XXVIII.—REPORT OF OPERATIONS AT CENTRAL STATION, UNITED STATES FISH COMMISSION, DURING 1883.

By MARSHALL MCDONALD.

1. GENERAL CONSIDERATIONS.

The central station of the U. S. Fish Commission is more complex in its organization and characterized by greater diversity in its operations than any other station of the commission.

a. It is a depot of the property of the Commission and of the property and collections of the U. S. National Museum. The care and preservation of these, and of the buildings and grounds, requires a storekeeper, a watchman, and one or more laborers.

b. It is the center of distribution for carp, tench, and other species of fish bred at the ponds of the U. S. Fish Commission in Washington; and the larger proportion of shad which are sent out each season are hatched at and distributed from Central Station.

c. It is the principal station of the Commission for the propagation of shad; from twelve to twenty millions of this species being hatched each season from eggs collected from the fishing shores and gill-net fishermen on the Potomac River.

Considerable numbers of whitefish, lake trout, and various other species of Salmonidæ are hatched out at the station each winter, and distributed to suitable waters conveniently reached from the station.

This division of the work involves the employment of a superintendent of propagation permanently, and from time to time such assistants as the emergencies of the work may render necessary.

d. It is a station for the conduct of biological and experimental investigations relating to fish-culture. The materials for such researches are gathered and held here, and the station being in immediate proximity to the National Museum, it affords to students of natural history an admirable field for the study of the life history of those species which are interesting either on account of their economic importance, or are in essential relations to them. The series of aquariums containing living specimens of many of our freshwater species of fish, and the illustrations of the methods and apparatus of modern fish-culture to be found at the station, are objects of absorbing interest to visitors, and the pro-

posed extension of the system by the addition of interesting forms of life which belong to salt water will render this feature of the station most valuable as a means of engaging public attention, awakening public interest, and communicating instruction in natural history.

2. The personnel of the station.

This consists of a superintendent of the station, a superintendent of fish-culture, a storekeeper, and such assistants, watchmen, laborers, &c., as the exigencies of the work from time to time require.

3. Improvements and alterations.

During 1883 the following changes were made:

a. That portion of the lower or basement floor heretofore occupied by Mr. Horan was vacated, and the interior reconstructed and arranged with reference to the greater convenience of the work of propagation and distribution.

b. The roadways and footways in the interior of the inclosure were concreted and asphalted, the interspaces sodded, and a substantial retaining wall of brick, with heavy stone coping, built along the line of the B street siding.

c. The hatching-jars improvised for the shad work of 1882 were substituted by the perfected jars, which were designed for but not completed in time for the work of 1882.

d. Six collecting aquariums of plate-glass sides and ends, and slate frames, each having a storage capacity of one-half million shad fry, were added to and completed the equipment of the fish-cultural division of the station.

4. Current work of the station.

Propagation of shad.—The eggs hatched at Central Station during the season were obtained exclusively from the Potomac River. The eggs collected from the gillers and from the fishing shores were concentrated at Fort Washington, whence they were shipped to Central Station either by the steamer W. W. Corcoran or by the steam yacht Lookout. In emergencies shipments were made by the Herreshoff launch attached to the Fort Washington Station. The work of collecting and forwarding the eggs was under the direction of W. C. Babcock, U. S. N., with James Carswell as executive officer in immediate charge of the details of the work. The total number of eggs forwarded from the Fort Washington station was 24,275,000, which, after being freed from shells, and from unimpregnated and water-hard eggs, amounted to 17,761,500, and yielded for distribution 470,000 eggs and 12,128,500 fry. The percentage of loss in forwarding and hatching was exceptionally great, and is to be attributed to several causes, namely:

(*a*) Carelessness in handling the eggs resulting in imperfect impregnation.

(*b*) The forwarding of unimpregnated water-hard eggs under the impression that they were impregnated.

(*c*) The low temperatures of water prevailing during the season, which made impregnation very difficult in the hands of unskilful or careless spawn-takers.

The following summary (Table I) shows the sources from which the eggs were obtained, and the quality of the eggs in each case, as indicated by the percentage of loss in transportation and hatching.

TABLE I.—*Summary of shad eggs received at Central Station, season of* 1883.

Whence obtained.	Number of eggs received from collecting stations.	Number of eggs received alive.	Percentage of eggs alive on arrival.	Number of eggs shipped.	Number of eggs which produced fish.	Number of eggs lost in course of hatching.	Percentage of eggs shipped which produced fish.	Percentage of eggs received alive which produced fish.
Moxley's Point	7,518,500	5,420,500	72	220,000	3,648,500	1,552,000	48	67.4
Gillers	5,818,000	4,224,500	72	120,000	3,092,000	1,012,500	53	73.2
White House	5,315,000	4,175,000	78	80,000	2,998,000	1,097,000	56	71.8
Ferry Landing	3,312,000	2,425,000	73	50,000	1,370,000	1,005,000	41	56.9
Chapman's Point	1,097,000	620,000	56	.....	391,000	229,000	35	61.4
Fort Washington	1,089,500	851,500	78	.....	592,000	259,500	54	69.5
—— (not stated)	125,000	45,000	36	.....	37,000	8,000	20	82.2
Total	24,275,000	17,761,500	66⅔	470,000	12,128,500	5,163,000	45½	68.9

Table II furnishes as complete a history of each lot of eggs received at the station as it was practicable to obtain, but some of the records lack the precision necessary to furnish the data for satisfactory conclusions. It is evident, from the table, that in general the period of incubation varies inversely to the temperature prevailing during the incubation. But we cannot disguise the fact that there are other influences not well understood which accelerate or retard development under precisely the same conditions of temperature. We know, for example, that strong light, whether direct or diffused, will accelerate development; again we know that continuous dark and cloudy days will retard development under precisely the same conditions of water temperature. It is possible, too, that the rate of development may be in a measure determined by the initial temperature, or that prevailing at the time of impregnation. It will require careful observations for several seasons to obtain the data necessary to discuss the conditions influencing development, and Table II is published here in order to put on record, in convenient form for reference, such data bearing on the question of development as have been accumulated.

TABLE II.—*Daily register of eggs received and fish hatched at Central Station, U. S. Fish Commission, season of* 1883.

No. of record card.	Eggs taken.		Eggs received.		Whence obtained.	By whom taken.	Total number received.	Number received alive.	Number of fish produced.	Disposal of eggs while hatching.		Period of hatching.				Temperature during incubation.			Days and hours in incubating.	
												Began.		Ended.						
	Date.	Hour of day.	Date.	Hour of day.								Date.	Hour of day.	Date.	Hour of day.	Max.	Min.	Av.		
		h. m.		*h. m.*									*h. m.*		*h. m.*				*d.*	*h.*
1	Apr. 14	9	Apr. 14	17	Fort Washington		25,000	12,500	10,000	III	31	Apr. 22	8	Apr. 26	8	57	50	55¼	11	23
2	Apr. 14	16	Apr. 15	13	Moxley's Point		40,000	25,000	20,000	III	32	Apr. 23	8	Apr. 27	8	57	54	55½	12	16
3	Apr. 15	20	Apr. 16	16	....do		100,000	62,000	34,000	III	17	Apr. 23	11	Apr. 28	19	57	54	55½	12	23
4	Apr. 15	20	Apr. 16	16	....do		100,000	65,000	50,000	III	29	Apr. 24	9	Apr. 29	19	57	54	55½	13	23
5	Apr. 15	20	Apr. 16	16	....do		100,000	60,000	33,000	III	28	Apr. 23	11	Apr. 28	19	57	54	55½	12	23
6	Apr. 16	19	Apr. 17	16	....do		70,000	42,500	33,500	III	18	Apr. 23	11	Apr. 28	9	57	54	55½	11	14
7	Apr. 16	19	Apr. 17	16	....do		70,000	40,000	32,000	III	30	Apr. 23	11	Apr. 28	9	57	54	55½	11	14
8	Apr. 17	18	Apr. 18	16	....do	Luckett & Manning	112,000	99,000	45,000	III	24	Apr. 26	8	May 1	10	57	54	55½	13	16
9	Apr. 17	18	Apr. 18	16	....do	....do	110,000	90,000	45,000	III	23	Apr. 26	8	Apr. 30	7	57	54	55½	12	13
10	Apr. 17	18	Apr. 18	16	Fort Washington	Johnson & Carswell	90,000	72,500	26,000	III	21	Apr. 25	13 45	Apr. 29	13	57	54	55½	11	19
11	Apr. 17	18	Apr. 18	16	....do	....do	97,500	75,000	27,000	III	22	Apr. 25	13 45	Apr 29	13	57	54	55½	11	19
12	Apr. 17	18	Apr. 18	16	Gillers	....do	105,000	75,000	30,000	III	20	Apr. 26	7	Apr. 30	14	57	54	55½	12	20
13	Apr. 18	21	Apr. 19	16	Moxley's Point	Luckett & Langley	37,000	15,000	9,000	III	26	Apr. 26	9 15	Apr. 30	16 15	57	54	55½	11	19¼
14	Apr. 18	22	Apr. 19	16	Fort Washington	Johnson & Manning	55,000	30,000	19,000	III	27	Apr. 26	9 15	Apr. 30	16 15	57	54	55½	11	18¼
15	Apr. 19	21	Apr. 20	17	Moxley's Point	Luckett & Langley	82,500	45,000	12,000	III	25	Apr. 28	6	Apr. 30	14	57	54	55½	10	17
16	Apr. 19	21	Apr. 20	17	....do	....do	82,500	53,000	20,000	III	19	Apr. 28	7	Apr. 30	14	57	54	55½	10	17
17	Apr. 19	21	Apr. 20	17	....do	....do	100,000	60,000	30,000	III	18	Apr. 28	11	Apr. 30	18	57	54	55½	10	21
18	Apr. 19	21	Apr. 20	17	....do	....do	82,500	60,000	30,000	III	17	Apr. 28	11	May 2	21	57	54	55½	13	00
19	Apr. 19	18	Apr. 20	17	Gillers	Skinner	52,000	15,000	4,000	III	26	Apr. 28	6	Apr. 30	14	57	54	55½	10	20
20	Apr. 20	22	Apr. 21	17	Moxley's Point	Luckett & Langley	84,000	10,000	5,000	III	3	Apr. 30	8	May 4	12	59	54	55½	13	14
21	Apr. 20	22	Apr. 21	17	....do	....do	110,000	35,000	None.											
22	Apr. 20	19	Apr. 21	17	Gillers	Skinner	105,000	45,000	9,000	III	4	Apr. 30	8 15	May 3	21	58	54	55	13	2
23	Apr. 21	12	Apr. 21	17	Fort Washington	Luckett	65,000	50,000	11,000	III	5	Apr. 30	8 15	Apr. 30	21	57	54	55½	9	9
24	Apr. 21	9	Apr. 21	17	Moxley's Point	Skinner	90,000	50,000	21,000	III	2	Apr. 30	8	May 4	12	59	54	55½	13	3
25	Apr. 21	20	Apr. 22	17 30	Gillers	....do	125,000	95,000	40,000	III	17	Apr. 30	7 30	May 3	12	58	54	55	11	16
26	Apr. 21	19	Apr. 22	17 30	Chapman's Point	Johnson & Manning	80,000	67,000	41,000	III	21	Apr. 30	16 15	May 3	19	58	54	56	12	00
27	Apr. 21	22	Apr. 22	17 30	Moxley's Point	Luckett & Langley	50,000	10,000	9,000	III	25	May 1	9	May 2	23	57	54	55½	11	1
28	Apr. 23	19	Apr. 24	16	White House	Johnson & Skinner	130,000	70,000	None.											
29	Apr. 26	17 30	Apr. 27	16 10	Chapman's Point	Johnson & Manning	48,000	40,000	15,000	III	3	May 4	10	May 4	18	59	55	56½	8	0½
30	Apr. 27	20	Apr. 28	16	Ferry Landing		15,000	None.												
31	Apr. 28	18	Apr. 29	16	Chapman's Point	Johnson & Keese	40,000	None.												
32	Apr. 29	18	Apr. 30	16 15	White House	Jones & Skinner	90,000	68,000	18,000	III	31	May 6	7	May 8	13	62	55	58½	8	19
33	Apr. 30	19	May 1	15 45	Chapman's Point	Johnson & Manning	35,000	20,000	None.	III	30									
34	May 1	18	May 2	16 30	Moxley's Point	Luckett & Langley	65,000	30,000	None.	III	26									
35	May 1	18	May 2	16 30	Gillers	Wesley	47,000	18,000	None.	III	26									
36	May 1	22	May 2	16 30	Ferry Landing	Richard Faunce	75,000	50,000	15,000	III	28	May 9	6	May 10	15	65	56	60	8	17

37	May 1	14	May 2	16 30	White House	Jones & Skinner	65,000	43,000	35,000	III	29	May 9	6	May 11	15 30	66	56	60	10	1½
38	May 1	19	May 2	16 30	Chapman's Point	Johnson & Manning	82,000	68,000	60,000	III	27	May 7	15 30	May 10	15	65	56	60	8	20
39	May 2	19	May 3	16	....do	....do	80,000	45,000	24,000	IV	2	May 8	9 30	May 12	7	67	58	62½	9	12
40	May 2	19	May 3	16	....do	....do	80,000	40,000	21,000	IV	3	May 8	9 30	May 12	7	67	58	62½	9	12
41	May 2	18	May 3	16	White House	Jones & Skinner	75,000	60,000	30,000	IV	4	May 8	9	May 12	14	67	58	62½	9	20
42	May 2	18	May 3	16	....do	....do	70,000	35,000	25,000	IV	5	May 8	9	May 12	14	67	58	62½	9	20
	May 2	18	May 3	16	Moxley's Point	Luckett & Langley	60,000	None.		IV	11									
43	May 2	18	May 3	16	....do	....do	75,000	5,000	4,000	IV	12	May 9	6	May 11	8	66	58	61⅞	8	14
44	May 2	20	May 3	16	Ferry Landing	Richard Faunce	80,000	45,000	32,000	IV	9	May 9	6	May 11	8	66	58	61⅞	8	12
45	May 2	20	May 3	16	....do	....do	65,000	35,000	24,000	IV	10	May 9	6	May 11	8	66	58	61⅞	8	12
46	May –	.....	May 3	16	.....	.....	60,000	15,000	13,000	IV	7	May 8	11	May 12	13	67	58	61⅝	.....	.....
47	May –	.....	May 3	16	.....	.....	65,000	30,000	24,000	IV	8	May 8	11	May 12	13	67	58	61⅝	.....	.....
48	May 3	7	May 3	16	Ferry Land'g giller	.....	65,000	15,000	None.	IV	6	.....	.....	.....	.....	.....	.....	.....	.....	.....
	May 3	22	May 4	16	White House	Jones & Skinner	75,000	None.												
49	May 3	22	May 4	16	... do	....do	82,000	20,000	34,000	IV	16	May 9	6	May 12	16	67	59	63¼	8	18
50	May 4	12	May 4	16	Fort Washington giller.	.....	55,000	38,000	18,000	IV	25	May 9	15 45	May 12	13	67	59	63¼	8	1
51	May 3	19	May 4	16	Chapman's Point	Luckett & Langley	40,000	25,000	23,000	IV	24	May 9	15 45	May 12	23	67	59	63¼	9	4
52	May 3	20	May 4	16	Moxley's Point	Johnson & Langley	105,000	85,000	50,000	IV	8	May 9	15	May 13	8	67	59	63¼	9	12
53	May 3	20	May 4	16	....do	... do	82,000	37,000	33,000	IV	32	May 9	6	May 12	16	67	59	63¼	8	20
54	May 3	20	May 4	16	....do	....do	90,000	40,000	33,000	IV	31	May 10	7	May 12	13 30	67	59	63¼	8	15½
55	May 3	20	May 4	16	....do	... do	90,000	52,000	45,000	IV	13	May 9	6	May 12	13	67	59	63¼	8	17
56	May 3	20	May 4	16	....do	... do	75,000	37,000	32,000	IV	14	May 9	6	May 12	13	67	59	63¼	8	17
57	May 3	22	May 4	16	....do	....do	75,000	35,000	21,000	IV	11	May 9	6	May 11	10	66	59	62⅝	7	12
58	May 3	22	May 4	16	....do	....do	82,000	30,000	19,000	IV	12	May 9	6	May 11	10	66	59	62⅝	7	12
59	May 4	20	May 5	16	....do	Langley & Keese	70,000	30,000	30,000	IV	16	May 10	8	May 11	8	66	60	62⅝	6	12
	May 4	20	May 5	16	....do	....do	75,000	None												
60	May 4	20	May 5	16	....do	....do	70,000	20,000	12,000	IV	22	May 10	6	May 12	13	67	60	63½	7	17
61	May 4	20	May 5	16	....do	....do	85,000	37,000	35,000	IV	21	May 10	6	May 12	13	67	60	63½	7	17
62a	May 4	23	May 5	16	Fort Washington	.....	25,000	12,500	8,000	IV	5	May 10	6	May 11	11	66	60	63	6	12
62b	May 4	23	May 5	16	Gillers	.....	25,000	12,500	8,000	IV	5	May 10	6	May 11	11	66	60	63	6	12
	May 4	18	May 5	16	Chapman's Point	Luckett & Manning	60,000	None.												
	May 4	18	May 5	16	....do	....do	60,000	None.												
63	May 4	18	May 5	16	....do	....do	120,000	15,000	12,000	IV	6	May 10	6	May 11	23	66	60	63	7	5
64	May 4	17	May 5	16	White House	Jones & Skinner	56,000	5,000	None.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
65	May 4	17	May 5	16	....do	... do	50,000	5,000	None.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	May 4	17	May 5	16	....do	....do	50,000	None.		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	May 4	17	May 5	16	....do	... do	60,000	None.		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
66	May 5	14	May 5	16	Fort Washington giller.	.....	35,000	30,000	27,000	IV	3	May 10	15	May 12	16	67	60	63½	7	2
67	May 5	11	May 6	16	Ferry Landing	Richard Faunce	92,000	70,000	45,000	IV	26	May 11	15	May 13	16 30	67	61	64½	8	5½
68	May 5	18	May 6	16	White House	Jones & Skinner	92,000	40,000	30,000	IV	30	May 11	8	May 13	8	67	61	64	7	14
69	May 5	14	May 6	16	Chapman's Point	Luckett & Manning	90,000	75,000	60,000	IV	14	May 10	6	May 13	3	67	61	64	7	13
70	May 5	14	May 6	16	....do	....do	90,000	60,000	45,000	IV	15	May 10	7	May 13	8	67	61	64	7	18
71	May 5	11	May 6	16	Gillers	.....	32,000	15,000	8,000	IV	23	May 10	7	May 13	8	67	61	64	7	21
72	May 5	11	May 6	16	Ferry Landing	Richard Faunce	95,000	40,000	25,000	IV	23	May 10	9	May 13	8	67	61	64	7	21
73	May 6	12	May 7	16	... do	.....	112,000	55,000	30,000	IV	10	.....	.....	May 13	16	67	61	65	7	4
74	May 6	12	May 7	16	....do	.....	90,000	50,000	25,000	IV	12	May 11	10	May 13	23	67	61	65	7	11
75	May 6	18	May 7	16	Fort Washington giller.	.....	65,000	40,000	35,000	IV	18	May 10	9	May 14	10	67	61	65	7	16
76	May 6	18	May 7	16	....do	.....	65,000	45,000	35,000	IV	17	May 10	9	May 14	10	67	61	65	7	16
77	May 6	16	May 7	16	White House	.....	85,000	65,000	50,000	IV	20	May 11	9 15	May 14	14	67	61	65	7	22

TABLE II.—*Daily register of eggs received and fish hatched at Central Station, U. S. Fish Commission, season of* 1883—Continued.

No. of record card.	Eggs taken. Date.	Eggs taken. Hour of day.	Eggs received. Date.	Eggs received. Hour of day.	Whence obtained.	By whom taken.	Total number received.	Number received alive.	Number of fish produced.	Disposal of eggs while hatching.		Period of hatching. Began. Date.	Began. Hour of day.	Ended. Date.	Ended. Hour of day.	Temperature during incubation. Max.	Min.	Av.	Days and hours in incubating.	
		h. m.		h. m.									h. m.		h. m.				d.	h.
78	May 6	16	May 7	16	White House		90,000	70,000	50,000	IV	19	May 10	9	May 14	13	67	61	65	7	21
79	May 6	16	May 7	16	....do		90,000	60,000	44,000	VI	3	May 11	7	May 14	11	67	61	65	7	19
80	May 6	16	May 7	16	....do		90,000	70,000	45,000	VI	5	May 11	10	May 14	20	67	61	65	8	4
81	May 6	23	May 7	16	Moxley's Point		82,000	70,000	50,000	VI	6	May 11	10	May 15	9	67	61	65½	8	10
82	May 6	23	May 7	16	....do		90,000	75,000	45,000	VI	7	May 11	10	May 15	9	67	61	65½	8	10
83	May 6	23	May 7	16	....do		90,000	75,000	55,000	VI	1	May 11	7	May 15	11	67	61	65½	8	12
84	May 6	23	May 7	16	....do		92,000	80,000	56,000	VI	2	May 11	7	May 14	13	67	61	65	7	14
85	May 7	.....	May 7	23 30	Chapman's Point		95,000	80,000	30,000	VI	8	May 11	10	May 14	13	67	62	65	.....	
86	May 7	.....	May 7	23 30	....do		97,000	85,000	60,000	VI	9	May 11	11 30	May 14	13	67	62	65	.....	
87	May 7	.....	May 7	23 30	White House		105,000	97,000	45,000	VI	10	May 11	10	May 15	9	67	62	65	.....	
88	May 7	.....	May 7	23 30	....do		90,000	80,000	50,000	VI	11	May 11	10	May 15	11	67	62	65	.....	
89	May 7	.....	May 7	23 30	....do		112,000	100,000	65,000	VI	12	May 11	10	May 14	20	67	62	65	.....	
90	May 7	.....	May 7	23 30	....do		120,000	97,000	65,000	VI	13	May 11	10	May 15	9	67	62	65	.....	
	May 7	22 30	May 8	16	Moxley's Point		35,000	None.												
	May 7	14	May 8	16	Ferry Landing		80,000	None.												
	May 7	14	May 8	16	....do		105,000	None.												
91	May 8	16	May 8	20 30	....do		120,000	75,000	None.	VI	30									
92	May 8	16	May 8	20 30	....do		93,000	70,000	None.	VI	31									
93	May 8	16	May 8	20 30	....do		105,000	70,000	None.	VI	29									
94	May 8	16	May 8	20 30	....do		65,000	40,000	None.	VI	27									
95	May 8	15	May 8	20 30	White House		92,000	82,000	65,000	VI	23	May 12	1 30	May 15	11	67	63	64	6	20
96	May 8	15	May 8	20 30	....do		92,000	65,000	40,000	VI	22	May 12	7 30	May 15	11	67	63	64	6	20
97	May 8	15	May 8	20 30	....do		85,000	65,000	40,000	VI	21	May 12	7 30	May 15	11	67	63	64	6	20
98	May 8	16	May 8	20 30	Fort Washington		95,000	82,000	75,000	VI	26	May 12	10 30	May 16	10	67	63	64½	7	18
99	May 8	16	May 8	20 30	....do		92,000	82,000	45,000	VI	25	May 12	6	May 15	15	67	63	64	6	23
100	May 8	16	May 8	20 30	....do		75,000	60,000	35,000	VI	24	May 12	6	May 15	15	67	63	64	6	23
101	May 9	17	May 9	22	....do		48,000	40,000	37,000	VI	15	May 12	11	May 16	13	68	64	66	6	20
102a	May 9	17	May 9	22	Moxley's Point		30,000	25,000	23,000	VI	14	May 12	11	May 16	13	68	64	66	6	20
102b	May 9	17	May 9	22	Gillers		63,000	50,000	45,000	VI	14	May 12	11	May 16	13	68	64	66	6	20
103	May 9	19	May 9	22	Ferry Landing		90,000	70,000	None.	VI	19									
104	May 9	19	May 9	22	....do		75,000	60,000	None.	VI	18									
105	May 9	17	May 9	22	....do		45,000	35,000	None.											
106	May 9	17	May 9	22	White House		112,000	60,000	50,000	VI	16	May 12	11	May 16	11 30	67	64	66	6	20½
107	May 9	17	May 9	22	....do		105,000	90,000	70,000	VI	28	May 12	10 30	May 16	13 30	67	64	66	6	20½
108	May 9	17	May 9	22	....do		90,000	75,000	60,000	VI	20	May 12	30	May 16	13 30	67	64	66	6	20½
109	May 10	17	May 10	23	....do		105,000	95,000	60,000	VI	27	May 13	17	May 17	11	68	66	66⅓	6	18

110	May 10	17	May 10	23	....do		125,000	90,000	60,000	VI	25	May 13	15	May 16	16		68	66	66½	5	23
111	May 10	17	May 10	23	Ferry Landing		85,000	60,000	30,000	VI	31	May 13	17	May 16	11	30	67	66	66½	5	18½
112	May 10	17	May 10	23	....do		90,000	70,000	45,000	VI	30	May 13	17	May 17	9		68	66	66½	6	16
113	May 10	17	May 10	23	Gillers		75,000	65,000	45,000	VI	29	May 13	17	May 16	13		68	66	66½	5	20
114	May 10	18	May 10	23	....do		70,000	60,000	50,000	VI	17	May 14	6	May 15	10		67	66	66⅝	4	16
115a	May 10	20	May 10	23	....do		70,000	62,000	62,000	VI	3	May 13	17	May 17	15		68	65	66½	6	19
115b	May 10	19	May 10	23	Ferry Landing		20,000	17,000	10,000	VI	3	May 13	17	May 17	15		68	65	66½	6	20
116	May 11	.....	May 11	22	White House		98,000	98,000	90,000	VIII	1	May 15	7	May 19	8		68	65	66⅔	.....	
117	May 11	.....	May 11	22	....do		112,000	112,000	100,000	VIII	2	May 15	7	May 19	9		68	65	66⅔	.....	
118	May 11	.....	May 11	22	Lookout gillers		120,000	110,000	100,000	IV	28	May 14	16	May 18	8		68	65	66½	.....	
119	May 11	.....	May 11	22	Ferry Landing		90,000	80,000	75,000	IV	27	May 14	15	May 18	6		68	65	66½	.....	
120	May 11	.....	May 11	22	....do		112,000	110,000	90,000	IV	4	May 14	16	May 18	7		68	65	66⅓	.....	
121	May 11	.....	May 11	22	....do		120,000	105,000	75,000	VI	19	May 14	13	May 18	10		68	65	66⅓	.....	
122	May 11	.....	May 11	22	....do		120,000	100,000	80,000	VI	18	May 14	16	May 18	10		68	65	66⅓	.....	
123	May 11	19	May 11	22	Fort Washington		115,000	75,000	60,000	IV	6	May 14	16	May 18	3		68	65	66½	6	8
124	May 11	19	May 11	22	....do		56,000	30,000	25,000	IV	5	May 14	16	May 18	7		68	65	66½	6	12
125	May 11	18	30	May 11	22	....do		112,000	100,000	96,000	IV	29	May 14	16	May 19	3		68	65	66⅔	7	8½
126	May 12	18	May 12	22	50	Ferry Landing		112,000	105,000	85,000	IV	30	May 15	15	May 19	16		68	65	66½	6	22
127	May 12	18	May 12	22	50	....do		127,000	120,000	100,000	IV	31	May 15	15	May 19	16		68	65	66½	6	22
128	May 12	18	May 12	22	50	....do		105,000	100,000	75,000	IV	16	May 15	13	May 19	9		68	65	66½	6	15
129	May 12	18	May 12	22	50	....do		127,000	120,000	100,000	IV	17	May 15	13	May 19	9		68	65	66½	6	15
130	May 12	20	May 12	22	50	Fort Washington		105,000	95,000	85,000	IV	1	May 15	12	30	May 19	20		68	65	66½	7	00
131a	May 12	18	May 12	22	50	....do		40,000	35,000	33,000	IV	3	May 15	13		May 20	8		68	65	66½	7	14
131b	May 12	18	May 12	22	50	White House		45,000	40,000	37,000	IV	3	May 15	13		May 20	8		68	65	66½	7	14
132	May 12	18	May 12	22	50	....do		127,000	118,000	97,000	IV	32	May 15	15		May 19	4		68	65	66⅓	6	10
133	May 12	18	May 12	22	50	Moxley's Point		87,000	87,000	80,000	IV	2	May 15	15		May 20	6		68	65	66⅓	7	12
134	May 13	18	May 13	22	15	White House		82,000	75,000	65,000	VIII	7	May 16	16		May 21	7		68	65	66½	7	13
135	May 13	18	May 13	22	15	Moxley's Point		112,000	105,000	75,000	VIII	6	May 16	16		May 19	17		68	65	66½	5	23
136	May 13	18	May 13	22	15	....do		105,000	95,000	75,000	VIII	5	May 16	7		May 19	15		68	65	66½	5	21
137	May 13	18	May 13	22	15	....do		75,000	67,000	60,000	VIII	4	May 16	7		May 19	18		68	65	66⅔	6	00
138	May 14	18	30	May 14	23	50	....do		105,000	97,000	85,000	VIII	13	May 17	14	30	May 21	13		68	65	66	6	18½
139	May 14	18	30	May 14	23	50	....do		75,000	75,000	70,000	VIII	14	May 17	14	30	May 21	14		68	65	66	6	19½
140	May 14	20	May 14	23	50	Ferry Landing		120,000	110,000	50,000	VIII	32	May 18	18		May 20	15		68	65	66	5	19
141	May 14	20	May 14	23	50	....do		90,000	88,000	68,000	VIII	15	May 18	6		May 20	9		68	65	66	5	13
142	May 14	20	May 14	23	50	....do		67,000	65,000	52,000	VIII	16	May 18	6		May 20	15		68	65	66	5	19
143	May 14	19	50	May 14	23	50	White House		105,000	100,000	85,000	VIII	10	May 17	17		May 21	7		68	65	66	6	11½
144	May 14	19	50	May 14	23	50	....do		105,000	85,000	80,000	VIII	11	May 17	17		May 22	9		68	65	66	7	13½
145	May 14	19	50	May 14	23	50	....do		105,000	105,000	98,000	VIII	12	May 17	17		May 21	13		68	65	66	6	17½
146a	May 14	19	50	May 14	23	50	....do		27,000	27,000	17,000	VIII	9	May 17	14		May 21	7		68	65	66	6	11½
146b	May 14	21	May 14	23	50	Gillers		40,000	40,000	28,000	VIII	9	May 17	14		May 21	7		68	65	66	6	10
147	May 15	19	30	May 15	23	Ferry Landing		78,000	75,000	65,000	VIII	29	May 19	10		May 21	21		68	65	66	6	1½
148	May 15	19	30	May 15	23	White House		125,000	112,000	82,000	VIII	31	May 19	9		May 22	8		68	65	66½	6	12½
149	May 15	19	30	May 15	23	Moxley's Point		112,000	97,000	80,000	VIII	30	May 19	9		May 22	2		68	65	66½	6	6½
150	May 16	21	May 16	24	Ferry Landing		112,000	90,000	70,000	IV	8	May 19	18	May 23	5		68	65	66½	6	8
151	May 16	18	May 16	24	Gillers		52,000	45,000	37,000	IV	7	May 19	18	May 22	15		68	65	66½	5	21
152	May 16	19	May 16	24	White House		135,000	112,000	65,000	IV	9	May 19	18	May 23	1		68	65	66½	6	6
153	May 16	18	50	May 17	2	Moxley's Point		82,000	75,000	50,000	IV	22	May 20	8		May 22	18		68	65	66½	5	23½
154	May 16	18	50	May 17	2	....do		80,000	75,000	75,000	IV	10	May 19	18		May 22	8		68	65	66½	5	13½
155a	May 16	18	50	May 17	2	....do		80,000	75,000	55,000	IV	26	May 19	18		May 22	18		68	65	66½	5	23½
155b	May 16	.....	May 17	2	Gillers		25,000	25,000	20,000	IV	26	May 19	18	May 22	18		68	65	66½	5	23½
156	May 16	19	50	May 17	2	Fort Washington gillers.	90,000	85,000	60,000	IV	24	May 19	18	May 22	15		68	65	66⅓	5	19½

TABLE II.—*Daily register of eggs received and fish hatched at Central Station, U. S. Fish Commission, season of* 1883—Continued.

No. of record card.	Eggs taken. Date.	Eggs taken. Hour of day.	Eggs received. Date.	Eggs received. Hour of day.	Whence obtained.	By whom taken.	Total number received.	Number received alive.	Number of fish produced.	Disposal of eggs while hatching.	Period of hatching. Began. Date.	Began. Hour of day.	Ended. Date.	Ended. Hour of day.	Temperature during incubation. Max.	Min.	Av.	Days and hours in incubating.
		h. m.		*h. m.*								*h. m.*		*h. m.*				*d.* *h.*
157	May 16	19 50	May 17	2	Fort Washington gillers.		82,000	67,000	40,000	IV 23	May 20	8	May 22	8	68	65	66⅓	5 12⅛
158	May 17	21	May 18	1	Moxley's Point		112,000	110,000	80,000	VI 12	May 21	8	May 23	9	68	65	66⅛	5 12
159	May 17	21	May 18	1	....do		115,000	105,000	75,000	VI 11	May 21	8	May 23	8	68	65	66⅛	5 11
160	May 17	21	May 18	1	....do		112,000	100,000	80,000	VI 10	May 21	8	May 23	8	68	65	66⅛	5 11
161	May 17	21	May 18	1	....do		112,000	90,000	75,000	VI 24	May 21	8	May 23	8	68	65	66⅛	5 11
162	May 17	21	May 18	1	....do		105,000	90,000	75,000	VI 13	May 21	8	May 23	9	68	65	66⅓	5 12
163	May 17	19	May 18	1	Gillers		98,000	75,000	60,000	VI 21	May 21	8	May 24	9	68	64	66	6 14
164	May 17	18	May 18	1	White House		65,000	60,000	55,000	VI 22	May 21	8	May 24	9	68	64	66	6 15
165	May 17	18	May 18	1	....do		80,000	72,000	50,000	VI 23	May 21	8	May 23	8	68	65	66⅓	5 14
166	May 17	20 30	May 18	1	Ferry Landing		83,000	65,000	None.	VI 20								
167	May 18	19 30	May 19	2	Gillers		105,000	95,000	90,000	IV 2	May 22	8	May 25	8	68	64	65⅓	6 13⅛
168	May 18	21 30	May 19	2	Ferry Landing		60,000	55,000	45,000	IV 1	May 22	8	May 25	8	68	64	65⅓	6 10⅛
169	May 18	21 30	May 19	2	White House		65,000	60,000	50,000	IV 3	May 22	8	May 25	8	68	64	65⅓	6 10⅛
170	May 18	17	May 19	2	....do		90,000	85,000	85,000	IV 4	May 22	8	May 25	8	68	64	65⅓	6 15
171	May 18	21 30	May 19	2	....do		112,000	105,000	85,000	IV 32	May 22	8	May 25	9	68	64	65⅓	6 11⅛
172	May 18	21 30	May 19	2	Moxley's Point		95,000	82,000	55,000	IV 5	May 22	8	May 24	10	68	64	65	5 12⅛
173	May 18	21 30	May 19	2	....do		83,000	75,000	60,000	IV 31	May 22	8	May 24	15	68	64	65	5 17⅛
174	May 18	21 30	May 19	2	....do		75,000	68,000	52,000	IV 30	May 22	8	May 24	15	68	64	65	5 17⅛
175	May 18	21 30	May 19	2	....do		80,000	68,000	53,000	IV 29	May 22	8	May 24	15	68	64	65	5 17⅛
176	May 18	21 30	May 19	2	....do		75,000	65,000	52,000	IV 28	May 22	8	May 24	15	68	64	65	5 17⅛
177	May 19	17	May 20	1 30	White House		105,000	95,000	70,000	VI 15	May 22	19	May 26	13	68	64	65⅓	6 20
178	May 19	17	May 20	1 30	....do		105,000	88,000	68,000	VI 14	May 22	19	May 26	13	68	64	65⅓	6 20
179	May 19	17	May 20	1 30	....do		100,000	90,000	75,000	VI 16	May 22	20	May 26	13	68	64	65⅓	6 20
180	May 19	21	May 20	1 30	Moxley's Point		112,000	97,000	65,000	VI 17	May 22	20	May 25	9	68	64	65⅓	5 12
181	May 19	21	May 20	1 30	....do		112,000	95,000	70,000	VI 18	May 22	18	May 25	9	68	64	65⅓	5 12
182	May 19	21	May 20	1 30	....do		105,000	85,000	68,000	VI 19	May 22	7	May 25	10	68	64	65⅓	5 13
183	May 19	21	May 20	1 30	....do		120,000	105,000	90,000	VI 20	May 22	19	May 25	10	68	64	65⅓	5 13
184	May 19	19 30	May 20	1 30	Gillers		90,000	80,000	60,000	VIII 16	May 22	19	May 26	13	68	64	65⅓	6 17⅛
185	May 19	19 30	May 20	1 30	....do		90,000	85,000	67,000	VIII 15	May 22	18	May 25	9	68	64	65⅓	5 13⅓
186	May 19	19 30	May 20	1 30	....do		85,000	80,000	67,000	VIII 14	May 22	19	May 26	13	68	64	65⅓	6 17⅛
187	May 19	23	May 20	24	Moxley's Point		95,000	None.										
188	May 19	23	May 20	24	....do		90,000	None.										
189	May 20	21	May 20	24	....do		90,000	80,000	45,000	VI 3	May 23	14	May 26	14	68	64	65⅓	5 17
190	May 20	21	May 20	24	....do		80,000	75,000	40,000	VI 4	May 23	14	May 26	21	68	64	65⅓	6 00
191	May 20	21	May 20	24	....do		95,000	85,000	50,000	VI 1	May 23	14	May 27	8	68	64	65½	6 11

192	May 20	21	May 20	24	....do		95,000	90,000	50,000	VI	2	May 23	14	May 26	14	68	64	65¼	5	17
193	May 20	19	May 20	24	Gillers		105,000	90,000	55,000	VI	28	May 23	14	May 27	7	68	64	65½	6	12
194	May 20	19	May 20	24	White House		97,000	85,000	75,000	VI	32	May 23	14	May 28	11	68	64	65½	7	16
195	May 20	19	May 20	24	....do		105,000	95,000	80,000	VI	31	May 23	14	May 28	7	68	64	65½	7	12
196	May 20	19	May 22	1 30	Moxley's Point		120,000	None.												
197	May 21	22	May 22	1 30	....do		120,000	105,000	75,000	VIII	4	May 25	8	May 28	7	68	64	65¼	6	9
198	May 21	22	May 22	1 30	....do		105,000	95,000	60,000	VIII	2	May 25	8	May 27	7	67	64	65	6	9
199*a*	May 21	22	May 22	1 30	....do		30,000	27,000	20,000	VIII	1	May 25	8	May 28	7	68	64	65½	6	9
199*b*	May 21	22	May 22	1 30	....do		70,000	63,000	45,000	VIII	1	May 25	8	May 28	7	68	64	65½	6	9
200	May 21	22	May 22	1 30	....do		100,000	90,000	65,000	VI	27	May 25	8	May 28	8	68	64	65½	6	10
201	May 20	21	May 22	1 30	White House		37,000	None.												
202	May 21	21	May 22	1 30	....do		85,000	75,000	60,000	VIII	7	May 25	8	May 28	7	68	64	65½	6	10
203	May 21	21	May 22	1 30	... do		75,000	75,000	50,000	VIII	6	May 25	8	May 28	7	68	64	65½	6	10
204	May 21	20 30	May 22	1 30	Gillers		75,000	60,000	60,000	VI	29	May 25	8	May 29	7	68	64	65½	7	10½
205	May 21	20 30	May 22	1 30	... do		75,000	65,000	50,000	VI	30	May 25	8	May 28	7	98	64	65½	6	10½
206	May 21	21 30	May 22	1 30	Lookout gillers		83,000	80,000	60,000	VIII	3	May 25	8	May 28	7	68	64	65½	6	9½
207	May 22	19 30	May 23	1 30	White House		90,000	85,000	55,000	VIII	31	May 26	9	May 29	7	68	64	65½	6	11½
208	May 22	18 30	May 23	1 30	....do		105,000	95,000	65,000	VIII	30	May 26	9	May 29	7	68	64	65½	6	12½
209*a*	May 22	18 30	May 23	1 30	....do		75,000	70,000	40,000	VIII	29	May 26	9	May 29	7	68	64	65½	6	12½
209*b*	May 22	18 30	May 23	1 30	....do		30,000	25,000	20,000	VIII	29	May 26	9	May 29	7	68	64	65½	6	12½
210	May 22	18 30	May 23	1 30	....do		112,000	90,000	50,000	VIII	4	May 26	9	May 29	12	68	64	65½	6	17½
211	May 22	23	May 23	1 30	Moxley's Point		120,000	100,000	70,000	VIII	3	May 26	9	May 29	12 15	68	64	65½	6	18½
212	May 22	23	May 23	1 30	... do		100,000	100,000	65,000	VIII	2	May 26	9	May 29	11	68	64	65½	6	12
213*a*	May 22	23	May 23	1 30	....do		40,000	35,000	15,000	VIII	1	May 26	9	May 29	7	68	64	65½	6	8
213*b*	May 22	23	May 23	1 30	Gillers		80,000	75,000	30,000	VIII	1	May 26	9	May 28	11	68	64	65	6	8
214	May 23	15	May 24	2	White House		105,000	88,000	53,000	IV	12	May 27	8	May 30	11	68	64	66	6	20
215	May 23	15	May 24	2	Moxley's Point		60,000	58,000	40,000	IV	16	May 27	8	May 30	7	68	64	66	6	16
216	May 23	15	May 24	2	....do		120,000	100,000	67,000	IV	13	May 27	8	May 30	11	68	64	66	6	20
217	May 23	15	May 24	2	... do		75,000	70,000	45,000	IV	14	May 27	8	May 30	11	68	64	66	6	20
218	May 23	15	May 24	2	... do		82,000	75,000	60,000	IV	15	May 27	8	May 30	11	68	64	66	6	20
219	May 24	15	May 25	30	Gillers		35,000	30,000	20,000	IV	21	May 28	11 30	May 31	12 30	68	64	66½	6	21½
220	May 25	30	May 25	11 15	Moxley's Point		105,000	97,000	60,000	VIII	16	May 28	11 30	May 31	12 30	68	64	66½	6	12
221	May 25	30	May 25	11 15	... do		85,000	85,000	(*)	IV	19									
222	May 25	30	May 25	11 15	....do		85,000	85,000	(*)	IV	18									
223*a*	May 25	19 30	May 25	22 30	White House		30,000	30,000	(*)	VI	7									
223*b*	May 25	18 30	May 25	22 30	Lookout gillers		22,000	20,000	(*)	VI	7									
224	May 25	13	May 25	22 30	Moxley's Point		52,000	50,000	(*)	VI	6									
225	May 26	30	May 26	14	... do		105,000	60,000	58,000	IV	19	May 29	11	June 1	20	69	65	67½	6	19½
226	May 26	20	May 26	23	White House		98,000	98,000	{50,000* / 45,000	VIII	29	May 29	9	June 1	20	69	65	67½	6	00
227	May 27	20	May 27	22 30	Gillers		112,000	100,000	90,000	VIII	30	May 30	9	June 3	5	70	66	68	6	9
228	May 27	19	May 27	22 30	... do		83,000	78,000	70,000	VIII	31	May 30	9	June 2	9	69	66	68	5	14
229	May 27	18	May 27	22 30	Ferry Landing		127,000	110,000	{50,000* / 55,000	VIII	1	May 30	9	June 2	6	69	66	68	5	12
230	May 27	16	May 27	22 30	Moxley's Point		60,000	55,000	50,000	VIII	2	May 30	9	June 1	17	69	66	67½	5	1
231	May 27	16	May 27	22 30	... do		75,000	67,000	40,000	VIII	3	May 30	9	June 2	6	69	66	68	5	14
232	May 28	20	May 28	23	Gillers		105,000	97,000	80,000	VI	26	May 31	8	June 3	8	70	66	68½	5	12
233	May 28	20	May 28	23	....do		120,000	100,000	{30,000* / 50,000	VI	6	May 31	8	June 3	7	70	66	68½	5	11
234	May 28	20	May 28	23	....do		110,000	97,000	75,000	VI	7	May 31	8	June 3	7	70	66	68½	5	11

* Eggs shipped to Weldon, N. C.

TABLE II.—*Daily register of eggs received and fish hatched at Central Station, U. S. Fish Commission, season of* 1883—Continued.

No. of record card.	Eggs taken. Date.	Eggs taken. Hour of day.	Eggs received. Date.	Eggs received. Hour of day.	Whence obtained.	By whom taken.	Total number received.	Number received alive.	Number of fish produced.	Disposal of eggs while hatching.	Period of hatching. Began. Date.	Began. Hour of day.	Ended. Date.	Ended. Hour of day.	Temperature during incubation. Max.	Min.	Av.	Days and hours in incubating. d.	h.
		h. m.		h. m.								h. m.		h. m.					
235	May 29	21	May 29	22 50	Lookout gillers		105,000	80,000	52,000	VI 1	June 1	7	June 3	23	70	67	69	5	2
236	May 29	21	May 29	22 50	....do		68,000	60,000	60,000	VI 2	June 1	7	June 3	23	70	67	69	5	2
237	May 29	20	May 29	22 50	Gillers		105,000	90,000	75,000	VI 3	June 1	7	June 3	23	70	67	69	5	3
238	May 29	20	May 29	22 50	....do		105,000	105,000	85,000	VI 32	June 1	7	June 3	23	70	67	69	5	3
239	May 29	20	May 29	22 50	....do		120,000	90,000	70,000	VI 31	June 1	7	June 3	23	70	67	69	5	3
240	May 29	20	May 29	22 50	....do		105,000	100,000	67,000	VI 30	June 1	7	June 3	23	70	67	69	5	3
241	May 30	21	May 30	23 30	Fort Washington gillers.		105,000	None.											
242	May 30	21	May 30	23 30	Lookout gillers		68,000	75,000	65,000	VI 10	June 2	7	June 4	19	71	68	69½	4	22
243	May 30	21	May 30	23 30	Gillers		112,000	105,000	90,000	VI 23	June 2	7	June 5	19	71	68	69½	5	22
244	May 31	21 30	May 31	23 30	Fort Washington gillers.		52,000	50,000	40,000	VIII 14	June 4	9	June 6	11	72	68	70	5	13½
245	June 1	.....	June 1	23 30	Gillers		100,000	80,000	60,000	VI 11	June 4	12	June 6	15	72	69	70	.....	
246	June 1	.....	June 1	23 30	....do		110,000	90,000	80,000	VI 12	June 4	12	June 6	15	72	69	70	.....	
	June 1	.....	June 1	23 30	....do		100,000	None.											
247	June 2	.....	June 2	10	....do		112,000	95,000	75,000	VI 15	June 4	12	June 6	20	72	69	71	.....	
248	June 2	.....	June 2	10	....do		52,000	50,000	30,000	VI 20	June 4	12	June 6	20	72	69	71	.....	
249	June 3	.....	June 3	10	....do		110,000	85,000	65,000	VIII 6	June 5	8	June 7	20	73	70	72	.....	
250	June 3	.....	June 3	10	....do		95,000	80,000	55,000	VIII 10	June 5	8	June 7	22	73	70	72	.....	
251	June 3	.....	June 3	10	....do		90,000	75,000	45,000	VIII 26	June 5	8	June 7	9	73	70	72	.....	
252	June 3	.....	June 3	10	....do		90,000	80,000	65,000	VIII 23	June 5	8	June 7	18	73	70	72	.....	
253	June 3	.....	June 3	10	....do		90,000	80,000	65,000	VIII 7	June 5	8	June 7	20	74	70	71½	.....	
254	June 3	.....	June 3	10	....do		90,000	75,000	55,000	VIII 9	June 5	8	June 7	20	74	70	71½	.....	
255	June 3	.....	June 3	10	....do		90,000	75,000	45,000	VIII 25	June 5	8	June 7	21	74	70	71½	.....	
256	June 3	20	June 4	9	....do		85,000	50,000	40,000	IV 31	June 6	6	June 8	17	74	70	72	4	21
257	June 3	20	June 4	9	....do		82,000	70,000*											
258	June 3	20	June 4	9	....do		90,000	53,000	40,000	IV 30	June 6	6	June 8	17	74	70	72	4	21
259	June 4	.....	June 5	9	....do		95,000	None.											
260	June 4	.....	June 5	9	....do		67,000	None.											
261	June 5	.....	June 6	9 25	....do		112,000	None.											
262	June 5	.....	June 6	9 25	....do		112,000	None.											
263	June 5	.....	June 6	9 25	....do		100,000	None.											
264	June 7	18	June 7	22	Ft. Wash'n seine.		60,000	43,000	40,000	VI 1	June 9	15	June 11	21	76	74	75	4	3
265	June 7	18	June 7	22	....do		70,000	62,000	60,000	VI 2	June 9	15	June 11	21	76	74	75	4	3

*Eggs shipped to New York City.

Distribution of shad and herring.

	Shad.	Herring.
Number of shad and herring fry distributed through Central Station	14, 523, 000	6, 850, 000
Furnished by the Battery Station, Susquehanna River	1, 275, 000	.....
Furnished by the Fish Hawk, Potomac River	1, 684, 000	6, 850, 000
Furnished by Central Station, Potomac River	11, 564, 000	.....
Total	14, 523, 000	6, 850, 000
Number actually planted	12, 408, 000	6, 850, 000

NOTE.—Details of the different shipments will be found in Table III.

TABLE III.—*Shipments of fish and eggs from Central Station, U. S. Fish Commission, during the shad season of* 1883.

Date.		Fish.		Eggs.		Messenger.	Destination.	From what stock.
Day.	Hour.	Variety.	Number.	Variety.	Number.			
1883.								
April 30	4 p. m.	Shad	250,000			Donnelly	Monouky River	Central Station.
May 3	4 p. m.	do	175,000			do	do	Do.
6		do	111,000			Mace	Little Falls of Potomac River	Do.
11	9 p. m.	do	30,000			Moore, car 1	Cincinnati, Ohio	Fish Hawk.
11	9 p. m.	do	198,000			do	do	Central Station.
11	9 p. m.	Herring	4,300,000			do	do	Fish Hawk.
14		Shad	410,000			Mace	Little Falls of Potomac River	Central Station.
15	7.10 a. m	do	300,000			Quinn	Riverton, Va	Do.
16		do	247,000			Davenport	Savage, Md	Do.
16	5.20 p. m	do	3,360,000			Moore, car 1	Richmond, Va	Do.
16	10.35 p. m	do	277,000			Quinn	Danville, Va	Do.
18		do	175,000			Davenport		Fish Hawk.
18	5 p. m	do	175,000			Stewart	Laurel, Md	Do.
18	5 p. m	Herring	1,700,000			do	do	Do.
20	6.20 p. m	Shad	1,657,000			Moore, car 1	Illinois and Missouri	Central Station.
20	6.20 p. m	Herring	850,000			do	do	Fish Hawk.
20	10.35 p. m	Shad	164,000			Quinn	Chattanooga, Tenn	Do.
20	10.35 p. m	do	86,000			do	do	Central Station.
22	7.10 a. m	do	250,000			Davenport	Georgia	Do.
22	10.35 p. m	do	300,000			Huske	South Carolina	Do.
23	10.35 p. m	do	150,000			Page	Lynchburg, Va	Fish Hawk.
24	8.40 p. m	do	300,000			Quinn	Maryland	Do.
25	9.50 p. m	do	550,000			Moore, car 1	Troy, N. Y	Do.
25	9.50 p. m	do	947,000			do	do	Central Station.
26	6.30 a. m			Shad	270,000	Ellis, Charles	Weldon, N. C	Do.
26	10.10 p. m	Shad	329,000			Quinn	Cumberland, Md	Do.
27	7.10 a. m	do	300,000			Davenport	Waynesborough, Va	Do.
27	10.10 p. m	do	150,000			Quinn	Ohio	Fish Hawk.
29	6.30 a. m			Shad	100,000	Adams Express	Weldon, N. C	Central Station.
29	10.35 p. m	Shad	1,440,000			Ellis, car 2	South Carolina and Georgia	Do.
30	6.30 a. m			Shad	30,000	Adams Express	Weldon, N. C	Do.
31	6.20 p. m	Shad	750,000			Moore, car 1	Kentucky	Do.
	6.20 p. m	do	725,000			do	do	Battery Station.
June 3	—a. m	do	200,000			Quinn	Maryland	Do.
4	10.35 p. m		1,227,000			Ellis, car 2	Georgia	Central Station.
5	10.20 p. m			Shad	70,000	Adams Express	New York City	Do.
8	6.20 p. m	Shad	915,000			Moore, car 1	Louisiana	Do.
10	—a. m	do	250,000			Quinn	Colorado	Battery Station.
12	4.20 p. m	do	100,000			Page	Poughkeepsie, N. Y	Central.
13	12.36 a. m	do	100,000			do	do	Battery.
	Total	Shad	14,523,000	Shad	470,000			
		Herring	6,850,000					

Distribution of carp, &c.—The carp, tench, ides, and goldfish distributed by the U. S. Fish Commission are all bred in the ponds of the Commission, at Washington, Mr. Rudolph Hessel being superintendent of this division of the work of the Commission, the entire product each season being distributed through Central Station. The fish are sent out by car and messenger shipments or by express, as may be most convenient and economical. Mr. J. E. Brown, store-keeper, Central Station, has charge of the details of this branch of the work. The extent of it will be see from the following:

The number of carp applicants supplied was 7,015, scattered through every State and Territory of the United States. The distribution reached 292 congressional districts and 1,308 counties, the average distance of applicants from Washington being 911 miles. The work done was equivalent to sending 7,015 10-pound packages by express an average distance of 911 miles.

PROPAGATION AND DISTRIBUTION OF WHITEFISH.

The following consignments of whitefish eggs were received from the Northville station: December 15, 1883, 1,000,000; December 18, 1883, 1,000,000; total, 2,000,000.

From these were produced 1,600,000 fry, which were distributed as follows:

Date.	Where sent.		Number.
Feb. 22, 1884	To West Virginia Junction, Potomac River (by J. E. Brown)		600,000
Feb. 25, 1884	To Potomac River at Keyser, W. Va		500,000
Mar. 7, 1884	To Potomac River at Little Falls, Maryland		500,000
			1,600,000
	Number of eggs lost during incubation	300,000	
	Number of fish reserved for experiment	100,000	
			400,000
	Total		2,000,000

Hatching began February 11, 1884; ended February 28, 1884.

PROPAGATION AND DISTRIBUTION OF LAKE TROUT.

December 15, 1883, a consignment of 100,000 eggs of the lake or salmon trout were received from the station of the U. S. Fish Commission at Northville, Mich. In reference to these Mr. W. F. Page reports as follows:

	Number.
Died on the way from Northville	1,265
Died up to December 28, 1883, when hatching began	2,478
Died from time hatching began until it ended, March 12, 1884	10,649
Died from time hatching ended until complete absorption of sac, April 8	2,468
Planted in Potomac River at Cumberland, Md	80,000
Reserved for experiment and aquarium exhibits	3,130
	99,990

The planting of both whitefish and the lake trout in the waters of the Potomac is an experiment, the success of which can only be judged by the results. Experience has shown that the lake trout will thrive and grow vigorously when confined in ponds, and it is therefore possible that we may acclimate this species in the waters of the Potomac, as it will probably be temperature-locked, and cannot, therefore, very well stray beyond the limits prescribed for it.

SHAD AND HERRING FISHERIES OF THE POTOMAC.

Accurate daily records of the receipts of shad and herring at the Washington fish-wharves have been kept by Mr. Gwynn Harris, inspector of marine products. The daily receipts given by him fairly indicate the fluctuations in the daily catch, and serve as a measure of the fluctuations in the run of shad and herring in the river. At the close of the fishing season Mr. Harris, by direction of the Commissioner, obtained a summary for the season of the shad and herring of the Potomac reaching the market through Alexandria, Georgetown, and other points not embraced in his Washington returns.

The report made by him will be found summarized in form convenient for reference in Tables IV, V, and VI.

TABLE IV.—*Daily record of the receipts of shad at the Washington fish-wharves for the season of* 1883.

Date.	No. of fish taken.	Date.	No. of fish taken.	Date.	No. of fish taken.	Date.	No. of fish taken.	Date.	No. of fish taken.
Feb. 21..	2	Mar. 21..	9	Apr. 11 ...	6,017	May 2 ...	5,489	May 23...	1,137
Feb. 24..	1	Mar. 22..	361	Apr. 12 ...	7,951	May 3 ...	4,564	May 24...	1,844
Feb. 27..	1	Mar. 23..	187	Apr. 13 ...	8,338	May 4 ...	4,873	May 25...	1,117
Mar. 3..	11	Mar. 24..	54	Apr. 14 ...	9,206	May 5 ...	4,789	May 26...	1,485
Mar. 5..	17	Mar. 26..	263	Apr. 16 ...	7,097	May 7 ...	4,784	May 28...	2,278
Mar. 6..	22	Mar. 27..	616	Apr. 17 ...	15,865	May 8 ...	3,288	May 29...	438
Mar. 7..	4	Mar. 28..	681	Apr. 18 ...	6,814	May 9 ...	3,866	May 30...	696
Mar. 8..	2	Mar. 29..	3,259	Apr. 19 ...	9,443	May 10 ...	3,222	June 1 ...	449
Mar. 9..	24	Mar. 30..	3,229	Apr. 20 ...	10,346	May 11 ...	2,845	June 2...	326
Mar. 10..	7	Mar. 31..	1,609	Apr. 21 ...	5,087	May 12 ...	3,532	June 4...	296
Mar. 12..	56	Apr. 2..	1,261	Apr. 23 ...	11,112	May 14 ...	3,678	June 5...	388
Mar. 13..	7	Apr. 3..	1,037	Apr. 24 ...	6,592	May 15 ...	2,530	June 6 ..	284
Mar. 14..	95	Apr. 4..	2,490	Apr. 25 ...	6,086	May 16 ...	2,772	June 7...	340
Mar. 15..	106	Apr. 5..	2,472	Apr. 26 ...	6,784	May 17 ...	1,649	June 8...	297
Mar. 16..	151	Apr. 6..	2,974	Apr. 27 ...	6,673	May 18 ...	1,804	June 9...	80
Mar. 17..	11	Apr. 7..	6,156	Apr. 28 ...	6,040	May 19 ...	1,585		
Mar. 19..	174	Apr. 9..	5,036	Apr. 30 ...	5,602	May 21 ...	2,809		257,687
Mar. 20..	309	Apr. 10..	11,362	May 1 ...	7,784	May 22 ...	1,269		

TABLE V.—*Daily record of the receipts of herring at the Washington fish wharves for the season of* 1883.

Date.	No. of fish taken.	Date.	No. of fish taken.	Date.	No. of fish taken.	Date.	No. of fish taken.	Date.	No. of fish taken.
Feb. 19..	20	Mar. 19..	2,915	Apr. 10 ...	81,791	May 2 ...	164,541	May 24 ...	21,352
Feb. 21..	90	Mar. 20..	4,490	Apr. 11 ...	47,339	May 3 ...	122,511	May 25 ...	7,463
Feb. 24..	196	Mar. 21..	200	Apr. 12 ...	60,386	May 4 ...	142,374	May 26 ...	11,802
Feb. 26..	115	Mar. 22..	2,483	Apr. 13 ...	106,843	May 5 ...	162,837	May 28 ...	10,063
Feb. 27..	465	Mar. 23..	490	Apr. 14 ...	120,713	May 7 ...	234,248	May 29 ...	9,847
Feb. 28..	39	Mar. 24..	464	Apr. 16 ...	139,914	May 8 ...	68,718	May 31 ...	10,440
Mar. 3..	780	Mar. 26..	3,720	Apr. 17 ...	112,057	May 9 ...	85,478	June 1 ...	3,687
Mar. 5..	530	Mar. 27..	5,608	Apr. 18 ...	120,027	May 10 ...	134,727	June 2 ...	1,362
Mar. 6..	560	Mar. 28..	3,154	Apr. 19 ...	143,174	May 11 ...	121,877	June 4 ...	604
Mar. 7..	290	Mar. 29..	10,549	Apr. 20 ...	219,298	May 12 ...	84,925	June 5 ...	1,892
Mar. 8..	210	Mar. 30..	8,869	Apr. 21 ...	121,858	May 14 ...	102,423	June 6 ..	406
Mar 9..	224	Mar. 31..	13,424	Apr. 23 ...	267,068	May 15 ...	92,291	June 7 ...	640
Mar. 10..	280	Apr. 2..	9,091	Apr. 24 ...	194,169	May 16 ...	57,807	June 8 ...	446
Mar. 12..	661	Apr. 3	10,730	Apr. 25 ...	120,159	May 17 ...	63,627	June 9 ...	906
Mar. 13..	523	Apr. 4	13,950	Apr. 26 ...	102,567	May 18 ...	72,381		4,914,261
Mar. 14..	1,095	Apr. 5..	33,584	Apr. 27 ...	128,192	May 19 ...	62,870		
Mar. 15..	2,105	Apr. 6..	33,801	Apr. 28 ...	171,213	May 21 ...	98,667		
Mar. 16..	1,783	Apr. 7..	66,331	Apr. 30 ...	183,415	May 22 ...	29,080		
Mar. 17..	420	Apr. 9..	60,554	May 1 ...	228,618	May 23 ...	17,419		

TABLE VI.—*Statistical summary of the shad and herring fisheries of the Potomac River for the season of* 1883.

	Shad.	Herring.
Landed at Washington	257,687	4,914,261
Landed at Alexandria, Va	81,429	2,331,900
Landed at Georgetown	2,200	360,000
Shipped from Glymont, Md	14,250	.....
Shipped from Piney Point, Md	.....	78,000
Shipped from Kinsale, Va	4,100	24,000
Shipped from Cone River	3,450	32,000
Sold on the different shores	16,700	1,250,000
Total	379,816	8,989,261

It will be seen from this summary that the herring product is about the same as that for 1882; probably a little in excess of that year. The shad figures indicate a decrease of 70,000 as compared with last year.

SHIPMENT OF SHAD EGGS BY EXPRESS.

The possibility of shipping shad eggs collected from the fishing shores to Central Station at Washington by what is known as the "dry method" was experimentally demonstrated in the latter part of the season of 1881. This method was generally adopted for the season of 1882, and has been continued with the best results during the season of 1883.

The transportation of eggs from the fishing shores to Washington being by boat, and in charge of a messenger, the eggs were in great measure guarded from rough handling or jarring during transportation, but the satisfactory results obtained in our work on the Potomac gave no positive assurance that we could adopt the same methods with like satisfaction in making shipments of shad eggs by express.

A method by which we could satisfactorily transfer shad eggs from the collecting stations to points in the vicinity of the waters to be stocked, and where they could be hatched successfully, promised results of such importance to fish-culture that Mr. S. G. Worth, the active and progressive superintendent of fisheries for North Carolina, made arrangements early in the season of 1883 to forward the eggs intended for stocking the Neuse River from Avoca, his collecting station on the Albemarle Sound, to Raleigh, N. C., by ordinary express shipment.

To guard against rapid fluctuations of temperature, which is always disastrous, and at the same time to retard development during transportation, the eggs were placed on wire-bottom frames, covered with cotton cloth. A stack of twelve or fifteen of these were strapped together, placed in a packing box, and surrounded on all sides with a layer about 6 inches thick of chopped hay and pounded ice.

The cases thus prepared were forwarded by steamer to Franklin, Va., and thence by rail to Raleigh, N. C. Arriving at this point, the eggs were transferred to hatching jars, and the young fry obtained were planted in the Neuse River, in the vicinity of Raleigh. These experiments were fairly successful. They indicated that when the conditions of successful transportation were established by experience, the method would prove an important adjunct to fish-cultural work by greatly cheapening the cost of production and distribution.

To enable Mr. Worth to continue his experiments, I was instructed by the Commissioner to forward to him, at the rock-fish hatching station at Weldon, N. C., several lots of eggs by messenger and by express. The details of these experimental shipments, which were made under the immediate personal supervision of Mr. Page, superintendent of propagation, Central Station, were reported as follows:

"The first shipment consisted in part of lot 221, 85,000, and lot 222, 85,000. They were taken at Moxley's Point at 12.30 a. m. May 25, and transported to Central Station on dry trays, reaching there at 11.15 a. m. on the 25th. They were then put into McDonald jars and kept there until 2.30 p. m. on the 25th, when they were repacked on dry trays. They remained crated until 6.30 a. m. on the 26th, receiving frequent sprinkling with water. Also shipped in same lot 223*a*, 30,000, from White House, taken at 7.30 p. m., 25th; lot 223*b*, 20,000, from the gillers, taken at 6.30 p. m., 25th; and lot 224, 50,000, from Moxley's Point, taken at 1 p. m., 25th. These last three lots, making 100,000, reached Central Station at 10.30 p. m., 25th; and were immediately placed in McDonald jars. They were repacked at 6 a. m. on the 26th. The entire shipment, 270,000, was sent by rail, in charge of Mr. Charles Ellis, to Mr. S. G. Worth, superintendent of North Carolina Fish Commission, at Weldon, N. C.

"The second shipment consisted of part of lot 226, of 50,000, from White House, taken at 8 p. m., May 26; reached Central Station 11 p. m., May 26; placed in McDonald jar till 4 a. m. on the 29th, and then

taken out and repacked. The remainder of this was a part of lot 229, of 50,000, from Ferry Landing, taken at 6 p. m., 27th; reached Central Station at 10.30 p. m., May 27; was put in jars, and remained there till 5 a. m., 26th; then repacked for shipment. These two lots were put on our trays and crated in the manner usually employed in the Potomac River work; but in addition were packed in large outer case, with 6 inches of ice and hay (three-fourths bulk of hay, one-fourth bulk ice) on all sides. These were shipped on 6.30 a. m. train, by Adams Express Company, to Mr. S. G. Worth, superintendent of North Carolina Fish Commission, Weldon, N. C. The remainder of lot 226 began to hatch at 9 a. m., 30th, and finished at 8 p. m., June 1. The remainder of lot 229 began to hatch at 9 a. m., 30th, and finished 6 a. m., June 2.

"The third shipment consisted of part of lot 233, of 30,000, from the gillers, taken at 8 p. m. on the 28th of May; reached Central Station at 11 p. m., 28th; were immediately placed in jar, and remained there till 5 a. m., 30th; then taken out for shipment and packed as in the second shipment, except that flannel bottom trays were substituted for our wire-bottom cotton-covered trays. This lot also was shipped by Adams Express Company to Mr. Worth, at Weldon, N. C. The remainder of this lot began to hatch at 8 a. m. of the 31st, and finished at 7 a. m. of June 3."

In the first experiment, in which no provision was made to control fluctuations of temperature, the eggs proved almost a total loss. The second and third lots reached Weldon in good condition, and were hatched with less than 5 per cent of loss.

The results of these experiments were detailed by Mr. S. G. Worth, superintendent of fisheries for North Carolina, as follows:

"Of the three lots sent from Washington to the Weldon station on May 26, 29, and 30, the first lot of 270,000 suffered a loss of 95 per cent, due, I suppose, to the fact that segmentation had not taken place; that the melting ice was immediately on the top of the trays; and that uniform temperature was not maintained on the way, there being no surrounding cushion of moss or other non-conductor, and, further, that there was no elastic cushion between them and the vibrating floor of the car.

"The second lot of 100,000, part forty-six hours and the rest sixty hours old on arrival, suffered a loss in transit of only 3 per cent, and hatched without further appreciable loss.

"The third lot, containing 30,000 eggs, forty-four hours old on arrival, suffered a loss of 4 per cent on the way, and produced excellent results in hatching."

The season having closed at Weldon, a fourth experiment was made and reported as follows:

"Lot 257, of 70,000, from the gillers, near Fort Washington, taken 8 p. m., June 3, reached Central Station 9 a. m., June 4; were put into jar, and remained till 6 p. m., June 5; were then repacked, as in No. 2 ship-

ment, and forwarded on the 10.20 p. m. train, by Adams Express Company, to M. McDonald, care Eugene Blackford, Fulton Market, New York City. Corresponding lots remaining at the hatchery began to hatch at 6 a. m. on June 6 and finished at 5 p. m. of June 8th."

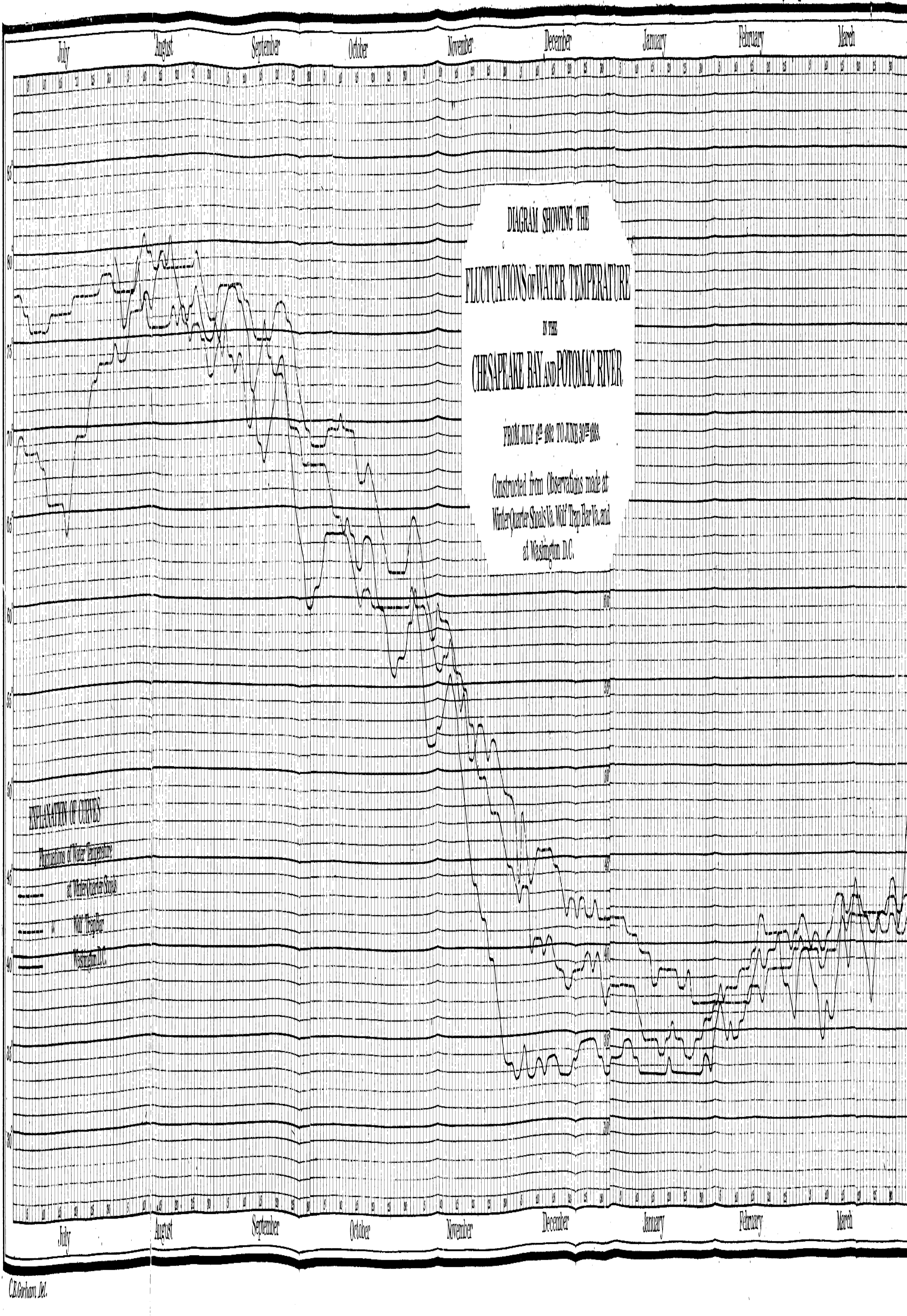
These eggs reached me in as good condition apparently as when they left Washington; were transferred to McDonald jars, and were exhibited in process of hatching before a meeting of the American Fish-cultural Association, then in session at New York.

These eggs when shipped were forty-six hours from impregnation, and the outline of the fish had begun to show plainly. It is at this stage that the eggs seem to bear transportation best. The egg seems to be peculiarly sensitive to injury at that period of rest which immediately succeeds the granulation of the embryonic disk. Handling them at this stage is almost certain to prove fatal.

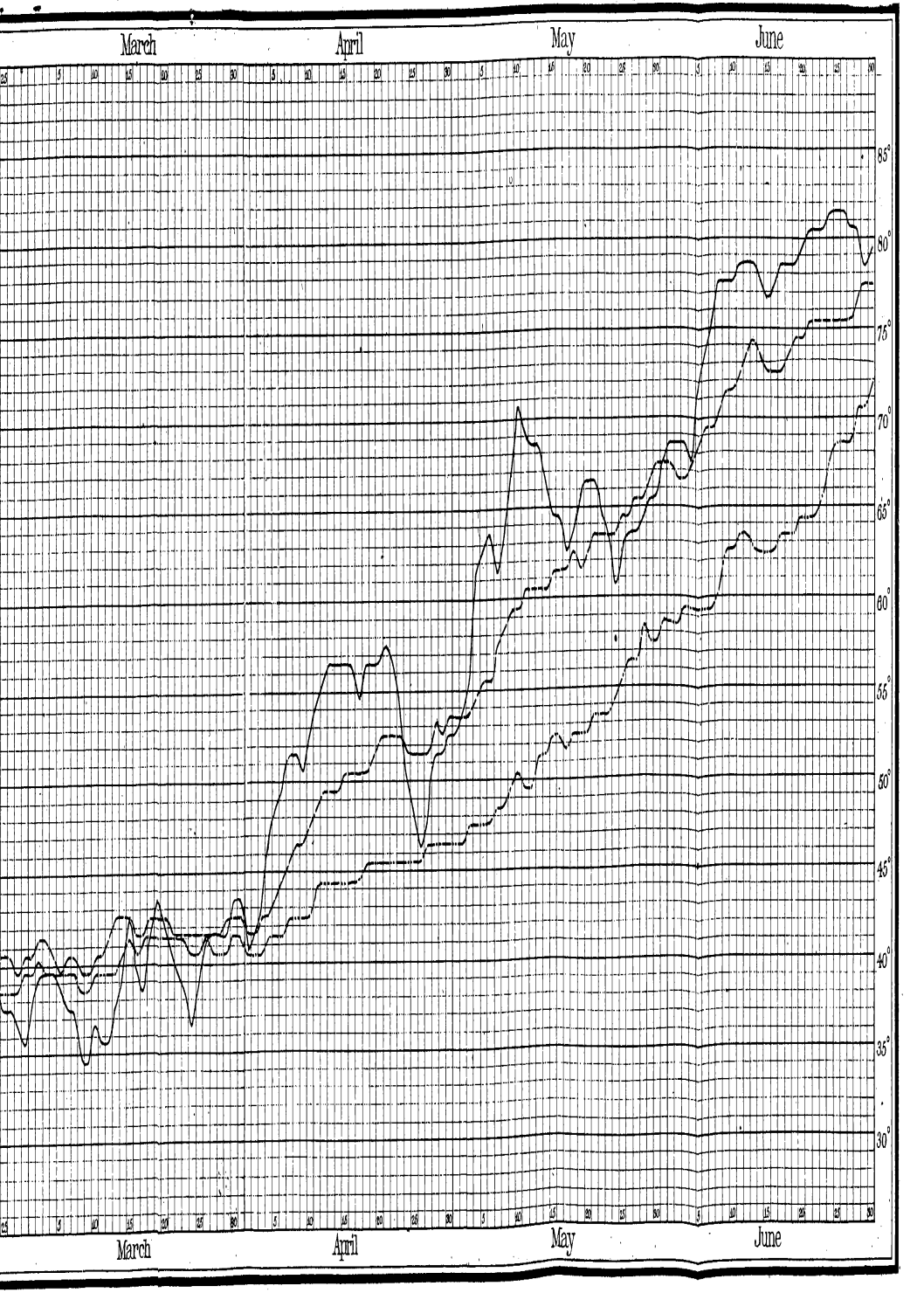
It will require further experiments in the direction above indicated before we attempt a radical departure from the methods now in use; but we may expect in the near future to send eggs instead of young fish to localities remote from our collecting stations, and as a package containing 100,000 eggs may be sent at about the same cost as a can containing 20,000 fry, the expense of distribution will thus be greatly diminished.

FLUCTUATIONS OF WATER TEMPERATURE IN THE CHESAPEAKE REGION.

The diagram showing fluctuations of water temperature in the Chesapeake region furnishes very interesting and suggestive data for discussion. By reference to it it will be seen that, during the winter months, the water temperatures on the ocean plateau, outside of the capes, is higher than that of Chesapeake Bay or of the Potomac River. The latter part of February, or early in March, the temperature of the bay waters rises above that of the ocean waters outside. Coincident with this, the shad make their appearance in the Chesapeake and are taken in the pounds which are set in salt water along the shores of the bay. About the 1st of April the temperature of the water in the Potomac River rises above the temperature of the water in the bay. Coincident with this is the beginning of the shad season in the river (see tables of Gwynn Harris). The lesson taught by the diagram is that shad do not enter our rivers to spawn until the temperature of the river waters is higher than that of the salt water from which they come. The observations of 1882–'83 but repeat those of 1880–'81–'82, and confirm the conclusion already arrived at and published. Should the waters of either the Potomac or the Susquehanna continue during the season at a lower temperature than those of the bay, we would have no run either of shad or glut herring during the season.



C.B.Gorham. Del.


March
April
May
June
85°
80°
75°
70°
65°
60°
55°
50°
45°
40°
35°
30°
March
April
May
June