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PUBLIC OFFICERS AND INSTITUTIONS

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1868-9.

AUGUSTA:
SPRAGUE OWEN & NASH, PRINTERS TO THE STATE.
1869.

SECOND REPORT

OF THE

COMMISSIONERS OF FISHERIES

OF THE

STATE OF MAINE.

1868.

AUGUSTA:
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REPORT.

To the Governor and Council:

We, the undersigned, have the honor to present herewith a report of our investigations during the past year, in accordance with a Resolve of the Legislature of 1867, entitled "Resolve relative to the restoration of sea fish," and a Resolve of the Legislature of 1868, continuing the same in force.

Our work for this year has been for the most part supplementary to that of 1867. We have substantially completed the survey of the rivers, with the exception of the St. John waters, sufficiently to enable us to state the condition and needs of each river visited. The work of building fishways has been commenced by the erection of several on the East Machias and Denny's rivers, and the location and ordering of several on the St. Croix. We were unable to proceed as we wished to the work of opening the Kennebec and Penobscot, by a fault in the language of an act to give us general authority in the matter, passed last winter. Nevertheless, we think the money at our command has been well expended in continuing the work of examination left incomplete last winter, in a careful personal examination of the modes employed in taking migratory fishes, and in experiments on the reproduction of several species.

With these preliminary remarks, we will proceed to lay before you the results of our examination of each river visited, commencing at the eastern boundary of the State; and will then present such suggestions as may occur.

St. Croix.

This river was visited, the dams at Calais, Milltown and Baring a second time examined, and sites selected for fishways. The proprietors were consulted, and agreed to build the fishways according to plans that were drawn and left in the hands of Mr. Seth Emerson, who was engaged to superintend their erection.

Yet we regret to say, that for some reason unexplained, the season was allowed to pass and no fishways were built.

The law forbidding fishing within half a mile of the lower dam has been openly violated, under the plea that its observance was not to be expected while there were no fishways.

Salmon are thought to be increasing slightly in this river. A few of them reached Milltown this year. With good facilities for ascending to the fine spawning grounds, that lie all along the main river and on many of its branches, they would in a few years become tolerably plenty. The whole cost of opening fishways would, we think, not exceed $3,000. There are many driving dams on the upper tributaries, but they are not generally prejudicial to the salmon, and scarcely any expense would be required to avoid obstructing them altogether. The greatest danger is that they might be used by poachers to take fish illegally.

Denny's.

Salmon and alewives are still steadily increasing in this river, and we have no doubt that they will regain something of their ancient numbers. The dam at Dennysville of B. &. E. Lincoln, which has been a serious hindrance to the increase of the fish, has this year been provided with a good fishway in accordance with the directions of the Commissioners.

East Machias.

The fishways on this river being in an unsatisfactory condition, the owners of dams were directed to place them in proper repair, and to make certain alterations deemed necessary. The proprietors agreed to make the required alterations and repairs, but from some cause failed to do so during the past season, with the exception of P. S. J. Talbot & Co., who constructed a new fishway through their dam at Jacksonville. It is presumed that another season will see all the other dams in East Machias provided with better ways than now.

Besides the dams above referred to, there are four upon the upper part of the river which we examined this year. They are as follows:

1st. Monson Rippling's dam, commonly closed during the first run of fish.

2d. Long lake driving dam.

3d. The Barstow dam, so called, in the town of Crawford.

4th. The dam at the outlet of Crawford Lake.

None of these are provided with fishways, and all are obstructions to the ascent of fish.

This year there was a marked increase in the number of salmon in the river.

Wescongus.

Salmon continue to come to the falls at Columbia, but are unable to pass the dam at that place. A few have been carried by and put into the river above; but for any important increase, a good fishway and a stringent law are required. The present fishway was built so far from the main channel, in order to secure it from freshets, that salmon will not take it. One to succeed must be built under Mr. Harris' mill.

Narraguagus.

The people at Cherryfield are much interested in the restoration of fish to their waters; and at the request of Messrs. Campbell, principal mill owners at Cherryfield, the dams, five in number, were examined. They average ten feet in height, and present no special obstacles to the construction of fishways. It is hoped that the Commissioners will, at an early day, be able to direct the construction of suitable fishways. It is but a few years since this river produced salmon, shad and alewives in abundance.

Union.

All the dams in Ellsworth were examined. There are none that present unusual obstacles; the average height is ten feet.

The fishery on this river was formerly excellent, producing salmon, shad and alewives; but it has shared the common fate, and these species are now nearly extinct here. The expense of constructing fishways and re-stocking the river would be comparatively small.

In a tributary that drains Reed's pond there is a fishery for "land-locked" salmon, which species was once abundant but is now scarce through reckless fishing. A strict enforcement of a stringent law is needed to protect them, but the general law protecting trout and salmon at the spawning season is sufficient if well enforced. It was from a tributary of this river that the fish was obtained which Girard has described as *Salmo Gloveri*, but this

name has by subsequent writers been applied to the fish found in Grand Lake and other parts of the St. Croix waters, without, so far as we know, ascertaining the identity of those fish with that described by Girard.

PENOBSCOT.

The time that we were able to give to the Penobscot this year was mostly occupied in a tour through the fishing district, during the month of May. The weirs were then in full operation and much valuable information was elicited.

In old times the most abundant fish (in bulk) in this river was the shad; this was probably the most valuable. Next came the salmon. Alewives were exceedingly abundant but little esteemed. Bass, (*Roccus lineatus*, Gill.) were not rare. At Oldtown falls as many shad and alewives were taken as would supply the demand, and many fold more might have been taken; the price, one dollar per hundred for shad, was not sufficient inducement to provide beforehand the necessary barrels and salt to take care of them. On the lower part of the river the market was more convenient, many vessels, mostly from Connecticut, coming every season to load with shad and salmon. Immense quantities of them were shipped in this way. Before the river was closed with dams the price of salmon had risen to six cents a pound, that of shad to six cents apiece. Alewives, smoked hard for the West India market, brought in early times thirty-three cents a hundred in Boston, and the price afterwards rose to one dollar and one dollar and a quarter, when they were very profitable. The fishing, previous to 1785, was all done with nets, but they have been gradually superseded by weirs and at the present time very few nets are used. Their use, however, was continued as long as it was profitable. At one time there were, it is estimated, two hundred men employed in drifting between Mill Creek and Olamon's ledge. In 1811 a Mr. Emerson of Phippsburg, came to the Penobscot with what he claimed to be a patent weir, and it was a great improvement over the half-tide brush weirs then in use. The latter consisted of a single enclosure of brush, left bare at low water, and covered with six feet depth at high water; the fish simply swam in over the top of the enclosure and were left by the receding tide. Such weirs are still used to advantage in particular sites and for certain purposes—for instance in the winter fishery for smelt on the Kennebec. But in the ordinary summer fishery the weir introduced by Emer-

son was far more effective ; it had three pounds and was built to the top of the tide with an entrance for fish as in those described in the last Report of the Commission. Further improvement was introduced by one Holliday from St. John, N. B., who substituted marline for brush on part of the pounds. The quantities taken by these new inventions were enormous. Emerson's first weir, built on Treat's Flats, was, it is said, quite burst open by a quantity of fish that it could not hold.

During all these early years the fish found extensive breeding grounds above the occupied portion of the Penobscot valley. Though shut out from some of its tributaries, a circumstance alone sufficient to effect, in time, a decrease in their numbers, the great highway to the many lakes and streams in the wild lands remained open until about the year 1830. It was then nearly closed by Fiske and Bridge's dam at Oldtown Falls, in which there was and is still a passage by which some salmon pass every year; and in favorable seasons shad and alewives pass up in limited numbers. After this, was built the Great Works dam, and in 1834 or 1835 the Veazie dam. The latter was closed in the winter. When the fish came in the spring they found an impassable barrier across their way ; they gathered in multitudes below the dam and strove in vain to surmount it; many returned down the river, and after the usual time for the spawning of shad was past they were taken in weirs in the town of Bucksport, loaded with ripe spawn which they could no longer contain ; a phenomenon which a man who has fished with weirs at that point for forty-three years had never observed at any other time. These were doubtless shad whose natural spawning grounds lay far up the river, and who had after long contention given up the attempt to pass the Veazie dam. A great many shad and alewives lingered about the dam and died there, until the air was loaded with the stench.

For a few years after the construction of these dams, fish were abundant ; then a rapid decline set in, and in a few years more they were comparatively scarce. In the case of salmon, they reached their lowest point ten years ago, since which time there has been a considerable increase, which may be owing to some increased facilities for passing the dams. We know that the water has made a way for itself around the end of the Veazie dam, where water enough flows to enable salmon to surmount it, so that at the present time, as stated in our last report, salmon, (the most vigorous ones, that come at the right season, and do not get

caught in the traps set on the falls,) can reach the head waters of some of the upper branches. But the decrease of shad has never ceased. They are growing constantly less, and instead of exporting shad by the cargo, the people of the Penobscot valley are forced to import from other rivers shad for their own consumption. From some erroneous information received by us last year, we were led to estimate the yield of shad in the Penobscot at a figure which appears, in the light of the facts elicited by us this year, to be exceedingly extravagant. We supposed it probable that the Penobscot produced several times more shad than the Kennebec, whereas our present estimates say that it yields not one twentieth part as many. At first view this is a most singular fact—two rivers running side by side, of nearly equal size and of very similar character, and originally producing the same kinds of fish in nearly the same proportion, should now yield, the one less shad than salmon, the other two hundred fold more—as in the table—

	Salmon.	*Shad.*
Penobscot yields,	8,000	5,000
Kennebec,	1,000	225,000

If we next consider the state of the dams across the two rivers, and the facilities that fish have for passing them, the yield of shad appears still more remarkable; for in the Kennebec they do not pass the very first dam, that at Augusta, while we know that they do sometimes succeed in surmounting all the dams on the Penobscot, and it is stated that it is no uncommon thing to find young shad wrecked on the Oldtown falls on their way down to the sea. We think that the true explanation of the phenomenon is found in certain natural features of the two rivers which we have not yet noticed. In the Kennebec the shad breed all the way above the outlet of Merrymeeting Bay as far as Augusta, and in the various tributaries that enter Merrymeeting Bay, including the Androscoggin as far as Brunswick. Close and practical observers of their habits consider Merrymeeting Bay as a most favorable ground for the breeding of shad, and the main stay of the Kennebec river. Its broad, sandy flats, bared by each ebb to the rays of a summer sun, and giving back its heat to each incoming flood of fresh water, have a wonderful influence in hastening the maturity of the breeding fish that seek the shallows. All the tributaries of this bay, the Kennebec, Eastern river, Abagadassett, Cathance, Androscoggin, afford many miles of warm waters flowing back

and forth with the tide, very favorable to the development of the embryo fish. The saltness of the sea is rarely or never perceptible in these waters, until after the spawning of shad; and in the middle of a dry season we think it is not perceptible farther than Richmond. Ripe shad are at the proper season found in all waters of the bay and its tributaries. The Penobscot has no such expanse as Merrymeeting Bay, nor such tidal tributaries as have the Kennebec and Androscoggin. Its waters, seldom fresh at Bucksport, are in a dry season brackish all the way to Bangor. Its natural breeding grounds lie farther up the river. Ripe shad have never been found in Bucksport but once, as above stated. Now these differences are sufficient to cause a great disparity between the two rivers, much too great to be counterbalanced by the offspring of the few shad that pass the dams on the Penobscot; but does it account for all? It would seem that there should still be fresh water enough below Veazie to breed more shad than the small catch of five thousand would indicate. There is certainly one other possible cause—namely, the sawdust. We know as yet too little about the conditions essential to the development of the young shad to say confidently whether the parent fish will deposit her spawn, and the young hatch, on a bed of sawdust. If not, no young shad can be produced below the lumber mills. It is, however, tolerably certain that all life is destroyed on the bottom where a body of sawdust settles. There are no more of the insects and other minute creatures that thickly people all stony and gravelly bottoms, and on nearly all natural bottoms afford abundance of food to young fish. Young shad must eat, and if born on a barren sawdust bottom must get into other waters quickly or starve. We must not, however, be too confident in this matter, for we do not know to what extent they are dependent on the bottom for food, or how far the barrenness of the bottom deprives the water above of nourishing food. Compared with the Penobscot, the Kennebec is tolerably free from sawdust.

The fishing is at the present day almost entirely confined to weirs. Set nets do not pay, nor do drift nets except near the falls. Mr. Simeon B. Rich of Bucksport, fished with a drift net thirty and forty years ago, and would get sometimes three hundred shad in a single night; in 1867 he tried it again, but caught no more than three shad in any one night,—sometimes two, one or none. The weirs are mostly built below Bucksport, extending along the

east shore of the bay as far as Castine and along the west shore as far as Camden. We have a tolerably accurate list of those on the east shore, and on the west shore as far as Sandy Point (or "Fort Point") in Stockton. Between the latter point and Belfast nineteen can be counted from the deck of a steamer. Below Belfast we can merely estimate them. The following will be found nearly correct:

	No. of Weirs.
Between Bangor and Bucksport, both sides,	24
" Bucksport and Eastern R.,	5
" Eastern R. and Orland shore, about	24
In Penobscot and Castine,	31
In Verona,	32
West Shore from Fort Knox to Sandy Point,	27
From Sandy Point to Belfast, about	20
" Belfast to Camden, about	20
Total,	183

One of these is merely a hedge with a gill net set in the end of it; one is a half-tide weir; thirteen or fourteen others (in Eastern river) are shoal weirs, built only to low water mark. The remainder are all deep weirs, built into from eight to twenty-five feet depth at low water. The stakes for many of them have to be forty feet long. The construction of these deep weirs is totally different from that of the deep water weirs used on the Kennebec, described and figured in the last report. All of the Penobscot weirs whether built in shoal or deep water, are essentially on the same plan. That enclosure in which the fish are taken is floored in all cases with boards, and corresponds with the last part of the "pocket" of the Kennebec shoal weir; and no matter to what depth of water the weirs are built, this floor is always sufficiently high to leave the fish bare or nearly so at low water. They generally consist of three pounds, one large and two small ones, the latter being both floored. The cost of a new weir is about eighty dollars, ($80), but as the netting lasts about three years and the stakes five or six, the average annual cost per weir may be put at sixty dollars ($60). Total annual expense of building 183 weirs, $10,980. In the river the weirs are built as soon as possible in the spring, for salmon are then running; they have even been caught at Oldtown before the ice is out of the river below. On the other hand the weir at the entrance to Castine harbor is not built until May tenth to twentieth,

because no salmon can be caught earlier; in 1867 it was finished about the eighth, and not a salmon was caught until the twenty-ninth. Along the shore from Castine to Orland the weirs are stripped about the middle of August, a few salmon coming up to that date, and we suppose the same to be the case with other parts of the bay, although the Verona people say that the fishing season is substantially closed by the middle of July, and probably the weirs are not maintained so long in the river as below. The law regulating the fisheries of this river, which prescribes that the weirs shall be stripped July fifteenth does not apply below Verona.

We have collected a mass of information about the yield of the various fish caught, from which we will draw a few general statements. The yield of salmon is better in the bay than in the river. The most productive weir of which we have any information is that at the entrance of Castine harbor, which produced in 1867 more than 1,600 pounds of salmon. Along the shore from Castine to Orland the average catch is set at fifty per weir; best catch in 1867, ninety-five in one weir. In Verona the best weirs yielded about one hundred each; average fifty or more. Above Bucksport the average is about thirty. It is supposed that the weirs on the west side of the bay are as productive as those on the east side. Assuming the general average to be forty salmon per weir, the total catch of 183 weirs appears to be 7,320 salmon, and the number caught by other means may make up the number to 8,000. Numerous statements agree that the yield is not more than half what it was twenty-five years ago, but that it is decidedly better than in 1860. Yet the people above Bucksport have not perceived this recent increase, but have found their salmon growing fewer and fewer.

The catch of shad was in some places reported equal to that of salmon, in others as much less. Alewives are principally caught on the east side of the bay, and in Eastern river and thoroughfare. They are supposed by some close observers to breed only in the ponds on Eastern river; we certainly know of no other breeding ground open to them, unless a few can surmount the dams or find some suitable spot below them, on the main river.

In the records of the town of Orrington are found some statistics which enable us to compare the present yield with that of the few years preceding the building of dams. We extract the following items:

For ten years previous to 1836.		For ten years subsequent to 1840.		For ten years previous to 1869.	
Year.	Sales.	Year.	Sales.	Year.	Sales.
1826,	$359 00	1841,	$42 70	1856,	$31 28
1827,	410 50	1842,	54 85	1858,	7 00
1828,	492 00	1843,	22 25	1860,	1 00
1829,	440 60	1844,	7 69	1861,	2 65
1830,	445 60	1845,	2 47	1862,	4 50
1831,	530 75	1846,	9 61	1863,	4 50
1832,	481 00	1847,	6 30	1865,	18 00
1833,	171 25	1848,	33 15	1866,	21 25
1834,	40 70	1849,	32 72	1867,	9 50
1835,	144 83	1850,	4 04	1868,	26 50
Total,	3,516 23		215 78		126 18
Average,	351 62		21 58		12 62

The river was completely closed by the Veazie dam in 1835 or about that, and by 1840 had accomplished its work of destruction, and we observe that from 1840 to 1850 the sales averaged only one sixteenth (1-16) as much as before 1836. Of late the yield has been even less, and in 1857, 1859 and 1864 no sale was effected; for the last ten years when a sale was made the average amount received was only $12.62, or about one twenty-eighth (1-28) of the receipts previous to 1836. Now, then, we suppose that this record of Orrington is a fair representation of the decline in the fisheries on the whole river; and had there been no change in the price of fish since the first decade we could ascertain very closely the amount of fish that the same instruments of capture now used would have taken at that time, by multiplying the present ascertained yield by twenty-eight (28). Thus the 183 weirs now built are estimated above to have taken 7,320 salmon in 1867, and it will certainly be safe to put their catch at 5,000 annually for the last decade. Multiplying this number by 28, we find that these 183 weirs would, on the supposition of no change in prices, have taken 140,000 salmon in one year previous to 1836. And after taking into consideration the appreciation in prices which hinders the Orrington records from showing the full decline of the fisheries, and the great number of drift nets and set nets that were once at work and have now been abandoned, we can confidently say that the average annual yield of the Penobscot before its obstruction by dams, could not have been less than the equivalent of 150,000 salmon and 150,000 shad. As shad were

then far more abundant than salmon, we may raise the estimate for them to 2,000,000, and lessen the estimate for salmon to 100,000 annually. Their value at present prices would not be far from *half a million of dollars.*

One fact of particular interest was established by the testimony of all with whom we conversed on the subject. In many cases two weirs are built on the same hedge, one at its middle and one at its outer end. The inner weir invariably catches the most fish —twice as many salmon and three times as many shad and alewives. This shows us the course taken by these migratory fishes. Instead of following the center of the channel they follow its banks, and at high water spread out over the flats. The experience of drifters is to the same effect. They meet with the best success when they follow the banks of a broad channel rather than its center. The fish are all coasters, and when first found approaching the rivers, while yet perhaps far from their mouths, they are sedulously feeling their way along the shore.

With regard to the laws regulating the fishery, they do not appear to be regarded on this river. The act of the last Legislature prohibiting the fishing within a half mile of the lower falls has been openly and continuously violated, and we are informed that the Bangor market has been principally supplied, and some shipped to Boston from drift nets on the forbidden ground. A trap has been set on the falls and taken many salmon. Evidently there is fault somewhere. We are of opinion that greater responsibility should be put upon the wardens, and that a larger number is needed on such a river as the Penobscot. The law, having been amended by abolishing the office of Fishwarden for Waldo county, now provides for only two wardens, one to reside in Penobscot county and one in Hancock, and at the present time there is a vacancy in Hancock county. It is idle to expect one man, however well meaning, to guard the whole Penobscot river.

A projected exploration of the upper waters of the Penobscot fell through in consequence of the ill health of the Senior Commissioner. We are however, able to state on good authority, that there is a dam at North Twin Lake sixteen feet high which needs a fishway. There is another dam at the outlet of Chesuncook lake.

The state of the various obstructions on the river remains the same as last year. We deemed it inexpedient to move in the matter since it was thought that the act of the last Legislature, intended to give us power in such cases, did not apply to the Penobscot,

and that the authority to build fishways or order their construction still remained in the hands of the wardens.

Eastern River, Orland. This branch of the Penobscot was the second time visited this year on the first of June. The people of Orland are anxious about the constant decrease of the alewives, and desire to have some effective measures taken to secure an increase. The general opinion is that the imperfect means of passing the dams are mainly to blame for the decline of the fish. At the lower dam the water falls three feet and a half below the floor of the lock through which they pass, so that fish cannot get into the lock at low water, but collect at the dam. Before the present stone dam was built they used to be dipped in large quantities in a pool, but now there is no good place to dip and few are taken at these falls. A man is paid ten dollars per season to lock the alewives through. It is done in this way: the lower gates are opened and the water started through the upper gates sufficient to attract the alewives; when they are seen to have entered the lock in sufficient numbers the lower gates are closed and the upper opened, so that the fish may pass out; but they sometimes refuse to leave the lock, if it is near dark when the gates are opened, and are liable to be stolen out by poachers before morning. We deem it of great importance that the alewives should be able to enter the passage way and pass the dam at whatever time they may arrive at the barrier, and this cannot be accomplished by the lock. When boats and lumber are passing the fish are disregarded, and near low water it is impossible for them to enter the lock. A fishway built on the east side of the river away from the bustle and noise which must frequently disturb them at the lock, and being open and passable at all stages of the tide, would be much better than the lock, however faithfully this may be tended.

The same reasons will not fully apply to the upper falls, but there, too, we have no doubt that a fishway will be much better than the lock. It is complained that the fishing at this point is reckless, and without regard to the law—that the fish are taken under the saw-mill, where they are tolled by the greater flow of water, and are often stolen out of the lock.

At the time of our last visit the wardens were endeavoring to restrict certain of the weirs in the tide water which had been built beyond the limits fixed by the special law regulatiug this river. The legal limit is low water mark. In the three miles of tide water over which the wardens consider their jurisdiction as extending

are twelve or fourteen weirs, and a slight extension into the channel would prove very detrimental to the fish. It is even doubtful whether they will not prove too effective even with the legal limit strictly observed. There is some complaint about their obstructing navigation, but this might be obviated by a proper construction of the hedges, so that they would not present serious opposition to the momentum of a schooner under way;—this is already done to a certain extent.

The amount of fish taken by the weirs is very considerable. They average 30,000 alewives apiece, those fourteen within the jurisdiction of the special law probably yielding 400,000 annually. Great numbers of alewives are taken along the shore toward Castine, in Verona and in Eastern thoroughfare, a large part of which must breed in this river. 400,000 may safely be added from this source. Of those taken at the upper falls in Orland we cannot speak confidently, but some believe as many are caught there as in the fourteen weirs. But if we add 200,000 for the falls, the total annual produce of these breeding grounds appears to be 1,000,000 alewives.

It might be necessary to forbid entirely the fishing at the upper falls. At any rate fishing about the locks or fishways should be carefully avoided. The license system which we shall in this report recommend would enable the officers of fisheries to restrict the number of nets and other implements used as far as they should deem necessary; but the most essential thing is a good fishway over each dam, carefully protected from all encroachment.

St. George.

Alewives are the only fish of importance caught in this river now. They are mainly taken at Warren. This town has had the management of the fisheries within its limits since 1802. Their practice is to employ an agent with deputies to take the fish. Tickets are issued to heads of families, each ticket entitling the holder to three hundred alewives. Sixty cents is charged for each ticket, and their order of precedence is determined by lot. Certain poor are supplied gratis. All the tickets being supplied, the remainder are sold for the town to any buyer. From these sales large sums were formerly realized. The highest sum obtained was $2,300, which paid the town tax for that year, the minister's salary, and left something over. The sales for the last twenty years have been as follows:

Year.	Sales.	Year.	Sales.
1849,	$206 00	1859,	$340
1850,	144 25	1860,	471
1851,	565 90	1861,	150
1852,	826 77	1862,	229
1853,	473 00	1863,	190
1854,	1,146 16	1864,	65
1855,	591 00	1865,	no sale
1856,	420 00	1866,	176
1857,	355 00	1867,	138
1858,	382 00		

The causes of the decline are overfishing on the lower part of river and imperfect fishways. There are six weirs built below Thomaston and one above. Many persons in Warren and Cushing fish with long set nets, and take large quantities of fish. One man took 30,000 before the 10th of May. All these engines are illegal. The nets are, however, permitted until the 10th of May, when the Committee notify all persons to cease their use. Yet they are still used in defiance of the law. The Committee has no authority beyond the town of Warren; and until the amendments of last session the wording of the law was such that it was difficult for them to enforce its true intent.

There are two dams in Warren, and they are both provided with fishways, but the upper end is in each case too difficult, the water forcing through under a head of several feet, and being too violent for alewives to stem readily. The fishway should be carried up further until its head can be constructed as recommended in the report of last year. The same cause hinders the young fish in their descent; if no water is flowing over the dam they cannot find the head of the fishway, and at the upper dam run down a long canal and into its only outlet, a covered flume leading to the wheel of a powder mill, which destroys a great many of them.

It is generally observed that the young alewives, on their journey to the sea, swim near the surface, and if the upper entrance to the fishway were open, and a coarse wooden grating placed obliquely across the head of the canal, the greater part of them would doubtless go down the fishway. The approach to the foot of the lower fishway is through too shoal water. There should be a deep pool at the foot. Its location is not the best; it should be on the west side of the river. Where it is now the fish are con-

stantly disturbed and driven back by the passing of persons to and from one of the fishing stands.

The essential needs of the Warren fishery are then a curtailment of the amount of fishing, by restricting the nets and weirs, perhaps a positive prohibition of the nets, and improvements in the fishways which we have indicated. If managed under the general law which we shall propose, there would be sufficient power in the officers of fisheries to effect all these desirable reforms, but if the town is to continue to manage the fisheries under a special law, jurisdiction should be given to the officers on the whole river.

Pemaquid.

The town of Bristol by authority of an act of March 4, 1826, has had the management of the fisheries on all streams within its limits. The principal stream is Pemaquid river, which drains several ponds lying in Bristol and adjoining towns having an area of two thousand acres or more, and is by nature a most excellent alewife stream. In old times it furnished large quantities of food to the inhabitants of several towns. Until 1830 everything went on smoothly. The owners of the dams were ready to do their part by providing passage-ways for the alewives and keeping them in good order, that the people might have plenty of fish. The latter were abundant, and were really a blessing to the people who shared them. But about 1830 Jas. Drummond, proprietor at Bristol Mills, sold his mill and dam; the upper dam at the same village was afterwards built, and in 1839 the lower falls also changed hands. The new proprietors seem to have lacked the generous public spirit that distinguished the old ones; and were quite ready to sacrifice a great public good to private convenience. Henceforward there was a continual struggle between the fish committee and the mill owners; the former striving to obtain the right of way which belonged to the fish, and the latter studying "how not to do it." The upper dam known as the "Bearce" dam, was very formidable and its owners succeeded in managing it in such a way that it was rarely passable by alewives. The other dams, except that now owned by Mr. Hatch, were managed, it is alleged, against the fish. We presume, too, that there was some over-fishing. Mid all these difficulties the fish declined and the people were dissatisfied. In striving to protect the fish against poachers and to secure a passage for them to their spawning grounds, the town

became involved in expensive law suits, in which it generally, and we think always, lost. There are charges of incompetence and mismanagement against various officers connected with these suits, but we had not time to sift the matter, nor was it deemed necessary. The most expensive of these suits arose in consequence of the fish committee cutting away the Bearce dam because the owner would not provide a fishway. This case was carried up to the supreme court, and we learn from the report (Bearce *vs.* Fossett, 34 Me. 575), that the case was decided against the town because the constable who posted the notice of the town meeting where the fish committee that cut away the dam was chosen, omitted the words "and conspicuous" in his return, stating that he had posted the notice "in three public places" instead of "three public and conspicuous places." This informality was the sole ground of the decision, and would have been equally effectual to invalidate any and all of the acts of all the town officers elected at that meeting. Nevertheless it was used with effect to throw odium on the alewife fishery, and its cost was sufficient to swell the amount of expense to far beyond the actual reciepts of the fishery.

A statement has been drawn up from the records of the town by Mr. C. C. Robbins, showing the income and outsets of the alewife fishery for forty years; from which it appears that the total income during that time was $1,626, and the outsets $4,031.22. Certain items of interest are improperly included in this statement, and without them the amount of the outsets is $3,730 20. Of this sum $3,218.20, was expended in law suits, showing the normal expenses of the fishery for forty years to be $512, and the receipts $1,626. The whole extra sum of $3,218.20 is the cost to the town of having selfish mill owners, greedy poachers and incompetent officers. But on the other hand it must not be supposed that the sum of $1,626 represents the entire value to the town of the fishery, for it was never managed as a source of revenue, but to furnish cheap food to the citizens.

In consequence of these various troubles the people of Bristol have become tired of managing the fishery, and a petition signed by a large majority of the voters was presented to the last Legislature, praying that all laws relating to the subject be repealed.

This petition was considered by the Committee on Fisheries, and referred to the next Legislature, with the understanding that meantime we should visit Bristol and examine the matter. We have performed that duty, and have elicited the facts stated above.

In conclusion, we have to say that the natural advantages of the Pemaquid river are superior and it ought to yield a large amount of food yearly; but that through the selfishness and greed of a few individuals, and general mismanagement, it has become an expensive luxury. The town of Bristol will not be likely, in its present temper, and with the influences that now sway its councils, to manage the fishery either successfully or wisely, and we advise that it be relieved of the charge by repealing the act of March 4, 1826.

Damariscotta.

We visited this river during the alewife fishery. No other kind of summer fish are taken here in considerable numbers. The only breeding ground for alewives is in Damariscotta pond, a sheet of water about ten miles long and containing perhaps six or seven thousand acres. So near to the sea, it is admirably fitted for the production of those fish. Its waters fall directly into salt water. But naturally it was quite impossible for fish to ascend to the pond. The fall is fifty feet in height, over a rugged ledge. The flow of fresh water always attracted a few straggling alewives; but no large number of them ever came to this stream; a man must dip for several hours to get a mess of them. The inhabitants obtained their supply from Pemaquid and Warren, where alewives were then abundant. But about the year 1803 the idea was conceived of putting some of the fish over the falls into Damariscotta pond. This was done by Daniel Waters, James Kavanagh, David Clark, Jeremiah Russel and some others. In about three years an increase was observed, and instead of carrying the fish up by hand, it was thought best to build them a fishway, (fish-stairs the structure might well be called.) This was done by constructing a long series of small pools of loose stones laid on the ledge in a small channel that ran near the east bank of the stream. We should say there might be twenty or thirty of these pools, and the water pours from one to the other, following a long crooked route to the tide below. The alewives came, and searching for a passage found this artificial way and followed it to the pond above. They now increased wonderfully, and although not now so plenty as once, they yield as many at this one point as are taken by the eighty-six weirs built on the Kennebec.

In 1810, the towns of Nobleborough and Newcastle, obtained an act from the Legislature and assumed the control of this fishery. For the last three years it has been sold at public auction, the fish

committee (usually the selectmen) first fixing the price at which the purchaser shall sell fish fresh to all applicants. Fifty cents a hundred has lately been the price. The auction sale brought in 1866, $1,080; in 1867, $1,450; in 1868, $1,505.

The management of this fishery by the two towns appears to be eminently satisfactory, and we think it should be continued in their hands. Some complaint is made that the weirs on the lower part of the Damariscotta river are interfering with the cultivation of the alewives, and many citizens regard the alewives as the exclusive property of their towns and object to the residents on the lower part of the river being allowed to take any of them. It would certainly seem that a community that has succeeded in producing by their persistent efforts such a supply of food where was original sterility, should have the fruits of their toil and care secured to them. That such has been the history of this fishery has been disputed, but we have taken pains to search into the matter, and are satisfied that the fishery was created as related above. Amongst other persons who are acquainted with the facts, Mr. David Clark is still living; and Mr. Wm. Hunter of Bristol, ninety-one years of age, but of remarkably tenacious memory, has fully confirmed the story of Mr. Clark. On the other hand the owners of weirs state that they have long been accustomed to build them, never heard of the early cultivation of the fish by the people at the mills, and that the matter has been only recently agitated; and that the alewives they catch are but few and cannot interfere seriously with the profits of the Newcastle and Nobleborough people. Disinterested parties estimate the total number taken by the weirs at not more than two hundred thousand yearly, and we think that is not far from right. That would make a difference to the towns at the falls of a thousand dollars yearly, could all these be caught above. Some of the weir owners say further that the majority of the people of Nobleborough and Newcastle are quite willing they should still exercise the privilege of fishing, and that only a few interested persons desire to deprive them of it. We are of opinion that if the people of the two towns, or a majority of them, desire that weir fishing or taking alewives in any manner except at the falls under their management be prohibited, it should be granted.

Sheepscot.

This river was once prolific in all the kinds of migratory fishes common to Maine. But as in other cases dams have been built without fishways and the ordinary result has followed.

Salmon come every year to the lower falls in Alna, half a mile or more above the head of the tide, but are not able to pass it.

One man saw last year sometimes as many as five or six at once at the foot of the dam, and speared two. Shad are seen at the same place, and of alewives a man can sometimes dip one hundred in a day. There is some fishing with weirs at the head of the tide; sometimes three of them are built, but this year only one, which is estimated to have caught 1,000 shad, quite a number of bass, alewives, &c. These weirs are described to us as being built entirely across the stream; in the center is a gap which is open during flood, but closed with a bag-net at ebb tide.

About thirty years ago the dam at Alna was carried away by a freshet, and the fish had access to the river above. Mr. David C. Pottle informs us that the very next year they came into the river in far greater numbers than has been known since old times. This is a phenomenon we cannot explain. It encouraged the hope that these numbers might be retained, and on the re-building of the dam a fishway was constructed, but it did not work well and soon went to decay. The present owners of the dam express a readiness to construct a good fishway. There are several places above where it is supposed that fishways would be required.

Kennebec and Androscoggin.

For certain reasons it is more convenient to view the fisheries of the Kennebec and Androscoggin together. In our last report they were all regarded as belonging to the Kennebec. Yet the Androscoggin is hardly to be rated as a tributary of the Kennebec. The true line of demarcation between the two would be drawn in Merrymeeting bay; the waters of the Cathance and Abagadasset being considered as tributary to the Androscoggin.

These fisheries were not examined last year, although a certain amount of information was gathered respecting them and presented in the report. A considerable part of June (1868) was devoted to a personal examination of them. The instruments of capture employed in the summer fishery are shoal and deep weirs, seines and drift nets. Set nets are no longer employed on these rivers.

The fishery for smelts, carried on in the fall and winter is not included in these estimates. The drift nets are very irregularly used and we find it difficult to estimate their numbers or their catch. The number and distribution of the weirs is as follows:

		No. of Weirs.
Between Merrymeeting bay and the sea, about		41
In Merrymeeting bay, Androscoggin branch.		
Outside of Brick Island,	2	
On Brick Island,	2	
Androscoggin Channel,	7	
Cathance Channel,	6	
Abagadassett Channel,	8	
Flats near Abagadassett,	1	
	—26	
Kennebec branch.		
West side,	5	
East side,	8	
Swan Island,	4	
Eastern river,	2	
	—19	45
		86

We have been more minute in the statement of the weirs in Merrymeeting bay, because they are supposed to have had much to do with the decline that the summer fisheries have experienced during the last fifteen years, and because they are of a far more formidable character than those on the lower part of the river. Of the forty-five weirs erected this year above the Chopps, (the outlet of Merrymeeting bay) one, the uppermost on Swan Island, had no pound for taking fish, but depended upon a net set at the end of the hedge; another was improperly built and ineffective; of the remainder, all well built weirs, one (that between the Abagadassett and Kennebec channels) was an ordinary shoal weir; two were broken down early in the season, leaving forty deep weirs of various degrees of efficiency in operation during the past season. This is about the number built each year, the same sites being occupied for many years in succession. It should however be remarked that two of them are double weirs, that is, have two setts of pounds and two hedges, the second being on a line with the first and built out directly from it further into the channel.

The length of the leader or hedge and the depth of the water in the fish pound vary of course with the conformation of the ground.

In some cases it is necessary to extend the leader across broad flats in order to reach the desired depth; in others the channel runs close to the shore. As a general rule the deeper the water the more productive is the weir, yet in many locations the extension into very deep water does not pay for the extra expense. In the course of our examination soundings were taken at the outer side, and sometimes on the inside of many of the weirs, and the results reduced to a low water standard.

Of the weirs built on the Androscoggin channel we examined five situated on the southern shore, and all were found to be within the limits prescribed by the law for the Kennebec,—namely, ten feet maximum depth at low water. It is a matter of doubt whether that law applies to these waters. It would certainly seem that if the Androscoggin river was intended to be regulated by it, there would have been a provision whereby some of the counties on that river would have been represented on the board of wardens, whereas they are appointed only from the counties of Sagadahoc, Kennebec and Somerset. However, the people interested seem to have considered themselves bound by the law. It appears to have been the practice of the owners of weirs in this river as in the Kennebec to extend their weirs into much deeper water than ten feet. The people who are interested in seine fishing further up the Androscoggin believed that they were being robbed of their rightful share of fish by these deep weirs, and in the absence of officers, determined to take the matter into their own hands. Accordingly in the spring of 1867 they came down from Brunswick and ordered certain weirs to be curtailed. One man who had built his weir on the flats was obliged to remove it at considerable loss to the Bath shore. On the opposite side of the river the netting was forcibly stripped from one of the weirs and hung upon the stakes.

In 1868, a notice signed by certain men in Brunswick headed by a Mr. Storer, was sent to the weir owners, that the law respecting weirs should be enforced. Mr. Storer came down again in June to inspect the weirs, and pronounced himself satisfied with those on the south shore, but found some fault with those at the entrance of Cathance river. It is certainly to be regretted that the necessity should exist for any such irregular proceeding as the forcible removal of a fish weir by private individuals, but in the absence of any efficient officers we hardly see how they could in any other way protect themselves in what they esteemed their

rights. Yet we must say that the obstructions on this channel appear to be less formidable than those on any other channel entering Merrymeeting bay.

The six weirs built in Cathance river vary in depth at low water at the entrance, from seven feet to fourteen and one-half; at their outside from nine to fourteen and one-half. The most formidable are the first on the south side, belonging, we believe, to Robert Curtis, and the two uppermost, belonging to Jellison, Raymond & Co. Mr. Curtis' weir measures fourteen and one one-half feet at the entrance of the first pound or "pasture," and the same at the outer side of the fish pound. The two owned by Jellison, Raymond & Co., are opposite to each other, and are built in the deepest water of the channel, which happens here to be along the two banks, the water in mid-channel not being so deep by two feet as inside their northerly weir. From the entrance (on the landward side) of their south weir to the low water mark is fifty feet or more, —probably more; for at forty feet distance shoreward from the entrance there is five feet at low water.

Abagadassett river is even in a worse condition than Cathance. It is a smaller river, yet seven or eight weirs have been built in it this year, and they have been pushed far out into the narrow, crooked channel. At low water the weir built above the lower bridge by Messrs. Preble, was seen to stand in the very middle of the channel and to occupy one third or more of its width; the same may be said of that built by J. W. Cushing, not far below the bridge; and those farther down are not much better. The leader of one of them extended quite across one small channel. The weir at the lower end of the flats between the Abagadassett and Kennebec channels is one of the deepest, measuring at low water fourteen and one-half feet.

On the Kennebec channel the weirs are generally deeper than on the others. That at Abagadassett Point, built by Capt. Robert Jack, measures about twelve feet, the two of the Preble Brothers eleven and fourteen respectively, that of Maxwell, fifteen. On the south end of Swan Island flats two built by J. L. Brown, seventeen and fourteen feet. The first weir on the east side of the Kennebec is built by Winchell Lilly and others, of Dresden; this is a double weir, and is the most formidable, as well as probably the most profitable on the river. It is built across one channel of fifteen feet depth at low water, across a broad shoal, and into the edge of the main channel of the river. Its leader has about 450 stakes

and its entire length is not far from one hundred rods. The inner pounds are at something more than half the entire length of the leader from the shore; at their entrance is twelve feet of water, and between them and the shore the water is fifteen feet deep. The outer pounds have a depth of ten feet. This weir is reported to take a great many salmon. We know of its having caught three salmon in a tide on several occasions in June last, while not one of the weirs above it on the same side of the river had caught a single salmon up to the twenty-fifth of June.

The weirs on the east side proceeding upward, and their depths, are as follows: A. Reed and Lilly, eleven feet; Thwing, sixteen feet; Hawthorne, seventeen feet; Thwing and Perkins, sixteen feet; Perkins, six feet; W. W. Walker & Co., taken up before June twenty-fourth; Clancy and Lewis, eleven feet. In Eastern river, D. Clancy, eleven feet; W. W. Walker, thirteen feet.

It will be seen that a great part of these measurements exceed the legal limit of ten feet. In fact very little regard has been paid to that or any other legal restriction since the passage of the act limiting the pay of wardens to twenty-five dollars a year each, they bearing their own expenses. That measure was introduced and carried through in the interest of the weir builders, for the express purpose of destroying the efficiency of the board of wardens. It is to be sure averred that one of the wardens was commencing suits for the purpose of lining his own pockets with his share of the fines, and it is complained that those prosecutions for violation of the law were costing the public a great deal of money; but we have heard nothing which tends to show that the wardens did anything more than it was their duty to do. It is not denied that violations of the law were numerous, and we think the offenders are the parties really responsible for the cost which their prosecution entails. And if the wardens failed to execute the law fully, it was not for want of zeal and determination, but in consequence either of a want of personal acquaintance with the business of fishing, or of a defective law. It is very certain that a law requiring a gate to be opened in a weir ten feet under water, and be kept open certain days in each week is difficult of execution against the will of the owner, unless an officer who is well versed in the construction of weirs is close at hand on every unlawful day. The fishermen with whom we talked on this subject did not attempt to conceal the fact that they had circumvented the wardens and

evaded the law, and some amusing stories are told of the manner in which the officers were outwitted. At present no pretensions are made to the observance of the law. Of course it is folly for an officer to attempt to enforce it on twenty-five dollars a year. The wardens can do scarcely anything more than hold their yearly meeting as provided by law. The supervision of fishways also devolves upon them, but for the same reason it is out of the question for them to do anything about it.

The weirs between Merrymeeting bay and Bath are partly deep water and partly shoal water weirs. The conformation of the river does not favor the building into deep water to such an extent as in the bay.

Below Bath, the weirs, with a single exception, are shoal weirs, having "pockets" with board floors near low water mark. The exception is a deep weir like those of Merrymeeting bay, built the last two seasons on Crow Island, at the mouth of Back river. Two others of the same kind were constructed last year, but as they did not pay, the experiment was not repeated. The locations on this part of the river where deep weirs can be operated are very few. When the tide is out the water must be slack enough to allow a seine to be used in the fish-pound. It is complained by the fishermen up the river that these lower weirs are kept up too late in the season and destroy vast numbers of the young shad and alewives on their way to sea.

The fishing season proper closes as early as the middle of July, and the object of maintaining the weirs in effective condition after that is to catch bait for the cod fishery outside the river. We presume it was for this reason that by law that part of the river below Fiddler's reach was excepted from the operation of the fishery law, giving to the people of this section the privilege of fishing when and how they please. In consequence of this exception, that provision requiring the weirs to be stripped on or before the fifteenth of July is entirely inoperative; for the fishermen of Merrymeeting bay of their own accord not only strip their weirs but take them all up before that date, and the law does not apply to that section where weirs are kept up later. But the practice of the people in this favored section is not uniform. Some perhaps take up their weirs as soon as the upward run of shad and alewives is over; some merely take the netting from the pockets; some take off the netting but maintain the other pounds in effective condition for taking bait; while a few keep on the netting till late in the fall.

The bait appears to consist of herring, (sometimes known as *English herring,*) scattering alewives, some full grown, some half grown, many bluebacks, a few young shad; pogies and various other species stray in with them from the sea. Sometimes a large number of pogies will be caught in a weir, or of mackerel. We are informed that some of the weirs are kept up through the fall to catch smelts. The sea shad, too, are taken in the summer for some time after the run of river fish, but they have of late years been very scarce. This is attributed to the blue fish which are rapidly increasing in numbers (breeding on our coast,) and run into the Kennebec at the time when the sea shad might be expected; but we are inclined to think the general decline of the shad has much to do with the decrease of the number that are found in the state called "sea-shad." How much injury is done by the destruction of the young of river fish we cannot say with confidence, and the testimony is conflicting. Several persons have said that they had seen young shad and alewives lying dead on the floors of the weirs, bushels of them together. Mr. Nathaniel Perkins, of Hunnewell's Point, who has fished there for forty years, says they are not caught and destroyed by the weirs whose pockets are constructed of netting, because they can and do freely pass through the meshes and escape, and that he never knew an instance of their being destroyed in that way. On the other hand, Mr. John C. Homer of Bucksport, who has built a weir there ever since 1825, says that every year he sees young alewives two or three inches long coming down the river in large schools; that they run into the weirs, and do not know enough to go through the meshes; that many are eaten by eels, and the rest left on the floor dry. We are inclined to think there is truth in the assertion that these young fish do die in the weirs very often. We have seen them repeatedly in pockets, when the water had fallen so low that escape was no longer possible, and a fall of a few inches more would certainly leave them dry, notwithstanding that the meshes were sufficiently large for them all to pass out had they made the attempt. It is the same with other small fish. We have seen a school of young herring not two inches long embayed in a weir, and about to be left bare although the meshes would have been no hindrance to the passage of fish twenty times their weight. For this reason we doubt whether the use of a slightly larger mesh on the pockets, as recommended by some, would obviate the difficulty. Still, it may be that the loss of fish from this source is inconsiderable. It

should be borne in mind that the death of a single fish that has arrived at maturity has really far greater effect to depopulate the waters than the death of many young. And this is the reason:—the greater part of the young of shad and alewives and of most other species fall a prey to stronger than they; and of the vast numbers that are hatched in any breeding river and start for their feeding grounds in the sea, a very small part probably return to the river. We presume it is within bounds to say that the man who kills one five pound shad on her way up the river to spawn is doing more harm than he who kills fifty young on their first journey to the sea. Now then, it may be made to appear, notwithstanding there is a considerable destruction of young fish by these weirs, that they are doing no more harm than the same number of wiers fishing during the ascent of the breeding fish, and that the capture of such bait as they take for the cod and hake fishery, is of quite as much importance in the production of food as is the capture of full grown fish for direct consumption. There is, however, another argument bearing on this point that we have not considered, and that is the catch of salmon. Should this species become much more abundant it would pay the owners of weirs to maintain them much later in the season than the fifteenth of July for the sake of salmon alone; and this might interfere seriously with their increase, so that it might be necessary to remove all obstructions much earlier than the people would now be willing. A little more research is needed in this matter.

There were two seines used this year near Augusta, neither of which did a paying business, and six in the Androscoggin. Whether any was in operation in Eastern river we did not learn. Those in the Androscoggin have not done well this year, and their very earnest attempts to have the weirs restricted are very good evidence that their profits have been seriously impaired for some years before. Their dependence is upon shad, and of these they appear to catch more than could be done on the Kennebec. Mr. Daniel Hunter, who runs a seine near the bay bridge, says that seven to ten thousand shad is a fair catch; but we suppose this is better than has been done of late. Mr. Hunter's catch up to 23d of June this year was only 1400 shad. He has not caught a salmon for several years—few bass, and not more than two hundred alewives yearly. The fishing season is from 6th to 20th of May to the last of June.

We have heard from various sources the complaint that these seines on the Androscoggin have been very destructive to the shad by "sweeping out great quantities of spawn from the spawning beds." It has been described as coming out in bulk by the "cartload." Now all that we know of the reproduction of shad tends to render this story very improbable. It is not supposed that shad cast their egg in heaps, and even if they did, it is known that the eggs are very light, and do not adhere in any degree to each other; so that it would be impossible to draw a mass of them ashore—they would all easily slide through the meshes and escape. But the story may have easily arisen from the fact (as we have reason to suppose it is,) that many ripe shad are often taken in large numbers, and as they lie in bulk the spawn is pressed out, and may accumulate in heaps on the ground or in a tub.

There is another complaint against the Androscoggin fishermen which appears to be more reasonable. It is said that at the mouth of a small stream, somewhere above Bay Bridge, where smelts are accustomed to run in the spring to spawn, and where it has been the custom to dip them, for several years a seine has been used, and tons of them were taken out when nearly worthless for food. Many were shipped to New York, and commanded a price that hardly paid for transportation. This is an abuse that should be stopped. We think no smelts should be taken during the spawning season—say from April first to June first. Enough can be taken in the fall and winter, when they are in good condition, and it is wonderful that they can stand the draft that is then made on their numbers.

It seems to be the general opinion among the fishermen of the Kennebec that the time has come for a radical change in some direction or other to save the fisheries from destruction. There is, to be sure, very little harmony in their views of a remedy. The different classes of fishermen too generally exonerate themselves from all blame and throw it upon the other classes.

Self interest will warp the judgment of most men. But we have found only one man who thinks that the fish are not decreasing in numbers, and his experience only extends over a period of seven years. With this single exception, the many with whom we have conversed have agreed that the shad and alewives have fallen off alarmingly within fifteen years, and that they are now rapidly diminishing. All agree further in blaming the dams and insisting upon the necessity and justice of having good fishways

over them. Nearly all further agree that the deep water weirs are in a great degree responsible for the decline since 1852, about which time they were first introduced. Even some owners of these weirs have confidently stated to us that they believed they were a curse to the river and ought to be forbidden; and many of them have declared that unless fishing speedily revived they must give up the business. All these facts brought to light by our investigations in this matter during two summers have tended to show that since the building of deep water weirs has been introduced, there has been a decline in the numbers of certain species which can be attributed to no other cause; that they are peculiarly deadly since they lie directly athwart the way of ascending fish which seek to follow the banks of the channel; that if such weirs could and should be built generally on the lower part of the river, the almost utter extinction of the river fish would be the result, We advise that all river weirs be restricted to low water mark.

Introduction of Black Bass and Land-locked Salmon.

No attempt has yet been made to introduce black bass. We do not know of any experiments with the spawn of this species. They have been introduced to many new waters by carrying the live fish. The most extensive transportation of which we have any accurate account was accomplished by Dr. W. W. Fletcher of Concord, N. H. He was employed by the Commissioners of New Hampshire to introduce black bass to some of the waters, and succeeded in bringing from Lake Champlain, and liberating in good condition in New Hampshire waters several hundred (we think the exact number was 221), at an expense of about three dollars each. Dr. Fletcher thinks they could be brought from the same point to Maine for five dollars apiece. We are of opinion that no fish promise to thrive so well and give so much satisfaction generally in our perch and pickerel ponds as the black bass. But as there are several species known by this name, it might be well to ascertain whether the species inhabiting Lake Champlain is the best, or is equal to any other kind of black bass.

During the fall of 1867, an attempt was made to obtain the spawn of the Sebago Salmon, in order to introduce the species into new homes. After much time expended several thousands of the eggs were obtained in Harrison, properly fecundated as we believed at the time, and now believe, packed in baskets of bog moss, and brought by stage and rail to Manchester, where they

were deposited in some hatching troughs prepared to receive them. They were carefully tended, and to experienced persons appeared to promise favorable results until long after the time when they should have shown some decisive development. Yet of the whole lot we only know certainly that *one* hatched. The cause of the failure we were for a long time unable to even surmise, for everything had been done as nearly as possible in accordance with the directions of the authorities. But we now entertain no doubt that the cause of the failure was transportation too soon after fecundation. During its early days the principle of germination in the egg is easily destroyed; it requires quiet and plenty of pure water. But when the young fish is once fairly formed, so that it can be seen with the naked eye, it can be safely handled and carried long distances packed in some damp substance. The eggs in question were packed up and transported immediately after fecundation. We were led to expect success from the apparent success of Dr. Fletcher's first attempt to introduce salmon by the egg from the Miramichi river to New Hampshire in 1866. His eggs were packed up directly after being taken from the fish; the most of them were planted in the Pemmigewasset river where their fate could not be known, but of several hundreds taken and hatched in a spring, ninety per cent. hatched. Still, general experience has been against Dr. Fletcher's. A gentlemen in Boston has informed us that he has tried the transportation of eggs of brook trout from Rangely lake, after they had been fecundated one week, and met with a failure nearly as disastrous as ours.

This year we determined to try again, and to obtain the eggs from Grand Lake Stream. Accordingly we went to the outlet of Grand Lake on the 24th of October, and made preparations to take the spawn. Search was first made for a suitable spring, and one that would answer our purpose was at last found within half a mile of the stream. A large basin was excavated and walled in with seasoned timber, and a rough house built over it. A number of seives were floated in the basin, in which the eggs were to be deposited as fast as obtained—this being the best arrangement we could make in the short time left before the spawning of the salmon.

We had made no preparations to take fish in any way except by hook, relying on the confident statement of our assistant, an experienced fisherman, that he could take them in plenty when just in the proper condition, with the hook. This statement was par-

tially justified by the fact that many females seized the bait with avidity, from which a few eggs flowed with the slightest provocation; but in every such instance it was found that these eggs were the last remains of the season's spawn, and in no case did such a fish yield more than twenty or thirty eggs. A large part of the eggs were obtained from fish speared by Indians; the remainder from fish caught with the hook and confined in baskets and floating cages until ripe. The first ripe fish was found on the night of the 26th of October, but the spawning season was not at its height until about the fifth of November. It was necessary to await the partial development of the eggs deposited in the spring, and it was not until the tenth of December that it was thought safe to pack them up. The development was doubtless retarded by the variation of temperature in the seines, where the water was found on the coldest morning, that of December tenth, to be several degrees colder than that outside, in the basin, and the latter had fallen below the normal temperature of the spring.

The eggs were packed in tin boxes of bog moss (*Sphagnum*,) and these tins in baskets of drier moss, sawdust, &c. A portion were sent, according to agreement, to the Massachusetts Commissioners, who contributed to the expense of the expedition. The greater part of the remainder were brought to Manchester and deposited in hatching-troughs erected last year, where after all losses, by imperfect fertilization, and by transportation, we have several thousand eggs in which the embryo fish is distinctly visible.

Some eight hundred eggs were deposited in a stream tributary to Cathance lake.

Hatching of Shad.

Believing that an acquaintance with the mode in which the eggs of shad can be taken from the parent fish and successfully hatched into living fish would be of much practical utility should it become necessary in the process of restoration to introduce the fish again to the waters from which they had been long excluded, some experiments were undertaken last summer in the Kennebec. The place selected for operations was the seining ground of Messrs. Tibbetts and Dennen in Augusta. Being busily occupied elsewhere, we were not able to commence until near the close of the fishing season. The first lot of eggs was taken on the night of June 28th, and the operation continued each night until July 4th.

It was necessary to operate entirely by night, for during the day but very few shad could be taken. The results obtained did not vary much from those obtained by the experiments at Holyoke on the Connecticut, under the auspices of the Massachusetts Commissioners of River Fisheries, and reported by them last year. We will, however, briefly state the mode of operating, and some of the results.

As each "haul" of fish was brought on shore the shad were examined, and such as were ripe, emitting either eggs or milt on being gently pressed, were laid aside. As soon as they had ceased to struggle violently, one of the female fish was taken in hand, held above a pail partly full of water, and the eggs pressed into it. A male was then taken and from him the milt or male element was expressed into the same dish. The other fish were treated in like manner. After standing awhile in the pails, (varying from a few minutes to several hours,) the eggs were deposited in the hatching boxes. These were of boards, about eight inches deep, of various lengths and breadths, with wire cloth bottoms. They were made to float in the river attached to a boom where the current was gentle on the flood tide and rapid on the ebb, but always in the same direction. The current kept a constant circulation of water through the bottom of the box, and in some cases the eggs were in a constant state of agitation, but without injury.

The temperature of the water was from 70° to 75° F., and the period of incubation varied from seventy to near one hundred hours. When taken from the fish the egg measures in diameter not quite one-twelfth of an inch, but water is rapidly absorbed by the outer coating until the diameter is more than one-eighth of an inch. The eggs are so nearly transparent that they can hardly be seen when lying in a pail of water; but when placed in a position favorable for the eye, the process of development can be traced at every step. At eighteen hours from impregnation the vertebral column can be distinctly seen; at thirty-four hours the eyes are plain and the heart is beating; at seventy hours the young fish bursts his covering and swims free. The unfecundated egg also undergoes development up to a certain point, being for a time undistinguishable from the fecundated; but it always stops short of the formation of the vertebral column, or any development in which we can trace the form of the young fish.

As soon as all the eggs in a box were hatched, they were turned into the stream; young shad begin to feed early and bear confine-

ment with nothing like the patience of trout or salmon. It will doubtless be found practicable to feed them and confine them for a certain length of time, but how to do it successfully is not yet discovered.

In these experiments probably one hundred thousand (100,000) eggs were manipulated, and half of them hatched and turned into the river. This is too small a number to amount to anything economically, and there is no place in the State where shad can be hatched on a sufficiently great scale. There would be no difficulty in hatching them by millions, could the necessary number of ripe fish be caught. We did not succeed in getting from each fish the large number of eggs reported by the experimenters at Holyoke. Not a shad that we manipulated yielded more than five thousand eggs, whereas the ovary really contains many times that number.

There are some reasons, however, for considering the result satisfactory. It is really very good success to hatch fifty per cent. at the first attempt; that is much better than nature would have done. We have besides ascertained that the eggs of shad can be obtained in the Kennebec to stock any river that may need it—at least to start a new brood in any exhausted stream. To carry live fish, particularly shad, to any considerable distance and put them into a new home in good condition is a work of great difficulty; but the eggs can be carried and hatched with the greatest ease.

Some study was given to the reproductive habits of several other species—among them the little smelts of Monmouth, of famous flavor, and the large smelts of Sidney and Belgrade, that weigh frequently three quarters of a pound each; both of these are fresh water species, quite distinct from the smelt of the tide waters and from each other, running up into the brooks in spring, and depositing their eggs on stones, sticks and weeds, where they adhere tenaciously until hatched. They are among the very finest of edible fishes—next to the white-fishes, perhaps. The white perch, (*Merone Americana*, Gill,) received some attention, but we are only able to say of this species that in the Kennebec and the Penobscot it spawns in June and July, at which time we were occupied. The striped bass, (*Roccus lineatus*, Gill,) was also found in the breeding state in the Kennebec about the first of July.

Suggestions toward a revision of Fishery Laws.

In our investigations during the past two seasons, we had constantly in anticipation a revision of the fishery laws. Those on

the statute books are very numerous and of very diverse character. As stated in the former report, the whole number of them in force at the present time is about one hundred and fifty, and they are increasing at the rate of eight or ten yearly. They are founded on no common system, and the officers to enforce them are without organization and generally without efficiency. It must occur to every one, that with such a similarity as exists in most of our rivers, their fisheries can be regulated by the same general provisions, that there need be a variation only in minor details, and that responsibility will greatly augment the efficiency of the officers. We have now proceeded so far in our investigations that we can with tolerable confidence advise a general repeal of old statutes, and suggest the main features that should be embodied in a new code. We therefore submit the following suggestions as to the provisions of the proposed new law:

First, That a board of commissioners be appointed, who shall have general supervision of the fisheries through the State.

Second, A board of wardens for each river basin.

Third, No drift-nets to be allowed in any of the rivers or lakes.

Fourth, No weirs or other fixed engines of capture to extend below low water mark.

Fifth, No weirs or traps to be used in any except tide waters; nor any nets except a dip-net, for five years, and then the nets should only be used for the migratory kinds.

Sixth, All fishing for salmon, shad and alewives to cease on the fifteenth of July, except hook fishing, which shall cease on the first of September.

Seventh, A weekly close time of two days, during which all weirs shall have open gates.

Eighth, No salmon or trout to be taken during October, November and December.

Ninth, No smelts to be taken in April or May.

Tenth, All weirs, seines, and other implements except hook and line, used in catching salmon, shad, alewives, smelts or bass, to pay a license fee of ten dollars.

Eleventh, Some legislation, if any is necessary, to give adequate protection to any person who may engage in the cultivation of fish.

For some of these recommendations it is proper to state our reasons, and to suggest some further details.

First, The existence of some supervising officers is deemed

essential to secure the proper enforcement of the law, and the vigorous advancement of measures for the improvement of the fisheries. The members of this board should hold office for more than one year,—say for three years. They should be authorized to examine the dams and other obstructions existing in the rivers, to decide upon the proper form and location of fishways and cause them to be built in case the owners of the obstructions fail to do so; to visit all sections where fisheries are carried on and examine the working of the laws; to introduce and disseminate valuable species of fish; to revise any minor regulations that the boards of wardens may be authorized to make; to issues licenses; and to report annually to the Governor.

Second, The boards of wardens should be appointed by the State, should be sworn to a faithful performance of their duties, a penalty being affixed to neglect; should have power, and it should be their duty to enforce the law; to seize all implements of fishing found in illegal use, and to bring the offender to justice; to decide upon the plan and location of fishways, subject to the approval of the commissioners, and to enforce their building subject to the same approval; the number of men appointed and the compensation allowed them should be sufficient to ensure the full execution of the laws. In the case of certain rivers like the Saco and St. John, the appointment of wardens might be deferred for a time.

Third, No drift nets should be allowed. Our reasons for this are that drift nets, owing to their mode of use are exceedingly difficult to control, are destructive and wasteful in their operation, and if permitted are capable of being multiplied to such an extent as to be very detrimental. While weirs are stationary and seines can only be used in a few localities, where the fishery officers will always be able to see their operations, the drifter, if permitted at all to pursue his mode of fishing, will find but little difficulty in eluding the vigilance of the wardens and extending his operations within forbidden limits. Again, an increase of the numbers of the fish would be a great inducement for many persons to engage in the drift net fishery,—so many as to render a limit to their number quite necessary. This limit would be difficult to maintain since the nets are not stationary. We do not consider it desirable that fish should be caught in this way, for all that can be spared each season from the stock of breeding fish will be taken by the modes permitted. It is well argued by Mr. W. H. Venning, in his report on the fisheries of New Brunswick, that if, while the shores are

studded with weirs and set-nets the channel should also be occupied by drift nets, no fish could possibly ascend to their breeding grounds. The arguments generally urged in favor of drift nets are that they are the poor man's mode of fishing and must therefore be allowed, and that they are not very destructive. Neither of these reasons do we think are valid. When shad are the fish caught, a drift net will kill many that do not mesh enough to hold them, fall to the bottom and are lost. As to the other argument it is very certain that none but able bodied men can drift, and for such there is sufficient employment of other kinds to be found. At the present time there are comparatively few persons who are engaged in this mode of fishing and scarcely anybody would be seriously injured or incommoded by its prohibition.

Fourth, The reason for the prohibition of deep weirs, so far as concerns the Kennebec, are given in our report upon that river, and we believe the same reasons will apply to all other rivers.

Fifth, The lake, pond and stream fisheries will not bear fishing in the productive modes employed with the migratory species.

Sixth, Experience in Great Britain and Ireland has shown that the most beneficial results follow from closing the salmon season early. The late fish are generally inferior in quality since many of them have been a long time in the fresh water. Yet we think the use of the hook may safely be continued somewhat longer than the more productive modes.

Eighth and Ninth, The forbidden months cover the breeding season of the respective species, and so far as we can see are sufficiently long. Perhaps whitefish and togue should be included with salmon and trout although in some sections whitefish are only taken with the spear while spawning ; in Moosehead lake they are taken with the hook. The fresh water smelts may be for the present excepted from the prohibition to take smelts.

The entire prohibition of all nets except dip-nets, of all weirs and traps, and the protection of the salmon family during the spawning season are, we think, all the provisions necessary to protect the fresh water fisheries from depletion. It may perhaps be necessary to extend the above season of trout and salmon another month into the winter ; but we are not aware that any further protection is necessary for perch, pickerel and other species than is contained in the prohibition of nets. All the old laws upon the subject might safely be repealed. Yet we would advise exceptions to be made in favor of certain acts which will expire by

limitation in a few years; for instance the act of last winter in relation to the Sandy river ponds.

Tenth, It seems desirable that the State should derive something directly from the fisheries to assist in defraying the cost of protecting and improving them; and it is but just that those who are immediately benefitted should contribute directly. The license system will assist the officers in keeping the fishing establishments within reasonable limits, and it may prove the germ of a large revenue to the State.

There is a river of Scotland, the Tay, whose salmon fisheries are owned by a few individual proprietors on its banks; these fisheries are rented yearly and have of late brought the proprietors a sum equal to $75,000, gold, annually. Were all our waters to yield in that proportion, and we know no reason why they should not, our salmon fisheries would rent for *more than a million dollars in gold.*

Eleventh, We would call attention to the doubtful character of any private claims to natural bodies of standing or running water, and consequently to the fish that might be cultivated therein. It is sufficiently well established that large ponds and lakes are the property of the State; but how is it with smaller bodies? Are these also public property, or is there a point, determined by its size, where a body of water ceases to be public and becomes private property? If the latter, it is very uncertain where the point of distinction lies—whether at ten acres, at one acre or one rod. A legislative enactment authorizing private persons to appropriate and use water on their own premises or surrounded by them for the purpose of cultivating fish would secure these interests and obviate the necessity of many special acts.

There should be some exceptions to the operations of these laws. For instance the fisheries of Damariscotta and East Machias are well managed by their local communities, who evince a desire to retain their special laws. Some other cases may occur and should be considered. The exceptions made in the "act regulating certain fisheries," of last winter, should be retained.

Nearly all these provisions could take effect immediately, but those forbidding certain modes of fishing for salmon, shad and alewives should not take effect before the close of the next season, because persons engaged in those fisheries will have their preparations for next season far advanced before the new regulations could be promulgated.

Conclusion.

In conclusion we beg leave to urge that two seasons have now been almost wholly expended by the Commissioners in preliminary examination; and that the next should be the commencement of vigorous work in restoring the seafish to our rivers. As intimated elsewhere, the first and by far the most important work to be done, is the construction of fishways. We have advised that it be part of the duty of the Commissioners to be appointed under the new law, to decide upon the location and plan of these structures, and to enforce their construction. A sufficiently liberal appropriation should be made to enable them to push forward the work as fast as other circumstances will permit. Every year the reform is delayed the public suffers a loss of hundreds of thousands of dollars in healthful food. Our remarks on the Penobscot river will show that in that river alone, there is an annual loss of several hundred thousand dollars by neglect of the fisheries. Public expenditure is a fair test of the estimate placed upon the fisheries by different States. We find the State of New Hampshire appropriating three thousand dollars in a single resolve for this same object that we have in view; the State of Massachusetts, appropriating from ten to twenty thousand yearly; and these States have much less at stake than the State of Maine. The English Government expends $112,000 yearly on the fisheries of the United Kingdom, and we find the salmon fisheries of Scotland and Ireland producing annually, a sum equal to *four millions of dollars.*

Under a wise and liberal policy, there is no reason to doubt that the fisheries of Maine can be restored to something like their former productiveness.

All of which is respectfully submitted.

N. W. FOSTER,
CHAS. G. ATKINS, } *Commissioners.*

Augusta, December 31st, 1868.