HORNELL

MADRAS FISHERIES DEPARTMENT

REPORT ON THE INSPECTION OF PEARL BANKS IN THE GULF OF MANNAR AND PALK BAY IN MARCH AND APRIL 1923

BY

JAMES HORNELL, F.L.S., F.R.A.I.,

Director of Fisheries.

Report No. 6 of 1923

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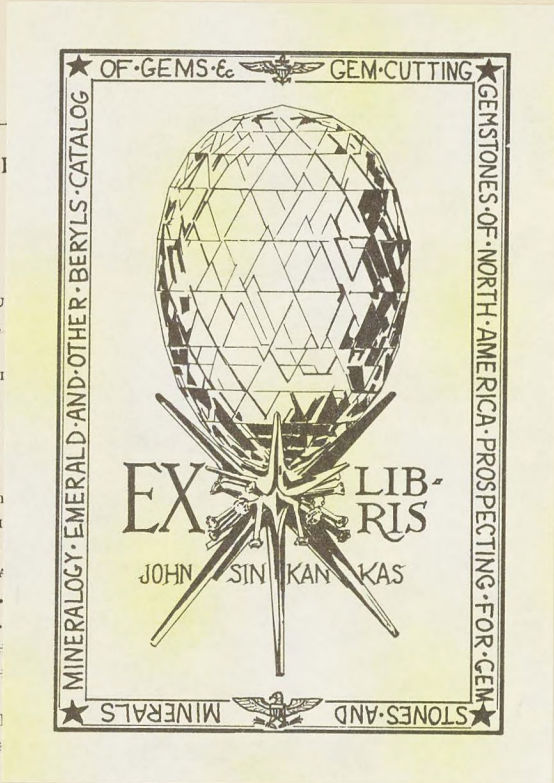

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For various reasons, until this year, no regular inspection of the pearl banks within the jurisdiction of the Madras Government has been made since I vacated the position of Marine Biologist at the end of 1918. It had however been the intention of the late Mr. Allan, Assistant Director (Marine), to carry out a regular inspection this year, as the inspection vessel the *Lady Nicholson*, having been re-engined in 1922, was again available for this duty. The accidental death of Mr. Allan last September upset this plan; it was then arranged that as I was the only officer in the department capable of carrying out an exhaustive inspection, I should undertake the necessary operations and at the same time initiate Rao Sahib J. A. Fernandez, the newly-appointed Superintendent of Pearl and Chank Fisheries, into the routine of the work.

2. Unfortunately owing to considerable damage received through grounding at Minicoy when on inspection duty for the Revenue Department, the *Lady Nicholson* was not available for pearl bank inspection till much later than the date on which operations should have begun. This added very considerably to the difficulties, as the best weather for inspection was lost, thereby curtailing the available period and preventing the inspection of the banks between Vaippar and Pamban. As these have not given a fishery within the past hundred years, the omission is probably of no consequence, and can be remedied another season.

3. Pending the completion of repairs to the *Lady Nicholson*, the Tuticorin Port launch *Minto* was requisitioned for the inspection of the northern beds off Tuticorin, on the 8th and 10th March;

compass bearings, however, cannot be accurately fixed from this launch, hence the attempt to inspect with her aid had to be abandoned. The regular inspection was therefore delayed till 26th March, when I was at last able to put to sea with a complement of divers aboard the *Lady Nicholson*.

From that date onwards, the inspection proceeded normally with occasional intermissions due to weather conditions and the need to replenish stores, etc., till April 25, when bad weather compelled work finally to cease.

During this period the whole of the pearl oyster grounds from Vaippar in the north to Manappad in the south was carefully inspected, as also the banks in Palk Bay, off Rameswaram and Tondi.

4. It is unnecessary here to go into any amount of biological detail; such is duly recorded in the diary of the inspection lodged at the Tuticorin office.

5. Young pearl oysters were found in great abundance upon the majority of the banks lying off Tuticorin and also on those between Tiruchendur and Manappad (for list see annexure 1). Curiously enough no pearl oysters were found on the banks off Pinnakayal (see annexure 2); similarly no oysters were found on the Devi Par and the banks northward (off Vaippar). Oysters were found on 28 banks out of a total of 54 banks inspected.

6. Many of these banks are small in area and closely associated with others adjacent having the same faunistic and physical characteristics. For this reason, it is convenient to arrange them in groups as I recommended in my report to Government in 1905 (*vide Fisheries Bulletin*, No. XVI). Adopting this system and proceeding from north to south, the main facts observed may be summarized briefly as follows:—

Series VII—Inner Vaippar Group.—Only on the two most southerly banks, Padutta Marikan and Padutta Marikan Thundu Pars, were oysters found. On the Devi Par, however, great quantities of very tiny spat covered the large fucoid seaweeds abundant there. The size was too young to permit one to be certain whether they were the spat of pearl oysters or of other shell-fish closely akin. If the former, whether they settle down and become established, cannot be ascertained till next year.

Series VIII—Cruxian Group.—All the pars were thickly populated.

Series IX—Utti Group.—All banks except the small and unimportant Uduruvi Par were full of oysters. In this group should be included another par, the Petha Par, lying south of the Nagara Par and east of the Utti Par. It has not hitherto been marked on the pearl bank chart in use and should now be inserted as it appears an even better bank for rearing oysters than the Utti Par itself.

Series X—Pasi Par Group ; XI—Tholayiram Par Group ; XII—Pulipundu Group.—Oysters very abundant except towards the northern end of the Tholayiram Par, where the bottom being largely sandy is less favourable than the southern portion for the settlement of oysters.

Series XIII—Kanna Tivu Group.—The component banks lie inshore and being very muddy are unsuited to the growth of pearl oysters. None was found upon them.

Series XIV—Nenjurichan Group.—All the pars in this group were crowded with oysters, often even on sandy areas where there is occasional cultch in the form of Nullipore balls and dead shells. Those on such areas were much larger and finer than those on predominantly rocky areas, being less densely settled.

Series XV, XVI, XVII—Inner and Outer Kudamuttu Groups, and Kadeiyan Group.—Every one of the 14 banks or pars making up these three groups, was bare of oysters. These banks lie off the mouth of the Tambraparni river, emptying into the sea at Pinnakayal, and it may possibly have been that a rush of fresh water from this river coincided with the time when the adjacent sea was full of free-swimming oyster larvæ and that this influence was fatal to their survival and settlement upon these banks now found devoid of oysters.

Series XVIII—Karuwal Group.—Only on the two most southerly pars of this group were oysters found—the Karai and the Velangu Karuwal Pars. Where they occurred the oysters were in great abundance.

Series XIX, XX and XXI—Odakarai, Chodi and Thundu Groups.—All these are more inshore than the Karuwal Pars; the Chodi and Thundu Pars are also subject to great turbidity of water in rough weather. No oysters were found on any of them.

Series XXII—Manappad Group.—Except on the two most southerly banks, the Semman Path Par and Manappad Par, the hard bottom in this group is thickly populated with oysters. A few

stragglers were found on the north side of the Semman Path Par, and these appear to mark the southern boundary of the area upon which pearl oyster spat has settled.

Series XXIII—Manappad Periya Par.—This most extensive so-called par was given most careful attention as it has been very seldom inspected in the past. I found it really unworthy of being denominated a *par*, for this signifies among the fishermen of this coast, a hard bottom, predominately rocky or stony, whereas I found very little bottom of this nature; by far the greater part of the area is simply a sandy shoal, quite unfit to bring pearl oysters to maturity.

The groups comprised in Series I to VI inclusive, could not be inspected for lack of time. This was of the less importance as none of these banks, which extend from the neighbourhood of Vaippar, eastwards to Pamban, have borne oysters since the pearl fishery of this coast came under British control.

7. The occurrence of young pearl oysters on the banks off Tuticorin was first signalized in November 1922, when our chank divers brought in numbers of chanks bearing clusters of young pearl oysters attached to their shells. This is usually the first intimation we receive of a local spat-fall. The presence of immense quantities on a number of the Tuticorin pars was further certified by examination of the ground on these banks by divers taken out specially by the Superintendent. From samples received, I estimated the age to be from 3 to 4 months, which would make the spawning period fall either in July or August, when we have reason to believe conditions are favourable to the emission of the reproductive products. In March and April the most vigorous of the oysters had advanced from sizes ranging between ·6 to ·75 inch in November to an average of 1·62×1·59 inches (as on the south-west of Theradi Piditta Par). A great number of those on rocky ground were much overcrowded and these were particularly stunted and showed very little growth; indeed so little that one was tempted to believe that they belonged to a different spat-fall and were possibly 4 months younger than their neighbours. Such oysters in a typical sample (rocky ground of Theradi Piditta Par) averaged no more than ·81 inch in depth by ·77 inch in length. The thickness was in similar ratio. Some of the chanks brought up by the divers afforded striking instances of how overcrowded young pearl oysters often are. I have counted as many as 60

young oysters upon the back of a single chank shell, the area occupied as foothold being not more than 2½ inches by 2 inches or 12 oysters per square inch. A good many of the oysters were, however, attached to the shells of other oysters, so that only about half the number were adhering to the chank. After full consideration and the experience of finding the extremes of size always segregated in separate deposits with intermediate sizes also separate, I cannot come to any other conclusion than that in April, the age of the great bulk of the oysters whether large or small, was from 8 to 9 months. The differences in size must then be due to differences in the food-supply, ample and adequate when the oysters occur sparsely scattered as on the margins of the banks and on sandy bottom where there is occasional cultch, scant and altogether insufficient for rapid growth when overcrowded as they are on predominantly rocky areas. Similar great variations in the size of individuals of the same age have been noticed on European mussel beds, caused by differences in nutrition produced by variations in the density of population.

For future comparison it may be noted that 100 well-grown live oysters from the Vantivu Arupagam Par obtained on 10th March weighed $14^{1}/_{5}$ oz. (presumable age 7 to 8 months).

8. Oysters growing on rocky bottom besides varying in size, frequently differed greatly in colour and appearance from those on mixed bottom (sand and rock). The former were characteristically darker in colour, both because the colouring of the shell itself is darker and because there was often an adherent growth of lowly red algæ sometimes forming a thin felting. Those from a mixed and more or less sandy bottom or from the edges of a par, besides being usually of remarkably large size, were pale in colour with little or no algal growth adherent.

9. Corroboration was found of the conclusion I came to some years ago, that the pearl oyster can breed at the end of the first year of life, or even possibly somewhat earlier. Everywhere that we found the oysters well grown and healthy, the gonads contained ova and milt apparently fully ripe—the ova well formed and the spermatozoa having already the usual characteristic form.

10. Where overcrowding was great, a considerable mortality had taken place judging from the large number of dead valves present. Small boring gastropods were also very abundant in many places and these were exacting a heavy toll, by boring through the young

oyster's shell and sucking out its flesh. But in view of the serious overcrowding general on the banks this is to be welcomed as helping to thin out the oysters and thereby giving the remainder a better chance to obtain a sufficiency of the microscopic organisms (plankton) floating about in the sea around. As soon as the oysters grow a little larger, these small gastropods will cease to cause much havoc; even now they prefer to feed upon the little web-spinning mussel known locally as *surān*. This little shellfish is also a competitor for the same kind of food as that required by the pearl oyster; this and the smothering nature of the felting which it weaves over the sea bottom cause it to be reckoned quite a considerable menace to pearl oyster beds when it is particularly abundant. Fortunately it is comparatively scarce this year, seldom forming continuous sheets over the sea-bottom such as I have frequently seen in previous years.

11. *Prospects of a pearl fishery.*—The pearl oysters on the Indian side of the Gulf of Mannar grow less quickly than those on the most valuable and extensive of the Ceylon beds—the Cheval Par—which come to fishable maturity in 3½ to 3¾ years. But no hard and fast rule can be formulated further than saying that given the most favourable conditions—an absence of overcrowding and consequent abundance of food—pearl oysters may be fished a few months before attaining 4 years of age, but that where overcrowding is present, the resultant slackening of growth may postpone the fishery one year and even two years in extreme cases. For example the 189,984 oysters fished in 1889 from the Tholayiram Par were 5¾ years old. After this age they begin to die off rapidly and very few survive into another year.

12. The spat-fall that occurred in July or August of last year was phenomenally abundant and widespread. I know nothing comparable with it in the whole of my experience, save that which resulted in Ceylon in the fisheries of 1903 and 1904. The banks occupied by oysters in April 1923 covered an aggregate length of 20 miles, 12 miles being off Tuticorin and the other 8 off Trichendur. It is quite probable that some of these beds may mature earlier than others and that a fishery may be possible on some of them in March 1926 when they will be 3¾ years old. It is, however, likely that the main fishery will take place in 1927 at the age of 4¾ years. The prospects just now look more promising than I have ever known them within my personal acquaintance

with this locality, which dates from the inspection of 1904. Further, so far as I can ascertain from past records, no equally rich and widespread fall of spat was ever met with during the whole of the nineteenth century.

13. The favourable factors comprise (*a*) an unusally extensive area occupied by enormous quantities of young pearl oysters, (*b*) the scarcity of competing organisms, notably of *surān*, (*c*) lack of any evidence of extensive depredations by oyster-eating fish, and (*d*) the attainment of a size and thickness of shell which automatically reduces the number of potential fish enemies. Mischances may yet occur to prevent these oysters yielding a fishery in 1926 or 1927, but the omens have never been, nor could they be, better.

14. *Precautions if any to take to conserve the deposits.*—The pars on which the bulk of the oysters are settled are areas of hard bottom more or less interspersed with sandy patches. These are largely resorted to by the local line-fishermen. The hard bottom, consisting mainly of slab-shaped pieces of calcrete and the remains of dead corals, gives foothold to a host of sedentary organisms, sea-weeds, sponges, hydroids, corals, sea-fans, polyzoa, and tube-forming worms. Fishes find rich pasturage thereon, and after them come the fishermen with hook and line. Formerly it was supposed that fishing disturbed the oysters and thereby caused them to migrate. The fact that pearl oysters cannot migrate has since been proved, so this objection to the presence of fishermen on the banks falls to the ground. But it will be necessary to impose some safeguards when the oysters come to a pearl-producing age, say when 2½ to 3 years old, and there is theoretical objection to the use of stone-anchors, such as are commonly used by the fishermen to anchor their canoes. In my 1905 Report on the pearl banks, I suggested that these stones should be interdicted and iron grapnels substituted, in order that oysters should not be crushed and destroyed when the stones are dropped on the bottom. In view of the overcrowded condition of the oysters wherever they occur on hard bottom, I consider that no restriction need be enforced. Indeed it will be an advantage if a certain number of oysters be destroyed by these stones, as it will do something, though not very much, towards a useful thinning out.

15. It has also been suggested that when pearl oysters are overcrowded, measures should be taken to reduce their numbers, by dredging, trawling and other means. I have myself advocated such operations. With riper experience I have come to the conclusion that the heavy expenditure that these means necessitate, are not justifiable from a financial standpoint. "The game is not worth the candle," in view of the uncertainty of reaping any results. There would also be much practical difficulty in carrying out the operations in a way that would not cause as much or more damage than any benefit to accrue. And as I have pointed out the beds extend to an aggregate length of 20 miles. Were we able to count on regular annual fisheries as in the case of the Persian Gulf fisheries, the position would be entirely altered. But so long as our local pearl oyster can never be counted on with reasonable certainty to live to fishable age or until fishing actually begins, the risk is too great to warrant heavy expenditure upon thinning out and transplanting. In short the sum total of my 21 years' intimate experience of the bionomics of the local pearl oyster is that cultural operations on the banks are so uncertain in their results and entail such heavy expenditure in the upkeep of expensive steam-vessels and the employment of a highly salaried staff that it pays better to restrict attention to inspection and to let Nature have a free hand. Even inspection need not be annual during a series of blank years. As an oyster takes a minimum of 3¾ years to come to fishable age, I consider that no inspection is necessary for two years after any year in which the banks are found bare of oysters. Even if an oyster spat-fall took place three months after a barren inspection, and no inspection were made till the third year following, the oysters on the banks would then be only 2¾ years old at the utmost, one year at least and normally two years before reaching fishable age. This would give ample time to prepare for a fishery and save all expenditure on inspection for two whole years out of each series of three. In actual practice if oysters did appear during the two years when no inspection takes place, the chances amount almost to certainty that the fact would be discovered at an early date, as the Government chank divers fish in the vicinity of many of the most productive pearl banks, and when a spat-fall takes place on any of these, numbers settle on the shells of the chanks living in the neighbourhood. It was in this way indeed that we received the first

intimation (in November 1922) of the recent reappearance of pearl oysters on the Tuticorin Banks. The line fishermen constitute a second important source of information, for if oysters appear in quantity on the pars, these men's fishing lines and hooks frequently entangle some of the young oysters and bring them to the surface when hauled in. The news quickly becomes common property and so reaches the ears of our staff at Tuticorin and elsewhere.

PALK BAY PEARL BANKS.

16. These beds were first discovered and charted in the spring of 1914 by myself ; those off Tondi and Karankadu yielded a small fishery in the autumn of the same year.

The Tondi beds.—The present year's inspection shows an entire absence of oysters from the potential pearl oyster area, here limited to the sea-bottom lying between the 5½ and 6 fathom lines. Not only were pearl oysters absent; every other organism that was associated with them in 1914 was equally awanting, e.g., the Twisted Ark-shell (*Arca* [*Parallelopipedum*] *tortuosa*), the Hairy Ark-shell (*Barbatia barbata*) and the Window-pane Oyster (*Placuna placenta*). Living as well as dead valves of all these shells formed the principal foot-hold for the oysters found in this locality in 1914. It would seem that the cause which has brought about their disappearance has entailed the absence of pearl oysters, by removing the only solid bodies formerly scattered over the otherwise barren stretches of sandy mud whereon pearl oysters were in the habit of settling. The local fishermen recognize that considerable changes have occurred of recent years on the sea-bottom in Palk Bay ; they assert and I am inclined to believe they are correct, that the cause lies in the excessive and wholly abnormal rainfall of the past three years in this region. It well may be that the lessened salinity caused by abnormal river floods together with the immense volumes of fine silt carried into the sea at the same time, have been factors so inimical to sedentary life on the adjacent sea-bottom that great numbers died off; even the dead shells would disappear after a time, being easily rolled by the strong currents often noted here, either into shallow water or into the depth beyond the 6 fathom line, where they would be engulfed in soft oozy mud.

17. It was also noted during the inspection that the general fauna of the sea-bottom off Tondi and Karankadu was strikingly

impoverished compared with the richness and variety which characterized it in 1914.

These unfavourable conditions have in turn reacted strongly upon ordinary net fishing; the catches of fish for three years past have been unusually unprofitable and as a result many fishermen were glad to enlist for chank fishing, finding it more profitable. The catches of chanks for the past three seasons have been in consequence abnormally heavy, rising from an annual average of about 15,000 to 35,641 in 1920-21, 37,542 in 1921-22 and about 27,000 in the present season.

Several years will have to elapse before normal conditions again prevail. Much will depend upon when the next dry cycle commences, excessive river floods being detrimental to the establishment of conditions favourable to oyster spat-fall and growth.

18. *Rameswaram Pearl Banks.*—These beds lie in slightly shallower water than those off Tondi, the depth being consistently 5 fathoms. Three different patches were inspected, viz., one to the eastward of the Velangu Par and two to the south respectively of Nadu and Tandi Kambi Pars. On all these areas large numbers of the empty valves of large and well-grown pearl oysters were found. By all appearances they could not have been dead longer than a few months—within the past six months probably—as the hinge ligament was still intact and elastic, and few growths were present upon the inside of the valves. It seems certain that they died about the end of last year. Not a single living individual was found. Their numbers must have been considerable for everywhere we inspected the divers brought up 3 to 4 shells. Had they been living oysters, the men would have been more energetic and the numbers per dive would have doubled and trebled. Their size was remarkably uniform, ranging between 3⅛ and 3¼ inches in depth (from hinge to ventral edge) and between 2⅝ to 2¾ inches in length. All were of very free and vigorous growth. From various indications, I should estimate their age at about 4 years at the time of their death. With them were associated large numbers of the Hairy Ark-shell (*Barbatia barbata*) all likewise dead but with the hinges still intact. Upon many of these Ark-shells as well as on many of the pearl-oysters, were seated clusters of tall and slender barnacles (*Balanus* sp.), also all dead.

19. I consider it probable that the whole of these organisms died at the same time and from the same cause. What that was

can only be surmised, but when we note that wholly abnormal rains and river floods occurred in the Madura and Ramnad districts at the end of November 1922, involving the bursting of many irrigation tanks and the breaching of the railway line in numerous places, there appears reason to believe that in this we have the factor which involved ultimately universal death to the three most conspicuous organisms inhabiting the Rameswaram Pearl Banks.

20. It is probable that these beds will be repopulated with pearl oysters during the next south-west monsoon, by spat either from the Tinnevelly or the Ceylon beds. During that period strong currents set northward through Pamban Pass and the channels in Adam's Bridge and these will transport multitudes of the swimming larvæ spawned during July and August from some at least of the myriads of sexually mature oysters on the beds on both sides of the Gulf of Mannar. These larvæ remain free-swimming for a week or thereabouts, and so are ready to settle down on the bottom by the time they enter Palk Bay and meet eddies and counter-currents that obstruct the impetuous flow of the incoming current from the south.

These Rameswaram beds should be inspected annually at the time the adjacent chank fishery is in progress. It can then be carried on practically without incurring extra expense; the towing launch can be utilized for this purpose after taking the chank canoes to their fishing ground and the work done on the homeward journey in the course of three or four days. Although it is never likely that oysters here would be sufficiently abundant to warrant a regular fishery being conducted, still it may very well be that enough oysters of good pearl-bearing quality may mature on these beds to be worth fishing; in such case they should be fished departmentally, using the regular chank divers for the purpose, payment being made by results as in the case of the chank fishery.

SUMMARY OF RESULTS.

21. A very heavy pearl oyster spat-fall occurred in July or August of 1922 upon the majority of the banks or *pars* off the Tinnevelly coast. Twenty-eight banks out of the 54 inspected were found thickly populated with pearl oysters. Except for a break of 9 miles off the mouth of the Tambraparni River, these oyster-stocked pars extend continuously parallel with the coast from a point 9

miles north-east of Tuticorin to one midway between Tiruchendur and Manappad—a total distance of 29 miles. The northern assemblage of oyster-covered ground lying off Tuticorin, measures fully 12 miles in length; the second, off Tiruchendur, is about 8 miles long. The breadth varies, but is greatest immediately east of Tuticorin.

22. The oysters were from 8 to 9 months old in April 1923. In size they vary greatly according to their relative abundance; on most places where the ground is rocky, overcrowding and slow growth are noticeable. Where sandy patches are frequent growth has been much more rapid; in extreme cases such oysters may attain double the dimensions of those overcrowded on rocky ground.

23. The numbers are so extraordinarily great that ample margin is available to meet all ordinary adverse contingencies and still to furnish a sufficiency of full-grown pearl-bearing adults in 3 to 4 years' time to permit of a great pearl-fishery being held. 1926 is the earliest year a fishery is possible; 1927 is more likely as these oysters owing to their very abundance, will be slow in growth. But stunted oysters are accounted good pearl-producers. The present prospects for a series of remunerative fisheries from 1927 onwards are better than they have been for at least 60 years past. They could not be brighter so far as concerns the largeness of the area covered and the abundance of oysters thereon; the one anxiety is caused by their very superabundance, entailing as it does serious overcrowding.

24. All the beds in Palk Bay were found bare of living oysters. Off Rameswaram three beds of oysters (of small extent) appear to have been in existence last year; large numbers of dead shells, with the valves still connected by ligament, were found. These oysters, all of mature size, appear to have died within the six months preceding the inspection It is probable that the abnormal floods experienced towards the end of 1922 caused wide-spread devastation throughout the south-west portion of Palk Bay to many of the species of shell-fish that lived there.

RECOMMENDATIONS.

25. No detailed inspection with its corollary of heavy expenditure and the attendant disadvantage of diverting the Superintendent's attention from the supervision of the chank fishery

is necessary in the spring of 1924. It will suffice if the Superintendent verifies the continued presence in quantity of oysters on a few of the more important and extensive banks off Tuticorin and Tiruchendur, and notes their condition and the extent of their growth since the previous inspection. This can be accomplished in a few days with one of the launches, and the help of dredges and a few divers.

26. In April 1925, the surviving oysters will be 2¾ years old. As it may be possible that some of these will be sufficiently well grown by 1926 to justify a fishery, a detailed inspection to ascertain the exact area occupied by such oysters and their approximate numbers, will be requisite. For this purpose an inspection vessel will be necessary and no other vessel will satisfy requirements except the *Lady Nicholson*. Contrary therefore to my former recommendation made prior to the discovery of this great spat-fall on the Tinnevelly banks and the prospect now promising of a series of productive pearl fisheries in the course of the next few years, this vessel should be retained for the service of the Fisheries Department. During 1924, the department will not have need for her; the Revenue Department may therefore be informed that this vessel can be placed at their disposal for the Laccadive inspection or other purpose from now until 1st January 1925. But on this date she should be returned to the Fisheries Department without fail, for a detailed pearl bank inspection such as will be essential, will take three months to complete and should begin by the 1st February at the latest. In the present year the work of inspection was rendered most difficult and was less extensive than it should have been, because of the delay entailed by the damage received by the vessel when in the hands of the Revenue Department. After December 1924, the only months when the *Lady Nicholson* will be available for the Laccadive inspection will be November and December in each year, so long as detailed pearl bank inspection is necessary.

27. No restrictions need be placed upon line fishing on the pars prior to 1925, when some precautions may be necessary to prevent these fishermen from poaching on the banks. Without interfering to any appreciable extent with their legitimate occupation, it should not be difficult to define certain areas where fishing shall not take place. Fortunately the extent of the fishing grounds off Tuticorin and Pinnakayal is so extensive that the interdiction of

a few banks will not constitute any real hardship to these men. I do not recommend any restriction being placed on stone anchors used by the line fishermen at present.

28. I do not recommend either that cultural operations of any kind be attempted. They are extremely expensive and remunerative results are more than doubtful.

29. During the past inspection I took the opportunity afforded to initiate Rao Sahib J. A. Fernandez, the Superintendent of Pearl and Chank Fisheries, into all the details of inspection work. I have every confidence that he is now competent to carry out future inspection satisfactorily. Mr. Sebastian Pillai, the tindal of the *Lady Nicholson*, is an excellent and very conscientious navigator and should be retained in the permanent service of the department as he will be a most useful assistant to the Superintendent in fixing the ship's position on the banks during inspections. They both rendered loyal and faithful service during the recent inspection and deserve special commendation.

30. In conclusion, I am pleased to record that I found the inspection vessel *Lady Nicholson* greatly improved both in stability and in speed since the installation of the new motor engines supplied by the Gleniffer Motor Company. Under ordinary conditions the vessel is now quite comfortable to live in at sea. The speed of between 7 and 8 knots is ample for inspection requirements, while the engines since the engine-room staff have become familiar with their working, give no trouble whatever. The Government may be congratulated on having a very efficient and withal economical vessel at their disposal.

OOTACAMUND,
14*th June* 1923. JAMES HORNELL.

ANNEXURE I.

PEARL BANKS ON WHICH YOUNG OYSTERS WERE FOUND IN ABUNDANCE, MARCH AND APRIL 1923.

Series I, off Tuticorin.

Padutta Marikan Par.
Padutta Marikan Tundu Par.
Cruxian Par.
Cruxian Tundu Par.
Tuticorin Kuda Par.
Vantivu Arupagam Par.
Nagara Par.
Utti Par.
Petha Par.
Kilathi Par.
Attuvai Arupagam Par.
Pattarai Par.
Pasi Par.
Athombadu Par.
Tolayiram Par.
Kuthadiar Par.
Par Kundanjan Par.
Nenjurichan Par.
Melonbadu Par.
Vada Ombadu Par.
Saith Ombadu Par.
Puli Pundi Par.
Kanna Puli Pundi Par.

Series II, off Tiruchendur.

Karai Karuwal Par.
Velangu Karuwal Par.
Tiruchendur Puntoddam Par.
Sandamacoil Piditta Par.
Teradi Piditta Par, and several other small ones in the immediate vicinity of the last three, not marked on the chart.

In all, a total of 28 banks bearing pearl oysters.

ANNEXURE II.

PEARL BANKS FOUND BARREN.

Vaippar Periya Par	Off Tuticorin.
Devi Par	
Pernandu Par	
Uduruvi Par	
Kanna Tivu Arupagam Par	
Pinnakayal Seltan Par	Off Pinnakayal and Kayalpatnam.
Sundamaram Piditta Par	
Irai Tivu Kudamuttu Par	
Nadu Kudamuttu Par	
Kovil Pidditta Pattu Par	
Sankuraiya Pattu Par	
Nilan Kallu Par	
Sattu Kuraiya Pattu Par...	
Kudamuttu Par	
Rajavukku Sippi Soticha Par	
Saith Kudamuttu Par	
Naduvu Malai Piditta Par	
Periya Malai Piddita Par	
Kadeiyan Par	
Tundu Par	
Chodi Par	Inshore banks.
Odakarai Par	
Semman Patta Par (a few oysters here)...	Off Manappad.
Manappad Par	
Manappad Periya Par	

A total of 26 banks barren.

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3. THE PRESERVATION AND CURING OF FISH. BY SIR F. A. NICHOLSON, 1909. (Exhausted; revised edition under preparation.)

4. MADRAS FISHERY INVESTIGATIONS, 1908. BY JAMES HORNELL. (Out of print.)

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