of this vacinity. The entomostraca were chiefly large cladocera (*Simocephalas*), cyclops, and canthocamptus. To the algæ, the little fishes have paid no attention whatever, although they are well scattered through the water. They have followed the smaller entomostraca aronnd with growing interest from the first, occasionally making irresolute efforts to capture them, but did not actually begin eating until today. Now, however, more than one-half of them have evidently taken food. In the seven cases examined, this consisted entirely of cyclops and canthocamptus, the smallest entomostaca in the water. The cladocera are evidently too large for them, and they even seem afraid of them, although, of course, the former could do them no harm.

The fishes all have visible remains of the egg within the body, but, as their teeth are already well developed, they are doubtless at the proper age to commence eating. This seems to me nearly conclusive proof, taken with my previous observations, that the first natural food of the whitefish is small entomostraca, especially cyclops (*Canthocamptus* occurs rarely, if at all, in Lake Michigan), but it may be worth while to repeat my little experiment on a larger scale and under more natural conditions.

I have consequently taken steps to study a number of specimens kept in the water of the lake and supplied with the organisms occurring in the lake waters.

It will be impossible for me to keep alive the few which I have, long enough to tell how well they would flourish on the food supplied to them.

ILLINOIS STATE LABORATORY OF NATURAL HISTORY,
Normal, Ill., February 20, 1882.

SOME RESULTS OF THE ARTIFICIAL PROPAGATION OF MAINE AND CALIFORNIA SALMON IN NEW ENGLAND AND CANADA, RECORDED IN THE YEARS 1879 AND 1880.

[Compiled by the United States Fish Commissioner.]

NEW BEDFORD, MASS., *May* 20, 1879.

Prof. S. F. BAIRD:

SIR: I have just been in the fish market and a crew were bringing in their fish from one of the "traps." A noticeable and peculiar feature of the fishery this year is the great numbers of young salmon caught, especially at the Vineyard, although some few are caught daily at *Scontieut* Neck (mouth of our river). There are apparently two different ages of them. Mostly about 2 pounds in weight (about as long as a large mackerel) and about one-half as many weighing from 6 to 8 pounds; occasionally one larger. One last week weighed 23 pounds and one 18 pounds. The fishermen think they are the young of those with which some of our rivers have been stocked, as nothing of the kind has occurred in past years at all like this.

JOHN H. THOMSON.

NEW BEDFORD, MASS., *June* 1, 1879.

Prof. SPENCER F. BAIRD:

SIR: I received yours. I have examined carefully since your letter, but no salmon have been taken. The run was about the two first weeks in May and a few the last of April. Mr. Bassett had about 30 to 35 from the trap at Menimpsha, and 10 or 12 from Sconticut Neck, mouth of our river. Mr. Bartlett, at his fish market, had about one dozen; 12 from the traps near the mouth of Slocum's River, six miles west of here, and I have heard of two taken at mouth of Westport River. As to the particular species, I do not get any reliable information, as so few of our fishermen know anything about salmon, and in fact the men from the traps on Sconticut Neck did not know what the fish were.

JOHN H. THOMSON.

FISHING ITEMS.

The squid fishery from this port has thus far proved a failure. There have been five arrivals with but a few barrels. Schooner Crest of the Wave is high-line, she having succeeded in obtaining fifty barrels.

A ten-pound salmon and seventeen tautog, weighing over one hundred pounds, were taken from the weirs of Magnolia, Thursday night. This is the first salmon caught off Cape Ann for over thirty years. On Saturday morning three more large salmon were taken and 150 large mackerel. The fishermen are highly elated at the prospect of salmon catching.—(Cape Ann Advertiser, June 6, 1879.)

[Postscript to a letter from Monroe A. Green, New York State Fishery Commission, to Fred Mather, June 9, 1879.]

"P. S.—Kennebec salmon caught to-day in the Hudson River at Bath near Albany weighing twelve and a half pounds, sold for 40 cents per pound. The first that have been caught for years."

STATE OF MAINE, DEPARTMENT OF FISHERIES,
Bangor, August 25, 1879.

[Extracts.]

DEAR PROFESSOR: * * * We have had a great run of salmon this year, and consisting largely of fish planted by us in the Penobscot four or five years ago, so far as we could judge; there were a very large number, running from 9 to 12 pounds. The east and west branches of the Penobscot report a great many fish in the river. On the Mattawamkeag, where we put in 250,000 and upwards, in 1875 and 1876, a great many salmon are reported trying to get over the lower dam at

Gordon's Falls, 13 feet high. These fish were put in at Bancroft, Eaton, and Kingman, on the European and North American Railroad. The dam at Kingham is 13 feet; at Slewgundy, 14 feet; at Gordon's Falls, 13 feet, and yet a salmon has been hooked on a trout fly at Bancroft, and salmon are seen in the river at Kingman, and between the dams at Slewgundy and Gordon's Falls. * * * The dealers in our city have retailed this season 50 tons Penobscot salmon, and about 3 tons Saint John salmon; it all sells as Penobscot salmon. Saint John salmon costs here, duty and all included, about 14 cents per pound. Our first salmon sells at $1 per pound, and so on down to 12½ cents the last of the season. Salmon at Bucksport has sold to dealers here at 8 cents. Two tons taken at Bucksport and Orland in 24 hours. Average price at retail here for whole season, 25 cents.

Truly, yours,

E. M. STILWELL.

STATE OF MAINE, DEPARTMENT OF FISHERIES,
Bangor, October 4, 1879.

DEAR PROFESSOR: My delay in replying to your kind letter has been from no want of courtesy, but a desire to send you the required "data" you asked. Neither myself nor Mr. Atkins have been able to procure them. The weir fishermen keep no records at all, and it is difficult to obtain from them anything reliable; while the fishermen above tide water are a bad set of confirmed poachers, whose only occupation is hunting and fishing both in and out of season. They are always jealous and loth to let us know how good a thing they make of it, for fear of us and fear of competition from their own class. Four or five years since I put in some 300,000 salmon fry into the Mattawamkeag at Bancroft, Eaton, Kingsmore, and at Mattawamkeag village. There are three dams between Mattawamkeag and Bancroft—none less than 12 feet high. About six weeks since Mr. Nathaniel Sweat, a railroad conductor on the European and North American Railroad, while fishing for trout from a pier above the railroad bridge at Bancroft, hooked a large salmon and lost his line and flies. Salmon in great numbers have been continually jumping below the first dam, which is called "Gordon's Falls." My colleague, Everett Smith, of Portland, a civil engineer, while making a survey for a fishway, counted 15 salmon jumping in 30 minutes. A Mr. Bailey, who is foreman of the repair shop at Mattawamkeag, walked up to the falls some three weeks since entirely out of curiosity excited by the rumors of the sight, and counted 60 salmon jumping in about an hour, within half or three-quarters of a mile of the falls. This is on the Mattawamkeag, which is a great tributary of the Penobscot. On the east branch of the Penobscot there has been a great run of salmon. An explorer on the Wassattaquoik reported the pools literally black with salmon. A party of poachers, hearing the rumor, went in from the town of Hodgon and killed 25. I inclose you

a letter to me from Mr. Prentiss, one of our most wealthy and prominent merchants, which speaks for itself. I will be obliged to you if you will return this, as I shall have occasion to use it in my report. On the west branch of the Penobscot I hear reports of large numbers of salmon, but the breaking of the two great dams at Chesancook and the North Twin Dam, which holds back the great magazine of water of the great tributary lakes which feed the Penobscot, which is used to drive the logs cut in the winter, through the summer's drought, has let up all the fish which hitherto were held back until the opening of the gates to let the logs through. These fish would not, of course, be seen, as they would silently make their way up. I regret that I have nothing of more value to give you. Hoping that this small contribution may at least cheer you as it has me,

I remain, truly, yours,

E. M. STILWELL,
Commissioner of Fisheries for State of Maine.

Prof. SPENCER F. BAIRD,
United States Commissioner Fish and Fisheries.

BANGOR, *October* 3, 1879.

E. M. STILWELL, Esq.,

DEAR SIR: Prof. C. E. Hamlin, of Harvard, and I made a trip to Mount Katahdin last month for scientific examination and survey of the mountain. I had been salmon fishing in July on the Grand Bonaventure, on Bay of Chaleur, and I could not see why we could not catch salmon on the east branch of the Penobscot at the Hunt place where we crossed it on our way in to Katahdin. I thought the pool from mouth of Wassatiquoik to the Hunt place, about a half-mile, must be an excellent salmon pool, and my guide and the people there confirmed this opinion. They said over a hundred salmon had been taken in that one pool this season. The nearest settlement, and only one on the whole east branch, is about six miles out from there, and the young men go on Sundays and fish with drift-nets. No regular fishing for market—only a backwoods local supply can be used. These fish were all about of one size—say 8 to 11 pounds. There were never enough fish there before to make it worth while for them to drift for them. A few years ago no salmon were caught there at all. Twenty-two years ago, before our fish laws were enacted, the farmer at the Hunt place used to have a net that went entirely across the river clear to the bottom, which he kept all the time stretched across, and he only used to get two or three salmon a week. I was there August, 1857, with Mr. Joseph Carr, an old salmon fisher, and we fished for ten days and could not get a rise. The net had been taken up, because the farmer did not get fish enough to pay for looking after it. But the stocking the river makes it good fishing, and I intend to try the east branch next season with the fly.

Very truly,

HENRY M. PRENTISS.

EAST WINDSOR HILL, CONN., *October* 13, 1879.

Professor BAIRD:

DEAR SIR: It may be of interest to you to know that your salmon are not all lost. Last Friday, 10th, I was with a party of three fishing in Snipsic Lake, and one of our party caught a salmon that weighed 1¾ pounds. This is the second one taken since the pond was stocked, as I was told. The other was caught this summer and weighed 12 ounces.

Cannot something be done to save our fish in Connecticut River? There is an establishment at Holyoke, Mass., and another at Windsor Locks, Conn., that are manufacturing logs into paper, and I am told that the chemicals used for that purpose are let off into the river twice a day, and that the fish for half a mile come up as though they had been cockled. Both of these factories are at the foot of falls where the fish collect and stop in great numbers and are all killed. Our shores and sand-bars are literally lined with dead fish. Three salmon have been found among them within two miles of my office. They were judged to weigh 12, 20, and 25 pounds. The dead fish are so numerous that eagles are here after them. I have received nine that have been shot here in the past two seasons.

I have written you in order that the fish commissioners might stop this nuisance and save the fish that they have taken so much pains to propagate.

Truly, yours,

WM. WOOD.

May 29 to June 13, 1879.—W. Scott Lord, Esq., gives the following weights of 51 Salar salmon caught in the Restigouche River near the junction with the Matapediac:

1 of 4 pounds.
1 of 10 pounds.
2 of 11 pounds.
2 of 12½ pounds.
1 of 13 pounds.
1 of 14½ pounds.
2 of 15 pounds.
1 of 15½ pounds.
1 of 16 pounds.
1 of 17½ pounds.
1 of 20½ pounds.
2 of 23 pounds.
5 of 24 pounds.
1 of 24½ pounds.
1 of 24¾ pounds.
6 of 25 pounds.
3 of 25½ pounds.
8 of 26 pounds.
4 of 27 pounds.
1 of 29½ pounds.
2 of 33 pounds.
1 of 34 pounds.
1 of 36½ pounds.
1 of 38½ pounds.
1 of 40½ pounds.

51 weighing 1,200¼ pounds.

SAINT STEPHEN, *March* 1, 1880.

Prof. SPENCER F. BAIRD,

U. S. Commissioner Fish and Fisheries:

DEAR SIR: I send you remarks in relation to the Restigouche and Saint Croix Rivers, which, though crude, I am sure are quite correct, as they are either taken from the official statistics, or are facts of which I am myself cognizant. You may, if of use, publish any part of them. I very much wish we could procure some young shad for the Saint Croix; this fish was once very abundant, and perhaps would be again if introduced. I know you have been very successful in restocking the Connecticut. Our old people deplore the loss of the shad—say it was a much better food-fish than the salmon. I do a great deal of shooting, and am much interested in ornithology, and specimens of our birds that you might want I should be happy to lookout for; do a good deal of coast shooting winters; have been hopefully looking for a *Labrador duck* for a number of seasons—fear they have totally disappeared.

I have nice spring-water conducted to my house and think of doing a little fish-hatching in a small way. The amount of water I can spare is a stream of about half-inch diameter; the force will be considerable, as the water rises to top of my house, some 50 feet above where I should set trays. I write to you to ask what hatching apparatus would be best to get, where to buy, and probable cost. I am trying to get some sea-trout ova to hatch in it. I presume all your California ova have been disposed of ere this.

FRANK TODD.

SAINT STEPHEN, *March* 1, 1880.

Prof. SPENCER F. BAIRD,

U. S. Commissioner Fish and Fisheries:

SIR: In regard to the Saint Croix, would say, that it was once one of the most prolific salmon rivers in New Brunswick, but owing to the erection of impassable dams, fifteen or twenty years ago, this valuable fish had almost entirely disappeared. At about this time fishways were placed in all the dams, and gradully salmon began to increase, but the first great stimulus was given some ten years ago by the distribution of some hundreds of thousands of young salmon in the headwaters, by the fishery commissioners of Maine. The Dobsis Club also placed in the Saint Croix some 200,000 or more from their hatchery, a portion being the California salmon. With these exceptions our river has had no artificial aid, but for the last five years the number of salmon has largely increased, due mainly, no doubt, to the deposits before mentioned. The fish ways are generally in good condition (although some improvements will be made), and fish have easy access to headwaters, That large numbers go up and spawn is evidenced by the large numbers of smolt seen at the head of tidal water in the spring, many being taken by boys with the rod. I have reason to expect that our government will hereafter

distribute annually in the Saint Croix a goodly number of young salmon, which, together with the contributions of the Maine commissioners, will soon make this fish again abundant. Alewives are very abundant, and apparently increasing every year. Shad that were once plenty have entirely disappeared. I very much wish that the river could be restocked with this valuable fish; possibly you could kindly assist us in this. Landlocked salmon (here so called) are, I think, *nearly* or quite as plenty at Grand Lake Stream as they were ten years ago; this, I think, is almost entirely due to the hatchery under the charge of Mr. Atkins; the tannery at the head of the stream having entirely destroyed their natural spawning beds, the deposit of hair and other refuse being in some places inches deep. The twenty-five per cent. of all fish hatched, which are honestly returned to our river, is, I think, each year *more* than we would get by the natural process, under *present* circumstances, in ten years.

FRANK TODD.

SAINT STEPHEN, N. B., DOMINION OF CANADA.

Prof. SPENCER F. BAIRD,

U. S. Commissioner Fish and Fisheries:

SIR: I think it has been clearly demonstrated in this Dominion that, by artificial propagation and a fair amount of protection, all natural salmon rivers may be kept thoroughly stocked with this fish, and rivers that have been depleted, through any cause, brought back to their former excellence.

I would instance the river Restigouche in support of the above statement.

This river, which empties into the Bay of Chaleur, is now, and always has been, the foremost salmon river in New Brunswick, both as to size and number of fish. It has not a dam or obstruction to the free passage of fish from its mouth to its source, yet up to 1868 and 1869 the numbers of salmon had constantly decreased. This, no doubt, was occasioned by excessive netting at the mouth, and spearing the fish during the summer in the pools; natural production was not able to keep pace with this waste. In the year 1868 the number of salmon was so small that the total catch by anglers was only 20 salmon, and the commercial yield only 37,000 pounds.

At about this date, the first salmon hatchery of the Dominion was built upon this river and a better system of protection inaugurated; every year since some hundreds of thousands of young salmon have been hatched and placed in these waters, and the result has been, that in 1878 one angler alone (out of hundreds that were fishing the river) in sixteen days killed by his own rod eighty salmon, seventy-five of which averaged over twenty-six pounds each; while at the same time the numbers that were being taken by the net fishermen below, for commercial purposes, were beyond precedent, amounting in that one division alone

(not counting local and home consumption) to the enormous weight of 500,000 pounds, and the cash receipts for salmon in Restigouche County that year amounted to more than $40,000, besides which some $5,000 was expended by anglers; this result was almost entirely brought about by artificial propagation. A new hatchery of size sufficient to produce five million young fish annually will no doubt soon be erected by the Dominion Government upon this river.

A somewhat similar record might be given of the river Saguenay. Some years ago anglers and net fishers of this river said it was useless to lease from the department, as the scarcity of salmon was such as not to warrant the outlay. A hatchery was built, and this state of things is now wonderfully changed; so much so, indeed, that in 1878 salmon, from the great numbers which were taken at the tidal fisheries, became a drug in the market, selling often as low as three cents per pound, and angling in the tributaries was most excellent.

Some one hundred million young salmon have been artificially hatched and distributed in the waters of the Dominion during the last few years, and new government hatcheries are constantly being erected.

Yours, &c.,

FRANK TODD,
Fishery Overseer, Saint Croix District.

FOOD OF THE SHAD OF THE ATLANTIC COAST OF THE UNITED STATES (ALOSA PRÆSTABILIS DE KAY); AND THE FUNCTIONS OF THE PYLORIC CŒCA.*

By E. R. MORDECAI, M. D.

1. The small size and the arrangement of the teeth would suggest that the food of this fish is easy of prehension.†

2. The gullet is capacious.

3. The stomach, as is well known, consists of a conical, and gizzard portion. The tissues of the former do not differ from those of the stomach of an ordinary fish. The latter is a powerful muscular apparatus, terminating in a very constricted pyloric orifice.

4. The pylorus opens into an intestinal tube neither remarkable for its length nor breadth.

5. The pyloric cœca are fusiform sacculi, varying in number, by my enumeration, from sixty to a hundred—according to the development of the fish.

They enter the intestinal canal. The points of communication are marked by depressions in the mucous membrane of the wall of the viscus. Sometimes six or eight cœca will be found to open into a single depression.

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* Reprinted from a pamphlet entitled: Food | of the | shad of the Atlantic coast | of the | United States, | (Alosa præstabilis De Kay); | and the | functions of the pyloric cœca. | by | E. R. Mordecai, M. D., | Member of the Academy of Natural Sciences of Philadelphia. | — | Philadelphia: | King & Baird, Printers, 607 Sansom St. | 1860.

† The teeth are very minute.