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Preliminary observations on the copepods of Tudor Creek, Mombasa, Kenya

N. Revis
Laboratorium voor Ecologie en Systematiek, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussel, Belgium

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Abstract

The zooplankton of Tudor Creek, a mangrove estuary in Kenya, was investigated from November 1984 to October 1985 at monthly intervals. One hundred and two copepod species were identified of which twelve were abundant. Densities are given for these species and their seasonal fluctuations are discussed.

Introduction

Little is known of the zooplankton of the East African coast. To the author's knowledge, except for the work of Smith & Lane (1981), Okera (1974) and Okemwa & Revis (in press) no further research has been carried out in this region.

As a part of an ongoing project on tropical marine ecology, zooplankton was sampled monthly at three stations in Tudor Creek, Mombasa, Kenya, from November 1984 to October 1985. The present paper describes some of the results on Copepoda from this 11-month study.

Study Area

Tudor Creek is a tidal mangrove estuary, one of the two estuaries around Mombasa Island. Three stations were chosen in function of their location with regard to the ocean (Fig. 1). Depth decreases from the most seaward station (STN 1) to the most inland station (STN 3) (Fig. 2). Two seasons occur; the northeast monsoon from November to March and the southeast monsoon from April to October. A rain period occurs when the

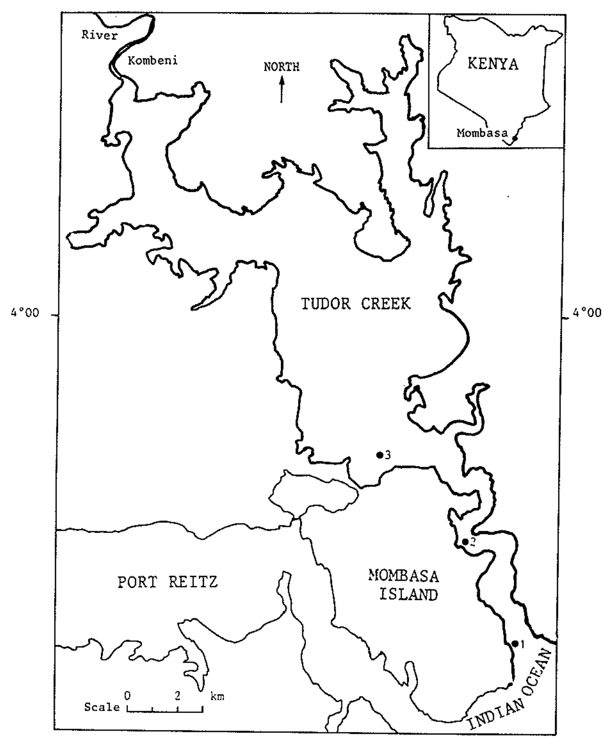

Fig. 1. Map of Tudor Creek showing sampling stations.

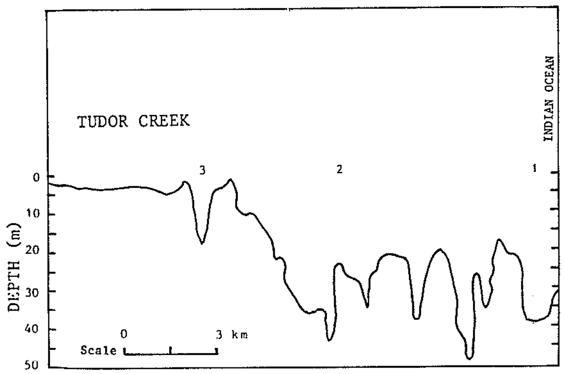

Fig. 2. Longitudinal section of Tudor Creek showing depth and sampling stations.

winds change direction: the short rains occur in November–December and the long rains in April–June.

Methods

Samples were taken monthly halfway between neap and spring tides and between low and high tide during day time. At each station turbidity, surface temperature and salinity were measured. Zooplankton was collected by horizontals hauls at 1.3 m depth with a 335 μm mesh net. Samples were immediately preserved in 5% formaldehyde. All the zooplankton in the subsample (1/10–1/50) were identified and counted to a as low a taxonomic level as practicable. Copepoda were identified to species. Abundance was calculated as numbers 10 m^{-3}.

No samples were taken in November 1984 or at station 3 in March 1985.

Results

The annual temperature fluctuation is rather small, as is characteristic for tropical waters. The temperature is higher during the northeast monsoon than during the southeast monsoon and is higher as one moves inland (Fig. 3). Salinity is more or less constant throughout the year except during the long rainperiod, when it decreases more and faster as one moves inland. In the driest month of the year, February, the salinity reaches 36‰. (Fig. 3). Throughout the year the transparency is higher at the mouth of the creek then at the inner creek waters (Fig. 3).

The total zooplankton density shows three peaks, one in December after the short November rains, a second in March–April after the beginning of the long rain period and a third in June. The first two peaks are caused by a density increase of all taxa, including copepods, the last by an increase of decapod larvae only. It has to be kept in mind, however, that vertical migrations may influence the surface densities sampled.

Up to now 102 copepod species have been identified, belonging to 41 genera and 30 families. Three new species have been encountered and their descriptions are in preparation: *Tortanus* sp., *Kelleria* sp. and *Harpacticella* sp.

Twelve copepod species were numerically abundant (Fig. 4). These can be categorised in 5 main groups:

Species of group 1

These species are abundant in March only but remain sporadically present throughout the year.

Acartia amboinensis is the most abundant calanoid in March at station 2, but its density declines rapidly form April to June. From July to January it is absent or rare.

Acartia pietschmani is rare or absent throughout the year except in March at station 2 (when it is the third most abundant species) and at station 1 (there is ranked fifth). It is not found at station 3.

Centropages furcatus is the third most abundant calanoid at station 1 and occurs sporadically throughout the year at the three stations. It shows a small peak in August at station 1.

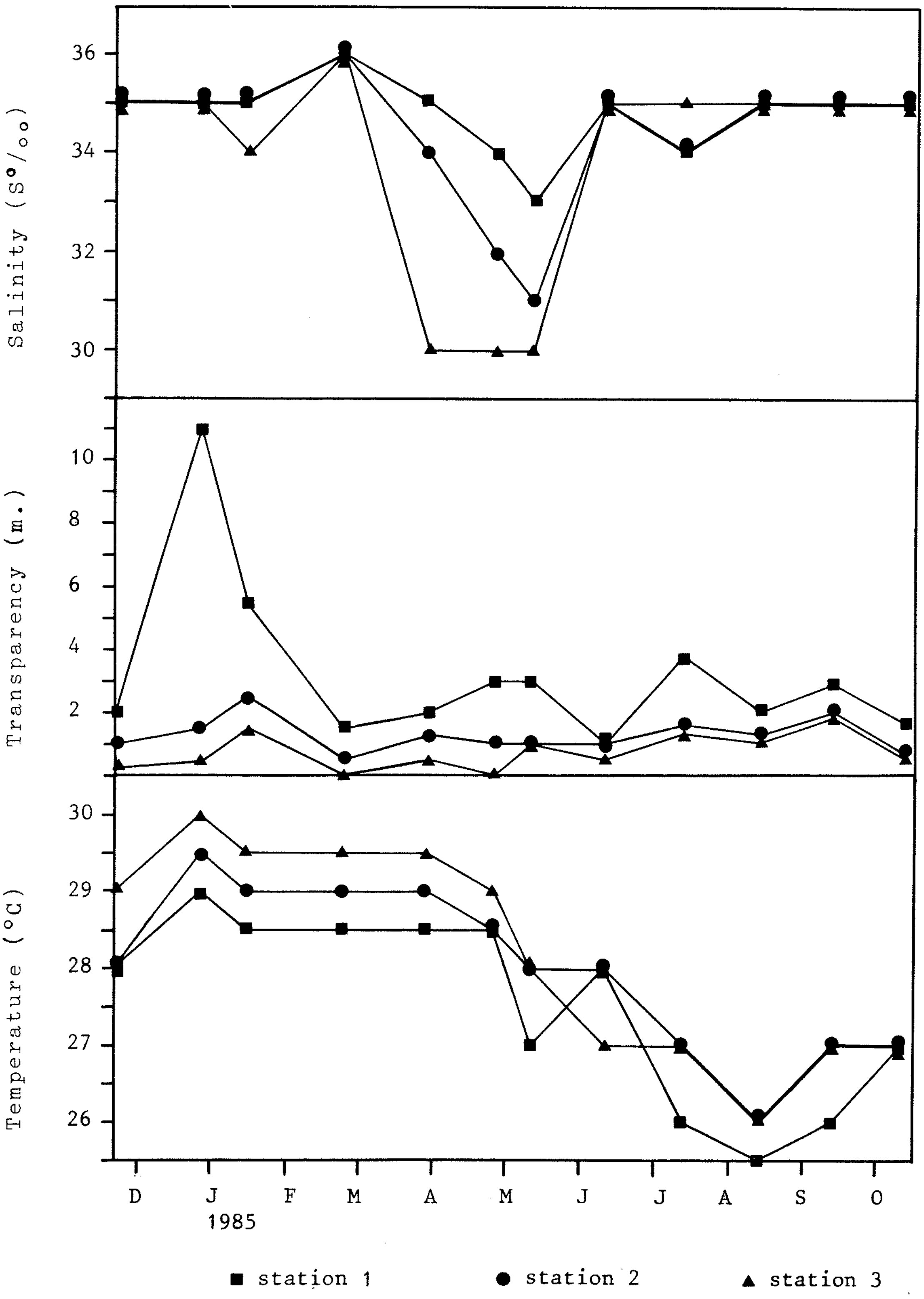

Fig. 3. Seasonal distribution of salinity, transparency and temperature.

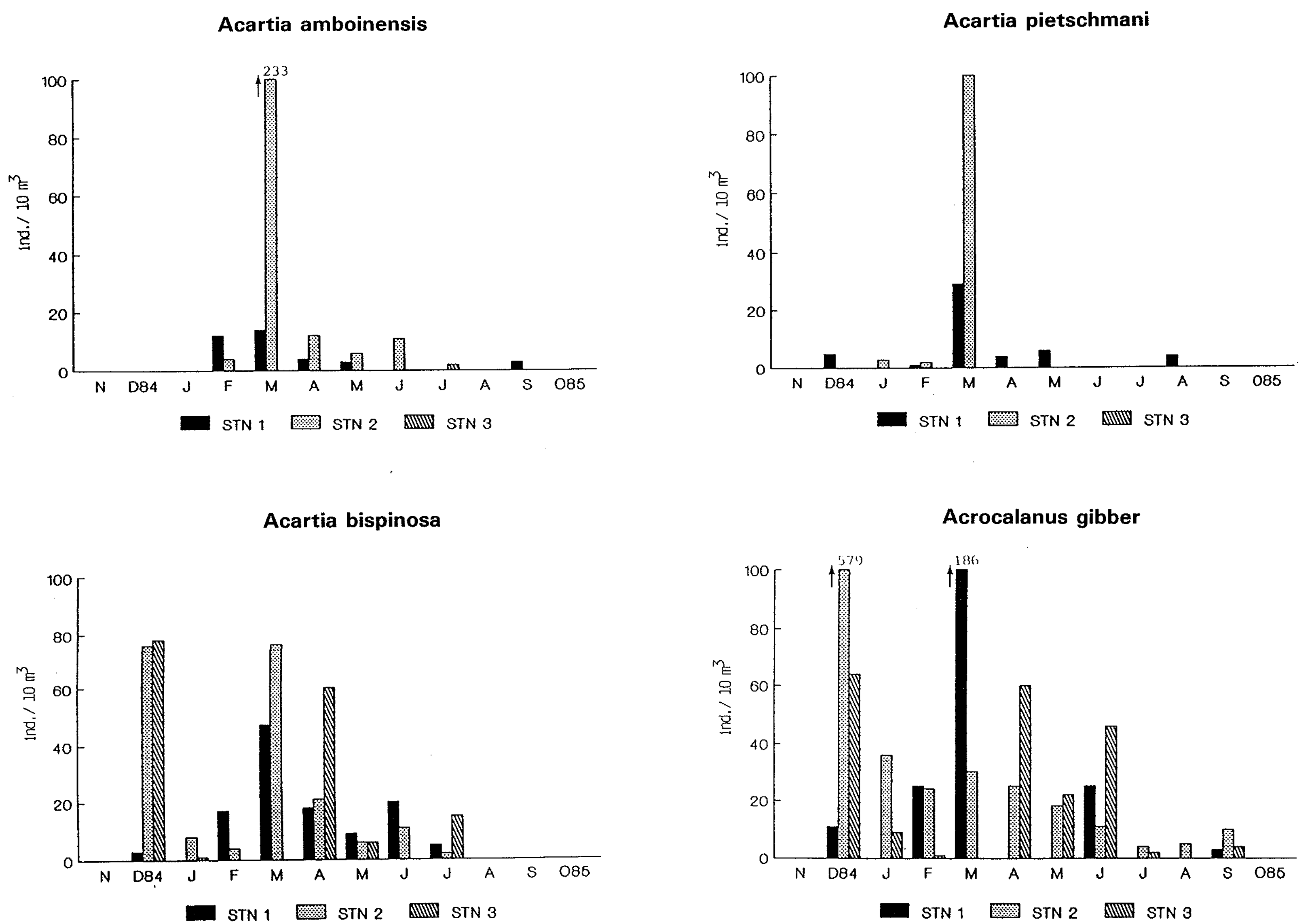

Fig. 4. Spatial and temporal distribution of copepod species.

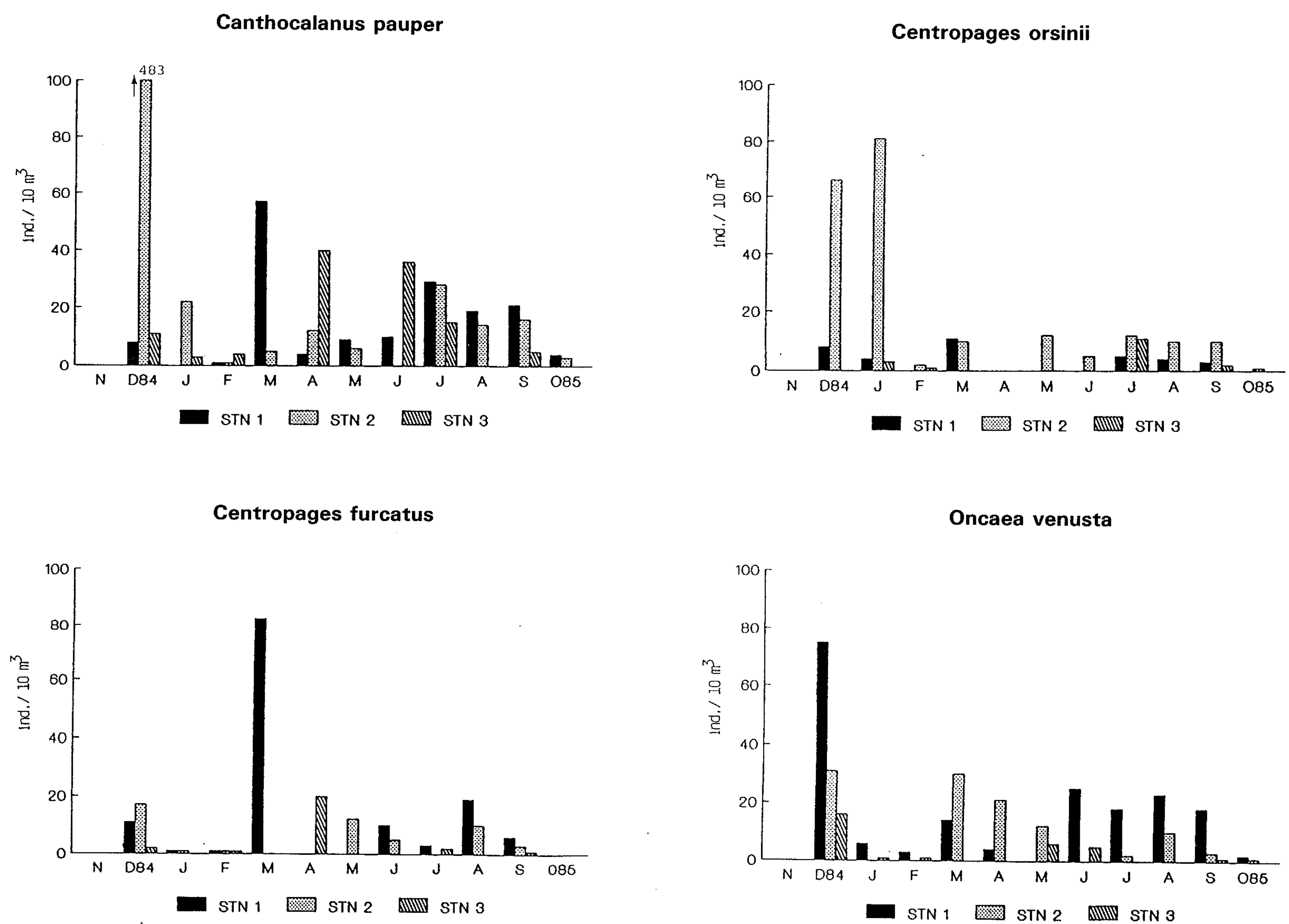

Fig. 4 (Continued).

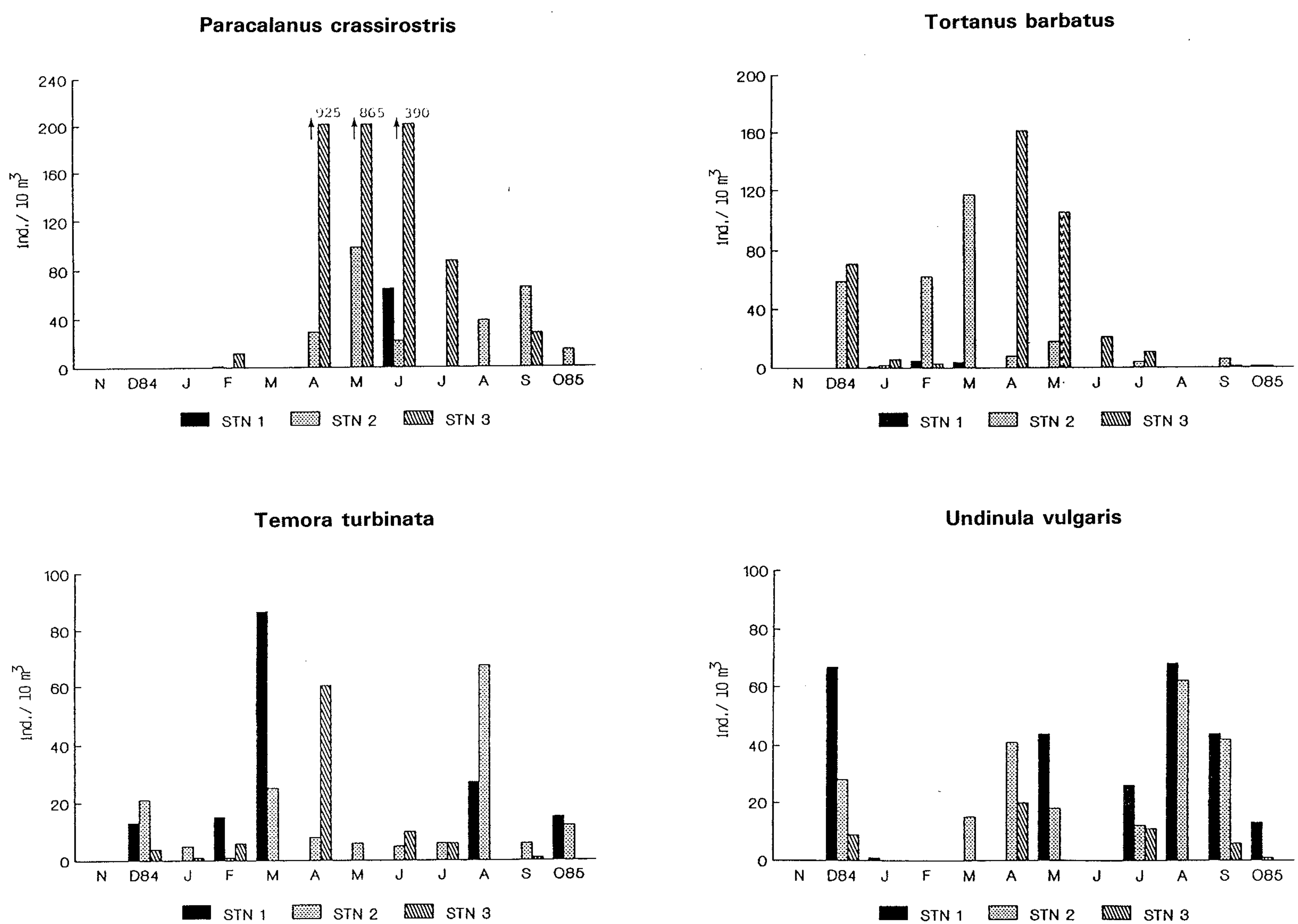

Fig. 4 (Continued).

Species of group 2

These species are present throughout the year, with high abundance in December and March–April and low densities in July–October.

Acartia bispinosa shows a density peak in December at station 2 (third most abundant) and at station 3 (most abundant). It also shows a peak in March at station 1 and station 2 (fourth most abundant).

Acrocalanus gibber is the most abundant species at station 1 in March with a small peak in June. At station 2 it is the most abundant in December. *A. gibber* shows smaller peaks in December, April and June at station 3.

Tortanus barbatus occurs mainly from December to May at stations 2 and 3. It shows peaks in December and February–March (the second most abundant) at station 2 and in December and April–May in station 3. At this station it is the second most abundant species.

Species of group 3

These species have a simular pattern to group 2, but a somewhat smaller March peak and relatively higher densities in July–October.

Canthocalanus pauper is the most abundant species at stations 1 and 2 in July, and the third most abundant at station 3. *C. pauper* shows a peak in December at station 2 (second most abundant) and in March at station 1.

Oncaea venusta is the most abundant species in December at station 1.

Undinula vulgaris has a density peak in May and August at station 1 and in April at station 2 (most abundant species). It is the second most abundant species in December at station 1 and in August in station 2.

Species of group 4

These are species with relatively high densities July–October, a density peak in March but none in December.

Temora turbinata is the second most abundant in March and August at station 1 and in April in station 3. It shows a peak (most abundant calanoid) at station 2 in August.

Paracalanus crassirostris is present from April to October in stations 2 and 3. Throughout this period it is the most abundant species at station 3. It is the most abundant at station 2 in May–June and September–October. *P. crassirostris* shows also a peak at station 1 in June.

Species of group 5

This group contains only one species

Centropages orsinii occurs mainly at station 2 in December and January (most abundant species) while all the other species have a very low density in January.
If we compare the 12 abundant species within one station following remarks can be made:

Station 1
O. venusta and *U. vulgaris* have a peak in December; several species have a peak in March, in order of descending value: *A. gibber, T. turbinata, C. furcatus, C. pauper, A. bispinosa, A. pietschmani, A. amboinensis* and *O. venusta*(tied), and *C. orsinii.* Some species have a peak in August: *U. vulgaris, T. turbinata, O. venusta* and *C. furcatus. U. vulgaris* has a peak in May which is followed by a peak of *P. crassirostis* in June. This succession is also found at station 2.

Station 2
U. vulgaris has a peak in April and August which is followed by a peak of *P. crassirostis* in May and September. More species have a peak in December at station 2 than at station 1 and the densities

are in general higher. The two most abundant species in December are *A. gibber* and *C. pauper* followed by *A. bispinosa, T. barbatus, O. venusta, T. turbinata*, and *C. furcatus*.

Several species show a peak in March: *A. amboinensis, T. barbatus, A. pietschmani, A. bispinosa, A. gibber, O. venusta, T. turbinata*, and *C. orsinii*.

Station 3

Only 10 species are present, and most of them at rather low densities. *A. bispinosa, T. barbatus*, and *A. gibber* have a small peak in December. *P. crassirostris* is by far the most abundant species during and after the long rains. During the long rain period *T. barbatus* is the second dominant species.

Conclusions

Several copepod species have peaks in December and in March, i.e. after the short November rains and after the beginning of the long rains in March, respectively. During the rain periods high concentrations of dissolved nutrients occur as a result of landdrainage (Grindley, 1984). As more food is available, many species may increase in density. Most species show a density decrease during and after the long rains. Changes in salinity during rainy seasons may cause periodic mass mortalities of marine organisms (Grindley, 1984). Nevertheless *C. pauper, O. venusta, P. crassirostris, T. turbinata, T. barbatus* and *U. vulgaris* are well represented during this period.

T. turbinata, P. crassirostris, and *T. barbatus* are eurythermal and euryhaline species (Greenwood, 1982). This may explain the dominance of the latter two species at station 3 (most inland station) during the rain period.

Most copepod species have low densities in January–February, the driest period of the year.

According to the distribution pattern we can see that: *A. bispinosa, A. gibber, C. pauper, T. turbinata*, and *U. vulgaris* occur in the three stations. *A. amboinensis, A. pietschmani, O. venusta, C. furcatus* and *C. orsinii* occur mainly in more oceanic waters. *T. barbatus* and *P. crassirostris* prefer station 2 more inland waters.

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References

Greenwood, J. C., 1981. Occurrence of congeneric pairs of Acartia and Pseudodiaptomus species (Copepoda, Calanoida) in Moreton Bay, Queensland. Estuar. coast. Shelf Sci. 13: 591–596.

Greenwood, J. C., 1982. Calanoid Copepods of Moreton Bay (Queensland) V. Ecology of the dominant species. Proc. r. Soc. Qd 93: 49–64.

Grindley, J. R., 1984. The zooplankton of mangrove estuaries. In F. D. Por & I. Dor (eds), Hydrobiology of the Mangal. Dr. W. Junk Publishers, The Hague.: 79–87.

Okera, W., 1974. The zooplankton of the inshore waters of Dar es Salaam (Tanzania, S. E. Africa) with observations on reactions to artificial light. Mar. Biol. 26: 13–25.

Okemwa, E. & N. Revis, (in press). The biology of marine copepods in Kenyan Waters. Planktonic Copepods from Coastal and Inshore Waters of Tudor Creek. Kenya J. Sci. Tech. ser.

Smith, S. L. & P. V. Z. Lane, 1981. Biological Oceanography of the Somali Current Data Report. Informal Data Report n° 29098 Brookhaven national Laboratory, Upon NY, 126 pp.

Wooldridge, T. H., 1977. The zooplankton of Mgazana, a Mangrove estuary in Transkei, southern Africa. Zool. afr. 12: 307–322.

Wooldridge, T. H. & R. Melville-Smith, 1979. Copepod succession in two South African estuaries. J. Plankton Res. 1: 329–341.