

61.—REPORT UPON THE RESULTS OF SALMON PLANTING IN THE HUDSON RIVER.**By FRED MATHER.**

In compliance with instructions from the U. S. Commissioner of Fish and Fisheries, dated July 11, 1888, I made, during the summer and fall of 1888, an examination of the Hudson River from its mouth to the tributary trout streams of Warren County, N. Y., with a view of ascertaining the number of adult fish captured during the last season, and the possibilities of taking salmon eggs in sufficient numbers to warrant the establishment of a temporary station for this purpose; with the object of learning the character of the small streams, and determining which give promise of the best conditions for developing the young fish during their river life; and also for the purpose of obtaining information respecting the height and character of the natural and artificial obstructions to the ascent of salmon. The results of these investigations are herewith presented.

PLANTINGS OF SALMON.

With the exception of some quinnat, or chinook, salmon planted in the Hudson ten or a dozen years ago by the New York Fishery Commission, which have never been heard from, I believe that all the plantings of *Salmo salar* in the river have been made under my immediate supervision.

In 1880 I suggested to the late Prof. Spencer F. Baird, then U. S. Commissioner of Fisheries, that the streams of the upper Hudson had all the requisites for growing young salmon, and he agreed with me that it might be possible that the river had never been a salmon river because of the natural obstructions to the ascent of the parent fish. On January 16, 1882, I was ordered to try to obtain a hatchery near New York City for the purpose of hatching salmon for the Hudson, and secured one from Mr. Thomas Clapham, at Roslyn, on the north side of Long Island, about 23 miles from the city, and in the spring planted 225,000 fry in the streams of Warren County, as well as some in other waters.*

In January, 1883, I was appointed superintendent of the new hatching station of the New York Fishery Commission at Cold Spring Harbor, Long Island, and transferred the work of salmon hatching there, where it has since been conducted.

* Rept. U. S. Fish Commission, 1882, p. 876.

The following plants have been made in the tributaries of the river :

1882	225,000
1883	244,900
1884	385,700
1885	*319,100
1886	297,573
1887	140,450
1888	440,000
Total	*2,052,723

Where the odd figures occur I would explain that there was no pretense to actual count, but from the measured number of eggs there was an actual count of the losses of eggs and fry, my men being instructed to keep such a record, and the loss being deducted left odd numbers, which were always added in the last shipment, except in cases of loss in transportation, when they were deducted from that particular shipment.

The streams in which the fry were placed are good trout streams, but there exists great confusion as to their names; for instance, while on this investigation, I asked Nat. Bennett, a well-known Adirondack guide, where "Roaring Brook" was, and he said that it was only another name for "Thirteenth Brook." This happened at the North River Hotel, and the latter brook empties into the Hudson about 100 yards above, while others said that "Roaring Brook" was a tributary of North Creek. As it will be found that a brook by this name was stocked in four different years, I can not say which one received the two plantings of 1883, made by O. B. Hewitt; nor that in 1884, by F. A. Walters, because the men are no longer in my employ, and I do not know their addresses. The plantings in "Roaring Brook," made in 1886 by C. H. Walters, and in 1888 by O. V. Rogers, were in the stream emptying into North Creek. Depending, as we must, on the natives for the nomenclature of these little mountain streams, we find that the names are much mixed, and the maps do not name these little brooks. My foreman, C. H. Walters, tells me that Eldridge Brook, stocked by him in 1886, is the stream also known as "Balm of Gilead," and that it had two plantings in that year in consequence of its double name. I have now a better knowledge of the smaller brooks, and will try to avoid confusion of this kind in the future. The following is a list of the brooks, with the numbers of salmon placed in them:

Carr's Brook, also called "Deleby Brook," which comes into the Hudson from the east, a mile or two above North Creek, the northern terminus of the Adirondack Railroad, is a good trout stream, and is one of the best

* And 150 yearlings.

for planting salmon, as it contains insect larvæ and crustaceans in apparent plenty. It received the following plants:

1882	35,000
1883	49,800
1884	39,200
1886	119,600
1887	49,000
1888	50,000
Total	342,600

Glen Brook flows in from the west at the station of the Adirondack Railroad called The Glen, and is some 20 or 30 miles below North Creek. It received 50,000 in 1882 and 39,000 in 1884. It is said to be a good trout brook.

Balm of Gilead Brook, also known as "Eldridge Brook," is a fine stream which comes into the river from the west, half a mile below the village of North River, and received the following plants:

1882	40,000
1883	49,700
1884	39,000
1886	*58,973
1886	*59,800
1887	49,700
1888	50,000
Total	347,173

Raymond Brook.—This is a good stream, which comes in from the west, 2 or 3 miles above North Creek and below Balm of Gilead; it appears in the earlier reports as "Raymont." It had:

1882	45,000
1883	39,000
1884	38,000
1885	49,800
1886	49,500
1888	50,000
Total	271,300

Roblee Brook.—This is not a good stream, because the lower portion is dry in summer. It runs through the village of North Creek and is a strong stream most of the year. In 1888 it had 50,000 fry, but I would not recommend it for future stocking. There is another brook by this name which comes into North Creek.

North Creek.—This is a good stream. It has a dam and a tannery at its mouth, in the village of the same name. It directly received:

1884	38,900
1887	41,750
1888	55,000
Total	135,650

*These two plants were made in the same brook, owing to the confusion of names by the residents in recommending it.

Besides this it had plants in one of its tributaries, known as Roaring Brook, given below.

Roaring Brook.—This stream is referred to on page 410, and I have reason to believe that all the plants made were in the tributary of North Creek, and not in Thirteenth Brook. Those of 1886 and of 1888 certainly were. The stream received:

1883.....	*67,400
1884.....	38,800
1886.....	59,800
1888.....	50,000
Total.....	216,000

Thirteenth Brook.—A rapid stream, which comes from the west and empties at the village of North River. It is sometimes dammed for logging purposes, but was avoided on the years when it was so used. It received:

1885.....	†79,900
1888.....	50,000
Total.....	129,900

Beaver Meadow Brook is a tributary of Indian River, which enters the Hudson in Essex County. The brook crosses the stage road from North River to Blue Mountain Lake, about 8 miles from the former place, and if the roads were better in the spring this would be a good point of deposit. In 1883 there were 39,000 salmon planted in this stream.

Indian River received 36,200 in 1884.

Minerva Brook was stocked in 1888 with 35,000 salmon at Olmsteadville, Essex County. It is a tributary of the Schroon River, which enters the Hudson at Warrensburgh, some 20 miles, as the crow flies, below, but by the course of the river is nearly double that distance. This stream is a celebrated trout brook, and I strongly recommend it for salmon.

Loon Lake empties into the Schroon at Starbuckville, Warren County, and received 38,600 salmon in 1884. I am not certain that lake plantings are good for these fish. I prefer mountain brooks.

Gulf Brook and Hokum Pond received 55,000 fry in 1882. Hokum Pond is in the town of Johnsburgh, Warren County, south and west of the village of North Creek. Its outlet is Mill Brook (not Mill Creek, in same county), which is tributary to North Creek. Gulf Brook empties into Mill Brook near the outlet of Hokum Pond.

Kelso Brook was stocked with 37,000 in 1884. It empties into Minerva Brook a mile above Olmsteadville, in Essex County, and is therefore tributary to the Schroon River. Another stream with the same name empties into Carr's Brook in the town of Chester, Warren County.

Cedar River comes from the southwest and joins the Hudson in Essex County, about 3 miles above the point where Indian River comes in.

* Two plants.

† In the reports this plant was credited to North River.

It rises in the Cedar Lakes, near the middle of Hamilton County, and flows northeast. Within a mile or two of its source, the West Canada Creek rises and flows off southwest to the Mohawk, and the south branch of Moose River, another tributary of the Mohawk, via Black River, rises within a mile and a half of the Cedar. In 1885 I made a plant of 59,900 salmon in the Cedar, where the stage road from North River to Blue Mountain Lake crosses it, just beyond the village of Indian Lake. There was no logging on the stream that year, and the fish could have a run of a dozen or more miles up the river.

Clendon Brook flows into the Hudson about 5 miles above Glens Falls and is an excellent stream for salmon. I have already recommended this stream, and at a meeting of the American Fisheries Society, in Washington, have shown young salmon from it which were caught and sent by Mr. A. N. Cheney, who, I think, also sent some to Mr. E. G. Blackford. It is a good trout stream, and is protected by its owners against public fishing. On the 23d of August, 1888, in company with Mr. Cheney, I visited the brook and we fished it for about half a mile. In an open spot we took a few chubs and a few little trout, which we returned to the water. Following down the stream, through a dense growth of alders, we found a pool in which was a school of perhaps twenty fish, which Mr. Cheney said were salmon, and on casting his fly in it he took one, which proved to be a salmon of 7 inches in length. In another pool he took a second one, and by letting my fly drift down under the brush, leaving the rod back on the ground and holding the line in my hand, I brought one up where I could identify it before it broke loose. Mr. Cheney's fish were both returned to the stream. We then stopped. I had seen enough to assure me that the fish were there in numbers.

Clendon Brook has received the following plants :

1884	41,000
1885	*59,700
1886	19,700
1888	50,000
Total.....	*170,400

I can strongly recommend this brook for future plantings. It not only is a good stream for rearing the fry in, but is below several of the falls, especially the great one at Jessup's Landing, which is a formidable one for a fish to go over, but which is dry in summer, owing to the water being used in the great paper mill at that place. (See account of Palmer's Falls, under the head of "Dams and obstructions.")

When I began the work, Professor Baird left the selection of streams to me, as I had a slight knowledge of the Adirondack region, but some of the brooks I did not know and depended on the opinions of the natives, judging that if they were good trout brooks they would do for

* And 150 yearlings.

salmon. I am, however, more indebted to Mr. Cheney than to any other man, for this information, as well as that respecting the dams and obstructions lower down, as he has fished that country very extensively, and is one of our best-informed anglers. Stoddard's excellent map of the Adirondacks was also of use, but its scale does not permit the naming of the smaller brooks.

Recapitulation of plantings since 1882.

Carr's Brook.....	342,600	Beaver Meadow Brook.....	39,000
Balm of Gilead Brook.....	347,173	Roaring Brook.....	216,000
The Glen Brook.....	89,000	Clendon Brook.....	*170,400
North Creek Brook.....	135,650	Thirteenth Brook.....	129,900
Raymond Brook.....	271,300	Indian River.....	36,200
Gulf Brook.....	55,000	Cedar River.....	59,900
Roblee Brook.....	50,000	Loon Lake.....	38,600
Minerva Brook (including Kelso).....	72,000	Total.....	2,052,723

CAPTURES OF SALMON.

Up to 1888 it may be fair to consider only the three first plantings, which comprised 890,000 fry. In 1886 several salmon were taken, one by John B. Denyse, in Gravesend Bay, and three at the Troy dam, the weights ranging from 10 to 14½ pounds.† It has been estimated that a dozen or more were taken in that year by the fishermen. Mr. Blackford bought the salmon caught by Denyse, and displayed it on his stand, where it attracted great attention as a Hudson River salmon.

In 1887 many "North River salmon" were sold in New York, and were reported to have been taken up the river, although I know that some were taken in Gravesend Bay. On November 1 of that year a spent male salmon was taken at Port Monmouth, N. J., and sent to Mr. Blackford. It was very poor, and while it measured 2½ feet in length it weighed but 7 pounds. The hook on the jaw was slight, and the sides were blotched with red, as is usual with a ripe or spent male.

This year, 1888, I have met with some difficulty in interviewing the shad fishermen, who are the ones who catch them, because of a New York State law, enacted during 1887, which forbids their capture, except with hook and line. The law is as follows:

CHAP. 530, LAWS OF NEW YORK.

AN ACT for the protection and preservation of salmon in the waters of this State.

Passed June 6, 1887, three-fifths being present.

The people of the State of New York, represented in senate and assembly, do enact as follows:

SECTION 1. No person shall at any time kill or catch, or attempt to kill or catch, salmon in the waters of this State with any device, or in any manner, save that of angling with line or rod held in hand.

SEC. 2. No person shall catch, or attempt to catch or kill, any salmon in said waters save only from the first of March to the fifteenth day of August in each year.

* And 150 yearlings.

† Rept. U. S. Fish Commission for 1885, foot-note to page 110.

SEC. 3. Any person using nets in that part of the Hudson River within the jurisdiction of this State, in fishing for other fish allowed to be taken therein by nets, shall upon catching any salmon immediately return and restore the same to the water, without injury. The foregoing provisions are not to apply to the operations of State or public hatcheries or to the artificial propagation of said fish by State or public authority.

SEC. 4. Any person violating any of the foregoing provisions of this act shall be deemed guilty of a misdemeanor, and, in addition, shall be liable to a penalty of one hundred dollars or one day's imprisonment for each dollar of fine; any informer to receive one-half of said fine. Actions for any violation of this act may be brought before any justice of the peace in any county which borders on the river or water opposite where the offense was committed, without regard to channel boundaries.

SEC. 5. All acts inconsistent with this act are hereby repealed.

SEC. 6. This act shall take effect immediately.

Being assured that the information was desired for the use of the U. S. Fish Commission, in order to judge of the expediency of continuing the planting of salmon fry in the Hudson River, many records of captures were obtained, and they are all supposed to be authentic. The names of the fishermen who took them incidentally in their shad nets, in New York waters, are omitted.

Gravesend Bay.—The largest number of salmon taken by one man, which has come to my knowledge, is ten. These were captured in fyke nets set for shad in Gravesend Bay, which is a part of Lower New York Bay, between May 9 and 29. They averaged from 9 to 12 pounds each, the largest weighing 19 pounds. Eighteen more fish were taken in the same bay, making twenty-eight in all. Seven were caught by one person, four by another, three by a third, while four men took one fish each.

New York Bay.—There were twenty fish taken in the bay, weights not given. The following men took them: L. Kells, Greenville, N. J., 3; H. Meserole, ditto, 4; J. Gelshion, ditto, 4; J. M. Minugh, Communipaw, N. J., 2; J. Woods, ditto, 1; J. McLaughlin, Jersey City, N. J., 1; George Griffin, Pamrapo, N. J., 2; Van Buskirk & Titus, ditto, 2; Richard Cadmus, Bayonne, N. J., 1; total, 20.

Prince's Bay.—Three fish are recorded from this water: D. Finnegan, Morris & Brown, and W. M. Morris, all of Port Monmouth, N. J., each took one.

New Jersey shore of the Hudson.—Five salmon were taken just above Weehawken by as many men or fishing partners, J. & J. Ludlow, S. & J. Ludlow, and R. Du Bois, all of Weehawken; each took one salmon, as did also Henry Scott, of Pleasant Valley, N. J., and Barber & Wilson, of Alpine, N. J.

From New York to Troy.—By favor of Mr. E. G. Blackford I obtained the addresses of the men who fish for shad in the Hudson, and was thereby enabled to go directly to the fishermen, which greatly simplified the work in the different cities and villages by saving the time in making inquiries for them. Mr. Henry Burden, also one of the New York fishery commissioners, helped me to many facts concerning the

catch about and above Troy. Mr. Burden has taken much interest in this matter, and was instrumental in getting a McDonald fishway put in the Troy dam by the State mainly for the passage of salmon, which had been seen jumping at the dam and had been netted below it in former years. Mr. Matthew Kennedy, of the city of Hudson, and one of the fish and game protectors of the State, as well as a shad fisherman owning several nets and employing a number of men in season, gave me valuable assistance in reporting such salmon captures as had come to his knowledge.

Matthew Kennedy says that eight salmon were taken at Hudson by two parties, and the fish were returned to the water alive. He saw the fish, and his men caught some of them. His nets were old and tender and the salmon made holes in them, but if the nets had been stronger a great many more would have been taken. If the striped bass were as plenty about Hudson as they were a dozen years ago that fish would have been credited with making the holes, but the bass are scarce now, and he believes that salmon made them, for they were too small to have been made by sturgeon. Four of these fish were taken on one day in rough weather, and Mr. Kennedy thinks it worthy of note that all the others were taken when the water was rough. They were caught between the 1st and 14th of June. The water in the river was very high up to the middle of May and but little shad fishing was done until after that date.

Stockport.—At Stockport four fish were taken, the weights of the same not being reported, and at New Baltimore three fish weighing 40 pounds, or an average of over 13 pounds each. At this point the channel is shallow and the nets are short, and salmon can escape them better than in most places.

At the following places I learned of fish being taken. The towns are given as found on my note-book, without regard to their geographical sequence. In some cases it was not possible to learn the names of the captors, nor the weights of the fish. Highland Falls, one; Mull's Fishery, seine, two, 11, 11½ pounds; Catskill Point, seine, one, 15 pounds; Cornwall, one, 9 pounds; Barrytown, drift net, two, 10¾, 13 pounds (several persons intimated that more were taken at this place but were cautious about giving information for fear of being called on as witnesses); Kingston Point, drift net, two, 10, 8 pounds; North Staatsburgh, two, 10, 12 pounds; Hyde Park, drift net, one; Elmore's Dock, drift net, two, 10, 18 pounds; Newburgh, one; Verplank's (Stony Point), three, 12¾, 11½, 15½ pounds.

Troy.—As before stated, Mr. Henry Burden kindly volunteered to get the needed information at this place, and his knowledge of men and locality enabled him to work the field better than a stranger could. I went out with him to a fisherman's floating house one day and found that the man in charge was very suspicious, and if he or his friends had

caught any salmon they were not going to expose themselves to a fine by telling it. Mr. Burden writes me as follows:

224 THIRD STREET, TROY, July 30, 1888.

MR. FRED MATHER:

DEAR SIR: The catch of salmon in the vicinity of the Troy dam for the season of 1888 was twenty-six, varying in weight from 5 to 26 pounds. This number was known to have been taken, but the person who obtained the information thinks that more were caught.

Very truly,

HENRY BURDEN.

Of the salmon in the lower river, Forest and Stream of May 17, 1888, said:

Up to Saturday last fourteen salmon have been taken in the Hudson River between Communipaw and Yonkers. The largest one weighed 10½ pounds and the smallest 8 pounds. They were taken by the shad fishermen in gill nets, and were therefore too badly injured to be returned to the water, as the law requires. The fisherman who took the fish at Yonkers did not know what it was, and on cutting it open found that it was red inside and threw it away as uneatable. The stocking of the river, begun by Professor Baird, is being continued by Colonel McDonald, and about 440,000 will be planted this spring from the Cold Spring Harbor hatchery. Over half of the fry have already been planted in the trout streams of Warren County, and the end of this week will find them all in the tributaries of the upper river. The experiment seems to be proving successful in spite of the doubters.

The Troy Times of May 26 said:

This morning W. E. Hagan, of the Fish and Game Protective Association, reported to District Attorney Griffith that a salmon had been caught at the State dam in a net. The catch of salmon in this way is a violation of chapter 530, Laws of 1887. The penalty is \$100 fine or thirty day's imprisonment, at the option of the magistrate. A fine of \$25 is also to be imposed on any person having in his possession a salmon caught in a net. The salmon was in the possession of McGrath & Laflam, fish dealers at the Fulton Market, Troy. They said they purchased the fish from William Askins, who caught it. The fish had been sold to a citizen, but when the latter was told that it would be a violation of law to receive it he declined to accept the salmon. District Attorney Griffith sent Officer Forest after Askins, who said he did not know that he had violated any law. He was admonished to refrain from fishing for salmon with a net hereafter, and as this was the first case reported, it is not probable that Askins will be prosecuted. The same law prohibits fishing in the Hudson River on Sunday, and the agents of the Fish and Game Protective Association called on Superintendent Willard and requested that the law be enforced within the city limits. The superintendent said he would direct the police to enforce the law. The salmon caught at the dam weighs 20 pounds.

Mechanicsville.—Some fish went over the Troy dam in the June rise and got up as far as Mechanicsville, where the dam is high and impassable even at the greatest floods known. Concerning this I have received the following letter:

GLENS FALLS, N. Y., July 24, 1888.

MR. FRED MATHER:

DEAR SIR: Mr. A. C. Johnson, of Mechanicsville, N. Y., writes me that the salmon are below the dam at that place. He saw five at one time yesterday, and one was found dead last week, which weighed 12½ pounds. He says that the boys want to

shoot or spear them, but he does not mean that they shall. The water is low, and the fish can not pass the dam. He says they are all big fish. There is a necessity for fishways in order to let the fish get to the breeding grounds, and the dam should be watched in order to keep the fish from being destroyed. The people should be instructed to let the breeding fish alone in order that they may be benefitted hereafter.

A. N. CHENEY.

There was a rumor that several salmon had been dynamited at Mechanicsville, and the following letters relate to this:

TROY CLUB, August 18, 1888.

Mr. FRED MATHER:

DEAR SIR: On my return home from Rochester I found a letter from Mr. A. N. Cheney giving an account of the dynamite outrage at Mechanicsville, and stating that he had written the Lake George game constable to go over there and investigate. I visited Mechanicsville a few days ago, with the builder of the Troy fishway, to look at the dam at that place. I saw Mr. A. C. Johnson, the person who reported about the dynamite to Mr. Cheney, and he said that no game constable had been there and that it was now too late to fasten the crime on any one from the evidence on hand, although suspicion pointed strongly to two prominent citizens of the village. He said that three salmon, weighing from 8½ to 12½ pounds, were found dead floating about the day after the dynamite was used.

Mr. Johnson also reported that a salmon was taken there recently on a trolling- spoon. I never heard of such a case, and can hardly believe it. Will investigate further and try and find out about it.

HENRY BURDEN.

TROY, N. Y., November 12, 1888.

Mr. FRED MATHER:

The name of the man who took a salmon with a trolling-spoon is John Conners. He is employed in the Fitchburg car-shops at Mechanicsville.

HENRY BURDEN.

Newburgh Bay.—A newspaper slip, sent me by a correspondent, said that Mr. Eugene B. O'Sullivan, who lives at Fishkill Landing, caught a salmon weighing 9¾ pounds with a fly, and sold it to Thomas Talbot, a fish dealer at the latter place. This was important if true, and in conversation with State Game Protector Willett Kidd, I told him of it. Mr. Kidd kindly looked the matter up, and found that the fish was taken in a shad net.

Recapitulation of captures.

Gravesend Bay	28	Kingston Point	2
New York Bay	20	North Staatsburgh	2
Prince's Bay	3	Hyde Park	1
New Jersey shore	5	Elmore's Dock	2
Hudson City	8	Newburgh	1
Stockport	4	Newburgh Bay	1
New Baltimore	3	Verplank's	3
Highland Falls	1	Communipaw to Yonkers	14
Mulls' Fishery	2	Troy, below the dam	26
Catskill Point	1	Mechanicsville	4
Cornwall	1		
Barrytown	2	Total known	134

I have no doubt that four times this number were taken by the shad fishermen, who, as before stated, are very cautious about giving information.

PROSPECTS FOR SPAWN GATHERING.

There are but two places where the fish have been taken in sufficient numbers to enable us to get some spawning fish. These are Troy and Gravesend Bay. At Troy a number could be caught or bought from the shad fishermen. At Gravesend Bay they might be kept alive by the fishermen until the season was over, and then be purchased. The fishermen at this place did not know of any law on the subject, and openly sold their fish in the New York markets, receiving from 25 cents to \$1 per pound, the last figure being for the first two or three fish taken.

I do not think the water in the Hudson below Troy is cool enough to pen salmon. Between Troy and Mechanicsville there are deep, cool spots which I think would answer. Mr. Burden thinks that the trout ponds at Cold Spring Harbor would be the best place to keep those captured in the lower river until the spawning season, and in this I agree with him. At Mechanicsville the fish would require watching night and day, but this might be done by watchmen at the mills, or an inclosure might be made in the tail-races of the mills where it would be difficult of access. I believe that some eggs might be taken next season, but experiment only would determine the number and the cost of obtaining them. If the operations were confined to the upper river a few might be obtained at Hudson, through Matthew Kennedy, and taken up in a fish-car to add to the Troy catch. If the lower river was to be worked for fish to store at Cold Spring Harbor, a small sail-boat with a well in it would be needed.

POLLUTIONS OF THE RIVER.

In my opinion ordinary house or water-closet sewage does no harm to fish in a big river. In proof of this, I would call attention to the fact that shad have increased in the Hudson, through artificial culture, in spite of the growth of cities along its banks. Chemical works pollute the water to some extent, but the injury depends entirely on the relative amounts of chemicals and water. A poisonous stream entering one side of a river does not mix at once with the whole stream, but continues down one shore, and is finally precipitated and becomes harmless. The poisoned water would kill a fish entering it, but the instinct of the fish teaches it to avoid it. At times the muddy water of the Missouri River can be seen for many miles below its junction with the Mississippi, and this will serve to illustrate this point.

The paper-mills formerly poured great quantities of chloride of lime in the river, and this substance was claimed, rightfully or otherwise, to be the cause of the decrease of shad in the Connecticut River some years ago, because of the paper-mills at South Hadley Falls, Mass.

There are paper-mills on the Hudson from Troy up to Jessup's Landing, both numerous and large, but in all of them that I visited I was told that the use of chloride of lime had decreased to a mere fraction of what was formerly employed. In these mills wood-pulp is the basis of paper, and it does not require the bleaching that other materials do, and, as one manufacturer said, "We do not use as much chloride of lime in a month as we did in a day before we began using wood-pulp, and you will find that this is the rule with all the paper-mills." In conversation with other paper manufacturers they confirmed this statement, and therefore there is now less than 4 per cent. of poison from the paper-mills than there was before wood-pulp was used to make paper.

DAMS AND OBSTRUCTIONS.

The first obstruction that a salmon meets in the Hudson is the State dam at Troy, which barred their ascent until in June last, when a rise in the river gave 2 feet of water on the crest of the dam, and some salmon went over it. These are the fish referred to above, seen at Mechanicsville. The State legislature made an appropriation for a fishway in this dam, and one was built last summer after the salmon run was over, by the McDonald Fishway Company. After the completion of this fishway I was in Troy, but the water was too high to see the structure, which, I am informed, is substantially built, and is complete in all respects. This form of fishway differs in principle from all others, and from a study of fishways in Europe and America I believe it to be the best in use. I have drawings of all the different fish passes in the world, some of which have never been published, and some of them are very odd. When in charge of the department of American fish-culture at the International Fisheries Exhibition, held at Berlin in 1880, I gathered a mass of material, which was never published because the Government did not issue a report of that exhibition, and among my sketches are some odd fishways in the English department. Allowing me to judge, I will say they were, some of them, of a most primitive sort, and of little use to most fishes. I merely cite this to show that I have paid attention to the construction of fishways, and have a knowledge of the principles of all the different fishways, without professing to know anything about the practical building of one. From a study of working models I am satisfied that the McDonald fishway is the easiest of ascent of any. I have seen a model of a catamaran actually go up one by the force of the side currents, while the water in the middle of the fishway was a turbulent rapid, gradually working down, but checked at every foot into a semblance of a mountain torrent.

I think, and so said in print a dozen years ago that fish will find the entrance to a fishway with greater certainty if it is at the foot of the dam, instead of below it, and would therefore advocate the building of a fishway above the dam, if possible to do so.

Mechanicsville.—The dam at this place is 9 miles above the Troy dam,

and the water between them is a splendid series of salmon pools and rapids. It was at the foot of this dam that several salmon were seen jumping by a Mr. Greene, residing there, and where a 12-pound salmon (not elsewhere reported) was found dead by George Baxter. The bed of the river here, as well as above and below, is a slate formation. The dam is 15 feet high, built of stone laid in cement. I looked the dam over, in company with Commissioner Henry Burden, and settled on a place where a fishway could be placed. Later Mr. Burden visited the dam and wrote me as follows:

TROY, N. Y., August 18, 1888.

Mr. FRED MATHER:

DEAR SIR: We found a new place to locate a fishway in the Mechanicsville dam, and that is alongside of the stone wall forming the canal from which the mill-wheels take water. The gates at the head of this canal are always open, so that fish could get through to the river above. If there is no pollution in this canal I think a fishway could be built as cheap, if not cheaper, than the one at Troy. It would be out of the way of ice, and would not cut into the main dam.

Sincerely yours,

HENRY BURDEN.

Stillwater.—This place has a dam made of logs, with an 8-foot perpendicular face, and it is 3 miles above Mechanicsville and 15 miles below the Fort Miller dam. Although the dam is 8 feet high on the west side of the river, it is not a foot high on the east side, and before the dam at Mechanicsville was built suckers and river herring (alewives) went over it in the spring. No fishway is needed here, because in ordinary seasons, while fish are running, they can pass this dam. Surely a salmon will have no trouble with an obstruction which a sucker can pass. A fishway at Mechanicsville would give the salmon a clean run from Troy to the next dam, a distance of 27 miles.

Thompson's Mills (P. O.).—The Saratoga State dam is at this place, 2 miles below the Fort Miller dam, and it is of stone, 824 feet long, 9½ feet high, with an apron of 10 feet. There are no falls here, only "riffs," or swift water, below. In stages of high water there is moderately deep water below, which would serve as a resting place for salmon.

Fort Miller.—The dam here is a wing-dam, 10 feet high at one end but only 18 inches at the other. It is of wood, with a square face, and would not obstruct the passage of salmon. It is 2 miles above Thompson's Mill.

Fort Edward.—There is an old wooden dam here, made of log cribs, which will soon require to be rebuilt, as it is much decayed. The dam is 16 feet high. There are good pools just below it, which have 14 feet of water in them at low water. There is a "spill-way" in the dam, through which all the water goes when the river is low. This is for the passage of logs in summer. Below the dam is a great bed of sawdust, on the east bank.

Baker's Falls and Dam.—These falls are at Sandy Hill, a few miles below Glens Falls. It is said that before there were any dams on the river the shad came up as far as this, but could go no farther. I heard

this tradition from several persons, but can not say more. The falls are slate-rock and fall $58\frac{1}{2}$ feet in about 500 to 600 feet, the exact height having been obtained from Allen Brothers, paper manufacturers. A pool below, where the shad formerly stopped, is said to be 70 feet deep. Half way up the falls is a pool about 125 by 75 feet, and apparently 15 feet deep. The dam on top of the fall varies from 3 to 8 feet in height. Above this dam, within half a mile, is Richard's dam, the intervening water being broken, falls perhaps 9 or 10 feet in that distance. This second dam is $11\frac{1}{2}$ feet high, is new and made of hewed logs, with a spill-way at the deepest part of the river.

Glens Falls and Dam.—The falls are hard stratified rock, and at low water the descent from the crest of the dam is 40 feet, in a distance of 150 feet. There are several steps and pools; in some of them the vertical distance is not over 30 feet. In the center it is higher and consequently the great body of water flows to each side. I saw it on August 23, and the river was then exceptionally low. It looked at that time to be practicable to make a passage for fish part of the way in the rock.

State Dam, at Feeder Dam.—This is $1\frac{3}{4}$ miles above Glens Falls. It feeds the Champlain Canal and runs two saw-mills. Its height is 13 feet and 10 inches, and it is built of wood with an 18-foot apron. Water goes over this dam until July, when the brackets are put on and the water is all used by the canal and the mills. From this dam to Clendon Brook, above, is 5 miles by river.

Palmer's Falls.—These are at Jessup's Landing. The dam on the crest is 25 feet high, then rapids for a distance of 100 feet, more or less, and a sloping fall of about 50 or 60 feet. It is 85 feet from the pool below to the foot of the dam. In dry times the enormous paper-mill takes all the water in the river, but when I saw this fall, November 22, it was a terrible place to think of going over, either for a salmon or a man. While building the dam in this wild mountain gorge two men went over the falls. One was killed and the other was so badly injured that he has never fully recovered. If the salmon planted above this fall go down safely they can go the rest of the way without injury. I confess to being doubtful about it and begin to think that possibly Clendon Brook may have supplied a good share of the fish that have grown to maturity, for this fall surprised me with its violent rush through a narrow pass and its lack of a deep pool to receive the falling waters. I do not see how a living thing could escape being battered to death on the many exposed rocks, and especially at the foot of the dam, where there is a sheer fall of 25 feet and a shallow pool.

Rockwell's Falls.—These are at Luzerne, or Hadley. The village is on both sides of the river, in different counties, and has two names. This is the last obstruction on the river. The dam is 15 feet high on the west bank, and runs to nothing on the east bank. A salmon could go over it with ease, if it could get here. The Sacandaga River enters the Hudson about 200 yards below these falls.

CONCLUSION.

While I have expressed surprise that anything could live after passing Palmer's Falls I do not wish to be understood as saying that it is impossible for it to do so. The varying current, which would dash a man to pieces on the rocks, may be safely run by a salmon going down tail first and keeping steerage way all the time by a vigorous up-stream motion; but if one simply looks at these formidable falls with the idea that a salmon would go down them as he or any other mammal would, he would shudder at the thought. The fact that all fishes go down stream, in rapid water, tail first, when not hooked or frightened, must save them many a contusion, which a cow would get. I have seen a trout go over a small dam, when, of course, it did not know what might be below, and it would back down until its fear would cause it to resist the rapid current, and so would feel of it, always heading up-stream, until at last it let the water have its way, in part, only, and with head up-stream and caudal fin in active motion, it was prepared to meet the wild rush of water with such muscular energy as it could muster. Taking this view of the case it is possible that young salmon may safely go down any impediment in the Hudson, but, if they go down at a low stage of water, when the whole river is turned into the wheels of the mills, "ay, there's the rub," for in that rush of turbines what grinding comes when salmon have "jumped this bank and shoal," is more than we can say.

While holding fast to that which is good, and this means stocking the streams which have reared fish and sent them to sea in sufficient numbers to return again, I would suggest that the Sacandaga River be stocked. I know that its lower waters, especially below Mill Creek, where the new hatchery of the New York Fish Commission is located, contain pickerel (*Esox lucius*), but so does the Hudson, from Albany, up to above North Creek. If the Sacandaga is to be stocked I would say that the nearest way to reach its headwaters is via North River, 6 miles above North Creek, where the Adirondack Railroad ends, and thence by wagon to the "Drake Place," 3 miles east of Oregon, and make the plant in Diamond Mountain Brook and in Siamese Brook, and also in Buck Meadow Brook and Botheration Pond. The latter is the head of the Sacandaga River. There is no need for me to write an essay on the benefits of planting salmon in the headwaters of streams where they get insect and crustacean food and escape their larger enemies.

I think that the tributaries of the Hoosic River, which enters the Hudson as low down as Stillwater, and other streams in Washington County, N. Y., might prove to be good rearing streams for salmon, but I have no personal knowledge of them. The same might be said of streams in the Catskills, of which I also know little beyond the fact that there are good trout streams there. If it is desirable to extend the number of streams to be stocked or to substitute others for those which,

in my opinion, are not as good as they should be, then some competent person should make an examination of other brooks.

I do not know at what time of the year the young salmon go down past the obstructions named. If they go at low water, when at several places the great body of water goes through mill-wheels, many of them may be killed; hence my suggestion of stocking some streams lower down. If, however, the fish make the descent of the upper river at times of high water they have the choice of going over dams or through wheels. However this may be, some have escaped, and the stocking of the Hudson with salmon is one of the successes of fish culture with which I feel proud to have been connected.