THE ROLE OF SANDHOPPER (*TALITRUS SALTATOR*, MONTAGU 1808) IN SEAWEED DISINTEGRATION IN POLISH COASTAL SANDY BEACH SYSTEM

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INTRODUCTION

The supralittoral macrofauna can reach a considerable biomass and, in temperate areas, is usually dominated by talitrid amphipods. Sandhoppers are generally considered to be primary colonisers of newly stranded wrack and often dominate the supralittoral fauna of Polish beaches with a moderate macrodebris input (Węsławski et al. 2000a, b, c). Although stranded wrack material may form a large proportion of the diet of many supralittoral fauna, there is, however, little evidence for the direct contribution of these animals to wrack breakdown (Jędrzejczak 1999, 2002a, b, c). Once very common along Polish coast, today sandhopper occurs on isolated localities only, avoiding the most visited tourist places. Environmental change, food limitation, and tourism are among the possible factors that have a negative impact on sandhopper occurrence, as demonstrated in a research made in Poland (Węsławski et al. 2000a, b) on the Hel Small Beach and the Sopot Beach. Together with their surf zones, these beaches are ideal recreational areas and a very popular holiday destination in Poland (Fig.1). Recently, however, sandhopper disappeared from these places previously occupied.

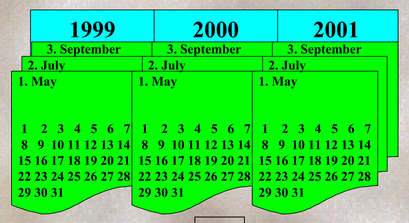


Fig.6

Following the litterbag procedure adopted previously (Jędrzejczak 1999), the study, modified to local conditions, was continued (Jędrzejczak 2002a,b,c). Litterbags, 225 x 105 mm in size, were made from fine nylon mesh with either 0.5-mm (Fig.4a, b) or 48-µm apertures (Fig.4c, d), designed to exclude the beach macro- and meiofauna, respectively. Litterbags of a coarser mesh size were produced from larger plastic-coated steel mesh, 235 x 120 mm with 12 mm wide openings (Fig.4e), and filled with wrack. The latter bags were designed to allow all of the supralittoral fauna access to the enclosed wrack material. Each fine-mesh litterbag was separately enclosed inside a coarse-mesh litterbag. Fresh *Zostera* was collected, blotted dry, and 60-g wet weight portions of leaves were placed within the bags.

Simultaneously, the Barber's traps (6 items) were employed to catch epigeic invertebrates on the beach (Fig.5a - side view, 5b - view from above). Barber's samples were, however, retrieved 1, 3, 6, 9, 12, 15, 18, 21, 24 and 27 days after start.

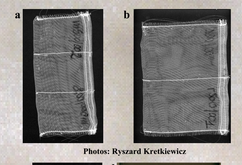


Fig.4

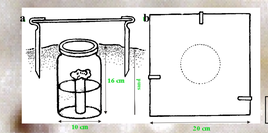


Fig.5

The associated fauna was retained by enclosing each bag within a 30 x 30-cm plastic container. Insecticide was then sprayed through a hole into the container and, after c. 5 min, the litterbag and any visible fauna transferred to a plastic bag. An area of sand 30 x 30 cm beneath the litterbag was excavated to a depth of 10 cm. This sand was passed through a 1-mm mesh sieve to recover the burrowing specimens of macrofauna and through a 48-m mesh sieve to recover the meiofauna.

MATERIAL AND METHODS

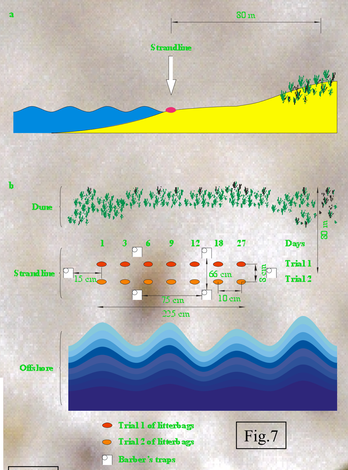


Fig.7

Two parallel experimental trials were done in May, July and September during a three-year study 1999/2001 (Fig.6). Each trial ran for 27 days and was set up on the strandline (Fig.7a - beach-dune profile, 7b - view from above). Bags of each mesh size were randomly positioned in areas around the driftline from which existing wrack had been removed. Each bag was then lightly covered with sand. Litterbags were sampled at random 1, 3, 6, 9, 12, 18 and 27 days post-placement, not in a spatially consecutive way. 1260 litterbags were used in the all experimental studies (3 years x 3 seasons x 4 mesh fractions in 2 trials x 7 samples x 5 replicates).

FIELD STUDY

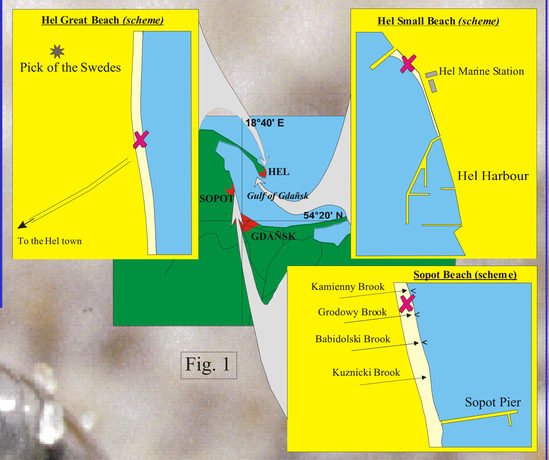


Fig. 1

The study was carried out on the northern coast of Poland on the Hel Great Beach (Fig.1) at the end of the Hel Peninsula (54 36'N, 18 49'E; Fig.2). The beach is situated in a former restricted military area of the Marine Landscape Park, where human impact is still relatively low. It was selected as an example of a relatively undisturbed Polish beach (Fig.3). *T. saltator* occurs in all zones of the beach in average densities of 30-60 indm^{-2}; these rise to over 360 indm^{-2} beneath debris and wrack at the strandline (Węsławski *et al.*. 2000a).

Fig. 2

Fig. 3

AIM AND HIPOTHESES

The responses of major macrofaunal taxa with *Talitrus saltator* assemblage in particular to the stranded decaying leaf litter of the seagrass *Zostera marina* were investigated through a field colonisation experiment. The null hypothesis was that the sandhoppers might contribute greatly to the breakdown of stranded *Z. marina* tissue in Polish coastal sandy beach system as a result of their own feeding activity and through the spread of microorganisms, and so accelerate and spread the wrack decay.

CONCLUSIONS

Amphipods, herbivore beetles and seaweed flies were attracted to fresh deposits, on which they feed and/or lay eggs, and these subsequently attracted predatory species (Staphylinidae, Coccinellidae, Carabidae; Fig.13). However, major macrofaunal wrack consumers, including *T. saltator* and Coleoptera, did not affect the rate of seagrass disintegration.

The grazing of amphipods and other detritivores may accelerate the decomposition of vascular plant material by the mechanical action of tissue fragmentation, or alternatively, by the selective grazing of the microbiota, which leads to a general increase in the community metabolism through the excretion of nitrogen-rich materials enhancing microbial growth.

The succession from macro- to meiofauna is the principal feature of the changes in the community (Fig.13). Meiofaunal assemblages played an important part in the colonisation of very old wrack. It was probable that the material is more readily available to microbial decomposers and does not require the mechanical and enzymatic action of macroconsumers to facilitate saprophytic decay.

Despite the rather low contribution to the productivity of the beach as a whole, the macrofauna (and *T. saltator* in particular) may be of disproportionate importance in the initial process of fixing particulate organic material and making it available for mineralisation by bacteria in the interstitial environment.

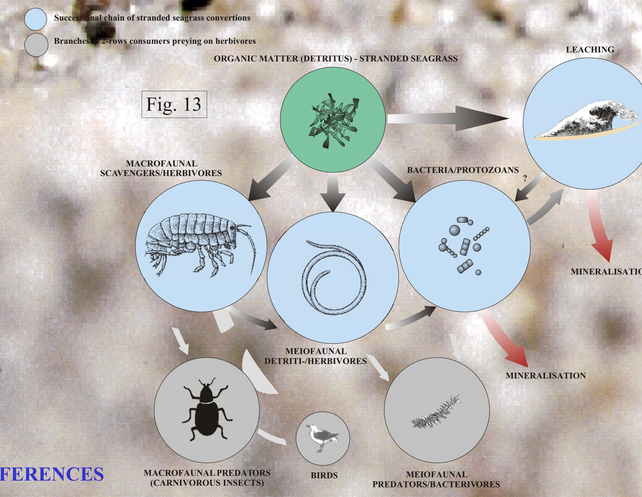


Fig. 13

RESULTS

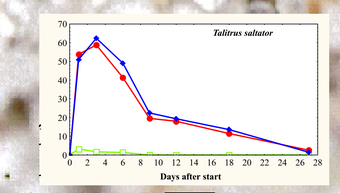


Fig.8

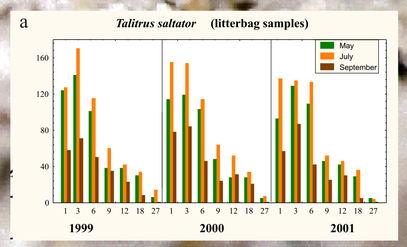
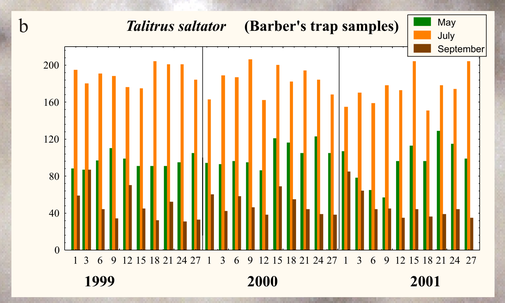


Fig.9



The highest densities of most macrofaunal animals were found within 3 days of the bags being placed on site (Fig.8, 10, and 11). Examination of the wrack tissue suggested that *Talitrus saltator* was likely to be the most important of the macrofaunal consumers. Circular holes with diameters of between 1 and 5 mm were found on leaves recovered from the coarse-mesh bags. In the 0.5-mm and 48-µm mesh sieves numbers of *Talitrus* were lower and no evidence was found of feeding. Amphipod abundance in the samples of both trials varied throughout the experiment but was greatest within 3 days of the bags being deployed (Fig.8). Both in the litterbags (Fig.9a) and Barber's samples (Fig.9b), the highest abundance of *T. saltator* was noted in July, the lowest in September. High positive correlation was found between abundance of *T. saltator* and wrack mounds, parallel to the shoreline (Fig.12).

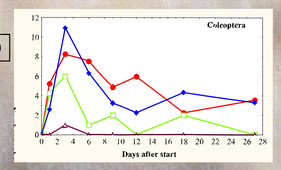


Fig.10

Fig.12

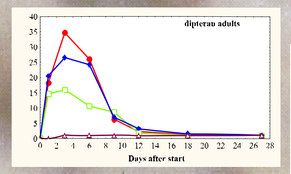
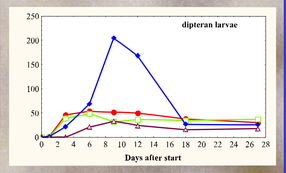


Fig. 11



The mean number of beach macrofauna per litterbag sample (Y-axis):
coarse mesh bags in the first trial; coarse mesh bags in the second trial; 0.5-mm mesh bags in the first trial; 48-µm mesh bags in the second trial.

ACKNOWLEDGEMENTS

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