# THE FAUNA ASSOCIATED WITH KELP STRANDED ON A SANDY BEACH

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## 1. INTRODUCTION

Seventy percent of the southern African coastline consists of sandy beaches (McLachlan et al. 1981), but these received little attention until Brown's publications (1964, 1971a,b) on the general ecology of beaches around the Cape Peninsula. Since then McLachlan (1977a-c, 1980), Dye (1979), McLachlan et al. (1979, 1981), Dye et al. (1981) and Wooldridge et al. (1981) have investigated the physical parameters and fauna of eastern and southern coast beaches and Bally (1981), those of sandy beaches along the west coast north of the Cape Peninsula. All these are clean open beaches which receive only erratic deposits of macrophytes. The only form of primary production arises from offshore blooms of phytoplankton with the occasional stranding of carrion.

By contrast the west coast of the Cape Peninsula has extensive offshore kelp beds dominated by *Ecklonia maxima* and *Laminaria pallida*. Newell et al. (1982) have reviewed the available information on primary productivity, standing stocks and ecological energetics of consumer organisms inhabiting these beds. Much of the kelp material is ultimately uprooted and stranded on nearby shores, providing a rich source of energy for the intertidal fauna. One particular area along this coastline, Kommetjie (34°08'S, 18°19'E), has been a focus of study for the past few years. The beach is approximately one kilometre in length with sandy pockets bordered by rocky outcrops. Several of the primary consumers of stranded kelp have been investigated, principally the amphipod *Talorchestia capensis* (Muir 1977), the isopod *Ligia dilatata* (Koop, Field 1980,1981) and larvae of the kelp fly *Fucellia capensis* (Stenton-Dozey, Griffiths 1980). A one month survey of the macrofauna associated with stranded kelp and the rate at which this material was degraded was also undertaken by Griffiths and Stenton-Dozey (1981). Koop and Griffiths (1982) studied the relative significance of the macro-, meio-fauna and bacteria and recently the fluxes in material arising from decomposing wrack has been investigated (Koop et al. 1982a,b).

This paper presents results of a year-long survey conducted at Kommetjie to establish the seasonal pattern in composition, distribution, abundance and biomass of macro-, meio-fauna and bacteria and their relative contributions to the beach economy in terms of standing stock and productivity. Fluctuations in the fauna are correlated with the deposition rate of kelp material.

## 2. MATERIALS AND METHODS

### 2.1 Beach zonation and collection of wrack

In zoning the beach, three stages of kelp degradation were recognised at the time of low spring tide, namely those in which deposits were old, in the process of decay and fresh. The position of these corresponded to HWS, MW and LWS respectively and this zonation generally followed the pattern suggested by Dahl (1952), but in this case it was subjected to the condition of surface wrack rather than using indicator species of the

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fauna to determine zones.

To establish the quantity of material cast ashore, each month five $1m^2$ quadrants were removed from fresh deposits along the 300m stretch of beach. A large area was covered to compensate for patchy deposition. The mean wet weight of these samples, times 300m was then regarded to represent the total quantity of new material present on the day of sampling. This value was later increased by an estimated rate for the total replacement of stranded kelp in order to reach a monthly figure.

2.2 Macrofauna

Four random $0,2m^2$ quadrants were collected monthly from each zone at the time of low spring tide. Since many species, notably kelp flies and beetles, are very motile, each quadrant was initially enclosed with a plastic tank, sprayed with insecticide and left for 10 minutes, whereafter kelp and sand to a depth of 15cm were transferred to plastic bags. Sandpiles from each zone were pooled and the fauna identified to species, counted and oven dried at $60^{0}C$.

2.3 Meiofauna

Once every three months, four random sand cores were extracted from each zone using a stainless steel corer 30cm in length and $10cm^2$ in cross section to depths of 30cm and 60cm. It was not considered necessary to sample beyond this depth as Koop and Griffiths (1981) found that 97% of the meiofauna associated with a nearby wrack bed at Kommetjie was concentrated in the upper 60cm. A 200ml subsample was removed from the pooled cores and fixed in 5% formalin. Animals were separated from the sand in a modified Oostenbrink apparatus (Fricke 1979), stained with rose bengal and counted under a dissecting microscope, a distinction being made between the major taxonomic groups. Counts were increased by 10% to account for extraction loss (Fricke 1979). Biomass for a taxon was determined by placing a hundred representative individuals on each of three silicon glass cover slips which were oven-dried at $60^{0}C$ to constant weight. The mean individual dry mass was used to convert numbers to biomass.

2.4 Bacteria

Bacterial densities were established quarterly from four random sand cores extracted at 30cm depth intervals to the water table in each zone. From the cores, which were mixed for a sampling site, a 10ml subsample was preserved in 10ml of 10% formalin in sterile seawater. Bacteria were firstly removed from sand grains by shaking the samples in a DAWE Sonicleaner type 6442A, and then stained with acridine orange and counted under an epifluorescent microscope (Hobbie et al. 1977; Linley et al. 1981). Bacterial densities were calculated using the formula in Mazure (1978). The proportion of rods to cocci and the dimensions of these cells were determined from scanning electron micrographs. Volume was converted to wet weight assuming a specific gravity of 1,1 and wet weight to dry weight using a ratio of 0,23 (Luria 1960).

3. RESULTS AND DISCUSSION

3.1 Kelp deposition

In attempting to determine the quantity of kelp cast ashore, an estimate of turnover rate is required. Koop and Field (1980) and Koop et al. (1981a) estimated an eight day cycle of replacement in which period approximately 80% of the kelp present passed through the grazer and microheterotrophic pathways. Although an initial rapid loss in kelp mass was also observed by Griffiths and Stenton-Dozey (1981), total degradation was only completed after two weeks. It is therefore believed that the total replacement of kelp has a fourteen-day cycle, coinciding with spring tides and this has been used to estimate the quantity of kelp cast ashore annually.

Maximal kelp deposition occurred in winter (Table 1), a feature common along the Cape west coast