XXIII.—REPORT OF OPERATIONS AT NORTHVILLE AND ALPENA STATIONS FOR THE SEASON OF 1883-'84.

By FRANK N. CLARK.

PRELIMINARY WORK.

The work at the Northville Station from the beginning of the fiscal year until about the middle of August consisted only of the usual routine—cleaning and repairing ponds, assorting the stock of fish, &c. Two hands of the winter working force were retained through the summer, and were kept quite busy with that work. All the breeding fish were placed in ponds connected with race-ways, and the fry in the others. The floats which had been used on the ponds to furnish shade were found to gather a considerable amount of fungoid matter, which sloughed off and polluted the water; we therefore had them removed and constructed shades of boards laid on sleepers extending across the ponds.

The volume of water being inadequate to the increased amount of work laid out for the season, we found it necessary to adopt apparatus that would increase its availability. A supply of McDonald's closed jars was obtained, and the tanks rearranged for their accommodation. These jars are specially adapted to the use of a limited water supply, as they can be arranged to run the same water through several of them. With the open jars the water can only be used once, unless there is fall enough to admit of placing several tiers of jars one above the other. The work of reconstructing the tanks and placing the jars was completed and the hatchery ready for the reception of eggs by the 1st of November.

THE WHITEFISH WORK.

The first installment of whitefish eggs—four cases—was received at Northville, from the islands in Lake Erie, November 14, and the first arrival at Alpena was received November 5. Although the bad weather caused a very light catch of fish in the lower lakes, we had a supply of eggs greatly in excess of that of any former year, owing to our much more extensive arrangements for obtaining them. The heavy storms which prevailed on all the lakes from the 10th to the 15th of November effectually stopped the pound-net fishing, and our only supply after that time was derived from the gill-net work in Lake Huron. It is a fact well known by fishermen that when the whitefish are driven from their coast spawning grounds by storms they will not return during the season.

This is considered so certain that as soon as the storm abates the fishermen withdraw their nets not destroyed by the wind and waves and abandon the fishing grounds for the season. No more fishing is then done in our territory except with gill-nets in some parts of Lake Huron. It was from this source that all the supply was obtained, after the storms above mentioned, from the shoals at the mouth of Thunder Bay. The shoal run is a short one, beginning about November 18, and with it closes the white-fish season. The fishing in the shoal grounds grows lighter with each successive season. This is attributed by fishermen to overfishing and to the yearly loss of many nets with fish fast in them, which decay and foul the bottom. The water being but 3 to 8 fathoms in depth and the bottom rocky, the nets are destroyed by a very moderate sea and current.

Although the fishing was very light on the western shore of Lake Huron, very heavy catches were made on the Canada side, around Cockburn and the Duck Islands, and on the coast reefs in Northern Lake Michigan, and the reefs west of Mackinaw Straits, between Beaver Islands and the north shore. Fishing on the latter reefs is done with pound-nets; but as there is no shore to lead from, the nets have four leaders radiating at right angles. Three to six tons were taken from these nets at each lift during the season. Two men were sent there at the beginning of the season, but found no ripe eggs the first day. On the second day, they took about half a million good eggs, and on the third day the operations were brought to an abrupt ending by the storm. Some heavy catches were made at Duck Island, in Canadian waters. Just before the storm, the propeller Roberts passed down from there with about 45 tons of whitefish and trout. The whitefish of that locality are of a large type, specimens weighing 15 to 20 pounds being frequently taken. The captain of the Roberts mentions one that weighed 26 pounds.

The Lake Erie catch previous to the storm was up to the average. The fall fishing is done with pound-nets leading from the coast and island reefs, so that there was no chance to collect eggs there after the storm, as at Alpena, where there was subsequent fishing with gill-nets.

The experiment of holding whitefish in inclosures until they ripened was quite successful, although it was not conducted on a scale large enough to add greatly to our crop of eggs. The funds not being sufficient to provide suitable harbors adjacent to the fisheries, the fish were placed in floating crates, and it was not deemed advisable to place a large number of fish in them, where they were liable to be destroyed by wind and waves. Two crates were used at North Bass Island in Lake Erie, and two at the Alcona fisheries in Lake Huron. The former were anchored about twenty rods from the beach, in about twelve feet of water; the latter in a small bay partially protected from the lake seas. The fish confined in them yielded about five or six million eggs, and not one died while in the crates, but a few—twenty-five or thirty, per-

haps—escaped through a hole made in one of the crates by floating drift-wood.

For the successful confinement of immature whitefish, it is absolutely essential that the floating crates be placed within protected inclosures, in pure water of suitable depth.

AT THE NORTHVILLE HATCHERY.

The first whitefish eggs were received at this station, from Lake Erie, November 14, arriving in good condition. There were four cases, filling eighteen McDonald jars. More eggs were expected on the 15th, but the steamer which brought them was windbound, and they did not arrive at the hatchery until the 17th, when they were found to be badly frozen, and could not be removed from the trays until thawed. We found an unexpected difficulty in the use of the closed jars. Air would find its way into the jars, forming bubbles which passed rapidly through the tubes, conveying many of the eggs into the tank. We had considerable trouble trying to remedy this evil, and occasionally found a jar entirely emptied. After considerable experimenting we overcame this trouble by so arranging the jars as to increase the water pressure.

The last lot of eggs direct from the fishing grounds was received December 1, making 25,000,000, which, with 35,000,000 received in several installments from the Alpena hatchery, made the total number handled at this place 60,000,000. Of this number, about 12,000,000 were shipped to various points, and 8,000,000 lost in various ways; the total number of whitefish hatched at this point was therefore 40,000,000.

SHIPMENTS.

Whitefish eggs were sent to various points as follows:

Date.	Where shipped.	Number of eggs.
Dec. 11	Central Station, Washington, D. C	1,000,000
15	Central Station, Washington, D. C	1,000,000
Jan. 7	Anamosa, Iowa	1,200,000
7	Germany	1,000,000
8	New Zealand	1,000,000
14	Raleigh, N. C	500,000
15	Hillsborough, Md	200,000
16	Plymouth, N. H	200,000
18	New York	100,000
19	Saint Paul, Minn	2,000,000
21	Cold Spring Harbor, N. Y	900,000
31	Saint Paul, Minn	1,000,000
Feb. 6	Saint Paul, Minn	2,000,000
	Total number sent away	12,100,000

It is to be regretted that all recipients of eggs do not acknowledge receipt of same, stating condition on arrival and other particulars. All reports received, including those from New Zealand and Germany, were very favorable. The former shipment left Northville January 8, and was accompanied by me to Omaha, whence it went by express to San Francisco, in care of R. J. Creighton, arriving there January 13; thence by steamer to New Zealand, arriving February 16.

HATCHING AND DISTRIBUTION OF FRY.

The eggs received from Alpena arrived in good condition. In order to retard the hatching, a considerable portion of the eggs were kept in a refrigerator through December, and in order to preserve them in good condition they were taken out and washed once a week. This prevented the inconvenience of having them hatched faster than we could take care of them. A few fry appeared early in February, but the number was very small until the 16th, when the record shows that there were about 2,000,000 in the tanks. One million more were hatched on the 17th; and on the 20th, Car No. 2, in charge of J. F. Ellis, left for Manistee with 3,000,000, and on the 22d for Grand Haven with 3,000,000; on the 25th to Erie, Pa., with 3,000,000, which nearly exhausted the supply. The weather was very cold for the next few days, and eggs hatched very slowly. No more shipments were made until March 3, when the car went to Traverse City with 3,000,000. The hatching continued slowly, but another 3,000,000 were sent on the 10th to Oswego, N. Y., and an equal number on the 14th to Port Huron. Hatching was by this time going on more rapidly, and the car was kept going quite lively in its work of distribution; 3,000,000 more went to Oswego on the 17th, and 3,000,000 on the 20th to Ludington, Mich. The rest of the shipments were as follows: March 22, Port Huron, 3,000,000; 23, Monroe, 3,000,000; 25, Bass Islands, 3,000,000; 30, west shore of Lake Michigan, 4,000,000; Bass Islands, April 8, 3,000,000; making a total of 40,000,000 whitefish fry sent out and planted in good condition.

THE WORK AT ALPENA.

This station is supplied with water from the city water-works, which enables us to have a higher head and greater pressure. We can therefore do the work with much less water and with less trouble with the closed jars than at Northville. The hatchery is equipped with both McDonald and Chase jars, the latter placed in six tiers, one above the other, the highest being near the ceiling, and the same water passing through all. We were not able to detect any difference in the hatching in the upper and lower tiers.

The supply of eggs was derived from the following sources:

	Jars.
Round Island, 9 pound-nets	9
Nine-Mile Point, 6 pound-nets	16
Hammond's Bay, 16 pound-nets	55
Oscoda, 4 pound-nets	16
Alcona, 11 pound-nets	148
Beaver Islands, 10 pound-nets	8
Ossineke, 8 pound-nets	5
Scarecrow Island, 4 pound-nets	5
Total from pound-nets	262
From gill-nets in various grounds	113
Total from all sources	375

Of the above supply of eggs, 32,000,000 were hatched at Alpena, and the remainder shipped to Northville, as it was much cheaper to ship the eggs than the young fish, which would have to be sent to some railroad point where the car could reach them. The larger part of the fry from this station were planted along the west coast of Lake Huron, in the vicinity of Thunder Bay. The first shipment, 2,000,000, were planted off North Point in above bay, April 15. On the 17th 2,000,000 were planted near Scare Crow Island, in said bay; April 18, 2,000,000 near Alcona; April 20, 4,000,000 near Round Island and the shoal reefs; April 21, 4,000,000 more went to Alcona; April 23, 4,000,000 were sent to Bay City by boat, whence they were taken by car to Apostle Islands, Lake Superior, near Ashland, Wis. They were deposited on the 26th. April 25, 2,000,000 were planted near Oscoda, Lake Huron; April 27, 2,000,000 in Hammond's Bay; April 29, 3,000,000 in Lake Huron, at Ossineke and Harrisville; April 30, 2,000,000 by boat to Saint Ignace, and thence by baggage car to Marquette, Lake Superior, where they were planted May 1; May 3, 4,000,000 were taken to Bay City, thence by car, via Chicago, to Escanaba, Lake Michigan, reaching their destination on the 6th. On May 4, 250,000 were planted in Taylor's Lake, inland, 4 miles from Alpena; May 5, 500,000 near Sulphur Island, Thunder Bay; same day, 250,000 in Black River Lake, 12 miles inland from the village of Black River, which closed the whitefish work at this station.

THE TROUT WORK.

The operations with trout are carried on quite extensively at this station, where the cold spring water is well adapted to their growth. The brood trout are kept in ponds, described in previous reports, adjacent to the hatching-house. There are also a large number of wild trout of both the brook and rainbow species in the stream—a branch of the river Rouge—which runs near the hatchery. In the mill pond, a short distance below, we caught and obtained eggs from 33 female brook trout. On examination of our trout in the ponds July 1, we found that the fry and yearlings had grown very rapidly, and seemed to be larger for their age than in any previous year. The usual work of sorting and counting the fish was completed July 30, showing the following result:

German trout fry in nursery tank (estimated)	1,400
Land-locked salmon, fry	100
Brook trout in tank in house, fry	325
Brook trout in pond C, fry	9,697
Brook trout in pond F, yearlings	1,980
Brook trout in pond D, two years old	573
Brook trout in pond B, three and four years old	500
Rainbow trout in pond H, fry	6,000
Rainbow trout in pond G, yearlings	2,777
Rainbow trout in pond E, two and three years	575
Goldfish in pond A (estimated)	150
Whitefish in tank in house	280

BROOK TROUT.

This branch of our work is the most useful and profitable branch of our trout department. Our record of handling last year is as follows: 260 wild trout were taken from the creek near the hatchery, and of this number 33 ripe females were found, from which 18,000 eggs were taken. The first eggs from wild trout were taken October 10, and the last, November 21, covering a period of forty-one days. Pond fish were handled as follows: Of fish twenty months old, 346 females were handled, from which 81,000 eggs were obtained; first eggs were taken October 9; last ones, December 20; period of taking, forty-one days. Of fish thirty-two months old 160 females were handled and 86,000 eggs obtained; first eggs taken October 27; last, December 12; period, forty-five days. Of fish three and a-half years old 110 females were handled and 110,000 eggs obtained; first eggs taken October 24; last, December 10; period, forty-seven days.

The eggs from the wild trout were hatched in January and February, and the fry planted in the stream adjacent to the hatchery.

SHIPMENT OF EGGS.

On December 18, we sent 75,000 brook trout eggs to the Central Station, Washington, D. C.; January 7, 25,000 to Fred. Mather, New York, for reshipment to Germany; January 19, 75,000 to Central Station; January 28, Nebraska commission, South Bend, Nebr., 6,000, and 6,000 to Henry T. Root, Providence, R. I.; January 29, Minnesota commission, Saint Paul, Minn., 6,000; Maryland commission, Baltimore, 6,000; Connecticut commission, Poquonock, 12,000; Cold Spring Harbor hatchery, Long Island, 6,000; Iowa commission, Anamosa, 6,000.

LAKE TROUT WORK.

The catch of lake trout from the big reef in Central Lake Huron and other trout reefs, and landed at various points along the lake shore, was a large one, compensating largely for the light run of whitefish to the coast, and prevented a heavy loss to fishermen on the American side, as the coast catch of the latter fish was insufficient to pay expenses. The best day's fishing of the season was November 7, when six tugs brought in about twenty tons of trout as the result of the day's lift.

The fish spawned this season much later than usual. When the last eggs were taken, November 18, a good many hard fish were reported. The number of eggs taken and sent to Northville was 280,000. Shipments from here were as follows: December 11, 100,000 to Central Station, Washington, D. C.; January 7, 25,000 to Von Behr, Germany, through the hands of Mr. Fred. Mather, Newark, N. J. Both shipments arrived at their destination in good condition. About 105,000 eggs were hatched here, and 75,000 of the fry were distributed by car No. 2, which left Northville April 11. The fry were delivered the same

day—one-half in Star Lake, one-fourth in Strawberry Lake, and the remaining fourth in Crooked Lake, all in Northern Michigan. Thirty thousand were delivered to Mr. Bassett, who deposited them in Arnold's Lake, Washtenaw County, Michigan.

PENOBSCOT SALMON.

Mr. Charles G. Atkins, of Maine, sent a case of 30,000 eggs of this species to this station. They arrived February 28 in good condition, only three dead eggs being found on unpacking them, and the subsequent loss was 105. The first fish were hatched March 16, and the last on March 24. The loss of fry in hatching was about 600, and the remainder, something over 29,000, was planted May 25 in headwaters of the Huron River, near the village of Walled Lake, Oakland County, Michigan.

RAINBOW TROUT.

As an instance of the climatic effect of transfer, our rainbow trout have so far changed their habits as to become winter spawners, and we believe that in a few years their spawning will occur simultaneously with the brook trout. The period of taking eggs extended from December 19 to March 31, but the largest portion was taken in January and February. We got about 125,000 eggs, but could not succeed in fertilizing more than one-fourth of them. The results were better than last season, but far from satisfactory. We shipped away 18,000 eggs and hatched 10,000, retaining 4,000 of the fry for breeding stock. Eggs and fry were shipped as follows: March 24, to Fred. Mather, New York, for reshipment to Herr Von Behr, Germany, 12,000 eggs; April 11, to Mather, 6,000 eggs, one-half of which were to be forwarded by him to Société d'Acclimatation, Paris, and the other half to the Fish Cultural Association, London, England. On May 12, 2,500 fry were sent to A. C. Lanier, of Madison, Ind.; May 23, 1,000 to J. E. Bassett, Saline, Mich.; May 30, 2,500 to A. L. Delano, Mount Vernon, Ohio.

When the eggs intended for European destinations reached New York, Mr. Mather found that they had become overheated, and that all were too far advanced to ship. He therefore exchanged them for an equal number of less advanced eggs from the Cold Springs Harbor station, which he forwarded. The German consignment arrived in poor condition. We have received no reports from the other two lots.

A case of 4,000 rainbow trout eggs was received March 18 from the Central Station at Washington, where they had been sent direct from the McCloud River Station, in California. They reached here in prime condition, and hatched soon after arrival. The fry were retained here for a breeding stock.

GERMAN TROUT.

On February 18 we received a case of 5,000 eggs of German trout (*Salmo fario*), which arrived in good condition. They hatched about the middle of March, and were taken April 11, in car No. 2, and planted in a branch of the Pere Marquette River, in Northern Michigan.

RECAPITULATION.

The following table combines the work of both stations for the season:

Fish.	Eggs taken.	Eggs received from other sources.	Eggs shipped.	Fish hatched.	Fish shipped or deposited.
German trout		5,000		4,900	4,900
Rainbow trout	125,000	4,000	18,000	14,000	6,000
Brook trout	295,000		223,000	20,000	15,000
Lake trout	280,000		125,000	105,000	105,000
Penobscot salmon		30,000		29,900	29,200
Whitefish	100,000,000		12,100,000	72,000,000	72,000,000

Whitefish eggs were shipped to States and countries as follows:

Minnesota	5,000,000
Iowa	1,200,000
Maryland	200,000
North Carolina	500,000
New Hampshire	200,000
New York	1,000,000
Central Station, Washington, D. C	2,000,000
Germany	1,000,000
New Zealand	1,000,000
Total	12,100,000

Whitefish fry were distributed as follows:

Lake Ontario	6,000,000
Lake Erie	12,000,000
Lake Huron	27,500,000
Lake Michigan	20,000,000
Lake Superior	6,000,000
Inland lakes near Alpena, Mich	500,000
Total	72,000,000

Record of temperature observations made at the United States Fish-Hatching Station at Northville, Mich., from October 3, 1883, to April 15, 1884.

Day of month.	Temperature of—						Wind.						Sky.		
	Water.			Air.			Direction.			Intensity.			Condition of.		
	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p m.	8 a. m.	12 m.	5 p. m.
1883.	°	°	°	°	°	°									
Oct. 3	48	52	53	41	60	48	NW.	NW.	NW.	Brisk	Calm	Brisk	Clear	Clear	Clear.
4	46	50	53	33	56	42	NW.	NE.	NE.	Light	do	Light	do	Cloudy	Cloudy.
5	48	50	52	40	57	50	NE.	E.	E.	do	do	Calm	Cloudy	do	Do.
6	49	50	50	46	56	50	SE.	SE.	E.	do	do	do	do	do	Do.
7	59	52	50	46	57	52	NE.	SE.	S.	Calm	do	do	do	Clear	Do.
8	50	54	56	46	78	60	SW.	SW.	SW.	Brisk	do	do	Fog	Cloudy	Do.
9	52	60	62	60	80	76	SW.	SW.	SW.	Calm	Light	do	Clear	do	Do.
10	65	64	57	68	68	56	SW.	NW.	N.	Strong	do	do	Cloudy	do	Do.
11	52	58	58	52	63	58	NE.	SE.	SW.	Calm	Calm	Light	do	do	Do.
12	53	56	56	55	62	62	NE.	NW.	SW.	do	do	Brisk	Misty	do	Do.
13	52	52	52	49	50	52	NE.	NE.	NE.	Light	Light	Strong	Cloudy	do	Do.
14	50	50	49	42	42	43	N.	NE.	NE.	do	do	Light	do	do	Do.
15	46	52	47	36	42	40	NE.	E.	NE.	Calm	Calm	do	do	Clear	Clear.
16	46	58	48	34	60	40	NE.	SE.	E.	Brisk	do	Calm	Clear	do	Do.
17	44	58	50	34	50	50	NE.	S.	SE.	Light	do	do	do	do	Cloudy.
18	48	50	50	52	58	56	SW.	SW.	SW.	do	do	do	Cloudy	Cloudy	Do.
19	53	54	54	59	68	60	SW.	SW.	SW.	do	do	do	do	do	Do.
20	48	49	47	36	42	40	NE.	NW.	NE.	Brisk	Light	Brisk	do	do	Do.
21	45	46	44	36	56	39	NE.	NE.	NE.	Strong	Brisk	do	do	do	Do.
22	44	46	45	38	46	37	NE.	NE.	E.	Light	Light	Calm	Clear	do	Do.
23	46	46	46	38	48	42	NE.	NE.	NE.	Calm	Calm	do	Cloudy	do	Do.
24	46	48	47	40	48	45	E.	NE.	NE.	do	Light	do	do	do	Do.
25	47	49	48	43	48	47	NE.	E.	NE.	Brisk	Calm	Light	do	do	Do.
26	46	47	50	42	52	47	NE.	E.	NE.	Light	do	Calm	do	do	Do.
27	45	49	48	30	54	46	NE.	E.	E.	Calm	Light	do	Clear	do	Do.
28	48	49	49	46	52	50	NE.	SE.	SE.	Light	do	Light	Cloudy	do	Do.
29	50	50	52	56	64	52	SE.	SW.	NW.	do	Brisk	Brisk	do	do	Do.
30	48	49	50	56	56	54	SW.	NW.	NW.	Brisk	Strong	Light	Clear	do	Do.
31	48	47	46	40	42	40	NW.	W.	W.	Light	do	Strong	do	do	Do.
Nov. 1	44	43	46	36	40	40	NW.	NW.	W.	Brisk	do	do	Cloudy	do	Do.
2	44	45	46	38	42	34	NW.	NW.	W.	Light	Light	Calm	do	do	Do.
3	42	44	44	34	39	38	W.	W	W.	do	do	Light	do	do	Clear.
4	48	48	50	48	54	50	SW.	SW.	SW.	do	Brisk	Brisk	do	do	Cloudy.
5	50	50	50	44	46	48	W.	SW.	SW.	do	do	Strong	do	do	Do.
6	50	49	48	45	45	42	SW.	W.	N.	Strong	Light	Light	Clear	do	Do.
7	45	46	48	27	46	50	W.	SW.	SW.	Calm	Strong	do	do	Clear	Do.
8	46	47	48	38	48	49	E.	SW.	SW.	do	Light	do	Cloudy	do	Clear.
9	48	50	50	49	58	48	SW.	W.	SW.	Light	Strong	do	do	Cloudy	Do.

Record of temperature observations made at the United States Fish-Hatching Station at Northville, Mich., &c.—Continued.

Day of month.	Temperature of—						Wind.						Sky.		
	Water.			Air.			Direction.			Intensity.			Condition of.		
	8 a.m.	12m.	5 p.m.	8 a.m.	12 m.	5p. m.	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.
1884.	°	°	°	°	°	°									
Nov. 10	49	50	49	41	50	46	SW.	W.	NW.	Light	Light	Light	Clear	Cloudy	Clear.
11	46	48	46	36	52	48	NW.	SW.	NW.	do	Brisk	Strong	do	Clear	Do.
12	40	38	38	25	28	27	SW.	NW.	W.	High	Strong	do	do	Cloudy	Do.
13	38	42	43	30	46	40	W.	W.	W.	Strong	do	do	do	Clear	Cloudy.
14	34	36	36	19	23	21	SW.	NW.	W.	do	do	do	do	Cloudy	Do.
15	34	34	34	15	20	16	W.	W.	W.	Light	High	Brisk	do	do	Do.
16	34	37	38	9	20	19	SW.	W.	SW.	do	Brisk	do	do	Clear	Clear.
17	37	39	38	23	38	36	SW.	SW.	SW.	Brisk	do	do	do	do	Do.
18	40	42	43	38	39	44	SW.	SW.	SW.	Light	Light	Light	Cloudy	Cloudy	Cloudy.
19	41	46	47	30	41	43	SW.	SW.	SW.	do	do	Calm	Clear	Clear	Clear.
20	44	45	48	38	50	54	SW.	S.	SW.	Calm	do	Light	Cloudy	Cloudy	Cloudy.
21	52	52	52	55	62	62	W.	SW.	SW.	Light	do	do	do	do	Do.
22	50	49	50	44	46	45	NW.	NW.	NW.	Strong	do	do	do	do	Do.
23	48	48	46	46	47	46	SW.	SW.	SE.	Light	Calm	Calm	do	do	Do.
24	48	50	49	46	47	46	SE.	SE.	SE.	do	do	do	do	Clear	Clear.
25	45	47	48	38	48	40	SW.	SE.	SE.	do	Light	do	Clear	do	Cloudy.
26	48	52	48	52	41	35	NW.	W.	W.	Brisk	Brisk	Light	Cloudy	do	Clear.
27	40	40	39	19	26	30	NW.	W.	N. W	Calm	Light	Calm	Clear	do	Do.
28	39	40	40	20	30	29	W.	W.	N. W	do	do	do	do	Cloudy	Cloudy.
29	41	42	42	38	45	42	NE.	NW.	NW.	do	Calm	Light	do	do	Do.
30	43	42	42	40	50	48	SW.	W.	NW.	Brisk	Light	Calm	Cloudy	do	Do.
Dec. 1	42	43	45	30	36	34	NW.	W.	SW.	Light	do	Light	do	do	Do.
2	41	41	41	32	29	26	NW.	NW.	NW.	do	Strong	do	do	do	Do.
3	38	40	40	16	33	30	NW.	NW.	NW.	Calm	Calm	Calm	Clear	Clear	Clear.
4	39	39	42	32	38	42	NW.	NW.	SE.	do	do	do	Cloudy	Cloudy	Cloudy.
5	41	43	46	29	49	48	NE.	SW.	SW.	do	do	do	Clear	Clear	Clear.
6	42	43	44	35	44	36	SE.	S.	SE.	Light	Light	do	Cloudy	do	Cloudy.
7	45	47	47	48	51	52	SW.	SW.	SW.	do	do	Light	do	Cloudy	Do.
8	45	44	43	33	53	49	SW.	W.	NW.	Brisk	do	Calm	do	do	Do.
9	42	44	44	30	43	45	SW.	W.	NW.	Light	do	Light	Clear	Clear	Clear.
10	42	43	44	40	42	40	NW.	NW.	NW.	do	do	Calm	do	Cloudy	Cloudy.
11	41	42	44	32	40	42	W.	W.	W.	do	do	Light	do	Clear	Clear.
12	41	42	46	34	42	40	W.	W.	W.	do	Calm	Calm	Cloudy	Cloudy	Cloudy.
13	42	43	46	36	54	52	SW.	SW.	SW.	do	do	Brisk	Clear	do	Do.
14	44	43	41	34	32	23	NW.	NW.	NW.	do	Strong	do	do	Clear	Do.
15	33	33	34	16	20	21	N.	NW.	NE.	Light	Light	Light	Cloudy	Cloudy	Do.
16	37	37	36	20	14	20	W.	NW.	W.	do	do	do	do	do	Do.
17	34	36	38	6	26	22	NW.	SW.	NW.	Calm	Brisk	do	Clear	do	Do.

	18	36	38	37	22	26	20	NW.	NW.	NW.	Brisk	Light	Calm	Cloudy	do	Do.
	19	36	38	38	14	20	14	NW.	NW.	NW.	Calm	Calm	do	do	do	Do.
	20	37	38	38	14	24	18	W.	SW.	W.	do	do	do	do	Clear	Do.
	21	38	38	38	18	28	22	SW.	SW.	SW.	Light	Light	Brisk	do	Cloudy	Do.
	22	37	37	37	9	20	19	NE.	W.	SE.	Calm	Calm	Light	do	do	Do.
	23	36	35	35	18	24	28	SE.	SE	W.	Brisk	Brisk	Brisk	do	do	Do.
	24	38	39	38	32	35	30	W.	NW.	W.	Light	Light	Calm	do	do	Do.
	25	38	39	38	24	33	30	SW.	NW.	SW.	do	do	Light	do	do	Do.
	26	38	38	40	26	41	36	SW.	SW.	NW.	Brisk	do	Calm	do	do	Clear.
	27	40	38	38	34	26	20	NW.	NW.	NW.	Calm	Brisk	do	do	do	Do.
	28	36	38	39	16	26	16	NW.	SW.	SW.	do	Light	do	do	Clear	Do.
	29	37	38	38	—4	33	26	E.	SE.	SE.	do	Calm	do	Clear	Cloudy	Do.
	30	39	40	40	35	38	36	E.	SE.	NE.	do	do	do	Cloudy	do	Cloudy.
	31	42	42	42	32	37	31	NE.	NE.	NE.	Light	Light	do	do	do	Do.
Jan.	1	38	37	35	21	25	24	NE.	NE.	NE.	do	Strong	Strong	do	do	Do.
	2	34	34	33	22	—27	—26	SW.	W.	NW.	Strong	Brisk	Brisk	do	do	Do.
	3	32	32	35	4	3	3	NW.	NW.	NW.	do	do	do	do	do	Do.
	4	35	36	36	— 3	9	—3	W.	NW.	NW.	Brisk	do	Light	do	do	Do.
	5	36	37	36	0	12	8	NW.	NW.	NW.	Light	Light	Calm	do	do	Do.
	6	36	36	36	— 5	11	3	NW.	W.	W.	do	do	Light	do	Clear	Clear.
	7	36	36	36	6	22	12	NW.	SW.	W.	do	do	Calm	do	Cloudy	Cloudy.
	8	38	38	39	—12	20	15	NE.	NE.	NE.	do	do	do	do	do	Clear.
	9	35	35	36	16	23	19	NW.	NW.	NW.	Strong	Brisk	do	Clear	do	Do.
	10	36	37	37	10	30	30	E.	SE.	SE.	Calm	Light	do	Cloudy	do	Cloudy.
	11	38	38	37	23	29	22	W.	NW.	SE.	Light	Calm	do	do	do	Do.
	12	37	37	38	13	23	20	SW.	SW.	SW.	do	Light	Light	do	do	Clear.
	13	37	38	40	31	44	39	SW.	SW.	W.	Brisk	Brisk	Brisk	do	do	Cloudy.
	14	38	38	38	28	29	21	NW.	NE.	NE.	Light	Light	Light	do	do	Do.
	15	36	36	37	11	17	12	NE.	NE.	NW.	do	Calm	Calm	do	do	Clear.
	16	36	38	38	10	24	20	NW.	SW.	W.	do	Brisk	Light	do	do	Cloudy.
	17	38	37	37	18	29	30	SW.	SW.	SW.	Brisk	do	do	do	do	Clear.
	18	37	39	40	22	36	31	SW.	W.	W.	Light	Light	do	Clear	do	Do.
	19	36	39	35	17	15	11	NE.	NE.	N.	Strong	Strong	do	Cloudy	do	Cloudy.
	20	32	34	35	0	20	12	NW.	NW.	NW.	Brisk	Light	Calm	Clear	Clear	Clear.
	21	36	37	38	10	21	12	SW.	SW.	W.	Light	do	Brisk	Cloudy	Cloudy	Cloudy.
	22	37	38	40	—19	34	28	W.	SW.	NW.	do	do	Calm	do	do	Do.
	23	37	38	38	27	22	14	NE.	NE.	NE.	do	do	Brisk	do	do	Do.
	24	33	33	34	— 3	7	2	NW.	NW.	NW.	Brisk	do	Calm	do	do	Clear.
	25	34	36	37	21	14	9	NW.	NW.	NW.	Calm	Calm	do	Clear	Clear	Do.
	26	37	38	38	13	28	24	SW.	SW.	SW.	Light	do	Light	Cloudy	do	Cloudy.
	27	38	39	39	18	39	24	SE.	SE.	SE.	Calm	Light	do	do	Cloudy	Do.
	28	38	39	39	26	42	39	SE.	SW.	SW.	Light	do	Calm	do	do	Do.
	29	40	40	41	35	40	37	W.	SW.	SW.	do	do	do	do	do	Do.
	30	41	43	47	41	44	46	SW.	SW.	SW.	do	do	Brisk	do	do	Do.
	31	37	38	39	22	32	28	W.	W.	W.	do	do	do	do	do	Do.
	1	35	38	38	8	25	26	NW.	SW.	SE.	Calm	do	Light	do	do	Do.
	2	38	40	41	35	40	31	W.	N.	NW.	Light	do	do	do	do	Do.
	3	39	40	40	26	30	27	NE.	NE.	E.	do	do	do	do	do	Do.
	4	38	38	38	23	27	26	E.	SE.	E.	do	do	do	do	do	Cloudy.
	5	40	41	42	36	38	35	SW.	SW.	SW.	do	do	do	do	do	Do.
	6	40	42	41	30	36	30	E.	SE.	SE.	do	do	Calm	do	do	Do.
	7	40	41	46	25	28	24	E.	NE.	SE.	do	do	Light	do	Clear	Clear.

Record of temperature observations made at the United States Fish-Hatching Station at Northville, Mich., &c.—Continued.

Day of month.	Temperature of—						Wind.						Sky.		
	Water.			Air.			Direction.			Intensity.			Condition of.		
	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.	8 a. m.	12 m.	5 p. m.
1884.	°	°	°	°	°	°									
Feb. 8	40	41	43	24	43	34	SE.	SE.	SE.	Calm	Calm	Light	Cloudy	Cloudy	Cloudy.
9	43	45	43	35	33	30	NE.	NW.	NW.	Light	Brisk	do	do	do	Do.
10	39	40	40	17	27	26	E.	NE.	E.	do	Light	Calm	do	do	Do.
11	38	40	39	24	26	28	E.	E.	NE.	do	Calm	Light	do	do	Do.
12	38	39	38	27	31	33	E.	SE.	SE.	do	Light	do	do	do	Do.
13	40	42	42	32	40	38	SW.	SW.	SW.	do	Calm	Calm	do	do	Do.
14	36	37	37	11	18	14	NW.	NW.	NW.	Strong	Brisk	Light	Clear	do	Do.
15	37	40	40	18	22	20	NW.	NW.	NW.	Light	Calm	Calm	Cloudy	do	Do.
16	38	40	42	20	40	38	SW.	S.	S.	Calm	Light	do	do	do	Do.
17	42	43	44	36	38	44	SE.	SE.	SE.	do	Calm	Light	do	do	Do.
18	44	44	45	36	43	38	SE.	SE.	SE.	do	do	Calm	do	Fog	Fog.
19	44	48	48	40	50	48	SE.	SW.	SW.	do	Light	do	Fog	Cloudy	Cloudy.
20	38	36	38	14	26	24	NW.	NW.	NW.	Strong	do	Light	Clear	Clear	Clear.
21	38	38	40	33	27	24	SW.	NW.	NW.	do	Strong	do	Cloudy	Cloudy	Do.
22	37	40	38	24	40	20	SW.	SW.	NW.	Light	Light	do	do	do	Cloudy.
23	38	40	41	20	26	22	NW.	NW.	NW.	Calm	do	do	do	do	Do.
24	38	39	40	20	29	24	SE.	SE.	SE.	Light	do	do	do	do	Do.
25	40	41	43	25	38	26	SW.	SW.	SW.	Calm	do	do	Fog	do	Do.
26	40	42	42	30	36	32	NW.	NW.	NW.	Light	do	do	Cloudy	Clear	Do.
27	40	42	43	24	38	32	NW.	SW.	W.	Calm	Calm	do	do	Cloudy	Do.
28	34	34	45	2	9	3	NW.	NW.	NW.	Strong	Brisk	Brisk	do	do	Do.
29	34	38	39	—10	12	12	NW.	NW.	NW.	Light	Light	Light	Clear	do	Do.
1	38	39	40	4	22	17	E.	E.	E.	do	do	do	Cloudy	do	Do.
2	37	39	40	— 9	25	22	SW.	SW.	SE.	Calm	do	Calm	Clear	Clear	Do.
3	38	39	39	12	22	17	NE.	NW.	NW.	Light	Brisk	Light	Cloudy	Cloudy	Clear.
4	37	39	41	— 4	26	20	W.	SW.	SW.	Calm	Light	Calm	Clear	do	Cloudy.
5	38	40	42	1	32	24	NE.	SW.	SE.	do	Calm	Light	Cloudy	do	Do.
6	40	42	45	22	32	29	NW.	W.	SE.	do	do	do	do	do	Do.
7	41	42	42	22	28	22	NE.	NE.	NE.	Light	Light	Brisk	do	do	Do.
8	36	38	40	20	27	22	NE.	NE.	NE.	Brisk	do	Calm	do	do	Do.
9	38	40	42	21	36	30	NE.	W.	W.	Light	do	Light	do	do	Do.
10	38	39	41	0	15	32	NW.	NW.	SE.	do	do	do	Clear	Clear	Do.
11	41	43	44	36	48	48	SE.	SW.	SW.	Calm	Brisk	Brisk	Cloudy	Cloudy	Do.
12	40	42	44	34	38	34	W.	W.	W.	High	do	do	Hazy	Clear	Clear.
13	40	47	50	34	43	44	W.	SW.	SW.	Light	Light	Calm	Clear	Cloudy	Cloudy.
14	43	45	35	28	35	33	SE.	SE.	NE.	Brisk	do	Light	Cloudy	do	Clear.
15	41	45	46	28	40	35	W.	NW.	NW.	Light	Brisk	Calm	Clear	do	Cloudy.
16	41	43	46	30	41	36	SE.	SW.	SW.	Calm	Light	do	do	do	Do.

17	44	48	48	40	48	43	SW.	NW.	W.	....do	....do	....do	Cloudy	....do	Do.
18	43	48	48	30	42	40	E.	SE.	SE.	....do	....do	Light	....do	....do	Do.
19	45	45	45	36	40	38	NE.	NE.	NE.	Light	....do	....do	....do	....do	Do.
20	44	45	46	36	49	40	N.	NE.	NE.	....do	....do	Calm	....do	....do	Do.
21	44	50	47	34	50	53	SW.	SW.	SW.	Calm	Calm	....do	....do	Hazy	Do.
22	46	50	52	38	56	48	NE.	SE.	SE.	....do	Light	....do	....do	....do	Do.
23	49	55	54	47	62	53	SW.	NW.	NW.	Light	....do	Light	....do	Clear	Clear.
24	46	50	54	36	54	48	NW.	NW.	SE.	Calm	....do	Calm	....do	Hazy	Cloudy.
25	48	48	48	40	46	44	SE.	SE.	SE.	Light	Calm	....do	....do	Cloudy	Do.
26	47	47	47	46	44	44	SW.	W.	NW.	....do	Brisk	Brisk	....do	....do	Do.
27	44	46	55	42	48	56	NW	NW.	SE.	....do	Light	Calm	Clear	Clear	Clear.
28	48	48	49	40	50	49	SE.	SE.	SE.	....do	Brisk	Light	Cloudy	Cloudy	Hazy.
29	47	48	49	41	44	39	NW.	NE.	NE.	Brisk	Strong	Brisk	Clear	....do	Clear.
30	42	46	46	25	38	34	NE.	NW.	NW.	Light	Light	Light	Clear	Clear	Cloudy.
31	48	48	48	44	50	41	SE.	SE.	SW.	Brisk	....do	....do	Cloudy	Cloudy	Do.
Apr. 1	46	46	46	36	38	36	SE.	SE.	E.	Calm	....do	Brisk	....do	....do	Do.
2	42	44	43	32	34	37	NE.	NE.	NE.	Brisk	Brisk	Light	....do	....do	Do.
3	39	48	48	32	44	48	NW.	NW.	NW.	....do	....do	....do	Clear	....do	Do.
4	44	50	52	44	55	52	NW.	NW.	NW.	Light	....do	....do	Cloudy	....do	Do.
5	45	48	51	36	44	48	NW.	NW.	NW.	....do	....do	Calm	Clear	Hazy	Clear.
6	46	50	50	30	45	47	NE.	NE.	NE.	Calm	Light	Light	Cloudy	Clear	Do.
7	46	48	49	34	50	52	E.	SE.	SE.	....do	....do	Calm	Clear	Cloudy	Cloudy.
8	45	51	50	44	50	52	NE.	E.	SW.	....do	....do	Light	Cloudy	....do	Do.
9	45	47	48	36	46	45	N.	NW.	W.	Light	....do	....do	....do	....do	Do.
10	45	49	50	36	50	44	NW.	W.	NW.	Brisk	Calm	....do	Clear	....do	Do.
11	46	46	48	36	46	42	NW.	W.	W.	Calm	Light	....do	Cloudy	....do	Do.
12	50	50	51	36	54	52	NE.	SE.	SE.	....do	....do	....do	....do	....do	Do.
13	50	50	52	40	56	51	SE.	SE.	SE.	Light	Brisk	Calm	....do	Hazy	Do.
14	48	54	55	54	66	60	SE.	SE.	SE.	Calm	Light	Light	....do	Clear	Clear.
15	50	50	52	52	57	54	SE.	W.	SW.	Light	Brisk	Strong	....do	Cloudy	Cloudy.

Temperature of water at Alpena Station from November 1, 1883, to May 1, 1884.

Date.	8 a.m.	Date.	8 a.m.	Date.	8 a.m.	Date.	8 a.m.	Date.	8 a.m.	Date.	8 a.m.
1883.	°	1883.	°	1884.	°	1884.	°	1884.	°	1884.	°
Nov. 1	46	Dec. 2	37	Jan. 1	34½	Feb. 1	34½	Mar. 3	34½	Apr. 3	37½
Nov. 2	46	Dec. 3	37	Jan. 2	34½	Feb. 2	34½	Mar. 4	34½	Apr. 4	38
Nov. 3	46	Dec. 4	37	Jan. 3	34½	Feb. 3	34½	Mar. 5	34½	Apr. 5	38
Nov. 4	45½	Dec. 5	37	Jan. 4	34½	Feb. 4	34½	Mar. 6	34½	Apr. 6	38
Nov. 5	45½	Dec. 6	37	Jan. 5	34½	Feb. 5	24½	Mar. 7	34½	Apr. 7	36
Nov. 6	45	Dec. 7	37	Jan. 6	34½	Feb. 6	34½	Mar. 8	34½	Apr. 8	36½
Nov. 7	45	Dec. 8	36½	Jan. 7	34½	Feb. 7	34½	Mar. 9	34½	Apr. 9	36½
Nov. 8	45	Dec. 9	36½	Jan. 8	34½	Feb. 8	34½	Mar. 10	34½	Apr. 10	38
Nov. 9	45	Dec. 10	36½	Jan. 9	34½	Feb. 9	34½	Mar. 11	34½	Apr. 11	38
Nov. 10	45	Dec. 11	36½	Jan. 10	34½	Feb. 10	34½	Mar. 12	34½	Apr. 12	40
Nov. 11	44	Dec. 12	36½	Jan. 11	34½	Feb. 11	34½	Mar. 13	34½	Apr. 13	40
Nov. 12	43	Dec. 13	36½	Jan. 12	34½	Feb. 12	34½	Mar. 14	35	Apr. 14	40
Nov. 13	38	Dec. 14	36	Jan. 13	34½	Feb. 13	34½	Mar. 15	35	Apr. 15	41
Nov. 14	37	Dec. 15	36	Jan. 14	34½	Feb. 14	34½	Mar. 16	35	Apr. 16	41
Nov. 15	36	Dec. 16	35½	Jan. 15	34½	Feb. 15	34½	Mar. 17	35½	Apr. 17	41
Nov. 16	36	Dec. 17	35	Jan. 16	34½	Feb. 16	34½	Mar. 18	35½	Apr. 18	41½
Nov. 17	36	Dec. 18	34½	Jan. 17	34½	Feb. 17	34½	Mar. 19	35½	Apr. 19	41½
Nov. 18	36½	Dec. 19	34½	Jan. 18	34½	Feb. 18	34½	Mar. 20	35½	Apr. 20	42
Nov. 19	36½	Dec. 20	34½	Jan. 19	34½	Feb. 19	34½	Mar. 21	35½	Apr. 21	42
Nov. 20	37	Dec. 21	34½	Jan. 20	34½	Feb. 20	34½	Mar. 22	36	Apr. 22	42
Nov. 21	37	Dec. 22	34½	Jan. 21	34½	Feb. 21	34½	Mar. 23	30	Apr. 23	43
Nov. 22	37½	Dec. 23	34½	Jan. 22	34½	Feb. 22	34½	Mar. 24	36	Apr. 24	43
Nov. 23	37½	Dec. 24	34½	Jan. 23	34½	Feb. 23	34½	Mar. 25	30	Apr. 25	43½
Nov. 24	37	Dec. 25	34½	Jan. 24	34½	Feb. 24	34½	Mar. 26	36	Apr. 26	43½
Nov. 25	37	Dec. 26	34½	Jan. 25	34½	Feb. 25	34½	Mar. 27	36½	Apr. 27	44
Nov. 26	37	Dec. 27	34½	Jan. 26	34½	Feb. 26	34½	Mar. 28	36½	Apr. 28	44
Nov. 27	37	Dec. 28	34½	Jan. 27	34½	Feb. 27	34½	Mar. 29	36½	Apr. 29	44
Nov. 28	37	Dec. 29	34½	Jan. 28	34½	Feb. 28	34½	Mar. 30	37	Apr. 30	44
Nov. 29	37½	Dec. 30	34½	Jan. 29	34½	Feb. 29	34½	Mar. 31	37½	May 1	44
Nov. 30	37½	Dec. 31	34½	Jan. 30	34½	Mar. 1	34½	Apr. 1	37½		
Dec. 1	37			Jan. 31	34½	Mar. 2	34½	Apr. 2	37½		