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SHORT COMMUNICATION

Additional Information on mangrove distribution in Kenya: some observations and remarks*

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INTRODUCTION

The distribution of mangroves in the tropics is linked with the presence of estuaries and creeks (Macnae 1968; Barth 1982). There is a consensus that river discharges into the oceans cause the brackish water micro-environment; which is the key factor for development of mangroves and that in sheltered conditions they form luxuriant forests (Macnae 1968; Barth 1982; Joshi and Boshale 1982; Snedaker 1982).

In Kenya a similar pattern (figure 1) exists, but with some specific differences. For example there are no mangrove trees in the estuary of River Sabaki despite the fact that it is a permanent river. In addition, the bulk of the mangrove forest cover occurs in creeks and estuaries of seasonal rivers (Doute, Ochanda and Epp 1981). There are also mangrove trees growing at places without any river inputs, such as:

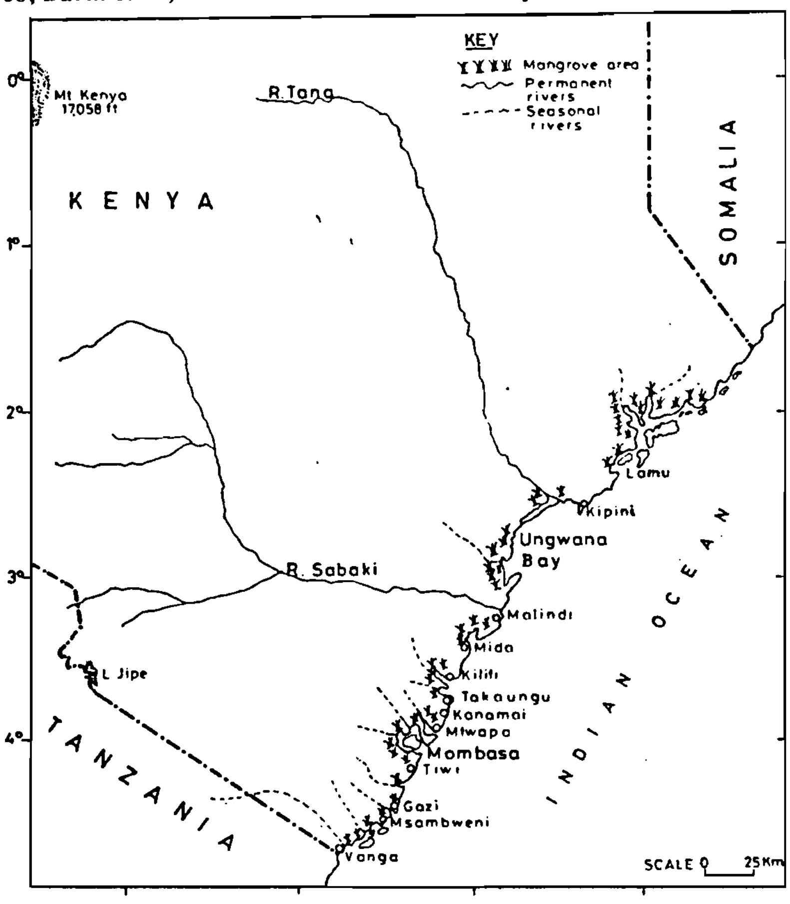

Figure 1. River system and mangrove distribution along the Kenya coastline

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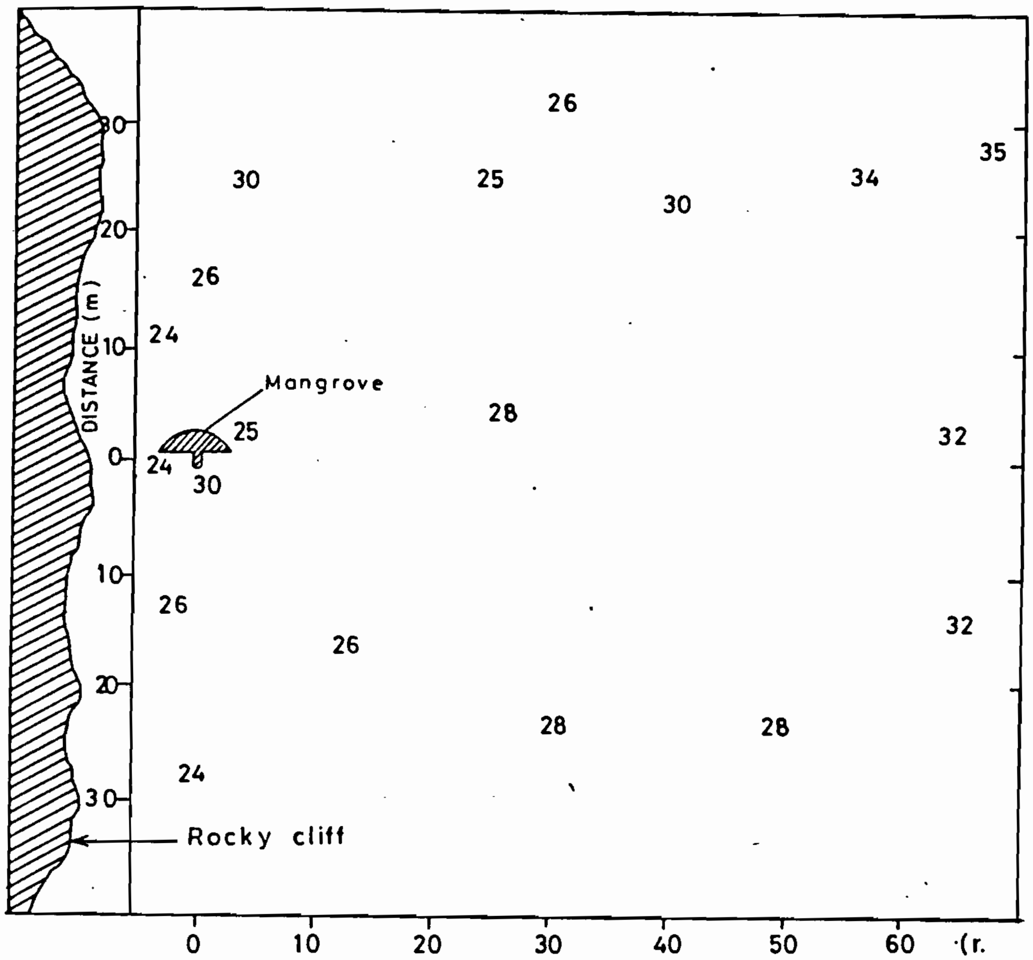

Figure 2. Salinity (%) measurements around the lone mangrove at Kanamai on a sunny day during ebb tide (6 June 1985).

1. in front of rocky cliffs where there is heavy wave action, e.g. Kanamai;
2. in the sheltered inlets of the sea whose ambient water salinities are oceanic i.e. 35%, e.g., Mida creek.
3. in a sheltered site behind the high rocky cliffs at Bamburi where some mangroves are thriving successfully.

These niches occupied by some of the mangroves in Kenya appear to be exceptional at first sight. As these exceptions are most interesting we set forth to study the micro-environments of:

1. the lone mangrove of Kanamai;
2. the estuarine system at Gazi mangrove swamp;
3. the Mida creek mangrove ecosystem with an aim of explaining the distribution patterns of the mangroves in Kenya.

METHOD AND RESULTS

The site where the lone mangrove *Sonneratia alba* J. Sm. at Kanamai is thriving remains wet throughout the low tide period. Careful observations on the micro-environment under the mangrove reveals small trickles of water coming out from the underground. The salinities at these discharge points and those of neighbouring pools in the vicinity of the mangrove tree were measured using a refractometer. They were measured during ebb tide and at high tide on a sunny day. The salinities at high tide were constantly 35% i.e. fully oceanic salinity. The results of the measurements during ebb tide are as shown in figure 2.

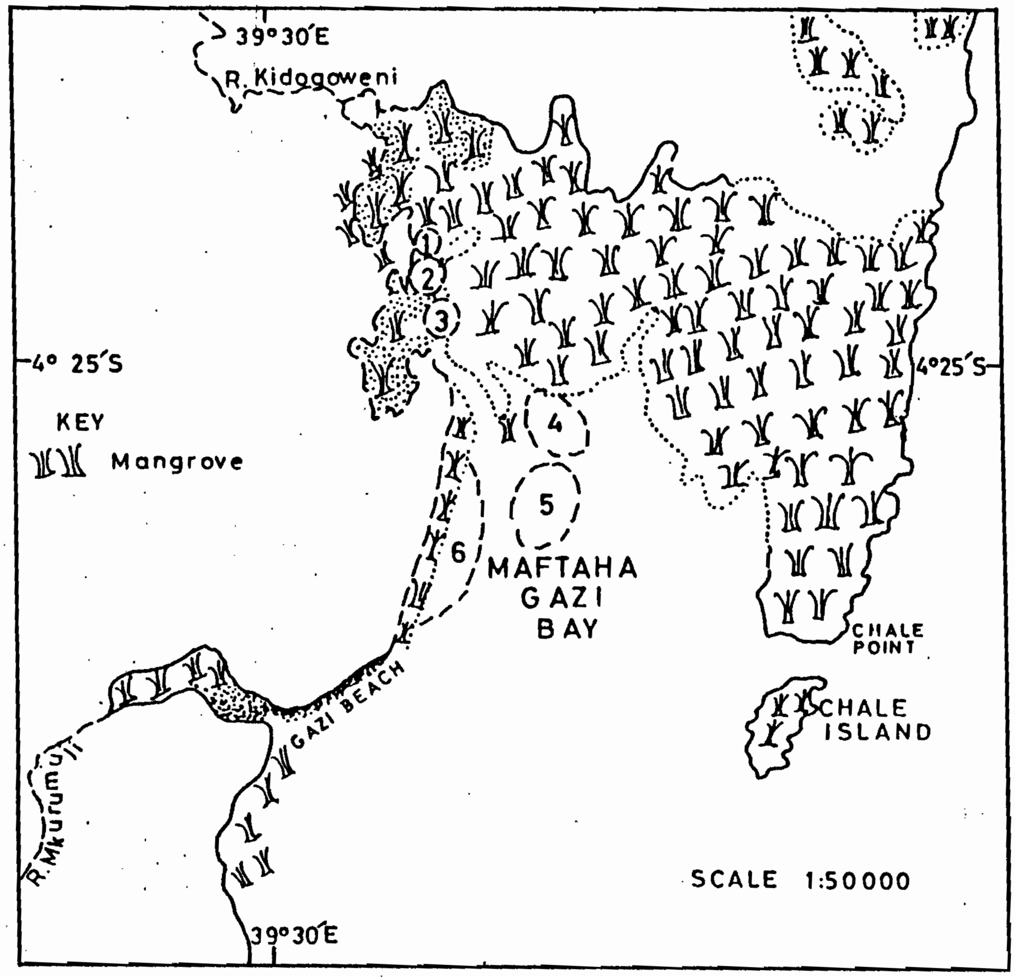

Figure 3. Study sites at Gazi mangrove swamp.

Other salinity measurements were carried out at the Maftaha Gazi Bay, Gazi mangrove biotope (figure 3). Almost all the water in the bay is replaced in each daily tidal cycle. There are two seasonal rivers discharging into this bay namely, Mkurumuji and Kidogoweni. During the dry season (January to April) they are almost non-existent, but they discharge heavily during the rainy season in May and June. The salinities were taken on a sunny day during the daytime low tide at areas 1,2,3,4,5 and 6 (see table 1). At high tide the salinities in the bay were 33-34%. Further salinity measurements were carried out at the Mida mangrove biotope. The salinities were measured during low tide, in the daytime on a sunny day. The salinities at various seepage points were 29,30,31 and 32%. Almost all the water in this creek is also replaced in each daily tidal cycle.

DISCUSSIONS AND CONCLUSIONS

Seepage of underground water into the sea is very common in the lower eulittoral zone:

1. at the bases of high rising rocky cliffs, e.g. Kanamai, Mtwapa, Bamburi, Mombasa Island, Tiwi, and Msambweni,
2. on beaches, e.g. Kanamai and Tiwi.
3. in creeks, e.g. Gazi and Mida.

Table 1. Salinity of isolated pools of Gazi mangrove biotope during low tide on 15 July 1985.

Site	Salinity					
1. River discharge area	27 n= 2	28 n = 3	29 n = 2	—	—	
2. Pool	27 n = 1	28 n = 4	29 n = 2	—	—	—
3. Pool	27 n = 3	28 n = 4	29 n = 2	—	—	—
4. Pool	28 n = 1	29 n = 3	30 n = 3	31 n = 2	32 n = 1	33 n = 1
5. Pool	30 n = 1	31 n = 2	32 n = 12	33 n = 1	—	—
6. Pool	30 n = 2	31 n = 6	32 n = 1	33 n = 1	—	—

At high tide the salinity in this creek was 34-35%
n = number of measurements at different points.

Although Isaac and Isaac (1968) and Knutzen and Jasuund (1979) reported observing seepage in Kenya they neither measured the salinities of the seepages nor did they study their consequences to the marine life.

From our data on salinities it is clear that seepages of underground water to the seashore change the micro-environmental conditions from oceanic to brackish water, creating suitable micro-habitats for colonization by mangrove seedlings and therefore offer suitable habitats for mangrove development. Ituli's (1984) flow model for underground water flow in the Athi and Tana River basin indicates that the Mida area is one of the places exhibiting highest flow rates into the sea. The latter may explain the existence of a big mangrove forest without any river discharging into it. This seepage phenomenon was overlooked by Isaac and Isaac (1968) when describing the distribution of mangroves in Kenya.

The role of seepage in the mangrove colonization and development was reported by Macnae and Kalk (1962) after observing that on the river-less Inhaca Island (Mozambique) a mangrove forest was growing in an area without river discharge and 30 km away from the nearest river input on the mainland. They did not measure the salinities but since the water from wells dug near the mangrove forest was portable fresh water they were convinced that the seepage effectively caused a suitable brackish environment to allow colonization by mangroves. Similarly, at the Kenyan coast boreholes near mangrove forests give portable fresh water. In a semi arid zone like the Kenya coastal zone the presence of underground portable water near mangrove forests seems to explain why major villages and boreholes are concentrated around these biotopes. Indeed, in view of the information available we can even say that the mangroves are indicating where underground water is released into the sea.

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