M.R.O. 1—20,002—12-3-65.

(1) Number of Pages.....

(2) Date of repair.....

(3) Initials of the Referencer.....

MADRAS RECORD OFFICE

GOVERNMENT OF MADRAS

Revenue DEPARTMENT

G.O. No. 3 Press
~~B.P. No.~~ ~~Mis.~~
5-6

Dated 3-1-1866 196 .

Not to be folded or roughly handled

No. 5. Read the following letter from CLEMENTS R. MARKHAM, Esq., to the Secretary to the Government of Madras, Revenue Department, dated Tuticorin, 26th November 1865:—

1. I have the honor to report, for the information of His Excellency the Governor of Madras in Council, and with reference to paragraph 2 of the Despatch from the Secretary of State for India in Council to His Excellency, dated September 1865, on the subject of the Pearl Fisheries, that I arrived at this place on the 23rd instant, on my way to the Neilgherry Hills, and that I have delivered to Captain Phipps the plan and instructions for arranging the Aquaria, and the Microscope and other instruments which will enable him to conduct the contemplated investigations. I fear, however, that he will find great difficulty in preparing a suitable place for the Aquaria, which ought to be in an underground chamber, or rather in a position somewhat below the level of the ground, and protected from the sun by a good roof. I have also, after visiting the works on the middle bank, and passing a day on the Cruxian paar, fully discussed the various points bearing on the experimental Pearl Oyster Nursery with Captain Phipps.

2. The examination of the banks off Tuticorin has been very unsatisfactory this year, and no better result is expected from the Trichendoor banks. They are absolutely denuded of pearl oysters. Mr. Holdsworth, the Naturalist employed by the Ceylon Government, is now examining the banks on the opposite coast, and if his investigations, as is anticipated, are equally unsatisfactory, it will become a serious question how the Nursery, which is approaching completion, is to be stocked. There is, I think, every reason to expect successful results from the experiment of rearing pearl oysters, and at all events it is well worth trying. It has occurred to me that a sufficient supply of oysters might be obtained from the Bahrein banks in the Persian Gulf, which are, by B. I. S. N. Company's Steamers, within less than a fortnight's sail of Tuticorin. I have, therefore, made some enquiries on the subject, the results of which I shall have the honor of communicating to you.

3. I beg to enclose a copy of a Report giving a general sketch of the history of the Tinnevelly Pearl Banks, dated 20th June 1865, which was prepared for the information of the Secretary of State for India.

REPORT ON THE TINNEVELLY PEARL FISHERIES, 26TH JUNE 1865.

1. The experiment which has now been commenced, for so improving the Tinnevelly Pearl Fishery as to ensure a large annual profit to the revenue, is so important, that a brief account of its former history, and of the recent proceedings connected with it, may prove useful. The experiment itself possesses considerable scientific and general interest.

2. From time immemorial the pearl fishery in the narrow sea which separates India from Ceylon has been famous in all the marts of the Old World, and has rivalled the still more renowned fishery of Bahrein in the Persian Gulf. Opinions have always varied respecting the value of the pearls from these fisheries. Tavernier, the old travelling Jeweller, said in 1651 that the pearls from the sea that washes the walls of Manaar in Ceylon are, for their roundness and water, the fairest that are found, but rarely weighing three or four carats. Master Ralph Fitch, a London merchant, who made a voyage to the Indies in 1583, asserts, on the other hand, that though the pearls of Cape Comorin are very plentiful, they have not the right orient lustre that those of Bahrein have. Whatever the truth may be respecting the water and orient lustre of

the pearls of these rival fisheries, there can be no doubt that a vast concourse of merchants has been annually attracted to the fisheries in the Gulf of Manaar from the most ancient times, which is sufficient evidence of their value.

3. The Ceylon fisheries have retained their old reputation down to modern times, while the fame of the hitherto less productive banks on the opposite side of the Gulf of Manaar, off the shores of the Collectorate of Tinnevelly, has yet to be re-established.

4. In the golden age of the Tamil people of Southern India, the Tinnevelly Pearl fishery paid tribute to the Pandyan kings of Madura. Its head quarters, we are told by Ptolemy, was then at Koru, the modern Coil. Marco Polo, in the end of the thirteenth century, mentions the land of Maabar,* where many beautiful and great pearls are found off the coast. The merchants and divers, he says, congregated at Betalar, in April and May ; and he relates how the divers, called *Abraiamain*, performed incantations to preserve themselves from the attacks of great fish in the depths of the sea. In those days the sovereign received a tenth, and the divers a twentieth of the proceeds of the fishery. The great abundance of pearls from the Tinnevelly banks excited the wonder of all the bold wanderers, from Europe, who completed the perilous voyage to India in early times. Friar Joidanus, a quaint old Missionary Bishop, who was in India about 1330, says that 8,000 boats were then engaged in this fishery and in that of Ceylon, and that the quantity of pearls was astounding and almost incredible. The head quarters of the fishery was then, and indeed from the days of Ptolemy to the seventeenth century, continued to be at Choyl, or Coyl, literally "the temple." Old Ludovico de Vartheme mentions having seen the pearls fished for in the sea near the city of Choyl in or about 1500, A. D. ; and Barbosa, the Portuguese who travelled about the same time, says that the people of Choyl are expert jewellers, who trade in pearls. This place is, according to Dr. Vincent, the Kora of Ptolemy, the Kholhi of the author of the Periplus, the Koil or Choyl of the travellers of the middle ages, the Ramana Koil (temple of Rama) of the natives, the same as the sacred promontory of Ramnad, and Isle of Rameswarum, the head quarters of the Indian pearl fishery from time immemorial.

5. But Tuticorin, the present head quarters of the fishery, has supplanted the ancient Coil for the last two centuries ; and since the middle of the seventeenth century, the agents of the powers that have successively presided over the fishery, whether Portuguese, Dutch, or English, have uniformly taken their station at this little port. It is about 90 miles N. E. of Cape Comorin, on the Tinnevelly coast. When the Portuguese were all-powerful on the Indian sea-board, the Jesuits were allowed the proceeds of one day's fishing, and the owners of the boats had one draught every fishing day. The Naiks of Madura, the sovereigns whose family had succeeded the ancient Pandyan dynasty, also had the proceeds of one day, as Lords of the coast. These Naiks were the builders of all the magnificient edifices which now beautify the city of Madura, and their dues from the fishery were probably used as offerings to Minakshi, the fish-eyed goddess of the vast Madura Pagoda, who now possesses, amongst her jewellery, a numerous collection of pearl ornaments. In the days of the Naiks and Portuguese there were 400 or 500 vessels at the annual fishery, and at the subsequent fair held at Tuticorin, there was an assembly of from 50,000 to 60,000 persons. The divers, at that time, were chiefly Christians from Malabar. Captain Hamilton, who was travelling in the East from 1688 to 1723, described Tuticorin when the Dutch were the masters at that port, as well as in Ceylon. He says that a Dutch Colony at Tuticorin superintended a pearl fishery a little northward of the port, which brought the Dutch Company £20,000 yearly tribute.

6. The Dutch appear to have fished too recklessly and too often, and when the English succeeded them at Tuticorin, the banks were very far from yielding £20,000 a year. Our predecessors well nigh killed the goose with the golden egg, and for many years we followed in the same track. It is the old story. A valuable product is discovered to be a source of considerable wealth, and

* *Maabar* of Ibn Batuta and Marco Polo, in the southern region of the Coromandel coast, comprised in the modern districts of Madura and Tinnevelly. Colonel Yule has suggested that the word may be Arabic (*Ma'abar* a ferry) in reference to the passage or ferry to Ceylon.

forthwith a system of reckless destruction for the sake of immediate gain is inaugurated. Then the supply begins to fail, a panic ensues, and when science and forethought are called in, it is discovered that ordinary prudence and a judicious system of conservancy would have ensured an annual unfailing yield from the first. Such has been the history of Chinchona bark in South America, of the Teak of the Indian forests, and such also is the story of the Tinnevelly banks since the Dutch times.*

7. In 1822 the Tuticorin pearl fishery contributed about £13,000 to the Indian revenue, and in 1830 about £10,000, but after the latter date there was no yield at all for many years. Between 1830 and 1856 there were thirteen examinations of the banks, and on each occasion it was found that there was not a sufficient number of grown oysters to yield a profitable fishery, and none was therefore attempted. The unsatisfactory condition of the banks was attributed to several causes. Captain Robertson, the Master Attendant at Tuticorin, thought the widening of the Paumben channel, which caused a strong flow of current over the banks on the coast, prevented the molluscs from adhering ; and that the fishers for large conch shells called *chanks*, (which are used as horns in the worship of idols, and cut into segments of circles as ornaments for women's wrists,) anchoring their boats on the banks, killed the oysters. The dead oyster would of course have a fatal effect on their neighbours. The native divers attributed the state of the banks to the pernicious influence of two other shell fish, called *soorum* and *kullikor*,† which are mingled with the pearl oysters on the banks and, as the natives believe, destroy them.

8. In 1856, however, an examination was made by Captain Robertson, and it was found that at least four of the banks off Tuticorin, namely :—

Cooroochan Paar,
Navary Paar,
Oodorroovie Paar,
Clothie Paar,

were well covered with young oysters, which would be old enough to be fished in 1860-61. The Madras Government, therefore, determined that every precaution should be taken in order that the banks might receive no damage in the interval. The chank fishery off Tuticorin was ordered to be put a stop to at the termination of the contract, and vessels were provided to protect the pearl banks from poachers. Captain Robertson was unfortunately lost in a pattamar that had been obtained from the Bombay Government, in March 1859. He was succeeded as Master Attendant at Tuticorin and Superintendent of the Tinnevelly Pearl Banks, by Captain Phipps, to whose zeal and intelligence the fishery owes its present hopeful condition, and under whose auspices the fishery of March 1860, the first that had been attempted since 1830, was opened.

9. A Government pearl fishery is a most legitimate source of revenue, and forms an exception to other monopolies. Pearls are simply articles of luxury in the strictest meaning of the word. The seas in which they grow cannot well become private property, and if a profit can be derived from their sale, it is certainly a source of revenue which can give just cause of complaint to no man, while it benefits the community at large. In India, too, the Government are possessed of advantages which enable them to get the work of superintendence and management done with far greater economy and efficiency than could be secured by any private individual or Company. So high an authority as Mr. McCulloch has taken an opposite view, and says that the Government monopoly ought to be abolished, because the expense of guarding and managing the banks exceeds the sum for which the fishery is let, and because any one who likes should be allowed to fish, on

* On the Ceylon side the Arappo banks were fished by the Dutch from 1667 to 1768, with short intervals. The last Dutch fishery was in 1768. There was then no fishery until 1796, but from 1796 to 1809 the Ceylon fishery yielded £517,812 to the English. From 1828 to 1837 it yielded £227,131. and from 1855 to 1860 £117,453. In 1859-60 the Modrigan bank yielded 12,000,000, and the Chevel Paar bank 60,000,000 Oysters.

† *Soorum* is a *Modiola*, a sort of mussel, but differing from the latter, in the anterior margin of the shell being rounded out beyond the umbo, which in the *Mytilus* is terminal.

Kullikor is an *Avicula* belonging to Lamarck's family of Malleaceæ. The hinge of the shell is lengthened into auricular appendages, and there is a hiatus in the left valve for the passage of the byssus.

paying a moderate license duty. The last edition of the Commercial Dictionary was published in 1860, and during the two following years the Tinnevelly pearl fishery yielded a large net revenue to the State. This is a sufficient answer to Mr. McCulloch's argument. It is true that there has since been disappointment, but the way to secure regular annual returns is to adopt a carefully considered scientific system of conservancy, and not by throwing the fishery open to the depredations of all comers.

10. The fishery of 1860 commenced on March 7th, and the sale of the Government share of oysters was conducted by public auction, which began at Rupees 15 and gradually rose to Rupees 40 per 1,000. As many as 15,874,500 shells were sold, realizing upwards of £20,000 as the net result to Government,* exclusive of all expenses, and of the shares allowed to the divers. The annual expense of the guard boats for protecting the banks is only £500. In 1861 the results of the fishery were equally satisfactory, but in 1862 the banks were found to be in a most unpromising state, and no fishery was attempted. Out of 72 banks that were examined only four contained oysters free from *soorum*, 11 had young oysters mixed with *soorum*, and 57 were blank. This unexpected failure of properly grown shells gave rise to Captain Phipps' experimental culture now in course of trial, and to a careful consideration of the conditions most likely to secure a good annual fishery, which shall not be liable to this periodical sterility.

11. The pearl banks are about nine miles from the shore, and six or seven fathoms from the surface. They are exposed to ocean currents which, by washing sand into the interstices of the rocks, often destroy the young oysters over a considerable area. The dead fish, when not removed, soon contaminate their neighbours, and in addition to these sources of evil the *soorum* shells exercise a pernicious influence either by dying and spreading death around them, or by accumulating sand. It is obviously quite impossible to watch these banks efficiently, and to eradicate the evils caused by sand accumulations and dead molluscs, owing to their great depth and exposed situation in the open sea, at a distance from land. Unless some plan is adopted for rearing the young fish on banks which are constantly accessible and free from the above drawbacks, the fishery will always be liable to failures, sometimes of long duration. The perfection to which science and intelligent care have brought the fisheries of edible oysters on the English and French coasts, leaves no doubt that equally satisfactory results might be attained from similar measures on the Tinnevelly pearl banks.

12. A few remarks on the habits of the pearl oyster will make this part of the subject more clear.†

It is perhaps unnecessary to observe that the pearl oyster *(Meleagrina margaritifera : Lam:)* is not in reality an oyster at all, but is more allied to a mussel, having, like the latter animal, a *byssus* or cable by which it secures itself to the rocks, one of the most important points in its organization. The animal's foot is composed of muscular fibres, and is 2½ inches long when distended. On the lower side there is a groove lined with a secreting membrane, which is an exact mould for the formation of the *byssus*. When the animal desires to attach itself to a rock, its foot is protruded and, after seeking out a suitable spot with the tip for some minutes, is again retracted into the shell. A strong fibre of the form of the groove in the foot is thus left attached to the base of the foot at one end, and to the rock at the other. The process is again and again repeated until a strong cable is formed ; and it was one of the most important results of the inves-

* In Ceylon the pearls are sized into ten sizes by being passed through ten sieves, and are then classed as follows : —

1. Anie, perfect sphericity and lustre.	6. Peesal, misshapen.
2. Anatharie, failing in one of the above points.	7. Oadwœ, beauty.
3. Masengoe, failing slightly in both points.	8. Mandangoe, bent or folded.
4. Kalippo, failing still more.	9. Kural, very small and misshapen.
5. Korowel, double.	10. Thool, seed.

The boats contain twenty-three persons and five diving stones of 14lbs. a weight. One *Tindal* or steersman, one Saman, *Oattee* who has charge of the boat, one *Thody* who bales out water, ten divers (two for each stone), and ten *Munducks* or divers' attendants. The remuneration of the boat's crew is a quarter of the daily yield. The divers work for six hours consecutively, being under water for sixty to seventy, and even ninety-five seconds. They bring up forty to fifty shells at each dive.—Mr. Vane's Report.

† From Dr. Kelaart's Reports.

tigations of Dr. Kelaart in Ceylon, that the power of the animal to cast of its *byssus* at pleasure was ascertained. It leaves its cable behind, to throw off another in a more convenient place, like a ship slipping her cable and going to sea. From this ability to shift its berth, it follows that the pearl oyster might safely be taken from its native beds, and made to colonize other parts of the sea; and also that it would move of its own accord, when the surrounding water becomes impure or sandy, or when there is an influx of fresh water. The animal can re-form its *byssus* at pleasure, if in good health and condition

13. The formation of pearls is another point which has received attention, but which has not yet been settled. It will form a leading subject of investigation in the course of the experiment at Tuticorin. Pliny and Dioscorides believed that pearls were productions of dew, but that observant old Elizabethean navigator, Sir Richard Hawkins, shrewdly remarks that "this must be some old "philosopher's conceit, for it cannot be made probable how the dew should come into the oyster." Modern research has suggested various causes for the intrusion of the nucleus round which the pearl is formed. The free border of mantle, lining each valve of the shell, dips downwards to meet a similar edge on the opposite side, thus forming a double fringed veil. The tentacles of this fringe consist of long and short flat filaments, which are exceedingly sensitive, so that the approach even of a foreign substance makes them draw forward, and shut out the intruder. They doubtless prevent the pearls from dropping out of the shell, and preserve the fish from the host of carnivorous creatures which infest its place of abode ; and if it be true that particles of sand form the nuclei of pearls, they must run the gauntlet of these ever watchful sentinels, before they can intrude themselves amongst the interstices of the mantle. The food of pearl oysters consists of foraminifera, minute algœ, and diotomaceœ ; and Dr. Kelaart has suggested that the siliceous internal skeletons of these microscopic diotoms may possibly permeate the coats of the mantle, and become nuclei of pearls. This I believe to be the correct theory. Lastly, the *ova* which escape through the distended coat of an overgrown *ovarium* may become imbeded in the interstices of the mantle, and form nuclei of pearls, especially as pearls are more usually found imbedded in the mantle near the hinge, where the ovarium is most liable to rupture. Large pearls often work their way out of the mantle and lie loose between it and the shell, or become attached to the surface of the latter. They have even been found outside the shell altogether, entangled amongst the shands of the *byssus*.

14. It is very important that the habits of the pearl fish should be systematically watched, in order to ascertain the duration of its life, the time of spawning, and the true cause of pearl formation. With a view to these investigations, Captain Phipps will be supplied with six aquaria of the most approved construction, fitted with dark chambers, and provided with a cistern and ebonite barrel force pump, to ensure a constant current of water. A microscope, arranged for the observation of aquatic objects, will also be furnished, that the food of the pearl fish, and the phenomena connected with the formation of spat may be carefully observed. If Dr. Kelaart's theory is correct, it is quite possible that very important results may be obtained from a careful observation of the food of the pearl fish. The kind of diotomaceœ which supply food for the fish producing the best pearls in greatest abundance should be ascertained, and the circumstances which tend to their production such as the nature of rocks, algœ, &c. A series of well registered facts of this kind, obtained from the pearl fisheries at Tuticorin, Ceylon, Bahrein, Panama, and Venezuela might possibly lead to discoveries, which would add sensibly to our power of producing costly pearls. I have already taken some steps to obtain a comparison of the microscopic food of pearl fish, at the fisheries in the different parts of the world.

15. It remains to describe the plan by which it is hoped that, in future, the Tinnevelly pearl banks will be supplied with a sufficient number of well grown shells to furnish a remunerative annual fishery. The idea was suggested by the method adopted with regard to edible oysters on the English and French Coasts. The chief external difference between the pearl and edible oysters is that the former secures itself to rocks and stones by means of *byssus*, while the latter merely lies flat on the ground on its convex side ; but there is no reason why the pearl oyster should not thrive on artificial banks, as well as the edible oyster.

16. In the Colne oyster fishery the *brood* (oysters two years old) are dredged up, out at sea, and placed on *layings* within the river Colne. These *layings* are generally dry at low water, and they are paved with stones, old shells, and any other hard substance, to a depth of a few inches, so as to form a bed for the oysters, which would otherwise be choked in the soft mud. This material is called *culch*. In France, M. Coste has adopted a system of placing fascines on the *layings*, instead of *culch*, as resting places for the oysters The *culch* must be kept perfectly clean and clear of mud, and every mussel shell is weeded out. The mussels are said to have a tendency to collect mud in heaps, probably owing to their elongated shape. and if they are allowed to remain on the *layings* there is danger of the oysters being choked with mud. The oysters remain on the *layings* for two years, when they are fit for eating; and during this time there are constant examinations in order that all dead fish and mussels may be removed and the *culch* kept clear of mud. In places where the *layings* are never laid bare by the tide, this is done by means of a dredge, all live fish and *culch* being carefully thrown back, while dead fish, soft mud, and mussels are removed.*

17. Some such system should be adopted in rearing pearl oysters, and Dr. Kelaart has said that he "sees no reason why pearl oysters should not live and breed in artificial beds like the "edible oysters, and yield a large revenue." He ascertained, by numerous experiments in Ceylon, that the pearl oysters are more tenacious of life than any other bivalve with which he was acquainted; and that they can live in brackish water, and in places so shallow that they must be exposed, for two or three hours daily, to the sun, and other atmospheric influences. Captain Phipps, the Superintendent of the Tinnevelly Pearl Banks, has come to the same conclusions, and, convinced that artificial nurseries for the young oysters are the only means by which remunerative fisheries can be ensured, he has proposed the following plan, which has been adopted.

18. The harbour of Tuticorin is formed by two long islands, and between them and the main land there is a bank about 1¼ miles long by half a mile broad, with a depth of from three to seven feet, entirely free from surf, currents, and influxes of fresh water. Captain Phipps proposes that this bank should be walled round with loose coral, until it is formed into a basin, the edges rising three feet above low water mark.

19. The basin will be divided into three parts or beds, one for the old oysters, the other two for the young ones that may be in process of rearing. A place of forty feet square, of hard stone rock, will be laid down in the centre of the first bed, and a similar space covered with coral Captain Phipps proposes thus to observe which material is the most suitable for pearl oysters to thrive on. A stock of oysters, about three years old, will be placed on the first bed. When the act of spawning takes place, which will be ascertained by careful watching, bundles of twigs, coir, matting, tiles, and poles with cross pieces will be placed in the water as *culch* to catch the *spat*. These will then be taken up, and the young oysters removed to the other beds. The second and third beds for the young oysters will be fitted with a platform about two feet from the bottom, with a grating on which tiles and slates will be placed. Here the young oysters will be laid; and hence they will be removed to the deep sea banks. The same plan will be followed on each succeeding year. On reaching a sufficient age they will be taken to the pearl banks in a Steamer. The last operation is necessary, because it would be impossible to enclose an artificial space which would hold as many grown oysters as are required for a remunerative fishery, and because it is believed that the quality of the pearl depends on the depth and clearness of the sea in which it has been formed.

20. A single pearl oyster, five or six years old, often contains no less than 12,000,000 eggs, and in the fishery of 1861 the total number of shells taken only amounted to 15,847,500 so that the number of young fish annually obtained from the nursery will be abundantly sufficient to stock banks for each year's fishery. Care will of course be taken that only such banks are selected for stocking, as have the rocks which compose them raised well clear of the surrounding sand.

* See my Report on the Colne Oyster Fishery, dated April 21st, 1863.

21. By this system, adapted as it is from those of the English and French edible oyster fisheries, several advantages will be secured, and all the dangers to which the pearl oysters are now exposed, will be avoided. The young growing molluscs, safe on their carefully watched *laying* at Tuticorin, will be secured from the choking sands of their natural banks, as well as from their alleged destroyer the *soorum*, the effects of which are probably the same as those caused by the mussel on the edible oyster layings in the Colne. It is during the period of their early growth that the pearl oysters are so exposed to these dangers. Banks have very frequently been found well stocked with young oysters, and giving promise of a lucrative fishery, at a preliminary examination, which, when the time for the fishery arrived, have been bare: all the inhabitants having died, and been washed away. But, if the fish are preserved during the first few years in the artificial nurseries, and are only placed out when they have reached maturity, the oysters can then form their pearls in comparative security until the season for the fishery arrives, and well stocked pearl banks may be reckoned upon for each year.

22. It is hoped that, by adopting these carefully considered plans, and improving upon them as experience may dictate, from year to year, a regular and unfailing source of revenue will be secured to the State; and the Tinnevelly Pearl Banks will thus regain the immemorial renown which was conceded to them alike in the days of Ptolemy and of Marco Polo. They form the most ancient fishery in the world, and now that science and careful supervision have been brought to bear, they will no longer be the least remunerative.

No. 6. ORDER THEREON, 3rd January 1866, No. 3.

Miscellaneous. Communicated to the Board of Revenue.

(True Extract.)

(Signed) J. GROSE,

Acting Under Secretary to Government.

To the Board of Revenue.
,, the Public Works Department.

Krd. T. O'Connor.

Pro: 11th November 65

No 146-147

12-2-92

11-10 10

Per = 1865 Dispatch

Pro: of Govt. for Jany 66.

No 35 & 7.

From C. Markham

Esqre.

Dated 26th. Nov.

Received 11th Decem.

1865.

E.

E-1.

Reporting his arrival at Tutticorin, delivery to Capt.n Phipps of the plan and instructions for arranging the aquaria & the microscope &c. to enable him to conduct the contemplated investigations, and his examination of the banks of Tuticorin - Enclosing for general sketch of the history of the Tinnevelly Pearl Banks. E. 3.

Copied & Ltr. Dispt.

& Repd

J. P. L.

3d Jan 1866

No 586.

15 Dec/65 Rly

14 Govt Boards Reports &c
21 & Rec'd Dispatches
C. & Financial &c Commce &c