TECHNICAL COMMUNICATION

Identification of Erosion-Accretion Regimes Along the Tamilnadu Coast, India

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ABSTRACT ■

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India has a long coastline extending over a distance of 6,000 km and Tamilnadu state constitutes a considerable length of it. Shoreline changes over a decade along Tamilnadu on the southeast coast of Indian have been studied and the results are presented in this paper. Berm crest data collected at 22 stations spread out along the entire study area have been analysed to demarcate eroding and accreting sites, and the rate of erosion/accretion over a decade for each site is determined. It is concluded that the shoreline of Tamilnadu has a dominant emergent aspect.

ADDITIONAL INDEX WORDS: *Shoreline changes, erosion, accretion, Tamilnadu Coast, India, berm crest.*

INTRODUCTION

The shore is the portion of land mass close to the sea which has been modified by the action of the sea. The beach is the seaward limit of the shore and extends roughly from the highest to the lowest tide levels. The relative stability of the shoreline is dependent on the material and energy available to the shore. Waves transport large amounts of energy and the continual dissipation of this energy can with time remove beach sand which results in erosion. Yet at different locations, waves transport sand to build-up beaches causing accretion. Any structure will result in a progressive change in the shoreline configuration.

STUDY AREA

Tamilnadu coast, the study area, is vulnerable to cyclones and storms surges. According to the classification of JOHNSON (1919), who had given importance to sea level oscillation, the south

Tamilnadu was considered an emergent coast. According to SHEPARD's (1963) classification, the Tamilnadu coast belongs to the nature of the coast where marine deposition dominates. Based on the existing characteristic features, AHMAD (1972) had classified this coast as a depositional plain type.

DATA BASE

The entire Tamilnadu coast with 22 different stations (indicated in Figure 1) was utilized for the identification of eroding or accreting sites. Each site was of a different length and the number of reference pillars for the collection of information on the crest of berm varied with the length of the site. Berm crest data on each site observed once in a month based on the lunar phase namely new moon, first quarter, full moon and last quarter. The berm crest is the seaward limit of the nearly horizontal portion of the beach or backshore formed by the deposition of sediments by the receding waves. These data available from January 1979 to December 1988 have been used to predict the average rate of erosion/accretion.

Table 1. *Shoreline changes along Tamilnadu Coast (1979–1988).*

Name of the Site	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
(1) Pulicat	−0.82	6.65	−11.06	−1.19	−12.39	−23.65	−24.54	−29.31	−27.94	−37.04
(2) Ennore	−6.27	−0.10	−3.25	14.60	80.69	85.63	70.71	67.06	79.85	70.96
(3) Royapuram	0.54	−0.61	−1.03	−9.59	−15.13	−26.96	−35.15	−33.25	−38.37	−45.39
(4) Foreshore Estate	−6.02	−6.21	5.29	5.78	6.62	1.57	−5.21	−5.02	9.47	6.56
(5) Elliot Beach	—	—	—	1.38	9.75	−7.33	−12.17	−6.93	−0.42	−0.62
(6) Kannathur Reddikup-pam	—	—	—	2.43	14.34	0.77	−8.56	−0.83	0.53	0.42
(7) Kovalam	18.34	18.11	15.98	—	18.53	8.29	−1.74	3.99	8.33	9.42
(8) Mahabalipuram (N)	−0.66	0.31	2.10	—	4.54	0.39	−5.86	−3.09	−1.58	2.70
Mahabalipuram (S)	18.60	23.05	19.32	—	15.39	9.55	8.70	17.36	21.55	23.93
(9) Pondichery	—	—	—	−4.62	−4.89	−5.89	−6.97	−7.83	−7.07	−6.92
(10) Cuddalore	23.49	22.35	17.45	20.24	18.13	17.00	14.78	29.53	35.72	36.32
(11) Kaveripumpattinam	—	—	−12.64	2.26	1.00	−11.62	−15.83	−8.83	−3.44	−11.81
(12) Tharangambadi (N)	−25.70	−26.23	−38.07	−35.32	−39.38	−46.54	−52.08	−41.54	−31.54	−51.29
Tharangambadi (S)	−14.73	−22.17	−36.14	−23.27	−29.75	−49.42	−43.46	−43.08	−33.58	−42.04
(13) Nagapattinam (N)	−2.29	17.88	−2.61	−0.23	−5.69	−8.93	−5.42	8.03	18.17	11.25
Nagapattinam (S)	7.53	13.24	13.60	9.58	5.87	0.14	2.18	2.35	15.72	1.60
(14) Point Calimere	−3.09	4.00	10.17	8.82	8.86	8.89	17.84	21.09	31.19	37.72
(15) Ammapattinam	3.04	6.43	8.42	8.38	6.09	5.28	6.11	6.96	5.88	5.86
(16) Mandapam	2.23	1.12	1.04	1.50	1.81	1.86	1.33	2.35	1.32	0.47
(17) Rameswaram	−3.98	−3.24	−2.53	−1.11	−0.88	−0.28	−0.51	1.09	0.44	0.50
(18) Keelakkarai	−2.06	2.16	0.80	2.03	2.10	1.93	2.39	2.44	−2.03	−0.49
(19) Thiruchendur	−5.61	−0.55	9.14	11.86	—	8.80	7.38	7.83	−0.86	−2.28
(20) Manapad	−3.36	4.73	−2.00	−6.48	—	−23.19	−4.67	−6.69	−16.06	−15.60
(21) Uvari	−5.51	−1.88	1.20	−1.87	—	−5.10	−4.18	−5.25	−14.29	−13.03
(22) Kanyakumari	—	−3.18	−10.18	−11.04	−11.42	−14.37	−11.40	−11.53	−19.58	−17.22

+ = accretion; − = erosion

Table 2. *Erosion/accretion along Tamilnadu Coast between 1979 and 1988.*

| Name of the Site	Length (m)	No. of Reference Pillars	Period of Observation	Eroded/ Accreted Area (m²)	Rate of Erosion/ Accretion (m/yr)
(1) Pulicat	710	4	New moon	−11,452	−16
(2) Ennore	3,265	4	I Quarter	150,157	46
(3) Royapuram	5,380	9	Full moon	−110,236	−21
(4) Foreshore Estate	2,300	13	Last Quarter	2,944	1
(5) Elliot Beach	2,080	5	New moon	−4,846	−2
(6) Kannathur Reddikuppam	240	3	I Quarter	312	1
(7) Kovalam	3,150	21	I Quarter	34,745	11
(8) Mahabalipuram (N)	2,655	13	Full moon	−345	−0.1
Mahabalipuram (S)	2,820	13		49,322	18
(9) Pondichery	1,190	7	New moon	−7,509	−6
(10) Cuddalore	1,538	6	I Quarter	36,143	24
(11) Kaveripumpattinam	1,905	7	Full moon	−14,497	−8
(12) Tharangambadi (N)	160	2	Full moon	−6,203	−39
Tharangambadi (S)	160	2		−5,402	−34
(13) Nagapattinam (N)	1,920	3	Last Quarter	5,798	3
Nagapattinam (S)	1,675	5		12,027	7
(14) Point Calimere	966	6	Last Quarter	14,055	15
(15) Ammapattinam	3,600	22	New moon	22,500	6
(16) Mandapam	2,194	12	I Quarter	3,291	2
(17) Rameswaram	3,295	13	Full moon	3,460	1
(18) Keelakkarai	2,900	14	Full moon	2,697	1
(19) Thiruchendur	1,525	7	I Quarter	6,054	4
(20) Manapad	1,600	8	I Quarter	−13,072	−8
(21) Uvari	2,600	5	I Quarter	−14,430	−6
(22) Kanyakumari	700	5	Full moon	−8,547	−12

+ = accretion; − = erosion
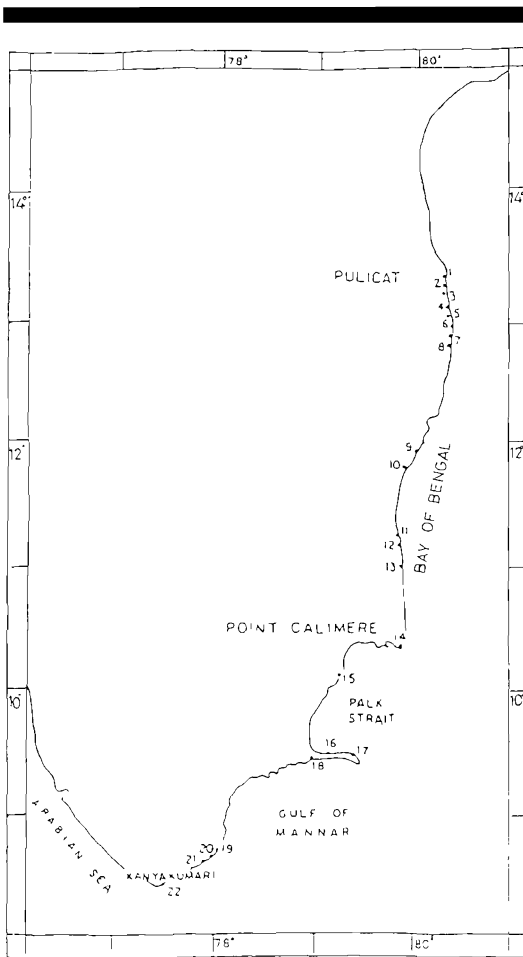
Figure 1. 1. Pulicat; 2. Ennore; 3. Royapuram; 4. Foreshore Estate; 5. Elliot Beach; 6. Kannathur Reddikuppam; 7. Kovalam; 8. Mahabalipuram; 9. Pondichery; 10. Cuddalore; 11. Kaveripumpattinam; 12. Tharangambadi; 13. Nagapattinam; 14. Point Calimere; 15. Ammapattinam; 16. Mandapam; 17. Rameswaram; 18. Keelakkarai; 19. Thiruchendur; 20. Manapad; 21. Uvari; 22. Kanyakumari.

COMPUTATION OF SHORELINE CHANGES

With January 1979 as the origin, eroding and accreting sites were demarcated. Importance has been given to the sites where manmade structures hinder the nearshore dynamics. Because of the projection of a shore temple, an old fort wall and port activities, respectively, at Mahabalipuram, Tharangambadi and Nagapattinam, analyses were carried out north and south of the structures. Taking into account the number of reference pillars at a particular station, the rate of shoreline changes for each year are computed and tabulated

(Table 1). The average rate of erosion/accretion over a decade for each site is determined based on ten-year average values. Rates of erosion/accretion along Tamilnadu coast are presented in Table 2.

RESULTS AND DISCUSSION

Based on the rate of shoreline oscillation observations from all the sites, estimates can be made of the net area eroded/accreted. For each station, an area of accretion/erosion is computed using rate of change of shoreline and the length of the site, as shown in Table 2. The total area of accretion and erosion along Tamilnadu coast is calculated to show the net shoreline erosion-accretion. The computations are as follows:

Length of East coast
  of Tamilnadu   = 900 km (approx.)
Total length of 22 sites   = 52 km
Area of Accretion in 52 km = 3.5×10^5 m^2
Area of Erosion in 52 km   = 2.0×10^5 m^2
Net area accreted   = 1.5×10^5 m^2

Assuming that the shoreline changes at the 22 sites represent the entire coastal stretch, the rate of accretion of the study area between 1979 and 1988 is computed.

Accretion/m run of beach length/year
= 0.28 m/m run of beach length/yr

CONCLUSION

Analysis of the shoreline changes of Tamilnadu coast over a decade between 1979 and 1988 shows that the coast prograges at a rate of 0.28 m/m run of beach length per year. The entire shoreline between Pulicat and Kanyakumari has a dominantly emergent aspect in its remarkable straightness.

ACKNOWLEDGEMENTS

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