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MADRAS RECORD OFFICE.

Government of Madras.

Public **DEPARTMENT.**

G.O. No.	<i>640</i> <i>650</i>	Press Mis.
Dated	<i>28.6.</i>	<i>18/46</i>

Not to be folded or roughly handled

PROCEEDINGS OF THE BOARD OF REVENUE, dated 4th June 1866.

Read the following letter from P. GRANT, Esq., Collector of Coimbatore, to the Secretary to the Board of Revenue, dated Ootacamund, 14th May 1866, No. 122 :—

1. On the 3rd instant, Dr. Day reported the unsuccessful termination of the experiment to introduce English Trout into the waters on the Neilgherry Hills. The whole of the Ova are dead. On the 5th instant, I received from Dr. Day the first part of his Report on the experiment. His Report is most interesting, and gives, in full detail, the history of the experiment from the time it was first mooted in 1863, to the present date.

2. With regard to the adaptability of the waters on the Neilgherry Hills for the introduction of the Trout, Dr. Day writes as follows: "I beg to draw especial attention to the fact that I have given no opinion in this portion of my report as to the adaptability of the rivers of the Neilgherry Hills for the introduction of Trout, it being a question that will require much research, but which I shall fully enter upon in the concluding part of my report, which I shall be unable to furnish some months, for the reasons detailed in paragraph 33."

3. One cannot read Dr. Day's Report without being impressed with a sense of the personal trouble undergone, and intelligence exhibited by him, in carrying out the experiment from the time he set to work to procure the Ova in England to the date on which they were deposited in the water on the Hills, and the non-success of the experiment finally reported on. Every thing that care and attention could accomplish seems to have been attended to. The experience of the past will, no doubt, tend to ensure success in any future attempts to introduce fish from England.

4. Dr. Day's original Report is herewith forwarded.

ENCLOSURE No. 1.

REPORT UPON AN EXPERIMENT MADE IN 1866, FOR THE INTRODUCTION OF ENGLISH TROUT, ON TO THE NEILGHERRY HILLS.

PART I.

1. *Preliminary Observations.*—Whilst on privilege leave on the Neilgherry Hills in 1863, I was struck by the absence of good eatable fish in the pieces of water that exist on that elevated plateau, especially in those at Ooty, Pykara, and the Avalanche, all of which, on a superficial examination, appeared well adapted for the finny tribes. Several persons, whose observations I deemed well worthy of consideration, expressed to me their great desire that I should suggest the introduction of some species, which would serve not only as an article of diet, but also as a means of recreation for convalescents and others, who wished to indulge in the sport of angling. I was informed that eels and both varieties of the morrul, the *Ophiocephalus marulius* and *O. Striatus*, were brought up from Mettapollium, and realized a ready sale in the bazars at excessively high prices, as did also the large carp (*Puntius*) of the rivers of the plains; although desirous of rendering every assistance in my power, still I had nothing to guide me in forming an opinion as to what course would most probably succeed. Scientific Zoological records as to the inhabitants of the air, land, and water of the Neilgherries were absent, and even the temperature of the hill streams was inaccessible to me. Still, however, I was sanguine that an attempt might be successfully made to introduce fish on to the hills.

2. *Fishes of the Hills.*—I then turned my attention to the indigenous fishes already existing on the hills, and only discovered one small species of minnow in the Ooty lake, and the Pykara and Avalanche rivers. But at Billicul, half way up the Seegoor ghaut, in a tank said to have been made and stocked in 1844 with fish, I found a species of loach, some fine Indian minnows (*Rasbora*), a carp and a variety of paradanio. Specimens of each of these species will

be sent to the Madras Museum, and my reasons will be given further on for considering three at least out of the four from Billicul, as having been introduced from the Segoor river, which flows along the base of the hills.

3. *Introduction of Indian Fish not proposed.*—For the following reasons I discountenanced the introduction of the Indian fish, which could only have been the different species of morrul (the *Ophiocephalus*), the carp (*Puntius*), and the eels including the mastacemblus. The first genus, which has a hollow head capable of retaining water, is eminently a tropical one, and adapted to hot climates. I, therefore, deemed its thriving on the hills problematical, as I was unaware, until a more recent period, that it breeds in the Wynad, and other elevated places. The carps are bony, as well as often of an earthy flavour; and the eels are very difficult to retain in one spot, besides being rich and indigestible.

4. *Introduction of European Fish proposed.*—Doubting the advisability of introducing the Indian fish, I at the same time considered that good European species might, with safety, be brought to that high and cool table land, wherewith to stock the Ooty lake, the Pykara and Avalanche rivers, and it seemed to me feasible to employ the discovery made by Mr. Youl, of transporting fish ova in ice, which he had done so successfully to Australia, by which means the young fish might be introduced into the waters of the hills. My first proposition with regard to this was made through G. A. Ballard, Esq., Collector of Malabar, to the Collector of Coimbatore in whose District the hills are situated. Concerning this I heard nothing more officially, and in February 1864, the day previous to my embarkation to Europe on sick certificate, I again laid the subject, through Mr. Brecks, before His Excellency Sir W. Denison, Governor of Madras, and was desired to state my views more fully in writing. This I did in a letter, dated May 4th, 1864, wherein I suggested that, if any experiment were tried, trout and perch might be introduced from Europe. It was subsequently found that perch were so difficult to keep alive in confinement, even in the Zoological gardens in London, and the obstacles raised to carrying them to India were so great, that any attempt with respect to their conveyance to Madras was abandoned for the time.

5. *Order of the Madras Government, No. 225, dated July 19th, 1864.*—In reply to this, the Governor in Council intimated that he would be glad to aid any experiment that might be made at a moderate cost, for the purpose of stocking the waters of the Neilgherry hills with good eatable fish, the rivers of which appeared well adapted for such. I was requested to furnish an estimate of the expense of bringing out trout ova, and other particulars, on the receipt of which Government would be able to decide as to the expediency of defraying the cost of the experiment.

6. *Further proposition. Estimated and actual cost of the experiment as far as Madras, exclusive of the ice from Suez.*—On the receipt of the foregoing I consulted with various gentlemen in England who were interested in the subject of pisciculture, and personally inspected the fish-hatching apparatus of Mr. Ponder, Mr. Francis, Mr. Frank Buckland, and those in the Zoological and Horticultural Gardens. I also applied to the Directors of the P. and O. S. N. Company to inform me whether they would allow the ova to be conveyed in the ice room of one of their vessels. They immediately (September 6th, 1864) accorded the necessary permission, but stated that the experiment must be undertaken in January or February, as, at that season of the year, their steamers were not so crowded as in the latter months. I proposed that an intelligent non-commissioned officer should be instructed in the process of fish-hatching, and sent overland in charge of the ova, and on arrival that he should proceed to the hills for six months to complete the experiment. The cost of sending ova to India, exclusive of ice from Suez to Madras, would, I observed, be about £30. In the details I subsequently found that I had been much mistaken. But, eventually, owing to undertaking it myself, and the liberal manner in which the P. and O. Company behaved, I was enabled to carry it out including all expenses to Madras, except for the ice from Suez, for £50-3-9, as per bill appended.

7. *Decision of Government Order, No. 1,251, of November 2nd, 1864.*—The Governor in Council sanctioned £100 for the conveyance of the trout over to Madras, but at the same time considered it advisable that the matter should lie over until my return to India, so that I might personally take charge of the experiment.

8. *Agree to take charge of the Experiment.*—On the receipt of the Government Order, I consulted with Mr. Youl and others, and on their promising me their cordial co-operation, I accepted the responsibility of the charge of the experiment in the commencement of the year 1866. I also suggested the expediency of sending out three slate-hatching troughs, with leaden pipes and wooden covers, which were sanctioned.

9. *Use of Ice in retarding the Hatching of Fish Eggs.*—Mr. Youl was good enough to invite me, on April 20th, 1864, to see two ice boxes opened, in one of which salmon eggs had laid 146 days, and in the other ninety-three, some of the former were alive, in the majority of the latter the eyes were even developed. Mr. Youl had discovered that as heat increased the rapidity of the hatching process, cold likewise retarded it without destroying the vitality of the eggs, provided they were not frozen. The ice employed should be quite pure; for, in the manufactured article, some of the chemical ingredients sometimes become mixed, and such would cause the death of the ova, for which reason the American ice only is adapted for packing the ova between Suez and Madras. I, therefore, made it an essential part of the experiment that such should be provided from Madras: for the expense of sending ice from England across to Suez would, I ascertained, be excessively heavy.

10. *Obtaining the Trout Ova.*—Much difficulty was experienced in obtaining permission from the proprietors of fisheries to collect the ova from their preserves, some had already promised it, others objected under the erroneous impression that injury would be caused thereby to the parent fish; whilst in few places the spawning was over at the period when the eggs were required. Finally, having obtained leave from Melville Portal, Esq., of Laverstoke Park, near Micheldever, Hampshire, to take some trout ova from the portion of the river Test, which runs through his estate, Frank Buckland, Esq., kindly consented to collect them. We proceeded accompanied by the keepers, Churchill and two Ballards, on January 18th, 1866, to the place where the fish were spawning. In the river flowing through the park, and below Oberton, we found sufficient ripe fish from which we obtained about five or six thousand ova of a fine size, and either of an orange, or of a yellowish white colour.

11. *Mode of collecting it.*—The mode of collecting the ova was as follows: the male and female fish having been caught by means of a drag net, first one of the latter six was taken: one person steadied it by holding it firmly (without exercising too much pressure) by the tail just anterior to the caudal fin, whilst the operator grasped it round the shoulder with his left hand, and then, with very gentle pressure, compressed the abdomen by passing his right hand from its head to its tail, during which time the fish was slightly bent backwards. During this process a third person held a flat tin pan, in which there was about an inch and a half of water, the abdomen of the fish just touched this, so that the ova rolled out directly into water, without being at all exposed to the air, and, owing to the flat bottom of the pan, the eggs did not roll one above the other. Next, the male fish was taken and treated in the same way, and the milt flowing out discolored the water, so that it appeared as if rice had been boiled in it. By gently agitating the tin pan for a short time, the milt became amalgamated with the water; this was continued for about a minute, when some of the water was poured off, fresh added, and this was repeated until the whole was quite clear. The eggs were then placed in a tin carrying can, care being taken neither to shake them, or expose them to the air.

12. *Previous attempt to convey Trout Ova to India in 1863.*—I may here refer to a previous attempt made to convey trout ova to India in the "Ripon" in 1863, which failed. My information was derived from Mr. Shave, who went in charge. The number taken was about five hundred,

and I think the eyes were developed before leaving Southampton. The development of the eye may be considered as ordinarily occurring about the thirty-fourth day, fourteen days subsequently to which the young fish generally hatch out: during this last period they bear vibration well, and at this time their carriage from one place to another in Europe is usually effected. Mr. Shave, according to his instructions, daily took the ova on deck, and removed the dead ones. Most of them died before reaching Alexandria, but a few appeared to be alive on the Indian side of Suez, but these never reached so far as Ceylon. The rapid changes in temperature, which, if this plan were adopted, would daily occur, must, no doubt, prove destructive to the vitality of the ova.

13. *Carriage of Ova and packing it at Southampton.*—The ova having been kept very cool all night, I started by the first train the next morning for Southampton, accompanied by one of the keepers. The tin can containing the ova was suspended to a stick, laid across from one seat of a railway carriage to the opposite. I took with me a hamper of fine moss collected from Lord Portsmouth's Park, and also a sack of charcoal; the small ova boxes had preceded me. At the P. and O. Stores at Southampton, I found that a refrigerator had been fitted up with ice, and we at once proceeded to pack the ova for carrying. I had eight boxes kindly furnished me by Mr. Youl, being identical with those he had had made for the Australian experiment: they were of inch pine; and 10½ inches long, by 7½ wide, and 4½ deep, inside measure; the bottoms and corners being perforated with about ten moderate sized holes in each, the lid screwing on. First a layer of charcoal was placed at the bottom of one of these small boxes, next a layer of moss and on that, one of trout eggs: then followed alternate layers of moss and trout eggs, being careful to avoid, as much as possible, the ova touching each other, or any pressure being employed, as that would either destroy the vitality of the eggs, or render the young fish cripples. The instrument made use of in moving them, was a curved hollow glass syphon, the upper end of which being closed by means of the thumb of the right hand, it was passed down close to the egg, when the thumb being removed from the top of the syphon, the egg was sucked up into it, and thus removed without any injury. To obviate too great and sudden a fall of temperature, in passing from the water to the ice box, as well as to facilitate packing, all was done in water containing ice, and only of such a depth as to be just sufficient to cover the moss. Six boxes were treated in this way, and each box, as packed, was placed inside the refrigerator, under ice.

14. *Carriage of Ova from Southampton to Alexandria.*—On February 2nd, I removed the ova boxes from inside the refrigerator in the P. and O. Stores at Southampton to on board the "Mongolia," where they were placed under the ice in the ice room. They took up very little space, and there was no difficulty in placing them there. For the purpose of carrying them from the docks on board the steamer, and also for conveying them across the desert, two cases were made of inch pine about three feet square: each of these I lined with a fine blanket, between which and the sides of the case a layer of cotton was inserted: outside were strong rope handles, by which it could be slung: whilst a tap was placed at the bottom to prevent any accumulation of water from the melting ice. To avoid the possibility of any interference with the cases, each was secured with a Chubb's patent padlock. The "Mongolia" left Southampton at 11:30 A. M. on February 4th, and very rough weather was experienced for the first two days. The run was as follows: At midday, on February 5th, 130 miles, 6th, 220, weather rough, much rolling, and great vibration; 7th, 235, considerable rolling, vibration decreased, sea smooth; 8th, 275, sea smooth; 9th, 275, on which date we arrived at Gibraltar. On the 10th, 237, sea smooth; 11th, 295, quite smooth; 12th, 285, slight breeze; 13th, 160, smooth, anchored at Malta; on 14th, 264, sea smooth, and so continued the remainder of the distance; 15th, 292; 16th, 160, when we anchored at Alexandria. Owing to some mistake one of the two large carrying cases was stowed away amongst the cargo, and as it could not be obtained for some hours, I determined to remain on board until the next day, and take the ova boxes on shore myself in a small boat. This course I likewise thought would be preferable to going in the small tender, in which the vibration is frequently considerable.

15. *Carriage across the desert.*—I therefore landed and obtained the services of a Dragoonman, who promised to have a boat alongside the steamer at 6 A. M. the following day, to enable me to be in time for the early train. The next morning one of the large cases was packed with ice, whilst the other contained the six ova boxes with ice above and below them. They were gently lowered into the boat, and we pulled directly on shore, where, from the landing place to the station, each case was carried on a wooden pole between two fellahs; not anticipating any detention, I was surprised at being stopped by a Customs House official, who wished to know the contents of the two cases into which he expressed a desire to look; but on the Dragoonman using the magic word "*bucksheesh*," and giving some money, we were allowed to pass in safety to the railway station. Here the railway officials found that the cases were too large and heavy to be swung in any carriage in the train then starting, but offered to send them by the evening train, in which they hoped they might have a carriage where they could be suspended, but in which train they informed me I could not myself proceed, but must entrust the care of them to a Native. Under these circumstances, and as if I agreed to this, it did not even appear certain that the cases could be slung, I was averse to leaving them with natives, whose language I did not understand, and to whom, consequently, I could give no directions, and I, therefore, preferred to adopt the alternative of taking them with me in the train unslung. The carriages travelled very smoothly to Cairo, where we arrived two P. M., the distance from Alexandria being 162 miles. I left the ova boxes at the . . . to prevent the shaking they would have received if I had had them carried into the town. On the morning of the 19th, just previous to leaving by the 7 A. M. train, I opened the box, and found that the ice had only very slightly decreased; consequently I might with safety have employed much smaller outside cases, which would have contained sufficient ice to last the journey, and also have been easier to carry. Here, again, I was unable to get the boxes slung in the train. By the afternoon we reached Suez, distant from Cairo ninety miles, and embarked at 5:30 P. M. on board the steam ship "Bengal." In the ice house of this steamer I found nine tons of American ice despatched by the Madras Government for the purpose of this experiment, and under some of this I placed the six ova boxes, the whole being well covered over with blankets.

16. *Voyage from Suez to Madras.*—At Suez I considered it very advisable to examine one of the ova boxes, to ascertain what the mortality had been, especially as the cases had been unslung in the railway journey across the Isthmus, a distance of 252 miles. I, therefore, opened one of them, and out of the whole of the upper layer did not perceive above five per cent. of dead ova, which I considered to be so far most satisfactory, clearly demonstrating that slinging in the railway train is not indispensable, at least after the ova have been a fortnight in ice.

17. *Voyage from Suez to Madras.*—On February 19th, at 6:30 P. M., we weighed, and had very smooth weather all the way to Madras. The vibration on board the "Bengal" was exceedingly great almost equalling that of a railway train. Owing to the heat of the weather, I found it necessary to see that the boxes were well covered with ice, at least every alternate day. The run was as follows: February 20th, 185 miles; 21st, 234; 22nd, 232; 23rd, 221; 24th, 171; 25th, 167, when we anchored at Aden at 11:40 P. M. On Monday 26th, we weighed at 10:15 A. M.; on 27th, 195 miles; 28th, 220; March 1st, 210; 2nd, 199; 3rd, 208; 4th, 216; 5th, 230; 6th, 207; 7th, 210; 8th, 213, arrived at Galle at 4:25 P. M. On March 9th, we left Galle at 6 P. M.; 10th, 150; 11th, 233; 12th, arrived at Madras at 6 A. M. Soon after anchoring, Captain Crowther, the Deputy Master Attendant, came on board, and when the small ova boxes had been packed in ice, inside the large carrying cases, he took them on shore to the Master Attendant's Office.

18. *Observations on the Voyage.*—Every assistance was received from the various officials in the P. and O. Steamers to facilitate the safe conveyance of the trout ova, but the person who was specially concerned was the butcher, as he has charge of the meat and vegetables in the ice room, and unless he had been careful, the droppings from the meat might have fallen upon the ova boxes. But any chance of such a catastrophe is more to be feared

theoretically than practically; what is most to be dreaded is that the boxes will not be properly packed at first starting, especially at Suez, for at the commencement of a voyage every one is exceedingly busy; but if this is efficiently done, very little care is requisite to ensure their being well conveyed, especially as blankets are placed over the ice that covers them: in fact from Southampton the ice last as far as Alexandria, without fresh being required. In the tropical seas it is necessary that they should be personally inspected at least every alternate day, and a little more care in stowing them is requisite, first, that they should not be too near the sides of the ice room; and secondly, that there should be plenty of blankets over the ice in which they are embedded.

19. *Carriage of Ova from Madras to Coimbatore.*—On landing at Madras, the large case which contained the ova was slung in a strong wooden frame, which Mr. Franklin, the Master Attendant, had made at his Office, and which could be placed inside a railway baggage carriage, thus completely preventing all vibration. But as I had experienced so much difficulty in the carriage of the two large cases, with the ova boxes and ice inside across the Isthmus of Suez, I felt certain that coolies would not carry them up the ghaut from Mettapollium to Coonoor, and therefore suggested, that smaller ones should be made of the following dimensions, 22 by 21 inches, and 16 inches high. Even these, as it subsequently turned out, were larger than was absolutely necessary. They were each lined with a blanket, and had rope handles, so that they could be slung in a palanquin. On the morning of the 13th, I placed a sufficient supply of ice in the large case containing the ova boxes to last to Coimbatore, and in the other box I packed a further supply in case it might be required. I left Madras at 5 P. M. on that day by rail, and proceeded direct to Coimbatore, arriving at midday on the 14th; for, although the day train takes a shorter time in completing the journey, the cool night air seemed most favorable for the conveyance of ova in ice. The large case containing the ova boxes, and slung in its frame-work, was placed inside a baggage van, which the Railway authorities directed should go on direct to Coimbatore, so as to avoid any moving. At Coimbatore the sun was so powerful, that, instead of continuing my journey at once, I decided on remaining until 4-30 P. M.

20. *Journey from Coimbatore to the Government Gardens at Ootacamund.*—At the railway station I removed the six ova boxes from the large carrying case, and divided them amongst the two smaller ones, which had been made in Madras (see paragraph 19). Each was slung by ropes inside a palanquin, and also covered over with a wet blanket. Having a large English blanket left, I soaked it in water, and covered over one of the palanquins with it; the other palanquin was covered with blue serge, which was also kept moist. The Tahsildar of Coimbatore, Govindurajoolu, accompanied me as far as Mettapollium, twenty-six miles, and rendered me every assistance on the road; we arrived at 1 A. M. at the bungalow, and at 2-30 A. M. on the 15th, as soon as the coolies were ready and every thing in order, we left again, accompanied by the Tahsildar, and ascended the Ghaut, arriving at Coonoor, fifteen miles, at 9 A. M., where, after remaining an hour, we left for Ootacamund, twelve miles distant. We reached the Government gardens at 4 P. M. Care was taken to shake the palanquins as little as possible, and as the ova boxes were slung inside, they could not have suffered much, whilst the wet blanket on the boxes, and also the wet covering over the palanquins, effectually kept the outside of the boxes moderately cool. On arriving at the Government gardens I went direct to the fish-house accompanied by Mr. McIvor, the Superintendent, and his Assistant, Mr. Batcock, who both then and subsequently rendered me every assistance, and cordially co-operated with me in carrying out my wishes.

21. *Expences to Ootacamund from Madras.*—The expence of conveying the ova to Ootacamund including my return to Madras was Rupees 292-11-3, as per statement appended.

22. *Fish-House.*—The fish-house was made of brick, with a solid six-foot stone foundation, and a roof of corrugated zinc. I found it situated above the Government gardens, and about 100 yards below the gate of the Dodabetta Chinchona plantation, facing E. S. E., and divided by the road from a ravine, which runs directly downwards towards the great basin of Ootacamund. Its back was towards a bank, from which stone and gravel had been removed, and at its upper gable end was the stream which fed the troughs inside. The length of the building

(inside measure) was about nineteen feet nine inches, its width eleven feet; its height to the top of the wall seven feet five inches, and at its gable ends two feet higher. Its walls had five rows of orifices, formed by the omission of every alternate brick in the row. At the upper end was a double-glazed window, which opened 44½ inches wide, and sixty-seven inches high, whilst at its lower end there was a single window, 29½ inches wide, by forty-six inches high. The door which faced the ravine was six feet two inches high, and thirty inches wide, it was glazed in its upper thirty-four inches. The floor, except for three feet of its width, was formed into two large tanks, separated by a solid low stone wall, into this the water from the ova boxes flowed; it was intended for the reception of the young fish. The slate ova troughs were placed in the upper corner of the building, one above the other, like steps in a ladder, the lowest being just in advance of the one above; they were laid in a brick foundation, the leaden pipes from one leading the water directly into the one beneath and anterior to it. Their size (inside measure) was 36½ inches long, by seven inches wide, and four inches deep, with a small leaden pipe fixed into the front of each near one extremity, and about one inch from the summit, with a piece of perforated zinc behind it to guard against the eggs being washed down it by the flow of the water, whilst each trough had a deal cover. The troughs were already in their places, and had some fine-pounded granitic stone in them forming gravel, which had been dug out of the solid rock behind the fish-house. This gravelly bottom was placed to prevent the eggs from rolling about, whilst the shallow water allowed sufficient oxygenation, and the constantly flowing stream rendered it as pure as was possible. The covers kept it dark, such being unfavorable to vegetation and deposit on the ova, whilst it is favorable for hatching fish eggs.

23. *Inspecting the Ova.*—As it was rather late on arrival, 4 P. M., time only permitted the unpacking of one of the large boxes containing three ova boxes. The ova looked very well, at least 1,500 being alive. As the temperature of the water stood at 55° I placed some ice in it, and in this I put the eggs as removed from the boxes. The number of live ova were sufficient to fill the three slate troughs, only about ten per cent. were dead. The next day I found that the temperature of the water was 51° in the early morning, 69° at midday, and 61° at 4 P. M. I left the unpacking of the second box until the evening of the 16th, when I completed it in the same manner as in the first box. The mortality was nearly twice as great as amongst those first unpacked, which I cannot account for, except that they appeared to have been shaken, and that they were from the box which was conveyed in the palanquin with the serge cover, which probably did not so effectually keep off the sun as did the blanket. These ova were placed in two large teak troughs, which Mr. MacIvor had had made for me, there not being sufficient room in the slate troughs to contain them all comfortably.

24. *Geological formation.*—The geological formation of the Neilgherry Hills consists of gneiss, with a substratum of decomposed felspar and hornblende. Everywhere around Ootacamund exists a very fine red sand.

25. *Stream of water.*—The water which was employed for the experiment, flowed down in a small pure stream from the Dodabet plantation, directly through the fish-house; the exposed length being about 100 yards from the gate of the wood to the fish-house.

26. *Temperature of the air and water.*—The temperature of the air and water are great considerations in such an experiment as this, for much depends upon that of the latter: "The proper temperature of the water, both in and out-of-doors, ought to range from 40° to 45° * *", "anything above 50° is weakening"—(Buckland, on Pisciculture.) The first thing that struck me on arrival, was that, although it was past 4 P. M., the water inside the fish-house stood at 55°, a temperature, apparently, too high for success. On the following day I found that early in the morning the water stood at 51°, at mid-day 69°, and at 4 P. M. 61°. From a series of observations taken at different periods of the day, I found in the month of March the temperature of the water in the slate troughs to average as follows:—

	7 A. M.	12 A. M.	4 P. M.
Water, temperature	51°	66½	59°

The heat of the water rose one day at 12 A. M. to 71° in the fish-house, the lowest it stood at, at that hour of the day being 60°. In the stream the usual temperature at midday was 72°; on the 22nd of the month it was a cloudy day, threatening rain, and the temperature of the water at midday was 66° of the air in the fish-house 62°, showing that the water was 4° warmer than the air. In the month of April there was not much alteration in the temperature.

I here insert the daily readings of the dry bulk of the thermometer, as taken in the Government Gardens:—

Months.		Dry bulk of Thermometer.			Daily variation.	
		7 P. M.	2 P. M.	6 P. M.	Maximum.	Minimum.
March	15th	...	...	58	...	...
"	16th	56	73	61	78	55
"	17th	59	74	62	77	53
"	18th	61	76	64	77	53
"	19th	54	74	70	77	52
"	20th	59	...	61	79	56
"	21st	60	77	64	80	55
"	22nd	61	73	63	80	57
"	23rd	60	77	60	80	56
"	24th	59	77	64	79	55
"	25th	60	79	64	82	55
"	26th	56	75	68	78	51
"	27th	57	70	64	78	55
"	28th	57	75	62	80	57
"	29th	61	78	62	80	56
"	30th	57	68	60	78	54
"	31st	54	...	60	78	49
April	1st	57	66	60	77	49
"	2nd	56	71	62	75	55
"	3rd	55	58	57	77	53
"	4th	58	...	60	72	55
"	5th	56	...	...	75	55
"	6th	55	75	61	76	51
"	7th	55	79	63	80	51
"	8th	63	72	64	77	56
"	9th	61	74	64	79	59
"	10th	60	75	65	80	58
"	11th	59	77	...	...	54
"	12th	...	...	...	...	...
"	13th	...	75	65	81	...
"	14th	57	74	61	77	57
"	15th	61	74	63	79	55
"	16th	56	75	64	78	56
"	17th	57	69	63	77	56
"	18th	55	71	60	70	54
"	19th	57	71	57	77	53
"	20th	56	76	63	86	54
"	21st	58	70	60	75	56
"	22nd	60	...	57	75	53
"	23rd	59	69	62	75	53
"	24th	58	64	55	71	55
"	25th	58	61	60	73	53
"	26th	58	72	59	79	56
"	27th	57	74	61	75	54
"	28th	59	75	...	77	55
"	29th	60	78	57	78	54
"	30th	57	71	56	75	56
May	1st	56	65	58	72	54
"	2nd	56	67	...	70	54

It will in this place be necessary to observe the heat of Ooty during the various months of the year, and to show the variations of the thermometer between the day and the night time, for which purpose I insert the following, also furnished me from the Government Gardens:—

Thermometer during the month.

Months.	Average Maximum.	Average greatest daily range.
January	72	33
February	74	30
March	77	31
April... ..	75	27
May... ..	75	24
June... ..	78	18
July... ..	72	18
August	71	17
September	68	25
October	69	26
November... ..	69	25
December... ..	71	29

The average daily range between the maximum and minimum of the thermometer is thus seen to be very considerable in the air even in the cold months of the year: it is, therefore, probable that the heat of the water at midday is great. Before any further experiment is undertaken, the daily range of a maximum and minimum thermometer, as it stands in a slate trough of water within the fish-house, should be noted, in order to ascertain if the temperature of the water is adapted, or not, for the hatching of trout ova. In Australia, the experiment was undertaken at the same period of the year as this one to India, but going from a northern to a southern hemisphere, it reaches its destination there at the beginning of the cold season, which, in India, is the commencement of the hottest months.

27. *Method employed for cooling the water.*—Finding that the sudden change from the ice box, in which the temperature stood at about 40°, to the water where it reached about 70°, was rapidly causing the destruction of the ova, I attempted to cool the stream by covering it over with bushes for 100 yards. This reduced the temperature 3° or 4°, sometimes as much as 5°, but as the bushes withered the leaves fell into the water. The stream was then covered over with large plates of corrugated zinc, and wooden boards, upon which the bushes were placed. Subsequently a loose brick drain was put in, and covered over with brick, above which were the zinc and boards, with the bushes above all. The roof of the fish-house was also covered with mats.

28. *Cleanliness of the water.*—The water looked beautifully clear, but in reality it deposited a fine sediment of red sand, and some vegetable matter also appeared to be carried in solution, probably derived from the decomposition of the leaves of the trees in the Cinchona plantation through which it flowed. As I had no English filters, I employed the first third of the upper slate trough as a filter, by placing pieces of perforated zinc across it, and raising fine sand barriers, through each of which the water had to pass. A fine sand filter was also placed at the entrance of the pipes leading to the slate troughs. In the boxes, having no slate tiles, panes of glass were laid over large walnut-sized pieces of gravel, but they did not seem to collect much of the deposit. The wooden covers were kept over the slate troughs, and the windows also were darkened by mats. In spite of all these precautions, and increasing the stream of water, some of the fine red sand managed to pass through, and attached itself to the eggs. On examining the stream, at its edges there were some appearances of vegetable deposit, so obtaining a number of loose bricks that had never been used, a drain was made for 100 yards in the following manner; one brick was laid for its bottom, one on either side, and one covering

it in at the top. Of course no mortar, chunam, or cement was employed in laying the bricks, they were merely put loosely into the stream to form a clean channel. At ten different places this channel was crossed by pieces of perforated zinc each of which had a sand filter posterior to it. This effectually prevented any foreign substance from being carried down, but still this did not altogether keep out the sand. On and after March 30th, distant thunderstorms commenced, the weather became more cloudy, and the water dirty, whilst insects managed to find their way into the troughs. On the night of April 1st, as many as 200 of the ova died due either to the insects, or to the deleterious state of the water, or both: whilst at the same time, it does not seem improbable that the electric disturbance might also have acted injuriously.

29. *Appearance of the Ova on reaching Ooty and during the progress of the experiment.*—On opening the small ova boxes, the following was the appearance of the eggs. The dead ones were of an opaque white colour, and some of them adhered to the moss, but this was by no means the rule. The living eggs were clear, some with a slightly lighter margin, others with a few vessels apparently converging towards one spot in the interior of the egg. A few of the eggs were of a clearish flesh colour, and these I had reason to believe were being affected by the change of temperature, for they soon afterwards died. The mortality for the first seven days, as might have been anticipated, was very great, evidently due to the change of temperature, from the ice boxes to the water; then it decreased, and the eggs became cleaner. On March 23rd, the eighth day, a dark spot began to be distinctly visible in the centre of the eggs, but the eyes were not apparent. The ova at this time were doing best in the lowest trough, where the deposit of sand was also the least. On March 29th, the eyes were first apparent, in some of the eggs of the first batch which were unpacked, but in the majority the eggs did not advance from this time as they should have done, although in a few the form of the rolled up embryo became apparent. But on the night of April 1st, a great mortality commenced, which continued until the death of the last ova, on April 10th. It began as follows: after a thunderstorm leeches commenced, moving about in the jungles, and a very fine species, some of which were hardly thicker than horse hair, and about half an inch in length, suddenly invaded the troughs passing through the filters. They seemed to make a bite in the eggs, thus destroying their vitality, and to have sucked out the juices. At this spot a white fungoid growth subsequently appeared, being the decomposed interior of the ova, starting out through the injured walls. A second species of insect, which seemed to do damage to the eggs, was subsequently detected. To preclude the possibility of its being stated at a future time, that I gave up the experiment before the full period had arrived at which the ova might hatch, namely, fifty days, I placed about 100 living eggs under fine sand, in the troughs, where I left them until May 2nd, when I found them as I anticipated to be dead.

30. *Remarks on the experiment.*—In the foregoing report of what has been done in the trout experiment, I have not included the voluminous correspondence which has passed, nor have I entered into the variety of details (from my diary) which I employed, as such, I considered, would only extend this report, which is now lengthy, to a very much larger space, without augmenting the information which I could offer. I spared no trouble in my efforts to make the experiment successful, and, although I much regret its termination, I do not believe that any more efficient means than were employed could, under the circumstances, have been adopted. I think that it has now been satisfactorily demonstrated, that trout ova properly packed in ice and carefully attended to, will survive the journey overland from England to Ootacamund, and, also, that their vitality has remained until the development of the eyes and the form of the embryo fish has been visible in the egg. Here the first experiment ceases, the heat of the water, the deposit contained therein, and the water insects, have unfortunately prevented success from crowning the attempt. But should it be the intention of Government to again try the introduction of European trout, conveyed in the same manner to India, I would venture to draw attention to the following circumstances, so as to give the experiment every facility for success.

31. *Opinions on precautions necessary should a second experiment be desired.*—The period of year chosen has not been that best adapted for success, but it was only in the months of January and February that leave could be obtained from the P. and O. Company to try the experiment in their Steamers, but this brings the ova to the Hills in the beginning of the warm weather, when the water is too hot for the purpose. The latest period for leaving England should be at the end of October, or beginning of November, when trout ova may be obtained. "The Thames trout have all completed their spawning operations by the end of November"—(Frank Buckland, "Land and Water," page 77.) I feel certain that Frank Buckland, Esq., would assist in the furtherance of this experiment, and would, perhaps, obtain the ova. If it could not be procured as early as I have intimated, it would be more prudent to defer the experiment to the following season. If they left England in the beginning of November, they would arrive at Ooty in the cold season, when thunderstorms and even showers are absent, so the onslaught of water vermin need not be feared. The trouble of bringing out ova overland is not great; the small ova boxes having been properly packed under the ice, at Southampton, should not require even to be looked at before reaching Alexandria. For going on shore and crossing the desert smaller boxes than I employed should be used, in fact rather less than those in which the ova boxes were carried up the Ghaut to Ooty (see paragraph 18). Regarding the question of the expense, I would propose trying, in Madras, whether the manufactured ice, as used on board the P. and O. vessels, would, or would not, destroy the vitality of fish ova. In the train it is certainly advisable, but not indispensable, that the boxes should be slung. At Madras, and along the route, nothing could be better than the precautions taken by Government, to ensure success in the experiment.

32. *Preparations at the Fish-House.*—At the fish-house I would suggest some alterations. In the stream there should be a brick reservoir, made near the gate of the Cinchona plantation, 100 yards above the fish-house: and a second one inside the fish-house, in the form of tubs; whilst from the first reservoir to that inside the fish-house, a leaden pipe of two inch diameter, guarded by a stop cock at both ends, should be laid along the brick water-course, and down this pipe all water going from one reservoir to another should be conveyed. These tubs should contain sufficient to last twelve hours, so that water should only flow in during the night, that for the day time being supplied from the tubs wherein it would continue cool; from these, two pipes also furnished with stop cocks should lead the water to the top of two English filters. The water having passed through the filters, should fall into the upper of a series of cooling chatties, nearly filled with sand and charcoal, and the water from the lowest should fall down direct to the upper of the slate ova troughs. For this purpose the lower tank in the fish-house must be deepened, and the ova trough placed four feet, or more below the present level of the ground: but, as there is a six-foot foundation, this can easily be accomplished. Of course, the stream, and especially the reservoir out-of-doors, should be kept well covered over, and the brick drain be continued, as it is now, for about 200 yards higher up the plantation. If some Australian or other trees could be planted to shade the fish-house, it would also be better, otherwise the roof should be thatched. The apparatus should be kept in full working order for at least a month, previous to the expected arrival of the ova, a shorter period would be insufficient to ensure its correct working.

33. *Concluding remarks.*—In the second part of this report, I propose fully entering into the question, of whether European trout may be expected to be an ultimate success on the Neilgherry Hills? and secondly, if Indian species would be better adapted for stocking the various pieces of water existing there? But as this will necessitate the examination of several hundred Zoological specimens, which I have collected on the Hills, and researches amongst those existing in the Madras Museum, as well as references to my books which are in Madras, some months will probably elapse before it is completed, therefore I considered it best to despatch at once the first half of my report for the consideration of Government.

OOTACAMUND,
May 5th, 1866.

(Signed F. DAY,
Surgeon, Madras Army.

Expenses incurred in the Trout experiment up to the time of reaching Madras exclusive of ice from Suez.

	£.	s.	d.
Three Journeys from Cheltenham to London, &c.	6	6	0
Three do. Ryde to Southampton, with carriage of Large Case and Ova Boxes...	4	18	6
Three Slate Tanks, Packing and Expenses of sending, &c	4	17	6
Two Chubbs' Padlocks	1	4	0
Two large Cases, two brass Cocks, Hammer, TurnscREW, Ice-pickers, Ropes, Nails, &c. ...	1	16	3
Two large and one small Blankets, cotton for lining Cases, Tacks, &c. &c.	2	5	0
Expenses of collecting Ova—Fly—Keepers—Railway Ticket, &c... ..	14	15	0
Ticket and expenses from Ryde to Whitehead, Southampton, and return; also packing Ova, and cost of placing Ice in the Refrigerator	3	10	0
Extra luggage on board Steamer, Dock Charges, Carriage to Steamer, &c.	7	0	0
Butchers, &c, on board Steamers	2	0	0
Bribing Customs House at Alexandria	0	5	0
Boat landing Ova Boxes and carriage to Railway Station at Alexandria, &c.	0	18	6
Expenses at Cairo and Zuez	0	8	0
Total... ..	50	3	9
Received... ..	60	0	0
Leaving in hand... ..	9	16	3

(Signed) F. DAY.

Ooty, 5th May 1866.

Expenses incurred from Madras to Ooty.

	Rs.	A.	P.
Ticket to Coimbatore and extra Luggage	54	8	4
Two Carts from Coimbatore to Ooty	14	0	0
One Moncheil from Mettapollium to Coonoor	9	0	0
Bullock Transit to Ooty	9	0	0
Return Ticket to Madras (excluding extra Luggage, Moncheil, Transit, &c.)	86	8	4
Received... ..	150	14	0
Leaving in hand, exclusive of amount advanced by the Collector of Coimbatore, sanctioned in Government Order, No. 444, dated May 1st, 1866	300	0	0
Leaving in hand... ..	149	2	0
Leaving in hand... ..	141	13	3
Leaving in hand... ..	7	4	9

(Signed) F. DAY.

Ooty, 5th May 1866.

1. Submitted for the information and orders of Government.
2. The Board think it very desirable that the experiment should have a further trial.

(True Copies and Extract.)

(Signed) R. A. DALYELL,
Acting Secretary,

To the Secretary to Government, Revenue Department.
Copy to the Collector of Coimbatore.

Exd. J. Wright.

21

My dear Sir
B. N. N. is
acting for Day, &
at the same time
performing his
College duties,
as it happens,
were Day down
here. N. N.

1866.

Department

No.

PROCEEDINGS OF THE BOARD OF REVENUE,

Dated 4th June 1866

No. 3,815.

Submitting for information and orders letter
from Collector of Coimbatore forwarding report
of Doctor Day on experiment to introduce
English Trout into waters on Nelgherry Hills.

would ~~only~~ not
be available
for other duty,
except as a temporary
measure in the
Princery -

The Com^{rs} lately
sitting in consultation
have recommended
that the appoint-
ments of Pipeper

beaker ~~be assigned~~
to Henry ~~and also~~
the two Sheriffs
that ~~last~~ / ~~the~~ / ~~the~~ /
understand it, do
not agree in this
view, and in
my opinion the
appointments
should not be
combined - there is
little work for

an Officer the Professor
of Mathematics had been
in the College &
the medical
Storekeeper in the
Fort.

Day, not having taken
up his appointment
Storekeeper before
going to the hills
draws only his

military pay \$
N 823-11-5: When
he joins the lines
his salary will be \$2000

Dr. Medicine draws
N 451 Military Pay
N 15-6 Professor
N 274 For the lines
where he is not acting for
the day he would draw
N 300 as Professor
so Govt. actually

Save a few rubles
by the present
arrangement
at present a rather
next month the
College. By doing
this I think
I shall be able
not be absent
from the States,
when the

College resumes
work
I may be able
to see them

We have kept things in form and have P. General's
report that the report of the medical department is so correct
that he cannot find fault with it. I am very much pleased
to hear that the report is so correct.

#

In Order

Dr. Day has evidently
the are the neither trouble
was sure in the experi-
ment and merits the
handbook put
that before receiving the
Experiment put with, I
presume want for the
promised report in which
the all important question
is the report with it.
Cudde

The jury have ~~been~~ ^{been} the
report with much interest
and are satisfied with the
day. I did not think it was in the power
to bring the experiment to
a satisfactory conclusion.
The ~~experiment~~ ^{experiment} of his last evening
was made as a test for the
report promised in the
before deciding whether
the experiment has succeeded
or not.
The day will be in-
teresting and must take
up the
evening.

16-9-01

Public 1866. Department.

No. 551.

*PROCEEDINGS of the MADRAS
GOVERNMENT.*

Dated 28th June 1866.
7912/192 of 1867 -