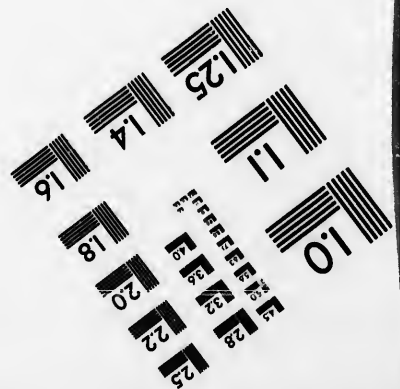
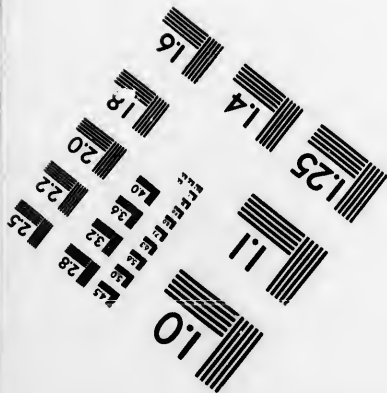
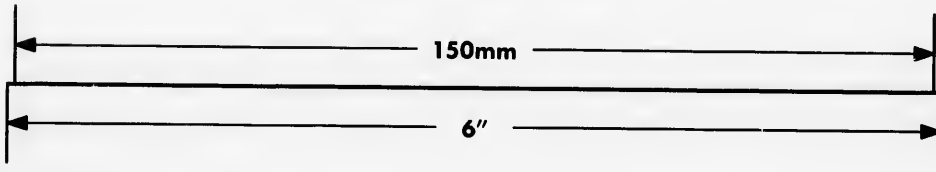
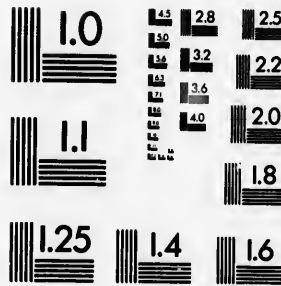
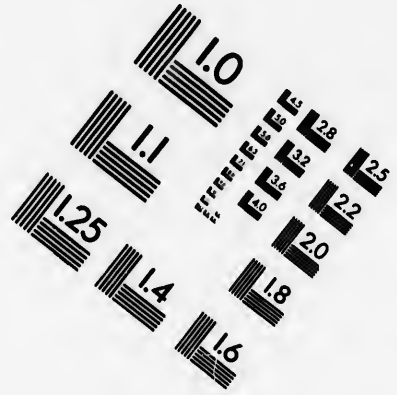
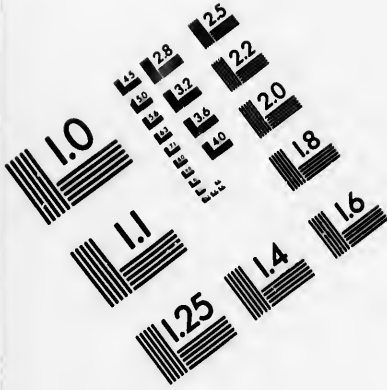


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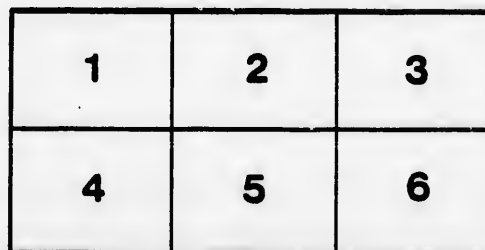
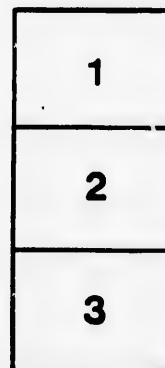
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REPORT
ON
FISH-BREEDING OPERATIONS
IN THE
DOMINION OF CANADA
1890.

PRINTED BY ORDER OF PARLIAMENT.



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SUPERINTENDENT'S REPORT ON FISH-BREEDING OPERATIONS, 1890.

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REPORT

- OF -

MR. SAMUEL WILMOT,

Superintendent of Fish Culture for the Dominion of Canada,

FOR THE YEAR 1890.

The Honourable
CHARLES H. TUPPER,
Minister of Marine and Fisheries,
Ottawa.

SIR.—The following report on the condition of, and transactions connected with, fish-breeding operations in Canada during the year 1890, inclusive of other subjects relative thereto, is herewith submitted. The report will include the following matter, namely:—

1. A general statement of the gross output of artificially bred fry from the several fish hatcheries in Canada during the past year, in which will be given the particular numbers, description and species of fry, amounting in the whole to a grand total of 90,213,000 young fish, distributed in many of the waters of Canada.
 2. Tabulated statements are also given particularising the numbers and species of young fish and eyed eggs, which were distributed from, and received at, each of the twelve fish hatcheries in the several Provinces of the Dominion during the past season.
 3. A schedule will also be found in which the individual quantities are given of the different kinds of fish eggs that were collected and placed in the hatching troughs, and automatic incubators in each of the hatcheries in the several Provinces during the past season of 1890, amounting in the gross to 144,613,000 ova of the superior kinds of fresh and salt water fishes of Canada.
 4. Another general statement is given which shows the gross numbers of fry of all kinds which have been bred and turned out of the several individual hatcheries into the waters of Canada since the first inception of the science of artificial fish culture as a governmental work in 1868, making a grand exhibit of 799,757,900 young fish of many species, comprised almost wholly of the higher grades of commercial fish indigenous to Canadian waters.
 5. A summary is given of the particular transactions at each of the individual hatcheries which have been in operation during the past year, describing briefly the amount of work performed at each, in relation to the output of fry, the capture of parent fish, the collecting of ova, and the present condition of these establishments, and their wants, together with other remarks of a general character connected with these institutions.
- LOBSTER BREEDING.**
6. In view of the commencement of the enterprise of breeding lobsters by the artificial methods in Canada during the coming season of 1891, particulars are given relating to a prospecting trip to the newly established lobster and cod hatchery at Dildo Island, in Newfoundland, and of the selection of a site for the erection of a similar establishment on the Northumberland Strait in Nova Scotia; both subjects are

embodied in this report, and views are contained in them setting forth the great necessity that exists for establishing more stringent regulations for the protection of the lobster, and for the prevention of the too general destruction of berried, undersized and immature lobsters, now so largely practised by the lobster fishermen and lobster packers throughout the Maritime Provinces, where this valuable crustacean is at the present time so avariciously sought after. In these papers will also be found other matters relating to the successes attending the artificial breeding of the lobster in Newfoundland and in the United States.

SALMON FISHERIES.

7. The subject of the salmon fisheries and of salmon nets is discussed in a memorandum which was submitted to the Department; it refers more particularly to the system which prevails in the Bay des Chaleurs in the Provinces of Quebec and New Brunswick; and a description is given of the inequality which exists regarding the modes of fishing by fishermen on either side of the bay, and of the relative positions in which the netters and the anglers stand towards each other, with reference to the general maintenance or depletion of the salmon fisheries generally.

FISH LADDERS.

8. Fish ladders or fish passes are also referred to in this report, in which is shown the necessity that exists for the Department to adopt the best and present most practically approved fish way which shall be built in mill dams, or where other artificial and natural barriers exist, in order to allow fish to pass up freely to their natural breeding grounds or rivers, and other waters; and where these barriers now prevent the ascent of these fish, thereby causing the present rapid extermination of fish life in many parts of the country.

SALMON CULTURE.

9. A few extracts from some of the reports of officers in charge of hatcheries are given of the successes attending the transferring of the fry of the Restigouche salmon into waters of the Miramichi River, with a view to acclimatizing and introducing the larger Restigouche salmon into the Miramichi, which latter river produces a smaller description of the salmon family. The experiment has been successful.

An interesting account is also given of the successful stocking of the Hudson River, in the United States, with salmon, in which this valuable fish has not been known to inhabit for the past century.

An article on the successful results of planting artificially bred whitefish fry in Lake Erie is also appended.

APPENDICES.

10. In the Appendices to this report will be found the reports of the several officers in charge of the individual hatcheries in operation in the Dominion, in which the more minute details of all work connected with each establishment are fully given.

ANNEX TO THIS REPORT.

11. In the annex to this report will be found certain correspondence relating to the proposed improvement of the whitefish industry in Lake Ontario, by the Commissioners of the State of New York; and also further correspondence between Marshal Macdonald, United States Commissioner of Fisheries, and Honourable Levi P. Morton, Vice-President of the United States, with the report of the United States' Congress, for the erection of a United States' Salmon and Whitefish Hatching Station on Lake Ontario, which will prove one of the most important stations of the United States Commission of Fish and Fisheries.

An article on the results of fish culture, from *Forest and Stream*, by W. N. Byers, of Columbus, Ohio, in which he defends artificial fish culture against the attacks made upon it by others.

A very instructive paper is also annexed taken from the *Edinburgh Scotsman* on Aquaculture, by George Malcolm, Invergarry, showing the progress of fish culture, its present condition and results in various countries of the world.

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1.—GENERAL STATEMENT OF THE OUTPUT OF FRY, AND OF THE COLLECTION OF FISH EGGS AT THE SEVERAL HATCHERIES IN 1890.

The gross output of fry of all kinds from the hatcheries in Canada during 1890 was 90,213,000, as follows:—

Atlantic salmon (<i>Salmo Salar</i>).....	9,861,000
Pacific salmon, Suckeye (<i>Oncorhynchus nerka</i>).....	6,730,000
Salmon trout, Great Lakes (<i>Najmacush</i>).....	8,721,000
Brook trout, rivers and streams (<i>Fontinalis</i>).....	376,000
Whitfish, Lake Region (<i>Coregoni</i>).....	42,325,000
Pickeral, doré (<i>Luciopercha</i>).....	22,000,000
Total	90,213,000

2.—The following table gives a statement of the numbers of the young fish and semi-hatched eggs that were distributed from each of the hatcheries during 1890. The name of each hatchery in each of the Provinces is shown on the schedule, opposite which is given the gross number of fry, and the species which were put out from each nursery, together with the quantities of eyed-eggs sent from, and received at, some of the hatcheries.

The particular lakes, rivers and other waters in which the fry were planted, will be found minutely described in the reports of the several officers in charge of each of the establishments, in the appendices hereto attached.

SCHEDULE showing the Number of Fry and Eyed-eggs Distributed from the Individual Hatcheries in 1890.

Number.	Hatchery.	Fry Put Out.	Eyed-eggs sent to other Hatcheries.	Eyed-eggs Received from other Hatcheries.	Description of Fish.
1	Fraser River, B.C.	6,640,000			Salmon, sea.
2	Sydney, C.B., N.S.	1,953,000			do
3	Bedford, N.S.	1,480,000			do
	do	370,000		500,000	Salmon trout.
	do	10,000		15,000	Speckled trout.
	do	2,000,000		2,000,000	Whitefish.
4	Dunk River, P.E.I.	Not in operation			
5	St. John River, N.B.	482,000			
	do	1,000,000		500,000	Salmon, sea.
	do	40,000		1,500,000	Salmon trout.
	do	2,000,000		15,000	Speckled trout.
	do	1,022,000		2,000,000	Whitfish.
6	Miramichi, N.B.	2,395,000			Salmon, sea.
7	Restigouche, Que.	806,000	525,000		do
8	Gaspé, Que.	1,700,000			do
9	Tadoussac, Que.	1,600,000			do
10	Magog, Que.	1,275,000		2,000,000	Speckled trout.
	do	4,700,000		2,000,000	Whitefish.
	do	2,750,000	5,500,000		Salmon trout.
	do	286,000	105,000		Whitefish.
11	Newcastle, Ont.	30,000,000	15,000,000		Speckled trout.
	do	22,000,000			Whitefish.
12	Sandwich, Ont.	112,000			Pickeral, doré.
	do	1,051,000		175,000	Salmon, sea.
	do	70,000		1,500,000	Salmon trout.
	do	4,500,000		75,000	Speckled trout.
	do			6,000,000	Whitefish.
	Totals.....	90,213,000	21,270,000	21,270,000	

3.—FISH EGGS COLLECTED AND PLACED IN THE HATCHERIES IN 1890.

The following table will show the numbers and descriptions of fish ova collected and put in the troughs and incubators of the individual hatcheries throughout the Dominion in 1890. The Magog, St. John River and Ottawa Hatcheries are supplied at the proper season of the year with their quota of impregnated eggs from the Newcastle and Sandwich nurseries in Ontario; and in the case of salmon ova for the St. John River Hatchery, from the Restigouche establishment in Quebec. The total number of eggs collected, as shown below, amounted to 144,613,000.

No.	Hatchery.	Province.	No. of Eggs.	Species.
1	Fraser River.....	British Columbia.....	3,861,000	Pacific salmon.
2	Sydney.....	Nova Scotia.....	1,218,000	Atlantic salmon.
3	Bedford.....	do.....	400,000	do
4	Dunk Biver.....	Prince Edward Island.....		Not running at present.
5	*St. John River.....	New Brunswick.....		
6	Miramichi.....	do.....	810,000	Atlantic salmon.
7	Restigouche.....	Quebec.....	1,800,000	do
8	Gaspé.....	do.....	1,020,000	do
9	Tadoussac.....	do.....	1,879,000	do
10	*Magog.....	do.....		
11	Newcastle.....	Ontario.....	11,125,000	Salmon trout.
	do.....	do.....	500,000	Brook trout.
	do.....	do.....		Whitefish.
12	Sandwich.....	do.....	90,000,000	do
	do.....	do.....	32,000,000	Picherel, doré.
13	*Ottawa.....	do.....		
	Total Eggs, 1890.....		144,613,000	

* These hatcheries will obtain their supplies of semi-hatched eggs from Newcastle and Sandwich during January or February next.

4.—GRAND TOTAL OF YOUNG FISH OF ALL KINDS PUT OUT OF THE SEVERAL CANADIAN FISH HATCHERIES FROM THE ORIGIN OF THE INDUSTRY UP TO THE PRESENT TIME, 1890.

The following schedule shows the gross output of fry of all kinds, from each hatchery in each Province, the name of the hatchery, the Province where located, the year in which they were each established exhibiting a total number of fry of all species amounting to 795,757,700 :—

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STATEMENT showing the Places where, and the Years in which the several Fish Hatcheries have been erected ; also the number of Fry distributed from each Establishment, annually, since they were built.

Year	NEW BRUNSWICK.		NOVA SCOTIA.		PRINCE EDWARD ISLANDS.		BRITISH COLUMBIA.		TOTALS.
	Miramichi.	St John River.	Bedford.	Sydney.	Prank River.	Prank River.			
1868-1873									
1874									
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Totals.									

The particular descriptions of Fry above enumerated were as follows :
Salmonidae—Atlantic and Pacific salmon, salmon trout of the Great Lakes, and speckled trout of the Straits.
do Whitefish (*Coregonus*) of the Great Lake region.
Percidae—Pickerel, or Doré (*Lucioperca*) and Black Bass.

Grand Total of all kinds.....

Note.—In addition to the above written 73,134,000 fry distributed from the Parent Establishment at Newcastle, there has been transferred from this institution to the Passmore Province Hatcheries 34,200,000 of semi-hatched ova. Grand total, 107,334,000.
In like manner the Sandwich Nursery has transferred 50,500,000 of eyed eggs to other hatcheries, exclusive of the 541,000,000 of fry put out.

5.—SUMMARY OF TRANSACTIONS OF EACH OF THE HATCHERIES IN THE DOMINION DURING THE SEASON OF 1890.

1.—FRASER RIVER HATCHERY, BRITISH COLUMBIA.

The crop of young salmon of the suck-eye family put out of the Fraser River Hatchery during 1890, was larger than formerly, amounting in the whole to 6,640,000. They were planted in some of the most important lakes and rivers of British Columbia, where reasonable means of transportation was at hand for safely performing the work. The distribution throughout was satisfactory and safely accomplished.

The capture of parent salmon during the past autumn was considerably less than formerly. The operations were commenced somewhat later in the season, when freshets set in swelling the streams and bringing down débris of all kinds, breaking open the pens or reservoirs containing the parent salmon and allowing them to escape; the consequence was only 3,861,000 eggs were collected; about one-third of the quantity obtained in 1889. These were placed in the hatchery in very fair condition, and are doing well at the present time.

Certain repairs were required to put the hatchery and water supply in good working condition. This has been done, but it is suggested that further improvements should not be of an extensive character in view of the contemplated erection of a more commodious and convenient hatchery on Morris Creek, some distance up the Harrison River, where the parent salmon can be easily captured earlier in the season and kept alongside in a safely constructed reservoir until required for spawning purposes; thus insuring a certainty of procuring full supplies of eggs, and avoiding the doubts and uncertainties which has hitherto prevailed in collecting eggs in the open river by netting later on in the season. It is confidently expected that by the building of a hatchery at Morris Creek with the reservoir attached, ample accommodation will be had for putting down 20,000,000 to 25,000,000 of eggs annually.

The present hatchery from the good work it has already done, with its small accommodation, for improving the Fraser River fisheries from the general report of the salmon canners and the public generally, warrants the early construction of a larger and more commodious establishment at Morris Creek.

2.—SYDNEY HATCHERY, CAPE BRETON, PROVINCE OF NOVA SCOTIA.

There were hatched and distributed from this hatchery in 1890, 1,953,000 young salmon of the *salar species*. They were put in some twenty of the more important rivers and brooks in the several counties of Cape Breton. On account of the lateness of the application for fry for Mabon River, last season, none were put there; this river will receive due consideration another year.

The collection of eggs last autumn was fairly satisfactory; several rivers were netted, and 437 parent salmon were caught, 342 of these were females, and gave 1,218,000 eggs. The heavy rains which prevailed enlarged the rivers and made the capture of salmon less successful, otherwise a larger crop of eggs would have been secured. The eggs to all appearances are doing well, and a large crop of fry may be expected.

The hatchery is in good repairs, having undergone a general overhauling by putting down new floors, sills, &c., which had become much decayed. The only requirement now will be painting, when the establishment may be quite complete for the next ten years.

Satisfactory reports are given of an evident increase of salmon in the streams where fry have been planted, from the Sydney Hatchery, in past years. It is suggested that fry of the land locked salmon should be put in certain lakes near Margaree, as at present these waters are useless for the want of some fish in them.

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3.—BEDFORD HATCHERY, PROVINCE OF NOVA SCOTIA.

Unqualified success is reported to have taken place with the hatching and distributing of fry from this hatchery during 1890. The difficulties experienced in hatching salmon trout fry in former years were overcome, and the yield proved most satisfactory.

About 500,000 of the salmon trout eggs, and 2,000,000 of whitefish ova, were obtained from the Ontario hatcheries, and placed in the Bedford nursery in good condition.

The fry from these eggs were planted in various lakes in several of the counties of Nova Scotia, amounting in the gross to about 2,370,000. In addition to these fresh water fishes, there were also put out from this hatchery 900,000 of the sea salmon, making a grand total distributed of 3,850,000 fry.

Six subsidiary hatcheries have been established in the more distant counties from the head establishment at Bedford, where they have proved to be most satisfactory for helping in the general work of fish culture in Nova Scotia. Semi-hatched eggs are transferred to these small provisory hatcheries from the larger one, at certain times, and there hatched; whereas fry could not be sent to these localities by reason of their remoteness, and the impossibility of carrying fry to them at the season in which the young fish require to be put out. These subsidiary hatcheries proving to be of such service, it is in contemplation to build others in other counties in Nova Scotia, where the benefits from artificial fish culture are anxiously sought for. It is contended that whilst the benefits already realized from fish culture are very satisfactory, yet the work has been carried out on too limited a scale to give such general effect to artificial culture as the exigency demands.

The usual success did not attend the collection of eggs the past season, difficulties of various kinds interfered in the capture of the requisite number of parent salmon. Heavy freshets carried the fish beyond reach in the Musquodoboit River—the usual place of dependence for procreating eggs. Wallace River was then resorted to, where a number of salmon were netted and impounded, awaiting the spawning time. A work of vandalism was done by certain of the inhabitants, by which the reservoir for keeping the salmon in was destroyed, and the mother fish killed and carried away, thus causing the loss of 54 parent fish laden with some 500,000 ripe fruitful eggs. This act of these miscreants has lowered the usual supply of ova for the Bedford Hatchery this season. These pouchers remain as yet undiscovered. From the above misfortunes only 400,000 eggs were laid down, barely one-fifth of the previous year's supply. Timely preparations were made by which a largely increased supply of water was brought into the hatchery, anticipatory of enlarged operations during 1890-91, which will not now be realized from the wanton destruction of the parent fish as related. It is proposed to supplement this season's reduced supply of salmon eggs, by transferring numbers of salmon-trout and whitefish eggs from the Newcastle and Sandwich Hatcheries in Ontario to Bedford.

Some minor repairs are required in the way of mending and painting the roof, and strengthening a portion of the foundation dividing the hatchery from the dwelling part of the establishment.

4.—DUNK RIVER HATCHERY, PROVINCE OF PRINCE EDWARD ISLAND.

This hatchery has not been running since 1888. Arrangements are being made by which the whole establishment will be put in order for fish cultural purposes for the coming season of 1891.

5.—ST. JOHN RIVER HATCHERY, PROVINCE OF NEW BRUNSWICK.

This hatchery has been supplied with semi-hatched eggs from the Restigouche, Newcastle and Sandwich nurseries for the past three years. The eggs of the "salmo salar" are obtained from the Restigouche Hatchery, and eggs of the salmon-trout and whitefish are supplied from the two latter hatcheries in Ontario. Prepa-

rations are being made to secure supplies of parent fish from the St. John Harbour fishermen, and impound the salmon in some convenient reservoir, until the spawning time, when the eggs will be gathered and conveyed to the St. John nursery for hatching. By this means, it is contemplated, full supplies of ova will be obtained without trespassing upon the stock deposited in the several hatcheries in other parts of the Dominion. About 4,000,000 of eyed-eggs of the salmon, salmon trout, and whitefish were transferred in this way to the St. John Hatchery during 1890. These were duly hatched and distributed, where applied for, in many of the lakes and rivers of New Brunswick. The work throughout was performed most successfully. A considerable amount of repairing has been performed on the hatchery during the past year, which will place the establishment in a first-class condition for work for some years to come.

The officer in charge reports the taking of salmon trout and whitefish in some of the waters where fry were planted from this hatchery in former years and in waters, too, which these fish were not formerly known to inhabit. Evidences which are to hand from several reliable persons and fishermen.

6.—MIRAMICHI HATCHERY, PROVINCE OF NEW BRUNSWICK.

The work at this institution resulted very satisfactorily, from the fact of no less than 1,022,000 of the young of the Atlantic salmon having been turned out from it into the principal tributaries of the Miramichi River. The experiment of planting some of the fry of the Restigouche salmon, which had shown such satisfactory results in the capture of adult fish of that family from previous years' plantings, was renewed during the past year, by a further transfer of about 40,000 Restigouche fry to the waters of the North-West Miramichi River.

Difficulties attended the collection of the usual supplies of eggs here during the past autumn. Although the parent salmon were very plentiful in the river, yet the extreme freshets which prevailed last season prevented the possibility of capturing the necessary stock of salmon to fill the hatchery with its accustomed quantity of eggs. It was only possible to net 195 fish, of which 111 were females, which gave 810,000 eggs. This number was much below that of 1889.

It is proposed to overcome this difficulty of capturing parent salmon during the heavy autumn freshets, by making preparations to catch them from the earlier runs and impound them till required, in like manner as at some of the other hatcheries where the system has been worked out with the utmost satisfaction.

During the past season certain necessary repairs have been made to the buildings, dams and other appliances, which will place this institution in proper working condition for many years to come.

Appended to the main report will be found many certificates from the most reliable sources to show the undoubted benefits which have resulted from the putting out of young salmon from this hatchery during former years.

7.—RESTIGOUCHE HATCHERY, PROVINCE OF QUEBEC.

The output of salmon fry from this hatchery was considerably in excess of any previous year, the number reached 2,396,000. They were planted largely in the Main Restigouche River, and also in many of its tributaries, and in other rivers elsewhere as follows:—

The Kedgwick, Upsulquitch, Metapedia, Caraquet, Jacquet, Nipisiquit, Middle and Miramichi. In addition to this number of young salmon, there were also transferred to the St. John River Hatchery 500,000 semi-hatched ova, thus making a grand total of 2,869,000 salmon fry and eyed eggs put out of the Restigouche Hatchery in 1890.

The quantity of eggs procured the past season of 1890 was far below that of 1889, caused by the first and largest run of salmon having passed up river during the prevalence of an extraordinary high freshet, which prevented the setting or working of the nets in the river. Only 307 fish were secured, 175 of these were females, which gave 1,800,000, a trifle over half obtained in 1889.

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The Departmental net hitherto set at the Mission Point Station has not done as well as was expected; it is therefore proposed to remove from this station further up the river to Pitt's Creek nearer to the reservoir, where a trial was made late in the season with a certain amount of success.

The several nets in use will require repairing, and a new net will also be required for next season. The reservoir will require strengthening with new timbers, cross-ties, stakes, and wire netting, at a probable cost of \$200; certain other repairs will also be required to the hatchery, such as pointing the roof, plastering the ceilings to give additional warmth, more distributing cans and other matters costing about \$200. The estuary and coast salmon fisheries were not quite up to the average, by reason of the unprecedented freshets from the river, which carried away and otherwise damaged these nets. Fly fishing, however, up river after the subsidence of the floods was never known to be better. The pools and river generally were unusually full of fish. From the improvement of angling on the river of late years property has risen to almost fabulous prices, caused by the prevailing opinion of those well acquainted with the subject, from the protection given for the natural spawning of the salmon, and the very liberal annual planting of young fry from the Restigouche Hatchery.

8.—GASPÉ HATCHERY, PROVINCE OF QUEBEC.

The number of fry bred at this hatchery in the season of 1890 was 806,000. They were planted in the St. John, York and Dartmouth Rivers, all emptying into the Gaspé Bay, near to where the hatchery is located. The planting was performed satisfactorily during June and July.

The Departmental nets for netting parent fish were kept down from 4th June till 1st September. The total number of salmon caught and purchased was 83, of these 50 were females and gave 620,000 eggs. These were supplemented by a further number of 400,000 collected from salmon taken in the York River later in the fall, making a total of 1,020,000.

The hatchery is reported to be in first-class condition, excepting painting on the outside which will cost about \$30. Considerable damage was done to the trap-nets and reservoirs, from the great freshet which appears to have prevailed generally throughout the Provinces. These repairs will require early attention at the coming spring.

Net fishing and angling are reported to have been satisfactory. There were a large number of nets set in the tidal waters, and they had a successful year. They make a heavy drain upon the rivers. With this improved catch the conclusion is that the work of protection and propagation is conferring benefits to those engaged in the salmon industry.

9.—TADOUSSAC HATCHERY, PROVINCE OF QUEBEC.

One million seven hundred thousand salmon fry were put out of this hatchery last year in the several tributaries of the Saguenay River and in some small lakes which discharge into the St. Lawrence. A steam tug was employed to convey the fry to the Upper Saguenay. They were all put out under the personal oversight of the officer in charge of the hatchery.

The Departmental nets were put out in May; the first fish were caught on the 27th, and, up to the 3rd July, 980 salmon were caught, when the nets were taken up by instructions. If the nets had been kept down the rest of the season the probabilities are that this number might have been nearly doubled, as about the beginning and during the month of July the salmon principally pass up river. The Sunday close time was kept, giving only 33 days' fishing, in which an average daily catch of 30 salmon was made. This catch is almost unprecedented. Some days the catch ran thus: 71, 81, 93, 102, the highest being 111. Of the 980 captured only 325 were kept for hatching purposes; the remaining 655 were set at liberty without any

injury. Of the number kept 185 were females, from which an average of about 10,000 eggs each were gathered, making a total of 1,879,000 ova laid down in the hatchery and completing the work of spawning on the 15th November.

The increase in the catch of salmon in that immediate district is truly phenomenal. With exactly the same number of nets set by fishermen the increase has been very great from 1886 to 1890. In 1886, 14,790 lbs. were taken; in 1890, 61,000 lbs. were caught, and this does not cover the actual quantities, as the fishermen invariably give in smaller returns in order to prevent, as they think, an increase in their license fees. The accounts from the anglers and guardians of the St. Margaret River, especially, are most gratifying as to the immense number of salmon seen in it: they report seeing and counting 100 salmon in passing through a single pool. The guardians on the other rivers also give similar pleasing accounts of the great numbers of fish seen by them. Even as far up as the River Shipshaw, at the upper waters of the Saguenay, salmon were reported as plentiful. Large schools of small sized salmon, about 25 inches long, were seen passing up and down the Saguenay, in the neighbourhood of the wharf near the hatchery. About 100 of these on the 18th November came into the reservoir at the hatchery and mixed with some of the parent salmon which had not yet left the pond. The evidence from all quarters was most satisfactory.

Extensive repairs are necessary to make the present old dilapidated hatchery suitable to carry on the work in the future. Decay has set in throughout in the foundations of the building, which rest largely upon slabs built up from the refuse which collect. When the building was originally run as a saw mill,

The proposition made by the officer in charge regarding the hatchery is entitled to the favourable consideration of the Department, namely, to dispense with any further expenditure upon the old building at Tadoussac and put up a new one at or near Chicoutimi on the Shipshaw River, where all desirable conveniences are to be had, both for hatching and distributing purposes, and where the results would be more beneficially and economically experienced than is the case at the present site at Tadoussac.

10.—MAGOG HATCHERY, PROVINCE OF QUEBEC.

This hatchery is supplied with its quota of eggs from the Newcastle and Sandwich establishments in Ontario. From the semi-hatched ova obtained in this way, some 3,900,000 fry of the whitefish and salmon trout were hatched and put out of the Magog Hatchery into the lakes in the Counties of Megantic, Stanstead, Brome and Sherbrooke.

Reports from fishermen and others living along the lakes go to show that an increase in the catch of salmon trout and whitefish is apparent. The increase in the salmon trout is slower on account of the extensive poaching carried on in the large areas which the present too limited number of guardians have to oversee. Some small repairs and some additional apparatus will be required for the hatchery.

11.—NEWCASTLE HATCHERY, PROVINCE OF ONTARIO.

The work in this primary institution for artificial fish culture in Canada was quite successful during the past year. There were transferred from this hatchery to the Lower Province nurseries 5,500,000 semi-hatched eggs of the salmon trout, speckled trout and whitefish species. There were also distributed in numerous lakes, rivers and streams in Ontario 7,841,000 fry of the salmon trout, speckled trout and whitefish, making a grand total of 13,441,000 fry and eyed-eggs put out of the Newcastle establishment, all of which are reported to have been distributed in good condition. The several waters in which they are planted are particularly described in the Newcastle report in the appendix.

Certain repairs were made which will make the hatchery efficient for work for a length of time; the outside of the building, however, requires re-painting, as many years have passed since it was first painted. This should be done in the coming

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The work of collecting supplies of ova at Wiarton for Newcastle, as well as the hatcheries in the Lower Provinces, resulted most successfully; some difficulty was experienced in procuring assistance for setting the pound-nets, as few experts at this class of work are to be found. It is expected that one of the regular employees of the hatchery from the experience gained will be able to perform this work another season.

The quantity of ova collected at Wiarton the past season was very large and was satisfactorily obtained; upwards of 11,000,000 were collected between the 1st and 23rd November; all of them were safely transported by railway under the immediate charge of an expert, and deposited in the hatching troughs at the Newcastle establishment, where it is reported they are progressing very favourably. The diary connected with the work at Wiarton will be found attached to Mr. C. Wilmot's report in the appendices.

The usual quantities of eyed eggs will be transferred from Newcastle to the hatcheries of the Maritime Provinces at the proper time for their safe transport.

12.—SANDWICH HATCHERY, PROVINCE OF ONTARIO.

From the quantity of whitefish ova deposited in this hatchery in the fall of 1889, 15,000,000 of them in a semi-hatched state, were transferred to other hatcheries in the east, and 30,000,000 produced fry, which were liberally planted in the waters of Lakes Huron, Erie, Ontario and St. Clair, and in the Detroit River. They were put out in good condition, and will no doubt further add to the benefits which have already been experienced by similar deposits of fry in these waters during former years.

In addition to the above described whitefish product from this hatchery, there were also hatched and distributed from it 22,000,000 of pickerel (*doré*) fry; these were also planted in well adapted waters for their after growth. The total of whitefish and pickerel put out of the Sandwich nursery during the season of 1890 amounted to 67,000,000. Improvements which were made during the past summer, will give accommodation for putting down upwards of 100,000,000 of whitefish ova during the breeding season of these fish in the autumn, exclusive of such numbers of the pickerel eggs as may be obtained during their spawning time in the spring of the year. The improvements include the general overhauling of the hatching room, by which its whole area has been utilised for hatching purposes; and specially in the setting up of 600 automatic incubators in place of 350 formerly worked; together with other necessary appliances to facilitate more extended hatching capacity in the establishment generally. These improvements were completed in time for last autumn's work, and have been found to answer the purpose admirably.

The quantities of eggs collected and put in the hatchery during 1890, were as follows:—Whitefish eggs, 90,000,000 in the month of November last; and of pickerel, in April last, 32,000,000. The product of the pickerel eggs have already been referred to, as being put out last spring; whilst the 90,000,000 of whitefish eggs whose period of incubation extends through the winter months, cannot be accounted for till the spring of 1891.

The method of procuring whitefish eggs last fall was more satisfactorily performed, and resulted in obtaining about one-third more in number than in 1889. The quantities being in 1888, 40,000,000; in 1889, 70,000,000, and in 1890, 90,000,000. This satisfactory result was brought about by the Department taking full control of the whitefish fisheries on the Detroit River during the "close season" of the month of November, and enforcing the close time as against all fishermen; and by carrying on the work under the management of the officer in charge of the hatchery. This system should be continued in the future, but upon even a more exclusive plan than in 1890, by which the "close season" shall be inviolably kept by all—and the Department to exercise its own right of capturing sufficient supplies of parent fish, by its own officers, with the necessary plant of nets, and other material requisite to fully perform the work.

Herring which were a short time ago very abundant in the Detroit waters, are showing evident signs of decrease, and the officer at Sandwich suggests the propriety of applying the artificial methods of propagation to sustain if possible this declining fish product of that section of the country. The decline of the sturgeon fishery is also being seriously felt and similar means might also be instituted by which this fish might not become too rapidly depleted, as the present appearances would seem to indicate.

13.—OTTAWA HATCHERY, PROVINCE OF ONTARIO.

The work of artificial fish culture in the city of Ottawa was only practically commenced during the past year, by the hatching and distributing of several millions of fish of various species.

This institution was established at the seat of Government with the view of giving more particular insight into the enterprise of propagating fish by artificial means, and exemplifying to the Canadian public visiting Ottawa, the feasibility of this work, as an important factor for stocking lakes, rivers and other waters, with particular kinds of fish, which had either become greatly reduced from their own original source, or in which they were not hitherto known.

This nursery and Fishery Exhibit connected with it, has become an acknowledged educator not only for the general public, but specially for the citizens of Ottawa and the inhabitants of the surrounding districts, who had not hitherto opportunity of visiting and personally witnessing the practical working of an institution of this kind; the attraction and popularity of which is fully shown by the register book, in which the names of no less than 22,800 persons are recorded as visitors to this hatchery during the first year in which it has been in operation.

The system adopted here is to obtain the requisite supplies of fish eggs in the semi-hatched state, from the Newcastle and Sandwich nurseries. The ova procured are of the species of fish best adapted for the waters in the surrounding counties, and when the fry are hatched out, they are distributed throughout the lakes and streams which may be considered best adapted for them, or where the requests of public bodies, or individuals, may have been made to get them.

The establishment is fitted up on a much less extensive scale than at the other hatcheries, by reason of the space in the lower flat of the fishery exhibition building being somewhat limited. The arrangements are for hatching salmon, trout, speckled trout and whitefish; the appliances for hatching ova are of the latest, and most approved descriptions. There are also a number of aquaria with glass sides in this hatchery put up with the view to exhibit living fish of various kinds and sizes. Thus showing in the establishment the ova with the rudimentary form of the fry inside whilst hatching, and the after growth of the young fish in the aquaria up to certain after stages in its life.

The fish put out of this Ottawa Hatchery during the first year of its operations were as follows:—

Salmon fry, sea salmon.....	112,000
Salmon trout fry.....	1,051,000
Speckled trout fry.....	70,000
Whitefish fry.....	4,500,000
Total.....	<u>5,733,000</u>

These were distributed in several lakes and streams in the counties in the Ottawa valley.

There are several improvements and additional fixtures yet to be made in this institution to bring it up to the standard it should occupy as a complete representation of fish cultural work at the seat of Government of Canada.

Arrangements are in progress by which supplies of eggs of various kinds of fish will in due time be transferred from Newcastle and elsewhere to fully stock the Ottawa Hatchery for another season's work.

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6.—LOBSTERS.

Special report by Mr. Wilmot.

LOBSTERS AND THEIR ARTIFICIAL PROPAGATION.

Connected with this subject will be found an account of a visit to Newfoundland, with the view to obtain practical knowledge regarding the methods of carrying on artificial lobster hatching by the Government of that country, under the direct management of Adolpe Neilsen, an expert in this work, formerly of Norway.

There will also be found herewith particulars relating to another report on the selection of a site for the erection of an establishment for the artificial breeding of lobsters in Canada.

As the result of these two reports, it may be here mentioned that the views submitted, and the site as selected at Bayview, on the Northumberland Strait, near the harbour of Pictou, in Nova Scotia, having been sanctioned by the Government, all necessary preparations are now being made to enter upon the work of lobster breeding next season, during the months of June, July, or during such periods as may be found most advantageous to carry on the enterprise.

The ground has been purchased and the contracts have been let for the erection of the building and the construction of a pier alongside, as well as the putting in of the requisite machinery. The breeding apparatus is being provided for also, and unless from some unforeseen causes, the whole establishment will be in readiness for actual work by the middle of May next.

In connection with this primary nursery for rearing this valuable crustacean at Bay View, it is also in contemplation to introduce amongst the lobster fishermen and canning companies a description of floating incubator, which has been used in Newfoundland during the past season with the most satisfactory results. This floating incubator is simply and cheaply made, and from the accounts given of it by Mr. Neilsen it can be readily worked in almost any sheltered bay or inlet along the coast by any ordinary intelligent fisherman, or other person who may feel desirous of aiding either in a private or public way in the cultivation of the lobster. Mr. Neilsen, at my request, is about sending on one of these incubators as a sample, from which a number may be constructed, with a view to distributing some of them amongst such fishermen and canners as may be disposed to work them, or to aid in resuscitating the lobster industry, which, from over-fishing, is now making such rapid strides towards depletion. In these reports will also be found matter relating to the lobster family which may be considered of interest as showing the vast amount of destruction going on by the present modes adopted in the killing of immature, undersized and berried lobsters.

DILDO ISLAND FISH HATCHERY, NEWFOUNDLAND.

Official instructions were given to me to proceed to Newfoundland, with the view to obtain information regarding the artificial breeding of lobsters, where this industry has been carried on under the patronage and support of the Government of that colony by Mr. Adolph Neilsen, an expert in the science of artificial fish culture, whose practical application to the subject in Norway had made him prominent there in cod and lobster propagation.

The evidently declining state of the codfish in and around the coasts and bays of Newfoundland induced the Government of that Island to enter upon the work of resuscitating these fisheries by introducing the artificial methods of propagation, which, it appears, had been practised with much success in Norway, and where the breeding of lobsters also had been carried on with satisfactory results; and hence it was that the services of Mr. Neilsen were obtained to introduce cod and lobster breeding into the waters of Newfoundland.

From the last year's published reports of the Fishery Commission of that Island, it would appear that this work had been most satisfactory, and from the knowledge

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already gained in the matter it was confidently expected that many millions of the young of the cod and the lobster families would be turned out of the Trinity Bay hatchery in future years.

To obtain an insight into the working of this industry from an ocular and practical standpoint, and with a view to its utilization in Canada, was the object of my mission to Dildo Island, on Trinity Bay, where the hatchery is erected, a distance of 100 miles from the city of St. Johns.

Leaving Ottawa on the 5th of June, and taking the most direct route, St. Johns, Nfld., was reached on the 11th, thence to Trinity Bay, arriving at Dildo Island on the 12th June, and remaining there till the 16th. During this stay every facility was given me by Mr. Neilson to inspect, note and watch the operations going on in collecting codfish eggs, and the *modus operandi* of hatching them. Lobster hatching had not yet commenced; extreme cold weather had somewhat delayed the collection of these eggs, but the delivery of some 700 lobsters at a canning factory near by gave me ample evidence of the particulars relating to the methods pursued for obtaining the ova and of placing them on the apparatus used for hatching them.

Full particulars were also taken by me of the class of building, and of the several appliances connected with it; notes were also taken of all matters which might be found useful for the carrying out of a similar work in Canada, and from what I saw and learned it may be confidently concluded that no serious difficulties can arise to prevent the artificial breeding of lobsters to almost any extent, in any of our maritime Provinces, if judicious locations are chosen and proper care given to prosecute the work.

The great object at starting the undertaking should be to select a suitable point, somewhere on the coast, where the sea water will be strongly saline, free from sedimentary matter, and of low temperature, and, if possible, in the immediate vicinity to places where lobsters are numerously taken to supply canning factories, thus affording the necessary means for securing full supplies of eggs, either from the lobster trappers or from the factories, where usually large numbers of these fish are daily brought in for canning purposes.

Such a location being chosen (and there are no doubt, many of them on the long extent of our coasts), the necessary buildings and appliances should be put up, with the view to permanency; and whilst it may not be contemplated to enter upon the work to the fullest extent required at once, nevertheless the buildings, appliances and all surroundings should be calculated upon such a scale as to afford the facilities for turning out annually lobster fry by the hundreds of millions, in order that the artificial propagation may in a certain degree be somewhat in keeping with the natural production. With this combination, to be strongly reinforced annually by enlarged artificial propagation, with rigid enforcement of proper close seasons for natural breeding, and preventing the killing of immature fish, the recuperation and healthy sustentation of the lobster industries of the country would be happily experienced by those engaged in the lobster trade, as well as by the country at large. But with the present reckless and unlimited scale in the destruction of the millions upon millions of fruitful eggs, with the embryo lobsters just ready to drop from the bodies of the parent fish, and the equally wanton and unwise destruction of the young, undersized lobster, comprising, perhaps, one-third of the total of all going into the factories—too young to reproduce their species—must, in a short time, prove fatal, and eventually exterminate the whole lobster industry of Canada.

DESCRIPTION OF THE BUILDINGS AND APPARATUS.

A brief description of the buildings and appliances generally, connected with the cod and lobster hatchery at the Dildo Island establishment, is herewith given:

The main building is a frame and wooden structure, 75 feet long by 45 feet in width, and two stories in height; the lower flat is principally devoted to breeding purposes, the whole of the floor area being taken up with tanks containing salt water, and hatching apparatus of many kinds adapted for cod and lobster hatching. Glass incubators, as are used in Norway and in the United States, are excit-

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sively operated here for hatching the codfish eggs ; whilst the apparatus for lobster hatching consists of many contrivances. The certainty as to which of them is best is not yet fully determined by the Newfoundland Superintendent.

The "Wilmot Automatic Glass Incubator," now in general use in Canada and other countries for hatching the eggs of the Coregoni family, had not been applied to the Dildo hatchery. Mr. Neilsen was, however, of the impression that this jar would be well adapted for the lobster eggs, and he expressed a wish to make a trial of them, if possible, the present season. I therefore, on my return through Halifax, instructed the officer in charge of the Bedford hatchery to forward half a dozen of those jars to Mr. Neilsen, who will make full trial of them and acquaint me of the result. I am of opinion the "Wilmot Jar" can be made to answer the purpose well. This opinion is corroborated by Col. MacDonald, Chief of the United States Fish Commissioners, who, in previous correspondence, has informed me that, having used these jars, he found them suitable for hatching the lobster eggs.

A portion of the lower flat is partitioned off from the hatching room for the engine room, boiler, pumping apparatus, &c., which draws the salt water through wooden pipes some 320 feet from 5 fathoms depth of water in the little cove formed by projecting rocky points in Trinity Bay. The sea water, which is very pure and cold, is forced through this pipe into a large tub or reservoir on the second floor of the building, from which it is run off through a series of wooden pipes and taps into numerous small incubating tanks, in which the glass jars containing the eggs are placed. Three of these tanks are placed steplike, one after the other ; and the water is syphoned from one into the other, by which means a continuous upward and downward flow of water is kept up through and amongst the eggs in the glass jars during the whole period of hatching the cod eggs.

The motive power to carry on this work consists of a steam boiler of sufficient capacity to work an 8-horse power "Blake Duplex Pump," capable of supplying 200 gallons per minute if required.

The upper flat of the building is divided off into rooms, such as office, bed rooms, dining room and kitchen, &c. All the employés, some ten in number, are lodged and boarded on the premises. The fresh water for the boiler and for domestic purposes is obtained from a small spring well sunk in rear of the house.

Fronting the hatchery, which is within a few feet of the edge of the cove beach, a short pier or wharf is built out a short distance, making a safe shelter and landing place for the steam launch and other crafts connected with the work of the establishment. A part of this pier is so constructed as to form safe pens or reservoirs for keeping parents codfish, which may be brought in and found to be unripe to deliver their eggs at once.

A small steam launch is attached as an indispensable requisite in the working of this establishment for collecting codfish and lobster eggs from the fishing stations and canning factories, which are situate at various points here and there along the shores of Trinity Bay. The launch is also specially advantageous for the distribution of fry throughout Trinity Bay and elsewhere, where their transport is required.

An estimate of the cost of the Dildo hatchery, as furnished by the Superintendent in round figures, viz :—

Cost of building complete.....	\$2,500
Cost of boiler, engine and pump.....	1,600
Cost of machinery, incubators and other apparatus, including steam launch	3,400
Total.....	\$7,500

Maintenance.

60 tons coal for engine and launch at \$4.....	\$240
3 men as engineers—2 in hatchery, 1 in launch—at \$1.50 = \$135 per month for 3 months.....	810
3 men in hatchery at \$1 = \$90 for 6 months.....	540
4 men collecting fish eggs, at \$120 for 6 months.....	720
1 housekeeper and servant, at \$12.....	72
Total	<u>\$2,382</u>

The hatchery is supposed to be run from about 1st May till 1st November.

From the above cost of the Dildo hatchery, the following computation is made as to the probable cost of the construction and maintenance of a lobster hatchery, to be built in any of the maritime Provinces of Canada, thus:—

Say:

Cost of building (a summer one).....	\$1,500
Boiler, engine and pumps.....	1,000
Machinery, incubators, apparatus.....	1,000
Steam launch, &c. &c.....	1,500

Total..... \$5,000

NOTE.—The boiler, engine and pump at the Sandwich hatchery cost \$770.

Maintenance.

Say:

60 tons coal, engines and launch, at \$4.....	\$240
3 men, engineers—2 in hatchery, 1 in launch—at \$1.50 per diem = \$135 per month, say 3 months.....	405
4 men, collecting eggs and taking care of them in hatchery, at \$1.50 = \$6 per diem, or \$180 per month, for 3 months.....	540
Incidentals for engine and launch.....	315

Total..... \$1,500

At the Dildo hatchery six months are occupied in collecting and hatching cod and lobster eggs, the codfish taking up an earlier period than lobster. The period given for lobster breeding in Canada would be three months—say, June, July and August—therefore largely reducing the maintenance for an establishment in Canada as compared with cod and lobster breeding at Dildo.

The result of the within described inspection of the Dildo establishment for breeding codfish and lobsters and from experiments made in Norway and other countries in Europe, and also in the United States, is, that lobster breeding by the artificial method is not a difficult undertaking, and its application might be held to be more favourable and attend with better results in the maritime Provinces of Canada than in the countries above mentioned, from the fact that greater facilities are at hand in Canada for procuring the necessary supplies of the parent lobster, by which almost any quantity of their eggs could be secured, thus giving a goodly supply of seed, which, if properly husbanded and the crop well cared for afterwards by judicious legislation, would undoubtedly give to Canada a superiority over all other countries in the commercial traffic connected with the lobsters industry.

SELECTION OF A SITE FOR LOBSTER HATCHERY IN CANADA.

In connection with my inspection and report relative to the Dildo cod and lobster hatchery in Newfoundland, I desire also to report upon the selection of a site made by me for a lobster hatchery near the Cariboo Islands, on the Northumberland Straits, in the Province of Nova Scotia.

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After visiting the Dildo establishment in Newfoundland and returning to Halifax I considered it advisable to examine certain points of the shore of the Newfoundland Strait, in the vicinity of Cariboo Islands, where several lobster factories were located and where it had been represented to the Department that these islands near Pictou harbour gave promise of furnishing all the necessary conveniences for the establishment of a lobster hatchery. Leaving Halifax on the 23rd of June, I reached Pictou the same day, and learned that lobster fishing was being largely carried on along that coast, and that within a distance of some 20 miles there were then a dozen or more factories in full operation. Upon further enquiry I found out the names of the proprietors of most of them and their particular location, as follows:—

	Location.
1. Burnham & Morrell, Bayview factory.....	Mainland
2. Hamblin & Sons, Cariboo do	Cariboo Island
3. do	Tony River
4. Burnham & Morrell, Cape John.....	Cape John
5. do McDonald's Cove.....	McDonald's Cove
6. Hogg's factory.....	Pictou Island
7. do do	do
8. McClures factory.....	do

These were all situated in front of, and westward of Pictou harbour. There are also several other factories, some distance to the eastward of Pictou. These latter I did not visit, nor did I obtain any particulars regarding them except that, a pretty large amount of canning was done at each of them.

With this number of factories so near at hand, I concluded that an abundant supply of lobster eggs might be readily secured, in the event of a lobster hatchery being located somewhere in their neighbourhood, and where the requisites of shelter and purity of water were at hand, also, for the satisfactory working of such an establishment.

PROSPECTING FOR A SITE FOR THE HATCHERY.

Occasion was therefore taken to closely prospect the coast line from Pictou harbour westward to Cape John, some twenty-five miles, and also the shores of the Cariboo Islands to find, if possible, a convenient site for locating a hatchery. This was satisfactorily accomplished in selecting a well adapted spot, almost immediately alongside the Bayview factory, on the mainland, opposite to Little Cariboo Island—a place almost completely sheltered from any winds or storms which might prevail in the Strait outside.

Here the water is constantly in motion, and highly aerated, from the rapid running of the tides through the narrow passage (which separates Little Cariboo Island from the Mainland) into Cariboo Harbour, which extends westward many miles. This site, so well protected, is shown in red on the small tracing of the harbour and islands hereto appended. The conveniences of this spot are certainly most favorable, not only by reason of the sea water regularly flowing through the narrow inlet immediately in front, but also from the depth of water of some 4 and 5 fathoms within 100 feet of the shore, thus requiring only a short length of piping to draw the cold sea water into the building, which could be placed within 100 feet of the Bayview lobster factory, where certain supplies of eggs could always be depended upon. This site, furthermore, possesses the advantage of being centrally situated for the other factories westward, and for the 3 large factories on Pictou Island, only 6 miles out in the Strait. A hatchery here would, therefore, have no less than 8 large canning establishments to procure eggs from, and not counting the factories which are situated to the eastward of Pictou harbour. Another great advantage would be its closeness to the town of Pictou, only 4 miles distant, where ready means are at hand for procuring building material, and where engine and boiler making is carried on, having easy approach by railway and affording facilities for getting supplies of all kinds. Comprising all these advantages, this proposed site is a most desirable one to commence the enterprise of artificial lobster hatching in Canada.

In conversation with Mr. Neilsen, of the Dildo hatchery, Newfoundland, he was strong in the advocacy of pure, cold, strongly saline water for hatching cod and lobster eggs, and that the hatchery should by all means be as near as possible to lobster factories, to warrant full supplies of eggs; and that it should be in a sheltered place from the winds, so that the action of the storms would not stir up and roll the water, and cause sedimentary matter to be conveyed through the suction pipes into the hatching apparatus to foul the eggs.

A site at Cariboo harbour will possess these requisites and many more which the Dildo hatchery, from its remoteness from the inhabited parts, has not or cannot have. The temperature of the water, however, at Dildo, was 44°, whilst at Cariboo it was 58°; but as some ten days had elapsed between the trials at the two places, and hot weather had intervened, no doubt this difference in temperature would be greatly modified. I do not, however, think this would materially affect the case of hatching, as the natural habitat of the lobster at either places would adapt itself to the surroundings actually required for its propagation. Under all the circumstances, I feel safe in reiterating my former opinion, that the site at Lakeview is well adapted for artificial lobster hatching.

EGGS FOR THE HATCHERY—HOW OBTAINABLE.

Whilst the Lakeview site possesses the many advantages above related, I considered it advisable also to find out particulars regarding how the necessary supplies of eggs could be procured for it, if the hatchery were placed there. The result of this investigation gave evidence that almost unlimited quantities of lobster eggs could be secured from the several canning factories near by if satisfactory arrangements were entered into with the several proprietors owning them. Astonishing results were also brought out as to the wholesale destruction which was going on almost daily with the lobster by the method pursued at the several canning establishments which I visited, and from which I have formed my data for the calculations given below; and although only eight of (no doubt) the most extensive and best managed factories on the coast are included, I have no doubt that each factory throughout the several maritime Provinces is pursuing precisely the same course which, if allowed to continue, must sooner or later exterminate the lobster industry of the country.

To obtain knowledge for myself personally, as well as for your Department (if deemed worthy of consideration), I closely noted matters when visiting some of the lobster factories above named, with the view to learn particulars relating to the industry, and to make myself acquainted with the nature of the lobster, as to its re-productive powers, when mature or immature, its fecundity, and other characteristics of its nature, from which I could form an intelligent and reasonable conclusion regarding the natural and artificial production of them, and of the times and modes by which proper legislation might be framed for the present and future protection and maintenance of the lobster wealth of the country, which is now so rapidly declining.

REMARKS AFTER VISITING THE CANNING FACTORIES.

I found the proprietors and employés in every instance most willing to give me every information, and placing no restriction whatever in the way of preventing me from witnessing their operations, or from handling the lobsters in the various stages which they pass through in the work of being handled cooked and canned for the markets. The information almost volunteered to me by the cannery regarding the large daily catch, and pack of lobsters at the individual factories which I visited, as well as those which I could not readily reach, was to me somewhat surprising. It must be understood that, as a general rule, the packer buys the lobster from the trapper by weight, not by count—the price being 50 cents for the 100 lbs., which the trapper gets upon delivery at the pier or landing connected with the factory. The account of the daily receipts given me by the several proprietors was

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as follows, which covers the general daily average from the beginning of the season, about the 10th or 12th May, till the close of the season on 15th July:—

Proprietor.	Location.	No. of Lbs. Daily.
1. Morrell & Burnham.....	Bayview.....	10,000
2. Hamblin & Sons.....	Big Cariboo.....	14,000
3. do	Tony River.....	10,000
4. Burnham & Morrell.....	McDonald Cove.....	12,000
5. do	Cape John.....	15,000
6. Hogg's factory.....	Pictou Island.....	12,000
7. do	do	12,000
8. McClures factory.....	do	16,000
Total.....		<u>101,000</u>

These figures were given in round numbers by the proprietors. In one or two instances they were taken from their books.

In order to ascertain the number of lobsters comprised in these 101,000 lbs., it will be necessary to add about one-fourth to cover the great quantity of small sized ones, which are so numerously taken. This, then, would give a daily catch brought to these eight factories of 125,000 lobsters, say from 15th May to 15th July, which, if multiplied by the time, 60 days, would give a total of 7,500,000 taken during this part of the season.

It will now be necessary to make further search into this subject, in order to fully comprehend its destructive bearings upon lobster life and the industry connected with it. To do this properly this daily catch of 125,000 lobsters must be analyzed:

1. What proportion of this number would probably come under the term of "berried lobsters," or those taken contrary to the law? After the 15th or 20th of June large numbers of the lobsters are found heavily laden with almost matured eggs, in many instances ready to drop the embryos from their bodies.

2. What proportion of the 125,000 will be found to come under the legal standard of 9½ inches, and may be called immature, that is, not possessing the requisite functions of nature to enable them to reproduce their species? My observations and examinations of several hundred specimens led me to conclude that a very small proportion indeed under 9 inches are "berried" or able to propagate their young; and that very few, if any, under 8 inches have their organs of development sufficiently matured to enable them to be "berried" or reproduce their kind.

Now, taking these views regarding "berried" and "undersized or immature" lobsters to be correct in the main, or even approximately so, the following figures will assuredly show the immense destruction that is continually taking place throughout the whole country illegally, and otherwise, in connection with the lobster business:

Thus, in this case, say the daily catch to be.....	125,000
Deduct ¼ immature and undersize is.....	31,250
Balance to be called full size.....	<u>93,750</u>
One-half of these may be called females	46,875
Take off ¼ as unfit for breeding.....	11,718
Leaving of females	35,157
Scientists give an average of *20,000 each female....	<u>20,000</u>
Total eggs from females.....	<u>703,140,000</u>

* The writer has since learned from Prof. Neilson that 20,000 is below the average.

This 703,140,000 would be the daily loss of lobster eggs occasioned by the taking of "berried females" contrary to law, if it went on during the whole season of two months. But it must be borne in mind that whilst the whole season covers two months, the real time in which the "berried female" is principally taken commences about the latter half of the season, say 15th or 20th June, and continues till 15th July.

Now, if the daily products of fruit-bearing eggs is 703,140,000, and the actual time in which they are largely found on the female is from 20th June to 15th July in the open fishing season, 25 days are actually employed by the fishermen in catching "berried" or illegal lobsters—to say that all "berried" fish are put back into the sea, and that they are not used in the factories, would be simply a distortion of the truth).

The product of this loss at those eight factories alone would be the multiplication of 703,140,000 by 25 days, giving a total of upwards of *seventeen billions five hundred and seventy-eight millions* (17,578,500,000) of lobster eggs and fry, which the present Departmental regulation contemplates saving by not permitting "berried" females to be taken. Yet the regulation is not enforced by the officers; it is violated, and is bringing about speedy extermination of the lobster industry.

It is by such an application of the subject, and by such calculations in relation to it that the immense loss can be comprehended that is now going on in connection with the lobster business of the country; and when it is found that so much destruction is caused by the operations of the within-mentioned eight factories on a part only of the Strait of Northumberland, what must it be with all the other canneries, some 500 in number, along the whole extent of the coasts of the maritime Provinces, where, no doubt, the same ruinous course is being pursued at each of them. The result must soon be to utterly destroy the industry and exterminate the lobster from our shores, and this calamity is already being too truly experienced on many parts of the coast.

From the within related facts, it is fairly shown that in connection with the carrying on of eight lobster factories no less than an average of 1,875,000 immature, undersized lobsters are illegally killed during the two months, and at the lowest calculation some 17,578,500,000 matured lobster eggs, with embryos in them, are cast into the boiling vats of the canneries, all in violation of the law, too. It, therefore, becomes necessary that this wanton destruction of these valuable crustaceans should be stayed, before it is too late to prevent their final extermination.

To give some particulars in proof of the statement that lobsters under 9 or 8½ inches are immature and incapable of reproducing their species, I may state that I opened many of these undersized lobsters at three of the factories, and found no rudimentary signs of fecundity inside or outside of their bodies; while in the larger-sized lobster, eggs were invariably found either inside the body or on the swimmerets, under the tail outside. This circumstance convinced me of the wisdom of the regulation which establishes the legal length at 9½ inches (which, in reality, should be 10½ or 11 inches). It also impressed upon me the great necessity that existed for your Department in enforcing the 9½-inch regulation to the very letter, and preventing the vast number of undersized, immature fish from being caught in the traps, and daily canned in the factories.

As further evidence of the unfertility of lobsters under 8½ inches, I requested the general agent of one of the large packing companies to send me a box that would hold about 50 lobsters of different sizes under 9 inches, to be forwarded to Ottawa, C.O.D., with the view that I might more closely examine them, to discover whether they bore eggs within or outside their bodies. These were very promptly and kindly sent on, as requested. They were boiled before leaving the factory, in order that they would arrive in Ottawa in good condition. Nearly all of them did. I opened all these lobsters personally, and thoroughly examined them, with the result as shown in the notes taken of each and described in the paper herewith attached. The examination of some of these lobsters was witnessed by other persons also. Some whole specimens and parts of others were put in alcohol for obser-

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vation in the Museum. It was found in these specimens that no perceptible signs of fertility were to be discovered in any of the lobsters under 8½ inches in length. On one or two samples that measured plump 8½ inches some eggs were found on the outside of the body.

The following are the particulars relating to an examination made with the lot of lobsters received from the Bayview factory, Cariboo Islands, N.S.:-

No. of Lobsters.	Length of Lobsters.	Square of Body.	Remarks.
	Inches.	Inches.	
4	6½	1¼	No evidence whatever of eggs inside or outside.
3	7	1¾	do do
6	7½	1½	do do
9	8	1¾	do do
2	8½	1¾	do do
*6	8½	1¾	"Berried" eggs outside on some of them.
8	9	2	Two berried; rest apparently males. No eggs.

1	2	3	4	5	6

Scale of 6 inches.

*It must be considered somewhat exceptional to find any considerable number of 8½ inch lobsters bearing eggs—or, at least, such was the result of a pretty general examination made of a large number of lobsters received at the canning factories

referred to. It is possible, however, that in closely overhauling many thousand a few "berried" $\frac{3}{4}$ -inch lobsters might be found, and this may have been the case with those sent to Ottawa for examination.

Since the above described examinations were made I have received information from Prof. Adolphe Neilsen, the Norwegian expert in lobster and cod hatching now employed by the Newfoundland Government to manage this industry, and who has been so eminently successful in hatching and turning out upwards of four hundred millions of young lobsters during the past season in the Newfoundland waters by the artificial methods. He thus writes: "As it may be of use to you, I will give you the number of eggs I have found on the lobsters here in Newfoundland, after the most careful count. Thus:—

A 11-inch lobster carries....	22,154	eggs.
11 $\frac{1}{2}$ do do	22,600	do
12 do do	23,080	do
12 $\frac{1}{2}$ do do	23,260	do
12 $\frac{3}{4}$ do do	23,680	do
13 do do	24,100	do
14 do do	25,000	do

The inference to be drawn from Mr. Neilson's practical knowledge of the lobster family is, that he cannot, or that he does not obtain matured eggs from lobsters under 11 inches. It may be possible that some eggs may be got from lobsters under that size, but he does not consider it worthy of mention in his correspondence. He furthermore says: "'Berried' lobsters were seldom found under 8 inches, and more frequently over than under 10 inches."

In my examination of the lobsters their size was considered, and close measurements made as illustrated in the above sketch. From the squares shown of the body size of the several lobsters examined a somewhat proper conclusion may be drawn for regulating the width between the bars or slats of the lobster traps, so that in adopting any regulations regarding legal lobster traps a space shall be left sufficiently wide to allow small-sized lobsters to pass through, and thus prevent the unlimited killing of under-sized and immature fish.

CONCLUSION.

If in the work of nature it was ordained that this wonderful fecundity of the lobster family was requisite to keep up the balance of nature in the general line of marine animals; and if in the wisdom of the Legislature of this country judicious laws have been enacted intended to protect and reasonably sustain this balance of nature, yet give a fair and legitimate supply of this much desired crustacean for man's use and traffic, why should the laws of nature and of the country be allowed to be over-ridden, and be made of no effect, to gratify the selfish desires of a few persons, for their own immediate aggrandisement, and who also advance special pleas and give erroneous statements regarding the nature and habits of the lobster, with the view simply to obtain more extended privileges for carrying on the work of ruination to the lobster industries of the country?

Surely the sad experience which other countries have already realized by allowing the unrestricted killing of this valuable crustacean should give timely warning to Canada, and cause her to put forth her energies to preserve and maintain in her waters the lobster wealth which she now so largely possesses over almost any other country.

The remedy and means are already to hand, which, if strictly enforced, would yet preserve the lobster industry, and maintain it in a large degree, both for the present and the future:

By a determined enforcement of a properly selected close time;

By the absolute prevention of the killing of under-sized and immature lobsters;

By placing all lobster trappers and packers under license surveillance, with such regulations as will effectually stop the present wicked and destructive methods

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carried on in connection with the lobster business, and by supplementing their natural production by entering upon an extensive plan of artificial propagation.

If these means were enforced by parliamentary enactments, and not by Orders in Council, the present constant importuning of the Department would be prevented by interested individuals, companies and representatives from localities, all of whom are constantly pressing for changes to be made in the close season and regulations regarding lobsters from their own local and selfish standpoints, irrespective of the general requirements of the public at large for the preservation and maintenance of the lobster wealth of the country.

Appended hereto will be found a plan of that portion of the Strait where the site for a hatchery has been selected, on which are also shown the locations of the present lobster factories which are within reasonable limits for securing supplies of lobster eggs for the contemplated hatchery. The names of the proprietors of the factories, with the daily catch of lobsters at each, are also shown.

IRREGULARITIES CONNECTED WITH THE CANADIAN LOBSTER TRADE.

There is an unjust and discriminating system allowed to be carried on in favour of the foreign packer as against the Canadian packer and the trade interests of the Dominion.

Some of the lobster packing companies carrying on the canning business in the Maritime Provinces are only temporary residents, being actual residents and citizens of the United States, where they also carry on the lobster-packing business quite extensively. These American companies have been in existence in various parts of the United States for many years, and have established themselves in the lobster industry under well-known "trade marks," represented by brilliantly-got-up labels affixed to each package put up by them, thus conspicuously advertising their goods, and the country in which they are produced, to the general consumer throughout almost every part of the globe where this edible crustacean is eaten.

Finding by over-fishing, and the destructive methods adopted in killing the lobster, which has been permitted by the authorities in the United States, the lobster crop has almost come to an end, these companies have, therefore, in many cases established themselves in the lobster packing business at many important points all along the coasts of the Provinces of Nova Scotia, New Brunswick and Prince Edward Island, where they have found the lobster crop to be far more abundant than in their own country. There they carry on an evidently Canadian industry from the product of Canadian waters, this might not be considered of such an objectionable character if deception, or, in fact, fraud, were not practised, by misrepresenting this actual lobster wealth of the Canadian waters, by advertising it to the world by their "trade marks" and labels as the product of the waters of the United States.

But a still more iniquitous system is also practised, when all the superior qualities of the lobster packages are labelled as the product of American waters, and the inferior qualities are labelled as the product of Canadian waters, whilst all are canned in the same factory and all are caught in Canadian waters.

This evidently irregular and discriminating proceeding in favour of the American lobster packers carrying on the canning business in Canada should be stopped, as being not only injurious to the resident Canadian packer, but also damaging to the commercial interest of the Dominion, in allowing a fraudulent advertisement of an extensive article of trade to go forth to the world at large as the growth and product of the United States, when in reality it is wholly Canadian. I hereto append to my report the following extracts regarding lobster culture in Newfoundland and in the United States.

SUCCESSFUL OPERATIONS IN LOBSTER AND COD HATCHERY, NEWFOUNDLAND.

MR. NEILSEN'S REPORT.

At a meeting of the Executive Committee of the Fisheries Commission on the 24th instant, Mr. Nielsen presented his report on lobster hatching for the present season. From this it appeared that at Dildo hatchery, fifteen millions of lobsters had been hatched and planted. Returns received from nine of the

hatching stations showed that three hundred and sixty-five millions of lobsters had been hatched and set free in the waters. These stations were distributed around Fortune, Placentia, Conception, Trinity and Bonavista Bays. At each station thirty-six floating incubators were employed. The eggs were obtained at the different lobster factories, and would otherwise have been destroyed. The female lobster, as is well known, carries her eggs in a fertilized state under her tail. Before the lobsters are thrown into the boilers these eggs are carefully removed by the men in charge of the incubators and brought to life; and the young have the same chance of surviving as if produced by the natural process and liberated in the waters. There is thus a clear gain of what would otherwise have been devoted to destruction.

Three stations in Green Bay, each having thirty-six incubators, are yet to be heard from. Should they have been as successful as the others it will be found that they have hatched 116,000,000. The result of the whole, in that case, would be, this season, that 480,000,000 of young lobsters have been hatched and planted in the waters of our bays, to sustain this great and valuable fishery. Who will deny after this that the Fisheries Commission is doing a good work?

This is not all. The fishermen around Dildo and in the various arms of Trinity Bay report having seen lately enormous numbers of tom-cods of a much smaller size than they had ever seen before—in fact, not so much as half the usual size. The reports come from various quarters and from a considerable number of fishermen. Mr. Neilsen has verified the reports, and seen the young cod himself, which he considers are beyond doubt the product of his hatchery, the young cod fry which he planted in the early part of the summer having reached this stage of growth. They are present in enormous numbers. This news is of the highest importance, as it gives abundant promise of success in the present effort to re-stock our exhausted waters. It corroborates the experience of the American Fisheries Commission, who have succeeded, in three years, in creating an abundance of codfish, off a portion of the coast of Massachusetts, where till recently there were none, by artificial propagation. Cod-hatching is now proved to be a great success.

COD AND LOBSTER HATCHING.

(From Cape Anne "Advertiser," U. S.)

The fish hatchery on Ten Pound Island is in full tide of successful operation, all but three or four boxes being full. Some seven millions baby cod have recently been liberated, and there are now twenty-six million eggs in the boxes. The Commission's agents go out in shore boats to secure fresh eggs, pressing the spawn and milt from whatever ripe fish are taken, and keeping it in proper condition until they come in. Any immediate overplus of spawn will probably be taken to Wood's Holl.

The hatching of codfish, haddock, &c., first attempted in this country at Gloucester, during the visit of the U. S. Fish Commission here in the summer of 1878, has passed beyond the experimental stage to that of demonstrated success. Large quantities of codfish have been hatched at Gloucester and Wood's Holl, and the benefit has already been seen in the fishing grounds off Cape Ann and at Nantucket Shoals. Last summer and fall many young codfish were taken in the traps and weirs, and the school of fish now being caught off shore are of a size and character to indicate that they are the result of this artificial hatchery.

The restocking of the shore grounds is proving a bonanza to the local fishermen. It is reported that the schooner "Dixie," up to Saturday, had stocked \$3,000 in seven weeks, her crew sharing \$344. Schooner "Lottie S. Haskins" took 4,000 lbs. on her first set in Ipswich Bay. The little sloop "Messenger" stocked \$40 the first day's fishing; and the schooner "William H. Cross," with improvised lines, recently took 5,000 lbs. in one day's hand-line fishing in Ipswich Bay.

The artificial propagation of deep-sea fish has been carried on successfully in Norway for some years, and a hatching station has recently been established at Dildo, Newfoundland, under the charge of a Norwegian expert, where excellent success has been met with in hatching codfish and lobsters, especially the latter.

In the summer of 1885 an interesting experiment was conducted at the Norwegian hatchery at Flodevig by Carl Rognenid, Commissioner. A basin filled with sea water was provided, about 140 x 66 feet, and 16 feet in depth, having a capacity of about 88,000 cubic feet. In this several kinds of sea-plants were placed, and on the 3rd of May half a million young cod, hatched a week previously, were placed in the tank. The fish at this time were one-fifth of an inch in length.

Their increase in size was carefully marked from week to week, the greatest growth being obtained between 6th June, when they were within a minute fraction of four-fifths of an inch in length, and they began to eat the food furnished them twice a day, and 12th July, when they were 2.17 inches in length; 12th August their length was 2.76; 12th September it was 3.35 and 12th October it was 4.53 inches. These figures give the average length of the fish taken for measurement, the largest one examined at the latter date being 6.18 inches long.

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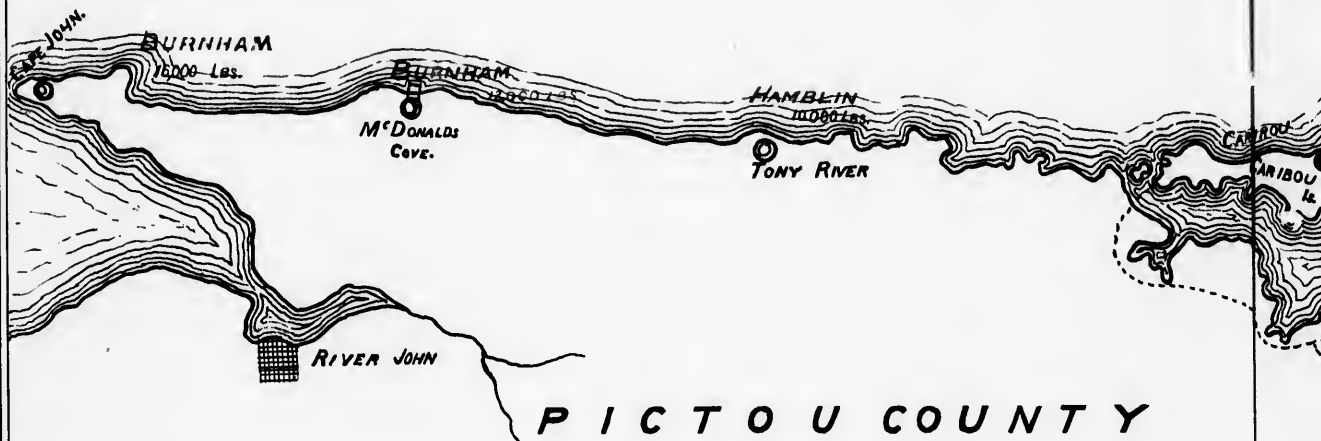
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PLAN

SHOWING PROPOSED SITE OF HATCHERY.



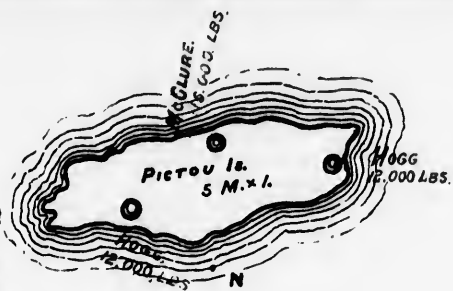
Shows location of Factories with daily catch of Lobsters and names of Proprietors.



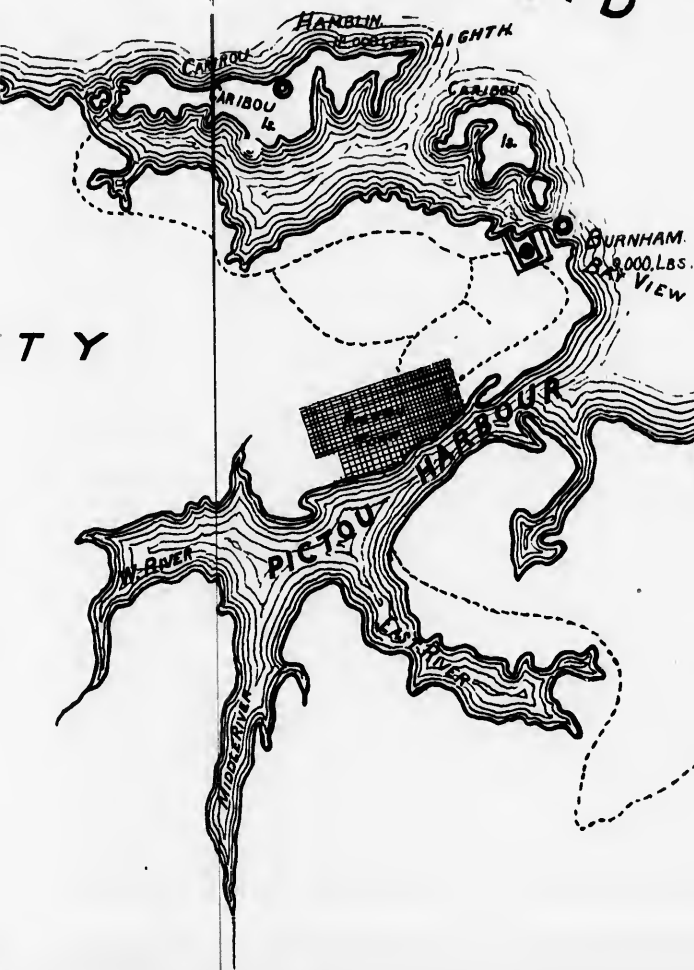
Shows proposed site for Hatchery, alongside one Factory, and within reasonable reach of 7 others.

These 8 Factories return an average daily catch of about 125,000 Lobsters from 15th May till 15th July—say 6 millions in the season.

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7.—SALMON FISHERIES OF THE BAY DES CHALEURS.

MEMORANDUM submitted to the Honourable the Minister of Marine and Fisheries by Mr. Wilmot, Superintendent of Fish Culture, regarding the correspondence of certain prominent persons, and the Petition of the Fishermen of the County of Bonaventure, relative to the Salmon Fisheries of the Bay des Chaleurs, together with remarks on the Salmon Fisheries generally and their modes of capture, with the several kinds of nets now employed; also sketches of the various descriptions of Pound, Trap and Stake Nets in use in many of the Coast and Estuary fisheries in the Dominion.

The complaints of the petitions on the Quebec side of the Bay des Chaleurs are:—

- (1.) That their compliance with the Sunday close time is injurious to them by reason of the fishermen on the New Brunswick side of the bay being allowed to fish unmolested through this close time.
- (2.) That the annual open period for netting salmon is too short, and should be enlarged.
- (3.) Because they are compelled to lift and tie up their nets from Saturday night till Monday morning, whilst the New Brunswick fishermen are permitted to keep their nets down and to fish them at this time.
- (4.) That the decrease of the salmon fishery by nets is brought about by the abuse of fly fishing up the river.

These complaints were referred to Inspecting Officer Wakeham, of that division, who reported adversely to these petitioners' views, and Mr. Wilmot fully endorses that report, and now in addition enters more largely into the general subject of the salmon fisheries of the Bay des Chaleurs by saying that:—

(1.) The complaint of the petitioners that, "their compliance with the Sunday close time is injurious to them," is no doubt correct, when they see their brother fishermen on the opposite side of the bay are permitted to fish during this close time, and in violation of the regulation forbidding it. To obviate a continuance of this complaint by the Quebec fishermen they should either be allowed to fish during the weekly close time, or that year Department should enforce it against all, indiscriminately, by strictly enforcing the weekly close time against all fishermen alike. But to allow the weekly close-time to be wholly set aside would mean absolute ruination to the salmon fisheries of the Bay des Chaleurs and its tributary streams within a sooner or later period of time.

(2.) The request of the petitioners for a change in the regulations for lengthening the annual fishery season, is simply to obtain for themselves more extended facilities for capturing more fish, whilst it would also add very greatly towards bringing about the destruction of Salmon fisheries by giving additional help to the ruinous effects from the non-observance of the weekly close time.

(3.) With regard to the complaint "of nets being injured from tying up for the Sunday close time,"—this is but an excuse to gain a point. This was never thought of in former years, when all fishermen tied up their nets alike, but since the introduction of the trap-net, which is somewhat more difficult to tie up, a pretext is made by the Quebec fishermen that keeping the Sunday close time so injures their nets that they should be allowed the same privilege as the one usurped by the New Brunswick netters, who, in violation of the law, keep their nets down during the weekly close time. The not only absurd, but selfish statement made, that "the salmon which escape the nets by keeping the Sunday close time are caught further up on Monday," goes to show the trac inwardness of these lower netters, who, in fact, say: "We want all the salmon, you upper netters and river fishermen shan't have any if we can help it." Not only do they have the first chances of taking the incoming salmon, but so avaricious are they that they petition for a privilege which means, "no salmon shall pass us to benefit our brother fishermen above, nor reach the spawning grounds to the river for breeding purposes."

(4.) The petitioners allude to the "decrease of salmon being brought about by the abuse of the right of fly-fishing in the Restigouche River." Captain Wakeham meets this fallacious statement pretty clearly; but to his statements should be added others bearing more conclusively, in contradiction of prejudiced ideas entertained by these netters in the tidal waters, whose dependence upon maintaining their catch of salmon for the future rests largely upon the protection given to the rivers by the fly fishermen. The net fisherman, from the nature of his calling, is in no way whatever the protector; he is the destroyer of the salmon. The ambition and calling of the tidal fisherman is to invent and apply the most destructive engines possible, for intercepting, capturing and killing the incoming runs of salmon on their migrations from the sea, on the coast line, to their native rivers, to produce their young; and if it were not for restrictive regulations as to times and modes of fishing, these netters would so bar the passage of salmon to their rivers, by extending their nets out in the bay, and across the estuaries of rivers, as to wholly forbid the possibility of sufficient numbers reaching the spawning grounds to keep up their species. The whole legislation in Canada, in Britain, and throughout the whole world, so to speak, has been to make laws to keep within bounds the avarice of the net fisherman from exterminating these migratory fish, whose nature it is to travel together in "runs" or "schools" within certain short periods of the year to their spawning grounds. In England and in Scotland, after centuries of experience, the netter has been so restricted in the use of the destructive engines which were formerly in use there that at the present time many of the more important rivers continue to uphold almost their original standard of fish,—thus actually benefiting the tidal fishermen, the rivers proprietors, and all concerned.

The policy has been that, while the netter is allowed to take a fair proportion of the salmon for commercial purposes sufficient numbers should be allowed to pass by to benefit the upper proprietors of rivers for angling, and yet leave a sufficient supply of parent fish to breed, and keep up the standard of the river. This has all been achieved by establishing a proper annual close time, and a weekly close time for tidal fisheries, and the use of such description of nets as shall not be too destructive in their operations, and the fixing, also, of a proper close time in rivers to regulate angling. This course has also been adopted for the preservation of the salmon fisheries in the Baie des Chaleurs and its rivers; but the regulations, by reason of expediency, and the inefficiency of fishery overseers, have been permitted to be so encroached upon as to become almost useless, and also brought about the outcry so frequently advanced (whether correct or not) that the salmon fisheries are being rapidly exhausted.

It must also be borne in mind that the tidal salmon fisherman is destructive, not protective in his calling, as before stated. He renders no support whatever, pecuniary or otherwise, for guardianship of the rivers and other nurseries which produce for him the supplies of salmon which come to his nets to enrich him. It is the upper proprietors of the rivers, and the anglers who lease them at high rentals, who bear the whole burden of guarding the rivers against the invasion of the poachers, and who are compelled to protect the parent salmon and the spawning beds. The result of which is, that the netter gets the lion's share—and what is this share? If the record of the anglers' catch of salmon on the Restigouche River and its tributaries is taken and placed in comparison with the catch of the netters below in the estuary and coast it will show that, whilst the netter gets some 95 or 96 per cent. of the salmon caught on their migration to their spawning grounds, the angler takes but 4 or 5 per cent. It will be quite within bounds when it is said that the cost of every salmon to the ordinary angler will amount to \$1 per lb., whilst the cost per lb. to the netter will not exceed $1\frac{1}{2}$ cents per lb.

In fact, by an illustration herewith given from the best known records of the catches of the netters and anglers, this widely comparative difference will be shown. It will be necessary to take the only now present available data for this exhibit from the departmental chart of the Baie des Chaleurs salmon fisheries, referred to in the calculations made relative to this whole subject. By this may the

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netter will be placed in a better position than the angler, from the fact that not more than one-half the salmon were then taken with the fly, as of later years; but the gross average of the fly catch of the later years will be placed in comparison with the netter's catch. And this exhibit will only show the operations of the netters on the New Brunswick side of the bay, and of the angler on the Restigouche River, it being correctly held that the Restigouche River is the principal breeding river to supply the tidal fisheries on the New Brunswick side. The records, which do not fairly give the netters' full catch, show that on the New Brunswick side, in the counties of Restigouche and Gloucester, there were taken by nets all told 801,555 lbs. of salmon. Allow for the weight of each salmon 20 lbs., and 40,076 will be the number. There are 179 stations for netters, thus giving 224 salmon on an average to each netter.

These salmon will be estimated at \$2 apiece; each netter would thus get \$448. To offset this, the cost must be considered with his average rate of license fee added. There were 29,137 fathoms of net recorded, which, at 3c. per fathom, would give \$874.11. This sum divided by 179 netters would give the average fee to each of \$4.88. Then, say two months fishing nets at \$50, \$100. Without first costs of nets the expenditure would be \$104.88. Deduct this cost of expenditure from the \$448, and the balance to profit is \$344. Each fish of 20 lbs. will cost the netter about 46½c., or 2½ cts. per lb., and he realizes a profit per fish of \$1.53½, or, on his whole average catch for the season, a profit of \$344.

The position of the angler is thus: Say a fair average number of days for his fishing to be 20, and the cost per diem for Indians, canoes, tents, scowling, provisions and accommodation cannot be estimated at less than \$10 per diem.

The 20 days, angling would amount to.....	\$200 00
His privilege or license to fish for the season on any of the Restigouche waters will not be less than.....	200 00
Average railway fare to and from his residence in New York, Ontario or other parts.....	50 00
Total	450 00

The angler's catch may be *nil*, but to give a fair allowance, say one fish a day, or 20 salmon for his 20 days, as shown above, will cost him each \$22.50. He gets nothing for his salmon, as they are invariably consumed or given away; he therefore makes no profit whatever on his catch, like the netter, but expends \$22.50 on each fish taken, or \$1.12½ per lb., all of which is spent amongst the settlers and others for provisions, labour, &c.

The cost of the original outfit of the netter and the angler is about thus: Ordinary price of net, \$100; ordinary outfit for angler not less than \$150, and in many instances reaching double and quadruple this sum.

Now, taking an extra catch of salmon by anglers on the Restigouche, and it has never exceeded 2,000 fish, but in a great majority of cases very much less, and place the results by a comparison between the outlay or cost of 2,000 salmon as between anglers and netters thus:—

Cost of capturing 2,000 salmon by anglers, at \$22.50....	\$45,000 00
do 2,000 do netters, at 46½ cts.	930 00

Leaving a surplus spent by the angler of..... \$44,070 00

In addition, the angling proprietor or lessee of angling privileges will have to pay his quota of the cost of guarding the river, for which the tidal fishermen pays nothing whatever on this score.

The undersigned feeling quite assured of the deep interest which many prominent individuals and the public also now take, and have always taken in endeavouring to uphold the salmon fisheries of the Baie des Chaleurs, and of the several rivers which

empty into it, considers that any suggestions coming as they have from persons having a practical knowledge and long experience on this subject should receive from your Department of Fisheries due consideration.

Frequent reference is made to the want of uniformity and inability to obtain correct returns. This is, no doubt, the case, as it is well known by those practically acquainted with the fisheries on the Baie des Chaleurs that the returns made to the Department are imperfect, and do not give anything like a true and correct account of the numbers of salmon annually taken in the nets operated in the estuaries of the several rivers and along the shores of the bay. These imperfect returns are caused by the desire on the part of the fishermen to withhold the true catch made by them, fearing that it might affect their interests with regard to the value to be put upon their licenses in after years. This no doubt would be the natural feeling of the fishermen; and to carry this out the overseers are often hoodwinked by the fishermen, and consequently these overseers simply take the *ipse dixit* of the fishermen, without taking further interest, as they should, by frequent examinations of the nets, and seeing the fish actually taken from time to time. This would require a live active men whose sole duty should be to daily inspect these salmon stations during the short time of ten or twelve weeks when the fishery is carried on in its fullest extent. A personal knowledge of this matter, when inspecting portions of the bay, in connection with the specialty of fish breeding, has given evidence of the prevalence of this want of thorough oversight of the large salmon fisheries in the neighbourhood of Dalhousie, and elsewhere.

Attention is also drawn to the present unfairness and want of discrimination which exists regarding the location of fishing stations, the length of nets, and the rate of license fees paid. This must appear obvious to even the commonest observer from a glance at the fishery stations on the departmental plans of 1878 (and it is more apparent at the present time), which shows the location and length of every net set, and their catch, and it will so elucidate the whole matter as to carry conviction with it, as to this inequality of the existing mode of licensing the salmon stations, especially in the bay below Dalhousie, on the New Brunswick side. To explain:—

The license fee on the New Brunswick side is 3 cents per fathom of net. Now take as an example the multitude of nets set in Eel Bay at Dalhousie, and commence at station No. 71 where the first net is placed for intercepting the shore wise course of salmon, after passing Heron Island, in their migration from the sea coast, and follow from No. 71, round the curves of this bay to station No. 43, and you find every available space allowed by law taken up with 27 nets, entered at 200 fathoms each. (Query—With this want of proper inspection, are these nets kept within correct limits or lengths?) and the present unfairness, and want of discrimination of a license fee of 3 cents per fathom are most apparent:

No. 71 shows the catch at.....	Lbs.
70 do	4,000
69 do	4,724
68 do	1,800
67 do	3,290
66 do	1,197
65 do	3,000
64 do	3,000
63 do	3,100
62 do	3,436
61 do	2,544
60 do	3,000
59 do	5,500
58 do	3,998
57 do	3,000
56 do	3,511
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..... 3,000
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..... 3,000
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..... 4,135

No.	Shows the catch at	Lbs.
53	do	} 31,000
52	do	
51	do	
50	do	
49	do	10,500
48	do	8,659
47	do	6,291
46	do	6,229
45	do	9,000
44	do	} 22,000
43	do	
		17,000
		1,142
		164,05

Here it will be seen that one net, No. 44, took 520 per cent. more fish than the 16 nets each,—71 to 56—did, and yet each paid the same fee, viz., \$6.

Now, if the same system existed on the New Brunswick side as on the Quebec side of the bay, viz., 40 cents for every 200 lbs. of the catch, the average fee payable by the 16 nets referred to would have been \$6.40 each, and No. 44, at the same rate (with 17,000 lbs.) would have been \$34. This, I should say, was conclusive evidence of the unfairness of the present system—unfair towards the fishermen themselves on the New Brunswick side, and more so towards the fishermen on the Quebec side. Taking the aggregate catch of these 27 nets of 200 fathoms each as operated on the limits of Eel Bay, on the New Brunswick side, the gross amount of fees paid by them to your Department was \$174; whereas, if these same nets had fished on the Quebec side the amount of fees payable by them would amount to \$328.

With regard to this evident unfairness and want of discrimination with fishing stations and license fees, it may be asked how it is that certain nets, or that one net, can possibly take such greater numbers of salmon when located almost (so to speak) alongside so many other nets in Eel Bay? It is somewhat easy to explain, when the migratory habit of the salmon is known, and their instinctive nature for following the coast line until they reach their native rivers, which they ascend for spawning purposes. The larger proportion of salmon belonging to the Restigouche River would naturally strike Eel Bay, on their direct line from their seaward journey, passing by Heron Island. This bay being the first coast line struck by them, as the numerous nets set there would indicate, they commence their coast, or shore, course onward. Nos. 70 and 71 nets show the larger catch of these fish at the lower end of the bay. The fish being driven outward somewhat by these first nets, they pass along with a somewhat uniform catch, till a smaller bay, at the mouth of Eel River, is reached, when they instinctively turn inshore again, striking nets Nos. 51, 52, 53, 54, where the catch runs up from an average in the 17 nets below of some 3,000 lbs. to 41,000 lbs. (in these 4 nets), or an average of over 10,000 lbs. each. From this point they pass on with the accumulations of others coming in direct from their seaward line, giving an increased catch in the six nets above (Nos. 50, 49, 48, 47, 46 and 45) of nearly three times the catch of the 17 first-mentioned nets below, or 8,700 lbs., as compared with 3,000 lbs. each. From this point the salmon strike directly outward to get round the point at the head of the bay, when net No. 44 takes 17,000 lbs., and the next, No. 43, takes only 1,140 lbs.

Thus, it appears that the nets located at either end of this Eel Bay, although using the same number of fathoms as all others, get certainly the lion's share of the salmon and pay no more license fee. This appears very unequal and unfair, and these nets, or the owners of them, at these naturally better-located stations, have no greater legal right to the fishery than their neighbours; custom and occupation has, it appears, made these occupants of the better stations think they can hold them as of their exclusive right. Riparian rights do not prevail in the tidal waters,

and consequently their occupation of the fishery is only permissive from the Government, which they acknowledge by paying the annual license fee for fishing these stations. Then why should one man, merely by the peculiarity of his fishing station be compelled to pay \$6 as a license fee for catching 3,000 lbs. of salmon, whilst another, with the same length of net, and paying the same fee of \$6, takes 17,000 lbs. of salmon? The remedy lies in the necessity that exists for abolishing the small fee of 3 cents per fathom, and placing a uniform charge of a certain amount upon every fish, or 100 lbs. of fish, taken by each net. In this way the taxation would be not only justly applied, but equitably proportioned amongst all the fishermen whether his station were a good or a bad one, or his net long or short.

In connection with this subject of license fees, the following views are suggested for your consideration, which, if carried out, would no doubt in the end benefit the fishermen themselves, in more fairly equalizing the profits accruing from their somewhat laborious calling, and the expenditure connected with their individual fishing stations, and also produce an income to the Department from the catch of fish to sufficiently pay a live overseer, whose time should be wholly devoted to seeing that the fisheries regulations were thoroughly enforced, and thus establish faith in the minds of the public of the determination of your Department to maintain for the present time, and for the future, the salmon wealth so largely obtainable from the waters of the Baie des Chaleurs, and the rivers tributary to it.

Taking the same data for figures and quantities of salmon referred to previously, and confining these remarks to the same 27 salmon stations at Eel Bay which, whilst it may be only a section of Baie des Chaleurs, will nevertheless be a proper criterion to draw a correct conclusion for operating all the fisheries in that large salmon-producing area (the Baie des Chaleurs)—and even elsewhere and in other Provinces. These 27 nets gave a return of 164,056 lbs. At present the netter on the Quebec side pay 40 cents per 200 lbs.—this, after all, is a very trifling fee and is not found fault with. I would suggest a uniform fee of 50 cents on every 200 lbs. of salmon— $\frac{1}{2}$ cent per lb. of fish. At this rate the 27 nets with their 164,000 lbs. of salmon would give an income from the license fund of \$410. This income, trivial as it is, from this large catch of salmon (and so considered by the fishermen themselves, if equitably exacted from them) is derived from only 27 stands of nets, out of 230 stations in Baie des Chaleurs, and taking in only 7 miles, out of 156 miles of the shores of that bay, as laid down in the fishing chart, describing salmon stations. From every standpoint a license fee based upon the quantity of fish taken is preferable, and more equitable in the interests of all parties concerned.

(3.) Reference is also made to the "necessity for enforcing the law regarding Sunday close time for nets." This regulation is of such vital importance for the better maintenance of the salmon fisheries on the tidal waters, by allowing certain portions of the "runs of salmon" to pass up to their native rivers unmolested from Saturday night at 6 o'clock till Monday morning at 6 o'clock, that it should be strictly enforced in the Baie des Chaleurs and elsewhere, in all tidal waters where salmon fisheries are carried on. It is a law which has existed upon the statute book of Canada since Confederation, and of the several Provinces previous to that time and has always been held to be, not only in Canada, but in the countries of the old world, as one of the most important aids for giving opportunities for salmon to reach their native river for reproductive purposes. Do away with this Sunday or weekly close time, and allow the fishermen to carry on their avaricious desires for keeping their nets set from the opening to the close of the fishing season, and the flood gate of destruction is wholly opened up to expedite the extermination of the salmon wealth of the country.

This weekly close time is and always has been a permanent record upon the statutes of almost every civilized country in the world, in the waters of which the noble salmon are indigenous. The salmon, being migratory, make their journeys to their native rivers in large bodies, or "runs," as they are called, within certain limited periods of time. In some cases a longer or shorter period is taken. In the Baie des Chaleurs the time will be included in about six or eight weeks; and should these

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Following views are suggested
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weeks; and should these

nets be kept down during the whole of this time they would become barriers (or fixed engines completely) to the upward passage of salmon along the coasts, and shores, on their migration to the rivers to uphold their species.

To show the destructive nature of some of the nets used, sketches are herewith giving of those in general use on both sides of the Baie des Chaleurs. Some of them are such complete engines of destruction and set in such direct opposition to the requirements of the law and regulations as to demand their confiscation, and infliction of the severest penalties upon the parties who use them. The statutes read, sub-sec. 7, sec. 14, Fisheries Act. "No one shall use a bag-net, trap-net or fish pound for capturing salmon." Now, in opposition the nets used for capturing salmon on the New Brunswick, side of the Bay are the most complete and wicked invention of a trap-net that could be devised for the capture of salmon. The statute furthermore says: "No one shall fish for, catch or kill salmon in tidal waters from 6 o'clock in the afternoon of Saturday till 6 o'clock in the forenoon of every Monday."

Now, not only are these illegal and wickedly destructive trap-nets set and in general use on the New Brunswick side of the bay, but they are kept there as fixed engines during the whole of the fishing season, and not taken up during the weekly close time from Saturday night till Monday morning. Thus, these fishermen are actually usurping a privilege from your Department which is hastening the end of the salmon wealth of that bay and the rivers emptying into it, and enriching themselves by wrongdoing, as against their brother fishermen on the other side of the bay who carry out your fishery regulations, and in addition creating strife and dissatisfaction with other fishermen who, through their representatives in Parliament, are importuning your Department for permission for the same privileges which the others are tacitly permitted to enjoy as of their own right.

Appended will be found plans of several descriptions of nets in use for capturing fish in tidal waters, and it would appear that hardly two persons agree upon what a trap-net is. From what I can learn, the nets used on the New Brunswick side of Baie des Chaleurs, shown in figures Nos. 3¹ and 3², are the wickedest of traps for killing salmon. My definition, is that any fixed net so set as to lead fish through one or more apertures into a pen or pound attached thereto, from which they cannot escape, is a veritable "trap-net."

Even the hang nets herein given would be interpreted in England as "fixed engines." I quote from the report of the Fishery Board of Scotland for 1888, thus: "As to the destructive effects of hang-nets on river fisheries, the English inspectors point out in their fourteenth annual report that they, in a few years, reduced the annual yield of salmon in the Tyne from 129,100 to 21,746, after which a by-law was passed restricting the area of their operations, since which time the Tyne fisheries have very greatly improved."

Mr. Berrington, the Chief Inspector of Fisheries for England, in his report to the English Board of Trade, says:—

"The mode of fishing in the sea for salmon is exclusively by hang-nets. This description of net is capable of intercepting a far larger proportion of incoming fish than would be taken by draft-nets, and in this district its efficiency is habitually still further increased by the illegal practice of anchoring the shore end. On my arrival at Whitby I saw two nets anchored off the pier, extending several hundred yards seaward. On the following evening I saw four nets used in this manner, and acting as a complete barrier to the passage of fish. I drew the attention of the conservators to this illegality."

"It would be undesirable to alienate the upper proprietors, who have the control of the spawning grounds; and considering the exertions they have made, it would be unfair to reduce their opportunities of taking fish after the nets are removed."

The mode of fishing in the public water or tide-way of the Trent is by beam-nets. They are fished from a smack, but are stationary when at work, and are placed as to face either the flow or the ebb of the tide. The length of the beam is from

20 to 22 feet; the mesh of the purse is very small. * * * The complaints against the beam-nets are that they take salmon illegally and destroy large quantities of immature fish. These nets cannot fail to take salmon * * * The law respecting the use of small-meshed nets in salmon fisheries is one which deserves consideration. * * * In the case of beam-nets, they are in fact fixed engines and cannot on that account lawfully be used for the capture of salmon. * * * With regard to the complaint that the beam-nets (as fixed engines) destroy large quantities of immature fish, it is necessarily true. * * * The salmon fishermen complain seriously of the number of salmon taken by them, and of the injury they do to the young of salmon if used in the spring months.

The consensus of opinion by most authorities on the preservation of the salmon fisheries in Britain and other countries in the old world has been that, "fixed engines," as stationary nets, were so destructive to the salmon fisheries generally, and that they so barred the passage of these fish to their native rivers for breeding purposes, that these "fixed engines," as they are styled, have been almost wholly abolished: and it is said that from this cause, is mainly to be attributed the present continued supplies of the salmon in most rivers of Britain.

A single instance is here given of a river which has been fished for centuries—the Tay, in Scotland. The rentals of the salmon fisheries connected with it have during the past six years given an average annual income of \$101,825. The country through which this river runs, from its source down to the sea, is densely inhabited, and its estuary and coast line connected with it is crowded with shipping and traffic of all kinds to an enormous extent. Manufacturing industries of various kinds are located almost throughout the whole extent of the river, yet it is found that salmon are taken in such abundance in its waters as to produce the annual wealth above mentioned, giving employment from these salmon fisheries to many people, and adding luxury and pleasure to anglers and others of the general community. This river Tay, I am informed, is actually insignificant, when compared with the Restigouche, its estuary, and the famous Baie des Chaleurs connected with it. The Restigouche, with its numerous tributary rivers, may be said to be in their primeval state, almost down to the tide-way. Not a mill or manufactory is built upon the river; its waters are not contaminated with pollutions of any kind and its purity and capacity as the home of the salmon is the same as when it first fell from the hand of nature. It has always held widespread notoriety as one of the greatest salmon-producing rivers since the first settlement of Canada; and why should it be allowed now to become reduced in its capacities for keeping up a great standard of fish wealth, somewhat in comparison with the river Tay, above referred to? And so it might, if the providence and avarice of the netters were stayed, and they were compelled to adhere to the fishery regulations, as to the use of proper descriptions of nets and the due observance of the weekly close time.

In a reference to the close seasons for net fishing, and angling on the river Tay a much greater latitude is given by the Scottish laws than in Canada.

The annual close time for netting on the Tay is from 27th August to 10th February; on the Baie des Chaleurs, 15th August to 1st March. For angling on the Tay, from 31st October to 10th February; on the Restigouche, from 15th August to 1st February. From this it will appear that the fishery authorities in Scotland do not consider that angling for salmon is as injurious as the use of netting by fixed engines. The Tay anglers are permitted to take salmon up to the 31st October, which gives a period of two months and a-half longer than is allowed anglers on the Restigouche or other Canadian rivers.

The general law for close times for salmon in England is from the 1st of September to the 1st of February for nets, and for angling from 2nd November to 1st February. In many rivers the season commences later. Thus, throughout England salmon angling is permitted two months later than in Canada.

The undersigned, after a careful consideration of all the bearings relative to the question of the maintenance of the salmon fisheries of the Baie des Chaleurs, and after a relation of the various points from which his conclusions are drawn, recommends the following:—

1. That the description of salmon net to be used along the coast, and in all of the tidal waters of said bay, should be similar to the one marked No. 1 of the plans hereto attached, known as the *wing-net*, or *hook-net*. It has no trap, nor bottom attached to it; it was the net universally used in all of the waters of the bay previous to 1878, and is the net now used on the Quebec side of the bay, in the counties of Gaspé and Bonaventure. The lifting it is easily performed to comply with the weekly close time, and should now be as satisfactory and remunerative to the fishermen of the present time as previous to 1878, and especially so when the netters on the Quebec side of the bay use it, and would be satisfied to still use it if the netters on the New Brunswick side were compelled to do the same. But if one portion of the bay is fished with an illegal net, which is more destructive and better adapted to entrap the salmon, all other fishermen naturally desire to partake of this privilege, illegal though it may be.

2. Restrictions should be made, even regarding the above-named net No. 1, as to its length, for one station with 100 fathoms may be so favourably situated (but ruinously so, on the upward passage of salmon) as to capture more fish—in some instances two, three or four times the number that a 200-fathom net set just alongside will take.

The meshes of all salmon nets in the Baie des Chaleurs and the estuary fish-ways should be a like size for leaders, wings and hooks, namely, $6\frac{1}{2}$ inches. The meshes of nets now in use are almost invariably 7 inches. In licensing the nets, the length of net in fathoms should include the length of the leader, as well as all hooks or wings that may be connected with the working of the net.

3. The salmon stations for nets should be so located as not to interfere too destructively with the incoming "runs" of salmon when rounding certain points, now well known to fishermen and others. The length of each net licensed should be established from the adaptability of the station for capturing salmon.

4. The close season for salmon, by netting, to be as laid down in the consolidated regulations of 1889, and that the weekly close time, from Saturday until the following Monday, be strictly enforced everywhere alike.

5. That the fee of 3 cents per fathom on salmon nets be abolished, and that in lieu thereof a tax of $\frac{1}{4}$ of a cent per pound of fish, or 25 cents per 100 pounds, be exacted in all cases on the catch of salmon in the Baie des Chaleurs, and in all other salmon fisheries by nets in the Atlantic Provinces.

angling on the river Tay
Canada.

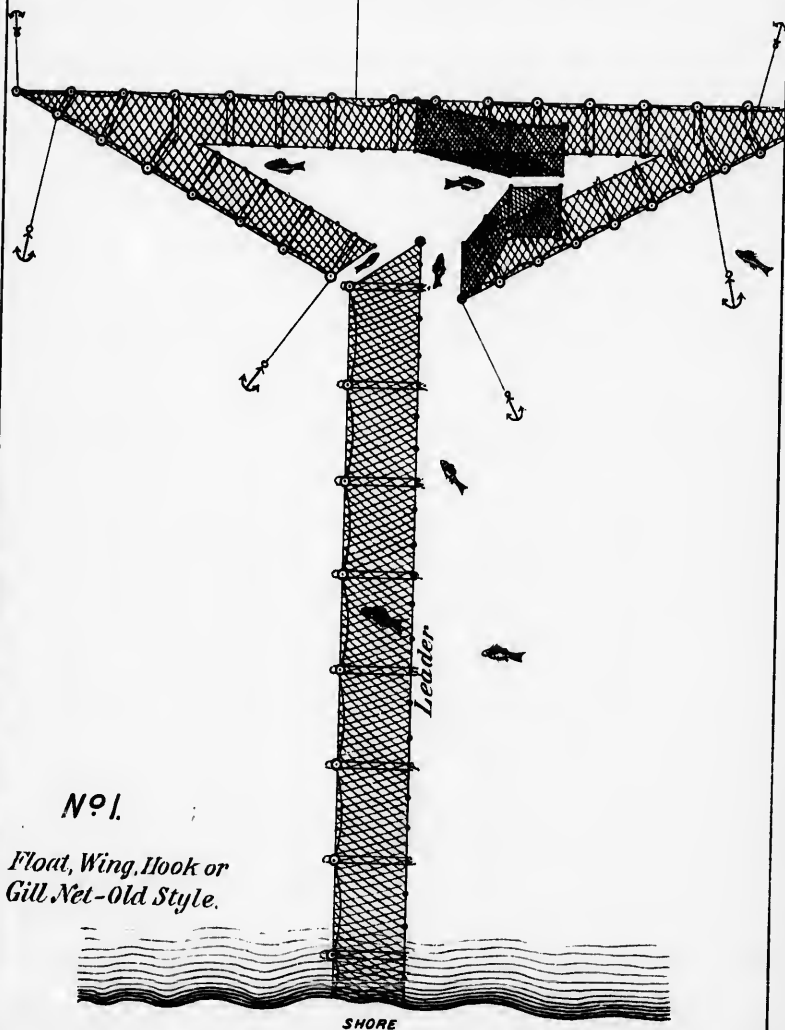
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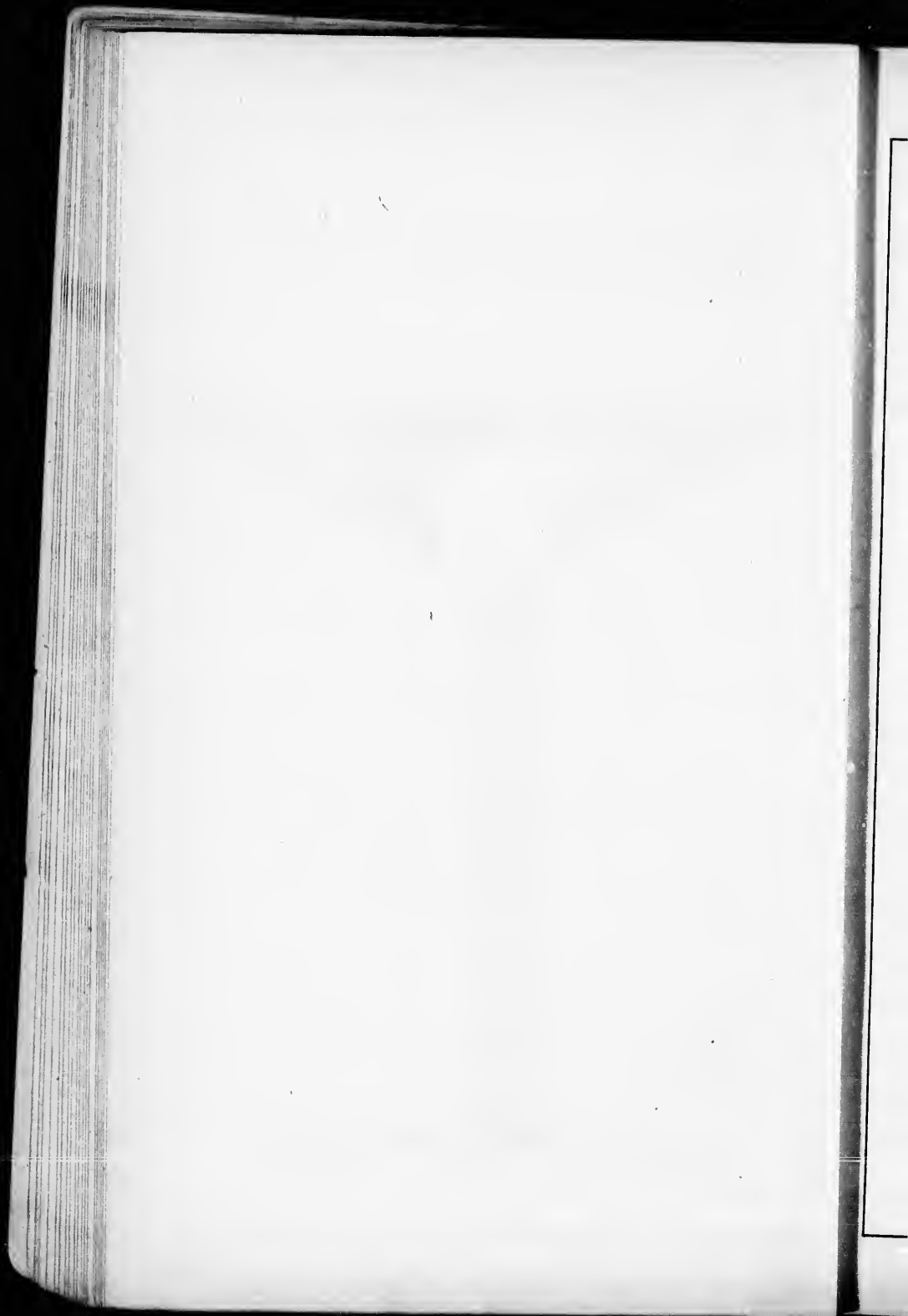
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Wing-Net or Hook Net, none other used prior to 1878 in Bay des Chaleurs.- and the only legal one now in use in Quebec Side in Gaspé, and Bonaventure, can be easily lifted to comply with Weekly close time by tying up-

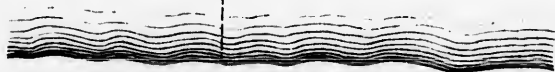


Nº 1.

*Float, Wing, Hook or
Gill Net - Old Style.*



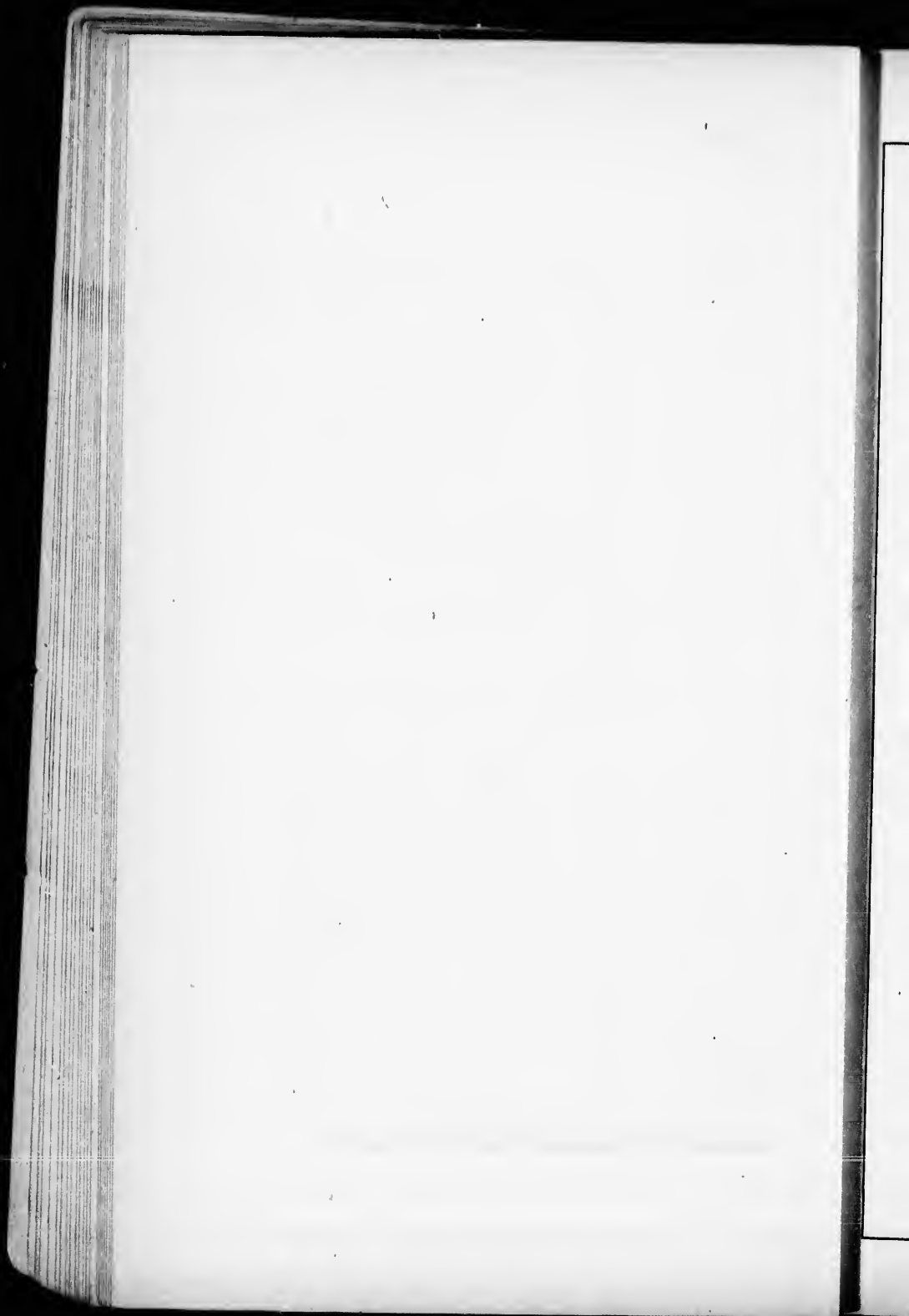
Nº 10

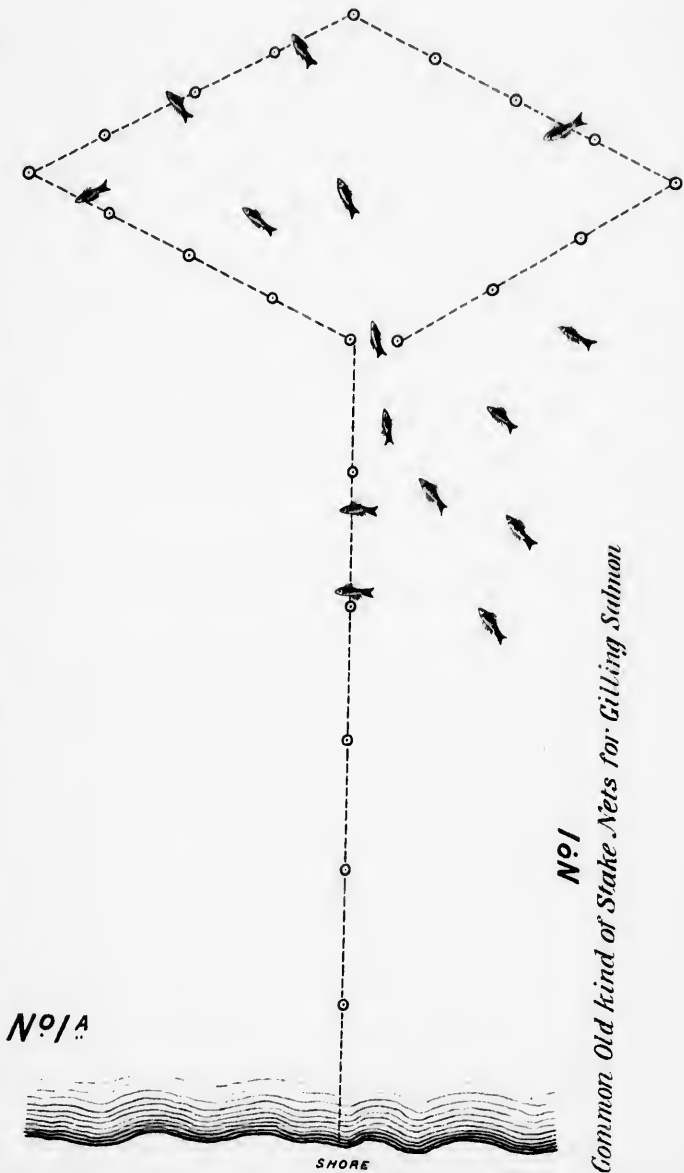


SHORE

Nº 11

Common Gill or Stake Net easily Lifted



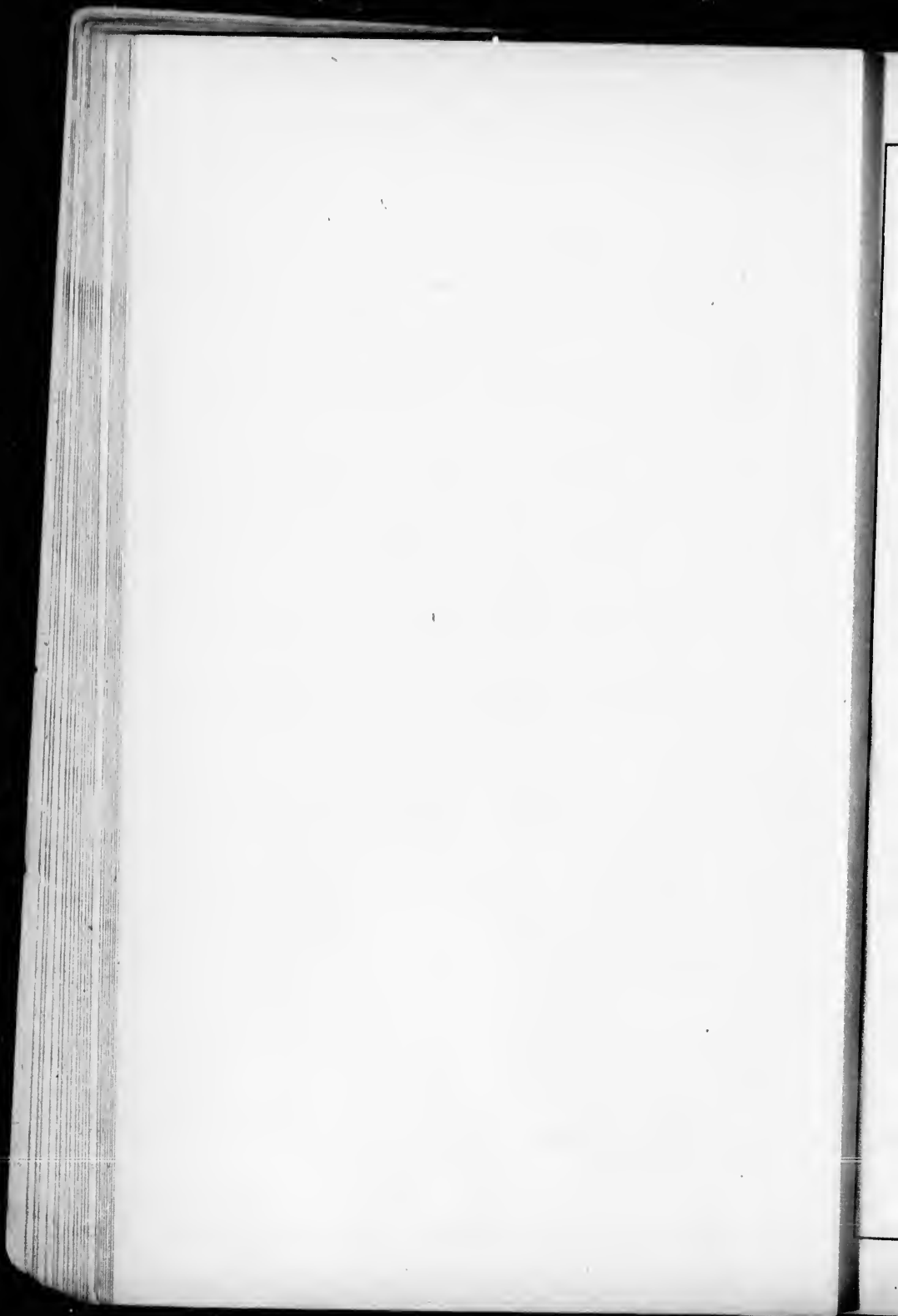


No 1 A

No 1

Common Old kind of Stake Nets for Gillnet Salmon

SHORE



N^o.2.



N^o.2.
Common Hang or Stake Net for Gilling Fish, open top and bottom.

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witho

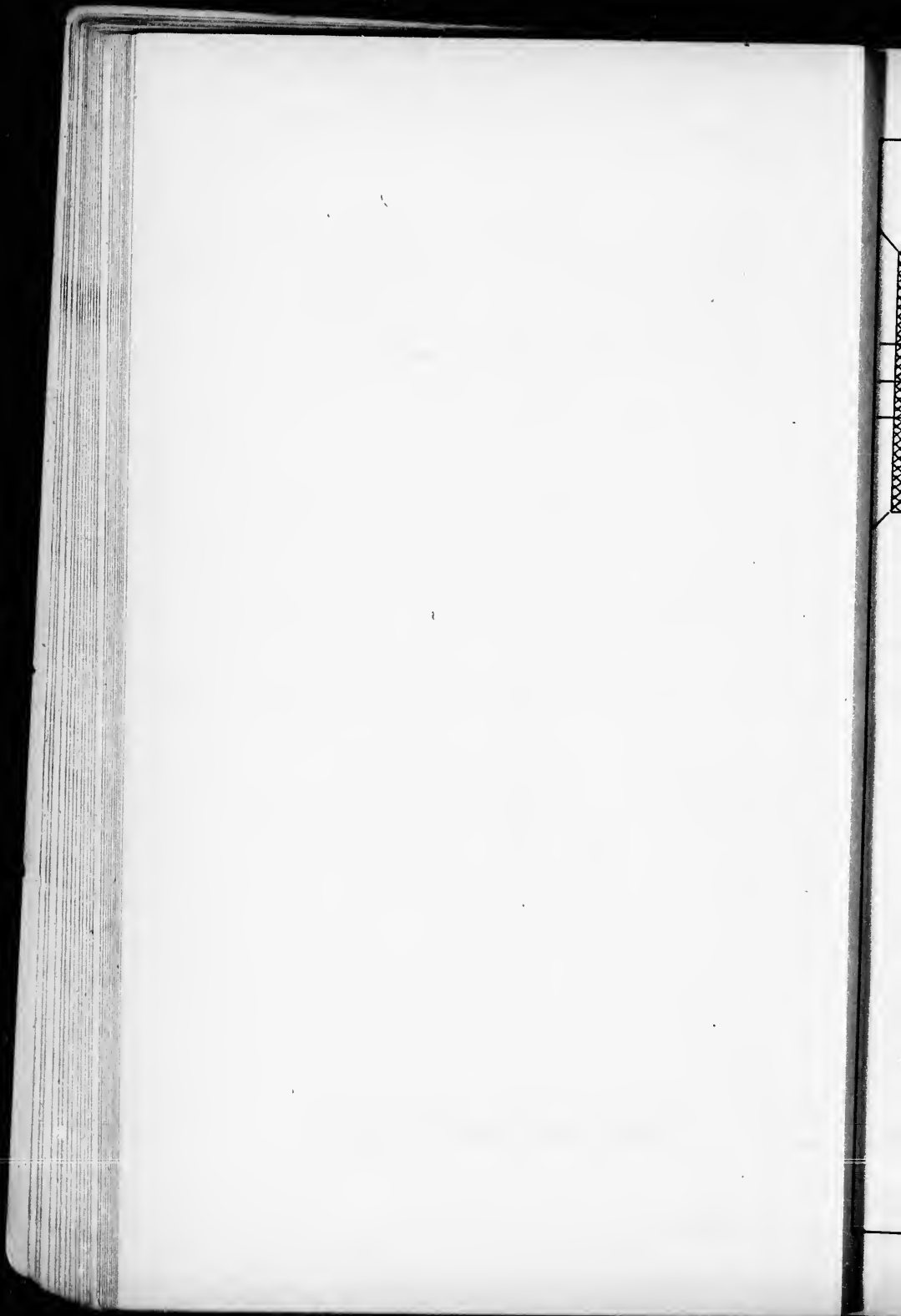


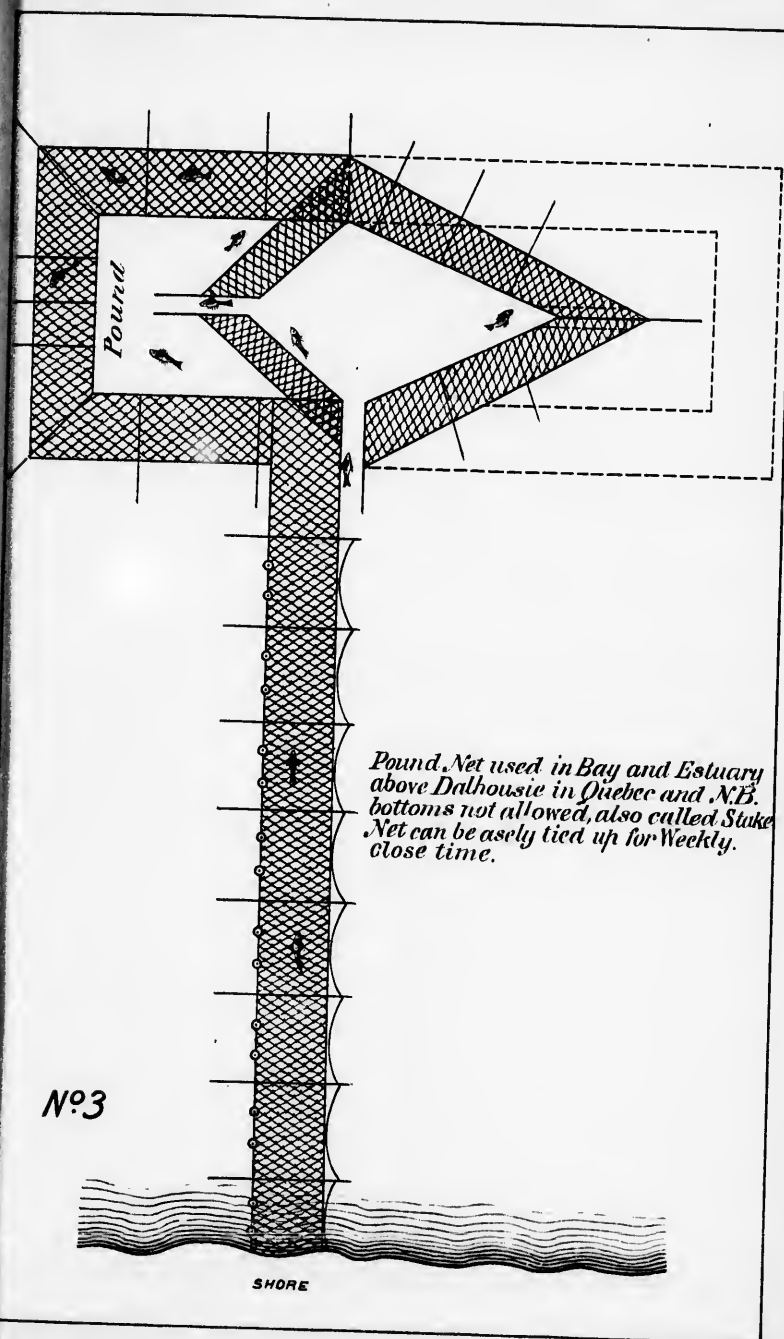
Nº 2 A

*Gill Net
without bottom*



SHORE.



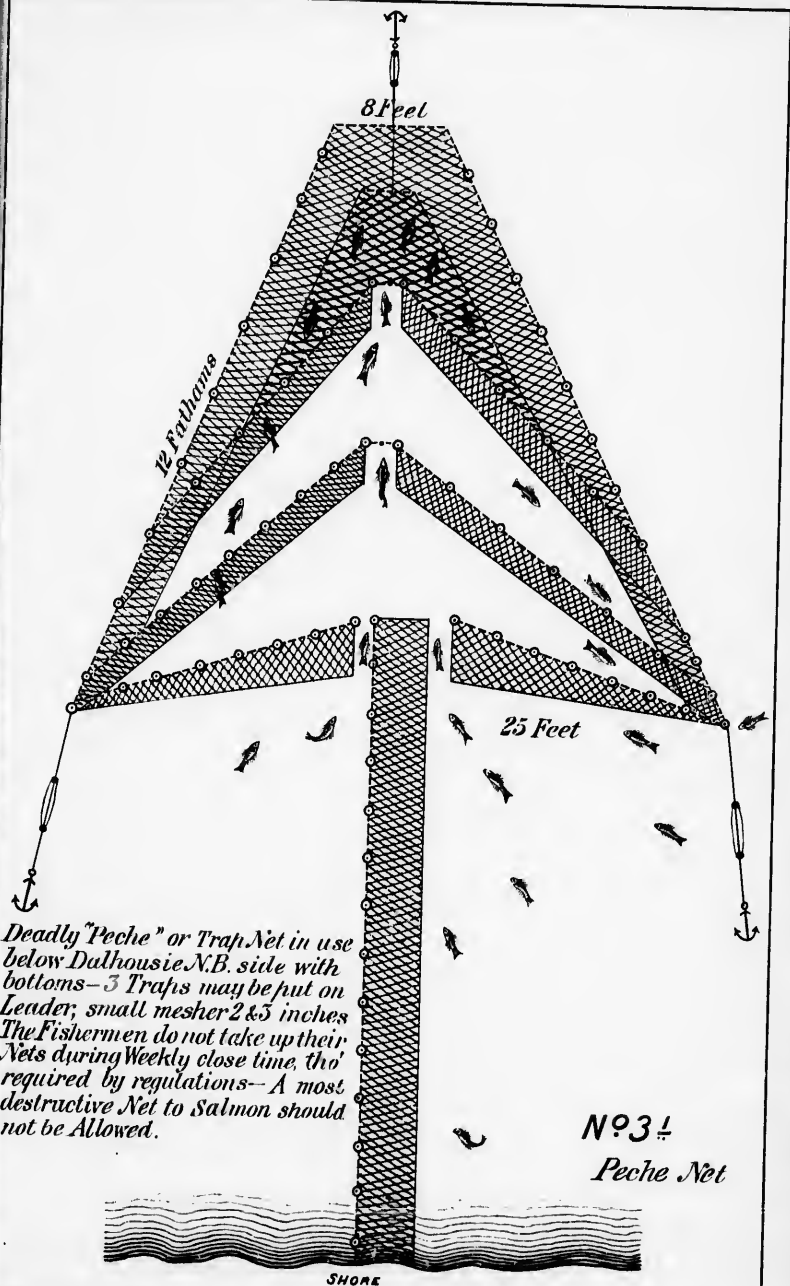


*Pound Net used in Bay and Estuary
above Dalhousie in Quebec and N.E.
bottoms not allowed, also called Stake
Net can be easily tied up for Weekly
close time.*

Nº3

SHORE

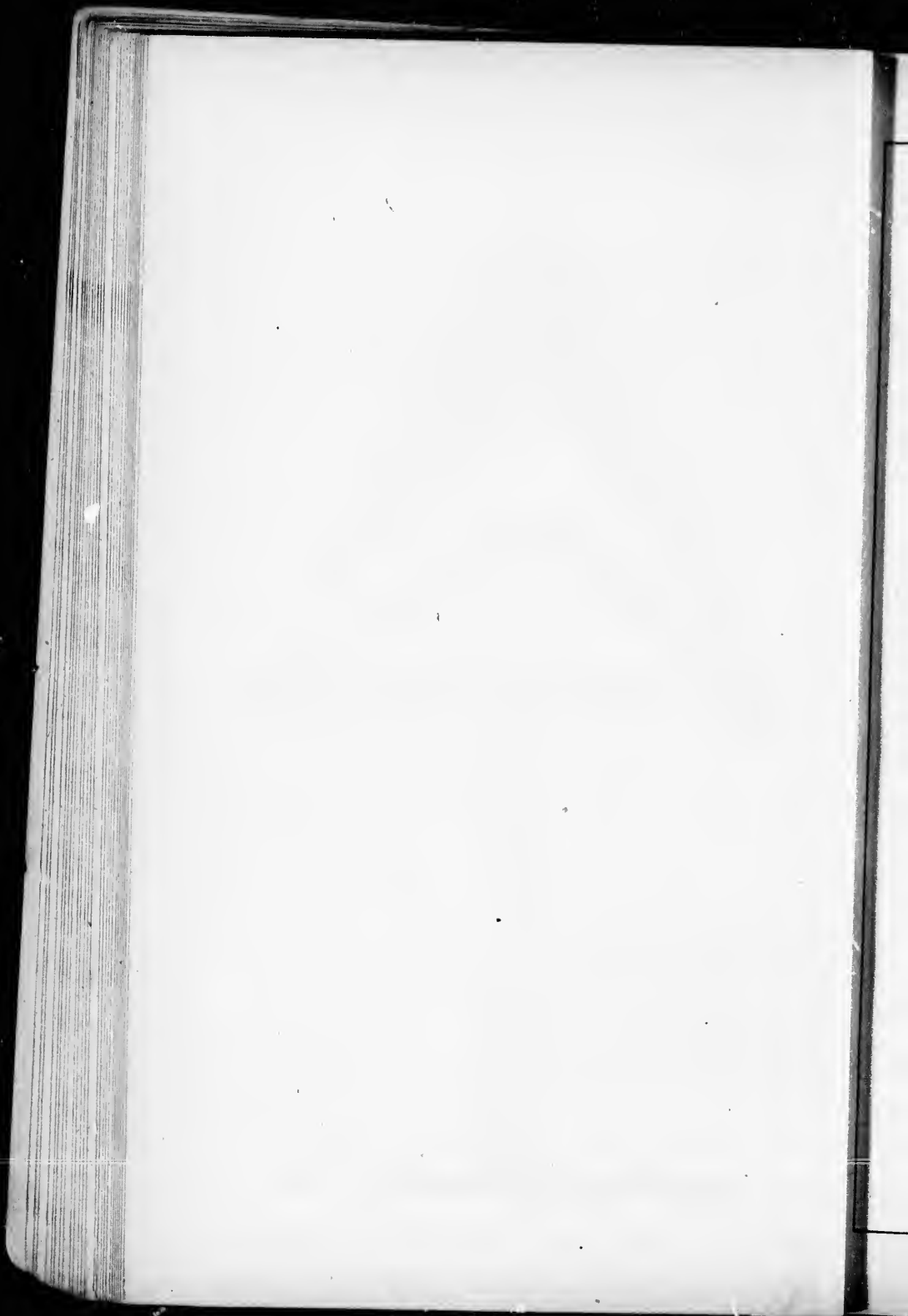
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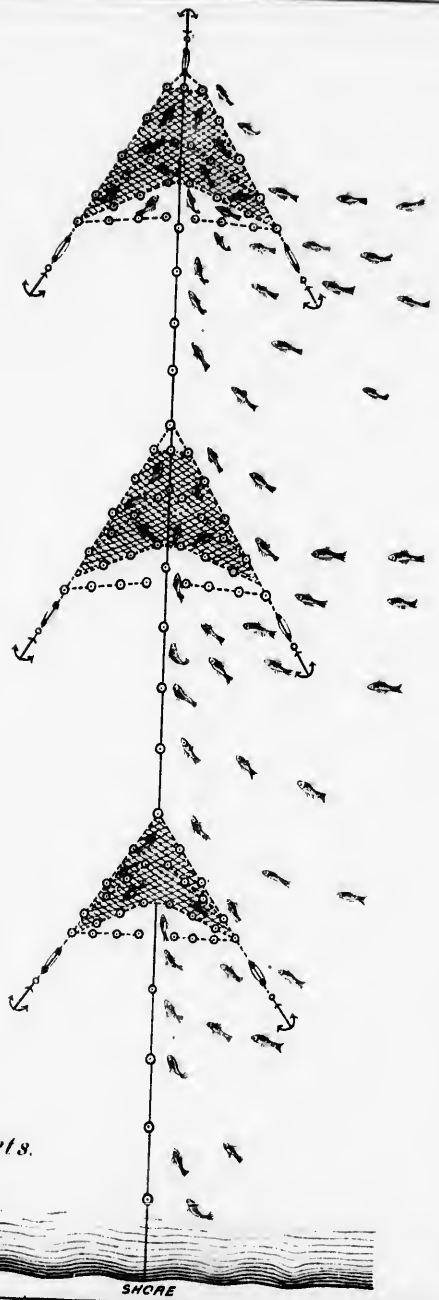
*Deadly "Peche" or Trap Net in use
below Dalhousie N.B. side with
bottoms—3 Traps may be put on
Leader; small mesher 2 & 3 inches
The Fishermen do not take up their
Nets during Weekly close time, tho'
required by regulations—A most
destructive Net to Salmon should
not be Allowed.*

N^o 3!

Peche Net

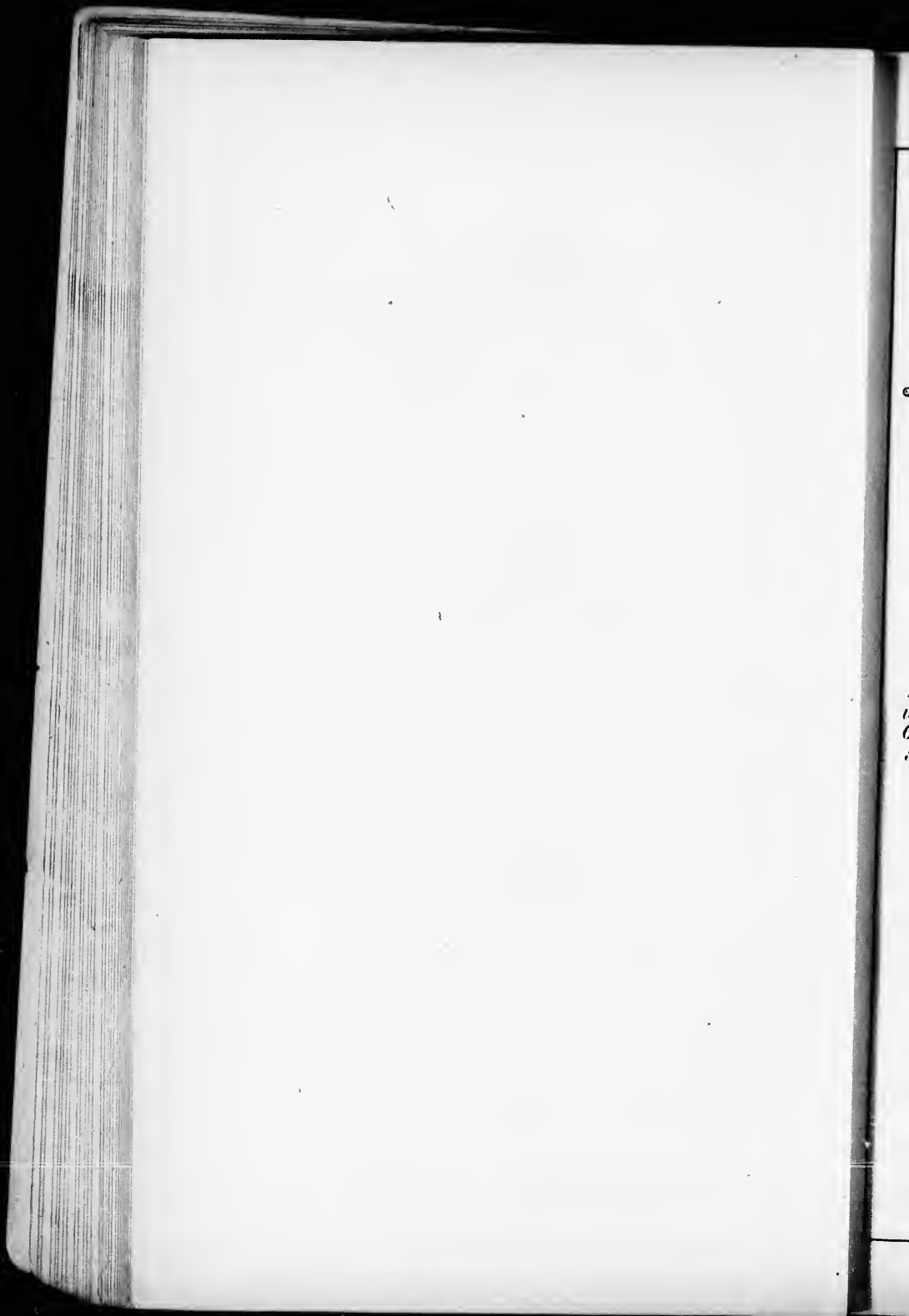


Most destructive Trap, and found Art in use on AB. side of Bay Chateaux- same Style as N^o 5² with 5 Traps used with bottoms, and not taken up during Weekly close time, which is contrary to Law; their Traps and pounds should be Abolished



N^o 3²
Pêche Nets.

SABLE





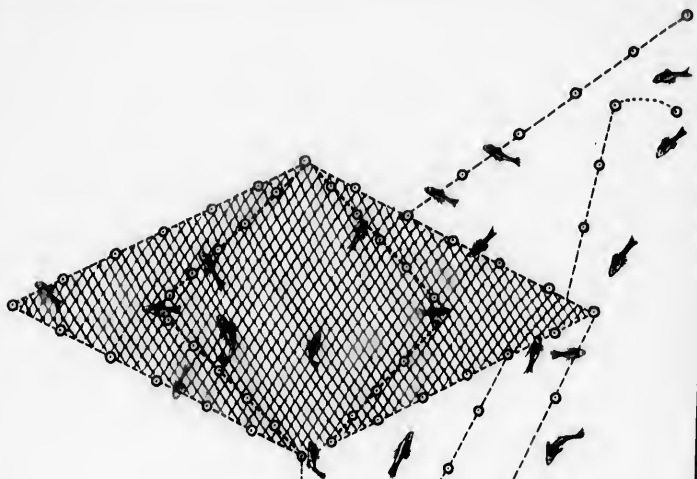
*Bar Net and pound with bottom,
upper tidal Water, Miramichi,
6 in. Mesh Leader & bottom
small Mesh.*

N^o 33
*Bar Net
and Pound.*

Leader →

SHORE

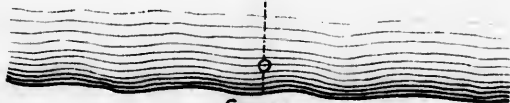
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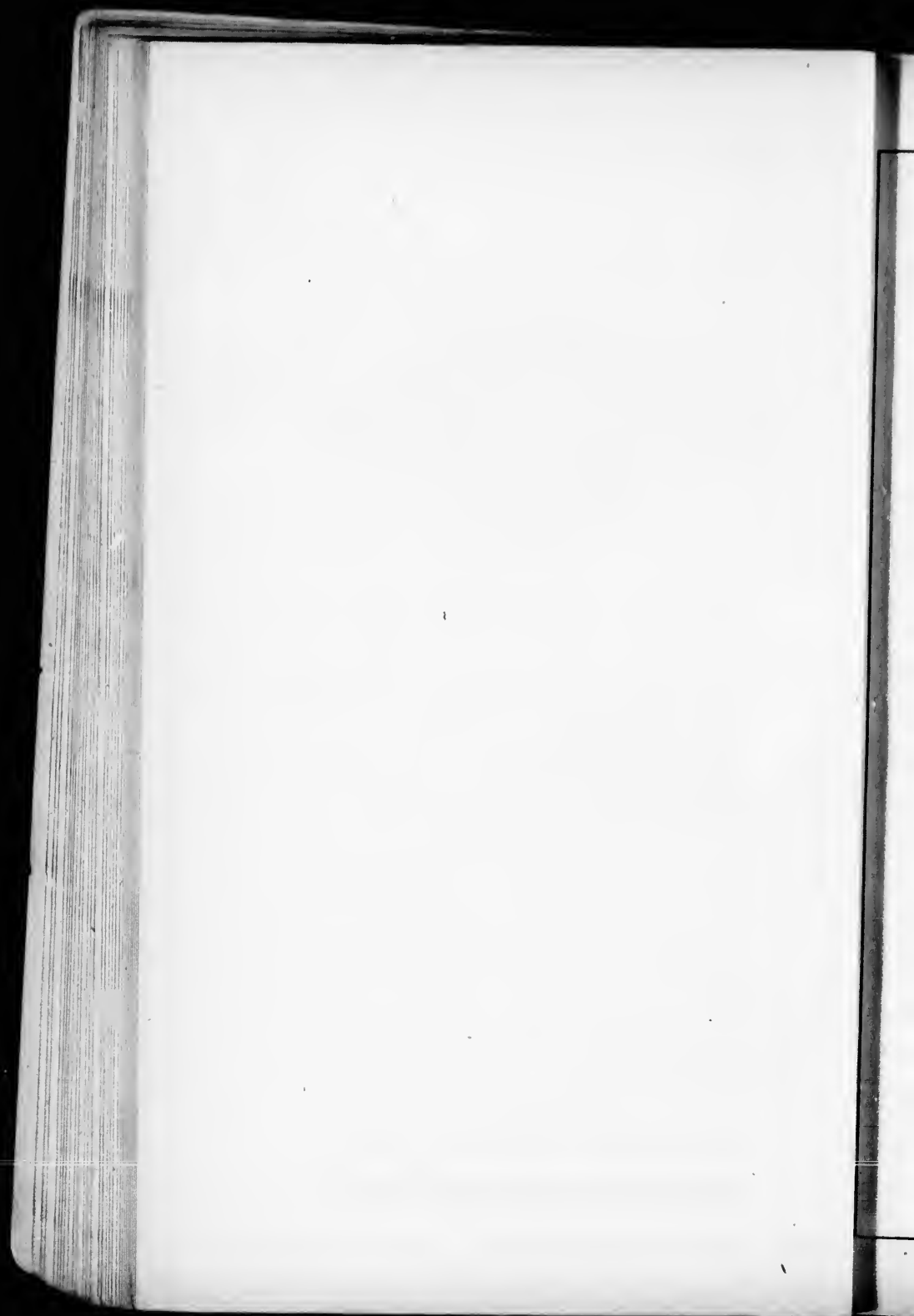
This Net is in use in upper tidal Waters of Miramichi has several Wings, one found small Mesh bottom - in which Grilse are largely taken along with Salmon.

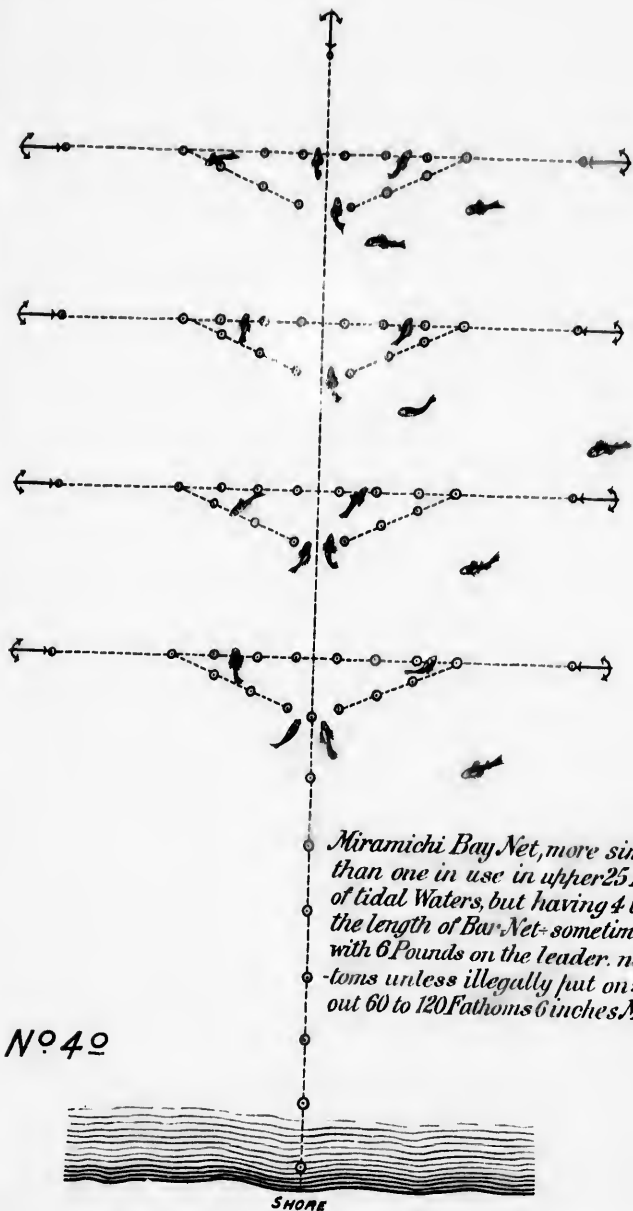
N^o 4.

Same as N^o 3. with additional Wings.



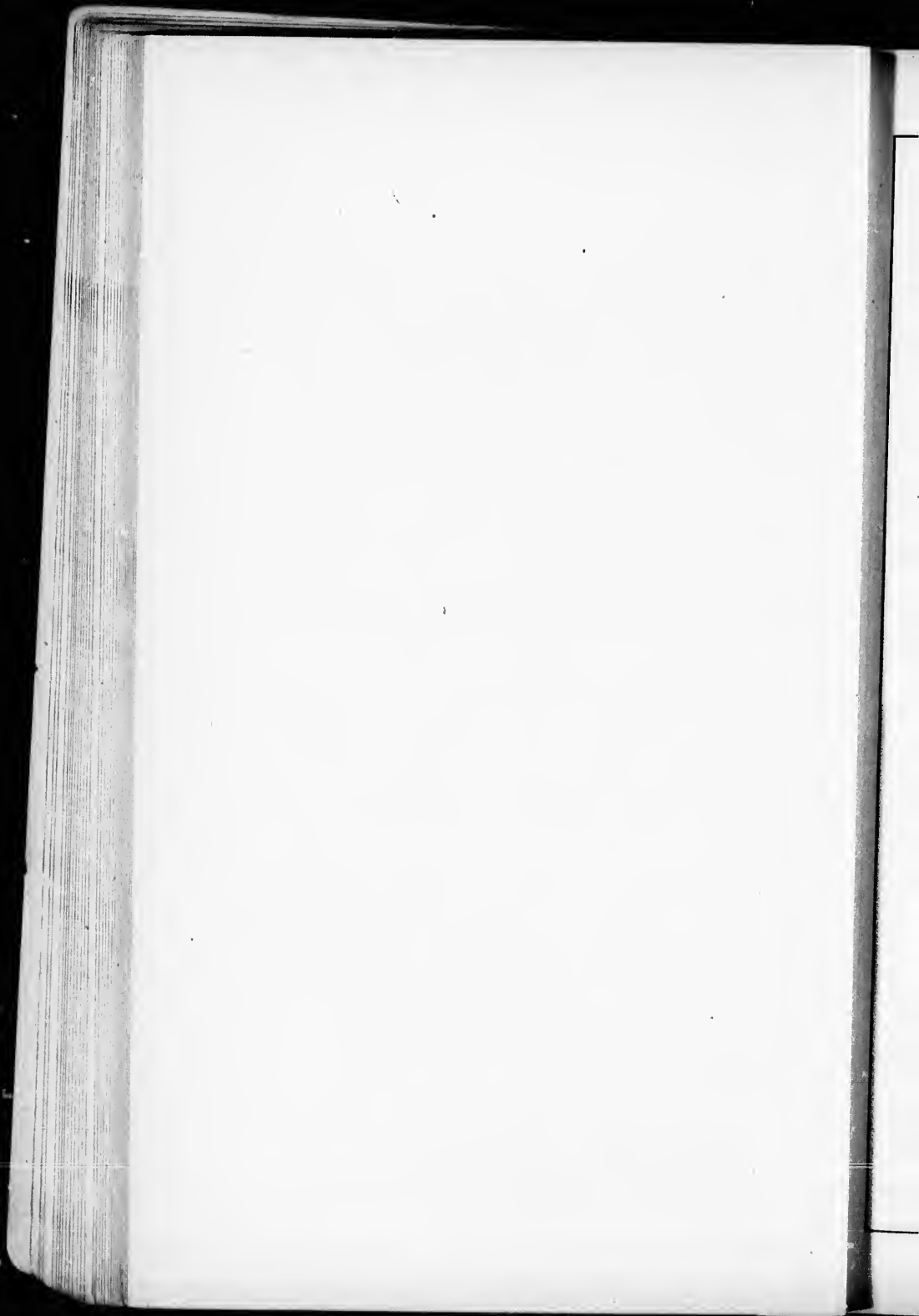
SHORE



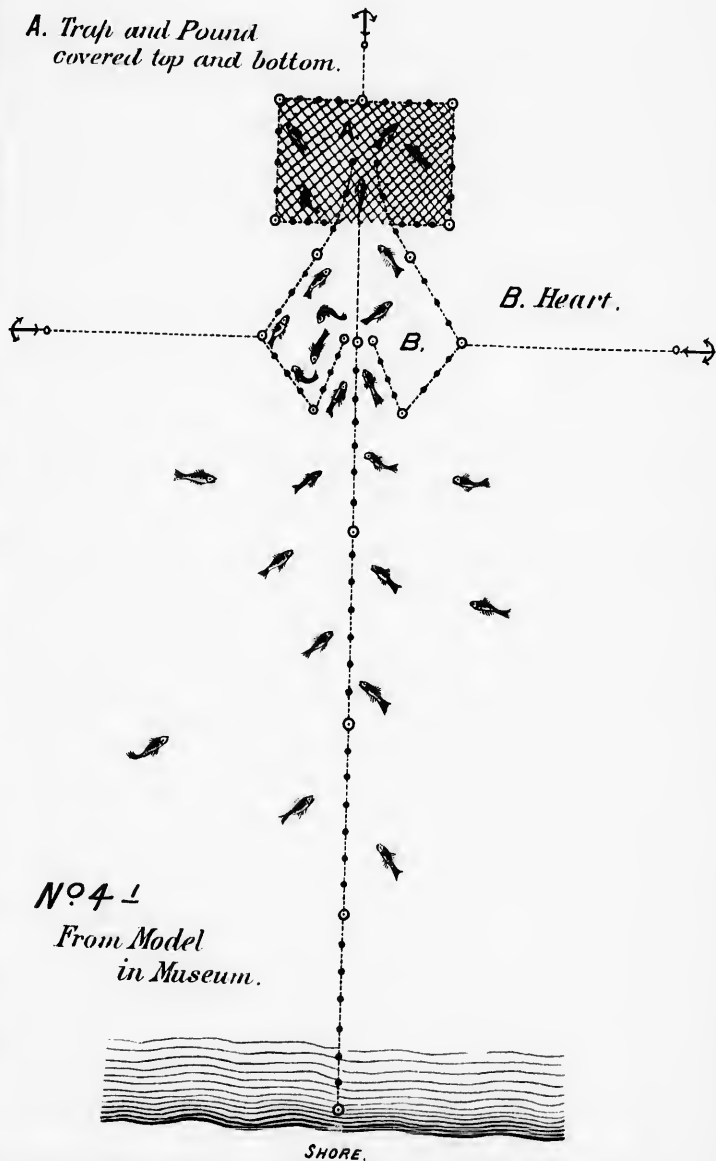


N^o 40

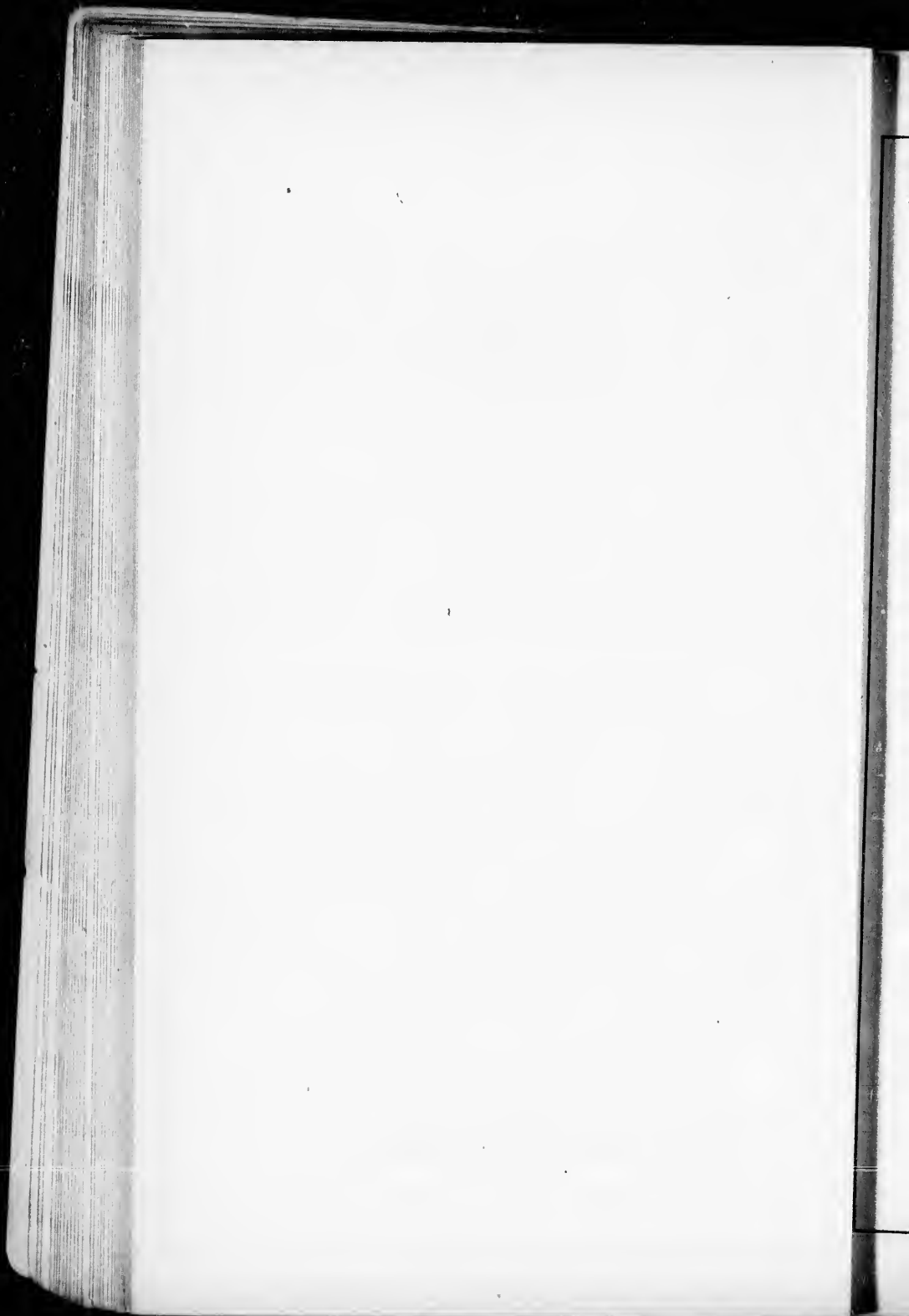
Miramichi Bay Net, more simple than one in use in upper 25 Miles of tidal Waters, but having 4 times the length of Bar Net- sometimes with 6 Pounds on the leader. no bottoms unless illegally put on- put out 60 to 120 Fathoms 6 inches Mesh.



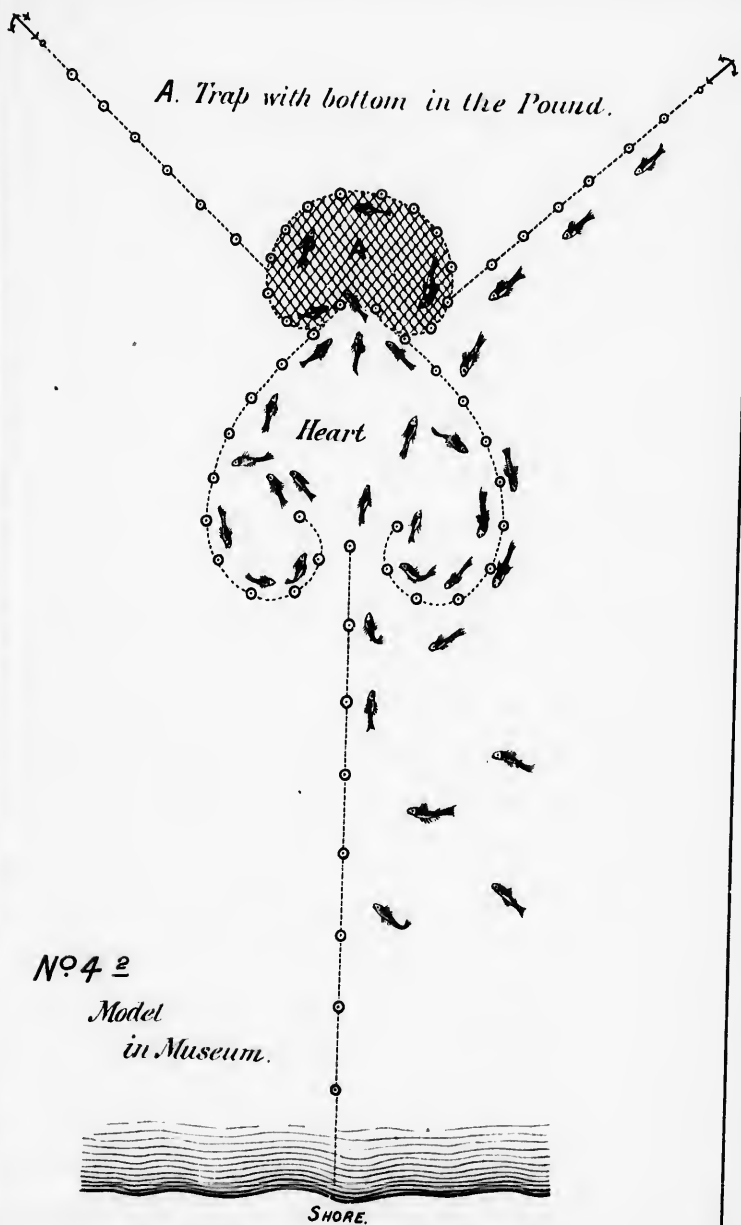
*A. Trap and Pound
covered top and bottom.*



*Nº 4 1
From Model
in Museum.*



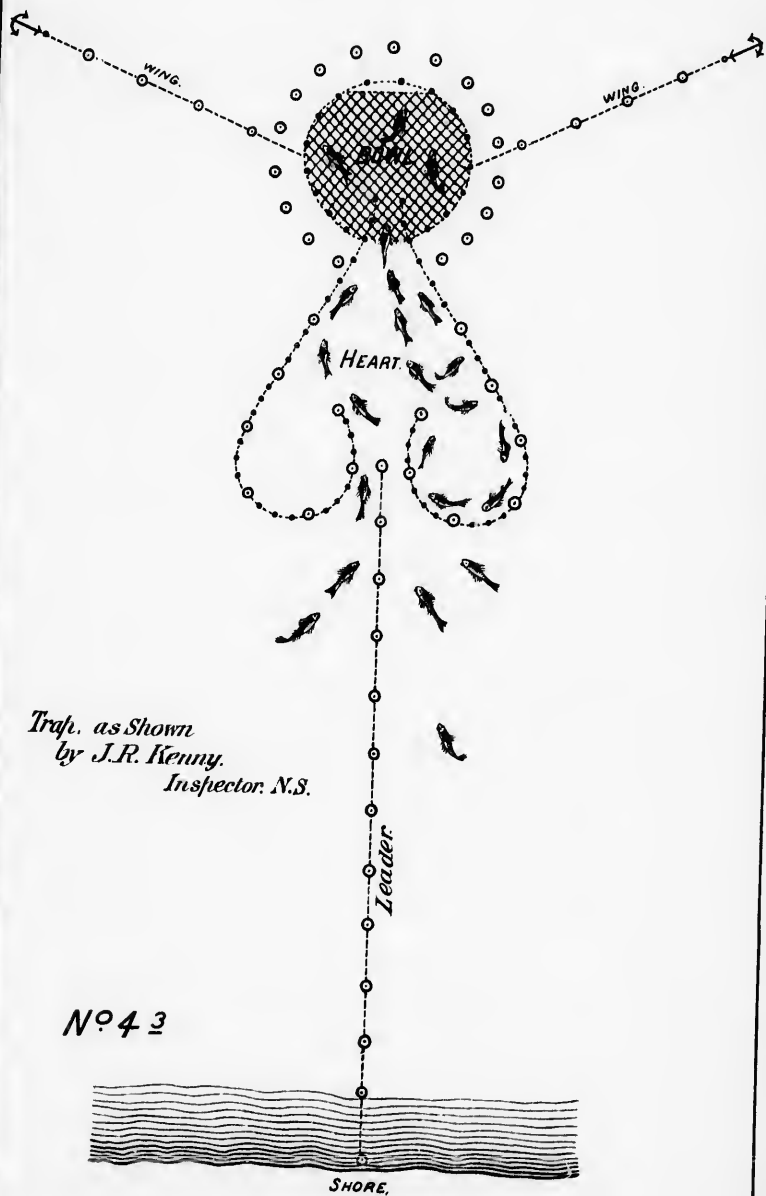
A. Trap with bottom in the Pound.



Nº 4

*Model
in Museum.*





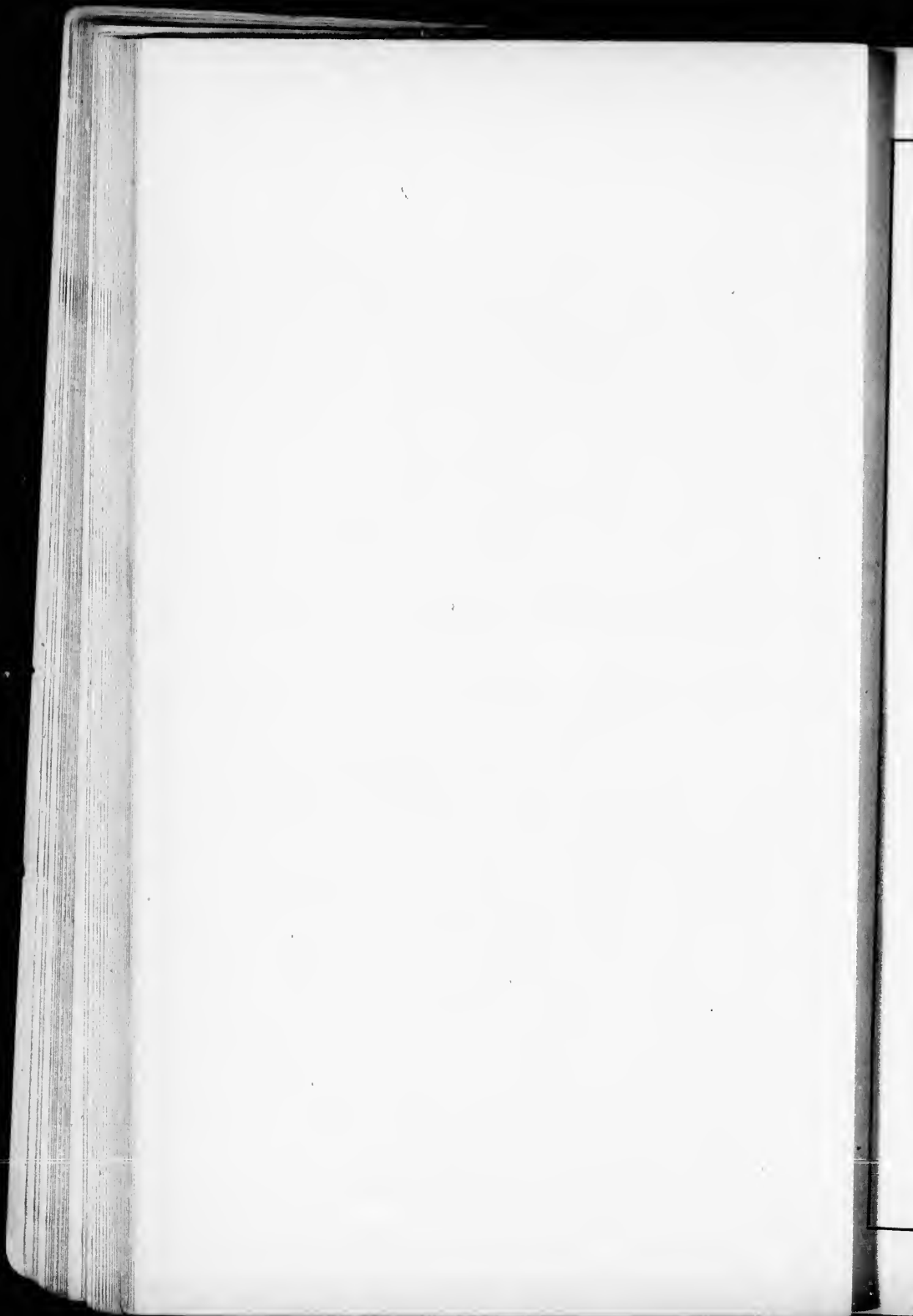


*Trap & Pound Net
from Model
in Museum.*

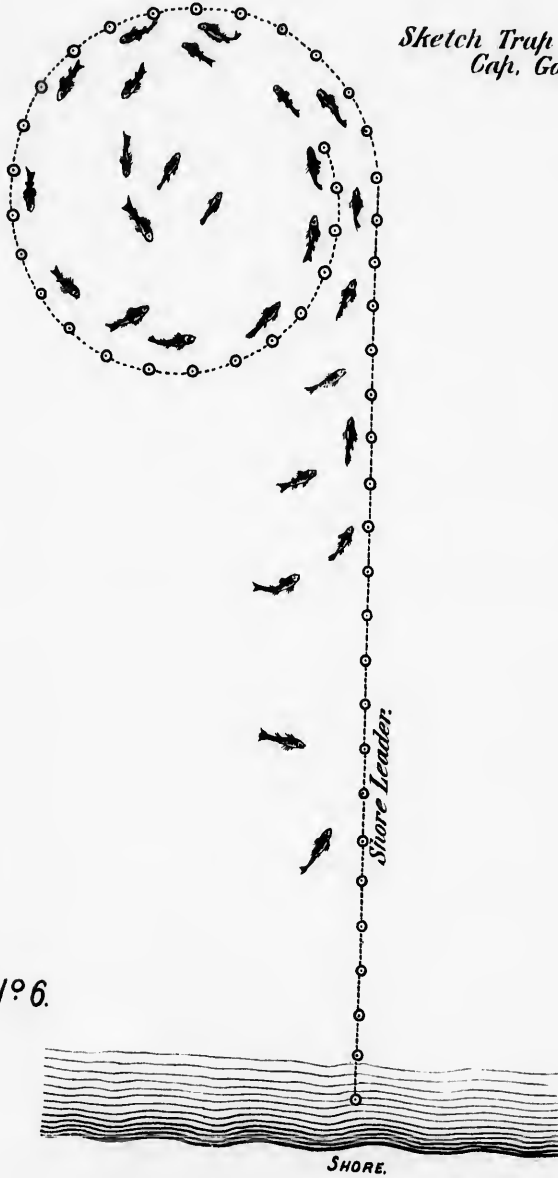


No. 5.

SHORE.



*Sketch Trap Net,
Capt. Gordon.*

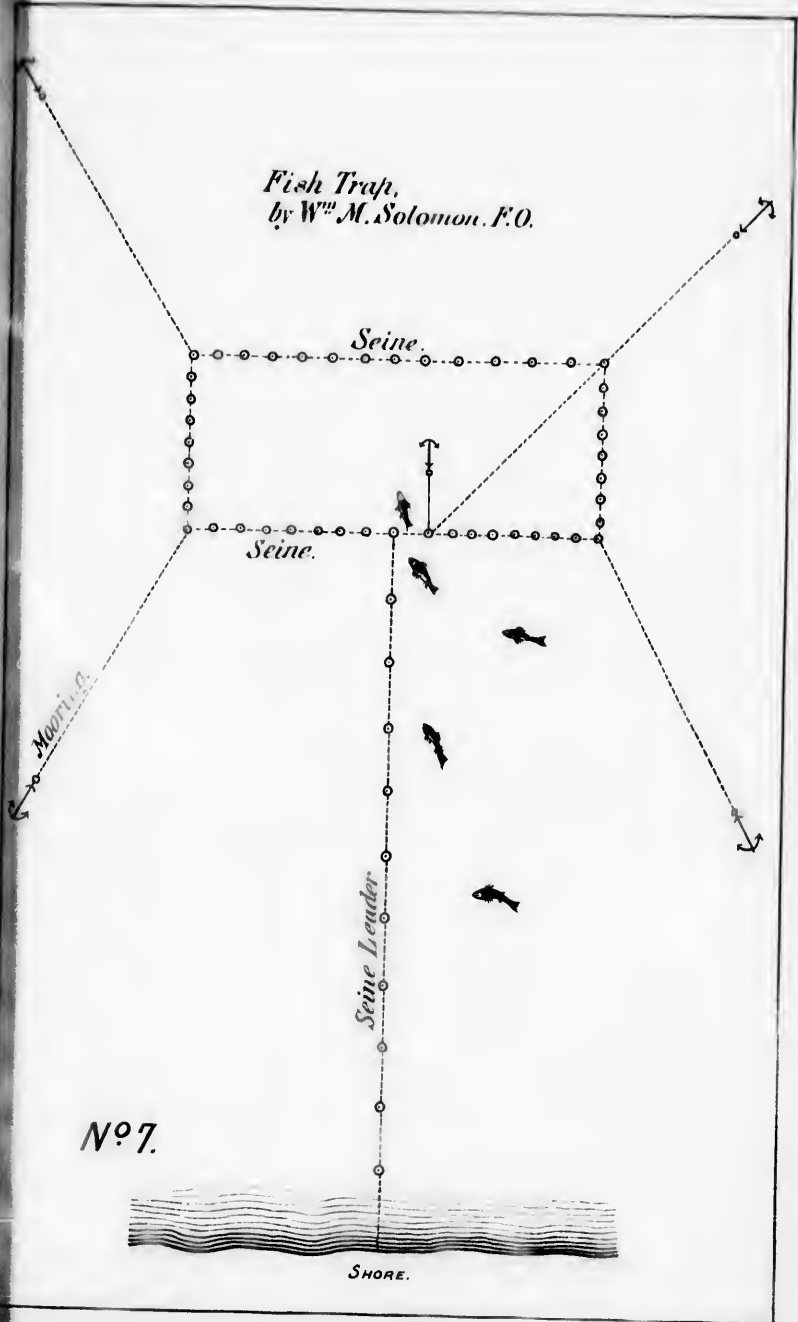


Nº 6.

SHORE.



*Fish Trap,
by W^m M. Solomon. F.O.*

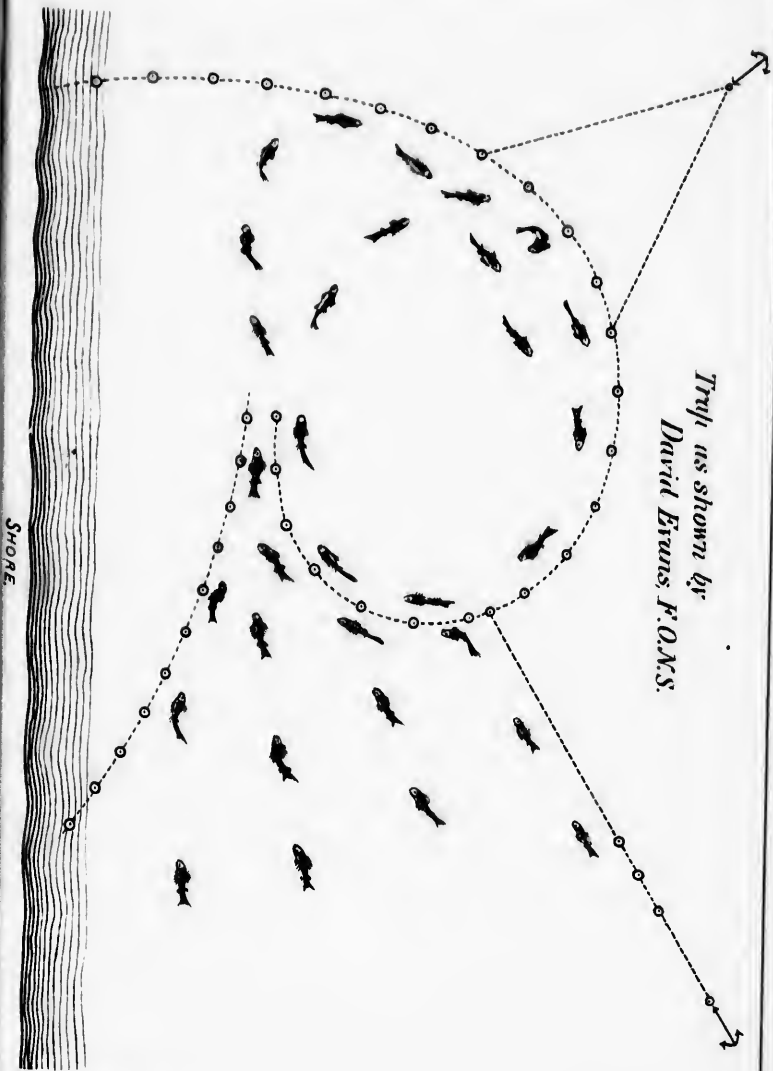


N^o 7.

SHORE.

SHORE

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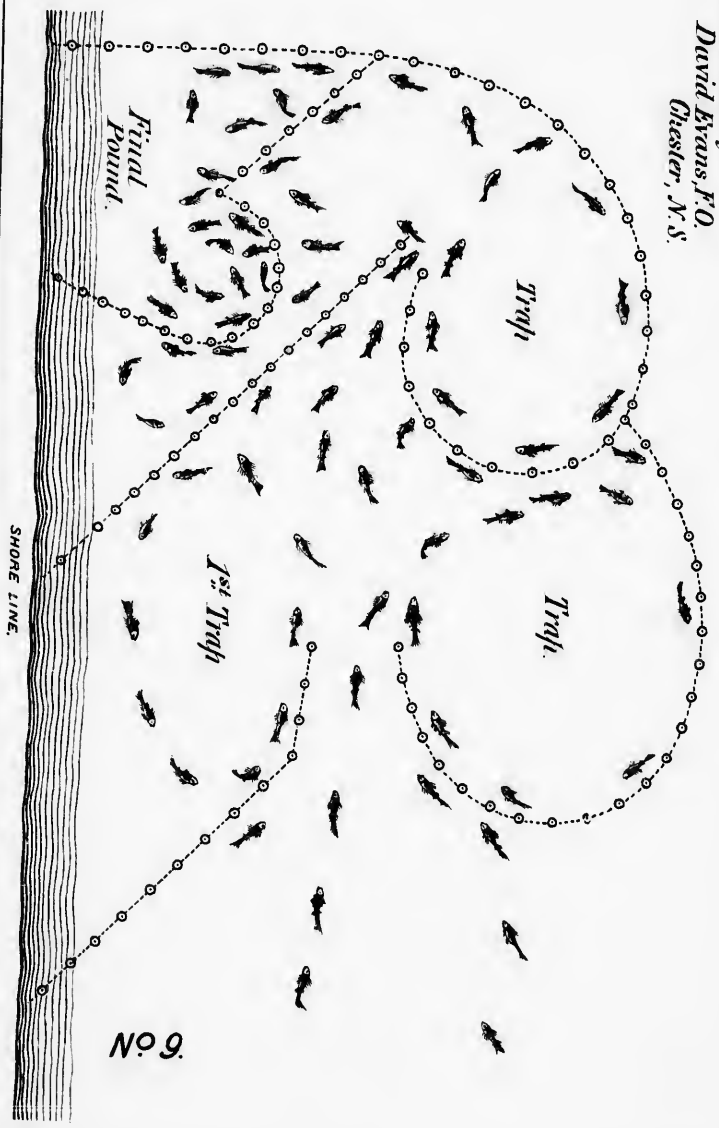
*Trawl as shown by
David Evans, F.O.N.S.*

No 8.

SHORE LINE.

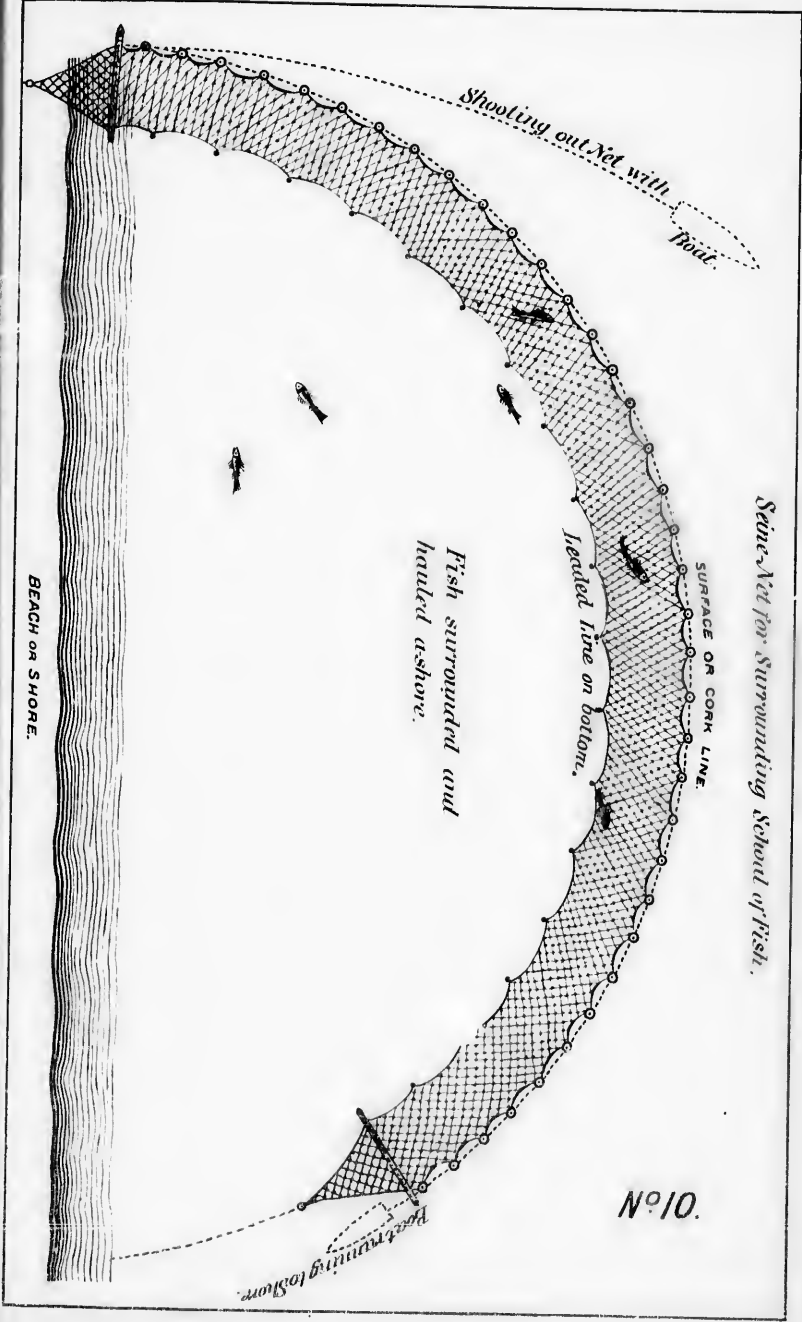


*Trawl as shown by
David Evans, F.O.
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No. 9.

BEACH OR SHORE.



Seine-Net for Surrounding School of Fish.

No. 10.

Shooting out Net with Boat.

Hauling in to Shore.

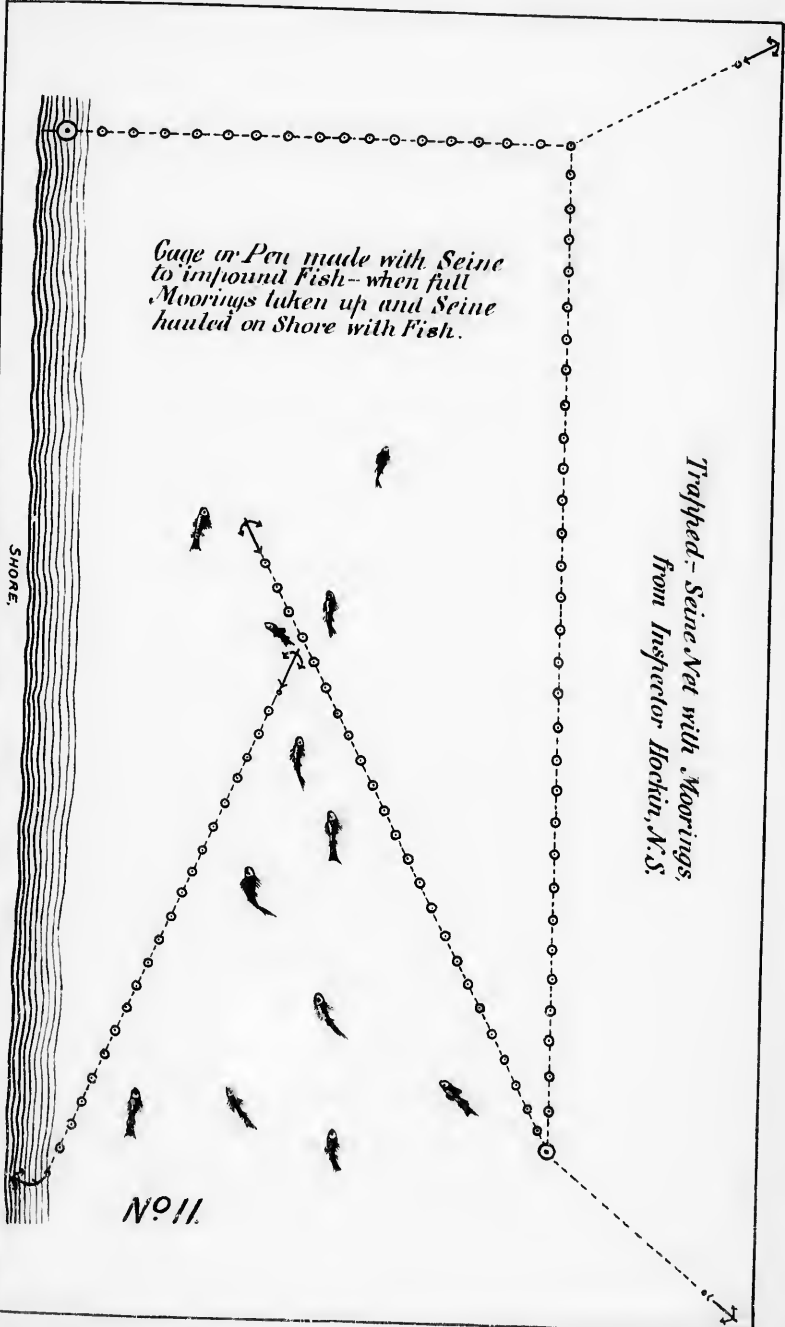
BEACH OR SHORE.

Fish surrounded and hauled ashore.

loaded live on bottom.

SURFACE OR CORK LINE.

SHORE.



*Gage or Pen made with Seine
to impound Fish - when full
Moorings taken up and Seine
hauled on Shore with Fish.*

SHORE.

*Trapped - Seine Net with Moorings,
from Inspector Hookin, N.S.*

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FISH-LADDERS.

THEIR NECESSITY FOR THE MAINTENANCE OF FISH LIFE WHERE MILL-DAMS AND OTHER IMPASSABLE BARRIERS EXIST.

This fish-ladder question is one of vital importance for the maintenance of fish life in the rivers streams and other waters of Canada on which natural barriers exist, or where artificial barriers have been built, which shut off the passages of fish to their breeding grounds to the waters above, and in addition to this prevention for the upward migration of fish, these dams invariably form deep holes or basins just below them, in which the fish collect in large numbers, waiting, as it were, for some opportunity to ascend the difficulty before them. Here they become the easy prey for the fisherman and poacher, who, regardless of the fact of these fish being penned there, mercilessly slaughter them in every conceivable way.

It is not an uncommon occurrence to see at the foot of the dam or other barrier, at the running times of fish (which means the time their instinct leads them onward to their spawning grounds), scores of men and boys with every kind of engine of destruction—nets, spears, hooks, traps and even guns—catching and killing these ripe, pregnant fish, with the fruitful eggs flowing from their bodies, besmearing the boats and banks of the stream. If it were not for these impassable barriers stopping the fish they would pass on, and not become impounded in these pools or pens, and opportunity would be given them to scatter their eggs here and there all along throughout the streams and other waters above, where nature had directed them to go.

Whilst there are many natural barriers to be found shutting off the ascent of fish, there are also innumerable artificial ones, which have been permitted to be built by man, such as mill-dams, sluices, &c. Many of these are placed directly across the streams, and these are the principal causes which have brought about the great destruction of fish life which is now so sadly experienced throughout the country, and which so frequently calls forth the attention of the Fisheries Department by applications to erect fish-passes and other contrivances by which the remnant of the fish in many streams may be enabled to surmount these barriers and reach their spawning grounds to keep up their species.

Great ingenuity has been shown by inventing various kinds of appliances to give facilities to the fish by which they could surmount these natural and artificial barriers. In some cases the old original zig-zag fish-ladder in use for the past century stands supreme in many parts of the world, and has rendered great service both for introducing and maintaining fish life where it has been properly put up.

Besides the old ladder just referred to, later designs have been invented in Canada. One, known as Rogers' ladder, has been put in operation on some streams, and conflicting accounts are given regarding its proper working; and later Hockin's fish-pass has been patented, and whilst its simplicity of build and apparent utility bids fair to supersede all others, it has, nevertheless, not had sufficient trial to warrant perfection in its practical working to give authority to the Department to adopt it as the governmental fish-ladder which shall be applied to all places where such an improvement is required to advance the fisheries' interests throughout the country.

Artificial barriers, such as dams, may in the great majority of cases be found suitable to have built in or attached to them passes of the latter kinds, such as Roger's and Hockin's; but where natural barriers, such as waterfalls over rocky ledges, &c., these ladders can not, as a rule, be applied, without great expense in blasting out a locality for the pass. In such cases the old zig-zag pass will still hold its place of superiority. If, perhaps, by some modification of the Roger's and Hockin's ladders they could be somewhat satisfactorily applied below the barrier; but the main object of excellence over all others now claimed by these patentees is, that their location is in the pond above the dam, or other barrier to surmount.

In view of the great necessity that exist for establishing some one perfect fish-ladder by the Department, which shall in all cases be erected wherever fish are prevented from passing up the river and other streams to spawn, by reason of mill-

dams or other obstructions, the undersigned would suggest that the Department should cause one of Hockin's fish-passes to be erected on some river, or other stream which the more important kinds of fish are known (or have been known) to pass up to breed, and at the head or outlet of such pass build a large cage, or trap, into which all fish ascending the ladder must enter, and become impounded until liberated—such pen and ladder to be placed under the special guardianship of some competent and trustworthy person during the period in which fish are on their migration. In this way, if the ladder shall prove its utility and efficiency for carrying fish over the dam, the fish so passing through the ladder must also enter the cage or pen at its head.

In this way the question will be practically solved regarding the efficiency of the pass, and in this way the Department could come to a satisfactory conclusion that the money granted for erecting fish-passes over dams, &c., was properly spent; and that facilities were at hand by which many rivers and streams now almost barren of fish, in which they were formerly plentiful, could be made again reproductive.

The undersigned has been instructed on several occasions to visit and inspect certain fish-ladders in different parts of the country, and in every case has found them to be perfectly useless, either from unsuitability of location or want of proper construction, the consequence of which has been that these passes, which cost considerable sums of money to help sustain the fisheries of the locality, acted the reverse way, by giving greater facilities to persons to kill the fish at the entrance of these passes, and by squandering the money in the construction of them—thus showing the necessity that exists for adopting the most perfect fish-ladder now known, and compelling the owners of mill-dams to put in these passes, under the requirements of the Fisheries Act, sec. 13. This want of a duly authorised fish-ladder, and the delay in having an efficient one put in every mill dam or slide or other obstruction in all of the streams of the country, is telling most severely against the keeping up of fish life by the natural as well as the artificial methods of reproduction.

In connection with these remarks on the fish-ladder subject, I beg to append the following as being quite pertinent:—

HOCKIN'S NEW FISH-WAY.

One of the problems which has occupied attention for some time has been that of reconciling the use of the water power of the country with the fisheries interest. Mill-dams across a river are no doubt a necessity, but at the same time if anadromous fish—that is, fish which live in the salt water but spawn in the fresh water—cannot have access to their spawning grounds, in a very short time they become extinct in the river, and the coast fisheries in the country are thereby materially affected, for to quote the late Professor Baird, the eminent ichthyologist:

"It is well known that while anadromous fish were present on the rivers there was an ample supply of eel, haddock, halibut, lake and various other species close into the shore, for the reason that these fish feed upon and therefore follow anadromous fish as they come upon our shores for the purpose of ascending the rivers. And again, when the fish have spawned in the rivers and lakes and, the young fish reached a certain stage of development, they descend the rivers in immense numbers and are fed upon by deep-sea fish."

There can be no reasonable question that the great decrease in numbers of anadromous fish has been caused in large part by human agencies—(mill-dams, sawdust in rivers, destruction of the fish while in the rivers to spawn)—and that to this fact it is owing that year by year the location of deep-sea fish it is found further and further from the shore.

It will be seen, therefore, that any contrivance which would enable the water power of the country to be used, and at the same time afford free access of fish to their spawning grounds, must greatly add to the wealth of the country. Efforts in this direction have been made, with some degree of success, by means of an inclined plane to enable a fish to get over a dam. The most elaborate of these structures is that of the United States Commissioner of Fisheries, Marshall McDonald. This, however, cost a large sum to build. The Rogers' fish-pass, which has been used by the Department of Fisheries for some years, is constructed on this principle, and there are several others. We give a cut of a recent invention by Robert Hockin, esq., M. P., of Pictou, Inspector of Fisheries for eastern Nova Scotia, which has been patented in Canada and the United States, and application has been made for a patent in Great Britain and the continent, the simplicity and apparent practicability of which will probably lead to its supplanting all other systems. It is constructed of a series of successive compartments, formed by longitudinal side walls and subdivided transversely by partitions—(a) forming compartments (b) and provided with a floor (c). The partitions (a) have each an aperture (d) near or at the bottom, and preferably in line with one another, and with a like aperture (e) in the dam (a), so that all the water fed to the compartments will pass through the aperture in the dam into the first compartment and thence into the several compartments successively. The water from natural causes diminishing step by step in each of the compartments, and finally flowing out of the last com-

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partment into the river below, under a head of 18 inches or 2 feet, and therefore with a velocity so reduced that fish can easily contend against it, swim into the compartment, and thence through the several compartments into the dam above. A fish-way built on this principle 28 feet long will overcome a head of water which would require a pass 80 or 90 feet, built on the incline plane principle, while the great length of the latter and the fact of its being near the surface renders it very liable to be destroyed by ice. A Hockin pass built inside of a dam, from the bottom upwards, does not present any hold for the ice. Again, incline plane passes, being fed from the surface, are liable to be choked with floating debris, and are subject to frequent changes in the height of water in the dam, requiring attention to open gates to suit the height. The Hockin pass being fed from under the surface is not liable to be choked, and is always supplied with a sufficient quantity of water. As a matter of fact, it has been found that the quantity of water vented by this fish-way is so little that its loss is not felt by the mill-owner. The Department of Fisheries have caused several of these fish-ways to be built, the one in Cumming's dam, Melrose, Guysboro, being the first or experimental pass. The fishery officer in charge, Thomas McKeen, says: "I regard this as a perfect fish-way, almost equal to the natural stream." One has been put in the dam at Tidnish, Cumberland County, approval. We have examined an excellent working model, and were struck with the simplicity and apparent efficiency of the invention. It may be explained that the cut is only for the purpose of illustrating the principle. Fish-ways are set within the dam with the outlet into the river below.

NOTE.—Plates of Hockin's fish-way will be found at page 16 of part I of the supplement to the report of the Department of Fisheries.

9.—RESULTS FROM ARTIFICIAL FISH CULTURE.

(From Officer Sheasgreen's Report, with evidences of successes of Salmon Culture from the Miramichi River Hatchery.)

In order to show that this institution is regarded as a benefit by all the fish dealers, and by the greater part of the net fishermen themselves, who were at one time the most sceptical, I will submit the following opinion expressed by these men:

John Betts, Esq., a fish dealer and shipper at Derby, South-West Miramichi, who owns and controls several sets of nets on that branch of the river, says:—

"I am a firm believer in the method of breeding fish by artificial means. I have now been in the salmon fishery business for quite a number of years, and I maintain, through my experience, that artificial breeding for the past eight years has been the means of sustaining the life in our fishing industry on the Miramichi. It is my belief that the theory which some advance, viz., that the different runs of fish which enter our river belong to different species is sheer nonsense. It is certain that we have different runs of fish during the autumn, but all belong to the one species, for where is the person who can state that ever a bright salmon was met with during the spawning season. The catch of fish on this river during the past three or four seasons does not show the slightest signs of decreasing, which, considering the enormous strain that is year by year put upon our waters, speaks very favourably for artificial breeding, as any sane man who is acquainted with the habits of parent salmon when depositing their ova cannot maintain that it is by natural means only the enormous demand is year after year supplied."

The Honourable Michael Adams, one of our best fly-fishermen, says: "Salmon were plentiful this season. If it were not for the benefits derived from the fish hatchery the salmon would now be nearly exterminated in our streams."

Jared Tozer, Esq., of the firm of Tozer & McDonald, fish dealers, says: "If it were not for the large numbers of fry that are yearly planted in our rivers from the hatchery the supply of fish would now be nearly exhausted. The catch of salmon by our nets this past season was good."

John McColm, another fisherman and dealer of North Esk on the North-West Miramichi, says: "Without the assistance received from the successful working of the salmon hatchery which the Government has placed upon our river salmon fishing would have been a total failure long before this time, instead of which we find that this industry is as remunerative as it was twenty years ago. At that time not one-fourth the nets and traps were in use as at the present day, still, the average number of fish taken by each net is greater, although the lower part of the river and bay is literally blocked with netting. Artificial breeding is the only means of supplying the demand that is made upon these rivers every season."

John Fergus, fly-fisherman, says: "Artificial breeding of salmon is a great benefit towards keeping up the supply of this important fish."

Park Gillis, a tide-head fisherman, says: "Artificial fish hatching is beyond any doubt the means of keeping up the supply. The catch of salmon in this vicinity is good each season; and when it is considered how the river is obstructed with nets along the lower parts, one would think it almost impossible for fish to reach this point at all. This shows that they must be plentiful in the river."

Many more opinions similar to the above could be here inserted but as they all agree in saying artificial hatching is a benefit, and that salmon are plentiful, it is useless to do so. It will be noticed that John Bells, Esq., comments upon the theory advanced by some concerning the different "runs" of fish. He therein contradicts the statements of some persons, who cannot deny but that a large number of fry are annually turned out from this hatchery; but who still circulate these statements simply to injure the reputation of the institution among the unthinking fishermen. However, in a very short time all these misleading theories must fall to the ground, as the good results are too evident to be denied by any fair-minded man. The animosity and ill-feeling which extended against establishments of this kind when first instituted have gradually worn away, until at the present time, only the dissenting voices of a few old sceptics, who will never be converted to any modern idea, are to be heard; but the great majority of the fishermen, fish-dealers and others interested in the fishing business are in favour of the artificial work, plainly seeing that it is impossible for the natural means to keep up the supply with the demands now made upon it.

In order to show what a large number of salmon are taken in this river during one season, let us take Mr. Jared Tozer's nets for example—the north four sets in this vicinity, from which he has taken over 1,000 salmon. This number of nets occupy about two miles of the river. It shows an average of 250 fish to each net. It must be borne in mind that these are short river sets. What an enormous quantity of fish must be taken in the lower 30 miles of the river and bay, where the nets are twice and sometimes nearly three times as long and where nearly double the number of fish will be taken from each net; and still after all this destruction the fish are very plentiful in the upper parts of the river, where fly fishing was also unequalled during the past season. This certainly shows that salmon are abundant in these waters, and points most conclusively to the fact that artificial breeding is the remedy which has restored the almost depleted state of the waters of this river, in which they were a few years ago, and should place the great benefits which are already derived from this institution beyond doubt in the minds of thinking men.

"St. JOHN, N.B., 10th December, 1890.

SUCCESSFUL RESULTS OF TRANSPLANTING RESTIGOUCHE SALMON FRY INTO THE
NIPISQUIT AND MIRAMICHI RIVERS:

"ALEXANDER MOWAT, Esq.,
"Officer in charge Restigouche Hatchery,
"Campbellton, N.B.

"DEAR SIR,—In reply to your favor of the 8th inst., enquiring 'If you have received any benefit from the planting of Restigouche fry in your river for the past number of years?' I have to state, that since the planting of Restigouche fry in the Nepisquit River, in 1883, I have on several occasions observed that a very considerable number of the grilse were undoubtedly of the Restigouche kind, and distinct from the native Nepisquit grilse; and I have, as a consequence, expected them to be followed in due season by a large number of salmon of the Restigouche type. In this expectation I have been disappointed, having only observed a small number of the salmon that were not of the true Nepisquit type. I attribute the cause of the absence of a fair return to the Nepisquit of full grown salmon from the planting of the Restigouche fry, to the fact that the fish, being large, are impounded in the traps, pounds and bag-nets so extensively used down the coast; while some of the smaller Nepisquit salmon get through the nets and come on to the river. When a Restigouche salmon bound for the Nepisquit gets there it is early in the season,

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before the salmon beach nets are set or when they are disordered by rough weather.

"This year, early in the season, I, and my friend fishing with me, killed six large Restigouche salmon at the Paveneau Falls of the Nepisiquit, but saw none later on. I may here mention that except as provided in 1883, I have always been opposed to the manner in which the fry have been planted, for lack of proper facilities for wide distribution of the contents of each can of the young fish in well chosen parts of the river, instead of being dumped from the contents of the cans 'en masse,' cart load after cart load, where the highway chanced to come near the river.

"I am assured that the gentleman riparian owners, and possessors of the fly fishing of the Nepisiquit River, will fully contribute towards the cost of any well defined and practical plan for the reception, detention and feeding of the young fry through the first season, until they can better take care of themselves.

"Your's truly,

"J. DE WOLFE SPURR."

(From Officer Alexander Mowat's Report.)

CAMP ADAMS, NEWCASTLE, N.B.,

MAIN NORTH-WEST, 2nd July, 1890.

MY DEAR MR. MOWAT,—Thanks. Your young salmon fry arrived in fine condition and were carefully placed in pools. We are experiencing the results this season. Already we have captured seven of your fish 17-18 lbs., and yesterday one by Mr. Brown, of Colorado, 23 lbs.—the largest fish yet caught at Camp Adams. This person was more than rejoiced, and carries him home as a trophy of victory. I wonder how long it would have taken to convince certain sceptics that we could solve this problem in so short a time. Our catch since 19th, June to date, 33 salmon, 32 trout. Touching the latter, we only count trout weighing over 3 lbs.

Your most respectfully,

M. ADAMS.

THE SUCCESSFUL STOCKING OF THE HUDSON RIVER WITH "SALMO SALAR," WHERE THEY HAVE NOT BEEN KNOWN FOR THE PAST CENTURY.

The "Forest and Stream."

"Salmon in the Hudson River had been noted by scores this season. A fish-way have been put into the the dam, and the fish are going over that obstruction in large numbers. The stocking of the Hudson with salmon may now be regarded as an established fact, or at least as a enterprise for which success can with excellent reason be promised. There are other dams, and falls yet to be provided for with fish-ways, and now that the above results are shown it would be only folly to postpone the task. The Hudson as a salmon river is destined to be famous."

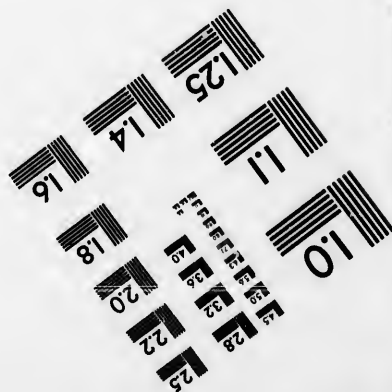
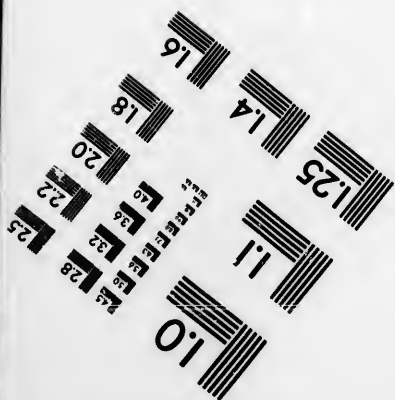
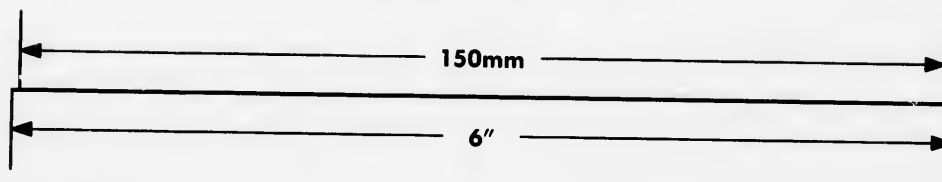
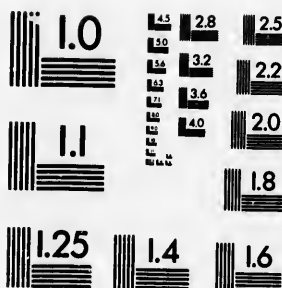
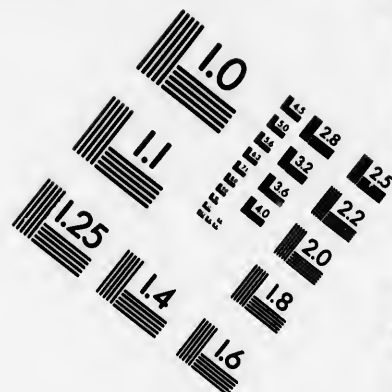
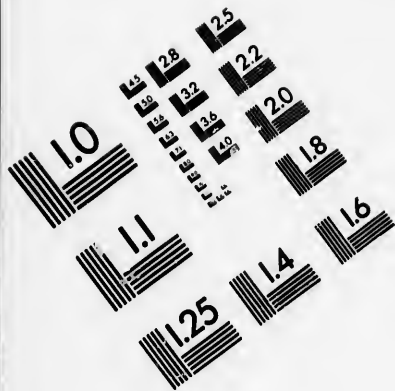
From "Fishing and Shooting."

"The idea of stocking the Hudson River with salmon originated with Mr. Fred Mather, who made the suggestion to the late Prof. Baird, who was then United States Fish Commissioner, and the first eggs were hatched and fry planted in 1882. The State made an appropriation for building fish-ways with dams at Mechanicsville and Fort Miller, and these fish-ways are being built. The following is related with regard to salmon in the Hudson in July, 1890:—

"The gates of the Hudson River Power and Pulp Company were opened to drain down the water, so that it would not flow over the dam during the progress of putting in a fish-way in the 16-foot stone dam across the Hudson River, and over one hundred salmon were counted in the shoal water thus created at its base as they retreated back into greater depths. They were from 1 to 3 feet in length, and



IMAGE EVALUATION TEST TARGET (MT-3)



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 Fax: 716/288-5989

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probably averaged from 5 to 8 pounds in weight. The largest salmon caught here this season by angling measured 30½ inches, and weighed 22 lbs. 7 ozs. The fish-way is now under construction; when completed it will allow the salmon to pass the river to the shoals and tributaries they seek for spawning purposes. * * * These fish are all the results from the placing of salmon fry on the Hudson, commenced eight years ago by Col. Fred. Mather, from the United States Hatchery, Cold Springs; L. I., at the request of N. Cheney, Esq., angling editor of *Shooting and Fishing Journal*.

RESULTS OF ARTIFICIAL WHITE FISH CULTURE.

(From the Report of the State Commissioners of Fisheries for Pennsylvania, U.S.A.)

The people realize that fish propagation is no longer an experiment. Hundreds of depleted trout streams now restored to good condition and filled with fish attest the success of restocking.

The increase in the catch of shad in the two great rivers of the commonwealth, the Susquehanna and Delaware, bears witness to the beneficial results of the artificial propagation of this delicious fish, and indicates a future plentiful supply that will cheapen its price to all.

Nor must we forget the wonderful increase in the catch of white fish in Lake Erie, where as late as the year 1885, the supply was so nearly exhausted that the fishermen most largely engaged hesitated to embark in an enterprise that promised but scant and profitless returns. This result is directly traceable to the great plants of fry in that Lake by the hatcheries of Pennsylvania and those of the neighbouring States bordering on the lake.

The yield of white fish in Lake Erie during the past season has been greater than the yield of any season for the past twenty years, and larger than the combined catch of all the other great lakes, and brought to our city of Erie alone a return of over three hundred thousand dollars.

Fourteen million six hundred thousand (14,600,000) white fish fry, and all distributed in good condition, from two to six miles from the shore in Lake Erie. The white fish hatcheries established by the States of Michigan, Ohio and Pennsylvania, with that of the United States Commission, have effected a revolution in the fishing industries of this lake. It will be noticed that the catch of whitefish was very largely in excess of the catch of 1886, which only amounted to 61,500 pounds, as stated in the last biennial report of the Commission. The catch of 1888 amounted to 2,200,000 pounds.

NOTE.—By Mr. Wilmot—it may be here stated that the year in which, the 14,600,000 fry were put out from the Erie hatchery, 56,000,000 whitefish fry were put in the waters of Lake Erie from the Canadian hatchery at Sandwich, Ont., and that previous to that year 248,650,000 fry were also planted in the waters of Lake Erie from the Canadian nursery, and if the output of the years since be added, there will be shown a grand total of 377,773,000 whitefish fry turned out from this one Canadian hatchery.

The above report for the year 1890 is respectfully submitted.

SAMUEL WILMOT,

Superintendent of Fish Culture for Canada.

FISH CULTURE 1890.

APPENDICES.

REPORTS FROM THE SEVERAL OFFICERS IN CHARGE OF FISH-BREEDING ESTABLISHMENTS IN THE SEVERAL PROVINCES OF CANADA FOR 1890.

1.—FRASER RIVER HATCHERY.

PROVINCE OF BRITISH COLUMBIA.

REPORT OF THE OFFICER IN CHARGE OF THE FRASER RIVER HATCHERY FOR 1890.

I have the honour to submit my seventh annual report of this hatchery, together with a statement of the fry distributed and eggs collected in 1890.

From the supply of eggs collected in 1889, consisting of 9,233,000, the following numbers of fry and semi hatched ova were distributed on the dates and at the places below named:—

December 17, 1889,—Eyed ova, Nanaimo River, Vancouver's Island, near waggon bridge.....	500,000
December 25, 1889,—Cowichan River, above railroad bridge.....	509,000
February 4 1890,—Sent to experimental hatchery, Ottawa	100,000
March 5, 1890,—Fry in Pitt Lake, half-way up north side	800,000
March 27, 1890,—Coquitlam River, below C. P. R. bridge.....	320,000
March 31, 1890,—Pitt River, head of lake.....	480,000
April 7, 1890,—Stave River, 1½ miles up.....	640,000
do 9, 1890,—Harrison River, at foot of rapids.....	1,040,000
do 11, 1890—do do	1,120,000
do 17, 1890—Nicomekle River, Surroy.....	60,000
do 19, 1890—Pitt Lake, half-way up on south side,...	570,000
do 21, 1890—Sumas River, near the mouth.	510,000
Total.....	<u><u>6,640,000</u></u>

All of the above were obtained from fish which were caught in traps at the mouth of Morris Creek, where it flows into the Morris Lake.

There were not any eggs or fry received here from any other hatchery in the Dominion; but 100,000 eggs of the (O. Nerka) "Suckeye" were sent on the 4th of February to the experimental hatchery at Ottawa, which I learn reached in good condition.

The ova which supplied the above number of fry were all obtained from one species (O. Nerka) or "Suckeye," which are the principal commercial fish now caught in the waters of British Columbia.

Capture of Parent Fish and Collection of Ova.

There was no memorandum kept of the number of fish caught in the trap or with the drift nets this season, or of those that were stripped; but, as usual, the number was very large.

It is almost impossible to keep a record of the small salmon passing through the trap without a salmon register; And if the Department constructs the new pen which I have suggested, I would recommend having a register put in it.

Owing to the lateness of commencing operations this season the majority of the "Suckeye" salmon had ascended the Morris Creek before we could set our traps, and a few days after we got them in an exceptionally heavy of rain commenced, which lasted for ten days, raising the stream, overflowing its banks and carrying with it large quantities of logs and rubbish, that tore away the pens and allowed all the fish that had been captured to escape. From this misfortune, therefore, we only secured 1,000,000 eggs, where in previous seasons we obtained our full supply.

As the best of the season was then passed, and the fish had all gone out of the lake into the mountain streams beyond our reach, we had to resort to drift-net fishing on the Harrison River rapids to secure a supply, which was found to be a slow and expensive method. The fish captured with the gill-nets were unsatisfactory, as many of the females were found to be spent, or partially so, whilst others had to be kept for ten or fifteen days before they matured, during which time a large number sickened and died, owing to the rough method of capture by gill-nets and confinement in the retaining pens. We left the hatchery, to commence spawning operations, on the 10th of October, and finished on the 18th of November, securing in all 3,861,000 eggs, all of the Nerka or "Suckeye" species.

Condition of the Hatchery.

The hatchery is in good condition, the eggs are doing much better than in previous seasons, the rate of mortality among the ova is much less, and they are all looking very healthy. Upon their arrival at the hatchery they were immediately put in the wire hatching baskets, and distributed thinly, so that the supply would extend over the entire building. This, together with the careful stripping of fish at the spawning grounds, which was done entirely by myself and only one assistant, and by increasing the supply of water by the erection of a new flume, has been the principal cause of the present success.

Repairs.

The hatchery should have an entire coat of paint outside, and the walls white-washed in the hatching room. The walls of the dwelling portion should be painted and a new kitchen floor laid. The total cost would be about \$300.

I think it inadvisable to expend more money to increase the capacity of the present hatchery, as I am satisfied that in a very short time the Province will require another and much larger hatchery, with a capacity of putting out 25,000,000 of fry annually, in order to replenish the Fraser and other waters, which are bound in the near future to be reduced in their salmon yield, on account of the enormous quantity which are being caught each season.

Such a hatchery could be now built on the Morris Creek on Harrison River, with but little more expense than for the erection of the present one six years ago.

The good result from the present hatchery has now been clearly proven from the past two seasons' enormous runs of fish in the Fraser River.

The small streams around the Harrison, and other places where the fry have been distributed, were quite as thickly crowded with salmon as last year, while the fishery guardians and others on the Nanaimo and Cowichan Rivers inform me that the "Suckeye" salmon are appearing each season in increasing numbers.

I have the honour to be, Sir,

Your obedient servant,

THOS. MOWAT,

Officer in Charge.

2.—SYDNEY HATCHERY.

PROVINCE OF NOVA SCOTIA.

REPORT OF THE OFFICER IN CHARGE OF THE SYDNEY HATCHERY FOR 1890.

SIR,—I have the honour to submit herewith my annual report upon the work done at this hatchery during the past year.

Distribution of Fry.

As stated in former reports, I laid down in the hatching troughs 2,540,000 ova, from which 1,953,000 fry were hatched and distributed in the following streams, viz. :—

Margaree River (Inverness Co.).....	200,000
Bennecadin do (Cape Breton Co.).....	50,000
Sydney do do	350,000
Ball's Creek do	100,000
Trout Brook do	150,000
Black do do	100,000
Grand Lake do	100,000
Estrasonia River do	70,000
Salmon do do	100,000
George's do do	100,000
Leitch's Creek do	50,000
McLean's Brook do	75,000
Rory Brack's Brook do	75,000
Buddeke River (Victoria Co.).....	150,000
Middle do do	150,000
Grand do (Richmond Co.).....	50,000
Tier do do	50,000
Hatchery Brook (Cape Breton Co.)	33,000
Total.....	1,953,000

I regret not having been able to attend to the application for fry for the Mabou River. The application came too late, and to attend to it would upset all other arrangements. The application called for 1,000,000 fry, which was more than half my supply. I presume it meant 100,000, which I think would be sufficient for that river. Hereafter, I will make an allowance for that river of 50,000 or 100,000 fry.

Collecting Parent Salmon and Eggs.

This fall I succeeded in securing a fair supply of parent salmon. These were kept in good condition at the several fishing stations till ready to spawn. The following table will show the number of salmon caught, and the streams in which they were taken :—

Name of River.	Females.	Males.	Total.	No. of Ova.
Margaree.....	20	10	30	100,000
Margaree Big Inlet	1	2	3	20,000
Lower Middle River	14	16	30	60,000
Upper Middle River.....	127	103	230	600,000
Sydney River.....	53	39	92	318,000
Salmon River.....	27	25	52	120,000
Total	342	195	437	1,218,000

This was a most unfavourable season for the catching of parent fish. In the early part of the season the rivers were very low, and salmon could not ascend, although they were reported as unusually plentiful in the tidal waters during the month of September. Then, during the month of October it rained heavily and continuously, so that it was impossible to work the nets. This is particularly true, of the Margaree River. Salmon were reported very plenty in the Margaree, but could not be taken. In the Upper Middle River, where nets could be worked, some days the catch was above the average. The few days that nets could be handled in the Sydney River the catch was better than ever before. In all the rivers operated on the salmon were more plentiful than for some years back, but for the reason of the heavy rains we could not catch them.

Condition of the Hatchery.

The present condition of the hatchery is good. This fall the floor and bottom work of the building was found to be in such bad condition that it could not be repaired. All the bottom work had to be taken out and replaced by new material, which necessitated considerable labour and expense. New sills, trimmers, joice and floor had to be put in; also, the posts were considerably decayed, and had to be cut, up as high as the window sills. On one side new rough boards had to be put on outside and inside 3 feet high, and the same shingled on the outside and the inside wainscotted. The building is good now for eight or ten years more without any further repairs. It will, however, require painting, which will cost about \$80 for the outside and \$40 for the hatching room inside.

Increase of Salmon.

The beneficial results arising from the operations of this hatchery are becoming more apparent every year. The early run of salmon in the Mira River this season was far above the average. The few fishermen there, though poorly equipped, did better than for years past. Mr. Robertson, while engaged in building a bridge on the Sydney River, reports having seen more salmon sporting around there than ever before; so much so, he says, that some of the inhabitants decided to furnish themselves with nets for the coming season. Mr. Grantymire, of Little Bras d'Or River, reports having seen shoals of salmon of a very small and uniform size, and in numbers never seen there before. Mr. George Munroe reports the same of the Margaree River, having seen them on several occasions about the Margaree Harbour bridge. Mr. John Brown, at Big Pond Cranberry (entrance of the Sydney River) took 75 salmon in three days, all weighing from 9 to 11 lbs., and in the one week scored 100. I am informed that the Mira fishermen are very poorly equipped, some of them fishing with only the half of an old net, none of them having anything like proper gear. This is true of many of our salmon fishermen, but I understand they are to prepare themselves better for the coming season. The work of this hatchery is only beginning to show itself. Some men are very slow in giving credit to an institution of this kind, especially when they look upon it as experimental. Most of these men never heard of fish culture till this establishment was built, and look upon it as robbing nature of its work.

Land-locked salmon could be very suitably planted in some of our lakes. There is a chain of lakes near Margaree, called Lake Law, which I think would be most suitable for them. Several gentlemen from the States, who are thoroughly acquainted with the habits and requirement of these fish, pronounce these lakes suitable. At present these lakes are practically useless, as far as yielding any kind of fish is concerned. If stocked with land-locked salmon they would become of great value.

I have the honour to be, Sir,

Your obedient servant,

C. A. FARQUHARSON,

Officer in Charge.

3.—BEDFORD HATCHERY.

PROVINCE OF NOVA SCOTIA.

REPORT OF THE OFFICER IN CHARGE OF THE BEDFORD HATCHERY.

Sir,—I have the honour to transmit my report upon the operations at this hatchery during the past year.

I am pleased to be able to inform you that the most gratifying results were obtained in hatching the large stock of ova laid down in the troughs of this institution last season. The trouble experienced in previous years in hatching the salmon trout ova was not met with, and not only here at the central hatchery, but at all the outlying auxiliary hatcheries, the proportions hatched were very satisfactory indeed.

As stated in my last report, the number of salmon ova obtained last season was 2,000,000. In March last I received from the Ontario hatcheries a further supply of 400,000 salmon trout and 2,000,000 whitefish ova. Shortly after their arrival here mild and open weather set in, and as evidences of hatching began to appear, I deemed it advisable to convey those intended for remote points to the smaller hatcheries as early as possible.

This work I commenced on the 15th of March, and the semi-hatched ova were distributed amongst these hatcheries, as follows:—

	Salmon Trout.	Salmon.
Tusket Hatchery	40,000	70,000
Kempt do	50,000	150,000
Shelburne do	50,000	90,000
Lochaber do	40,000	110,000
Kentville do	60,000
Sheet Harbor Hatchery	120,000

making a total of 240,000 salmon trout and 580,000 salmon ova disposed of previous to the first of April.

As stated above, the most satisfactory success attended the hatching of the ova deposited in these hatcheries—with one exception, that at Shelburne, where considerable loss took place.

After the distribution of the semi-hatched ova, as above, I had still left 130,000 salmon trout, 900,000 salmon and 2,000,000 whitefish ova. The latter hatched early, and were distributed among lakes adjacent to the hatchery, as follows:—

Round Hill Lakes, Annapolis County	250,000
Aylesford do Kings do	250,000
Grand do Halifax do	500,000
Sandy do do do	500,000
Williams' do do do	500,000

making a total of 2,000,000 of these young fish planted in lakes considered most favourable for their growth.

The remaining stock of salmon and salmon trout were successfully hatched and planted in the rivers of the central portions of this Province, as per following schedule:—

Musquodoboit River, Halifax County	40,000
Nine Mile do do do	40,000
Little Salmon do do do	40,000
Pennant do do do	40,000
Salmon do Colchester do	40,000
Stewiacke do do do	40,000
Wallace do Cumberland County	80,000
Philip do do do	80,000
West do Pictou do	40,000
East do do do	40,000

Middle	River, Picton	County.....	40,000
Gasperenn	do King's	do	40,000
Cornwallis	do do	do	40,000
La Have	do Lunenburg	do	40,000
Gold	do do	do	20,000
Middle	do do	do	20,000
East	do do	do	40,000
Annapolis	do Annapolis	do	40,000
Round Hill	do do	do	20,000
Bear	do Digby	do	40,000
Kennitcook	do Hants	do	40,000
Tantrammar	do Westmoreland	do N. B.....	40,000
Total.....			<u>900,000</u>

Total Distribution from Bedford Hatchery, 1890.

Salmon fry.....	900,000	
Salmon trout fry.....	130,000	
Whitefish fry	2,000,000	
	Sal.Trout. Salmon.	
Eyed ova sent to Kempt.....	50,000 150,000	200,000
do do Shelburne	50,000 90,000	140,000
do do Tusket.....	40,000 70,000	110,000
do do Lochaber.....	40,000 150,000	190,000
do do Kentville	60,000	60,000
do do Sheet Harbor	120,000	120,000
Grand total.....		<u>3,850,000</u>

Throughout the whole of this distribution the most perfect success was met with, no loss whatever having occurred, notwithstanding, in some instances, long and tedious journeys over abominable roads were undertaken in order to reach the most suitable points on the rivers at which to deposit the young fry.

It will be seen that this distribution extended over the whole of this Province proper, and that every river considered suitable for stocking and could be reached with safety to the young fry received its quota.

The subsidiary hatcheries, of which there are now six in this Province, enable me to reach the most remote points, and many excellent rivers that formerly were beyond my scope are now receiving substantial aid from these points. Further, numerous lakes, quite in the interior, and far removed from all railway or steam communication, are being stocked with large numbers of salmon trout and whitefish. The wisdom of this attempt on the part of your Department to introduce these fish into the lakes of this Province, with the view of endeavouring to create an extensive inland fishery, is being gratefully received and acknowledged by all who are at all interested, or give the matter due consideration; and their confidence in the results of the experiment is shown by the increasing demands for these fish with which to stock the lakes in different localities. Fortunately, these demands can be complied with, as the full hatching capacity of this hatchery, or of the auxiliary hatcheries, has not yet been reached, and without reducing the plantings in those lakes already upon my list (which is not at all advisable), other waters can be embraced, by the addition of more small hatcheries, and the receipt of larger shipments of these ova from the Ontario nurseries in future.

The erection of some additional small hatcheries in the counties of Lunenburg, Guysboro', Digby, Annapolis, and the erection of a more permanent one at Shelburne,

in lieu of the temporary appliance used there last season, would extend the field of operations from this hatchery very materially, and would enable me to reach some very fine streams and lakes in those counties.

I may be permitted to say that the work of artificial fish-culture, as prosecuted in this Province, and although very satisfactory results have already been produced by it, is on too limited a scale to sufficiently affect and further materially the increase of fish.

There can be no doubt existing in the mind of any unprejudiced person who has studied the salmon fishery statistics for the last twenty years that our present supply of salmon is largely maintained through artificial culture. The continual decline in that fishery from 1870 to 1881 shows that unaided the natural production of salmon was insufficient to prevent the continuous decline in the annual catch, and it is also apparent that had no means been introduced to augment the production of young fry that this gradual depletion would have continued until the supply was entirely exhausted.

The beneficial effects of fish-culture began to appear in 1882, and, as is shown by the returns, a constantly increasing catch is reported up to 1887, since which date no further increase has taken place. This may be considered as an evidence that, with the present hatching and producing capacity of the appliances now in use in this Province, the full capacity of our hatchery has been reached, and that without additional efforts are put forth and more hatcheries erected no particular increase in the present annual catch can be expected.

Collection of Ova.

In undertaking this part of my work this season, and guided by my experience of past years, I decided to utilize the Musquodoboit River, in Halifax County, and the West River, in Pictou County, and applied to your Department for permission to do so. On the Musquodoboit River I had in part the necessary appliances for prosecuting the work, and my experience of past years on that stream led me to expect a good catch of spawning fish; but unfortunately for me, heavy freshets set in in August, and enabled the greater portion of the run to enter the river at that time, and previous to my commencing operations.

It has been my practice to commence fishing on this stream each year on or about the 1st of September, and when favourable conditions were met with large catches were made. This season the conditions were unfavourable, and resulted in securing but 57 salmon, as against a catch last year of 270.

On the West River, also, unfavourable conditions were experienced, and the catch was but 10 fish, as against 67 last year.

An attempt was made to secure a portion of my supply from Wallace River, and very good success was obtained in securing the spawning fish; but unfortunately, through the acts of some interested persons living upon this river, I was not permitted to collect the ova. The fish were caught at and below Rhinduss' dam, which crosses this river at the head of tide, and were retained in a tank or creel moored in the pond. In this tank were confined 54 of the largest salmon I have ever taken in this Province, and from which I expected to secure 500,000 ova. The particulars of the raid made upon the works, and the destruction of the appliances, and carrying away of the fish, having been already reported to the Department, it will be unnecessary to repeat them here. The loss of these fish occurred at the end of the fishing season, and I was consequently unable to make good this loss by further fishing.

The result of my efforts to obtain a stock of ova for this season's operations was most unsatisfactory and discouraging, and leads me to the conclusion that some more certain means must be adopted in future for this purpose. Whatever system may be introduced, its most essential principle must be the prosecution of the work on such a basis that it will no longer be subject to the ignorant prejudices and depredations of the fishermen living along the streams upon which we operate. But two plans present themselves to me at present—either buy the fish from the net

fishermen during the lawful fishing season, and construct salt-water ponds in which to confine them until ready to spawn, or locate the works on streams upon which there are no inhabitants above the head of tide.

As this question will be the subject of correspondence with your Department during the present season, it will be unnecessary to further allude to it now. The number of fish secured and ova obtained was as follows:—

	Ova Obtained.	
Musquodoboit River, 23 males, 34 females.....	340,000
West River, 4 do 6 do	60,000
Wallace River, 21 do 33 do	Nil.

making a total of 48 males and 73 females, from which I obtained 400,000 ova. This constitutes the full extent of the stock, and is not one-fourth of the capacity of the hatching troughs. I trust the deficiency may be made up by the receipt of a large supply of salmon trout and whitefish from the Ontario hatcheries.

Water Supply.

Since the change in the arrangement of the hatchery troughs in this hatchery and the substitution of 32 troughs placed transversely in the building for the 14 troughs placed lengthwise, the water supply has been quite inadequate for the hatching and nursing of a large stock of ova. Representations to this effect having been made to your Department, I was permitted during the past season to replace the old 6-inch pipe by one of 8-inch, and now have an abundant supply of water.

Repairs.

Some repairs of a light extent will be required next season. Some leaks in the roof are beginning to show themselves, and should be attended to at once, either by painting the shingles with two coats of some mineral paint, or patching. Painting, I think, is preferable to patching, as the paint will preserve the shingles, and it is said it will make them last ten or twelve years longer. New eave-troughs will also be required, the old wooden ones being now very much decayed and broken away. Some decay is taking place in the foundation of the partition separating the hatching room from the dwelling rooms, and should be attended to next summer. These repairs, with painting the interior of the hatching room, is about all the expenditure required this year.

I have the honour to be, Sir,

Your obedient servant,

A. B. WILMOT.

Officer in Charge.

— — — — —
Dunk River hatchery, P. E. Island, was not in operation in 1890.

5.—ST. JOHN RIVER HATCHERY.

PROVINCE OF NEW BRUNSWICK.

REPORT OF THE OFFICER IN CHARGE OF THE ST. JOHN RIVER HATCHERY, 1890.

Sir,—I have the honour to transmit herewith my report in connection with the operations at the St. John River hatchery for the year 1890.

In the fall of 1889 there were no native fish ova laid down in this house, as the attempt to capture parent salmon on the Tobique River proved a complete failure; neither has there been any fish eggs laid down this season. No effort was made to gather them, although there was a fair prospect of getting quite a number of fish, if it had been so desired. The run of salmon on the Tobique was fairly good; the lessees had them well protected; ten special guardians were employed all summer,

besides a head warden, who looked strictly after them, in order to guard the river day and night. By this means a number of salmon reached the spawning grounds—but under the most favourable circumstances the chances of getting a supply of salmon eggs on the Tobique or Serpentine Rivers to stock this house are very uncertain and unreliable.

In the month of March last I received from the Newcastle and Sandwich hatcheries, Ontario, per Mr. Charles Wilmot, a consignment of whitefish and salmon trout eggs in a semi hatched state, comprising about 1,500,000 salmon trout, 2,000,000 whitefish and 12,000 speckled trout; and later in the month I received 500,000 salmon eggs from the Restigouche, in charge of Mr. Alexander Mowat. They were all in good condition when received, and continued to do well during the remainder of the hatching season, and a fair percentage of young fry were turned out last spring and summer; a small loss took place with the salmon trout. The loss of salmon, and whitefish, and speckled trout, were, comparatively speaking, very light. On the 9th of April last I commenced to distribute the whitefish, and on the 24th of July we finished putting out the salmon and salmon trout. It was a long and tedious operation, requiring care and diligence; but I am able to inform you that the work was done in a good and satisfactory manner, as the subjoined letters will show. Below is a tabulated statement of the several kinds of fish distributed, with the names of the different lakes, rivers, and streams, their locality, and the quantity planted in each, viz.:—

Whitefish.

Magaguadavic Lake, York Co.....	700,000
Harvey Lake, do	700,000
Oromocto Lake, do	300,000
Lakeville, Carleton Co	300,000
	<u>2,000,000</u>

Salmon Trout Fry.

Williamstown Lake, Carleton Co.....	60,000
Jones Lake, Carleton County.....	120,000
Oromocto Lake, York do	120,000
Harvey Lake, do do	120,000
Magaguadavic Lake, York County.....	60,000
Chumcook Lake, Charlotte do	60,000
Foster Lake, do do	60,000
Meadow Lake, Victoria do	60,000
Portage Lake, do do	60,000
Long Lake, do do	60,000
Frasers Pond, do do	20,000
Byrams Pond, do do	40,000
Several private parties, Victoria County.....	60,000
Turned out at Hatchery.....	100,000
	<u>1,000,000</u>

Sea Salmon Fry.

St. Croix River, Charlotte County.....	132,000
Toby Guzzle, do do	72,000
Lake Utopea, do do	36,000
Magaguadavic River, York do	32,000
Tobique River, Victoria do	90,000
Salmon River do do	60,000
St. John River do do	60,000
	<u>482,000</u>

Speckled Trout Fry.

Skiff Lake, York County.....	6,000
Toby Guzzle do	4,000
	<u>10,000</u>

Recapitulation.

Whitefish planted the present year	2,000,000
Sea salmon do do	482,000
Salmon trout do do	1,000,000
Speckled trout do do	10,000
Total number.....	<u>3,492,000</u>

In making the above distribution I took a different method of transporting them from the nursery from the one I formerly pursued. Heretofore, we would start with eight or ten cans of fry at one time. This brought us in continual contact with the baggage-masters on the trains, on account of the great space we occupied, and then we could only make one trip every two or three days. The past season I sent one of my sons with six cans every morning, which was more acceptable to the train men; consequently, we got along more amicably, and by traveling in the night each messenger could start every second morning. By this plan six cans of fry were sent away every morning. This arrangement worked admirably, and gave one of us the opportunity of being daily in attendance to look after the hatchery and young fish.

Repairs to Hatchery.

Before I got the fry all out the floor of the hatching room began to break down, and I found it necessary to secure the services of a carpenter to examine the floor and report what repairs he considered necessary to put the house in proper order. I reported to the Superintendent of Fish Culture the result of the examination, specifying the repairs required and the quantity of lumber needed, when I got orders to ask for tender. I did so, and the contract was awarded to Albert Dixon, who did the work to my entire satisfaction. Beyond this contract, other repairs were made. There are several other repairs that will have to be made next season, such as painting, whitewashing, and some little plastering, especially in the hatching room, office and hall. In all other respects the house is in good order.

It is very much to be regretted that the Department cannot arrive at some definite conclusion whereby this nursery can be supplied with salmon eggs every autumn, without depending upon the other hatcheries for a supply every year, especially when the facilities this hatchery has for the work are so great. It is fully equipped with all the necessary apparatus, with a good supply of pure water the whole year round, and having easy access to and from it by a railway station almost at the door. The whitefish and salmon trout hatched here are beginning to show up in some of our waters; some very fine specimens have been taken from some of the lakes the past year. Quite a quantity of very nice whitefish were caught in the Oromocto Lake the past autumn; this kind of fish was never known to inhabit that lake before. The residents there are unanimous in their opinion that they are the result of the whitefish fry planted in the lake about three years ago. Some nice salmon trout were taken in Chamcook, Skiff and Williamstown lakes, and there can be no doubt but that these fish are abundant in several of these lakes where I planted them three or four years ago, but many of the lakes are controlled by clubs, or private owners, and they will not allow any person to fish therein except with the fly, and it is a well-known fact that this class of fish cannot be taken that way. Some

have been caught by other parties in a surreptitious manner, but they will not willingly give any information about them, at least not publicly. A few parties were prosecuted for poaching in Chamcook Lake the past season.

I have the honour to be, Sir,
Your obedient servant,

CHAS. McCLUSKEY,
Officer in Charge.

6.—MIRAMICHI HATCHERY.

PROVINCE OF NEW BRUNSWICK.

REPORT OF THE OFFICER IN CHARGE OF THE MIRAMICHI HATCHERY, 1890.

I beg herewith to submit my annual report upon the operations in connection with this establishment for the year 1890.

As shown by last year's report, there was laid down in the hatchery troughs, in the autumn of 1889, 1,100,000 salmon ova. The closest attention was given to these eggs during the period of hatching, and I am pleased to state that the best of success was met with during this time, as well as in the transportation of the fry to the different planting grounds upon the head waters of the Miramichi.

Distribution of Fry.

There were 1,022,000 healthy fry distributed as far up the following streams as possible, viz.:-

North-West Miramichi.....	400,000
Stony Brook.....	50,000
Little South-West Miramichi.....	300,000
Sevogle River.....	100,000
Main South-West River.....	150,000
Stewart's Brook.....	22,000
Total.....	<u>1,022,000</u>

In addition to these native fry, I received 40,000 eyed eggs from the Restigouche nursery. These were successfully hatched and planted in the North-West Miramichi and one of its small tributaries.

North-West Miramichi.....	40,000
Stony Brook.....	15,000
Total.....	<u>40,000</u>

This shows that the total number of salmon fry distributed from this hatchery in the spring of 1890 amounted to 1,062,000. The 25,000 Restigouche fry, along with 25,000 native, were planted a short distance above the falls on the North-West Miramichi, and at the Honourable Mr. Adam's fishing camp on the same stream, distant about 75 miles by the river from this nursery.

Repairs.

During the summer months all necessary repairing about the ponds, dams and buildings were completed, except the shingling of the roof of the hatchery, which was delayed until after the stock of ova was gathered. The total cost of shingling the roof amounted to about \$106. The dams, ponds and buildings are now all in good

condition, and unless through an accident some unexpected expense is incurred, no further amount will be required during the coming year than may be necessary to carry on the ordinary routine work.

Collecting Eggs, 1890.

The work of collecting parent salmon was not as successful this season as the previous year. This was not due to any scarcity of fish, but on account of the prevailing high water the fishermen were unable to use their nets until very late in the season. Then, before it was possible to procure a sufficient number to fully supply the hatchery, the spawning season set in. The men were kept at work as long as there was the slightest hope of adding to the number, until the cold weather caused operations to be altogether suspended.

The total number of fish amounted to 195. These parent salmon were taken from three different branches of the Miramichi, viz.: North-West Miramichi, 73; South-West Miramichi, 80; Little South-West Miramichi, 42. The total number of females captured amounted to 111, the remaining 84 being males. If the water had not been so far above the usual height during nearly all the time fishing was practicable a far larger amount would have been taken, as the rivers were swarming with fish; but as it was almost impossible to use the nets, at least to any advantage, thousands upon thousands of parent fish passed up beyond our reach. The ova that these fish deposited are now nearly a total loss, as the beds upon which they were placed will have become almost completely bare, leaving the ova exposed to frosts, snow and ice. When salmon deposit their ova during a season that the streams are not above their usual height the ova will not be exposed to as much danger of being laid bare and destroyed after the heavy frosts sets in as it would be if the fish deposited the ova in the streams when they are far above their usual height, such as they were last season. Every one is aware that salmon naturally place their ova upon bars and gravelly shoals. If the one-half of the fish that ascended these streams during last autumn deposited their ova upon bars and shoals at the height the water was at that time, millions upon millions of eggs are now a total loss.

The total number of eggs gathered from 111 females amounted to 810,000, showing an average of about 7,400 to each. Comparing the average number of eggs taken from each female during the last three years, it will be seen that the number increased from 5,530, in 1888, to 7,400 for the present. This, in my opinion, points to the conclusion that the fry which have been hatched here from the eggs of the Restigouche salmon, which are of a much larger family than the Miramichi salmon, are showing some good results, from the increasing numbers of the very much larger salmon which are now to be found in this river.

I have the honour to be, Sir,

Your obedient servant,

ISAAC SHEASGREEN,

Officer in Charge.

NOTE.—The portions of this officer's report, relating to the success of "Artificial Culture" will be found under that heading in the general report on Fish Culture, to which this report is appended.

7.—RESTIGOUCHE HATCHERY.

PROVINCE OF QUEBEC.

REPORT OF THE OFFICER IN CHARGE OF THE RESTIGOUCHE HATCHERY, 1890.

SIR,—I have the honour herewith to submit my annual report in connection with the operations of the Restigouche hatchery for the past season.

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As previously reported, 3,022,000 eggs were deposited in the hatchery in the fall of 1889, from which were successfully hatched and planted in the various waters, as follows:—

Kedgwick River.....	200,000
Main Restigouche, from Indian House to Kedgwick....	400,000
Main River, from hatchery to Indian House.....	500,000
Upsalquitch River above the Great Falls.....	300,000
Matepedia River, including lake.....	490,000
Nepisquit River, Bathurst.....	200,000
Middle do do	100,000
Miramichi do	70,000
Caraget do	100,000
Jacquet do	5,000
Pond at hatchery.....	4,000
Total fry.....	2,396,000

The above numbers of fry were all planted in the various streams in a fine, healthy condition, with the exception of those deposited in the Middle River, Bathurst. A small loss occurred to this lot, owing to the train being several hours late. The fry were detained too long in the cans, and some of them were in a sickly condition when planted.

Independent of this number of fry, 500,000 semi-hatched or eyed eggs were transferred to St. John River hatchery 17th April, making a grand total of 2,869,000 fry and semi-hatched ova distributed from the Restigouche hatchery the past season; and I humbly beg to draw your Honour's attention to the small percentage of loss, 152,000, or about 5 per cent., from the handling and hatching of this large number of eggs, which must at once convince all unprejudiced persons of the benefit and utility of the artificial breeding of salmon in the Dominion, and more especially considering the authenticated statements that not more than 4 per cent. of the natural-laid ova reach maturity. I have overturned the salmon rids, both on the Restigouche, Princes Edward Island and St. John rivers, after the water has receded late in the fall and left the rids dry, and the ova to perish, and in all instances not more than one vitalized egg in fifty were found; whereas, by the artificial works 95 per cent. of living fish are turned into the streams, and 90 per cent. of the parent fish liberated, which otherwise would have been marketed and their product totally lost to the river.

Government Net at Island.

Owing to the unusual late spring and high water this net was not set out before the 12th June, by which time the major portion of the fish had entered and already passed up the river; therefore, the catch was much less than last season, being as follows:—

Net at Island.....	220
Mission Point.....	10
Pitt's Creek.....	30
Purchased from Mr. Adams.....	59
Total.....	319

Stripping began on the 20th October and continued till the 8th November; 307 fish were found in the reservoir, 175 females and 127 males, from which were collected 1,800,000 eggs. These were packed, as usual, in the trays, and conveyed to the hatchery by scow, and are now in fine condition, and a very successful hatch is anticipated. About a dozen fish died after they were placed in the reservoir, being injured by

escaping through the nets below. There were also a few fish tangled in the nets and drowned. These and all fish that died and were fit for food were sent to the dealers and credited to the Department.

The reason why the net fishermen do not furnish more salmon to us, although offering them full market value for them, is, that owing to the use of the small mesh net creating a wall, and the rush of water through the small meshes, the fish get scared and will not enter the traps; and consequently the netters find their catch 50 per cent. less when using the small mesh; therefore, they all have, excepting Mr. Adams, discontinued giving any more parent salmon.

The hatchery with all its appliances is working very satisfactory; all trays, tanks, troughs, sawcets, &c., &c., were varnished during the past summer, and were in a first-class condition for the reception of the ova in the fall; also, a new boat house, 12 x 30 feet, was erected at the east end of the hatchery. This will be used in general for boat and store house. A new floor was laid in the loft; a dozen new distributing cases were obtained; the old primary log hatchery having outlived its usefulness was taken down, and the material used for a bridge and other purposes on the public road. This old nursery has been one of the greatest factors in making the Restigouche River what it now is, namely, one of the finest salmon rivers on the continent of America.

Repairs to Hatchery for 1891.

The roof and outside of building is much in need of painting, as the first coat is entirely worn off; also, the inside plant, such as troughs, tank posts, &c., &c., should be painted, and the ceiling under the beams lathed and plastered, in order to make the house sufficiently warm and frost-proof, the cost of which would be about \$200. Plant may be also required, such as sawcets and distributing cans.

The Retaining Pond at Hatchery.

This pond is only 40 by 60 feet, 2 feet deep, and was overflowed from the brook during a heavy snow freshet in the spring of 1889, and all the young fry put in the previous year were supposed to have escaped; but such was not the case, as quite a number of "parrs" were to be seen in it this summer, and when a fly was thrown into the pond a dozen or more would rush at it. I caught a few of those, and on examination found they were just about the size of the river "parrs." I am firmly of the opinion it would be a very unsafe and expensive undertaking to retain a large number of salmon fry through the winter season, where there is so much frost and floods to contend with. However, I may here mention that the Restigouche Salmon Club are anxious that something of this kind should be done, and talk of making the trial themselves; they have very suitable grounds on their property at Metapedia, and a pure stream of water to supply the ponds with, and if they feel inclined to construct them there till a year old, I would suggest that the Department supply the fry for that purpose.

Net at Mission Point.

As this net for taking parent fish has, comparatively speaking, proved a failure, I would suggest that it be discontinued, and the net located in some better place.

Government Net at Pitt's Creek.

Failing, as I have stated, to capture a sufficient quantity of fish in the Mission Point net, it was deemed advisable, as a trial, to set another net higher up on the river and nearer to the reservoir. This net was not set until the 18th of August. It has always been the opinion of old fishermen that fish do not enter the river after the above date, but between the 18th August and the 1st October some 30 fish were taken in this net. This trial has proved two very important points: first, that more or less salmon enter the river all the season through, from 1st May to 1st October; second, that it is in every way a very suitable locality for catching parent

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salmon and conveying them to the reservoir, as it is only two miles above the reservoir. I am pretty fully convinced that with the two Government nets we can generally rely on getting a good supply of fish for the hatchery.

Repairs to Nets and Reservoirs, 1891.

The nets will require repairing and dying, and perhaps another new set. The reservoir will require some new timber and cross-ties and new netting, and five or six hundred new stakes. The whole will probably cost \$200.

Condition of River Catch of Fish with Fly and Nets for 1890.

The net fishery on the estuary and coast was not quite up to the average, although some large catches were made between Petit Rocher and Miscou; but why this falling off in the net fishery while the river was teeming with fish? The elements over which man has no control answers the question. One of the highest freshets ever known on the Restigouche prevailed, bringing down thousands of drift logs and debris of all kinds; this, combined with a heavy easterly storm, tore up the stake nets, overturned and displaced the trap nets on the coast, just at the time when the largest run of fish were entering the river; and while this destruction and loss in the estuary and on the coast was taking place the anglers were rejoicing and having one of the best fishing seasons ever known on the Restigouche, some of the angling parties killing as high as 100 fish in ten days, and eight or ten fish were often taken by one individual in a day. Mr. J. Mowat killed nine fish on a small pool at Deeside, the 5th June, where salmon were never thought of being fished for until very lately. Some 2,000 salmon were taken by anglers with the fly this season on the river. The guardians, lumbermen and all others acknowledge there never were seen so many fish in the Restigouche River as there were this season. Mr. A. Robertson, the Chief Guardian of the Restigouche Salmon Club, told me he went to the head of the Kedgewick River during the latter part of August, when the water was low and clear, and every pool was filled with salmon, and in places he had never seen a salmon before they could be counted in hundreds.

It may not be out of place in this report to give a few figures showing the increase and value of angling property and some of the prices paid during the last season. Some five miles on one side of the stream, near Indian House, brought \$35,000 in cash; only half a mile on one side of the stream, near Upsalquitch, was sold for \$18,000; eighty rods frontage on one side, near Metapedia, brought \$2,000; forty rods, \$1,800; sixty rods front, near Metapedia, \$2,500. Four or five years ago very few of those places could be sold, or even leased—in fact, there was no fishing on them; but since then the river has become one continuous pool, so to speak; every inch of vacant water is largely sought after. Then why should not the hatchery and the many millions of fry that have been planted from it annually the last ten or twelve years be credited with at least a fair share of bringing about this most gratifying state of affairs?

To this I desire to give the testimony of a couple of the lessees* who have been receiving a supply of fry from the Restigouche hatchery for the stocking of the Miramichi and the Nepisquet rivers. Referring to a paragraph in Mr. Spurr's letter, I beg to say canoes were used in the distribution of fry every year until last season, and no two cans were emptied in one place, but carefully-selected, moss-covered bottoms and grassy-banked pools were chosen, and the fry were distributed in various places throughout twenty miles of the river in fine condition. It was the lessees' own fault if there were no canoes; they were notified to send canoes, but did not do so.

In conclusion, I beg to say that every precaution is invariably taken, both in the hatchery and the distribution of the fry, and performed as economically as possible.

I have the honour to be, Sir,

Your obedient servant,

ALEX. MOWAT,
Officer in Charge.

* The letters referred to above will be found in this report under "Success of Fish Culture," page 41.

8.—GASPÉ HATCHERY.

PROVINCE OF QUEBEC.

REPORT OF THE OFFICER IN CHARGE OF THE GASPÉ HATCHERY, 1890.

Sir,—I beg to submit the annual report of operations connected with the above hatchery during the past year.

Work in Dartmouth River was commenced on 19th May, when preparations were made for the summer. Scows and flats were repaired and other necessary work was carried out. The trays and troughs were varnished, and subsequently the interior of the hatchery was painted, cleansed and aired, and all other appliances fully prepared for the winter labours.

The sphere of our work embraces the three rivers—St. John, York and Dartmouth, all flowing into the basin south and west of Gaspé Bay. The following shows the number of young salmon bred and put out during the year.

St. John River	136,000
York River.....	100,000
Dartmouth River { Above the falls.....	400,000
{ Below the falls.....	170,000
Total.....	<u>806,000</u>

Our operations are solely concerned with salmon, and all were liberated in excellent condition. The planting was commenced on 23rd June and completed on 22nd July, notwithstanding the fact that the majority of the Dartmouth fry had to be conveyed, at the cost of much labour, above the falls. This operation was ordered by the Superintendent. Though involving an expense beyond the previous outlay, it appears to be justified by its more effectual results.

The Department nets were set from 4th June to 29th August in the Dartmouth River, and captured 60 parent salmon. According to instructions, I purchased 23 more from William Stanley, at the current price of \$2 each. When taken from the piers these 83 fish were found to include 33 males and 50 females. The spawning continued from 8th October to 2nd November, and the 50 females produced as follows:—

20 averaging 14,000.....	280,000
20 do 13,000.....	260,000
10 do 18,000.....	80,000
Total.....	<u>620,000</u>

In September I received instructions to proceed to York River, in order to capture additional fish to stock our hatchery. Owing to the lateness of the season there was considerable scarcity, as salmon had nearly all passed above the Narrows. We succeeded, however in securing 25 females and 12 males. These produced:—

10 females, averaging.....	17,000 = 170,000
10 do do	16,000 = 160,000
5 do do	14,000 = 70,000
Total.....	<u>400,000</u>

We thus obtained a total of 1,020,000 eggs from all the salmon in good condition which were placed in the hatchery. It will be observed from these figures that the York salmon were much more productive than those taken in the Dartmouth.

The hatchery itself is in first-class condition, but not having been painted for over twelve years, it is desirable that its extension should be done during the

ensuing year. The estimated cost of it is \$30. The pond in connection with the hatchery requires a new railing to fence it in, as its present condition involves danger to the life of the inhabitants. This would involve an outlay of about \$12. An unprecedented storm swept over this locality on 28th and 29th August. In consequence of this, the Dartmouth River rose over 12 feet in twenty-four hours, and inflicted vast damage on the surrounding country. On these days we lost 8 of our fish, the land around the pond being submerged. We also lost since 350 feet of boom (which is necessary to the protection of our trap net) and part of the net itself, and the stakes. This damage must be repaired in the spring, and will cost about \$16.

During the year we purchased 8 tons of coal for the nursery, at a cost of \$40. I had the pleasure of meeting one of the lessees of the Dartmouth River, who was well satisfied with the number of salmon he had taken with the fly. The number taken this year was a larger increase over previous years. It is the unanimous opinion of anglers that a large number of salmon went up the Gaspé River before the nets were set, thus accounting in part for the well-stocked state of the upper waters. This has been the subject of much favourable comment. The guardian of the York estimates that his river contains many hundreds of salmon—46 were taken with the fly, and as there were considerable less fishing than usual, which practically shows that a substantial increase has taken place over previous years. The St. John is well stocked with salmon fry and smolt; no statistics are available yet, but it must be remembered that there were a large number of nets in tidal waters, and they must have had a successful year. These nets during recent years have made a constant drain upon the river. In view of this fact, and the improved catch, leads to the conclusion that the work of fish culture and protection, as carried on here, confers a benefit on all interested in the salmon industry,

9.—TADOUSSAC HATCHERY.

PROVINCE OF QUEBEC.

REPORT OF THE OFFICER IN CHARGE OF THE TADOUSSAC HATCHERY, 1890.

In accordance with the requirements of the Department, I herewith submit the following report of the proceedings at the Tadoussac Hatchery for the year 1890:—
 From the crop of salmon eggs obtained last year, 1,700,000 fry were hatched and distributed in the tributaries of the Saguenay and lakes having a discharge running to the St. Lawrence River. The loss on our eggs was somewhat greater than usual, caused by the ravages of rats entering the hatchery. The temperature of the water remains the same the whole winter—34 degrees—and the eggs began to hatch in May, when the water was 36 degrees.
 Following is a list of the rivers and lakes, with the numbers of fry planted in each:—

Deschene's River, Upper Saguenay, Chicoutimi Co.....	250,000
A Mars do do do	250,000
St. John do St. John's Bay do	125,000
Jacques Cartier River, Portneuf, Quebec.....	30,000
Mowat's Lakes, Tadoussac, Saguenay Co.....	995,000
Hatchery Lake, do do	50,000
Total.....	<u>1,700,000</u>

The distribution in the Upper Saguenay was done with the assistance of a tug boat belonging to the firm of Price Bros. & Co. All the distribution has been made in all the places under my personal care, with a man to help me in changing and aerating the water in the cans. To take advantage of the coolness of the nights for the fry we left the hatchery at 11 o'clock at night. By doing so we reached the

Upper Saguenay the next morning. By all means it is very important that the greatest part of the distribution should be made in the Upper Saguenay. I claim there ought to be as much pains taken to distribute fry as there is in hatching them.

We set our nets for the capture of parent salmon in May, and everything was ready for the last high tide of the same month. The first salmon was caught on the 27th of May, and herewith is given the catch in detail up to 3rd of July:—

Date.	Number of Fish.	Males.	Females.	Liberated.
May 27	12	1	7	4
do 28	14	2	9	3
do 29	10	3	5	2
do 30	4	2	2	2
do 31	10	3	2	5
June 1 (Sunday)				
do 2				
do 3	3	1	2	
do 4	4		2	2
do 5	12	8	2	2
do 6	12	2	6	4
do 7	12	5	7	
do 8 (Sunday)	2			20
do 9	7			
do 10	7	2	3	2
do 11	20	4	6	10
do 12	31	10	6	15
do 13		12	10	20
do 14		18	35	40
do 15 (Sunday)	8	18	28	35
do 16				
do 17	111	15	30	66
do 18	47		17	30
do 19	71		20	71
do 20	27		10	17
do 21	57		12	45
do 22 (Sunday)	102			102
do 23				
do 24	24			24
do 25	18			18
do 26	30			30
do 27	10			10
do 28	15			15
do 29 (Sunday)	8			8
do 30				
July 1	20			20
do 2	15			15
do 3	24			24
	14			14
Total	980	106	219	555

On the 7th of June it was blowing a north-west gale, the boatmen could not go to the fishery, and next day being a Sunday, I gave orders to open the door of the fishery, and 20 salmon were liberated. As can be seen by the manner our nets were kept from the 20th of June to 3rd July, this was done to ascertain the number of salmon coming in our nets, they were counted and many were liberated at the same tide. Of the number caught, 325 parent salmon were kept in our pond for breeding purposes, and 655 were set free again. There were 185 females, they gave us a crop of 1,879,000 eggs, being an average of about 10,000, all the females being of medium size. The seining of the parent salmon from the pond commenced on the 27th of October, and the spawning time was completed on the 15th of November. The greatest part of the work was done in the last week.

The Salmon Fisheries.

The salmon fishing this season has been very good in this district, the increase from 1886 is very remarkable, with always the same number of salmon fisheries, 12

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in all; 14,790 pounds of salmon were taken in 1886; 16,720 pounds in 1887; 24,000 in 1888; 37,900 in 1889, and 61,000 pounds this year, 1890. I am satisfied that this great increase in the catch of salmon is largely the result of the planting of salmon fry in the tributaries of the Saguenay River. For many years salmon have not been so plentiful in our rivers, as in the year now drawing to a close. The largest river in my district, the Ste. Marguerite, is full of parent salmon, by a report made to myself by the president of the Ste. Marguerite Club, Mr. James Grant, of New York. His nephew, Mr. Charles Grant of Montreal, told me that they counted one hundred salmon while passing one pool. The local guardian, Mr. Gravel, reports the same thing. The same good reports come from the Little Saguenay River, St. John River, Eternity River, A Mars River, and as far up as the Shipshaw River in the Upper Saguenay. On the 18th of November, after the wire net of the pond was taken up, about one hundred fine young salmon about 25 inches long, and very fat, came in the pond and mixed with the parent salmon. I called Mr. Plourde, the guardian, to have a look at them, it was high tide at the time, they went round the pond with the old ones and all went away again. On the 16th of October, Mr. Plourde, being at the rocky point of the hatchery cove outside the wharf, saw, quite close to the rocks, a very large number of young salmon, about the size of the ones mentioned above, coming down the Saguenay. He says there were many thousands.

Repairs.

No repairs have been made about the house the past summer, although some were much needed for the last few years. The building, inside and outside, and the wharf are in a dilapidated state; something must be done.

As reported last year, no doubt, in view of economy, it would be better to have a new building, instead of making additional expenditure on this old building. It is erected on a wharf made of slabs, and is becoming every year more and more filled with rats, which destroy many eggs, no matter what precaution is made to prevent it.

Distribution of Fry.

As the distribution of fry is the most delicate part of our work, and upon which depends all good results therefore everything should be done to facilitate it. Tadoussac is certainly the right place, with its natural pond, to keep the parent salmon during the hot season, and as the Tadoussac Hatchery is intended for the Saguenay River, it would be far better to have the hatching located at the Upper Saguenay, thus saving, every year, a large sum of money in the distribution of the fry, and with better chances of success, as there are so many streams of the purest water to plant the fry in.

The inconvenience of the small lake here which gives the water supply to the hatchery, is that the ice remains too long on it in the spring, keeping the temperature very low, and retarding the hatching of the eggs. Last year the ice on the lake broke up on the 18th of May. And as soon as the ice is all melted, the temperature of the water goes up very fast, the sun and the heat having great power on the small surface of water in this lake. I have always found it unsafe to keep the fry after the 20th of June, and as I never put out the fry before the sack is fully absorbed, it gives us a very short time for the general distribution.

For many reasons if the hatchery is to be rebuilt, I would suggest the Shipshaw River, in the Upper Saguenay, as a very central and desirable place. This river is a splendid one, with its pure and abundant supply of water coming through a wild country and affording facilities for the distribution of fry in it, and also in the other waters of the Saguenay by land and by water.

The erection of a good building to hold from five to six millions of eggs, at a cost of a couple of thousand dollars, would, in a few years, repay what it now costs for a tug, and boats and carters, and instead of planting a few thousands of fry up river as at present, millions could be planted for less money and with more safety. All

the windows of this old building could be used for the new one, and by pulling down the old hatchery and carrying away the slabs forming the wharf, and using all the heavy timber found suitable to improve and extend the dam of the present reservoir up to the rocks, a splendid pond would be had to keep a thousand parent salmon if wanted.

I have the honour to be, Sir,
Your obedient servant,
L. N. CAPELLIER,
Officer in Charge.

10.—MAGOG HATCHERY.

PROVINCE OF QUEBEC.

REPORT OF THE OFFICER IN CHARGE OF THE MAGOG HATCHERY, 1890.

In accordance with the requirements of the Department, I beg herewith to submit my annual report for the past year.

On the 26th of March, 1890, two millions whitefish and two millions salmon trout eggs were received, in good condition, from the Newcastle Hatchery.

The small fry from the hatching of the above-named eggs were successfully planted on the following named waters, to wit:—

Whitefish.

Lake Megantic, County of Megantic.....	100,000
Massawippi Lake, County of Stanstead.....	100,000
Memphremagog Lake, Counties of Brome and Stanstead.....	800,000
Orford Lake, Counties of Brome and Sherbrooke.....	200,000
Brome Lake do do.....	100,000
Total.....	<u>1,300,000</u>

Salmon Trout.

Megantic Lake, County of Megantic.....	100,000
Massawippi Lake, County of Stanstead.....	150,000
Memphremagog Lake, Counties of Brome and Stanstead.....	1,160,000
Orford Lake, Counties of Brome and Sherbrooke.....	150,000
Ste. Rose.....	40,000
Total.....	<u>1,600,000</u>

We did not catch any parent fish to supply the Magog Hatchery with eggs this year. They were all received from Newcastle.

Two millions whitefish and two millions salmon trout eggs were placed in the Magog Hatchery in 1890.

The hatchery will be in good working condition when the supplies are furnished which have been asked for.

The supplies required and applied for are: 1 wood stove, 50 lengths pipe, 6 distributing cans, conductor or pipe for whitefish, with cocks; $\frac{3}{4}$ -in. rubber hose, 12 tins, 6 cords dry hardwood, 8 globe valves; estimated cost about \$70.

From information which I have received from fishermen and others living near the lakes wherein salmon trout and whitefish fry have been deposited, I find that there is an increase in both salmon trout and whitefish, but that the increase of the former is much retarded in some localities by poachers during the spawning season. The few fishery officers employed, and the large area over which they have to watch, has a tendency to make the poachers more bold and the trout less plentiful, other-

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wise the increase would be much more apparent. Large schools of small whitefish are now noticed in all the bodies of water wherein the fry have been deposited. These all came from the Magog Hatchery, as no whitefish were ever seen in them before the hatchery commenced operations.

I have the honour to be, Sir,

Your obedient servant,

A. H. MOORE,

Officer in Charge.

II.—NEWCASTLE HATCHERY.

PROVINCE OF ONTARIO.

REPORT OF THE OFFICER IN CHARGE OF THE NEWCASTLE HATCHERY, 1890.

I have the honour herewith to submit my annual report of the operations carried on at the Newcastle fish breeding establishment for the past year.

The work of hatching and distributing the various kinds of fish was most successfully carried out. The fry when planted even at the most remote points from the hatchery, appeared to be quite as lively and strong as when taken out of it.

In February last I received instructions from the Department to transfer from Newcastle to some of the Maritime nurseries a quantity of eyed eggs. As previously reported these eggs reached their destinations, under my personal supervision, in good order. No trouble need be apprehended in the carriage of fish eggs even for long distances if escorted by a careful and experienced officer; but it is quite unsafe to ship these delicate and perishable eggs by express messengers alone. I notice in reading some of the United States reports on fish-breeding that the American nurseries have met with some very serious losses by allowing boxes of carefully packed eggs to be shipped in care of the express messengers on board the trains. These agents, though they may be deeply interested in this industry, have little or no time to devote their close attention to these perishable eggs when sent long distances, even though written instructions may have been sent with the consignment. It is, therefore, always desirable, in fact absolutely necessary to send an experienced officer to take charge of either fish eggs or young fish, when shipped from the hatcheries to their points of destination.

The total number of semi-hatched eggs shipped to the Lower Provinces last winter, and the fry of various kinds liberated from the Newcastle establishment this spring was as follows:—

Semi-hatched Salmon Trout.

Magog hatchery, Province of Quebec.....	2,000,000
Bedford do do Nova Scotia.....	500,000
St. John do do New Brunswick.....	1,500,000
Ottawa do do Ontario.....	1,500,000
Total	<u>5,500,000</u>

White-fish Fry.

Toronto, Lake Ontario.....	500,000
Cobourg do	250,000
Newcastle do	300,000
Colborne do	100,000
Meaford, Georgian Bay.....	1,000,000
Belleville, Bay of Quinté.....	500,000
Lefroy, Lake Simcoe	100,000
Total.....	<u>2,750,000</u>

Salmon Trout Fry.

Toronto, Lake Ontario.....	500,000
Cobourg do	200,000
Colborne do	200,000
Kingston do	400,000
Newcastle do	250,000
Bowmanville, Lake Ontario.....	250,000
Marmora, Crow Lake	100,000
Lakefield, Stony Lake.....	100,000
Port Carling, Rosseau Lake	200,000
Belleville, Bay of Quinté	500,000
Toronto, Howard Lake.....	25,000
Collingwood, Georgian Bay.....	500,000
Warton do	500,000
Meaford do	200,000
Barrie, Lake Simcoe.....	200,000
Orillia do	200,000
do Row's Lake.....	25,000
Lefroy, Lake Simcoe.....	50,000
Total.....	<u>4,700,000</u>

Speckled Trout Fry.

R. Croft Hulme, Belleville	5,000
James Haw, Orillia.....	4,000
D. Martin, Guelph.....	5,000
Woodstock Club, Woodstock.....	20,000
John Barr, Shelborne.....	5,000
Israel Kinney, Brantford.....	11,000
Doctor Mallory, Grafton.....	5,000
Harry Piper, Toronto.....	5,000
E. R. C. Clarkson, Toronto.....	10,000
Samuel Dice, Milton.....	3,000
R. Burgess, Muskoka	10,000
W. McDonald, Tilsonburg	10,000
J. Forsythe, Barrie.....	2,000
W. H. Rittenhouse, Barrie	2,000
J. Gardiner, Paris.....	5,000
G. P. Buchanan, Paris.....	10,000
J. T. Brownridge, Paris.....	1,000
G. Farnham, Hamilton.....	1,000
J. E. Murphy, Hepworth.....	5,000
Z. A. Lash, Toronto.....	50,000
R. Z. Rogers, Grafton	50,000
E. C. Cochrane, M.P., Toronto.....	2,000
W. Williamson, Ingersoll.....	5,000
R. Southam, London.....	5,000
Number turned out in hatchery stream.....	45,000
Number kept on hand in spring tank.....	5,000
Number semi-hatched eggs sent to Ottawa.....	75,000
do do St. John Hatchery.....	15,000
do do Bedford do	15,000
Total	<u><u>391,000</u></u>

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Grand Total Fry Hatched.

White-fish.....	2,750,000
Salmon trout.....	4,700,000
Speckled trout.....	391,000
Total.....	<u>7,841,000</u>
Semi-hatched eggs shipped to other hatcheries in Lower Provinces.....	5,500,000
Grand total.....	<u><u>13,341,000</u></u>

Repairs to Hatchery.

The main tank or trough, which supplies the hatchery trays with water, was very much decayed and unsafe. This was renovated last summer and lined with galvanized iron, making it perfectly secure for years to come.

The outside of the hatchery has not been painted since its first erection, and unless it is attended to next spring the building will become much injured. With the exception of a few other unimportant repairs which can be done with little expense after the fry are liberated the establishment and all its appliances are in first-class condition.

The grounds and fish ponds adjoining the hatchery are kept in good order and are visited by a large number of people during the summer.

Collection of Salmon Trout Eggs.

This undertaking received my personal supervision last fall, and was commenced on the 15th of October and completed the 3rd of December, which will be seen by reference to my daily statement of the work hereto appended.

Some important changes were made last fall in locating the pound nets. The two formerly set on the Indian reserve, at White Cloud and Hay Islands, were not placed there this season. It was found that these nets did not capture as many parent fish as was expected, and as the distance from Wiarton to these nets was about fifteen miles, it was decided to abandon these locations and try the experiment of putting one of these nets close to the old and reliable stand at Gravelly Point, which is only nine miles down the bay from Wiarton. This proved to be a great success, notwithstanding the views put forth that two pound nets would not operate successfully when located close to each other. As many eggs were taken from the fish in these two nets as were collected from three during the previous season. The distance to be travelled by tug was lessened by many miles, and the guardians had much less difficulty in protecting the nets against poachers.

A good deal of trouble was experienced in getting a suitable person to set the pound nets last fall. The expert who managed the work last year promised to undertake the job again, but disappointed me at the very last moment, and after writing to several other persons capable of performing this special work, I was compelled to go to Port Dover and procure the services of Capt. Allan to overcome the pressing difficulty. It was most fortunate that his services were obtained, otherwise the collecting of a supply of salmon trout eggs for the several hatcheries in the Provinces must have proved a failure. The proper setting down of pound nets requires years of experience. In fact there are few men to be found in the country who practically understand this business. I am glad to report, however, that after the several years experience now had at Wiarton in connection with the management of the pound net system, that with another season's work our own employees will be able to manage this difficult undertaking without employing these expensive experts as formerly.

I herewith append a statement of the work at Wiarton which gives the number of salmon trout eggs collected daily last fall, also the number of parent fish mani-

culated and liberated, together with other valuable information which will serve as a reliable record to the Fisheries Department, especially in refuting erroneous statements which are often made by fishermen and interested fish dealers in reference to the "close season" for salmon trout and whitefish. It will be noticed by looking at the last three yearly statements that the Department had wisely set apart the whole month of November, and I am glad to learn that it is the intention of the Government to lengthen the period. This step is absolutely necessary, as it can be proved beyond doubt that large numbers of salmon trout and whitefish spawn as early in the season as the 15th of October.

Condition of the Eggs in the Hatchery.

The hatchery with its large number of eggs, upwards of eleven millions, is at present very much crowded, and as it will be utterly impossible to hatch out more than half this quantity safely next spring, it will be necessary to remove at the proper time, say six millions, to the Ottawa and other establishments in the Eastern Provinces.

I have the honour to be, Sir,

Your obedient servant,

C. WILMOT,

Officer in Charge of Newcastle Hatchery.

STATEMENT showing the daily operations of collecting Salmon Trout Eggs at Wiarton during the Season of 1890.

Date of Lifting Nets.	No. of Nets Lifted.	No. of Fish from which Spawns was collected and liberated.		No. of Fish Stripped out before entering Nets and liberated.	No. of Fish found injured or dead in Nets.		No. of Eggs collected.	Remarks.
		Males.	Females.		Whitefish.	Salmon Trout.		
Oct. 15.								
do 16.								J. Kenfick and I arrived at Wiarton.
do 17.								Capt. J. S. Allan arrived at Wiarton.
do 18.								Commenced getting nets ready.
do 19.								Put stakes on spile driver and drove a few.
do 20.								Too rough to work at driving stakes.
do 21.								Drove stakes for pound nets.
do 22.								Finished driving stakes for one net.
do 23.								No. 1 net completed and set.
do 24.								Sunday. Rough and blowing.
do 25.								Set 11 stakes for No. 2 net.
do 26.								Too rough to drive stakes.
do 27.								Finished driving stakes for No. 2 net.
do 28.								Rough weather, could not work.
do 29.	1	83	170	7	4	11	600,000	No. 2 net completed and set. Early run of fish; wind east; fine warm weather.
do 30.								Snow fell one inch; cold weather.
do 31.	2	52	140	15	6	15	60,000	Snowing; fish scarce; weather cold.
Nov. 1.								Too rough to lift nets; raining and blowing.
do 2.								Net not ripe in nets.
do 3.	2	70	210	12	2	10	700,000	Fish very scarce; fine weather; 4 1/2 inches snow fall to-day.
do 4.								Fish in nets not ripe.
do 5.								Wind south-west; could not lift; blowing agale.
do 6.								Very heavy sea running; wind northeast.
do 7.	2	210	454	87	5	27	1,500,000	Wind southwest; raining and freezing; a new run of fish in nets, but many of them not ripe.

Date of Lifting Nets.

Nov. 8
do 9
do 10
do 11
do 12
do 13
do 14
do 15
do 16
do 17
do 18
do 19
do 20
do 21
do 22
do 23
do 24
do 25
do 26
do 27
do 28
do 29
do 30

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STATEMENT showing the daily operations, &c., at Warton—*Concluded.*

Date of Lifting Nets.	No. of Nets Lifted.	No. of Fish from which spawn was collected and liberated.		No. of Fish spawned out before entering Nets and liberated.	No. of Fish found injured or dead in Nets.		No. of Eggs collected.	Remarks.
		Males.	Females.		Whitefish.	Salmou Trout.		
Nov. 8.								
do 9.								Fish in nets not ripe.
do 10.	2	221	163	60	0	22	1,650,000	Sunday; fine weather. Fine warm day; wind east; fish spawning freely.
do 11.								Had to take spile driver down and set stake which got out of place.
do 12.	1	175	207	49	1	14	1,000,000	Too rough in afternoon to lift No. 2 net; male fish more plentiful.
do 13.	1	70	152	37	4	12	550,000	Wind south-west; guardians report no poaching going on.
do 14.	1	110	287	54	2	29	1,100,000	Fine warm weather; no new run of fish coming on.
do 15.								Fish in nets not ripe; not nearly as many fish in nets as at this date last year.
do 16.								Sunday; cold and blowing.
do 17.	2	157	300	62	5	37	1,400,000	Raining all day; wind north-east.
do 18.	1	40	70	43	1	9	200,000	Lifted nets but fish very scarce and not ripe.
do 19.								Unless a new run of fish enter nets we will not get many more eggs.
do 20.	2	129	342	98	7	31	1,150,000	Some fresh run fish in nets; very cold and rough.
do 21.								Did not lift; fish not ready for spawning.
do 22.	2	79	271	114	4	29	675,000	Run of fish about over; snowing and blowing and freezing hard.
do 23.								Sunday; cold and rough.
do 24.								Blowing hard; heavy sea.
do 25.								Weather has considerably moderated; took out one net to-day.
do 26.								Blowing and freezing; have net up for winter.
do 27.								Took out No. 2 net and stowed away ropes, &c.
do 28.								I came home and left Kemick to take scow and spile driver to moorings.
do 29.								Sunday.
do 30.								
		1,396	3,222	638	50	246	11,125,000	

We had not more than half as many fish in nets as last year. Under these circumstances we should feel that the work was a great success.

C. WILMOT.

12.—SANDWICH HATCHERY.

PROVINCE OF ONTARIO.

REPORT OF THE OFFICER IN CHARGE OF THE SANDWICH FISH HATCHERY.

I herewith forward the annual report of the work performed at the Sandwich Fish Hatchery for the past year.

From the eggs placed in the hatchery last year there were hatched 45,000,000 young fish. This was somewhat under the regular percentage, and may need a little explanation. We gathered more eggs than we had incubators or room for, at the time, and in order to accommodate these eggs we were put to the last resort of using the old wire trays that were in use years ago, when the culture of whitefish was first begun. The numbers hatched in the glass jars were fully up to the usual standard, and the falling off on the general percentage can only be laid to those

hatched in the wire trays. Taking this into consideration we can feel quite satisfied with the number of young fish that were hatched. These young fish were placed in the following waters:—

Newcastle (eyed eggs).....	3,000,000
Ottawa, Ont. do	6,000,000
Magog, Que. do	2,000,000
Bedford, N.S. do	2,000,000
St. John's, N.B. do	2,000,000
Point Edward, Lake Huron.....	Young fish... 2,000,000
River St. Clair, at Port Lambton.....	do ... 1,000,000
Lake St. Clair, at Mitchel's Bay.....	do ... 2,000,000
Peach Island, Lake St. Clair.....	do ... 2,000,000
Fighting Island, Detroit River.....	do ... 1,000,000
Stony Island do	do ... 2,000,000
Bois Blanc Island do	do ... 2,000,000
Pigeon Bay, Lake Erie.....	do ... 2,000,000
Bar Point do	do ... 1,000,000
Kingsville do	do ... 1,000,000
Colchester do	do ... 1,000,000
Port Stanley do	do ... 1,000,000
In Lake Erie, below Bois Blanc Island....	do ... 3,000,000
Niagara, Lake Ontario.....	do ... 1,000,000
Hamilton do	do ... 1,000,000
Toronto do	do ... 1,000,000
In river at hatchery.	do ... 5,000,000

Making the total of..... 45,000,000

These young fish were in fine condition when placed in the above named waters.

Collecting Pickerel Eggs.

After having cleared the house of the young whitefish, preparations were made for the reception of the pickerel (doré) eggs. Below are given the numbers collected, and the names of the places where secured:—

Wees Bros., Lake Huron.....	8,000,000
Joseph Leazeau do	8,000,000
Hitchcock & Stead, Point Edward	16,000,000

Making the total secured..... 32,000,000

From these eggs were hatched out 22,000,000 young pickerel, which were placed in the following waters:—

Ottawa (eyed eggs).....	1,000,000
Point Edward, Lake Huron.....	Fry... 2,000,000
Port Lambton, River St. Clair.....	do ... 1,000,000
Mitchel's Bay, Lake St. Clair.....	do ... 1,000,000
Peach Island do	do ... 2,000,000
Fighting Island, Detroit River.....	do ... 2,000,000
Bois Blanc Island do	do ... 2,000,000
Pigeon Bay, Lake Erie.	do ... 3,000,000
Bar Point do	do ... 2,000,000
In river at hatchery.	do ... 6,000,000

Making the total..... 22,000,000

I can here state that the different fishermen report to me the catch of pickerel was above the average last spring, and, as usual, give great praise to the hatchery for the cause of the increase in these fish.

I have just received certain nets from the Department for the purpose of securing our own fish, but as yet have not decided on a location where to place them. Several places have been recommended to me, but until some satisfactory place is located I would not advise the giving up of the present mode of securing parent fish until the new venture had proved successful.

Collecting Whitefish Ova.

The fall of 1890 can be recorded as having the greatest number of whitefish eggs laid down since this hatchery was first organized, there being fully ninety millions of eggs put in the incubators. Those eggs were taken from fish caught at the following places:—

Bois Blanc fishery.....	30,000,000
Fighting Island fisheries.....	45,000,000
Mainland fisheries.....	15,000,000
	90,000,000

The Catch of Whitefish.

From all around this section of the country comes the report of increase in the catch of whitefish. The fishermen are jubilant, and expect greater results from the artificial hatching in years to come, from the fact that the catch continues to improve from year to year, and from the size of the fish caught it is contended that they are largely the production of artificial breeding. For instance, take the Bois Blanc fishery's catch this fall. Here there were hauled in over 1,000 small fish which were put into the racks for spawning purposes, nearly all escaped through the openings which were made suitable to keep in the ordinary sized fish. The fishermen claim that these small fish were, without any doubt, the production of the hatcheries. The same statement of the catch of small fish comes in from every fishing ground hereabouts. This catch at Bois Blanc Island fishery is a very strange one, but is a very strong argument in favour of the hatcheries, as the fish formerly taken at this fishery were noted as being the largest of any caught in the river.

The Herring Fishing.

Although we have never done anything with the cultivation of the herring, yet, I believe, it will be advisable to do so, as that fish seems to be fast decreasing in these waters. The catch this year is a long ways below that of any former year, and the fishermen are beginning to ask if we are not going to breed them in the hatchery in like manner as the whitefish. I would recommend the Department to engage in the cultivation of the herring.

Improvements in the Hatchery.

Since last year several improvements have been made in this house. The entire floor is now devoted to the hatching of fish, and instead of running 350 glass jars as formerly we now operate 600, and will be able to turn out about double the number of young fish. In the centre of the floor a large tank is built, in which there were placed 100 adult whitefish, which gave quite a quantity of eggs. I think the idea of bringing the fish, which we are unable to spawn at the fishing stations, and putting them in this tank, is a good one, and one which will in after years prove of great benefit to the hatchery, as we will then secure quite a number of eggs that otherwise could not be had. In speaking of the improvements that have been made it might be well to speak of another which is needed—that of securing and controlling a steam yacht for the purpose of putting out the young fish at our convenience.

Last season, on account of no steamer running to Pelée Island, it was impossible to place any fish at that place without heavy expense, which I did not incur. With a small yacht fry could be distributed readily and cheaply at this and other important points. This boat would not only be useful for the distribution of young fish, but also for the collecting of eggs, and would save the Department much expense now incurred and at the same time advance this hatchery. The cost of such a boat would be in the neighbourhood of \$500 or \$600.

There should also be a movable breakwater built at Bois Blanc fishery to prevent the water dashing the fish against the racks when storms prevail, which they frequently do at this point. The cost of this would be \$100, and would save the fish from being bruised, which materially injures the egg within them.

The only other improvement that I know of now for this establishment is the painting of the hatchery, the cost of which will amount to about \$200.

In closing this report I desire to say something about the decrease of the sturgeon. As this has become a very valuable fish, I would recommend that efforts be made to secure some of their ova and propagate them in the same way as we do other fish.

I desire also to state that all the improvements ordered by your Superintendent of Fish Culture, Mr. Wilmot, is working admirably.

I have the honour to be, Sir,

Your obedient servant,

WILLIAM PARKER,

Officer in Charge.

13.—OTTAWA HATCHERY.

PROVINCE OF ONTARIO.

REPORT OF THE OFFICER IN CHARGE OF THE OTTAWA HATCHERY, 1890.

Herewith is submitted the first annual report of the working of this hatchery. The ova received from the different hatcheries were as follows:—

Salmon ova from British Columbia	150,000
do Restigouche Hatchery, Prov. Quebec.	25,000
Salmon trout ova from Newcastle Hatchery, Ontario...	1,500,000
Speckled trout ova from do do	75,000
Whitefish ova from Sandwich Hatchery, Ontario.....	6,000,000

The young fry were distributed from this hatchery last spring in excellent condition, considering the long journeys and rough roads to their destination. They were planted in the waters at the following places:—

Salmon fry.

Meache's Lake, Province Quebec.....	84,000
Knowlton do do	14,000
Smallions do do	14,000
Total	<u>112,000</u>

Salmon Trout fry.

Meaches Lake, Province Quebec.....	20,000
Moseau do do	30,000
Rideau do Province Ontario	200,000
Duchesne do do	60,000
Bernard's do Province Quebec.....	21,000
Duchesne do do	200,000

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Lancaster, River St. Lawrence.....	80,000
Summerstown do	80,000
Rideau Lake, Province Ontario	60,000
Lower Rideau Lake, Prov. Ontario.....	60,000
Bernard's do do Quebec	90,000
Clidcotts do do do	60,000
Crutch and Antonine Lakes, Province of Quebec.....	40,000
Seybold and Gibson do do do	20,000
McKenzie Park Lake, Province of Ontario.....	20,000
Total.....	<u>1,051,000</u>

Speckled Trout-fry.

Trout Lake, Province of Quebec.....	15,000
Graham's Lake, Province of Quebec.....	15,000
Green do do do	25,000
Bernard's do do do	15,000
Total.....	<u>70,000</u>

Whitefish Fry.

Charleston Lake, Province of Ontario.....	600,000
Little do do do	150,000
Bass do do do	150,000
Delta do do do	600,000
Singleton do do do	150,000
Greppin do do do	150,000
Rideau do do do	600,000
Mud do do do	600,000
Duchesne do do Quebec	150,000
Seybold and Gibson Lake, Province of Quebec	150,000
Meache's Lake, Province of Quebec.....	225,000
Mississippi Lake, Province of Ontario.....	225,000
Stoney do do do	450,000
Ireland's do do Quebec.....	225,000
Clark's do do do	75,000
Total.....	<u>4,500,000</u>

Remarks.

All the fry were planted in the different waters in good condition, with the one exception of some Fraser River salmon fry which were shipped by express to Brome Lake in the Eastern Townships, and to avoid any such loss in the future it will be found absolutely necessary that the officer in charge or some other competent person shall accompany the fry to the different waters in which they are to be planted.

The hatchery being newly constructed, considerable difficulty was experienced by not having sufficient accommodation for them at the proper time, many whitefish and salmon trout were hatched out before the tanks were built outside to receive them. It will be found necessary to have two more rows of tanks put up next spring to accommodate the young fish and prevent over-crowding in the troughs inside. The hatchery and the frames for the outside will require painting the coming summer, and there will also be required some carpenter's work for putting up additional stands for the tanks in the yard.

I have the honour to be, Sir,

Your obedient servant,

PHILIP VEALE, *Officer in charge.*

ANNEX TO FISH BREEDING REPORT.
 REPORT.

WHITEFISH FOR LAKE ONTARIO.

CORRESPONDENCE RELATIVE TO STOCKING LAKE ONTARIO WITH WHITEFISH.

ROCHESTER, N. Y., 14th January, 1891.

SAM. WILMOT, Esq.,
 Ottawa.

DEAR SIR,—Please read the enclosed slips and tell me fully what your answer is to the accusation against your people.
 An early answer will oblige.

Yours truly,
 F. J. AMSDEN.

MEETING OF THE NEW YORK STATE FISH COMMISSIONERS.

(*"Evening Post," 14th January, 1891.*)

A meeting of the State Commissioners of Fisheries was held to-day in the market and Fulton Bank building, at Gold and Fulton streets. Applications for twenty oyster franchises were granted, and a long list of arrests and fines by the state game protectors was read. The reports from the various state Superintendents of fisheries for the coming season were encouraging.

A letter was read from F. J. Amsden, of Rochester, asking for the co-operation of the commission in bringing about concerted action on the part of the United States and Canada for the propagation of the whitefish in Lake Ontario and elsewhere. It was said there was a necessity for such action, and that more attention should be paid to the more common varieties of food fish. However, no united action could be taken with the Canadian Government, nor could uniform laws be passed on both sides of the lakes as long as the Canadians permit net-fishing. Most of the whitefish had now been taken from waters off the Canadian large whitefish being taken, but thousands of the small whitefish were caught and sold in this city and elsewhere as herrings.

CORRESPONDENCE REGARDING PRESERVATION OF WHITEFISH IN LAKE ONTARIO.

Mr. Edward F. Doyle,

Secretary Commissioners of Fisheries, New York.

DEAR SIR,—I am in receipt of your favour of the 14th instant, informing me of the action of the Commissioners of Fisheries in respect to stocking Lake Ontario with whitefish, scisces and wall-eyed pike, and conveying the assurance that the Commission is in sympathy with myself and associates in the effort we are making to increase the supply of fresh-water food fish, available to the residents of States adjoining the Great Lakes.

The purpose of the association with which I am identified is entirely of a public nature, and its design is to render a wholesome article of food so abundant and accessible to the communities residing in States bordering the Great Lakes that any one can, for a small sum of money, have on his table, every day in the week, during the season, a supply of those fish which are universally regarded as highly desirable food.

The assurance that the Commissioners of Fisheries of the Empire State will co-operate with us in our endeavours is exceedingly gratifying, and cannot fail to be of the utmost importance in all future efforts that are to be put forth.

From the experience which I have acquired since becoming interested in this subject, aided by my correspondence with others, at home and abroad, who have also given much consideration to the project, I am convinced that the task before us will not prove to be an easy one to accomplish, but will call for persistent and concentrated efforts by all who take the matter to heart. The public voice will no doubt be interested that can always be depended on to oppose any public measure adverse to their own short-sighted and selfish policy. The fishermen who persist in using nets of such small mesh that they catch fish of not more than half a pound weight are pretty sure to be heard from in a united wail when an attempt shall be made, in the public interest, to compel them to abandon their foolish practice of taking the immature fish and thus depleting the waters, which, if fished in a rational way, would continue forever to supply the growing population with a generous amount of full-grown fish.

The importance of the subject suggests that it may be necessary to enlist international interests in the cause, or, if not international, at least interstate. It would be obviously futile for the State of New York

to expend money and effort in stocking the waters of Lakes Ontario and Erie with food-fish unless current action toward its reasonable protection should be taken by Pennsylvania, Ohio and the Province of Ontario. There are no bounds between the waters of the various States named that would prevent the fish planted by New York from going to other shores, where they might be caught out of season or by the use of nets, which would not be tolerated by the State which had them hatched. It is self-evident that those States, including the Dominion, which are so fortunate as to be bounded by the Great Lakes, must unite in a determination to stock their waters, and, when they are stocked, to give them such thorough protection that no one but an outlaw will think of violating the regulations prescribed by reason and than a waste of time and money.

I therefore respectfully submit to the Commission that, as it has the advantage of being a lawfully appointed and influential body, representing the Empire State, it could with grace invite representative organizations from other States interested to take up the subject in a common spirit and obtain such legislation from the respective States as will give assurance that when the minor work of depositing millions of fry in the waters of a lake has been done the more important and difficult task of protecting the stock until it is mature shall be carried out with fidelity by the united power of all the States that border on the waters.

In your communication of the 14th I note with interest the fact that the Commission intends to liberate 4,000,000 siscos in Lake Ontario next spring. It may be presumptuous in a private citizen to offer suggestions to a body of experts, but it has occurred to me that, as the sisco is at best but an indifferent fish, and when mature is not as large as a whitefish or pike should be before it is fit to be caught, the presence in the lake of so many siscos would offer a temptation for unscrupulous persons to set nets, the ostensibly for siscos, which would take innumerable young whitefish, lake trout and pike, that would otherwise remain in the water until large enough to be caught in the net of legitimate size mesh, which should alone be allowed in the water where the better fish are to be cultivated. If the purpose of putting out the siscos be to furnish food for the pike, then the objection would not prevail. But it would seem that such a large number of siscos would necessarily consume food that might better be reserved for the more valuable whitefish.

Respectfully yours,

FRANK J. AMSDEN.

F. J. AMSDEN,
Rochester, N. Y.

OTTAWA, 17th January, 1891.

Your note enclosing paper cutting to hand. I notice its contents. I am very much surprised at the want of knowledge shown therein regarding the whitefish question, when it is stated: "It will be useless to stock the lakes until netting is stopped."

It will be a nice question to solve, how whitefish are to be taken for commercial purposes unless with nets, as they cannot be taken in any other way. Whilst the taking of the whitefish in nets cannot be avoided, and should not be prevented, yet, with proper laws and regulations regarding the times and modes of applying them, the great whitefish industries of the country would, at the present day, have been largely upheld—in fact, had our American cousins shown the same anxiety and the same amount of wisdom for protecting the whitefish and other fisheries in Lake Ontario and many other waters on their sides of the lake, they would not now present the lamentable state that exists at the present day, and of which complaint is made "that the Canadian Government has been instrumental in bringing about." Why so forgetful regarding the mesh of nets to catch them, during the past thirty years and more, whilst the United States or the State of New York has not now and never had any laws and regulations for protection of this valuable fish, but has allowed indiscriminate slaughter throughout at the spawning time, and at all times, with every description of engine that the ingenuity and cupidity of the American fisherman could invent to kill and destroy fish with.

Not only has the absence of a law for protecting whitefish in American waters seriously injured—in fact, almost wholly depleted them—but it has also given trouble and difficulty without end in the enforcement of the Canadian fishery laws, its inhabitants complaining that they (the Canadian fishermen) were restricted from taking fish at the close time, when on the American side, where, in some cases, only an indefinite international line exists, the latter are allowed to fish how, when and where they chose. In some cases, where a narrow boundary existed like the Detroit River, by such proceedings and subterfuges of all kinds, the Fisheries Department of Canada had to give way and allow infringement upon its well-intentioned legislation to protect their fisheries. Did not the Fisheries Department of Canada erect the first governmental whitefish hatchery on this continent, or even in the world? And have not many of the States of the Union followed most wisely and liberally in this praiseworthy undertaking to replenish their waters with the whitefish. I regret to say that not only did the Federal Government but many of the State Commissions advance the fallacious idea that as the artificial breeding of fish had been entered upon, and had proved so successful, it was useless to restrict the fishermen from keeping any close season, and that the supplies of fish would be upheld by this artificial process. What a fallacy to put forth, that artificial breeding would take the place of natural breeding. No wise or favourable advocate of artificial fish culture should put forth such a statement, for in the minds of the more intelligent classes such a theory must injure rather than benefit the actual or anticipated results from artificial fish culture. Strong advocate as I am, and as only be considered as a great adjunct and supplementary aid to the natural process. The natural and artificial means, combined with judicious laws as to the close seasons and regulations regarding nets, etc., would maintain the fisheries for all time to come. Artificial propagation alone, without the other methods being wisely applied, will never effect the desired end of replenishing or maintaining the fish supplies in the waters of any country.

Let such of your people as may be desirous of intelligently husbanding, and improving the whitefish wealth of their country, and especially of Lake Ontario, which is referred to, adopt similar laws and regulations to those in Canada (which may yet be largely improved upon) for enforcing a "close season" in length, size of mesh, etc., so that the young and immature fish shall not be taken; supplement the nets by an extensive system of artificial propagation; adhere to this system for years, and every year; eschew the iniquitous clap-net of greedy fishermen and party politicians, whose only desire is to kill and destroy for the present, caring nothing for the future, and I doubt not the fish wealth which Providence had so bountifully supplied the waters with for the use of mankind may again be largely replenished. Otherwise, but a few more years of the present reckless system of fishing must inevitably bring about such a depletion in Lake Ontario and elsewhere, of the whitefish and other fishing industries, as to make them counted as things of the past.

Let your Commissioners condescend to ask the co-operation of the Canadian authorities for the preservation of the fisheries in Lake Ontario or elsewhere, and I doubt not but that it would be received courteously and acted upon with that mutual spirit which should prevail between people, though of different nationalities, for the preservation and improvement of a source of wealth which so largely abounded in the dividing waters between them, but which now, for the want of proper care, is fast passing away.

Yours very truly,
SAMUEL WILLMOT.

UNITED STATES SALMON AND WHITEFISH HATCHING STATION ON LAKE ONTARIO, N.Y.

Following is a report in Congress upon the Bill for the erection of the hatchery, and accompanying it is a letter from the United States Fish Commissioner. This will prove one of the most important stations of the Commission:—

Mr. Parqihar, from the Committee on Merchant Marine and Fisheries, submitted the following report:—

The Committee on Merchant Marine and Fisheries, to whom was referred the Bill (H. R. 13350) for the establishment of a fish hatchery in the State of New York, near the St. Lawrence River, respectfully report said Bill back to the House, with a proviso thereto as follows:—

Provided, That the Commissioner of Fisheries shall first be satisfied that the State of New York has taken efficient measures for the regulation of periods for fishing and for proper protection of fish in the spawning season in the waters of northern New York.

And that when so amended your Committee recommend the passage of said Bill. The accompanying letter from the United States Commissioner of Fisheries, communicated to the Senate, gives sufficient reasons for the establishment of the fish hatchery proposed to be established by the Bill, and the same is made a part of this report:—

U. S. COMMISSION OF FISH AND FISHERIES,
WASHINGTON, D. C., 26th January, 1891.

Sir,—In obedience to Senate resolution of 18th December, 1890, directing the United States Commissioner of Fish and Fisheries to report to the Senate as to the desirability of the establishment of a fish hatchery in northern New York, near the St. Lawrence River, I have the honour to report as follows:—

The basin of the St. Lawrence, including Lake Ontario and Lake Champlain and the innumerable smaller lakes and tributary streams which drain into these, comprises fully one-half of the area of the State of New York, about one-fourth of the State of Vermont, and on the Canadian side a more considerable drainage area.

In Lake Ontario whitefish were formerly very abundant. The value of this fishery has declined year by year, and at present the production is relatively insignificant compared with the whitefish fisheries of Lake Erie, Lake Huron and Lake Michigan.

In the waters referred to a like decline was in progress, but those who were interested in those fisheries were prompt to recognize the necessity of legislation to restrain and regulate the methods, and apparatus, and seasons of capture.

Artificial propagation was also systematically resorted to, to supplement and reinforce natural reproduction, and whitefish hatcheries were established by the States of Michigan, Ohio and Wisconsin, and by the Canadian Government. Entering the field at a later date, the United States Commission has established stations for the collection and hatching of whitefish at Alpena, Mich.; Duluth, Minn.; and Put-in-Bay, Ohio.

The result of this co-operative fish culture work by the Canadian, State, and United States Fish Commissioners has been not only to arrest the alarming decline that was in progress, but to determine a marked increase in the catch of whitefish in those waters in which fish-cultural work has been carried on.

The marked contrast between the present conditions of the whitefish fisheries of Lake Erie and Lake Ontario sharply defines and emphasizes the necessity of artificial propagation as a means of maintaining and improving our important commercial fisheries, and of creating such in waters where they have not before existed.

We can not afford to neglect so important an economic resource, one which gives such substantial and valuable returns for moderate expenditures.

We can not expect individual enterprise to undertake such work in public waters in the expectation of private gain. Men, however public-spirited, will not sow the seed of a harvest which all men may gather. Our lakes and rivers and coast waters must be farmed by the Government for the general use, and under such regulations as will establish and maintain the largest production.

Another important commercial species which formerly existed in Lake Ontario in marvellous abundance, but which is now so rare as to be an object of curious interest when seen, is the Atlantic salmon. Sixty years ago, each season it ascended the St. Lawrence in vast numbers, and swarmed in all its tribu-

aries. Following both shores of Lake Ontario, it ascended all the smaller streams which fall into it and which afford suitable spawning grounds for the mature fish and favourable nurseries for the fry during their period of river life.

The following extract from the annual report of the Department of Marine and Fisheries of Canada, for the year ending 30th June, 1899, will be instructive as well as suggestive:—

“Special Report of Inspectors Whiteher and Venning, on Fish-Breeding at Newcastle, Ontario.”

“We proceeded yesterday to Newcastle, Ontario, in compliance with your directions, and made a personal inspection of the fish-breeding establishment there, under charge of Mr. Wilmot. The premises are situated on Baldwin's or Wilmot's Creek, a small stream traversing the township of Clarke, in the County of Durham, and discharging into Lake Ontario, about forty miles east of Toronto. This creek is well situated for salmon, as it forms a natural inlet of the sheltered bend of the lake between Beudhead and Darlington. Although at its entrance into the lake it passes through a marshy bog, the bed of the stream farther inland is of a gravelly nature and the water is pretty clear, regular, and lively in its flow. In early times it was famous for salmon, great numbers of which frequented it every autumn for the purpose of spawning. They were so plentiful forty years ago that men killed them with clubs and pitchforks, the women seined them with flannel petticoats, and settlers bought and paid for farms and built houses from the sale of salmon. Later they were taken by nets and spears, over 1,000 being often caught in the course of one night. Concurrently with such annual slaughter, manufactories and farming along the banks had obstructed, fouled and changed the creek from its natural state, and made it less capable of affording shelter and spawning grounds. Their yearly decreasing numbers at length succumbed to the destruction practised upon them each season from the time of entering the creek, until nearly the last straggler had been speared, netted or killed.”

The history of the salmon fishery of Wilmot's Creek, so graphically told by the Canadian commissioners, has been repeated in every stream of the State of New York which drains into Lake Ontario and numerous colony of parr and smolts, which descended the St. Lawrence to the Gulf, where they remained until they had attained size and maturity, when, obeying the impulse of reproduction, they ascended the St. Lawrence and distributed themselves to all the tributaries of lake and river, carrying back to those inland waters the rich harvest of the sea which they had garnered.

This magnificent fishery has ceased to be. Did it exist to-day, and were the conditions which made such a fishery possible prevailing to-day, a hundred streams now barren would afford salmon fishing as attractive as the more favoured waters of Canada, and the catch by net in the lake itself would furnish the motive of a valuable commercial fishery.

The cause of the disappearance, practically, of salmon from the streams of the St. Lawrence Basin, has been chiefly and primarily the erection of obstructions in all of the rivers, which have prevented the salmon from reaching their spawning grounds, and so natural reproduction has been absolutely inhibited.

The restoration and maintenance of the whitefish fisheries of Lake Erie, or of the salmon fishery of the lake and rivers, would either of them furnish sufficient motive for liberal expenditure on the part of the Government, if we consider the matter from a purely practical and economic standpoint. It is not only possible, it is entirely practicable, to restore and maintain these fisheries, by adequate recourse to means and agencies entirely within our control.

The regeneration of the fisheries must be accomplished through fish cultural work, systematically and persistently pursued. Their maintenance must be assured by concurrent regulation of the lake fisheries by the United States and Canada, and by the enforcement on the part of the State of New York of such regulations and requirements as will permit the salmon to ascend to their spawning grounds. In the absence of such regulations and requirements it will not be reasonable to expect that the results of fish cultural work will be permanent or compensating, however extensive such work may be.

A fish cultural station, planned to meet all the requirements, must be very extensive and complete in all its appointments, and will involve larger expenditure than would be required for a station devoted exclusively to the production of whitefish or the salmonidae. The hatchery must be commodious, providing at once for the hatching of 100,000,000 of whitefish and for the incubation of 1,000,000 salmon ova. It must also provide trough accommodation for holding 1,000,000 salmon fry for some weeks after they begin feeding. Quarters, offices, storage rooms and shops must be erected; an extensive system of ponds for rearing the salmon must be constructed, for none would be released in open waters until they were of sufficient size to have comparative immunity from capture by other fish.

At the first installation of the station, and for several years, it would be necessary to draw our supplies of whitefish ova from our collecting stations on the upper lakes, and our salmon ova from Maine. With the improvement of the fisheries, we should expect to find our eventual source of supply in Ontario waters, and the location of the station should be with reference to this. Wherever placed, it should be convenient to transportation routes, and should control a gravity water-supply which should be without stint or measure.

The cost of such a station as I have indicated, complete in all its appointments, would not be less than \$20,000, exclusive of cost of site and water franchises, and for its maintenance there would be required an appropriation of \$9,000 per annum.

HON. LEVI P. MORTON,
Vice-President.

Respectfully,

MARSHALL McDONALD,
U. S. Commissioner of Fisheries.

RESULTS OF FISHCULTURE.

(“Forest and Stream,” 1st January, 1891.)

It is probable that to those of the readers of *Forest and Stream* who are not particularly interested in fish culture, and are therefore not acquainted with the facts, the statements of Mr. Milton Peirce, which have recently been made concerning the present aspects of trout culture, will appear to be quite frank and plausible. Therefore, in view of the attitude he holds toward present methods of fishculture in general, a little further dissection of them, as evidence of his competency as a critic, may be advisable. And first,

what does he offer to sustain his statements? Simmered down, it might be formulated into the following declaration, viz.: "I, Milton P. Peirce, an eminent authority on fish culture on my own showing, say that is so, and therefore it is so." Mr. Peirce's egotism is apparently unconscious, to do him justice. The *Angler* of 4th October:

"A MAD FISH CULTURIST.—We print the annexed communication in full at the request of Mr. Peirce, whose main trouble seems to be restlessness under opposite opinions to his own. His dictatorial style is offensive, and discussion of any subject with him appears to lead to personalities that are always avoided and condemned when gentlemen exchange views on public questions. Our editorial, 'A Mad Fish Cultivist,' published some weeks ago, was suggested solely by the humorous element contained in two public assertions by Mr. Peirce, that Byers (an old veteran) was a callow youth, and that he (Peirce) 'knew it all.' We had no special design to belittle Mr. Peirce's abilities or ridicule his pretensions, and cheerfully accede to his somewhat modest request that we should allow him to blackguard us in our own columns.—Ed."

I very respectfully decline to accept controversy upon Mr. Peirce's terms. Trout culture is not being abandoned, but is keeping step with other branches of fish culture, and needs no very urgent defence. Mr. Peirce states that trout culture has been discontinued in France. Now the papers by C. Raveret-Wattel, F. Muntadas and Frank H. Mason, Consul at Marseilles, in the Bulletin of the United States Fish Commission for 1887, are direct evidence to the contrary. Mr. Peirce's observation appears to be of the period when five years, during which the output has been yearlings, which are not only able at once to defend themselves against their enemies, but also to devour the smaller of them, and which policy is producing such marked results in this country and in Europe.

Mr. Peirce is willing to admit that if his methods are followed there is still some hope for fish culture. (This appears to be the main trouble with him). In trout culture it consists in increasing the meanderings of the streams. Even if there were anything in this, those who are at all familiar with trout streams are aware that they will insist upon laying out their own courses.

There is a vague hint of some experiment in shad culture by "Peirce's methods" now being made. This is certainly interesting news, and the result will be awaited with great expectations. But let us take up the shad and white-fish culture as tests of Mr. Peirce's fairness and reliability as an observer, since these are commercial fisheries, the statistics of which are regularly and accurately collected, and cannot be controverted by vague and unsupported assertions. Any reasonable person would be convinced by their growing abundance and cheapness that there is a constant increase in the numbers of shad. In spite of the fact that by reason of the wonderful improvements in methods of refrigeration, by means of which they not only can be shipped to any distance, but are kept in fresh condition for any length of time, and also coast States during the spring of 1890 for 25 cents each. Further, so great was the glut that for the first time in twenty-five years the salting of shad was begun on a commercial basis on Chesapeake Bay, pursue-net by mackerel fishermen. These evidences would be explained by Mr. Peirce by the assertion of "a year of plenty." To this I will refer further on.

Mr. Peirce's qualified admission as to the value of artificial stocking, as shown by the population of Pacific waters with shad, may be supplemented by some statistics of interest. The shad catch of California in 1888 was 151,871 lbs., or about 45,000 fish. In many places where the largest runs occurred, notably in Monterey Bay, there is no special apparatus used for shad, and more are taken by accident than otherwise. The catch, therefore, while large for a new fishery, probably gives no real idea of the abundance of the species. During 1887 as many as one or two tons of shad were shipped from Santa Cruz, Cal., in one day. They are found as far north as British Columbia and Alaska, and certainly furnish, to a reasonable mind, sufficient evidence as to the beneficial results of artificial stocking. If the one or two hundred thousand delicate little fry carried in cans from the Atlantic coast to California, and deposited in waters to which they were until then unknown, would live and multiply at such a rate, what must be the result of work so much more extensive and constant.

Now, to return to the Atlantic coast. If Mr. Peirce were to ask shad fishermen at Gloucester, N.J., Alexandria, Va., or on the Susquehanna, above Havre de Grace, whether the shad fishing is improving or declining, he would probably be told with a mournful shake of the head that shad fishing is "played out." It is very evident that it is from such sources that Mr. Peirce draws his inspiration. What are the facts in the case as shown by the carefully collected statistics of the Fisheries Division of the United States Fish Commission? Why, that at present the shad catch of the Atlantic coast is increasing at the rate of about one million per annum, that since 1884 this increase has finally resulted in an addition of \$1,200,000 a year to show that this is not mere vague, guess work or speculation let us take what statistics are available for the purpose. The first statistics which were taken after the commencement of the artificial propagation of the shad, which were those of the census of 1880, which showed the catch of that year to have been 4,140,968. It was not until 1885 that a systematic collection of statistics of the Atlantic coast fisheries was begun. In that year, although at that time, as compared with the present, the output of fry was but meagre, the catch had increased to 5,173,931, an increase of 1,032,963, representing an increase of value of \$208,593 over 1880. In 1886 the catch was 5,584,368, an increase in number of 1,443,300, and in money value of \$288,680 over 1880. In 1887 the catch was 6,715,405, an increase in number of 2,574,437, and of money value \$514,887 over 1880. In 1888 the catch was 7,660,474, an increase in number of 3,519,506, and of money value \$703,901 over 1880. The statistics for 1889 and 1890 are not yet complete, but a conservative estimate places them in the neighbourhood of 9,000,000 and 10,000,000 respectively. The money value is based on a rate of five shad to the dollar. It will be seen by the above statistics that in the four years of 1885-88 the aggregate money value of the increased production was \$1,714,061, and the average annual increase threatened extinction of that fish, more than to any other cause, that the United States Fish Commission came into existence, and to the work of that great organization, supplemented to a small extent by some of the States, alone can be traced this gradual and regular increase in the shad fisheries. How, then, are we to account for the impression which prevail in some localities that the river shad fisheries are on the decline,

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and which are undoubtedly the basis of Mr. Peirce's erroneous conclusions. Here comes in the value of statistics over the conjectures of disappointed fishermen and the local *Veritas* or *Pro Bona Publica*. The explanation of it all will be found in the development of the pound-net or gill-net fisheries of the Atlantic coast. Let us take Chesapeake Bay for example. The number of pound-nets in these waters in 1887 was 973; in 1888 it was 1,414. The statistics of 1889 and 1890 are not yet available, but it is estimated that there are now at least 2,000 of them. By reason of these great pound-nets, some of them stretching two and three miles out from the shore, the bulk of the shad catch is now taken in salt water, and finds its way to market, to a great extent, through new channels. As four men operate as many as ten pound-nets, there is great economy in this method of fishing. The gill-nets, also requiring but little capital, have greatly increased in number, and so the fish which find their way into the rivers are apparently less abundant, because the catch is divided among a greater number of fishermen.

The proportion of fish taken in the bays and lower portions of rivers is becoming greater each year, and thus the great and extensive shore seines in fresh water are becoming less and less profitable. As a matter of fact, however, there is a constant increase in the number of shad caught in the rivers, as the statistics show. During the season of 1890, which was regarded by the fishermen of the Potomac River as a poor one, 100,000 more shad were caught in that stream than in 1889, as shown by the statistics of Health Officer Addicks, of Washington, D.C.

It is well known that certain of the salt fish industries of New England are declining, simply because, by reason of improved refrigeration, more fish are finding their way to the markets of the country in a fresh condition, and this, to some, has the appearance of a decline in the fisheries themselves. During 1888, 1889 and 1890 the output of shad fry was many millions greater than during the entire previous history of the work, and this great output will probably be heard from 1891 to 1894, showing, it can be safely predicted, a still greater ratio of increase.

Mr. Peirce complains of the meagre shad catches of the New England waters. This can be traced to the meagreness of the output in those waters. The total output of 1886 was 34,659,000. Of these, but 5,500,000 were deposited in the Hudson and New England waters. In 1887 the output was 108,425,000, were sent to Cold Spring Harbour for hatching and deposit in the Hudson and its tributaries. Here we can trace out cause and effect very clearly. Perhaps in this connection the following concerning the shad fishery of Florida will prove interesting: Compared with 1880, the catch in Florida in 1889 was 1,000 per cent. greater, while the number of fishermen employed was only 200 per cent. greater.

The output of shad fry by the United States Fish Commission is now nearly 150,000,000 per annum. The survival of 7 per cent. of these would equal the shad catch of the Atlantic coast. "Does any one suppose that one in fifteen of the plant of young shad made in the waters of the Delaware last season will ever be seen again by mortal eye?" asks Mr. Peirce in the late *Journal of Corp Culture and Rural Hydraulics*. Well, judging by the results on the Pacific, some of them do live in spite of the wails and lamentations of the "prophets." And would the survival of seven out of one hundred of these fry be an unreasonable expectation?

And now concerning the "years of scarcity and abundance" which prevailed generally before the statistics were regularly and systematically collected, and which are still used as an argument by those who view the question from a purely local standpoint, or are not well informed. Regarding seasons of plenty and scarcity of shad, it has become recognized as a law of the species that years of plenty in certain rivers are superinduced by a high temperature of the water in the early season. Thus while the run of shad in southern rivers and coastal waters south of Virginia may be exceptionally large, the passage of these migratory hordes into the Chesapeake and Delaware basins, as well as into the Hudson and Connecticut, is controlled entirely by the temperature of those waters, while, as often is the case, the waters of the Chesapeake may be of suitable temperature, a reverse condition may exist in the Delaware, in which case the run in the Chesapeake and tributary streams is usually greater than in the Delaware. Reverse the order and like results are obtained. The movement of these migratory species in spring along the coast waters are not suitable the migration continues until proper conditions present themselves. A perusal of the reports of the Canadian fishery officials for the years in which the shad were least abundant in our waters shows that they were the most prosperous years in these regions.

Regarding the abundance of whitefish, it is acknowledged by all the leading dealers and fishermen of the largest shipping centre on the lakes (Sandusky) that artificial propagation is the only means of maintaining a supply of that species. Again, the facts adduced from the shad hypotheses are applicable to the whitefish. There are seasons of bounteousness in the United States, while the opposite extreme applies to Canada; yet an evenly distributed supply is more generally the rule. With this fish partial returns for artificially carried on on a large scale. This is especially noticeable in the fisheries of the western end of Lake Erie. In the region embraced between Toledo and Vermilion, and including those towns, together with Port Clinton, Sandusky, Bass Islands and Huron, the increase in the quantity of fish in 1888 as compared with 1885 amounts to about 12,000,000 lbs., having a market value of over \$300,000. The catch in 1888 in the region named was nearly as large as that of the entire lake in 1885. Now, let us see how the increase of fishing appliances would be likely to affect the individual catches of the fishermen and create the impression among them that the fishery is declining. It is hardly likely that declining fisheries would offer inducements for a rapid increase of fishing appliances. In Lake Erie there were, in 1880, 758 pound-nets; in 1885, 928. Of gill-nets there were in 1880, 5,775; in 1885, 22,664. Of haul seines there were, in 1880, 18; in 1885, 71. Persons employed in 1880, 1,690; in 1885, 4,298. Steam vessels there were, in 1880, 53. Other vessels and boats in 1880, 593; in 1885, 1,483. Total of primary products of the fisheries in 1880, \$21,087,000; in 1885, \$57,556,517. This shows the increase for five years, and the succeeding five years, when the statistics are completed, will show still greater increase. If Mr. Peirce is wrong in these matters of shad and whitefish culture where is he likely to be right?

My purpose in taking the trouble to produce these statistics is not with an expectation of convincing Mr. Peirce of the fallacy of his position, I am well aware that that is impossible. But they will enable the readers of *Forest and Stream* to form an intelligent opinion on the subject, as they represent not only the carefully collected statistics of a great Government bureau, but also reflect the opinions of the great fish culturists.

of the country, not one of whom will be found to agree with Mr. Peirce. His charge is that they are all self-interested, and in fact no better than robbers. I leave that element of the discussion to your readers. I will stop only to correct one of Mr. Peirce's misstatements. He attempts to make it appear that the publisher of the *Journal of Carp Culture and Rural Hydraulics* was in some way attacked by me. This is not so. That gentleman has my sympathy. The case still remains the same; Milton P. Peirce vs. the are frauds or victims of delusion. And further, if he is right the sooner we know it the better. The country is going to destruction rapidly enough now, according to the "prophets."

Mr. Peirce has some special personal grievances against me. First, he thinks I am not a fish culturist—as he is. I hasten to say that I am not, and never pretended to be.

Second, because some months ago I said that I had recently had an application to lease certain premises for a trout hatchery, he has since persistently advertised me as the malevolent owner of a trout stream with which I wanted to victimize some poor deluded fish culturist, who had not consulted Mr. Peirce. I am not so fortunate. The fact is, I own a little tract of land on which there is a group of springs, such as are used in this neighborhood for hatching and rearing trout. The State Hatchery has a similar group and its enterprise is a wonderful success. I know of five such plants near this city. I spoke of the application simply to show that another enterprising citizen wanted to embark in the business. The land was already leased and used for another purpose.

Third, I said early in this controversy that trout planting had greatly improved the fishing in many streams of this State, I think using the number "a hundred." Ever since Mr. Peirce has been in mortal distress because I would not give him the names of those hundred streams. I desire now to amend by saying "hundreds." I think the Platte alone has a hundred tributaries above where it leaves the mountains, and all its waters, accessible to trout, have been improved by planting, in the main stream and its larger branches, trout fry from the State hatchery. But only a few of these streams have been named as yet, and hence it is impossible to satisfy the consuming curiosity of Mr. Peirce upon that score. Besides the Platte, Grande, Les Animas, San Juan, Gunnison, Blue River, Eagle River, the Boulders, St. Vrain, Big and Little Thompson, Cache-a-la-Poudre, North Platte, and others. I may as well amend again and change "hundreds" to "thousands." And, bear in mind, the Eastern brook trout is not a creature of accident—introduced here but a few years ago through the State hatchery—the best investment the State ever made.

In order that Mr. Peirce may not stumble over any more imaginary obstacles on my account I wish to repeat that I am not a fish culturist; that I have no trout brook to lease, and am not a competitor in his line of business; that I never caught a fish for the purpose of selling it; that I never sold a fish first or second hand; that I know what I see, believe many things I hear a goodly portion of that which I read. I know that trout hatching and trout planting in the waters of Colorado have been a marvelous success; I am convinced that fish culture in other lines in this modern age to follow its history and to glory in its papers of the country, as he seems determined to do, will either stop or turn back the wheels of progress in this great industrial enterprise, nor do I think that all its disciples are fools, and that Mr. Peirce is the only living creature who knows all about it.—W. N. Byers.

FISH CULTURE.

ITS PROGRESS IN VARIOUS COUNTRIES OF THE WORLD, SHOWING ITS PRESENT CONDITION AND RESULTS.

(From "The Edinburgh Scotsman.")

[By GEORGE MALCOLM, INVERGARY.]

Can any one render a reason why the family fish-pond should not be as general and useful as the family poultry-house? The advances recently made in the art of fish culture can hardly be described as less than marvellous, and do certainly favour the view upheld by modern pisciculturists that there is no more difficulty attending domestic fish-rearing than there is about domestic poultry-keeping.

Many large fish-breeding establishments, or fish farms, as they are sometimes called, have lately been planted throughout England and Scotland upon a commercial basis, some of which are already doing an extensively and, it would appear, remunerative business. From these great numbers of young fish, and artificially fecundated ova of fish, chiefly of various varieties of non-migratory trout, have been disseminated throughout the country for the furnishing of small private fish nurseries, and the stocking or repopulation of larger lakes and streams, both at home and abroad. Printed catalogues and price-lists are now regularly issued from these establishments at the advent of every fish-hatching season, and orders are promptly executed to success which are marvellous, and would, if attempted not very many years ago, have been regarded as the wildest folly. Now we have rival fish farmers keenly advertising their wares by the same attractions as are practised by the breeders of pedigree cattle or poultry, and breeders proclaiming the superior purity of pedigree or surpassing vigour of constitution of their especial stud fish over others in the business.

All this is no doubt very novel, and may be startling to persons who have not noticed the silent but wonderful strides made in the fish-breeder's art in quite recent times. To those who have been engaged in the possibilities of fish culture have by no means yet been attained. We seem, indeed, to be only at the dawn of an art not only of a most fascinating character, but with a great future of national usefulness before it. Nor is the field of fish culture limited to the family fish-pond or to private cultivation; by far the more important side of pisciculture, or piscifaculture, as the French first called it, is that which bears on the question of an abundant, certain and cheap supply of food fishes for our teeming populations. In our country fish is rarely abundant and cheap, except during an accidental and profitless glut; and while nearly all other articles of human subsistence have been growing more abundant and cheaper, fish, on the whole, has been getting scarcer and dearer.

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Here, then, we have presented to us a very interesting economic problem, with remarkable possibilities of beneficial development; and it is perhaps due to this, and to the stimulation of the great International Fisheries Exhibitions held at Berlin, Edinburgh, London, New Orleans, and elsewhere, that among the few subjects of domestic or commercial interest which have not been suppressed by the domination of "Irish omnivorous instincts, but it would probably balk the ingenuity of the most versatile member of that party to discover in the incoherent sciences of ichthyology any design against his country.

In view of the encouraging successes of other nations, more especially America, of which more hereafter, may, well be again asked, is fish so dear? Fish is almost alone among the commoner commodities of life scarce and dear in this country. Only the rich and well-to-do can always have it; yet the existence of great magazines of fish food all around our coasts, our drafts on which are but small, is admitted on every hand. The wonder is increased when it is considered that these stores are of perennial growth, and capable of practically unlimited extension at comparatively small expense. Unlike agriculture, ocean fish farming, or aquaculture, is free to all, is subject to no rent, is exempt from rates or taxes, and requires neither tilling nor manuring in the sense applicable to land husbandry. Why, then, are these valuable possessions so little utilized? Why do the British public, though in chronic grumble about the price of fish, still submit to the present condition and prospects of the interesting and rapidly-advancing subject of pisciculture. The consideration of its bearing on our food and game fishes, and the subject naturally divided itself into two branches: viz.:-

1. Private fish culture for domestic requirements, recreative purposes, &c.; and
2. Public fish culture, conducted at the public expense, for national and commercial purposes.

In case the benefit derived from fish culture in the past, and the advantages expected from it in the future, may still be viewed with doubt in any quarter, it may be well to formulate some of the objects aimed at, and then to describe the benefits which may reasonably be obtained from an intelligent and liberal-spirited interpretation in practice of these objects. References will be made to the history, progress and present position of the systems of fish culture in other countries as well as our own.

Although our object is chiefly to describe the advances of fish culture in the most recent time, and its capabilities of further beneficial development, readers who are interested in the subject will be willing to have some short account of its past history. Everybody knows in a general way that the art of angling, and of fish capture at large, and possibly the art of artificial fish-breeding, too, in the cruder fashion, are of the highest antiquity. But though a few leading and favourite works, such as Walton's immortal "Salmonia," Christopher North's "Noctes Ambrosianae," and several of the more reputable manuals on angling, are extensively read, not many persons outside the circle of the knights of the angle, or the distinguished living American pisciculturist recently stated that his library contained upwards of 2,000 volumes relating to fish and fishing, and that he regarded his collection as far from complete. The late Mr. Alfred Denison, who was well known as one of the most enthusiastic of anglers, was the fortunate possessor of an almost unique library of angling works, which numbered over 3,000 volumes. In the "Bibliotheca Piscatoria" of Westwood & Satchell (1833) 3,158 editions and reprints of 2,148 distinct works are registered. And still new works on piscatorial subjects come in great abundance from the press of nearly every nation.

Antiquarians of the piscatorial type have claimed for angling, with perhaps less reliability than enthusiasm, that it was almost contemporaneous with the advent of man. It is at least frequently mentioned in the earlier portions of Holy Writ. Fishes take precedence of terrestrial animals in the Mosaic account of the genesis of life; and fishes were, in the nature of the case, the only form of life which suffered not from the Deluge. The readings of ancient Egyptian walls and monuments have revealed many allusions to angling and representations of hooks, spears and nets, showing that this people were anciently acquainted with some of the modes of fishing still practised, rude and simple though their implements were, as compared with the number and elaboration of the fishing requisites of our day.

"That the practice of casting into the brook," says a modern writer, "had its origin in necessity, the mother of so many inventions, can hardly be doubted; but it is equally clear that the refined skill exhibited in this pursuit in the present day has been derived from leisure and the love of sport, aided by the more delicate gear which modern ingenuity has invented for the deception of the finny race, by the ingenious and elegant production of the fishing tackle factories of our day; between the Vivaria of the Romans or the fish-stews of the middle ages, and the splendid fish farms and stations, with their scientific equipments of our day, there is indeed a long step.

Among the ancients the earliest systematic writer on fishing was Oppian, whose *Haliectica* in five books is entitled to rank. In our own country the earliest example of a printed book on fishing is the famous "Book of St. Albans," by Dame Juliana Berners, the first edition of which is dated 1486, less than ten years after the first book was printed in England. Dame Berners, who is said to have been Prioresse of the Benedictine Nunnery of Sopwell, is unquestionably the earliest writer in English literature on the art of angling. The "Dyeporte of Fysshynge," as originally published, was associated with treatises by the same authoress on hunting, hawking, horses, and coat armour, but ere long that part of the conjoined works in which we are here interested was separately republished, under the title "Treatise of Fysshynge wyth an Angle," and since that period this very quaint book has gone through many editions. Of the earliest editions very few copies are extant. Of the third edition (1563) only one copy is known. It belonged to Mr. George Daniel, and was sold in 1864 at his sale for £110, and is now in the Huth Library.

The next book of note on fishing was the first edition of Mascal's "Booke of Fishing with Hooke and Line, and all other instruments thereunto belonging," which appeared in 1590, but which is notable to us only as containing at that early date some remarks on the preservation of fish in ponds.

These two works, with the "Secrets of Angling," by John Dennys, 1613, and Markham's "Pleasures of Princes," were the only books dealing with angling which had been published in this country prior to

the appearance of Isaac Walton's "Compleat Angler," Barker's "Art of Angling" indeed appeared two years before Walton's book, and the latter acknowledges his indebtedness to the former in the preparation of his great work; but Barker's smaller work may be said to have ushered in the Waltonian period.

Of the "Compleat Angler" detailed notice is unnecessary. No book in its particular walk of literature, and few in any other department, has had a title of its popularity. Originally published in 1653, it has perpetuated its popularity of the art of angling, but rather from its almost perfect pastoral style, and the quaint and restful thoughts permeating its delightful dialogues and reveries. The earlier editions of the "Compleat Angler" are now very scarce. Copies of the first edition bring a very high price. The one in the Gibson Craig Collection, a fine specimen, recently sold, fetched the unprecedented sum of £195.

Some apology may be necessary for this digression into the domain of angling literature, which, however, will not be further pursued. Suffice it to say that so numerous have been the works published on fish and fishing during the last and the present centuries that at the present time it is computed that in English literature alone there are between 600 and 700 works on angling, and probably about 300 besides, which treat of the propagation of fish, and the management of British and colonial fisheries. The pursuits and pleasures of the knights of the rod and angle may be, and as a matter of fact already are, largely augmented by the aids of intelligent fish culture. It is, therefore, meet that the angler should be here considered, though it must be admitted that his part of the case is a mere fringe of it. Aquaculture embraces very much larger and more beneficent possibilities, and the day is probably not far distant when public fish culture, carried on for the public behoof at the public expense, will receive as much attention in this country as it does in many other countries, notably in America.

Whoever cares to look into this question will find no trustworthy traces of fish culture by artificial or aided means having been practised by the ancients, or even in the middle ages. Reference may, no doubt, be made to the extensive fish ponds or vivaria of the Romans, which, as is sometimes claimed for them, may also have been known in still older times to the Egyptians and Chinese; but there is no solid ground for believing that any of these nations ever practised or were in any wise acquainted with the modern methods of the fish culturist, who practises his art by manual extrusion of ova from live fish, followed by infantile and juvenile periods of fish life.

The mode of pond culture practised by the ancient Egyptians and the later Romans, just averted to, was in reality not fish cultivation, but fish capture, such as is known to the present day in the lagoons of the East. It consisted in merely driving fish by natural means into prepared water enclosures or vivaria, some of which were of vast extent, where the stock of impounded fish could be drawn upon at pleasure, and replenished from time to time by fresh drafts from the ocean. In much the same manner were managed the smaller ponds and fish stews of a later period in our own country, of which abundant remains—but little numerous where stood the homes of the monks and friars of a former age. Whosoever is curious about this will find, if he looks into the topography of the bygone great ecclesiastical houses, that they were set down with a very discriminating regard to the bounties as well as the beauties of their situation. While their founders had one eye open to the fairness and fertility of the surrounding domain, they generally turned the other to the proximity of some abundant fish, especially salmon. Alas! that so many of these rivers are now entirely bereft of salmon—indeed, of edible fish of any kind.

The practice of pond culture or the rearing of fish, chiefly carp and gold fish, in ponds for domestic use, has been long in use in Germany, and is still in considerable vogue. All the great land owners—Princes, Bismarck, for example—maintain a supply of carp, not only for their own private establishments, but in some cases for commercial gain. Nor is this confined to the larger houses; domesticated carp are very common among the Germans, who have set an example in that respect which has been very successfully copied recently by the Americans. From the eggs of highly-bred carp, originally imported from Germany, the United States Fish Commission have propagated large numbers of that fish, and distributed them to all or utilitarian purposes has been in abeyance for centuries. Some fish ponds there always have been, of course; but these have been maintained chiefly for sport, or for the embellishment of the private domains to which they are attached. We are again, however, it is hoped—thanks to the impetus derived from recent discoveries in pisciculture—on the eve of a revival of pond culture of fish for domestic requirements. Should there be such a revival, it may be presumed that, being now based on an intelligent alliance of science with practice, it may have the promise of success and stability. Many other varieties of fresh water fish than carp, though now, as regards this country, in a purely feral state, are amenable to a high degree of domestication. Intelligent artificial fish culture, it would therefore seem, may be the means of bringing the family fish pond into as real and common use as the family poultry or bee-house.

The merit of the discovery of the art of artificial fertilisation of the ova of fish belongs to a Westphalian German, named Stephan Ludwig Jacobi, who practised the art as early as 1778. Some critics have sought to belittle Jacobi's discovery, by the assertion that it was merely the revival of a lost art, formerly known to the Italians, but there would appear to be no good grounds for supposing that artificial fish culture was known to any people prior to its discovery by Jacobi in the middle of the last century. To him it came undoubtedly as an original invention, and as such he is entitled to the credit of it.

The importance and widely-reaching possibilities of this discovery were at once apprehended, though it was not until long afterwards that it was brought into extensive use even by the countrymen of the discoverer. By Jacobi's own family it was practised for many years, and they would appear to have had correspondents in England and France, as well as in America. The relations of Jacobi the elder with England seems to have secured him a pension in 1771 from George III. Though the art thus discovered in Germany about the middle of the last century has been slowly developed, it can be traced in Italy in 1791, in France in 1820, in Great Britain in 1837, in Norway in 1859, in the United States in 1853 and in Canada in 1863. It is, however, only within the last twenty years that under alarm as to the economic condition of many of the world's greatest fisheries it has been taken up by any nation (with the single exception of France, perhaps) upon a great scale, and under official auspices, as the only feasible means of reparation of impoverished and wasteful use of those fisheries, and of maintaining in the future a full supply for every possible

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public requirement. That public fish culture is equal to this will be seen later; but, in the first place, some account of the processes of artificial fish propagation, as it is now practised, and of its application to private fish culture, will here be given.

The last two decades have seen the establishment, on a commercial basis, of a considerable number of private artificial fisheries in our own country, and by this means, so far as regards inland private fisheries, all requirements are being supplied. From these fish-farms, too, somewhat extensive contributions of ova have been made to our Australian and New Zealand colonies, with a view of solving the problem (still unsolved, we fear) of acclimatization of salmonide in these waters. We have also had interchanges of ova with our American cousins. All this has been accomplished through private enterprise exclusively. It has been limited to non-migratory fresh water fishes and several varieties of salmonide (trise exclusively). It has known as game fishes. But these are no more than the outworks of this great matter. So far as Great Britain is concerned, the culture, by artificial help, of ocean fisheries has had no existence. In that field we are, at the present time, quite outpaced by other nationalities. All the successes and all the honours have fallen to foreign pisciculturists.

Like many great operations, the fertilisation of the ova or eggs of fish is an exceedingly simple though delicate process. Nothing more is required than care in the selection of healthy, mature fish in a ripe condition—that is to say, ready to spawn in the natural manner—and some caution and gentleness in performing the operation. The operation itself consists in the operator's hand down the abdomen of the female fish, thus extruding the ripe ova into a shallow receptacle, and afterwards suffusing the ova with the milt of the male fish obtained in the same manner. So far, if this process is carefully executed, there is almost no risk of miscarriage.

In early times a good deal of water was thought to be an essential admixture in the fertilising process, but now what is called the dry method—a discovery of Wrasskie, a Russian pisciculturist—is in all but universal practice. Under the dry method, where little water is used, the percentage of fertilisation is much greater than under the former plan. If skillfully manipulated unfertilised eggs should not exceed 5 per cent. The rationale of this discovery—which, though made in 1854, was not known out of Russia for a good many years afterwards—is that the spermatozoa or vital principle of the milt is much more powerful and active, and that for a longer period, when undiluted with water than when, as formerly was done, both it and the ova were submerged under several inches of water in the fecundating vessels.

It has been ascertained that ripe milt, if, when obtained, is at once excluded from air and water, may be kept alive for several days, an obvious advantage of this being that it is thereby unnecessary to hurry the process of impregnation. Some of the milt may even be saved for use on another day. It follows from this most interesting fact that, without removing the parent fishes from their homes, access may be effected between fish frequenting waters far apart. It may even be possible some day to effect changes of this kind and their more valuable fish species. On this subject, Mr. Livingstone Stone in his "Domesticated Trout," makes these amusing remarks:—

"In consequence of the discovery that all mature eggs are impregnated by coming in contact with ripe milt—the fish, both male and female, being taken at random—we are compelled to admit, however unmechanical mixing of the ripe milt of any male and the ripe eggs of any female creates the germ of one selecting its mate, counting for nothing. The fish of either sex has no choice and no knowledge as to out ever having seen her mate, and the male may become the father of innumerable offspring without ever having seen her mate, and the female may become a mother with- out having seen her mate. Whatever margin of uncertainty the unimpregnated eggs of the old system might afford for the conjecture that empty eggs were the consequence of misnating on the part of the fish, taken, produces all the results that mutual affection and choice of mates could accomplish. There is now no possible place left for sentiment in the conjugal relations of trout that are artificially spawned.

Having secured a supply of properly impregnated ova, the next step in the process of fish raising is to place it in the hatching boxes. Since the days of Jacobi, Shaw at Druunlaurig, and the earlier experiments at Stormontfield, on the great Scottish salmon river Tay, the advances in the knowledge of fish culture have included many improvements in the apparatus employed in hatching. But one must repair to Germany or America to see fish hatching on the largest scale. Our own hatcheries are as yet limited to the propagation of fresh water fish and anadromous salmonide, but they include several establishments which in notable example, upon which its owner, Sir James Maitland, Bart., has bestowed the greatest pains, and a not a little expense, to render it what it is—the most scientific and complete, though perhaps not the most extensive, fish farm in the world. Beginning in an experimental way, and on a small scale, some years ago, Sir James has made many investigations into fish cultural science, and has successfully solved some knotty problems relating to hybridisation and other subjects. He has gradually extended his operations, and his art has yet extended. Scarcely less complete are Mr. Armistead's well known works on the fish at Gulliford, Mr. Capel at Crays Fing, the National Fish Culture Association at Delafare Park, and the Miltland Fish Culture Establishment at Malvern Wells. A peculiarity of the last mentioned establishment is that it was conducted till his death with great spirit and success by Mr. William Burgess—is, that, for a small charge, parcels of ova are received from any quarter, and there hatched out, the owners receiving their parcels back in the condition of fry.

The first and most indispensable requisite of successful hatching is an unflinching supply of pure water. For hatching purpose spring water is considered best, because of its purity, equal temperature and small liability to freeze. Speaking here of hatcheries on a small scale for limited objects, whether for the stocking of private lakes and streams or family fish ponds, the hatchery should be located in a place accessible to a ready and steady water supply. The hatchery itself may be very simple and inexpensive, and in extent capable of turning out hundreds of thousands, hatching only a few hundreds, to a multiplication of boxes,

Various forms of hatching boxes have been devised and brought into use, some constructed of wood, some of slate, iron, fireclay, &c. In large permanent establishments it is, no doubt, desirable to have the incubating and other apparatus as durable as possible; but in small hatcheries, for limited service, there is nothing better or more economical than wood, well charred on the interior sides to prevent fungus, the most deadly foe of the fish culturist. The boxes are of rectangular shape—elongated to suit the situation. When gravel is used as a bed for the eggs it must be previously thoroughly well scalded with hot water. In practice, however, the use of gravel is now much discarded in favour of glass grilles, which were first introduced by M. Coste, the eminent French pisciculturist. These grilles or gratings are composed of thin glass tubes, extending across the hatching box, and placed side by side, with sufficient closeness as to support the eggs in rows in the hollows between the tubes. The great advantage of this system is its cleanliness, and its facility for segregation of the eggs, so that over and under and all about every individual one there flows an equal, properly aerated and incessant current of water, so essential to successful incubation.

Various other methods of hatching have been tried, some of them very ingenious, but none have in practice been found better than the system just described. The principle of some has been an upward, and of some a downward, current. Mr. Ainsworth, an ingenious American, is the author of a sort of hatching engine in which breeding fish may freely enter, but cannot leave till they have fulfilled their functions. This invention is somewhat on the lines of the mechanical poultry layer, with which our American friends amused us some while ago. All such inventions and mechanical aids, while very ingenious and probably not impossible contrivances, have been doomed to failure, however, before the simplicity, naturalness and economy of the prevailing method.

We have not space to enter at length into all the subsequent processes of fish rearing—the incubation of the embryo, lasting in the case of trout about fifty days, and about ninety days in the case of salmon; on the sac or yolk of the egg whence it issued, and to which it remains attached; the fry period; the yearling period; the two-year-old period; and, finally, the adult age—deeply interesting as the life history of fish is. Nor would these details probably be of much interest to the non-professional reader, who is not yet to some extent educated in the art and bitten by its fascinations. To such as wish to study the scientific principles of artificial fish culture, however, there are many excellent works available, by British, American, French, German, and other authors.

The amateur or domestic fish culturist requires for his guidance only a few simple rules, reduced to careful practice, and an ordinary supply of patience. His apparatus may be of very simple description. From one of the larger fish farms ova have, it is stated, been supplied to purchasers of every class, from Royalty to the schoolboy, and in all quantities, from many hundreds of thousands to the contents of a single box, thus illustrating the simplicity of this art as well as its growing interest among all classes. It is limited neither to the professional culturist, who pursues his vocation on a very large scale and on commercial lines, nor to the wealthy landowner, who desires in this way to stock or renovate his waters and sets up a private hatchery for this purpose. It may be taken up by the budding naturalist schoolboy, who, it may be, has secretly robbed the nest of a member of the finny tribe—as he has often done of the feathered tribe—and has transferred his spoil to a box or tub with a tiny rill flowing through it, and watches with great interest and delight the development of his delicate but clever little friends; or it may become an appanage of every household where there is a stream of pure water, and turned to profit with as much ease and certainty as the rearing of poultry and bees for family use; and certain it is that the fish fancier will derive no less interest and amusement from his art than the poultry or bee-fancier does.

It has already been said the apparatus required for domestic fish rearing may be very simple and inexpensive. The present writer has been concerned for some years with the rearing of *Salmo Levenensis* (the celebrated trout of Loch Leven) and *Salmo Fontinalis* (American brook trout) for the purpose of stocking certain virgin waters, and improving existing trout in certain others. Ova for this purpose have been procured from the famous Howietoun fishery. Although the situation involves a journey of about forty-eight hours, with much jolting over railway and road, the ova being carefully packed according to the latest knowledge, have invariably arrived in perfect condition, with hardly a dead specimen in the lot of some 30,000 or thereabouts. Here the subsequent hatching and alevin life have been effected in the domestic laundry (which is, of course, not in ordinary use at that time), in three or four hatching boxes surmounting each other, and supplied by the water of the laundry pipe, which, flowing into the nearest end of the uppermost box, overflows at the other end into the second uppermost box, and so on till it issues at the farther end of the lowermost box.

Reference has been made to the capability of domesticating and taming trout and other fish now in a feral condition. At Howietoun fishery many of the trout are said to be able to recognise their attendants and to answer to call or signal. Into the vexed question how many senses fishes possess—whether they can hear and smell as well as feel, taste and see—we shall not here enter; but there is at least no room to doubt that by touch, taste and sight—of which latter sense they have a most acute endowment—fish can be trained to a high degree of domestication and familiarity with man. In the cases in the writer's experience referred to in the preceding paragraph, the young fish became wonderfully tame. As a precaution against the cannibalistic propensities of the larger native trout in the lake for which they were being reared, they were, at large. While in these ponds they not only followed their attendant all around, but came without fear and took food from his hand.

As to the conveyance of ova and young fish from one place to another, so well is this now understood that ova can be sent in specially constructed boxes to any part of this country, with absolute safety under ordinary and obvious precautions; while with the aid of the ice and refrigerators, it can also be sent with comparatively little risk to any part of the world. For example, the Howietoun fishery successfully exported last year, to the order of the New Zealand Government, over half a million of salmon ova obtained from the Tay, Forth and Tweed rivers, and in 1887 sent a similar quantity to the same quarter, which also arrived in good condition. Then, as regard the transportation of live fish, this, by means of scientifically constructed tanks, aided by the use of ice, can be done with a minimum of risk to all parts of this country in this country, or of sending fish of any age abroad in large numbers, have been found insuperable. A consignment of live tench and perch in tanks was made to Japan in February, 1889, by the late Mr. Burgess,

of the Midland Counties Fish Culture Establishment, but we have not heard its fate. In Japan the subject of fish culture appears to be receiving considerable attention, both from the Government and private wheat, flour and the chrysalides of silk worms.

Additional interest in the means of transportation of fish has recently been aroused by an "invention" of an American gentleman, who thinks this can be done successfully by hermetically sealing them in vessels partly filled with water. As it is stated that tests of the invention have been made by one of the professors on the United States Fish Commission the matter would appear to have received some serious consideration, but it does not wear a likely look. It would, perhaps, be too much to say that we shall never attain to the means of transferring fish of any age or size from localities widely apart—probably by some adaptation of the compression of air—and no invention could be more valuable; but it must, we fear, be admitted that as yet we have had no approach to this.

With regard to the all-important matter of feeding of fish kept in confinement for domestic purposes, or in nurseries, till they are fit to defend themselves from all attacks, whether of their natural enemies or foes of their own species, it may be best to refer the reader to the various manuals on the subject. But here it may be briefly stated that after the young fish have passed the alevin stage, till which period they require no subsistence but that of the sac or ova from which they have sprung, they are in the nest or fry stage generally fed several times a day with finely divided yolk of egg; afterwards with liver and milk flesh or clams, or with any other available food of similar character. At Howieton, where several millions of ova are annually hatched, and a proportionate number of fish of all ages have to be fed, the fish of a considerable number of horses, and a very large quantity of shell fish are annually consumed—the latter being given to the large-stand fish. Similar provision for feeding is made at every fish farm. The writer, having access neither to horse-flesh nor shell-fish, has found venison a very good substitute when the surface of the water, and much may be done to augment and improve these natural supplies by the selection of sites for ponds supplied by water rich in natural food for fish, and by a judicious stocking of the ponds with aquatic plants suitable for fish rearing.

The preceding remarks have related chiefly to "Private Fish Culture" and to its bearings on domestic economy, and the stocking of private fisheries for purposes of sport. This is what may be called the recreative and minor side of the case. The political economist would regard it as the mere elements or outer rim of a great question laden with potential benefits to the great consuming public of the most important kind. Let us now try to set forth what is understood by "Public Fish Culture," and what its position is both at home and abroad.

What is here signified by "Public Fish Culture" is the cultivation of food fishes carried on for the public needs at the public expense. Its legitimate sphere is the adequate stocking of public waters with the valuable fish, and the maintenance of the same—in which fisheries the public interest is universal, and no individual or private rights exist. The scope of aquaculture is, it should be said, not restricted to food fishes, but, in the words of one of its ablest exponents, "is now understood to signify the exploitation of all products of sea, lake and river, including the capture of whales, turtles, pearls, corals and sponges." The present intention is, however, to limit the application of these remarks to such products of the ocean, lakes, and rivers as are really valuable for human food. Doubtless, the whale is a most precious animal, whose preservation is most desirable. Whale oil is a very valuable commodity, and whalebone is nearly invaluable, selling, as it does at the present time, at over £2,000 per ton. Every one knows how precious the epicure is the turtle; how beautiful and valuable are pearls and corals; and how useful are sponges. But these, not being regarded as necessary wants of the public, may here be left out of our account. We must, however, here allude for a moment to one of the latest feats of aquaculture in connection with sponges, which are now being successfully raised by means of cuttings, just as land plants are. A new industry, to which the Austro-Hungarian Government has extended its protection, has been created on the coast of Dalmatia by this method, first discovered by Professor Oscar Schmidt, of the University of Graz, who made to transplant live adult sponges from the bottom of one sea to that of another, but, so far, the success of this experiment has not been encouraging.

Notwithstanding the interest in commercial fisheries which was aroused by the International Fisheries Exhibitions held in Berlin in 1880, in Edinburgh in 1882, and in London in 1883, it is still improbable that more than a small minority of the British public at least ever associated the ocean with the land as a field fitted and prepared for a great cultivation of food. And yet it really is so. There are in the great sea are on the land immense tracts of unpopulated country, now mere wastes, but capable by cultivation of abounding returns of fruits of the earth. When the creative fiat went forth man was awarded dominion over the sea and all therein, just as much as over the land; but just as he must win the gains of the soil by the sweat of his brow, so must he reclaim the harvest of the sea by unceasing and intelligent methods of labour.

Further, all or nearly all the conditions and methods of land cultivation have their analogues in the economic cultivation of the waters. The sounds and shoals and banks in the ocean are the great fish farms; the complements of our scientific implements of land husbandry. Many foreign substances are in the present day applied to the soil for maintaining or renovating its fertility, and we do, or should do, something like this for our fish farms by the cultivation of *algæ* and other forms of aquatic vegetation upon which breed and live those minute organisms which so largely contribute to the support of fish life. When with regard to the land reparative measures are neglected, its fruitful elements soon become exhausted. We can breed and live those minute organisms which so largely contribute to the support of fish life. When with regard to the land reparative measures are neglected, its fruitful elements soon become exhausted. We can easily do the same to our ocean food possessions. We have too often, alas, done so already by a long course of improvident and wasteful reaping without adequate nursing or building up. By judicious interbreeding and preservation of the fittest we have enormously improved our agricultural stock; and by a like process, though not yet to an equal extent, we have done the same with some kinds of aquacultural stock, and have demonstrated that similar treatment may be extended to all. Scientific and provident farming ashore is

careful never to miscrop or overcrop, and is alive to the value of the practice of fallowing. Scientific and provident farming afloat will in time equally recognize the imperative need of these rules of good husbandry.

In several important respects the aquaculturist has advantages over the agriculturist. He has a free hand to sow and to reap where he wills. He is under no lord of the soil, and knows nothing of "Coercion" Acts or legislative vexations of any kind. He is hampered by no private rights. His husbandry exerts less personal attention, and his crops do not suffer from atmospheric influences, and, when obtained, they are quickly realised. And, above all, he sits, or rather sails, rent and taxation free.

But what use have we made of these bountiful oceanic provisions? Have we taken advantage of them for bread and beef adequate for our teeming and ever-increasing millions, we have hitherto strangely overlooked or neglected the possibility of relieving the demands of subsistence by a better cultivation of our marine food farms. We have been strangely passive under the ever-growing difficulty and cost of procuring sufficient supplies of fish, while it has been known that by the adoption of rational and adequate methods of fish culture and of fish capture we may indefinitely increase and consequently cheapen our national fish supply.

It may be asked, What are these rational and adequate methods? The reply is, that artificially aided fish culture is capable of increasing fish supply to a practically unlimited extent. There are four known methods of fish culture, viz. —1. By pond culture; 2. By transplantation of sexually mature fish; 3. By has already been shown that by the last-mentioned means complete control of the reproductive functions of fresh water and anadromous fish, such as the salmon, has been acquired. In the present day these kinds of fish can and are being multiplied to any required extent on many inland fish farms with all the certainty of a science. The remainder of our space will be devoted to a short review of the other methods of pisciculture above stated.

Necessarily, the cultivation and increase by artificial means of migratory and pelagic varieties of fish is attended with greater difficulty than is the case with non-migratory fish. Our knowledge of the life-history of many ocean-going fishes, and even of the salmon, when it repairs to the sea, is still far from complete. Many of these wandering fish do fortunately, however, once every year approach the land or run into sounds and shallows, for the purpose of breeding, and opportunity is thereby given to aid or protect the generation of these species. Some other kinds, which literally cast their seed upon the waters, are much less amenable to piscicultural control, but with regard to these nature has herself provided a safeguard against extermination. Their fecundity is so inconceivable that were it not for wholesale destructive acts of man would fail to make any practical inroad on their numbers, but the sea itself would cease to give room for them. It has been calculated that of some kinds of fish not more than one in 500,000 reaches adult life, and that for every full-grown oyster upwards of 1,000,000 die.

Thus it is that though the fertility of many kinds of oceanic fish surpasses comprehension, they are, nevertheless, so reduced in numbers by the operation of various natural causes—the predatory instincts of other species—and the wasteful arts of capture practised by man, that great difficulty is often experienced in obtaining an adequate fish supply for human needs. Some species would seem, indeed, to have been really exterminated, and others have narrowly escaped the same fate. The salmon itself, though now better protected, not so long ago seemed in danger of extermination, and has actually been completely and other mollusca. Such, also, has been the fate of the oyster, lobster,

In considering the best remedial measures for decayed fisheries, and the economic extension of the whole fishing industries, a controversy has arisen among experts as to the necessity or value of protective legislation. In Great Britain the positive side of this question is led by Dr. Francis Day, who is a strenuous advocate of close times and legal control generally; while the negative view is as firmly held by Professor Huxley, who sees no good in protective Acts of Parliament, or, as he puts it, "keeping the wolves off during the lambing season will afford not much protection if you withdraw shepherd and dogs during the rest of the year." In the United States of America, which at the present time leads the van of fishery matters, the Chief Commissioner of Fisheries, backed by public opinion, is averse to restrictive laws, and of these authorities are wholly opposed to protection of non-migratory fish during the fish-breeding period, no such enactments there exist. We take this to refer to sea fisheries, however, and must assume that none of the local habits of which would expose them to the danger of extinction. Fishes of anadromous and pelagic habits, however, could not be caught at all if not when they enter our rivers or approach our coasts to spawn. Nor can it matter at what season a fish is killed if it is killed, at all before it spawns. Here, however, pisciculture steps in and says all such considerations are superseded by its intelligent practice.

Our own nation cannot yet be quoted for the best illustrations of the power and value of public fish culture. On the contrary, we are, with respect to national recognition of this great question, almost at the foot of the scale, though by means of private enterprise, as has been shown, considerable progress has been made in one branch of the subject. We have been left behind by more than one nationality, but as the United States of America have outdistanced all others, a short account of what has there been done may be the best means of describing what may and should be done for national encouragement of pisciculture.

In America, as elsewhere, long neglect and improvident methods of fishing had seriously diminished the yield and value of many of the public fisheries, and the outlook was sufficiently gloomy when, in 1871, Congress appointed a Commission of Fish and Fisheries, whose duties were thus defined: "To prosecute investigations with the view of ascertaining whether any and what diminution in the number of food fishes of the coast and the lakes of the United States has taken place; and, if so, to what causes the same is due; and, also, whether any and what protection, prohibitory or precautionary, measures should be adopted in the premises." The late Professor Spencer Baird, secretary of the Smithsonian Institution, a biologist and scientist of the first rank, and the author of many learned works, was appointed Chief Commissioner. To Professor Spencer Baird, it may here be mentioned, the grand prize of the International Fisheries Exhibition at Berlin, in 1880, was awarded, as "the first fish culturist in the world."

Previous to this, it should be stated, several American States had made appropriations of money for the purpose of investigation and experiment on the lines of the Congressional Commission, and most of the States have followed, and vied with each other in liberal co-operation in the general work of the Commission.

The scope of the Commission, it will be seen, included a systematic investigation of the waters of the United States; the life history of their food fishes, and of the foes and friends of the same; the influence of currents, temperatures, and other physical phenomena on the welfare of fish. It included also a review of various methods and seasons of fishing then in use, and how far these had tended to the depletion of certain fisheries. That there had been a very serious depletion of some American fisheries, and that measures for their repletion were urgently required, was speedily ascertained by the Commission. It accordingly at once gave consideration to measures for improving these fisheries—the multiplication everywhere of existing valuable food fishes and the introduction and acclimatisation of others.

In furtherance of these objects, and liberally supported by his Government, the Chief Commissioner and his staff lost no time. Their labours have been more largely conducted along the North Atlantic coast than elsewhere, for there the most important sea fisheries are located; but stations have also been planted on the Pacific coast, and the great inland lakes and rivers. At the present time about twenty of these stations, each with its separate skilled staff, laboratory, hatching apparatus, &c., are in full operation in the United States; and some idea of the magnitude and usefulness of their work may be gathered from such facts as that during the first eleven years of the operations of the United States Fisheries Commission no fewer than 341,096,071 fish were distributed from these stations among public waters, and that in the year 1885 alone, among many other distributions, 92,000,000 eggs of the whitefish were hatched and distributed. Operations on the same gigantic scale have been carried on continuously by the Commission, and have extended to over thirty species of fish and molluscs, including brook, lake and squassa trout; Atlantic, California, and land-locked salmon; striped bass and sea bass; whitefish, shad, sturgeon, smelt, herring, coal, haddock, alewife, mackerel, pike, perch, grayling, carp, tench, goldfish, &c.; oyster, lobster, clam, &c.

As illustrating the thoroughness of the work of the American Fish Commission, a few words may be quoted from the pen of Professor Brown Goode, one of the members of the staff, and himself a leading pisciculturist:—

“For twelve years the Commissioner, with a party of specialists, has devoted the summer season to work on the shore at various stations along the coast from North Carolina to Nova Scotia. A suitable place having been selected, a temporary laboratory is fitted up, with the necessary appliances for collection and study. In this are placed from ten to twenty tables, each occupied by an investigator, either an officer of the Commission or a volunteer. The regular routine of operations at a summer station includes all the forms of activity known to naturalists, collecting along the shore, seining upon the beaches, setting traps for animals not otherwise to be obtained, and scraping with dredges and trawl the bottom of the sea, &c.”

The American Commission has also prepared careful life histories of the principal fishes; and embryology in connection with fish culture has been a special object of study. The influence of the temperature of the water and of storms upon the local movements of fish have been investigated and recorded. Fish-ways to facilitate the running of fish over natural obstacles have been constructed. Original and valuable improvements in the apparatus of fish capture and fish breeding have been brought into use, such as gill nets floated with covered glass balls, for the taking of coal, thus obviating the use of hooks and the necessity of bait.

The construction of incubating apparatus, with special adaptation to the physical properties of the various kinds of fish spawn, has had special attention. The eggs of fish are classified by ichthyologists into four varieties:—(1) Eggs non-adhesive, and too heavy to float, such as those of salmon and trout; (2) eggs also heavy, but adhesive, such as those of the herring, &c.; (3) semi-buoyant eggs, like those of the shad and whitefish; and (4) free floating eggs, like those of the cod and mackerel. The first of these kinds are hatched in boxes and on trays or glass grilles, as has already been described. The first of these kinds are hatched in boxes, to which they adhere. The other classes require somewhat different treatment, owing to the necessity for carrying on the process of incubation while the eggs are in suspension; but this has been met by ingenious contrivances for the impounding and safety of free floating ova, while still keeping up that degree of agitation or circulation of the water which is necessary for successful hatching. For the hatching of the eggs of the lobster an ingenious automatic jar, the invention of Colonel Macdonald, who is better known in connection with his improved fish-ladders, is now in successful use.

Aquatic plants, upon which flourish water insects and mollusca, which in turn are fed upon by the fish, have been freely introduced into American fish nurseries. Three or four steamers and several sailing craft, specially fitted up for fish culture work, have been placed at the disposal of the Commission. For more rapid and safe conveyance of fish and ova from the various distributing stations, specially constructed railway cars, fitted with refrigerators, &c., are run at reduced freights by the various railway companies. The best information has been collected, and instruction given, as to the curing and packing of fish for market.

Space forbids the giving of further details of the active work of the United States Fish Commission. The results have been eminently successful and highly gratifying to the Government, which originated and has so liberally supported the work. The field of operations has by no means yet been covered, but the benefits already derived have been most marked. Rivers, such as the Sacramento, which, owing to immediate and wasteful fishing—the direct result, probably, of the invention of fish canning—had been greatly depleted, have been marvellously recouped, so that even the canneries cannot now use up the available supply. The supply of salmon from the Sacramento has risen from 3,000,000 to 15,000,000 lbs. annually. The yield of fish from the Potomac has been trebled, and the same account is given of the Connecticut and other rivers, and of the lakes of the interior. From the Pacific coast alone no less than 81,302,400 lbs. of salmon were canned last year, the prime value of which amounted to £1,812,800. In short, it has been put beyond all doubt that by such endeavours as have been so well carried out by the United States Commission on Fish and Fisheries it is easy to sustain and to extend to almost any degree the supply of this leading article of food. Full information respecting the work of the American Commission, and the general progress of fish culture in that country, has been extensively diffused by means of the bulky annual report of the Commission, and many monographs and special reports by members of the staff and other experts. From time to time the work of the American fish culturists has received the highest commendation from authorities on the subject all over the world.

The United States of America have surpassed all competitors in the liberality, intelligence and success of their fish cultural operations; but other nations have given the matter considerable attention, and many are now awakening to its great importance. Before recrossing the Atlantic a glance may be made at the work done, and still being carried on by Canada. Here there are twelve large hatcheries or stations, which in 1884, nearly 400,000,000 of fry, and this work has since been continued at the rate of over 100,000,000 eggs especially in fresh waters. A notable example is the Fraser River, which, having been depleted of salmon to an alarming extent through reckless over-fishing, stimulated by the demands of the canneries, has been again rapidly restocked through cultural operations. She has likewise bestowed much attention on the arrest of destructive lobster and oyster fishing, and to the restoration and future protection of these valuable fisheries. At Dildo, Trinity Bay, Newfoundland, 5,000,000 young lobsters, and future protection of these valuable livers, were recently turned into a newly-erected fish farm. This farm has been prepared for the hatching and rearing of young cod, 200,000,000 millions of which it is capable of holding at a time; but having been completed too late last season for this purpose, is temporarily used to rear these five millions of young lobsters.

Among European nations greater attention has been given to fishery questions by Germany, France, Norway and Holland, than by others. There is a German Fishery Union, devoting itself chiefly to fish propagation, and a German Fish Commission, supported by Government, whose functions are chiefly investigatory of sea fisheries. In Germany the domestication of carp, goldfish, &c., has been practised for many centuries, and is turned to commercial profit as well as household use. Many of the greater landowners—among whom Prince Bismarck may be instanced—derive a considerable profit from this source. Very successful revivals of carp culture in ponds and small waters have been made in the United States, and elsewhere, from introductions of German stock. The chief seat of German pisciculture is at Hunningen, in Alsace, now by the fortunes of war a German possession, but which was originally established by the French Government in 1850 under Professor Coste. Here public fish culture was first systematically practised, and here are raised supplies for replenishment of the rivers of the Fatherland.

The sea fisheries of France are of great extent. At Boulogne alone it is calculated that the annual yield of fish is equal to the flesh of 40,000 bullocks; but for political and perhaps other reasons French fish culture has for some time been in rather a languishing condition. Formerly France took the lead; but she has been deprived of her leading establishment at Hunningen, and though she has founded another at Epinal in the Vosges Mountains which promises well, further time is needed for its development. In France great attention is now being given by means of the allotment system to ostraciculture, and the results so far are very encouraging. French fishermen are among the most intelligent of their class. A slight but significant instance of this is the attachment of small electric lamps to their gill-nets for the attraction of fish. Here is an idea which is probably destined to considerable extension, since it is well known that fish are readily attracted and deluded by artificial lights.

In Norway, Sweden, Holland, Denmark, Austria, Italy, Switzerland, Poland and Russia attention has for long been more or less bestowed on pisciculture, and the subject is at the present time more or less active, mainly in proportion to the extent and situation of available fishing grounds. In the last-named country M. Wransky, the discoverer of the dry method of fecundation of fish eggs, superintends an important fish cultural establishment, under Government auspices, at Nikolsk in Novgorod, which is capable of hatching about 2,000,000 ova every season.

In China and Japan primitive methods of fish culture have been practised for time out of memory; but now, in the latter country at least, the annual value of whose fishings is about £7,000,000, or nearly three times that of Scotland, all the modern methods of fish culture have been imported, and are being worked on a commercial scale with the encouragement and aid of the Government.

Finally, we come to the condition of the fisheries and of the fish culture in our own country. The scarcity and dearth of fish are with us matter of frequent complaint, and here, if anywhere, it might be thought every effort would be made, through public as well as private channels, to maintain and extend the productiveness of our public fisheries. It has been shown by convincing proofs that fish of every useful species can and are being by artificial help propagated and multiplied elsewhere for public needs. It is equally true that though now and then there may be a brief glut of fish in this or that local market, due to an accidental, or it may be, a culpable cause, the masses in this country are still most inadequately provided with this form of food. Here, surely, is a clear and imperative national duty, yet our Government has hitherto been almost wholly indifferent to it. By prohibitory legislation we have laboured to keep the offshore and inshore fishermen in deadly opposition to each other, with diminishing takes and dwindling returns as the result. But of scientific investigation into the decay or stagnation of our marine fisheries, or of enlightened measures for their recuperation and extension, we have as yet done nothing of practical value. We do not possess a single public hatchery or nursery for the propagation and distribution of fish. We have, within the past few years, established two or three small marine laboratories, poorly equipped, and scarcely seconded at all by skilled observations at sea, as they ought to be. Some feeble attempts at scientific investigation of certain fishery problems have been recently made by the Scotch Fishery Board, but little practical good has come, or could come, from an enterprise so very poorly furnished.

It is a saddening reflection that we can afford every year, with never a doubt or grudge, many millions of money for purposes of war, and so very little to render the first necessities of life more abundant and accessible. We have at last a Department of Agriculture, languishing and ineffective though it may be, but in the hardly less important domain of aquaculture, we may be said to be nationally doing nothing. Could we devote the price of a single warship to the development of our fisheries upon lines lying reasonably within the sphere of government, how great would be the stimulus to these national interests and revival of legislation directed to full satisfaction of the elementary wants of our race, and when, as one of the foremost results of this, the question of a full and cheap supply of wholesome fish for food will receive wise and adequate treatment from the national Executive.

