SESS. II.—1897.
NEW ZEALAND.

PROTECTION OF MULLET

(REPORT BY SIR JAMES HECTOR, K.C.M.G., AND EVIDENCE TAKEN BY HIM).

Presented to both Houses of the General Assembly by Command of His Excellency.

Sir JAMES HECTOR, K.C.M.G., to SECRETARY, Marine Department.

Memorandum re *Close Season for Mullet.*

HAVING, by observation and correspondence, continued to study the mullet question, at your request, throughout the entire year, I have come to the conclusion (from the evidence I submit with this) that no close season for mullet-fishing is required, and that all restrictions should be withdrawn. At the same time, I must admit there is a great want of accurate information still required on the subject; but it is most difficult to collect, and, as the variation in the time of spawning in different years, which is controlled by the weather, is undoubted, and also that the migrations of the mullet shoals are dependent on the supply of suitable food, which also is contingent on the weather, only one year's study of the subject will not have much avail.

The chief reasons that can be urged for protective legislation in regard to the mullet-fishing are as follows: (1) To prevent the fish, while reproducing, being disturbed by fishing operations; (2) to protect the fry during development; (3) to prevent the market being supplied with "spent" fish that are unfit for food.

Observers have hitherto been misled by a supposed analogy to the salmon in the spawning habits of the mullet. The evidence I have collected shows this is quite incorrect, and that the spawning takes place in the open sea at two seasons in the year—summer and winter; and that this difference probably represents two distinct species of mullet that frequent the coast of New Zealand. Captain Hutton, twenty-five years ago, expressed the view that the mullet in the Waikato went down to the sea in November to spawn, and returned in March ("Fishes of New Zealand," page 36). The evidence I have collected quite supports this statement, at Whangarei, Bay of Islands, Hokianga, Kaipara, and Auckland, at which places the only roe-fish obtained in January were from the outside deep water, and all fish caught inside were undeveloped and in prime condition. That large shoals of fish rush up the tidal inlets in the summer months is undoubted, but these also are mostly three-year-old fish, with undeveloped sexual organs.

I have obtained no evidence of a shoal of ripe female fish having made a rush in any tidal water; indeed, within the harbours the male and female fish and those of different ages appear to keep in separate schools, but in the outside open sea they appear to follow the same habit only to some extent. The shoals of mullet make their rushes up the creeks in pursuit of the small crustaceans and animalculæ, which swarm in tidal waters under certain conditions of season and weather.

As the ripe ova of the mullet was found by experiment to sink in the dense sea-water, and thus belong to the "demersal" class of ova, the spawning-grounds are probably in shallow bays, where there is a moderate depth of water.

The only measures to be recommended for the conservation of mullet and other fishes that spawn in the sea is artificial propagation, in the same manner as is largely followed in Europe and America; but, for the present, in New Zealand, there is no permanent decrease in the number of fish, nor have the very limited fisheries which are in operation any sensible effect on the supply. I append a very important paper on this subject by Mr. G. M. Thomson, F.L.S., Dunedin, and several important letters that have appeared in the *New Zealand Herald.*

Some arrangement might be made for effectually inspecting the fish offered for sale in Auckland and other large towns, so as to prevent the public being supplied with fish that is out of condition and unfit for food. As far as the canneries are concerned any such inspection would not be required, as it is clearly against their interests to purchase and preserve any fish that are not in prime condition. I attach the evidence I collected on the subject, and also an abstract of the previous file of correspondence.

JAMES HECTOR.

Colonial Museum, Wellington, New Zealand, 12th November, 1896.

SIR,— Colonial Museum of New Zealand, Wellington, 5th November, 1895.

I have the honour to report that, in compliance with the request of the Hon. the Minister of Marine, conveyed in your memorandum of the 17th ultimo, I left for Kaipara on the 20th for the purpose of inquiring into and reporting on the most suitable time and period for a close season for the kanae, or mullet.

I visited nearly all the various fishing and canning stations in the Kaipara, but, finding that it was too early in the season to make personal observations as to the breeding habits of the fish, I had to accept hearsay evidence, which, on many important points, is very contradictory. I therefore returned to Wellington on the 2nd instant without visiting the other fishing-stations mentioned in your instructions, as no satisfactory information could be obtained until the end of December. I learnt sufficient, however, to enable me to make a recommendation by telegraph on the 30th of October to the Minister, which was joined in by Captain Christy Smith, Harbourmaster, as follows:—

"Helensville, 30th October, 1895.

"Re *Close Season for Mullet.*

"HAVE examined seventeen persons—fishermen, settlers, Maoris, and canners, including Messrs. Masefield, senior and junior—and the unanimous opinion is that from the 1st December to the 1st March is a sufficient close period, and the majority are in favour of restricting to the Otamatea and Oruawharo as formerly. We strongly recommend that the Order in Council of the 9th September be withdrawn, and that the previous order be reverted to.

"JAMES HECTOR.
"J. CHRISTY SMITH."

I beg to enclose notes of the evidence taken, and on which I base the following provisional conclusions: The evidence that I have obtained clearly indicates that there are at least two different and distinct varieties of mullet, but whether these are distinct species, or seasonal, sexual, or only younger and older individuals has not yet been made clear. First, we have a mullet that feeds in the ocean, and congregates along the coast in enormous schools. These used to be captured in large quantities by the Maoris with seine-nets, which were dragged on the sandy beach. They are late in their sexual development, female fish in roe being caught up to April and May, corresponding in this respect with the grey mullet of the Australian coast. These fish sometimes enter Kaipara Harbour in large schools, following the clean salt-water of the flood-tide up the deepest channels, and returning again with the ebb; but in some seasons, especially in summer, they rush up the shallower channels and branches of the harbour, and disappear again suddenly. This variety of mullet is known to the fishermen and settlers as the "clean-gut," "clean-run," or "sea-mullet." They are always of large size, and whenever caught, at whatever season of the year, they are in prime condition.

After a school of these fish has entered the harbour they are frequently caught on the banks and shallows along with the other variety, but the fishermen have never any difficulty in distinguishing them. Unfortunately, out of several large hauls they did not find one "clean-run" fish for my inspection. They all said it was too early, as the season is a month later than usual. It is generally supposed that the "clean-run" mullet breeds on the sea-coast outside the harbour.

The other variety is known to the fishermen as the "settler" or "muddy fish." When opened they are not clean and bright, with the stomachs and intestines apparently empty, as in the case of sea-fish, but are full of slimy mud, the strong muscular pharyngeal stomach being distended with a mass of tough brown clay. This, when examined with the microscope, proved to consist of 90 per cent. of minute grains of volcanic sand similar to the mud along the banks of the rivers, and mixed with many microscopic organisms, such as diatom valves and crustacean fragments, the latter (chiefly Copepods) being very abundant, and evidently forming the favourite food of the fish. It is no doubt the relative abundance of the minute crustacea in the sea and brackish rivers at different seasons that regulates the movements of the fish, and not the direct influence of changes of temperature, which only act through affecting the food-supply. The muddy fish are caught inside the harbour only. In summer, on the banks especially off Komiti Point, they run up and down into the furthest extension of the tidal rivers and creeks, as is generally supposed, for the purpose of depositing the spawn. This opinion is chiefly based on the fact that the muddy fish are in full roe about the beginning of the year; but, so far as I learnt, no one has ever seen them actually spawning, nor has spawn been found imbedded in the mud. Another reason is that great swarms of young fish are seen in the tidal creeks in autumn and winter. There is, however, some room for doubt on this subject. It is difficult to conceive how the spawn can be deposited in the soft slimy mud which forms the banks of every stream in the Kaipara during the short time of flood-tide, as the process must, as in other fish, require a prolonged effort against a firm resisting surface to effect the extrusion of the ova. Nor is it possible to conjecture how the fertilisation of the ova by the male fish can be effected under such circumstances.

Then, again, these creeks are, for miles below where they are reached by the flood-tide, converted for many hours twice a day into mere muddy ditches, and any ova which had been deposited on the muddy bed would necessarily be exposed to desiccation by the air and hot sun. On the whole it seems not unlikely that the "muddy," or "harbour fish," if they really do spawn inside the estuary, spawn on those banks and shoals inside the harbour which have a surface of fine shelly sand and are never dry at low water, and that the rushing up the rivers and also the abundance on the top of the flood of young fish is merely due to the fish following an abundant food-supply. The permanent falling-off in the number of mullet in Kaipara has not been proved. It is true that there are not so many seen in the river as in former years, but, on the whole, on the banks they are still as plentiful as ever. Last season (1894) was an exceptionally good one for the canneries; but the influence of the canneries has been greatly exaggerated, as since the commencement of the factories, or about fifteen years, the total number of fish taken, allowing 10 per cent. for loss and

waste, has not exceeded two million fish, a number that would be produced from the spawn of four or five females. It is not the number of fish taken, but the improper disturbance of the fish when breeding, that has to be guarded against. In former years, when the waters of the Kaipara were navigated only by the silent Maori canoe, the consumption of fish was probably as great as now, but the disturbing influences were less. Nearly every fisherman seemed to consider that a great change has been caused in the estuaries of the Kaipara and Wairoa Rivers at the south and north ends of the harbour by the paddle-steamer "Osprey," and to a less extent by the five or six screw-steamers that ply in the harbour.

If the fish spawn on the banks, then spawning-grounds should be carefully defined and closed against all fishing, unless, as is indicated by some of the evidence, that whereas early in the season there is only about one male to every fifteen or twenty females in a school on the banks, later on (in February and March) it is quite exceptional to find a single female in a haul of fish. The females appear to slink singly down the channels into deep water and out to the ocean immediately before the act of spawning, as spent fish seem to be very rarely met with in the Kaipara. The other causes suggested in the evidence for the scarcity of summer rushes of leaping fish up the creeks no doubt require verification, as they are given only as matters of opinion. I examined a large number of fish, especially at Batley, where, on the 30th October, I saw the largest individual specimen. It was a female, 18 in. in total length, and weighed 2 lb. 7 oz. The ovaries were quite undeveloped, and, so far as the formation of roe or ova was concerned, they were of a reddish-brown colour, and measured 5 in. in length. The fish was taken in a haul of twenty dozen on that morning outside Komiti. I watched a great many of the fish being opened and saw only one male fish. The average weight of these fish was a little under 2 lb.

With regard to the probable age of the fish, I was informed by Mr. Ewing that in May, 1893, a bucket with six very small mullet was emptied into the freshwater dam, from which there is no outlet except by the boiler supply-pipe. In May last (1895) it was necessary to drain off the water, and these six fish were captured. They were fine bright fish, 18 in. long, and about 2½ lb. weight, and were all males with large milts.

At Helensville I examined the three smallest mullets I saw. They were caught off Shelly Beach. Two of them were 10 in. in length and weighed 7 oz., and contained ovaries, smaller, but in a similar undeveloped condition to the large fish I examined from off Komiti. The third fish was 8 in. long, weighed 4 oz., and showed no trace of sexual development. The fishermen considered it to be a one-year-old fish.

In conclusion, I have to report that I found that no one gave any reason why the close season should be extended to four months, so as to include the month of March. Even if any change is made I think it would be only fair that a longer notice should be given, as the matter affects the livelihood of a large number of persons who cannot readily turn to any other means of support on short notice.

The Collector of Customs at Auckland, and also the Harbourmaster at Kaipara, who have had experience in the practical control of such matters, are clearly of opinion that the only way to stop the over-fishing of mullet and the disturbance of the fish at breeding times is to close the canning-factories for that period, and, if the breeding-grounds can be discovered, to prohibit all fishing there for some years at least. In these views I concur; but there are many points in this most interesting investigation which cannot be solved until the proper season, which will be in January. In the meantime much can be done by the collection from week to week of a few fish, both male and female if possible, and sending them, packed in spirits, to me for examination.

I have, &c.,

The Secretary, Marine Department. JAMES HECTOR.

EVIDENCE.

Henry Bailey, Kaipara: Has fished in the Kaipara for twenty years. Mullet are not so scarce as they were many years ago, but less plentiful again of late; still, plenty. Some years are better for fishing than others, and the fishing varies with the seasons and the weather. The fish are mostly in full roe about Christmas time, but it varies, as you will see small roe in the fish at present. The date varies very much; this year you will find the spawning is very late. Last year it was a month earlier at this end of the harbour—at least, where we fish. It all depends on the season, whether warm or cold. This has been a very cold season, and the fish are late. Fish do not come into the shallow water or run up the rivers till the weather is warm. They are not active when cold. They spawn up the creeks, as young fish are first noticed there, but they are not very small or like fry. This is in the end of December and beginning of January. H. B. only knows that these large fish are to be found at all seasons; his nets do not catch small fish. The fishes of different ages keep in separate shoals. We use set-nets, and shoot them round the shoal of fish in the same manner as a seine-net. Our nets are 4¼ in. mesh, and made of strongish twine. They are of about 500 yards long, and 25 mesh, or 5 ft. deep. About Christmas the full-sized fish come in great shoals, and run up the creeks, leaping out of the water in thousands with flood-tide. Never see them in shoals going out with ebb-tide. They sometimes enter the harbour in enormous shoals; and large shoals can be seen outside along the shore. The fish are in best condition from April to December. The best prices are got in the winter time, but chiefly because they keep better, and stand carriage. They are out of condition when the roe is fully swelled, and for two months after spawning; say, from 15th December to 1st March. They are only caught when out of condition by the foreign fishermen, as no price can be got for them. They are then lean and soft, and would not keep in hot weather. The fish are quite thin when the roe is full-sized, and it is the warm weather that brings them on. The sea-mullet that are caught

outside the harbour are the best at all times of the year, but the same fish enter the harbour and are in good condition up the creeks in Spring. Is not aware whether offal is thrown into the sea from the canneries, but dog-fish are much more abundant than formerly. The chief enemies of the mullet are dog-fish, kahawai, and shags. The shags destroy a great number of fish, especially small ones. Other fish caught in the harbour are flounders, schnapper, kahawai, and eels, and sometimes other sea-fish, such as trevalli, gurnard, &c. The fishing is better and more varied near the Heads, and up those branches where there are no large rivers. All fish except the schnapper are caught with the nets, and only the one kind is used for all fish—viz., the mullet-nets. These are set across the creeks, and on the flats along the shores which are dry at low water. Most of the flounders are thus caught; they are entangled, but not struck by the mesh. As the tide recedes they are caught in the fold, and shaken out when the bank is dry. There is no scarcity of flounders. Considers that it would be best to have a close season for two months and a half of the year—from the 15th December to the 1st March—and it should apply to the whole harbour, as otherwise the fishermen would migrate on to other men's ground, and destroy fish that cannot be used.

Mate, s.s. "Osprey": Has been a fisherman for twelve years in Kaipara Harbour. Considers there are fewer mullet than formerly, and attributes the falling-off to the great increase in the number of shags. They are in thousands, and feed on the small fish. The Maoris used to keep the shags in check by eating them, and destroyed the eggs and young birds. He thinks a reward should be offered for the destruction of shags. Is of opinion that mullet go out to sea to spawn, as there is no suitable ground inside, for where there is not mud there is too strong a current sweeping the bottom. Young fry the size of whitebait can be seen near the Heads, entering with the flood-tide in solid shoals, about Christmas time or even earlier (October). Never caught spent fish in the harbour. When the roe is ripe the fish go outside to spawn. Thinks a close season is not required, as the fishermen know they can make nothing by the fish when not in good condition, and during the hot weather.

Moros, Greek fisherman at Kaihu: Exhibited a lot of mullet in fine condition, with ovaries 4 in. long, but not developed; no ova being found, being in a state in which they may remain dormant until favourable circumstances of temperature and situation for breeding are encountered. One male fish had testes like pack-thread, being quite undeveloped. These fish were caught down the harbour near the mouth of the Otamatea branch. Mullet do not come up to Wairoa in the winter time, or in the freshes, as the fresh muddy water drives them back. He (Moros) fishes all the year. There are always some good fish. Quite lately his brother took a thousand dozen of similar fish to those exhibited on Onapaua, but the canneries would not buy, and they were thrown away. The roe is big in January. After that see no spent fish, or fish in roe. They seem to go away at once after spawning. In summer, when the river is salt, schools of fish are seen leaping on the bank opposite Kaihu, with flood-tide. This is in the beginning of the year.

Mr. Rodgers, Innkeeper: Has been at Kaihu for three years. Has hardly ever seen fish leaping in numbers opposite his place, except at one time, when the "Osprey" was laid up. He thinks the paddle will drive away the fish, especially by stirring up the mud. Never any fish caught as far up as Kaihu when there is a fresh in the river.

Mr. Harding, Horihori: Has been fifteen years resident. He fishes for mullet by splashing along the bank, so that they jump into the boat in the evening when the salt water reaches up the river with flood-tide. This (October and November) is the best time for this sport. The most ever caught in one evening was forty. Out on the coast is the best place for large fish, and they are very superior in the quality of flesh. There are no small ones caught in the sea; all large, and about one size. They are caught with nets that are shot round the school and drawn on the beach. Has seen Maoris make morning hauls in this way; they dry the fish. When he first came to settle in Kaipara, and for several years afterwards, he used to see the river alive with mullet, passing his place with the flood-tide, when there was no fresh in the river above. They rushed in in great schools, rushing and darting with great activity; in the month of January. Never see such abundance now, and attributes the decrease to the steamer having frightened the fish entering the harbour channels.

Captain Smith, Harbourmaster: Adheres to his former written opinions that the canneries should be closed for three months, from the 1st December to the 1st March, and that no other close season is required. Thinks the reason why only large fish are got on the sea-beach is the large size of mesh used.

Mr. Monk: Has made inquiries of the Maoris, especially the elder ones, within the last few days, and reports that they have seen ova on the sides of the mud-banks, but they knew not how deposited, or if they were hatched out. The Natives used largely (and of late years to a less extent) to fish on the outside coast in the winter time, not in summer. The fish come close in shore in great schools during easterly winds. They are closely crowded together, with their noses protruding from the surface of the water, while they feed on a brown scum that drives off shore. The Natives, armed with a long net, stand 6 ft. apart, and, at the proper time, dart into the water and surround the fish on the shelving beach, enclosing them in the net. In this manner enormous quantities are taken. They are all of one size, large, and with firm flesh, being much superior to any taken within the harbour. In early winter (April and May) the fish are often greatly distended with fully-developed roe. The beach fishing is so important that it is subdivided and marked off by stakes, a section being allotted to each hapu or section of the tribe. The fish come in-shore, sometimes on one section, sometimes on another, and when caught become the property of the hapu owning that particular section of the beach. This is a very old custom, and is still observed. When Mr. Monk told them that Government were going to protect the kanae from being destroyed or lost they were greatly amused, and asked how it was that when there were many more Maoris than there now are in Kaipara, and who fished for and lived on the kanae all the year round, the fish did not lessen in numbers. They think that no close season is required.

I. M. Patrey, Frenchman: Has been fifteen years at Helensville, and fishes as far as South Head. He fishes in other parts of the harbour occasionally. He learnt fishing when young, on the north coast of France. Does not find the mullet are scarcer, but they vary in different seasons. They acquire the full growth of roe in January. Finds very few "milts," or male fish, in perfect roe at this time. Thinks the roe in the female fish takes two months to develop after it begins to swell. Cannot say when the fish are earliest, as at spawning-time, when it is hot weather we fish close to the market, and do not go down the harbour. Last year the mullet was in full roe very early, by the middle of December. They used to come up on the banks and edges of the rivers about Shelly Beach ("I thought to spawn"); but the last three years they have not done so, except a few at night. Supposes they must now spawn on banks nearer the Heads. The young fish are first seen about a month after the latest spawning. This is in March. They are then about 1 in. long. Thousands are to be seen in all the creeks between Shelly Beach and the Heads. At night one can hear them swarming when pulling the boat through them. They make a very peculiar sound, which cannot be mistaken. Small and big fish are not mixed up as a rule now. The little fish, larger than the fry, are still seen in millions up the river, but the big ones now keep more to the banks. Only uses set-nets, which have a 4 in. mesh, made of No. 12 hank twine. They are 6 ft. deep and 400 yards long, and are floated with corks. The nets are shot round the fish in half-circles, or sometimes a ring. The small ones escape, but the large ones are meshed in the gills. In summer the fish often escape below, or jump over the net; but in winter they behave as though blind, or dull with the cold. In summer the mullet are always rushing with the tide, more or less, but there is no particular season for their mobbing in schools. I have never seen them going through the Heads to the sea, but the Natives frequently bring fish from outside. Can always recognise them, as they are quite clean and free from mud in their guts, as they live by suction only. Has seen the fish in full roe in February and March. All winter the fish are in good condition, but from June to December they are best. Outside fish are almost too fat, but after having been a few days inside the harbour they appear to lose much of the coarse fat, but without becoming lean fish. The prices we get are not ruled by any particular time, as the supply of the market depends altogether on the coolness of the weather. The fish are least valuable immediately after the roe is spent; but, with the exception that the lower belly part is thinner, and the flesh less rich, there is no difference. In this state they keep, and are quite wholesome. In fact, at no season is the mullet out of condition so that they are unfit for food; but in warm weather it is difficult to send them to market, and we do not try to catch them. I have never yet sent fish to Auckland which arrived in bad condition, and am very careful about them. I believe the canneries drop the offal into the sea. It is the scales of the fish (not the offal) that will drive the fish away. Has known a mullet fishery in France destroyed by letting the scales escape into the sea. The chief enemies of the mullet are shags; schnapper only eat them after they are netted. Kahawai take a few young ones, but they live chiefly on the fish we call "sprats" here (the green sea-mullet—aua, or kahawhiti, of the Maoris). Dog-fish only attack mullet when they are meshed in the net, as they are not swift enough to catch them otherwise. There are a great many shags, but not more than there used to be. The other fish besides mullet caught in Kaipara are two flounders, the black one being very rare; one kind of sole, also very rare; kahawai, schnapper, trevalli (in spring time), horse mackerel, a few gurnard, and eels; but I only fish for flounders and mullet. I fish for flounders with the mullet-nets, as it would not pay to have a separate set of nets for them. The nets are set on a bank that goes dry, in a half-circle, and as the fish recede with the tide they are caught in the bunt of the net, but are rarely meshed. They are not getting much scarcer. Six months ago I got 300 dozen in one haul, of which I sent 180 dozen to market. About 500 dozen is the biggest haul of fish ever caught in Kaipara. It was last winter, and the men had to cut the net away. It was afterwards picked up at the pilot-station full of rotten fish. [This was afterwards corroborated by Captain Smith.] There is no real necessity for a close season for fishing. All fishermen require a slack time to put their nets and boats in order, and naturally choose the time when the fish are of the least value. The Batley men, on account of the great length of net they use, which by joining up are sometimes 1,000 yards long, require at least two months. Here we take six weeks. I wish to say, at Helensville, we have only four days in the week in which to make our living by supplying the Auckland market, owing to the number of holidays. We do not work on Sunday. We have Monday, Tuesday, Wednesday, and Thursday, and on Friday and Saturday there is no market. At Batley they fish seven days in the week. If there were to be a close season it should be from the 20th December to the 20th February, but only because this is the hottest time of the year. I do not think any closing is necessary, but if there is to be one, the old mouth of the Otamatea should be the boundary, as there is no man living inside that can catch fish for the local market, nor can he catch fish outside for the canneries, as the distances are too great at that season of the year in either case to deliver them in a fresh condition. One of the chief causes of the frightening and driving about of the fish is the use of the paddle-steamer "Osprey." The fish are all cleared out of the channel she follows. During the close season and hot weather the fish accumulate in the Otamatea arm and its branches, which are only visited by one screw-steamer in a week, and when the canneries resume work enormous hauls are made, such as 400 dozen to 500 dozen per week to each boat. These big takes last two months fully, and gradually the fish clear out, probably to Hokianga, and never come back.

Mr. Masefield, sen., Batley: Began fishing and canning fourteen years ago, following the American system. There have been many changes since then. There was no systematic fishing by white folks before I began. Fish was scarcer in 1884, at which time we left to start a factory at Hokianga, Bay of Islands. They increased again, but are now not nearly so plentiful as when we commenced. Now the fishermen have to go out of the river to the banks; formerly they got plenty in the river. They are not even so plentiful in the channels and on the banks. Formerly you could not pull a boat about the harbour without a number jumping into it; that never occurs now.

The quantity varies with the different years, the difference depending on the prevailing temperature. The fish are in full roe from the beginning of December to the 1st February. Spawn during the same period. Have never seen spawn. Think they deposit it at the head of the creeks in shallow water. They run up the creeks that are dry at low water and retire with the ebb in mobs. On one occasion I caught some of these. They were soft flabby fish, nothing in them, and not fit for use. This was after Christmas. Think they pay three or four visits to the spawning-ground before they are thoroughly spent. See very young fish in the creeks going up and down with the tide in thousands about the end of February. Only get one size and age when catching for the canneries, but formerly they were much larger compared with such as are at present obtained. Never get big fish now. From the Natives we used to get very large and fine fish from the outside coast. At present they are about 1½ lb., and the large fish would be about 3 lb. At present we employ two boats, which are out day about. The take is from 60 to 100 dozen per day. This is what we like to get, and can manage best in the curing-works. Our season begins in March. The fish then are plentiful and come in schools, or gather together, having had a period of rest. Formerly they gathered up the rivers, but now they gather only on the banks and in the channels. Since 1887, when the Otamatea has been closed for three months of each year, the fish have resumed gathering in the river before March, when the fishing season commences. The accumulation is caused by their first coming in to spawn in summer, and not leaving again. In March they are all right again, and fat, unless the hot weather continues very late, when the fish are later in recovering. Do not think it is necessary for mullet to go out to sea after spawning to recover their condition, but probably some may do so. School-fish, or "clean-guts," which have just come in from the sea, are caught in the winter with other fish on the banks. They can easily be distinguished. I never saw a clean-gut fish in roe. The first fall in condition is after spawning—*i.e.*, they lose their fat. They weigh heaviest when in mature roe, more than when in the best condition, in June and July. We throw away the roes and roe fat with the offal. The offal is only sometimes thrown into the harbour, but not as a rule. It is at once recovered by kahawai and dog-fish. As the close season up to now has been beneficial, as already explained, I am in favour of its being continued. It should be from the 1st December to the 1st March on the average. It would be better if the condition of the fish could be observed and the season varied from year to year, as there is often, as in last year, quite a month's difference in the time of the fish developing roe. A month's time of notice for the commencement of the season could always be obtained by inspection of the fish. A close period of three months is quite sufficient. The close season should apply to the whole harbour. The fact is, the fish are caught at night, and no one can say where they are caught—that is, if within or without the closed boundary. Last February some canneries commenced working a month before the opening of the season. The best way would be to make the closing apply to the canning-factories for three months. The fish would then be sufficiently protected, and the local fishing by settlers would not be interfered with—all taken by them would not matter. The close season should only apply to Kaipara and to the Bay of Islands, as only there are there any factories; but for the general benefit it would be better if all fishing in tidal creeks and channels were prosecuted during a short close season suitable to the spawning-time in each locality. Fish are very seldom seen up the creeks in winter, or before the warm weather comes. They avoid the cold water of freshets. It takes two months for the fishermen to get the spell work done any year, as they are only idle one month. During this they could go fishing for other fish, but could not well catch flat-fish without taking some mullet. During the idle time they can always find something to do. They like a rest, and take a holiday in town. They get in the winter supply of firewood, mend their nets, and tan them, and overhaul their boats. Have never heard our fishermen complain of any hardship in this respect. Our other employés at the factory have no time idle, as we do beef- and fruit-canning in January and February. On the 1st December, when the fishing season closes, we clean up and overhaul all the fishing establishment. This generally takes three weeks, so that we get the works all renewed and clean by Christmas for the beef- and fruit-preserving. The beef-tinning is in full swing by the second week in January, and about the 1st February we commence the fruit-preserving, such as pears, peaches, and plums. We employ the same hands as for the fish-canning, with a few exceptions. The fruit-canning is finished and we are ready for the fish-canning by the 1st March, but do not always begin, as the weather is sometimes still too warm. In such a case we continue to work with fruit as long as possible.

James Otamatea Masefield: Was born on the river. Has always been fishing and working with mullet. Have seen the mullet rooting in the mud between salt and fresh water, when it would be half-dry at low water. Thought they were spawning, but never actually saw spawn. Such places would not be quite dry at dead low water. I saw this about Christmas time. Much fewer fish than formerly. This applies to the whole harbour. It is not due to the shifting about. The following is a note of the fish delivery for one boat at Messrs. Masefield's factory at Batley:—

	1891.	1893.	1894.	1895.
March	229 dozen.	...	552 dozen.	455 dozen.
April	319 "	715 dozen.	617 "	327 "
May	288 "	572 "	641 "	387 "
June	413 "	827 "	555 "	316 "
July	862 "	1,286 "	491 "	394 "
August			674 "	218 "
September	476 "	1,148 "	398 "	270 "
October	587 "	1,293 "	1,103 "	700 "
November	...	1,000	917 "	...
	3,174 dozen.	6,841 dozen.	5,948 dozen.	3,067 dozen.

Closed down during season of 1892.

This is the first year we have been so late. It may be that the proper fish have not yet come in. I think they go to sea, and retire to spawn. Continually after spawning they go to sea—at least, I believe so—but we never see them going out. Spawning begins generally about the end of November, and, as a rule, all the fish spawn at the same time. The spawning probably continues for nearly three months. Young fish, from ½ in., are very abundant up the creeks in February and March. Get "clean-guts" all the year round on the banks. One haul may be clean and the next muddy. They are seldom mixed, except one or two odd ones. They are only mixed when those taken from different places have been mixed in the boat. The fishermen say that all the fish caught before sunset are muddy, and those caught after dark are clean. Cannot say this from my own knowledge. They get large hauls of clean fish in the winter, especially from the Heads. They seldom have spawn in them. The best hauls of fish are made in September and October. During October and November we have taken 700 dozen, and did not get so many in the previous three months. March is sometimes a good month, but is often too early for the fish to be in good condition. I think the three months' closing has improved the fishing. It should be closed for three months at least—from 1st December to the 1st March. No necessity at present to extend it another month. The closing should apply to the whole harbour under present circumstances, but if instead the canneries were closed for three months it would be a better way. The small number of fish caught outside the factory work would not signify. Think the spawning-grounds should be protected, and the former limit would be sufficient. Think a 4½ in. or 4¾ in. mesh should be required for flat-fish, as with such a mesh mullet would escape. There are tons of flat-fish that could be taken safely during the close season with a 4¾ in. mesh flounder-net. There is a close season for mullet at the Bay of Islands from the 20th December to the 20th March. Think there ought to be a close season there, although most of the fish are sea-going or clean-gut. The fishermen in Kaipara distinguish between "school fish" and "settlers." The "school fish" are those with firm flesh and quite clean inside, which occasionally enter the harbour from the ocean in enormous shoals. The "settlers" are those mullet of moderate size which stay in the harbour and run up the rivers. They are always muddy inside, owing to their feeding on the mud-banks. Cannot say if these are different species or not. The mullet are quite good until the roe is half-grown, and are then best flavoured, not being so rich.

Mr. Ewing, Batley: Have been eleven years engaged in canning mullet. Took over Mr. Masefield's business in 1884. There are more fish now than at the time I started. Thus, in the first year I canned 6,300 dozen, with five boats fishing continually. I have continued every year since then, but there was a break from the 7th February, 1891, to the 10th June, 1893, while I was starting a factory at Ohoro, near the North Cape, and which I abandoned on account of rough weather, which prevented a steady supply of fish being obtained. In 1893 (six months), with only one boat, we canned 5,350 dozen; and in 1894 (nine months), with only one boat, we only canned 6,940 dozen. During these two years Messrs. Masefield were also working. This year, up to the present (eight months), we have only canned 3,510 dozen, this having been a very bad season; but we expect to get about 1,200 dozen more in November, which will make a total of about 4,700 dozen. The following is a statement of the total number of fish canned by us since we began:—

	Dozen.
1884 (five boats, from 1st March to 10th December—9½ months)	6,300
1885 " " "	6,100
1886 (three boats, from 1st March to 10th December—9½ months)	5,600
1887 " " "	4,840
1888 " " "	6,032
1889 (two boats, from 1st March to 10th December—9½ months)	5,369
1890 " " "	5,500
1893 (one boat, from 1st March to 10th December—9½ months)	5,350
1894 " " "	6,940
1895 " " (8 months)	3,510
Total	55,542

We prefer the fish caught on the banks, and so do not take fish in the rivers as much as formerly, and cannot say if fish are scarcer. Certainly there is less leaping and splashing than formerly. I do not think the closing has had any perceptible effect in increasing the fish. We fish up to the 20th December, getting the fish from outside the boundary to that month. They are quite good for canning up to that date, and are mostly male fish. The heat of the weather does not hinder canning up to that date, the great heat not coming till later on. Assuming that the fish spawn in shallow water in summer up the creeks, the plan of closing the river and leaving the banks to be fished is the best. Firm hard fish can be got on the banks even in the hottest weather—that is, in February and March; but they are nearly all male fish. The nets used up to the present year were 4 in. and 4⅛ in. mesh, of three-ply salmon-gilling twine, 400 yds. long, and 5 ft. deep. By altering the number of leads they can be made either floating or drift nets. In deep water two nets are joined, one above the other. This has been done this last winter, and has proved successful, especially in stormy weather. Have only once seen a solid school of fish entering the Heads from the sea, but others have seen them frequently. The fish are in best condition for canning in November, when the roe is growing up to where it is rather more than half-formed. The prices given for fish are by agreement. We fish from the middle of February to the middle of December. For the first two and last two months of this time we get the fish much cheaper, as the weather is better and the fishermen can work longer. At present the offal is thrown into the sea. It is at once eaten up by kahawai and birds. Do not think it drives the mullet away. Do not consider the proposed change in the season is necessary or warranted. Quite contented if it is continued as it was before. If any change is made it should

rather be to shorten the close time. In fact, so long as fishing on the banks is permitted it does not matter to the canneries how long the rivers are closed. [See letter 18th June, 1895.] Do not approve of closing the whole harbour, because other fishing must be permitted; and the catching of mullet could not be avoided, and if they were thrown away this would only lead to the increase of dog-fish and other enemies.

Charles Simich: Have fished in Kaipara for thirteen years, and learnt fishing on the Dalmatian coast. Do not think the fish are scarcer now than they were formerly. Two years ago the most plentiful year I remember. They move about. They generally come into the harbour from outside sea in August. When a big school comes rushing into every river, the fish are then very plentiful. They stay in for a month or two, and then go out again; but there is no regular time for this. The schools are all clean fish, but they change to muddy fish in a week or two, especially when they go into the rivers. Most fish in roe are got after Christmas, and in January, but a few are got at any time of the year. In February hardly ever see any fish in roe. In December, with the floating nets on the banks, we get large hauls of fish; clean, and mostly males. The roe-fish are no good for us. We always try to get the male fish in summer. Think they spawn on the mud-flats up the creeks, because of the millions of young fish found there in January and February. A 2 lb. fish, which is the most common size, will be about three or four years old. About 1 lb. is the smallest that ever have roe. It would probably be about two years old. The biggest seen was about 7 lb. It was caught in a haul of 200 dozen, of which a dozen were from 4 lb. upwards, and all had roes. This was after a southerly gale about six years ago. They were caught off Okaru, and were part of a big school. In the river the fish are good and clean, even in the winter time, but not in the summer. At this season there are still good fish inside Komiti, and will be till the end of November. [Exhibited a splendid lot of fish, mostly female, 3 lb. weight.] It is very rarely we get spent fish, for as soon as they spawn they are off to the sea. I only remember once since to have struck one in the net when fishing on the banks. It is a mystery what becomes of the fish sometimes. At the end of February, 1889, the river from Komiti to Point Curtis was perfectly full, and we all joined nets, prepared to get a great haul. They rushed up, and made a great show, so that we expected a good season, and made great preparations. They all disappeared suddenly, however, and must have taken most of the local fish with them, as fishing with four boats only 200 dozen were taken in the following month (March), and it was four months afterwards before the fish were again plentiful that year. The natural enemies of the mullet are shags and kahawai, which destroy them in great numbers. We do not need a close season, we close the season ourselves each year. It is no use catching fish when we cannot sell them. There are as many fish as ever, only they have always made more show at some times than at others. They come and go with the change of weather. The steamer scatters the fish, but they are like sheep, and gather again in mobs. If a close season must be, we can get good fish up to the 20th December. By the 20th February the fish are quite a good age on the banks outside Komiti. We can take them in good order from there to the canneries even in the hottest weather. We can catch them outside the old boundary at night, and pull up the punt with the fish covered with wet bags, and deliver them in the early morning. It is only an hour's pull. These are the fish I mentioned as being all in good condition, and chiefly male fish. If the whole harbour is to be closed up for four months it may as well be closed altogether. There would also be four months of bad weather in the winter; that is eight; and I do not see how we can earn a living in the four months that are left. If there must be closing all over the harbour two months would be sufficient, and could be worked. Still, it would be better to close for three months inside Komiti, and open all the year round over the rest of the harbour, as has been the way up to now. There are twenty-three families in the Kaipara—viz., four at Kaiau, three at Aratapu, one at Tokataho, one at Sail Point, four at Helensville, one at Port Albert, two at Pahi, and seven at Otamatea. There are ten wives and fifty-nine children dependent on these fishermen. There are three factories—Rangiora, with six white men, having five wives and four children; Batley (Ewing and Co.), eight men, having two wives and four children; Masefield, eight men, having three wives and four children. This makes a grand total of 136 souls dependent on the mullet fishery at Kaipara.

William McLeod, Helensville: Has fished in the Kaipara for thirty-three years. The fish are not scarcer than they have been before. It has always been that they are more plentiful some years than others. Have seen many fish killed with sawdust in the rivers, and think that is often the cause of the loss of a season's spawning in some of the rivers. Think that from the 1st December to the 1st March should be the close season for the sale of fish over the whole harbour. Knows the fish in the sandhill freshwater lakes near to North Head; they are true mullet, and grow to enormous size, but are not well formed. There are lots of mullet in the sea, and they are very fine fish, and can be caught all the year round when the weather is favourable. They spawn on the outside beach later in the season than the fish in the harbour. They enter the harbour in schools, especially in winter, and often run up the Wairoa Channel with the flood to Sail Point, and return with the ebb. Have always thought them a different fish from the harbour mullet. They are also got in the salt-water lagoons at the Heads.

George Bennet, Batley: Have fished eighteen years. The fish are not scarcer, and only vary with the weather. Do not think they come much from the sea, except in great schools. They spawn on the banks. Get a very few spent fish on the banks in January. Clean-run fish are often caught in the same haul with muddy fish. With south-west wind the fish are in great quantity. With easterly weather the fish keep to the deep channels, and none can be caught. The wind has more to do with them than anything else. The day before yesterday there were plenty of fish, and yesterday and to-day, with fine weather and easterly wind, we could not get any fish. Would like the close season to be as formerly. Has ten children depending on him, and if the whole harbour is shut up he could not maintain them.

FURTHER NOTES OF EVIDENCE *RE* MULLET.

I left for Auckland on the 30th December, 1895, for the purpose of further investigating the breeding habits of the grey mullet in the northern parts of New Zealand. At Napier I made inquiries in passing, as a considerable supply of fish has been sent from there to the Wellington market by rail, in boxes, twice a week since September, and these boxes frequently include mullet. On the 15th November one lot which I examined were all undeveloped females in prime condition, weighing 25 oz. each, and on the 22nd November a similar lot. On the 11th December a lot received from Napier proved to be all males, quite undeveloped, but of large size, weighing from 26 oz. to 30 oz., and in prime condition. Both lots were clean fish, the intestines being empty, and the pharynx containing only a few drops of grey slime, consisting of deep-water forms of minute marine Crustacea and Diatomacea (*zygoseros*). I was informed at Napier that such fish are caught in the trawl-net, which is used outside the harbour beyond the Pania Reef. I found that at this date also the Napier market was supplied with mullet in excellent condition. These fish were therefore caught during what is the close season in other places, and were yet in excellent condition for use as food. On the 2nd January, in Auckland, I found a few mullet exposed for sale, of small size and very poor condition, and not fit for food. An early visit to the wholesale fish-market, on the 3rd January, discovered no mullet offered for sale, but mullet were served at table on the same day, and were not palatable; so that, so far as Auckland consumption is concerned, it would really be in the interests of the community to prohibit the sale at this season. On the 23rd January, as I returned, I still found inferior fish exposed for sale, and, although they were gutted and scaled, it was evident that they were spawning fish. So far as I could ascertain, the mullet supplied to Auckland mostly comes from the Hauraki Gulf, and a small proportion of much better quality at this season from Helensville. I saw a consignment of seventeen dozen very fine prime fish brought down to Auckland on the above date.

On the 4th January I arrived at Whangarei, and had a brief interview with Mr. John Monro, the Inspector of Fisheries for the district, at Marsden Point. As Mr. Monro has been the original instigator of this investigation, and has had very long experience in everything relating to fisheries, we agreed that it would be advantageous that I should consult with him, after having obtained all the information I could in other districts. I therefore went on to Whangarei, and happening to make the acquaintance of Mr. Easter-Brook Smith, he put me in touch with the fishermen.

4th January, 1896 (Whangarei).—*Edward Blake* : Has fished mullet for twenty-two years, and for the last fifteen years in the upper reaches of the Whangarei Harbour and River. The fish are now harder to get than formerly, but not really scarcer. They are more disturbed. This year they are as plentiful as ever; but years vary very much. Fish with hard roes are generally found up the river about Christmas, but this year they are much later, probably owing to last winter being so cold. By "hard roe" is meant when the eggs are distinct and firm when cooked. They have undeveloped roes at other seasons, but have never seen any hard roes later than the end of January. Have never seen mullet-spawn lying on the banks of river or anywhere else. Mr. J. L. Wilson has told me that the sea at Parua Bay has frequently been covered with floating spawn. Cannot say if it was mullet-spawn (most probably flat-fish spawn). Young fish which are supposed to be mullet are first seen coming up the river on fine days in spring time—October and November. They increase rapidly in size when the warm weather comes. Large and small fish run separately; all the fishermen know this, and use different-sized nets. Large fish mostly keep to the deep channels; but on warm days, even in winter, the large fish sometimes come on to the banks. In summer the fish move everywhere, but from March on through the winter months either a big haul is taken or none at all, as they are then running in "schools." Have never seen any spent fish but have occasionally caught fish with roes fully ripe for shedding coming down the creeks. Have never seen any mullet that I would not have eaten. Never caught any foul or muddy fish in Whangarei. Shags are the chief enemies of the mullet, as they eat great quantities of the young fish. Think any regulations for mullet-fishing are quite unnecessary for Whangarei. The mullet are quite able to take care of themselves, owing to the harbour having deep channels, in which there are strong tidal currents, so that nets can be set only in the dead-water at high and low tide. In the deep water we have to wait and watch the channels at high and low water slacks. All the nets used are sinking-nets—that is, the sinker a little stronger than the floats. The mesh varies from 3½ in. to 4¼ in., but very few fish are caught with the latter. No fish caught with a mesh less than 3 in. would be worth taking. That would be a mullet less than 12 in. long and about 12 oz. in weight before being cleaned. The mullet-fishing is best in northerly winds and worst in southerly. No part of the harbour should be closed as a spawning-ground at any season. About three weeks ago—10th December—some large mullet with hard roes were caught outside the heads with a 4½ in. mesh. These were of the large blue-backed kind that are rarely seen in the harbour, but are reported to be in great shoals outside.

Note.—In the afternoon Mr. Blake arrived with a take of very fine mullet which had been caught with a 3½ in. mesh net in the reach above the Railway Wharf during the first of the flood-tide. I cut up and examined forty of these, and found five to be males and thirty-five to be females. In no case were the sexual organs more developed than those I examined at the end of October. The largest fish in the lot was a female—length 16 in., and weight 22 oz. The ovaries were 3 in. long but were quite undeveloped, of a deep purple-red colour, without any appearance of segmentation. The smallest fish was a male, 12 in. long and 12 oz. weight, milt undeveloped. The smallest female was 14 in. long, 16 oz. in weight, and with undeveloped ovaries 1½ in. long. All the fish were in prime condition, quite clean, and very fat.

14th January (Whangarei Heads).—*John Munro:* Thinks there should be a close season for mullet when in full ripe roe. Does not know when that season is. Used to think that all the mullet spawned up the creeks, but has made no observations to prove this, and rather doubts it now, as large fish in spawn are found outside the Heads when none such are caught inside at the

same season. No set-nets of more than 3¾ in. mesh should be legal, as roe-fish are mostly caught with 4½ in. mesh gill-nets. Seine- or sweep-nets used in shallow bays and creeks should be prohibited. There should be a close season for mullet in all waters from the 1st December for three months, and during this season all canneries should be closed.

9th January (Russell).—*P. Barker:* Has been fishing mullet for eight years. Fish not so plentiful as formerly. The seasons are getting later, and irregular, as if the habits of the fish were interfered with. Caught fish all the year round, but the Waikari is a winter fishing-ground. This year saw no roe-fish before the 20th December. Male fish are rare this season. The seasons are so irregular from year to year that can see no advantage for a close season being fixed. Early in last season, after the 20th March, for six weeks the fishing was good. Was using 3¾ in. mesh nets. Previously we used 4½ in. mesh: 3¾ in. mesh will not gill full-roe fish. Instead of a close season, would recommend that the size of net be fixed during the spawning season, and that sweep-nets should be prohibited. Three years ago roe-fish were abundant in the bay (harbour branches) in October. Last year none were seen till the end of November, and this year, when the fishing was closed on the 20th December, few or none were seen. At all seasons of the year schools of mullet run in the harbour at early morning, and leap out of the water, but they will not strike a net, except in a shallow bay or creek; and in the evening about sunset they clear out. This occurs whether it is flood or ebb-tide. The flood or ebb of the tide has no influence. During the night time they are never found. Thinks the mullet deposits its spawn outside the bay in salt water, but about the outlets of freshwater creeks. This year the close season has been very hard on the fishermen. It has been a late season, and fish were very scarce until just before the season closed on the 20th December. It is not so every year. Since the close time commenced the fish are very abundant, and appear to be in good condition, but no fishing is allowed. This closing of the fishing is not required; and it had no effect this year, as just before closing some very large takes were made—indeed, so many fish that the factories could not take them. They were all splendid clean fish without roes and in prime condition, and lots were thrown away, as there is no local market outside the factories. There are nine boats at work kanae fishing in the bay: Paroa, two boats, four men; Russell, two boats, four men; Purerua, three boats, six men; Opua, two boats, four men.

W. Baker: Has had experience for five years in what is termed the outside fishing at Paroa. He is familiar with the enormous shoals of large mullet that are met with outside in the blue water along the coast at certain seasons, but chiefly from November to the end of January. When they enter the shallow bays they are caught with drag seine-nets. Caught 60 dozen on the 20th December outside Paroa Bay, and did not see a single roe-fish among them. The outside fish are all very large, and are very black on the back. The Maoris call the young fry of the mullet "karahihi." They swarm in July outside. The half-grown fish are named "poto," but they are not often caught.

Note.—Mr. Stephenson showed me specimens that were supposed to be young kanae, but they proved to be small-fry of the aua, or sea mullet (*Agonostoma fosteri*).

10th January, 1896.—*Stanley Empson*, Purerua, Bay of Islands, manager of a mullet cannery: Has managed the factory since its establishment three years ago, so that his experience of the fishing is only since then. The first season, 1894, was the best he had, "our take being 2,342 dozen." Since then the fish inside the bay have been a little scarcer, in 1895 the take being 2,326 dozen. Last year, after the opening of the season—March and April—the take was again fairly good—viz., 367 dozen—but from then up to September the weather was cold and rough, and only 400 dozen were taken in five months—June to September. From September up to the 20th December, at which date the fishing closed, there was a good supply, as the following figures will show: September, 257 dozen; October, 378 dozen; November, 401 dozen; December (to 20th), 869 dozen. This was the take of one only of the two boats we employ; but the other boat did not do much work this season. 3¾ in. mesh nets are used, and the fish taken weigh about 6 dozen to 112 lb. dead weight (22 oz. each), and the average length about 15½ in. The fish are always struck by the net behind the gills. The roe season is supposed to be in December, but this varies greatly in different years. In 1894 the fish began to get out of condition with full roe towards the end of November, but in 1895 they were still in prime condition and without roes on the 20th December, when the fishing closed. Have observed that the roe takes six weeks to develop after starting to change colour from purple to orange, and enlarge, and that after the fourth week the fish are of no use for canning, as they fall off in condition. The mullet is supposed to spawn on the mud-flats, but no one has proved this yet. Great masses of floating spawn have been observed up the Ti and other arms of the bay, but this has not been proved to be mullet-spawn. The nets used here are made of grey salmon-twine, 36 mesh deep, 3¾ in. mesh, which shrinks to 3⅝ in. The offal from the factories all goes into the sea, and attracts kahawai and a few dog-fish. Only three sharks have been caught here. They were 9 ft. in length, and three kits of mullet-heads were taken out of one of them. Does not believe that a close season is at all required. If the fish are spawning and out of condition the factories will not buy from the fishermen, nor will any one else, and they will not be caught. A close time would require to be varied from season to season, and to be made different for inside and outside fishing, and for every different bay along the coast.

Note.—The fish were leaping in abundance close to the factory, and a special haul was made for examination with a 3½ in. mesh used as a cast-net, the fish being caught by the gills, as in the ordinary set-net. About thirty fish were taken, about a third of which were males. They were all clean fish, and in prime condition. There was no marked difference in size between the sexes, and none showed any marked development of the reproductive organs. They varied in length from 14¾ in. to 15¼ in., and in weight from 20½ oz. to 23 oz. The average depth of body was 3¼ in., or one-fourth the total length. The lateral line had forty-six scales, and the transverse line fifteen. The pectoral fin had 16 rays; the ventral, ¼; the anal, ⅜; the second dorsal, ⅛; and the caudal, 1/9. The smallest, a male (weight 20½ oz.), was cleaned and trimmed as for canning, and then yielded 12½ oz. of prime quality.

11th January, 1896 (Russell).—Fish specially caught by *Mr. Saunders* on shoals at Paroa, in outside waters, not in inlets or bays that receive or communicate with large freshwater creeks or rivers. The take was made by a gill-net of 4 in. mesh, surrounding a shoal in open water. Seven dozen were caught and brought to Russell. Of these, fifty fish were selected for examination—thirty-three were females and seventeen males. Twenty-eight of the female fish were in ripe roe, the spawn escaping freely on handling the fish and sinking rapidly in a bucket of pure sea-water. The roes weighed 10 oz. to 12 oz., and by a rough estimate contained 500,000 eggs each fish. The boat was smeared with the bright yellow roe. The other seven female fish were of smaller size, and the ovaries were undeveloped. The whole of the male fish, twenty-one in number out of eighty-four, and easily distinguished from the females, were examined. Seven were fully developed, and shedding milt; six were fully developed, but the sac was intact, and the pair of milts weighed 3 oz. to 4 oz. The remaining eight were quite undeveloped, the milt organ being like a long slender thread. Several of the mature fish were examined in detail. The lengths varied from 18·5 in. to 19·7 in. This includes the caudal fin when closed, the middle ray of which is 1·5 in., and the outer rays $3\frac{3}{4}$ in. The weight varied from 32 oz. to 35 oz. Roes weighed from 9 oz. to 12 oz. the pair. Height through centre of eye, 1·6 in.; snout from centre of eye, 1·2 in.; width between orbits, from upper edge, 1·9 in.; width of gape, 1·3 in.; depth of gape, 1·7 in.; length of gape, 2·3 in.; length of head, 3·5 in.; greatest depth of body (at half-distance between ventrals and vent), 4·5 in.; snout to first dorsal, 6·5 in.; length of base of first dorsal, 1·8 in.; second dorsal, commencing at free snout, 12·5 in.; snout to ventral, 6·5 in.; snout to anal, 13 in.; length of base of anal, 2 in.; lateral line, 43 scales; transverse line, 15 scales. Head blunt but pointed, and convex above, compressed beneath. Eyelids were developed, with slit narrow and vertical. Eight lines of lateral pores. All females clean gut, and stomach empty; quite fat. This fish seems to be different from those examined at Mr. Empson's factory.

10th January, 1896.—*John Dunning:* Has fished mullet in the Bay of Islands for the last twenty years. Kanae are not scarcer than formerly, but they move about more, and are more disturbed up to the Waikari, on account of the coal wharf at Opua. Used to get the best fishing in that part of the harbour. At this time of most years the fish are not very large up there, only 20 oz. or thereabouts, and 15 in. long, with the roe just starting to swell at the end of January. The fish come in occasionally all the year round, and in October and November generally some very large fish come up the river, even to 7 lb. weight. Never saw any roes in them. Think the present close season is of no service. Recommends that the use of all nets larger than $3\frac{3}{4}$ in. mesh should be forbidden for four months in the year, but that $3\frac{3}{4}$ in. mesh nets might be used all the year round. This would not harm the fish-supply, and would provide for the local markets. Believes he has seen the large mullet spawning in the deep channels of the Waikari branch in the month of March, in eleven fathoms, and when the water is salt.

8th January, 1896 (Hokianga Heads).—*Mr. John Webster*, who has had very long experience, thinks a close season for mullet cannot be fixed for Hokianga. The fish swarm outside at some periods of the year, especially in winter, when the wind is easterly or off the land, but comparatively few enter the harbour. Two years ago, at Christmas time, during a westerly gale, enormous quantities of what was thought to be mullet-spawn was cast up on the beaches in the lower harbour, and lay for several days in long ridges, until they decayed. Therefore he believes the spawn is shed in the open sea. Mature mullet are never seen inside the harbour. They are only found outside, and are occasionally caught in the nets used by the Natives; but the bulk of the fish which they catch are fat and in prime condition. When they go fishing the kanae are in solid shoals. Considers there is no necessity for regulating the mullet or other fishing in Hokianga. The velocity of the tidal current in the channels, except at slack water, sufficiently controls the fishing.

Note.—At Hardiman's, at the North Head, the fishermen said the kanae were very abundant, but only since the last few days; before that there were none, but they are either too large or too small for the 3 in. mesh net they were using. A cast was taken, and only three fish obtained. They were 14 in. long and 14 oz. in weight. The lateral line had forty-six scales. They were very deep in the body, and sleek-sided. They were foul fish, the stomach and intestines being filled with slimy mud, and the abdominal cavity flaccid and dirty. There was no trace of reproductive organs, but I concluded they were spent female fish, from the membrane shreds and the condition of the post anal orifice.

9th January, 1896.—At Hoeriki, forty miles up the Hokianga Inlet, and where the river entering that branch has a marked influence on the tide, though the flood-water is still salt, I observed the kanae leaping up freely at 5 a.m., and captured two. They were female fish, one 17 in. long and 23 oz. in weight, and the other 14·5 in. long and 18 oz. in weight. They were both in prime condition, and very fat. The ovaries were not in the least developed, being $2\frac{1}{2}$ in. in length and $\frac{1}{4}$ in. broad, of a pale transparent livid tint, and no sign of segmentation. These fish belonged to the variety known as the outside mullet, as they had broad flat heads with intensely black-blue back, and forty-six scales in the lateral line.

15th January, 1896.—In the Auckland market I saw only a few mullet, and very bad they were, spent females, and quite unfit for food.

16th January, 1896 (Helensville).—*Mr. Petrie*, a fisherman, had just returned from his first fishing trip since the 20th December. Although at this end of the Kaipara there is no close season he does not fish, as his only market is the Auckland fish-supply, and he finds that it does not pay in the hot season. His first haul was 60 dozen, and among them were no full-roe fish. They were all fat, and in good condition. Another haul of 60 dozen, which I examined, were all very fine fat fish, but the roes were not developed. He has seen many more fat fish than is usual at this season where he fishes, near Shelly Bay.

18th January, 1896 (Rangiora).—Up the Otamatea set a net ($3\frac{1}{2}$ in. mesh) in the river on flood-tide. Caught twenty-one female fish, all in prime condition, 15 in. to 18 in. length, and from 18 oz. to 24 oz. in weight. Only four of the lot had the ovaries in the least degree enlarged.

18th January, 1896 (Batley).—*Messrs. Ewing* informed me, in continuation of their former return, that the following number were taken in the last three months of the season since my former visit: October, 428 dozen; November, 388 dozen; December (to 17th), 450 dozen. A take was made for me about two miles below the factory: forty-two fish were taken, of which thirty-eight were females and four males. The average length was 17½ in., and weight 23 oz.; lateral line, 43 scales; and transverse, 15 scales. The male fish showed no reproductive development, the testes being like packthreads. Only six of the thirty-eight female fish showed the slightest ovarian development. All the fish were in prime condition—very fat, and fit for canning.

21st January, 1896.—Obtained a sample of forty fish taken on the banks outside of the Otamatea, and beyond the close boundary. Notwithstanding the absence of restraint, this is the first take of the season since the 17th December. Twenty-seven were male, and only thirteen female. They were from 15 in. to 17 in. in length, and from 18 oz. to 20 oz. in weight. Their snouts were rounded, not pointed, and the forehead was only slightly convex. They were a light-grey on the back, and the sides and the abdomen were not brightly silvery, as in the black-backed kanae. They were all good prime fish, except six females that were slightly muddy. The hard muscular first stomach, or pharynx, was, in every case examined, filled with a muddy slime, consisting of 80 per cent. of Kaipara Channel mud and the rest of Copepods, &c., in a fragmentary condition. At Otamatea it therefore appears that in the month of January inside and within the forbidden fishing-ground there are 90 per cent. females and 10 per cent. males. Outside Komiti, on the banks which are open for fishing, there are 40 per cent. female and 60 per cent. males. Of the female fish caught inside, 16 per cent. might spawn this year, but not for several months hence. Of the fish caught on the banks, only 5 per cent. of the females could possibly spawn this season, but not for four months; and 6 per cent. of males might mature, but they would be very late. The following measurements were made of a mullet, the largest specimen in a haul of 20 dozen, taken outside Otamatea, on the banks: Weight, 27 oz.; length, snout to mid-cordal, 18 in., less caudal middle ray, 1·5 in.; outer ray, 3 in.; length of body without caudal, 16·5 in.; length of head, 3·7 in.; height of body (2 in. before vent), 4·2 in.; snout pre-orbital, 1·1 in.; orbital diameter, 0·7; gape, 0·8 in.; first dorsal ray from snout, 7·5 in.; first ray, second dorsal from snout, 9 in.; anterior insertion of pectoral from snout, 4 in.; anterior insertion of ventral from snout, 9 in.; anterior insertion of anal from snout, 11·5 in.; length of base of first dorsal, 1·5 in.; length of base of second dorsal, 1·8 in.; length of base of pectoral, 0·8 in.; length of base of ventral, 1·5 in.; length of base of anal, 2 in.; stretch of caudal, 6 in. Fin-rays—pectoral, $\frac{1}{12}$; line, ventral, $\frac{1}{6}$; dorsal, $\frac{1}{8}$; anal, $\frac{3}{8}$; caudal, $\frac{8}{8}$. Lateral, 45 scales; transverse, 16 scales. Female, ovaries, 5 in. long, but no ova developed; surface slightly spotted and marked. Shape, profile of head and back arched. The backward position of the first dorsal, the larger number of scales in the lateral and transverse lines, the extra soft ray in anal fin, and few rays in the caudal fin, mark this as a distinct fish from those examined at Russell and in Wellington, and differing greatly from *Mugil cephalotus*, to which species the New Zealand grey-mullet has been referred.

21st January, 1896 (Pouto).—*Captain Smith*, Harbourmaster, says that mullet has been scarce this season, as there has been few easterly winds. It is only then that the mullet enters the heads. A cast of the net was made near the Pilot Station, but only one mullet was caught. It was a male fish, 15 in. in length, and quite undeveloped, and in prime condition. Mullet appeared to be very abundant with the flood-tide, but they cannot then be caught. Ohara Bay was tried with nets, as it is a favourite fishing-ground, but none were obtained, although many were leaping. A scrim net was used to capture young fish that were supposed to be immature mullet, but they proved to be only the young of the sea-mullet (*Agonostoma fosteri*), and of the kahawai (*Arripis salar*).

16th April, 1896.—*Mr. Stephenson* reports that from the commencement of the open season he has, at short intervals, visited the factories and inspected several lots of mullet caught, and finds, with the exception of an odd fish or so, that the spawn had almost disappeared. He goes on to say that the fishermen are using at present 3¾ in. mesh, the same as used from about the middle to end of last season. They give as a reason that it would not pay otherwise, as the large fish are very scarce, and in deep water. At the commencement of the open season of 1895, the fishermen were using nets double the length, and a smaller mesh—viz., 3¾ in.—with the result that so far the take is about equal with the corresponding period of last year. From this, he says, it would seem as though the supply were diminishing, and adds that the same number of boats and men are employed this year as last. He offers, as his opinion, that a close season is very necessary, for the reason that the mullet fishing-grounds are, to his mind, very limited compared with other food-fishes.

24th June, 1896.—*Mr. Stephenson* further reports that during the month the take of mullet has been less than usual, and the fish are small in size. No roes have been seen since March. On the same day, Mr. Ewing reports that in Kaipara this season mullet are of splendid quality, but fewer in number than last year at this season. He also forwarded samples of mullet-roe in an advanced stage of development, taken on the 21st June. In the take, which was a fairly large one, about one in ten of the fish had similar ovaries, which are much more advanced than any I saw in Kaipara during the month of January.

3rd July, 1896 (Wellington).—A number of fine mullet were brought to market from Queen Charlotte Sound. All that were examined were females in prime condition, and with roes about half-grown. They were of the dark-backed variety, but not so large as those seen in the North during the summer.

15th October, 1896.—*Mr. Stephenson* reports that mullet are now abundant, the take at Russell being now about 300 dozen per week, and the fish being of much larger size than those caught a few months ago, and adds: "I now see that the weather has a great effect on the movements of the fish." Writing on the 29th, he says: "When visiting the factories a few days ago I found a few of the larger mullet had roes about 3 oz. in weight, and fairly developed. These larger fish are caught with a 4¼ in. mesh. Smaller fish caught with a 3½ in. mesh had no roes."

Wellington, 12th November, 1896. JAMES HECTOR.

APPENDIX TO EVIDENCE TAKEN.

In making inquiries on the subject, the following points were kept in view: What experience have you had? Are the fish scarcer than formerly? Do they vary in different seasons and years? At what time are the fish in full roe? When do they first show roe or milt? Does the date vary in different years? Does the date vary in different places? Where do the fish spawn? Where are young fish first seen? About what date? What are the sizes at the different seasons? Are small fish ever seen with large ones? What nets are used? What is the size of mesh and kind of twine? What is the size of the net? Do the fish make runs or schools? At what seasons? Are they seen going to sea in shoals? Do they enter the harbour in shoals? When are fish in best condition? When do you get (or give) the highest price? When are they out of condition? Are they ever caught at that time? Does the condition depend on spawning? or does it vary with the temperature? Are the fish best in the harbour or the sea? Are there fish in the closed lagoons? Of what quality are they? Is offal from canneries thrown into the harbour? Does it drive away mullet and attract dog-fish? What natural enemies destroy mullet? Have shags increased of late years? What other fish are caught in the harbour? How are they taken? Are tidal nets ever set on the banks? What is your opinion about a close season? For how many months? For which months of the year? Should it be restricted, or apply to the whole harbour?

Wellington, 5th November, 1895. JAMES HECTOR.

APPENDIX.

ABSTRACT OF CORRESPONDENCE *RE* MULLET PRIOR TO THIS INVESTIGATION.

Whangarei, 11th June, 1885.

THE fish is full of spawn in the months of December and January. At that season it enters the rivers and over the mangrove flats, no doubt to deposit its spawn, as myriads of the young mullet are seen in the rivers the following season. The fish at that season (December and January) are small and lean, also flabby and insipid in taste, the same as the salmon is in its spawning season, which I mentioned as being similar in my former letter. This time of year the mullet is caught in deep water, when it is in prime condition. JOHN MUNRO.

Wellington, 18th September, 1885.

The information I possess regarding the kanae agrees with the statement that some spawn in December–January. Towards the end of summer—that is, during March to May—they enter all the large inlets and rivers in the north, and as far south as Porirua and occasionally Wellington Harbour. They are then full of partly-grown roe, and in prime condition, and are supposed to seek fresh water for the purpose of spawning, the well-developed fish returning to the sea on the approach of spring. The young fish hatch out from January to March, and then swarm up the rivers in some cases, and remain for about two years in brackish waters and estuaries until they are adult. As the mullet, like other kinds of fish, is only valuable as food when the roe is growing, to prohibit fishing for a long time before spawning would only put a stop to taking the harvest. The information I have tends to prove that during the months of November to January is the schooling season for the kanae, when the fish congregate in the estuaries and bays preparatory to going out to sea, before the full development of the ovaries. I agree with Mr. Munro in that they are at this time of the year lean and unfit for food; but I do not agree with his statement that they are at that season full of spawn, as it is after the spawning is over that the kanae, like the salmon, becomes insipid, flabby, and unfit for food. On the coast of Australia there are three species of mullet, each having different habits, chiefly as regards the relative proportion of the year they spend in fresh- and sea-water, and it is quite possible that our kanae, which is a fourth species, has some variations in its habits in different localities. Thus, they were certainly caught in Wellington and Porirua Harbours this year in unusual numbers and in prime condition, and full of roe, in the months of May and June. I strongly urge that before the issue of further regulations an effort should be made to get exact information not only respecting the locality of this but also of other species of food-fishes.

JAMES HECTOR.

Whangarei, 27th May, 1886.

You also state that it is alleged by some that they are in the finest condition when full of roe, &c. I beg leave to contradict that allegation. I have it, besides, on the authority of intelligent persons who follow the fishing, that they cease catching them when they are in that state, as the fish are then almost unfit for food. Such an allegation shows entire ignorance of the nature of fish, and would be set forth by persons who caught them as long as they could sell them without considering their quality. JOHN MUNRO.

Wellington, 10th August, 1886.

The information contained in these papers point to the urgent necessity that exists for declaring a close season for mullet. J. Masefield, fish-preserver, Kaipara, considers the close season should be from the middle of November till the end of March. J. Gardner, fish-preserver, of same place, recommends from middle of November to middle of February. J. Munro, coast-waiter at Whangarei, who has had extensive experience in fisheries, recommends from December until February inclusive. He observes that the mullet in May and June are in the finest condition, being then in deep water; come into shallow water in December to spawn; full of spawn in December and January, then enter the rivers to spawn on the mangrove flats. The harbourmaster at Kaipara says spawn appears in the fish about the beginning of December, spawning over by end of January. During this period fish in good condition, moving about in large shoals. After spawning fish get into low condition, and very little good again until the beginning of March. Recommends close season from 1st December till end of February. Not fit for canning until at least the beginning of March. Dr. Hector says mullet, like other kinds of fish, is only valuable when in roe; to prohibit fishing before spawning would only put a stop to taking the harvest; real cause of mullet getting scarce is the disturbance of the schools during the actual time of spawning. December and January is the schooling season, when the fish congregate in sea estuaries and bays preparatory to going to sea; they are at this time lean and unfit for food. Mr. Pearce, who was the first to commence fish-tinning in New Zealand, says mullet caught in the summer season will not keep preserved in tins, and is at that season unfit for food.

WILLIAM SEED.

Auckland, 20th August, 1886.

I have made inquiries of the different fishermen and fish-dealers. The roe of the mullet is prepared in Auckland as a speciality, in season (December, January, and February), and exposed for sale separately. The part is taken out whole, salted, dried, smoked, and is soon fit for use. Specimens of mullet with roe are already making their appearance, but this is quite an exceptional case. So also the fact of fish being got with roe as late as the beginning of March should not be taken as a general rule; the condition of the fish and peculiarities of the fishing-ground having something to do with the exact time of spawning. It is agreed that the fish are in the best condition in the winter time. I saw some smoked mullet to-day which were in splendid order, having been selected for show in the Co-operative Company's establishment. Fishermen present assured me that samples quite as good would be seen in the ensuing two months; also, that the fish are much easier obtainable during the breeding season; that they come into shoal water in December to spawn, and that by the beginning of March the fish have completely recovered their condition. So poor do they become, that when the roe is taken out very little of value is left for food. Several persons who take a great interest in the industry suggest that the close season begin in November, in order to allow a month before the actual spawning time, and that the month of February be included therein. The mullet seeks shelter, and of course fishermen are guided thereby. I know that the mullet has a habit of leaping when startled, so that the fish sometimes fall into the boat. They are generally captured with nets. Some persons say that the mullet will take bait; but if so, it must be exceptional. As a matter of fact, enterprising persons have endeavoured to show what may be done with a trawl.

R. Duignan.

Kaipara, 2nd September, 1886.

The spawn first commences to appear at the end of November, December and January being the months during which the spawning takes place; but, as you remark, the fish remain in a poor and flabby condition during February, so that from the 1st December to end of January should, in our opinion, be nominated as a close season. We may mention that we ourselves have always made it a rule to close our factory during these months.

Ewing and Co.

Wellington, 4th October, 1886.

It is evident from these papers that the date of the breeding-time of the mullet is influenced to a greater extent than has been supposed by the locality, and variations in the character of the seasons in different years. Perhaps in Kaipara, being a large inlet of the sea, the fish never actually go out to sea, but merely return to the deeper channels after spawning. When it is stated that the fish spawn from the 1st December to the end of February it is obvious that there must be spent or unclean fish during the whole of this time, as during the time of spawning, and for a long time after the act, fish are quite unfit for food. As the mullet fisheries, except those north of Auckland, are quite insignificant, it will do no great harm to adopt for the close season the months that seem to suit the Kaipara—that is, from the 1st December to the 1st March. At the same time, I think the collection of exact information should be continued, and it would be very advantageous if, instead of general impressions and recollections, exact observations could be made as to the conditions of the fish on precise dates, and, if possible, if specimens of the viscera, especially the stomach, pyloric appendages, and the roes and milts, could be preserved. All that is necessary is to supply a jar of spirit, into which the viscera should be dropped after being washed and drained, each with a label of tea-chest lead fastened on, on which a date is written with a pointed stick. Exact notes, and jars thus filled during a season, from the Kaipara, Whangarei, Bay of Islands, and the Waikato at Mercer, would almost settle the question. I attach for your information extracts from the fisheries reports of New South Wales and the United States of America on the habits of the fish, which in their waters is almost identical with our kanae.

James Hector.

Wellington, 7th October, 1886.

On Tuesday last there was a consignment of kanae (mullet) received in Wellington, and I was told by the fishmonger that they had been caught in Nelson. It was the ordinary Auckland mullet, and I examined several and found them to be out of condition, and not in a fit state for food, and certainly not for canning. There was no appearance of either roe or milt in those I examined, but along the sides there was a layer of soft, oily, fat substance, occupying the position of the swimming bladder in other fishes, &c.

James Hector.

[Extract from Report of New South Wales Fisheries Commission in 1880.

The sea-mullet is a large fish, attaining, when full grown, a length of 2ft. and a weight of 8 lb. It is unsurpassed in richness and delicacy of flavour by any fish in the world, the salmon not excepted, and it offers itself for our use in countless numbers at the very season when it is in the best possible condition. The history of this fish is now pretty well known, though there are many very conflicting statements given. To begin with the spawning season, in the later end of summer—that is, at periods varying from the middle of March till the middle of May—the sea-mullet is seen to enter all the harbours and inlets of the coast in successive shoals, some of the most astonishing vastness. It is then full of roe, and in splendid condition. When not interfered with by the fisherman (for it is a fish easily turned from its course), or diverted by storms or floods, these shoals penetrate to all parts of these inlets, and run up the rivers even into fresh water in search of suitable places for the deposition of their spawn. When a suitable spot is reached the deposition of the spawn commences, and the process is carried on in much the same way as that of the salmon and other fish of similar habits. Sometimes, however, from bad weather, or the persecution of fishermen, the shoals are prevented from seeking suitable spawning-grounds, and the fish being no longer able to retain the spawn, shed it loose upon the water, where it becomes entirely lost. When the ova are perfectly fertilised and left undisturbed, the young fish make their appearance on the approach of warm weather in spring, when they may be seen in large shoals close to the land and in shallow water. From that period until they become adult, which is probably at the age of two years, they seem to keep entirely to the rivers, lakes, and mud-flats, where they thrive and grow with amazing rapidity. When in this half-grown condition they are very inferior in flavour to what they become afterwards, having an oily and muddy taste. As they are without teeth they are incapable of eating either animal or vegetable substances in the ordinary sense of the term, but they are possessed, Dr. Günther informs us, of a pharyngeal apparatus which sifts the organic from the inorganic particles in mud which they swallow, and on which they live. When the period at length arrives for the mature fish to go to the sea preparatory to spawning, the instinct which actuates them seems to be irresistible. There can be little doubt that the fish after spawning find their way back to their old haunts, but they have very seldom been seen so returning. The spent fish are for a time unfit for food, but they improve in condition very rapidly. The only instrument of capture used for the mullet is the seine-net.

Wellington, 2nd December, 1886.

Great excitement prevails among the fishermen of Auckland relative to this impending Proclamation. Possibly you may have seen the telegraphic correspondence between myself and the Premier, acting in your absence. The fishermen allege, supported by expert knowledge and experience, that the Proclamation is wholly unnecessary; that the mullet are not scarce; that the fish is cheaper now than it was many years ago, showing no scarcity; that the information given and requests made by Ewing and Co. (at whose instance chiefly the close season is made) are interested and selfish, and put forward mainly to enable their stock of canned fish to be disposed of; and that if the Proclamation is persisted in it will be the means of throwing out of employment numbers of fishermen, possibly *one hundred*, on many of whom a family is dependent. As this matter affects Auckland seriously, and as I have had several interviews with fishermen, whom I promised to aid if possible, I beg to urge you to refrain from enforcing the Proclamation, and in the meantime (for the purpose of further action) to obtain the report of Dr. Hector on the necessity of any step such as is contemplated. I signed the authority for the Proclamation, but I am quite sure now that the department has been misled. The oldest residents in Auckland assure me that spent mullet are never caught, because they are not, of course, saleable, and, moreover, as a rule, go out to sea and deep water for the purpose of recruiting, &c.

Jos. A. Tole.

Wellington, 8th December, 1886.

I think prescribing a close season for mullet was premature, for several reasons: First, that no proof has been offered of a general scarcity of the fish, but only that they migrate, and are more abundant in particular localities in one year than another; second, that there is a great conflict of testimony as to the proper months for a close season, and especially as to whether the same close season would answer for all localities. More precise information should have been collected on these points, and it would have been particularly useful to have obtained the evidence of the Natives, who are largely interested. The total white population of the Kaipara district, for instance, is not one-tenth of what the Native population used to be, and yet the Natives were almost wholly dependent on the mullet for food at certain seasons. Either the Maoris must have thoroughly understood how to conserve the fisheries while our people have lost the art, or else there must be some mistake about the great falling-off in the supply. I can quite understand that in the narrow creeks and inlets near a cannery, if the offal is discharged into the tideway, the fish may cease to frequent the vicinity, and that dog-fish and their other enemies will increase; but in that case the falling-off of the fish-supply would be local, and could be easily remedied. I should recommend that the experiment be confined for the present to one locality,—say all those parts of the Kaipara Harbour within the Otamatea and Oruawharo branches, as shown by the red line A–B from Komiti Point to Oewa Point on the attached plan, as I gather from the attached papers that it is in this part of the harbour that the scarcity of fish has been complained of.

JAMES HECTOR.

Kaipara, 17th April, 1895.

In answer to your memorandum of the 4th ultimo, *re* close season for mullet, I have the honour to report that to the best of my knowledge there has been no breach of the law in catching mullet in the closed part of the harbour. Had there been any, the matter would soon have been reported to me, as the two preserving companies here are very antagonistic, and each one keeps a rather sharp look-out on the other's operations. I do not think it advisable to close the whole of the harbour during any portion of the year; by doing so during any of the summer months you would deprive the local people of an article of diet when most required, and one which is sought after the whole year round. I do not think there is any danger of mullet diminishing in quantity through local sales, but rather by the large quantities supplied to the canning factories, more especially during the spawning season. That being so, I would advise that instead of proclaiming a close season in any waters provided that all canning factories be closed during the months of December, January, and February (the spawning season). There being no clashing of interests in the sales of fresh and corned mullet, the canning companies should not object to this arrangement; besides, it merely changes the close season from the water to the factory, with the advantage of its being better and easier overlooked, and also, I believe, would tend more to preserve the fish than the present method of closing certain waters.

J. CHRISTY SMITH, Harbourmaster.

Wellington, 5th June, 1895.

Only a small portion of the harbour is closed from the 1st December to the 31st March, and Masefield Brothers complain that other canning companies catch and can mullet during the close season, and escape the consequences by alleging that the fish were caught outside the closed limits. They urged that it is impossible to verify this, and that it is necessary to close the whole harbour in order that those who are disposed to break the law may not have an advantage. The harbourmaster reports against this, stating that he does not think the law has been infringed, and urges that residents outside of the present closed limits should not be deprived of the opportunity of taking mullet for their own use or for sale. He suggests that the canning-factories should be closed instead from December to March. This would require an alteration in the law, but it seems to me to be a very good solution of the difficulty. I propose that Messrs. Masefield be asked to express their opinion on it.

W. T. GLASGOW.

Wellington, 20th July, 1895.

No reply has been received from Masefield. Ewing and Co. point out that the proposal to shut factories during the close season will not affect Masefield Brothers, because they tin fruit in their factory, the time for which is the close season. If Ewing and Co. were deprived of the liberty to can during the close season fish taken outside the portion of the harbour closed, a great hardship would be inflicted on them, as they would have to dismiss their men, and take on a new lot when the season opened. In view of this conflicting interest, I find it difficult to advise. Possibly the member for the district—Otamatea, part of Kaipara—might aid in arriving at a settlement.

W. T. GLASGOW.

5th October, 1895.—W. T. Glasgow: Instructions for Sir J. Hector to proceed to Kaipara.

1st October, 1895.—Mr. Massey: Question about hardship of recent Order in Council.

Mr. Ewing, Veterinary Surgeon: Seventy people will be thrown out of work. No scarcity of fish. Only one firm wants to can fruit for December to March, and to prevent others canning fish. Says the close season should be from 20th December to 20th February, and should only apply to canneries, and not to fishing.

Petition (23 signatures): Against the change in the regulations, made on the 9th September, 1895. Consider old regulations sufficient.

10th October, 1895.—Ewing and Co.: Enclose petition against change, and state that no fishermen and only one firm desire the change. Ask for an inquiry.

9th September, 1895.—Order closing the whole of Kaipara Harbour from 1st December to 31st March.

9th September, 1895.—Ross: Objects to any change; that three months long enough to close season.

4th September, 1895.—Mr. Mitchelson: Question: Wants the change.

21st August, 1895.—Masefield and Co.: Urge the change to 1st December to 7th March.

30th August, 1895.—W. T. Glasgow: Minutes. Mr. Thompson agrees with Masefield, and thinks whole harbour should be closed from 1st December to 31st March.

14th August, 1895.—Alex. Rose, Collector of Customs, Auckland: Recommends that close season should apply to everywhere.

10th August, 1895.—Masefield Brothers: Complain that the law is evaded. Says, 1st December to 10th March all canneries should be closed.

NEWSPAPER EXTRACTS.

[Extract from the *New Zealand Herald*, 26th October, 1886.]

THE CLOSE SEASON FOR MULLET.

MR. C. BISHOP, of Customs Street, sends us the following: "To my very great astonishment I read in your issue of the 22nd instant that there was to be a close season for mullet during the months of December, January, and February, reputed to be spawning-time. Now, the mullet has two spawning seasons in the year, so that we should want the fishing for mullet to be prohibited altogether. What would be the result of this close season? Why, a hundred men would be thrown out of the means of earning a livelihood, and many of them just having spent their all on their nets and boats. (A case in point—there is a man who has just spent £12 on a net to fish during the months which, with this law coming into force, would be to him a great loss.) And with the depression hanging over us at present, what are these men to do? Will our law-makers find them employment to keep their wives and families during the time of their enforced inactivity? The paragraph also states that inquiries have been made respecting this question; but I cannot find any one in Auckland that heard anything about it until it appeared in your columns. Before such a great change as this was made in our fishing, it ought to have come before the House in session, so that reliable evidence could have been obtained, and we should then have known who the parties were who were so interested in some way or the other for themselves by trying to throw a hundred

men in the Province of Auckland alone out of employment. This prophecy of approaching exhaustion is by no means a new cry, and if regarded as a general statement can only be taken as absolutely ridiculous. At the commencement of the eighteenth century a bishop in the Old Country strongly impressed with the approaching decay of the herring fishery, directed a special prayer to be offered in every church of his diocese for its restoration and continuance. In the same year, says Mr. Walpole, that our Queen ascended the throne, I found a petition which had been presented to Parliament in these terms: that the fishermen of Ireland, Scotland, and Holland had found out the breeding-places of the herring, had resorted there to catch them, and since the discovery was made the fish generally throughout the west and north of Scotland had annually decreased. Now, it is a striking fact that at the very time this petition was presented the herring fishery was increasing year by year, and that its yield now is more than four times greater than at the time this gloomy prophecy was made. As regards fish being scarcer one year than another, I would call the attention of your readers to the fact that in the year 1880 rather more than 130,000 tons of fish came to the London market, while in 1881 the quantity rose to 193,996 tons. I may say that the mullet carries on an average 500,000 eggs, so we need not fear our mullet supply being exhausted. There are various causes for their being scarce at times, but there are more mullet on our coasts now than there were years ago. Pardon me for trespassing on so much of your space, but I could not let this pass without showing your readers the absurdity of having a close season for mullet, and the injustice of throwing the fishermen out of employment, besides taking from the public an article of food during the summer. I trust this matter will not be allowed to rest, but will be taken up by every lover of justice, and we shall still have our mullet, and the stock will not be diminishing."

In our impression of Friday last we published a telegram from Wellington stating that, as representations had been made to the Government on the subject, it had been determined to have a close season for mullet, during which the catching of that fish should be prohibited. It further stated that strong evidence had been furnished that these valuable fish do not now appear on our coast in anything like their former abundance. We are further told that the Government had taken much trouble "to procure all available evidence as to the increasing scarceness of the fish." We suppose we are expected to believe this as it emanates from Wellington, and from the Government. But it is difficult to take it all in. We publish elsewhere a communication from Mr. Bishop, of Customs Street, who ought to know if any inquiry at all had been made, and who says that he cannot find any one in Auckland who had heard anything about the proposal to make a close season until the announcement appeared in our columns. As to the mullet becoming scarce from the fishing that has been carried on, we simply do not credit the statement. If the few people now in New Zealand have already decreased the number of fish on our shores, when the colony is thickly peopled we shall not have a fish left. The assertion seems to us ridiculous. If it can be shown that during a certain portion of the year the fish are unfit for food, then by all means let fishing during that period be prohibited. But it is absurd to say that mullet are becoming scarce from over-fishing. In a matter of this kind there should be full publicity. It is of great importance, as it affects an article of food, and the means of livelihood of a large number of men. Who has collected the evidence that the fish are becoming scarce, and has determined as to the close season? We hear a good deal about promoting our fisheries, about forming fishing settlements, and encouraging large numbers of expert fishermen to come here. But how can we go on doing this if our coasts are already over-fished, and that the mullet is actually becoming scarce? Mr. Bishop says that the mullet carries five hundred thousand eggs, which is about one for every inhabitant of New Zealand. He adds, "There are various causes for their being scarce at times, but there are more mullet on our coasts now than there were years ago." At all events we protest against the secrecy with which this has been done. The evidence on which such a step is taken ought to be laid before the country, so that it may be seen if there is absolute necessity for it.

[Extract from the *New Zealand Herald*, 17th November, 1886.]

WHOLESALE DESTRUCTION OF FISH.

To the Editor.

SIR,—Five hundred bundles of flat-fish thrown overboard: call a meeting, elect a vigilance committee to protect the fish. Now, I have no knowledge of the particular five hundred bundles of flat-fish save through reading the letter of our respected citizen, Mr. Lewisson, in a late number of the *Herald*; but I feel sure the fisherman are not likely to catch fish and then throw them away if they could be sold, so I conclude the fish must have been unfit for human food. It is not to defend the parties that threw them away that I write this, but rather to express my surprise that men endowed with reason can think, in this nineteenth century, that five hundred bundles, or even five million bundles, of fish can have any effect on the number of fish in the sea. Nature is so prolific that the more we catch the faster they multiply. To illustrate my theory it will be necessary to state that in the month of August the fish were very scarce near Rakino Island, and my boats had to go up the Thames Gulf, nearly off Tapu. Here about ten boats (not all mine) could be seen, each manned by three men, hauling in fish as fast as it was possible to get them off hooks without barbs. Each boat would be from one to three miles apart, and the fish so thick that every hook has a fish on before it has time to go down 3 fathoms with 2 lb. of lead for a sinker. Now, what were those millions of tons of schnapper doing? Why, consuming flat-fish, soles, &c., at a rate that "wholesale" will not describe if we apply the word to the five hundred bundles alluded to. Nearly every fish caught would have more or less soles, eels, and flat-fish in their stomachs. If we think this over, and reason it out, we shall find that the number of flat-fish, &c., consumed by this shoal of schnapper would be many millions of bundles every minute. Now, the fish are again back at Rakino. What are they doing? Why, in place of eating one fish at a bite they are actually swallowing 500,000, more or less, at every mouthful—eating spawn of other fish by the ton. The wheel of nature is always turning, assuming different forms, never lessening the whole one atom, but so regulated by Him that fallen man is powerless to control or affect in the least. When I think of the wonders of the deep I am in the same fix as when I think of time and distance, as revealed to us by astronomers—lost in wonder. The fact is, the whole thing is beyond our power to control. In spite of all those facts I have alluded to, the Government are advised to proclaim a "close" season for mullet, thereby depriving a number of men of the means of living, and making their instruments of production worthless, in order that the next generation may not go short of mullet. It is all bosh! There is selfishness at the back of it. An inquiry should be held, *à la* Stark. In conclusion, I may explain that I am not interested in catching mullet. In fact, to take a narrow-minded, selfish view of the thing, it looks as if the close season for mullet would cause more demand for schnapper; but if we look a little deeper we shall see that true prosperity is only attained by making every other industrious person prosperous. Unless all the people are profitably employed, they have not the means of purchasing the wealth we are all engaged in producing. In my opinion, a "let alone" policy is the best policy to adopt, and in a short time we shall all fit into the grooves for which we are adapted. One year all the cry is, start fisheries, and the next year there is a howl to blot them out.—I am, &c.,

Rakino, 15th November, 1886. ALBERT SANDFORD.

[Extract from the *New Zealand Herald*, 19th November, 1886.]

THE CLOSE SEASON FOR MULLET.—CORRESPONDENCE WITH MINISTERS.

A few days ago, on the statement being published that the Government intended to proclaim December, January, and February as a close season for mullet, Mr. Bishop, fish-salesman, wrote, questioning the necessity of any such measure. On the Hon. Mr. Tole coming to Auckland Mr. Bishop was introduced to him by Mr. Thompson, M.H.R., and after some conversation he promised to telegraph to the Premier asking him on what evidence the Government had proceeded in proclaiming a close season. The following correspondence was the result:—

"Memorandum for the Hon. Mr. Tole, Auckland.—With reference to your telegram of 12th instant, on the subject of the close season for mullet, I find that the Order in Council prescribing a close season was not issued until after strong evidence had been furnished that the fish do not appear on our coasts in anything like their former abundance. Communications recommending a close season were received from Mr. Moat, M.H.R., also from Messrs.

J. Masefield, J. Gardner, and Ewing and Co. (all fish-curers at the Kaipara), and from Mr. J. Shepherd and Mr. J. Munro; the latter, who is Customs Officer at Whangarei, being an old and experienced fisherman. Information was also obtained from Auckland to the effect that the fish are in the best condition during the winter months, that they are most easily captured in the spawning season, December and January, when they come into shallow water to spawn, and that they do not recover their condition until March. It is stated that when the fish are caught immediately before the spawning season they are in such poor condition that when the roe is taken out very little of value is left for food. I enclose copy of a letter on the subject, which has been received to-day, from Messrs. Ewing and Co. —ROBERT STOUT.—Marine Department Wellington, 15th November, 1886."

"Batley, Kaipara, Auckland, 5th November, 1886.—The Hon. Commissioner of Trade and Customs, Wellington. Hon. Sir,—Confirming our respects of the 1st instant, we have since learnt from the Auckland papers that a close season for mullet is proposed to be gazetted now for the months December, January, and February, which we feel sure will be very satisfactory tidings to all who have any staple interest in the matter. At the same time, we notice that the proposal has called forth a certain amount of opposition, as shown by letters published in above papers; and although we do not think such opposition worth noticing, emanating, as it does, from fishmongers whose interest it is naturally to keep their trade going all the year round, and especially during the summer months, still we should be glad to hear from you should any serious opposition be made that would be likely to influence the question, as in that case we should be prepared to enter fully into the discussion, and bring to bear on the subject some evidence of weight, both of our own and of all the fishermen employed in this district. However, as yet the arguments published in the papers against the measure are from men whose only interest in the question are on an entirely different footing to those whose business it is to can the fish up in quantities for export and home consumption, and are so ridiculous and unable to bear the light of investigation that we do not think them worthy of discussion. It is surely the strongest argument in favour of the measure that all the canning companies in this district have always hitherto, of their own free-will, closed their operatons during December, January, and February, notwithstanding the expense it means to some to have their works lying idle.—We have, &c., EWING AND CO."

To this Mr. Bishop and the fishermen replied that the fish are as numerous now as ever they were on our coasts. And indeed it is absurd to think that the few people who now catch fish on our coasts can make any difference in the numbers of the mullet. If so, what will be left of our fisheries when the country is thickly populated, and when ten thousand fish are caught for every one now taken? There are, of course, times when fish are scarce, but these have nothing to do with anything done by man. The mullet, it seems, are in the best condition just before spawning. Spent-fish are not often caught, because when they spawn they hurry back into deeper water to recruit. The desire of the canners for a close season is accounted for by the fact that during the height of summer they cannot carry on their operations owing to the heat, while if fresh mullet are not allowed to be caught they will have a good chance of selling the canned article. It will be impossible to stop the catching of mullet altogether, for in many places the mouth of a creek is spanned by a net, and mullet and other kinds of fish are taken. So stands the controversy as to the mullet, and in the meantime the taking of mullet is illegal from the beginning of December to the end of February.

[Extract from the *New Zealand Herald*, 23rd November, 1886.]

THE MULLET CLOSE SEASON.

To the Editor.

SIR,—I have read with great interest the correspondence in your paper respecting the above. I have been engaged in the mullet-fishing from Auckland for the last twenty years. There is one fact I would draw the attention of all your readers to—namely, the price of mullet now and formerly. Twenty years ago the price from the boats was 17s. to £1 10s. per dozen. Now, Sir, if the mullet (according to the statement of Ewing and Co., Kaipara) do not appear on our coasts in the same numbers as formerly, what would be their price to-day, considering we have a population about four times larger? Why, they would be a great luxury, only obtainable by a very few wealthy individuals; but, on the contrary, they are found in larger numbers, and are cheaper than they ever were. You can now for 6d. get a larger mullet than formerly for 2s. These are facts undeniable. I may say that all of us fishermen caught more mullet last winter than were ever caught before within my experience. Then, why this cry to Government for a close season for mullet? The only answer, I hear, is for Ewing and Co. to sell their canned mullet, while we hard-working fishermen have to remain idle for three months and let the sharks and yellowtail eat the mullet that ought to be coming to market and sold as food for man. Now, Sir, I hope all the members for Auckland will stand by us, and not allow such a cruel thing to pass, whereby over twenty men and their families will be placed in a position of want, through the Government taking notice of men who are either not acquainted with anything pertaining to fish, or are actuated by base, selfish motives. I trust the Press will help us, and all impartial men, for we will not give up our bread without a hard struggle. I may say that the statement relating to spent mullet being unfit for food is true; but do ever any come to the market? I can say that during my fishing I have not caught more than a dozen fish in twenty years. We scarcely ever see them; they go into deep water to recruit.—I am, &c.,

Auckland. J. COPE, Fisherman.

Re the close season for mullet: A fish-curer informs us that to stop the fishing for a time is quite right, but it should have been a month earlier, as the fish are now spawning. The close season begins in November.

[Extract from the *New Zealand Herald*, 24th November, 1886.]

THE CLOSE SEASON FOR MULLET.

Our Matakohe correspondent writes: "In a few days, unless the Government recalls its veto, the new close season for mullet will commence. At the very time when the fish seek the shallow creeks, and settlers are able without much waste of time to take them—at the very time, too, when they are fattest and in best condition for the table, our sapient law-makers (of stoat and weasel notoriety) have prohibited their being caught. Is it possible that the mullet have become so scarce as to require protection? The whole of New Zealand, North and South Island, does not equal in population a first class English town; and it is therefore most alarming if the fishery is already beginning to fail. The herring-fishery is carried on in England and Scotland during the spawning season, and thousands of herrings are taken there for every mullet captured in New Zealand, and yet the fish are as plentiful as ever. It is difficult to believe the Government are not mistaken about the mullet; but if they, unfortunately, do require protection, why, in the name of common-sense, are the months of December, January, and February chosen? During these months the mullet-canning factories suspend operations on account, I believe, of hot weather, and the fish have comparatively a good time of it. Possibly our learned statesmen, having looked up the natural history of the mullet, selected the months because the fish are then in full spawn. But all the fish which have been soldered down in their tin coffins by Messrs. Ewing and Co. and Messrs. Masefield Brothers, during the now-expiring season, would, had they been undisturbed in the water, have been just as full of roe as any of those that are to be protected, and I am certain there are more fish taken in one week when the tinning-factories are in operation than are caught during the whole of the three months (December, January, and February) that they are closed. If there must be a close season, then why not make it earlier in the year, when fish are caught in large quantities, and not punish the poor settlers by stopping their supplies of mullet during the only period of the year that they can be caught near home? There is another point I should like to mention. During the proposed fence months young sharks and dog-fish come up the creeks in great numbers, and in fishing many of these enemies of the mullet are captured in the nets and destroyed. A few days before last Christmas 127 young sharks and dog-fish were taken here one afternoon in a net about 200 yards long. Now, supposing that each of these sea-vermin eat a mullet a day (a very low estimate), they would have destroyed by this time about 40,000 fish, or about ten times as many as I believe are

caught altogether in the Kaipara during the months of December, January, and February. To forbid the mullet being taken is, of course, tantamont to forbid net-fishing, as it would be impossible to prevent the protected fish from getting in the net, and mullet once meshed do not live. The new regulation will therefore be the means of taking away from the water-side settler, during the summer months, a grand supply of food, which he has hitherto depended on, and at the same time will be of no use whatever to the fish it is intended to benefit.

[Extract from the *New Zealand Herald*, 26th November, 1886.]

There has been a good show of mullet in town during the last few days, as the fishmongers seem determined to furnish those who delight in this fish with a meal before the close season commences. The fish look in splendid condition.

[Extract from the *New Zealand Herald*, 29th November, 1886.]

CLOSE SEASON FOR MULLET.

To the Editor.

SIR,—As a few people are of opinion that mullet are scarce in the Kaipara, I may state that a few weeks since I was offered Kaipara smoked mullet at 3s. per dozen, a price that speaks for itself. I believe the Kaipara curers do not run their establishments in the hot weather, therefore they wish a close season. To put jesting aside, I do really think the Government should proclaim a close season this summer for yachts and sailing-vessels that sail about the harbour for pleasure, as last autumn we had a lot of calms that seriously interfered with coasting vessels getting along. It is my opinion that the calms were caused by so many vessels using up all the wind, which, of course, will make the wind scarce and more difficult to raise. Certainly it will be very hard for the mullet men to raise the wind.—I am, &c.,

ALBERT SANDFORD.

To the Editor.

SIR,—I was greatly surprised at the ignorance displayed by Ewing and Co. when they stated to the Commissioner of Trade and Customs, Wellington, that the arguments used against a close season for mullet emanated from fishmongers, whose interest it was to keep the trade all the year round, and were not worth any notice. Now, Sir, it is quite evident that Ewing and Co. know as little about fishmongering as they do about fishing and the habits of fish. Now, as regards a fishmonger in the Old country, he is accustomed to have fish in season, and to be without a certain kind of fish for a time, which may be a close season in the case of salmon and a few river-fish; also, cod is not eaten during the three summer months; but there is no legislation to stop catching them or selling them. Now, a fishmonger's business is to sell fish, not any particular kind, but all fish that are eatable, and therefore it would not make any difference to him—as people will eat fish; if not mullet, they will have other sorts. I may say, for the public information, having lived in and near Holland for some time, that previous to 1857 the Dutch fishermen were hampered by the Government in various ways, by making close seasons for one fish and another, the result being that year by year the fisheries were declining; but in 1857 all restrictions were removed, and the result is that there are more than twice the smacks engaged in the fishing, and many of them double the size. Now, will a Government, on the evidence of a few men (who imagine by keeping the fresh mullet out of the market will enable them to sell their canned), stop an industry in its very infancy, and throw men and their families out of their means of living for three months at the present time, when there is so much depression? I hope all intelligent people will help to put down such a monstrous thing. How is it our members are so silent? I believe Mr. Tole will do his best; but he must be supported. The fishermen ask no favour, but fair-play and common-sense to be used in making their laws. And if our Auckland members will inquire into this, and ask impartial men for evidence, we shall soon have the thing put right.—I am, &c.,

29th November, 1886. W. NELSON, Fishmonger, Queen Street, Auckland.

[Extract from the *New Zealand Herald*, 3rd December, 1886.]

CLOSE SEASON FOR MULLET.

I am informed that the Hon. Mr. Tole, Minister of Justice, has, in the form of a memorandum, submitted to the Hon. Mr. Larnach the information collected by him during his recent sojourn in Auckland respecting the alleged scarcity of mullet upon the New Zealand coast. Mr. Tole tells me that this information comes from expert fishermen who have been connected with the industry for years. According to this testimony mullet were never more abundant or cheaper than at present. I learn from another source that the question at issue is purely one of fact; that he will carefully consider the whole of the evidence, and will at an early date be in a position to say whether the restriction upon catching mullet by the recent Order in Council should be removed.—(Own Correspondent.)

[Extract from the *New Zealand Herald*, 4th December, 1886.]

CLOSE SEASON FOR MULLET.

A correspondent, over the signature of "Mullet," writes from Awanui on the above subject: "In your issue of the 6th November, I see the Government are about having a close season for mullet. Now, I think before the Government took upon themselves the responsibility of throwing two or three hundred men out of employment in these hard times, with their families to starve for three months, they should have had an open inquiry, and got the experience of real practical men. They would then have found that the mullet are far more plentiful on the New Zealand coast now than they were twenty-one years ago, when I started fishing in New Zealand waters. When steamers began to frequent the bays and harbours I have found that the fish have disappeared, but only to appear in greater numbers in the bays where there were no steamers going. Now, as the New Zealand Governnent profess to foster local industry, they could not do the people of New Zealand a greater kindness than let the fishing industry go unfettered, and make some provision for the present unemployed, and not add to their numbers."

[Extract from the *New Zealand Herald*, 20th December, 1886.]

OUR HARVEST OF THE SEA.—SHOULD IT BE PROTECTED?—OPINIONS OF T. L. CHEESEMAN, F.L.S.

Considerable controversy has lately taken place as to whether or not New Zealand's fish-supply, particularly mullet, should be conserved by means of a close season. Some have contended that cessation from catching mullet is not required; while others have averred that unless the fish remain unmolested during at least their spawning season the supply will diminish. Mr. Cheeseman, the curator of the Auckland Museum, having devoted attention to the colony's "harvest of the sea," a *Herald* representative recently waited upon him to ascertain his views.

Statistics Wanted.

"It is rather a difficult question, that of a close season for mullet," said Mr. Cheeseman, in answer to the question put to him, "because we know so little of the life-history of the mullet, and we have so few statistics as to the annual take, and the number of men employed in the fishery. It is, therefore, hard to compare the take of one season with another, and find out whether the fish are stationary in numbers, or whether they are increasing or diminishing. My own opinion is that a close season, not of very long duration, is advisable.

"What are your reasons for saying that?—My reason is that of all our food-fishes the mullet has, by far, the narrowest range. It is found, in fishable quantities, between the North Cape and the Bay of Plenty on the east coast, and Kawhia Harbour on the west coast. In addition to that, it is only found in shallow water with a muddy or

sandy bottom. On rocky coasts and in deep water—and by that I mean, say, water of over 20 fathoms—it is not found at all. On the east coast, consequently, it is only found in the harbours and tidal estuaries, or in certain sandy bays, and these only constitute a small portion of the coast-line. On the west coast the mullet seems to be more generally distributed. But the heavy surf that is continually breaking on the open sandy beaches that form pretty nearly the whole of the west coast, makes it impossible to use the nets, except for a very few days in the year. So that, practically, on the west side of the island, the only mullet-fishing is in the harbours of Hokianga, Kaipara, the Manukau, Raglan, and Kawhia."

But partially distributed.

"Is there any reason for the mullet confining itself to such a limited area?—The reason of the partial distribution of the mullet is in the nature of its food, which consists of certain minute—in fact, microscopic—organisms, which we find on the surface of the mud, or sand, in shallow water, and nowhere else. The mullet works this about in its mouth, rejects all the large and rough pieces—in fact, all the coarse, indigestible matter—the remainder being strained through a peculiar filtering apparatus at the mouth, and swallowed. You will see from the facts I have stated that the mullet is only found in comparatively few localities—that it would be a very easy matter to reduce their number. I do not mean to say that I have any evidence that the mullet has already been seriously interfered with so far as numbers are concerned, because we have no statistics, but a short close season could do no harm."

The Fishermen.

"It is contended that a close season would throw a number of fishermen out of employment?—I do not think it would do them very much harm, and at the same time it would be a very wise precaution. There is no greater fallacy than the belief, which many people entertain, that because any fish, or any other animal, is found in large numbers that consequently there is no fear of those numbers being reduced. In fact, in other countries, it has frequently been that this belief has been acted upon until a species has gone some distance towards extermination. It is, perhaps, worth while mentioning the case of the American shad, a fish of the herring family, once common over the whole of the Atlantic coast of North America. It was particularly abundant in the Potomac, and was caught in enormous quantities. The number taken to market gradually increased until 1873, when nearly a million and a quarter were sold in Washington alone. The numbers then rapidly declined, until in 1878 only 170,000 were marketed. Scientists who were employed to investigate reported that this decrease was entirely due to over-fishing; and it was plain the species would soon be exterminated. The United States Government interposed, brought in legislation compelling the removal of fixed nets, which had prevented the fish from reaching their spawning-beds, and also established a hatchery for the artificial production of the fish. It has only been through very large expenditure that the Potomac has been, to some extent, restocked. In the same way cod has been almost exterminated along portions of the Atlantic coast of the United States, where it had once been very plentiful; and there again they have been compelled to attempt restocking. Of course the cod is still plentiful in other places. But I mention these two facts to show we must not believe that because the mullet is plentiful it is going to stand the very large and fixed drain upon its numbers. We should rather attempt to anticipate matters, and, by means of a close season in spawning-time, effectually prevent the fish being disturbed when they visit their spawning-beds."

Increasing Depletion.

"With a growing population there will be a growing demand for fish year by year, and the depletion of number will increase constantly. That would appear to be the inevitable outcome of your reasoning?—Precisely. And in view of that, it would be very short-sighted policy, I think, to allow indiscriminate fishing. This point must be borne in mind: Most people, when thinking of our fisheries, think of the coast-line as being of so many hundred miles from north to south, and that being so, we have an inexhaustible fishery. They entirely forget that though the coast-line is so very extensive, the area of shallow water is very small indeed. We have only to go a very short distance from land to get several hundred fathoms, which is far too deep for our food-fishes. In Great Britain there is the whole of the North Sea, which stretches right across from England and Scotland to Norway, and the whole of which is shallow water; in fact, it is one immense fishing-ground. We have nothing whatever comparable to that in New Zealand, and have not such illimitable resources.

"And yet there has had to be protection there?—Yes; they have to adopt very stringent measures, although these matters have been very greatly neglected even there. Salmon-fishing only exists now in consequence of protective measures of a very severe kind indeed. If it were not for the exertions of the United States Fish Commission, there would be very little salmon left on the eastern side of North America. In the early gold days so many Tasmanian oysters were sent to Melbourne that the beds gave out, and a scientist had to be brought from England to do what he could. Now there is a prospect of things recovering themselves there. All this points to the fact that interest is best served by a limited amount of protection in time. People who fight against it, really, in my opinion, are fighting against their own interests.

"When would you suggest as a fitting close season?—About two or three months at spawning-time. That is at the hottest part of the year, when one would think, at any rate, the canning operations were rather risky. It is," said Mr. Cheeseman, in conclusion, "in my opinion very important that no fish or animal of any economic importance should be allowed to have its numbers greatly reduced, and it would be far better, even as a protective measure, to have a close season for our fish."

[Extract from the *New Zealand Herald*, 13th February, 1896.]

IS A CLOSE SEASON FOR MULLET WANTED?

To the Editor.

SIR,—I have read several letters in the *Herald* lately respecting the above. I would like to place a few facts before the public about fish when they are spawning. In the first place, I may say I do not know where there are laws in any country having a close season for any kind of sea-fish (shell-fish not included). Mr. Frederick M. Wallem, in his work on the fish-supply of Norway, says, "In these thousand years there has never been any fear that the enormous takes of spawning fishes should have any bad effect on the schools. The places where the fishing is carried on are exclusively spawning-places. Scarcely any shoals are found there during the rest of the year." The late Professor Huxley has described the coming in of the cod on the coast of Norway in the months of January and February as one of the most wonderful sights of its kind in the world. The fish then form what is called a cod's mountain of a depth of from 120 ft. to 180 ft., and the fishermen, when they let down their loaded lines, feel the lead knocking against the bodies of the fish for a long time before it gets to the bottom. A careful calculation has been made, with the result that there are about 120,000,000 cod to the square mile in such a shoal. At the Lafoten fisheries it is stated that about 26,000,000 cod are taken during the spawning season; but what is all this to the numbers remaining? And it has never been proved that the schools of cod-fish at Lafoten have decreased for the last thousand years; the facts, indeed, leading to the contrary conclusion. That the schools have increased very much in spite of large takes is more probable, as the cod-fish sometimes are thin and meagre owing to want of food procurable amongst such enormous numbers of fish. What is said of the cod is also applicable to herrings and other kinds of fish. Herrings have been known at the spawning season to come along the coast in such quantities that thousands have been driven ashore and picked up dead on the beach. And I never came across any one who wanted herrings but what they asked for either a soft or hard roe. And when the herrings had no roes there were but very few selling. (I may say I have sold thousands.) Are the herrings scarcer to-day than they were fifty years ago? I say most decidedly No, when we consider there are about from 14,000 to 20,000 spawn to each fish. The question is often asked, What is the cause of fish being scarce sometimes for two or three seasons? Let us turn to the blue-book on fisheries, published by the Imperial Government in 1878. Mr. Frank Buckland and Mr. Spencer Walpole, who were Inspectors of Fisheries at that time, say that, "So far from the stock of fish decreasing, we believe that the supply of fish taken on the whole is at least as great as it ever has been. Sometimes there are

scarcities of fish in season. We all know the enormous influence which a warm or cold year has on the production of insect and vegetable life. Precisely the same thing occurs in the ocean, and the minute forms of life on which fish feed are very sensitive to the warmth or cold of any particular season. When there is a failure of these forms of life the fish are obliged to scatter in search of food, and are not therefore collected together to be so easily caught by the net fishermen." These facts apply to all our fishes in New Zealand, so that we need not fear that in a few years there will not be any fish, or that any particular kind of fish will be destroyed by over-catching at spawning or any other time. Many of the readers of this will remember the times when they have had a nice bloater with a hard or soft roe, as their taste dictated, and will not be frightened by the silly remarks some of your correspondents have stated as regards fish at spawning-time. I could state a great many more facts from my own knowledge and from that of scientists, but I think these statements will show that no close season is needed for sea-fish. Certain people may like it for selfish purposes, but not for the good of the many.—I am, &c.,

C. BISHOP, Fishmonger.

[Extract from the *New Zealand Herald*, 3rd February, 1896.]

KILLING THE GOOSE THAT LAYS THE GOLDEN EGG.

To the Editor.

SIR,—Formerly there was a nominal close season for mullet, but the law was framed in such a way that it could be, and was evaded every year. A close season was established last year, but for some reasons has been altered, and a great scientist investigated the matter, with the result that things are worse than before. Certain fishermen have started fishing and canning a fortnight ago, although it is only the middle of the spawning season, and we maintain, with all due deference to scientific or any other opinion, that mullet is unfit for canning purposes during that time; and we further maintain that the mullet industry will die a natural death if a close season is not properly and strictly enforced. We want to look for the future, and do not want to see the industry we have started killed by a lot of short-sighted people.—We are, &c.,

MASEFIELD BROTHERS.

[Extract from the *New Zealand Herald*, 12th February, 1896.]

KILLING THE GOOSE THAT LAYS THE GOLDEN EGG.

To the Editor.

SIR,—Under the above heading a letter appeared in your issue of the 3rd February signed "Masefield Brothers," in which they seek to establish that in the interests of the mullet-canning industry there should be an extended close season during which that fish would be prohibited from being caught. They contend that for some additional months mullet are unfit for canning purposes, and that the industry will die a natural death if a prolonged close season is not properly and strictly enforced. Now, Sir, owing to the representations made by Messrs. Masefield Brothers, the Government last session extended the close season for catching mullet from the 1st December to the 31st March; but upon Mr. Ewing and others interested in that business representing to the Ministers and members of Parliament that a great injury was being done both to the industry and the firms engaged in same, the newly-imposed and altogether unjust restriction was cancelled, and the close season remained as before. Finding that those interested in the industry differed so materially in their opinions as to the time the close season should exist, the Government wisely decided to obtain expert information upon the question, and appointed Sir James Hector to deal exhaustively with the matter. That gentleman visited the Kaipara, and spent considerable time on the Otamatea River, especially obtaining during his stay mullet caught both in that river and the Kaipara Harbour. The results of the Government expert's scientific investigation are reported to be adverse to a general close season, an opinion which is indorsed by all practical fishermen at Kaipara. Anticipating that Sir James Hector's report would be unfavourable to their views, Messrs. Masefield Brothers say in their letter that what they maintain is right, "with all due deference to scientific or any other opinion." Scientific investigation, made by a gentleman totally unbiassed and enjoying a high reputation; the experience and knowledge of others engaged in the mullet-preserving industry; of the fishermen employed, are of no value when opposed to the opinion of Masefield Brothers. Why this firm contend upon this question as they do may be easily explained by those who are aware of the facts. It may suit Messrs. Masefield Brothers splendidly to discontinue the mullet-canning industry from the 1st December to the 31st March, so that they can utilise the same plant to carry out their fruit-canning; but how about firms who have not immense orchards of fruit to preserve? They must, forsooth, close down for months until the fruit season is over. Sir, this is February—about the middle of the period Messrs. Masefield Brothers claim mullet are not fit for canning—and we can give you our personal experiences of mullet caught during the last two weeks. We say unhesitatingly the fish are in splendid condition—especially suitable for canning; and we are glad to be able to state are as plentiful as at any time in our long experience in these waters. Messrs. Masefield Brothers and the general public may rest assured that our company for one will not assist in any way to "kill the goose that lays the golden egg" either by canning ill-conditioned mullet or in any other respect; but we most strongly object to having to close down for months to serve the private interests of an opposing firm.—We are, &c.,

Otamatea, Kaipara, 5th February, 1896. THE ZEALANDIA CANNING COMPANY.

[Extract from the *New Zealand Herald*, 15th February, 1896.]

CLOSE SEASON FOR MULLET.

To the Editor.

SIR,—I shall be obliged if you will grant me space in your columns to reply to the letters signed "Masefield Brothers," which have appeared on above subject.

A close season was not established last year. An Order in Council was issued making certain alterations in time and area affected by the regulations; but, as these alterations were condemned by all canners and fishermen in the Kaipara with the exception of one firm, that Order in Council was cancelled before the date on which the new regulations were to come into operation, and the regulations which have been in force for some years remain as before. Now, as the regulations at present are exactly identical with those which have been in force for some years, how can things be worse than before? The Government, very rightly, deciding that legislation without knowledge as to the exact condition of the fish and their habits might prove infinitely worse than no legislation at all, appointed Sir James Hector to investigate and report. That gentleman, until he began his investigation, was, I believe, an absolute stranger to all the canners, and had no bias or personal interests in the matter. His duty was simply to ascertain facts and report same. He has devoted considerable time and taken much trouble to get and demonstrate the facts of the case before giving his opinion, and in this he differs from the writer of the letters under reply, who seems to consider his *ipse dixit* sufficient to end argument. Masefield Brothers writes, "Mullet are plentiful in summer months, when fish come into the rivers to spawn." If he is so certain that mullet spawn in the rivers and creeks, and as the three rivers Otamatea, Oruawharo, Arapaua and their tributaries are closed under existing regulations, what more does he want? But the fact is, he is quite aware that Sir James Hector has shown that it is almost a certainty that mullet do not spawn in the rivers and creeks. Sir James had fish caught in January (which Masefield Brothers state is the middle of the spawning season) in the rivers and creeks at Bay of Islands, Hokianga, and Kaipara. Those caught in Kaipara were cleaned and examined by Sir James Hector, Captain Smith (Harbourmaster), Captain Ross (master s.s. "Wairoa"), myself, and a few others. The result of the examination was, not one spent fish was found. Not one fish with fully developed roe was found. A few fish with roe from quarter- to half-developed were taken, but the great majority were fish which could not have shed spawn this year, and the balance were mostly fish which could not have spawned during present close season. On the other hand, every fish was fat, most of them very fat; every fish was sound and firm-fleshed throughout, and in every way splendid fish, in perfect condition for eating and canning—in every way better fish than I anticipate getting in April. However, fish taken at the Heads, or outside the Heads of the harbours, were nearly all full-roed fish, some of the roes weighing fully 12 oz. Surely, with all due deference to Masefield Brothers, this evidence entirely disposes of the opinion, unsupported by any evidence, of any individual or firm. Before leaving

this part of the subject I wish to say that, so far as I am aware, no person has ever seen newly and naturally shed mullet-spawn in any of the creeks or on the banks or flats in the rivers, though it has been diligently searched for. Again, it is a very rare thing for a newly-spent mullet to be caught; personally, I cannot remember ever having seen one, and fishermen who have fished in Kaipara for over twelve years informs me that the number of such fish caught by them during these years is under one dozen. In support of his statement that fish are now getting scarce, Masefield Brothers, writes, "Last year Masefield Brothers took 2,000 dozen less than in 1894." This is one of those half-truths which Tennyson has so well characterised, and which are so misleading. In 1894 more mullet were taken and canned in Kaipara than in any previous year, and, though it may be true that Masefield Brothers canned 2,000 dozen less in 1895 than in 1894, that proves no scarcity of fish, for taking all the canneries together the number of mullet caught and canned in 1895 is not far from double the quantity canned even in 1894.—I am, &c.,

W. N. Ewing.

NEW ZEALAND INSTITUTE.

New Zealand Fisheries, and the Desirability of Introducing a New Species of Sea Fish, by G. M. Thomson, F.L.S.

[Read before the Otago Institute, 8th October, 1895.]

In the official record of the New Zealand and South Seas Exhibition a short sketch of the fisheries of the colony was given by the present writer. It was necessarily imperfect, for, as was pointed out, "there are no statistics as to the number of persons dependent upon the fisheries; the number of men actually engaged in fishing, curing, &c.; nor as to the number, quality, tonnage, &c., of the boats employed." In the six years which have elapsed since the above was written very little additional information has been collected or is available, but considerable developments have taken place in various localities, as, for example, at Napier, where one or two little steam-trawlers are employed where a few years ago nothing much bigger than a punt was utilised. Practically no additions have been made to our knowledge regarding the fishes themselves and their life-histories, and of the biological and physical conditions of the surrounding seas as far as these refer to the fishing industry. But it is true, as I wrote before, that, "among all the sources of natural wealth which this colony possesses, her fisheries must always occupy a prominent place. Great as is her mineral, pastoral, and agricultural wealth, she only shares these in an almost equal degree with her great sister-colonies of Australia; but in her fisheries she holds a unique position. Her coast-line of some 5,300 miles in length, indented by numerous bays, fiords, and estuaries—very many of them sheltered in nearly all weathers—renders it possible to carry on the fishing industry the whole year round with but little interruption." Such an adjustment of trade relations with Australia as would enable New Zealand fish to be entered free of duty at all ports would do very much to further our fisheries. Meanwhile I wish to draw the attention of members of the Institute to the subject, with the view of stirring up more interest in the subject generally, and, if possible, of getting steps taken to enrich our sea fisheries by the introduction of the finest edible fishes of other countries. I propose to divide the subject roughly into three parts, as follows: (1) Present state of the fisheries; (2) Laws at present in force regulating the fisheries; (3) Possibility or advisability of introducing new and desirable species of fish.

(1.) As already pointed out, the information on the present state of our fisheries is very meagre. By the census returns for 1891 the number of persons specified as fishermen in the colony is 565, and if we include persons engaged in fish-canning, oyster-dredging, &c., the total number occupied in the fishing industry is only 667. In "The Sea-fisheries Act, 1894," one clause reads, "Every sea-fishing boat shall be licensed, and for that purpose every such boat which is not of tonnage sufficient to require entry on the register under any Act relating to the registry of British ships shall be entered in a register for sea-fishing boats by the Collector at the port of the place to which such boat belongs, or at the port nearest to such place." This, no doubt, has special reference to oyster-fishing, and all boats engaged in this industry are, I presume, registered. But the Act does not draw any such limitation; consequently, on my applying to the Marine Department for information, I was surprised to learn that the "number, weight, and kind of boats employed" (*i.e.*, in the fisheries generally) "and the value of the catch, cannot be ascertained." The department has, however, kindly supplied me with the accompanying return, which is of interest:—

Return showing the Quantity and Value of Fish imported into and exported from New Zealand during the Years 1884, 1889, and 1894.

Year.	Fish canned.		Fish cured.		Fish frozen.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	Imported.					
	Cwt.	£	Cwt.	£	Cwt.	£
1884..	13,493	42,473	4,533	8,613	..	..
1889..	6,434	17,435	2,220	3,857	..	..
1894..	8,776	23,178	2,615	4,091	..	..
	Exported.					
1884..	203	523	139	222	155	150
1889..	1,315	4,072	7,778	5,774	1,384	1,247
1894..	1,133	3,264	741	672	4,640	3,683

Exported for Bonus (included in above figures).

(The Fisheries Encouragement Act, granting a bonus, was passed in 1884.)

	Tons	cwt.	qr.	lb.	£	s.	d.
Canned, 1d.—							
1889	45	9	2	16 ..	424	10	0
1894	25	19	3	12 ..	242	12	0
Cured, ½d.—							
1889	230	4	3	0 ..	537	4	5
1894	4	6	3	4 ..	10	2	6
Cured, ¼d.—							
1889	128	2	0	8 ..	149	9	1
1894	16	3	1	21 ..	18	17	4

Total—1889, 404 tons, valued at £1,111 3s. 6d.
1894, 47 tons, valued at £271 11s. 10d.

Last year the colony imported canned and cured fish to the value of £27,269, an increase of £5,977 on the figures for 1889. The value of fish exported was only £7,619, a decrease of £3,474 in the five-yearly period. The diminution in the value of canned and cured fish during that period is remarkable, and not very encouraging.

(2.) The laws amending the sea-fisheries of New Zealand are embodied in "The Sea-fisheries Act, 1894," which repeals all previous Acts. The provisions of this Act have no doubt been carefully thought out by the framers, but it contains at least one clause which is in my humble opinion either premature or unworkable. Thus, clause 14 states that "All nets containing fish shall be emptied in the water; and every person who drags or draws on the dry land any such net is liable for every such offence to a penalty not exceeding twenty pounds." It is surely a mistake to pass laws which cannot be enforced. This is certainly one of them, for in many parts up and down the coast it is quite a common thing for people resident near the sea-shore to drag in the surf, and in this way often make a good haul. If this is illegal by the Act, then the Act should be amended; but whether it is or not, it cannot be enforced, and is therefore absurd. No doubt the main object of the Act is to provide a basis on which further legislation can build up such additions as are required from time to time.

Clause 12 of the Act specifies that "The Governor, by Order in Council gazetted, from time to time may declare that in any part or parts of the colony any species of fish, oysters, or seals shall be protected and come under the operation of such of the provisions of this Act as may be specified in such Order in Council, and may from time to time revoke, alter, and amend any such order." By an Order in Council gazetted on the 2nd May, 1895, it is provided that "Any person who takes, buys, sells, exposes for sale, or has in possession, any fish of any of the species enumerated in the Schedule hereto of a less weight or size than that set opposite the name of such fish in the said Schedule, is liable to a penalty not exceeding twenty pounds: Provided that for the purposes of this regulation, during a period of three months from the date hereof (but no longer), a person shall not be deemed to take or have in possession any fish if, having unintentionally caught the same in a net or seine of lawful mesh whilst lawfully fishing therewith, he returns all such fish to the water when sorting out the haul."

Schedule.

Description of Fish.	Weight.	Description of Fish.	Weight.
Hapuku	5 lb.	Kingfish	3 lb.
Kahawai	6 oz.	Warehou	4 oz.
Schnapper	1 lb.	Mackerel	8 oz.
Tarakihi	4 oz.	Blue-cod	8 oz.
Trumpeter	1 lb.	Rock-cod	8 oz.
Moki	8 oz.	Red-cod	8 oz.
Barracouta	8 oz.	Gurnard	4 oz.
Horse-mackerel	4 oz.	Mullet	4 oz.
Trevally	4 oz.	Butterfish	4 oz.
	Length.		Length.
Flounder	9 in.	Garfish	9 in.
Soles	9 in.	Herring	5 in.

This seems to me a regulation of questionable value. No subject relating to sea-fisheries has been more debated than the possibility which may exist of exhausting the supply. The consensus of opinion to-day, gathered from the information now being rapidly accumulated in Europe and America, may be summarised as follows: (*a.*) It is possible very easily to exhaust all fisheries which are purely local, such as—(*a*) beds of oysters and other mollusca, and (*b*) flat-fish fisheries in inland waters, or in more or less enclosed areas. (*b.*) Fisheries confined to a limited zone, such as those of crayfish on the coast, are also capable of depletion, especially near centres of population. (*c.*) On the other hand, fisheries in the open sea cannot easily be effected, except within range of the fishing fleets of densely-peopled countries.

When one considers the enormous number of ova produced by most species of fish, it is difficult to believe that any amount of fishing can make the slightest appreciable difference in the available supply. We have absolutely no data regarding the number of ova produced by our New Zealand fishes, but trustworthy and accurate information has been collected regarding many of the European species. The following figures are taken from the Ninth Annual Report of the Fishery Board of Scotland, 1890 (p. 254, &c.). The number of ova taken from a single individual of the following species was: herring, 22,000 to 47,000; whiting, 109,000 to 131,000; haddock, 156,000 to 806,000; brill, 825,000; halibut, 1,490,000 to 4,451,000; cod, 2,963,000 to 6,652,000; turbot, 5,612,000 to 10,114,000; ling, 12,300,000 to 28,360,000. One large fish of the last-named species, 96 in. long, weighing 86 lb., had a roe weighing 14 lb., and estimated to contain 60,000,000 ova.

Dr. T. Wemyss Fulton, who is at the head of the scientific department of the Scotch Fishery Board, points out in the report just quoted that the Royal Commission of 1854 recommended that no restrictions whatever should be made in regard to the sea-fisheries, and, as the late Professor Huxley put it, every one should be free to fish "where you like, when you like, and as you like." The Royal Commission appointed in Belgium in 1865 made the same recommendations. The Scotch Commissioners of 1863–66 "went very exhaustively into the subject, and apparently found no trustworthy evidence of over-fishing; and they recommended 'that all Acts of Parliament which profess to regulate or restrict the mode of fishing pursued in the open sea be repealed, and that unrestricted freedom of fishing be permitted hereafter'"; and this was done by the Act of 1868. The Commission of 1878 stated "that there was no evidence that the supply of fish generally on the coasts of England and Wales is decreasing"; while the last great Commission stated that, as regards offshore waters, "no decrease, except in the case of soles, has been proved in the total takes of the North Sea." Since the publication of the report of this Commission several biological stations have entered on the investigation of the question, and Dr. Fulton points out (chap. i., p. 274) that "Within the last few years a certain amount of definite knowledge has come to the surface, particularly in relation to the North Sea fisheries, which leaves no room for doubt that over-fishing has occurred, and is going on to a serious extent." This over-fishing he attributes to the rapidly augmenting populations round the North Sea, and the vast increase in the extent and efficiency of the machinery of fishing.

It is difficult to give anything like a correct estimate of the great number of boats and men engaged in the fisheries of the North Sea and its neighbourhood. To take Scotland alone: In 1889, over forty-nine thousand men and boys were employed in the boats, besides fifty thousand who found occupation on shore; fifteen thousand boats, of a total tonnage of 125,000 tons, valued at £777,000, together with nets valued at £713,000, and lines at £125,000, were in use. In the same year thirty-eight steam-trawlers, of 4,369 tons burthen, valued at £110,000, were employed; but in 1891, two years later, the number of steamers had increased to sixty-one, of 5,929 tons, and valued at £208,000. The majority of these boats were employed in the North Sea. When we remember that in addition an immense number of boats are employed by England, France, Belgium, Holland, Germany, Denmark, Norway, and Sweden fishing in the same limited area, we need not be surprised that the total available number of certain kinds of fish in the North Sea has of late shown signs of diminishing. But no such possibilities occur in this colony. It is surrounded on all sides by an ocean of vast extent. The population of the coast-lines of the habitable lands in these southern seas is extremely sparse, and it is not likely to become very dense for a considerable length of time, so that there is no possibility of even perceptibly diminishing the fish-supply, as far as all offshore fish are concerned. This being so, it seems to me that while clause 12 of the Act of 1894, giving the Governor power to declare any special fish protected, should stand, the Order in Council of 2nd May last might, without any harm to the fisheries and with advantage to fishermen, be rescinded, and that a new order should be issued protecting only all flat-fish and grey-mullet (*Mugil perusii*) up to a certain size.

A second objection against the regulation of 2nd May, as gazetted, is the want of scientific accuracy in the schedule. The most of the fish named are well enough known by their popular appellation perhaps to stand, but several are obscure. If the regulation is to remain in force these ought to be more strictly defined. For instance, what is mullet? In Auckland the grey-mullet, or kanae (*Mugil perusii*), is meant; in Dunedin it is the sea mullet (*Agonostoma forsteri*), a totally different fish. The schedule limits the size of the blue-cod to 8 oz., and of the rock-cod to 8 oz. But these two names apply to one and the same fish (*Percis colias*), the first name being that by which it is known in the southern part of the colony. Lastly, what is meant by the herring? The so-called Picton herring is affirmed by some to be the sea-mullet (*Agonostoma*), while the fish which is so abundant round the southern and south-eastern coasts of this Island in the early part of the year is the sardine or pilchard (*Clupea sagax*).

The general conclusion I would arrive at is that there is very little need for fisheries legislation at the present time in this colony, particularly as such legislation is apt merely to harass those engaged in a struggling industry, without any compensating advantage to either the community at large or to the industry itself.

(3.) I now come to the third portion of my subject—viz., the possibility or advisability of introducing new and desirable species of fish into the New Zealand seas, and in this connection I would for the present confine my remarks to the following fishes: Cod, herring, and turbot; and to one crustacean, the edible crab, or partan, of Britain (*Cancer pagurus*).

I wrote to Dr. Fulton last year on this question, and he has favoured me at some length with his views on it. I quote the following extracts from his letter of 8th November, 1894: "It seems to me that two points should first of

all be cleared up before the experiment is tried: first, the physical and biological condition of the area where it is proposed to place the fish or their eggs, so far as it may affect the experiment; and, secondly, the means and methods of transport that may be available. The introduction of a new form in this way may be done by means of a considerable number of adults before the spawning-time, or by eggs or fry, but in any case the success of the experiment will depend upon the survival of the first generation to the reproductive period in numbers sufficient to carry on the species. The two points in regard to the physical conditions which should be investigated are the temperature and the currents, both of which might be simply ascertained. I need say nothing about the influence of the temperature, except that it has been too much exaggerated; but from experiments we have now in progress it appears that the action of the currents might have an important bearing upon the case by transporting the pelagic ova or fry a considerable distance from the place where they, or the adults producing them, were placed in the sea. In regard to the biological conditions, it would be important to ascertain the spawning-time of the native species, and when their eggs and larvæ are found in greatest abundance in the sea, for it can scarcely be doubted that that would be the preferable time to introduce the new forms, as the minute life upon which larval fishes prey is then most abundant, and the other conditions most suitable."

It would seem at first sight, from the enormous fecundity especially of the cod and turbot, that, even if one or two adult fish could be introduced into these seas, and their ova were once liberated and fertilised, the experiment would be bound to succeed. But a remark of Dr. Fulton's on this matter is worth quoting here. He says, "A single female turbot may produce in one season 9,000,000 or 10,000,000, a cod 6,000,000 or 7,000,000, a ling 20,000,000 or 30,000,000, a haddock 500,000 to about 1,000,000, and so on. The import of this enormous fecundity has frequently been altogether misunderstood; arguments have been based upon it to show the inutility of interference in fisheries. In reality, fecundity is a measure of the natural destruction that occurs in the life-history of any species, since, on the reasonable assumption that the total number of a species remains fairly constant over a period, it is only necessary that a few individuals of the new generation should, on the average, survive to the reproductive stage in order to keep up the relative abundance of that species. Hence the proportion of the eggs produced by sea-fishes which give rise to reproductive individuals is infinitesimal. Of the 10,000,000 produced by the turbot, 9,999,998, or thereabout, take no part in the production of another generation, but are destroyed at one period or another when left to natural conditions. So with other species." (Tenth Annual Report, page 190.) The enemies which the young fish would have to encounter here are just as numerous as in their native seas; so that, unless the young fish after escaping from the egg were protected for a time, the chances against their survival would be very great.

In order to arrive at any sure ground on which to base conclusions, I propose to consider, first, what is known about the life-history of these fish bearing on this subject; and, second, what we require to know about local conditions as affecting the possibilities of carrying out any experiment to a successful issue. My facts under the first head are chiefly drawn from the annual reports of the Scotch Fishery Board, supplemented by papers in the Journal of the Marine Biological Association of Great Britain.

The cod (*Gadus morrhua*) spawns in Scottish waters from about the end of January to the end of May, but chiefly in March. As is the case with the majority of food-fishes, the eggs float at the surface of the water, and remain floating up to the time of hatching. The ova hatch out in about fourteen days, when the temperature of the water is 6·52 deg. C. This seems to be about an average temperature for the surface-waters of the east of Scotland towards the end of April. With a lower temperature the process of hatching is retarded. I have no data with regard to the cod, but, taking the figures given in the twelfth annual report for the plaice, I find that with a temperature averaging 5·24 deg. C. the eggs took twenty-one days to hatch out, while at 8·86 deg. C. they only took fourteen days. By lowering the temperature of the water in the hatching-boxes it would then be quite easy to retard the hatching for some weeks. In January, February, and March, when cod begin to spawn, the temperature may range from 3 deg. to 5 deg. C., but it would seem that very few fish hatch out till April, when the temperature begins to rise steadily. It would therefore be a very simple matter to obtain eggs during these months, and transmit them to New Zealand by direct steamer in suitable boxes, supplied with a steady stream of sea-water cooled probably to 0 deg. C., as recommended by those competent to do so. Such eggs would arrive in the colony in the month of May, and would have to be dealt with at once. Perhaps adult cod could be brought out in suitable tanks. Dr. Fulton, however, seems to think that the carriage of round fish will always be a matter of greater difficulty than that of flat-fish, and there really seems no reason why fertilised ova could not be easily carried and kept during the voyage at such a temperature that their hatching could be retarded for several weeks. The hatching of cod and the protection of the fry for a very brief period is now carried on on a vast scale in many countries. When it is remembered that the greatest destruction of fish takes place while they are still in the egg, the ova being cast forth by millions into the open sea, and devoured in the great majority of cases before they can hatch, it will be seen that the protection and hatching of the eggs is the all-important step towards reducing the death-rate among them.

In 1892 the Dildo hatchery, in Newfoundland, liberated 39,650,000 cod fry; the Wood's Holl station, in New England, hatched out 7,820,000 (in 1891, £36,000,000); while the great Fiödevig hatchery at Arandel, Norway, hatched and planted 207,000,000. The Dunbar hatchery, in Scotland, was only opened in 1893, and operations were chiefly confined to the hatching of plaice, of which over 26,000,000 fry were liberated. Of cod, only 500,000 eggs were hatched, but the hatching-house is capable of accommodating 80,000,000 ova at one time, and two lots can be dealt with in a season. Of the 500,000 eggs placed in the hatchery, and which were obtained, not from the fish kept in the breeding-ponds, but from specimens caught and stripped at sea, it is interesting to know that not above 4 per cent. died. It is clear there would be no difficulty whatever in obtaining ova, nor in getting the services of men thoroughly qualified to carry on the work of a hatchery.

The herring spawns chiefly in spring (March to May) and in autumn (September and October), but the process goes on to some extent in nearly every month of the year. The ova, contrary to the usual rule in food fishes, are naturally deposited in gravel-covered areas, and form a layer on the surface nearly ½ in. thick, and at depths from seven to thirteen fathoms. Professor Cossart Ewart has described at length the whole process of hatching and rearing the fry in the Second Report of the Scotch Fishery Board for 1884. He obtained ripe herring and artificially fertilised the ova, and these hatched in from eighteen to twenty-two days.

An attempt was made by the Stout-Vogel Government to introduce herring-ova to this colony in 1886, and the experiment failed from a very simple cause indeed. Professor Ewart, who undertook the conduct of the experiment up to the shipping of the ova, secured at very considerable trouble a number of trays of ova from the famous Ballantrae beds in the west of Scotland. The steamer "Jackall" was placed at his disposal for the purpose, the boxes were prepared, and, when all was ready, the steamer went in among the fishing-boats and obtained from them a number of ripe fish just taken in the nets. The ova were collected into the boxes, and at great trouble were conveyed to the steamship "Ruapehu," which was ready to sail for New Zealand. Arrangements had been made for keeping the ova constantly supplied with cold sea-water during transit. The eggs were in excellent order when put on board the steamer, and an expert was sent out to look after them during the voyage. But on arrival of the steamer at Madeira, a telegram was despatched to London to say that all the ova were dead. The pipes to supply sea-water to the boxes, instead of being sent through coolers filled with ice, which would have lowered the temperature to 0 deg. C. were sent through the steamer's refrigerator, with the result that at the very outset the water in them was frozen. It is quite clear from this experiment that there is no great difficulty either in getting or in transmitting herring-ova. On arrival in the colony it was intended to transfer the ova to a floating box, the bottom of which was made of a fine-meshed cloth, so that the eggs would hatch out in a sort of floating cage, in which, while supplied with abundant change of water, they would be protected till it was considered safe to liberate them.

The turbot spawns from the beginning of April to the end of July, but chiefly in the month of June. At this time the average temperature of the North Sea ranges from 9 deg. to 12 deg. C. The eggs are slightly smaller than those of the cod, and when deposited they float singly on the surface of the sea, but they seem always to sink some days before hatching takes place. I have no results to record as to the artificial hatching of these fish, for the experiments at Dunbar were not far enough advanced to be included in the annual report for 1893, and I have not seen that for 1894; but tow-net surface gatherings in the North Sea in July and August usually contain young turbot from 5 mm. to 15 mm. (1-5 in. to 3-5 in.) in length. They appear to remain near the surface till the adult form has been assumed, and then descend to the bottom to spend the first winter of their life, probably in comparatively shallow

water, at no great distance from land, for in the first warm weather of spring and early summer young turbot of 8 cm. to 13 cm. (3 in. to 5 in.) in length are found along the sandy beaches of the British Isles. There would probably be no difficulty in getting turbot ova from a hatching-station like that of Dunbar, and in conveying them to this colony. Dr. Fulton is of opinion that under proper conditions adult fish could also be conveyed to New Zealand just before the spawning season.

Crabs.—Some years ago, before the Otago Acclimatisation Society made its successful importation of lobsters, I wrote to Professor G. O. Sars, of Christiania, on the subject of introducing crabs; but he was of opinion that they would prove much more difficult to bring out than lobsters. At the Dunbar hatcheries, however, crabs have been kept in confinement for months, and Dr. Fulton anticipates that there would be no difficulty in conveying them to this colony.

The second point suggested for consideration in this matter is what we require to know about local conditions as affecting the possibility of carrying any experiment for the introduction of sea-fish to a successful issue. The principal points we ought to know are: (1) the temperature of the sea throughout the year; (2) the direction and speed of the ocean currents; (3) the spawning time of the native species, and when their eggs and larvæ are found in the greatest abundance in the sea; for, as Dr. Fulton points out, "it can scarcely be doubted that that would be the preferable time to introduce the new forms, as the minute life upon which larval fishes prey is then most abundant, and the other conditions most suitable."

In regard to the temperature of the sea, observations of the sea temperature round the coast were made for twelve months in 1868, and the results were published by Sir James Hector in a report to Parliament, 2nd December, 1869. An abstract of this report appears in his introduction to "Notes on the Edible Fishes of New Zealand," published in 1872. Sir James Hector informs me that this is the only information on the subject. It is very meagre, and we can only regret that during all these years in which the "Hinemoa" has been regularly going round these islands supplying the lighthouses from Cape Maria van Diemen to Puysegur Point an attempt has not been made by the Marine Department to secure a regular series of observations. It is not too late yet to make a beginning.

Satisfactory information as to the spawning-time of the native species of fish is not yet available, and will not be for many years—until, indeed, systematic observations of this and cognate facts have been carried out for a series of years. The catalogue of "New Zealand Fishes," by Hutton, and the "Notes on Edible Fishes," by Hector, published in 1872, contains no information on the subject. When Mr. L. Wilson was in charge of the Marine Department an attempt was made to gather statistics on this subject from the lighthouse-keepers round the coast. These men, though a most intelligent body of public servants, had no special knowledge of the subject, and their reports were found to be of comparatively little scientific value. The results, such as they were, were published by me in a paper which appears in the 24th volume of the "Transactions of the New Zealand Institute," page 202. Selecting only those species of which the observations regarding the maturing of the ova were at all uniform, I find that none had ripe ova in June or July, one in August, five in September, four in October, eight in November, five in December, eight in January, four in February, two in March, and one each in April and May. This result, imperfect as it is, would seem to show that the majority of our species spawn in the late spring and the summer months, and it is probably then, of course, that the pelagic food-supply would be found to be most abundant. If, therefore, the ova of cod, herring, or turbot were to be introduced into the colony they would arrive at the middle of our winter, when it is pretty safe to infer that the pelagic food-supply would be at the minimum. On the other hand, I have found that even in the depth of winter there is an immense amount of minute life (copepoda, larval decapoda, medusæ, worms, &c.) floating near the surface, and which is taken in the tow-net; and it is more than probable that the amount available for feeding larval fish would be very large. Of course, if it were possible to bring out adult fish of the species named, and confine them in ponds, the success of the experiment would be assured. The ova could then be dealt with whenever it matured, and the larval fish be kept in rearing-ponds till it was time to liberate them.

No scheme for introduction of fish or fish-ova into the colony would be complete unless full provision was made for the keeping of such fish in confinement after arrival, and the hatching of the ova in suitable apparatus. Full particulars of the Dunbar hatchery are given in the Twelfth Annual Report of the Scotch Fishery Board, and without going into details of the whole I will very briefly specify the general arrangements. The fish from which the ova are procured are either caught in the nets of the Board's steamer, the "Garland," or are obtained from the fishing-boats and transferred to the tanks on board the steamer. They are got either just when ripe, as required, or are secured beforehand and kept in suitable enclosures. The details of the collecting and placing of the ova need not detain us here. The spawning-pond is constructed of concrete, and is sunk in the ground. It is 40½ ft. long, 11 ft. deep, 26½ ft. broad at one end, and 18 ft. at the other, and is capable of holding about 10,000 cubic feet, or 62,000 gallons of water. The water is supplied by 4 in. galvanised-iron pipes from the harbour, a distance of over 100 yards, and the pumps are worked by an 8-horse-power engine. Below the spawning-pond is a filtering and spawn-collecting chamber, 27 ft. long, 12 ft. broad, and 8 ft. high, built of wood and covered with corrugated iron. Below this again is the hatching-house, a wooden building 35 ft. long, 24 ft. broad, and 20 ft. high, containing the hatching apparatus. There is also a tidal pond, made by enclosing a small natural inlet of the sea, which is about 40 ft. long, and this serves not only as a supply from which filtered water can be drawn in stormy weather, but as an additional storage-pond for spawning fish. Such an establishment would cost in this colony, for erection alone, about £350—that is, a building with brick foundations, timber walls lined inside, and spawning-pond of masonry, in cement mortar, or concrete. The laboratory, boiler-house, tanks, boiler, and pumps to lift 7,000 gallons per hour would cost from £150 to £200. These estimates have been very kindly worked out for me by Mr. G. M. Barr, C.E., to whom I take this opportunity of expressing my obligations, and who assures me that they are on the over rather than on the under-side. To these items would have to be added the cost of, say, eight hatching-boxes, which it would be best to have constructed either in Britain or in Norway, and imported ready for putting together. I suppose £100 would cover the total expense of making and importing them. This brings up the total cost of erection and fitting-up of such a station to £650. The locality would have to be within easy distance of one of the principal ports, so that fish or ova could be transferred without the loss of many hours direct from the steamer to the hatchery. I believe that a suitable site could be obtained in the neighbourhood of any of the principal harbours of the colony, and none better perhaps than just within the entrance of Purakanui Inlet, or of Otago Harbour, on the north spit. There would be an important geographical advantage in having such a hatchery here. The general drift of the ocean current outside Otago Heads is in a northerly direction, and this current extends to abreast of Cook Strait. By means of it a certain number of the pelagic fry of the fish hatched out would be readily spread along the coast-line. On the other hand, a northern station would not be so favourably situated for supplying this part of the colony.

The final and important question is, Would it be advisable at this stage of the colony's progress to undertake the work of introducing these sea-fishes? I think it would. The development of trade with Australia, which may be looked for by the opening of ports like Sydney and Melbourne, will inevitably lead to a demand for fish from New Zealand, these being already considered as generally superior to the fish found on the Australian coasts. In a very few years it is probable that brown-trout, and, to a less extent, salmon-trout, will be extensively taken as sea-fish, as great shoals of these fine fish are now becoming common along the coasts of Otago and Canterbury. And if to these could be added the three finest food-fishes of Britain—the cod, the turbot, and the herring—the fisheries of New Zealand would rank among the most valuable assets of the colony. But there is another and more local way of looking at it. The desirability of establishing a biological station in these islands has often been affirmed, but beyond this stage it has never got. The presence of such a station here would be not only of immense practical value, but also of great scientific importance. Without some such practical side to it I do not think that those in power in New Zealand would be induced to assist the undertaking with public funds. But were our institute to take the initiative in this matter, and devote to it some of the money which has been accumulating at deposit account for several years past, waiting for some such favourable opportunity, then I think we would ere long rejoice in the possession of a biological station which would be of colonial importance, as well as prove a valuable adjunct to our own University.

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