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T A S M A N I A.

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S A L M O N.

REPORT OF MR. BLACK ON THE INTRODUCTION OF SALMON.

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Laid upon the Table by Mr. Colonial Treasurer, and ordered by the House to be printed, 14 August, 1860.



*Hobart Town, 13th August, 1860.*

SIR,

I HAVE the honor, in compliance with the instructions of the Government of Tasmania, to submit the following Report on the practicability of introducing Salmon Ova from Britain into this Colony.

In the first place, I propose to show that the coast and river water of Tasmania is in every way suitable to the health and propagation of the Salmon, with directions how to choose the best site for a Piscicultural establishment.

On the 29th June I commenced to examine the Derwent and its tributaries up to its junction with the Ouse, and the River Ouse up to Mr. Edol's farm.

The gentlemen residing on the banks courteously aided me in my examination, and afforded me every information relative to the river with the exception of its temperature.

The river I find to be a tortuous brisk-running stream, with here and there ledges of rock lying in its bed, in parts longitudinally, sometimes transversely. None of these ledges will impede the Salmon when migrating. At these spots the stream flows rapidly over or between the rocks, as the case may be, diverging into long reaches, and, at this period of the year, flowing fully from bank to bank (slightly tinged, yet clear), over a fine gravelly bottom, into deep pools finely shaded by steep woody banks. In similar pools in its native rivers the Salmon delights to loiter when ascending the river from the sea. Then again, as links connecting some of the reaches, the river spreads out (before it converges) and runs swiftly over a fine gravelly bottom admirably adapted for spawning beds. From information derived, as I before stated, this appears to be the general character of the Derwent, and of several of its affluents up to their tributary lakes. These are situated in a cold sterile country—a circumstance which will greatly tend to maintain during the summer months the low temperature of the streams they feed, which is so necessary to the acclimatising and propagation of the Salmon. It appears also that these streams are subject to frequent inundations and violent currents, which will prove very destructive to the ova and fry. As an equipoise, however, to these destructive agencies, which point to the expediency of maintaining a system of artificial rearing, the rivers are singularly void of predaceous fishes, so that what the floods spare are not likely to be devoured as prey. Thus far the Derwent compares favourably with the finest Salmon streams in Britain. But the real question to be considered as affecting the experiment of acclimatising the Salmon in Tasmania, is the temperature of its rivers, coast waters, and climate. I may here observe, that the result of many experiments I have made on the Salmon ova proves that, in a temperature of water exceeding  $55^{\circ}$ , a healthy condition of ovum will not be long maintained: hence I infer, that in water of that average temperature the Salmon will cease to propagate,—and in a temperature of  $60^{\circ}$  the ovum instantly dies.

I shall now proceed to show, by comparison of temperature, and by relative position, that the waters of Tasmania are considerably below the maximum temperature in which the Salmon ceases to propagate; and, unless it be the circumstance of hot winds and severe droughts visiting the Island during the embryo stage of the first brood, I see nothing else to apprehend.

The temperature of the Tay and Tweed in the end of last January (the most inclement month ever recorded in our meteorological tables) was  $36^{\circ}$ , whilst in July that of the Derwent was  $44^{\circ}$ , that of the Ouse  $41^{\circ}3$ . In the former case the difference is only  $8^{\circ}$ , in the latter only  $5^{\circ}3$ . This, however, is not a fair comparison, inasmuch as these streams take their rise in the coldest mountain ranges in Britain. A just comparison will be, both as respects the river

and the coast water, the west and south of Ireland. There is the Shannon, which rises in the Loughs of Roscommon, Westmeath, and Clare. There are the little rivers of Kerry running out of several small lakes in that country, and the Laune issuing from the Killarney lakes. All these rivers and lakes abound with Salmon of a fine quality. The central and west of Ireland where these loughs are situated, but particularly the south (Kerry), is celebrated for possessing the highest temperature within the British Isles; and certainly, if I am informed rightly, differs widely in aspect and climate from the mountainous region whence flow the Derwent and its affluents.

These rivers also debouch into coast water that cannot differ more than  $1^{\circ}$  or  $2^{\circ}$  from that of Tasmania, from the circumstance that a branch of the gulf stream (Rennel's current) flows obliquely across the Channel, and either impinges on that portion of the coast or sweeps closely by it,—no doubt slightly influencing the coast water, as its warm water certainly somewhat modifies the climate.

The end of last February, on the coast of Wales, the channel water was  $46^{\circ}5$ , that of the coast water of Tasmania was  $51^{\circ}$  in July, only  $4\frac{1}{2}^{\circ}$  difference. I infer that the average difference cannot exceed  $4^{\circ}$ .

Therefore it appears that the thermal condition of the river and coast waters of this Island does not differ materially from that of the natural habitat of the Salmon; and the geographical position of Tasmania in respect to oceanic currents is not dissimilar to that of Ireland. It is not, therefore, unreasonable to infer that, whilst the rivers of the Colony are suitable for a nursery and habitation for Salmon, the adjacent marine feeding grounds will afford abundance of food, and the temperature of the water prove congenial to the fish.

I recommend the following as fitting spots for the reception of the Ova on its arrival:—The first, on the right bank of the Styx, two miles above its junction with the Derwent; the second, on the right bank of Russell's Falls, a few hundred yards from its mouth; and finally, a spot between a rocky cliff of considerable elevation and the right bank of the Ouse, a short distance below Mr. Edol's farm. This last is peculiarly eligible. The success of the experiment depends entirely upon the temperature of the water; I therefore suggest that, at each of the above-named points, the temperature of the water should be accurately ascertained (with a tested thermometer) each day about 3 P.M. during the ensuing summer, and the spot found to have the lowest temperature selected.

In the selection of these spots I have been guided by the advantages of their being above the highest point of inundation, yet permitting the river water to be easily led on to them, and the circumstance of their affording an easy egress to the smolt and of being close in the vicinity of fine spawning beds, on which the spawning fish can be captured for the purpose of artificial propagation without injuring it. The North West Bay River pond may be of use as an accessory to the experiment; and, not knowing that it was possible to convey the Vivarium any distance by land without injuring the ova, it is the best place that could have been selected. But now this difficulty is obviated entirely, as the Vivarium will be so constructed that it can easily be embarked with the ova in it, transhipped at Melbourne, and borne on men's shoulders up to the breeding ponds at any of the indicated spots, without in the slightest degree injuring the ova. If even another spot in a different stream was selected in which to deposit a few ova, it might be of advantage.

I shall now proceed to describe the most feasible means to be adopted for conveying the ova from England to the breeding ponds of Tasmania.

A Manager and two Assistants are indispensable. With respect to funds, this matter should be clearly and definitely settled in accordance with the Estimate that may be approved of by the Government, so that no impediment from this cause can arise to mar the arrangements of the Manager; and, as the success of the experiment will wholly depend upon him, no interference whatever should be permitted with his plans and arrangements. I presume that, if the Australian Association were requested by the Tasmanian Government, they would cheerfully afford the Manager their valuable advice and assistance.

With respect to the selection of a ship, a large and fast vessel is more suitable than a smaller one. If such a one is on the berth in Liverpool, the preference should be given thereto, inasmuch as it appears on the average that the passage to Melbourne is less from that port than from London. Liverpool is also nearer the spot whence the ova is likely to be obtained; consequently any unnecessary journey by rail, so prejudicial to the ova, is avoided. The end of January or beginning of February is the best season to embark the ova.

The plan of apparatus used for the late experiment, modified and extended, should be

adopted for any future experiment, inasmuch as, notwithstanding its inaccuracy of detail, together with the unusually adverse circumstances under which it was tried, a part of the ova was conveyed to 30° south latitude, and then the cause of death resulted from the ice being expended.

The following is a description of a suitable apparatus:—The form of frame frustum of a cone; bars of galvanised iron, connected with cross bars at top and bottom; spirally round this is a trough 1 foot wide by 4 inches deep, divided into compartments; placed in this is a peculiar perforated tile of glass, with glass cover, to contain the ova; a tank, capacity 250 gallons, on deck, one of same dimensions on the deck below,—the former a feeding tank, the latter receives the water after passing through the Vivarium; inserted in the deck tank is a 1½ inch copper pipe, well tinned, led entirely round the ice-house, whence it emerges and is led with a flexible joint into the upper compartment of the Vivarium; the water flowing through it is carried by a pipe into the tank on the lower deck, whence it is force-pumped up into the tank on the upper deck through an aerating machine, which also contains a stratum of granulated charcoal through which the water percolates; an ice-house of 25 tons capacity; tanks to contain 6 tons of water. All these must be lined with block tin. A frigorific machine of a peculiar construction: this is to be used in the event of any casualty occurring to the ice-house, or the ice failing. In the event of any of the ova hatching, a kind of fountain tray will be provided in which to place them. This will require a small feeder with tubing, a quantity of elastic bands and tubes, pails, force-pump, &c.; a few gallons of deodorising fluid, and a carboy of sulphuric acid, or a quantity of either, carpenter's tools, nails, &c., and spare boards, tin and lead, and a set of thermometers and test tubes.

It will also be advisable, if by force of weather or otherwise the ship has to put into the Cape of Good Hope, Rio de Janeiro, &c., for the Manager to be supplied with a letter of credit.

The following is an approximate Estimate of the cost:—

	£
Ice-house, capacity 25 tons, water tanks to contain 6 tons, Vivaria, frigorific apparatus, and requisites connected therewith.....	500
Ice, 25 tons, at £5 per ton .....	125
Procuring ova and water .....	49
Freight of 80 tons at £4 per ton .....	320
Passage of 2 Assistants with families, say 6 people at £16 each .....	96
Passage of Manager .....	60
Wages of 2 men at £75 each per annum .....	150
Salary of Manager.....	500
In addition for travelling expenses in Britain, 20s. per day.....	50
For incidental expenses .....	150
A letter of credit for £100 .....	100
Add 10 per cent. for contingencies .....	200
	£2200

I have the honor to be,  
Sir,

Your most obedient Servant,

ALEXANDER BLACK.

*The Honourable the Colonial Secretary.*

As an Addendum to this Report, it now only remains for me to point out what arrangements are necessary to render this enterprise of permanent good to the Colony.

I beg leave to remark, that it will be very unwise indeed to commence a very costly, difficult, and delicate experiment,—an experiment involving a question of so much importance to the Colony,—and, in a fit of false economy, imperil the success thereof by not completing the whole of the arrangements requisite to ensure it. I believe breeding ponds suited to the circumstances of the case, and the climate, to be as indispensable a part of the arrangements in the latter part of the experiment as the ice-house is in the former. Therefore I advise that the Manager be instructed to obtain in Europe every information relative to the most recent improvements in Pisciculture, and to prepare a modified plan of a breeding establishment, adapting modern improvements to the difference of the climate and the temperature of this country. This plan, with working instructions, can be transmitted so as to reach the Colony in sufficient time to admit of the ponds being prepared for the reception of the ova prior to its arrival. The Vivarium will be so constructed that the ova will remain in it until it is hatched. The embryo

fish can then easily glide into the pond prepared for it, where it will remain two years as fry; at the end of that time it changes its appearance, and is ready for its first journey to the sea. It has now become a smolt, and during its migrations it is gregarious; at this period, as it descends the river, evil-disposed persons may easily capture and destroy the whole brood, thereby inflicting a serious pecuniary loss, and an irretrievable injury upon the Colony. In order to guard against the possibility of such a disastrous occurrence, I beg leave to recommend the following system, as calculated to afford effectual protection to the fish, whilst, at the same time, it will commence and complete the organisation of the fisheries in the most efficient and most economic manner.

In the order noted hereafter, introduce from Britain thirty-five married salmon fishermen, of good character and of industrious habits. Men of this class are not always to be obtained; therefore early steps should be taken to secure in time the services of men indispensable in this case, but under any circumstances a valuable acquisition to a Colony. The duties of these men will be varied and arduous; viz., acting as water-bailiffs for the prevention of poaching, fishing, repairing the fishing-gear, attending to the ponds, and removing from the bed of the river matter obstructive to fishing or obnoxious to the fish.

When the river is adequately stocked, and the fisheries fully established, the question may arise, whether it will be advisable to rent the fishings to these men?

It will now be in place to make some remarks on the process of stocking the river, and show how quickly this may be accomplished. Then, with reference to the introduction of the ova, I do not think it at all hazardous to predict that of 50,000 ova embarked 30,000 will be landed alive, and placed in the ponds prepared for them. Two years after their introduction they will leave the ponds in the shape of smolt, and proceed to sea, where they will continue from six to ten weeks: they will then re-enter the river, and slowly wend their way up it until they arrive in the vicinity of the pond. Being now fecund, they will select a suitable bed for spawning, and each female will deposit 5000 ova. I assume that 10,000 grilse have been returned to the river: 5000 of these are females, which will deposit the astonishing quantity of 25,000,000 ova about two years and eight months after its introduction. The following tabular statement will show the rate of increase, the number and weight of the fish after each journey to the sea, and the proper appellation of each. Marvellous as this increase appears, I have no doubt but that this rate of increase will be fully maintained in the waters of Tasmania.

Date.	Ova Ponds.	Ova River.	Grilse, weight 6 lbs.	Salmon, 1st Year, weight 12 lbs.	Salmon, 2nd Year, weight about 20 lbs.	Salmon, 3rd Year, weight about 30 lbs.
1st & 2nd Year	Fry and	Smolt.	—	—	—	—
3rd Year.....	300,000	24,000,000	10,000	—	—	—
4th Year.....	300,000	48,000,000	None	8000	—	—
5th Year.....	300,000	Infinite.	350,000	None	6000	—
6th Year.....	300,000	Infinite.	500,000	300,000	None	4000
7th Year.....	300,000	Infinite.	The River is now fully stocked.			

The river may in the sixth year be considered adequately stocked, and capable of furnishing an inexhaustible supply of fish.

The next question to be considered is—At what time will it be advisable to commence fishing? Assuming the process of stocking the river to go on in the ratio set forth in the preceding table, the fishing may be commenced in the order exhibited in the following tabular statement, without in the least impeding the operation of stocking the river. The first, second, and third columns are the date, name of fish, and weight; the fourth column, the number of fish in the river; the fifth the number of fish that may be taken out of the river without detriment to stocking it; the sixth, weight in pounds of annual take of fish; and seventh, price; the eighth, the annual account sales of each kind; ninth, total annual account sales.

Year.	Name of Fish.	Weight.	No. of Fish in River.	Annual Takē.	Weight of Annual Take.	Price per lb.	Account Sales per annum.	Total annual Account Sales.
		lbs.			lbs.	s. d.	£	£
3rd ..	Grilse.....	6	10,000	500	3000	1 6	250	250
4th ..	Salmon ....	12	7500	1000	12,000	1 6	900	900
5th ..	Grilse.....	6	365,000	60,000	360,000	1 6	27,000	34,500
Ditto	Salmon ....	20	4500	500	10,000	1 6	7500	
6th ..	Grilse.....	6	Infinite	50,000	360,000	1 6	27,000	74,250
Ditto	Salmon ....	12	200,000	50,000	600,000	1 6	45,000	
Ditto	Salmon ....	30	3000	100	3000	1 6	2250	

In order to protect the fish, and to fish the river on this system, the men will have to be introduced in the following order—five men the first year, five the second, ten the third, and fifteen the fourth year. I think this will be a sufficient nucleus round which to gather men procurable in the Colony.

The river should be divided, from where it first contracts its banks up to the breeding ponds, into fishing stations four or five miles apart. By the end of the fourth year, at each of these stations, house accommodation should be erected for four Bailiff Fishermen and their families.

From the beginning of the third year subsequent to the colonisation of the fish, the "Plant" generally should be augmented each year, to meet the demands of the subsequent year's fishing.

In the fourth year a depôt ice-house will be requisite, at some spot convenient to the wharf in Hobart Town, for the reception of the imported ice, and for the Salmon intended for exportation; when it can be put up in boxes packed with straw, and deposited in the ice-house of the steamer. By this means it will be carried to the principal markets in the Colonies as fresh as when embarked. In the fifth year, possibly, one or two district ice-houses will be required.

In the fourth year, perhaps 50 tons of ice will be required. A contract should be made to ensure a regular supply, at least 400 tons annually, from the Wenham Lake Ice Company. Henceforth the demand will be regular. This, however, may probably incite local enterprise to procure it from one of the Islands lying south of this, where it, no doubt, can be procured at a rate to pay. In this year, also, the export freight will be a considerable item in the account. A contract may be made with the Manager of the regular steamers to put up in their hold a permanent ice-house, in which to carry the fish to market.

In this year, "Fishing Licences" may be granted to qualified persons, and under certain restrictions.

By pursuing this system, the market will have time to be developed. People will gradually become acquainted with the best mode of turning this new source of wealth to profitable account; and in the sixth year (the year in which I assume the river to be adequately stocked) the river will be not only effectually protected, but fished to the best advantage. There will then be the means of speedily and cheaply conveying the produce to a market which has been gradually expanding.

*AN ESTIMATE of the Expenditure requisite to complete the Fisheries by the end of the Fifth Year.*

	£	s.	d.	£	s.	d.
<b>FIRST YEAR.</b>						
Cost of introduction of Ova .....	2200	0	0			
Principal Piscicultural Establishment and Houses .....	1500	0	0			
				3700	0	0
<b>SECOND YEAR.</b>						
Ten Bailiff Fishermen, at 30s. per week each; Manager, £700 per annum	1480	0	0			
Ten Houses at Fishing Stations, each £120 .....	1200	0	0			
Boats and Fishing Gear .....	80	0	0			
One Spring Cart, £22; Horse, £20 .....	42	0	0			
Forage for Horse, £35; Food for Fry, £15 .....	50	0	0			
				2852	0	0
<b>THIRD YEAR.</b>						
Twenty Bailiff Fishermen at £78 each, £1560; Manager, £700 ....	2260	0	0			
New Boats and Nets, £60; repairing old, £20 .....	80	0	0			
Ten additional Houses at Stations, £120 each .....	1200	0	0			
Two Spring Carts and Horses, £84 .....	84	0	0			
Forage for three Horses, £105; Food for Fry, £15.....	120	0	0			
				3764	0	0
<b>FOURTH YEAR.</b>						
Thirty-five Bailiff Fishermen, £78 each, £2730; Manager, £700 ....	3430	0	0			
Cost of Ice-house in Hobart Town, &c. ....	700	0	0			
Fifteen additional Houses for men at Stations, each £120 .....	1800	0	0			
New Boats and Nets, £60; repairing old, £20 .....	80	0	0			
Two hundred Boxes for Fish, 20s., £200; fifty tons Ice, at £7, £350.	550	0	0			
Repairs of Cart, Horse, &c., £15; Forage and Food for Horses and Fry, £120.....	135	0	0			
				6695	0	0
<b>FIFTH YEAR.</b>						
Forty Men, £3120; Salesman, £120; Clerk, £200; Manager, £700	4170	0	0			
Four hundred tons Ice, at £7 per ton.....	2800	0	0			
				6970	0	0
<i>Carried forward</i> .....	6970	0	0	17,011	0	0

	£	s.	d.	£	s.	d.
<i>Brought forward</i> .....	6970	0	0	17,011	0	0
Four hundred tons Freight to various ports, at 40s. ....	800	0	0			
New Boats and Gear, £50; repairing old, £30 .....	80	0	0			
One hundred Fish Boxes, 20s., £100: two district Ice-houses, £300 each	700	0	0			
Two Carts with Horses, £84; Repairing, &c. old, £30 .....	114	0	0			
Forage for Horses, £175; Food for Fry, £20 .....	195	0	0			
				8859	0	0
				£25,870	0	0
<b>BY CREDIT.</b>						
Account Sales of third year, 3000 lbs. fish, at 1s. 6d. per lb. ....	250	0	0			
Ditto fourth year, 12,000 ditto, ditto .....	900	0	0			
Ditto fifth year, 370,000 ditto, ditto .....	34,500	0	0			
				35,650	0	0
<i>Balance</i> .....				£9780	0	0
By Account Sales of sixth year, 963,000 lbs. at 1s. 6d. per lb. ....				£74,250	0	0

I have the honour to be,

Sir,

Your most obedient Servant,

ALEX. BLACK.

*The Honourable the Colonial Secretary.*