D.—No. 2.

PAPERS

RELATIVE TO THE

INTRODUCTION OF SALMON INTO THE COLONY.

PRESENTED TO BOTH HOUSES OF THE GENERAL ASSEMBLY, BY COMMAND OF HIS EXCELLENCY.

WELLINGTON.

1869.

ORDER OF REFERENCE.

(*Extract from the Journals of the House of Representatives, Monday, the 23rd day of September*, 1867.)

Resolved,—"That, in the opinion of this House, it is desirable that inquiries should be made by the Government, with a view of ascertaining the best means to be adopted for introducing Salmon into the Colony, the most favourable situation for carrying out any experiments in connection with the breeding of Salmon, and the probable cost of such experiment."

PAPERS

RELATIVE TO INTRODUCTION OF SALMON INTO THE COLONY.

No. 1.

Copy of a Letter from Mr. MURISON to the Hon. E. W. STAFFORD.

SIR,— Dunedin, 17th October, 1867.

I would feel obliged if the Government would forward to me from time to time copies of any correspondence or written information respecting the introduction of salmon, consequent upon a Resolution bearing upon this subject which was passed in the House of Representatives on the 23rd September last.

I am led to make this request not only because I moved the Resolution referred to, but because I believe that I take a special interest in the question.

I have, &c.,

The Hon. the Colonial Secretary. W. D. MURISON.

No. 2.

MEMORANDUM by Dr. HECTOR.

THE Tasmanian Government and the Honorary Secretary of the Acclimatization Society of Victoria could suggest the best sources of information as to the results of the experiments which have been made in those countries.

The Government of British Columbia might also be communicated with, as it is probable that not only salmon, but many kinds of game could be introduced from that country with great facility and success by the employment of a special agent.

It would be desirable, in my opinion, in order to prepare for selecting the most favourable situation for experiments in introducing salmon, to employ any Government officials that are available for the purpose to observe and record the temperature of the water of the various rivers round the New Zealand coast; and also that of the tidal waters that ebb and flow in the estuaries and inlets the salmon would probably frequent.

23rd December, 1867. JAMES HECTOR.

No. 3.

Copy of a Letter from the Hon. E. W. STAFFORD to the Hon. M. G. KEON.

(No. 3.) Colonial Secretary's Office,

SIR,— Wellington, 3rd January, 1868.

The Government of New Zealand being desirous of ascertaining the best means to be adopted for introducing salmon and other animals into this Colony, and the probable cost of the experiment; and as British Columbia, from the nature and value of its indigenous animals, and from the facility of communication with it, presents peculiar advantages for the purposes of acclimatization in this country, I shall feel much obliged if you would favour me with any information in your power as to the best means and probable success of introducing salmon ova and game and other valuable animals from British Columbia into New Zealand, by the employment of a special agent for the purpose; and as to the result of any experiments which may have been made in sending such ova or animals from British Columbia for the purpose of acclimatization in other countries.

I have, &c.,

The Hon. the Colonial Secretary, British Columbia. E. W. STAFFORD.

No. 4.

Copy of a Letter from the Hon. E. W. STAFFORD to the Hon. Sir R. DRY.

Colonial Secretary's Office,

SIR,— Wellington, 3rd January, 1868.

The Government of New Zealand being desirous of ascertaining the best means to be adopted for introducing salmon into the Colony, and of securing their propagation, and the probable cost of the experiment, I shall feel much obliged if you would furnish me with detailed information as to the results of the experiments which have been made in Tasmania, and as to the temperature and character of the rivers, estuaries, and sea where they were tried, and with any further information which you may consider useful on this subject.

I have, &c.,

The Hon. the Colonial Secretary, Tasmania. E. W. STAFFORD.

[Letter of same tenor and date sent to Honorary Secretary, Acclimatization Society, Victoria.]

No. 5.

Copy of a Letter from the Hon. Sir R. Dry to the Hon. E. W. Stafford.

(B.—23.) Colonial Secretary's Office,

Sir,— Tasmania, 31st January, 1868.

In reply to your letter of the 3rd instant, requesting to be furnished with detailed information as to the results of the experiments which have been made in the introduction of salmon into this Colony, &c., I have now the honor to forward to you the accompanying copy of Reports of the Salmon Commissioners from 1862 to 1867 inclusive, which will be found to contain full information on the subject in question.

The Chairman of the Salmon Commissioners (Dr. Officer), to whom your communication has been referred, writes,—"I am not aware of any information likely to be of practical use which they do not contain."

I would, on the present occasion, take the liberty of recommending the New Zealand Government to secure the services of Mr. J. A. Youl, of Waratah House, Clapham Park, London; his well-known zeal and great experience would be invaluable.

I have, &c.,

The Hon. the Colonial Secretary, New Zealand. Richard Dry.

Enclosure 1 in No. 5.

Report by the Tasmanian Salmon Commissioners, 1862.

To His Excellency Colonel Gore Browne, C.B., Captain-General and Governor-in-Chief of the Island of Tasmania.

May it please Your Excellency,—

The Commissioners appointed by your Excellency to direct the measures to be adopted for the introduction of Salmon into the rivers of this Colony have already reported to the Government the arrival of the "Beautiful Star," and the disastrous result of their first experiment.

They have now the honor to lay before your Excellency a report of their proceedings in their efforts to fulfil the important duty confided to them, from the date of their appointments to the present time.

During the Parliamentary Session of 1860, the question of the introduction of salmon was referred to a Joint Committee of both Houses. In their Report, presented to both Houses, the Committee recommended that all the arrangements necessary to be made in England in furtherance of this highly important undertaking should be intrusted to the Committee of the Australian Association in London; and before the appointment of the Commission had been issued by your Excellency, that body, acting under the authority and instructions received from the Executive Government of the Colony, had already made progress in the task they had undertaken, and had completed all their arrangements before any communication reached, or could have reached, them from the Commissioners.

Aware that among the members of the Australian Association there were many gentlemen of great intelligence, intimately connected with this and the neighbouring Colonies, to all of which the enterprise was of deep interest, who would willingly give their best services to promote its success, the Commissioners cannot but regard as judicious this recommendation of the Committee.

Among others to whom the Committee had looked for valuable assistance was Mr. Edward Wilson, of Melbourne, who had already distinguished himself so greatly by his zeal in the work of acclimatization. The services of this gentleman were, however, lost to the enterprise, by his early return to Victoria, and its chief direction fell into the hands of our fellow-colonist, James A. Youl, Esq.

The zeal and energy displayed by Mr. Youl in the performance of this voluntary and patriotic duty deserve the highest commendation. No personal labour was spared by him to ensure the successful result of the experiment. Mr. Youl was from the first fully impressed with the importance of embarking the ova in a vessel at once swift and roomy, and sailing direct to the port of Hobart Town. He appears, however, to have encountered much difficulty in his efforts to secure these three conditions,—essential, in the opinion of the Commissioners, to the success of the undertaking.

This difficulty arose chiefly from the fact that, at the season during which the ova could be obtained, none of the regular first-class ships sailed for this Colony, and that none of the clipper vessels trading to Melbourne could be induced to incur the delay and risk involved in calling at this port.

After the failure of other negotiations, however, the owners of a large and fast ship, the "Zealander," fulfilling all the necessary conditions, offered to convey the ova to Hobart Town for a sum of £750. At the same time an offer to perform this service was made by the owners of a small iron steamer, of only 120 tons, for a charge of £500, but which was to make the voyage jury-rigged, and with sails only.

The Commissioners think Mr. Youl committed a fatal error of judgment in preferring this vessel to the "Zealander;" and since they heard that the ova had been placed on board the "Beautiful Star," they have regarded the success of the enterprise as all but desperate.

The charge of the experiment on board of the "Beautiful Star" was intrusted to Mr. W. Ramsbottom, a son of Mr. R. Ramsbottom, long distinguished for his skill in the artificial propagation of salmon.

Mr. W. Ramsbottom has placed in the hands of the Commissioners the journal kept by him during the voyage of the "Beautiful Star," and has also furnished them with a Report on the whole experiment. From these sources, from personal communication with Mr. Ramsbottom, and an inspection of the vessel and the apparatus in which the ova were placed, the Commissioners have obtained a clear perception of all the causes which have led to the failure of this undertaking, and of the conditions that are necessary to a successful result on a future occasion.

The character of the vessel in which the experiment was made must, without other defects, have rendered success all but impossible.

Under no conditions could it be supposed that the ova or fry would survive 160 days at sea, nor could it be expected that a vessel of the dimensions of the "Beautiful Star," and rigged as she was, could perform the voyage much under that period.

The suspended apparatus appears to have been skilfully contrived, and in a suitable vessel, and under other proper conditions, would in all probability have brought their charge in safety to their destination.

But the small dimensions of the vessel did not afford space to permit it to swing freely, and the constant and excessive rolling kept the gravel in which the ova were deposited continually shifting, causing their death by mere attrition; and, from the same cause, the apparatus could not safely be approached for many days in succession.

Mr. Ramsbottom has, however, pointed out some changes in the construction of the suspensory apparatus which would, in the opinion of the Commissioners, considerably improve it, and render it as near as possible perfect for a future experiment.

The second apparatus, constructed on the Gimbal principle, was a failure from the first, and, by its excessive motion, soon caused the death of all the ova which had been placed in it.

But if the ova had not nearly all perished from the cause referred to, the failure of the ice, seventy-four days after the sailing of the vessel, must necessarily have led to the same disastrous result; although on board a fast vessel its duration for that period might have been sufficient.

Mr. Ramsbottom calculates that at least two-thirds of the ice embarked, amounting to twenty-five tons, were lost by melting. The Commissioners are, however, of opinion that a great part of this excessive waste was due to the faulty construction of the ice-house, and the mode in which the stream of water was made to pass through it from the tanks to the trays. They believe that such improvements could be made as would certainly guard against this source of failure, and secure the preservation of the ice for a period much beyond that occupied in an ordinary voyage from England to this Colony.

At an early period of the voyage, Mr. Ramsbottom discovered another source of disaster, which, if he had not been able to remove it, by the detention of the vessel at Scilly, would alone have caused the destruction of the ova. It was found that the water contained in the iron tanks brought with it to the trays, and deposited on the ova, so considerable a quantity of that metal, in the form of a fine powder, as to cause the death of great numbers of them before a remedy could be applied. The remedy consisted in causing the water to pass through a filter before it reached the trays. The use of wooden tanks, lined with block tin or slate, would effectually prevent future disaster from a similar cause.

The Commissioners have learned that some of the ova were several weeks old when first placed on the trays. They notice this fact more with reference to any future experiment that may be undertaken than to that which has just terminated. They are of opinion that every precaution ought to be taken to retard the hatching of the fry during the voyage, and that, as one important means of obtaining this end, the ova, when embarked, should not be more than a few days old.

Mr. Ramsbottom appears to the Commissioners to be thoroughly acquainted with the duty he undertook to perform, and to have discharged it with much diligence and zeal. They believe that if another effort of the same nature should be made, it could not be confided to a more efficient agent, or one more likely to ensure a successful result.

The chief practical work that the Commissioners have had to perform has consisted in the necessary preparations for the reception of the salmon ova, if they should happily reach the Colony in safety, and the construction of a breeding pond. At their first meeting, the Commissioners unanimously decided that their attention should at first be confined to the stocking of the Derwent; and that the breeding ponds should be constructed on the bank of one of its tributaries. After a careful personal inspection of the locality, a spot on the east bank of the River Plenty, about two miles from its junction with the Derwent, was selected as the site of the pond. The Commissioners were led to this selection by the generally ample volume, low temperature, and gravelly bed of this stream; while its proximity to the head of the navigable portion of the Derwent, above New Norfolk, affords facilities for the safe transport of the ova from the vessel importing them to the ponds. Several other important advantages were secured by this selection; among which were the much smaller cost at which the pond could be constructed on the bank of the Plenty than on the main stream, the more complete security from the danger of floods, and the easier capture of the fish on their return from the sea, for the purpose of further propagation.

The land on the east bank of the Plenty is the property of Robert Read, Esq., of Redlands, and the thanks of the Commissioners are due to that gentleman for the liberal spirit displayed by him in offering, without restriction, the use of any portion of his ground that the Commissioners might deem most suitable for the object they had in view.

After due exploration, a piece of ground, about three acres in extent, half a mile above Mr. Read's residence, was chosen as the site of the ponds. The ground thus selected offered every necessary facility for the cheap and expeditious accomplishment of the undertaking, and was at the same time sufficiently elevated to protect it from the reach of the highest known floods. By Mr. Read's further liberality, permission was obtained to procure the necessary supply of water from his main irrigation channel, by which the labour and heavy expense of a long cutting to the river itself was saved to the public. It was Mr. Read's desire that the use of his land should be gratuitous; but the Commissioners deemed it desirable that a small rent should be paid under a regular and formal lease. A lease for fourteen years, at a yearly rental of £15, was accordingly prepared, and on its due execution the Commissioners lost no time in commencing the necessary operations. The pond has long since been completed; and the Commissioners believe that in no part of the world has a more perfect work of this character ever been constructed.

Although deeply disappointed by the failure of the late attempt to introduce the salmon into the Colony, the Commissioners entertain a confident hope that, at no distant period, the work thus constructed under their direction will be put to the test of actual experiment; and they desire to express their earnest trust that the Government and Legislature will not abandon an enterprise, which is calculated to confer on this Colony a material benefit at once so extensive and so enduring, until

success has crowned their efforts. They believe that the stocking of our rivers with salmon would confer a prominence and distinction on Tasmania which cannot be anticipated from almost any other source.

Until the subject has been further brought under the consideration of the Government and the Parliament, the Commissioners refrain from offering any specific proposal for the further prosecution of the undertaking. They may, however, with propriety now observe that two other plans for the introduction of salmon have often been proposed as a substitute for the direct action of the Government: It has been suggested that this important object might be attained by the offer of an adequate reward, or by calling for tenders.

Both of these plans possess the advantage of securing the Colony against pecuniary loss in the event of the failure of the attempt; and they might both, with propriety, be had recourse to, at least without risk. But the Commissioners greatly doubt whether an enterprise, which must be new to whatever parties might undertake it, and which would involve in it the embarkation of so considerable a capital, is likely to be soon accomplished in that manner. On the other hand, the Commissioners are of opinion that the causes of probable failure in a future undertaking have been so well ascertained from the late experiment, and could be so certainly obviated and guarded against, that success could hardly fail to crown another effort, except in the case of actual shipwreck, or some similar disaster.

As the Colonies of New South Wales, Victoria, South Australia, and New Zealand are all more or less interested in this question, they may all be expected to bear a share in the expense of future undertakings.

Victoria has already liberally assisted us, and a contribution of £200 has been received from New Zealand. The cost of another, and of each succeeding experiment, if more than one should be found necessary, would certainly not exceed £1,000, which, divided among the five Colonies, would only require from each a contribution of £200, a sum quite insignificant when compared with the importance of the enterprise, and the benefits that must flow from its successful accomplishment.

But, whatever future measures may be adopted for the further prosecution of this great undertaking, the Commissioners trust that the unalterable motto of this Colony, at least, will be "Try again," until all difficulties have been overcome, and complete success achieved.

The Commissioners respectfully refer your Excellency to the Report of Mr. Ramsbottom, transmitted herewith, for details connected with the experiment on board the "Beautiful Star," which it is not deemed necessary to embody in their Report.

A statement of the whole expenditure incurred in this experiment is hereto appended. The expenditure under the direction of the Committee in London has considerably exceeded the estimate; but that result need not excite surprise, when the novelty of the undertaking is considered.

Mr. Youl is of opinion that the cost of a future experiment would not exceed £1,000; while Mr. Ramsbottom estimates it at a still less amount.

R. Officer, Chairman.

Appendix No. 1.

Report by Mr. William Ramsbottom on the late Experiment on the Introduction of Salmon Ova into Tasmania, in his charge, by the ship "Beautiful Star."

The "Beautiful Star" sailed from London, 4th March, with about 50,000 salmon ova. J. A. Youl, Esq., and Mr. Robert Ramsbottom, of Clitheroe, accompanied us to Gravesend, where we anchored for the night. The ova and one young fry looking well.

March 5th, 1862.—Steamed to Margate Roads; lay at anchor for three days through stress of weather. The ova on the glass trays in the Gimbal apparatus are dying in great numbers, caused by the violent rolling of the apparatus keeping them continually in motion.

8th.—Weighed anchor; nearly reached the Isle of Wight, when a strong head wind compels us to put back to the Downs. Remain at anchor until the 12th instant; during which time the ova suffer greatly, both from the heavy labouring of the ship, and also from the varnish upon the Gimbal apparatus.

Up to this time the loss of ova cannot be less than from 4,000 to 5,000.

Since we put back, wrote to Mr. Youl giving him all particulars respecting the serious loss of ova and the working of the apparatus. Mr. Youl, on the receipt of my letter, came down at once to see if anything could be done for the preservation of the ova; but I am sorry to say nothing at this time could be altered.

Mr. Youl could only recommend a strict attention to the suspended apparatus, which hitherto had worked tolerably well.

13th.—Weighed anchor 9.30 p.m.; wind south-east, very strong.

15th.—Busy all day taking out dead ova and removing from the glass trays those ova which yet look moderately healthy. Wind east, strong.

16th.—Putting back to the Scilly Islands for repairs to the ship, having in the night lost the plug of the propeller space. I find that the rust from the iron tanks is settling very thickly upon the ova and gravel. Should this rust be allowed to continue, I am persuaded that the whole would be entirely buried within a month.

17th.—Reach Scilly this morning. Remain until the 24th instant.

24th.—Weighed anchor 12 a.m. Wind W.S.W. The loss of ova from the 12th to this date is about 2,500.

26th.—During the night of the 25th, and early this morning, a strong gale from the west. The ship laboured extremely, causing the apparatus to swing to and fro with such violence as to render it dangerous to approach it,—the bilge-water also washing up the sides of the ship (even to the deck), some of which fell in amongst the ova; but the assistant, seeing it, threw a covering of blankets over the whole of the apparatus, which prevented further injury; and I have good reason to believe that little damage was done by the bilge-water, as but a very little got into the apparatus; but, with the violent tossing and rolling of the ship, and swinging of the apparatus, it is impossible to state the precise loss of ova caused

by this one gale, as I, with the assistant, were continually picking out dead ova for the four following days; but it could not have been less than 7,000.

The one little fry, which up to this time had been so lively, died, being twenty-three days old.

April 5th.—The weather for the last few days has been much finer. 11 p.m.—Three fry newly hatched, and looking well. Deaths of ova for the last five days, about 2,500.

12*th.*—From the 5th to the 12th instant, three to six fry have been hatched per day. At the same time, numbers died whilst hatching. Have been obliged to make use of ice, the temperature having risen four degrees in five days. It is now 54° in the apparatus.

Should have commenced using ice five or six days earlier; but, seeing the sailing qualities of the ship, feared to begin with it before it was absolutely necessary. Could calculate, at this time, on a very long passage.

17*th.*—Loss of ova for the past week, about 3,000. Since the 12th instant, the young fry have all died. The last of them lived ten days.

During the last two days have been engaged in cleaning out the whole of the ova beds,—a work which ought never to be done if it could possibly be avoided; but, from the number of decayed ova that were under the gravel, it was necessary, as wherever any dead ova were allowed to remain in the gravel, those immediately above them were sure to perish.

May 7.—From the 17th April to this day, nothing of importance has occurred. Weather fine, but hot, causing much trouble to keep down the temperature of the water.

The ice cannot last much longer, at the rate necessary to use it.

The average loss of ova from the date of cleansing the trays does not exceed twenty per day.

8*th.* 9 p.m.—To-night, as usual, went into the ice chamber. The ice having got very low, discovered a little box of ova which had been bedded in it by order of J. A. Youl, Esq., before leaving London. On taking up the box, found that the lid was broken off, but the ova were well covered with moss.

Had no expectation of finding living ova (even had the box been perfect); but, on lifting up a portion of the moss in which the ova were bedded, had the satisfaction to perceive that, amongst the many dead, there were still some living.

Having procured a large vessel and submerged therein the whole (moss, dead and living ova), carefully took out the moss, and poured off the greater portion of the water. Having done this, emptied the contents of the vessel into one of the trays with all the care and speed possible, keeping it apart from the other ova; then picked out the dead ova, about 250 in number, and had nineteen living, to all appearance in good health.

This little experiment will no doubt prove of much future value, as indicating a new and successful method of transporting salmon ova to distant countries.

9*th.*—During last night and to-day have lost five of the ova taken from the box; but no doubt the cause is from injuries received when cleaning away the moss and placing them in the tray.

11*th.*—The ship pitching and rolling, causing the apparatus to swing so violently as to strike the beam to which it is suspended.

15th.—In Latitude 21° 36′ S., Longitude 20° 8′ W.; wind East, calm. Ice nearly finished. With no better breeze than at present, the ova must of necessity die.

16*th.*—No change in weather. Have taken from the chamber the last three blocks of ice, which cannot last many hours,—10 p.m.

17*th.*—Latitude 22° 19′ S., Longitude 25° 55′ W. Have been allowing the temperature of the water to rise a little by degrees; but all to no purpose. Ice all melted about 12·30 a.m., and the whole of the ova died at 1 a.m., at a temperature of 59°, with the exception of those that had been taken from the moss, which lived eight hours longer, at a temperature of 65° (9 a.m.); being seventy-four days from London, and eighty-eight days from the time of their being taken from the parent fish.

I can only add, on looking over the Journal, my extreme astonishment at the ova surviving so long under such tremendous disadvantages.

It is useless to mention the Gimbal apparatus, which was a failure from the beginning.

On the other hand, the value of the suspended apparatus, in which my only hope was placed, was rendered nugatory by the utterly unsuitable character of the ship.

The gale that prevailed on the 26th March (when the bilge-water washed up to the deck) caused the death of 7,000 ova placed on the surface of the gravel, as also of a great number of those deposited under it which could not then be removed, and which, by their subsequent decomposition, proved the destruction of many others.

Under all these disadvantages, it is only surprising that any of the ova survived for so long a period as seventy-four days from the date of their embarkation, and eighty-eight days from the time of their being taken from the parent fish.

The above facts show conclusively, in my opinion, that if the late experiment had been made in a roomy and fast ship, with properly constructed tanks, many thousands of the ova would have reached their destination in safety.

WM. RAMSBOTTOM.

APPENDIX No. 2.

Statement of Expenditure.	£	*s.*	*d.*	£	*s.*	*d.*
To constructing Salmon Ponds at River Plenty	727	4	11			
Fencing ground round ponds	60	13	0			
Salary to Mr. Ramsbottom, and accounts paid in Hobart Town ...	111	6	6			
				899	4	5
Amount reported by Mr. Youl to have been paid by him in England ...				1,420	0	0
				£2,319	4	5

Enclosure 2 in No. 6.

REPORT of the TASMANIAN SALMON COMMISSIONERS, 1864.

To His Excellency Colonel THOMAS GORE BROWNE, C.B., Captain-General and Governor-in-Chief of the Colony of Tasmania and its Dependencies.

MAY IT PLEASE YOUR EXCELLENCY,—

In the month of September, 1862, the Commissioners had the honor to report to your Excellency that, profiting by the important lesson derived from the history of the little box of salmon ova imbedded in moss, which had been placed in the ice-house of the "Beautiful Star," as detailed in the extract from Mr. W. Ramsbottom's log appended to their report dated August, 1862, they had resolved to send Mr. W. Ramsbottom back to England with the least possible delay, in order that he might assist in ascertaining from actual experiment for what periods the salmon ova packed in moss, and deposited in some of the ice vaults in England, might be kept in an undeveloped state and afterwards hatched into living fish.

In accordance with this determination of the Commissioners, Mr. Ramsbottom at once proceeded to Melbourne, from whence he took his departure in the steamship "Great Britain," and reached England in December.

While despatching Mr. Ramsbottom to England for the purpose mentioned, the Commissioners, retaining a lively sense of the zeal and energy displayed by their fellow-colonist Mr. J. A. Youl in the first attempt which they had made to introduce the salmon into the Colony, and then recently brought to an unsuccessful conclusion, addressed a letter to that gentleman, earnestly requesting his continued co-operation in their renewed endeavour to effect this great object; and subsequently committed the direction of all that was to be done in England to the Australian Association, to whom the management of the first experiment had been intrusted, knowing that, as on the previous occasion, it would practically devolve on Mr. Youl, one of its members.

The Australian Association accepted the trust which the Commissioners desired them to undertake, but immediately delegated to Mr. Youl "the sole superintendence of the necessary preparations for the renewed experiment about to be tried." How earnestly and zealously Mr. Youl discharged the duty thus devolving upon him, will appear from our further report of his labours in this patriotic undertaking.

Immediately on Mr. Ramsbottom's arrival in England, the experiments to which the Commissioners have referred, and to the issue of which they looked forward with the deepest interest, were commenced under Mr. Youl's direction, and carried on during the year 1863.

The success of these experiments fully satisfied the expectations of the Commissioners, at whose instance they were undertaken. A large proportion of the ova that had been deposited in the Wenham Lake Company's ice vaults in London, for periods varying from 45 to 144 days, were found at the end of those periods to be still in a state of healthy vitality; and were afterwards hatched into vigorous fish by various pisciculturists to whom they were committed after removal from the ice vaults.

In the conduct of these experiments Mr. Youl was zealously assisted by W. Ramsbottom, by his father, Mr. R. Ramsbottom, of Clitheroe, and by the Manager of the Wenham Lake Ice Company, who, on Mr. Youl's application, had generously granted the free use of their vaults in London, in which they were carried on through their first stage. The result of these experiments constitutes, the Commissioners believe, one of the most valuable discoveries ever yet made in the art of pisciculture, and must ever indicate an important era in its history.

This result was no sooner communicated to the Commissioners than they came to the conclusion that this was the method by which the salmon was to be successfully introduced into the waters of Tasmania; and that the expensive, troublesome, and uncertain mode of conveying the ova in suspended trays, requiring a constant stream of iced-water to pass over them, might henceforth be dispensed with.

They were unanimously of opinion that, in the condition of ova placed in an ample body of ice on board a fast vessel sailing direct to Hobart Town, the salmon could not fail of reaching their destination in safety. This opinion the Commissioners conveyed to the Australian Association, and was, as far as possible, carried into practical effect by Mr. Youl. That gentleman, however, found on this, as on the previous occasion, that his principal difficulty consisted in finding a vessel fulfilling all the conditions deemed necessary for the successful transport of the ova to their destination at the Antipodes. One vessel only, the "Alfred Hawley," was advertised to sail for Hobart Town about the period suitable for the shipment of the ova, and, although in other respects supposed to be a smart vessel, she was of a tonnage too small to inspire confidence in her making a rapid passage.

With the owners of this ship Mr. Youl entered into and carried on negotiations until it was discovered, in the beginning of January, 1864, that, having only just returned from China, there was no hope of her cargo being discharged, and the preparations necessary for the reception of ova completed, until too late for their shipment during that season. In this emergency Mr. Youl acted with admirable promptitude and decision, which saved the experiment from being shipwrecked and delayed until the following year.

The "Alfred Hawley," and the idea of a direct passage to Hobart Town, were immediately dismissed from his mind, and application made to Messrs. Money Wigram and Sons, the owners of the splendid and well-known clipper ship the "Norfolk," then advertised to sail for Melbourne on the 20th of January, to undertake the conveyance of the salmon ova by that vessel. To this application these gentlemen not only assented with alacrity, but declined to receive any remuneration for the important service which they undertook to perform, desiring only that it might be accepted by the Australasian Colonies as a proof of the interest which they took in the welfare and advancement of these rising communities.

When Messrs. Money Wigram and Sons first intimated their intention of making no charge for the conveyance of the ova by the "Norfolk," Mr. Youl had, in a truly liberal and patriotic spirit, undertaken to pay them one hundred guineas from his own pocket, if they should think fit to receive

it, as some remuneration for the occupation of a twentieth part of their noble ship. Of this offer, however, these gentlemen ultimately declined to avail themselves, desiring that the service should be entirely gratuitous. From copies of the letters that passed between Mr. Youl and the owners of the "Norfolk," given in the Appendix to this Report, the character of this transaction, which reflects much credit on them both, will be fully understood by your Excellency. A space measuring fully fifty tons, equal to a twentieth part of the whole tonnage of the "Norfolk," was thus gratuitously dedicated to the service of the undertaking by her public-spirited owners. But the value of the service is not to be measured by the mere extent of tonnage occupied for the purposes of this great experiment. Besides the disturbance of the usual arrangements in the hold of their vessels caused by the erection of the ice-house, shipowners appear to have entertained a fear that a leakage might take place from the ice-house, and injure the goods stowed below. From these causes the owners of vessels who have been applied to on former occasions have demanded much higher rates of freight than they would probably have considered adequate under other circumstances.

For the conveyance of the ice-house and swinging apparatus, with the passage of Mr. W. Ramsbottom, the sum of £500 was paid to the owners of the "Beautiful Star," whose whole capacity did not much exceed 100 tons. The freight demanded by the owners of another vessel, the "Zealandia," with whom Mr. Youl had entered into negotiations for the conveyance of the ova to Hobart Town on her way to New Zealand, was £750; while, for a like service by the "Percy," a regular Hobart Town trader, no less a sum than £1,500 was required. In this last case, however, some derangement in the usual period of sailing from London was involved.

Having thus provided for the conveyance of the ova to Melbourne by one of the fastest ships in the Australian trade, and having nearly completed the arrangements necessary for their reception on board the "Norfolk," whose departure was positively to take place on the 20th of January, Mr. Youl forwarded instructions to Mr. Robert Ramsbottom, the well-known pisciculturist of Clitheroe, to procure forthwith, from the Ribble, the number of ova intended to be despatched to Tasmania. On former occasions Mr. Ramsbottom had never found any difficulty in obtaining whatever quantity had been required by Mr. Youl; and in the previous year, on the 12th of January, an abundant supply of spawn had been obtained from the Ribble. A week earlier in the present year, dependent on some peculiarities of the season, every fish captured by Mr. Ramsbottom was found already to have shed its spawn in the river.

On receiving this embarrassing information from Mr. Ramsbottom, the same energy that had been called forth by the difficulty of finding a suitable means of conveyance to the antipodes was displayed by Mr. Youl. Mr. Ramsbottom, with his son, Mr. William Ramsbottom, were immediately despatched to the Dovey, in Wales, and Mr. W. Johnston, another experienced and trustworthy pisciculturist, to the Tyne. At the same time, with much judgment, Mr. Youl published in the *Times* a general appeal to the proprietors of salmon fisheries, and to all who were engaged in or took an interest in the work of pisciculture throughout Great Britain, to assist in the great experiment then in hand.

That appeal was successful, and was responded to in the most liberal and generous manner by noblemen, gentlemen, and others, both in England and Scotland. Through their kind assistance, and the zeal and activity displayed by the agents employed by Mr. Youl, amongst whom Mr. Ramsbottom of Clitheroe, our Superintendent Mr. William Ramsbottom, and his brother Mr. Restab Ramsbottom, greatly distinguished themselves, the requisite supply of ova, exceeding 100,000 in number, with several thousands of trout ova, were ultimately obtained.

In spite, however, of all the energy and activity that had been displayed, these ova did not reach London until the 18th January; nor could it have been possible to have shipped them all and completed the arrangements in the ice-house, had not Messrs. Money Wigram and Sons given a further proof of their generosity by detaining the "Norfolk" for one whole day after she was quite ready to set sail.

The history of this anxious part of the undertaking is so well given in Mr. Youl's letters to the *Times*, dated the 6th, 12th, and 21st January last, that the Commissioners append them entire to their Report.

The Commissioners have learned from a perusal of these letters, and from other communications how deeply they are indebted to the various parties enumerated by Mr. Youl for the ready and valuable aid afforded by them during a most critical period of the experiment; and they feel assured that, by your Excellency, the Executive Government, the Parliament and people of Tasmania, their services will be duly appreciated and gratefully acknowledged.

All difficulties having been thus successfully overcome, the ice-house was finally closed on the evening of the 20th day of January; and the "Norfolk" took its departure on the following day with its precious and novel burden, towards the ultimate fate of which the attention of the whole scientific world, and of all taking an interest in the well-being of the Australasian Colonies, was anxiously directed, accompanied by Mr. W. Ramsbottom, their special custodian and guardian.

On the 15th day of April, the "Norfolk" cast anchor in Hobson's Bay, having thus completed her voyage to the far South in the brief space of eighty-four days.

Mr. Youl had, with much judgment, consigned the ova to the care of Mr. Edward Wilson, President of the Acclimatization Society of Victoria, whose zeal in the cause of acclimatization is known and appreciated throughout the length and breadth of the civilized world. It was impossible to have committed the charge into abler or more zealous hands.

Before the arrival of the "Norfolk" at Melbourne, Mr. Wilson had applied to the Government of Victoria for the use of Her Majesty's Colonial steamship "Victoria," for the conveyance of the ova from Hobson's Bay to Hobart Town. That application had been liberally and promptly acceded to, and the vessel ordered to be in readiness for the performance of this service the moment the arrival of the "Norfolk" should be announced.

Soon after the "Norfolk" had dropped her anchor she was boarded by Mr. Wilson and other members of the Acclimatization Society, in whose presence the ice-house was unlocked by Mr. Ramsbottom, for the first time since it had been closed in the Thames. One of the small boxes containing

salmon ova was then forthwith opened, and to the joy of the anxious observers it was found that a considerable portion of its contents were still in a sound and promising condition.

No examination of the remaining boxes was deemed necessary; but the most energetic measures were immediately taken for the speedy transfer of the ova, with the remainder of the ice, amounting to about twelve tons, from the "Norfolk" to the hold of the "Victoria." Strong wooden boxes were prepared, in each of which fifteen of the small original boxes of ova, covered over with a considerable thickness of ice, and enveloped in blankets, were securely packed. With commendable foresight these boxes were fitted up so as to admit of their being at once slung on bamboos, and thus carried by bearers from the termination of the navigable portion of the Derwent to the ponds on the Plenty, a distance of nearly four miles; and this arrangement was, in practice, found greatly to facilitate the conveyance of the ova over that part of the way.

Thus prepared, eleven boxes containing 170 of the original packages were carefully removed from the "Norfolk" to the "Victoria," and deposited in a part of the hold least exposed to the injurious action of the machinery, from which they were further protected by placing stuffed pads between the boxes.

The remaining eleven boxes were retained by the Acclimatization Society, for the purpose of being hatched in Melbourne, without exposing them to the possible accidents and certain delay involved in a second voyage, and to the tremor caused by the action of the screw, from which Mr. Youl, as well as the Commissioners, had apprehended considerable danger to the life of the ova.

In the presence of a large ice manufactory, in close proximity to which the hatching box was placed by the Acclimatization Society, and where could be obtained at all times an unlimited supply of ice, so essential to the well-being of the ova, that body possessed an element of success not enjoyed by the Commissioners in this Colony, whose sole dependence rested on the surplus from the ice-house of the "Norfolk." The Commissioners, therefore, cannot but regard the retention of a small portion of the ova in Melbourne as a prudent course, and as affording an additional guarantee against the failure of this great undertaking.

All necessary arrangements having been completed on board the "Victoria," that vessel took her departure for Hobart Town on the morning of the 18th of April, and dropped her anchor in the Derwent at 3 o'clock in the afternoon of the 20th of that month. She was immediately visited by the Commissioners present in Hobart Town; and the work of removing the ova and ice, now reduced to about ten tons, into a barge provided for their reception, was forthwith begun. The zeal evinced by Captain Norman, his officers, and men, soon brought that work to a conclusion; and all was completed in less than six hours.

At 9 p.m. the barge was taken in tow by the little steamer "Emu," which had been waiting all day ready to start at a moment's notice, having on board two of the Commissioners and Mr. Ramsbottom; and at 1 a.m. on the following morning safely reached the wharf at New Norfolk, where the barge, with its invaluable cargo, was securely moored and carefully guarded until daylight appeared.

As soon as it was known that the ova had reached New Norfolk, gentlemen residing in the town and its vicinity vied with each other in their offers of assistance by their servants and teams. At an early hour the barge was towed from the steam wharf to the place of debarkation at the Falls, where from forty to fifty bearers and ten horse teams were waiting to take a part in the transport of the ova and ice to the banks of the Plenty.

Five of the large cases of ova were, without loss of time, landed from the barge; and being slung on bamboos, for which they had been prepared in Melbourne, they were placed on the shoulders of the men selected to carry them, and were, in a space of a little more than two hours, safely and without the slightest accident deposited on the margin of their new home. In like manner, and with the same success, the remainder of the cases were brought up from the barge, five at a later period of the same day, and the remaining one early on the following morning.

Some hours after the first portion of the cases had reached their destination, and after some alterations had been made in the gravel of the hatching boxes in the ponds, Mr. Ramsbottom, zealously assisted by one of the Commissioners, Mr. Morton Allport, began the process of unpacking the ova from the little boxes in which they had been so long imprisoned, and placing them in the limpid stream which had long been awaiting their advent. This operation was continued during the remaining part of the afternoon and a great portion of the night, and actively resumed at the dawn of the following day, in the course of which it was concluded.

This process was conducted by Mr. Ramsbottom in the most careful manner, and in the way which his experience and observation had taught him was least likely to injure the delicate and sensative ova. The layer of moss, over the surface of which the ova were scattered, was immersed in the gently flowing water of the breeding troughs, by the action of which the ova, both dead and living, were quickly disengaged from the moss, and quietly settled down on the gravel below.

The removal of the dead ova was a further, and subsequent, as well as a laborious and delicate task, but was executed with all possible despatch.

After a considerable number of the small boxes had been opened, and their contents examined, it was seen that the condition of the ova varied greatly in the different packages. While in some the greater portion of the ova still retained their vitality and healthy aspect, in others nearly every one had perished.

After some further opportunity of observation, it was perceived by Mr. Ramsbottom and the Commissioners present, that a close and almost unvarying relation existed between the fate of the ova and the condition of the moss in which they were enveloped. Where the moss retained its natural green hue and elasticity, there a large proportion of the ova retained a healthy vitality. Where, on the contrary, the moss was of a brown colour, and in a collapsed or compressed form, few of the ova were found alive, and all were more or less entangled in a network of fungus.

The Commissioners cannot, therefore, help suspecting that the condition and quantity of the moss in which the ova were imbedded in each small box greatly influenced their health and vitality. Messrs. Allport and Ramsbottom, by whom the chief part of the ova were transferred from the packing-boxes to the ponds, assured the Commissioners that the smallest amount of mortality was invariably found to

have taken place in those boxes in which the moss had been most loosely packed, and the ova subjected to the least amount of pressure.

The Commissioners have already communicated to Mr. Youl their observations and conclusions on this point. By him, and by other pisciculturists in England, the subject will doubtless be duly investigated. The point involved is one which experience and observation can alone decide.

It is impossible for the Commissioners to say, with accuracy, what was the number of ova placed in the ponds in an apparently living and healthy condition. Mr. Ramsbottom had, with some hesitation, estimated them at 30,000, or a little more than a fourth part of the number embarked in the "Norfolk." From this number, however, it has since been discovered that a large deduction has to be made on account of those that have been found sterile in consequence of deficient fecundation. A large portion of the ova of this character have maintained, during the whole progress of hatching, and many of them even still preserve, their brilliant and healthy aspect, but on close examination are found to contain no embryo fish within.

Mr. Ramsbottom has estimated the number of these unfecundated ova at not less than 16,000. The number of healthy trout ova placed in the ponds is believed by Mr. Ramsbottom not to have exceeded 300; and his opinion is confirmed by the Commissioners present at the opening of the boxes, and other observers.

Immediately before commencing the operation of depositing the ova in the breeding troughs at the ponds, blocks of ice were placed in the small stream which flows over them, which had the effect of reducing the temperature of the water from 55° to 44°. This was continued while the ice lasted,—a period of two days,—and was found amply sufficient to carry the ova safely through the critical stage of transition from the low temperature in which they had previously existed to the higher temperature of the ponds to which they now became exposed. All danger, however, from this source, if any existed, was effectually prevented by a natural and considerable fall in the temperature which took place in the water of the Plenty before the supply of ice had become exhausted, and which has since remained very uniform, not exceeding 49° nor falling below 39°.

With a view to provide an additional guarantee against total failure, a portion of the ova were subjected, in accordance with the advice of Mr. Youl, to the process of hatching in an apparatus entirely apart from the ponds, and consisting of two tubs filled with gravel and supplied with a slender stream of iced water from a large cask with which they were connected. In this manner a small portion of ice, reserved for the purpose, was found sufficient to maintain the water at a reduced temperature for some time after it could no longer be applied to the larger apparatus connected with the ponds. In these tubs, however, no greater success was achieved than in the larger breeding troughs.

The salmon ova were deposited in the ponds on the ninety-first day from the date of their embarkation on board the "Norfolk;" and, with the exception of the contents of two small boxes of greater age, about the ninety-sixth from their exclusion from the parent fish, and thus four days within the period beyond which it has always been represented by Mr. Youl that it would be highly dangerous to delay their immersion in their native element.

The ova having been thus all deposited in the ponds, it is unnecessary for the Commissioners to inform your Excellency that their progress towards maturity was watched with intense anxiety.

Two boxes have been mentioned as containing ova of a greater age than the others. These had been taken from the parent salmon about the 6th of December, 1863, had lain for six weeks in the ice vaults of the Wenham Lake Ice Company, and were therefore forty-five days old at the time of embarkation in the "Norfolk," and one hundred and thirty-six days when placed in our ponds. They had been sent out by Mr. Youl with the special object of further ascertaining for what period the process of hatching might be retarded beyond the natural period. Of these ova few were found to have survived, but most of those that were still living already exhibited the eyes and outlines of the fish within. Among the others of shorter age, and especially the trout ova, the same encouraging proofs of development were soon perceived.

On the 4th of May, the first trout made its appearance, followed on the succeeding day by the first salmon that had ever been seen in Australia, or south of the equator.

The further hatching of the trout and salmon proceeded very slowly for some days, but then became more rapid, especially among the trout. Among these the process was completed about the 25th day of May, producing upwards of 200 healthy fish. The hatching of the salmon was more protracted, and was not concluded until the 8th of June, on which day the last little fish was observed making its escape from the shell. As they continued to make their appearance from day to day, their numbers were counted by Mr. Ramsbottom with tolerable accuracy up to about 1,000, after which it was no longer possible to keep any reckoning.

It is impossible for Mr. Ramsbottom, or the Commissioners, to make even an approximate estimate of the number of young salmon now in the ponds. That they amount to several thousands they have no reason to doubt; and, as the mortality amongst the ova after deposition in the ponds was very moderate, and quite insignificant among the young fish, there is reason to hope that they may exceed rather than fall short of expectation.

Although the first living salmon was discovered in one of the troughs containing a portion of the younger ova, there is no doubt that it was preceded by some hatched from those of greater age, although, from being concealed under the pebbles, they were not sooner noticed. That they had preceded the others, however, is evident from their superior size, and other marks of greater advancement. From these older ova not more than four or five fish have been produced.

The trout have now entirely lost their umbilical appendages, and receive their morning and evening meals of boiled liver from the hands of their keepers. The salmon are rapidly advancing to the same condition.

Having been urged by Mr. Youl not to admit the trout into the same rivers with the salmon, the Commissioners have decided in the meantime to place the former in the circular clearing pond under Mr. Ramsbottom's immediate eye and care, where they will doubtless thrive and multiply, and at no

distant period afford the means of stocking all the rivers of the Colony into which it may be considered proper to introduce them.

The great undertaking of introducing the salmon and trout into Tasmania has now, the Commissioners believe, been successfully accomplished; and they trust they are not premature or too sanguine in congratulating your Excellency, and the Colony on this auspicous event, which cannot fail at no distant time, to exert a very beneficial influence on the interests and resources of the Australian Colonies.

Few countries of the same extent possess more rivers suited to the nature and habits of this noble fish than Tasmania. A stranger acquainted with the salmon rivers of Europe could scarcely behold the ample stream and sparkling waters of the Derwent without fancying that they were already the home of the king of fish. And the Derwent is but one of many other large and ever-flowing rivers almost equally suited to become the abode of the salmon. When these rivers have been stocked, they cannot fail to become a source of considerable public revenue, and of profit and pleasure to the people.

Where so many have assisted in obtaining this important boon for the Colonies, it is difficult to particularize all those to whom it is indebted for their disinterested services.

The untiring zeal and indefatigable exertions of Mr. Youl stand forth conspicuous, and have been mainly instrumental in bringing the present experiment to a successful issue.

The noble liberality of Messrs. Money Wigram and Sons has been already dwelt on; and those gentlemen, the Commissioners are aware, have received the well-merited thanks of your Excellency's Government.

To those noblemen, gentlemen, and others, who rendered such important and timely aid to Mr. Youl in his arduous labours, the thanks of the Commissioners, and of the whole Colony, are due.

A special vote of thanks has been transmitted by the Commissioners to Mr. Robert Ramsbottom, of Clitheroe, for the untiring interest he has long manifested in the attempts to introduce the salmon into Australia, of which he has given practical proof by his hearty co-operation with Mr. Youl, and the free use of his practical skill and experience in promoting the success of the experiment.

The Commissioners have felt it to be their duty, with the sanction of the Government, to present pieces of plate, with an expression of their thanks, to Captain Tonkin, of the "Norfolk;" to Mr. Carpenter, his chief officer; and to Captain Norman, of Her Majesty's Colonial steamship the "Victoria," in acknowledgment of the deep interest displayed by them in the success of the undertaking, and their efforts to secure the rapid transport of the salmon ova from London to Melbourne, and Melbourne to Tasmania, upon which their safety in a great degree depended.

This Colony is under deep obligations to the Government and Parliament of Victoria, and to the President and Members of the Acclimatization Society, for their disinterested assistance.

Towards the expenses of the experiment by the "Beautiful Star," the liberal sum of five hundred pounds was cheerfully contributed from the Public Treasury of that Province: and, on the recommendation of the Acclimatization Society, a similar amount was granted in aid of the second experiment, together with the use of the fine steamship "Victoria." The importance of this latter service can hardly be too highly estimated. It supplied a link in the progress of the experiment which had caused the Commissioners much anxiety. The value and disinterestedness of these services are enhanced by the fact that, at the time they were rendered, the faintest hope only existed that Victoria would be benefitted by the success of the undertaking except in a very secondary degree. It is only lately that the idea of acclimatizing the salmon in some of the rivers of that Colony has been entertained; and the Commissioners will hear with much pleasure that this reasonable expectation has been fulfilled.

They rejoice to learn that nearly 300 healthy young salmon have been produced from the few boxes of ova left in the hands of the Acclimatization Society; and it will be their first duty, as some acknowledgment of the generous aid they have received from Victoria, to render every assistance in their power towards the early stocking of the rivers of that great Colony fitted to become the homes of the salmon and trout.

Since the process of hatching was completed, the mortality among the young fishes, both salmon and trout, has been very insignificant, and has been almost entirely confined to a small number of the former that came forth from the egg with crooked spines or some other deformity. They have grown considerably, and present every characteristic of vigorous health.

The Commissioners have no reason to doubt that the young parr will in due season attain to the condition of complete salmon, fulfil the long-cherished hopes of the Colony, and make an ample return for all the expense and labour incurred in introducing them. They entertain every confidence that, under the guidance of their unerring instincts, they will, when the proper time arrives, proceed to and return from the sea in safety, and in their journey will meet with no enemies more formidable than those to which their progenitors have been exposed in the waters of Great Britain.

Notwithstanding the success, however, that has already been achieved, the Commissioners are unanimously of opinion that at least one more importation of ova should be undertaken without loss of time. It is not probable that the young fish now in the ponds will produce any spawn, by which their numbers may be multiplied, until a period of from two to three years has elapsed, and thus much time will be lost in fully stocking the rivers of the Colony unless a further supply of ova be obtained.

The whole expense of another importation would not, the Commissioners believe, exceed £800; which, divided among the various Colonies, which they have every reason to believe would contribute towards the expense of another importation of ova to Tasmania, from which as a centre they will be distributed to the surrounding Colonies at a very trifling additional cost, and without any risk of failure, would prove a very insignificant burden to any of them. The undertaking can no longer be regarded as an experiment, but as a commercial transaction, to be carried out with results varying only in amount. Considerable as has been the success on the present occasion, the Commissioners believe that the additional experience which has been gained by Mr. Youl in England, and by themselves and their intelligent Superintendent, Mr. W. Ramsbottom, in this Colony, would ensure still more favourable results from a renewed importation of ova.

Of all the Australian Colonies, New Zealand possesses a climate most nearly resembling that of

Tasmania, and the greatest number of rivers that may be supposed fitted to become the habitation of the salmon. From Southland the liberal contribution of £200 has been received in aid of the last experiment; but she alone, of all the Provinces in that extensive Colony, has hitherto given any response to the appeal long since made to them.

The Commissioners earnestly hope that your Excellency's Government will recommend to the Parliament now sitting the appropriation of such a sum as will enable them to take immediate measures for the introduction of a further supply of salmon ova

In the appendix will be found a statement of the whole cost of the last importation.

The Commissioners have every reason to be satisfied with the manner in which their Superintendent, Mr. Ramsbottom, has discharged the important duties of his office. He has amply fulfilled the expectations which induced them to send him back to England in 1862; and since his return to the Colony, the intelligence and devotion with which he has watched and aided the progress of his valuable charge has merited their warmest commendation.

The Commissioners, anxious not to anticipate any expenditure that could be postponed until the success of the undertaking should be fully established, have hitherto refrained from recommending the erection of a residence for the Superintendent in the vicinity of the ponds. That work should now no longer be delayed; and they recommend that a comfortable weatherboarded cottage should be built with all possible despatch for the accommodation of Mr. Ramsbottom and his family.

The thanks of the Commissioners are due to R. Read, Esq., for his kind hospitality in receiving Mr. Ramsbottom (who must otherwise have lived in a tent) into his house at Redlands.

The salary hitherto paid to Mr. Ramsbottom for his services has been very small, and is, in the opinion of the Commissioners, no longer commensurate with the duties intrusted to him. On this subject they will further address your Excellency's Government in a separate communication.

R. Officer,
Chairman of Commissioners.

Enclosure 3 in No. 6.

Report of the Tasmanian Salmon Commissioners, 1866.

To His Excellency Colonel Thomas Gore Browne, C.B., Captain-General and Governor-in-Chief of the Colony of Tasmania and its Dependencies.

May it please Your Excellency,—

In their Report addressed to your Excellency in the year 1864, the Commissioners expressed their unanimous opinion that, notwithstanding the considerable amount of success that had attended their recent attempt to introduce the salmon and trout into the Colony, resulting in the hatching of several thousands of the former and 500 of the latter, they should be authorized to procure another importation of ova, which they considered still necessary for ensuring the ultimate success of the undertaking, which they could not regard as complete until crowned by the return of some of the salmon from the sea, and with the view of accelerating the full stocking of our numerous fine rivers with these invaluable fish.

To this proposition the Government and Parliament promptly and liberally assented; and the sum of £800 having been placed at their disposal, the Commissioners lost no time in taking measures for the performance of the task assigned to them. They made immediate application to Mr. James Youl, who had so zealously and successfully conducted the previous shipment of ova, and whose co-operation they regarded as almost indispensable to success, selecting him again to afford them his valuable assistance, and not doubting his ready compliance. In this expectation, however, the Commissioners were disappointed. Mr. Youl declined to engage again in a work which had already cost him much personal labour and anxiety; and as his reply was not received until it was too late to make other arrangements for carrying out their object during that year, the season was thus lost to them.

Under this difficulty and disappointment, the Commissioners, in concert with the Council of the Acclimatization Society of Victoria, who had always cordially co-operated with them in this important work, determined to seek the aid of Mr. Edward Wilson, then resident in England, who had always taken a warm and practical interest in our previous attempts to introduce the salmon into the rivers of Australia. Although then labouring under an almost total loss of sight, since happily in a great measure restored, Mr. Wilson did not decline the task which he was solicited to undertake.

The Commissioners had no desire that Mr. Wilson should, and no expectation that he could, do more than appoint fitting agents to perform the work required; but even this was a labour which must have proved difficult and embarrassing to one suffering under such a privation. Happily, however, he was relieved from all embarrassment by the spontaneous offer of Mr. Youl again to undertake, on behalf of his friend, the whole management of another shipment of ova. The Commissioners need not assure your Excellency that they received the intelligence that Mr. Youl had thus again devoted himself to the work with much satisfaction. They felt assured that the skill and energy that had contributed so much to the success of the former enterprise would not be wanting to the renewed undertaking; but aided by the experience acquired on that occasion, and during the interval of two years that had since passed away, would ensure a higher success than had attended any of their previous efforts. In this expectation the Commissioners have not been disappointed.

Mr. Youl's first work was to secure proper accommodation, paying the usual rate for freight, on board the fine clipper ship "Lincolnshire," the property of Messrs. Money Wigram and Sons, whose vessel, the "Norfolk," brought out the ova in 1864, which was advertised to sail for Melbourne at a date suitable for his purpose. In the hold of this vessel an ice-house was constructed, on the same general plan as that used in the "Norfolk," but of rather larger dimensions, and with some improvements which experience led Mr. Youl to adopt.

The salmon and salmon-trout ova were obtained from various rivers in Great Britain, through the agency of Messrs. Ramsbottom, Johnson, and Allies, who exerted themselves most zealously to fulfil

their task, rendered peculiarly arduous by the stormy weather that prevailed whilst they were engaged in their work, and greatly impeded the capture of the parent fish.

Mr. Youl draws the special attention of the Commissioners to the merits and exertions of Mr. Thomas Johnson, by whom a very large proportion of the ova was obtained and brought to London, without which the number required for shipment would have been greatly deficient.

The ice-house was fitted for the reception of 150,000 ova, which it was Mr. Youl's desire and intention to have placed in it; but, from the cause above mentioned, he was unable, in spite of the utmost efforts of himself and his assistants, to procure more than 104,000, consisting of about 93,000 salmon, 10,000 salmon-trout, and 500 brown trout ova. These having been carefully packed in moss, and placed in small wooden boxes of the same character and dimensions as those used on the former occasion, were then deposited in the ice-house, covered by and distributed through a mass of thirty-five tons of ice obtained from the vaults of the Wenham Lake Ice Company. The door of the ice-house was then closed, not to be opened until the "Lincolnshire" reached her destination at the antipodes.

The ship took her departure on the 20th January, the same day of the same month on which the "Norfolk" had sailed with her former shipment in 1864, with every prospect, from her well-known sailing qualities, of making a speedy voyage. Unfortunately, in passing through the Downs, she came into collision with another vessel, and suffered so much damage as to be compelled to return to port for repairs, thus greatly retarding her passage to Victoria. This unfortunate accident caused Mr. Youl much anxiety, nor was it less a source of regret and alarm to the Commissioners when they were apprised of the disaster. Both were fully aware that the ova could not be detained in their ice prison, as it then appeared certain they would be, for more than 100 days, without danger and loss.

The repairs of the ship having been completed, she again started on her long voyage, and safely reached Melbourne on the 1st May, after a favourable passage of average duration, but extending to 100 days from the date of her first setting sail.

On the arrival of the "Lincolnshire" in Hobson's Bay, Mr. Ramsbottom, the Superintendent of our breeding establishment at the Plenty, whom the Commissioners had despatched to Melbourne some time before, for the purpose of superintending the transhipment of the ova into the "Victoria" steamship, which the Government of Victoria had with the utmost liberality again placed at the service of the Commissioners, immediately proceeded on board, accompanied by the President and other members of the Council of the Victorian Acclimatization Society. Two of the small packages of salmon ova having been anxiously inspected by these gentlemen, they were gratified by discovering that a large proportion of them appeared to be in a sound and healthy condition, notwithstanding the long and disastrous voyage to which they had been exposed. The most energetic measures were immediately adopted for the removal of the ova to the "Victoria," in effecting which Mr. Ramsbottom was cordially assisted by the Council of the Acclimatization Society and their Secretary, Mr. Sprigg, as well as by Captain Norman, who had afforded every facility and aid within his power for making the necessary preparations for the conveyance of the ova to Tasmania in the vessel under his command.

The small boxes containing the ova were packed as before in large cases, but of only half the size of those used on the former occasion, which had been found too ponderous to be conveniently or easily carried from New Norfolk to the Plenty.

Although the Council of the Victorian Acclimatization Society had borne a considerable share of the expense of the enterprise, they liberally, and the Commissioners considered wisely, refrained from detaining any of the salmon or salmon-trout ova to be hatched under their own care, preferring that they should have the advantage of the more complete and matured appliances at our command, with the skill and experience of our Superintendent. The small box containing the brown trout ova was alone left in their charge, and these, when examined, were unfortunately found to have all perished.

The cases containing the salmon and salmon-trout ova having been all securely placed in the hold of the "Victoria," and covered over with the remnant of the ice from the "Lincolnshire," still amounting to about fifteen tons, within twenty-four hours after they reached Melbourne Captain Norman got up steam, and proceeded on his voyage across the Straits; but, in order to obviate the danger to be apprehended from the vibration caused by the machinery, using only half steam-power. This precaution must have necessarily prolonged the passage to a considerable extent; but it was unfortunately still further protracted by a dense fog that prevailed in the Straits compelling Captain Norman, for the safety of his ship and all she had on board, to proceed with the utmost caution, and even to cast anchor under Goose Island for the greater part of one night. The passage from Hobson's Bay to the Derwent thus occupied three days instead of forty hours, in which it is usually performed by the steamers trading between these two ports.

From Hobart Town the ova were promptly conveyed, together with about ten tons of ice that still remained undissolved, to their future home at the Plenty, by means almost precisely the same as those employed in 1864, and which it is therefore unnecessary again to describe in detail. Within thirty hours from the arrival of the "Victoria" at Hobart Town, the whole of the ova had been safely deposited in the hatching boxes at the ponds.

As soon as the first boxes reached their destination, the process of unpacking was commenced by Mr. Ramsbottom, assisted by or in presence of several of the Commissioners and many other anxious spectators. The first two packages opened presented a very discouraging aspect. In these nearly all the ova had perished. As the work proceeded, however, better indications appeared; and when all the boxes had been unpacked, the general conclusion was that nearly half, and certainly not less than 40 per cent. of the ova were to all appearance alive.

Although these results were highly encouraging, and gave promise of a large degree of success, the Commissioners and their Superintendent were fully aware that the number of fish might fall far short of the number of ova that reached their hands in an apparently sound condition. The appearance of the ova that had perished indicated that by far the largest portion of the mortality had taken place within a very recent period, and led to the conclusion that they had been dying in large and daily increasing numbers for a week or two before their arrival at the ponds. Nor was it to be expected that this mortality would be immediately stayed by the removal of the still living ova from their late unnatural home to the waters of the pond. It was scarcely to be doubted that in many the process of

decay had already begun, although not to be detected by the eye. The Commissioners were further aware, from their own experience as well as from that of all pisciculturists in Europe, that a considerable deduction has always to be made on account of imperfect fecundation, against which no care or skill can fully provide.

Among the ova imported by the Commissioners in 1864, it was found that 16,000 were thus barren, and out of our recent importation 10,000 at least have been ultimately found to be in the same condition. The number of ova, therefore, received at the ponds, capable, under any circumstances, of producing living fish, was reduced to 30,000. From these 30,000 ova that had travelled over half the circumference of the globe before they reached our ponds, and had been unnaturally immersed in their little wooden prisons for 104 days, we have obtained about 7,000 healthy young fish, consisting of 6,000 salmon and 1,000 sea trout,—a number not only large in itself, but representing a percentage not very far short of that attained at Henningen, the best conducted fish-breeding establishment in the world, where the ova are received without having passed through any of the perils and disasters to which these had been exposed.

It will have been observed that, while only about 3,000 fish were produced from the importation of ova in 1864, more than double that number have been hatched from about the same number of ova received on the last occasion, although fourteen days longer on shipboard. This discrepancy in the results of the two undertakings, and the greater success of the last, are probably in a great measure due to the lighter packing of the moss in which the ova were embedded, and to some improvements in the ice-house; to both of which Mr. Youl was led by his previous experience. A portion of this higher success is also to be attributed to some alterations in the hatching boxes at the ponds, consisting chiefly of the substitution of a finer for a coarser gravel, by which the ova were prevented from ever sinking out of view, enabling Mr. Ramsbottom at once to remove all that died, and became a source of danger to the living during the process of hatching. The temperature of the water also, which was several degrees lower in the month of May last than during the same season in 1864, had no doubt a favourable influence on the result.

The young salmon and salmon-trout have already in a great measure been freed from their umbilical appendages, and have become vigorous and active fish. The mortality since the process of hatching was completed has been of the most trivial amount.

The Commissioners regard the salmon-trout as an acquisition especially valuable. These fish nearly approach the true salmon in the size to which they attain, as well as in their qualities as an article of food; and it is now a well-ascertained fact that they will thrive and multiply their numbers in fresh water without visiting the sea. The Commissioners, therefore, entertain no doubt that they will be as successful in acclimatizing this valuable fish as they have already been in the case of the brown trout. The number of these last, hatched from the ova imported in 1864, were for some time estimated not to exceed 150, but were afterwards, when captured and accurately counted, found to approach to double that number. Of these, about forty were set at large in the Plenty in April, 1865, and the rest retained in the pond as a breeding stock, where they have thriven without interruption, and have attained a size and weight exceeding the standard which the trout usually reaches at the same age in the rivers of Great Britain. For several months past it has been anticipated that some of these fish would spawn during the present winter season. This expectation has now been fulfilled, and the Commissioners have the pleasure of reporting that a considerable number of ova have already been secured from a few of the trout, and that others are on the point of spawning.

The Commissioners cannot say with any certainty what will be the number of ova which the present season may yield, but from so small a body of fish in the first year of their spawning the produce will necessarily be limited. They hope, however, to be enabled to furnish an immediate supply to the Council of the Victorian Acclimatization Society, and to the association lately formed at Launceston for procuring the early stocking of the rivers in the northern division of the Colony, who have given a guarantee that suitable preparation shall be made for the safety and due hatching of the ova that may be intrusted to them.

The Provinces of Canterbury and Southland, in New Zealand, from both of which pecuniary contributions have been received in aid of the undertaking, as stated in their last Report, have a just claim to share in the benefit of our success, which the Commissioners gladly acknowledge, and which it will be their anxious desire to satisfy at the earliest possible opportunity.

At Christchurch a pond and hatching boxes have long since been constructed under the superintendence of Mr. Johnson, Secretary to the Acclimatization Society of that place. This gentleman has further offered to come in person to this Colony for the purpose of receiving and conveying to Christchurch such supply of ova as the Commissioners may be able to furnish, and which it will afford them much gratification to provide during the present season, if the numbers of ova at their disposal should prove sufficient.

The claims of other localities will be attended to as rapidly as possible, according to the means which may be at the command of the Commissioners.

In another year a much increased number of ova may be expected from the same fish; and in the meantime other centres of supply will have been established, from which ova or fry may be distributed in all directions.

It may be expected, according to the preponderance of authority on that long-disputed question the duration of the stay of the salmon in the sea, that the fish produced from the hatching of 1864 will return to the neighbourhood of their birthplace towards the end of the present year, when their arrival will be anxiously looked for as the happy consummation of this great enterprise.

The English trout may be now regarded as established in our rivers beyond all risk of failure; and the Commissioners entertain a confident belief that the young salmon already set at large in the Derwent, with the still larger number which they have lately succeeded in hatching and are now thriving in the ponds, would suffice for the ultimate stocking of our waters with this still more valuable fish. At the same time, their opinion that this great work should never be regarded as fully accomplished until the fish have returned from the sea, and provided the means of further propagation, remains unchanged. They therefore very earnestly recommend that they should be authorized and

enabled to procure at least one more importation of ova from England, which would not only give a further guarantee against ultimate failure, but would greatly accelerate the full stocking of the rivers of the Colony, and the early realization of the vast benefits that cannot fail to flow from the accomplishment of this great work.

When the almost incalculable value of the salmon and trout as articles of human food, as a means of extending our commerce, increasing our population, and affording employment to our labouring classes, are considered, besides the direct pecuniary returns to the Treasury of the Colony, the expense incurred in their establishment in our rivers sinks into insignificance. In their last Report the Commissioners estimated the cost of each future importation of ova at £800, and that estimate has proved strictly correct.

The Commissioners have been informed by the Council of the Victorian Acclimatization Society that, although entirely concurring in the opinion that another shipment of ova should be procured, they are unable, in consequence of having no funds at their command, to bear any share in its cost. The Commissioners are, however, persuaded that the Government of that prosperous Colony, which has always shown a deep interest in the enterprise, and given it a general support, would not, if applied to, refuse their further aid; nor can they doubt that the other adjoining Colonies, and more especially the various Provinces of New Zealand, whose rivers are so well suited to become the home of the salmon and trout, would be found ready to assist us. But, without waiting to learn whether any or all of these Colonies will agree or decline to contribute to the expense of a further prosecution of this great enterprise, the Commissioners earnestly hope that your Excellency's Government will not hesitate to recommend, and that the Parliament will sanction, the appropriation of such a sum as will enable the Commissioners, without loss of time, to take measures for proceeding with their task.

Since the date of the last Report, various improvements have been made in the ponds at the Plenty; the chief of which has been the construction of two winding rivulets several hundred yards in length, one being connected with the small circular pond in which the trout are confined, and the other attached to the large pond devoted to the use of the salmon. To these rivulets both kinds of fish have freely resorted, with undoubted advantage to their health and progress.

The addition of the salmon-trout to the family under their charge, and the spawning of the brown trout, have necessitated the formation of a small additional pond, which is now in progress, and will soon be completed. The Commissioners have also found it advisable to provide for the complete draining off of the water in the large pond when required, by laying down a few iron pipes fitted with a secure valve, which shall effectually prevent the escape of any of the young fish with which it will be again soon peopled. The expense involved in these various improvements will be of only trifling amount.

In accordance with the recommendation of the Commissioners contained in their Report of 1864, the Government sanctioned the erection of a cottage for the use of the Superintendent, for which the necessary funds were granted by Parliament. This building was completed in a very satisfactory manner in the course of last year, and has since been occupied by Mr. Ramsbottom. The addition of a small room for the use of the Superintendent's assistant, who has lived for several years in a mere tent, has been approved by the Government, and contracted for at a small cost.

The grounds attached to the ponds having been found of insufficient extent to admit of the increased accommodation which the well-being of their charge demanded, an additional acre has been obtained on lease from the proprietor for the same period, and on the same terms as those on which the original area is held.

The Commissioners have much pleasure in again bearing testimony to the zeal and intelligence with which their Superintendent, Mr. Ramsbottom, has continued to discharge the important duties of his office.

The Act passed during the last Session of Parliament for the protection of the salmon, and the several Proclamations issued by your Excellency under its authority, have been found to operate in a very beneficial manner. The Commissioners believe that few attempts have been made to infringe the provisions of the law. In some of the bays bordering on the municipality of Glenorchy some unlawful fishing with the seine is supposed to have taken place; but this violation of the law has been promptly and energetically suppressed by the Warden and Councillors of the district, aided by their very efficient police and the active and zealous water-bailiff, Mr. Young. Efficient, however, as the Salmon Act has proved to be, experience has shown to the Commissioners, as was to be anticipated, that it admits of some amendments which it will be their duty to suggest to the Government at an early date, in order that they may be considered, and, if approved, enacted during the approaching Session of Parliament.

In conclusion, the Commissioners desire to express their acknowledgment of the constant support which they have on all occasions received from your Excellency's Government in the performance of the arduous duty intrusted to them.

R. Officer,
Chairman of Commissioners.

Enclosure 4 in No. 6.

Report of the Tasmanian Salmon Commissioners, 1867.

To His Excellency Colonel Thomas Gore Brown, C.B., Captain-General and Governor-in-Chief, of the Island of Tasmania and its Dependencies.

May it please Your Excellency,—

In their last report the Commissioners had the satisfaction of informing your Excellency that from the last importation of salmon and trout ova which arrived at Melbourne from England on board the "Lincolnshire," on the 1st May, 1866, reached Hobart Town by the "Victoria" steamship on the 5th, and on the 6th of the same month were safely deposited in the ponds at the Plenty, they had succeeded in hatching 6,000 of the former and 1,000 of the latter fish.

They have now the further pleasure of reporting that, during the year that has since elapsed, these young fish have continued to thrive and grow in a most satisfactory manner, with a very small amount of observed mortality. The season is now close at hand when many of these parr will begin to assume the garb of smolts, preparatory to their first visit to the salt water, when they will be set at large to join their elder relatives now in the Derwent, and left to their own resources. These older fish set out on their journey seaward in the month of October, 1865; and doubtless the younger brood will take their departure about the same period of the present year.

Of the salmon-trout it is proposed to detain a portion in the ponds, in the hope that their numbers may be increased by propagation, as the Commissioners have been assured on high authority they may be, without visiting the salt water.

But the object which has for some time past engaged the chief attention and occupied the anxious thoughts of the Commissioners has been the return of some of the brood of 1864 from the sea to the Derwent. The first detachment of these, as has just been mentioned, left the ponds in the form of smolts in October, 1865; and, according to the opinion of many eminent pisciculturists, a portion of them ought to have returned from the sea about the end of the same or the beginning of the following year, after an absence of from two to four months. Not one, however, as far as the Commissioners are aware, was seen, or even reported to have been seen, in the Derwent about that period. Upon this merely negative and superficial evidence, however, the Commissioners cannot take upon themselves to say that none returned. It is quite possible that considerable numbers of them may have been present in the river without having been observed by any one; for a thousand fish in such a stream as the Derwent might pass and repass without attracting notice. Of this fact the Commissioners were strongly warned by the late lamented Mr. Ffennel, Chief Inspector of English Salmon Fisheries, who admonished them not to be disappointed or discouraged if no salmon should be seen in the first year of their migration and return. And, undoubtedly, the return of the salmon was far more confidently and generally looked for in the beginning of the present than of the previous year, so that the eyes of many deeply interested in the undertaking, including Mr. Ramsbottom, the indefatigable superintendent of the salmon-breeding establishment, were directed to the waters of the Derwent with more constant and more earnest attention during the latter than the former season.

In the month of January of the present year some large and strange fish, never before observed by them, were seen to leap in the Derwent, opposite the town of New Norfolk, by several residents of the highest respectability; but as various kinds of salt-water fish occasionally visit this part of the river, although far inferior in size to a salmon or a grilse, and of which none have ever been known to rise above the surface of the water, the Commissioners refrained from drawing any positive conclusion from these observations, although the parties by whom they were made and reported were worthy of every trust.*

But on the 14th February unquestionable evidence of the presence of the returned salmon in the river was afforded by a party of gentlemen† of the first standing in the community, by whom, whilst riding close along the bank of the Derwent, near a place called the "Dry Creek," several miles beyond the reach of the tide, and above several rapids, a large fish was twice seen to leap from the water, which was afterwards observed gliding under the surface for some distance, and was at once recognized as a salmon by one of the party familiarly acquainted in Ireland with the appearance and motions of that fish.

On the 21st February, two miles above the spot last mentioned, a large fish was seen leaping by a respectable tradesman, while driving along the road, which runs close to the bank of the river.

On the 28th, at a spot a mile still further up the stream, a gentleman passing along on horseback, and one of the water-bailiffs attached to the establishment, simultaneously, and from opposite banks of the river, saw a large fish leaping, which the latter, an old salmon-fisher from Scotland, at once identified as a salmon or grilse.

On the 15th March, Mr. Ramsbottom, the experienced superintendent of the ponds, and a salmon-fisher from his earliest years, having been informed by the water-bailiff that at a place a short way below the mouth of the Plenty he had seen a great commotion in the Derwent, apparently caused by great numbers of small native fry pursued by some large fish, stationed himself on the bank of the stream at the spot indicated, and soon after distinctly saw a salmon or grilse rise from the water.

On the 18th March, the same gentleman, his assistant, and a friend (Dr. Moore) from New Norfolk, visited the same part of the river, and in the course of a few hours in the afternoon were rewarded by witnessing seven distinct rises.

On the 1st April, one of the Commissioners (Dr. Officer), accompanied by two friends (Mr. and Mrs. Myles Patterson), took his station an hour before sunset near the same spot, but on the bank of the stream opposite to that from which Mr. Ramsbottom and others had made their observations. Scarcely had he and his companions directed their eyes to the surface of the stream when they perceived that it was in a state of unusual agitation, which they quickly discovered was caused by shoals of small fry skimming along the surface, in their endeavour to escape from some large fish by which they were closely pursued, and whose track close behind them was plainly seen. The character of the pursuers was soon revealed to the beholders by two great fish which in rapid succession rose from the water, fully exposing their glittering bodies to view, and proclaiming themselves to be real salmon. This scene of flight and pursuit continued to be enacted for upwards of an hour, not in one spot only, but in several places simultaneously, over a considerable extent of the river, and terminated only with the setting of the sun. During these observations the large dorsal fin of one of the pursuing fish was distinctly seen rapidly cleaving the water, while another was observed for a few moments reposing close under the surface.

Again on the 3rd and on the 5th April salmon were distinctly seen in the same part of the river by Mr. Ramsbottom and one of the Commissioners (R. C. Read, Esq., J.P.), and another gentleman (Dr. Moore).

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* Mrs. Sharland, Miss Kirkpatrick, and Mr. Oakley.

† Right Rev. Dr. Murphy, Rev. Mr. Dunne, Rev. Dr. Hayes, of Melbourne, Rev. Mr. Hennebrey.

This portion of the Derwent in which the salmon have been thus observed to such advantage, and where they had evidently congregated in considerable numbers, consists of a reach of deep still water four or five hundred yards in length, bounded at each extremity by a rapid which at the lower end passes over a fine bed of gravel, likely, in Mr. Ramsbottom's opinion, to be selected by the salmon as a suitable place for forming their nests and depositing their ova, and is in close proximity to the mouth of the Plenty (their parent home), into which there was every reason to expect that some of them would enter for the purpose of shedding their spawn.

The progress of the salmon has thus been clearly traced from New Norfolk to the mouth of the Plenty,—a space following the course of the Derwent of upwards of eight miles in length. But the instances above related by no means embrace all the occasions on which the salmon have been seen in the river. The fish do not appear to have passed up the stream in one body; for, after their appearance in the Derwent at the various points above indicated, they have been subsequently seen at several places between the Plenty and New Norfolk, showing that they did not travel in one body, but by detachments, or in a continuous stream.

Near a place called "Bell's Terrace," close to New Norfolk, where a fine gravel bed exists, the fish were seen on various occasions by more than one observer* long after their appearance near the Plenty. The last known occasion on which the salmon have been observed occurred on Sunday, the 21st April, when two were seen to leap from the water in a very distinct and striking manner by the same Commissioner to whom they had before exhibited themselves in so satisfactory a manner, near the mouth of the Plenty, and by another gentleman† at precisely the same spot where they had first been noticed on their return from the salt water.

Soon after the date last mentioned the winter season set in, and the Derwent became considerably flooded, in which condition it has since more or less continued, thus precluding all hope of any of the fish being seen in these waters without capture.

The salmon have shown no disposition to enter the Plenty for the purpose of finding a spawning ground, but have preferred to remain in the larger stream of the Derwent, towards the sources of which, as in European rivers, they have probably proceeded in search of a suitable locality as the birthplace of their young. Had some of the fish, as expected, entered the Plenty, their capture would have been easy, and the Commissioners would thus have been enabled, in accordance with their anxious desire, to have added the proof of handling to that of seeing. They believe, however, that the evidence of the return of the salmon as above recorded is complete and irrefragable, and must soon be confirmed by their actual capture, for which the Commissioners have been furnished with all necessary appliances.

If the opinion that a portion of the first body of smolts that proceed to the sea return as grilse within a period of from two to four months from the date of their departure be correct, it follows that some of the fish now in the Derwent have already twice visited the sea, and that those seen in the river during the past seven months comprised both grilse and salmon. And if a part of the young smolts that set out on their second journey in October, 1865, thus returned during the summer and autumn of 1866, they must also have spawned during the winter of that year, and their young must now be in the Derwent in the shape of parr, ready in a month hence to assume the character of smolts, and in their turn to seek a temporary sojourn in the salt water. But, even if this view should be incorrect, and all the young fish should have remained in the salt water for sixteen months, instead of from two to four months, there can be no doubt that a large number of ova have been deposited in the present season soon to become living fish, and add many thousands to the family now occupying the river.

When the Commissioners shall have been enabled to introduce the salmon into some of the smaller rivers of the Colony, such as the South Esk, the Mersey, and many others, they will have no difficulty in ascertaining with accuracy the exact period of the stay of these fish in the salt water, thus solving a question which has long been, and still is, a subject of contention among pisciculturists.

The Commissioners believe that there are few rivers approaching the size of the Derwent where so small a number of enemies dangerous to the life of the young salmon are to be found. Eels, and the small fish locally called mullet, which seldom attain a weight of more than half a pound, with some predaceous birds, are the only foes against which they will have to contend in the fresh waters of that stream. With respect to the mullet, it is a singular and perhaps fortunate fact that, although they had previously been abundant in all parts of the Derwent above the influence of the tide, in the year 1865 they almost totally disappeared from the river and its tributaries.

In that year the Commissioners reported that a disease of an epidemic character had appeared in the ponds, by which from fifty to sixty young salmon and a few of the trout were carried off, and that a great number of the native mullet had at the same time perished apparently from the same cause. It was afterwards discovered that this malady had operated so severely on the native fish that the mullet had almost entirely disappeared from the river, and a few stragglers of small size could alone be be seen. More lately they have shown some signs of recovery and increase, but they are still comparatively few in number and of small size, and cannot be dangerous to the young salmon, of which they are more likely to be the prey.

The Derwent from New Norfolk, a short way below which the water begins to be brackish to Hobart Town, where it is quite salt, including the numerous intervening bays, so teams with the fry of various kinds of fish, greatly increased since the passing of the Salmon Act, that a vast number of salmon would find abundance of suitable food without proceeding further to sea. Below Hobart Town to the mouth of the river in Storm Bay, such is the expanse of water abounding with the young of an infinite variety of fish, that it seems improbable that the salmon will ever have occasion to pass into and incur the dangers of the open ocean, unless prompted by some other motive than mere hunger.

During the past year an incident occurred in the history of our young salmon which excited considerable interest both here and in England. A fine smolt was captured by a young gentleman‡ while fishing for the small native fish in the New Town Creek near the Orphan School, and was with much judgment transmitted to one of the Commissioners,§ with a statement of the facts attending

* Mr. and Mrs. Shoobridge and others. † Major Lloyd. ‡ Master H. V. Bayley. § Mr. M. Allport.

its capture. This fish must have very recently descended the Derwent from the vicinity of its birthplace on the banks of the Plenty, and having reached New Town Bay after a journey of upwards of thirty miles, a considerable portion of the way through salt water, had again sought fresh water, and entered the little stream above mentioned, up which it had passed nearly two miles. The chief point of interest in the history of this little fish consists in the fact that, having entered the salt water, it had again sought the fresh water while still in the condition of a smolt.

This occurrence having been reported to Mr. Youl, was by him communicated to the eminent pisciculturist, Mr. Frank Buckland, who has assigned a conjectural reason for the apparent eccentricity in the behaviour of this young traveller.

Nor has the progress of the trout under the charge of the Commissioners been less gratifying than that of the salmon. In the month of June, 1866, these fish, being then about two years old, began to shed their first spawn, and during the course of the season several thousand of their ova were secured, which, after being duly fecundated, were placed in the hatching-boxes attached to the ponds.

One portion of these ova was subsequently despatched to Melbourne for the use of the Acclimatization Society of Victoria; another was forwarded to Launceston to the care of an association of gentlemen which had been formed with the object of promoting the early stocking of the rivers of the Northern Division of the Colony with salmon and trout; and the remainder were retained in the ponds for hatching under Mr. Ramsbottom's observation.

The result of this first attempt to propagate fish from ova produced in the Colony was unfortunate. The hatching-boxes prepared for the reception of the ova forwarded to Victoria, having been erected on a spot which proved to be subject to inundation, were shortly afterwards, with their contents, swept away by a flood.

Of those despatched to Launceston, although conveyed by Mr. Ramsbottom in person, a large number perished on the way. From the remainder only a few living trout were produced, and these, after attaining a considerable size, were, as in Victoria, carried away by an overflow of the stream near which hatching-boxes had been constructed. From those retained under Mr. Ramsbottom's immediate charge, about forty young trout only have been obtained, which will to that extent add to the number of breeding fish for the season of 1868. A large share in this unproductiveness is attributable to causes which are now understood, and will not be allowed to influence future attempts to increase the number of this fish.

During the past year many of the parent trout detained in the ponds, and still more those at large in the Plenty, have increased in size and weight at a surprising, and the Commissioners believe unprecedented rate.

In June last, a male trout was found dead in the Plenty, evidently killed in an encounter with some of its associates during the exciting season of spawning, which measured 19½ inches in length, and weighed 3½ pounds. On the 29th July last, another was captured alive by Mr. Ramsbottom, of which the length was 22¼ inches, and the weight fully 4 pounds, although the fish was then in a spent and consequently lean condition, having but recently shed its milt. If in full condition, Mr. Ramsbottom estimates that the weight of this fish would have been between 5 and 6 pounds. Many others have been seen in the Plenty of similar dimensions, and some of those confined in the ponds are little inferior to them; although the trout set at liberty in the river and left to provide for themselves have always been somewhat in advance of their brethren imprisoned in the ponds, where they have been carefully and diligently fed.

The trout thus greatly increased in size began to spawn for the second time in the rivulet attached to the pond on the 23rd June; and at the same time some of those at large in the adjoining river were observed busily engaged in forming their nests and depositing their ova.

The season of spawning extended over a period of about six weeks,—terminating on the 6th August. On this occasion the fish were permitted to deposit a large portion of their spawn in the natural way, the remainder only being taken for artificial propagation. While the spawning was going on the parent fish readily passed from the pond into the rill; and, when the operation was completed, a considerable extent of the little stream was to be seen thickly studded with their nests. Before the spawning began, Mr. Ramsbottom had erected a temporary wooden screen close to the bank of the rivulet, from behind which the whole interesting process was watched by him, and clearly seen by some of the Commissioners and many other visitors, without disturbing the fish during their operations. Although a large portion of the ova were left undisturbed in the gravel in which they were deposited by the parent fish, the number of ova obtained for artificial hatching exceeds the total produce of the preceding season. From the store thus obtained, about 1,300 have been despatched to the care of the Victorian Acclimatization Society in Melbourne, which, with a loss of about 25 per cent., are now in a thriving and promising condition in the pond prepared for their reception. A supply of about 800 have also been placed in the hands of Mr. Johnson, Secretary to the Acclimatization Society of Christchurch, in New Zealand, whom the Council of the Society had judiciously despatched to this Colony for the purpose of receiving in person the contribution promised to them. Mr. Johnson at the same time took charge of a smaller supply, 400 in number, for the use of the kindred society in the neighbouring Province of Otago. From both of these Provinces liberal contributions in aid of the enterprise in which this Colony is engaged had been received.

A fish pond, with hatching boxes attached, has been formed during the present year on the estate of Strathmore, on the South Esk, under the direction of Mr. Charles McArthur, who has long taken a warm interest in the establishment of salmon and trout in Tasmania, and took a leading part in the attempt of last year, unfortunately unsuccessful, and of Mr. Cox, of Clarendon. This spot was last year inspected by Mr. Ramsbottom, who pronounced it admirably adapted to the purposes of fish culture, and a convenient centre from which the means of stocking the other rivers in the north might be supplied. Concurring with Mr. Ramsbottom's views on this subject, and having received an assurance and guarantee that they would be tended with all necessary care and attention, 1,200 ova were lately handed over to Mr. McArthur, who had come in person to receive them, and have been by that gentleman safely conveyed to their destination, and placed in the hatching boxes at Strathmore with the most trifling loss. The ova thus supplied have been received by Mr. McArthur and Mr. Cox

on the distinct understanding that they were a public and not a private charge, and that the future disposition of their produce should be under the control of the Commissioners.

The Commissioners conceive that from a centre such as that now established at Strathmore, when fully stocked, the other rivers of the north may be stocked much more conveniently and inexpensively, and with less waste of ova, than from the ponds at the Plenty. In the meantime, and until this source becomes productive, the Commissioners will be prepared, to the utmost of their ability, to furnish the supplies for other approved localities, as well in the north as in the south, where they are assured that adequate means for the due hatching of the ova and the preservation of their produce have been provided.

During the ensuing summer the Commissioners propose to place a small body of young trout in the North-west Bay River, which has all the attributes of a fine trout stream, and to which they can be conveyed by water with facility and safety.

Since the date of their last Report, the Commissioners have made several inexpensive improvements in the establishment at the Plenty, of which the most important have been the completion of the small pond therein referred to, and the formation of a new rill, rendered necessary by the addition of the salmon-trout to their charge. During the ensuing summer some further extensions of the same kind will be required.

Although the water-bailiff stationed at Prince of Wales Bay has been indefatigable in his endeavours to prevent poaching, there is reason to believe that during the past year the law has in some instances been violated; and the Commissioners are of opinion that it will be necessary, for the due protection of the salmon, at no distant date to appoint an additional bailiff. The temptation to poaching has become greatly augmented by the vast increase that has taken place in the number of small fish that now swarm in the Derwent between New Norfolk and Hobart Town, due to the protection afforded to them by the operation of "The Salmon Act." And the prohibition of all fishing in this part of the river is not more necessary for the safety of the salmon than it is conducive to the real interests of the fishermen of the Derwent. That portion of the river which lies between Bridgewater and Hobart Town is the natural nursery in which various kinds of fish, usually inhabiting the deeper water below, deposit their spawn, and from which their numbers are recruited from year to year. The meshes of the nets used by the fishermen are so minute that the fish of the very smallest size are captured and destroyed, and are thus effectually prevented from descending into the deeper water below the city, where they would speedily attain a far greater size and value.

The breeding establishment at the Plenty has from its first erection been an object of great interest and attraction, yearly increasing, not only to the public of Tasmania, but to visitors from all the adjoining Colonies. The Commissioners trust that, at no distant period, they will be able to calculate the time when the existing attractions may be increased by granting permission to use the rod and line.

At the request of the Commissioners, the Government instructed the Surveyor-General to cause a drawing and plan of the salmon ponds to be prepared; and this work has been admirably performed by some of the officers of the department, the survey having been executed by Mr. Morrison, and the drawing by Mr. Piguenet. The former it is proposed to hang in some public place for general inspection. Of the latter a considerable number of excellent lithographs have been executed under the direction of the Surveyor-General, which will be generally circulated, and will afford information respecting the plan and construction of the whole breeding establishment, which have long been sought for, not only by the people of this and the adjoining Colonies, but by many eminint pisciculturists in England, who have been watching with much interest the progress of our enterprise.

ROBERT OFFICER, Chairman.

No. 7.

Copy of a Letter from Mr. T. BLACK to the Hon. E. W. STAFFORD.

Acclimatization Society's Office,
Melbourne, 6th February, 1868.

SIR,—

I have the honor to acknowledge the receipt of your letter of the 3rd ultimo, requesting information as to the best means to be adopted for introducing salmon, &c.

In reply, I beg to inform you, that I immediately wrote to Dr. Officer, the Chairman of the Tasmanian Salmon Commissioners, requesting him to furnish me with copies of the Reports published by the Commissioners. These Reports I now have the honor to enclose with a copy of Dr. Officer's letter.

It may, perhaps, be well to remind you, that a shipment of salmon and trout ova for the Government of Otago is now on its way from London to Dunedin, and His Honor the Superintendent of that Province can doubtlessly furnish you with any further details, if such be required.

I have, &c.,
THOMAS BLACK,
President.

The Hon. the Colonial Secretary,
Wellington.

Enclosure in No. 7.

Copy of a Letter from Dr. OFFICER to the SECRETARY of the VICTORIAN ACCLIMATIZATION SOCIETY.

SIR,— New Norfolk, 28th January, 1868.

In compliance with the request contained in your letter of the 20th instant, I have instructed the Clerk of the House of Assembly to forward to you copies of the various Reports of the Salmon Commissioners by the first mail, but I have some doubt whether one of them is not out of print. I may mention to you that the same request that has been made to your Society has been preferred to

our Government, and that copies of the above Reports have been transmitted to the Colonial Secretary of New Zealand.

I have, &c.,
R. OFFICER.

George Sprigg, Esq.,
Secretary to the Acclimatization Society of Victoria.

No. 8.

CIRCULAR to SUPERINTENDENTS.

Colonial Secretary's Office,
Wellington, 4th January, 1868.

SIR,—

The General Assembly having requested the Government to ascertain the most favourable situations in which experiments for breeding salmon in New Zealand could be conducted with the greatest probability of success, the object which the Legislature has in view would be much promoted if your Honor would be good enough to cause, by means of the Provincial Survey and Harbour Officers, or other competent persons, an observation and record to be kept of the temperature of the water of the principal rivers on the coast of the Province of , and also of the tidal waters at time of ebb and flow in the estuaries and inlets which salmon would probably frequent, and to transmit to me the results when completed. A descriptive statement of the depth and general character of the rivers and their beds should accompany this record.

I enclose forms to assist the collection of information, but it is not intended to limit the information, which should be as full as possible; for instance, changes of temperature at different seasons of the year should be particularly specified.

It will be impracticable to furnish the complete information on the latter point before the expiration of a twelvemonth, but it is important that as much information on the whole subject as can be procured before next April should be forwarded to this office as soon as possible after it is obtained.

I have, &c.,
E. W. STAFFORD.

No. 9.

Copy of a Letter from Mr. MURISON to the Hon. E. W. STAFFORD.

Dunedin, 13th March, 1868.

SIR,—

I have to acknowledge receipt of yours of the 5th instant, inclosing copy of a Memorandum by Dr. Hector, and the Reports of the Tasmanian Salmon Commissioners.

I may state that in my opinion the action taken by the Provincial Government of Otago for introducing salmon into the Province will obviate the necessity for the General Government of the Colony taking any further steps towards carrying out the instructions conveyed in the resolution upon this subject which was adopted by the House of Representatives during last Session.

The ship "Celestial Queen" was to leave London on the 15th January last, having on board about 100,000 salmon ova for this Province, and ponds and hatching apparatus are now in course of preparation for their reception on the River Waiwera, a tributary of the Clutha. Should the General Government feel disposed to render any assistance towards the introduction of salmon into New Zealand, they might adopt the recommendation of the Salmon Commissioners of Tasmania, by making arrangements for a shipment of ova from England in the beginning of 1869, and I have no doubt that if the Provincial Government of Otago were communicated with they would readily place at the disposal of the General Government the ponds, &c., which are now being prepared.

Upon referring to the Tasmanian Commissioners' Reports, I find the estimated cost of such a shipment to be £800. The Commissioners recommend two or three shipments, in order that the rivers of the Colony may be stocked as soon as possible.

I have, &c.,
W. D. MURISON.

The Hon. the Colonial Secretary, Wellington.

No. 10.

Copy of a Letter from the Hon. T. M. HAULTAIN to His Honor J. MACANDREW.

Colonial Secretary's Office, Wellington, 2nd April, 1868.

SIR,—

Understanding that the Provincial Government of Otago are causing ponds and hatching apparatus to be constructed on the River Waiwera for the reception of salmon ova expected to arrive soon from England, I have to request your Honor to be good enough to inform me whether, in the event of the Colonial Government sending for a further shipment of salmon ova, the ponds and hatching apparatus referred to would be available, and if so about what time, for the reception of such ova.

I have, &c.,
T. M. HAULTAIN
(for the Colonial Secretary).

His Honor the Superintendent, Otago.

No. 11.

Copy of a Letter from His Honor J. MACANDREW to the Hon. E. W. STAFFORD.

(No. 7,347-47.)

Superintendent's Office,
Dunedin, 13th April, 1868.

SIR,—

In reply to your letter of the 2nd instant relative to the salmon-rearing apparatus on the Waiwera River, I have the honor to state that it is intended that the apparatus shall be kept in constant use for the hatching of ova for years hence. The services of a duly-qualified pisciculturist, to take charge of the Waiwera Ponds, have been secured permanently, and he is now on his way from

England in the "Celestial Queen." Should the General Government at any time desire to avail itself of these ponds for the hatching of ova, there will be no objection on the part of the Provincial Government to take charge of the ova, and to conduct the operations free of cost.

I may observe that should our operations at the Waiwera Ponds prove successful, there is no reason why the whole of the New Zealand rivers should not be supplied with salmon from thence in the course of a few years.

I have, &c.,
JAMES MACANDREW,
Superintendent.

The Hon. the Colonial Secretary, Wellington.

No. 12.

REPORT by Dr. HECTOR on the TEMPERATURE of the SEA and RIVERS in and about NEW ZEALAND.

(No. 45-68.)

Geological Survey Office,
Wellington, 30th July, 1868.

SIR,—

I have the honor to forward for Mr. Stafford's information the results of the observations for determining the temperature of the sea and rivers in and about New Zealand, with the view to the introduction of salmon as suggested in my Memorandum of the 23rd December last. These observations will have to be continued for a much longer period before reliable deductions can be made, but already very interesting results are indicated. It appears that the lowest temperature of the sea along the coast is in Foveaux Straits, from the West Cape eastward to Dunedin, where a branch of the great Australian current becomes superficial, and mixes with the great North-east current, giving the low average temperature of 52°. From the West Cape northward the temperature rises rapidly, especially at some distance from land, where it ranges from 64° to 70°. On the East Coast we have a general lowering of the temperature from East Cape, where it is 62°, to 58° at Lyttleton; but in the Bay of Plenty and Hauraki Gulf we find the same temperature as on the West Coast.

The inshore observations display such irregularities from local causes that they are not reliable; but the open-sea temperatures are very regular. The temperatures of the running streams show that, as the best authorities consider that the maximum average temperature for the salmon should not exceed 50°, several of the rivers of the South are suitable for their introduction.

The thermometers used for taking these observations were carefully compared with a standard at this office, and the index errors computed. The instruments were then forwarded in sets to the Provincial Government of each Province, and to the Marine Department, by whom they were distributed to properly qualified observers in various districts wherever it was considered advisable. Tables of observations have been received from many of these; but some districts, where there are important rivers, and even whole Provinces, are still unrepresented. Those which have come to hand have been carefully compiled, and the condensed results are shown in the appended tables and Abstract. In examining this Abstract, it must be borne in mind that the number of observations in some localities—as for instance the rivers in Hawke's Bay—were very few, in some cases even single observations, and at one season only, namely, April, and therefore cannot, of course, be considered an average even for that season. There are, however, some explanatory notes appended by the Provincial Engineer and Surveyor of Hawke's Bay, and by many of the other observers, which will throw more light on this subject.

The returns have been received in two separate series, embracing the months of March, April, May, and June. They are kept separate in the tables, but are condensed in the Abstract, with, however, the dates appended. In tidal rivers or in an estuary, the time of tide was always noted, and the mean temperature of the ebb and flow ascertained. The returns received are as follows:—

Auckland—
Rivers Horotiu and Waikato, at Hamilton: W. M. McColl, Armed Constabulary.
River Waikato, at Port Waikato: H. H. Fenton.

Hawke's Bay—
Rivers Tutaekuri, Tukituki, Wairoa, Ngarurora, Mohaka, open sea, and wharf at Napier, &c.: Charles Locke, Chief Surveyor.
Sea, at Tiri Tiri Island: ———.

New Plymouth—
River Waitara: ———.
River Urumi: ———.
Harbour at Taranaki: ———.

Canterbury—
River Waimakariri: ———.
River Avon: R. L. Holmes, Meteorological Observer.
Estuaries of Avon: ———, Pilot.
Little Port Cooper: ———, Pilot.
Akaroa Harbour: Mr. Townsend, District Surveyor.

Otago—
Tairoa Head: ———, Lighthouse-keeper.

Southland—
Estuary of Jacob's River: John Sale, Pilot.
Mataura River (at the Falls): Hugh Cameron.
Mataura River (at Aralussa): A. McNeill.
Omutu River: ———.
Waiau River: R. W. Aitkin.
Purrapurrakino: ———.
Orawia and Mosley: B. H. Reinecker.

Makarewa: Charles Coster.
New River and Foveaux Straits: Thomas Thomson, Harbour-master.
West Coast, Middle Island—
G. A. Woods, Marine Surveyor in s.s. "St. Kilda," survey steamer.
Dr. Hector, in schooner "Matilda Hayes," Geological Survey of Otago.
East and West Coasts, North Island—
Captain Fairchild and Dr. Hector, in s.s. "Sturt."

I have, &c.,
JAMES HECTOR.

The Under Colonial Secretary, &c.

ABSTRACT of OBSERVATIONS on the TEMPERATURE of the RIVERS and SEA in and about New Zealand.

	Average Temperature of			Average Range of Temperature observed.	Date of Observations.
	Air.	Running Stream.	Sea.		
NORTH ISLAND.	°				1868
A. Rivers flowing to the East	68·9	54·5	...	—	April 6 to May 3.
B. Rivers flowing to the West	55·2	54·7	...	8·5	April 1 to June 30.
SOUTH ISLAND.					
C. Rivers flowing to the East	53·3	49·6	...	14·5	March 6 to June 30.
D. Rivers flowing to the South	49·4	47·9	...	12·6	February 23 to June 30.
NORTH ISLAND.					
E. Sea, East Coast	67·9	...	62·4	3·1	February 6 to April 30.
F. Sea, West Coast ...	57·5	...	58·9	9·2	February 1 to May 31.
SOUTH ISLAND.					
G. Sea, East Coast	55·9	...	53·8	9·5	March 8 to June 30.
H. Sea, West Coast ...	49·6	...	51·6	17·0	April 19 to May 31.
I. FOVEAUX STRAITS ...	51·3	...	52·0	6·6	February 18 to June 30.
SOUTH ISLAND.					
K. Sea, West Coast ...	52·5	...	53·8	—	*May to December*, 1863.

GENERAL ABSTRACT.

Rivers, East Coast of both Islands	52·0 °	A., C.,
Rivers, West Coast of North Island	54·7	B.,
Rivers, South Coast of South Island	47·9	D.,
Sea, East Coast of both Islands	58·1	E., G.,
Sea, West Coast of both Islands...	55·2	F., H.,
Foveaux Straits	52·0	I.

A.—RIVERS FLOWING TO THE EAST.—NORTH ISLAND.

Locality.	Date.	Average Temperature of				Extreme range of Temperature of Water observed.	Remarks.
		Air.	Running Stream.	Ebb Tide.	Flood Tide.		
Hawke's Bay—	1868.	°	°	°	°	°	
1. Tutaekuri ...	April 29 ...	65·	56·	...	...	...	Three miles from mouth—Tidal.
Do. ...	„ 6 ...	73·	59·	...	...	...	Twelve miles from mouth.
2. Tukituki ...	„ 6 ...	71·	54·	...	...	...	One mile from mouth—Tidal.
Do. ...	May 3 ...	66·	54·	...	...	...	One mile from mouth—Tidal.
Do. ...	April 9 ...	73·	56·	...	...	...	Forty miles from mouth.
3. Wairoa ...	„ 27-28 ...	52·–76·	52·–53·	...	...	...	Near the mouth—Tidal.
4. Ngarurora ...	„ 7 ...	74·	55·	...	...	...	One mile from mouth.
Do. ...	„ 30 ...	77·	54·	...	...	...	One mile from mouth.
Do. ...	„ 14 ...	70·	53·	...	...	...	Twenty miles from mouth.
5. Mohaka ...	„ 25-26 ...	60·	54·	...	...	...	Near the mouth—Tidal.
Do. ...	„ 26 ...	64·	54·	...	...	...	Two miles above mouth—Tidal.
Do. ...	„ 30 ...	58·	52·	...	...	...	Two miles above mouth—Tidal.

B.—RIVERS FLOWING TO THE WEST.—NORTH ISLAND.

Locality.	Date.	Average Temperature of				Extreme range of Temperature of Water observed.	Remarks.
		Air.	Running Stream.	Ebb Tide.	Flood Tide.		
Auckland—	1868.	°	°	°	°	°	
6. Waikato ...	April 11 to 30 ...	56·	58·	...	...	4·	At Hamilton, Upper Waikato.
Do. ...	May 1 to 31 ...	49·5	54·	...	...	4·	Do. do.
Do. ...	May 7 to 31 ...	60·	56·2	55·5	57·0	9·	Port Waikato, 1½ mile inside the Bar.
Taranaki—							
8. Waitara ...	April 1 to 30 ...	62·5	58·5	57·5	59·5	14·	
9. Urunui ...	April 1 to 30 ...	60·	60·5	60·	61·	16·	At Atkinson's Wharf.

C.—RIVERS FLOWING TO THE EAST.—SOUTH ISLAND.

Canterbury—							
10. Waimakariri ...	March 6 to April 30	59·	53·2	53·5	53·0	20·	At Kaiapoi, about four miles from mouth.
11. Avon ...	March 5 to April 30	58·3	55·3	...	...	11·3	At Christchurch, about seven miles from mouth.
12. Estuary of Avon and Heathcote	March 7 to April 30	61·7	52·0	50·2	53·7	17·	At Sumner, near the Bar.

D.—RIVERS FLOWING TO THE SOUTH.—SOUTH ISLAND.

Southland—							
13. Jacob's River Estuary	March 18 to April 29	59·	54·	54·	54·	8·	At Riverton, from a boat or rock.
14. Mataura ...	March 9 to May 7...	53·	50·	...	...	20·	At the Falls.
15. Do. ...	March 10 to May 4	58·	50·5	...	...	13·	At Aralussa.
				Still Surface of Pools.			
16. Omutu ...	Feb. 23 to April 26	55·5	52·5	55·		11·	At Blackwater.
17. Purrapurrakino ...	Feb. 23 to April 26	55·5	48·5	55·		14·	At Blackwater.
18. Makarewa ...	March 14 to April 30	61·5	55·5	56·		14·	At Woodburn, New River.

E.—SEA, EAST COAST.—NORTH ISLAND.

Locality.	Date.	Average Temperature of				Extreme range of Temperature of Water observed.	Remarks.
		Air.	Ebb Tide.	Flood Tide.	Sea.		
	1868.	°	°	°	°	°	
19. Open Sea ...	April 8 to 27 ...	69·0	...	...	59·5	5·	Off Hawke's Bay.
Napier ...	April 8 to 14 ...	69·5	...	...	58·5	1·	At the Wharf.
Open Sea ...	February 6–12 ...	67·6	...	...	62·	3·	Wellington to Tauranga.
20. Open Sea ...	„ 10–13 ...	70·0	...	...	67·	1·	Off Opotiki.
Tiri Tiri Island ...	March 28 to April 30	63·5	65·	65·	65·	5·3	Off a rock.

F.—SEA, WEST COAST.—NORTH ISLAND.

Auckland—							
In shore ...	February 4 ...	60·	...	...	64·5	...	Off Manukau.
New Plymouth ...	April 20–30 ...	58·2	58·7	58·2	58·5	9·5	At the landing place, off a boat or rock.
Open Sea ...	January 27 to 29 ...	66·2	...	...	67·	...	Off Patea.

G.—SEA, EAST COAST.—SOUTH ISLAND.

Canterbury—							
Little Port Cooper	March 8 to 31 ...	63·	61·	59·5	60·2	10·	At the Pilot Station, from a rock.
Akaroa ...	March 11 to April 30	62·	59·	60·	59·5	12·	Two chains from beach, off the Jetty.
Otago—							
Tairoa's Head ...	March 3 to April 30	57·	54·5	54·5	54·5	5·	At the Lighthouse, from Jetty or rocks

H.—SEA, WEST COAST.—SOUTH ISLAND.

Westland—								
21.	Jackson's Bay ...	May 9 to 31 ...	48·	...	...	49·	18·	From the survey steamer "St. Kilda," off the ship's side when at anchor.
	Cape Campbell ...	April 24 to 26 ...	51·5	...	...	54·	14·	
	Flaxbourne ...	April 19 ...	54·	...	...	60·	...	

I.—SEA, FOVEAUX STRAITS.—SOUTH ISLAND.

Locality.	Date.	Average Temperature of				Extreme range of Temperature of Water observed.	Remarks.
		Air.	Ebb Tide.	Flood Tide.	Sea.		
		°	°	°	°	°	
22. Between the Heads and Invercargill Jetty	February 18 to 25...	59·	58·5	56·5	57·5	5·	From the Pilot cutter.
Between New River Heads and Port William	March 1 to 11 ...	51·	54·5	55·	54·7	1·	From the Pilot cutter.
Entrance of New River	March 12 to 24 ...	56·5	54·5	53·	53·7	4·	From the Pilot cutter.
Between Saddle Point and Port William	February 15 to 16...	55·	57·	57·	57·	2·	From the Pilot cutter.
Pilot Station at New River	March 26 to April 25	58·	53·5	50·5	52·	7·	From the rocks.
23. Starling Point, Bluff	March 18 to April 24	56·5	54·5	55·5	55·	5·	From the rocks.
One mile off Jacob's River	March 21 to April 28	56·	53·	53·	53·	6·	From a boat.
Dog Island ...	March 5 to April 30	52·5	55·5	54·5	55·	4·	From a rock.

RECORD of the TEMPERATURE of the SEA observed on board the schooner "Matilda Hayes," on the South and West Coasts of Otago, New Zealand by Dr. HECTOR, F.R.S.

1863.	Hour.	Temperature of Air.	Temperature of Sea.	Locality.
		°	°	
May 21	9.30 a.m.	50·	50·	Off the heads, Otago Harbour.
„ 25	3.30 p.m.	55·	52·	Bluff Harbour.
„ 27	3.30 a.m.	52·	52·	Clearing Bluff Harbour.
„ 27	9.30 p.m.	53·	50·	Riverton Harbour.
„ 28	9.30 a.m.	50·	52·	Mouth of Jacobs River.
„ 28	9.30 p.m.	50·	47·	Riverton.
June 12	3.30 p.m.	48·	52·	Between Riverton and Port William.
„ 17	9.30 a.m.	45·	53·	Chalky Inlet.
„ 17	3.30 p.m.	48·	53·	South Port, Chalky Inlet.
July 18	9.30 p.m.	45·	51·	North Port, Chalky Inlet.
„ 23	9.30 p.m.	45·	51·	Deas Cove, Thompson's Sound.
„ 28	3.30 p.m.	51·	50·	Crooked Arm.
August 5	3.30 p.m.	55·	54·	Entrance to Deas Cove.
„ 7	3.30 p.m.	48·	53·	Milford Sound.
Nov. 24 to Dec. 12 ...	...	58·	57·6	Open Sea.
November 26 to 27 ...	...	57·8	58·	Anita Bay, Milford Sound.
„ 27 ...	...	66·	61·	Bounty Haven.
„ 28 ...	...	56·4	57·7	Bounty Haven, just inside the Bar.
„ 29 to 30 ...	...	57·3	59·	Anchorage Cove, George's Sound.
December 10 ...	...	56·	56·5	George's Sound.
„ 13 ...	...	54·	56·8	Dusky Bay.

B.—RIVERS FLOWING TO THE WEST.—NORTH ISLAND.—(SECOND SERIES.)

Rivers.	Date.	Average Temperature of				Average range of Temperature observed.	Remarks.
		Air.	Running Stream.	Ebb Tide.	Flood Tide.		
	1868.	°	°	°	°	°	
Auckland—							
Waikato	May 7 to 31 ...	57·5	53·7	53·0	54·5	9·0	At Port Waikato—Tidal.
Waikato	May 1 to 31 ...	49·5	54·0	...	...	4·0	At Hamilton.
Horotiu	June 1 to 30 ...	55·0	50·0	...	...	4·0	At Hamilton.
New Plymouth—							
Waitara	May 1 to June 30...	50·5	50·5	50·5	50·5	14·0	At Waitara—Tidal.

C.—RIVERS FLOWING TO THE EAST.—SOUTH ISLAND.

Canterbury—							
Waimakiriri	May 1 to June 30 ...	43·5	41·2	40·5	42·0	17·0	At Kaiapoi—Tidal.
Avon	May 1 to June 30 ...	50·6	50·5	...	...	9·0	At Christchurch.

D.—RIVERS FLOWING TO THE SOUTH.—SOUTH ISLAND.

Rivers.	Date.	Average Temperature of				Average range of Temperature observed.	Remarks.
		Air.	Running Stream.	Ebb Tide.	Flood Tide.		
Southland—		°	°	°	°	°	
Orawia	June 5 to 19 ...	38·5	42·0	...	...	8·0	At Mount Beaumont.
Waiau	May 1 to June 30 ...	45·0	46·0	...	...	16·0	At Clifden.

F.—SEA, WEST COAST.—NORTH ISLAND.—(SECOND SERIES.)

Locality.	Date.	Average Temperature of				Average range of Temperature observed.	Remarks.
		Air.	Ebb Tide.	Flood Tide.	Sea.		
		°	°	°	°	°	
Taranaki	May 1 to 31 ...	53·5	54·5	54·5	54·5	9·0	At the Landing Place, from boats or off the rocks.

G.—SEA, EAST COAST.—SOUTH ISLAND.

Canterbury—							
Akaroa	May 1 to June 30 ...	52·5	49·5	49·0	49·2	13·0	From the Jetty, two chains off shore.
Otago—							
Tairoa's Head	May 1 to June 30 ...	50·0	49·5	50·5	50·0	7·0	From the Lighthouse Jetty.

H.—SEA, WEST COAST.—SOUTH ISLAND.

Jackson's Bay	May 9 to 31 ...	48·0	...	...	49·0	18·0	Open Sea, off the ship's side when at anchor.

I.—SEA, FOVEAUX STRAITS.—SOUTH ISLAND.

New River Heads ...	May 1 to June 30 ...	46·5	49·5	48·0	48·7	14·0	From the rocks.
Dog Island	May 4 to June 30 ...	48·0	50·0	50·0	50·0	4·0	From the rocks.

Hawke's Bay Rivers.—Observations taken by the Provincial Engineer; with Notes.

1. *The Tutaekuri* rises in the Kaweka Ranges, and after a course of about forty-six miles through high and broken country empties itself into the shallow branch of Hawke's Bay, known as Ahuriri Lake. The river flows the first twenty-five miles over large boulders between precipitous banks, its width not exceeding sixty feet; thence for eighteen miles over a wide shingle bed, until it becomes sluggish near the mouth, adjoining which are about 500 acres of mud flats, partly uncovered at low water. The depth of the river averages about eighteen inches to within ten miles of its source, when it assumes the character of a mountain gorge. The Tutaekuri is fed from July to October partly by snow water from the Kaiwaka, and the range of its temperature will probably lie between 39° in August near the source, and 64° in February about ten miles from its mouth, where it spreads over a wide shingle bed.

2. *The Tukituki* rises in the Ruahine, and has a course of about sixty-eight miles—the first fourteen in clearing the Ruahine; ten miles in traversing the Ruatanui Plains; it then flows for thirty miles through undulating country, until it reaches the southern boundary of the Ahuriri Plains. The Tukituki and its principal tributary the Waipara have in the Ruahine the character of mountain streams, running over boulder beds; thence flowing to within half mile of its mouth over shingle beds from twenty to forty chains in width, in different streams, having everywhere during the summer a depth of at least two feet. The Tukituki has a shifting bar mouth with seldom less than eighteen inches of water, and approaches close to that of the Ngarurora River. The Tukituki is fed from July to October partly by snow-water from the Ruahine, and the range of its temperature will probably be between 37° in August (at the base of the Ruahine) and 65° in February, about twenty miles above the mouth, where it spreads over a shingle bed half a mile in width.

3. *The Wairoa*, which has a course of about fifty miles, is formed by the confluence of the Wairoa and the Waiau about fourteen miles from the mouth, the Waiau being the larger river. From that confluence the Wairoa is navigable for vessels of seven feet draught, and above it both branches are navigable for canoes for a distance of sixteen miles; but the navigation is impeded at several places by rapids. The width of the Wairoa, three miles from its mouth, is about 650 feet, and seven miles above it about 250 feet. The course of the two head branches runs between high and partly wooded ranges, for the greater part over beds of boulders. After the confluence, the river flows through rich alluvial flats, between well-defined banks, scarcely ever subject to being flooded. The mouth has a bar with rarely less than five feet of water at ebb tide. The fluctuation in temperature will probably be less in the Wairoa than in any other river of Hawke's Bay, it being less fed by snow water than any other,

and having less spread over shingle beds. It will not probably fall below 41° in July and August near the sources, and not rise above 61° during the summer near the mouth.

4. *The Ngarurora* rises in the Ruahine Ranges, has a course of about sixty-five miles over large boulders; the first twenty-five miles confined principally between high headlands. From the spurs of Ruahine to the head of the Ahuriri Plains, a distance of about twenty-two miles, the river runs in different channels over a shingle bed, averaging twenty chains in width, with an average fall of about fifteen feet per mile; the last eighteen miles through the Ahuriri Plains. The river is confined between high alluvial banks, which it very rarely, and on few spots only, overflows. Its average fall, to within three miles of the sea is about four feet per mile, with light shingle bottom. The last three miles are under tidal influence with a hard clay bottom. The mouth has a shifting bar with rarely less than two feet at low water. The depth of the river to three miles from the mouth, averages about seven feet, whence it decreases to about four feet to the head of the Ahuriri Plains, with but very few fords of two feet. From the head of the plains to the spurs of the Ruahine, the river runs in shingle channels, having in the summer season at least fifteen inches of water. Higher up the river, its tributaries assume the character of mountain gorges, over large sandstone boulders. The river is fed partly from snow water during June to November. The range of temperature will probably be between 36° in August and September in the ranges, and 62° in February at the head of the plains, where it spreads over a large shingle bed. The Ngarururo appears to be well adapted for salmon.

5. *The Mohaka* and its principal tributaries have their rise in the Ruahine and Kaweka Ranges. Its course is about eighty-five miles, and it is the largest of the rivers in Hawke's Bay. It runs for the greater part of its length between high and partly wooded ranges, which it only clears within a few miles of its mouth. For the first fifty miles it runs over a boulder-bed, and thence over shingle to its mouth. The banks are generally high and precipitous, and but very little subject to encroachments. The depth of the river, for sixty miles from its mouth upwards, is very rarely under two feet during the summer season, with the exception of a few rapids in the middle of its course. The Mohaka being fed for nearly six months by snow from the ranges, and being confined for the greater part of its course between high hills, its temperature is lower than that of any other river in Hawke's Bay, and will probably range between 59° near its mouth in February, and 37° near its source in July and August. It has a bar mouth, with frequently only one foot of water at ebb tide. The Mohaka appears well adapted for salmon, and is singularly free from eels, the great enemy of the young, owing to the absence of swamps within its drainage area.

Memo.—The instrumental observations of temperature having extended over little more than one month, I have been compelled to supplement them for the different seasons, with estimates based upon impressions obtained through the last nine years, while my duties connected with the road and survey departments have led me constantly over the different portions of the Province.

My observations induce me to consider Hawke's Bay and its rivers well suited for salmon, as the head-waters of nearly all the rivers are sufficiently deep, cool, and well shaded for spawning, especially the Ngarurora and Mohaka, and as the estuary of the Tutakuri and the Petane Rivers is a shallow, land-locked tidal basin, of twelve square miles, known as the Ahuriri Lake, well adapted for the young fry.

The only drawback to the successful development of the young fry seems to be the large number of eels which frequent the rivers and estuaries from the adjacent swamps, but those even have decreased gradually of late, and must necessarily decrease daily with the drying up and draining of the swamps, which is rapidly taking place.

The heads of all rivers, especially the Mohaka and Ngarurora, are so cool and rapid that eels are not frequently met with there; in fact, the Natives say that they are very scarce even in the lower parts of the last-mentioned rivers, which for this reason are perhaps the best suited for experiments.

6. *Hamilton, Upper Waikato.*—Observations taken by W. M. McCol, Armed Constabulary.

7. *Port Waikato.*—Observations by H. H. Fenton.

Memo.—The range under "temperature of air" may be taken as rather higher than most other localities, owing to the protection of a high range of hills from the cold and prevailing winds. The salt water, at the highest spring tides, never flows higher than six miles above this.

HAROLD HYDE FENTON,
Port Waikato.

8, 9, 10. Names of the observers not given. No notes.

11. *River Avon, Canterbury.*—The observations on the temperature of this river were taken by R. L. Holmes, Meteorological Observer.

Extract from Memoranda appended.

"The observations were taken in the City of Christchurch, about five miles from the estuary, where it is not influenced by the tide. The course of the river is about twelve or fourteen miles; it rises in large springs, and flows between well-defined banks, with an average velocity of three or four miles an hour. The bottom is in general muddy, but the water is beautifully clear, except after rainfall. There is a considerable quantity of swampy land in some parts of its course, and there are extensive mud flats in the estuary, where it joins the Heathcote River. It is frequented by eels, but in what quantity I cannot say. Observations continued for twelve months will show, I believe, a comparatively small range of temperature, owing to the nature of its rise and course.

"These remarks apply equally to the River Heathcote, which runs into the same estuary, except that up to the present time it has not, like the Avon, been occasionally flooded by an overflow from the Waimakariri during heavy floods."

12. Name of observer not given. No notes appended.

13. *Jacob's River, Southland.*—Observations taken by John Hall, Pilot, Riverton.

Extract from Letter appended.

"The bed of the river in different places is composed of sand and shells, with cockle banks. The depth of water varies from twenty feet to about three. After heavy rains the river is quite brackish at low water for several tides, and continues so until the heavy rains are over."

14. *Mataura River, Southland, at the Falls.*—Observations taken by Hugh Cameron.

"The bed of the river at this point and for three miles down is rocky, with breaks of shingle now and then. After that the bed is shingle all the way to the coast, the shingle getting finer as it nears the sea. The bed of the river above the falls is principally shingle also. The depth varies from about two feet to fifteen; the average depth may be reckoned at about six or seven feet. The water of the Mataura, previous to sluicing operations commencing at the Switzers Diggings, which are on a tributary to the Mataura, was clear and pure, but since then has become so thick and dirty as to become quite unfit for salmon to live in. As these diggings are likely to last some years, the Mataura is rendered useless for the present as a salmon river.

15. *Mataura River, at Aralussa.*—Observations taken by Alexander McNeill. No notes.

16. *Omutu River, at Blackwater.*—No observer's name.—The Omutu creek runs amongst limestone downs, and is for four or five miles nearly parallel with the Purrapurrakino, which it ultimately joins. Its average width would be about eight or ten feet, and its depth about three. The bottom is coarse gravel; the banks steep and clothed with high flax and Korimiko, which shades the waters, and accounts in some measure for its coolness in summer. It is inhabited by numbers of aquatic insects and shells. Three or more species of small fish are plentiful. Eels are not very numerous. On the whole, the Omutu would make an excellent trout stream, if that forms any part of the Government scheme. Its only recommendation as a place for salmon-breeding is, that nearly the whole of it runs through three or four private properties occupied as sheep farms; the fish would therefore be less liable to be molested than in many other rivers which in other respects might seem more eligible. Map showing stream and place of observation, in red, appended.

17. *Purrapurrakino River, at Blackwater.*—No observer's name.—The Purrapurrakino takes it rise in the Largwood Ranges, and drains nearly the whole eastern face of them, as well as those wooded hills facing on the Aparima. Of its whole length, two-thirds, I should think, runs through forest. At the point where the observations have been taken it is about seventy feet wide, its depth variable, the bottom consisting of coarse sand. The number of snags and dead trees fallen into and across the stream have formed pools and ridges, the former being ten or twelve feet deep. The water is clear and rather hard, and of a dark colour from dead leaves, &c. Two miles below this it is joined by the Omutu Creek, and is there a tidal river, navigable for small craft. About six miles further down it passes through a rocky gorge, and, forming the Aparima or Jacob's River at its estuary, flows into the sea at Riverton. About two miles above the point of observation it is a shallow rapid stream, its bottom being gravel and rock. The principal advantage of this river is its seclusion; whilst, from its proximity to the Aparima and Orete, it would ultimately stock both these rivers, which, though far finer streams in themselves, flow through a more populous district. I enclose herewith a map showing the stream and the place of observation marked in red.

18. *Makarewa River, Southland, at Woodburn.*—Observer, Charles Caster.

Memo.—The Makarewa is not a tidal river, but falls into the New River. The spot where the observations have been taken is fifteen or twenty miles, by the windings, above the New River estuary; and there is a considerable body of water for a distance of ten or twelve miles above Woodburn, running through a partially wooded country. The river has a gravelly bed, with deep pools and shallows alternating, and loamy well-defined banks. Draining as it does a flat country, until it enters the flat hills twenty or more miles from its junction with the New River, it is not subject to such sudden and violent floods as most of the rivers in this country; neither is it fed by snow waters like the Arete and others.

19. *Sea, off Napier.*—Observations by the Provincial Engineer.

Memo.—The temperature of deep water of Hawke's Bay appears to vary between 57° and 59°; and in the shallow places of the Ahuriri Lake between 56° and 65°.

20. *Open Sea, off Opotiki.*—Observer, Dr. Hector.

Memo.—There appears to be a warm spot in the sea off Opotiki (67°).

21. *Jackson's Bay, Cape Campbell, and Flaxbourne.*—Observations taken by G. A. Woods, Marine Surveyor.

22. *New River and Foveaux Straits.*—Observer, Joshua Clare, Pilot.

Memo.—The entrance of this river, and for two miles inwards, has a shifting sandy bottom, with from two and a half to four fathoms of water. In the upper part of the river the bottom is composed of shells and clay, with numerous cockle beds; the banks, which dry at the last quarter ebb, are covered with green seaweed. There are holes in this river that have a depth of three to four fathoms at low water. The shallowest part of the river has a depth of three feet at low water. The water is salt. The flood-tide runs from one and a half to three knots; the ebb-tide from two and a half to four. The fish that frequent the river are the red cod, mullet, and flounder; the small fry are very plentiful in the summer months.

Starling Point, Bluff Harbour.—Observer, Thomas Thomson, Harbour-master.

Memo.—The observations on the temperature of the sea at Starling Point have been compared with that at several parts at Bluff Harbour, with no perceptible difference observable. The bottom of the Bluff estuary is principally composed of coarse gravel, sand, and shells; there are also patches of soft loamy mud, portions of which are covered with grass. From the Bluff, round westward as far as New River, a distance of twelve miles, the shore is rocky; from thence to Jacob's River, eight or nine miles, there is a fine sandy beach. To the entrance of the Bluff, as far as the mouth of the Mataura River, a distance of seventeen or eighteen miles, the beach is composed of coarse gravel, sand, and shells, which is also the character of the bottom of Foveaux Straits adjacent to the Bluff.