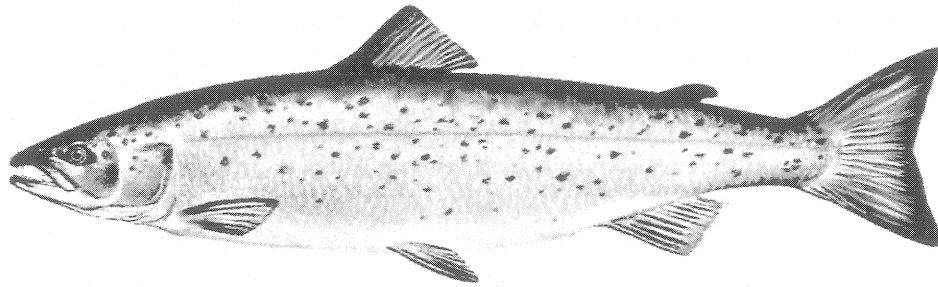


# The River Fisheries of Maine



by Charles G. Atkins, Maine's first Commissioner of Fisheries

The following excerpt is from the 1887 U.S. Gov't publication entitled "Fisheries and Fishery Industries of America", by George Brown Goode, the U.S. Commissioner of Fisheries.

Atkins' contribution to this was based on years of research. He assumed his office in 1861 and methodically began reviewing the present and historic condition of Maine's fisheries. He consulted the oldest fishermen still living to help him estimate Maine's anadromous fish resources prior to the era of dam building and industrialization. He conceived and built the Atlantic salmon hatchery still in existence at Craig Brook in Orland-- without which, in all likelihood, the Penobscot River strain of salmon would have long ago been extinguished from the face of the earth.

## 1. GEOGRAPHICAL AND CLIMATIC RELATIONS.

The State of Maine, occupying the extreme northeast corner of the United States, lies between the parallels of 43° and 48° north latitude and the meridians of 67° and 71° 10' longitude west from Greenwich. Its climate is variable, the thermometer moving sometimes through forty degrees of Fahrenheit's scale within twenty-four hours, changes of wind occurring frequently and suddenly, and the distribution of rainfall through the year being frequently irregular.

The mean annual temperature averages 42° 36 F. The mean of January, the coldest month, is 15° 79, and of July, the warmest month, is 67° 85. As extremes there occur almost every year maximums of over 90° and minimums of — 15° to — 35°.

The precipitation at Orono\* has averaged 43.6 inches annually, including the snowfall, which had a mean annual depth of 92.96 inches and constituted about 44 per cent. of the total precipitation. Near the coast there is less snow and farther in the interior considerably more. The distribution through the year (deduced from the mean of sixteen years) is pretty even, the driest month being June, with a mean of 3.06 inches, and the wettest, October, with a mean of 4.87

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\* The generalizations of air, temperature, and rainfall are drawn from observations by President M. C. Fernald at the State College, Orono. This station is near the geographical center of the State.

inches. The fluctuations of the same month from year to year are illustrated as an extreme case by the record of October, which shows a fall of 1.14 inches in 1874 and 9.57 inches in 1869. As compared with other regions, it appears that Maine has a rainfall a little in excess of that of the other Northern and Middle States, less than that of Oregon and the Gulf States, and greatly exceeding that of England, France, or Germany. The evaporation has been estimated at 60 to 65 per cent. of the rainfall, and the remaining 35 or 40 per cent. is discharged through the rivers.

The area of woodland in Maine has probably changed but little since 1869, when Mr. Wells estimated it at 21,200 square miles, or 67 per cent. of the entire surface of the State, of which 61 per cent., is primeval forest.\* The latter lies in two principal bodies, which are also contiguous, the first by far the greater, occupying the northwestern part of the State, and comprising the northern portions of Oxford, Franklin, Somerset, Piscataquis, Penobscot, and part of Aroostook Counties; the second in the southern part of the State, in Hancock and Washington Counties, and extending at several points quite to the sea. The head waters of all the large rivers and many of the small ones are in the wooded districts. These forests consist largely of coniferous trees, spruce, hemlock, pine, and arborvitæ. They contribute in several ways to a constancy in the flow of the rivers. The ground is carpeted with moss and leaves, which check the surface flow of water during and after rains, and in the spring the trees shield the vast masses of snow covering the ground from the sun and winds, and cause it to melt gradually. The woodland streams are also free from the mud and other pollutions that are washed in from cultivated fields and drains of cities and villages. Amid these forests, moreover, lie the natural breeding-grounds of the salmon, which are doubtless safer there from pursuit than they would be in populous districts.

The extreme head waters of the largest rivers, the Androscoggin, Kennebec, Penobscot, and Saint John, are within 75 miles of each other along the western border of the State in the highlands forming the water-shed between the Gulf of Maine and the Saint Lawrence River. From this elevated region, of which the valleys are from 1,500 to 2,000 feet above the sea, and the mountain peaks from 1,000 to 2,000 feet higher, streams radiate in all directions, those of Maine flowing towards the northeast, east, southeast, and south.

A secondary water-divide stretches across the State from west to east in latitude 46° 10' and separating the Penobscot from the Saint John basin. This is not coincident with the Appalachian hills, which lie mostly to the south. The elevations of this divide are from 1,500 feet in the west to about 500 feet in the east. The surface of the State is thus divided into a northern slope of 7,500 square miles, and a southern slope 25,000 square miles. The former has a gentle inclination to the north and east, and is wholly drained into the Saint John. The latter embraces that portion drained by rivers emptying into the Gulf of Maine within the limits of the State, and has in the western portion a southeasterly and in the eastern portion a southerly inclination, with many local irregularities. The southern slope is for the most part accessible naturally to the anadromous fishes, but the greater part of the northern slope, about 5,000 square miles, is cut off from the sea by the intervention of the impassable Grand Falls of the Saint John River, in New Brunswick.

## 2. CHARACTERISTICS OF MAINE RIVERS.

**DECLIVITY.**—The rivers of Maine are characterized in the first place by a considerable yet moderate descent. The surface of the main slope rises very gradually from the sea to the headwaters, and the river beds are sunk very little beneath the general plane. A fall of 1,085 feet in 140 miles, or 7.8 feet per mile, may be taken as representing the mean declivity.† Some of the

\* Wells, Water-power of Maine, page 24.

† Wells, Water-power of Maine.

river beds in the western part have a slightly steeper incline, and some in the eastern a more moderate one. The declivity is in general well distributed through the course of the river, but is in nearly all cases greater at a distance from the sea, and its uniformity is much broken by the occurrence of abrupt falls and lakes. The falls are not often precipitous or sufficient to prevent the ascent of fish, though this sometimes occurs, as at Hiram on the Saco, East Rumford on the Androscoggin, and on several tributaries of the Kennebec.

**LAKES.**—The great number of lakes that dot the surface of the State forms a striking feature in its topography. On the published maps there are represented 1,620, varying in size from 100 acres to 120 square miles, and it is probable that several hundred more above the minimum in size are unrepresented. Their depths are in no known case very great, but few of them exceed 100 feet, and many with an area of several square miles have in no place a greater depth than 50 feet. One of the deepest is Lake Sebago, which has in one spot 410 feet of water. The lakes exert a favorable influence on the rivers as homes of migratory fishes in various ways. They serve as regulators of volume, preserving from extreme low stages, and as clarifying basins in which the sediment borne by the tributary streams is deposited. They afford breeding grounds for alewives and possibly retreats for salmon during the summer preceding and the winter following their spawning season.

**RIVER BEDS.**—The stony character of most of the soil of Maine and the rapid flow of the rivers combine to give the latter in general a clear hard bed of rock *in situ*, or of boulders and gravel, with, however, occasional stretches of muddy bottoms and banks.

In the western part of the State the lowland adjoining the rivers is often composed of sand, which in that case forms the banks and sometimes part of the river bed. As a whole these rivers abound in the gravelly rapids to which salmon resort for spawning purposes.

**PURITY OF WATER.**—There is in the soil of the State comparatively little material that is readily taken up and held long in suspension by the streams and rivers. The occasional turbidity following a sudden and excessive fall of rain in the disforested districts soon disappears through the precipitation of the earth in suspension. The lakes also are immense clarifying basins, and discharge waters of great purity. The waters are, in most cases, strongly tinged with brown from peaty or earthen solutions, and the general color of the water, both of rivers and lakes, when seen in great depth, is an inky blackness, though when examined in a small receptacle, as in a goblet or pail, they appear of crystal purity.

**VOLUME.**—Of the total rainfall it may be assumed that 65 per cent. is evaporated and the remaining 35 per cent. is discharged by the rivers into the ocean. This calls for a mean delivery of 67.44 cubic feet of water per minute (35,452,000 cubic feet per annum) for each square mile of area drained. Applied to the Penobscot, this ratio indicates a mean discharge of 498,000 cubic feet per minute.

The fluctuations in the volume of a river are governed by several circumstances, of which we may mention, first, the irregularities of precipitation; second, the variation of the evaporation with the changes of weather and the season; third, the area of storage basins in the shape of lakes, and the extent to which they are brought into use. Many rivers of the second class have such extensive storage basins that the volume is very constant, the variations of level rarely exceeding 2 or 3 feet. But on the Kennebec and Penobscot a variation of 8 feet within four months is not very rare, and a difference of 6 or 7 feet between flood and drought is the rule. For instance,\* on the

\*These data are furnished me by Mr. W. W. Fellows, engineer in charge of the water works, from personal observations.

first day of April, 1877, the Penobscot stood 7.25 feet above the dam at Bangor; through April it ranged from 7.25 to 4.75 feet; through May from 4.8 feet to 1.9 feet; through June from 1.9 to 1.4 feet; through July from 1.5 to .08; and in August it stood for a few days at the minimum of one-half foot. On the 29th of the following November it had risen to 6.25 feet; in December it fell from 5.9 to 1.5 feet; but through the whole of the following February (1878) it stood at 6 and 7 inches (.5 and .6 foot). The highest stage for the spring of 1878 (6.46 feet) was attained in April; the lowest stage for the summer was 15 feet, in August; the lowest for the year was 6 inches, October 1 (with flush boards on the dam); and the highest for the year was 9.2 feet, December 14. In 1879 the maximum (8.85 feet) was attained May 3, and during that month the water averaged higher than in April; it was low (15 inches) July 17, and still lower (1.3 inches) October 19. In 1880 the highest water was in May and the lowest between August 17 and October 24, during all of which time an extreme drought prevailed, the water standing just at the crest of the dam or an inch or two above or below it. Thus in four years we have seen the water at its highest stages twice in April, once in May, and once in December, and the lowest stages once in February and October (the same year), once in October alone, once in August alone, and once extending from August to October. The data existing on the subject are scanty, and the best generalization to be made must be founded partly on general observation, and would be as follows: The Penobscot is at its highest stages generally, but not invariably, in April or May; it is fairly full from March to July, inclusive, and never experiences a drought during those months. The lowest stages occur in August and September, often extending into October. In the winter there is generally a depression, which in some instances reaches the stage of a drought. The discharge of the Penobscot has been estimated by an expert\* at 117,000 cubic feet per minute in a severe summer drought, and at 5,760,000 cubic feet per minute in a heavy freshet.

**WATER TEMPERATURE.**—Ice from 15 to 24 inches thick covers all the fresh water during the winter. On the lakes it forms about November 15 or 20, and melts out in April, commonly near the close of the month, in the southern part of the State. In the more northerly or elevated lakes it does not melt until May 10 or 15. The larger rivers, the Kennebec and Penobscot, are closed to navigation (at the ports of Gardner and Bangor, respectively) about four months or four and a half. The melting of the snow in the spring produces a flood which clears the rivers of ice in April two or three weeks before the melting of the lake ice.

During the winter the temperature of the rivers is generally within one degree of the freezing point, but after the breaking up of the ice it rises rapidly, and through the summer generally ranges from 60° to 70° or higher, in those parts above the influence of the sea.

**TIDAL PARTS OF RIVERS.**—The tidal portions of the Maine rivers are for the most part of considerable extent. In the Kennebec the rise and fall of the tide is felt as far as Augusta, 44 miles from the sea, and before the erection of a dam at that point it was perceptible some 10 miles farther. In the Penobscot the influence of the tide extended originally to Eddington, 30 miles above the mouth of the river, or, including Penobscot Bay, 60 miles from the sea. In the other rivers the tidal portions are less extensive absolutely, and in many of them likewise relatively, to the size of the river. The Androscoggin is not affected by the tide above Brunswick 25 miles, and the Saco only to Biddeford, 5 miles from the sea. The actual penetration of the sea-water is confined within narrow limits. On the Kennebec the water does not contain salt enough to support a growth of marine algæ above Bath, 12 miles from the sea, though in seasons of great

\*H. F. Mills, C. E., quoted in Wells's Water-power of Maine, p. 105.

drought the water becomes brackish above Richmond, 14 miles farther up, and the flood-tide is strong enough to reverse the current some 10 miles farther still. On the Penobscot marine algæ are not found above Winterport, 18 miles below the natural head of the tide.

The brackish portions of a river have a lower temperature than the fresh portions, varying with the proportions of sea water present. The ocean water on the coast of Maine has a lower temperature than the fresh rivers all the summer season, from May to October, inclusive. When the salt and fresh water meet they do not immediately commingle, but the fresh water, being lighter, flows out on the surface and the salt water sinks to the depths. On the flood tide a strong inflowing current of salt water exists at the bottom often while the surface current is still flowing seaward. The salt water in the lower stratum, exposed over its entire upper surface to the fresh water, slowly commingles with it and rises, to be replaced by the constantly renewed flood from the sea.

The most of the rivers empty into broad estuaries before reaching the open sea. The most notable example is the Penobscot, whose estuary is 30 miles long and 20 wide at its mouth. The most notable exceptions are the Kennebec and the Saco, whose lower courses are confined in narrow channels quite to their entrance into the open sea.

The river fisheries are mainly carried on in the tidal portions, where strong flood and ebb currents alternate. Weir fishing is never attempted above the flow of the tide, and the most common form of weir depends for its working upon the retreat of the tide, which leaves the fish stranded upon a floor.

The tide averages about 11 feet rise and fall, varying from 8½ feet at Saco to 18 feet at Eastport.

**ARTIFICIAL CONDITIONS.**—The artificial alterations in the condition of the rivers are very considerable. They arise in part from the cultivation of the soil, but mainly from the erection of dams and the throwing of refuse from the saw-mills into the water. The exposure of the bare earth to the action of rains, as in all cultivated fields, especially in hilly districts, results in the washing of great quantities of soil into the rivers, where it settles in all places not swept by strong currents, but more especially near the mouths of the rivers. From the first occupation of the country\* until very recent times it has been the general custom to throw into the river all refuse from the saw-mills, including not only sawdust but shavings, edgings, and in many cases even slabs.

\* The aboriginal population of Maine does not appear to have been at any time very dense. It has been estimated at 37,000 in 1615, but the data are exceedingly meager and this may be erroneous. About that time they were greatly reduced by intertribal war, and still more by a destructive pestilence, by which it is believed that whole tribes were nearly exterminated. Between 1675 and 1758 they were involved in repeated destructive wars with the whites, by which many perished and many more were driven to emigrate to Canada. By the close of the eighteenth century but a few hundred remained. The coast was much frequented by European fishermen at the beginning of the seventeenth century, and the first settlements were mere fishing stations, located at points convenient for the capture and curing of cod and other marine species. The trade in furs early attracted attention, and many posts were established at accessible points on the coast and larger rivers, mainly with an eye to trade. After the fishermen came the lumbermen, attracted by the magnificent forests of timber which covered the whole land with the exception of the corn fields of a few thousand aborigines; and after all there came the white tillers of the soil. The earlier settlements experienced many vicissitudes; some of them were abandoned after a few years existence, and many were swept out of existence by their savage foes; but there are some settlements that have been continuously occupied from as early a date as 1623, and many others that can claim almost as long an existence, with the exception of a temporary suspension in consequence of Indian hostilities. Yet so slow was the increase in population that in 1675 (just before the beginning of the Indian wars) there were but 6,000 people in the whole State, there being at that time from 120,000 to 150,000 in all New England. In 1675 a desolating Indian war broke out, and the progress of settlement was arrested for about forty years. In 1735 the white population is estimated to have been 9,000; in 1743 there were eleven towns and 12,000 people. Wars with the Indians finally closed in 1758, and a year later fear of their renewal was allayed by the conquest of Canada from France. Immediately after this began an extensive immigration from Massachusetts, which continued uninterruptedly for more than half a century, and brought the population from 24,000 in 1763 to 96,540 in 1789, 298,269 in 1820, and 399,455 in 1830. The population in 1889 was 648,936.

Some of these materials were sufficiently water-soaked to sink at once to the bottom; others floated many miles, some of the coarser sorts even to the open sea; but sooner or later all of the sawdust and a great part of the other refuse sank to the bottom. The coarse and heavy portions resisted the action of the currents much more than the sawdust alone could have done, and the interstices being filled with sawdust and mud, deposits were thus formed that after the lapse of years came even to obstruct navigation.

The degree to which the fisheries are affected by this refuse is not easily determined. So long as it remains in suspension it does not seem to deter fish from ascending a river, though swimming thickly in all the strata of the water from the surface to the bottom. Where it settles to the bottom, however, it undoubtedly destroys all those animals that find their home in the sand and gravel and mud of the natural bottom, and to that extent deprives young fishes of their natural food. It is not unlikely that this may have had much to do with the disappearance of shad and bass from some localities.

Of a more serious character are the changes resulting from the erection of dams. Almost every stream in the populated parts of the State large enough to turn a saw-mill has been thus obstructed at from one to a dozen points in its course. The dams were with scarcely an exception built in utter disregard of their effect upon the fish, and in the majority of cases no adequate fish-ways were provided. The breeding grounds of salmon, shad, and alewives were therefore greatly curtailed in all the rivers, while in others they were entirely cut off. For example, in the Kennebec River the building of the dam at Augusta in 1837 completed a chain of obstructions that reduced the range of shad in that river and its tributaries from 150 to 50 miles, and that of salmon from about 300 to 50 miles. These figures do not, however, represent the injury done to those fisheries, which is measured rather by the reduction of the area of spawning-ground. This, in the case of the salmon, was from perhaps 50 miles of rapids to less than half a mile, and in the case of shad from 100 miles of gently flowing water to about 25 miles. It would be difficult to arrive at an exact estimate of the amount of the injury thus done, but I deem it safely within bounds to estimate the diminution of the productive capacity of the rivers at 90 per cent. from this cause alone.

The revival of interest in the river fisheries, which began in Maine in 1867, has given rise to renewed efforts to facilitate the passage of fish up the rivers. Improved forms of fish-ways have been devised and constructed in many places, yet but a small proportion of the waters affected have been as yet reopened.

### 3. NATURAL AND ECONOMIC HISTORY OF THE RIVER FISHES.

LIST OF SPECIES.—The river fisheries of Maine aim at the capture of the following species: Salmon (*Salmo salar*), shad (*Clupea sapidissima*), alewife (*Clupea vernalis*), smelt (*Osmerus mordax*), striped bass (*Roccus lineatus*), eel (*Anguilla rostrata*), tom-cod (*Microgadus tomcod*), and sturgeon (*Acipenser sturio*). The blueback alewife (*Clupea astivalis*) is also caught to some extent in the weirs that are built for the true alewife, and in some cases the two are confounded. White perch (*Roccus americanus*) are rarely taken, this species being in Maine mostly confined to the non-tidal fresh waters. As a neglected species may be mentioned the lamprey, which occurs in nearly or quite every river, but is rarely utilized in any way.

#### THE SALMON (*SALMO SALAR*).

NATURAL HISTORY.—The salmon of Maine (*Salmo salar*) is identical with the salmon of all the rivers of Eastern North America and Europe. A brief statement of the principal points in its natural history will suffice. It enters the rivers in the spring and summer, beginning and

completing its run earlier in the central and western part of the State than in the eastern. In the Penobscot it is sometimes taken near Bangor in the month of March, and always early in April. It is more abundant in June, and the catch practically ceases early in July. Those individuals that succeed in escaping capture, reach the upper waters early in the summer and lie there quiet until their spawning season, which is the last of October and the first of November. They lay their eggs at night on gravelly shallows, covering them loosely with gravel. The old fish return to the sea mainly in the spring, spend one entire year in recuperation and further growth, and the second year again visit the rivers for spawning. The eggs lie under the gravel, slowly developing, from November till May, when they hatch. The young salmon feed in fresh water one or two years, then descend to sea, and after the lapse of a period not definitely ascertained, but probably two or three years, revisit the rivers as adults, weighing from 9 to 14 pounds. The general average of adults taken is about 13 pounds, but it varies from year to year, being sometimes less than 12, and sometimes (rarely) as high as 18 pounds. Salmon eat nothing while in fresh water, constantly falling away in weight and deteriorating in quality. They swim mainly by day and near the surface.

It is well ascertained that salmon originally frequented the following rivers, viz: The Piscataqua, Mansam, Saco, Presumpscot, Royals, Androscoggin, Kennebec, Sheepscot, Medonak, Saint George, Penobscot, Union, Narraguagus, Wescongus (Pleasant River), Machias, East Machias, Orange, Denny's, and Saint Croix. At the present day they are found only in the Androscoggin, Kennebec, Sheepscot, Penobscot, Machias, East Machias, Denny's, and Saint Croix.\* In the Androscoggin only a few are found, seeking to ascend the river; in the Sheepscot only occasional specimens are observed; of the Machias about the same may be said; in East Machias the yield is unimportant (only 35 in 1880); the Denny's has of late yielded from 200 to 1,000 yearly, the Kennebec about the same, the Saint Croix from 100 to 500, and the Penobscot from 5,000 to 15,000.

**MODES OF CAPTURE.**—Salmon are captured with spears, dip-nets, drift-nets, set-nets, weirs and traps, or pound-nets. The spears have only been used by the Indians, and appear to have been their ordinary, if not exclusive, implement for the capture of this fish. An Indian spear of the present day consists of a wooden handle, a straight, plain terminal spike of steel, and a pair of wooden jaws on opposite sides of the spike. When a fish is struck the spike pierces the body, the jaws spring apart, and then close upon the body of the fish and hold it securely. They are plied at night, by torchlight, from a canoe. Dip-nets have been in use since the occupation of the country by Europeans to capture salmon in difficult places about falls; but on nearly all rivers it is now unlawful to take anadromous fishes in such places, and therefore dip-nets are not much used for salmon-fishing.

**Drift-nets and set-nets.**—Drift-nets and set-nets take salmon (and other fish) by enmeshing them. They have a large mesh, from 6 to 7 inches, and are essentially alike, being simple straight nets, buoyed at the top and leaded at the bottom. The same net may be used in either way, and in early times such was a very common practice. Previous to the present century the salmon of the Maine rivers were taken almost wholly by meshing nets, either stationary or drifting. At points where the shore was bold a net would be set directly from it, the shore end being made fast to a stake and the outer end kept in place by killocks anchored off at proper distance. On a gently-sloping shore the fisherman would build a brush hedge to a suitable distance from shore and set the net at the end of that. The size of these nets was not uniform, but a common length

\* Single specimens are indeed sometimes taken in other smaller streams, as the Harrington River, but these are considered strays.

was 40 feet, for use on a bold shore; the prevailing mesh was 7 inches, stretch measure, and the common depth twenty meshes, or about 8 or 9 feet; they were knit at home, of hemp twine of medium weight. In 1814 the length of nets set in the Penobscot River, including any other contrivance to which they might be attached, was limited by statute to one-third the width of the stream where used. The use of set-nets for salmon has been generally abandoned on the Penobscot and Kennebec since the erection of weirs became common, but is continued in Denny's River to a small extent.

Drifting for salmon was formerly practiced in all the salmon rivers. In the Kennebec and Penobscot the drifting-ground was the whole length of the river, though of course the best spots were just below obstructions, on the Kennebec at Waterville and on the Penobscot between Bangor and Oldtown. After the building of dams these grounds were changed, and were always below the lowest obstruction. As the salmon became scarcer drifting on the lower courses of the rivers was gradually abandoned. It is now practiced more or less on the Saint Croix, Penobscot, and Kennebec, but the recent laws forbidding fishing within 500 yards of a dam or fishway have greatly discouraged it.

Angling for salmon has been successfully practiced for many years in Denny's River, and it is probable that the lack of success that has thus far attended its trial on the Penobscot is attributable to transient causes.

*The salmon weir.*—The most radical difference in the river weirs concerns the mode in which the captured fish are removed. In the most common forms the fish are finally entrapped in an inclosure of rather small size, provided with a board floor, upon which they are left by the retreating tide, and upon which the fisherman comes and picks up his catch. Upon the Kennebec River there is in use a weir of which the "fish-pound" is a large inclosure, with no floor but the bottom of the river, from which the fish are removed by means of a small seine operated from a boat, which is pushed into the inclosure. This is known as a "deep-water" weir, and as its use is mostly or wholly confined to the Kennebec River, where the shad is the main object of pursuit, it will be described in connection with the remarks on shad. The kind first mentioned, which may be called a "floored weir," will first receive description.

For an example of a typical floored weir we may take the Penobscot salmon weir. This generally consists of a "leader" and three "pounds." The leader is a straight fence running out from shore, generally at right angles with it, constructed of stakes driven firmly into the ground 2 or 3 feet apart, and woven with brush or, rarely, hung with nets. Its length varies according to the natural features of the locality. It is always sought to place the pound in the channel, or, in case that is not attainable, in as deep water as can practicably be reached, generally from 10 to 20 feet at low water. In some cases broad "flats" intervene between the shore and the chosen site for the pounds. In other cases the bottom slopes off steeply into the deep water and powerful currents of the channel. The former may require a leader a third of a mile in length; the latter less than 50 feet. The outer end of the leader stands in the middle of the entrance to the outer pound, dividing it into two parts, which occupy the base of the large, symmetrical, heart-shaped figure formed by the walls of the inclosure. The entrance (embracing both sides of the leader) is about 22 feet wide; the pound is about 60 feet in extreme width and 60 feet in length. It is generally built of brush, not rarely in whole or part of netting. It has no floor. At its apex it opens by a narrow entrance into a smaller inclosure, the "second" pound, which has a floor above low-water mark. The second pound is also heart-shaped, is 18 feet wide, is always made of netting, or, as termed on the Penobscot, "marlin." It leads by an entrance but 12 inches wide into an oval "fish-pound." This is also floored and built of the best and strongest netting.



Around the edge of the floor runs a single upright board, the "ribbon board," to which is attached the lower edge of the "marlin," which is thus relieved from the force of the struggles of the fish when they find themselves about to be stranded on the floor. The floor is of rough boards, and the cracks between them are sufficient to allow the water to drain out freely. The entrances of the second and fish pounds are tunnel-form, the sides standing to each other at an angle of about 80 or 90 degrees, and the outer entrance approaches the same form. The stakes employed in weir-building are commonly of black spruce, an abundant tree in the fishing districts, which grows straight, slender, and smooth, and affords strong and elastic wood. The brush is oftentimes alder or white birch, but other kinds are also used. The netting is always of cotton, from the twine described as "18-thread, No. 20," with meshes  $1\frac{1}{2}$  inches square, or what is known as a two-inch-and-a-half mesh," and tarred before being put to use. It is woven to accommodate the entire height from the floor to extreme high-water mark. When a new piece is bought it is placed upon the fish-pound, and the older pieces are used on the outer and second pounds, where they last several years.

The ordinary sites selected for salmon weirs are on muddy bottoms, and the entire structure even to the floors, is supported by stakes or posts thrust or driven into the ground by workmen operating from a scow. The brush is woven in with the stakes above water and then pushed down, one piece at a time, by a crotched pole or an iron implement made for the purpose. The closeness of the work varies much, but it is not thought advisable to make a very close matting, as that would hinder too much the passage of the currents through it and would render some parts, especially of the outer pound, too dark. Where netting is applied, it is rarely put below low-water mark, the lower parts being of brush. The substitution of net for brush appears to have operated favorably by facilitating the passage of currents. The old-fashioned fish-pound, woven of brush so close that fish could not escape, was a comparatively dark, stagnant inclosure, and a very inefficient arrangement compared with the modern netted pound.

There are many variations from the typical weir above described, most of them of slight importance. In some cases there are but two pounds; in others there are four. In ordinary sites the pounds project, one beyond the other, into the river; but where the bottom slopes off too steeply for such an arrangement the series is produced parallel with the shore. In some districts the entire bottom is too hard for staking, and the weirs are built in sections with timbered bottoms in which the stakes are fixed, and which are towed to the proper place, sunk, and ballasted with stone. On exposed shores it is sometimes necessary to support the principal parts against the force of wind and waves by guy-ropes attached to heavy moorings. Instead of the shore the outer extremity of a weir is sometimes made the base from which to start the leader of another weir. On the Kennebec floored weirs are for the most part confined to shoal water, another form, to be described below, being employed in deep water, and a slightly different nomenclature prevails.

The cost of building a salmon weir with a long leader, all new, may be put at from \$80 to \$100, including pay for the labor, which, however, is mostly performed by the proprietor. To keep up the same weir, including necessary repairs, would cost from \$50 to \$80 per year.

The received theory of the operation of these weirs is that the migratory fishes, moving up or down the river along the shore, are intercepted by the leader, and, in striving to pass it, fall into the outer pound, which is of such form that, once within it, the fish rarely succeed in finding the path by which they came, the curved sides, which they follow, leading them constantly past the outer entrance and directly toward the second pound, which in turn conducts them to the fish pound, the whole arrangement being based upon the propensity of fishes to move in straight lines

until turned aside by some obstruction. Its practical working proves the theory to be well founded; but some uncertainty exists as to the degree of perfection attained by the device and the ratio of fish caught to those encountering the weir and escaping. The testimony of some close observers indicates that a very considerable proportion of the salmon that are enticed into the outer pond, and some even of those that reach the fish pound, find their way out again. Whether there is utility in the two entrances, on the upper and lower sides of the leader, is also a matter of doubt, as it is not known whether as a rule the fish enter the weir on the lower or the upper side, whether with the flood or ebb tide.

The precise location of a weir for most effective work appears to receive less attention than the importance of the subject demands; yet it would not be correct to say that the fishermen are heedless in the matter. In nearly all the fishing districts since weir-fishing first began there have been many experiments tried in the location of weirs, and those sites that paid best have been selected and continuously occupied. The locations that have thus stood the test of experience are strictly regarded by their owners, and many of the best weirs have been built in the same position, with scarce the variation of a fathom, for a generation; for all this, it is probable that a careful study of the tides and currents and the influence upon their movements of the fish would lead to a change of location for the better in many cases. The observations of some intelligent fishermen have led them to the conclusion that the line of contact between a tidal current and an eddy is the place where fish (especially salmon) are most likely to congregate, and that the nearer the entrance of a weir can be brought to this line the greater will be its success, other things being equal. This is not so easy a thing to do as might at first appear. The position of an eddy line varies with the strength of the tides, the volume of the river, and the force and direction of the wind; so that a weir which is to-day in just the most favorable position may not be so again for a month. Sometimes for a whole season the mean position of an eddy line may be some rods away from its normal position. More generally recognized are the direct influences of the winds. Almost any fisherman will say "such a wind is favorable for me, but with such another I catch nothing." In general, it appears that a lee shore is better than a sheltered shore. Perhaps the wind influences solely by roughening the surface of the water, which in nearly all kinds of fishing is a favorable circumstance. Calms are universally unfavorable.

*The pound net, or trap.*—The pound net or "trap" (the ordinary term) in use on the Penobscot consists of the "run," the "inner pound," and the "outer pound." The run is a straight net running out into the water at right angles to the shore. It is 11 or 12 feet deep, and its length depends somewhat on the character of the site; 25 fathoms is the common length, but in very "bold" water 18 or 20 fathoms will answer. At the extremity of the run is the inner pound, which is shaped like an obtuse arrow-head, the two barbs being styled "hooks." The entrance of this inner pound, 6 feet wide, is between the barbs or "hooks," and at its tip is an opening 1 foot wide, which leads into the outer pound, an inclosure about 18 feet square. Both pounds have bottoms and are of the same depth as the run, 11 or 12 feet. The whole is supported by wooden floats, so that it rises and falls with the tide, and is held in place by anchors planted at the extremities of long "warps." The mesh employed is 6 or 6½ inches long, being 3 or 3½ inches square. This mesh is too small to enmesh a 22-pound salmon and too large to catch one of 6 pounds. It is supposed that if small salmon ever enter these nets they pass out through the meshes. The majority of the medium-sized and large salmon do not mesh, but remain free in the pound, being too wary to strike the meshes. The bottom of the net is commonly several fathoms above the ground; and were not the salmon that encounter its run persistent surface-swimmers, they would dive under it and escape without entering the pounds. The three parts first described constitute what the fishermen call a "hook

of nets." Sometimes from the outer extremity another run is set with pounds at the end of it, constituting another "hook of nets," and this combination is called a "gang of nets." Sometimes as many as four hooks are set in a single gang. The invention of this style of net is ascribed by the fishermen to one "Halliday, an Englishman," with reference, doubtless, to the same Halliday who introduced the use of netting or "marlin" on the weirs in the Penobscot River. The net in use before the introduction of the present form of trap had only one pound, corresponding to the inner pound. It was much inferior, as a great many salmon escaped by the entrance, which had to be wide to induce them to enter at all, and in this way the very largest salmon were always lost, being too large to mesh. Still farther back the pound was represented by a mere bend of the net at its outer end, and this was also preceded by the simple straight gill-net which was in common use for the capture of salmon in Penobscot River and Bay in the eighteenth and early part of the nineteenth centuries. The improvements were very gradually made, and as late as 1850 fishing with nets with only the bend at the extremity was common. The trap is used only in Penobscot Bay, and with the exception of a single net set in 1880 at Searsport, it is confined to the west side of the bay below Belfast, and to Long Island.

**CURING AND MARKETING.**—In the early days of the Maine salmon-fishery the bulk of the catch was either salted down in barrels or smoked. For smoking, the salmon were prepared by first splitting, removing the backbone, but leaving the head on, and salting for two or three days, according to the size of the fish. When sufficiently salted they were washed off, spread by applying thin braces of cedar or spruce across the back, and then hung up in the highest part of a little domestic smoke house. Constant exposure to the smoke for two or three days completed the process.

Salt salmon were to some extent consumed in local markets, but it appears that the greater portion was sent out of the State. Smoked salmon became early in the present century an article of traffic with the larger sea-ports of other States. Many were shipped on vessels laden with lumber and miscellaneous produce. Small vessels belonging in Southern New England used to visit several of the larger rivers annually and load with pickled shad and smoked salmon, buying a part of their salmon already smoked and smoking part themselves. This trade died out before 1850.

With the growth of the modern demand and the modern facilities for preservation and transportation, the practice of marketing fresh increased, and for many years it has been exclusively employed. For this purpose each fisherman has an ice-house and puts up a supply of ice every winter. As soon as caught the salmon are placed on ice. The dealers have like facilities, and in transportation the salmon are always packed in ice. There is a considerable local demand for salmon in the cities and villages of Maine, but this is partly supplied from the rivers of New Brunswick, and much the greater portion of those caught in Maine is shipped to Boston, where most of them are retailed.

#### THE SHAD (*OLUPEA SAPIDISSIMA*).

**NATURAL HISTORY.**—This is the common shad of the Atlantic rivers from the Saint Lawrence to the Gulf of Mexico. It is the finest in quality of all those members of the herring family that frequent fresh water, as it is of all the Clupeidæ of North America. In Maine it attains a size of 12 pounds, but this is extremely rare, the average being not far from 3 pounds, and the ordinary range from 2 to 5 pounds.

The shad is mainly a marine feeder, but it reproduces its kind exclusively in fresh water, spending several weeks in the rivers for that purpose in May, June, and July. The earliest shad

are taken in the Kennebec or tributaries during the last days of April, but the main run is in May and June. Before the erection of mill-dams the shad ascended the Kennebec and tributaries to a distance of 100 miles, and the Penobscot to a distance of 170 miles from the sea; and it is probable that their spawning-grounds in those days were largely in the quiet stretches of river above the influence of the tide. But in recent times their migrations have been restricted to the tidal portions of both those rivers, as also of nearly all the rivers in the State, and their eggs are all laid in water subject to the action of the tides, yet entirely free from salt. The earliest ripe spawn is observed the last week in May. Spawning doubtless begins before June 1, but is mostly performed in June, while the latest shad are not ready till July—possibly a few individuals not until August. The poor and shrunken shad that have completed the work of spawning are first seen on their return to the sea about June 20, and they are constantly met with through July. They begin to feed before reaching the open sea, and recover a good deal of fat and flavor before disappearing.

The eggs of shad have a slightly greater specific gravity than water. Extruded into the open waters, protected by their transparency, swayed hither and thither by the currents, they develop with great rapidity, and in three or four days, according to the temperature of the water, give birth to living fish. The young shad descend very shortly to sea.

Shad are believed to attain maturity in three or four years. A portion of the males have active sexual functions when a little larger than an alewife, and probably a year old. A more numerous class of immature individuals feed about the bays and in the mouths of the rivers during the summer later than the ascent of the main body of breeders. They are of smaller size, fatter, more numerous, with sexual functions dormant. The fishermen call these "sea shad," and consider them quite distinct from the "river shad" or "spring shad," but there is abundant reason to believe them merely the common shad at a particular stage of growth. They never ascend the rivers so far as the spawning shad, rarely showing themselves in any great numbers above the reach of brackish water. They frequent some salt bays entirely removed from fresh rivers; for instance, the northeast branch of Casco Bay, where fisheries for them have existed for many years, and have sometimes been quite productive. But these localities are in the vicinity of the Kennebec River, and I know of no instance of their occurrence at any great distance from a shad river.

The original range of shad in Maine included almost if not quite every river in the State; but in the smaller rivers it does not appear from the scanty evidence attainable that they were ever very plenty. From nearly the whole extent of some of the larger rivers they were excluded by impassable falls, and from many of second size they were shut out by mill-dams at so early a date that their former presence is attested only by a dim tradition. In short, there are only three rivers in the State in which it is quite certain that there ever existed an important shad-fishery. These are the Saint Croix, Penobscot, and Kennebec, and in the Kennebec alone has the fishery continued to be of considerable importance to the present time, while in but three other rivers and a few salt bays is there now any attempt to fish for shad.

**MODES OF CAPTURE.**—Shad are caught in weirs, seines, drift-nets, and dip-nets.

*Weirs.*—The weir mainly employed at the present day for the capture of spring and summer fish in the Kennebec River, in which shad are the most important fish taken, differs from the salmon weir already described, in that the fish are not left by the retreating tide on a board floor, but in a deep and spacious inclosure, from which they are taken with a seine. They have been generally termed "deep-water" weirs, but, from the mode of operation, may be better styled "seine-weirs." The seine-weir commonly consists of three pounds, denominated, "first pound" or "pasture," "second" or "middle" pound, and "third" or "fish pound." The latter is an inclosure

of about 120 feet circumference, surrounded by a strong net running quite to bottom, its lower edge being weighted down with a heavy chain. When the tide is out the water in this inclosure is from 2 to 15 feet deep. It is "fished" about low water by sweeping it with a small seine,\* and hauling the fish into a boat. The method of construction is similar to the floored weir above described, but more net and less brush is used. The net is of cotton twine from sixteen to twenty-four thread, meshes 2 to 2½ inches *in extenso*, is kept tarred (pine tar being preferred for fresh water), and lasts several years. These weirs were introduced on the Kennebec about 1852, and have proved far more effective than the floored or "pocket" weirs that preceded them. The most important advantages possessed by them appear to be the following: First, the fish can enter the fish pound readily at all stages of tide and on a level with the bottom of the river; second, the fish pound is more capacious; third, if fishing is omitted for a tide or two, the fish do not die, but have plenty of water to swim in until next tide.

The floored weir, already described as a salmon-weir, was, early in the century, the instrument of the capture of immense numbers of shad, along with alewives and salmon, in both the Kennebec and Penobscot. At the present time they furnish all of the few shad taken on the Penobscot, and many of them are still built for the mixed fishery of the lower Kennebec. Half-tide weirs, such as are described in connection with the alewives, were also formerly much employed for the capture of shad and alewives, especially on the Penobscot, but with the diminution of the supply have almost wholly gone out of use.

*Seines.*—A seine, in the common parlance, is a movable net by which fish are surrounded and captured either by pursing up the bottom or drawing both seine and fish ashore. All the seines employed in the river fisheries of Maine are of the latter class, and of a size requiring four men to each seine. The ordinary method of operating is to coil the net on the stern of a large seine-boat, from which it is "paid out" or "shot," as the boat is rowed out and back in a semi-circular course. From each end of the seine lines run ashore by which it is "hauled." All fish within the inclosed area are brought ashore except those small enough to slip through the meshes. Salmon, shad, alewives, bass, perch, and sturgeon may all come in together. It is necessary to have a smooth bottom and smooth shore, and be in close proximity to the channel where the fish run. Nature has fitted but few seining grounds on Maine rivers, and most of the grounds that have been used have been cleared up for the purpose, with a more or less considerable expenditure of labor. In consequence of this lack of facilities seines have never been extensively used. On the Kennebec and tributaries fourteen seining berths are enumerated as having been occupied in former times, but nearly all of them are now abandoned. On other rivers seines have been still less employed.

*Drift-nets.*—Drift nets were formerly largely employed for the capture of shad in all the rivers frequented by them, especially the Penobscot and Kennebec. This was an important industry down to 1840, or a little later, since which date it has entirely ceased in the Penobscot, and lost nearly all its importance in the Kennebec. At the present time 56 drift-nets are plied in Eastern River, a branch of the Kennebec, and 66 more in the Kennebec and its other tributaries. In Casco Bay there are 90 drift-nets in use, but only for a few nights each season. The shad drift-nets of the present day are of about 4½-inch mesh, varying slightly in different localities. This size is adapted to sea shad. In Casco Bay they are knit of fine linen twine, from thirty-five to forty-five meshes deep and of various lengths, from 100 to 300 feet. When fishing in a broad

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\* The seine is a net fixed on two poles or "staves" at either end, with corks at top and leads at bottom. By means of a line running through rings around the bottom it is "pursed" or "tucked" after the ends are brought together, and the fish are thus bagged.

channel a single boat will sometimes put out 3 of these nets joined together. At Georgetown, on the lower Kennebec, they are 30 fathoms (180 feet) long and fifty-five meshes deep. In early times, when the large river shad were alone taken, a much larger mesh was used,  $5\frac{1}{2}$  inches being the rule on the Penobscot. Drifting for shad is done only at night. In the rivers the ebb-tide is chosen, but in Casco Bay the state of tide is considered a matter of indifference.

*Dip-nets.*—Before the original abundance of shad had been much affected by the operations of man, productive dip-net fisheries for them existed at many points on the rivers where natural obstructions existed, which were nevertheless not impassable. Among these stations may be mentioned Waterville and Skowhegan Falls, on the Kennebec, and Salmon Falls, on the Saint Croix. At the latter point there was in use, in 1825, “a large dip-net attached to a long swinging pole like a well-pole. It was heavily leaded to make it sink in the swift water; it was then swung round, and it was not at all uncommon to take two or three barrels of shad at a single dip of the net.”\*

The only instance of a dip-net fishery for shad in recent times is in Nonsuch River, a very small stream, not over 20 miles in extreme length, in the town of Scarborough. The nets here used are about 9 feet deep and hung on wooden bows, 3 to 5 feet in diameter, with a long and heavy pole. When in use the bow rests on the bottom of the stream in the middle of the channel, which is very narrow, and the pole is supported by a crotched stake planted on the bank. The stake serves as a fulcrum on which to lift the net out of the water when the striking of a fish is felt.

**METHODS OF CURING SHAD.**—Three-quarters of all the shad now caught in Maine are marketed fresh. The rest are pickled. The proportion pickled has been constantly diminishing since about 1840 or 1845, at which date it embraced substantially the entire catch of the Kennebec and other shad rivers beyond those used in the local markets.

**PROCESS OF PICKLING.**—The inspection laws of Maine require pickled shad to be assorted in three grades, denominated “mess,” “No. 1,” and “No. 2.” For the highest grade the fish is opened along the belly, the entrails removed, the body split so as to lay it out flat on its back, and the anterior two-thirds of the backbone cut out. As fast as dressed the fish are thrown into a tub with water, from which they are shortly removed to another tub of clean water (either fresh or sea water) in which they are laid, flesh side down, to facilitate the escape of blood. After lying here about two hours and being swashed about to wash off the blood and gurry, they are salted down in a hogshead tub to “strike.” They are first thrown upon salt in a shallow box, rubbed in it, and, with the salt sticking to them, are placed in the tub flesh side up. If the crew is working fast and there is any danger of not getting on salt enough, more is thrown on as the filling progresses. There is no danger of getting too much salt. The “striking” takes one bushel to a hundred fish. The length of time required for this process depends upon the weather. If warm, three days is enough; if cool, four to six days may be necessary. If necessary the shad may be left in the striking-tub a month without harm. They are packed 4 inches above the top of the tub, but as the pickle makes they settle down to 1 inch below the top. As soon as they reach a certain point in the process of striking, commonly in two or three days, the fish rise in the pickle. The upper layer is then turned flesh side down, two or three quarts of salt spread on top and a moderate weight put on, just enough to keep them under the pickle. When the striking is completed the salt is rinsed off in the pickle, and 200 pounds of fish are weighed off for a barrel. As they are placed in the barrel salt is thrown on occasionally, half a bushel being thus employed for a barrel.

\*Perley's Report on Sea and River Fisheries of New Brunswick, 1852, p. 125.

A convenient quantity of pickle is now poured in, the barrel is headed up, and then completely filled with pickle through the bung-hole. The pickle used is the same in which the fish were struck.\*

No. 1 differ from the mess shad merely in having the backbone in and the tails on. The third grade, No. 2, embraces thin and poor fish, but these, as well as the two higher grades, must be well preserved. An inspector must attend as the fish are packed and see that it is properly done. His brand is placed upon the head of the barrel, and if any purchaser finds the fish of inferior quality or in bad condition he can recover damages of the inspector.

It takes nowadays from one hundred and twenty to one hundred and thirty Kennebec River shad to make a barrel of mess. Previous to 1820 it took but ninety shad to the barrel. From 1820 to 1840 one could rely upon one hundred shad filling a barrel. After that there was a decline in size until one hundred and thirty were required to the barrel, which was the rate for some years previous to 1880. In the latter year, however, there has been an improvement in size, and one hundred and twenty are now sufficient.† The sea shad are much smaller. Of those caught in Casco Bay a barrel will hold one hundred and seventy-five. One informant estimated the number in a barrel in 1853 at one hundred and thirty or one hundred and forty, showing that these fish as well as the river shad have deteriorated in size.

The barrels now in use are almost wholly of spruce staves and pine heads, bound with twelve hoops, which are commonly of white ash. The law allows the use of white oak, white ash, pine, chestnut, and poplar for staves, and prior to 1850 pine was generally employed. Both Cadiz and Liverpool salt are in use. One experienced packer prefers to strike shad in Liverpool salt and use Cadiz in the barrel, considering the latter of superior strength, but the former better adapted to striking because finer.

The price obtained for salt shad varies ordinarily from \$9 to \$11, but as extremes may be mentioned \$6 and \$16.33 per barrel. The latter price was obtained for some lots at Richmond in 1867 or about that time. The high price combines with other circumstances to forbid the consumption of many salt shad at home. They are consequently nearly all shipped out of the State. For about twenty-five years previous to 1867 almost the entire catch went into the hands of a single firm in Boston, but since that date a considerable portion is shipped direct to Philadelphia, which market is reputed to ultimately absorb most of those sent to Boston and other points. At present this business is of little importance, but 384 barrels of shad having been packed in Maine in 1880. As an illustration of the decline in recent years may be adduced the statement that at Dresden as late as 1860 to 1865 there were packed from 200 to 400 barrels yearly, against 75 barrels in 1880.

#### THE ALEWIFE (*CLUPEA VERNALIS*).

**NATURAL HISTORY.**—The range of this species is from Florida to Newfoundland. In Maine it has a more gregarious character than any other river fish. It pushes up the rivers in dense bodies, which appear to seek unerringly each their native lakes, and the young descend to sea in solid columns. Before the obstruction of the streams by far the greater part of the alewives deposited their spawn in lakes and ponds. No stream seems to be too small for them if its waters are derived from a pond, and there can have been hardly an accessible pond in the whole State they did not visit. The inaccessible waters were those rendered so by the interposition of insurmountable falls or too great a distance from the sea. They are known to have ascended the

\* Statement of W. W. Walker of Dresden. In other districts there may be some difference in the details.

† Statement of John Brown, W. W. Walker, and others.

Sebasticook, a branch of the Kennebec, to Newport, 100 miles from the sea, in great numbers, and on another branch, the Sandy River, tradition says that they bred in Templé Pond, about 120 miles from the sea. It is not probable that their migrations were more extensive than this in any part of the State, except on the east branch of the Penobscot, where tradition says they reached a point nearly 200 miles from the sea.

The main body of the alewives enter the rivers late in May; some rivers not until June. They move almost exclusively by daylight and especially in bright sunny weather. An unusual flow of water deters them from entering a stream. They are very courageous in the passage of falls, venturing into very small channels that promise to lead them past obstructions, and often forcing their way up inclined planes where the depth of water is not enough to cover their bodies. After spawning, the old fish soon return to sea, and the young follow them between July and September, when from 2 to 4 inches in length. The time that they require to attain maturity is estimated at three or four years. They do not appear to ascend the rivers more than once in a lifetime for any other purpose than to spawn.

The alewives frequenting the same breeding place are remarkably uniform in size and appearance, but between those of different streams there are remarkable differences, mainly in the matter of size. Among the largest are those of the Kennebec, of which three hundred and fifty will fill a barrel, while of the Damariscotta alewives a barrel holds four hundred and twenty-five, and of the Brooksville alewives seven hundred and fifty. The latter are the smallest known, but are very good fish.

There is another species (*Clupea aestivalis*) that is sometimes confounded with the alewife, though nearly all fishermen recognize it as distinct. It enters the mouths of the rivers several weeks later than the true alewife, does not appear to breed in fresh water, is of slightly different shape, smaller, of finer quality, but on account of excessive fatness is cured with difficulty and generally treated as refuse, to be employed as bait or as a fertilizer for the soil.

The ovaries of a Maine alewife contain about 165,000 eggs. With this high degree of fertility they combine a considerable degree of hardiness in both adult and young compared with other members of their family, and to these characteristics we may attribute the fact that they increase with remarkable certainty and at a rapid rate when afforded even ordinary facilities. The placing of a few hundred adults in a pond at the season of their ascent is surely followed by the descent of a throng of young a few weeks later, and the return of a considerable body of mature fish after the lapse of three or four years. It is doubtful whether there is another among our whole list of fish that will so well repay efforts at cultivation.

MODES OF CAPTURE.—Alewives are caught in weirs, seines, drift-nets, set-nets, and dip-nets. The weirs do not differ essentially from those already described as built for the capture of salmon and shad, along with which the alewives are taken in such waters as are frequented by those species. This method is in use in the tidal part of every river where alewives abound. The seines are the same as the shad-seines already described. They have recently almost wholly gone out of use, but are plied in a few localities, among which may be mentioned the lower part of Damariscotta River. Drift-nets, with a mesh of 2½ inches, have been employed for catching alewives down to recent times in the Kennebec River, but have now been abandoned. They were cast from a boat at night, the banks of the channel just outside of the weirs being considered the best ground. There has never been a time when many alewives were taken in this way, and they are not known to have been so taken in any other river. Set-nets have been used only in a few localities and to a very limited extent.



The dip-net fisheries for alewives are next in importance to the weir fisheries. It is by this method that the alewives are taken at Damariscotta Mills, Warren, East Machias, and Dennysville. The dip-net is a very economical piece of apparatus, and requires no very expensive fixtures, but for its effective use it is essential that all the alewives shall be compelled to pass a narrow or difficult place within reach of the nets. This only happens in rivers where their spawning-grounds lie above tide-water, and where obstructions, natural or artificial, exist.

The form and construction of the dip-net vary considerably in different localities. Those found of late in use at Damariscotta and Warren have wooden bows bent into an oval form 2 feet wide and seized on to wooden handles, the bag being knit of coarse cotton twine and hung about 3 feet deep; they are plied in narrow basins or artificial inclosures which the fish are allowed to enter. At East Machias, where the fish are dipped directly from the open river, they use larger nets 5 feet deep, hung on a steel bow  $3\frac{1}{2}$  feet in diameter, at the end of a pole from 10 to 17 feet long. Platforms are erected at points most convenient for dipping; generally along-side a pool just below an obstruction, where the fish congregate. It is necessary that the water be swift and somewhat broken, otherwise the fish will dodge the net. Upon the platform are also the tubs or bins into which the fish are thrown as they are dipped. These fisheries are operated almost wholly in the afternoons of pleasant days. In cloudy weather the alewives are very backward about attempting the ascent past difficult places, and at night they invariably fall back into quiet pools, where they lie until the next day is well advanced. The run of fish lasts about a month, but the most of the catch is often effected during a single week at the height of the season.

The alewife fisheries have in numerous instances been from an early day held as municipal property by the towns in which they are located. They have been generally, if not always, appropriated in accordance with an enabling act of the legislature, which describes in detail the way in which they shall be managed. In some cases, the towns are to choose "fish committees," who shall capture the fish, personally or by proxy; in other cases the privilege of taking them is to be sold at auction to the highest bidder, but in either case it is generally provided that citizens of the town shall be allowed to buy limited quantities of fish at a fixed price, and certain poor people are supplied gratis. If there is a surplus the committee or the lessee can dispose of them as they see fit. These town fisheries in most cases nominally include also salmon and shad, but on the small rivers both of those species have long since been practically exterminated.

UTILIZATION.—Alewives are used as bait for deep-sea fisheries to a small extent, but by far the greater part are used as food for man. The prevailing methods of curing, are, first to salt and smoke them, second, to pickle and afterwards pack them in barrels. The former method is generally regarded as more profitable for fishermen who are able to retail the products of their fisheries, and is therefore most employed by them, each man having a little smoke-house of his own. Where great quantities are taken by one party, as by the lessees of the Damariscotta fisheries, they are barreled and sent to the wholesale markets. On the Kennebec, about seven-eighths of the alewives caught are smoked and consumed locally, and smoking has been the prevalent mode of curing for many years. On the Penobscot, at Bucksport, previous to 1830, the most of the alewives were pickled, but the practice of smoking came into general use shortly after that date and has for many years entirely supplanted pickling.

For smoking, alewives are first prepared by salting lightly in a large tub, without scaling or any other dressing; they are treated with about 8 quarts of salt to a barrel of fish. Some add 2 ounces of saltpeter. In three days the fish are sufficiently "struck," and they are then, after rinsing in clean water, impaled on straight sticks of split cedar or spruce, which are thrust through the gills, ten on a stick (formerly twelve), and hung up in the smoke-house. On the ground beneath

them a fire is made, generally of hard wood and smothered with saw-dust. After four to six days in the smoke-house, during which they may be actually exposed to smoke less than half the time, they are ready for sale. This is an outline of the practice of a Kennebec fisherman. The practice of individuals varies not a little, and the finished product is of many grades of excellence or inferiority. They are most palatable when lightly salted and smoked, but in that condition cannot be kept long. Selling at 40 to 80 cents per 100 and retailing at a cent apiece, they form a cheap and toothsome article of food, much sought for in all parts of the State.

For barreling, alewives are "struck" with  $1\frac{1}{2}$  bushels of salt to the barrel, without dressing or scaling, and after lying from four to six days they are packed closely in barrels with half a bushel or more of new salt per barrel, and filled up with sweet and strong pickle. Alewives keep better in pickle than other fish, and are therefore exceptionally well fitted for exportation to warm climates. Great quantities of them are exported to the West Indies and other warm countries. The practice of packing them without pickle has prevailed at times in some localities.

#### THE SMELT (*OSMERUS MORDAX*).

**NATURAL HISTORY.**—The smelt ascends the rivers for the double purpose of feeding and of depositing its spawn. On the eastern part of the coast it may be caught with hook and line in the harbors all through the summer season; farther west it is not to be caught until September or October, being probably a short distance off shore. In October it begins its advance all along the line, and as soon as the law permits (now October 1) the fishermen begin to set their fykes and bag-nets and ply their seines in the mouths of the rivers. With the first strong ice in December the fish are found already present in the fresh tidal parts of the rivers, and during the whole of the winter there are smelts to be found everywhere from the mouths of the rivers to the head of the tide. The smelt is a ravenous feeder at all times of the year except about the spawning time. At Robbinston it begins to take the hook about May 1, and continues to bite through the summer, autumn, and winter.

The spawning time is in April and May, a week or two after the ice leaves the river. Phenomena observed indicate that it is extended through the greater part of both months. In several brooks in Bucksport the smelt spawns from May 20 to 25, but in certain brooks in Dear Isle just a month earlier. The eggs are adhesive, and stones, sticks, weeds, and any rubbish furnish receptacles. Sometimes they are deposited on the stony or weedy bottom of a tidal river, either in fresh or brackish water, and sometimes in the pure, fresh water of small brooks.

Owing probably to over-fishing, the smelts now caught are in most rivers much smaller than formerly. Those of the Saco are nearly or quite the largest in the State; they are said to weigh from 2 pounds to  $2\frac{1}{2}$  pounds per dozen (five or six fish to the pound). Those taken in New Meadows River in weirs and seines count fourteen to the pound; those taken by hook in the Kennebec at Gardiner sixteen to the pound. The smallest marketed (but not the smallest caught) from Bucksport are adults 6 inches long and weigh about 1 ounce; among the larger specimens are some weighing 4 ounces and measuring 8 to 9 inches in length.

**MODES OF CAPTURE.**—The modes of catching smelts now or formerly employed in Maine comprehend the use of weirs, seines, bag-nets, gill-nets, dip-nets, and hook and line. All of these modes are in use at the present time except gill-nets.

**Weirs.**—The weirs used for smelts are generally "half-tide" weirs. They are built sometimes in a narrow cove, which they completely span, and sometimes at the head of a broad and shallow bay, where they receive the form of a tunnel with the apex pointing outward. At high water the smelts pass freely over them into the bay or river, but on the ebb-tide are intercepted by the spread-

ing wings of the tunnel and fall into the pounds at the apex. Such weirs are employed in the Kennebec, Sheepscot, Piscataqua, and Casco Bay. They are generally erected in early autumn and kept in operation until broken down by the ice of winter.

*Seines.*—Seines are but little used, and only in the vicinity of Brunswick and Harpswell. They are small affairs, 15 to 20 fathoms long, and of 1-inch mesh, and are used in narrow creeks and coves from October to December, and occasionally in the spring.

*Bag-nets.*—The bag-net fishery for smelts is of considerable importance, a larger aggregate quantity being caught this way than by any other method except hook and line. Its principal seats are the Kennebec and Penobscot Rivers, but it is also carried on in the Wescongus, Harrington, and Tunk Rivers to a small extent.

The bag-nets used in different localities vary some, but those of the Penobscot may be taken as the type, and will be described in detail. These nets are plain bags, knit of strong cotton twine, of  $1\frac{1}{2}$ -inch mesh. The mouth of the net is rectangular, 25 or 30 feet wide and from 12 to 18 feet deep. The "trail" or length of the bag is 30 or 35 feet. The bottom and top commonly taper toward the trail to half their width at the mouth, and the sides taper to a point. The fixtures to which this net is attached and the mode of attachment vary according to circumstances, the fishing being pursued sometimes in the open water, sometimes in the spaces between the piers of a bridge, and sometimes beneath the ice.

For an open-water fishery the bag-net is hung upon a rectangular wooden frame a little larger than the mouth of the net, to the corners of which are attached four guys, running to a slightly buoyant log of wood, which, in its turn, is chained to a heavy stone, dropped to the bottom of the river. Thus anchored the net swings freely in the tide, but with a current of moderate strength it is pressed down until the bottom of the frame rests on the bed of the river. The attachment of the net to the frame is by means of large rings, which slide freely up and down on the upright sides of the frame. Ropes passing over pulleys at the top and bottom serve to open the net and draw it down to its place in the frame, or to close its mouth and draw it up, while the same lines running to the surface and suspended by small buoys mark the place of the net, and enable the fisherman, working from his boat, to draw it up. In some districts this frame is called a "wrinkle."

If ice covers the fishing grounds a very different arrangement must be resorted to. A narrow hole, as long as the net is wide, is cut in the ice at right angles with the current, and at either end of it is planted, upright, a stout pole something over 40 feet in length, running down 35 feet, more or less, into the water, and secured in position by guys attached to both top and bottom, and anchored in the ice. Ropes running through blocks draw the net down to its place at the bottom of the poles, or draw it up through the ice to be emptied of its fish. The whole arrangement rises and falls with the tide. The net is therefore, when set, at a constant depth beneath the ice, and at a varying height above the bottom of the river. Nearly the same arrangement is employed at a bridge as at Bucksport, but in this case the fixtures are attached to the bridge, and the net is at all times, when fishing, close to the bottom.

The bag-net, whether used on a frame in open water, beneath the ice, or at a bridge, is drawn entirely out of the water to secure the fish. It is made fast to the standing fixtures securely, but so as to be easily cast off and taken ashore. The fishing is done both by day and night, but, in general, the night tides are by far the most productive. Flood tide is at Verona bridge much more productive than ebb-tide, but at Sparks's Point, 3 miles below, a frame fishery finds the opposite to be true. Spring tides are more favorable than neap tides.

*Fykes.*—Fykes are double bag-nets, the large open-mouthed net in front leading by a narrow opening at its apex into a smaller one, termed the "pocket," from which, as from a weir, fish escape with difficulty. The fish are taken out by drawing up the "pocket," through a separate hole in the ice, and unlacing an opening at the bottom, the main part of the fyke remaining under water for weeks or months. The fyke has been used in various parts of the State, but does not appear to have given entire satisfaction. There is complaint of its being more difficult to clear of rubbish, anchor ice, &c., than the plain bag-net, which has in some cases superseded it.

The various forms of bag-nets have been in use on the Kennebec since 1852, and in the Penobscot for a shorter period.

*Gill-nets.*—The only form of gill-net known to have been used for the capture of smelts in Maine was in use in the Kennebec before the introduction of bag-nets. It was a small affair, stretched on a frame about 6 feet square, and set through a hole in the ice. A great many of these were used in small tributaries of Merrymeeting Bay, and were quite effective while smelts were plenty and large.

*Dip-nets.*—Dip-nets are only used in the spring, in brooks where the smelts spawn, or at points where their ascent of the rivers is obstructed. The product of this fishery is of small amount, and contributes very little to the supply of the markets.

*Hook and line.*—The hook and line fishery has always been the most important mode of taking smelts, whether we regard the gross product or the number of persons employed, though when it is brought into direct competition with bag-net fishing on the same ground, it is found less productive. Smelts can be taken with hook and line during the autumn months, but it is not until winter that any considerable numbers are thus taken. As soon as the ice forms on brackish and fresh tidal waters the line fishermen begin to ply their vocation. Through December and January the work is generally brisk, but in February the catch begins to slacken, and very few fishermen continue their efforts in March. Smelts can be caught through the ice as far up the fresh rivers as they ascend, but the most productive fisheries are located on brackish estuaries and bays, as Nequasset Bay in Woolwich, Damariscotta Bay, the Medomak River in Waldoborough, and Bagaduce River in Brooksville.

The outfit of a hook fisherman for smelts formerly embraced only a hook and line, an ax or ice-chisel for cutting holes, and perhaps a pail for bait and a few boughs to stand on. A thrifty fisherman would, after finding a good location, protect himself from the cold winds by means of a clump of evergreen bushes, and a progressive development in the direction of comfort produced finally the present smelt fisher's house with its dry board floor and stove.

In the Damariscotta fishery (which has been selected for description as representing the prevailing style), the smelt houses were at first built of heavy boards, then with wooden frames and walls of clapboards, and finally a few years ago other coverings gave place generally to cloth. They are commonly 5 feet long and 4 wide, cost about \$5 all complete, with stove, and can be easily moved about on a hand-sled. Each house is occupied by one man, who uses two lines with one hook, or sometimes two, on each line. The lines are of cotton, either plain or laid in oil, and Kinsey hooks, Nos. 13 to 16 are used. For bait they employ generally pieces of marsh minnows, which are caught in the fall and kept alive until used. When minnows cannot be had they cut up smelts for bait. In old times the fishing was always in shoal water, but it is now found that the smelts can be taken in water of any depth from 2 to 20 feet and on either ebb or flood tide. The fishermen do not agree as to what part of the bay is best nor do the smelts appear to be constant in frequenting any particular spots; in searching for them the houses move about a great deal, often changing location several times a day.

In other localities experience and practice vary a little from those of Damariscotta. At Woolwich they use clam-worms for bait; at Waldoborough, clam-worms, smelts, eels, fresh beef, and minnows. At Saco there are more ambitious houses, 6 feet long and nearly as wide, with walls, 5 feet 9 inches high, and costing \$17 to \$20; in such a house a man uses six lines made fast to a bar overhead and dropping through a hole 6 feet long; fishing mainly at night, he places a kerosene lamp with a white paper shade, at each end of the hole to attract the smelts, and in one corner stands a coal stove.

The hook fishery is pursued by people of many different callings, who find a lack of employment in the winter—farmers, laborers, and mechanics of various trades, comparatively few of whom are engaged in fishing at other seasons. Some of them are strictly amateurs and catch merely for their own tables; many others dispose of their surplus in the local markets, but a very large number follow the occupation steadily and send their fish to distant markets, mainly Boston and New York. Altogether there is no branch of the river fisheries that contributes so much to the comfort and well-being of the local population as this.

**MARKETING SMELTS.**—Smelts are all marketed and consumed fresh. It is the common practice to freeze them, and then forward to market in boxes and barrels. It has been recently discovered that a partial freezing, leaving the fish flexible, is a better preparation for transportation than freezing them stiff; besides, a much larger quantity of the flexible smelts can be put into a barrel or a box of given dimensions. It is also a recent discovery that without freezing smelts can be shipped to Boston or New York in a tight fish barrel filled with iced water, a large lump of ice being placed in the middle. This is a very satisfactory method to the dealers; the fish opening in fine condition with a very fresh appearance and meeting with a ready sale; but it involves the transport of a great deal of water and ice, and for that reason is not much employed except in time of warm weather when freezing cannot be effected, and dry packing is not safe.

Probably the quantity of smelts consumed in Maine does not exceed 10 per cent. of the total catch. Of the remainder nearly all find a market in Boston and New York, the latter taking more than half. Thus, of 254,000 pounds shipped to those two points from Bath, Woolwich, Waldoborough, Warren, and Thomaston, 138,000 pounds went to New York, and 116,000 pounds to Boston.

#### STRIPED BASS (*MOXOSTOMA LINEATUS*.)

**NATURAL HISTORY.**—The data for a complete account of the natural history of this species do not exist, and as there is a special lack of knowledge of its life in Maine rivers, the present notice will properly be very brief. The bass is found in substantially all the brackish waters of the State, and ascend the rivers a short distance at various seasons of the year. On the Kennebec it used to ascend the main river as far as Waterville, and the Sebasticook a short distance above its mouth; but since the building of the dam at Augusta that place has been the limit of its migration. The principal run is in the month of June, at which time it feeds greedily, apparently ascending the rivers for that purpose. It continues to feed in weedy coves and bays till November. In the winter great numbers of young, 2 or 3 inches long, are found in the rivers, and many of them fall into the bag-nets and are captured along with smelts and tom-cods. Larger individuals appear in many cases to retreat to quiet bays and coves of fresh water in the lower parts of the rivers, and pass the winter in a state of semi-hibernation.

There are some facts that favor the view that bass spawn in the rivers. For instance, a male with ripe milt has been observed on the Kennebec as far up as Augusta about the 1st of July. The fishermen of Merrymeeting Bay think that they spawn in the summer, because they are to be found

there in June full of spawn, which is not, however, found ripe during the shad-fishing season, which extends sometimes into July; while in the fall they contain no spawn unless in the very first stages of growth. Bass sometimes attain a great size in Maine, though they do not appear to average so large as farther south. The largest reported, weighing 100½ pounds, is said to have been taken some years ago in Middle Bay, an arm of Casco Bay, and specimens of over 50 pounds in weight are not very rare,\* yet the average weight of all caught is probably less than 5 pounds. Those caught in the weirs will hardly exceed 2 pounds. Those taken in gill-nets under the ice at Sheepscot Bridge weigh from 3 to 12 pounds, rarely 30 to 40.

**MODES OF CAPTURE.**—Bass of marketable size are caught in the spring weirs, but to no great extent at the present time. The fishermen say that they are difficult to catch, being cunning enough to find their way out of the weirs. Four methods appear to have been specially employed for their capture: (1) Dip-nets, set under the ice. (2) Stop-nets, set in summer and autumn across the mouths of coves. (3) Gill-nets. (4) Hook and line.

*Dip-nets.*—These were used many years ago in the mouth of Eastern River, Dresden, specially for bass. They were plain bags, 7 or 8 feet wide at the mouth, hung on a semicircular bow at the end of a large pole which was held in the hand, and were operated by pushing down through holes in the ice and resting on the bottom. As soon as a bass struck the net it was immediately pulled out. This fishing was done in the edge of the evening on the "dark" of the moon. As many as sixty nets were counted at one time fishing at that place. This fishery was discontinued in consequence of scarcity of bass, about 1850. In Winnegance Creek, just below the city of Bath, one winter a man who was spearing eels in the mud took, by accident, a bass. Nets were immediately brought into use and "tons and tons" of bass taken out.†

*Stop-nets.*—The "stopping" of coves is a modern method. At high water a stout net, generally 12 feet deep and of 2½ to 3 inches mesh is stretched at high-water directly across the mouth of a cove, and kept in place until low water. Bass doubtless frequent such places for the purpose of feeding. They move very quietly and close to the bottom, and their presence is not easily ascertained till the tide has left them. This method of fishing, therefore, proceeds entirely at random as to the presence of the prey. Sometimes it is entirely unsuccessful, and at other times great hauls are made. It was first practiced ‡ by Thomas Spinney and John Marr, of Georgetown, who made their first attempt with salmon nets at Preble's flats, opposite Bath, somewhere between 1844 and 1848. On that occasion they took out 11,000 pounds of bass, and during that year shipped 52,000 pounds to New York. Another instance of a successful haul occurred at Butler's Cove, an arm of Merrymeeting Bay, one autumn about 1850, on which occasion fifteen cart-loads of bass were secured. Eighty-five barrels of them were sent to New Orleans and sold for \$8 per barrel. This method of fishing is employed irregularly, and no one appears to have been engaged in it in 1880.

*Gill-nets.*—These are used, among other places, in Sheepscot and Dyer's Rivers, above Sheepscot Bridge, in the winter, under the ice. The nets used at this place are commonly 35 feet long, 12 to 15 feet deep, and of a 4-inch mesh, furnished with ordinary floats and very heavy sinkers, costing, complete, about \$4. In operating, a narrow opening is cut through the ice across the channel (whose width is about equal to the length of the nets, though quite deep), and the nets

\* Mr. M. B. Spinney, of Georgetown, who has made a business of fishing for bass with stop-nets, says that he once took a bass of 89 pounds, and another, which, after dressing, weighed 62½ pounds, equivalent, he thinks to over 90 pounds live weight, and of specimens that exceeded 50 pounds he has taken hundreds. Mr. S. is also the authority for the capture of the bass weighing 100½ pounds.

† Statement of John Brown.

‡ Statement of M. B. Spinney.

set in without any frame. The tide is so strong that the nets can only be drawn out when it is rather slack; so they are drawn only at high and low water, and kept in place all the rest of the time. This method has also been in use at some points on the Kennebec River, and indeed is probably a very ancient method.

*Hook and line.*—The hook and line fishing for bass is practiced as a pastime at a few points, especially near obstructions at the head of the tide, as at Augusta, on the Kennebec.

**MODES OF CURING.**—The only mode of curing bass employed in Maine is salting in barrels. Some parties once dried a large lot of them in Casco Bay, but they are said to have been too fat to keep, and all were lost. With the exception of an occasional large haul all the bass are now marketed fresh.

**HISTORICAL NOTES.**—Bass were undoubtedly quite plenty in early times in most of the rivers west of the Penobscot. In the latter river the old fishermen speak of them as having been "plenty," but the degree of abundance was by no means equal to that existing in the Kennebec, and at no time has this species been marketed in any considerable numbers from the Penobscot or any river farther east. In the west they were early subjects of legislation, indicating not only that they were plenty enough to be thought worthy of attention, but also that there was an actual or apprehended diminution of their numbers. The preamble to an act of the New Hampshire legislature "to preserve the fish in Piscataqua River," recites that the fishing for bass and bluefish\* in winter "hath almost destroyed the bass and bluefish in said river." In 1800 the legislature of Massachusetts passed an act "for the preservation of fish called bass in Dunstan River in Scarborough, in the county of Cumberland." On the Kennebec at Abagadasset Point, as late as 1830, bass were so plenty that the fishermen were troubled to dispose of those taken in the weirs. A single weir has been known to take 1,000 pounds at one tide. There was no demand for them. Sometimes hired men would take them in pay. When plentiest they were given away. Mr. John Brown says that about the time of their first diminution he obtained a contract with General Millay, the keeper of the Bowdoinham town poor, to furnish 1,600 pounds of bass at three-quarters of a cent per pound, but the fish were not plenty that year and he caught only 800 pounds. The extent of the diminution is illustrated by comparing the above statement with the statistics representing the present condition of the bass fishery. The total catch of twenty-two weirs on and about Abagadasset Point in 1880 was but 3,510 pounds; the Kennebec River yielded a total of 12,760 pounds, and the entire State 26,760 pounds.

#### THE EEL (*ANGUILLA ROSTRATA*).

**NATURAL HISTORY.**—The common eel is found all along the coast of Maine and in all the rivers accessible from the sea, as well as in some fresh waters which would appear to be absolutely inaccessible in their present condition.† In waters communicating with the sea the young eels move up-stream in early summer to the fresh water of lakes and streams, where they feed and grow. At the beginning of this migration the young eels are very small. In the month of July they can be found 4 or 5 inches long climbing dams at the head of tide waters. They are able to crawl many feet up a perpendicular wall down which the thinnest sheet of water is trickling, and it is probable that they pass many dams that are insuperable to all other fishes, and thus reach some waters very remote from the sea. The adult females, or a portion of them, are found

\* The term "bluefish" must refer to some other than the marine species now known by that name.

† This is still debatable ground, some observers maintaining that all eels, however remote from the sea they may be found, reached their abode by ascending the rivers.

descending the rivers to the sea in the autumn very large and full of spawn. In winter eels are found bedded in mud at the bottoms of rivers and bays in fresh, brackish, or wholly salt water. In some cases they leave the salt water in autumn and push up into fresh-water streams, even into very small brooks, and there pass the winter in the mud.

Observations made in other countries indicate the probability of these conclusions: that the female eel alone ascends the rivers, the males staying behind in the salt water; that the females when mature always go down to sea and pass out beyond the reach of observation, where they are joined by the males, and lay their eggs early in winter; that after spawning once the females die. Unlike the salmon, shad, and alewife, the eel is a predatory fish while in fresh water, greedily devouring all animal substances. At the beginning of their seaward migration, however, the females cease to eat.

**METHODS OF CAPTURE.**—Eels are taken with spears, in traps and pots set for the most part in tidal rivers, and in weirs built across the streams that they descend in the autumn.

**Weirs.**—An eel-weir has much the form of a smelt-weir, two wings running out from the opposite shores of the stream obliquely downward and converging to form a tunnel; at the apex is a long narrow spout leading into a box from which the eels cannot escape. Rough weirs are occasionally made of brush and stakes, but the most efficient have the wings constructed of sawed slats combined in racks, which, when in place, rest on a close piling, affording the eels not the slightest opening for escape, and effectually preventing their undermining the structure. The best specimen of an eel-weir, and indeed the only systematically conducted fishery of the sort that has come under the writer's observation, is found on the Cobbossecontee stream, at Gardiner, on the Kennebec. Mr. T. H. Spear, the proprietor, has extended his operations to the collection of young eels as they enter the river in summer and their transfer to the waters above.

**Eel-traps.**—An eel-trap, known only among the fishermen of the lower Kennebec, is a diminutive eel-weir, planted on the flats in a favorable position to intercept eels in their movements along the shores. They are generally set so as to make captures on the ebb tide. When the trap was first invented, about the year 1875, it was set with a view to taking eels as they descend in the spring, from their winter bedding places in the mud of fresh-water marshes on the small brooks near tide water, and the most of the traps are still constructed so as to take eels descending with the ebb tide; but experiment has demonstrated that they can be successfully caught with the arrangement reversed so as to take only those that are ascending the river; and it is probable that the fish that fall into the traps are merely working their way along the shore, either up or down, in search of food. A good eel-trap costs about \$25.

**Eel-pots and baskets.**—Pots and baskets of various forms are much used in some districts. The most approved form of late is made from a barrel by substituting funnel-formed screens for the heads. Baited with fresh fish, free from taint, these are sunk to the bottom in favorable positions often alongside fish-weirs. The eels, probably scenting the bait, push their way in by the tunnel-formed entrance, but are unable to escape. This is a very old method of fishing.

Pots and traps are often used in conjunction by the same fishermen, as they are available at the same season. On the Kennebec they are used from May 10 to the last of September.

**The spear.**—The implement most widely known and used for the capture of eels is the spear. The form in common use in Maine consists of a spatula-formed center piece with three teeth on either side, each tooth having a single barb on the inner side. The teeth are of steel, about 3 inches long, slender, elastic, spreading at the tips about 8 inches. With this implement at the head of a long wooden pole the fisherman industriously prods the soft muddy bottom through a



hole in the ice, or sometimes from a boat. Each several thrust is made entirely at random, but experience guides to a choice of the proper kind of bottom and the topographical location and extent of the beds.

At Dresden, in the mouth of Eastern River, are some beds much resorted to now and for the last eighteen years. The water there is entirely fresh. The fishing is, as a rule, done on the channel banks, but sometimes quite out in the channel, so that at low tide the depth of water over the different parts of the beds may vary from 5 to 25 feet. Some observers are led to the conclusion that mud meeting in all respects the requirements of the eels occurs only in patches, and when they find one of these patches they will bed in it to whatever depth it may carry them. So the fishermen come armed with two spear poles, one of which is often 28 or 30 feet long.\*

Another locality for eel-spearing is in Quohog Bay, in the town of Harpswell. Here in 1876 an eel-bed was discovered which is famous as being the most productive one ever known in that region. It lies in 13 feet of water at low tide, just outside the eel-grass zone, and extends over about 10 acres. When first discovered it was so densely inhabited by eels that a spear often brought up four or five at a time. This still continues to be more productive than any other bed in the vicinity, and yields about three-quarters of all the eels taken in Harpswell.† The time when the fishing can well be carried on is limited to about six hours at each low tide, and is practically confined to the tide occurring in the daytime and to the first two months after the ice forms. Later the labor of cutting through the thick ice becomes too great.‡

There are doubtless many such beds yet to be discovered. The more thinly inhabited beds are well distributed all along the coast.

*Marketing eels.*—The eels taken in summer with pots and traps are for the most part packed whole ("round") with ice in barrels and shipped to New York. The demand is very lively during the first part of the season, and shippers receive about 6 cents a pound, free of freights and commissions. The product of the spear fisheries and of the fall weirs is, on the other hand, dressed before marketing, and brings about 7 cents per pound in New York. As the shipper has to pay freight and charges, and as 200 pounds live weight will not dress more than 140 pounds, it will be seen that the round eels, the product of pots and traps, give the best profits.

#### STURGEON (ACIPENSER STURIO).

*NATURAL HISTORY.*—The common sturgeon of the Atlantic rivers is the only species known to visit the rivers of Maine. It ascends the larger of them for the purpose of depositing its spawn, which it does in midsummer. Some intelligent observers think their natural spawning grounds are almost wholly above the flow of the tide. On the Kennebec it is believed that they were mainly between Augusta and Waterville, a view which is supported by the fact that the closing of the river by a dam at Augusta was followed by a great decrease in the number of sturgeon. Very little is known about the growth of the sturgeon in Maine. The earlier stages are rarely seen, except that a considerable number about 18 inches in length are caught in the smelt-nets of the Kennebec in winter; they are very slender and sharp-nosed, and are termed by the fishermen "pegging awls." The adults caught in the Kennebec average not far from 120 pounds in weight.

*METHODS OF CATCHING.*—Sturgeon ascending the rivers in company with shad, alewives, and salmon fall often into the weirs built for those species, and to fishermen who have not made arrangements for utilizing them they prove sometimes a very great nuisance. But the only means specially or regularly employed for taking them is the drift-net. Those now in use on the

\* Statement of W. W. Walker.

† Statement of Stephen Kemp, of Harpswell.

Kennebec are of cotton (sometimes hemp) twine of 12-inch mesh (occasionally varied, but always between 10 and 13 inch), 25 to 30 meshes deep, 80 to 100 fathoms long, corked and leaded like any drift-net. These are set by night on the ebb tide from a large punt worked commonly by two men. The ordinary fishing grounds on the Kennebec extend from Bath to Richmond, but sturgeon can be and sometimes are caught as far up as Augusta.

**UTILIZATION.**—At the present time no portion of the sturgeon is saved but the clear flesh, which is cut from the trunk, packed in ice and sent to New York, where it is smoked for use. About half the fish is refuse, including the entrails, head, skin, and vertebral column. The preservation of the roe for the making of caviar, and the trying out of the oil with which the refuse abounds have been sometimes practiced in former years, but at present all but the clear flesh is thrown into the refuse heap and employed only for fertilizing the land.

**HISTORICAL NOTES ON THE STURGEON FISHERY.**—Sturgeon were apparently more highly esteemed in the early days of American history than now. They were specially mentioned in the original grant of the King of England to Ferdinando Gorges, conveying a large territory in the southwestern part of the State inclusive of the Kennebec River. In the early part of the eighteenth century there existed a flourishing sturgeon fishery in the province of Maine, which employed some years over twenty vessels, and was esteemed an important branch of industry. It does not appear, however, to have been prosecuted continuously. Very early in the present century a company of men came to the Kennebec, and, locating themselves on a small island near the outlet of Merrymeeting Bay, since known as "Sturgeon Island," engaged in the catching of sturgeon, which they soured, packed in kegs, and shipped to the West Indies, where they sold at \$1 a keg.\* This business was, however, suspended, for what reason is unknown, and though sturgeon were very abundant in the Kennebec during the early part of the present century, at least until about 1840, no attempt was made to utilize them except occasionally for home use, until 1849.

In 1849 a Mr. N. K. Lombard, representing a Boston firm, came down to the Kennebec, established himself at "Burnt Jacket," in the town of Woolwich, between Bath and Merrymeeting Bay, and undertook to put up the roe of sturgeon for caviar, and at the same time boil down the bodies for oil. A large number of fishermen engaged in the capture of sturgeon to sell to Lombard. The price paid was 25 to 50 cents apiece. The first year there were obtained 160 tons of sturgeon.† They yielded oil of fine quality, superior to sperm oil for illuminating purposes, in the opinion of the inhabitants of that vicinity, who have been accustomed to use it when attainable. The attempt to utilize the roe was at first unsuccessful. It was put into hogsheads, very lightly salted, and all spoiled. The next two years the roe was cured by salting heavier, drying, and laying it down with a little sturgeon oil, and was pronounced satisfactory. However, the business was discontinued after 1851. That year the sturgeon were quite scarce.

From this time there was a suspension of the sturgeon fishery until 1872, when some of the local fishermen of the Kennebec took it up again. In 1874 a crew of fishermen, headed by one John Mier, of New York, went into the business, catching and buying all they could, and shipping them to New York, where they proposed to smoke the flesh and utilize the roe for caviar and the sounds for glue. They aimed to catch the sturgeon early in the season, while the roe was yet black and hard, and to keep the fish alive until the proper time arrived for opening them. For the latter purpose they constructed a great pen, in which they at one time had seven hundred live sturgeon. After five years the sturgeon again became scarce, and the business was relinquished

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\* Statement of John Brown.

† Statement of Jos. Partridge, of Woolwich.

to local fishermen, who still continue to ship the flesh to New York, but throw away all other parts. In 1880, the least successful season in recent times, 12 fishermen were engaged in the business on the Kennebec, and the total catch was about 250 sturgeon, producing about 12,500 pounds of flesh, which sold in New York at 7 cents and returned the fishermen about 5 cents per pound.

#### 4. DESCRIPTIVE AND HISTORICAL NOTES ON LOCAL FISHERIES.

**SAINTE CROIX RIVER.**—The Saint Croix is remarkable, even among the rivers of Maine, for the great extent of the lake surface among its tributaries. On the best maps are represented 61 lakes, of which the smallest has an area of three-quarters of a square mile and the largest of 27 square miles. Their aggregate area is about 150 square miles, which is about 15 per cent. of the entire basin of the river. These lakes afforded breeding ground for great numbers of alewives, and, in the main river and its branches, here the salmon and there the shad found their favorite haunts. The exact limit of the upward migration of all these fishes is very naturally unknown with any degree of exactness, the entire upper portions of the basin being a wilderness till long after the occupation of the lower banks and the erection of artificial obstructions; but the fact of their existence in great numbers in the river shows that they must all have passed the only serious obstacle to their ascent, the natural fall at Salmon Falls near the head of the tide, and found their breeding grounds in the upper waters.

The best accessible testimony as to the former condition of these fisheries is found in Perley's "Report on the Fisheries of the Bay of Fundy."\* The testimony there adduced may be thus summarized: From the first settlement of the country till 1825 there was annually a great abundance of salmon, shad, and alewives. Vessels from Rhode Island, of 100 to 150 tons burthen, followed the fishing business on the river and were never known to leave without full cargoes. There were also several seines belonging to the inhabitants, which were worked in the tideway of the river, the owners of which put up annually from 1,500 to 2,000 barrels of alewives for exportation, besides a sufficiency for country use. At the same time shad were caught in great numbers, often more than a hundred of them being caught in a small net in a single night. Salmon were so plenty that, according to testimony, a boy of fifteen has been known to take 500 in a single season with a dip-net, and a man has been known to take 118 salmon with a dip-net in a single day. The dipping place, both for salmon and shad, was at Salmon Falls. The prevailing price for salmon was 4 or 5 cents per pound. About 1825 the building of dams had reached such a stage as to seriously interfere with the ascent of fish, and they began rapidly to decline in numbers. In 1850 it was estimated that not over 200 salmon were taken. The decline in the alewife fishery had been equally great, and in the shad fishery still greater.

At the present time the condition of things is not much better than in 1850. The three dams at Calais and Baring, notwithstanding the construction of fishways, are very serious impediments, partly because they facilitate the work of poachers, and but few fish reach their spawning-grounds. Salmon are now taken in sufficient numbers to encourage the continuance of the fishery, and as incidental items there are taken a few alewives, a very few shad and bass, and small quantities of smelts and eels. The implements of capture are five weirs in the tidal portions and an uncertain number of drift and dip nets at Calais and Saint Stephen.

The weirs are similar to those in use on the Penobscot and Kennebec; two of them, those farthest up river, are half-tide weirs, and the others are "high weirs," with two pounds each, built of netting and stakes. They are all built in the spring and removed in the autumn. The half-

\* Made by M. H. Perley, esq., to the Government Emigration Office, Saint John, New Brunswick, March 12, 1851.

tide weirs take smelts, alewives, a very few bass, sometimes a shad or a salmon, and miscellaneous fish, such as herring, bluebacks, &c., which are utilized to fertilize the land, but no shad or salmon were taken in them in 1880.

The high weirs, three in number, are built mainly for the capture of salmon, but take also alewives, smelts, shad, bass, herring, and a few cod and other sea fish. These weirs are all built in Calais; one of them just above Devil's Head, the other two near Red Beach. Farther down the river are weirs for the capture of herring, and in these, too, a very few salmon are taken.

The drift-nets are used solely for the capture of salmon, just below the lower dam in Calais and Saint Stephen. They are generally 75 feet long and 8 feet deep, with a 6-inch mesh. There are known to have been as many as seven of these nets in existence in 1880, but as they are often used covertly and illegally in immediate proximity to the dam, there is no means of ascertaining how many were in actual use at any time.

The dip-nets are used for the capture of smelts and alewives about the falls, but all this fishing is exceedingly irregular, no one pursuing it as a regular industry, and all the product being consumed locally.

The salmon fishery has been in a low condition for many years, and the yield for the year 1880 ranks among the poorest of the last decade. The total number taken by all modes appears to have been 300, averaging in weight 12 pounds, and aggregating in value about \$750.

The shad taken are mostly of the small size, termed "sea shad," but these are not taken in any considerable numbers. Sometimes a weir will take 500 of them in a season, and market them fresh along with alewives in Calais. Of the adults, to which the term "shad" is restricted among the fishermen, merely a few specimens are taken. The best weir sometimes takes twenty or thirty in a season, but in 1880 did not get half a dozen.

Of alewives about 115 barrels were taken in 1880, of which about 10 barrels were sold fresh, 30 barrels smoked, and 75 barrels salted. There are considerable quantities of bluebacks taken; they are not distinguished by the fishermen from alewives, but the above figures are believed to represent the numbers of true alewives.

Of bass (*Roccus lineatus*) very few are taken, about as many as of the river shad. One weighing 27 pounds was taken in one of the weirs in 1880.

Smelts are caught in the weirs in small numbers and in dip-nets at the Union dams in Calais. They are consumed locally, and the total quantity marketed probably does not exceed in value \$150 yearly. The dip-net fishery is limited to two or three weeks in the spring. Smelts in plenty can be taken with the hook all through the summer in the lower part of the river.

Messrs. Lewis Wilson & Son have been engaged since 1853 in fishing in Calais just above Devil's Head, with a weir, always in the same spot and of the same form, without any perceptible interference from other weirs. Their experience may fairly be taken as indicating the relative abundance of the fishes that they catch. Their record of salmon has been very carefully kept, and shows that the years of the greatest abundance of that species were, in order, as follows: 1862, 1871, 1877, 1866, 1867, 1863, 1868; and the years of least abundance, in order, were 1859, 1874, 1869, 1853, 1865, 1864, 1857. Perhaps the most noteworthy fact disclosed by Mr. Wilson's record is that salmon run much later in the season on the Saint Croix than in the central and western rivers of the State. Fifty-two per cent. of the catch for the entire period was obtained later than the month of June, 21 per cent. was taken in August, and 3 per cent. in September. Similar generalizations can be made from the recent record of a weir at Red Beach, farther down the river, and the salmon are also known to run late in the Machias and East Machias Rivers. These are all in

marked contrast with the Penobscot River, where the principal catch is in the month of June, and where the number of salmon to be taken after the first ten days of July is rarely enough to warrant the fishermen in keeping their weirs in working condition.

**PENMAQUAN RIVER.**—This little tributary of Cobscook Bay drains a small territory in the towns of Charlotte and Baring, not exceeding 50 square miles in area, and affords an outlet to Penmaquan Lake and several smaller bodies of water. It is naturally well adapted to the growth of alewives, which formerly abounded in it, and tradition also says that there were once a good many salmon here. But very far back in the history of the country dams were built without suitable provision for the ascent of migratory fish, and the usual result followed. The salmon have entirely disappeared and very few alewives remain.

**DENNY'S RIVER.**—This is the first considerable stream west of the Penmaquan, and is the principal tributary of Cobscook Bay. It drains a basin of about 150 square miles, including two considerable lakes, Meddybemps and Cathance. The character of both the Denny's and its principal branch, the Cathance, is favorable for the breeding of salmon, and alewives find a breeding ground of great extent in Meddybemps Lake. Both of these species are known to have abounded in the river anciently, and tradition says that shad, too, frequented it. The shad disappeared early, but the salmon and alewives continued to ascend the river until 1846. Since the first settlement of the country there has been a dam at Dennysville, near the mouth of the river, but fish were able to pass it. In 1846 another dam, quite impassable, was built a mile farther up the river. The effect of this was to nearly exterminate the alewives, and the salmon, though they continued to breed in the river below this dam, were reduced to very small numbers. In 1858 this dam was destroyed by a fire which consumed the mill, and fish were again admitted to the upper waters. The alewives were still shut out from Meddybemps Lake, but in 1863 a fishway was constructed there which admitted them to the lake.

After the reopening of the river the salmon increased but slowly, owing to their persistent persecution at the dams and the setting of gill-nets at the mouth of the river. The alewives, however, increased very satisfactorily; in 1865 the number taken was estimated at 2 barrels; in 1866 at 15 barrels, and in 1867 at 240 barrels (about 125,000 fish). Since then the passage of the river has been a second time obstructed by a difficult dam, and a falling off in the number of fish resulted. At present the alewives are increasing, and it is estimated that in 1880 there were taken about 75,000, of which 30,000 were pickled and shipped to New York, and the remainder mostly smoked and consumed at home. The only mode of fishing for alewives employed here is with the dip-net.

Salmon are taken occasionally by spear and dip-net at the dams, now and then with the hook, but mainly in set-nets at the mouth of the river in tide-water. In 1880 there were four of these nets in use, and the total number of salmon taken is estimated at 200.

Denny's River is noted as the only river in the United States where fly-fishing for salmon has been practiced. In 1867, and for some years previous, it was the resort of several gentlemen from Portland, who succeeded fairly well, and the sport has been continued down to the present time by residents of Dennysville.

**COBSCOOK OR ORANGE RIVER.**—This is a very small river, lying almost wholly in the town of Whiting. It was in primitive times inhabited by many salmon and alewives, and according to tradition by shad also. Near the head of the tide three insurmountable dams were built many years ago, utterly exterminating the salmon, and reducing the alewives so that the catch was barely a dozen a year. In 1861, and subsequent years, an effort was made to restore both alewives and salmon, but it was only partially successful and at present the river is entirely unproductive.

**EAST MACHIAS RIVER.**—Naturally well adapted to the growth of alewives, this river continues to produce more of them than any other river in Maine east of the Penobscot. A few salmon are taken and scattering specimens of shad. In the winter smelts and tom-cods are caught in small numbers.

The spring and summer fisheries are carried on mainly by means of dip-nets at the falls in East Machias village, a few are caught in the same manner at a point 2 miles farther up the river, and a very small catch is secured by a few weirs in the tide-way. In 1880 but two of these weirs were built.

The dip-net fishery employed regularly, the whole or part of the time during the fishing season, about forty persons, besides an indefinite number of men and boys who took part in it occasionally. The site of this fishery is between the two dams that here cross the river, and just below the lower one. The fishermen build platforms at convenient points along the river's edge, and swing their nets in the foaming rapids. The nets in use are very well made and efficient. The best of them have steel bows  $3\frac{1}{2}$  feet in diameter, poles 10 to 17 feet long, and nets of fine twine 5 feet deep. The East Machias alewives are of good size, 400 of them filling a barrel when salted and packed for market. Of the 399 barrels caught in 1880, there were salted, 234 barrels; smoked, 135 barrels; and used fresh, 30 barrels.

Salmon are not known to have ever been very abundant in this river, and at the present time but very few are taken. For many years past there has been no decided increase nor decrease, though many fluctuations. In 1880 just 35 were caught, all of them in dip-nets by the alewife fishermen. This was much below the average catch.

Smelts are taken by night in April and May for home use and local market in dip-nets, differing from the alewife nets only in having a smaller mesh. They rarely ascend as far as the dams, but are caught along shore farther down. The smelt fishing commonly lasts ten or fifteen days. The yield in 1865 was but 15 barrels, and they appear to be decreasing. Tom-cods are taken in the winter with dip-nets to the extent of 55 barrels a year. Shad yield only occasional specimens now, though within twenty-five years they have been plenty enough to be of some importance. Some are now taken in the herring weirs of Holmes Bay.

**MACHIAS RIVER.**—In its original condition the Machias abounded in salmon. It yielded also shad and alewives, though in less numbers than the East Machias, owing, perhaps, in part to a very difficult natural fall at the head of the tide, and in part, so far as alewives are concerned, to the comparatively smaller area of lakes on this river. The difficulties of the falls at the head of the tide were further increased by the erection of a dam by the earliest white occupants, probably not later than 1784, the date of the incorporation of the town of Machias. Shad and alewives could no longer ascend the river, but the alewives were maintained in the river for many years by transferring a large number from the lower to the upper side of the falls each year. Salmon continued to breed and be caught in the river, until other and impassable dams were built, when they too disappeared along with the shad and alewives. At the present time the river is almost utterly unproductive of fish, the entire catch not exceeding 2 barrels of alewives and 5 barrels of tom-cods.

**CHANDLER'S RIVER.**—This little river, draining about 50 square miles of territory, once yielded, tradition says, salmon, shad, alewives, smelts, &c. Alewives and smelts are still taken in small numbers, as are also tom-cods, but salmon and shad have long since disappeared. Of alewives but five barrels yearly are taken by means of dip-nets. One bag-net is set for smelts in early winter, and some few dip-nets plied for them in spring, with an aggregate product of about 40 barrels yearly. A dip-net fishery for tom-cods in December yields about 200 bushels yearly.

**WESCONGUS OR PLEASANT RIVER.**—The drainage basin of the Wescongus measures about 110 square miles, the greater part of which is, like the basins of all the rivers thus far mentioned, covered with forest. The country about its mouth has been occupied by civilized people for more than a century, and is at present organized in two towns, Addison and Columbia Falls. The latter contains the most important village, which is located at the head of the tide, and was founded as early as 1765. At this village were found facilities for the building of mills for the sawing of lumber, which engaged the attention of the first settlers.

Salmon, tradition says, were once very abundant in this river, and notwithstanding the serious impediments placed in their way by the dams, continued to struggle up to their breeding grounds for many years after the settlement, and even at the present day are not utterly exterminated, a very few being yearly taken. About 1820 it was possible for a man to take a dozen in a day with a dip-net, which was the ordinary mode of capture, though gill-nets were sometimes used. In 1830 but a single one is known to have been caught. Salmon used to appear at Columbia Falls rarely earlier than June 1, but from that date they continued to ascend the river till January.\* They ranged in weight from 6 to 18 pounds, the latter size being more common than the former; 7 and 8 pound fish were common. Their ascent of the main river is believed to have been stopped by an insurmountable natural fall 6 miles above Columbia Falls, and they are said to have spawned in a fine, gravelly tributary called "Lower Little River."

Alewives were pretty plenty sixty years ago, and were then of good size, whereas they are now small. Though they have not been able to surmount the dams at Columbia Falls for many years, they still come there yearly, about the middle or last of June (say two weeks later than at East Machias), and about 30 barrels yearly are dipped and smoked.

Shad are taken to a very limited extent in the three weirs built in the river and occasionally in drift-nets, of which several are owned in Addison, but none regularly used. They do not appear to have been plenty in the river within the memory of old inhabitants.

A very few eels are taken with spears. Tom-cods are caught with the smelts in very small numbers, but rarely sent to market. No sturgeon or bass are caught.

The most important place among the fishes of this river is now held by the smelt. About 15 tons of them are taken in weirs and bag-nets in Addison, 25 bushels are dipped at Columbia Falls in the spring, and perhaps an equal quantity in the brooks all up and down the river.

The weirs, which were introduced about 1872 or 1873, are all built of stakes and brush, standing with their tops 3 or 4 feet below high-water mark, the tide flowing over them. They are in the form of the letter L, the long arm running straight ashore and the short arm pointing up river; at the angle is a small pound constructed of wooden pickets. There were 3 of these built in the census year, all below Addison village.

The smelt-nets are in part plain bags, such as are used farther west, but most of them are fykes. They are set by attaching them to poles, which are planted through the ice into the mud in a location where the water is 8 feet deep at low tide. The nets are set both on the flood and ebb tide, and hauled at both high and low water. Fishing begins as soon as the ice will bear, which is generally about December 10 or 15, and continues till near April 1, the limit fixed by law. The first attempt at bag-net fishing was made by H. E. Willard, of Portland, in 1868. For the last eight years it has been carried on continuously. In the early years of the fishery smelts were plentier than now, prices were higher, and great returns were sometimes realized; in one instance, \$58 for a single barrel of smelts. They are now marketed in Boston and New York, about two-

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\* Statement of Gowen Wilson, of Columbia Falls.

thirds of them in the latter city. They are uncommonly large. Some of the fishermen say they will average 6 or 7 to the pound, and that the largest will weigh 7 to 9 ounces; but it will not do to accept these figures without question.

**HARRINGTON RIVER.**—This is a tidal estuary lying wholly in the town of Harrington, and fed by a single fresh-water stream, a mere brook. The fisheries followed are: 1st, a summer fishery, with weirs for miscellaneous fish, in which a few alewives and shad are taken; 2d, a winter fishery for smelts, with bag-nets and weirs; 3d, a winter fishery for eels, with spears.

The summer fishery employed in 1880 but one man, who built a single weir.

The smelt fishery employed sixteen men, who set 18 bag-nets and built 4 weirs. They took 11½ tons of smelts, which were marketed, one-half in New York, three-eighths in Boston, and one-eighth in Philadelphia. The weir fishery for smelts has been carried on here for thirteen years, and the net fishery for ten years.

The eel fishery is not pursued persistently. The spears took about half a ton and a ton was obtained from the weirs. Some of them are salted, but most of them are sold fresh. They average, alive, half a pound in weight. The largest known weighed 4 pounds.

**NARRAGUAGUS RIVER.**—This river is larger than the three last mentioned, draining a territory of 215 square miles. In early times great numbers of salmon, shad, and alewives were taken here, but the dams at Cherryfield long ago destroyed them. Smelts have been taken in bag-nets in recent years, but this fishery also has been suspended, and the weir is this year quite unproductive.

**TUNK RIVER.**—Another very small stream, draining only 60 square miles of territory. There are some alewives, eels, and tom-cods caught and now and then a salmon, but the only fishes taken in numbers enough to be of any importance are smelts, which are fished for with weirs and bag-nets. There was but one weir built in 1879-'80, but 10 nets were in use, giving employment to nine men. The nets are plain bags, and are set in a line up and down the narrow channel, but, in obedience to local custom, never across it. The total catch was 4½ tons of smelts.

**WEST BAY (Gouldsbrough).**—This is not an established fishing ground, but in the winter of 1879-'80 two men fished here with a bag-net for smelts, and caught 3,000 pounds.

**WEST GOULDSBOROUGH.**—Here is a fishery for alewives in the stream, which forms the outlet of Jones Pond, which is held as private property and claimed to be originally and always an artificial fishery. One Colonel Jones, one of the early settlers and proprietor of the mills at this place, about 1794 got some alewives from Mount Desert and put them into the mill-pond, thus establishing the brood in the stream. From that time down to the present it has been maintained wholly by carrying up and turning into the pond a few of the alewives caught. It has been the ordinary practice to carry up a basketful (one-third of a bushel) for each barrel killed. When the father of the present proprietors was in possession, they once caught a great quantity, estimated at over 200 barrels, but during the past twenty years the catch has ranged from 40 to 100 barrels, and in 1880 was as low as 30 barrels. They are all smoked and marketed locally.

**SULLIVAN RIVER.**—Some of the tributaries of this river have in former times supported alewife fisheries, as attested by tradition and by the record of legislation. In 1831 the legislature passed an act to regulate the alewife fishery in the town of Franklin, and in 1833 it passed another with reference to the town of Sullivan; but all these fisheries suffered the common fate—extinction by dams. In the expansion of the river known as Hog Bay smelt fisheries on a small scale have been carried on occasionally, but not regularly, and eel fisheries of some local importance exist at the east end of the bay in Donnell's Stream. The entire yield for the census year amounted to but 4,000 pounds of smelts and 5,000 pounds of eels.



**MOUNT DESERT ISLAND.**—Several ponds on this island formerly afforded breeding ground for alewives, but they are now almost extinct and afford no statistics. In 1821, and again in 1828, these fisheries were thought worthy of legislative protection.

**UNION RIVER.**—No river fisheries now exist here, though formerly salmon, shad, and alewives abounded. Especially good facilities are found at Ellsworth for the erection of dams, and they were improved at a very early date. A settlement was made here before the close of the last century and the corporate existence of the town of Ellsworth dates from the year 1800. In 1815, 1816, and 1823 the legislature passed acts regulating the fishery, but they were not sufficient to keep it alive many years.

In Patten's Stream, a tributary of the lower part of Union River, alewives have continued until the present time, but, owing to the obstructions offered by the dams, in numbers too small to afford statistics. Smelts, too, are caught, but in very small numbers.

**BLUEHILL.**—Here was formerly an alewife fishery, which was the subject of legislation in 1816, but it has long since been extinct.

**PENOBSCOT RIVER.**—The Penobscot is the largest river of Maine; its basin has an area of 8,200 square miles, extending almost entirely across the central portion of the State, a distance of 130 miles, and thence narrowing up rapidly as it approaches the sea-coast, where it is limited to the bed of its estuary. Thus it happens that though in its lower course it traverses a well-populated country, yet about half its basin, its entire upper portion, is covered by the original forest, where are neither tilled fields nor manufactories to foul its waters, nor lofty dams to limit the range of the salmon. In its western and southern portions the Penobscot Valley embraces several hilly and even mountainous districts, but, taken as a whole, it is much flatter than any of the river valleys to the westward of it. The elevations are very inconsiderable, and the rivers for the most part rather sluggish. The headwaters of the main branch are in the highlands on the western border of the State, from 1,600 to 2,000 feet above the sea, and about 300 miles from it by the river's course. But the river-bed falls off rapidly, and three-quarters of the descent to the sea is accomplished in half the distance. At Mattawamkeag, about 80 miles from the sea, the elevation of the river is but 190 feet. A descent of 98 feet is distributed over the 45 miles intervening between Mattawamkeag and Oldtown, and the remaining 92 feet fall is accomplished in the short distance of 15 miles between Oldtown and Bangor, where the river attains tide-level, though still 30 miles above the mouth of the river as fixed by the charts, but near 60 miles from the open sea. At the head of the tide and for some distance above, the river is 800 feet wide. At Mattawamkeag it is 500 feet wide after receiving the waters of the Mattawamkeag River, which has a width of 300 feet at its mouth.

The annual discharge of the Penobscot, exclusive of the tributaries below Bangor, is estimated at 278,800,000,000 cubic feet of water. The discharge at different seasons of the year is however, very unequal. In a heavy freshet 5,760,000 cubic feet of water pass Bangor per minute, while in time of drought the discharge at that point is but 146,000 cubic feet per minute, or about one-fortieth as great.\*

The principal branches of the Penobscot are: on the east side, the Passadumkeag, 35 miles long; the Mattawamkeag, 85 miles; the Mattagamon or East Branch, 63 miles; on the west side, the Piscataquis, 71 miles long. The smaller tributaries are very numerous, but, while nearly all of them contributed in olden times to production of fish, few remain open to them now except on the headwaters, which are beyond the reach of any but salmon. Of the lower tributaries there are

\* For the most of the facts as to the elevations and volume of the Penobscot I am indebted to Wells's Water Power of Maine.

but two which are now accessible to anadromous fishes, the Bagaduce in Castine and Brooksville and the Eastern River in Orland, and even in these, especially in the former, there are serious hindrances to the ascent of the alewife, the only species that visits them.

Taken as a whole, the upper waters are well fitted for the propagation of salmon, as they abound in gravelly rapids, alternating with quiet stretches and deep pools, in which the salmon may bide their time, and to which they may retreat after spawning. The quiet waters of the main river and its principal branches are well adapted to the breeding of shad, and of the numerous lakes, whose number is 467 and aggregate area about 535 square miles, a sufficient number were naturally accessible to alewives to afford them very extensive breeding grounds. There are no insurmountable natural obstacles to the ascent of shad and alewives on the main river for 120 miles from the sea, and in some of the tributaries the way was open for nearly as great a distance, while salmon were able to push many miles farther up. At the present time both the main river and nearly all its branches are greatly obstructed by dams, which prevent the ascent of shad beyond tide-waters, which have extinguished the ancient broods of alewives that bred in the main river or tributaries above Bangor, and still shut them out from nearly all tributaries, and which have greatly hindered salmon in their ascent. All the principal dams on the main river are provided with fishways, which serve to keep the way open for salmon to their natural breeding grounds on the headwaters, but of neither alewives nor shad have new broods yet been established.

*Present condition of the Penobscot fisheries.*—The river fisheries of the Penobscot are now conducted for the capture of salmon, alewives, eels, and smelts. The few shad and bass taken are merely incidental to the salmon and alewife fishery, and the tom-cods to the smelt fishery.

*Salmon.*—Salmon are fished for with pound-nets or "traps" in the bay, with weirs in the upper bay and river as far up as Orrington, and with drift-nets at Bangor. The pound-net fishing is limited to the east shore of the island of Isleborough, and to the towns of Camden, Lincolnville, and Northport, on the western side of the bay. Nets of similar but simpler construction were formerly used on the eastern shore of the bay in the town of Brooksville, but since 1850 they have been abandoned.

The Isleborough salmon fishery is confined to the upper part of the eastern shore of the island, centering about Sabbath day Harbor; some berths formerly occupied with nets toward the south end have been abandoned as unprofitable. The entire western shore of the island is bare of nets, no profitable "berth" having been discovered. In 1880 there were 14 gangs of nets set on the island, comprising a total of 17 traps, and the aggregate catch that year was 900 salmon. As compared with 1873, this is a slight falling off in the catch, the number of gangs and traps remaining the same.

In Camden, Lincolnville, and Northport, salmon nets are scattered along the coast a distance of about 12 miles, but they are plentiest and most productive on the north side of Duck Trap Harbor, in the town of Lincolnville, where on a single mile of shore are nine gangs, of which one has four traps and four others have three traps each. In all there were in this district 27 gangs of nets, embracing 45 traps. The catch in 1884 was 1,398 salmon, being 163 less than in 1873.

Above Duck Trap Harbor there are no fisheries for a distance of 12 miles along the shore. At Moose Point, near Searsport, and at Castine, on the east shore of the bay, begin the weir fisheries, which extend, with occasional interruptions, as far up the river as Orrington. These weirs are built all on essentially the same plan, that of the ordinary floored weir, in some places exclusively for salmon and in others exclusively for alewives, but in most cases both species are taken in numbers enough to divide the interest of the fishermen between them.

In the district stretching from Moose Point eastward to Fort Point, including Searsport Harbor, Brigadier's Island, and Cape Gellison, the fishing is mainly for salmon. The shore of Cape Gellison trends about east-northeast, and is exposed to the full violence of southerly storms, which, together with the hard character of the bottom, necessitate greater care in building than in most districts. The use of frame foundations is common. The fishing is wholly with weirs, except two traps that were used in Searsport in 1880, but not regularly. The natural features of the district are favorable to the capture of salmon, and some of the most productive berths on the river are found here. Ninety per cent. of the money yield of these fisheries is derived from the salmon. In 1880 there were 20 weirs and 2 nets in this district, and their aggregate catch was 1,398 salmon.

From Fort Point north to Fort Knox, opposite Bucksport, weirs only are used, and 20 of them were built in 1880. The incline of the bottom being mostly steep, they are with one exception, built on separate hedges. Salmon are here also the most important fish caught, constituting in value 88 per cent. of the catch. The aggregate product of these 20 weirs in 1880 was 1,000 salmon.

On the eastern side of the bay salmon fishing now begins at Castine, where there has been a fairly productive fishery since early times near the light-house on Dice's Head. Between this point and Morse's Cove a few weirs are built, but they are not very productive. From Morse's Cove to the mouth of Eastern River the shore is thickly studded with long-hedged weirs, which are fairly productive of salmon, and take nearly twice as many alewives as the weirs on the opposite side of the bay. Within the mouth of Eastern River few salmon are taken, the yield falling off rapidly, while that of alewives increases as we ascend this river. The yield of 31 weirs and one net in the towns of Castine and Penobscot (the latter extending a mile up Eastern River) was 1,000 salmon.

Directly in the mouth of the Penobscot (or according to the pilot books, 8 miles above the mouth) is the island of Verona, formerly known as Orphan's Island or Whitmore's Island. This is one of the best salmon districts, but the salmon fishing is mainly confined to the south end, and to the west side, which is washed by the main channel. Weirs alone are employed. In 1880 there were thirty-four of them built, including one on Odom's ledge, and their aggregate yield of salmon was 2,053.

The town of Orland, including all of Easton River above the town of Penobscot, and all that part of Bucksport lying on the "Thoroughfare" (or channel that separates Verona from the mainland on its northeast side), make up a district little interested in salmon, 37 weirs taking but 420.

Above Fort Knox, on the west side, and Indian Point (formerly known as Mack's Point), on the east, are built 30 weirs, which are, however, far less productive than those below, their total catch being 1,044 salmon. The most of these weirs are located in the towns of Bucksport, on the east side, and Winterport, on the west. Above Winterport Village the yield rapidly diminishes, and 2 miles below Hampden Village we find the last weir.

Above Hampden there is no fishing done except by gill-nets, which are commonly employed in drifting, but are sometimes "set." Their operations in recent years are much limited by protective laws, which have driven them from their former grounds near the Treat's Falls dam. In 1880 there were eight fishermen thus employed in Bangor and Hampden, using 16 set-nets, but not constantly. At Veazie and Eddington there were six men, with 10 drift-nets, and their catch was 100 salmon. On the east branch of the Penobscot there were 10 set-nets used, and 686 salmon taken. This was an illegal fishery, was never followed to such an extent or so successfully before, and is not likely to be permitted in the future.

The totals of the Penobscot salmon-fishery are as follows: Number of weirs built 172, including the alewife weirs, of which all but 7 take some salmon, though 20 of them take so few that they are not considered of importance; traps (or pound-nets) set, 65; gill-nets in use, 36; number of salmon caught, 10,016.

*Alewives.*—The alewife fishery extends on the west side of the bay and river, from Moose Point to Hampden, and on the east shore from Castine to Orrington, but centers at Orland on Eastern River above the ordinary range of salmon. From early times the alewife fishery was far better on the east than on the west side of the bay and river, a fact which may be taken to indicate that the eastern tributaries originally contained more extensive or more favorable breeding grounds than those on the west. However this may have been when all the tributaries of the west side were accessible, it is certain that for a half a century the best and nearly all the breeding grounds have been on the east side. For nearly that length of time the lakes and ponds in Orland have been the principal breeding places of the alewife. At the present time the only other accessible pond is Walker's pond in Brooksville, which, however, has no appreciable effect on the fishery except in Castine Harbor and in Bagaduce River, where it is quite insignificant. Of the total of 730,000 alewives taken in 1880, only 95,900 (equal 13 per cent.) were taken on the west side.

The implements of the alewife fishery are the weirs, mainly the same engaged in the salmon fishery. Those built especially for alewives in Eastern River have no important peculiarities. There is also at Orland a small dip-net fishery, in which about thirty persons engage irregularly during the few days occupied by the alewives in ascending the dams.

The alewife fishery of the Penobscot may be summarized as follows:

District.	Number of weirs.	Number of dip-pere.	Number of alewives caught.
Castine to Penobscot.....	21	.....	65,000
Orland and Thoroughfare.....	37	20	392,000
Verona.....	24	.....	177,700
Searsport and Cape Gellison.....	20	.....	37,900
Fort Point to Fort Knox.....	20	.....	37,000
Above Indian Point.....	30	.....	21,000
Total.....	172	20	730,600

A few of the alewives are consumed fresh and a very small number salted (in 1880 only 17 barrels), 95 per cent. are smoked, and the most of these are disposed of in local markets.

*Shad.*—Nearly everything that can be said about shad in the Penobscot is of a historical character, and will be found on another page. At the present time the catch of shad is an incident, and a very unimportant one, of the weir-fishery for salmon and alewives. Only 800 were taken in 1880, as ascertained by careful inquiry.

*Smelts.*—The fishery for smelts ranks in importance next to that for salmon, the aggregate product being 266,875 pounds, valued at \$14,579. It is carried on by means of weirs, bag-nets, and hook and line.

The weir fishery for smelts is confined to 4 small weirs, built in Eastern River and the Thoroughfare.

The bag-net fishery is the branch by which by far the greater part of the smelts are taken. It is confined to a few localities, mainly Eastern River and the Thoroughfare, the main river from Winterport to Mill Creek (South Orrington), and Marsh River, in Frankfort. The style of the

nets and the mode of setting them vary a little, to adapt them to the presence or absence of ice. In open water the nets are attached to frames which swing at heavy moorings. When the ice is strong enough to bear, the net is attached to a pair of long poles pushed down through a hole in the ice, with which the whole fixture rises and falls with the tide. In the Thoroughfare, and in the main river at Winterport, though the ice sometimes forms, it is too uncertain and unstable to be made use of to support the fixtures. But farther up the river, above Mill Creek, the ice-fixtures are in exclusive use. From Mill Creek down to Hurd's Brook fishing begins before the ice forms, and when it does form the nets are removed from the open-water fixtures and the ice-fixtures brought into use.

At the Bucksport and Verona bridge is a fishery of nets which are set between the piers of the bridge, substantially in the manner of the ice-nets of Orrington, but with the poles resting on the bottom.

In the winter of 1879-'80 there were 15 bag-nets in use in Orland; 31 in the Thoroughfare (including 8 at the bridge); 10 at Frankfort; 20 at Winterport Village; 13 at the "Bolan" ground some 2 miles above Winterport Village; 25 in Orrington.

The only dip-net fishing for smelts now existing on the Penobscot is at Orland, and that has long ago ceased to be of any importance.

Fishing for smelts with hook and line is occasionally tried in the main river near Mill Creek and at some other points, but is regularly employed only in Belfast Harbor and in Bagaduce River. In the latter locality it is followed by nearly one hundred persons. The fishing ground extends from Johnson's Narrows upward about 5 miles. The smelts are at hand in the fall, and in November the fishermen sometimes fish for them from rafts. But it is not until December that the river freezes up and the regular fishing begins, in little cloth huts on the ice. The first of the season only the ice above the toll-bridge at North Brooksville is strong enough to bear, but later operations extend down to the vicinity of the narrows. The fishing is followed at any time of tide, but only by day. The catch in 1880 amounted to about 61,000 pounds.

The total yield of all branches of the fishery for the year is estimated at 366,875 pounds of smelts.

*Historical notes on the fisheries of Penobscot River.*—Of the great immigration into Maine that set in from the other colonies, especially from Massachusetts, shortly after the middle of the eighteenth century, the Lower Penobscot Valley received its fair share. The early settlers found salmon, shad, and alewives very abundant, and engaged in their capture on a limited scale with such implements as they could command. Across the mouths of a few shallow coves they built, with stakes and brush, half-tide weirs to catch alewives, and with them took many shad. They knit nets with which they caught salmon, either by drifting in mid-stream or by setting the nets out from shore, secured by stakes and killocks. In the small streams and at convenient points in the larger ones they plied the dip-net. Notwithstanding the primitive character of their methods and apparatus, they took great quantities of fish. The local consumption was small; there were no good facilities for sending fish to the larger markets. The surplus salmon were mostly smoked, the shad pickled, and the alewives dry-salted and packed in barrels. These cured fish were forwarded to market by schooners bound for Boston, New York, or more southern ports. The demand for shad was limited, and they were less objects of pursuit than salmon and alewives; at first they were only taken in the cove-weirs built for alewives, and as accidental captures in the salmon nets, but after a while a better demand arose, and nets were knit and plied especially for them.

In the village stores salmon, shad, and alewives were bought and sold, and the merchants' books give us some information about prices.\* The storekeeper paid for fresh salmon 2*d.* per pound, for salt salmon 2½*d.* and sold salt salmon at all seasons of the year for 4*d.* per pound. A half barrel of salmon is charged at £1 4*s.* Shad were bought in May and June at from 1½ to 3*d.* each, and sold in March at 6*d.* each. The selling price of a barrel of shad was from 30*s.* to 36*s.* Alewives are bought in May at 3*s.* per barrel, and retailed in December and February at £1 4*s.* The same merchant was retailing dry codfish at 4*d.* to 6*d.* per pound; salt pork at 10*d.*; salt beef at 4*d.*; flour at 6*d.*; corn at 8*s.* per bushel; sugar at 1*s.* per pound; sheeting at 2*s.* 6*d.* per yard. Thus the fisherman bartering his salmon for store goods would give 2 or 3 pounds of salmon for a pound of codfish; 5 pounds of salmon for a pound of pork; 2 pounds of salmon for a pound of beef; 3 pounds of salmon for a pound of flour; 48 pounds of salmon for a bushel of corn; 6 pounds of salmon for a pound of tea, and 15 pounds of salmon for a yard of sheeting. A comparison with the modern prices for these articles shows us that when salmon are sold by the fisherman at 12 cents per pound (and the price rarely goes lower) their purchasing power has increased, in exchange for codfish about 6 times; for pork, 5 times; for beef, 2 times; for flour, 10 times; for corn, 8 times; for sugar, 6 times; for sheeting, 22 times.

Shortly after the year 1800 weirs with three pounds, substantially of the modern form, were introduced. They were constructed wholly of stakes and brush, or in some cases partly of woven cedar mats. They had no floor but the bottom of the river, and were not extended beyond low-water mark because the fisherman must take his catch out with a dip-net. Such a weir in latter days would be a total failure, but in those times took a great abundance of fish. Their introduction is attributed by several authorities to one Hawley (or "Hollis") Emerson, of Phippsburg, in 1811 or 1815. The latter year he appears to have built such a weir at Treat's Point, on the west side of Marsh Bay, and it inclosed at one time such a mass of fish that its sides burst open and let them out. This form of weir came into immediate use, and in the river from Castine and Searsport to Orrington supplanted set-nets generally, though these have never passed wholly out of use. About the same time, or a few years later, floors were made for the fish-pounds, and one Halliday, said to be a Scotchman, and to have come from New Brunswick or Nova Scotia, introduced the use of netting for the walls of the fish-pound. To him is also by some attributed the introduction of floors. He built a weir on the west side of Orphan's Island (now Verona), and that was the first weir with "marlin" (netting), or with a floor, that was built in that neighborhood. The use of netting was, however, only gradually adopted, and we know that as late as 1829 some productive weirs were built at Bucksport without it. In Penobscot Bay, below Castine and Searsport, weirs were never adopted, but set-nets continued in use until comparatively recent times, when they were gradually transformed into the "traps" or pound-nets of the present day.

About the date of the introduction of three-pound weirs there sprung up a better demand for shad, which now became the leading fish for sale. Small vessels from Southern New England, some also from Portland, came and passed the fishing season in the Penobscot, buying salmon and shad to smoke and salt, and also buying the cured fish, not only of these species, but of alewives, salted or smoked. A considerable part of the catch found its way to market through their hands.

Fish were not continuously plenty; 1820 was a year of great scarcity, which continued several years after that date. In 1822 fish were scarce in Marsh Bay, but about the 1st of July, there was an extraordinary run of salmon which gave good fishing in Penobscot Bay, and as far up the

\* Data from the books of Mr. Robert Treat, who kept a store in Bangor from 1786 to 1790.

river as the north end of Orphan's Island. The year 1820 is also noted as having been a year of complete failure of the shad fishery of the Kennebec. The recovery of the fisheries from this depression was, however, rapid and complete.

From 1823 to 1832 may be considered the palmy days of the Penobscot River fisheries. Not that the fish were more plenty, for it is quite likely, especially in the case of alewives, that the closing of the tributaries was already beginning to tell on their numbers, but the gross quantity of fish taken and utilized and the profit received from them were probably greater than at any other time. Weirs were built through all the districts where they are now built, in some cases in greater and in others in less numbers than now, and there were flourishing drift-fisheries for both salmon and shad all up and down the river, 200 of them fishing between Mill Creek and Odom's Ledge, and a more extensive net-fishery for salmon on the shores and islands of the bay than now.

Bucksport became the most important center of the fish business. Dram Point flats, on the eastern side of Marsh Bay, became the site of a productive weir-fishery for alewives and shad. Weirs were built in imitation of Emerson's weir on the opposite side of the bay. In 1832 there were 17 weirs on these flats where in 1812 there was but 1 weir, and in 1873 but 3 weirs. Five firms were engaged in the capture and packing of the fish caught. Alewives were in less demand than shad, and it was sometimes necessary to get rid of them by giving them away or by turning them back into the river. When the number of fish exceeded the capacity of the packing houses, it was sometimes the rule to throw the alewives into the river direct from the weir. Dipping shad and alewives together from the pound, if the fisherman found that he had in his net mostly shad he would throw them into his boat, but if alewives predominated he would throw them overboard. The greater part of the fish caught were cured and packed, and sold to the small vessels engaged in the fish trade. The salmon were largely smoked, the shad all salted, the alewives dry-salted or smoked, the latter method having come into general favor. The following are quoted as prevailing prices: 5 to 7 cents per pound for salmon, \$6 to \$7 per barrel for shad, and \$2.50 per barrel for salted alewives.

In 1832, however, this period of prosperity was rapidly approaching a disastrous end. Spurred on by the increasing demand for lumber and the profit to be derived from it, the operators were no longer contented with the mill-power derived from the tributary streams, but sought to bring the main Penobscot itself into their service. Up to 1830 there was no fixed impediment in the way of fish ascending the main river, but in that year a dam was built at Oldtown which seems to have seriously hindered the passage of shad and alewives, and in 1834 or 1835 there was another dam built at Veazie which for several years constituted an impassable barrier. By the gradual washing away of the left bank of the river there was uncovered a crevice in the ledge which enabled salmon to ascend, and they were thus preserved from complete destruction, but shad and alewives never recovered, though there is evidence that shad have sometimes, in small numbers, passed both of the above dams. Very soon after the building of these dams a rapid decline in the fisheries began. The shad fishery was in a few years utterly extinguished. The alewife fishery above Bucksport was also destroyed, no breeding ground now remaining but in Easton River, which alone did not even suffice to prevent deterioration of the fisheries in its immediate vicinity. The salmon continued to decline till about 1860, when their lowest point was reached.

The town records of Orrington afford some data which indicate in a general way the relative productiveness of the fisheries for a long series of years. In 1807 the legislature of Massachusetts passed an act authorizing the town to exercise exclusive control of the river fisheries, and it was

the practice to sell the right to fish annually at auction. There were three sites for weirs, which were all sold when fish were plenty, but in times of scarcity some of them occasionally stood idle. The blanks are understood to indicate, in most cases, a failure to effect any sale. As a record of special interest it is presented entire.

Year.	Rental.	Year.	Rental.	Year.	Rental.
1814	\$48 50	1827	\$361 37	1850	
1815	63 50	1838	124 00	1860	\$1.00
1817	138 00	1839	13 70	1861	2 85
1818		1840	37 22	1862	4 50
1819	85 25	1841	42 70	1863	4 50
1820	150 50	1842	54 85	1864	
1821	68 25	1843	22 25	1865	18 00
1822	12 53	1844	7 69	1866	21 25
1823	15 00	1845	2 47	1867	9 50
1824	157 05	1846	9 61	1868	26 50
1825	219 95	1847	6 30	1869	10 50
1826	359 00	1848	33 15	1870	2 50
1827	410 00	1849	82 72	1871	
1828	492 00	1850	4 04	1872	
1829	440 00	1851	15 25	1873	
1830	445 60	1852	50 50	1874	27 75
1831	530 75	1853	14 02	1875	
1832	481 00	1854	15 00	1876	1 55
1833	171 25	1855	22 62	1877	2 00
1834	40 70	1856	81 38	1878	13 00
1835	144 83	1857		1879	6 00
1836	335 88	1858	7 00	1880	5 00

In 1814 it is probable that the implements employed in fishing were of a very primitive character, and that the same incentives to effort, a brisk demand and the remunerative prices of ten or fifteen years later, did not yet exist. The price obtained in 1820 indicates that the result of the fishery of 1819 was encouraging, but the scanty catch of 1820 and 1821 (which rests on satisfactory direct evidence from other sources) finds its natural result in the sudden dropping off in the bids in 1821 and 1822. The rapid recovery of the fishery is shown by the rise of the rental after 1823. Prosperity continued to attend the fishery till 1832. The result of the fishery that year was evidently disappointing, and the next year the rental fell off 62 per cent., and in 1834 there was a further drop of 66 per cent. from 1833. In this we see the result of the decline of the alewife and shad fishery. The revival of 1835, 1836, and 1837 was, it is fair to presume, the result of the excellent condition of the salmon fishery, which, according to another authority,\* was at this time showing an increase, which culminated in 1836. The general decline of the salmon fishery is shown by the falling off of the rental from 1837 to 1845.

Since 1860 there have been various fluctuations in the numbers of salmon and alewives, but the shad have remained steadily at low-water mark. The years 1867 and 1868 were good years for salmon; so also were 1872 and 1873. In 1867 the State commissioner of fisheries estimated the catch, from imperfect data, at 8,000 salmon and 1,000,000 alewives. In 1873, after careful inquiry, the number of salmon caught was estimated at 15,000.† The latter year was beyond question the best since 1860, and probably the best since 1850.

**SAINTE GEORGE RIVER.**—The Saint George is a small river, draining only 210 square miles of territory. Its water surface, however, embraces seventy-two lakes and lakelets, of which the

\* Mr. Amos Treat, of Frankfort.

† Rept. U. S. Fish Com. 1872-73, p. 313.



sixteen largest have an aggregate area of 14.35 square miles. All or nearly all of these were naturally accessible to alewives, and, as may be inferred, the river produced this species in great abundance. Shad and salmon were also found there, and tradition says in plenty, but it does not appear how plenty. At any rate, since the beginning of the present century, salmon have been rare and shad not abundant.

Alewives, smelts, and eels are now caught in this river in sufficient numbers for market purposes; the alewives in weirs in Thomaston and Cushing, and in dip-nets in Warren; the smelts in weirs in Thomaston, in bag-nets under the Cushing Bridge, and by hook in Warren; the eels are taken with weirs, pots, and spears.

The alewife fishery at Warren is controlled by the town. The weir fishery is free. There is also a free fishery with drift-nets, which is believed to be mainly illegal.

The town fishery at Warren dates as far back as 1802, when it was established by act of the legislature of Massachusetts. It was the practice until 1879 for the town to appoint an agent, who, with his deputies, captured the fish and dealt them out according to law. Tickets were issued to heads of families, each ticket entitling the holder to 300 alewives on payment of the fixed price, which was generally 20 cents per hundred. The order of precedence of the tickets was determined by lot. Certain poor were supplied gratis. After all the tickets were supplied, the remainder were sold for the town to any buyer. From these sales large sums were formerly realized, and one year it amounted to \$2,300, which paid the town tax for that year, the minister's salary, and left something over. The gradual curtailment of the area of their breeding grounds by the closing of tributary lakes and the difficulty of passing the dams at Warren caused a decline in the number of the alewives. From 1849 to 1858, inclusive, the average amount received from sales was \$511 yearly; the best returns being \$1,146.16 in 1854, and the poorest \$144.25 in 1850. During eight years, from 1859 to 1867, inclusive (excepting 1865, when no sales were made), the average of receipts was \$219.87. The lowest ebb appears to have been reached in 1864, when but \$65 were received. For some years the fishery continued to yield very little, and in 1873 was almost a total failure. Since then, however, there has been a great improvement, the sales in 1875 amounting to \$526.28, and subsequent years having been quite productive. The improvement may be reasonably ascribed in the main to the construction of improved fishways.

The total catch of alewives in 1880 in the river by all methods was 515,000. There were 400,000 smoked and 134 barrels salted.

The smelt fishery of the Saint George is of greater pecuniary importance than the alewife fishery, though its origin dates from no further back than about 1870 or 1868, when several weirs were built for them in the river just below Thomaston. At present there are 8 weirs built on the river, and nearly all the smelts are caught in them. There are, however, 3 bag-nets used at the Cushing Bridge, and a few men fish with hook at Warren. The product is shipped by rail to Boston and New York, the latter taking commonly 80 to 90 per cent of the total. The census year was the best year in the history of the fishery, 95,000 pounds of smelts having been sent to market. The next best year was 1875-76, when the shipments amounted to a little over 60,000 pounds. In other years since 1872 they have amounted to from 25,000 to 42,000 pounds.

No tom-cods of consequence are caught in this river, and the eel-fishery, followed with pots and a few spears, produces but about 8,000 pounds a year.

**MEDOMAK RIVER.**—A small river, draining but 62 square miles of territory and less than 3 square miles of lake surface, the Medomak has never been a very important producer of fish. It

was closed to the anadromous fishes by legislative sanction in 1800. At present it has only a few smelts. There is a prospective alewife fishery, the result of the encouragement given this species through the construction of fishways and restricted fishing, but in 1880 the capture of alewives was still forbidden.

The smelt fishery is limited to the operations of 3 weirs built in Broad Cove, and a large number of hook fishermen, of whom about 80 are estimated to have fished for them for sale in cloth huts similar to those used in other places. The total catch in 1879-'80 was 33,910 pounds. The smelt fishery of the Medomak dates from the year 1871, when one George Preble came from the Kennebec and built a weir about  $1\frac{1}{2}$  miles below the village on the east side of the river. He met with good success, and the next year two weirs were built. From this the weir fishery suddenly developed itself until the hedges were forbidden by law as impediments to navigation. About 1877 it was discovered that smelts could be taken here with hook, and there was an immediate development of that fishery. The fishing grounds are at various points within 2 miles of Waldoborough village.

**PEMAQUID RIVER.**—This is a very small stream, having a drainage basin of only some 10 or 15 square miles. An alewife fishery of some local importance once existed here, but it was destroyed by impassable dams and improvident management.

**DAMARISCOTTA RIVER.**—This is also a small river, having a drainage basin of little more than 50 square miles, and a lake surface of 10 square miles. In the matter of fisheries it is, however, the most important river in the State after the Penobscot and Kennebec. The river has its source in a lake of 10 miles area, known as "Damariscotta Pond," which is fed by many small brooks. From the outlet of this lake to the sea is about 19 miles, of which less than a quarter of a mile is fresh water, the rest being a tidal brackish estuary. From the lake the river plunges at Damariscotta Mills down over a steep rocky descent, at the foot of which it enters Damariscotta Bay, a sheet of slightly brackish water about 2 miles long, which is connected with the lower and salter part of the river by a narrow and rather shallow passage. This bay appears to be especially well fitted for a winter home for smelts and eels, and here all the fisheries for those species are plied.

The alewife fishery is claimed and generally believed to have been in its origin wholly artificial, but there is some evidence to the contrary, and it must be regarded as an unsettled question whether alewives ever succeeded in ascending to the lake before they were assisted by man. This much, however, seems to be established, that if such was the fact the extermination of the original brood (doubtless by dams which were very early erected here) was effected so long ago that its existence was unknown to those living in the vicinity seventy-five years ago. The tradition is that up to 1803 no alewives had ever ascended the falls. A few stragglers came yearly to the foot of the falls and by plying the dip-net industriously a man might get a mess of them, but as they were unable to reach any breeding ground, they did not increase. In 1803, however, some of the citizens got a lot of alewives from Pemaquid River (some say from Warren) and put them into the lake, and when their descendants in due course of time came back from the sea a rude fishway was constructed of loose stones for them to ascend. The result was the establishment of a flourishing fishery. In 1810 the towns of Nobleborough and Newcastle, whose boundary is formed by the river at the falls, assumed control, under legislative sanction, of this fishery, and have continued to manage it down to the present time after the manner of town fisheries in other parts. Until 1865 the fish were taken by the fish committee and sold to the citizens and the public at 25 cents per

hundred. From 1865 to 1880, inclusive, the committee has sold the privilege of taking fish at auction, and the price was in 1866 raised to 50 cents per hundred. Receipts from the auction sales, and the estimated number of fish taken each year, have been as follows:

Year.	Proceeds of auction sales.	Number of alewives taken.
1866.....	\$1,200	700,000
1867.....	1,300	1,300,000
1868.....	1,800	800,000
1869.....	2,040	750,000
1870.....	2,245	1,000,000
1871.....	1,875	350,000
1872.....	1,340	400,000
1873.....	1,840	600,000
1874.....	2,040	800,000
1875.....	2,055	800,000
1876.....	2,050	600,000
1877.....	1,845	600,000
1878.....	2,040	850,000
1879.....	2,100	737,000
1880.....	2,100	1,700,000

From this it appears that the best catch since 1865 was that of 1880. But this was sometimes exceeded in the first half of the century. The year 1843 is remarkable as the most productive ever known. The spring of that year was a season of exceptionally large rainfall, and the water in the river was very high. The product of the sales at 25 cents per hundred was about \$3,000, and a great many were taken by private parties who did not pay for them.

The above statements refer only to the fishery at Damariscotta Mills, which is managed by the towns, and the implements of which are dip-nets exclusively. There, however, exists a weir fishery of early origin and now embracing 13 weirs on the lower part of the river in Bristol and Edgecomb, a gill-net fishery with about 20 nets in the same vicinity, and a seine fishery at Rutherford's Island. By all these methods there were taken in 1880 about 2,300,000 alewives, or about 5,400 barrels, of which 2,950 barrels were salted, and 2,400 barrels smoked.

The earliest alewives make their appearance in the vicinity of Damariscotta Mills at the end of April or the first of May, and they continue to ascend the stream for five or six weeks. The first captures are generally made from May 5 to 10, and the principal run is expected about May 20 to 25. Of the early runs 400 fill a barrel, but at the close of the season it takes 500.

The smelt fishery of the Damariscotta has sprung up within the last twenty years. It has always been exclusively a hook-and-line fishery through the ice of Damariscotta Bay. In its earliest stages the fishermen stood by their holes without shelter. Then they resorted to clumps of brush to break off the cold winds. The next step was the building of a heavy wooden shanty, and these have finally given place to neat, comfortable, and easily-movable cloth huts, of which in the winter of 1879-'80 there were in use 154—the greatest number ever known. Each house is occupied by one man with 3 lines, and each line generally carries a single hook. The favorite and ordinary bait is the marsh minnow, which is collected in the fall and kept in springs or in pits in house cellars. The smelts bite on either tide, and their movements about the bay are so irregular that the fishermen are unable to agree as to best location for fishing, and the huts are often moved about to find better ground. The catch of 1879-'80 aggregated 70,500 pounds, of which about one-third was sent by sleds into the country in various directions, and the remainder forwarded by rail to Boston and New York. The prices obtained averaged to the fisherman 4½ to 5 cents per pound.

The eel fishery of this river is also located in Damariscotta Bay, and employs no implement but the spear. The product has fallen off some in recent times in spite of a protective law which limits the fishery in point of time to the four months of December, January, February, and March. In 1879-'80 the yield was 18,200 pound.

**SHEEPSCOT RIVER.**—The Sheepscot drains about 200 square miles. Its tributary lakes are few and small, and it seems to have been, as tradition asserts, frequented by salmon and shad to a greater extent than any other river between the Kennebec and Penobscot, while alewives were relatively less abundant. Impassable dams at Alna, at the head of the tide, have for many years shut the migratory fishes out from nearly its entire course. The main river was exempted from the operation of the fish law by act of legislature in 1800. This exemption did not extend to Dyer's River.

At the present day the fisheries of the Sheepscot are of little importance, the total value of the product being but \$2,540, which is about the ninth part of the product of the Damariscotta. About 1,000 shad are taken in traps arranged for them in the river near Alna. One or two salmon are commonly taken in these shad-nets, but none in 1880. No alewives of consequence are caught, there being no fishing specially for them, and no summer weirs built. Bass, smelts, and eels are the species taken for market.

The implements employed in the smelt fishery are 11 weirs, 3 bag-nets, and the gear of about thirty-five hook fishermen. The weirs are built at various points both above and below Wiscasset, and operate in the fall and winter. The bag-nets were set at three bridges, on the tributary known as Back River. The hook fishery is located near Sheepscot Bridge, from half a mile above to 2 miles below, varying from year to year, according to favorable or unfavorable condition and extent of the ice. This fishery dates from the winter of 1876-'77. About \$1,000 worth of smelts have been taken out yearly, except in 1879-'80, when, on account of the unstable condition of the ice, there was little fishing done at this point, and the total catch of smelts in the whole river was but about 22,000 pounds, valued at \$1,100.

Bass are taken in summer with hook and line at Flying Point, in Wiscasset, and in winter in gill-nets, above Sheepscot Bridge, in both the main river and its principal tributary, Dyer's River—mostly in the latter. This fishery began about 1873, some men from the Kennebec being the first to engage in it. In the channel of Dyer's River, which is here uniformly very narrow and of even depth, they set gill-nets about 35 feet long, 12 to 15 feet deep, and with a 4-inch mesh, through the ice across the channel, which they in general completely span. The bass taken are ordinarily from 3 to 12 pounds in weight, but some of 30 to 40 pounds are now and then caught. The catch of the gill-nets is estimated at 5,000 pounds and of other methods at 3,000 pounds.

Eels are plenty in Dyer's River. They are taken with spears to the extent of about 4,000 pounds yearly.

**KENNEBEC RIVER.**—The Kennebec is the second river in the State in size, and second in the importance of its fisheries. It drains 5,800 square miles, of which 450 square miles is lake surface. About two-thirds of the basin is covered by forest, and nearly the whole of it is hilly or mountainous. Far the greater part of its volume is contributed by its western tributaries, several of which, the Sandy, Carrabassot, Dead, and Moose Rivers, take their rise in the mountainous district on the western border of the State. The Kennebec proper takes its rise in Moosehead Lake, 155 miles from the sea. This lake is the largest in the State, having an area of about 120 square miles. The sources of some of the tributaries are from 2,000 to 3,000 feet above the sea, but the main river issues from Moosehead Lake at an elevation of about 1,023 feet. As the descent thence to the sea-level is accomplished in the 112 miles between the lake and Augusta, the Kennebec is a very

rapid river. There is very little dead water, the current averaging near 3 miles per hour. Rapids abound, and at several points there are important falls, as at Waterville, Skowhegan, Carritunk, and several points near the lake. Below Augusta there is a 20-miles stretch of water affected by the tides, but which is nevertheless in ordinary summers entirely fresh, ending in Merrymeeting Bay, where the Kennebec is joined by the Androscoggin and by several smaller rivers. From Merrymeeting Bay to the sea the river flows in a narrow channel, and, unlike the Penobscot and most of the other rivers of the State, it discharges into the ocean by a narrow mouth.

The tributaries of the Kennebec are of various character. Some of them are characterized by extensive chains of lakes, and others by long stretches of gravelly rapids. They are nearly all free from serious natural impediments, the most important exceptions being the Mussalunskee (Emerson Stream), draining the Belgrade lakes, which has a perpendicular fall of 38 feet at West Waterville, 8 miles from its mouth, and Dead River, or the West Branch, which has a similar fall of 28 feet, 15 miles from its mouth.

The artificial obstructions to the ascent of the Kennebec and its branches by migratory fishes are numerous and formidable. On the main river there are dams at Augusta, Waterville, Fairfield, Somerset Mills, Skowhegan, and Madison. All of the tributaries are dammed at frequent intervals. On the Cobbosseecontee there are 8 dams within 1 mile of its mouth. On the Sandy there are 3 dams within the natural range of fish, the same number on the Carrabasset; on the Seabasticook and branches 15 or more. The damming of the tributaries dates from the last century. The main river remained open till 1838, when the completion of the Augusta dam shut them out from all waters above that point. Previous to 1838 fishways were maintained on the Seabasticook and some of the lesser tributaries, but no adequate provision for the ascent of fish was made at Augusta until 1879, and meanwhile all the other fishways had been neglected.

In other respects the Kennebec has been less unfavorably affected by the influence of civilization than the Penobscot. Neither river has been polluted with sewage nor the waste of manufactures, and the discharge of sawdust and other mill refuse has been on a smaller scale on the Kennebec, and has not, so far as can be seen, exerted any unfavorable influence.

*Salmon.*—The original limit of the range of salmon in the Kennebec was probably about 12 miles above the "Forks," or junction of the West Branch, or Dead River, with the main Kennebec, and 144 miles from the sea. On Dead River it was at Grand Falls, 147 miles from the sea. Owing, however, to early sparsity of population very little information on this point has come down to us. The most serious natural obstruction in their way was Carritunk Falls, where they were obliged to surmount a perpendicular fall of 16 feet, and although it is certain that many succeeded in doing so, it may well be doubted whether they constituted a majority. In the Carrabasset and Sandy they ascended many miles from their mouths, and it is supposed that these two rivers afforded their principal spawning grounds. They are known to have ascended the Seabasticook, though only in small numbers, and they are said to have been sometimes found in the Wesserunsett and Cobbosseecontee.

The aborigines doubtless pursued the salmon, but very few facts about it are known. In 1754 a military force ascending the river found a few Indians at Norridgewock, and fresh salmon in their possession. Records of the year 1773 show that salmon in barrels were sent as articles of merchandise from Fort Halifax (near the present town of Waterville) to Fort Western (now Augusta).<sup>\*</sup> It was probably not many years after the latter date that drift-net and dip-net fisheries sprang up at Showhegan and Carritunk. The latter continued to be the best fishing

<sup>\*</sup> North's History of Augusta, page 115.

ground above Waterville as long as salmon were able to pass Augusta. There was at the same time a drift-net fishery of less importance at Augusta, several seine-fisheries, in which some salmon were taken at various points up and down the river, and a weir fishery near its mouth. An eye witness\* estimated the number of canoes fishing with drift-nets at Ticonic Falls since the beginning of the present century at about forty yearly, each canoe employing two men and one net. On one occasion as many as eighty-two canoes were counted at work at the same time. These canoes were all log dug-outs. Their ordinary catch was estimated at one hundred and twenty salmon for each canoe for the season, which would give a total of forty-eight hundred. Another witness† estimated the number of drift-nets fishing at Augusta in 1820 at twelve, and their catch at four thousand salmon. These are, however, off-hand estimates, and are liable to be far out of the way. In 1837 and 1838 the dam at Augusta was built, completely blocking the way of migratory fishes, and extinguishing all the fisheries of the upper waters. Of the salmon fishing below Augusta, we know that it was in a flourishing condition as late as 1814, when an old-fashioned shoal-water weir at Abagadasset Point, in Merrymeeting Bay, took one hundred salmon in a single season,‡ whereas in recent years a far more efficient weir on the same spot rarely or never takes as many as half a dozen in a season. From 1826 to 1835 the yield of salmon continued good, though by no means averaging so well as in 1814, which may have been an exceptional year. From 1837 to 1842 there was a decidedly higher yield, which was especially noticeable at Augusta. After this there was a sharp decline, which continued till 1855 or 1860, when the lowest point was reached, just short of utter extinction. The only breeding ground remaining accessible to the salmon was on the gravel beds within the first half-mile below the Augusta dam, and to this opportunity is the continuance of the brood in the river doubtless due. Since 1860 there have been several fluctuations, 1868 having been the best year then known since 1850, and 1873 having been still better. The number taken in 1867 was estimated by the state commission at twelve hundred, but this is regarded by some as too high an estimate. The data obtained by a careful inquiry (but not a thorough canvass) in 1873 led me to estimate the number taken in that year at fifteen hundred, of which nine hundred were taken below Bath and six hundred above that point. In latter years there has been a gradual decline, with some minor fluctuations. The total catch in 1880 was two hundred and sixty-nine salmon.

For the past twenty-five years the fishery for salmon has been little more than an adjunct of the shad and alewife fishery. It is probable that not a single weir would be built or seine operated on the river were it not for the shad and alewives, and the drift-nets at Augusta, the only implements used expressly for salmon, have rarely numbered more than two in a season, and have sometimes been suspended for a whole summer.

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\* Mr. William Getchell, who owned an island at Ticonic Falls, and carried on a dip-net fishery there, mainly for shad, from 1804 to 1837, and who was in 1867 still living in Benton.

† Mr. William Kennedy, of Augusta.

‡ The authority for this statement is Mr. John Brown, of Bowdoinham, who was at that time a boy living on the point. Mr. Brown has a daily record of his own fishing, extending, almost without interruption, from 1826 to 1861. With his free permission I draw the following facts therefrom; Mr. Brown's location was not favorable for salmon; no more, indeed, was any part of Merrymeeting Bay. The shad and alewives were the principal fish taken. The average number of salmon taken in his weir during the ten years ending in 1835 was 21.6 yearly. In 1837 there was an increase to 41, a greater number than any previous year since the record began. In 1838 there was a still greater number, 65. The four following years the catch was 46, 27, 49, and 27, respectively, and the average for the six years ending with 1845 was 42.5. This is held by Mr. Brown to show very plainly the effect of the Augusta dam in detaining the salmon, and even impelling them to retrace their course from Augusta toward the sea, at least as far as Merrymeeting Bay. From this time there was a sudden falling off, the average catch for the next five years being but 14. In 1850 it was but 5, the lowest point yet, and in 1855, 1857, and 1858, but one each year, notwithstanding that a more efficient weir had taken the place of the old one.

In early times the salting and smoking of salmon were common, and probably the greater part of the catch was disposed of in this way. Small vessels from Connecticut visited the Kennebec, as well as the Penobscot, to buy salmon. This was practiced as late as 1814 or later. But since 1825 it has been almost or quite the universal practice to market salmon fresh. The average price received in Bowdoinham in 1826 was about 9 cents per pound; in 1827, 15 cents per pound; and between these extremes it remained until 1845, with the exception of 1834 and 1840. Since 1845 there has been a considerable augmentation.

*Shad.*—The shad is the most important of the products of the spring fishery, yielding a pecuniary return sixteen times as great as salmon and nearly twice as great as the alewife. It is taken in weirs and drift-nets. Nearly every weir on the river depends more on shad than any other fish, but the most productive shad weirs are those of Merrymeeting Bay and vicinity, which are of the form already described as “shad weirs,” whose distinguishing characteristic is the capture of the fish in a large pound of deep water, from which they are taken with a seine. This form of weir is exclusively used in this vicinity, as on the lower part of the river the weir with a board floor is almost the only form in use. The principal reason for the difference in practice of the two sections is the difference in the condition of the river and the currents, a seine-weir requiring a gentle current for its successful operation. The form of weir has doubtless something to do with the fact that four-fifths of all the shad are taken in the Merrymeeting Bay district, including the Androscoggin arm of the bay and its tributaries, but it seems that while in the cooler and saltier water of the Georgetown district they are more inclined to avoid the shores and pass up the river. Of the 140,000 shad taken in the Kennebec in 1880, 108,000 were taken in the Merrymeeting Bay district, 5,800 above Richmond, 16,744 between the bay and Bath, and only 10,000 below Bath, including the Sasanoa or eastward arm, between Woolwich and Arrowsic. The approximate averages are as follows: In the bay district, 44 weirs averaged 2,048 shad; below Bath, 29 weirs averaged 345 shad. All included in the above statements are the breeding shad, called by the fishermen “river shad,” or “spawn shad.” The sea shad are mostly taken with drift-nets in the lower reaches of the river, but to some extent in the weirs. In 1880 the catch of sea shad was exceedingly small, and only about 80 barrels were cured. The drifting below Bath is wholly for sea shad; above Bath, for river shad.

In early times shad appear to have ascended the main river to Norridgewock Falls, Sandy River, a few miles from its mouth, and the Sebasticook in small numbers to Newport. Tradition also assigns the shad a place in the fauna of the Cobbosseecontee. There were productive shad fisheries at several points above the flow of the tide, among which we may mention Ticonic Falls (Waterville) and the Lower Sandy River. At Ticonic Falls there is an island in mid-stream, where great facilities existed for catching shad with dip-nets. This island was private property. The proprietor, from 1804 down to the extinction of the fishery, has stated that in the early days of his fishing he used to take \$500 to \$600 worth of shad yearly. As remarkable feats he mentioned that with the assistance of his three boys he had taken 1,100 shad and 20 salmon in an afternoon, and that one day four men dipped out and boated ashore 6,400 large shad. There was a similar but less productive dip-net fishery on the falls at Skowhegan.

The drift net, seine, and weir fisheries in the tidal waters were very productive. It is in evidence that in 1822 a seine at Augusta was known to take 700 shad in a day; that about 1837 there were about 100,000 shad taken in Eastern River (Dresden) alone. It is known that the shad-fishery was by no means uniformly productive. A period of scarcity occurred about 1820. That year the weir at Abagadasset Point took but 150 shad (its catch in after years ranged from 3,000

to 10,000 yearly), and another weir, on the eastern side of the bay, took but a half-hogshead tub full. A drift-net fisherman took but 20 shad. It was thought that shad-fishing was at an end; but the next year the shad were found to be increasing in numbers, and in a few years they were again plenty. The year 1831 was one of the best years ever known in Merrymeeting Bay; a seine at Beef Rock, on the east side of Swan Island, took 30,000 shad.\* To what causes to attribute these fluctuations we are unable to say, but they must of necessity have been natural causes. From 1830 to 1836 there were inspected in the three towns of Bowdoinham, Dresden and Woolwich 6,079 barrels of shad, an average of 868 barrels yearly. Inspection of packed and exported shad was compulsory, and it is safe to say that these figures represent seven-eighths of the shad caught. We may therefore estimate the catch in those towns at about 1,000 barrels, or 100,000 shad, yearly. There were at that time only 2 weirs in Merrymeeting Bay; and a few in Eastern River, all shoal-water weirs. The most of the fishing was done with drift-nets in the small rivers, like the Cathance and Eastern, and with 4 or 5 seines. In 1867 in the same district the catch of 40 deep-water weirs, several seines, and an unknown number of drift-nets was about 180,000. In 1880, 44 weirs, 2 seines, and some 60 drift-nets, covering nearly the same district, took about 105,000 shad. It appears, then, that the product of the Merrymeeting Bay shad fisheries is as great now as in 1830-1836; but this catch has been accomplished by the use of a great number of far more efficient implements.† The seine-weirs were introduced in 1851 and 1852, and soon almost entirely replaced the shoal-water weirs. In other parts of the river, where their construction was impossible, the catch of shad has fallen off remarkably since 1830, and the entire fishery of the districts above Augusta was of course extinguished in 1841, when the Augusta dam was finally closed.

*Alewives.*—All the weirs take alewives along with shad and salmon, and at the present day none of consequence are taken in any other way, the use of drift-nets having been discontinued since 1867, and the fish no longer ascending to places where they can be taken with dip-nets. As with shad, the most productive weirs are those of the Merrymeeting Bay district, especially in Eastern River and the main river on the east of Swan Island, where 7 weirs took, in 1880, 147,820 alewives, an average of over 20,000 per weir. In the bay, north of Abagadasset Point, 15 weirs averaged 12,500; south of Abagadasset Point, including the Androscoggin, Cathance, &c., 22 weirs averaged but little more than 5,300 alewives; between the bay and the city of Bath, 14 weirs averaged about 7,500; below Bath, in the main river and branches, 29 weirs averaged but 1,862 alewives. Thus the catch of alewives increased with distance from the sea in the main river, but fell off in the Androscoggin arm of the bay. The total catch in 1880 is estimated at 675,000. Only 20 barrels (part of the catch of Eastern River) were salted, and 600,000 were smoked.

Perhaps the earliest mention to be found of the alewives of the Kennebec is in a letter of the French priest Rasle, writing from the village of Norridgewock in 1723: "At a particular season of the year," says he, referring to the customs of the natives, "they repair to a river not far distant, where during one month the fish ascend in such numbers that a person could fill 50,000 barrels in a day, if he could endure the labor. They are a kind of large herring, very agreeable to the taste when fresh. Crowding one upon another to the depth of a foot, they are drawn out as if they were water. The Indians dry them for eight or ten days, and live on them during all the time that they are planting their fields."

\* Statement of Mr. John Brown.

† Mr. Brown's weir produced in the ten years ending in 1835 an average of 5,961 shad yearly; in the twelve years from 1837 to 1849 (1844 being omitted from the record) the average was 3,120 per year, a little more than half the former yield.



Fifty years later than this the whites had taken possession of the country and began to build saw-mills. They found the alewives ascending the river in immense numbers, extending their migrations to Norridgewock Falls, 91 miles from the sea, and up the Sandy River some 20 miles farther. Their principal breeding places were, however, in the lakes and ponds of tributaries nearer the sea, especially Cobbosseecontee stream (at Gardiner), Seven-mile Brook (in Vassalborough), and the Sebasticook River. The first of these afforded an extensive breeding ground in its 21 square miles of lakes and ponds, and must have contributed an important quota to the population of the river, but it was early closed. In 1737 we find the town of Wales (then including Monmouth) appointing a fish committee, which the next year was designated a "committee to see that the fishways are kept open according to law." The dams at Gardiner, however, were impassable, fishways were not maintained, and very early in the present century this brood of alewives was extinguished. A similar fate overtook the alewives of Nehumkeag and Worromontogus streams, two small tributaries on the east side of the river. At Seven-mile Brook and in the Sabasticook the alewives continued to breed until 1837, when the dam at Augusta finally cut them off.

The Sebasticook was probably the principal nursery of alewives for the Kennebec. It has a lake surface of 48 square miles, nearly every mile of which was accessible. After suffering great diminution while running the gauntlet of the tidal fisheries, there still remained a vast throng of fish to attempt the ascent of the Sebasticook. Fishing in this river was at first entirely free to the public, but after some years it was found that there was a diminution in the numbers of alewives, and protective legislation was then obtained for the most important points, which were at the falls, natural and artificial. The fisheries at such places were generally put into the hands of the towns. It does not seem that these measures were entirely effective, but that there was a gradual decline from obstructions and excessive fishing. There was a dam at the upper falls in Clinton previous to 1775, but it was provided with a fishway and the alewives continued to ascend in great numbers as far as Newport, on the main Sebasticook, and to the principal lakes on the tributaries. In 1809 a more formidable dam was put across the river at Benton. A serious falling off of the fish was soon perceptible and the dam was cut away to allow them again to ascend. In 1814 the town of Benton took charge of the fishery under legislative authority, and by a more careful management effected a substantial improvement. The right to take the fish was sold at auction yearly and brought from \$500 to \$1,500, though under the condition that the poor should be supplied gratis and all townsmen at a set price. The last year of the fishery (about 1837) it sold for \$225; one or two years earlier, for \$500.

Thus one by one the feeders of the river were cut off, with only one exception, that of Nequasset stream, in Woolwich, which remained open until very recent times, and, indeed, is not regarded now as permanently closed. The breeding ground in the main Kennebec was also largely curtailed, and is now limited to the tidal portions of the river in and above Merrymeeting Bay, and of the small tributaries centering in Merrymeeting Bay. So far as they go, however, these waters are very good nurseries, and in its yield of alewives the Kennebec now stands third among the rivers of Maine, only the Damariscotta and Penobscot surpassing it.

Of the number of alewives caught yearly in early times we are no better able to form an estimate than in the case of salmon and shad. There can, however, be no reasonable doubt that tradition is right in assigning them numbers far greater than has been known to any one now living. There must have been a great decline in their numbers consequent upon the erection of impassable dams across the streams by which they were wont to reach some of their best spawning

grounds: Yet measured by the standard of recent years they were still abundant in 1830. During the ten years ending with 1835 Mr. Brown's single shoal-water weir in Merrymeeting Bay took on the average nearly three times as many alewives as two deep-water weirs in the same vicinity took in the year 1880. The average catch of the same weir for the twelve years ending with 1848 shows a decline of about 40 per cent. In 1867 the State commissioners of fisheries estimated the aggregate catch of the river to have averaged about 1,200,000 alewives for some years previous, there being then eighty-six weirs, eight seines, and a few drift-nets in operation. In 1880, with eighty-seven weirs and two seines in operation, there were taken about 675,000 alewives. The latter estimate does not include bluebacks, of which some 400,000 were taken in 1880, an unprecedented number. The estimate made in 1867 is supposed to include few if any bluebacks.

*Smelts.*—The capture of smelts in the Kennebec was carried on on a small scale with hook and line and also with small gill-nets as early as 1814. Both these methods were in vogue in Eastern River at that time, and the hook and line fishing was probably common in other parts of the river, especially farther up, but it does not seem that the use of gill-nets was known elsewhere. The use of nets extended to other parts of the Kennebec, and this continued to be the most productive mode of taking smelts until the introduction of bag-nets, about 1852. The most of the smelts taken fifty years ago were for home consumption, but even then there was a small trade in them for the supply of local and inland markets. One cent per dozen is quoted as the price received by a fisherman for his entire winter's catch. About 1850 there sprang up a brisk demand for smelts to supply the large cities, especially New York, which has always taken the greater part of the catch of the Kennebec since that time. The introduction of fykes and bag-nets dates from 1851 and 1852. Both these nets were used in the Kennebec for many years, but the fykes have gradually gone out of use and plain bag-nets taken their places.

With the exception of two nets on tributaries in Georgetown and Arrowsic, the bag-net fishery is confined to the district between Bath and Richmond. There were one hundred and fourteen nets employed in the winter of 1879-'80, and their catch was about one-third of all the smelts taken in the Kennebec.

Weirs for smelts are employed only below Bath, mainly in the mouth of Back River, between Georgetown and Arrowsic. They are half-tide weirs, built and put in operation in autumn, and if not earlier broken down by ice they fish until the smelts are all gone past up the river, which varies from year to year, but averages about the middle of January. The total product of the fishery in Georgetown and Arrowsic in 1879-'80 was about 52,000 pounds.

The hook fishery is carried on in two districts: first, in the Sasanoa, at Preble's Point (the northern extremity of Arrowsic); second, in Gardiner and Hallowell. The latter locality is an old one, having been occupied with little or no interruption, though with all degrees of success, from very early times. About 1850 it was very productive, but, according to local testimony at Gardiner, it has fallen off greatly since the introduction of bag-nets in the Bay district. In 1879-'80 there were about a hundred persons who fished for sale, but not more than a dozen followed it persistently; the aggregate catch was about 19,650 pounds, all of which were disposed of in local markets. The fishery at Preble's Point has just sprung into existence, the discovery that smelts could be caught here having been first made in the winter of 1878-'79. The next winter there were one hundred and fifty men, with 50 cloth-houses and 350 lines, at work most of the fishing season, and their catch is estimated at 45,514 pounds of smelts.

*Eels.*—This fishery in the Kennebec, as in most other rivers, has been carried on very irregularly, and little can be said of its history. Eels have been marketed from the Kennebec from very early times. About 1840 a fishing smack from New London, Conn., followed for several years the

business of buying eels in the Kennebec at one cent per pound and carrying them alive to New York. At present, though followed by a few persons at other points, it is mostly confined to Phippsburg, Georgetown, and Dresden. In Phippsburg and Georgetown there is a summer fishery, with traps and pots, employing a portion of the time some fourteen men and yielding 28,000 pounds of eels, of which about half were shipped "round" (packed alive in barrels with ice), and the rest dressed, nearly all to New York. The fishery at Dresden is a winter fishery, conducted on the ice with spears by some twenty men, whose catch, however, is only about 4,000 pounds. The only other eel fishery worthy of mention is an autumn weir fishery at Gardiner, in the Cobbosseecontee stream. The catch here consists solely of gravid female eels on their way to the sea. The proprietor, Mr. W. H. Spear, has sometimes practiced transferring the young eels found so plentifully in early summer in the Kennebec to the lakes above, hoping thereby to increase his catch.

*Sturgeon.*—All essential facts with reference to the sturgeon fishery of the Kennebec are stated above in connection with the description of the natural history of the sturgeon and modes of catching it. The catch of 1880 is estimated at 250 sturgeon, weighing 12,500 pounds.

*Striped Bass.*—The principal points in the bass fishery of the Kennebec have already been stated (see p. 693). The only modes of fishing expressly for bass that have been employed on the Kennebec are the stop-net above described, and a floored weir, of which latter method only a single example has come to our knowledge, a weir having been built expressly for bass in 1880, just below Merrymeeting Bay. Bass were once plenty in the Kennebec, but there was at that time little demand for them. Now they are in demand, but are unfortunately scarce. The catch of 1880 is estimated at 12,760 pounds.

*Tomcod.*—This fish is little prized in the Kennebec, and is now taken only as an incidental product of the smelt fishery, except those captured with dip-nets and grapples at Augusta in mid-winter, which are estimated for the winter of 1879-80 at 40,000 pounds. The quantity taken in the smelt fishery is estimated at 60,000 pounds. The greater portion of these are fed to animals, but the best of them are selected and sold for human food.

*Blueback.*—The fishermen of the Kennebec almost without exception distinguish the blueback (*Clupea astivalis*) from the true alewife (*C. vernalis*). As a rule the former is not cured or marketed in any way, but is sold for bait to passing fishing vessels or thrown into the refuse heap. Occasionally, however, some of them are smoked and sold as alewives. The number taken in the Kennebec in 1880, estimated at 400,000, was much larger than ever known there before.

**ANDROSCOGGIN RIVER.**—The Androscoggin ranks in size as the third river of Maine, draining 3,600 square miles, of which 2,750 are within the State limits. Its aggregate lake surface is 213 square miles, but very little of this was ever accessible to migratory fishes. Its sources are in the mountainous region of Western Maine and Northern New Hampshire. Its upper waters are more elevated than those of any other river, and its descent to the sea steeper. It abounds in gravelly rapids and so far as accessible afforded in early time excellent breeding ground for salmon. The highest point reached by salmon appears to have been Rumford Falls, a little more than 100 miles from the sea, where a natural fall prevented their further progress. It is matter of direct testimony that a few salmon were taken here about 1815, and of tradition that they were abundant here and in Swift River, a near-by tributary, at an earlier date. Probably, however, the falls at Lewiston was always a serious impediment to salmon, being quite impassable to shad and alewives. Salmon are known to have been caught at Lewiston as late as 1815. They were finally shut out by a dam at Brunswick. Alewives used to breed in Sebattus pond, and shad in the main river below Lewiston. Neither of these species has ascended farther than Brunswick for many years; consequently they are reduced to exceedingly small numbers.

The recent fishery of the river is confined to the tidal portions, within 6 miles of its junction with the Kennebec, in Merrymeeting Bay, where a few shad, alewives, and sturgeon are taken. For convenience these fisheries are regarded as part of those of the Kennebec River, and have therefore been included in the remarks on that river.

**CASCO BAY AND TRIBUTARIES.**—This district possesses no river fisheries of great value, the aggregate product being estimated at \$5,609. The species caught, arranged in order of their pecuniary importance, are as follows: Smelts, shad, eels, salmon, tom-cods, alewives.

The smelts are mainly taken in weirs, of which there are 25; located in New Meadows River, 4; in Harpswell Sound, 2; in Middle Bay, 2; in Maquoit Bay, 3; in Freeport, 1; in Yarmouth, 6; in the Presumpscot River, 2; in Portland Back Cove, 3; and in Portland Harbor, 2. In this district (in New Meadows River and Freeport) there are also four smelt seines in use, the only ones in the State. The smelt fishery of this district is of very recent origin, none of the weirs dating back more than twelve years.

The shad taken here are nearly all sea-shad, and are probably immature fish belonging to the brood of the Kennebec. They are mostly taken in drift-nets, which are plied in New Meadows River, Quohog Bay, Harpswell Sound, Middle Bay, Maquoit Bay, and some other localities. Middle Bay has been the best ground. This fishery has been carried on for nearly thirty years and possibly longer. During the past twenty years it has greatly declined. The product is salted and marketed as mess-shad.

The principal eel fishery of this district is in Quohog Bay, where there was discovered in 1876 a most remarkable eel-bed, the most productive ever known in the State. It extends over about 10 acres, on a muddy bottom, without grass, at a mean depth of 13 feet at low tide. The eels are taken out by spears worked through holes in the ice, which commonly forms here in December. The first and second winter from its discovery this bed yielded 2 tons of eels a day for the first five or six days of fishing. Eels are taken in many other localities around the bay with spears, and in the Presumpscot River and around Portland with pots or baskets.

The salmon taken in Casco Bay are believed to belong to the Kennebec River, with few exceptions.

The only tributaries of Casco Bay large enough to demand notice are Royal's River (Yarmouth) and the Presumpscot. Royal's, though a very small river, was frequented by salmon regularly and in considerable numbers at the beginning of the present century; but they have long been shut out by dams, and the last seen were caught in a weir more than twenty-five years ago.

The Presumpscot drains about 520 square miles of territory, and among its tributaries are lakes with an aggregate area of 90 square miles. Lake Sebago, the second lake in the State in size, lies but 22 miles from the sea, but has an elevation of 247 feet. The Presumpscot is therefore a rapid river. It has remarkably clear water, and abounded naturally in gravelly rapids. It was frequented by salmon, shad, and alewives, but seems to have been best adapted to salmon. All fisheries were practically extinguished early in the present century by a dam at the head of the tide. That dam was afterwards abandoned, and alewives have since found a limited breeding ground, and though unable to ascend the river far, both shad and salmon have occasionally been found in it in recent years. All the dams now on the river, some seven in number, have been recently provided with fishways, through which alewives do, and salmon may, ascend to Lake Sebago.

**SACO RIVER.**—The Saco drains an area of 1,400 square miles, of which 600 square miles lie in the State of New Hampshire, including the greater part of the White Mountain region. Its sources are therefore more elevated than those of any other Maine river. Probably half of the

entire basin is covered with forest. Its lake surface measures 46.8 square miles. A much larger proportion of its basin is occupied by sandy and gravelly land than any of the larger rivers of the State, a circumstance that doubtless contributes largely to the constancy of its flow. The main river is deep, not a single ford existing within 100 miles of the sea. The tributaries, however, afford many gravelly shallows adapted to the requirements of salmon as spawning ground. Several natural falls of considerable height oppose the ascent of anadromous fishes. The first, at the head of the tide, seems to have prevented the ascent of any but salmon, which were able to surmount all obstacles as far as Hiram, 45 miles from the sea, where they encountered an insurmountable obstacle in Great Falls, about 80 feet in height. Below this point they had access to the Great and Little Ossipee Rivers, tributary to the Saco on the west side, in which they are believed to have found their best breeding ground. Tradition asserts their ancient abundance, but that had passed away more than ninety years ago, and at no time within seventy-five years have they been so abundant that a man could take more than five or six in a day with a dip-net at Saco Falls, the principal fishing place known to Saco tradition. The latest date of the capture at Salmon Falls, 16 miles from the sea, was in 1843, and since 1850 they have been practically extinct, but in recent years occasional specimens are taken with dip-nets in an illegal and surreptitious way at the Saco and Biddeford Falls.

Shad and bass have been taken in the tidal portion of the river in recent times, and both were much fished for in 1860. In 1867 gill-nets were in use for shad and several men found occupation in the fishery, but it has since been abandoned. Several nets are still in existence and occasionally set, but not regularly. Alewives are sometimes dipped, but not regularly, nor in any considerable numbers.

The smelt fishery is the only one regularly followed. The only method employed is that of hook and line, plied under the shelter of a movable house on the ice. The favorite location is about 2 miles below the falls, and the fishing is done mostly by night, the houses being lighted by kerosene lamps and heated by small coal stoves. The largest and best houses use six lines each. Some twenty-five men engage in the business. Their aggregate catch is estimated at 6,250 pounds of smelts in the winter of 1879-'80, and they received better prices than the fishermen of any other locality, owing to the superior size and quality of the smelts.

**MOUSAM RIVER.**—This small river, about 24 miles long and draining about 120 square miles of territory, runs for nearly its whole length through a sandy country, and its water is very pure. At its head is Mousam Pond, a body of water covering about 3 square miles. The Mousam was anciently frequented by salmon, shad, and alewives, and salmon were at one time very plenty. The salmon were exterminated many years ago, and though a few alewives and shad yearly enter the river, there is no fishery for them nor for any other river fish at present existing.

**YORK RIVER.**—The extreme length of York River is about 12 miles, and its basin has an area not exceeding 50 square miles. Of its early history no facts have been learned. At present it is the site of a small smelt fishery employing two bag-nets and producing 3,000 pounds of smelts in a year.

**PISCATAQUA RIVER.**—The drainage basin of the Piscataqua, which forms the boundary between Maine and New Hampshire, has an area of 550 square miles, of which 240 square miles is in the State of Maine. Its lakes, having an area of 16 square miles, are thoroughly utilized as reservoirs for extensive mills at Great Falls and Salmon Falls. At the latter point the main river (here called Salmon Falls River) is hopelessly obstructed against the ascent of anadromous fishes, and the principal tributaries are in nearly the same condition. The main upper waters are believed

to have been inaccessible for nearly two hundred years, so that the very tradition of their presence has become dim. It is, however, beyond question that before the obstruction of the river the principal anadromous fishes, especially salmon, were very plenty. Salmon have continued to show themselves occasionally in the river to within forty years. Shad and alewives held on much better, and considerable numbers of both were taken twenty years ago, but since then have greatly declined, and at the present time the attempt to catch them is almost wholly abandoned. Two or three small weirs yielding a very small number of shad and alewives are still maintained on the New Hampshire side of the river. The fishery on the Main shore in 1880 was reduced to a half dozen smelt weirs, whose united product of smelts, tomcods, bass, eels, and perch was valued at \$965.

##### 5. LAWS RELATING TO THE RIVER FISHERIES OF MAINE.

**THE COMMON LAW.**—The common law, as interpreted and applied by the Maine courts, makes a broad distinction between navigable and unnavigable rivers. In the former category are placed all rivers and parts of rivers in which the tide ebbs and flows; in the latter all in which the tide does not ebb and flow.

In navigable rivers, as thus defined, the riparian proprietors own the soil from high-water to low-water mark, excepting cases in which the distance between the two marks is greater than 100 rods, and in these cases they own to the 100-rod limit and no farther.\* This title to the soil carries with it the exclusive right to erect fixtures for fishing or other purposes, or even to make a net fast to the shore or bottom within the 100-rod limit; but does not include any exclusive ownership in the water covering the flats, nor in the fish that may swim in it, nor any exclusive right to use a movable net or other apparatus for catching fish, nor does it include any title whatever beyond the 100-rod limit. The public, on the other hand, have not only a right, on equal terms with the riparian owner, to fish in the deep water and on the flats beyond the 100-rod limit, but also the right to take fish with movable apparatus in the water over the soil of the proprietor even up to high-water mark. †

In unnavigable rivers the title of the riparian owner is held to extend to the land under the water from each shore as far as the middle of the stream, carrying with it the exclusive right to fish by any mode in the water covering this land, the public rights being limited to the privilege of passing with boats and other craft, and to float timber up and down streams of suitable size. In the case of fresh-water lakes and natural ponds of greater area than 10 acres, the law of Maine is founded upon that of Massachusetts, ‡ and the exclusive rights of the riparian owner extend only to high-water mark.

Thus we have in fresh-water ponds and lakes a fishery with movable apparatus in the hands of the public, in non-tidal rivers an exclusive fishery with movable apparatus in the hands of the riparian owners, and in tidal waters both the same free fishery with movable apparatus and a fishery with fixed apparatus in the hands of land-holders. The law on these points is sufficiently clear, but custom does not in all points agree with the law. Neither have the riparian owners on the non-tidal rivers enforced their rights against the public, nor the public against the riparian owners on tidal waters. In the former case the public has always enjoyed, and now enjoys, the privilege of free fishing with movable apparatus, which is alone allowed by law in those waters; and in the latter the riparian proprietors have maintained an exclusive fishery with fixed apparatus in the waters in front of their respective estates, not merely on the shores laid bare by

\* This modification of the common law springs from Massachusetts colonial ordinances passed in 1641 and 1647.

† According to decision of the courts even the digging of clams on flats which are private property is held to be a public right.

‡ An ordinance of 1641 decreed free fowling and fishing in all such great ponds.

the retreating tide, but beyond low-water mark as far as it is found practicable to extend their structures from the shore, in many cases to the maximum depth of 20 feet at low water.

**STATUTE LAWS.**—All of these fishing rights are held subject to the regulation of the legislature, which has not been backward in exercising its power. During the sixty years of the separate existence of the State of Maine, the legislature has passed 433 acts relating to fisheries, of which 11 were of a general character, 51 related to the sea-fisheries, 161 to the anadromous fishes, 159 to fresh-water fishes, 7 to shell-fish, 22 to the inspection of fish products, 7 to fish culture, and of 5 the precise bearing was not ascertained. In addition to this mass of legislation, we are able to cite at least 48 acts of the legislature of Massachusetts having special reference to the river fisheries of Maine, besides other acts of a more general character which were also in force in the "district of Maine." Of the 433 acts passed by the Maine legislature, there were 114 passed between 1821 and 1840, inclusive; 74 from 1840 to 1860; 245 from 1861 to 1890. Of the 161 acts relating to the anadromous fishes, 71 were passed in the first period of twenty years, 29 in the second period, and 61 in the third period. Of the acts relating to the inspection of fish products, 14 were passed in the first period, 3 in the second, and 5 in the third.

The aims of legislation on the river fisheries have been: first, the preservation of the supply of fish; second, the harmonizing of conflicting interests; third, the prevention of fraud in the sale of fish products. The first object was attained by provisions compelling the removal or abatement of obstructions, especially by the construction of fishways, and by a great variety of provisions touching the time, mode, and extent of fishing. The second purpose was prominently in view in the framing of many of the special laws instituting town fisheries in which all the citizens should have an interest, and was often influential in provisions that restrict certain methods for the benefit of others. And to the prevention of fraud in sale of products was devoted a long list of enactments relative to the inspection of dried and pickled fish.

In the matter of the construction of fishways it has been the uniform policy of the State to require the owners of dams to construct and maintain them. The courts have rendered repeated decisions affirming the principle that "every owner of a mill or dam built it under the condition that a sufficient passageway be allowed for the fish, and the limitation, being for the public benefit, is not extinguished by any neglect to compel compliance." Provision for the enforcement of this rule of law has constituted a considerable part of the legislation on the fisheries for salmon, shad, and alewives. A heavy penalty has been attached to a breach of the law. At times the dam-owners have been left to devise for themselves such contrivances as they might, and at other times officers have been appointed, and charged with the duty of deciding the plan and location. Sometimes, as in a general act passed in 1741, there was provision for the appointment by a court of justice of committees to inspect dams and decide all questions as to fishways. In 1786 it was left to committees chosen by the towns. Early in the present century the county commissioners were assigned this duty in cases not governed by special acts, of which, however, there were very many, covering the majority of the rivers and giving fishway questions into the hands of the local officers. Since 1868 the State commissioners of fisheries have had jurisdiction in such matters, with power to order fishways built or repairs made at their discretion, in all cases serving formal plans and specifications.

The prominent provisions of legislation relative to time and modes of fishing are: the maintenance of yearly and weekly close-times; the limitation of length of nets and other apparatus; the prohibition of fishing near fishways.

The yearly close-time for salmon, shad, and alewives has generally begun from the first to the last of July (sometimes as early as June 16 for shad) and extended to December. At the

present time the close-time for salmon, shad, and alewives begins July 15 and extends to the first of the next April, rod-fishing being, however, allowed from July 15 to September 15. The weekly close-time that has been generally maintained has been from sunrise on Saturday to sunrise on Monday.

Nets and other apparatus were early limited in length to one-third of the width of the stream or water where used. At present they may not, except in the Penobscot River, occupy more than one-eighth the width of the channel, nor shall fixed apparatus extend more than 100 feet beyond the line where there is a depth of 2 feet at low-water.

Early laws exempted but a very small area, 3 or 4 rods from a fishway, from fishing, but since 1868 the limit has been removed farther and farther until now it is fixed at 500 yards; but there are many exceptions in small rivers.

The foregoing remarks have reference especially to the fisheries for salmon, shad, and alewives. About other anadromous species there has been little legislation. Smelts are protected by a yearly close time, from April 1 to October 1, dip-nets being, however, allowed from April 1.

The earliest provisions relative to the inspection of fish products applicable to Maine appear to be contained in a colonial ordinance of Massachusetts of the year 1652, which, after rehearsing the injurious effects on colonial trade resulting from the fraudulent practices of some dealers, provided for the appointment of "viewers," who should scrutinize fish at the time of their delivery by the seller to the buyer, and decide whether they were merchantable or not. Only dry salted fish appear to have been included. In 1692 a much more comprehensive ordinance was passed, in which provision was made for the size of casks, the appointment of "gaugers and packers" in every town where necessary; the inspection of goods packed to see that they are of good quality; the marking of the cask with the brand of the "gauger and packer"; the infliction of penalties for the infraction of the laws, &c. Similar provisions have remained upon the statute book until the present time. Inspection is compulsory, and penalties attached to its omission, or to the exportation of unpacked fish. If the goods are found by the purchaser or consumer to be otherwise than as represented by the brand, damages can be recovered of the inspector.