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Short-term Impact of Beach Fest on the Topography, Vegetation Coverage and Sediment Distribution of the Mengabang Telipot Beach, Terengganu

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ABSTRAK

Pengukuran secara grid untuk tumbuhan pantai, pengukuran profil pantai serta penganalisaan enapan telah dibuat sebelum dan selepas pesta pantai untuk menentukan impak pesta pantai terhadap satu kawasan di pantai Mengabang Telipot. Walaupun pesta pantai dijalankan selama tujoh hari sahaja, ia didapati meninggalkan kesan kemusnahan terhadap pantai. Tumbuhan pantai didapati habis mengalami kemusnahan sementara hakisan berlaku dikawasan belakang pantai dan bahagian atas pantai. Enapan dikedua-dua kawasan tersebut berkurangan saiz puratanya serta menjadi lebih kurang sempurna jenisnya. Bahagian hadapan pantai yang di pengaruhi oleh pasang-surut tidak terganggu oleh aktiviti pesta main pantai.

ABSTRACT

Grid measurements of beach vegetation, beach profile surveys and sediment analyses were done before and after the beach fest in order to assess the impact of the festivities on a stretch of the Mengabang Telipot beach. Although the beach fest was held for only seven days, its impact on the beach was found to be damaging. Beach vegetation was completely destroyed, while the backshore and the front portion of the upper beach were eroded. Sediments on both the backshore and upper beach decreased in mean size and became poorly sorted. The foreshore area, which was influenced by tides, was not affected by the beach festivities.

Keywords: beach, topography, vegetation, sediment

INTRODUCTION

Although beaches occupy only a small fraction of the coastal zone, which in itself occupies only 12.5% of the earth's surface (Gross 1990), they, nevertheless, play a vital role in protecting the hinterland. They are the first line of defence against the large destructive waves that normally occur during stormy conditions.

Beaches are in dynamic equilibrium with the forces of nature, such as waves, tides and other climatic conditions. These forces not only vary in magnitude but also in duration, and as such may cause varying degrees of change on beaches. The diurnal or semi-diurnal rise and fall of tides may result in small-scale and short-term topographical changes on the beach. Hill (1966) found that small-scale beach erosion occurs when the tide rises while accretion occurs when it falls.

On a medium time scale, beach changes are cyclical in nature following the predominant weather conditions. In temperate countries, large waves and strong onshore winds occur during the winter, resulting in beach erosion, while the summer brings smaller, longer period waves resulting in sediment deposition and recovery of the beaches (Shepard 1950; King 1972). This type of seasonal cycle is also typical for the beaches on the east coast of Peninsular Malaysia. Studies by Wong (1981) and Mastura (1987) found that beach erosion dominates during the northeast monsoon season while deposition and repair of the beaches take place during the inter monsoon periods.

On a longer time scale, marine transgression and regression causing coastal erosion and deposition have been reported to follow the rise and fall of sea level. Periods during which sea level rises and transgresses inland results in erosion while periods where sea level regresses results in deposition and recovery of land from the sea (Shenan 1987).

As beaches are in a dynamic equilibrium, changes caused by the natural forces are usually temporary, and beaches can normally recover to their original state. However, beach changes can be caused not only by the forces of nature but also by man's activities, interrupting the dynamic equilibrium state of the beach. Such interference normally results in a net negative change with erosion. Man's interference may take the form of physical development on beaches, such as the construction of jetties and ports, or may be more subtle, such as usage of the beach for recreational purposes. Examples of beach changes as a result of man's interference via physical development are various, and examples have been reported by Barnes (1978) and Komar (1983a; 1983b). However, studies on the impact of man's recreational activities on beaches are rare. This may be due partly to the difficulty in quantifying the various activities that may occur on the beaches, and the variability of such activities with time and space.

In the state of Terengganu, a traditional festivity - the beach fest - is held annually along several stretches of beach. At Mengabang Telipot, it is normally held during the month of May for a period of seven days. The beach fest is traditionally held by inland padi planters after the harvest as a holiday during which they offer thanks for a bountiful harvest. During the beach fest period the farmers erect huts as temporary shelters on the backshore and the upper beach. Additional huts and stages are also built to cater for entertainment and commercial activities by the local authorities and hawkers. The activities and shows conducted during the beach fest period also attract the surrounding populace who come to watch and join in the festivities. An initial survey conducted by the authors estimated that about 800-1000 people attend the beach fest daily. Activities are held both during the day and at night time.

As yet the impact of the beach fest on beaches has not been quantitatively measured. Thus, the objective of the study was to measure and record the impact of beach fest activity on the beaches of Terengganu, in particular the Mengabang Telipot beach. The parameters measured and monitored were beach vegetation cover and beach topographical and sediment distribution changes on both the festive and on an adjacent non-festive beach.

Study area

The study area is a stretch of beach in Mengabang Telipot, approximately 15 km north of Kuala Terengganu (*Fig. 1*). The beach is composed entirely of unconsolidated quartz sand and faces the South China Sea. The beach fest area extends approximately 200 m northwards from the stretch of beach fronting the Universiti Pertanian Malaysia, Marine Science Station (UPM beach). Except for some usage by the local villagers, the stretch of beach where the festivities are held is relatively undisturbed. The biggest single activity on this stretch of beach is the annual beach fest. The UPM beach is not used by the villagers and it is not affected by the beach festivities.

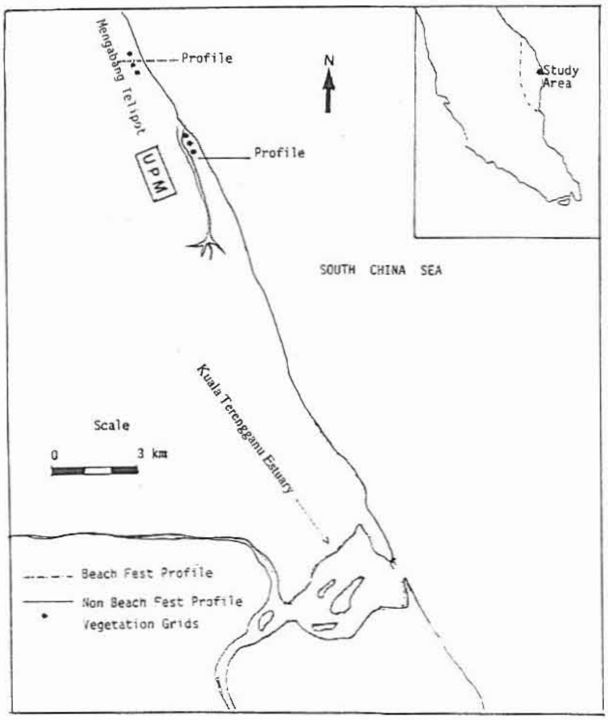

Fig. 1. Profile and beach vegetation monitoring stations at the Mengabang Telipot beach

METHODOLOGY

Beach Profile Measurement
Two profiling stations were set up on the beaches. One was in the middle of the beach fest area, where the huts and activities are most concentrated, and one approximately 200 m southwards on the UPM beach. Two beach profile measurements were made at each station: one before and one after the beach fest period. The time interval between measurements was 14 days.

At each profiling location, a permanent benchmark was set in reference to a permanent landform for the purpose of recording and checking the accuracy of the benchmarks during every profiling. The benchmarks were buried to a metre depth, approximately 15 m inland from the seaward vegetation edge on the upper beach.

The location of the two profile stations is shown in *Fig. 1*. Measurements of the vertical height and horizontal distance on the beach were made following the procedures described by Goldsmith *et al.* (1977). The height of the beach was measured using a transit meter and a telescoping levelling rod graduated to 0.003 metres. The horizontal distances on the beach were measured with a measuring tape graduated at 0.015 metre. Measurements were made from the benchmark where vertical and horizontal readings were taken at all significant breaks in the slope as far seaward as possible.

Sedimentological Analyses
For sedimentological analyses, approximately 200 g of beach sediments were collected, using an aluminium scoop, at the surface level to about 3 cm depth at three locations on the beach: the foreshore, the backshore and the upper beach.

The sediment samples were air-dried and thereafter approximately 100 g of the sediments were passed through a set of ASTM standard sieves. The sediments were sieved using a sieve shaker for 15 minutes. The sediments trapped on each sieve were then weighed, recorded and used in the determination of the sedimentological parameters: mean, median and skewness.

Calculations of the sedimentological parameters were made by the method of moments as suggested by Griffiths (1967), McBride (1971) and Folk (1980) among others. Formulae used for the calculation of the sedimentological parameter are as given below:

$$\text{Mean } (X_\phi) = \frac{\Sigma fm}{n}$$

Standard Deviation (σ_ϕ) $= \sqrt{\dfrac{\Sigma f(m - X\phi)^2}{100}}$

Skewness (Sk_ϕ) $= \dfrac{\Sigma f(m - X\phi)^3}{100\sigma\phi^3}$

f = weight percentage (frequency) in each grain size grade present
m = midpoint of each grain size grade in phi values
n = total number in sample, which is 100 when 'f' is expressed as a percentage.

Vegetation Cover

Vegetation cover on the festive and the non-festive beaches was measured using grids. The grids were set up by fixing permanent grid points on the vegetated upper portion of both beaches. Strings were then tied to the grid points to mark out the grid area. Each vegetation grid measured approximately 4 m by 2 m. Three set of grids were set on each beach. Photographs of vegetation within the grid areas were taken at a single fixed point and height above ground, both before and after the beach fest period.

To calculate the percentage cover of vegetation, the photographs were overlaid with transparent graph paper. A tracing of the vegetated area was then made and the area covered by the vegetation calculated by counting the number of squares on the graph paper covered by vegetation. Results are reported as percentage cover relative to the total area of the grid.

RESULTS AND DISCUSSIONS

Even though the beach festivities lasted for only seven days, the effects on Mengabang Telipot beach were quite damaging. Measurements and data collection before and after the beach fest period, 14 days apart, show that drastic changes had occurred in the topography, and severe damage had been inflicted on the vegetation on the upper beach. Analyses of sediments showed that sediment decreased in mean size and become poorly sorted after the beach fest period.

Fig. 2 shows that the festive and the non-festive beaches were almost identical in topography before the beach fest period. The upper beach, where the vegetation is most dense, sloped slightly upward for approximately 30 m from the benchmark to join the backshore portion of the beach. The zone where the upper beach ends and the backshore starts is differentiated by the vegetation line, and has only a gentle slope with no notable bluffs or scarp. The backshore also has a gentle slope and joins the foreshore, which has a steeper slope to the water's edge. There were no conspicuous berms on the backshore.

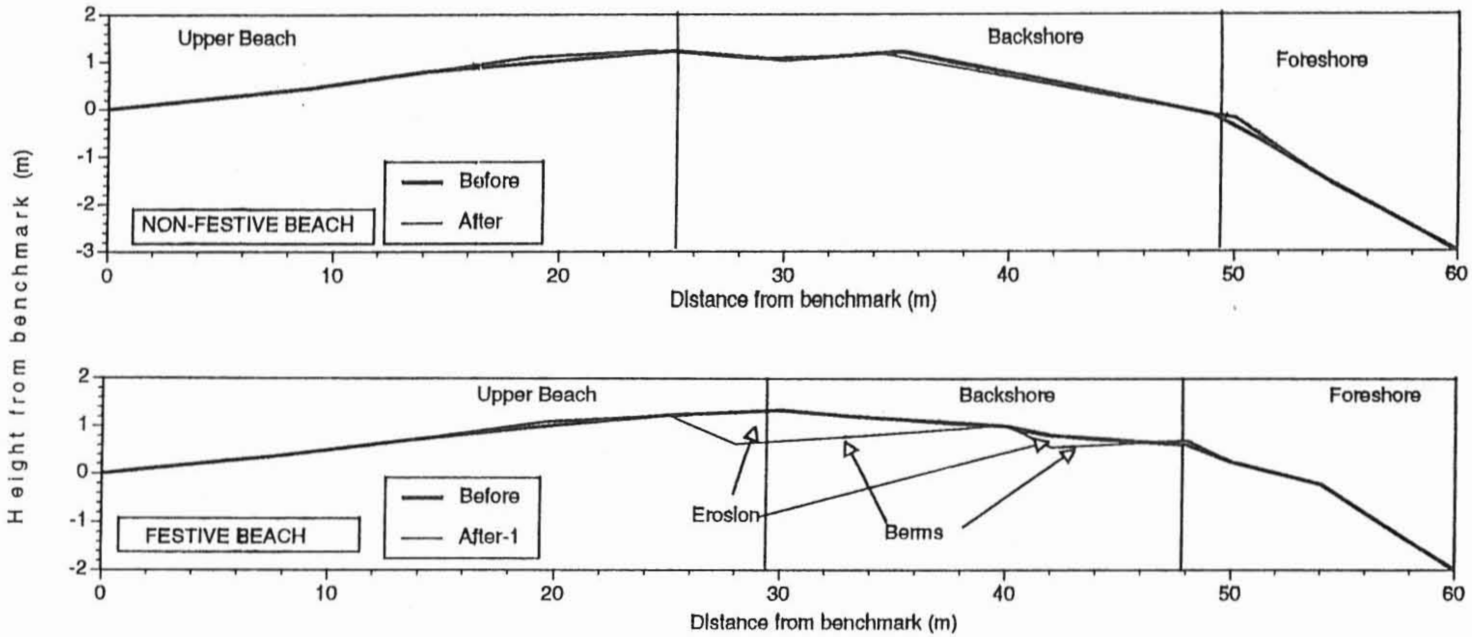

Fig. 2. Beach profiles before and after beach fest period (Vertical Exaggenation scale of 1: 2.5)

After the beach fest period, the topography of the non-festive beach remained the same while the topography of the festive beach was drastically modified. Erosion had occurred on the front portion of the upper beach and the adjoining backshore of the festive beach. Erosion had also occurred on the front of the backshore, which joins the foreshore. Erosion of the backshore and the upper beach resulted in two notable berms on the backshore. Two reasons may be forwarded to account for the drastic change in the topography of the festive beach. First, the activities undertaken by the local authorities and villagers in preparing the beach for the festivities involved both heavy and light vehicles moving across the upper beach on to the backshore, in order to transport building materials for the construction of huts and platforms for entertainment shows. Second, there was heavy pedestrian traffic on the upper beach and the backshore during the beach fest period. On the foreshore, which is covered by tides, there were no huts or activities except for some pedestrian traffic. Moreover, whatever impact the pedestrian traffic may have on the foreshore was quickly nullified by the daily rise and fall of tides accounting for the similar topography both before and after the beach festivities (McIntyre 1978).

Table 1 shows the sedimentological characteristics of mean size, sorting and skewness for both the festive and the non-festive beaches. Although there is a slight difference between the values of the sedimentological parameters before and after the beach fest period for the non-festive beach, the categories in which the value of the parameter falls did not change. This indicates that there was negligible disturbance on the non-festive beach. The slight change in values of the sedimentological characteristics at the foreshore and midshore may be attributed to the effect on these areas by waves and the rise and fall of tides.

The difference in sedimentological values at the midshore and backshore of the festive beach is greater than that which occurred on the non-festive beach. The mean size at the two sites decreased in value and sorting became poorer. The change in sediment skewness from fine skewed to coarse skewed indicates a change in the size distribution of sediments. The initially positive skewness indicates the dominance of coarse sediment with a small amount of finer sediment. However, the negative skewness indicates that the reverse had happened: finer sediment dominates with a small amount of coarser sediments. The change in skewness sign follows the pattern of decreasing mean sediment size and the increasingly poorer sorting of sediments after the beach fest.

These changes in the sedimentological characteristics on the festive beach may be attributed to the mixing of sediments from various parts of the festive beach due to erosion. Erosion of the upper beach and the backshore resulted in the very coarse sand of the upper beach being transported to the backshore by pedestrian and vehicle traffic. Similarly, the sand from the backshore and foreshore was transported upwards and

TABLE 1
Sedimentological characteristics of beach sediments before and after beach fest period

	Mean (FestiveBeach)	Mean (Non-Festive Beach)	Skewness (Festive Beach)	Skewness (Non-Festive Beach)	Sorting (Festive Beach)	Sorting (Non-Festive Beach)
HT	-0.40 (very coarse sand)	-0.30 (very coarse sand)	0.33 (strong fine skew)	0.35 (strong fine skew)	0.63 (moderately sell sorted)	0.62 (moderately well sorted)
HT*	0.70 (coarse sand)	-0.30 (very coarse sand)	0.20 (fine skew)	0.32 (strong fine skew)	1.04 (poorly sorted)	0.62 (moderately well sorted)
MT	0.70 (coarse sand)	0.60 (coarse sand)	0.25 (fine skew)	0.25 (fine skew)	0.83 (moderately sorted)	0.69 (moderately well sorted
MT*	0.60 (medium sand)	0.60 (coarse sand)	-0.10 (coarse skew)	0.22 (fine skew)	1.05 (poorly sorted)	0.69 (moderately well sorted)
LT	150 (medium sand)	1.00 (medium sand)	-0.08 (near symmetrical)	-0.08 (near symmetrical)	0.61 (moderately well sorted)	0.67 (moderately well sorted)
LT*	1.60 (medium sand)	1.20 (medium sand)	-0.10 (near symmetrical)	-0.10 (near symmetrical)	0.76 (moderately sorted)	0.68 (moderately well sorted)

HT= High tide; MT= Mid tide; LT= Low tide
*= Denote measurements made after beach fest

TABLE 2
Beach vegetation coverage before and after beach fest period

Grids	% Coverage on festive beach				% Coverage on non- festive beach			
	Before Beach Fest	After Beach Fest	% Difference	Relative Change (%)	Before Beach Fest	After Beach Fest	% Difference	Relative Change (%)
1	45	0	-45	-100	66	67	+1	+1
2	38	0	-38	-100	59	59	0	0
3	52	0	-52	-100	71	71	0	0
	Average % Difference		-45.0	-100.00	Average % Difference		+1.0	+1.0

+: indicates increase in vegetation coverage
- : indicates decrease in vegetation coverage

mixed with the sediments on the upper beach by pedestrian and vehicle traffic and wind action. The very coarse sand at the upper beach mixed with the coarse sand at the backshore, while on the other hand the coarse sand from the backshore may also have been brought up and mixed with very coarse sand of the upper beach. Additionally, the medium sand on the foreshore may have been transported up to the backshore by wave action and to the upper beach via wind and traffic (vehicles and pedestrians). Erosion by the mechanisms mentioned thus accounts for the decreasing mean size and poorer sorting of sediments on the backshore and upper portion of the festive beach. Tidal and wave action can be discounted because it did not reach the upper beach during the beach fest period.

The upper beach acts as a sand reservoir that serves to repair the foreshore and backshore area of a beach eroded during storm conditions (Husain and Yaakob 1988). It is stabilized by vegetation which helps to build the reservoir by trapping sand blown by the wind from the backshore and foreshore. The amount of vegetation preceding the festivities ranged from 79 to 88% and 38 to 50% of the grid area for the non-festive and the festive beach respectively (Table 2). This difference may be due to the upper portion of the festive beach being used occasionally by the local villagers but is of little consequence to this study. More importantly, however, is the scale of destruction caused by the beach fest. While the non-festive beach recorded a slight increase in vegetation cover, the vegetation coverage on the festive beach was totally destroyed. The heavy vehicle and pedestrian traffic present during the beach fest period caused the total destruction of beach vegetation on the beach fest area.

Since the non-festive and the festive beach are approximately 200 m apart, it may be assumed that both have the same environmental conditions prevalent on this part of the coast, such as tides, waves and related meteorological forces. Thus the changes in topography and the sedimentological distribution between the festive and the non-festive beach, are due to the activities that occurred during the beach fest.

Although it can be argued that the magnitude of erosion and destruction is small compared to that which occurs during the monsoon, the changes caused by the fest constitute interference with the dynamic equilibrium of the beach. The most severe erosion on the beaches abutting the South China Sea occurs during the NE monsoon, and to a lesser extent the southwest monsoon period (Wong 1981; Mastura 1987), when large waves erode the beaches and transport the eroded sand offshore to form sand bars. However, during the non-monsoon period the waves are fairly small and have longer periods. These waves erode the offshore bars and transport the sand back on to the beaches. Some of this sand is blown by the wind to the backshore and the upper beach area and trapped by the beach vegetation to rebuild the sand reservoir. This cycle of erosion and deposition is seasonal, contributing to the dynamic equilibrium nature of these beaches. The activities during the beach fest caused destruction to the beach vegetation and erosion of the backshore and upper beach, so changing the natural beach topography, and interfering with the natural recovery process of the beach from monsoonal erosion. These changes demonstrated by monitoring may cause the beach to experience net erosion in the long term. The decreasing mean size of beach sediments after the beach fest period makes them more easily transported, rendering the beach more prone to erosion, particularly during the monsoon seasons.

CONCLUSION

Although this study was made of the impact of a specific festival on a specific stretch of beach - the Mengabang Telipot beach - on the east coast of Peninsular Malaysia, similar destruction and change in beach topography can be expected to occur on other recreational beaches where heavy pedestrian and vehicular traffic are allowed on the upper beach area. The changes inflicted on the beach interfere with the dynamic equilibrium and may result in net erosion dominating in the long term.

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REFERENCES.

BARNES, R.S.K. 1978. The coastline. In: *The Coastline* ed. R.S.K. Barnes p. 3-30. Chichester: Wiley Interscience.

DARLING, J.M. 1964. Seasonal changes in beaches of the North Atlantic coast of the United States. In *Proceedings of 9th Conference on Coastal Engineering*, Lisbon, p. 236-248.

FOLK, R.L. 1980. *Petrology of Sedimentary Rocks*. Austin: Hemphill.

GOLDSMITH, V., S.C. STURM and G.R. THOMAS. 1977. *Beach Erosion and Accretion at Virginia Beach, Virginia and Vicinity*. Report No. 77-12. U.S. Army Corps of Engineers.

HUSAIN, M.L. and R. YAAKOB. 1988. The beach: Our resource and friend. *Nature Malaysiana* **13:** 12-15.

KING, C.A.M. 1972. *Beaches and Coasts*. New York: St. Martin Press.

KOMAR, P.D. 1983a. Beach processes and erosion-an introduction. In: *CRC Handbook of Coastal Processes and Erosion.* ed. P.D. Komer and J.R. MOORE. Boca Raton, Florida: CRC Press. p. 1 - 20

KOMAR, P.D. 1983b. Coastal erosion in response to the construction of jetties and breakwater. In: *CRC Handbook of Coastal Processes and Erosion,* ed. P.D. Komer and J.R. Moore. p. 191 - 204 Boca Raton, Florida, CRC Press.

MASTURA, S. 1987. *Coastal Geomorphology of Desaru and its Implication for Coastal Zone Management.*Universiti Kebangsaan Malaysis, Monograph no.13 Faculty of Social Sciences and Humanities.

MCBRIDE, A.D. 1978. Sandy foreshore. In: *The Coastline* ed. R.S.K. BARNES. Chichester, Wiley Interscience. p. 31 - 48

SHENAN, I. 1987. Holocene sea level changes in the North Sea. In: *Sea Level Changes,* ed. M.J. Tooley and I. Shennan. Oxford: Blackwell. p. 109-151

SHEPARD, F.P. 1950. *Beach Cycles in Southern California.* Beach Erosion Board, Technical Memorandum No. 20, Washington, D.C.

WONG, P.P. 1979.Contemporary beach changes: east coast Peninsular Malaysia. In: *Workshop on Coastal Geomorphology.* University of Singapore.

WONG, P.P. 1981. Beach changes on a monsoon coast Peninsular Malaysia. *Geol. Soc. Mal. Bull.* **14**: 59-74.