

MADRAS RECORD OFFICE.

Government of Madras.

Marine DEPARTMENT.

G.O. No.	<i>48</i>	Press
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<i>9-10.</i> Dated	<i>12. 2.</i>	<i>18 59</i>

Not to be folded or roughly handled

Fort Saint George, Marine Consultation, 15th February 1859.

No. 9. From Lieutenant A. D. TAYLOR, Indian Navy, Commanding Her Majesty's Surveying Vessel "Bheema" to T. PYCROFT, [Esq., Chief Secretary to Government, Fort Saint George, dated Mangalore 24th January, No. 7 of 1859.

SIR,

I have the honor to forward a report upon Cochin Bar and Harbour, drawn up after my survey; it was my intention to have detained it until I could also send in a copy of the Chart, but having furnished the Cochin Chamber of Commerce with copies of both in accordance with your permission, I have been requested by that body to allow them to publish the Report.

2. Copy of their request is herewith sent; if Government will permit the Report to be published, it would perhaps be best that you should communicate such permission to the Chamber, as I shall for some weeks be moving about from place to place.

Enclosure No. 1.

A Report on the Bar of Cochin.

My survey shews the Cochin Bar to be a very narrow ridge of sand extending in a semicircle from the shoal water off Vypeen point to that off Cochin point. Literally speaking the whole of this semicircular sand is the Bar, but the Bar proper, or deepest part of this ridge, is an arc of a Circle, the Chord of which is 600 yards, and its versed Sine about 100 yards. Throughout the entire length of this arc there is on the shoalest part a depth of 13 feet at lowest water, but the ridge having this depth is broader in some places than in others; the fair Channel, as I shall call the narrow part, is about 100 yards wide, and its cross section is not more than ten yards; indeed it is in some places so very narrow that, sounding as slowly as I could over it from side to side, I frequently missed it, not finding less than 14 feet, (reduced to lowest water;) but on returning over the same line and lingering about the spot I just hit upon the 13 feet, and thus destroyed my hopes of having found a deeper Channel.

2. Before making any suggestions as to the possibility of improvement, I would offer a few remarks on the nature of the River Bars along this Coast.

1stly. As to their cause.

2ndly. Their liability to fluctuations in depth.

3rdly. The influence of the Ocean swell and currents upon them.

3. Their cause is the Ocean swell and the Ebb tide. The position of the Bar is determined by the relative strength of these two Agents; that is, the ridge of sand is formed in an arc where the Force of the Ebb water is counterbalanced by the Ocean swell, at that period of the year when both are in greatest force, that is during our rainy season. The fair Channel over the Bar is of course on the most projecting part of the semicircular deposit of sand, and opposite the line of deepest water from the River, on which line the Stream is the most rapid.

4. The set of the Ebb tide, and the direction from which the flood comes in are dependent upon the course of the great tidal Wave. This I have traced for the Indian Ocean, following Professor Whewell, taking many of his data, and adding later Observations of the Officers of the Indian Navy. I see by this that the great tidal Wave coming from the Southern Indian Ocean in its North West Course appears to divide itself against the Chain of the Maldivé Islands, and thence goes in two Branches; one onwards into the Arabian Gulf, the other slightly Eastward into the Bay of Bengal. The first when past the Maldivé Group seems to expand its crest as it were, opening out as a fan, and throwing back Eastward (for the onward Course of the Wave is of course Westward following the Moon and is only altered by the interposition of Islands and Continents) a derivative Wave whose broad head makes high water at nearly the same minute at places on the West Coast of India between the 15th and 17th parallel of Latitude; this locality becomes then a point of divergence, and places both North and South of it receive the Wave of

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high water later as they are more distant; Bombay at 11 o'clock coincident with Mangalore; Damaun at about 2h coincident with Cochin; Surat Roads at nearly 4h, or coincident with Cape Comerin or perhaps Colombo. A notable fact connected with the last named port is, that there the tide is known to ebb and flow sometimes 4 times a day. I explain this extraordinary fact thus; one high water is caused by the Wave which passing Eastward of the Maldives rolls into the Bay of Bengal; and 6 hours afterwards comes that Wave whose course we have just been tracing; thus there is no proper low water, for when the first mentioned tide has ebbed only 3 hours, the flood of the second tide begins to come in; thus is the small lift or rise and fall of tide accounted for, and it is my firm belief that the great irregularity of the tide at Cochin is also attributable to the same cause, though in a less degree, as here the two tides, that is the one from the North West and the one from the South, are more nearly though not completely coincident in their arrival at Cochin.

5. In proof of this theory of the tidal Wave we have the fact that at Bombay the flood comes in from South West; at Mangalore from West; amongst the Laccadives from West South West; and at Cochin from North West, and to point out this latter is the reason I have thus digressed, for the set of the Ebb tide is an important consideration in devising remedial measures for the bar.

6. Another and the primary cause of the irregularity in the Cochin tides must be the evaporation from and the precipitation upon that immense extent of backwater region, North, South, and East of Cochin; for it is reasonable to suppose that the water of the backwaters, so quiescent and shallow is it, must suffer more evaporation than does the Sea with its nearly equable temperature.

7. The Chart shews how tapering and gradually deepening is the sand point projecting West from the Cochin side of the river; but the sand on the North or Vypeen side has several breaches in it, forming so many Boat Channels with breakers on either side; these are caused by the Ebb tide which sneaks out to the North West, to which direction, as I have explained above, it has a natural tendency. Then again the flood running in from that quarter forms that point of the sandy shoal which requires to be marked by the black buoy, and on to which the Ebb has a strong tendency to set Vessels leaving with that tide. Trace on the Chart the deep water from the River to the Bar and note how on reaching that ridge of shoal water the stream of Ebb turns up to the North and nearly succeeds in forming a good passage into the River from that direction; this is the effect of the strong Monsoon Ebb opposed at the Bar by the Monsoon swell.

8. I have been thus particular in describing in this report (at the risk of its being thought prolix) all these peculiarities of the River entrance which make it to differ from most if not all other Bar Harbours, in order that I may be enabled to shew that what may be a remedy for one Port is not consequently good for another, whose position with respect to the concurrence of the Ocean swell and currents is dissimilar.

9. Now let us go to the 2nd and 3rd considerations the fluctuation in the depth of River Bars; and the effect of swell and currents upon them. We cannot expect otherwise than a variation in the depth when we take into consideration that the ebb (augmented by freshets from up River) is sometimes very strong when there is a heavy West swell; sometimes when the Sea is nearly calm; and again when there may be a North West or a South swell. At any such time there may or may not be a current running up or down the Coast. When the freshets run out of the River we may be sure there is a great quantity of earthy matter, sand or mud, held in suspension, and much of this must be deposited on the Bar where the strength of the Ebb is nullified by the heavy swell; thus is the Bar at such times piled up and made shoaler.

10. I have stated on the Chart that there is 13 feet at low water on the Bar, now the extreme rise and fall of tide is 3 feet, which would give 16 feet at highest tide, but the rise is generally not more than $1\frac{1}{2}$ foot so that $14\frac{1}{2}$ feet is the depth we may calculate upon as the average; but at high water there is frequently no wind, or the Ebb stream is too strong for a Vessel to get in; for here as elsewhere the stream of Ebb frequently runs for hours whilst the water is actually rising.

11. What is wanted is a steam Tug to tow Vessels in and out, and she may be used for the purpose of working a steam Rake or Dredge to deepen the Bar. If a Rake be worked over that Bar on strong Ebb tides I have not a doubt that the Channel may be deepened at least 2 feet; I

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say 2 only, because that will reduce it to the level of the shelf just inside of the shoalest ridge, which is about 40 or 50 yards broad, and has now 15 feet at low tide. Then we should have a Bar about 50 yards wide with $16\frac{1}{2}$ or 17 feet on it at ordinary high water, and 18 feet at the highest spring tides; thus enabling Vessels to be loaded inside to a draught of 15 or 16 feet. I feel myself to be underrating the probable result when I contemplate the above improvement, but it is better to be within bounds than to overrate the prospective advantages.

12. I have stated above that the tides are irregular, this is the case not only with respect to the streams of Ebb and Flood but to the rise and fall; for the flood stream sometimes lasts four hours, yet we find the perpendicular rise to be absolutely nothing. I would explain this by supposing that all the flood or incoming water had gone to compensate for some great amount of evaporation from the extensive surface of the back-waters whose embouchure is at Cochin. This deficiency in the rise is a source of great anxiety to the Master Attendant, for one should naturally expect a rise coincident with an ingoing stream of several hours' duration.

13. The only method of ascertaining what water is on the Bar is to have a standard of height marked on some unshifting perpendicular post; a *bench-mark* in fact to which the soundings on the Chart are reduced, such an one I have marked on a Pile of one of the jetties which has been pointed out to the Master Attendant; but from the perishable nature of the Pile, this mark is not likely to last many years; I would therefore suggest that a good Teak wood or Iron wood Pile with a screw at heel (easily obtainable from Dowlaishweram or Beypore) be screwed in alongside the Master Attendant's jetty as a future guide.

14. The Bench-mark or datum level of the soundings shewn on a Chart is an indispensable condition of accurate hydrography; but in a place like Cochin, where the sandy margin of the shore is liable to be cut away by strong tides aided by the wash of the Sea, a stout screw Pile of Teak or other such hard wood will be the only permanent Bench-mark we can adopt. I may perhaps be permitted to make a suggestion which though irrelevant to the subject of the Bar is not unimportant to the improvement of Cochin; it is, that the River face of the Town be properly reveted with Piling and stones, as it seems to be getting undermined by the current and a few years of delay may re-duplicate the required outlay.

15. A good Government Pier would also be a great improvement to Cochin, for doubtless this will be chosen as the Coaling Station on the Malabar Coast, and not Cannanore which, I hear, is in contemplation, but than which scarcely a worse could be chosen. If the steam Rake be adopted, I venture to predict that certainly most of the Steamers that are employed in trooping may come in and Coal alongside a Pier. The "Coromandel" may then easily enter, in fact all Wooden Steamers of less than 1,000 Tons, and Iron Steamers up to 1,500 Tons may avail themselves of this excellent Port.

16. The Pilot's leading mark over the Bar need not be implicitly followed in going in or out; 30 yards to the South of that and 70 yards to the North of it, the passage is equally good; and thus if the anchor boat were placed during the afternoon and shewed a light at night, a Ship could easily go out, for the night tides of this time of year are higher than those of the day. The night flood tide at this season is very strong and a Ship could easily be towed in them. The average high water depth on the Bar at night is 15 feet.

17. At the distance of 300 yards East by South from the North Buoy (as at present situated) is the tip of a shoal between which and the Bar, (as I have noticed in the latter part of para: 7,) the deep water turns up to the North. In entering or leaving Cochin River with an Ebb tide Ships frequently get set over to this bank which has a similar depth to the Bar itself; and this has given rise to the idea that there was an inner Bar, or a hummock of sand, at some distance within the outer ridge. Thus is it depicted on former Charts, and I need scarcely add it cost me many a moment of deep but unsuccessful thought in accounting for the peculiarity. I now believe that shoal point to be formed during the rainy season when at times the current sets strongly down the Coast, and meeting with opposition from the stream of Ebb, there is an eddy formed at that locality and for some hundreds of yards to the North-East, and sand hitherto held in suspension is deposited.

18. I cannot help thinking that a Dredge will be better than a Rake, for the sand that is got up from the Bar will be useful in Cochin where there is not a grain to spare for ballasting small

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Craft. But a Steam Dredge for Cochin needs careful supervision in the building; she must not be too bluff in the bows, as she will have to do also the work of a Tug; barges will be required for the sand, but these will also be useful as Cargo boats. If a Dredge be procured I recommend that the present South Buoy be moved 100 yards to the N. N. W. and moored with two anchors and a span, not as at present with a single anchor; and then it will become useful for mooring the Dredge and for pointing out the right position for her operations.

19. The subject of deepening the Bar, still more than can be done by a Dredge alone, may hereafter be taken into consideration, but a minute knowledge both of the set of the tides and of the prevailing Ocean currents, as also of the direction from which the heaviest swell of the South West Monsoon comes, will be indispensable to a right judgment; and I fear that to an absence of such knowledge may be attributed most Engineering failures in experiments on Bar Harbours.

20. It seems to be forgotten or perhaps it is not generally known that Backwater and Canal communication connects Cochin with Alipee, the most extraordinary and safe road-stead in these Seas. By direction of the Government, I have surveyed the latter place, and fully understand and appreciate its importance. Considered as part and parcel of Cochin a brief description of Alipee cannot be out of place here.

21. There is no bank outside and deep water within, as people have stated, but the whole road-stead has a remarkably soft muddy bottom; so soft it is that a pole with which I sounded penetrated 6 or 7 feet deeper than a 12 pound lead. Alipee is indeed similar to Coringa Bay in this respect, though superior to it on the whole: for Hurricanes and inundations, contingencies not uncommon at Coringa, are unknown at Alipee. In its approaches also the latter has the advantage of the former, for the navigation both to North and South is clear of all impediments of Rocks and sand banks.

22. What was written of Coringa seventy years ago is equally applicable to Alipee. Michel Topping in 1789 wrote of Coringa that its shallow Bar prevented large Vessels from entering the River, but he added "It is, however, with great pleasure, I inform the Honorable Court that, notwithstanding such hoped for admission is denied, the exclusion itself is a matter of little moment, being amply compensated for by the safety, commodiousness, and free access of the road of Coringa, a place of great convenience and security at every season of the year. It is true the road is open to the Sea from the North to the East points of the horizon; but besides that it is defended by its adjacent Shores from the effects of winds blowing from the remaining three-fourths of the Compass, it is rendered peculiarly favorable to shipping in distress by the mud-banks that are so situated within it as to receive without injury such Vessels as may, through any misfortune, be driven on shore. It is a common and well known practice with the natives of these parts, to run their shipping purposely on shore in this Bay, in order to secure them against the expected violence of the North East Monsoon, to which, it is true, they lie apparently exposed; but from which, it is equally true, they find themselves effectually secured. And this happens, not only because they are bedded in the soft mud, but because during such gales as blow directly on shore, there is actually very little Sea running, the fluidity of the water being diminished and its activity deadened by the accession of mud, that rises at such times from the loose bottom."

23. Alipee being on a straight sandy Coast is defended on the shore side against winds blowing from one half of the Compass only, yet the soft mud renders it perfectly safe anchorage, the fluidity of the water being diminished, and its activity deadened by the accession of mud that rises (when there is a heavy Sea outside) from the loose bottom; in fact there is at such times an impossibility to define where the mud ends and where the water begins; to such extent is it stirred up.

24. Vessels might be treated in the same way at Alipee, but there exists no occasion for grounding them; as a real gale of wind, such as visits Coringa periodically, bringing in its strain the storm wave, does not happen at Alipee; and when the breezes of the South West Monsoon are strongest and the swell highest in the offing in 7 fathoms, the anchorage for Vessels in 4 or 3½ fathoms is very smooth, and along the shore to the South of the Flagstaff under shelter of the softest part of the mud bank there is (as Michel Topping said of the Shore North of Coringa during the North East gale of December 1789) "no more surf than on the borders of the Thames."

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25. It may be objected, that this is only hearsay evidence of mine; that I have no actual test of the efficacy of that soft mud in destroying the turbulence of the waves; but I have one certainly unbiassed testimony from Mr. L. G. Lewis of the Vessel under my command, who was with Captain Selby on Survey of this part of the Coast, and often visited Alipee during the South West Monsoon. He subscribes to the statement of the Merchants and Ship Masters regarding the perfect security of the Alipee roads during the entire year.

26. The Canal runs to within 200 yards of the Sea at Alipee; I would recommend its being carried on Southwards half a mile, so as to bring its terminus nearer to the softest part of the mud bank where we find the smoothest water along the Sea shore.

27. Thus when the swell of the South West Monsoon seals the harbour of Cochin, there is a safe Port within easy and cheap access where Steamers may be Coaled conveniently; and say that the back-water carriage of the Coal through 32 miles costs a half Anna per Ton per mile, the value of the Coal will only be raised one Rupee per Ton, and taking into consideration the fact that the Coal will be landed alongside the Cochin Quay from the Ships which bring it from England, we cannot overrate the importance of Cochin as a Coal Depot.

Enclosure, No. 2.

From P. LESLIE, Esq., Honorary Secretary to the Cochin Chamber of Commerce; to Lieutenant A. D. TAYLOR, R. N., Commanding Her Majesty's Surveying Vessel "Bheema," Mangalore, dated 17th January, No. 7 of 1859.

DEAR SIR,

I am desired by the Committee to express to you the warm thanks of this Chamber for your very able and minute Report upon the Cochin Bar, which has duly come to hand.

As this Chamber is of opinion that your Report is a highly important one to the interests of Cochin, may I beg the favor of your informing me at your early convenience whether or not you would have any objections that it should be printed and published by the Chamber.

No. 10. ORDER THEREON, No. 48; dated 12th February 1859.

With the above letter, Lieutenant Taylor forwards his Report on the Bar and Harbor of Cochin, together with a communication from the Cochin Chamber of Commerce, to whom he had sent copies of his Survey and Report, requesting permission to print and publish the latter, as they consider it highly important to the interests of that port.

2. Lieutenant Taylor's Report now submitted will be communicated to the Superintendent of Marine, and to the Department of Public Works.

3. Government, in Extract Minutes of Consultation, No. 272, dated 17th July 1858, requested the Marine Board to report further on the proposal of the Cochin Chamber of Commerce to maintain a Steam Tug and Rake. The Superintendent of Marine will be desired to supply at an early date the information yet to be furnished.

4. Orders will be issued in the Public Works Department for the erection of the Screw Pile described in para: 13, where also will be considered the projects in paras: 14 and 15 for constructing a revetment on the River face of Cochin to check the inroads of the current, and a Pier for creating facilities to making the Port a Coaling Station.

5. The question para: 18 as to the preference of a Steam Dredge over a Rake will be considered when the Superintendent of Marine has made his further Report. Should it be decided to accede to the proposal of the Cochin Chamber of Commerce generally, it may be settled afterwards with them whether a Dredge or a Rake should be employed.

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6. The suggestion in para: 26 of Lieutenant Taylor's Report should be strongly pressed, through the Resident, on the Rajah of Travancore.

7. The Government see no objection to the Cochin Chamber of Commerce being allowed to publish the Report.

(Signed) T. PYCROFT,
Chief Secretary.

Exd. J. A. Wilson.

duration.

13. The only method of ascertaining what water is on the Bar is to have a standard of height marked on some unshifting perpendicular post; a bench mark in fact to which the soundings on the Chart are reduced. Such an one I have marked on a pile of one of the jetties which has been pointed out to the Master & Attendant; but from the perishable nature of the pile, this mark is not likely to last many years; I would therefore suggest that a good teak wood or ironwood pile with a screw at head (easily obtainable from Doolishewaram or Beyer's) be screwed in alongside the Master & Attendant's jetty as a future guide.

14. The Bench mark or datum level of the soundings shown on a Chart is an indispensable condition of accurate hydrography; but in a place like Cochin, where the sandy margin of the shore is liable to be cut away by strong tides aided by the wash of the sea, a stout screw pile of teak or other such hard wood will be the only permanent Bench mark we can adopt. I may perhaps be permitted

to make a suggestion which though irrelevant to the subject of the Bar is not unimportant to the improvement of Cochin; it is, that the river face of the town be properly revetted with piling and sluices as it seems to be getting undermined by the current and a few years of delay may reduplicate the required outlay.

Suggests in my minute

15. A good Government pier would also be a great improvement to Cochin, for doubtless this will be chosen as the Coaling station on the Malabar Coast and not Cannanore which I have in contemplation but than which scarcely a worse could be chosen. If the steam pake be adopted I am sure to predict that certainly most of the Steamers that are employed in prospecting may come in and coal alongside a pier. The Commodore may then easily enter, in fact all foreign Steamers of less than 1500 tons, and iron Steamers up to 1500 tons may avail themselves of this excellent port.

16. The Pilot's leading mark over the Bar need not be implicitly followed in going in or out; 30 yards to the South of that and 70 yards to the North of it, the passage is equally good; and thus if the anchor boat were placed during the afternoon and showed a light at night, a ship could easily

Marine Department.

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No. 48.

Extract from the Minutes of Consultation.

Dated 12th February 1859

Read letter from Lieut.

A. D. Taylor I. N., Com-
manding H. M. S. Surveying
Vessel the "Sheema" I. N. with
two Enclosures.

Here enter No. 7 dated 24th Jan-
uary 1859.

With the above letter, Lieut. Taylor forwards his Report on the Bar & Harbor of Cochin, together with a communication from the Cochin Chamber of Commerce, to whom he had sent copies of his Survey & Report, requesting permission to print & publish the latter, as they consider it highly important to the interests of that port.

2. Lieut. Taylor's Report

now submitted, will be communicated to the Superintendent of Marine, & to the Department of Public Works.

3. Government in Ex: Min: Cons: No. 272 dated 17th July, 1858, ^{requested} ~~called on~~ the Superintendent of Marine ^{Board} to report ^{further} on the proposal of the Cochin Chamber of Commerce ^{to} for the employment of a steam tug & rake, but they have not yet been put in possession of such a report.

4. Orders will be issued in the Public Works Department for the erection of the screw pile described in para. 13 - where also will be considered the projects in paras 14 & 15 for constructing a revetment on the river face of Cochin to check the inroads of the current, & a Pier for creating facilities to making the port a coaling station.

The Superintendent of Marine will be desired to supply at an early date the information yet to be furnished -

of the Cochin Chamber of Commerce

5. The question - para. 18 - as to the preference of a steam dredge over a rake will be considered when the Superintendent of Marine ^{made his report} has reported on the application of the Cochin Chamber of Commerce for a rake. Should it be decided to accede to their proposal, generally, it might be settled afterwards ^{with the Com} which it is to be

whether - a dredge or a rake? ^{should be employed -}

6. The suggestion in para. 26. of St. Taylor's Report, should be strongly pressed, thro' the Resident, on the Rajah of Travancore.

7. The Government see no objection to the Cochin Chamber of Commerce being allowed to publish the Report.

The Superintendent of Marine.
" Public Works Department.
" Resident of Travancore
" Cochin Chamber of Commerce.
" Lieut. J. D. Taylor. & c.

Dispt 14th

Dr. H. P. (University) Dr. H. P. (University)
Dr. H. P. (University) Dr. H. P. (University)

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By H. P. 15 July 59
H. P. 1839 Report

No. 48.

Dr. H. P. (University) Dr. H. P. (University)

Dr. H. P. 12 July 1839

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