XXIV.—OBSTRUCTIONS TO THE ASCENT OF FISH IN CERTAIN RIVERS.

For the purpose of more accurate information as to the accessibility of certain interior waters to salmon, shad, and other anadromous fishes, passing upward from the portion of the ocean or of the great lakes to which the former are tributary, I secured the valuable co-operation of certain gentlemen, whose reports are herewith communicated. With that of Mr. E. M. Stilwell, fish-commissioner of Maine, has been incorporated a similar communication from Mr. Charles G. Atkins. Dr. M. C. Edmunds has furnished a report on the streams connected with Lake Champlain and the Saint Lawrence River. Both these articles are accompanied by maps. Other articles of less magnitude, but of much interest, have been supplied of some rivers in Virginia, by Mr. McKennie, through Thaddeus Norris, and of tributaries of Lake Michigan, by Mr. J. F. Ingalls and by Mr. Milner.

A—OBSTRUCTIONS IN THE RIVERS OF MAINE.

By E. M. Stilwell.

SAINT CROIX RIVER.

1. Calais, fifteen miles*; Union Mills dam, according to tide, 10 feet.
2. Barring, nineteen miles; dam, 7 feet.
3. West Branch, forty miles; Princeton dam, 8 feet.
4. Vanceborough, E. B., fifty-seven miles; dam and fish-way.
5. Forest City, eighty-two miles; dam, 10 feet.

PENMAQUAN RIVER.

1. One and a half miles from mouth; grist-mill dam, 7 feet; saw-mill dam, 9½ feet.
2. Iron Forks, one mile; dam, 25 feet.
3. Little Falls, four miles; dam, 20 feet.

DENNYS RIVER.†

1. Dennysville dam, 10 feet; Dennysville dam, 1½ miles; 12 feet; fish-way.
2. Millwaukie, 4 miles; dam, 14 feet; fish-way.
3. Meddybemps, 20 miles; dam, 10 feet.

* Distance from mouth of river.
† See map for dams on tributary.

ORANGE RIVER.

Three dams near mouth, all with fish-ways.

EAST MACHIAS RIVER.

Main river, East Machias, 1 dam 8 feet high; 1 dam 14 feet high; 1 dam just above, 10 feet high.
Tributary, 1 dam.

MACHIAS RIVER.

1. Lower Falls, 3 miles; dam, 14 feet.
2. Upper Falls, dam, 14 feet.
3. Whitneysville, 8 miles; dam, 15 feet.

WESCONGUS, OR PLEASANT RIVER.

Main river, 1 dam at Columbia, 6 feet; 1 dam at Columbia, 7 feet 1 dam above, 5 feet; 1 dam above, 7 feet; 1 dam above, 7 feet; 1 dam above, 5½ feet.

NARRAGUAGUS RIVER.

Main river, 1 dam at Cherryfield, 9 feet; 1 dam at Cherryfield, 12 feet; 1 dam at Cherryfield, 9 feet; 1 dam at Cherryfield, 10 feet; 1 dam at Cherryfield, 10 feet; 1 dam at Deblois, 6 feet.

UNION RIVER.

Main river and tributaries, 8 dams, as per plan.
(See Atkins's Report, p. 300.)

PENOBSCOT RIVER AND TRIBUTARIES.

1. Veazie dam, 10 feet high, with fish-way.
2. Basin Mills, 4 miles above; fish-way, dam, 8 feet.
3. Orono dam, 8 feet high, with fish-way.
4. Great Works dam, 6 feet high, with sluice, passable for salmon.
5. Foot of North Twin Lake, West-Branch dam, 16 feet high; open from 25th day of June.
6. East Branch of Penobscot, dam at foot of Grand Lake, 30 miles from the forks of the river, 20 feet high; open from about 25th June to 1st July, to the end of the year.

Passadumkeag branch of Penobscot River.

7. Lowell, 12 miles; dam, 12 feet high.
8. Nickatous Lake, dam, 12 feet high; open 1st June.

Piscataquis branch of Penobscot and tributaries.

9. Milo, on Sebec River, dam, 10 feet high.
10. Brownsville, on Pleasant River, dam, 10 feet high.
11. Katahdin Iron-Works, on Pleasant River, dam, 10 feet high.
12. Sebec Village, at foot of Sebec Lake, dam, 12 feet high.

13. Head of Sebec Lake, at mouth of Ship-Pond Stream, dam, 12 feet high.
14. At foot of Ship-Pond, dam, 8 feet.
15. On Ship-Pond Stream and foot of Long Pond, dam, 8 feet high.
16. East Dover, dam, 18 feet high.
17. Dover and Foxcroft, dam, 18 feet high.
18. Guilford, dam, 10 feet high.
19. Abbot, dam, 16 feet high.

Mattawamkeag branch of Penobscot River.

20. Gordon Falls, 4 miles; dam, 14 feet high.
21. Slurgundy, 2½ miles above; dam, 15 feet.
22. Kingman tannery, dam, 18 feet.
23. West Branch Lake, 30 miles; dam, 8 feet.
24. Rockybeme Lake, 23 miles from Island Fall, dam, 10 feet.
25. East Branch, Mattawamkeag, 16 miles from Haynesville, dam, 12 feet.
26. Smyrna, dam, 6 feet.

SAINT GEORGE RIVER.

1. Warren Low Falls, 6 miles; dam, 9 feet.
2. Upper Falls, 6½ miles; dam, 10 feet.
3. Union dam, 33 miles; 10 feet.
4. Hill's dam, 34 miles; 12 feet.

MEDOMAC RIVER.

Main river, 1 dam at Waldoborough, 10 feet; 1 dam at Waldoborough, 8 feet; 1 dam at Waldoborough; 1 dam at Waldoborough, 10 feet; 1 dam above; 1 dam at North Waldoborough, 6 feet; 1 dam at North Waldoborough, 6 feet.

DAMARISCOTTA RIVER.

Natural fall, 50 feet; not a salmon-river.

SHEEPSCOT RIVER.

1. Upper dam, 31 miles; dam, 14 feet.
2. Cooper's Mills, 31 miles; dam, 14 feet.
3. Whitefield, 27 miles; dam, 12 feet.
4. King's Mills, 22 miles; dam, 15 feet.
5. Alna, dam, 10 feet.

KENNEBEC AND TRIBUTARIES.

1. Augusta, dam, 26 feet high.
2. Waterville, 18 miles above Augusta, falls, 18 feet in 50 rods; dam, at head of falls, 18 feet high.

3. Fairfield, or Kendall's Mills, 3 miles above Waterville, dam, 8 feet.

4. Somerset Mills, 3 miles above Kendall's Mills, dam, 8 feet.

5. Skowhegan, dam, 14 miles above Kendall's Mills, 12 feet.

6. Anson.

7. Moosehead Lake, dam at outlet, 8 feet.

1. *Sebastacook branch of Kennebec:* 18 miles above Augusta, dam, 7 feet; and one mile above, another dam, 8 feet.

2. Clinton, 11 miles above, dam, 8 feet; Burnham, dam, 12 feet; Unity, dam.

3. Pittsfield, 10 miles above, dam, 8 feet; Detroit, dam, 7 feet; Hartland, dam, 7 feet.

4. Newport, 8 miles above Pittsfield, dam, 8 feet.

1. *Carrabasset branch of Kennebec:* 1 dam at East New Portland; 1 dam at Kingsfield.

Sandy River and branches, tributary to Kennebec.

1. Starks, 2 dams.
2. New Sharon, dam, 8 feet.
3. Farmington Falls, dam, 8 feet.
4. North Chesterville, 1 dam, 12 feet.
5. East Wilton, 1 dam, 10 feet.
6. East Wilton, 1 dam, 13 feet.
7. East Wilton, 1 dam.
8. East Wilton, 1 dam.
9. East Wilton, 1 dam, 5 feet.
10. Wilton, 1 dam, 7 feet.
11. Wilton, 1 dam, 9 feet.
12. Wilton, 1 dam, 6 feet.
13. Wilton, 1 dam.
14. Wilton, 1 dam, 15 feet.
15. Phillips, 1 dam, 20 feet.

1. *Cobbosseecontee stream:* Gardiner, 8 dams.

Androscoggin branch of the Kennebec.

1. Brunswick, dam, 14 feet.
2. One-fourth mile above, dam and fish-way, 14 feet.
3. Lisbon Falls, 8 miles; dam, 10 feet.
4. Lewiston Falls, dam, 18 feet; falls, 35 feet in 50 rods.
5. Livermore Falls, 20 miles; dam, 7 feet.
6. Jay, 8 miles; dam, 8 feet.
7. East Rumford, Rumford Falls, 25 miles, 70 feet vertical pitch, natural falls.

Little Androscoggin: Auburn, 2 dams; 1 dam at Minot, 11½ feet; 1 dam above, 13 feet; 1 dam at Mechanic Falls; 1 dam at Mechanic Falls, 14 feet; 1 dam at Mechanic Falls, 14 feet; 1 dam at Welchville, 10 feet; 2 dams near Paris; 1 dam at Oxford, 10 feet; 1 dam at Oxford, 13 feet.

Nerinscot: 1 dam near mouth, 11 feet; 1 dam above, 12 feet; 1 dam, Turner, 12 feet; 3 dams at Buckfield; 2 dams at North Buckfield.

Webb's River: 1 dam at Dixfield; 1 dam at Berry's Mills.

PRESUMPSCOT RIVER.

1. Presumpscot Falls, 1 mile from mouth, accessible to salmon, shad, and alewives.
2. Cumberland Mills, nine miles; dam, 9 feet.
3. Saccarappa, ten miles; 2 dams, 10 and 14 feet.
4. Mallison Falls, sixteen miles; dam, 12 feet.
5. Gombo Falls, eighteen miles; dam, 8 feet.
6. Great Falls, twenty-three miles; dam, 20 feet.
7. Steep Falls, twenty-four miles; dam, 11½ feet.
8. Lindsey's Falls, twenty-five miles; dam, 14½ feet.
9. Sebago Lake, twenty-seven miles.

Songo River: Harrison, 3 dams; South Waterford, 2 dams.

Crooked River: Ede's Falls, 1 dam, 8 feet; 1 dam, 7 feet; Bolster's, 1 dam, 9 feet; 1 dam, 11 feet; 1 dam, 11 feet; North Waterford, 1 dam, 8 feet.

SACO RIVER AND TRIBUTARIES.

1. Biddeford and Saco, 2 dams, 26 and 6 feet.
2. Union Mills, 15 miles; dam, 14 feet.
3. Salmon Falls, 16½ miles; dam, 10 feet.
4. Box Mills, dam, 11 feet.
5. Moderation, dam, 12 feet.
6. Bonny Eagle, dam, 10 feet.
7. Steep Falls, dam, 12 feet.
8. Hison Falls, natural fall of 80 feet.

Little Ossipee: 2 dams near mouth; Ossipee Falls, 1 dam, 7 feet; Newfield, 1 dam, 9 feet; Newfield, 1 dam, 10 feet; North Shapleigh, 1 dam, 12 feet; North Shapleigh, 1 dam, 11 feet; North Acton, 1 dam.

Great Ossipee: Kezar Falls, 1 dam.

MOUSAM RIVER.

18 dams, as per plan.

SALMON FALLS RIVER.

Main River: 1 dam, 19 feet; 1 dam, 22 feet; 1 dam, 19 feet; 1 dam, 33 feet; 1 dam, 33 feet; 1 dam, 33 feet; 1 dam, 8 feet.

Tributary: 1 dam, 17 feet; 1 dam, 20 feet; 1 dam, 20 feet; 1 dam, 20 feet.

B—OBSTRUCTIONS IN THE TRIBUTARIES OF LAKE CHAMPLAIN.

By M. C. Edmunds.

Weston, Vt., *November* 22, 1872.

Dear Sir: In accordance with instructions from you under date of July 26, 1872, I proceeded to make examinations of the rivers in Lake Champlain Valley and the south shore of Lake Ontario. In proceeding to the work, I took up first in order Lake George. This lake is situated to the west of Lake Champlain, and in an obtuse angle to its flow northward. It is thirty-six miles long, and from one to three miles wide. It is principally made up of large springs at the bottom of the lake; some of the springs are very large, covering an area of one-half acre or more. High mountain-ranges extend on either side, from which issue small brooks and rivulets from three to five miles long, only one of which is sufficiently large for manufacturing-purposes. The water-shed of this lake is quite limited in extent, as the mountains shut in close upon the water's edge, and the streams are consequently rapid and precipitous. The lake debouches into Lake Champlain at a point near the village of Ticonderoga,* N. Y., and descends over high, perpendicular falls and roaring cataracts, 250 feet, in a distance less than two miles. No salmon or migratory fish was ever known to be in this lake, and the reasons are quite obvious, in the presence of the falls mentioned above.

I gave but little notice to the streams emptying into this lake in view of the foregoing facts, and can say only this in conclusion, that there would be little feasibility in introducing the migratory fishes. The probabilities are that it never could be stocked with these fishes without an enormous outlay for fish-ways. It is, however, one of the finest inland waters of America for the breeding of fish, because of the purity of its water. For all of the fresh-water *Salmonidæ* it is *especially* adapted, and is now, as formerly, largely inhabited by them.

I took up next in order the inspection of Lake Champlain and its tributaries, not visiting, however, any localities south of the junction of Lake George with this lake, owing to my previous knowledge of the marshy condition of the country surrounding the immediate portion of that part of the lake.

No rivers of any importance debouch into this lake between Ticonderoga and the mouth of Otter Creek in Vermont. The latter river is the longest in Vermont, and rises in the southwestern portion of the State, flowing northwesterly, and empties into the lake at about 44° 20′ north latitude. Eight miles from its mouth, at or near the city of Vergennes, is situated a natural fall 35 feet in height, over which no salmon was ever known to pass. I found that salmon frequented the river at

* See map.

an early day as far as the falls at Vergennes, although not in such abundance as in the rivers farther north, this being the most southerly river, formerly inhabited by the salmon, on the lake.

The knowledge of their once having been in the river is traditional, as I know of no writers in later or earlier times who have made a record of the fact. What information I obtained with regard to this river was from persons who had heard their grandfathers' stories about catching salmon in the Otter Creek below its falls. The present condition of the river offers no very promising inducements for beginning the experiment of restocking the same with salmon; yet, with a suitable fish-way over the falls, favorable results might follow the experiment, as the character of the water is such as to warrant a belief that much might be accomplished in this direction. From this point of observation, I journeyed northward to the Boquet River, which empties into the lake nearly opposite the city of Burlington, Vt. This river rises in the Adirondack Mountains of New York, in the famous John Brown tract. It flows northeasterly, through a mountainous region, until it reaches Willsborough, where is situated a high natural fall. From this point three miles from the lake, the river is navigable for the largest vessels, and it is said that in former times it was largely inhabited by the salmon.*

There is a small stream emptying into the river at Willsborough, called Willsborough Brook, rising in the north part of the township, in Rattlesnake Pond, which would doubtless be a good stream for the introduction of salmon.

It is doubtful whether the salmon, in an early day, ever got up the main river beyond the falls at Willsborough; but, that they found their spawning-beds and special haunts below the falls in small brooks, coves, and inlets, which are very numerous, we have sufficient evidence to believe. It is told, however, that salmon formerly ascended the falls, and got a long distance up the river into the interior. If it were not for the dams and falls, which are quite numerous, the river might be restocked with the salmon. This difficulty could be easily overcome in the erection of suitable fish-ways.

The next place visited was the Winooski River in Vermont, which empties into the lake at about 44° 30′ north latitude. The Winooski (formerly Onion River) was once a fine salmon-stream, and has its source far back in the mountains of the State. About five miles from its mouth is situated a natural fall, over which the salmon formerly passed, and took a long journey into the interior. It is said that in an early day salmon were caught in large quantities at the foot of these falls; and that for days and weeks together they would be found in great abundance at this point, and at night scale the heights.

The Winooski is fed by numerous small brooks and rivulets, which afford nice fields for the growth of this delicious fish. But for this natural fall, which is now surmounted by a high dam, the stream might

* See Watson's History of Essex County, New York. Albany, 1869. pp. 351, 352.

again be successfully restocked. With the introduction of fish-ways, this difficulty could, of course, be overcome.

You are next introduced to the Lamoille River, which I regard as the most favored region in Vermont in which to begin the experiment of restocking with salmon. It is a more rapid stream than the Winooski; has more dams situated on it, yet no high perpendicular fall. Although it has many cataracts and cascades, yet not being abrupt, and the dams and falls being low, they could be easily surmounted by the salmon without the aid of fish-ways. The bed of the river being gravelly and the water clear and cold, I think it affords unsurpassed advantage for the introduction of salmon. It will doubtless be the stream upon which operations will first be commenced.

The Missisquoi River, the last of the large rivers on the east side of the lake, empties itself into Missisquoi Bay at Swanton, Vt. This river is partly a Canadian river, taking its rise in the southeastern townships of the Lower Canadas, and flows southerly into the State of Vermont, and then in a westerly direction to the lake. This stream was once a great salmon-stream, like the others mentioned; and in an early day the salmon ascended the river nearly fifteen miles, to what is now called Highgate Falls. Over these falls no accounts are had of salmon passing, and I question very much their ability to do so, as the fall of water is somewhat perpendicular, and from 18 to 20 feet in height. There is only one dam between the mouth of the river and Highgate Falls, over which an easy fish-way might be constructed.

From the mouth of the river to Highgate Falls, several small streams debouch into the river, wherein the salmon would find suitable spawning-ground. This river is only second in importance to the Lamoille as a salmon-stream.

The next streams visited were the Saranac and Salmon Rivers, on the west side of the lake, in the State of New York. The Saranac River, which empties itself into the lake at Plattsburgh, is one of the finest rivers, comparatively speaking, in the whole Lake Champlain Valley for salmon, but, unfortunately, full of high impassable dams,* which, in connection with the shallowness of the water below them, render fish-ways in a measure impracticable. Twenty miles up this river, at Russia, are situated the Great Falls of the Saranac. These are a succession of falls, some of which have a perpendicular height of 35 feet. Large stories are told of the abundance of salmon inhabiting this stream at an early day, and I have no doubt that they were all true from what I saw of it. Mr. Fouquet, the proprietor of the Fouquet Hotel at Plattsburgh, informed me that his grandfather related the fact that he had seen immense schools of salmon making into the mouth of this river in his day, in such abundance as to completely fill the river, rendering their capture by the *cart-load* an easy matter. The last salmon known to have been caught upon this stream was in the spring of 1824.

* See Saranac River Fisheries—*People vs. Platt*, 17th New York Law Reports. Johnson, 1819.

Four miles south of Plattsburgh, a small stream, twenty to thirty miles long, called Salmon River, debouches into the lake, deriving its name from the abundance of salmon formerly caught there. This river has upon it a series of dams, almost innumerable. These are so high and in such close proximity to each other that there is no practicability in introducing salmon or any other of the migratory fishes. From an early day to within a few years, it has been largely used as a manufacturing stream, but an apparent decrease in the quantity of water indicates that it will not continue to afford the manufacturing facilities heretofore enjoyed.

I noticed several high dams that were going to decay, and which I am told will never be rebuilt. Should the time arrive when the stream will be free from these dams, or to such a degree that fish-ways would be practicable, I know no reason why the stream may not again be stocked with the valuable fish from which it derives its name. A Mr. Jones, living upon the bank of the river four miles from its mouth, informed me that so plenty were the salmon in an early day that a twenty-pounder could be bought for a "plug of tobacco;" that when a boy he saw his father take a one-horse load of salmon from the stream in the morning before breakfast, with no other implement than a common "pitchfork."

The next rivers in order of inspection were the Little and Big Chazy, the former of which I did not examine very closely, as it was never much of a salmon river, and is now obstructed with high, impassable dams. Of the Big Chazy, emptying into the lake two miles south of Rouse's Point, I made a thorough inspection, and think it the best river on the west side of the lake in which to begin experiments.

This river was the only one marked by Champlain on his discovery of the lake as in any way noted for its salmon-fishery. At or near where is now located the village of Champlain, he noted on his chart of the lake, "Salmon-Fisheries," it being doubtless the place where their greatest numbers were found. This river is navigable five miles from its mouth; and, although there are a great number of dams above this point, they are so low that they could be easily overcome by the salmon in their ascent of the river.

It is within the recollection of some of the older inhabitants on this river when the salmon ceased their annual visits to the Chazy; and it is their opinion that it was neither dams, sawdust, or other obstructions in the river that caused them to forsake it, but that the *last fish* coming into the river was caught.

From the Chazy I proceeded to St. John's, Province of Quebec, for the inspection of the Richelieu.

The Richelieu River proper begins here, although many ascribe its source at or near a point between the United States and Canada, by reason of the lake contracting itself into a channel not much wider than a large river; yet I think it must be conceded that the river commences at St. John's, twenty-three miles farther north of the line between the two countries. My reasons for this opinion are that at St. John's the

river contracts itself into quite a narrow channel, flowing over a gentle inclination, sufficient to cause a slight ripple in the water, and thus leaves no doubt of its river character.

St. John's is the head of navigation on Lake Champlain, and it is at this point where a ship-canal begins and from here extends twelve miles northerly to Chambly, where it terminates in the river again.

The Richelieu from St. John's to Chambly is quite a rapid stream, running at an average rate of speed of four miles per hour.

At Chambly, the river widens into a large basin or small lake, and from this point to the Saint Lawrence it is navigable for the largest class of vessels.

The character of the river between St. John's and Chambly is such as to admit of the passage of all the migratory fishes coming from the sea, and they will find an easy ascent into the lake. There are just below St. John's three eel-weirs, the first being of stone and the second and third of wood.

I am told it is quite a successful weir or trap for catching eels, as also for occasionally impounding fish. This whole structure, however, is measurably destroyed every spring by the ice in the river, and has to be rebuilt every season. I was assured by the Canadian government that these obstructions should be removed if they offered any hinderance to the free passage of the migratory fishes. They would doubtless afford no serious objection to the early run of salmon; but for the late run of shad or salmon, they would prove a great barrier.

I am of the opinion that an order should issue from the Government at Washington asking that these obstructions be removed, or that they should not be rebuilt after the summer of 1874 or of 1875, so that the shad and salmon placed in Lake Champlain in the years 1872 and 1873 may find an easy and safe descent to the Saint Lawrence.

The authorities at Ottawa gave me the most positive assurance that nothing should be wanting on their part to insure success to the project which our Government has in hand of restoring to Lake Champlain and its tributaries the migratory fishes. It is the opinion of some, however, that these weirs offer no serious objection to the ascent and descent of fish, as the smelt surmount them every year on their return to the lake. And if smelt can successfully pass them, why not the shad and salmon? Perhaps this may all be true, yet I should regard them as dangerous traps to the descending fish.

Farther down the river, there exists an occasional dam extending into the river about midway, but which offers no obstruction to the free passage of fish.

At Chambly, just before the river debouches into the basin before mentioned, there exists what are called the Chambly Rapids; these rapids extend up the river a distance of from one to two hundred rods, the river being quite wide and shallow at this point. They are never known to freeze over during winter, and it is here that the smelt may

be seen in great abundance in their midwinter journey to the lake. In view of the foregoing facts, it is readily seen that no serious impediments exist to the ultimate success of restocking Lake Champlain and its tributaries with the salmon.

I think the lake is well adapted to the introduction of these fishes, with its numerous rivers and brooks, coves and inlets, wherein these fish would find nice spawning-ground, or where they might be easily caught and artificially propagated to an extent that would make them as plenty in the future as in the past.

I am of the opinion that in former years the salmon never got up the large rivers into the interior of the country to any great extent, but that they found their fields for propagation around the mouths of the large rivers and in the coves and inlets of the lake. I reason thus from the fact that nearly or quite all of the large rivers have high natural falls upon them from five to fifteen miles inland, over which it would be impossible for salmon to ascend; and that their abundant increase in the lake was solely due to the nice gravelly coves and inlets so abundant along the shore of the lake and up the mouths of the large rivers. Many of the large rivers formerly noted for salmon have these coves to a great extent, while others have nice gravelly bottoms in their main channel near their mouths, that afforded a nice place for the salmon to deposit and protect their spawn through the incubation and hatching period.

Some of the bottoms of the rivers appear to have a peculiar slaty appearance, and the rivers are remarkable for their freedom from any sediment which might impair their facilities for salmon-breeding. The Saranac, Chazy, and Missisquoi Rivers are especially noted for this appearance.

The west shore of the lake north of Bulwagga Bay to the mouth of the Big Chazy is alternately rocky and gravelly, and the same is also true of the shore north of Shelburne Bay on the east side, while south of these points the shores are clayey, and the salmon formerly were never found. History does not record the fact that they ever existed in the lake south of 44° 20′ north latitude.

SAINT LAWRENCE RIVER AND LAKE ONTARIO.

The salmon formerly were very plenty along the southeast shore of the Saint Lawrence, inhabiting the lower reaches of the Chateaugay, St. Regis, Racquet, and Grass Rivers emptying into the Saint Lawrence within the Canadian Dominion, as also the Oswegatchie in the State of New York. Of these streams I took but little notice, but passed on to the inspection of the rivers immediately debouching into Lake Ontario proper.

Of these, first in order I inspected the Black River and Chaumont, both of which I found to have been formerly inhabited by the salmon. Neither of these rivers at the present offers any inducements for the introduction of the salmon, by reason of high and impassable dams.

Both of these streams at their outlets into the lake are susceptible of being made quite profitable fields for salmon-breeding could the trap-weirs and pound-nets be permanently excluded; but these are so plenty, and the fishermen so lawless, that it would be useless to begin any experiments here.

My attention was next directed to the Big Sandy Creek and Salmon River in Oswego County. The former of these ceased long ago to be a salmon stream, and received but slight notice at my hands, while the latter claimed my *special* attention, being the first river which I have yet found in all my travels in which the salmon are now found. I inspected the river several miles from its mouth upward, and found it all the way admirably adapted to the growth of salmon. There are several dams situated on the river, but so low and in such favorable localities as to give easy passage to the salmon. I found, on inquiry, the fact that several salmon were caught below and above the dams last fall, and that several were caught below the dams early the past summer. I think this, above all streams heretofore seen, to be the best calculated to commence the breeding of salmon artificially. It is quite evident that they ascend the river above the dams, and when above have a wide range and are free from the attacks of all predatory fish. An establishment might be built upon some favored locality above the dams where the process of artificial propagation could be begun and successfully prosecuted. I noticed several streams where such an institution might be begun, and where as favorable results could be effected as those attending the experiments of Wilmot at Newcastle, Ontario. There are no trap-weirs or pound-nets, as I am informed, in the mouth of the river to prevent the salmon from entering the same with safety. The people in this locality are all kindly disposed to aid and assist this project, and are quite anxious that experiments should be commenced here.

After leaving this river, I took up next in order of inspection the Oswego. This river has its source in the interior lakes of Central New York. It was also once a very noted salmon stream, and salmon ascended into the Cayuga and Seneca Lakes; but the canal, which extends from Oswego to Syracuse, follows nearly the whole course of this river, debouching into it, thus making it unfit for a salmon stream.

I visited several other small streams between this point and the Genesee, at Rochester, and found them equally well-noted salmon streams, as also the Genesee, as far as the falls, together with all streams between that point and the Niagara.

None of these streams visited are now inhabited by the salmon, but the testimony of all with whom I had any conversation on the subject confirmed the fact that they once had been salmon streams of greater or less celebrity. Their testimony all went to show that the last salmon that had ever inhabited these streams had been caught, and that neither sawdust nor other foreign matter had aught to do in their extermination.

It is a fact too apparent to need further confirmation that the trap and pound-nets have entirely exterminated this fish from the south shore of Lake Ontario. They have been set in the mouths of nearly all the rivers emptying into the lake, and consequently the fish have become an easy prey to the fisherman.

In conclusion, I would say that I found the Saint Lawrence to have once been inhabited very largely by the salmon, and it is the opinion of the inhabitants living along its banks that it might again be stocked.

Respectfully submitted.

M. C. EDMUNDS.

Prof. SPENCER F. BAIRD,
Smithsonian Institution, Washington, D. C.

C.—OBSTRUCTIONS IN SOME OF THE RIVERS IN VIRGINIA.

BY M. MCKENNIE.

UNIVERSITY OF VIRGINIA, *October* 2, 1872.

MY DEAR SIR: Your esteemed favor of 30th ultimo came duly to hand on yesterday. As you are aware, I have been much interested in this question for several years, but I fear that little can be done until some cunning leech is able to apply some plaster to our people which shall arouse them to a sense of their duty to themselves and their children. The project started in a small way by the legislature of 1870–'71 was dropped by that of 1871–'72.

In reply to your inquiry, I beg to state that, on James River, the first dam above Richmond* is 9 miles above that city.

The Appomattox is closed by a dam one mile above Petersburgh.

The Rappahannock is closed by a dam one mile above Fredericksburgh. The Rapidan is a tributary of Rappahannock.

The Pamunkey and Mattapony unite to form the York, and not far above their junction these streams are closed.

The Potomac is free pretty high up. Black bass have been caught in the Shenandoah at Port Republic, which place they have reached by going over the low dams which exist below that point.

The Chowan is also closed a very short distance above its proper mouth at the head of tide-water. The Roanoke is closed at no great distance from Weldon.

By introducing the fish into New River, or the Greenbrier, near Ronceverte, on the Chesapeake and Ohio Railroad, the headwaters of the Ohio might be stocked, if the length of the Mississippi and Ohio do not prove an obstacle to the ascent of the fishes to their spawning-grounds.

I am, yours, truly,

M. MCKENNIE.

THADDEUS NORRIS, Esq.,
Philadelphia.

* Richmond is at the head of tide-water.

D—CHARACTER OF THE STREAMS ON THE NORTHERN SHORE OF LAKE MICHIGAN.

By J. F. Ingalls.

Waukegan, Ill., *August* 23, 1872.

Dear Sir: I have gathered some information in regard to the rivers emptying into Green Bay, and also of some of those which empty into Little and Big Bays de Noquet and Lake Michigan. Some of them were visited by myself, and others by reliable parties, who gave me the information. I think the following report is essentially correct.

PENSAUKEE RIVER.

The length, following the course of the river, is seventy-five miles; it is rapid, clear, and comparatively cold, with sandy and gravelly bottom, and in some places rocky; the banks are high, except near the mouth where there are marshes; the depth, except near the mouth, is from two to three feet. There is one water-power mill about one mile from the mouth.

OCONTO RIVER.

This river has a length of about one hundred miles. There are marshy shores extending up the stream for about three miles from the mouth; it is comparatively dead water for about one mile from the mouth, which has a width of about 150 feet. Above the marshy region is a considerable stretch of the river, having an average depth of 6 feet; farther up are rapids and shoals, with gravelly bottoms, the water being clear and cold. There are seven steam-mills at the mouth; about twenty miles up the river is a mill-dam, which does not reach entirely across; and above this, there are a few driving-dams, which are open except in the spring.

PESHTIGO RIVER.

The length is about seventy-five miles; its shores are marshy at the mouth, where it has a width of about one hundred and fifty feet. Above the marsh are high wooded banks, and the river is clear and cool, with sandy and gravelly bottom and frequent rapids. There is one steam-mill at the mouth, and one water-mill with a dam eighteen miles above at Peshtigo Village.

MENOMONEE RIVER.

The length of this river, measuring either of its branches, is about one hundred and fifty miles. One and one-half miles from the mouth are rapids, and in the shoals are placed three log-dams, with open chutes at the sides for the passage of logs. Thirty miles up the river is Grand Rapids, with thirty feet fall in two miles. Fifty miles above these are the White Rapids; twelve miles above the latter are the Pemina Falls, with a nearly perpendicular descent of thirty feet. Twenty miles above these are the Sturgeon Falls, with a descent of forty

feet, in which are log-chutes, overcoming about six feet of the descent. Fifteen miles above these are the Lower Quinesec Falls, having a descent nearly perpendicular of sixty feet. A series of rapids extends above this for two miles to the Big Quinesec Falls, which have an almost vertical fall of eighty feet. For the next forty miles along the Brulé branch, the water is very rapid, and beyond this the surface is level.

The Michigaumee branch is very rapid, and heads in Lake Michigaumee. The Mequacumicum branch is also very rapid, and heads in small lakes. Below Quinesec are two large branches of rapid water on each side. The banks of the streams are generally high and rocky, and for a great part heavily timbered. The river at the mouth is about one-third of a mile wide; above the first falls, it is about one hundred and sixty yards wide. There are ten steam-mills at the mouth.

CEDAR RIVER.

The length of this river is one hundred miles. Its width at the mouth is about one hundred and fifty feet; two miles above the mouth, it has a depth of eight feet; above this, it is shoaler, with rapids; the first rapids have a descent of fifteen feet in one-half mile; above this are occasional rapids; then a slower current, with a sandy bottom; and again, rapids, with a rocky and gravelly bottom. The waters are clear and cold; the banks are high and heavily timbered. There is one steam-mill at the mouth, and three log-dams higher up the river.

BARQUE RIVER.

This stream is about fifty miles long; its width at the mouth about forty feet. There is scarcely any current for about one-fourth of a mile; above this, it is rapid, with a stony bottom for about one-fourth of a mile; then, for two miles, deep quiet water, about six or eight feet deep, with, in many places, marshy shores; above this, it is rapid, with high banks, and heavily timbered. The water is clear and cool. There are no mills on the river.

FORD RIVER.

This river has a length of about one hundred and twenty-five miles; its width at the mouth is one hundred and fifty feet; it has a depth for two or three miles of about three feet; above that, it is shallower, with occasional rapids. It has high banks heavily timbered. There is one steam-mill at the mouth, and no dams on the river.

ESCANABA RIVER.

The length of the river is about seventy miles; its width for fifteen miles above the mouth is about seventy-five feet; rapids and a mill-dam are found three miles above the mouth; above the dam the river runs over a flat ledge; it has high banks, and is heavily timbered.

WHITEFISH RIVER.

Its length is about seventy miles; its width fifteen miles from the mouth about seventy-five feet; it is rapid and runs over rocky bottom and sandy flats; there are no mills; the shores are covered with heavy timber.

STURGEON AND FISH DAM RIVERS.

These streams are very similar in character to the Whitefish River.

MONISTIQUE RIVER.

The length of this river is about seventy-five miles; it has sources in large lakes; its width at the mouth is about one hundred and fifty feet; forty rods from the mouth there are rapids and a mill-dam, and still higher up marshes and lakes.

SEUL CHOIX RIVER.

This is a small brook, six miles west of the point, twenty feet wide; it is rapid and about twelve inches deep; it heads in a lake one and one-fourth miles from Lake Michigan, and runs through dense swamps.

There is another small stream three miles north of Seul Choix Point; it is twenty-five feet wide at the mouth; there are six inches of water on the bar outside; it is shoal and rapid; on the upper portion, there is heavy timber; it heads in a lake four miles from the mouth.

One-half mile farther east is a small stream thirty feet wide at the mouth; it flows over flat limestone rock into Lake Michigan; it widens to about one hundred feet, and beyond this higher up it is shallow, rocky, and rapid; heavy timber covers the banks; it heads in a lake; it is deep enough at the mouth to float a small boat.

The more northerly streams I have mentioned are clear and cold. The fish inhabiting all of them are principally pike, dory, pickerel, perch, sturgeon, black-bass, catfish, and sunfish.

I cannot recommend the Pensaukee or Oconto for salmon. The Peshtigo is a good river if the dams can be overcome. I would judge all of the others to be favorable for the experiment.

J. F. INGALLS.

J. W. MILNER, Esq.

E—CHARACTER OF SOME OF THE NORTHERN TRIBUTARIES OF LAKE MICHIGAN.

BY JAMES W. MILNER.

The streams here referred to tributary to Lake Michigan I have not explored, but have gained some knowledge of their character from inquiry.

The letter from Mr. J. F. Ingalls contains full information about the more nothern rivers. The rivers here referred to are not in his list.

The Pine River, emptying at Charlevoix, which I ascended fifteen miles,

heads in the Jordan River, which is a very cold, rapid stream, containing the *Thymallus tricolor*, of Cope. The mouth of the Pine is a sharp rapids.

Elk Rapids, though emptying a large quantity of water into Grand Traverse Bay, would probably not be favorable for salmon, as it heads in a series of large lakes.

The Carp River.

The Betsey River.

The Manistee is a large, long river, emptying through a lake and a bay. The headwaters are very cold, and contain the grayling. There are twenty-eight mills, all steam, built on the shore of the lake, and an immense number of logs are rafted down every year. I believe the sawdust at the mouth would not be as objectionable for salmon as for whitefish, as I suppose they frequent the milling-rivers in Maine and along the Canada shores.

The Muskegon is another large stream containing the grayling, which is, I suppose, an indication of its being clear and cold.

There are other streams farther south; but the northern streams are probably most favorable for salmon.

The Escanaba River should be considered very favorable.

The Monistique is a favorable river if the steam saw-mill is left out of consideration.

The Pine River is especially favorable; it has a very sharp rapid at its mouth. The Jordan, at the head of the south arm of Pine Lake, would be a most favorable spawning-ground, as no dams obstruct the passage of the fish to its headwaters.

The Manistee has, perhaps, too many mills, and has also a large expansion into a lake not more than two miles long. Its broad waters would, undoubtedly, be favorable spawning-ground.

Blank page retained for pagination