This, however, would not prove a serious impediment were any demand to arise for iron ores: at present there is so little inducement held out, that there has been hardly any search made for them in this Province.

Art. VII.—On the Salmon of Nova Scotia.—By J. Bernard Gilpin, A. B., M. D., M. R. C. S.

(*Read February* 10, 1879.)

It is more than ten years since I read a paper before the Institute on the Salmonide of Nova Scotia. Since that time I have had greater opportunities of studying their habits, and my opinions are somewhat modified as regards the new facts I have obtained. Although this paper will be almost a repetition of what has been told, yet I have thought the importance of the subject may well allow it to be re-told—to be verified by personal observation, and to be put in proper order, and to be shown how this order is modified by the natural features of this Province. Thus this paper will be not upon the Salmon in general, but upon the Salmon of Nova Scotia.

If we examine the map of this Province we will find it a narrow peninsula scarce seventy miles wide, whose interior is filled by numerous lake basins of about four hundred feet elevation, from which flow the various salmon river streams to the ocean. Thus our Salmon in seeking their spawning grounds have only an elevation of four hundred feet to overcome, and at farthest scarce thirty miles to ascend. We know further, from personal observation, that they rarely ascend so high, or so far, but are often seen spawning four or five miles from the tide, and scarce fifty feet elevation. This fact is so important with me in modifying their habits that I shall verify it presently by formal statements and dates. We also recollect our climate is cold, and that our lakes are frozen towards the end of November, attaining a thickness of nearly four feet of ice, which is broken up and descends the streams by the middle of April. This is the general average, though varying in different seasons. Now compare these facts with the genial lakes of Eng-

land, seldom frozen on the toilsome passage to and from the sea, as some believe that the Lake Ontario fish have to perform. We must immediately admit that however valuable all these facts and personal observations may be, they can only be called the natural history of the Salmon of Nova Scotia.

Should any one diligently examine the shallow bottoms of our inland lakes or small streams, nay even the overflooded cart-ruts of an old road, he will find them filled with small fish or fry. On examining them they will be found of various sizes, but all differing from other minnows, by lateral bars upon their sides, and by having a rayless fin on the back near the tail. Some of these may be young trout, others young salmon. It is very hard to determine betwixt them. The sketches I show you came from Cole Harbour. Mr. Webb, Druggist, Water Street, had many of them in a vase in his window. They died very fast, and when he had them replenished, he was kind enough to procure me some, on Sept. 15, 1865. The eye is very large and the nose blunt, colour greenish with dusky bars and reddish fins. I have, myself, at Annapolis, seen the children catching them in brooks within a few yards of the tide, during October. These may be considered as having been hatched during April and May, and thus nearly five months old. They can not yet be called Parr, but rather Pinks. From that time I have been endeavoring through myself and my friends to obtain a Nova Scotia Parr; but have never succeeded. As these were taken late in September it is probable that the increasing frosts of October and November compel them to leave their shallow haunts and retreat to the lakes, which are soon frozen over, and thus they pass into Parrs unnoticed during early winter. Mr. Atkins, Commissioner of Fisheries, State of Maine, wrote me upon the same subject, saying he could never obtain Parrs.

By the first of May the Smolts become frequent in our lake waters, that is to say, these Parrs have now, in the early Spring, the lakes still ice-bound, cast off their greenish yellow with dusky bars, and present themselves in silver laced with blue, but still retaining the vermillion spots. Mr. Silver gave me one taken three miles from the sea, on May 1st, 1864, still retaining red spots. On

20th May, 1865, the one from which the sketch was made, I show you, was taken at Bedford, in my own presence, and within a few yards of tide. On 1st of June, 1864, Mr. Morrow gave me a Smolt taken six miles from the sea, but having no red spots. These dates are sufficient to show that in his Smolt form the Salmon is numerous now in our streams.

On 10th May, 1878, my son took a Smolt from a river in Digby Basin. He had travelled ten miles in the tide waters, and the nearest lake he might have been spawned in, may have been five or six miles from tide. In his efforts to free himself from the weir, he had scaled himself, and thus was one-half a smolt, the other half a parr.

Extreme length 7½ inches, head contained four and half times in body, from nose to end of caudal fin. The opercle had the round edge peculiar to Salmon, and the fin end of maxilla—the round point—one opercular spot, nose a little blunt. There were teeth upon intermaxilla, maxillæ, and palatines, none on vomer. The silvery scales remained upon fore part of body. On the rest of the body where the scales had been rubbed away, the lateral bars of its Parr state were very apparent. There were six, I judged the silver scales covered three more. The sketch I show you is from my sketch book, and though it is only a repetition of Sir Humphrey Davy's beautiful drawing in the Salmonia, done many years ago, yet it was a satisfaction to have it, and to fix it by a date and a drawing as occurring in Nova Scotia.

These Smolts are all taken going seaward, and during spring and early summer, and well known to the young fishermen who take them by bait and in greater numbers than they should be allowed to do. During the latter part of August and September formerly, our markets were supplied from the Shubenacadie by small Salmon weighing two or three pounds called Grilse. Of late years, owing I suppose to the fishing act being carried out more strictly, I scarcely see them.

Mr. A. B. Wilmot, in his report dated 31st Dec., 1877, speaking of Bedford River, writes:—"I placed a small trap at the head of the first ladder over the dam immediately above the hatching house, and succeeded in capturing about sixty, mostly Grilse. They were taken about the latter part of September." Mr. Wilmot was obtaining Salmon for spawning purposes. Thus we find that young Salmon ascend our rivers during the fall, and not for spawning purposes. The Commissioner of Maine

Fisheries wrote me to explain why he had never captured Grilse in Maine, whilst we took them in the Shubenacadie. I could only refer him to Couche's British Fishes. No Grilse are taken in the Severn, but many in the Scotch rivers. The real reason is, I fancy, that though they ascend all rivers, yet some physical difference in each river makes it more or less a place of better observation. Thanks to the marking of Smolts in the breeding stations, we have long been enabled to connect the Smolt of a few ounces and about six inches long running to sea in May, with the Grilse weighing three or four pounds, and a foot and a half long running to fresh water in September. The enormous growth during that period is remarkable.

The next stage in the Salmon life to which I will point your attention, will be as he appears during spring and summer in the Halifax market. The first sea-run fish is usually taken about Yarmouth or Mahone Bay, in March. I have heard of one in February; indeed an Indian told me whilst fishing for trout through the ice in a mill-pond a mile from tide-way, he caught an ocean-run Salmon of ten pounds on New Year's day. He assured me it was an ocean fish, and indeed the fact of its taking bait would almost prove it. The Indian Saul took ocean-run Salmon by fly in January, Shelburne River, according to the Editor of *Forest and Stream*, New York, in a letter to me. During April, May and June they continue to run, and our markets are well supplied until July. As I wish this paper to be complete I will repeat from my paper of 1866, the description:

"The description of a fresh run of fish from the ocean as they appear in Spring, from our markets, would be: Weight from six pounds up to twenty. Head very small, body very deep, and at the same time round or thick through, back very muscular and tail strongly based. The opercle is circular on its outside edge. The free end of the upper maxilla also rounded. In both these parts they differ from trouts, the eye rather small and about two and one-half diameters from tip of nose, the nostril double. The outline of back round up from the head then runs gradually upwards to dorsal fin, the dorsal is irregularly rhomboidal. The adipose fin commences opposite the fifth ray of the anal, its posterior edge opposite its last ray. The tail is very strong, and the outline of back runs from dorsal to tail, descending in an equal curve with the rise anterior to dorsal. The belly runs in an outline similar to the back. The colour is black along the back running into steel blue with green reflections to lateral line, all below is silvery. The head and opercle are on the upper part dark blue, on the lower

silvery. On the opercle and pre-opercle one or two black spots. The colour of the fins are—dorsal lavender with irregular black spots, rays dark blue, adipose dark blue, caudal base and edges dark, the rest pale yellowish white, anal pale yellow, ventral yellowish, rays and anterior edge dark, pectoral pale bluish white, anterior edge and rays dark blue, a number of dark irregular blotches occar along sides and belly. Teeth upon intermaxilla, maxillæ, palatine bones, one to three upon vomer, and about nine or ten upon tongue.

"Rays P 11, A 9, C 20, V 9, D 12, Gill rays 11 each side a large axiliary scale to V.

"In counting fin rays I may state this as only an approximation, that the dorsal and anal may be said to have strictly proper webs, that in the dorsal the first ray is short and joined to second without webb, that the anal has also the first very thick, and that in the rest the rays starting as in the caudal from many irregular bases, and in the pectoral and ventral from one, the web being all but obliterated, it makes a count exceedingly difficult and varied by each counter. At the same time these rays vary in different specimens even in the dorsal, and are not typical."

I have presented you now with a description and portrait of a Nova Scotia Salmon in the full glow, strength and beauty of his magnificent proportions. His rounded back and powerful tail, the glorious steel blue of his back and sides, the opal lights ever reflecting on his silvery belly, tinged as it sometimes is with the warm pink of his blood-red flesh showing through, and the fair lavender of his fins cannot be described, must be seen to be realized. Formerly, after the season was over, Salmon were often brought to Halifax from the Shubenacadie river, during the middle of July. They were always out of season fish, blackish, with reddish blotches over them. On the 10th July, 1865, I purchased from about two dozen, the fish I now show you the sketch of. They all resembled each other. Both jaws were curved, the teeth were gone, the tongue exposed, and they were all out of season. On 26th November, 1865, Michael Brown Esq., sent me a Salmon, a male, weighing perhaps sixteen pounds, a sketch of which I now offer you. The intermaxilla articulation was very loose, and much enlarged, the intermaxilla bone itself had grown at least two inches in length, formed into a beak like an eagle's, and filled with large teeth. The lower jaw had also grown to correspond in length, and was also armed with large teeth, a cartilaginous knob projected upwards from the tip, which fitted into a groove above in the intermaxilla. The new jaws

were so arched, that it was impossible for them to close in the centre, and the teeth were much larger and with wider bases than usual. Mr. Stayner also gave me on March 14th, 1866, the head of a male much like the last, but with the appearance of a large ulcer upon the pre-opercle, as if the increased growth was now dropping off. From these facts we gather that our Salmon, at least some of them, enter the rivers in early spring, remain there, and as early as the middle of August, commence those changes in colour, and in the male of the jaws, which culminate in November. During November, the spawning season takes place.

Mr. A. B. Wilmot, Bedford, allows me personally to state these facts from him. That he has retained Salmon all winter in ponds of fresh water. That the jaws of the male commence their changes in September and finish in November, and after that seeming only to shrink till dismissed in spring. That he has never seen the immense jaws I have figured from a portrait taken from Shubenacadie. That he has seen the upper jaws entirely perforated by a large hole made by a knob from the lower, but has never known the lower jaw to drop off before the upper, as some have asserted. That they take no food during winter, and that he has known Salmon retaining the bright and silver scale all winter, in the midst of others entirely blackish and reddish, but this formed rather the exception than the rule. He thinks the body of Salmon in Nova Scotia winter in the lakes, the Parrs which he has opened having melts developed and not ovas, leads him to suppose the male parr matures sooner than the female. This corroborates Mr. Anderson's letter, and also agrees with the English Salmon. The Parrs run to sea late in the fall as well as in the spring. In the manipulations of fish, he finds those taken in November, and from the sea, much easier to manage, from the absence of nacre or slime which soon covers those in fresh water.

It is necessary for the preservation of the eggs that they be deposited on a gravelly bottom of a running brook. In the Province these spawning grounds occur often within three or four miles of the tide, and at an elevation of scarce sixty feet. My friend, W. C. Silver, Esq., allows me to say he has frequently

seen them spawning in Salmon River, three or four miles from tide, and about five miles from Halifax. Here the male, conspicuous by his hooked jaw, and the female with the spawn streaming from her, were seen furrowing up the gravel in water so shallow that their tails flapped out of water. Charles Anderson, Esq., Magistrate, informs me he has seen the same at the Musquodoboit River, and that the male makes furious rushes at other males approaching him, and that he is often surrounded by young males, scarcely seven inches long, but with hooked bills like the adults. This is corroborated by melt being found in Smolts before going to the sea, and also by the accounts of Salmon in English waters. Mr. John Duncan, Ingraham River, St. Margaret's Bay, told me he once saw Snake Lake filled by hundreds of spawning fish. This lake is one of the sources of Ingraham River, and can be but only a few miles from, or a few feet elevation above tide. Mr. James V. Buskirk saw during November, at least seventy Salmon spawning in pairs, in a shallow gravelly run from the Shubenacadie lakes, their tails lashed the surface, the stream was turbid by the white melt of the male which he emitted from above the female and shed upon the ova. Both sexes covered the ova with gravel, and attending trout were eating what the stream washed away. His dog rushed into the water, when they all disappeared, but returned immediately. This was about 14 miles from, and two hundred feet elevation above tide.

The spawn now shed and impregnated by the males, must soon be ice-covered, and remains till about the last of April, when the young fish escapes, but with a placenta attached to its body. From Mr. A. B. Wilmot's excellent report, we learn the various stages of artificial hatching. The black dot, the signs of life in the embryo, the escape from the egg, and the final discharge of the young fish to its native waters. I have already said that in March, (rarely in January and February,) the Salmon commence to run from the ocean up our rivers, and that this run continues till July, when the markets are closed. In Mr. John Mowat's report (Government Report, 1877) we find him taking Salmon for hatching purposes in the Metapedia, 24th August;

and again Mr. Wilmot in the Musquodoboit and Bedford, taking them in September and October, males more numerous than females, and many grilse. In the year 1865, the Sackville River was very low from the November droughts, and as many as thirty Salmon were seen at flat rock, unable to get up. Then we have records of fish going up from every month except December, and we must suppose that for various reasons, all the Salmon bred in our waters, are, during November, held in our lakes; with the exception of the Smolts going to sea, we have no record of Salmon returning to the ocean. I say record, for no one seems to have studied our rivers, and it was the common belief, even amongst naturalists, that after spawning they returned immediately to the sea, principally because they came from the sea in spring.

Some ten years ago the Rev. Mr. Williams, stationed at Truro, who brought his fondness for fishing from his native Wales, brought to my notice some fish which he caught in the Shubenacadie River, in April. They were descending beneath the loose ice in such numbers, and so ravenous, that he took two at a cast, and might have filled a boat in a few hours. They were true Salmon, but perfectly discoloured, reddish-black, spotted, and no silvery scale. On further enquiries, I found that the Musquodoboit River was subject to the same exodus, Mr. C. Anderson being my informant, and also those streams flowing from the Hants, Horton, and Cornwallis Basins, into the Bay of Fundy, through the Avon, were all thus crowded during early spring. Every spring we hear, especially from the eastern parts of the Province, of the wanton destruction of this fish, of their quantities, and the easiness of their capture. As we have no other record of their descending, we must conclude that as regards our own Province, the Salmon ascend our rivers from March to November, some remaining all summer, or perhaps returning to re-ascend again; though of this we have no proof, that they remain all winter and return in vast multitudes to the ocean in early spring. That our facts are scanty, must be allowed, the ice covering concealing our researches, and that they may not be true as regards other countries, is equally conceded, but until further investigation, I think they must be admitted.

I have now shown you our Salmon from his almost first appearance as a minnow, explained how in our rivers his changes into a Parr and Smolt are obscured by the ice; exhibited him going to sea for the first time as a Smolt, and also by a rare chance shown him to you in his form of half parr, and half smolt, and that produced by his own efforts. I have pointed him out as a grilse, shown him again in his grand proportions, and glorious flashings of silver light, as he is exposed in our markets, and have lastly given you some drawing of his degeneration in colour, of his leanness, and the singular and almost grotesque changes in the jaws of the male during spawning. In this I have given you nothing new, but only, as it were, given you old things, stated from original and new material, yet it is well to fix all these with a sketch and a date. In fixing the dates of his prolonged journey up river from the sea, and his rapid exodus downwards, I cannot deny that they still require confirmation. That they may be found to vary not only in the different rivers of the Province, but at different seasons in each river, why some ascend early, remain long in fresh water, and perform the function of spawning thoroughly degenerated, and others perform the same functions with all the strength and health of ocean run fish—(we find, Report Fisheries, 1877, that at one hatching station, the fish taken for spawning purposes were kept till wanted in tide way basins)—remains to be explained. If we compare our short streams with the St. Lawrence, or even the St. John, of New Brunswick, our shallow lakes, lying so close to sea-board, with Ontario, or even our ice-bound streams with the never frozen waters of England, or the arctic winters of Greenland and Labrador, and remember that the same species frequent all, we can only wonder that these vast physical differences have produced so little changes. In regard to the only new fact I have put before you, the retention of all the Salmon in our waters during the winter, in the inland lakes, I think I am justified in asserting it, or at least of drawing the attention of observers to it; but such observation should only be made where the physical features correspond with our own. If I have succeeded in giving you the itinerary of a Nova Scotian Salmon, with his biography attached, only approximately even, the object of this paper is effected.

We find also, principally from the Fishery Reports, the following facts:—That Salmon are more vigorous, and their ova equally fertile, that have never been in fresh water, but have been kept in tide-way reserve ponds. (Reports of Tadousac Breeding Establishment). That the Ontario Salmon on the contrary never go to salt water, but are equally vigorous, (see Mr. R. Wilmot's reports,) and that a few in Nova Scotia resist the fresh water changes. These facts are all comparatively new, and bearing as they do, so strongly upon the question of what are called land-locked Salmon, by many scientific men, still in the United States Fishery Commission, they are well worthy of a most minute, exact and scientific series of new observations, which might be made with little expense, if connected with the various fish breeding establishments of the Dominion. The growth of scale, the discolouration of flesh and of body, the changes of teeth and jaws in the male, and the peculiar changes in the pyloric cœca in fresh water and ocean fish (lately pointed out by R. Morrow, a member of our Institute) as taking place in the three forms of all fresh water, all salt water, and partly fresh and salt water, with exact dates and minute comparisons, would well reward the attempt, and be a small boon from the Government to her men of science.

ART. VIII.—ON THE ANKERITE VEINS OF LONDONDERRY, NOVA SCOTIA.—BY HENRY LOUIS, *Assoc. R. Society, Mines, London.*

(*Read March 10th*, 1879.)

EXTENDING along the base of the southern slope of the Cobequid mountains, and parallel, roughly speaking, to the mountain axis, is a remarkable series of fissure veins, filled with a number of interesting minerals, of which, as at present known, the most plentiful and the most characteristic is the Ankerite. These veins, which I shall in this paper designate the Ankerite veins, although Ankerite is not by any means their sole constituent, occur in a band of slate and shale, varying in colour from a dark blue to a pale olive green, and forming apparently the topmost