Bayed A. (ed.). Sandy beaches and coastal zone management – Proceedings of the Fifth International Symposium on Sandy Beaches, 19th-23rd October 2009, Rabat, Morocco
Travaux de l'Institut Scientifique, Rabat, série générale, 2011, n°6, 105-106.

Macrobenthic trophodynamics of two South African pocket beaches: A not-so-simple perspective

Karien BEZUIDENHOUT [*1], Tris H. WOOLDRIDGE [1] & Dave S. SCHOEMAN [2]

[1] *Nelson Mandela Metropolitan University, Zoology Department, PO Box 77000, Summerstrand South Campus, Port Elizabeth 6031, South Africa*
[2] *University of Ulster, School of Environmental Sciences, Coleraine, Northern Ireland*

Sandy beach food webs are generally considered short and simple, with no or limited biological interactions occurring within the macrobenthic community. Beaches can range from self-sustaining ecosystems to subsidised interfaces. While some aspects of food webs have been described for sandy beaches, a number of questions remain. The importance of trophic linkages between sandy beaches and other ecosystems, in particular estuaries, have not been assessed in great detail. Food webs and the trophodynamics of pocket beaches similarly are not well understood.

The fossorial nature of sandy beach macroinfauna makes it difficult to study the feeding behaviour of these animals in their natural environment. Stable isotope analysis has proved to be a useful tool in assessing the feeding behaviour of animals. Stable isotope analysis is particularly useful to identify the food sources assimilated by an organism, as opposed to the food simply ingested. The principle underlying stable isotope theory is that there is a predictable stepwise increase (isotopic enrichment) in the heavy-to-light isotope ratio of an element (e.g. ^{13}C:^{12}C, ^{15}N:^{14}N) in consumer tissues relative to that of their food sources.

The aim of this communication was to assess the trophodynamics of macroinfaunal beach communities on two pocket beaches in a warm-temperate / subtropical transition zone, adjacent to a mangrove estuary. This was done by means of stable C and N isotope analyses.

The study area was located along the East Coast of South Africa, in the warm temperate / subtropical biogeographical transition zone. Sampling was conducted on two sandy beaches separated by a 500 m-long rocky promontory. Both beaches were associated with estuaries, the one being a temporarily open-closed system, and the other a permanently open mangrove estuary. Sampling was conducted over two years, and included two summers and one winter sampling event. The diets of individual species were determined using the IsoSource mixing model. A range of possible food sources were collected. These included estuarine and terrestrial sources (mangrove leaves; C_3 dune and marsh vegetation; C_4 grasses; eelgrass (*Zostera capensis*)) and marine sources (particular organic matter (POM; including phytoplankton and debris); macroalgae; carrion (fish, cnidarians); intertidal sediment organic matter). A total of 17 macrobenthic species were collected.

Based on the overlap between isotope signatures (Fig. 1) and using the IsoSource mixing model, it was determined that mangrove material and other C_3 sources contributed relatively little to macrofaunal diets. Marine sources and even other macroinfauna were the most important contributors to macroinfaunal diets. There was evidence for predation within the community, with whelks (*Bullia rhodostoma*) possibly preying on other macroinfauna. There was also a large degree of isotopic overlap among polychaetes, which could indicate the possibility of intraguild feeding in this group. These biological interactions are not generally associated with beach macrobenthic communities. Omnivory (feeding on more than one trophic level), has been shown to have either a stabilising or destabilising effect on communities. Intraguild feeding - which is the combination of predation and omnivory - is a form of competition.

Based on the most reasonable theoretical isotopic enrichment, two consumer trophic levels were identified, with a third, intermediate level, which indicated omnivory. These consumer trophic levels, together with the primary producers, and another one or two vertebrate trophic levels (surf zone fish and birds) amounted to about five trophic levels for the sandy beach ecosystem (where the ecosystem boundaries are the EHTM and the breaker point). The food webs of the two pocket beaches in the present study were longer than the global average (across various ecosystem

* Corresponding author
E-mail address: Karien.Bezuidenhout@nmmu.ac.za

types) of three to four trophic levels. Short food webs are generally associated with simple, dynamic or disturbed environments.

The present study demonstrated that the sandy beach food webs of pocket beaches are probably more complex than previously thought, with some evidence for biological interactions such as omnivory, predation and even possibly intraguild feeding and competition. Sandy beach food webs appear to be no simpler than the food webs of other community types, even on a global scale. The extent of these interactions and its importance in structuring pocket beach communities need to be assessed.

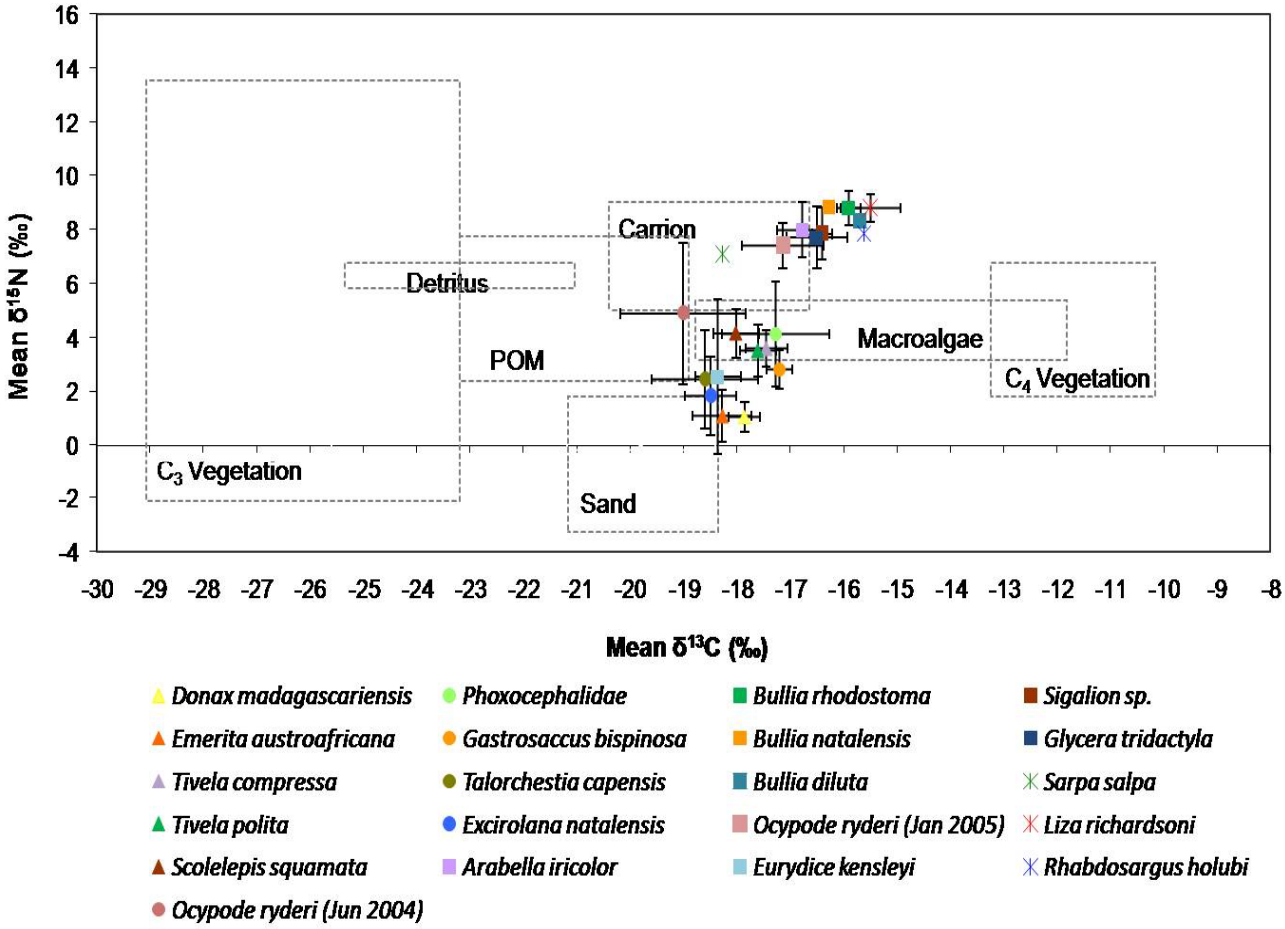

Figure 1: Mean stable isotope signatures of macrofauna and their potential food sources (± 1SD). The isotopic ranges of primary producers and other food sources are indicated with dashed squared. Macrofauna: Δ = suspension feeders; o = generalist feeders; □ = carnivorous feeders; other symbols = fish.