* 25	33	32½
March	60	28	36	33
April	74	25	51½	34
May	82	42	63	47
June	88	52	77	56

a Below zero.

GLOUCESTER STATION, MASSACHUSETTS (A. C. ADAMS, MASTER SCHOONER GRAMPUS, IN CHARGE).

This station was in care of a custodian from July 1, being practically closed until the arrival of Mr. Adams on October 9, 1893, at which time the machinist and crew of the schooner *Grampus* were engaged in getting the station in order for the season's operations. Capt. A. C. Adams resigned his position as master of the *Grampus* in order to become fish-culturist and custodian of the Gloucester Station.

On November 16, instructions were received from the Commissioner to begin work, and on that date three men were sent to Kittery Point, Maine, to arrange for a supply of cod eggs. On the 18th of November 200,000 cod eggs were taken in Ipswich Bay, and 453,000 were received from Kittery Point on the 20th. These began to hatch December 1, with a mean water temperature of 42°. By the end of November 3,557,000 eggs were on hand.

The following table shows the number of cod eggs collected monthly during the season, and the number of fry hatched therefrom and liberated:

Month.	Number of eggs collected.	Number of fry hatched and liberated.
November, 1893	3,557,000	1,574,000
December, 1893	8,200,000	3,109,000
January, 1894	16,421,000	5,697,000
February, 1894	16,126,000	5,300,000
March, 1894	18,513,000	8,053,000
April, 1894	1,302,000	884,000
May, 1894	650,000	

A snowstorm occurred on December 10, and by the 14th the temperature fell from 42° to 35°, retarding the hatching of all eggs taken previously. The water density also was from 24° to 24.5°, not enough to allow the eggs to float after a few days' development.

Shipments of cod eggs to the Woods Hole Station were as follows:

Date.	Number.	Method.
February 10	1,110,000	By messenger.
10	413,000	By express.
13	1,159,000	Do.
15	695,000	Do.
21	450,000	Do.
Total	3,827,000	

On April 16, 18,000 haddock fry were planted, and 1,500 on May 14.

Both haddock and cod eggs were taken March 21, and on April 7 the two species hatched with a mean temperature of about 37° for the 17 hatching days.

The entire number of codfish eggs collected during the season was 64,775,000, and of these 24,617,000 were hatched and liberated.

The lobster work was begun May 3, when 20 egg lobsters were secured, from which 274,000 eggs were taken and placed in McDonald hatching jars. The whole number of egg lobsters obtained in May was 293, and these produced 3,757,000 eggs, of which 3,380,000 were hatched and planted in the outer harbor off Gloucester.

On May 18, Mr. Adams was detailed to work under the direction of Mr. Richard Rathbun, assistant in charge of the division of inquiry respecting food-fishes, and the lobster work was continued with Mr. W. P. Sauerhoff in charge.

The collections of egg lobsters in June amounted to 482, and yielded 6,530,000 eggs; from these, 5,953,000 young lobsters were liberated.

The whole number of egg lobsters purchased during the season to July 1 was 775; whole number of eggs taken from these, 10,287,000; whole number of lobsters hatched from these, 9,332,000; percentage hatched, 90.7.

WOODS HOLE STATION, MASSACHUSETTS (JOHN MAXWELL, SUPERINTENDENT).

The fish-cultural work covered a period of eight months—from November to the end of July.

Codfish.—Between February 9 and 20, 3,903,000 codfish eggs were received from Kittery, Me., from which 1,254,000 fry were produced and liberated in Vineyard Sound within twenty-four hours after hatching. The storage of brood cod was improved by placing live-boxes or cars in the salt-water reservoir in the basement of the hatchery building, where exhaust steam from the pumps could be used if necessary to heat the water in severe winter weather.

Flatfish.—Between February 13 and March 26, 17 adult flatfish were obtained by means of a fyke net set in Woods Hole Harbor. These yielded 2,227,000 eggs, which produced 1,795,000 fry; and the latter well deposited in Buzzards Bay and Vineyard Sound. Both the cod and flatfish were hatched in McDonald boxes and Chester jars, operated by tide motion.

Lobster.—The lobster-hatching season covered the months of April, May, and June. From 4,026 egg lobsters 97,635,000 eggs were obtained, but 14,500,000 of these were in bad condition when placed in the hatching apparatus, and were turned out in the harbor on the fourth day. Hatching began June 18 with a water temperature of 64½° F. From the 83,135,000 good eggs, 69,066,000 fry were produced and liberated in Vineyard Sound and Buzzards Bay from twelve to twenty-four hours after hatching. The experiment of keeping lobster eggs in process of hatching during the winter was again tried, with the following results:

When stripped.	Number of lobsters.	Number of eggs produced.	Number of fry.	Number of days hatching.
December, 1893	38	361,000	225,000	146
January, 1894	38	426,000	325,000	129
February, 1894	9	121,800	95,500	106

The above shows that lobster eggs can be handled successfully during the winter, if the water temperature does not fall below 29° F.

A section of the basement under the hatchery was made into a reservoir by cementing, etc. In this reservoir 7 fish cars were erected with a capacity for storing 1,000 brood fish.

There were collected during the summer a large number of sea plants, shellfish, etc., for the World's Fair at Chicago.

The temperature of the water at the station during the hatching season was as follows:

Month.	Max.	Min.	Month.	Max.	Min.
	° F.	° F.		° F.	° F.
December, 1893	48	36	April, 1894	47	39
January, 1894	37	33	May, 1894	59	48
February, 1894	34	30	June, 1894	67	58
March, 1894	41	32			

DELAWARE RIVER SHAD-PROPAGATING STATION (LIEUT. ROBERT PLATT, U. S. N., IN CHARGE).

On May 8 the steamer *Fish Hawk* arrived off Gloucester City, N. J., to commence the season's work. The first eggs were obtained May 9 and the last June 7, during which time 9,651,000 eggs were taken from 395 fish. The number of fry produced was 5,768,000, and the number of eggs transferred 1,500,000. All were deposited in the Delaware River. The details of deposit are as follows:

Date.	Number of fry or eggs.	Locality.
May 16, 1894	1,699,000	Delaware Watergap, Pa.
18, 1894	800,000	Do.
19, 1894	500,000	Port Jervis, N. Y.
19, 1894	142,000	Gloucester, N. J.
22, 1894	1,100,000	Lambertville, N. J.
28, 1894	a 277,000	Delaware Watergap, Pa.
	709,000	
June 5, 1894	400,000	Callicoon, N. Y.
8, 1894	a 1,223,000	Delaware Watergap, Pa.
	418,000	

a Eggs.

The eggs were chiefly obtained, as in previous years, from Faunce's, Bennett's, and Howell's Cove fishing shores.

The water was muddy during the entire season.

The following table exhibits the take of eggs, temperatures, etc., during the season:

Date.	Fish stripped.		Number of eggs.	Noon temperatures.	
	Male.	Female.		Air.	Water.
				° F.	° F.
May 9	26	26	1,425,000	70	67
10	15	14	681,000	69	69
11	31	27	1,392,000	74	69
14	25	25	1,112,000	69	69
15	5	5	266,000	65	68
16	9	9	473,000	67	68
17	12	12	586,000	73	68
18	11	11	544,000	83	68
19	5	5	221,000	87	70
22	8	8	372,000	57	63
25	1	1	45,000	63	56
26	1	1	40,000	65	59
28	12	12	621,000	78	65
29	8	8	483,000	57	62
June 4	12	12	442,000	82	62
5	10	10	469,000	62	61
6	4	4	238,000	50	61
7	5	5	241,000	61	60
Total	200	195	9,651,000		

BATTERY ISLAND STATION, MARYLAND (W. DE C. RAVENEL, SUPERINTENDENT).

The station was opened April 1, and preparations commenced for the propagation of the shad. The collection of eggs began April 21, and continued to May 19. There were taken during that time 39,770,000 eggs, from which 22,695,000 fry were hatched, and of these 22,645,000 were distributed as follows:

Place of deposit.	Number.	Place of deposit.	Number.
North East River, Maryland	1,200,000	Susquehanna River, Pennsylvania	2,507,000
Elk River, Maryland	1,380,000	Nanticoke River, Delaware	450,000
Bush River, Maryland	630,000	Brandywine River, Delaware	1,330,000
Wicomico River, Maryland	345,000	Delaware River, Delaware	450,000
Gunpowder River, Maryland	450,000	Carp Ponds, Washington, D. C.	40,000
Tuckahoe River, Maryland	450,000	Hudson River, New York	5,414,000
Chester River, Maryland	450,000	Delaware River, New York	450,000
Chesapeake Bay, Maryland	2,976,000	Connecticut River, Connecticut	1,519,000
Susquehanna River, Maryland	1,104,000	Palmer River, Rhode Island	1,500,000

During the season eggs taken, numbering 5,634,000, were shipped as follows: To the New York Commission, for the Hudson River, 2,000,000; to the Palmer River, Providence, R. I., 1,669,000; to the Connecticut River, 1,610,000, and to Chesapeake Bay (Battery Station, Maryland), 355,000.

The water was generally clear.

The temperatures of air and water at noon during the season of 1894 were as follows:

Date.	Air.	Water.	Date.	Air.	Water.
	° F.	° F.		° F.	° F.
April 6	46	45	April 30	61	61
7	47	45	May 1	68	61
8	45	46	2	71	67
9	36	44	3	68	67
10	43	45	4	67	67
11	35	41	5	67	67
12	35	38	6	70	67
13	38	39	7	68	67
14	50	42	8	60	69
15	55	48	9	66	69
16	56	49	10	67	68
17	57	53	11	68	68
18	59	54	12	67	69
19	61	54	13	70	70
20	65	57	14	66	69
21	61	57	15	62	69
22	56	57	16	67	69
23	60	56	17	64	67
24	56	56	18	74	69
25	57	56	19	74	70
26	57	56	20	66	68
27	61	59	21	62	64
28	64	60	22	58	57
29	65	62			

On May 19, the last day on which eggs were taken, a severe storm set in which lasted three days, and caused the worst freshet that has occurred on the river since 1885, the island being under water for several hours on the 21st and 22d. This made the season the shortest that has ever been known on the Susquehanna, the station having been in operation only thirty-one days. After the freshet shad were caught in considerable numbers off Spesutia Island and in the vicinity of the station; but a careful examination failed to show a ripe shad between May 24 and June 3.

On April 25 one of the spawn-takers used a striped bass for fertilizing some 60,000 shad eggs, there being no male shad on hand, and on May 3 they were all hatched. When placed alongside of other shad fry hatched at the same time they seemed slightly different in color and action, and as it is claimed that the milt will not live exposed to the air more than a few minutes, it seems probable that the fry referred to are genuine hybrids.

Experiment was made in canning roes of shad and alewives for fish food for the rearing stations, but without success, the roes not having been sufficiently cooked or steamed. It is thought that the work in this line can be made a success if arrangements are made to do it early in April, when the herring or alewife first come in and when the roes are firm.

BRYAN POINT STATION, MARYLAND (S. G. WORTH, SUPERINTENDENT).

Until preparations for the shad season began, early in March, 1894, the property was in charge of a custodian. Mr. L. G. Harron, superintendent of the aquarium at Central Station, was sent to the station March 7, and on March 27 the launch *Blue Wing* was put in commis-

sion and assigned to the duty of carrying spawn-takers to fisheries lying between Bryan Point and Cockpit Point, at the lower entrance to Occoquan Bay.

The employees, with a few exceptions, were again housed in tents, furnished by Gen. Albert Ordway, commanding the militia of the District of Columbia, and the use of such quarters was found beneficial.

Seining operations with the Fish Commission seine began April 5.

Indurated fiber tubs with drop handles were substituted for the tin tanks formerly used for holding eggs in the boats and were found to possess many advantages. Being without joints and hoops, they do not fall to pieces or corrode, and they are good nonconductors of heat. The tubs are 17¾ inches in diameter and 8½ inches high, with tops of one-half inch white pine, to prevent splashing. Around the edge of the top is attached a rubber packing of suitable elasticity and in the center a 4-inch hole is cut to admit air.

The Fish Commission seine captured at Bryan Point 5,231 shad, of which 466 were skins, skips, or immature fish. The ripe fish yielded 4,350,000 eggs. Only a very small number of fish were hatched at the station. The total number of eggs obtained and the sources from whence derived are shown in the following statement:

Chapman Point seine	2,007,000
Stony Point seine	2,216,000
Tulip Hill seine	573,000
Tent Landing seine	235,000
Freestone Point seine	3,249,000
Bryan Point seine	4,350,000
Gill nets	19,763,000
Total	32,393,000

There were shipped to Central Station 32,254,000, which, on the day following their receipt in Washington, were measured and their number found to be 27,334,000, the loss in transportation being attributed chiefly to breakage of defective eggs. The eggs were packed in crates and delivered daily by the launch or small boat at Marshall Hall, whence they were taken in charge by Mr. F. H. Williams and carried to Washington on the Mount Vernon and Marshall Hall steamers. The season closed in early June, but shad continued to be abundant in the Potomac during June, July, and August, and some were observed in September. For the greater portion of that time eggs of apparently good quality could have been collected in large quantities.

CENTRAL STATION, WASHINGTON, D. C. (S. G. WORTH, SUPERINTENDENT).

From the beginning of the fiscal year until February 19, 1894, the superintendent performed the additional duties of acting assistant in charge of the division of fish culture during the detail of the assistant in connection with the World's Fair at Chicago. He was also a member of the examining board of the Civil Service Commission, and took the general oversight of the aquaria in the absence of the superintendent of aquaria.

The purchase and shipment of various supplies for other stations of the Commission were attended to by Mr. Worth, and numerous services were rendered for other departments of the Central office. The number of shipments of freight handled at the station was 618. The shad eggs collected at Bryan Point are hatched in Central Station, as well as eggs of trout, salmon, whitefish, pike-perch, etc., from distant stations of the Commission. This is the shipping-point also for the fish produced at the Fish Ponds in Washington, as well as for those hatched in the station.

A special carp-distribution pail, devised in October, 1893, has two small rings soldered midway between the ears of the handles. The openings in the rings and ears provide a ready means of fastening on the lids.

The cement used in repairing aquaria at the station is made according to the following formula: Putty, 4 pounds; litharge, 1 pound; red lead, 1 pound. The litharge and lead are kneaded into the putty. If the mixture should be too dry, linseed oil is added, drop by drop, until the desired consistency is secured. The cement may be darkened by asphaltum or lampblack. It requires several days to set.

For drilling glass, a file is fastened in a handle and the free end is ground on three faces with a $\frac{1}{8}$-inch bevel to a sharp point. "Bortine" or "glass-bore" is used as a lubricant in drilling.

In February, 1894, the office of the Commission was moved to the Atlantic Coast Line Building, corner of Sixth street and Pennsylvania avenue, and the first floor of the Central Station was used for storage during the repairs to the roof and upper floors. The work was completed and the office reinstated late in June.

In February, 1894, arrangements were made to discard the open water supply tank at the west end of the third-story hall. A safety valve was first connected with the iron piping supplying the hatching tables, and was found available as a temporary expedient during the hatching of some whitefish eggs. This was soon afterwards replaced by a 3-inch Watson water-pressure regulator, which proved entirely satisfactory. The regulator may be found useful at Alpena and other stations taking water by gravity.

In the spring of 1894, Superintendent Worth prepared 173 photographic prints from negatives of fishery and fish-culture subjects made for the World's Columbian Exposition, and these were sent to Dr. Ernst Ehrenbaum, Kgl. Biologische-Anstalt, Helgoland. Of similar illustrations, 36 were prepared and forwarded to Dr. Nicolas Borodine, Uralsk, Russia. Illustrations and explanations of the methods of the Commission in shad culture were also furnished to Mr. C. B. Hudson.

On June 27 the superintendent commenced an examination of the McDonald patent fishway at the Great Falls of the Potomac River to determine its condition and the number of fish ascending. A preliminary report was made, which was approved, and formed the basis of operations and expenditures.

The application of air for oxygenizing water in which living fishes

are kept has been a subject of experiment since the fall of 1888. References to this use of air will be found in the bulletin for 1890 and in the report for 1893. The first object of the experiments was to maintain fishes in salt-water aquaria without circulating the water. Rubber tubing, pricked with pinholes, to liberate air, was tried without satisfactory results. Section of dead grapevine, cornstalk pith, and twigs of various trees were substituted, with little improvement. Sponge, inserted in small openings in rubber tubes, also gave poor results.

Finally it was discovered, as detailed in the report for the preceding fiscal year, that twigs of the American linden or basswood furnish perfect liberators, and the difficult problem was solved. The liberator plugs are made from wilted or dead boughs of any size greater than $\frac{1}{4}$ inch in diameter. The bark is removed and the wood seasoned. It is then cut by a saw with very thin blade and fine teeth into sections $\frac{1}{4}$ inch to $\frac{1}{2}$ inch long. The plugs are made from $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter by forcing them through a round belt-lacing punch. The ends of the plugs may be smoothed with the finest sandpaper. The liberators continue useful from a few days to several weeks, according to the amount of grit entering the circulation. They were inserted in sections of $\frac{1}{2}$-inch rubber tubing.

In January, 1894, a Bishop & Babcock air-compressor of large size was introduced to furnish air for the aquaria in Central Station through small iron pipes. It delivers air under pressure of from 5 to 8 pounds per square inch. The water or power cylinder is $4\frac{1}{8}$ inches in diameter and $8\frac{1}{2}$ inches long; the air cylinder, $5\frac{7}{8}$ inches by $8\frac{1}{2}$ inches. Strokes per minute, $6\frac{1}{10}$, delivering 1,405.13 cubic inches of air under a pressure of 7 pounds per square inch, a rate of 364.8 liquid gallons per hour, equivalent to the flow of salt water through the aquaria. At delivery points, $\frac{1}{4}$-inch brass jet cocks were inserted into the $\frac{3}{8}$-inch conduit piping. To the jet cocks were attached sections of $\frac{1}{2}$-inch rubber tubing, and air liberators were inserted in the free ends of the tubing.

The air circulation proved so successful in the aquaria as to lead to the addition of an air pump to the steam plant on car No. 3, in August, 1893, and the result was equally good. It has been demonstrated that as many fish can be transported in the same bulk of water by air circulation as with water circulation.

In December, 1893, a practical test was made of the practicability of hatching floating eggs by means of air circulation. Cod eggs and sea water were obtained from the Gloucester, Mass., Station, and two shipments of eggs out of eleven produced fry.

The eggs were placed in universal hatching jars and the jars were embedded about two-thirds of their height in a mixture of crushed ice and salt, the upper third being free and exposed to a strong light. The water temperature was kept uniformly at 38° F. Air was introduced at the bottom of each jar through a rubber tube provided with a liberator. It was believed that the experiment would have been more

satisfactory if pure sea water had been available to make a complete change of water every third day during the hatching process.

Advantages claimed for the air-circulation process are: (1) Thorough aeration, (2) active movement of the eggs, (3) light, (4) ability to keep eggs in sea water of proper density and at a uniform temperature, (5) economy of labor and apparatus, (6) increased comfort to hatchery employees, (7) economy and improved quality of water, (8) reduction of cost of pumping, (9) increased facility in removing dead eggs, (10) increased cleanliness and absence of wet floors, (11) economy of space in the hatching room, (12) improved facilities for observing the condition of eggs and fry. Hatching operations could be carried on in jars on the cars en route or on board ship.

Two lots of pike-perch eggs were received from Put-in-Bay Station May 4 and 5, 1894, with a loss of about 90 per cent. Those received May 5 were in a temperature of 62° F. They were allowed to rise to 62° and placed in water at 68°, when hatching commenced at once.

On December 28, 1893, Superintendent Seagle sent from Wytheville, Va., 10,000 rainbow-trout eggs of different ages for use by Prof. W. K. Brooks, of Johns Hopkins University, in his studies of the development of fins. The young cod hatched at Central Station were also shipped to Professor Brooks, together with three universal hatching jars, complete.

Central Station is credited with furnishing for distribution the following fry:

Species.	Place where eggs were collected.	No. of fry distributed.
Shad	Bryan Point	21,082,000
Whitefish	Put-in-Bay	3,800,000
Landlocked salmon	Green Lake	2,500
Brook trout	Northville and Green Lake	19,500
Rainbow trout	Wytheville and Neosho	22,000
Pike perch	Put-in-Bay	75,000
Total		25,001,000

Of rainbow-trout eggs produced at Wytheville and Neosho 104,537 were reshipped to applicants in Baltimore, Md., Canada, Belgium, and France, as shown in the details of distribution. Of species forwarded from the Fish Ponds, World's Fair, Green Lake, Quincy, Wytheville, Neosho, Havre de Grace, and Put-in-Bay stations, 1,236,704 individuals were received and most of them were distributed.

AQUARIA, CENTRAL STATION (L. G. HARRON, SUPERINTENDENT).

At the beginning of the fiscal year the superintendent was on detailed duty at the aquarium of the Fish Commission at the World's Columbian Exposition, and remained in that service until October 30, 1893. Preparations for restocking Central Station aquaria began November 5, and on November 12 a collecting trip was made to lower Chesapeake Bay. Fish had left the inlets and shallow bays owing to cold weather, and very few specimens could be collected.

In February, 1894, during repairs to the aquaria, the fish were transferred to the outside supply reservoir and air currents were introduced, but all of them died during spring and summer. The superintendent was detached for duty at Bryan Point until after the close of the fiscal year.

The water motor, introduced in May, 1893, to pump salt water into the storage tank, works satisfactorily and at much less cost than the gas engine previously used. A line of ⅜-inch iron pipe was extended from the air compressor to establish air circulation in the aquaria.

Goldfish spawned in May and the eggs were hatched in tubs of standing water; the fry were reared in small "balanced" aquaria. Eggs of the paradise fish were hatched and the fry reared in the same way. Common darters (*Boleosoma olmstedi*) spawned in May and the eggs were eaten by the adult fish. Among the marine species some of the mummichogs (*Fundulus*) spawned in June and a number of fry were produced, but they were devoured by the adults.

Adult grayling, brought from the World's Fair November 3, 1893, to the number of 44, were kept with the loss of only 4 until February 17, 1894, when they were transferred to the Wytheville, Va., Station in excellent condition. About 50 young brook trout, reared from fry exhibited at the World's Fair, were transferred to the aquaria at Central Station November 5, 1893, and held without loss until March 5, 1894, when they were from 5 to 6½ inches in length. They were planted at Leesburg, Va. Some anemones from the Pacific Coast, exhibited four months in the aquarium at Chicago, were transferred to Washington November 5, 1893, and lived in salt water with air circulation until May, 1894, when they were killed by high temperature.

The mortality among marine species is merely nominal, and freshwater fishes, with the exception of the *Salmonidæ*, which can not endure summer warmth, are successfully maintained.

FISH PONDS, WASHINGTON, D. C. (R. HESSEL, SUPERINTENDENT).

The following yearling fish were taken from the ponds in November, and distribution of them made through Central Station: Carp, 51,802; tench, 10,022; golden tench, 431; goldfish, 8,427; golden ides, 1,947; black bass, 12,330; shad, 1,000,000.

On the night of October 12 a strong wind blew up, which developed into a hurricane by morning, and forced the water from the bay into the Potomac. Toward evening, at high tide, the water rushed over the banks and flooded all the large ponds containing carp, black bass, and tench, and for eight hours the water was on a level with the base of the office building. The water thus became brackish, and about 1,000,000 yearling shad were swept into the Potomac somewhat earlier than originally intended.

Ides.—Early in March the old ides were transferred to the hatching ponds, where they began to spawn on April 20. Subsequently the frost killed over 20,000 eggs, and only about 40 young ides were saved.

Black bass.—Both kinds of the black bass were raised—the large-mouthed and the small-mouthed. On April 1 they were placed in their respective hatching ponds. The small-mouthed bass spawned April 23, and the large-mouthed one week later. On May 8 the first young bass of both species were seen. The large-mouthed variety soon increased to about 60,000, while the small-mouthed did not produce over 4,000 eggs. Soon after May 10, the young bass were placed in the north pond and the old ones retained in the hatching ponds. The bass were fed on live food, 500,000 tadpoles and 400,000 young carp being placed at their disposal.

With the arrival of the warm weather the natural consequences of the October flood could be seen. Grasses and other water plants, the seeds of which had been carried into the station by the high water, grew very rapidly into a dense mass of vegetation, which had to be removed over and over again to prevent their interfering with the growth of the young fish. There also appeared at the same time two kinds of *Notonecta* and *Nepa*, both insects being very injurious to young fish. Daily efforts were made to destroy them, but without success.

Notwithstanding the abundance of live food, the young large-mouthed black bass commenced to attack each other, thereby causing a decrease in the number of young fish; and how to remedy this is a problem yet to be solved.

Carp.—The leather and scale varieties were raised in the new pond, while the blue carp were placed in another pond. The carp in the new pond suffered from the insects above referred to.

Tench.—This species was hatched and raised in the south pond, and the golden tench in a smaller pond. Compared with former seasons, the young fish grew very fast.

Pike perch.—A number of transport cans full of this fish were transferred to the new south pond, but the fish all died on account of the too warm water, the pond being but one foot and a half deep.

The shad hybrids also died from the same cause.

WYTHEVILLE STATION, VIRGINIA (GEORGE A. SEAGLE, SUPERINTENDENT).

The product of this station during the season was as follows:

Species.	Eggs.	Fry.	Yearlings.
Rainbow trout	104,500	15,000	90,640
Rock bass	.....	.....	20,750
Black bass	.....	.....	40
Carp	.....	.....	700
Goldfish	.....	.....	2,649

Of the rainbow trout 250,000 eggs were collected from the brood stock at the station, 114,000 were received in January from the Neosho Station, and 10,000 from the Troutdale Fish Farm, Mammoth Spring, Ark., making in all 374,200 eggs. Of this number, 180,360 were hatched

at the station, 104,500 were shipped to Central Station for foreign shipments, and 80,040 died during incubation. From the native rainbow trout 10,000 eggs were shipped to the station from Hoopa Valley, California, on March 24, and arrived at Wytheville April 2; but as all the eggs hatched en route the shipment was a total loss.

From 135 black-spotted trout at the station there were collected 12,000 eggs, but owing to the lack of milt only 500 were saved. The propagation of this species has been tried at the station the past two seasons, but without success. The sexes do not mature together, the male having passed out of season when the female comes in.

About November 5 the rainbow trout commenced to spawn and ceased about February 20. Many of the older rainbows did not spawn this season from some unknown cause. The brood stock of rainbows consists of 5,400 fish, of which 1,000 are from 6 to 12 years old; 3,200 are 2 years old, and 1,200 are 1 year old. Very few of the 2-year fish produced eggs this season. Of rainbows, there were distributed this year 90,320 yearlings, 320 adults, and 15,000 fingerlings. Fish of a summer's growth were distributed as follows: Rock bass, 20,750; black bass, 40; carp, 790; goldfish, 2,649. The goldfish commenced spawning this year March 24, and the carp April 27.

From the rainbow-trout eggs hatched at the station the past season there are on hand, in good condition, 80,000 fingerlings. The bulk of these fish are being reared in the troughs where they were hatched.

The maximum and minimum temperatures of air and water during the months of November (twenty-six days), December, January, and February (twenty days), were as follows:

	Temperature (air).		
	Max.	Min.	Mean.
	° F.	° F.	° F.
Twenty-six days in November	60	13	40$\frac{1}{8}$
December	58	12	30$\frac{1}{9}$
January	58	12	30$\frac{3}{7}$
Twenty days in February	58	12	37$\frac{3}{5}$
Water	54	53	53$\frac{98}{100}$

PUT-IN-BAY STATION, OHIO (J. J. STRANAHAN, SUPERINTENDENT).

The work of this station during the year was chiefly confined to the whitefish, pike perch, and lake herring. The egg-collecting season for whitefish and herring was one of the worst in the history of the commercial fisheries of Lake Erie. A very severe gale set in on November 12, which lasted, with the exception of November 16 and 20, to the close of the spawn-taking season, thereby greatly interfering with the collecting work.

Whitefish.—The first whitefish eggs were taken November 7, and the last November 29. The places and the number of eggs taken at each were: North Bass Island, 24,780,000; Middle Bass Island, 4,800,000;

Put-in-Bay Island, 5,190,000; Kelly Island, 2,880,000; East Sister Island, 1,260,000; Toledo, 140,000; total, 39,050,000.

Herring.—The first herring eggs were taken November 12, and the last November 26. From Put-in-Bay Island were received 31,000,000; from North Bass Island, 22,000,000; total, 53,000,000. Both kinds of eggs were, as a whole, of poor quality, owing to the difficulties under which they were obtained.

The work of penning live fish was a failure. There were penned only 82 fish, over one-half of which were males.

Only 45,000 lake trout eggs were collected during the season, and they were in such poor condition that but few of them hatched.

In the hatching, extensive and careful experiments were made with cone-shaped tubes as compared with the straight ones in general use. Eggs taken on the same day by the same person were mixed in a tub, and McDonald jars with open tops were fitted with the two styles of tubes and filled with these eggs. The percentage of loss was found to be much less with the cones than with the straight tubes. The percentage of loss after eye-specks were formed in the eggs was almost nothing with the cones, while it was considerable with the straight tubes. Like experiments were made with pike-perch eggs and with like results.

The cones were made at the station of tin, 6 inches long and 1 inch in diameter at the large end. Sections 6 inches long were cut from the lower end of the straight iron tubes, the cones centered and soldered on, after which all was coated with asphaltum.

Pike perch.—The season for collecting eggs of this species was very good, and 293,845,000 were obtained from the following grounds: North Bass Island, 80,580,000; Put-in-Bay Island, 61,030,000; Port Clinton, 100,725,000; Catawba Island, 3,400,000; East Sister Island, 21,760,000; Sandusky Bay, 26,350,000.

Of these, 248,965,000 were placed in the station, and 44,880,000 in the Sandusky station of the Ohio Fish Commission for the pike-perch season, the United States Commission having taken possession April 5.

On April 15, a series of experiments was commenced for the purpose of preventing the sticking together of adhesive eggs. Following the directions of Prof. Jacob Reighard, of Michigan, in 1 quart of dry corn-starch, dissolved in 5 gallons of water, was placed, after impregnation and 3 minutes interval, 1 gallon of pike-perch eggs. In another vessel was placed finely dissolved swamp muck in a solution of about the consistency of porridge, 2 quarts of this to 10 gallons of water, and in this were put 3 gallons of eggs. The spawn-taker making this experiment brought in 1 gallon of eggs in starch, and 2 gallons in muck. He reported that it was more work to keep the eggs free with the starch than under the former plan of constant stirring until the adhesive tendency disappears; as in the one case the eggs need attention only while being freed, while in the other they must be almost constantly

stirred until the station is reached. He reported that the muck entirely prevented adhesion, and gave no trouble whatever. After arriving at the station both lots were examined and then placed under running water as usual. The current carried over nearly all of the starch and a considerable portion of the muck. About twenty-four hours after being taken the two lots were separately removed from the kegs, passed through a screen with meshes large enough to admit of the passage of a single egg, when it was found that there were practically no lumps in either case. They were then put into a screen box with mesh fine enough to hold the eggs and all the muck was washed out, there being no starch remaining. Examination was made of both lots with the microscope, which showed minute particles of muck and starch adhering thickly all over the outer membrane of the eggs, thus preventing adhesion. Both lots showed a nearly equal percentage of good eggs, the muck eggs being slightly the better. In the starch solution 11 jars of eggs were taken; in the muck, 32. The muck was prepared by taking black muck from the shores of a pond near by, thoroughly mixing to a very thin solution with water, letting the vessel set about half a minute to settle out the coarser and heavier particles, then decanting off the water, holding the fine particles in solution, which was left to settle, when the nearly clear water was poured off, the muck being then rubbed through a fine wire screen, when it was ready for use.

An experiment was also made in hatching yellow-perch eggs. The eggs (73,000) were taken, April 27, from a fish weighing 9 ounces, and were at once impregnated, the milt of two small males being used. They were put in a McDonald jar and worked with a small amount of water, being thoroughly feathered twice a day or more. Eye-specks showed on the ninth day, and the fry hatched May 12. There was not 1 per cent of eggs in all which did not hatch.

Experiments were made in feeding the pike-perch fry to prevent cannibalism. One hundred thousand fry ten days old were placed in each of three kegs, each supplied with running water; one was entirely darkened; the fry in the second were freely fed on graham flour, and the third lot were left to themselves. The kegs were set up May 14. The darkened keg was opened on the 17th and again on the 19th, and but very few "doubles" were found—not over 1 per cent. The fry were light colored, and not as vigorous as those which had been in the light. On the 21st the keg was again opened, and a large percentage of the fry being dead, the experiment was abandoned and the live ones planted. There was a perceptibly greater mortality through cannibalism in the keg wherein the fry were not fed than in the one where they were, but it was considerable in the latter, although they seemed to eat the graham flour freely and remain healthy.

These experiments show that pike-perch fry can be held for two or three weeks for the purpose of facilitating shipment by providing ample tankage facilities, feeding often, and keeping the tanks moderately dark when the fry are not feeding.

Distribution and deposits of eggs and fry were made from the station, as follows:

Whitefish eggs to Central Station, Washington, D. C., 4,000,000; to Clayton, N. Y., State Fish Commission, 6,000,000.

Pike-perch eggs to Central Station, Washington, D. C., 3,700,000; to Constantia, N. Y., Fish Commission, 5,000,000; to Sandusky hatchery, 10,000,000.

Plants of fry were made in Lake Erie as follows: Whitefish, 21,710,000; herring, 30,005,000; pike perch, 132,000,000; lake trout, 121,000; yellow perch, 70,000.

Pike-perch fry delivered to United States Fish Commission (car No. 4), 24,300,000; to Ohio Fish Commission, 18,900,000; to John Fitzgerald (Winnow Point Club) at Put-in-Bay Station, for Mud Creek Bay, Ohio, 2,500,000.

NORTHVILLE STATION, MICHIGAN (F. N. CLARK, SUPERINTENDENT).

During the first half of the year there were completed two large ponds fed by pipe and race from the reservoir at the station, and twelve small rearing ponds were reconstructed. Drainpipes were introduced to all the remaining ponds, making it possible to draw each pond separately into the sewer.

The following table shows the number of each kind of fish on hand at the station July 29, 1893:

Kind.	Hatching of the year.			
	1893.	1892.	1891.	1890, or previously.
Brook trout	47,500	4,000	3,000	575
Von Behr trout	24,000	2,300	.....	900
Loch Leven trout	37,700	.....	.....	1,700
Black-spotted trout	.....	1,500	940	.....
Lake trout	25,700	.....	.....	.....
Total	134,900	7,800	1,240	7,175

There were not as many eggs collected this year from the parent fish at this station as in prior years, owing to the small number of breeders, a large portion of the stock fish having been shipped to the aquaria at the World's Fair.

Brook trout.—From 548 old fish (277 females and 271 males) 163,820 eggs were obtained, and from 3,106 yearlings (1,901 females and 1,205 males) 250,125 eggs, an average of 132 eggs to each fish. There were retained for hatching 228,945, and 185,000 eggs were shipped as follows: Troutdale Fish Farm, Mammoth Spring, Ark., 5,000; John G. Bailey, Rogers, Ark., 5,000; secretary of Hampshire Trout Club, Northampton, Mass., 10,000; Vermont Fish Commission, 20,000; Nebraska Fish Commission, 20,000; Minnesota Fish Commission, 20,000; A. P. Muzzey, New Richmond, Wis., 5,000; consul of Switzerland, at Havre, France, 20,000; Wytheville, Va., Station, 20,000; Duluth, Minn., Station, 20,000; Neosho, Mo., Station, 20,000; Central Station, Washington, D. C., 20,000.

Of yearlings, 29,100 were sent out, mostly to parties in Michigan, Pennsylvania, and New York. Six thousand fingerlings were shipped to persons in Michigan and Indiana.

When the brook-trout fry were 2 months old they began to die, and the loss continued as long as any of the fry were on hand, or until about July 1, 1894. It is thought that this loss was caused by the fact of the parent fish being diseased, a parasite attaching itself to their gills. About the beginning of March, when the disease was discovered, the fish were apparently clean, and from fifteen to thirty minutes after being attacked they would die. From early in March until in May over 3,000 of the parent fish, mostly from those 2 years old, died.

Von Behr trout.—Between October 31 and December 23 there were taken 235,000 eggs. Of these, 135,000 were distributed as follows: Troutdale Fish Farm Company, Mammoth Spring, Ark., 5,000; E. Chazari, City of Mexico, Mexico, 20,000; R. E. Follett, fish commissioner, Sheffield, Mass., 20,000; Minnesota Fish Commission, 20,000; Vermont Fish Commission, 20,000; Wyoming Fish Commission, 15,000; Green Lake Station, 25,000; Neosho Station, 10,000.

From the 24th of January to the 29th of March 14,972 fingerlings were distributed to parties in Michigan, Indiana, Ohio, Wisconsin, Iowa, and Kentucky.

Loch Leven trout.—Of this species 205,500 eggs were taken between October 30 and December 30. From these the following distributions were made: California Fish Commission, 20,000; Minnesota Fish Commission, 20,000; Green Lake, Me., Station, 20,000; Leadville, Colo., Station, 10,000; E. Chazari, inspector-general of pisciculture, City of Mexico, Mexico, 25,000.

Yearlings distributed, 10,600; fingerlings, 24,000.

Lake trout.—Eggs numbering 2,663,000 were received at the station during the season from Alpena, Mich., and 21,099 from the World's Fair on the 1st of November. Distributions of these eggs were made between January 17 and 19, as follows: Caledonia, N. Y., hatchery, 300,000; E. A. Brackett, fish commissioner, Winchester, Mass., 100,000; S. S. Watkins, superintendent Minnesota Fish Commission, St. Paul, 100,000; A. M. Musser, Salt Lake City, Utah, 100,000; C. C. Warren, fish commissioner, Roxbury, Vt., 300,000; Nebraska State Fish Commission, 100,000; R. E. Follett, fish commissioner, Sheffield, Mass., 100,000; Green Lake, Me., Station, 50,000; Put-in-Bay, Ohio, Station, 125,000; World's Fair, 54,000. Of this latter number, 21,099 were returned to the Northville Station November 1.

The number of fingerlings distributed between June 13 and 26 was 102,000: C. N. Clark, Cape Vincent, N. Y., 30,000; Lake Huron, off Sugar Island, 40,000; Lake Huron, off Alpena, 30,000; E. C. Dayton, Kalamazoo, Mich., 2,000.

Yearlings distributed, 19,423, to parties in New York, Pennsylvania, Ohio, Michigan, Indiana, and Montana. There were deposited in Lake Huron, near Alpena, Mich., 145 fish, 1, 2, and 3 years old.

Black-spotted trout.—The number of this species on hand April 1 was 927 of those coming 3 years, and 1,400 of those coming 2 years old. The 3-year-old fish were in excellent condition, but only 62,500 eggs were taken, and for some unknown reason these did not do well, as only about 20 per cent of very weak fry were produced, and nearly all of them died before they commenced to take food readily. Toward the close of the season nearly all the 2 and 3 year old fish died. This was caused by handling them while taking spawn during the very warm weather in May, and partially by the same disease which attacked the brook trout.

Salmon.—There were received from the World's Fair 40,000 Pacific Coast salmon eggs in very good condition, from which a good percentage hatched. After the sac was absorbed they were planted near Monroe, Mich., in the Rasin River, a tributary to Lake Erie. On April 30 there reached the station from Fort Gaston, Cal., 100,000 Pacific Coast salmon eggs, but on opening the package they were found to be all rotten.

Trout were forwarded from the Northville Station to the World's Fair, as follows:

Brook, 2 and 3 years old, 100; 1 and 2 years old, 100; yearlings, 300; fingerlings, 2,000.

Von Behr, 4 years old, 50; fingerlings, 2,000.

Loch Leven, 4 years old, 50; fingerlings, 2,000.

Black-spotted, 2 years old, 50.

Grayling, wild, 189.

Trout delivered to Michigan Fish Commission: Lake, 1 year old, 25; black-spotted, 1 year old, 25; 2 years old, 25; grayling, wild, 10.

On January 16, 20,000 rainbow-trout eggs were received from the Neosho Station, in fair condition. The loss in hatching these and up to the time of the absorption of the sac was 5,000. By the end of the year 8,000 more were lost, leaving 7,000 fingerlings on hand in good condition, which are held for distribution when a year old.

The following table shows the number of eggs, fry, and fish of each species on hand at the end of the year (June 30, 1894):

Kind.	Eggs.	Fingerlings.	1 year old.
Brook trout	228,945		
Loch Leven trout			1,500
Lake trout	1,388,000		
Von Behr trout	100,000		
Rainbow trout		7,000	

ALPENA STATION, MICHIGAN (F. N. CLARK, SUPERINTENDENT).

The operations of this station during the season were, as in previous years, devoted to the collection of whitefish and lake-trout eggs. The work of securing these commenced about November 1, and continued during the month. The fishing was confined to fewer grounds than formerly, and the severe weather during the spawning seasons of these two species of fish interfered greatly with the work.

In September spawning outfits were sent to Thunder Bay and Middle Islands, and other arrangements were made for collecting shoal-trout eggs for the United States Fish Commission exhibit at the World's Fair, but very few eggs were collected during the month.

Early in October 96,000 shoal-trout eggs were received at the station, 54,000 of which were shipped by express to the World's Fair on the 6th, and 42,000 to the Northville Station by boat to Detroit on the 11th.

Lake trout.—During the latter part of October 368,000 eggs of the lake trout were received at the station, and 160,000 of these were shipped to Northville. During November 1,316,000 eggs were received, and these, with the 208,000 on hand at the end of October, were sent to Northville, and 1,000,000 were taken direct from Charlevoix to Northville. All the lake-trout eggs sent from Alpena to Northville were from fish taken in gill nets on the Big Reef in Lake Huron, near Alpena, and from reefs in Lake Michigan near Charlevoix, Mich.

Whitefish.—The first whitefish eggs, about 1,000,000, were received on the 9th of November; 19,010,000 were received during the month. The loss on these was 230,000. There were 6,590,000 eggs received in December; there being in all at the station at the close of the month, in fair condition, 24,320,000. Of these, a loss of 820,000 took place in January, leaving 23,500,000 on hand, January 31, in first-class condition.

On the 17th of February 10,000,000 whitefish eggs were sent to Duluth Station by car No. 1, and on the 24th of the same month 200,000 were shipped to R. E. Follet, fish commissioner, Sheffield, Mass. The loss on eggs during February was 250,000; leaving 13,050,000 on hand in first-class condition. There was no loss on the eggs on hand at the station during March.

The first fish hatched on the 6th of April and the last on the 30th.

Deposits of whitefish fry were made as follows:

Date.	Points of deposit.	Number of fish.
Apr. 16	Lake Huron, near East Tawas, Mich	1,000,000
18	Whitefish Lake, near Corinne, Mich	2,000,000
24	Lake Huron, north of Thunder Bay Island	1,050,000
25	Lake Huron, near Sturgeon Point	1,000,000
26	Lake Huron, near Miller Point	1,000,000
27	Lake Huron, Detour Passage	1,500,000
May 2	Lake Michigan, near Manistique, Mich	2,000,000
7	Lake Michigan, near Charlevoix, Mich	2,000,000
11	Lake Michigan, Epaufette and Naubinway	1,500,000
	Total	13,050,000

The maximum and minimum temperatures of the water at the station for the months given were as follows:

Month.	Max.	Min.	Month.	Max.	Min.
	° F.	° F.		° F.	° F.
November, 1893	40	33	March, 1894	37	33
December, 1893	33	33	April, 1894	48	34
January, 1894	33	32½	May, 1893, to the 19th	54	50
February, 1894	34	33			

DULUTH STATION, MINNESOTA (S. P. WIRES, SUPERINTENDENT).

Dr. R. O. Sweeny, sr., tendered his resignation as superintendent to take effect July 31, 1893. The resignation was accepted. Mr. S. P. Wires, foreman of the station, was promoted to the position of superintendent.

The work at this station was confined during the year to the propagation of the whitefish, lake trout, brook trout, and pike perch.

Whitefish.—Between the 1st and 18th of November 750,000 eggs were collected: 500,000 from Siskowit Bay, Isle Royale, Mich., and 250,000 from Willey Island, vicinity of Bayfield, Wis.; and on February 22 10,000,000 eggs were received from Alpena Station. These 11,500,000 eggs produced 10,190,000 fry, which were deposited as follows: May 2, Raspberry Bay, Wisconsin, 2,000,000; May 2, Lake Superior, vicinity of Iron River, Wisconsin, 2,000,000; May 7, points between Duluth and Iron River, 2,000,000; May 11, Lake Superior, vicinity of Bayfield, 2,000,000; May 14, Lake Superior, vicinity of Isle Royale, 500,000; May 18, Siskowit Lake, Isle Royale, 1,000,000; May 19, Lake Superior, vicinity of Fish Island, Isle Royale, 490,000; May 19, vicinity of station, 200,000.

Lake trout.—The first lake-trout eggs of the season were collected at St. Ignace Island and Kings Bay, Ontario, September 25, and the last at Bayfield, Wis., November 17. Collections were made as follows:

St. Ignace Island, Ontario	973,400
Kings Bay, Ontario	729,650
Fishermens Home, Isle Royale, Mich	163,800
Grand Portage, Minn	437,300
Fish Island and Rock Harbor, Isle Royale, Mich	295,950
Wright Island, Isle Royale, Mich	180,000
Washington Harbor, Isle Royale, Mich	270,000
Port Arthur, Ontario	199,900
Bayfield, Wis	410,000
Total	3,660,000

From these were obtained 2,540,000 fry, which were planted in Lake Superior in many localities in May and June.

Brook trout.—On January 13th, 20,000 eggs were received from the Northville Station. There were lost of these, February, 1894, 1,000, mostly fry, and in March 9,000 fry. June 25, 10,000 fry were deposited in Washington River, Isle Royale, Mich.

Pike perch.—Between April 27 and 30, 23.000,000 eggs were collected at Pike River, Minn. In May there was a loss of 15,000,000 of these eggs. The 8,000,000 fry hatched were deposited at the following points: June 3, Pike Lake, St. Louis County, Minn., 2,500,000; June 4, Lake Vermilion, vicinity of Tower, Minn., 2,500,000; June 8, Lake Superior, vicinity of Sand Bay, Wis., 3,000,000.

The average temperature of the water was as follows: October, 44°; November, 35°; January, 34°; February, 34°; March, 33°; April, 32½°; May (from 33° on May 1 to 58° May 31); June, 65°.

QUINCY STATION, ILLINOIS (S. P. BARTLETT, SUPERINTENDENT).

As in former seasons, the work of this station was carried on from points along the Mississippi River above and below Quincy and from points on the Illinois River above and below Meredosia. The regular work of the station was delayed until the latter part of August, as the cars and equipments for the movement of the fish were used in the collection of fish for the aquarium at the World's Fair. Consequently, the collections were restricted to places not dried out by midsummer heat, or to rivers in which the water was not very low.

The fish distributed from the station were, in the main, much above the average size, and were in very good condition for transportation. They consisted principally of black bass, white bass, Warmouth bass, crappie, spotted catfish, pike, and sunfish. The following table shows the distribution work of the season:

State.	Black bass.	Crappie.	Catfish.	Warmouth bass.	Sunfish.	Yellow perch.	White bass.	Wall-eyed pike.	Pike.	Bream.	Rock bass.	Total.
Idaho	.....	.....	100	.....	.....	.....	.....	.....	.....	.....	.....	100
Illinois	752	1,000	2,800	150	.....	.....	.....	.....	.....	.....	30	4,788
Indiana	385	2,725	375	650	20	.....	.....	.....	.....	.....	.....	4,105
Iowa	1,212	1,075	9,642	620	100	167	.....	.....	.....	.....	.....	12,825
Kansas	853	540	1,100	100	.....	20	.....	.....	.....	.....	.....	2,622
Kentucky	5,012	1,740	1,165	219	.....	75	.....	.....	.....	20	.....	8,231
Massachusetts	190	.....	.....	38	.....	.....	.....	.....	.....	.....	.....	228
Missouri	375	306	450	115	.....	.....	.....	.....	.....	.....	.....	1,246
New York	50	50	125	.....	.....	.....	.....	.....	.....	.....	.....	225
Ohio	2,275	15	.....	.....	50	.....	.....	.....	.....	.....	.....	2,340
Oregon	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50
Texas	422	535	265	275	.....	.....	.....	.....	.....	.....	.....	1,497
Utah	50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50
Virginia	100	50	300	.....	.....	.....	.....	.....	100	.....	.....	550
Washington	550	18	100	.....	.....	.....	.....	.....	.....	.....	.....	668
Wyoming	600	25	25	.....	.....	.....	.....	.....	.....	.....	.....	650
Central Station	738	448	150	152	49	.....	9	61	.....	.....	.....	1,607
Total	13,564	8,542	16,597	2,328	219	262	9	61	100	20	30	41,732

In the distribution of these fish the four cars of the Commission were employed. The whole number of miles traveled was 16,498, transportation for 11,899 miles being given free by the railroads and 4,599 miles being paid for.

The residue of the fish taken from the ponds and lakes formed by the overflows of the Mississippi and Illinois rivers—those which had not been selected for distribution—was again returned to the nearest deep water. The kinds and numbers are as follows: White perch, 18,100; buffalo, 35,000; sunfish, 25,000; bullpout, 86,000; carp, 31,000; catfish, 109,000; warmouth bass, 3,900; pike perch, 500; white bass, 3,600; black bass, 1,000; crappie, 2,000; pike, 8,900; total, 324,000.

NEOSHO STATION, MISSOURI (WILLIAM F. PAGE, SUPERINTENDENT).

The operations of this station during the year were confined to the propagation of black bass, rock bass, carp, tench, golden ide, goldfish, spotted or channel catfish, brook trout, Von Behr trout, and rainbow trout.

A new railroad siding was projected to connect with the Kansas City, Pittsburg and Gulf Railroad at Neosho.

Owing to the ravages of crayfish, Mr. Page reports that the production of each pond has steadily decreased each season since its construction and no means have yet been found to destroy these pests. Another destructive agency is the boat fly (*Notonecta glauca*), by which 600 young goldfish were killed in about ten days.

Black bass.—About September 1 there were 2,000 of these fish at the station, but four months later, when distribution was about to be made, only 630 were shipped, the number being thus reduced by the fish eating each other, notwithstanding every effort was made to supply them liberally with both natural and artificial food.

On April 4, 20 old breeders were put in pond No. 10, and 23 2-year-old bass in pond No. 11, in which were 4 old breeders. April 21 these bass were found guarding newly made nests. By May 1 all the eggs in the earliest nests were hatched out, though new nests were seen up to June 10. June 1 the fish of the earliest hatch were 1¼ inches, and numbered from 8,000 to 15,000. On June 6 a heavy rainstorm destroyed most of them.

Rock bass.—Of this species 4,710 were distributed, mostly in Indian Territory, Texas, Arkansas, Missouri, Iowa, Kansas, and Nebraska.

Carp.—During the winter 2,275 yearling carp, ranging from one-quarter to one-half pound in weight, were shipped. It having been determined to discontinue the propagation of this species at this station, the breeders on hand were liberated, May 1, in Grand River, Indian Territory.

Tench.—The good results heretofore attained in the propagation of the tench were not realized this year, the total production being but 10,000, due, it is thought, to the depredations of crayfish. The number of yearling fish distributed was 9,210, to parties in Indian Territory, Texas, Missouri, and Arkansas.

Golden ides.—But 18 yearlings of this species were distributed during the season, and there is but one of two years old and one of four years on hand. These are employed as scavengers in the pond with the brood stock of rainbow trout.

Goldfish.—There were distributed 4,231 goldfish during the year. The production of this fish will hereafter be confined to a limited number of the finer specimens.

Spotted or channel catfish.—The fish of this variety which have been at the station for the past three years failed to spawn, and they all died during the winter, being attacked by fungus. There were distributed 1,059 yearlings.

Brook trout.—The 20,000 brook-trout eggs received from the Northville Station January 13, 1894, had every appearance of being in good condition when received, but twenty-four hours after unpacking 95 per cent of the eggs were dead. By February 11 all were dead. The cause of the loss is unknown.

Von Behr trout.—On January 19, 10,000 eggs were received from Northville. These produced 10,312 fry, which were placed in the outdoor pools.

Rainbow trout.—Of this variety there were distributed during the season 52,513 yearlings. This trout began to spawn December 12, and 787,339 eggs were produced, of which 604,923 (or about 75 per cent) were impregnated. Of those impregnated, 491,640 were shipped to other stations, and the remainder, 113,283, were retained for hatching and rearing. During the breeding season the loss of breeders from constant fighting incident to spawning amounted to 67 females and 103 males.

The temperatures of the waters in the various pools and ponds at the station during the year were as follows:

Location.	Max.	Min.	Location.	Max.	Min.
	°F.	°F.		°F.	°F.
Trout pools, A to F	59	56	Pond No. 7	70	59
Trout pool; new, eastern	62	56	8	72	32
Pond No. 1	68	50	9	82	32
2	69	32	10	81	32
3	80	32	11	86	32
4	82	32	12	79	32
5	75	32	13	71	32
6	87	32	15	67	60

The air temperatures during the year were:

1893.	Max.	Min.	Mean.	1894.	Max.	Min.	Mean.
	°F.	°F.	°F.		°F.	°F.	°F.
July	102	66	82.10	January	68	—20	38.50
August	100	51	80.40	February	60	— 1	35.60
September	96	42	77.40	March	80	14	54.50
October	87	28	60.70	April	90	31	64.95
November	70	10	44.70	May	92	43	72.90
December	66	11	42.60	June	103	52	84.40

LEADVILLE STATION, COLORADO (H. D. DEAN, SUPERINTENDENT).

In April, 1894, the United States acquired from John Law, Jennie Goodell Blow, and J. B. Grant their rights in the water of Rock Creek and their lakes and other property contiguous to the Government reservation, with exception of a prior right of De May to an amount not exceeding 500 gallons per minute from May to October, and an amount of water from Rock Creek not to exceed 1,000 gallons per minute for the Law Placer. The work at this station was, as in previous years, confined to the propagation of the trouts, the varieties handled being the brook, Loch Leven, black-spotted, rainbow, Von Behr, and yellow-finned.

Brook trout.—The first eggs were taken October 16; began hatching January 1, and feeding February 14. Between November 1 and 10 there were taken at Wellington Lake 789,200 eggs. Eye-spots showed in forty-four days; fish commenced hatching January 12 and completed January 30; 60 per cent hatched. The first lot began feeding April 5,

and the second March 16. Fully 75 per cent of the latter died from some unknown cause after hatching.

On November 4 there were taken at Uneva Lake 24,800 eggs from 5 females. These eggs began hatching January 29; 73 per cent hatched. They began feeding February 27, and on May 25 there were on hand 17,000 fish, or 68½ per cent. June 30, 8,500 were delivered to Searl & Lazenby, in accordance with agreement. There were taken from stock fish 448,400 eggs, 47 per cent of which hatched. The total number of eggs of this species taken was 1,262,400, of which 55½ per cent hatched. Between December 5, 1893, and June 11, 1894, there were distributed 23,000 fry and 35,900 yearlings, mostly to Colorado waters.

Black-spotted trout.—There were 74,800 eggs taken from stock fish, but they were very poor. It is thought that these fish can not be successfully kept in small ponds. From October 20 to December 6 there were 10,100 yearlings distributed to various parties for planting in Colorado waters, and 1,000 to Ernest Barthold, of Sheridan, S. Dak., for waters of that State.

Rainbow trout.—On January 18, there were received from Neosho 20,000 eggs. They were in very poor condition, however, and after hatching the fish were weak—would not take food—and on April 19 it was thought best to plant them, and 5,000 were deposited in Lower Evergreen Lake and 6,000 in Lake Creek. On November 12, 1893, 475 yearlings were furnished to W. R. Callicotte, of Denver, for his fish ponds, and December 5, 475 were given to Capt. G. L. Brown, Pine Ridge, S. Dak., which were deposited in Medicine Root Creek.

Loch Leven trout.—On January 21, there were received from Northville 11,200 eggs. After hatching, 80 per cent of them died. Between October 26 and December 18 there were distributed 19,800 yearlings in Colorado, Montana, New Mexico, South Dakota, and Wyoming.

Yellow-finned trout.—In December, the 2-year-old fish on hand began to die rapidly, and to save them the 700 that remained were planted in Lower Lake on December 13.

Von Behr trout.—In July, 450 yearlings were distributed in Colorado waters, and on December 24, 1,000 yearlings were deposited in Black Lake.

The mean air temperature for the year was 35¾°, and the mean water temperature 43⅔°. The highest air temperature was 72°, on July 2, 3, 4, 9, and on August 3. The lowest air temperature was on January 18, when it was 16° below zero.

The eggs, fry, and other stock on hand June 30, 1894, were as follows:

Species.	Eggs.	Fry or fish hatched in calendar year—		
		1894.	1892.	1891.
Brook trout	.....	145,000	3,445	1,123
Rainbow trout	.....	500	.....	26
Loch Leven trout	.....	2,000	1,580	27
Black-spotted trout	5,000	13,500	.....	424

BAIRD STATION, CALIFORNIA (LIVINGSTON STONE, SUPERINTENDENT).

The salmon rack across McCloud River having been built (in June) earlier this season than has been customary in recent years, accounts for the fact that there were more breeding salmon corralled at the station than there were last year, and a million more eggs were taken from the summer run of fish.

The regular fishing and spawn-collecting season for the summer run began August 22, when 104,000 eggs were taken. At the end of the month 840,000 eggs were in the hatching house. The season ended September 15, with a take of 2,069,200 eggs.

Fishing for the fall run of salmon began October 21 and continued till November 28, when a violent storm, lasting nine days, with a sudden rise in the river, tore out the rack and prevented further fishing for the season. During the fall run 6,019,150 eggs were obtained, making a total of 8,088,350, which was exceeded only in 1875 and 1878.

Five hundred thousand eggs were hatched at the station, and the fry distributed along the McCloud River; the remainder (7,500,000) were sent to the California State hatching station at Sisson, where they were hatched, and the young fish deposited in the Sacramento River.

On the 1st of September 50,000 eggs were sent to the World's Fair at Chicago, and were hatched there.

The highest temperatures of the air and water at 2 p. m. at the station during the year were as follows:

1893.	Air.	Water.	1894.	Air.	Water.
	° F.	° F.		° F.	° F.
July	102	59	January	60	49
August	104	58	February	71	50
September	90	56	March	82	53
October	90	52	April	90	53
November	81	48	May	92	56
December	70	44	June	*a* 90	*a* 59

a Noon.

FORT GASTON STATION, CALIFORNIA (CAPT. WILLIAM E. DOUGHERTY, U. S. A., SUPERINTENDENT).

The station is situated on the Trinity River in the Hoopa Indian Reservation, the site being on the military reservation of Fort Gaston by permission of the War Department, afterwards confirmed by the Indian Bureau of the Interior Department. The Indian agent, Capt. W. E. Dougherty, discharges the duties of superintendent of the station.

The water supply for the hatchery is drawn from a ditch constructed by the Government for the supply of the reservation. The ponds are supplied from a small stream about one-fourth of a mile distant from the hatchery. The ponds contain steelhead salmon and eastern brook

trout. Silverside salmon are caught below a rack in the Trinity, and a few quinnat salmon also are taken there.

A tributary collecting station has been established on Bair's ranch upon Redwood Creek. The substation has a small hatchery and ponds for penning salmon. Probably a smaller proportion of quinnat salmon are found in Redwood Creek than in the Trinity. The run is short and occurs in the fall.

Another hatchery site was selected by Commissioner McDonald at Korbel on Mad River, where there is a large run of quinnat salmon, and where there is less interruption from net fishing. The site is about one-half mile above Korbel, at a point where a small tributary (Clear Creek) enters the river and furnishes ample water for the hatchery. A flume 150 yards long will suffice to convey the water, and a large building, formerly used by the Korbel Lumber Company, can be utilized for a hatchery and quarters for the employees at the cost of the lumber which it contains. The salmon can be stopped by a rack opposite the station.

There were collected during the season, from November to May, about 800,000 eggs of salmon, and about 460,000 of the steelhead, 15,000 of the Von Behr, and 3,000 of the rainbow.

During the fall a disease occurred among the trout which was not checked until it had destroyed a large number of each variety and nearly exterminated the Eastern brook trout.

In August and September 5,450 yearling rainbow trout were deposited in the waters of Trinity Mountain, Humboldt County.

In March and April 10,000 rainbow-trout eggs were shipped to the Wytheville, Va., Station; 100,000 eggs of the steelhead to the Northville, Mich., Station, and 50,000 eggs of the steelhead to the California State hatchery at Sisson.

There were remaining on hand at the station and substation on the 1st of July fry, as follows: Salmon, 560,000; steelhead, 332,000; eastern brook trout, about 40; Von Behr, 15,000; rainbow, 3,000; brood stock, about 600. The salmon and steelheads, when sufficiently grown, will be planted in waters adjacent to the station.

The season was very unfavorable for taking eggs on account of the continuous high water during the winter months.

The highest temperatures of the air and water at noon at the station for the months given were as follows:

Month.	Air.	Water.	Month.	Air.	Water.
	° F.	° F.		° F.	° F.
November, 1893	56	50	March, 1894	57	48
December, 1893	61	53	April, 1894		
January, 1894	54	50	May, 1894	a 64	a 58
February, 1894	59	47	June, 1894	a 64	a 60

CLACKAMAS STATION, OREGON (WALDO F. HUBBARD, SUPERINTENDENT).

The hatchery is located on the Clackamas River, 4 miles from its junction with the Willamette, about 12 miles from Portland and about 5 miles from the Willamette Falls at Oregon City. The station is reached by driving from Portland.

The salmon stripped at the station belong to the spring run of quinnat into the Columbia. They are intercepted by a rack, below which the fish are detained until they are ready to spawn. The success of the work depends upon the free passage of the salmon through the river below the rack, but this was interfered with by dams and numerous nets so that in the fall of 1893 the number of fish below the rack was very small in comparison with the number detained several years earlier.

About 4 miles below the hatchery and 1 mile from the mouth of the Clackamas is a sawmill dam about 7 feet high, with no adequate means for the ascent of the fish. The net fishing below the dam is of itself sufficient to prevent the salmon from ascending the stream and unless prohibited or greatly restricted the station may have to be abandoned.

On July 5 the building of a rack across the Clackamas River at the station for the purpose of preventing the salmon from going any farther up the stream was begun, and finished August 3. August 28 a trap for catching spawning salmon was built near the rack. Near the station is a deep pool in the river where the salmon collect until ready to spawn. Above this pool is a riffle where the rack and trap are situated, and the salmon that go there are taken in the trap. Below the pool is another riffle where some of the salmon spawn, and these are caught with a net.

On September 16 two ripe female salmon were taken, from which 7,000 eggs were obtained, and from that date to October 6 fishing was carried on daily. On account of the high water in the Clackamas during the season, the highest known for seventeen years, the work in the catching of adult fish was not as satisfactory as expected.

The whole number of eggs taken during the season was 277,000. Of these, 40,000 were sent, October 13, to the World's Fair at Chicago by one of the cars of the Commission and reached there with a loss of only 92. The eggs at the station began hatching November 1 and the fry liberated in the Clackamas December 25; between which date and January 26, 1894, 213,000 young fish were deposited in the Clackamas. About 10 per cent of the eggs at the station were lost in hatching.

On December 11, 1893, in accordance with instructions received from the Commissioner, the superintendent left the station to locate a site for a State hatchery at or near Knowles Creek, a tributary of the Siuslaw. A suitable location was found where a good supply of water can be taken by gravity into the hatching house. The building of the hatching house was let by contract, and work on it is now completed. Arrangements have been made to begin work there preparatory to taking salmon eggs the first part of July, 1894.

DISTRIBUTION.

The fiscal year opened with the car and messenger service engaged in transporting fishes and other aquarium materials to the exhibit of the Commission at the World's Fair. In connection with the distribution of food-fishes of the Mississippi Valley, this work continued until November.

Fresh-water collections were brought from Wisconsin, Michigan, Lake Erie, Illinois, and Iowa, and marine species from Massachusetts, Florida, and the State of Washington. When the aquarium at the Exposition was dismantled the fishes were taken chiefly to Northville, Mich., Spirit Lake, Iowa, Champaign, Ill., and Washington, D. C.

The distribution of food-fishes from Quincy, Ill., began in August and was finished in December. Trout and salmon were taken from Green Lake in September and October; from Wytheville, November to March; Leadville, November and December; Neosho, December to March; Northville, January to March; and the fingerlings in June. The black bass reared in the Washington ponds were distributed in December and a few carp in January. Whitefish eggs were carried from Alpena to Duluth in February. Whitefish fry hatched at Central Station were taken to Lake Ontario in March, and fry of the same fish were distributed from Alpena in April and May. Pike-perch shipments were made in May, and shad were planted in May and June.

In accomplishing the above work car No. 1 was engaged 178 days; No. 2, 200 days; Nos. 3 and 4, each, 185 days. They made 129 trips, aggregating 105,529 miles, and carried 71,440,513 fish and eggs. In addition to the car travel, 40 detached messengers, during the distribution of the year, covered 60,228 miles.

A far greater bulk of distribution is carried on also from the various stations of the Commission to neighboring waters, especially cod and lobsters from Gloucester and Woods Hole, Mass. Eggs are forwarded by express to distant stations and to State commissions and foreign countries. Carp, goldfish, etc., are shipped from various centers to points more or less remote. The total distribution, amounting to more than 450,000,000, is set forth elsewhere in this report.

CHANGES IN CARS.

An improvement in the water circulation on some of the cars was effected by substituting galvanized-iron pipes for the common pipes previously used. Steam-pipes were placed under the cars to circulate steam from the locomotive. Air-pumps were introduced and connected with the transportation tanks with good results; but the attempt to take in air through water from a small supply tank was unsatisfactory. An ice coil was laid on the bottom of the ice box in car No. 3, to reduce the temperature of the water by pumping cold air into it, but without success. Aërating syringes were furnished to the cars and messengers for use instead of dippers in carrying trout and other large fish, but they were found troublesome to keep safely in car work.

LOSSES DURING TRANSPORTATION.

The mortality among rainbow trout in transit was notably larger than with other species, and especially on journeys over thirty to thirty-five hours in length. The number lost was 13,366.

The results of work with food fishes of the Mississippi Valley were reduced by the necessity of maintaining the aquarium at the World's Fair.

NEW WORK.

The supply of black bass for distribution was much increased by collecting them from the reservoir at Celina, Ohio.

An experiment in carrying 1,000 yearling landlocked salmon from Green Lake to Vermont proved so encouraging that a full carload of 12,000 was afterwards taken, and although 3,000 of these were lost, it was demonstrated that the fish can be transported successfully. It was previously considered impossible to do so.

DIFFICULTIES IN TRANSPORTATION.

In shipping shad eggs on the cars to the South, trouble arose from the water foaming through sudden changes of temperature, causing some of the fry to hatch prematurely. In other shipments, when the water at destination was too warm, the fish hatched out weak, and when too cold, hatching was almost entirely prevented.

The details of the distribution of fishes and the scope of the distribution service for the year are shown in the appended table, pages 62 to 76.

COLLECTING FISH IN THE LOWLANDS OF ST. FRANCIS RIVER, ARKANSAS.

At the suggestion of Superintendent W. F. Page, arrangements were made in August, 1893, to collect food-fishes from overflow pools in northeastern Arkansas, just the same species as are obtained yearly at the Quincy, Ill., station. The Commission was greatly assisted by Mr. G. H. Nettleton, president of the Kansas City, Fort Scott and Memphis Railroad, along whose line the pools are located, and also by Mr. H. W. Diggins, division superintendent of the road.

Owing probably to the extremely high temperature of the water in the pools (called "borrow pits"), the results of the experiment were poor; but large collections might have been made if the work had been begun earlier in the year. Mr. Page's report follows herewith:

REPORT ON THE COLLECTION AND MOVEMENT OF NATIVE FISHES IN NORTHEAST ARKANSAS.

The annual inundation of the Sunk Lands of the St. Francis River basin creates a great number of small ponds along the line of the Kansas City, Fort Scott and Memphis Railroad by filling the "borrow pits." The overflow usually occurs in March, a little prior to the spring spawning of the fishes. The adult fish coming in with the high water find in these borrow pits excellent conditions for spawning. They go out with the falling waters, leaving behind their young in almost countless numbers. The droughts of August and September dry these pits, killing all the young fish in them. It was hoped that very many thousands of these young bass,

crappie, pickerel, and channel catfish might be seined from these pools and moved to the river currents before the droughts killed them.

Marked Tree, Ark., was selected as a base of operations because it presented the following points: (1) It is a station on the line of the Kansas City, Fort Scott and Memphis Railroad; (2) it has a night and day telegraph operator; (3) all trains stop there; (4) it has a railway water tank; (5) it has two side tracks aggregating over a mile; (6) on one side the St. Francis River is within 40 yards of the track, and on the other side Little River is as close; (7) the borrow pits extend 7 miles west of Marked Tree and about the same distance to the east. It was contemplated to seine the borrow pits, transfer the catch on hand cars to Marked Tree, and retain the fish in live-boxes until it was convenient to ship them.

The last week of July was spent in making preliminary arrangements for this work. On August 1 actual seining was commenced, with a force consisting of two seiners with one man to help in sorting and caring for the catch, two men to run the hand car, and one man at the live-boxes to equalize the difference in temperature of the water in the borrow pits and the river. The first day's seining resulted in about 4,500 fingerling crappie and bass transferred to the live boxes in apparent good order.

On the morning of August 2 an examination of the boxes showed that nearly all of the fishes caught the day before were dead. It was thought that this possibly had been produced by an overstrong current in the box, and a change in the position in the boxes was made so as to reduce the strength of the current. On this day we caught and removed to the boxes something over 5,000 fish. By evening the dying and suffering of those caught in the morning indicated clearly that the trouble was not solely due to current.

On the morning of August 3 the boxes had only about 300 fish (in bad order) to show for the 10,000 put in them in the past two days. To-day we fished the borrow pits near Oak Dornic, handling the fish in small lots and much more carefully. We secured about 5,000 fish, mostly crappie, and transferred them to the live-boxes.

August 4. This morning the condition of the boxes being unimproved, and all known methods of handling fish having been tried without avail, it was concluded to abandon for the present any attempt to store the fish. Seining was continued throughout the day, resulting in about 5,000 crappie and bass, which were planted directly in the St. Francis River. In the afternoon a telegram was sent to the Commissioner, stating that the fish alive twelve hours after capture were fungussed, and a recommendation made that the work be discontinued.

August 5. We seined the borrow pits until noon, capturing about 3,000 crappie, which we placed in the St. Francis River. At noon a telegram was received from the Commissioner, directing that the work be discontinued and that the equipment be transferred to Neosho Station.

It is the opinion that the failure to successfully handle these fish was due to the very high temperature of the water in which they were found, the water in many of the pits ranging from 95° to 98° F. The fish living in this water were so tender that the gentlest handling produced an abrasion which quickly resulted in a fungus growth. It is very doubtful if any of those planted in the St. Francis River will survive the handling.

It has been suggested that this work might successfully be prosecuted earlier in the season, before the water in the borrow pits has become so very hot as to render the fish too tender for handling. There is no doubt but that this might be done, but to a limited extent only, because the waters are already at a high temperature before they commence to fall, and until the recession occurs seining would be nearly impossible.

The inundation of the Sunk Lands usually occurs in the latter part of February or early in March. In the year 1893 it was later than for many years, not coming on until May. To this cause undoubtedly is to be ascribed the scarcity of young game fish in the borrow pits. The adults had spawned elsewhere before the overflow came in.

FISH-CULTURAL NOTES.

The correspondence of the station superintendents furnishes many valuable records of observations and experiments which are not usually embodied in their annual reports. They may very properly be presented here, grouped under the names of the species to which they relate:

Mackerel (*Scomber scombrus*).—June 21, 1894, Mr. W. P. Sauerhoff found five small mackerel at Magnolia, Mass., containing ripe eggs, and obtained 116,000, the first taken this season.

Pike perch (*Stizostedion vitreum*).—Mr. Frank N. Clark wrote from Northville, Mich., March 30, 1894:

> In transferring pike-perch eggs from Detroit to the World's Fair last spring * * * the best success I obtained was in carrying the eggs in 10-gallon cans, putting from 12 to 16 quarts in a can, and frequently stirring the eggs and water to keep them from sticking together. If the eggs are to be held in jars * * * until the eyes show, I think you will meet with success in shipping them on flannel trays with a covering of damp moss on each tray, the top tray to contain nothing but fine ice, the whole to be surrounded with from 3 to 4 inches of sawdust; temperature from 55° to 60°. This is practically our mode of shipping eyed eggs during the winter.

Mr. J. J. Stranahan made the following report of an experiment with eggs and milt from dead fish:

> On April 23, 1894, I took 1 quart of eggs from dead pike perch, using milt from two dead males. Eggs came freely and looked fine. Milt flowed in a fluid stream, though very slightly thickened. The eggs were set up and worked in a jar in the usual way. Frequent examinations show that all are dead, and in 150 eggs counted and examined April 30 no life could be discovered. A curious feature in this case is that 95 per cent or more of the yolks are ruptured.

Mr. Stranahan weighed and counted a series at Put in-Bay, from which he puts the eggs at 170,000 to the quart. Mr. Bower uses the estimate of 150,000 to the quart. Mr. Stranahan says further:

> Eggs from different localities differ greatly in size. It seems to me that I can clearly see with the naked eye that the eggs of the Sandusky Bay pike perch (smallish, round, less compressed than lake fish, more fusiform, deep yellow instead of nearly white as in the lake fish), are perceptibly larger than those taken in the open lake. The pike perch from the bay, I feel sure, lives there, never entering the lake. It resembles very strongly those brought to Sandusky from the Lake of the Woods and those caught in inland waters belonging to the Mississippi system; also those from Saginaw Bay.

Handling of pike-perch eggs at Put-in-Bay.—April 15, 1894, Mr. Stranahan experimented with swamp muck for separating pike-perch eggs successfully. He screened the mud through fine wire cloth so that all was finer than the eggs. A pint of thick muck solution to a 12 gallon keg was sufficient. Afterwards he used a quart of muck of the consistency of sirup to a 15-gallon keg of water. An account of his experiments was published in the Transactions of the American Fisheries Society for 1894.[1]

[1] The handling of adhesive eggs. J. J. Stranahan, Trans. Amer. Fish. Soc. 1894, 22-25.

Pike and pike-perch hybrid (Esox lucius and Stizostedion vitreum.)—Superintendent J. J. Stranahan, of the Put-in-Bay, Ohio, station made the following report, dated April 26, 1894, upon an experiment with the grass pike (*Esox lucius*):

Nineteen adult fish were captured, but none of them in spawning condition. We penned the best and although most of them kept well, having been caught in the net by the teeth, the females refused to yield their eggs and were finally released. On April 22, Mr. John Dischied, of North Bass Island, noticed a grass pike from which the eggs were running freely. He took a quantity, and not having a male, impregnated them with the milt of a pike perch. * * * I made my first examination of them April 26. They have gone too far to see the segmentation under the microscope, and I am in doubt whether any are alive. There are about 9½ eggs to a linear inch, 759 to a cubic inch, measured in water, or 43,832 to the fluid quart. The eggs are of about the same specific gravity as whitefish eggs, and work readily in the McDonald hatching jar, but have very thin membranes, easily ruptured between the fingers.

Under date of April 28, 1894, Mr. Stranahan forwarded the following additional notes:

The grass-pike eggs referred to in my letter of April 26 have been examined daily and now show the fish form past doubt. I examined 140 this morning under the microscope and found 40 with the fish formed, or about 28½ per cent. These were worked from the start in a McDonald jar. Those handled in a floating box show a fraction over 20 per cent alive, which leads me to believe that with careful working muskellunge can be hatched in jars. The developing embryo is unlike any other I have observed. It covers about one-third of the circumference of the egg and has on each side of the body not far behind the head what seems to be an oil drop, nearly equal to the body in diameter. The yolk has no distinct large oil drop, but numerous small ones, pretty evenly distributed over its surface, for which reason the embryo is as likely to be in one position as another, no two apparently assuming the same position. The embryo now covers about two-fifths of the circumference of the yolk. The egg is more opaque than any other I have examined, making its investigation difficult.

On May 4, Mr. Stranahan reported that the above eggs began hatching in small numbers. There were not enough to work well in the jar, the eggs attacked by fungus being hard to separate from the live ones. All the eggs in the floating boxes died and it was estimated that only 10 per cent of those in the jar would hatch. The eyes were not discerned until May 3, and then very faintly.

Yellow perch (Perca americana).—About the end of April, 1894, Mr. Stranahan took the eggs from a yellow perch weighing 9 ounces. He wrote:

The eggs came freely in a continuous tube and I used two males for impregnation. After swelling the mass was 73 inches long, the tube 3 inches wide (or 6 inches if flattened out). We find 13 eggs to the linear inch, or 73,000 in all. Impregnation was almost complete. Aside from the fragment used for counting, there do not appear to be 1 per cent of dead eggs.

On March 20, 1894, the eggs from a yellow perch were taken from one of the aquaria in Central Station and placed in a McDonald jar. They developed without perceptible loss (hatching began April 12), and on April 14 about one-tenth of them were out.

Striped bass (*Roccus lineatus*).—Twenty large striped bass, three or four of them in spawning condition, were taken near Edenton, N. C., in sturgeon nets, about April 18, 1894.

Longjaw or blackfin whitefish (*Argyrosomus nigripinnis* ?).—Mr. E. A. Tulian wrote Mr. F. N. Clark from Alpena, Mich., November 30, as follows:

I telegraphed Platts yesterday to find out when the longjaw would spawn and whether we could get any quantity of the eggs. I received an answer this morning saying: "We can get plenty of longjaw spawn now; trout run over." I answered him to collect all long-jaw spawn possible, with Clifford's help, until further orders.

Mr. Clark wrote the office that the longjaw is becoming a valuable food-fish, selling in the market for the same price as the common whitefish. While it was found easy to get eggs, there were no males and the experiment failed. It is supposed the males run later, but the season could not be prolonged, for lack of funds.

Whitefish.—Mr. S. P. Wires counted a liquid quart of whitefish eggs taken in Lake Superior and found 33,600 eggs.

Mr. F. N. Clark writes from Northville, Mich., March 28, 1894:

Eggs from fish caught in gill nets in Lake Michigan, near Manistique, show a measurement of 1,115 to the ounce, or 35,680 to the quart. These eggs were taken on December 9, 10, and 11, 1893. Eggs taken November 25, from fish caught in pound nets set in Lake Huron near Miller Point, show a measurement of 1,097 to the ounce, or 35,104 to the quart. Possibly, measuring eggs almost at the period of hatching is not a fair test.

Brook trout.—In taking eggs of brook trout at Greensboro Pond, Vermont, November 15, 1893, Mr. John W. Titcomb stripped 140 males and 70 females. This large proportion of males is observed also by anglers.

Black-spotted trout.—On February 24, 1894, Mr. Seagle collected about 1,000 eggs, but could not find a male in proper condition. Last season about 50,000 eggs were lost for want of milt. On March 7 Mr. Seagle took 2,500 eggs, but found no suitable male. On March 12 he obtained 2,000 eggs and secured one male in fair spawning condition. Some eggs of the black-spotted species have been fertilized at Wytheville with milt of the rainbow.

Superintendent Clark began taking eggs of black-spotted trout at Northville, Mich., April 30, 1894, but they were not very good. The females seemed to have a quantity of water that flowed with the eggs, and Mr. Clark feared the same trouble experienced with rainbow trout, in which the eggs became glassy. The superintendent thinks by introducing water direct from a cold spring better eggs and fish would be produced.

Von Behr and Loch Leven trout.—Mr. Frank N. Clark sent by express from Northville, Mich., 20,000 Von Behr trout eggs and 20,000 of the Loch Leven trout to Mexico. Although these were 8 days in transit and were consigned to a warm climate, they were received with a loss of only 60 of the former and 72 of the latter.

Steelhead.—A case containing 100,000 eggs of steelhead (*Salmo gairdneri*) was shipped in April from Fort Gaston Station to Northville,

Mich., but they were spoiled on the way because the temperature was not kept low enough.

Landlocked salmon.—On October 21, 1893, Mr. A. N. Cheney, of Glens Falls, N. Y., suggested to the Commissioner the advantages to be derived from planting landlocked salmon in Lake George, with the object of stocking that body of water as well as the larger Lake Champlain, into which it empties and in which the Commissioner desired to introduce that species. Mr. Cheney's letter pointed out the superior claims of Lake George as an experimental field, and his plan was considered worthy to be carried out.

Packing trout eggs for transportation.—Mr. W. F. Page, superintendent of the Neosho Station, is in favor of using cut sponge as a packing material, because of its cleanliness, the rapidity with which it can be worked, firmness and evenness of packing, and its economy in the long run. It can be dried out and used almost indefinitely. One pound of sponge will pack 15,000 rainbow-trout eggs. A pound of sponge, however, in Mr. Page's experience, requires the entire attention of one man for ten hours to properly pick up.

Lobster.—Capt. A. C. Adams was instructed to buy lobsters at a price not exceeding 10 cents each for large ones and 5 cents each for small ones, the lobsters to be liberated after removal of their eggs. Mr. W. P. Sauerhoff was assigned to the lobster work at Gloucester May 16, relieving Captain Adams, and on the 23d he reported 191 females which had furnished 2,473,000 eggs.

At Woods Hole Station arrangements were made in the spring of 1894 to buy egg-bearing female lobsters from lobster men at Cuttyhunk, Menemsha Bight, Nomans Land, and Woods Hole. About 3,300 pots are set in these localities. Off Nomans Land very large lobsters, from 3 to 10 pounds in weight, are taken and the largest yield 30,000 eggs. The pots are hauled twice a week and the average catch is about 2,400 pounds at a haul, two-thirds of which are egg-bearing females.

FISH ENEMIES, DISEASES, AND FATALITIES.

Otter.—February 6, 1894, Mr. E. M. Robinson at Green Lake Station, reported the capture of an otter measuring 5 feet 6 inches, in two traps. He had eaten many trout before his capture. On February 24 the capture of another otter and one mink was reported.

Larvæ of caddis and black flies.[1]—In the spring of 1894 the superin-

[1] See also the following articles by the late Prof. C. V. Riley:
The death web of young trout. <Am. Ent. and Bot., Apr., 1870, v. 2, p. 174. Riley.
Supposed trout enemy. <Am. Ent. and Bot., Apr., 1870, v. 2, pp. 179-180. Riley.
The death web of young trout. <Amer. Ent. and Bot., May, 1870, v. 2, p. 211. Larvæ of a *Simulium*. Riley.
The death web of young trout. <Amer. Ent. and Bot., June, 1870, v. 2, pp. 227-228, figs. 143-144. Habits of *Simulium piscicidium*. Riley.
The so-called web worm of young trout. <Amer. Ent. and Bot., Dec., 1870, v. 2, pp. 366-367. Riley. Description of *Simulium piscicidium*, n. sp.
Remarks on *Simulium piscicidium*. <Trans. Acad. Sci. St. Louis, July, 1873, v. 3, p. 79 Proc. Nature and supposed ravages. Riley.
Carnivorous habits of caddis worms. <Amer. Ent., July, 1880 (v. 3), n. s., v. 1, p. 176. Riley.

tendent of the Green Lake Station reported the presence of the larvæ of two insects in the hatching troughs, and the destruction thereby of some newly-hatched landlocked salmon. Specimens were forwarded to the office of the Commission and were referred to the Department of Agriculture for identification. The following correspondence relates to the subject:

GREEN LAKE, ME., *May 7, 1894.*

I send by to-day's mail two specimens of water life which made its appearance in large numbers in our troughs just about the time the salmon were hatching or when the water reached 46° F. * * * The large specimens I would say were from five to six days old, while the small ones are not over two days old. The former are full grown. It seems they do not grow to any size, but their development is very rapid. * * * Any considerable number of them in a hatching trough in one night will spin the trough almost full of a very fine web; it is quite strong, too. They will sometimes spin a web around the neck of a fish and choke it to death; then they congregate in numbers and will eat the entire fish if left alone. They also attack the sac of the fish, and this is always fatal, as the sac soon bursts. They would not be able to harm the fish after they are ten days old, but should they come in numbers at the proper time they would destroy a good many fish if not kept out. I have no doubt this same insect will make excellent food for the fry a month later.

E. M. ROBINSON, *Superintendent.*

DEPARTMENT OF AGRICULTURE,
OFFICE OF ASSISTANT SECRETARY,
Washington, D. C., May 19, 1894.

SIR: I have the honor to acknowledge the receipt of your favor of May 12, transmitting vials containing larvæ received from the fish-cultural station at Green Lake, Me., and to report that they have been referred to the entomologist, who submits the following statement:

"The large larvæ sent by Colonel McDonald are predaceous in their habits. They belong to the species known as *Hydropsyche phalerata*, a form which is noted for the fact that it preys almost exclusively on the larvæ of the genus *Simulium*, known in different parts of the country as black flies, buffalo gnats, turkey gnats, etc. The smaller larvæ sent in a separate vial belong to the genus *Simulium;* the exact species can not be determined from the larva alone, but it is probably *decorum* or *invenustum*, and the adult is the common black fly of the Green Lake region, in all probability.

"The damage done by the larvæ of *Simulium* in fish hatcheries has been commented upon before. They feed upon aquatic vegetation in part, and in part upon minute infusoria, and the damage to the fish occurs through the spinning of their web through the water, as detailed by Mr. Robinson. The statement that the *Simulium* larvæ cluster upon the young fish after they are caught in the web, and feed upon them, may be doubted. It is very possible, however, that the *Hydropsyche* larvæ will feed upon very small fish captured in the net made by the *Simulium* larvæ. It is a very peculiar and interesting condition of affairs. The best article which has been published on the subject is entitled 'The death web of young trout,' and will be found in volume II of the American Entomologist and Botanist, pages 227–228 (June, 1870). Mr. Seth Green, the well-known pisciculturist of New York, was the first observer to call attention to this interesting habit of the *Simulium* larvæ. Mr. Robinson is perfectly correct in supposing that the young fry, when they are a little older, will feed upon the *Simulium* larvæ."

I have the honor to remain, respectfully, yours,

CHAS. W. DABNEY, Jr.,
Assistant Secretary.

Hon. M. MCDONALD,
Commissioner Fish and Fisheries, Washington, D. C.

GREEN LAKE, ME., *May 26, 1894.*

DEAR SIR: Your letter dated May 23, inclosing a copy of a report upon the larvæ sent, by the entomologist of the Agricultural Department, is at hand, and which I was glad to receive. I am not prepared to say positively whether the larvæ of the large caddis fly intentionally fed upon the fry, or whether the web spun was for the capture of the fry, but during a period of ten days they appeared in our supply and hatching troughs in large numbers, spinning them full of this fine web, which would naturally entangle a small per cent of the embryos. Clusters containing 25 or 30 of the large larvæ would be found all through the troughs, and invariably a fish would be found in the middle, in some cases almost entirely devoured; numbers would be seen moving to and fro, hither and thither; also quite a lot of them would adhere to the sides of the trough at water level. A single larva was noticed time and again to attach itself to the sac and sometimes to the head of the fish; the fish would swim around as if in severe pain for a moment or two, and would settle to the bottom dead or dying.

Of course, in one of our hatching troughs, where we were carrying from 10,000 to 12,000 fry, with as many thousand larvæ in it, it was natural to suppose that they were feeding upon them, which they surely did; it might not have been from preference but from necessity, as the troughs contained but very little else in the shape of food that could be seen with the unaided eye, though I am of opinion that they were feeding upon the sac of the embryo from preference, and I am sure that the sac of the young fry would make very delicate food. After the fish arrived at the age of 15 days, the larva was not able to entangle or capture them except in very rare cases, as the fish by this time had developed sufficient activity to free themselves. The larvæ of both the caddis and black fly have almost entirely disappeared. The fish is no longer the sufferer, but the fish-culturist, as the black fly is in all of his glory.

I am, very respectfully,

E. M. ROBINSON,
Superintendent.

DR. TARLETON H. BEAN,
Assistant in Charge Division of Fish Culture,
U. S. Fish Commission, Washington, D. C.

Fungus and parasites.—The parasite referred to in the following letter of Mr. Robinson was not identified, but similar attacks have been observed at other stations, and studies are now in progress looking toward the identification of the species and the elucidation of its life history, as well as the proper treatment of the fish affected.

GREEN LAKE, ME., *May 30, 1894.*

DEAR DR. BEAN: For the past month or twenty days the loss in our salmon fry began to be alarming, and at one time I feared the epidemic that caused so much destruction at the Craig Brook Station, and gave Mr. Atkins so much trouble, was upon us in its worst form. I first began to notice very fine fungus growth on the fins and near the gill covers; the little fish so affected would huddle together in the corners of the troughs and seemed to have no life about them, and in 24 or 36 hours would die. The next trouble discovered was a small parasite, not on any particular part of the body, but pretty generally distributed; these parasites looked to the unaided eye like very small warts, and showed white in the water. Whether the irritation of the parasite on the body of the fish causes the fungus I can't say, but am of the opinion it does.

As soon as the fungus and parasites were discovered I had salt used very freely; would have water cut off the troughs and drawn down to within 3 inches of the bottom; then made a strong brine by dissolving 1 quart of salt in a pail for each trough; this brine would be poured in, and at the same time be thoroughly mixed with the water and fish; all the little nooks and corners of the trough would

be washed out, and we would keep the brine on from 3 to 5 minutes. We feel by doing this we have checked the fungus and, in part, nipped the parasite; still, the parasite can be seen on a large number of the fish yet. The only remedy we know of is to keep cleaning and salting, and I am glad to say at this writing we can see a marked improvement in the fry. We are now salting every other day, and when a trough does not improve as we think it ought, we give it a quart every day. I send you by this mail two vials with labels inside that will show the parasite and fungus on the fins of the fry. Someone has said "the price of all fish is eternal vigilance," and I will add, in this locality, a free use of salt.

Very respectfully,

E. M. ROBINSON,
Superintendent.

Dr. TARLETON H. BEAN,
Assistant in Charge Division of Fish-Culture,
U. S. Fish Commission, Washington, D C.

Epidemic among trout.—April 21, 1894, Superintendent Clark reported an unusual loss of yearling and 2-year-old brook trout at the Northville, Mich., Station, which begun ten days before and was without visible cause. The fish were dying at the rate of from 40 to 100 a day in spite of the ample water flow and plenty of wholesome food. Trout in ponds below the dying fish did not seem to be affected, although the same water flowed through all.

Dr. R. R. Gurley was sent to Northville on April 23, and after investigation made a provisional report upon the epidemic. Arrangements were soon made also to isolate the diseased fish and to provide separate drainage for each pond. The epidemic abated considerably from the beginning of May. It involved the black-spotted as well as the brook trout.

Black bass killed by thunder.—On June 5, 1894, at the Neosho Station, Missouri, a very heavy storm of lightning and rain occurred about noon. Next morning thousands of young black bass were found dead on the bottom of a pond, mostly in water 3 feet deep. No signs of wounds or punctures were upon them and they were all in excellent condition in the morning of June 5. Some of the dead fish were examined by Dr. R. R. Gurley, assistant to the United States Fish Commission, who found no evident cause of death. He refers to an item in Rayer's Archiv de Med. Comp., Paris, 1843, pp. 253–254, in which it is stated:

> In times of storm fish, and particularly carp and perch, experience a very marked effect from the electricity. The fishermen assert that after a peal of thunder, in an étang or in a lake, fish have been seen to die in a few days.

Fish struck by lightning.—The Philadelphia *Public Ledger* stated that at Allentown, September 2, 1895, during a severe thunder storm lightning struck the water of one of the fish ponds of the State Fishery which contained 5-year-old California trout. The trout measured from 18 to 22 inches in length. Between 75 and 100 of the finest trout were paralyzed and many of them had their backs broken.

Details of distribution, 1893–94.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Spotted catfish:			
Applicant in District of Columbia			10
Boise River near Boise, Idaho			100
Kishwaukee River near Belvidere, Ill			25
Fox River near St. Charles, Ill			1,916
Elgin, Ill			300
Geneva, Ill			25
Applicants in Illinois			534
Pine Lake near Laporte, Ind			150
Applicants in Indiana			225
Iowa River near Limo Spring, Iowa			100
Chester, Iowa			100
Cedar River near Osage, Iowa			100
Lime Creek near Mason City, Iowa			600
Bishop Lake near Sheldon, Iowa			300
Twin Lakes near Rockwell City, Iowa			2,800
Des Moines River near Fort Dodge, Iowa			300
Storm Lake near Storm Lake, Iowa			4,000
Maquoketa River near Manchester, Iowa			150
Otter Creek near Oelwein, Iowa			225
Upper Iowa River near Decorah, Iowa			275
Cedar River near Cedar Rapids, Iowa			292
Iowa State Fish Commission ponds, Spirit Lake, Iowa			300
Applicants in Iowa			100
Kansas			1,099
Reservoir near Middlesboro, Ky			50
Tygart Creek near Olive Hill, Ky			50
Nolin Creek near Hodgensville, Ky			150
Clarkston Lake near Elizabethtown, Ky			100
Billys Creek near Elizabethtown, Ky			75
Blue Spring near Cecilian, Ky			50
Mud River near Russellville, Ky			75
Pond River near Bakersport, Ky			75
Drake Creek near Hortonville, Ky			75
Tradewater River near Dawson, Ky			75
Otter Creek near Cerulean Springs, Ky			100
Muddy Fork near Kuttawa, Ky			75
Applicants in Kentucky			240
Moreau River near Jefferson City, Mo			100
Applicants in Missouri			350
Johnson Creek near county line, N. Y			50
Mohawk River near Utica, N. Y			75
Applicants in Ohio			25
Texas			265
Virginia			50
Jackson River near Cedar Creek, Va			300
Applicants in Wyoming			25
Public lake near Montborne, Wash			100
Catfish (common):			
Herrealls Branch near Neosho, Mo			1,050
Carp:			
Applicants in Alabama			575
Arkansas			611
California			18
Colorado			30
Connecticut			390
Delaware			60
District of Columbia			235
Potomac River in District of Columbia			1,757
Applicants in Florida			364
Georgia State Fish Commission			3,000
Tallulah Creek, Tallulah Falls, Ga			1,000
Applicants in Georgia			489
Idaho			60
Illinois			150
Indiana			90
Indian Territory			150
Red River near Colbert, Ind. T			390
Grand River near Shawneetown, Ind. T			35
Applicants in Iowa			340
Kansas			1,001
Kentucky			320
Louisiana			190
Maine			30
Maryland			610
Massachusetts			260
Michigan			780
Minnesota			1,000
Minnesota State Fish Commission			2,500
Applicants in Mississippi			806
Missouri			450
Montana			740
Nebraska			110

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Carp—Continued.			
Applicants in New Hampshire			160
New Jersey			280
New Mexico			484
New York			5,355
New York State Fish Commission			5,000
Applicants in North Carolina			1,218
North Dakota			186
Ohio			810
Oklahoma			510
Oregon			30
Pennsylvania			720
Rhode Island			7
South Carolina			304
South Dakota			1,910
Tennessee			1,990
Doe River near Alleutown, Tenn			384
French Broad and Pigeon rivers in Jefferson County, Tenn			384
Holston River near Rutledge, Tenn			193
Strawberry, Tenn			192
Rogersville, Tenn			384
Tennessee River near Knoxville, Tenn			770
London, Tenn			384
Chucky Creek near Erwin, Tenn			192
Big Limestone Creek near Limestone, Tenn			192
Lick Creek near Mohawk, Tenn			384
Clinch River near Clinton, Tenn			386
Emory River near Harriman, Tenn			193
Obeys River near Lancing, Tenn			193
Red River near Cobert, Tex			390
Trinity River near Fort Worth, Tex			390
Applicants in Texas			1,100
Reed Creek near Wytheville, Va			1,086
Applicants in Virginia			2,535
Washington			280
West Virginia			210
Wisconsin			30
Tench:			
Applicants in Arkansas			500
Blue River near Armstrong, Ind. T			600
Applicants in Indian Territory			500
Iowa Fish Commission			50
Lime Creek near Mason City, Iowa			50
Bishop Lake near Sheldon, Iowa			40
Cedar River near Osage, Iowa			25
Applicants in Kansas			100
Appalachee River at crossing of Macon and Northern Railroad, in Georgia			2,000
Oconee River at crossing of Macon and Northern Railroad, in Georgia			2,000
Applicants in Maryland			60
Hickory Creek near Neosho, Mo			1,200
Applicants in Missouri			1,015
Applicants in New York			4,000
North Carolina			150
Ohio			200
Exalls Lake near Dallas, Tex			1,000
Canyon Lake near Cisco, Tex			1,000
Chesley tank near Cisco, Tex			300
Delmark tank near Cisco, Tex			300
Colorado River near Austin, Tex			600
San Marcos River near San Marcos, Tex			1,200
Applicants in Texas			900
Goldfish:			
Applicants in Alabama			48
Arkansas			124
Colorado			24
Connecticut			30
District of Columbia			6,771
Delaware			48
Florida			50
Florida Agricultural Department			24
Applicants in Georgia			138
Georgia Fish Commission			30
Applicants in Illinois			310
Indiana			127
Indian Territory			24
Iowa			110
Iowa Fish Commission			100
Applicants in Kansas			162
Kansas Fish Commission			30
Applicants in Kentucky			84

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Goldfish—Continued.			
Applicants in Louisiana			419
Maine			14
Maryland			360
Massachusetts			74
Michigan			60
Minnesota			10
Minnesota Fish Commission			50
Applicants in Mississippi			66
Missouri			479
Missouri Fish Commission			100
Applicants in Nebraska			6
New Jersey			120
New Mexico			12
New York			224
North Carolina			227
Ohio			466
Oklahoma			12
Pennsylvania			838
Rhode Island			12
South Carolina			117
Tennessee			198
Texas			318
Utah			6
Virginia			797
West Virginia			72
Wisconsin Fish Commission			100
Golden ide:			
Applicants in Arkansas			100
Colorado			125
District of Columbia			91
Florida			50
Georgia			50
Georgia Fish Commission			100
Applicants in Illinois			37
Indiana			25
Kansas			8
Administrator public buildings, New Orleans, La			100
Applicants in Maryland			24
Massachusetts			24
Minnesota Fish Commission			25
Missouri Fish Commission			50
Applicants in Missouri			25
New York			275
New Jersey			15
North Carolina			100
Ohio			166
Pennsylvania			115
Tennessee			100
Texas			125
Virginia			50
Golden tench:			
Applicants in District of Columbia			50
Illinois			6
Indiana			12
Iowa			2
Maryland			24
North Carolina			86
Pennsylvania			18
Tennessee			42
Virginia			20
United States of Columbia			12
Shad:			
Connecticut River near Warehouse Point, Conn		3,044,000	
Potomac River near Georgetown, D. C		469,000	
U. S. Fish Commission Fish Ponds, Washington, D. C		a 2,109,000	
Nanticoke River near Seaford, Del		450,000	
Brandywine Creek near Wilmington, Del		1,330,000	
St. Johns River near Palatka, Fla		2,250,000	
Ogeechee River near Midville, Ga		500,000	
Ocmulgee River near Macon, Ga		500,000	
Savannah River near Augusta, Ga		1,417,000	
Chesapeake Bay near Battery Island, Md	355,000	2,976,000	
Chester River near Chestertown, Md		420,000	
Patuxent River near Laurel, Md		899,000	
Patapsco River near Relay Station, Md		476,000	
Susquehanna River near Port Deposit, Md		1,104,000	
Bush River near Bush River Station, Md		630,000	
North East River near North East, Md		1,200,000	
Wicomico River near Salisbury, Md		345,000	
Gunpowder River near Gunpowder Station, Md		450,000	

a Not to be included in summations.

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Shad—Continued.			
Elk River near Elkton, Md		1,380,000	
Potomac River near Washington Junction, Md		1,676,000	
Tuckahoe Creek near Queen Anne, Md		450,000	
Delaware River near Gloucester, N. J		142,000	
Lambertville, N. J		1,100,000	
Callicoon, N. Y		400,000	
Port Jervis, N. Y		917,000	
New York Fish Commission	2,000,000	5,414,000	
Pasquotank River near Elizabeth City, N. C		429,000	
Lumber River near Lumberton, N. C		389,000	
Neuse River near Newbern, N. C		403,000	
Yadkin River near Salisbury, N. C		419,000	
Susquehanna River near Columbia, Pa		870,000	
Susquehanna River near Fites Eddy, Pa		757,000	
Peach Bottom, Pa		850,000	
Delaware River near Delaware Water Gap, Pa	300,000	5,276,000	
Palmer River near Providence, R. I	669,000	2,350,000	
Broad River near Columbia, S. C		1,000,000	
Congaree River near Columbia, S. C		2,155,000	
Catawba River near Catawba, S. C		900,000	
Potomac River near Widewater, Va		457,000	
Chappawansic Creek near Quantico, Va		1,407,000	
Cedar River near Catletts, Va		482,000	
Mattaponi River near Milford, Va		453,000	
Stony Creek near Stony Creek, Va		433,000	
Rapidan River near Rapidan, Va		448,000	
Little River near Taylorsville, Va		451,000	
Rappahannock River near Fredericksburg, Va		475,000	
Occoquan River near Woodbridge, Va		907,000	
Meherrin River near Bolfield, Va		381,000	
Tye River near Tye River Station, Va		463,000	
Rockfish River near Rockfish, Va		459,000	
Otter River near Evington, Va		447,000	
Nansemond River near Suffolk, Va		509,000	
Quinnat salmon:			
California Fish Commission	7,500,000		
McCloud River near Baird, Cal		438,500	
Raisin River in Monroe County, Mich		39,000	
Clackamas River and Clear Creek near Clackamas, Oreg		213,000	
Silver salmon:			
Mad River near Korbel, Cal		280,000	
Atlantic salmon:			
New York Fish Commission	60,000		
Pennsylvania Fish Commission	60,000		
New Hampshire Fish Commission	25,000		
Connecticut Fish Commission	25,000		
Perts Stream, tributary to Toddy Pond in Hancock County, Me			10,000
Sucker Brook, tributary to Toddy Pond in Hancock County, Me			8,000
Luke Harriman's brook, tributary to Toddy Pond in Hancock County, Me			9,200
Trundy Brook, tributary to Toddy Pond in Hancock County, Me			8,235
Conary Brook, tributary to Toddy Pond in Hancock County, Me			11,343
Hatch brook, tributary to Toddy Pond in Hancock County, Me			6,000
Saunders Cove, tributary to Toddy Pond in Hancock County, Me			5,900
Robert Gray brook, tributary to Toddy Pond in Hancock County, Me			6,191
Toddy Pond in Hancock County, Me			49,655
Meadow brook, tributary to Alamoosook Lake in Hancock County, Me			21,300
Wardwell brook, tributary to Alamoosook Lake in Hancock County, Me			14,625
Gully brook, tributary to Alamoosook Lake in Hancock County, Me			6,100
Alamoosook Lake in Hancock County, Me			32,089
Heart Pond in Hancock County, Me			9,809
Hen Brook, tributary to Narramissic River in Hancock County, Me			9,000
Dead Brook, tributary to Narramissic River in Hancock County, Me			18,662
Little Dead Brook, tributary to Narramissic River in Hancock County, Me			5,100
Green Lake in Hancock County, Me			3,908
Landlocked salmon:			
Caleb Gilman, Calais, Me	5,000		
W. T. Haynes, Oakland, Me	5,000		

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Landlocked salmon—Continued.			
W. L. Gilbert, Plymouth, Mass	1,000		
A. E. Adams, No. 115 State street, Boston, Mass	5,000		
E. R. Hewett, Ringwood, N. J	5,000		
Gardner Smaith, Ragged Lake, N. Y	5,000		
Bisby Club, White Lake Corners, N. Y	5,000		
New York Fish Commission	30,000		
Wilmurt Club, Buffalo, N. Y	5,000		
Adirondack League Club, Old Forge, N. Y	5,000		
Tuxedo Park Association, Tuxedo, N. Y	5,000		
Applicants in United States of Colombia	3,000		
Monocacy River near Frederick Junction, Md		2,500	
Applicants in Connecticut			300
Eagle Lake near Bar Harbor, Me			5,000
Fourth Pond near Bluehill, Me			1,000
Long Pond near South West Harbor, Me			5,000
Tributary of Duck Lake in Penobscot County, Me		6,000	
Whites Pond near Penobscot, Me			1,000
Big Tunk Waters near Ellsworth, Me			5,000
Donnell Pond in Hancock County, Me			10,000
Great Pond near Waterville, Me			1,000
Parlin Pond in Somerset County, Me			1,200
Beech Hill Pond in Hancock County, Me			2,500
Giles Pond in Hancock County, Me			5,000
Great Pond in Hancock County, Me			8,000
Great Pond near Waterville, Me			1,000
Funk Pond in Washington County, Me			1,489
Brewer Pond near South Brewer, Me			2,000
Blunt Pond in Hancock County, Me			2,000
Green Lake in Hancock County, Me			26,682
Toddy Pond in Hancock County, Me			6,585
Long Pond in Hancock County, Me			7,151
Flanders Pond in Hancock County, Me			2,665
Rocky Pond No. 2 in Hancock County, Me			5,000
Phillips Pond in Hancock County, Me			2,000
Branch Pond near East Dedham, Me			7,800
China Lake near Waterville, Me			1,500
Cuniculocus Pond near Egypt, Me			1,500
Hatease Pond in Hancock County, Me			3,000
Mountany Pond in Hancock County, Me			3,000
Great Brook in Hancock County, Me			6,000
Simmons Pond near Ellsworth, Me			1,000
Fish River Lakes in Aroostook County, Me			4,986
Browns River, tributary of Lake Champlain near Waterbury, Vt			2,269
Indian Brook, tributary of Lake Champlain near Essex Junction, Vt			2,269
Winooski River, tributary of Lake Champlain near Essex Junction, Vt			4,538
Vermont Fish Commission			1,000
Steelhead trout:			
California Fish Commission	50,000		
Government of Japan	25,000		
North Fork of Mad River near Korbel, Cal		308,500	
Loch Leven trout:			
California Fish Commission	20,000		
Minnesota Fish Commission	20,000		
Government of Mexico	25,000		
Orchard Lake, Oakland County, Mich		10,000	
Zukey Lake near Hamburg Junction, Mich		10,000	
Cold Creek near Tawas City, Mich		4,000	
Upper Clear Creek near Idaho Springs, Colo			2,000
South Platte River near Dome Rock, Colo			2,500
Estabrook, Colo			500
Frying Pan Creek near Thomasville, Colo			1,500
Ruedi, Colo			1,000
Eagle River near Berry's Branch, Colo			2,000
East River near Almont, Colo			700
Los Pinos River near Osier, Colo			2,500
Lake Creek near Idaho Springs, Colo			500
Lower Evergreen Lake near Leadville, Colo			600
Arkansas River near Boulevard, Colo			500
Applicants in Colorado			200
Oak Hill Lake near Butler, Ind			800
Clear Lake near South Bend, Ind			500
Hartman Lake near South Bend, Ind			1,000
Floods Pond in Hancock County, Me			2,500
Big Tunk Pond near Ellsworth, Me			4,000
Green Lake in Hancock County, Me			11,668
Simmons Pond near Ellsworth, Me			500
Branch Pond near East Dedham, Me			2,000
Heart Pond near East Orland, Me			46
Railroad Lake near Wingleton, Mich			2,000

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Loch Leven trout—Continued.			
Beitner Creek near Traverse City, Mich			1,000
Lake Mary Rowan near Jocko, Mont			1,000
Pecos River near Glorieta, N. Mex			800
Lake in Franklin Park, Columbus, Ohio			300
Deep Lake near Mount Pocono, Pa			3,000
False Bottom Creek near Deadwood, S. Dak			900
Applicants in South Dakota			1,400
Long Lake near Rice Lake, Wis			1,000
Cedar Lake near Rice Lake, Wis			1,000
La Prele Creek near Douglas, Wyo			1,000
Rainbow trout:			
Mammoth Springs Fish Co., Mammoth Springs, Ark	12,000		
J. E. Bailey, Silver Springs, Benton County, Ark	5,000		
Johns Hopkins University, Baltimore, Md	2,500		
Missouri Fish Commission	50,000		
Minnesota Fish Commission	42,000		
Nebraska Fish Commission	23,000		
Nevada Fish Commission	40,000		
Vermont Fish Commission	30,000		
J. E. Sherlock, Salt Lake City, Utah	10,000		
F. A. Thole, New Castle, Wyo	10,500		
Wyoming Fish Commission	45,000		
W. P. Groenough, Portneuf, Quebec, Canada	10,000		
Maj. W. Turner, Bertrix, Belgium	25,000		
A. Geoffroy St. Hilaire, Paris, France	57,000		
Raveret-Wattel, Fecamp, France	10,000		
Evergreen Lake near Leadville, Colo		5,000	
Lake Creek near Leadville, Colo		6,000	
Green Lake in Hancock County, Me		500	
Kephart stream near Glyndon, Md		9,500	
Patapsco Falls near Glyndon, Md		9,500	
Local streams near Alberton, Md		5,000	
Crane Creek near Crane, Mo		2,000	
Ocona Lufty River near Cherokee, N. C		5,000	
Dry Run in Bath County, Va		4,500	
Mill Creek in Bath County, Va		4,500	
Applicants in Virginia		1,000	
East Cahaba River near Birmingham, Ala			500
Applicants in Alabama			475
Spavina Creek near Nebo, Ark			1,000
Sugar Creek near Brightwater, Ark			1,300
Clear Fork of Illinois River near Johnson, Ark			800
Main Fork of White River near Durham, Ark			600
Delaney, Ark			600
St. Paul, Ark			800
West Fork, Ark			1,000
Winslow, Ark			1,000
Frog Gabou near Mountainburg, Ark			700
Frog Bayou near Lancaster, Ark			600
Lillie, Ark			600
Feazels Pond near Nashville, Ark			500
Applicants in Arkansas			1,400
Trinity Summit Lake near Trinity Summit, Cal			5,400
Colorado Fish Commission			475
Applicants in District of Columbia			97
Georgia			200
Clear River near Warren, Ill			725
Clear Lake near South Bend, Ind			1,000
Chamberlain Lake near South Bend, Ind			500
Applicants in Indiana			200
Jackson Creek near Cresco, Iowa			700
Clear Creek near Lansing, Iowa			977
Dourman Mill, Coulie Creek near McGregor, Iowa			500
Applicants in Iowa			50
Cow Creek near Baxter Station, Kans			500
Marmonton River near Fort Scott, Kans			2,000
Little Osage River near Fulton, Kans			1,000
Marais Des Cygnes River near Boicourt, Kans			5,200
Applicants in Kansas			1,200
Blue Spring near Cecilian, Ky			200
Lander Branch near Casky, Ky			100
Sinking Creek near Saulsberry, Ky			750
Applicants in Kentucky			100
Maine Fish Commission			471
Parlin Pond in Somerset County, Me			300
Almshouse Run near Hagerstown, Md			52
Lake Roland near Lutherville, Md			312
Beaver Run near Glyndon, Md			100
Local streams near Hagerstown, Md			500
Cronwell Creek near Timonium, Md			1,000
Big Pool near Hagerstown, Md			1,000
Minnehaha Creek near Glyndon, Md			425

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Rainbow trout—Continued.			
Egypt Branch near Brooklandville, Md			425
Applicants in Maryland			250
Kansas River near Kansas City, Mo			100
Indian Creek near Lanagan, Mo			2,200
Elk River near Rutledge, Mo			2,200
Shoal Creek near Neosho, Mo			350
Gasconade River near Arlington, Mo			3,420
Meramac River near Mosalle, Mo			1,500
Metcalf Spring near Steelville, Mo			500
Sugar Creek in McDonald County, Mo			1,000
Current River near Chicopee, Mo			9,300
Spring Pond near Ash Grove, Mo			100
Sylvan Lake near Ironton, Mo			500
Applicants in Missouri			400
Lake Creek near Rushville, Nebr			400
Worth Branch near Far Hills, N. J			500
Applicants in New Jersey			150
New York			300
Dods Lake near Babylon, N. Y			600
Jonathan Creek near Dellwood, N. C			800
Buck Creek near Marion, N. C			1,500
Linville River near Linville, N. C			760
Sugar Fork Run near Black Mountain, N. C			800
Long Branch near Black Mountain, N. C			300
Swananoa River near Black Mountain, N. C			500
Applicants in North Carolina			200
Ohio			300
Tributary of Gunpowder River near New Freedom, Pa			500
Deer Creek near New Freedom, Pa			500
Anderson Branch near Stewartstown, Pa			500
Loyalhanna Creek near Latrobe, Pa			500
Clover Creek near Altoona, Pa			500
Clear Creek near Johnstown, Pa			800
Trout Run near Bedford, Pa			300
Youghiogheny River near Ohiopyle, Pa			500
Elk Run near Ebensburg, Pa			800
Black Lick Creek near Ebensburg, Pa			500
Moore Run near Ebensburg, Pa			500
Long Run near Arnot, Pa			800
Bobs Run near Morris, Pa			500
Alder Run near Munsons, Pa			800
Little Montgomery Creek near Clearfield, Pa			500
Allegheny River near Coudersport, Pa			700
Freeman Run near Austin, Pa			300
Lick Run near Gaines, Pa			1,000
Cushing Creek near Coudersport, Pa			600
Local streams near Blossburg, Pa			4,000
Churchill Creek near Farmington, Pa			800
Clear Brook near Dubois, Pa			200
Falling Spring near Chambersburg, Pa			500
Trindle Run near Mechanicsburg, Pa			800
Hagerman Run near Williamsport, Pa			600
Local streams near Williamsport, Pa			1,275
Sugar Creek near Troy, Pa			800
Red Run Creek near Waynesboro, Pa			500
Glen Brook near Berwick, Pa			300
Harvey Lake near Nanticoke, Pa			500
Local streams near Stroudsburg, Pa			4,000
Pike Creek near Nanticoke, Pa			300
Roaring Brook near Scranton, Pa			600
Moss Hollow Creek near Hamilton, Pa			300
Spring River near Tobyhanna, Pa			100
Jerry Run near Lockhaven, Pa			1,000
Drury Run near Renovo, Pa			600
Deep Creek near Ashland, Pa			500
Quaker Pond near Shenandoah, Pa			200
Rock Run near St. Peters, Pa			475
Steens Run near Mortonville, Pa			425
Meadow Brook near Meadowbrook, Pa			500
Smyser Pond near York, Pa			100
Trout Run near York, Pa			500
Susquehanna River near Peach Bottom, Pa			588
Applicants in Pennsylvania			1,590
South Carolina			100
Indian Creek near Irwin, Tenn			2,900
Boon Creek near Irwin, Tenn			100
Knob Creek near Irwin, Tenn			100
Sinking Creek near Irwin, Tenn			100
Upper Doe River near Roan Mountain, Tenn			1,150
Cranberry Creek near Cranberry, Tenn			1,112
French Broad and Pigeon rivers in Jefferson County, Tenn			1,000
Doe River in Carter County, Tenn			1,000

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Rainbow trout—Continued.			
Spring Branch near Kimmins, Tenn			200
New River near Helenwood, Tenn			250
Little River near Knoxville, Tenn			1,000
Pigeon River in Knox County, Tenn			500
Tellico River in Knox County, Tenn			500
Applicants in Tennessee			1,594
Texas			442
Reed Creek near Wytheville, Va			320
Tyre River near Arrington, Va			1,500
Cowpasture River near Millboro, Va			500
Augusta Springs near Augusta Springs, Va			500
Barbers Creek near Craig City, Va			500
Spring Creek near Craig City, Va			500
Cowpasture River near Hot Springs, Va			1,000
Gordon Creek in Bath County, Va			1,000
Cedar Creek in Bath County, Va			1,500
Little Healing Creek in Bath County, Va			1,500
Walkers Creek near Pearisburg, Va			500
North Fork of Tye River in Nelson County, Va			492
Campbell County, Va			500
Clinch River near Tazewell County, Va			000
Wolf Creek in Tazewell County, Va			1,000
South Fork of Powell River in Wise County, Va			1,000
Powell River and branches near Bigstone Gap, Va			500
Beaver Dam Creek in Washington County, Va			225
Laurel Run in Rockbridge County, Va			300
Rappahannock River near Fredericksburg, Va			200
Spring Creek in Washington County, Va			225
Laurel River in Washington County, Va			450
Applicants in Virginia			1,586
Mound Spring Pond near Seymour, Wis			300
Wausaukee Fish and Game Club, Amberg, Wis			2,000
Gauley River in Fayette County, W. Va			5,000
Applicants in West Virginia			895
Von Behr trout:			
Troutdale fish farm, Mammoth Spring, Ark	5,000		
Connecticut Fish Commission	20,000		
Minnesota Fish Commission	20,000		
Vermont Fish Commission	20,000		
Wyoming Fish Commission	15,000		
Government of Mexico	20,000		
North Ten Mile Creek near Frisco, Colo			450
Black Lake in Summit County, Colo			1,000
Denslow Brook in Fairfield County, Conn			310
Trail Creek near Michigan City, Ind			300
Notre Dame Lake near South Bend, Ind			200
Applicants in Indiana			500
Hoover Spring near West Union, Iowa			200
Silver Springs near Waverly, Iowa			200
Spirit Lake near Spirit Lake, Iowa			1,325
Applicants in Iowa			400
Kentucky			300
Big Tunk Pond near Ellsworth, Me			3,000
Phillips Pond near Phillips Pond Station, Me			2,000
Rocky Pond in Hancock County, Me			3,000
Branch Pond near East Dedham, Me			4,228
Green Lake in Hancock County, Me			3,000
Pattens Pond in Hancock County, Me			5,000
Rogers Pond near Topham, Me			400
Heart Pond near Orland, Me			18
Lidensparker Pond near Waldoboro, Me			1,500
Fourth Pond in Hancock County, Me			2,000
One Mile River near Attleboro, Mass			500
Great Pond near Randolph, Mass			800
Almshouse Run near Hagerstown, Md			118
Pri Pond near Lawton, Mich			300
North Branch Tobacco River near Hatton, Mich			2,000
Centennial Mill and Pokagan Creek near Lagrange, Mich			722
Big Black Creek in Muskegon County, Mich			500
Big Bear Creek in Muskegon County, Mich			400
Little Bear Creek in Muskegon County, Mich			100
Pere Marquette River in Newaygo County, Mich			1,000
Little Manistee River in Newaygo County, Mich			500
Crooked Creek near Coldwater, Mich			500
Applicants in Michigan			150
Salt Peter Creek, near Rexville, N. Y			200
Local streams in Sullivan County, N. Y			1,200
Charlotte Creek near Onconta, N. Y			500
Tawawa Lake near Sidney, Ohio			500
Applicants in Ohio			268
Columbia Creek near Troy, Pa			300
Lackawaxen River in Wayne County, Pa			500

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Von Behr trout—Continued.			
Applicants in Pennsylvania			500
Mill Brook near South Pomfret, Vt			1,000
Big Spring near Leesburg, Va			85
Gauley River in Fayette County, W. Va			1,000
Rush River near Baldwin, Wis			300
Middle Inlet near Amberg, Wis			800
North Branch near Farmington, Wis			1,400
Main Creek near Bangor, Wis			300
Black-spotted trout:			
Frying Pan Creek in Pitkin County, Colo			1,200
Eagle County, Colo			1,300
Upper Boulder Creek near Central City, Colo			2,000
Mammoth Creek near Central City, Colo			2,000
Lake Creek near Twin Lakes, Colo			500
Spring Brook near Carbondale, Colo			500
Tomichi Creek near Sargent, Colo			1,800
Rito Alto Creek near Moffat, Colo			800
Spring Creek near Sheridan, S. Dak			900
Brook trout:			
Troutdale Fish Farm, Mammoth Spring, Ark	5,000		
John G. Bailey, Rogers, Ark	5,000		
Hampshire Trout Club, Northampton, Mass	10,000		
Minnesota Fish Commission	20,000		
Nebraska Fish Commission	20,000		
W. H. Vansicklo, Bevans, N. J	10,000		
Vermont Fish Commission	20,000		
A. P. Muzz, New Richmond, Wis	5,000		
Government of Switzerland	20,000		
J. J. Armistead, Killywhan, Scotland	20,000		
Lieut. H. R. Lemly, U. S. of Colombia, South America	3,000		
Rock Creek in Lake County, Colo		3,000	
Lake Creek in Lake County, Colo		2,500	
Arkansas River near Arkansas Junction, Colo		2,500	
Upper Lake in Lake County, Colo		15,000	
Spring Brook near Laporte, Ind		2,000	
Chamberlain Lake near South Bend, Ind		1,000	
Almshouse Run near Hagerstown, Md		7,000	
Creek near Dexter, Mich		2,000	
Wells Creek near Schoolcraft, Mich		1,000	
Washington River in Houghton County, Mich		10,000	
North River near Staunton, Va		12,000	
Arkansas River near Boulevard, Colo			1,900
Los Pinos Creek near Osier, Colo			1,250
Mill Creek near Idaho Springs, Colo			2,000
Fall River near Idaho Springs, Colo			2,000
South Platte River in Park County, Colo			4,500
South Boulder Creek near Central City, Colo			2,000
Jennie Lind Creek near Central City, Colo			2,000
Lake Creek in Lake County, Colo			500
Upper Twin Lakes in Lake County, Colo			1,000
Lower Evergreen Lake in Lake County, Colo			2,000
Lake Creek in Lake County, Colo			500
Crystal River near Carbondale, Colo			500
Tomichi Creek near Sargent, Colo			400
Gunnison, Colo			2,500
East River near Almont, Colo			850
Greenhorn River near Graneros, Colo			500
Roaring Fork River in Eagle County, Colorado			1,000
Applicants in Colorado			800
Hammonasset River near Madison, Conn			700
Whitlock Brook near South Norwalk, Conn			240
Jacks Brook in Litchfield County, Conn			500
Burr Oak Creek near Osage, Iowa			200
Craig Pond near East Orland, Me			4,505
Applicants in Maryland			400
Trout Brook near North Pembroke, Mass			800
Sweetwater Creek near Stearns, Mich			500
West Branch Donnaber Creek near Wingleton, Mich			500
Poquetts Creek in Lake County, Mich			500
Avery Creek near Cherry Valley, Mich			1,000
Spring Lake near Wingleton, Mich			300
Dannamber Creek near Wingleton, Mich			500
Mill Creek in Lake County, Mich			800
Baldwin Creek near Baldwin, Mich			800
Cedar Creek near Baldwin, Mich			500
Pickerel Creek near Baldwin, Mich			800
Sweetwater Creek near Branch, Mich			500
Sanborn Creek near Nirvana, Mich			500
Branch Pere Marquette River near Nirvana, Mich			1,000
Dock and Tom Creek near Lake Station, Mich			800
Chippewa River near Chippewa, Mich			1,000
South Branch Tobacco River near Clare, Mich			2,000

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Brook trout—Continued.			
Star Lake near Wingleton, Mich			2,000
Middle Branch of Tobacco River near Farwell, Mich			800
Willow Creek near Farwell, Mich			1,000
Indian Lake near Dowagine, Mich			300
Kesby Brook near Milford, Mich			100
Glenwood Lake near Jefferson City, Mont			500
Buffalo and Travis creeks near Helena, Mont			500
Applicants in Montana			500
Nebraska			250
Merrimac River near Hudson, N. H			400
Pecos River near Las Vegas, N. Mex			500
Tesuque River near Santa Fe, N. Mex			1,000
Musconetcong River near Trenton, N. J			900
Applicants in New Jersey			200
Crum Creek near Congers, N. Y			425
Sauquoit Creek near Waterville, N. Y			800
Bridgewater Stream near Bridgewater, N. Y			500
Beaver Meadow Creek near Cutting, N. Y			500
Little Broken Straw Creek near Clymer, N. Y			500
Unadilla River near West Winfield, N. Y			800
Little Moose Lake near Wilmurt, N. Y			1,000
Oriskany Creek near Waterville, N. Y			500
Ragged Lake near Owls Head, N. Y			990
Harvey Creek near Nanticoke, Pa			500
Roaring Brook near Scranton, Pa			500
Walker Creek near Herrick Center, Pa			200
Corey Creek near Herrick Center, Pa			200
Price Creek near Herrick Center, Pa			200
Lee Creek near Herrick Center, Pa			200
McGonegal Creek near Herrick Center, Pa			200
Patterson Creek near Herrick Center, Pa			200
Tingley Creek near Herrick Center, Pa			200
Bowell Creek near Herrick Center, Pa			200
Brookings Creek near Herrick Center, Pa			200
Barnes Creek near Herrick Center, Pa			200
Dunns Creek near Herrick Center, Pa			200
Johnson Creek near Pleasant Mount, Pa			200
Applicants in Pennsylvania			200
Battle Creek near Hermosa, Pa			500
Dotham Pond near Hartford, Vt			500
Lake Witchel near North Pomfret, Vt			600
Ottaqueechy River near Sherburne, Vt			1,000
Lakota Lake near Woodstock, Vt			500
Big Spring near Leesburg, Va			69
Eighteen Mile Creek near Pratt, Wis			800
Kinnickinnick River near River Falls, Wis			1,000
Local stream near West Salem, Wis			500
Bear Creek near Rice Lake, Wis			1,000
Shoshone Creek in Yellowstone National Park, Wyo			4,500
Yellow-finned trout:			
Lower Evergreen Lake near Leadville, Colo			700
Lake trout:			
Connecticut Fish Commission	100,000		
Massachusetts Fish Commission	100,000		
Minnesota Fish Commission	100,000		
Nebraska Fish Commission	100,000		
New York Fish Commission	300,000		
Utah Fish Commission	100,000		
Vermont Fish Commission	300,000		
Green Lake in Hancock County, Me		25,000	
Pretty Lake near Kalamazoo, Mich		2,000	
Lake Huron off North Point, Mich		29,000	
Sugar Island, Mich		38,000	
Lake Superior near Fishermans Home, Mich		100,000	
Wright Island, Mich		100,000	
Rock Harbor, Mich		100,000	
Tobin Bay, Mich		100,000	
Duncan Bay, Mich		100,000	
Washington Harbor, Mich		200,000	
Lester Park, Minn		40,000	
Two Harbors, Minn		200,000	
Beaver Bay, Minn		200,000	
Grand Marcus, Minn		200,000	
Poplar River, Minn		50,000	
Grand Portage, Minn		400,000	
Chicago Bay, Minn		100,000	
French River, Minn		20,000	
Fish Island, Minn		100,000	
Eagleneat Lake near Ely, Minn		100,000	
Burnside Lake near Ely, Minn		50,000	
Trout Lake near Tower, Minn		77,000	
Lake Ontario off Cape Vincent, N. Y		29,000	

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Lake trout—Continued.			
Lake Erie on North Bass Island Reef, Ohio		79,000	
Peach Point Reef, Ohio		42,000	
Lake Superior near Bayfield, Wis		300,000	
Hudson Lake near South Bend, Ind			1,000
Lake in Franklin Park, Columbus, Ohio			300
Lake Maxinkuckee near Marmont, Ind			3,000
Heart Pond near East Orland, Me			19
East Orland, Me			17
Lake Huron near Thunder Bay, Mich			145
off North Point, Mich			6,823
Star Lake in Saginaw, Mich			2,000
Bitter Root River near Hamilton, Mich			780
Ragged Lake near Owls Head, N. Y			1,096
Pundersons Lake near Burton, Ohio			1,810
Lake Winola near Falls, Pa			1,000
Beech Lake near Honesdale, Pa			500
Whitefish:			
Connecticut Fish Commission	200,000		
New York Fish Commission	6,000,000		
Lake Superior off Fish Island, Mich		990,000	
Siskouvit Lake, Isle Royal, Mich		1,000,000	
Lake Michigan near Naubinway, Mich		750,000	
Epoufette, Mich		750,000	
Charlevoix, Mich		2,000,000	
Manistique, Mich		2,000,000	
Lake Huron near East Tawas, Mich		1,000,000	
Detour Passage, Mich		1,500,000	
Lake Huron off Miller Point, Mich		1,000,000	
Sturgeon Point, Mich		1,000,000	
Thunder Bay Island, Mich		1,050,000	
Whitefish Lake in Mackinac County, Mich		2,000,000	
Lake Superior near Duluth, Minn		200,000	
Lake Ontario near Oswego, N. Y		1,900,000	
Sackets Harbor, N. Y		1,900,000	
Lake Erie on North Bass Island Reef, Ohio		4,340,000	
Rattlesnake Island Reef, Ohio		4,420,000	
Ballast Island Reef, Ohio		3,900,000	
Green Island Reef, Ohio		2,600,000	
Middle Bass Island Reef, Ohio		2,500,000	
Peach Point Reef, Ohio		1,250,000	
Starve Island Reef, Ohio		700,000	
Kelly Island Reef, Ohio		1,000,000	
Mouse Island Reef, Ohio		1,000,000	
Lake Superior near Bayfield, Wis		4,000,000	
Iron River, Wis		2,000,000	
Raspberry Bay, Wis		2,000,000	
Lake Erie on North Bass Island Reef, Ohio		5,450,000	
Rattlesnake Island Reef, Ohio		7,230,000	
Green Island Reef, Ohio		1,500,000	
Middle Bass Island Reef, Ohio		1,600,000	
Peach Point Reef, Ohio		3,125,000	
Ballast Island Reef, Ohio		3,300,000	
Starve Island Reef, Ohio		2,400,000	
Kelley Reef, Ohio		3,400,000	
Mouse Island Reef, Ohio		2,000,000	
Pike perch:			
Long Lake near Albion, Ind		500,000	
High Lake near Albion, Ind		500,000	
Pretty Lake near Plymouth, Ind		1,000,000	
Maxinkuckee Lake near Marmont, Ind		2,000,000	
Twin Lakes near Plymouth, Ind		1,000,000	
Lake of the Woods near Plymouth, Ind		1,000,000	
Blue River near Milltown, Ind		200,000	
Long Lake near Lagrange, Ind		500,000	
Dallas Lake near Lagrange, Ind		500,000	
Atwood Lake near Lagrange, Ind		500,000	
Applicants in Indiana		200,000	
Salt River near Shepherdsville, Ky		1,886,000	
Green River near Bowling Green, Ky		1,667,000	
Barren River near Munfordsville, Ky		1,647,000	
Applicants in Kentucky		100,000	
Pike Lake near Duluth, Minn		2,500,000	
Lake Vermilion near Tower, Minn		2,500,000	
Harper Lake near Center Village, N. Y		500,000	
Owasco Lake near Auburn, N. Y		500,000	
Cayuga Lake near Auburn, N. Y		500,000	
New York State Fish Commission	5,000,000		
Maumee Bay near Toledo, Ohio		13,600,000	
Sandusky River near Fremont, Ohio		2,500,000	
Sandusky Bay near Sandusky, Ohio		10,800,000	
Lake Erie on Rattlesnake Island Reef, Ohio		8,400,000	
Put-in-Bay Island Reef, Ohio		15,300,000	

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Pike perch—Continued.			
Lake Erie on Port Clinton Reef, Ohio		13,200,000	
Ballast Island Reef, Ohio		21,600,000	
Middle Bass Island Reef, Ohio		26,700,000	
Peach Point Reef, Ohio		15,000,000	
North Bass Island Reef, Ohio		7,500,000	
Ohio Fish Commission		18,000,000	
Beech Lake near Honesdale, Pa		2,000,000	
Chapman Lake near Jermyn, Pa		500,000	
Heart Lake near Jermyn, Pa		500,000	
Applicants in Pennsylvania		2,500,000	
Lake Superior near Port Wing, Wis		3,000,000	
Pike:			
Jackson River near Cedar Creek, Va			100
Yellow perch:			
Lake Erie on Put-in-Bay Island Reef, Ohio		70,000	
Applicants in District of Columbia			63
Cedar River near Cedar Rapids, Iowa			167
Clark Creek near Skiddy, Kans			20
City reservoir, Winchester, Ky			15
Applicants in Kentucky			25
Pennsylvania			50
Black bass:			
Cahaba River near Selma, Ala			100
Applicants in Alabama			240
Arkansas			100
District of Columbia			357
East Lake near Atlanta, Ga			200
Applicants in Georgia			367
Fox River near St. Charles, Ill			197
Elgin, Ill			150
Geneva, Ill			50
Lake Sibley near Sibley, Ill			22
Kiswaukee River near Belvidere, Ill			50
Applicants in Illinois			333
Long Lake near Miller, Ind			95
Applicants in Indiana			210
Lime Creek near Mason City, Iowa			50
Bishop Lake near Sheldon, Iowa			50
Cedar River near Cedar Rapids, Iowa			400
Badger River near Fayette, Iowa			25
Upper Iowa River near Decorah, Iowa			87
Otter Creek near Oelwein, Iowa			100
Twin Lakes near Rockwell City, Iowa			100
Storm Lake near Storm Lake, Iowa			100
Maquoketa River near Manchester, Iowa			75
Iowa River near Lime Spring, Iowa			50
Iowa River near Chester, Iowa			25
Cedar River near Osage, Iowa			25
Iowa Fish Commission			100
Applicants in Iowa			75
Clark Creek near Skiddy, Kans			50
Lake View near Lawrence, Kans			200
Applicants in Kansas			602
Lake Reba near Richmond, Ky			100
Clark County Fishing Club, Winchester, Ky			200
Clear Creek near Shelbyville, Ky			50
City Reservoir, Winchester, Ky			50
Middleboro, Ky			50
Fleming Creek near Flemingsburg, Ky			50
Kinney Creek near Vanceburg, Ky			50
South Licking River near Cynthiana, Ky			50
Tygart Creek near Olive Hill, Ky			100
Nolin River near Hodgenville, Ky			150
Clarkston Lake near Elizabethtown, Ky			100
Billys Creek near Elizabethtown, Ky			75
Blue Spring near Cecilian, Ky			50
Big Clifty Creek near Clifty, Ky			75
Caney Creek near Spring Creek Station, Ky			75
Mud River near Russellville, Ky			100
Pond River near Bakersport, Ky			75
Tradewater River near Dawson, Ky			50
Lake Slough near Kuttawa, Ky			200
Little River near Cerulean Springs, Ky			75
Asylum Lake, Lakeland, Ky			200
South Park Lake near South Park, Ky			50
Harrods Creek, Ky			200
Rolling Fork, branch of Salt River, Ky			450
Green River near Hustonville, Ky			300
Dix River near Danville, Ky			340
Knob Lick Creek near Junction City, Ky			150
Crystal Lake near Covington, Ky			75
Applicants in Kentucky			1,852

Details of distribution, 1893-94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Black bass—Continued.			
Bayou Robert near Moreland, La			230
Applicants in Louisiana			30
St. Catherine Lake near Mount Hope, Md			30
Patapsco River near Glenn Falls, Md			100
Patuxent River near Laurel, Md			100
Applicants in Maryland			100
Dodgewell Pond near Attleboro, Mass			30
Hebron Pond near Attleboro, Mass			30
Applicants in Massachusetts			130
Magruder Lake near Canton, Miss			100
Applicants in Mississippi			220
Lake View near Nevada, Mo			30
Moreau Creek near Jefferson City, Mo			300
Applicants in Missouri			245
Ireland Mill Pond near Bridgeton, N. J			100
Crosswicks Creek near Crosswick, N. J			100
Applicants in New Jersey			460
Johnson Creek near County Line, N. Y			50
Lake Wiley near Charlotte, N. C			100
Broad River in Rutherford County, N. C			100
Pig Run near Rocky Mount, N. C			100
Union Mill Pond near Mebane, N. C			100
Pond on Sandy Creek near Henderson, N. C			100
Ten Mile Pond near Flat Rock, N. C			50
Yadkin River near Patterson, N. C			100
Applicants in North Carolina			590
Stone Lake near North Bend, Ohio			125
City reservoir near Bellevue, Ohio			100
Middle Fork of Little Beaver River near New Lisbon, Ohio			100
Bass Lake near Chardon, Ohio			100
Tinkers Creek near Bedford, Ohio			75
Cuyahoga River near Shalersville, Ohio			75
Lake tributary to Cuyahoga River near Shalersville, Ohio			75
Wills Creek near Coshocton, Ohio			100
Xenia Water Company Reservoir, Xenia, Ohio			100
Applicants in Ohio			1,425
Oregon			50
Beaver River near Beaver Falls, Pa			200
Local creek near Bedford, Pa			100
Simmonahoning Creek near Winterburn, Pa			300
Lake near Yardley, Pa			50
Applicants in Pennsylvania			130
Seneca River near Seneca, S. C			100
Broad River near Alston, S. C			30
Ocall River near Parksville, Tenn			100
Lake Wildwood near Cleveland, Tenn			100
Clinch River near Clinton, Tenn			386
Emory River near Harriman, Tenn			200
Obed River near Lancing, Tenn			100
New River and tributaries near Helenwood, Tenn			400
Pigeon River near Knoxville, Tenn			100
Duck River near Wartrace, Tenn			50
Applicants in Tennessee			170
Mountney Lake near, Gainesville, Tex			15
Chesley Tank near Cisco, Tex			50
Palo Dowra Creek near Amarillo, Tex			50
Tulia Creek near Amarillo, Tex			50
Running Water Creek near Amarillo, Tex			30
Austin Rod and Gun Club, Austin, Tex			100
Applicants in Texas			587
Clinch River near Tazewell, Va			200
Rivanna River near Proffit, Va			200
Falling River and Seneca Creek near Lynchburg, Va			100
Jackson River near Cedar Creek, Va			100
Cowpasture River near Millboro, Va			100
Rappahannock River near Fredericksburg, Va			199
South Anne River near Ashland, Va			100
Applicants in Virginia			480
Shepherd Lake near Cheney, Wash			50
Clear Lake near Cheney, Wash			50
Lake near Hamilton, Wash			150
Lake Padden near Fairhaven, Wash			125
Applicants in Washington			175
Cheat River near Morgantown, W. Va			149
Gauley River near Camden on Gauley, W. Va			1,000
Applicants in West Virginia			50
Gibbon River in Yellowstone National Park, Wyo			250
Rock bass:			
Oxford Lake near Anniston, Ala			100
Applicants in Alabama			150
Arkansas			1,100

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Rock bass—Continued.			
Applicants in Delaware			500
Georgia			725
Georgia Fish Commission			600
Applicants in Illinois			30
Indian Territory			1,000
Kansas			800
Lake Reba near Richmond, Ky			500
Patuxent River near Laurel, Md			1,000
Applicants in Maryland			200
Missouri			640
Mississippi			600
Nebraska			300
North Carolina			2,975
Oklahoma			100
Pennsylvania			490
Allegheny River near Warren, Pa			500
Susquehanna River near Williamsport, Pa			1,000
Sinnemahoming River near Clearfield, Pa			300
Applicants in South Carolina			930
Tarra Blanco Creek near Amarillo, Tex			200
Applicants in Texas			600
State Capitol Ponds, Nashville, Tenn			200
Applicants in Virginia			2,661
Cove Creek near Wytheville, Va			300
Applicants in Tennessee			600
Warmouth bass:			
Applicants in Illinois			100
Fox River near St. Charles, Ill			50
Pine Lake near Laporte, Ind			525
Long Lake near Miller, Ind			75
Applicants in Indiana			50
Cedar River near Cedar Rapids, Iowa			50
Upper Iowa River near Decorah, Iowa			104
Otter Creek near Oelwein, Iowa			150
Twin Lakes near Rockwell City, Iowa			100
Storm Lake near Storm Lake, Iowa			150
Maquoketa River near Manchester, Iowa			75
Lake View near Lawrence, Kans			100
Mud River near Russellville, Ky			75
Lake Dlough near Kuttawa, Ky			69
Applicants in Kentucky			75
Patuxent River near Laurel, Md			90
Applicants in Massachusetts			38
Ohio			50
Texas			235
Crappie:			
Fox River near St. Charles, Ill			217
Elgin, Ill			145
Geneva, Ill			40
Lake Sibley near Sibley, Ill			81
Kishwaukee River near Belvidere, Ill			40
Applicants in Illinois			483
Pine Lake near Laporte, Ind			2,350
Applicants in Indiana			375
Storm Lake near Storm Lake, Iowa			150
Otter Creek near Oelwein, Iowa			175
Badger River near Fayette, Iowa			50
Upper Iowa River near Decorah, Iowa			275
Cedar River near Cedar Rapids, Iowa			400
Iowa River near Chester, Iowa			25
Lyons Creek near Junction City, Kans			25
Applicants in Kansas			474
Nolin River near Hodgenville, Ky			150
Clarkston Lake near Elizabethtown, Ky			100
Billys Creek near Elizabethtown, Ky			75
Big Clifty Creek near Clifty, Ky			75
Caney Creek near Spring Creek Station, Ky			75
Mud River near Russellville, Ky			100
Pond River near Bakersport, Ky			75
Drake Creek near Hortonville, Ky			75
Tradewater River near Dawson, Ky			50
Lake Dlough near Kuttawa, Ky			250
Muddy Fork near Kuttawa, Ky			75
Little River near Cerulean Springs, Ky			75
Otter Creek near Cerulean Springs, Ky			100
Reservoir near Winchester, Ky			15
Middleboro, Ky			25
Kinney Creek, near Vanceburg, Ky			25
South Licking near River Cynthiana, Ky			25
Applicants in Kentucky			400
Lake View near Novada, Mo			6
Applicants in Missouri			300

Details of distribution, 1893–94—Continued.

Disposition.	Eggs.	Fry.	Adults and yearlings.
Crappie—Continued.			
Applicants in New York			100
Johnson Creek near county line, N. Y.			50
Applicants in Ohio			40
Codorus Creek near Brodbecks, Pa.			17
French Creek near Phœnixville, Pa.			50
Moutney Lake near Gainesville, Tex.			20
Applicants in Texas			515
Jackson River near Cedar Creek, Va.			50
Sunfish:			
Lime Creek near Mason City, Iowa			50
Bishop Lake, Sheldon, Iowa			50
Pine Lake near Laporte, Ind			20
Applicants in Ohio			50
Cod:			
Vineyard Sound off the Massachusetts coast		1,254,000	
Massachusetts Bay off Gloucester Harbor, Mass.		24,617,000	
Haddock:			
Massachusetts Bay off Gloucester Harbor, Mass.		19,500	
Flatfish:			
Vineyard Sound off the Massachusetts coast		1,795,000	
Lobster:			
Vineyard Sound off the Massachusetts coast		69,066,000	
Massachusetts Bay off Gloucester Harbor, Mass.		9,332,000	
Total	24,123,000	424,320,500	1,867,043

Résumé by States and Territories of the distribution and assignment of fish and fish eggs.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Alabama	Carp			575
	Goldfish			48
	Rainbow trout			975
	Black bass			340
	Rock bass			250
Arkansas	Carp			611
	Tench			500
	Goldfish			124
	Golden ide			100
	Rainbow trout	17,000		10,900
	Von Behr trout	5,000		
	Brook trout	10,000		
	Black bass			100
	Rock bass			1,100
California	Carp			18
	Quinnat salmon	7,500,000	438,500	
	Silver salmon		280,000	
	Steelhead trout	50,000	308,500	
	Loch Leven trout	20,000		
	Rainbow trout			5,400
Colorado	Carp			30
	Goldfish			24
	Golden ide			125
	Loch Leven trout			14,500
	Rainbow trout		11,000	475
	Von Behr trout			1,450
	Black-spotted trout			10,100
	Yellow-finned trout			700
	Brook trout		23,000	26,200
Connecticut	Carp			390
	Goldfish			30
	Shad		3,044,000	
	Atlantic salmon	25,000		
	Landlocked salmon			300
	Von Behr trout	20,000		310
	Brook trout			1,440
	Lake trout	100,000		
	Whitefish	200,000		
Delaware	Carp			60
	Goldfish			48
	Shad		1,780,000	
	Rock bass			500
District of Columbia	Spotted catfish			10
	Carp			1,902
	Goldfish			6,771

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
District of Columbia	Golden ide			91
	Golden tench			50
	Shad		469,000	1,000,000
	Rainbow trout			97
	Yellow perch			63
	Black bass			357
Florida	Carp			364
	Goldfish			74
	Golden ide			50
	Shad		2,250,000	
Georgia	Carp			4,489
	Tench			4,000
	Goldfish			168
	Golden ide			150
	Shad		2,417,000	
	Rainbow trout			200
	Black bass			567
	Rock bass			1,325
Idaho	Spotted catfish			100
	Carp			60
Illinois	Spotted catfish			2,800
	Carp			150
	Goldfish			310
	Golden ide			37
	Golden tench			6
	Rainbow trout			725
	Black bass			802
	Rock bass			30
	Warmouth bass			150
	Crappie			1,006
Indiana	Spotted catfish			375
	Carp			90
	Goldfish			127
	Golden tench			12
	Golden ide			25
	Loch Leven trout			2,300
	Rainbow trout			1,700
	Von Behr trout			1,000
	Brook trout		3,000	
	Lake trout			4,000
	Pike perch		7,900,000	
	Black bass			335
	Warmouth bass			650
	Crappie			2,725
	Sunfish			20
Indian Territory	Carp			575
	Tench			1,100
	Goldfish			24
	Rock bass			1,000
Iowa	Spotted catfish			9,642
	Carp			340
	Tench			165
	Goldfish			210
	Golden tench			2
	Rainbow trout			2,227
	Von Behr trout			2,125
	Brook trout			200
	Yellow perch			167
	Black bass			1,262
	Warmouth bass			629
	Crappie			1,075
	Sunfish			100
Kansas	Spotted catfish			1,099
	Carp			1,001
	Tench			100
	Goldfish			192
	Golden ide			8
	Rainbow trout			9,900
	Yellow perch			20
	Black bass			852
	Rock bass			800
	Warmouth bass			100
	Crappie			499
Kentucky	Spotted catfish			1,190
	Carp			320
	Goldfish			84
	Rainbow trout			1,150
	Von Behr trout			300
	Pike perch		6,200,000	
	Yellow perch			40
	Black bass			5,342
	Rock bass			500

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Kentucky	Warmouth bass			219
	Crappie			1,765
Louisiana	Carp			190
	Goldfish			419
	Golden ide			100
	Black bass			260
Maine	Carp			30
	Goldfish			14
	Atlantic salmon			235,300
	Landlocked salmon	10,000	6,000	130,058
	Loch Leven trout			20,714
	Rainbow trout		500	771
	Von Behr trout			24,140
	Brook trout			4,505
	Lake trout		25,000	36
Maryland	Carp			610
	Tench			60
	Goldfish			360
	Golden ide			24
	Golden tench			24
	Shad	355,000	12,006,000	
	Landlocked salmon		2,500	
	Rainbow trout	2,500	24,000	4,064
	Von Behr trout			118
	Brook trout		7,000	400
	Black bass			330
	Rock bass			1,200
	Warmouth bass			90
Massachusetts	Carp			260
	Goldfish			74
	Golden ide			24
	Landlocked salmon	6,000		
	Von Behr trout			1,300
	Brook trout	10,000		800
	Lake trout	100,000		
	Black bass			190
	Warmouth bass			38
	Cod		25,871,000	
	Haddock		19,500	
	Flatfish		1,795,000	
	Lobster		78,398,000	
Michigan	Carp			780
	Goldfish			60
	Quinnat salmon		39,000	
	Loch Leven trout		24,000	3,000
	Von Behr trout			6,172
	Brook trout		13,000	16,200
	Lake trout		769,500	8,968
	Whitefish		15,040,000	
Minnesota	Carp			3,500
	Goldfish			60
	Golden ide			25
	Loch Leven trout	20,000		
	Rainbow trout	42,000		
	Von Behr trout	20,000		
	Brook trout	20,000		
	Lake trout	100,000	1,537,000	
	Whitefish		200,000	
	Pike perch		5,000,000	
Mississippi	Carp			806
	Goldfish			66
	Black bass			320
	Rock bass			600
Missouri	Spotted catfish			450
	Catfish (common)			1,050
	Carp			450
	Tench			2,245
	Goldfish			579
	Golden ide			75
	Rainbow trout	50,000	2,000	21,570
	Black bass			575
	Rock bass			640
	Crappie			306
Montana	Carp			740
	Loch Leven trout			1,000
	Brook trout			1,500
	Lake trout			780
Nebraska	Carp			110
	Goldfish			6
	Rainbow trout	23,000		400
	Brook trout	20,000		205
	Lake trout	100,000		

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Nebraska	Rock bass			300
New Hampshire	Carp			160
	Atlantic salmon	25,000		
	Brook trout			400
New Jersey	Carp			280
	Goldfish			120
	Golden ide			15
	Shad		1,242,000	
	Landlocked salmon	5,000		
	Rainbow trout			650
	Brook trout	10,000		1,100
	Black bass			660
New Mexico	Carp			484
	Goldfish			12
	Loch Leven trout			800
	Brook trout			1,500
Nevada	Rainbow trout	40,000		
New York	Spotted catfish			125
	Carp			10,355
	Tench			4,000
	Goldfish			224
	Golden ide			275
	Shad	2,000,000	6,731,000	
	Atlantic salmon	60,000		
	Landlocked salmon	55,000		
	Rainbow trout			900
	Von Behr trout			1,000
	Brook trout			6,015
	Lake trout	300,000	29,000	1,906
	Whitefish	6,000,000	3,800,000	
	Pike perch	5,000,000	1,500,000	
	Black bass			50
	Crappie			150
North Carolina	Carp			1,218
	Tench			150
	Goldfish			227
	Golden ide			100
	Golden tench			86
	Shad		1,640,000	
	Rainbow trout		5,000	4,860
	Rock bass			2,975
	Black bass			1,240
North Dakota	Carp			186
Ohio	Spotted catfish			25
	Carp			810
	Tench			200
	Goldfish			466
	Golden ide			166
	Loch Leven trout			300
	Rainbow trout			300
	Von Behr trout			768
	Lake trout		121,000	2,110
	Whitefish		21,710,000	
	Lake herring		30,005,000	
	Pike perch		153,500,000	
	Yellow perch		70,000	
	Black bass			2,275
	Warmouth bass			50
	Crappie			40
	Sunfish			50
Oklahoma Territory	Carp			510
	Goldfish			12
	Rock bass			100
Oregon	Carp			30
	Quinnat salmon		213,000	
Pennsylvania	Black bass			50
	Carp			720
	Goldfish			838
	Golden ide			115
	Golden tench			18
	Shad	300,000	7,753,000	
	Atlantic salmon	60,000		
	Loch Leven trout			3,000
	Rainbow trout			33,153
	Von Behr trout			1,300
	Brook trout			4,100
	Lake trout			1,500
	Pike perch		5,500,000	
	Yellow perch			50
	Black bass			780
	Rock bass			2,200
	Crappie			67

Résumé of the distribution and assignment of fish and fish eggs—Continued.

State or Territory.	Species.	Eggs.	Fry.	Adults and yearlings.
Rhode Island	Carp			7
	Goldfish			12
	Shad	669,000	2,350,000	
South Carolina	Carp			304
	Goldfish			117
	Shad		4,055,000	
	Rainbow trout			100
	Black bass			130
	Rock bass			900
South Dakota	Carp			1,910
	Loch Leven trout			2,300
	Black-spotted trout			900
Tennessee	Carp			6,221
	Goldfish			198
	Golden ide			100
	Golden tench			42
	Rainbow trout			11,506
	Black bass			1,006
	Rock bass			800
Texas	Spotted catfish			265
	Carp			1,880
	Tench			5,300
	Goldfish			318
	Golden ide			125
	Rainbow trout			442
	Black bass			882
	Rock bass			800
	Warmouth bass			235
	Crappie			535
Utah	Goldfish			6
	Rainbow trout	10,000		
	Lake trout	100,000		
Vermont	Landlocked salmon			10,076
	Rainbow trout	30,000		
	Von Behr trout	20,000		1,000
	Brook trout	20,000		2,600
	Lake trout	300,000		
Virginia	Spotted catfish			350
	Carp			3,621
	Goldfish			707
	Golden ide			50
	Golden tench			20
	Shad		7,772,000	
	Rainbow trout		10,000	16,398
	Von Behr trout			85
	Brook trout		12,000	69
	Pike			100
	Black bass			1,479
	Rock bass			2,961
	Crappie			50
Washington	Spotted catfish			100
	Carp			280
	Black bass			550
West Virginia	Carp			210
	Goldfish			72
	Rainbow trout			5,895
	Von Behr trout			1,000
	Black bass			1,199
Wisconsin	Carp			30
	Goldfish			100
	Loch Leven trout			2,000
	Rainbow trout			2,300
	Von Behr trout			2,800
	Brook trout	5,000		3,300
	Lake trout		300,000	
	Whitefish		8,000,000	
	Pike perch		3,000,000	
Wyoming	Spotted catfish			25
	Loch Leven trout			1,000
	Rainbow trout	55,500		
	Von Behr trout	15,000		
	Brook trout			4,500
	Black bass			250
Foreign countries	Golden tench			12
	Landlocked salmon	3,000		
	Steelhead trout	25,000		
	Loch Leven trout	25,000		
	Rainbow trout	102,000		
	Von Behr trout	20,000		
	Brook trout	43,000		