

X.—ON THE SALMON OF MAINE.

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1.—THE LAND-LOCKED SALMON.

[NOTE.—As containing some interesting information respecting the *Salmonidæ* of Maine, especially the so-called "Land-locked salmon," I reproduce, by permission, the following article from Lippincott's Magazine for May, 1869.—S. F. BAIRD.]

SALMON-FISHING IN MAINE.

A century ago the rivers and lakes of Maine teemed with the salmon and the trout. Not only were the great rivers and expanded lakes frequented by these valuable fish, but even the lesser streams that emptied directly into the sea or its fiords, and the most distant tributaries that drained the wild forests and mountain-ranges of the interior, were stocked with incredible numbers of the *Salmonidæ*. Since this time a great change has taken place; and while casting our fly to-day in our exhausted streams, we can hardly believe the stories of our octogenarian fishermen relative to the vast shoals of fish they encountered when boys, or the still earlier accounts of the Jesuit fathers when they visited our primitive forests and attempted to found "La Nouvelle France."

This almost complete extinction of the noblest of fishes in this State is not the result of the workings of natural law, but due entirely to causes within the control of man. The torch, the spear, the seine, the barrier-dam of the lumbermen, and the choking sawdust of their mills have produced disastrous effects; and, in consequence, but few of our largest rivers contain now any salmon at all, and most of our lakes and mountain-tarns have been despoiled of their trout. We may justly add to the above causes the introduction of the voracious pickerel—

"Tyrant of the watery plain."

The area in this State originally occupied by this miniature shark was very limited, and we even have doubts whether it was to be found anywhere in Maine prior to the year 1700. Its appearance in the Kennebec and Penobscot waters is a matter of recent history, and its ravages among our other fish have been well observed.

The migratory salmon enters now but few of our largest rivers; it ascends them in spring, and passes the summer and autumn season like its prototype, the *Salmo salar* of Europe; but it seems to differ from its European brother in game qualities, for it generally refuses to take the bright, gaudy flies and the silver-sided minnows which are so success-

ful in the hands of the British angler in the rivers of England, Scotland, and Ireland. There is no reason, so far as I know, why our fish should refuse the bait so tempting to his foreign brethren. Although disturbed at the mouths of the rivers by the fishermen with their weirs and seines, and harassed and injured by the floating sawdust in the current of the streams for a long distance, yet it finds deep, silent pools in the upper tributaries, which flow through the primeval forests, where the steps of men are seldom heard. And here, in the very depths of the forests and among the wildest glens, we might expect that success would attend the efforts of the skillful angler, but history records but few instances of it. I remember a party of European sportsmen, who fished twenty-five years ago in the undisturbed pools of the Aroostook River, catching but one salmon. I have seen the fish leap high into the bright sunshine after the natural flies as they played near the surface of the water on a summer evening, and yet refuse the golden-hued artificial insects of the angler.

Why the salmon should be so sullen, wary, or capricious I am at loss to comprehend; still, I am willing to admit that it is possible that in other seasons it might take the bait with great readiness. A part of this singular wariness may be due to the injurious effect of sawdust in obstructing the respiration of the fish; for we know that Sir Humphrey Davy could catch no salmon in the rivers of Norway, whose waters were disturbed by mills and laden with sawdust, yet he was eminently successful in Sweden, where the rivers were clear and unobstructed. On the Seine, the Loire, and other great rivers of France, the anglers cannot raise the salmon with their flies or minnows until they have reached the head-water streams, and all attempts at Paris and Nantes have failed. This circumstance should encourage our fishermen to persevere in their efforts and seek the fountain-streams of our salmon-rivers.

But if we cannot boast of our success with the sea-salmon, we may truly exult over the game qualities of the mysterious fresh-water salmon, which inhabits five of our lake-systems, and which affords as fine sport as the best fish of the Tweed or the Shannon. This fish is less known to anglers than to naturalists, since the latter have quarreled over its classification and made known to themselves the range of its habitat. But the naturalists have been very careful not to express themselves on paper, and hence the sporting fraternity have not been able to glean much from the scientific reports concerning the disputed fish.

Nearly twenty years ago I learned from the hunters that the great lakes which supplied the Saint Croix River abounded with little salmon, whose boldness and activity delighted the few sportsmen who had ventured to penetrate the lonely forests in which the fishing-places were situated. A wild and extensive district of forest-land surrounded the tributaries and lakes of the western branch of this river, and was uninhabited save by a portion of the Passamaquoddy tribe of Indians. This

great tract of forest embraced many thousand acres of land, and presented an extent of country about forty miles in its greatest length by twenty to thirty in breadth. More than twenty lakes appeared in this vast expanse of forest-land, and their tributaries and connected streams meandered or rippled through every part. At the period above mentioned the country exhibited all the wild freshness and sublimity of its primeval beauty; the forest abounded with noble game, and the clear lakes and the limpid and sparkling streams teemed with fine fish. It was in reality one of the wildest parts of the State, and comparatively unknown, except to the hunters, or to the venturesome lumbermen who penetrated into the deepest recesses of our distant forests in search of the pine and the spruce.

The glowing accounts which the hunters gave of the fish and the fishing in these regions were too exciting to be overlooked by a lover of angling, and I resolved to devote the next college-vacation to examining these unknown waters and their precious finny tribes. Therefore, the next September found me on the road which leads from Calais on our eastern frontier to the outlet of the chain of lakes in question, and which was about twenty miles distant. At the outlet I was to engage an Indian guide, and pass up the lakes, by means of a canoe, to the nearest fishing-grounds, which were fifteen miles farther up the lakes. On arriving at the lower lake I encamped at the humble and solitary inn, which serves as a refuge in spring to the returning lumbermen, and at other times to the benighted settlers on their way to new homes in the upper valleys of the Saint John. The worthy landlord corroborated the stories of the hunters in relation to the fish, and sent up to the Indian town for Toma, whom he regarded as the best hunter and fisherman in the tribe. The Indian soon appeared, and engaged to carry me in his canoe to the stream which empties from Grand Lake into the smaller lakes below. We arrived at the mouth of the stream the next morning, and, disembarking, we hid our canoe in a distant clump of alders, and shouldering our pack, started on the old Indian trail which led to the outlet of Grand Lake, nearly three miles distant. The stream, as it flowed from the lake, rushed with considerable swiftness over the remains of a decayed log-dam, and subsided a short distance below into broad, deep pools. The bed of the stream was of decomposed quartz, and heightened the clearness of the water, whose pure tints reminded me of the Rhone as it flows from Lake Lemane. Tall pines cast broad shadows across the bubbling waters, and sharp ledges of rock here and there stretched across the stream and changed the clear currents into foaming cascades. Taken all in all, it was the *beau-ideal* of the angler as a trout or salmon stream.

Laying aside our packs, we soon arranged our camp by stretching a rubber blanket over poles stuck in the ground, and then collecting a pile of fire-wood to cook our food and warn the wolves away at night. While the Indian was building the fire I adjusted my rod, and attached

to the line a gaudy red fly. Creeping out on the end of a log which overlooked a deep eddy below the outlet, I cast the artificial insect out among the bright bubbles dancing gayly down the current. As the fly was descending in the air I had misgivings as to success, for no signs of life were visible in the crystal depths; but the moment it struck upon the surface a dozen silvery forms shot upward to seize it. A strong pull upon the line, and the hum of my reel made my heart leap for joy. Across the stream the little salmon dashed and leaped his length into the air, shaking his head like a terrier in his efforts to free himself from the fatal hook. Down the stream he rushed, and again sprang into the bright sunshine, appearing like a bar of polished silver, so white and lustrous were his sides. Another unsuccessful rush, and he plunged sullenly to the bottom, but my tackle was too strong for him, and I steadily reeled him in, and soon laid him safely on the shore. A more beautiful fish I think I never saw—at least so harmonious a combination of color and symmetry.

"Bring him up here," called out the Indian; "me cook him." Toma took the fish to the spring, split it through the back, sprinkled it with salt, then laid it on a shield woven of alder twigs and exposed it to the heat of the fire which he had just kindled. A little piece of pork stuck on the end of a stick, and suspended over the broiling fish, kept it constantly moistened with its droppings of fat. In a few moments the fish was cooked, and a more delicious morsel never went down a hungry throat; really, at the time, I believed it superior to the salmon fresh from the depths of the sea; but something must be allowed to the success and enthusiasm of the moment, and the exhilaration produced by the balmy air of the forests and the delightful scenery around me.

"Now me show you how to catch fish," said the Indian, as he gulped down his portion of the broiled salmon. "Fish know me." Toma then pulled out from his hunting-bag a long and jointed salmon-rod, with reel and stout line, and some large flies which he had rudely made of the gorgeous feathers of the humming-bird, the red-headed wood-pecker, the blue jay, and others of the gayly-plumed birds of our forests. Climbing to the top of one of the old, decayed piers of the dilapidated dam, which commanded a wide extent of the stream below, the Indian swung out his gaudy fly in the westerly breeze, and made a cast that would have delighted that prince of salmon-fishers, Sir Humphrey Davy. As the rude insect fell upon the foaming current, it seemed as though fifty little salmon sprang for it, their silver sides glistening in the pure water like flashes of light. The stricken fish sprang out quivering in the bright sunbeams, and made a gallant struggle for his life, but in five minutes more he was laid out lifeless upon the white sand of the shore.

"There," said Toma, as he pointed out the beautiful colors of the dying fish, "that fish brother to salt-water salmon, only he forgot to go to sea, but stay in lake instead."

Yes, I think the Indian is right, for on careful examination I find no deviation from the typical structure of the migrating salmon. One observes the same linear markings, with trivial and transitory differences. The bony structure appears to be identical, and we find in the little fish fifteen rays in the pectoral fin, nine in the ventral, ten in the anal, twelve in the dorsal, nineteen in the caudal, and twelve branchiostegals—the same as in the great salmon of the sea. The formation of the head exhibits no radical difference, and the fish are perfect specimens of grilse. I caught out of the same stream little parr and smoults, perfect fac-similes of the young of the *Salmo salar*.

The most singular fact to be considered in connection with this fish is its weight, which in this lake never exceeds four and a half pounds, while that of the migratory salmon sometimes surpasses even sixty. As this fish has excited the curiosity of naturalists and caused much discussion, we will consider the question of its identity at length, making actual comparison of it with the migrating sea-salmon.

After cautious dissection and inspection of the fresh-water salmon from the five different systems of lakes in Maine, and after many comparisons with the migratory salmon, I have arrived at the opinion that it is identical with the sea-salmon known as the *Salmo salar*, and that radically there is no difference between them, save in the habit of visiting the sea. Some may ask, Why should there be a departure from nature's laws, and how is this variety in particular preserved, when the slightest deviation from the regulations of nature often causes the death of the animal? Others will exclaim, Why have not other varieties arisen from the effect of similar circumstances? In reply I will say that we observe great flexibility in nature's stern rules under the molding influences of man; and it is shown that certain effects of strange food, differing localities and temperatures, may give rise to slight deviations in form, color, and habits, without altering decidedly the characteristics of the animal.

The localities of some of the *Salmonidæ* are strangely circumscribed, and their geographical area or habitat may be very limited. The *Salmo hucho* is caught only in the streams that empty into the Danube. We do not believe, with Pallas, that it occurs in the rivers of Siberia, or that it may be found in those which empty into the Caspian Sea. In the Tweed, the *Salmo eriox*, or bull-trout, is caught as frequently as the salmon, and in the two rivers south of the Tweed there are fifty bull-trout to every salmon; but in the Forth and Tay, which flow into the sea farther north, the species is almost a stranger. The *Salmo trutta*, or trout, is strangely distributed in this State; for instance, it is not found in Sebec Lake, but abounds in most of the little ponds which are tributary, and which are also stocked with salmon. In Reed's Lake it is not found, although large ones are taken in its tributary, Philip's Pond, a mile distant. There are other examples in the State, but I am at a loss to explain this singularity in the distribution of the fish in question.

The 'gillaroo-trout is found only in the lakes of Ireland, and differs very little from the common trout in general appearance, except that it has more red spots and a yellow belly and fins, and is a little broader and thicker; but internally it has a different organization, possessing a large, thick, muscular stomach, which generally contains a quantity of shell-fish. The common trout of the same lakes is not altered in the structure of its digestive organs, and shell-fish are never found in its stomach. The goldie is said to be found only in Loch Eck in Scotland.

So far as habitat is concerned, there can be no objection to the fresh-water salmon of Maine being considered a distinct variety of the sea-salmon. In placing these salmon side by side, we do not observe any great difference of form that may not be explained as the effect of food and locality. Age and increased size make a marked difference in the appearance of the head and opercular apparatus, as may be seen by comparing a number of salmon of different ages and weights. The scales of the pectoral region in the small fresh-water salmon are decidedly ellipsoid, but in the full-grown sea-salmon they are quite circular. Shall we adopt this as characteristic? By no means, for we can find the elliptical scales in the young salmon, and explain the difference by the growth. If we take a number of salmon from different rivers, we will find differences in their general appearance, but not enough to justify an attempt at a new classification.

It is thus shown that forms may vary slightly, and that naturalists should not regard mere variations as a mark of distinction. For illustration, we will take the conger-eel of the British waters. If we consider difference of head and color of body, we might believe in the existence of several more species than are now recognized; for we may observe as much variation in the snouts of different individuals of the conger-eel family as there is between the sharp-nosed and the broad-nosed eel. Some specimens in the Edinburgh University Museum show elongated and narrow proportions in the anterior part of the head, but in others the same outlines are comparatively short and blunt.

The colors of fish are very capricious, and often depend upon local and adventitious influences. The coloring matter is not in the scales, but in the surface of the skin immediately beneath them, and is probably a secretion easily affected by the health of the fish, the quality of the water in which it lives, the light to which it is exposed, and the kind of food which it eats. In the dark waters which flow through boggy moors the tints of their finny inhabitants are deep; the light silver hues change to a golden yellow, and into the intermediate shades, even to a dark orange. But in the crystal waters of the purest streams, flowing over pebbly bottoms and white sands of decomposed quartz, the colors of the fish are very pure, and the luster is of such brilliancy as to give the appearance of transparency. We do not only observe this assimilation of color in fish to the places they frequent, but it is the same with the animals of the land. It is one of nature's provisions,

and is required for safety and concealment. Dr. Stark showed many years ago how suddenly the stickleback and other fish changed color when removed from dark pools and placed in white bowls. The change of hue took place with as much rapidity as though it were subject to the caprice of the fish, as is the case with the chameleon.

Food has a very decided influence, and in connection with other circumstances will produce a marked effect in the appearance of *Salmonidae*, even in the same lake. Thus, in Lake Garda, in Italy, we may observe one specimen with silver sides, blue back, and small black spots, and another of the same variety with yellow belly, red spots, and an olive-colored back. The like phenomena have been observed with trout of the same variety in the lakes of Germany and Ireland. Differences of food and habits, says Davy, may occasion, in a long course of ages, differences of shape and color, which may be transmitted to offspring. Trout that frequent clear and cold waters, and feed much on larvæ and their cases, are not only red in flesh, but they become golden in hue, and the red spots increase and outnumber the black ones; but when feeding upon little fish they become more silvery in color and the black spots increase. We have some singular examples of the effects of difference of diet. The peculiarity of feeding on shell-fish produced the gillaroo-trout, a remarkable variety found only in the Irish lakes. The charr also is liable to great variations from the effects of its food, and its history has, in consequence, been much confused by the naturalists. We observe similar effects with the *Coregoni*, or white-fishes; for instance, the powan of the Scottish and the pollan of the Irish lakes. Agassiz noticed that pet parrots, when fed upon certain fish of the Amazon, changed colors, and their green plumage became spotted with yellow.

Age also often causes a great difference in the appearance of fish, and the markings of the young change singularly with their growth. The Cornish sucker has two large ocellated spots behind the eye, which are not visible in the young fish.

It is true that there is a marked difference in size between the lake-salmon and the migratory salmon. There is also the fact that the one seeks the sea, while the other does not. But these seeming distinctions may be readily explained by the effects of food and locality. Sir Humphrey Davy, who was an angler for fifty years, believed that differences depending upon food and size will account for the peculiarities of particular fish, without supposing them distinct species. He sometimes caught salmon quite unlike in form, markings, and color, and satisfied himself that these differences were due to disease or to accidental circumstances. Young, in his admirable work on the history of the salmon, gives a remarkable instance of singular differences occurring in a very limited locality: "We know of five rivers which run into the same estuary, and all and each of these rivers have their own peculiar salmon; and the fish differ so much, the one from the other, that they are quite

easily distinguished. The first river has a race of well-shaped salmon whose average weight is about ten pounds. The second has a strong, coarse-scaled, rather long but very hardy salmon, whose average weight is about seventeen pounds. The third river has a middling-shaped salmon, whose average weight is about nine pounds. The fourth river has a long, ill-shaped salmon, averaging about eight pounds; and the fifth river has a very well-shaped salmon, whose average weight is full fourteen pounds." This experienced naturalist adds that it is rare for a salmon returning through the common estuary to miss its way to its own stream.

The difference of proportions in salmon taken from different and even contiguous rivers has often been noticed, and is due to local causes. The proportions between the salmon of the river Bush and the river Bann near the Giant's Causeway differ in the ratio of length to girth as 20 to 9 and 20 to 13.

The differences of color between the lake and migratory salmon are not great, and Agassiz does not regard color as of any importance in relation to specific character. The sea-salmon, when well-fed, has a smaller head, a more rounded body, and a more silvery luster. The small heads and rounded bodies, considered as merely proportional, are easily explained by the influence of food. The colorings of the fish are dependent upon the same cause, as well as upon age, season, and the purity and chemical composition of the water they frequent. For effect of food and locality we have many positive examples among our domestic animals and birds. Thus the lake-salmon may be identical with the migratory salmon, altered in size and disposition after many generations. This principle of change of character and transmission of such character to offspring is well explained by Darwin.

If there is no difference in typical structure, there is, however, a marked discrepancy in the habits of the two fishes, for the one has lost the instinct to visit the sea; and this is a very marked characteristic with the migratory salmon, the young fish sometimes throwing themselves upon the shore in their frantic endeavors to pass the barrier-dams. However, the English naturalists have admitted that it was possible for the parr to lose its instinct for the sea and propagate its species in the rivers, deteriorating greatly in size and quality.

The sea-trout, *Salmo trutta*, can breed and thrive quite well without descending to the sea, but it soon loses its marked characteristics, and resembles the common trout.

All of the systems of lakes where the fresh-water salmon is found were frequented by the sea-salmon up to within a comparatively short period of time, and the dams of the mill-men are now the only barriers to the migration and emigration of the fish. We can readily conceive that the young salmon might remain over one or two seasons in these lakes before visiting the sea, propagating a family which had less desire to visit the salt water; and thus in successive generations a race

might be produced which would lose all instinctive desire to migrate, and adopt the lake instead of the ocean as its habitat.

In reality, these inland waters are as the sea to this fish, for it ascends the tributary rivers to spawn, returning to the lake again, as the *salar* returns to the sea. But if this salmon has sprung from the sea-salmon, why do we not find it in the lakes of England, the lochs of Scotland, and the loughs of Ireland, where the salmon has had unrestricted access from time immemorial?

This certainly is a difficult question to answer with satisfaction, since we find the same variety of salmon in the lakes near Katrineberg in Sweden, where great numbers are captured annually. It is said that it is bred in the lakes there, and cannot have access to the sea on account of cataracts, and that it is small and inferior in flavor. When Lloyd first described it, the British naturalists denied the story, and maintained that the Scandinavian ichthyologists were at fault when they spoke of the fish as identical with the true migrating salmon. It must be admitted that it is somewhat strange that this variety is to be found only in the lakes of Maine and Scandinavia.

The naturalist will ask the question, Has not the lake-salmon appeared since the erection of dams, and, being thus confined and prevented egress to the sea, has it not degenerated into the present variety?

The evidence is very conclusive that this fish existed from the earliest times in all the lakes where it is found to-day, and long before the advent of the European on our coasts. The Indians speak of it in their early traditions. The term "land-locked" as applied to it is inappropriate, since the erection of the dams does not prevent the fish from passing to sea during the spring and winter floods. And the term "dwarfed salmon" is erroneous, since individuals have been caught in Sebago Lake of eighteen to twenty pounds weight, and in Reed's Lake of ten to twelve pounds weight; yet, strange to say, in the great lakes of the Saint Croix it never weighs more than four and a half pounds, and is a little smaller in Sebec Lake.

Here arises a new difficulty: Why should there be such a great discrepancy in the weight of these fish (the smallest coming from the largest lakes) if they are of the same family? In reply, we will ask in return, Why does the migrating salmon of certain rivers average larger than that of others, when there are no physical peculiarities, no difference observed in the respective depth, temperature, or extent of lake-basins to distinguish between them? Small rivers sometimes produce larger fish than rivers of much greater volume and length.

There are some queer exemplifications of this anomaly. Humboldt was astonished to find the crocodiles in Lake Valencia to be very diminutive, while the same species grew to an enormous size in the adjoining rivers. Scarcity of food will prevent the full development of any animal; but this hardly explains the difference in the sea-salmon, for it obtains its weight, after passing the age of the smolt, by feeding

in the sea. The migrating salmon actually loses weight while passing the summer in the rivers, and it does not regain it until it returns to the sea, where it increases in flesh with extraordinary rapidity.

Taking the migratory salmon as the type, we do not observe any differences from it in the structure of the lake-salmon that may not be explained by food and locality. In reality, the differences are trivial, since nature, undisturbed, is rigid in the laws of forms and proportion. But we may judge of their flexibility from the singular effects produced in pisciculture. The Chinese have shown in their fish-culture how man may play with nature and control organic form to a certain extent. The illustrations of the French naturalist, M. de Savigny, show how this singular people have cultivated the gold-fish even to eighty-nine varieties, and how they have secured and seemingly perpetuated certain forms with double fins or destitute of fins, and possessing other singularities; also, how they have succeeded in producing almost every possible combination of metallic tinting—gold and silver, orange, purple, and black. Yet these monstrosities, when left to themselves, soon revert to the original type, like the castaway horses of Sable Island.

The circumstances connected with the birth and growth of the salmon are very interesting, and have given rise to animated discussions among the European ichthyologists.

There are sedentary species of fish which live and die in the same locality, often extremely narrow in its limits; while there are others of migratory disposition, and condemned, like the Wandering Jew of the legend, by irresistible instinct, to move without cessation and without reaching an end to their lifelong journey. These wandering tribes, however, are subject to periodic laws, which direct their migration and emigration.

Of all the fish of passage, the salmon is perhaps the most remarkable. He is certainly the noblest, and ranks the highest among his class in intellectual instinct. The angler justly looks upon him as the prince of the streams; and what can compare with his beautiful proportions, his rapid and graceful motions, his silvery hues, his keen and lively eye, his rich and delicate flavor? The luxurious Romans, who searched distant climes for delicacies, knew nothing of this splendid fish—no more than we know of the gourami of China. The ancient writers are silent concerning it, with the exception of a remark of Pliny, and the inscription in the Mosella of Ausonius: *Purpureisque salar stellatus tergore guttis.*

In the spring and early summer the salmon enters the rivers, and swims up to the cool tributaries with great rapidity. Falls of ten feet in height he surmounts by a single leap, and he stems the swiftest currents with the greatest ease. On arriving in the clear streams which flow from the fountain-heads, his journey is at an end; he selects his mate and waits for the nuptial period of autumn.

Trout pair together in June, and their seeming constancy and affec-

tion for each other indicate something more than mere animal instinct. This fact was observed and celebrated by an Italian author in the "Loves of the Fishes," two hundred years ago.

We will not attempt to say whether the male or female salmon prepares the nuptial couch and digs the trench in the crystal sands. Some maintain that the female fish does all this, while others assert that the male prepares the bed. If the male does not do it, why should his lower jaw become like a hook at this period only? The sturgeon uses his elongated snout to plow up the mud, and why may not the male salmon his hardened jaw in furrowing the sand-beds? Not only does the lower jaw of the salmon change during this time, but his forehead becomes tough and strong.

In ninety days or more, according to the temperature, the eggs hatch—at least those which the hungry eel and trout have left—and the little fish then appear, to run the gauntlet of life from their voracious enemies. So great is the destruction of spawn and loss of infant fish that not more than one in a thousand eggs deposited hatch, nor one in three thousand come to maturity. But when protected by man, as in artificial breeding, more than nine out of every ten eggs hatch and thrive.

When the floods of the following spring have subsided, we observe the young salmon has increased to several inches in length, and is now one of the most beautiful of fishes, with its olive-hued markings on the back and its silver sides stained with crimson spots and decorated with a row of golden dots along the lateral line. Another spring these transcendent hues fade away; the red spots grow dim, the brighter aureoles disappear, and all the lively colors sink into gray. This is the migratory dress, and the fish is ready to commence his long voyage to the ocean, which may be hundreds of miles away. The path may lay across broad lakes, down foaming currents, and over seething cascades, but the little fish pursues his way boldly, and with the certainty of destiny. After a few weeks' sojourn in the sea, another remarkable change takes place both in size and color. The marine influence exercises such an extraordinary effect that the descending smolt of spring of a few ounces weight appears in autumn as the ascending grilse of several pounds weight. This same grilse increases but little, if any, during its sojourn in the fresh water, but on returning again to the sea it grows rapidly, and appears the next spring as an adult salmon of nine to twelve pounds weight.

Thus we have the four stages of the salmon's life: First the parr; then the smolt; afterward the grilse; and in the third year the salmon. These distinctive periods are well marked, and the changes of color and form have led many students of natural history into errors.

The researches of practical men like Young and Shaw first cleared away the obscurity which enveloped the early biography of the salmon. Professed naturalists have made the most ridiculous statements concerning this fish, but we know now that the mysterious parr is the

salmon fry. As the little parr progresses in life, many characteristics are laid aside, and only those which mark the species are retained; the parr-markings, the red spots, and most of the dark ones, especially nearly all of those below the lateral line, vanish. The dentition changes. The adult trout retains only the mesial vomerine teeth in a double row; the salmon loses all the mesial vomerine teeth and retains only those of the chevron.

The *Salmo Gloveri*, described by Girard as frequenting Union River in the State of Maine, is only a parr, and is caught in other rivers where the salmon appears. The samlet may remain several years longer than its usual period at the place of birth when debarred or impeded in its access to the sea, and may spawn and propagate a stunted race, as ill-fed animals are checked in their growth and remain stationary. Nearly all of the *Salmonidae* breed early in life, and size has no effect upon the faculty of breeding, the essential difference being as to number—a thousand eggs being reckoned to every pound-weight of the fish. The differences in position of fins in the *Gloveri* are trivial compared with those which we witness in the young of many other animals during their period of growth.

About forty years ago fresh-water salmon were caught in great numbers in Sebago Lake. The Indians in earlier times speared them in immense quantities in autumn on the shoals below the outlet; the early colonists caught them by the cartload during the spawning-period, but the thoughtlessness and carelessness of civilization have reduced them so much in number that they are now quite rare. Still, a few may be taken with the minnow as they run up the rivers in spring, or by trolling in the lake; off the rocky shore known as the "Image," which was a famous place of resort years ago. In the autumn they again pass into the rivers, and may then be taken with the fly. Some weighing thirteen and a half pounds have been taken with the minnow. Last summer one was caught of ten pounds weight. Others of much greater weight have been speared at night while in the act of spawning. The spear in the hands of the poacher has contributed more than any other cause to the scarcity of this fish. Two years ago two poachers speared in three nights in Songo River more than half a ton of salmon. No fish, however prolific, can long stand such a drain as this upon its numbers. A little protection and care in artificial breeding would make this lake, with its connecting streams, one of the most delightful places of resort for the angler in the world. Down below the outlet the water of the lake, which is of the purest quality, rushes swiftly down and over primitive ledges, and forms magnificent pools and eddies, which are the favorite resorts of trout and salmon. One bright morning last June found me rod in hand and casting the fly at the locality above mentioned, but it was too early in the season, and the gaudy insects failed to attract even a glance from the lurking fish. I substituted a minnow, and trolled him across the boiling eddies below. A whirl in the foam, a splash of

spray, and a strong tug at the line told the story. The hum of the reel as the line swiftly spun out indicated a large fish. Checking his speed for a moment, I could see his sides of silver and pearl glistening in the distant waters below. Alas for human expectations! The log on which I stood, swayed by the current, caused me to lose my balance for a moment. The line slackened for an instant, and the salmon, relieved of the constant strain, disengaged himself quick as a flash, and was off in a moment to a safe retreat.

My companion, however, was more fortunate, and landed a two pound fish. The first glance at this fish indicated a distinct variety from the salmon of the Schoodic and other lakes; for its sides were very much spotted, even below the lateral line, and some of the spots were underlaid with deep crimson, which appeared in rich contrast with the black and pearl of the sides; the dorsal fin was also very much checked with large and distinct black spots. It would remind the angler of the *Salmo trutta marina* and the *hucho* trout of Europe, so distinctly marked was the dorsal fin. But the examination of five other specimens at a later day proved that the spots were not constant; for not one of the five exhibited more spots than the fish of the Schoodic, and some of them not so many. The appearance of the dorsal fin was also much changed, and in some fish the spots had quite disappeared, which leads me to believe that the excess of spots is due to food and locality.

Bloch, in his work on the *hucho*, says that all the fins have black spots. Professor Wagner says the same; yet Davy, who angled in the Danube and its tributaries, the Save, Drave, Thur, and Isar, could not catch a single fish with spotted fins. The fish preserved in the collection at Munich have none. We may account for this diversity of statement by supposing that the fish were taken at different seasons and localities. I have observed that the pike, at certain times and in certain waters, becomes yellow, with black spots, and then again changes to gray, with pale-yellow dots. The *Salmo trutta*, when confined to rivers and running waters, gains more spots; it is the same with the *hucho*. Davy saw fish from some of the lakes in Ireland that were mottled in a singular way, and he ascribed it to the nature of the water, to exposure to light, and the kind of food. Similar peculiarities are observed with the trout of Lough Neah, which the Irish call "buddocks" and "dolochans." Trout in the river Boyle, running up to spawn late in October, have no spots, but are colored red and brown, mottled like the tortoise-shell. Hence I am inclined to think that the great number of spots sometimes seen on the Sebago salmon is not a fixed, and should not be regarded as a special, characteristic. I think it very probable that the same peculiarity may be observed at times with the salmon of the other lake-systems.

The most exciting, and by far the most proper, way to catch this splendid fish is by means of the artificial fly; and after a while the sportsman disdains to use any other method.

The lover of the "gentle craft" who has never taken the salmon with an artificial fly cannot boast much of his professional skill, since angling for this magnificent fish is deemed the measure or standard of his capacity, the test of his art, the legitimate object of his loftiest aspiration. No lover of nature will ever justify Dr. Johnson's snarling definition of the angler's profession, the poetic vituperations of Lord Byron, or the exaggerated description of the clever Horace Smith. There is no sport that will compare with scientific angling for exciting the mind and sustaining a joyous hilarity. The enjoyment of the pure air, rambling over green meadows, in the grand old woods, among the rugged mountains, and over the beautiful lakes—all this varied intercourse with nature inspires the mind with happy feelings.

The passion for angling is by no means limited to any class of society. The most eminent poets, painters, philosophers, statesmen, and soldiers have been fond of the art. Trajan loved angling, and Nelson threw the fly with his left hand after the Spaniards had shattered his right arm. Ovid, Boileau, Goldsmith, Rossini, were anglers. Dr. Paley was passionately fond of it, and, in reply to the bishop of Durham, as to when one of his most important works was to be finished, said: "My lord, I shall work steadily at it when the fly-fishing is over." Walter Scott, infinitely susceptible to the beauties of nature, was delighted with angling, and more than one passage in his works betrays his predilection for the sport. Walton has justly styled the gentle art as "the contemplative man's recreation." We do not think that angling should be classed with acts of cruelty, for fish, and all cold-blooded animals, are less sensitive than the warm-blooded animals, and the act of hooking a fish is probably attended with less pain than we imagine, as the cartilaginous part of the mouth contains no apparent nerves. A trout will often continue to pursue insects after escaping from the hook, though he will shun the artificial ones. The pike will seize the bait even when his mouth is full of broken hooks. Sharks are also remarkably insensible to pain.

When the evening is calm and tranquil after a warm day or a stormy period, then it is the best time to cast the artificial fly. At this hour the fish emerge from the cool places of concealment, where repose has sharpened their appetites, and they pursue with avidity the insects that sport near the surface of the stream, or the little minnows who dare venture from their safe places on the shallows. In the taking of the artificial fly, the trout rarely leaps at it more than once, while the salmon will make several attempts. Certain flies are very deadly on certain rivers, but not on others, even when not far distant. This peculiarity in the *Salmonidæ* is quite remarkable, and evinces either caprice or intellectual instinct.

In Switzerland and Illyria, the native sportsmen fish with the rudest imitations of flies, and on the Shannon the largest salmon are caught with clumsy artificial bugs and flies. Fish are not only deceived by these imitations of insects, but even birds are deluded by the sight. From

the lofty cliffs of some of the Ionian Islands the Greeks capture the swallow on the wing by casting into the air a long line with an artificial fly. Hofland missed his salmon in consequence of a swallow seizing the fly as it was falling toward the pool of water. At times the fish will refuse the tempting morsel, though rising to glance at it, and then dart away as though the deceit was perceived. It is not only evident that fish possess an accute sense of smell, but at times they are very particular as to what they eat; and this 'daintiness of food has been noticed by very ancient writers.

We believe that the *Salmonidae* have the sense of smell very acutely developed, for they have ample nostrils, and their structure, and the full and peculiar arrangement of the olfactory nerves, indicate that they possess this power, even if its existence were not established by numerous observations. Almost every angler has seen a fish reject a bait that did not suit his taste, even after he had taken hold of it. The salmon not only measures the objects of his pursuit with his eye, but he smells them while pursuing and tastes them when seized. Many times have I noticed the trout on a summer evening champing the luckless fly that had fallen into the water as though it was a delicious morsel. In trolling artificial minnows, whose artistic make almost surpasses nature in beauty of outline and color, I have been vexed to see a salmon darting around it with seeming disdain, and never attempting to seize it. In such cases, the fish must have been influenced by smell; for the eye could hardly detect the structure of the bait or the concealed hook.

The white shark has very large nostrils, and smells its prey at a great distance. Throw to a voracious pike a toad, and he will turn from it with very marked loathing. Hang a shiny tench under his nose and he will recoil as quickly as the sensitive maiden turns from the nauseous smell of the poppy.

Fish are much affected by external influences, such as inclement weather, &c. "Never angle while the chilly east wind blows," is a world-wide maxim. To illustrate the rapidity with which impressions are transmitted in water, I will give an instance that amused me in boyhood. On throwing a little pebble moistened with spittle into the pool below the dam of Pleasant River, not far from tide-water, I observed that the lamprey-eels sprang out on land as though the water of the pool was molten lead, but returned again in a few moments and became quiet. Large rocks thrown into the water did not disturb them, but a minute pebble covered with spittle threw them into the wildest agony. Forty years ago the lawyers attending court at Machias frequently amused themselves by disturbing in this manner the lamprey-eels as they congregated in the pool below the dam. The human saliva evidently acted as a poison, and its influence was felt instantly in the most distant parts of the pool. There are many other remarkable instances of the susceptibility and the delicate organization of fish. The vendace is said to perish the moment it is touched by the human hand.

As I have said before, the salmon occurs in five of our lake-systems. Although there are other lakes advantageously situated near the coast, and much frequented in former times by salmon, yet they do not contain the new variety, if variety we dare to term it. This singularity in its distribution is another remarkable feature to be considered in its study.

Early in the month of May the fish in question passes into the inlets and outlets in search of the smelts who have gone there to spawn. Here it remains a few days, and then returns with the smelts to the lakes. In June it again returns for a few days to the foaming currents of the swift streams to enjoy the aerated water and rid itself of the parasites which infest the still waters; for even fishes are troubled with parasites. Sometimes they appear as little leeches, and stick to the gills of the fish; and then again we find them in other forms, and attached to other parts of the body—in the eye, for instance, as is the case with the shark. They also become diseased like land-animals, which fact did not escape the notice of Aristotle two thousand years ago. One of my prizes from Sebago Lake had a cataract in its left eye.

In September the salmon again seeks the clear streams, where it remains until the spawning-period is past, or until November. In May it prefers for bait the minnow or smelt, but in June and autumn it will readily take the fly, preferring the bright and the gaudy.

We know of no places in America where the angler can be more gratified with a fishing-rod in hand than among these lakes.* If he be skillful in casting the fly or trolling the minnow, he will be charmed and astonished with his success in the great Schoodic Lakes, either in the Chepeteneck or the Witteguerguagum. And at the same time, if he be a lover of nature, he will find wild and lonely scenery, yet full of grandeur and picturesque beauty, and all that is calculated to make a deep impression upon the feelings and awaken the contemplative and reflective powers.

BANGOR, ME., *September 11, 1872.*

DEAR PROFESSOR: Yours of the 4th is at hand. The number of Lippincott's Magazine containing my article on the salmon is May, 1869.

Since I wrote this article, I have satisfied myself that the non-migratory salmon have been seen in the Schoodic, Penobscot, and Union River waters only since forty years. Concerning the Sebago salmon, I am not so positive, but am quite sure the variety is not one hundred years old, or since the erection of impassable dams on its outlet. The Schoodic salmon are about forty years old, and the old Indian hunters have given me the precise time of their appearance and the disappearance of the migratory salmon, which coincides with the erection of impassable dams.

* The Sebago, Sebec, Reed's, and the lakes of the two branches of the Saint Croix.
S. Mis. 74—23

Migratory salmon of large size were at that time speared on the same grounds where the small salmon are now taken in great numbers, and which are never over five pounds in weight.

I have published but one other paper on the *Salmonidæ*, that on the togue, which is printed in the Maine Geological Reports of Hitchcock's Survey, and I have no doubt but that the description is correct, and the fish new to the scientific world.

The *Salmo Gloveri* is nothing but a parr. I examined the fish several years before Girard saw his specimen, and recognized it as the young of the migratory salmon.

They have disappeared from Union River since the extinction of the salmon.

Yours, truly,

A. C. HAMLIN.

2.—*THE TOGUE.

Salmo toma, Hamlin.

This trout, known among the aborigines as the *togue*, *tuladi*, &c., has been classed by some observers as identical with the *Salmo hucho* of the Danube and of the lakes of Northern Europe; but in these classifications peculiarities of anatomical structure have been overlooked, and the habits of the two fishes have also been noted as similar, whereas in reality they present great contrasts; for the one, agile and alert, seeks the swift and foaming currents of the clearest streams; and the other, sly and sluggish, haunts always the quiet waters of the deepest lakes. It is mentioned by Mr. Gesner in his report upon New Brunswick, and identified with the *Salmo lacustris* of Lake Geneva; a proper examination of the two fishes, however, will satisfy the naturalists that few positive analogies can be drawn; and, again, it is identified with the *Salmo ferox* of Loch Awe, in Scotland, in the descriptive catalogue of fishes of New Brunswick, by Mr. Perley, who identifies from the characters drawn by Sir W. Jardine and Mr. Yarrell, some of which would certainly lead the observer, unless minute, into the same error; for it cannot be denied that great similarities are to be observed, but there are also as many with the *S. erythrinus* of Siberia.

In shape it is not so elegant as that of some other species of the *Salmonidæ*, but its whole form indicates great strength and swiftness, although it has the reputation of being slow and sluggish. The female is more perfect in its proportions than the male, not having that gibbous appearance at the nape, where the outlines of the head pass into those of the back, and, besides, its general contour is more delicate.

A rich, pearly luster covers the ventral regions, deepening into russet

*From the Second Annual Report of the Natural History and Geology of the State of Maine, 1862, (pub. 1863.) Article on the Togue, by A. C. Hamlin, M. D.

toward the lateral line, above which the color appears of a deep, mottled gray, still deepening into blue as it approaches the dorsal summit. The same pearly hues, blended and intermingled with gray, are observed upon the opercula. Spots and markings of a light sienna color appear on the sides; these spots are circular without being ocellate, and appear indistinct and grayish upon the dorsal and upon the commencement of the caudal. All these colors vary according to the seasons and local influences, being brighter at the spawning-period than at other times. Its proportions are quite harmonious. The following are the measurements of a small specimen:

Entire length	18 inches.
Greatest depth	3 $\frac{7}{8}$ inches.
Head	length, 2 $\frac{7}{8}$, with operculum, 4 $\frac{1}{2}$ inches.
Pectoral	length, 2 $\frac{7}{8}$
Ventral	length, 2 $\frac{1}{8}$
Anal	length, 2 $\frac{1}{4}$, in width, 4 $\frac{1}{4}$ inches.
Caudal	length, 3 $\frac{1}{4}$, in width, 1 $\frac{1}{8}$ inches.
Dorsal	length, 2 $\frac{1}{2}$, in width, 2 inches.
Br. 12; P. 12-13; V. 9; A. 11-12; D. 13; C. 19.	
Cæcal appendages, 113; Ver. 65.	

Scales are small and elliptical. They decrease in size as they approach the thoracic arch. There are 53 in a vertical row anterior to the entrals, of which 24 are above the lateral line.

The lateral line arises from the height of the upper third of the operculum, curves slightly downward, and proceeds with a slight inflection to its caudal insertion. The pectorals are not proportionally so long as those of the *siscowet*, and they arise much nearer the branchiostegals leaving a greater distance between their extremities and the plane of the commencement of the dorsal. The ventrals arise vertically beneath the sixth ray of the dorsal, are orange in color, and margined anteriorly with white. Their outer circumference is slightly oval. The anal is not so high as the dorsal by one-quarter, while in the *siscowet* it is of equal height; terminal line obtuse and parallel with the axis of the dorsal. These fins are of an orange hue, and tipped with white or light gray. The dorsal arises in the middle of the back, is of a dark-gray color, and spotted in the form of transverse bands—terminal line obtuse. Caudal long and much furcated, much more so than with the *siscowet*, nor does age change much the acuteness of its terminal line.

The branchiostegal rays are twelve in number, and are of a pure white, except the last, which is irregularly spotted with gray. Eye large and circular, with irides of a golden yellow, and pupil angulated toward the snout, which is obtuse. The upper maxillaries are longest, and at their union show in both sexes a singular depression, into which is received the curve of the lower maxillaries.

The maxillaries, intermaxillaries, and palatines have each a row of

conical and inflected teeth. Those upon the lower maxillaries are large and strong; those of the intermaxillaries are next in size; upon maxillary and palatines next in size, and those upon the vomer smallest, numbering only three or four, and not confined to the anterior extremity, but extending a good way backward. The tongue is deeply grooved, and furnished with inflected teeth, arranged in lateral rows.

The opercular apparatus is somewhat concealed by the thick skin which envelopes it, but the outer lines of the operculum are quite distinctly marked. The operculum is quadrilateral, of greater height than breadth, well rounded in its posterior free margin, denticulated in its lower, and nearly square in its upper, the anterior angle of which is characterized by a strong and prominent process. Suboperculum is nearly one-third smaller than the operculum, is triangular in its upper portions, elliptical in its lower borders, and terminates at its articulation in the form of a fish-hook. The interoperculum has, as usual, the form of a long square, but square on the posterior side, and forming an acute angle with its lower margin, slightly rounded on the anterior side. Finally, the preoperculum is long, slender, crescentic, and almost vertical in its position; it is thick and furnished with a prominent ridge and three foramina upon its anterior surface.

This trout inhabits many of the great lakes and deep mountain-tarus of Maine and New Brunswick; but it is believed not to exist in those of Eastern New Brunswick, which singular hiatus in its distribution perhaps may be explained by the absence of deep waters in that country. It haunts the deepest waters, where the cold, or the repose to which it leads, favors that development and conservation of fat which is, indeed, a characteristic, and it steals forth in quiet at the approach of twilight or at early morn to the shoals and the shores in quest of its prey, which consists for the most part of the *Lota* and *Cyprinidæ*; but its baffled voracity often contents itself with substances entirely foreign, as its stomach presents sometimes a heterogeneous mass of bones, leaves, twigs, and fragments of decayed wood.

Its habits vary in some localities. In certain lakes they are bold, and, ranging near the surface, at times may be taken by trolling, but never rising to the fly, while in other lakes they are timid, and seek the obscurest recesses; thus, for instance, their existence in the Tunk Lakes was unknown for more than half a century to the inhabitants living near their shores.

Its mysterious nature has furnished the all-observing Indian with some proper idioms, and it appears again in the vague mythology and wild legends of that almost extinct race. Its names are various among the different tribes; and if the present are not of the half-breed Canadian date, they are, perhaps, of recent origin, since the few remaining dialects have changed greatly within a century past. Considering, then, the uncertainty of its ancient name, and the diversity of its synonym, I propose my friend Toma of the Openangos.