

in every light. Viewing the Bermudas as formerly a portion of the American Continent, let us consider whether there be sufficient ground on which to base our supposition. The Islands are formed, as I have before stated, of sandstone composed of comminuted shell and coral; but the particular stone which I have instanced as forming part of the southern shore, is so compact as to have the appearance of solid sandstone, or, indeed, I may say limestone. Now if we are to identify the Islands as forming part of that main land which juts out in their direction, we must first ascertain if that extension of the main be of similar formation. Speaking to Mr. Hill, the obliging mate of the R. M. S. "Delta," on my return from the Islands in 1860, I found that he was well acquainted with the American coast; and upon enquiry he informed me that the geological character of Cape Hatteras was decidedly a white sandstone or limestone, very similar in appearance to Bermuda stone.

I am sorry I have no specimen of the Hatteras stone, to compare with that of Bermuda, and I also regret that I have not had an opportunity of consulting any work upon the geology of that locality, whereby I could clearly ascertain the real nature of its structure. However, as I merely mention the connection of the Bermuda group with the main as a probability, and *nothing more*, and as my views are decidedly in favour of volcanic origin, we may leave the consideration of the question for future investigation, as I beg to do other subjects connected with the geology of the Bermudas, which, I hope, if life and health be spared me, to treat of in another paper.

ART. III. ON PISCICULTURE. BY LIEUT. COL. SINCLAIR.

[Read Dec. 4, 1865.]

Viz. : Ombre or Grayling—*France and Italy*; Pike—*Italy*; Carp—*China*; Bream—*doubtful*; Tench—*doubtful*.

America could introduce *S. Fontinalis*, Pike, Perch, Gasperæux, Striped Bass, Black Bass, Cat Fish, Sun Fish, *S. Confinis*, and two other varieties of Lake Trout, one not yet determined.

MOST varieties of the fresh-water fish proper of Great Britain are exotics, and were introduced by the learned monks of the ancient monastic orders.

These ecclesiastics expended much labour in preparing artificial lakes and ponds, which now exist, and still contain the scaly descendants of the old stock.

In those days, the transportation of live fish across the Channel or German Ocean, must have been a difficult undertaking. There is no account on record, showing that our ancestors were possessed of the knowledge that fish could be cultivated by means of milted spawn.

The Province of Nova Scotia should not be the last country to take advantage of, and reciprocate, the benefits which are likely to accrue from the late advancement made in piscicultural science. Her fresh-water lakes are of every conceivable size and kind; no country in the world offers superior natural advantages for a comparatively inexpensive introduction of many of the fish of the temperate latitudes.

The atmospheric isotherm of Nova Scotia corresponds with the south of Sweden; but her fresh water isotherm will approximate to that of central Germany, where the summers are warmer than ours, and the lake waters are frozen for two or three months during winter.

With one or two exceptions, the fresh water fish of temperate climes (indigenous or imported) cannot endure tepid waters; those few which *can*, do not suffer from hard winters, for the physical reason that the mean temperature of all waters is the same under a frozen surface.

The interchange of different varieties of fish by the agency of man, seems to be peculiarly indicated. In agriculture, the cultivation of exotic plants has much more to contend with: the same zones of latitude will not, as a rule, produce the same crops. For instance: Nova Scotia lies in the same latitude as the south of France, but will not ripen the finer sorts of wine grapes, the olive, and the fig. But the Province is somewhat nearer this condition than Great Britain, where the cucumber and maize will not ripen in the open air. The thermal condition of our lakes is higher in summer than that of the British lacustrine waters, and for a longer period; with reference to the hybernation of fish, for the reason already given, they may be ranked with lakes only frozen occasionally in winter elsewhere.

Aquatic plants give a good indication for comparing the waters of different countries, with the object of ascertaining whether they will sustain similar species of organic creatures.

The white and yellow water lily, the pickerel, and other lake weeds of this Province, are identical with those of Great Britain. There is a far greater diversity in the land plants and shrubs, which are indigenous in the two countries, proving that the thermal condition of their waters approximate much nearer than their atmosphere.

It is probably owing to higher temperature in summer, that many of our lakes have few or no trout in them. For this reason, they would be all the better reservoirs for other kinds of fish.

For instance: no one would now take the trouble to wet a fly in that fine sheet of water, the lower lake at Dartmouth; but were it stocked with fish, perhaps less esteemed than trout, it would afford healthy amusement to many who may not be adepts in the more scientific branches of angling. Enjoyment is only relative, and there are not a few who take as much interest in the bobbing of a cockney float, as in the rise of a pound trout; and even the experts might condescend to enjoy surer, though slower sport in the summer evenings, at a season when the trout, sickened with heat, refuse to take. As for the rising generation, they would be happier and better spending their spare time dibbing for roach, dace, tench, carp, and bream, than idling at home, or in city or town.

It would require a naturalist of practical experience to decide whether the white perch of America is the same as the British perch. It is not likely. The British perch, in all considerable lakes, grows to a very large size, and would probably do so here, where the native perch rarely attains the weight of two pounds.

Without pretending complete exactness, suggestive lists of fish are appended to this paper.

Possibly a correspondence with the Acclimatization Society in Great Britain, might lead to some results in an interchange of fish or spawn. As the delicate salmon roe has been transported and hatched successfully in the Antipodes, there could not be any difficulty or much expense, attending experiments of the same sort with other fish, by means of the mail steamers. The gaspereau would almost certainly thrive in Loch Awe and similar lakes, accessible to and from sea, and fed by a diversity of rivers and streams; and our trout, *salmo fontinalis*, would be no mean acquisition to the British lakes.

It is remarkable that the lithographic history of the ancient world reveals the fact, that there was then a difference of the fish

of the European and American continents, although they were less dissimilar from one another than either from modern fish. Some of the ganoid fishes had a vertebrated neck, and were thus able to look about them.

The same similarity prevails in the present day, when man is present to take advantage of it. The great *siluris glanis* of the Danube, whose introduction into Great Britain has caused attention, is undoubtedly one of the types of the large Channel cat fish of America, probably distinguished by some local peculiarity. The sturgeon of the Danube is most likely the same as the St. Lawrence sturgeon, with a difference.

Many of the European fish, if introduced here, might deteriorate in size and quality; but, considering the extent, purity, and varied conditions of our lakes, on the average, quite a contrary result may be confidently anticipated.

LIST OF BRITISH FRESH WATER FISH NOT FOUND IN NOVA SCOTIAN WATERS.

British Trout inhabits both lakes and rivers, as well as small streams, in which he will attain a good weight. Maximum weight, 10 lb.

Thames, and Colne, Driffeld Brook, Waltham Tarn.

and solitary than those of the "*salmo fontinalis*," or American trout; he also grows much larger in some waters than the *fontinalis*, which rarely, if ever, exceeds six pounds; seeks cover under roots and rocks.

B. Lake Trout — Maximum weight, 15 lb.; exceptional weight, one from Loch Awe taken five and twenty years ago, 30 lb.

Lochs Awe, Scotland; Neagh, Ireland; and other Scotch and Irish lakes. The Lake Trout of Cumberland is only an overgrown River Trout, overfed with minnows, found in Crummock Water and other lakes in North England.

NOTE. — Naturalists are more obscure about the varieties of lake trout than about any other fish. It is impossible for a lay brother to form ideas from reading or catching.

Affects deep holes in streams, and shallow gravel banks in lakes, and does not roam except near spawning time; runs very greedily at the minnow, particularly in rivers or streamlets discolored by recent rains; his habits are much more stationary

and solitary than those of the "*salmo fontinalis*," or American trout; he also grows much larger in some waters than the *fontinalis*, which rarely, if ever, exceeds six pounds; seeks cover under roots and rocks.

There are several varieties — three or four, at least: —

1. The gillaroo trout, of Loch Neagh, which has a gizzard, and feeds partly on clams.

2. The great gray lake trout, of Loch Awe, is distinct from the gillaroo, unless the gizzard story be a myth.

3. The bull trout.

Salmon Trout — Maximum weight, 9 lb.

Decidedly different from our sea trout ; has no round white spots, or more obscure ; scaled more like a salmon, larger size, and cuts red just like a salmon.

B. Grayling — Maximum weight, 4 lb.

Itchen near Winchester, Derwent, Wharfe, Done, and other rivers ; varies much in size according to waters ; is supposed not to be a "cold water" fish, but has lately been introduced into Scotland.

A delicate, very tender fish, excellent eating, taken almost always with the fly ; likes a stream not too rapid, alternating with long clay bottomed glides, and gravelly streams ; only one variety found on this continent ; Back's grayling in the Arctic regions ; the grayling, so miscalled, of

Grand Lake, N. S., is a lake trout.

B. Pike — Maxm. weight, 40 lb.

Well known as a voracious fish, not to be trusted as an import ; it is difficult to confine him, and he eats all before him, even his own species — frogs, young ducks, and any swimming thing less than his swallow.

Carp — Average weight, 2 lb., but will grow to 8 or 10 lb. in very favorable waters.

A tolerable fish for the table, but of no very superior quality ; breeds prodigiously ; Chinese by origin, but will live in temperate or even frigid climes ; likes gravelly ground, in still waters.

Tench — 3 lb.

Pond and lake fish of very excellent quality ; likes muddy or weedy places ; stillwater fish.

Bream — 4 lb.

A fine deep-bellied fish, better than carp ; he is a stillwater fish, and would most likely attain a large size in those of our lakes where trout are scarce ; he gives good sport during summer, when few other fish will take — sport for float anglers, and a well-grown, good fish.

B. Perch — Much larger than the Provincial Perch. in weight — would probably increase in weight.

A desirable fish to have as an experiment ; might either improve or deteriorate

B. Barbel and Chub.

Uneatable, and destructive of the spawn of other fish ; they are the curse of English waters, and not fit for anything.

Roach and Dace — 1½ lb. (*Isaac Walton*, 2 lb., minus 1 oz., *Roach*.)

Sport for young anglers ; tolerable "pan" fish.

Minnow.

Breeds in vast quantities, and useful in streams and lakes as food for trout and other predaceous fish, and a good bait.

Bullhead, loach, ruff, bleak, and a rare fish-burbot (*a silaris*), are not worth consideration; also, fresh water cray-fish, gudgeon, &c.

Charr — Small Herring size. Of the cold deep lakes of the north of England; a very delicate fish, schooling in the autumn, when they are netted and potted for consumption and sale; difficult to transport, the fish being very tender, and their spawning habits obscure. The charr, if introduced, would be of great value. The *fontinalis* has been called a charr, but he is not the same fish at all. The lake charr has his seasons, and disappears and schools again just like the herring, not being seen but in his season.

PRINCIPAL NOVA SCOTIAN FISH NOT KNOWN IN GREAT BRITAIN.

Common Trout, *Fontinalis* — Sea Trout, maximum weight, 6 lb. Colonel Drummond, a very acute ichthyologist, was of opinion that this fish and the N. S. sea trout are the same; that the *fontinalis* runs to the sea when able to get access to it, returning well grown, with a white scale. The *fontinalis* in our lakes is erratic, being constantly on the move in schools like mackerel.

Great Striped Bass — 6 lb. to 50 lb. Would probably succeed in Loch Awe, and in the larger British rivers, where the shad is found, such as Severn, Ouse or Trent; also in rivers accessible from sea, flowing through lakes into estuaries, provided access be available; they would run up Shannon, but the Queen's gaps, lochs, weirs, or weir shoots are too steep; they are a large game fish, heavier than salmon.

Gaspereaux. Do., of high economic value.

Salmo confinis — Maximum weight not known. A lake trout of considerable size; would make a good exchange with the British lake trout.

Grayling (so called) — 3 lb. A handsome white lake trout, not unlike a large salmon smolt fresh from sea.

White and yellow perch, small varieties of roach (shiners), suckers not included, being inconsequential.

ENUMERATION OF SOME OF THE AMERICAN FISH NOT FOUND IN NOVA SCOTIA.

Maskelunge, or American Pike. Lake Erie, Rice Lake, and other Canadian waters. 10 lb. to 30 lb. Similar to the British pike, and that of Norway and the European continent.— See notes in British list.

Black Bass — 3 lb. Canadian rivers and lakes.

A superior fish, habitat lakes with deep rocky rivers, debouching into, or flowing out of them ; he is allied to the perch, but will not breed in lakes without rocky rivers or runs.

Pike Perch — Habitat Canadian lakes and Continental American waters. Lakes Erie, Champlain, St. John, Can. Richelieu River, and New Brunswick lakes ; not found in Nova Scotia, but very much distributed in other American waters.

A handsome lake fish, more voracious than the perch, less so than pike ; he does not exceed 10lb. weight, but averages 4lb. ; has the spinous back fin characteristic of the perch tribe ; is yellow, with a forked tail, finely tapered ; his introduction is questionable. The pike is less actively formed, yet finds its way into apparently inaccessible waters. The pike perch would certainly thrive in our waters, also in the lakes and rivers of England.

Sun fish, cat, shiners, some smaller fry, and the fish peculiar to the great lakes, omitted ; the large cat fish and *siluris glanis* might do in St. John River, New Brunswick.

APPENDIX — SUBJECT TO EMENDATION.

SEA FISH OF GREAT BRITAIN NOT FOUND ON THE AMERICAN COASTS. SUBJECT TO CORRECTION.

The Sole. Desirable, if the water be not too cold on the outer Banks.

Turbot.

Large Crab.

Desirable.

John Doree.

Probably would not thrive, as he is a Mediterranean fish, requiring warmer waters than the Arctic current prevalent on these coasts.

Sea Bass of the South of England.

Prawn.

Shrimp.

Desirable, but water possibly too cold, on account of the Arctic current which covers the Banks of Newfoundland, and flows down our coasts as far as Florida.

The American sea fish non-existent in British waters, would not thrive on the British coasts and banks. The porgee, hog fish, red bass, drum, &c., are inhabitants of Southern waters.

NOTE. — The sheepshead, white fish, and fresh water herring, of the great lakes ; also, the Mackinaw trout, are the principal fishes omitted, as manifestly not adapted to our waters or those of Great Britain ; two or three other fish are omitted for the same reason, but the lists can be amended. Controversy will be declined. — R. B. S.