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Macrofaunal Community Pattern in an Intertidal Sandflat: Effects of Organic Enrichment Via Biodeposition by Mussel Beds. First Results

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With 5 Text-Figures

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The distribution of macrofauna in and around mussel beds (*Mytilus edulis*) in an intertidal sandflat was studied in the framework of the ELAWAT Ecosystem Research Program of the Wadden Sea (BERGFELD 1996). The study focused on the impact of biodeposition of organic material (faeces and pseudofaeces) produced by mussel beds on macrofaunal community patterns.

Sampling took place on the „Swinnplate", a sandflat located in the backbarrier tidal flats of the East Frisian island of Spiekeroog in October 1994. A sample grid of 27 stations was used covering an overall area of approximately 1.5 km² including beds of *Mytilus edulis*, populations of *Lanice conchilega* and sandflats partly inhabited by *Arenicola marina* (Fig.1; cf. HERTWECK 1995).

A total of 63 macrofaunal species were detected, of which polychaetes were dominant with 38 species. Molluscs and crustaceens contributed 11 and 10 species, respectively.

Erosion of biodeposits by the tidal currents caused a gradient of decreasing organic enrichment (TOC) from biodeposited muds in mussel beds across adjacent *L. conchilega* populations to sandflats occupied by *A. marina* (Figs. 2–3). Dense lawns of *L. conchilega* stabilized the biodeposits.

Univariate and multivariate data analyses (MDS, SIMPER; Primer program package, PLYMOUTH MARINE LABORATORY 1996) showed distinct macrofaunal communities which differed between the habitats. In the MDS-plot (Fig. 2) stations in the sandflats are clearly seperated from the group of stations in the *Mytilus-Lanice* habitat. *Mytilus* beds and dense *Lanice* populations form a subgroup of stations, whereas the stations in the sparse *Lanice* population indicate their transitory character towards the sandflats.

The *Mytilus-Lanice*-habitat showed the highest mean species numbers (3–13 spec./20 cm²), mean abundances (33–1534 Ind./0.01 m²) and biomasses (195–25970 mg AFDW/0.01 m²) (Figs. 3–4). The macrofauna was dominated by oligochaetes and subsurface deposit-feeding polychaetes such as *Tharyx killariensis*, *Heteromastus filiformis* and *Capitella capitata* (Fig. 5), which benefited from the organic enrichment because of the higher food availability (particulate organic matter, microbial biomass). Due to their opportunistic life strategy (e.g., small body size, fast reproduction, H_2S-tolerance) these species withstood the permanent disturbance by biodeposition. A spatfall of *Macoma balthica* caused the dominance of this tellinid. A limitation for the macrofauna seemed to be reached in the center of mussel beds where biodeposition – indicated by TOC – is highest (Fig. 4; see also DITTMANN 1987, 1990; KRÖNCKE 1996).

In contrast, the sandflats were only poorly populated with mean species numbers below 5 spec./20 cm², mean abundances and total biomass rarely exeeding 100 Ind./0,01 m² and 100 mg AFDW/0,01 m², respectively (Fig. 3). The characteristic species were mainly *Scoloplos armiger* and *Spio martinensis*

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(Fig. 5). The latter species is regarded as new for the German Wadden Sea, probably overlook in the past, because of its high taxonomic similarity to *Spio filicornis* (BERGFELD 1996). *S. armiger* and *S. martinensis/filicornis* are well adapted to high sediment mobility near the tidal channels (ZÜHLKE & REISE 1994).

The results indicate that biodeposits effect the macrofaunal communities of sandflats by varying the amount of organic matter in the sediments. In addition, they support the suggestion that *Mytilus-Lanice* biosedimentary systems may play an important role in the ecosystem, compensating (partly) the long-term loss of mudflats observed in the Wadden Sea (REISE et al. 1994; FLEMMING & DAVIS 1994).

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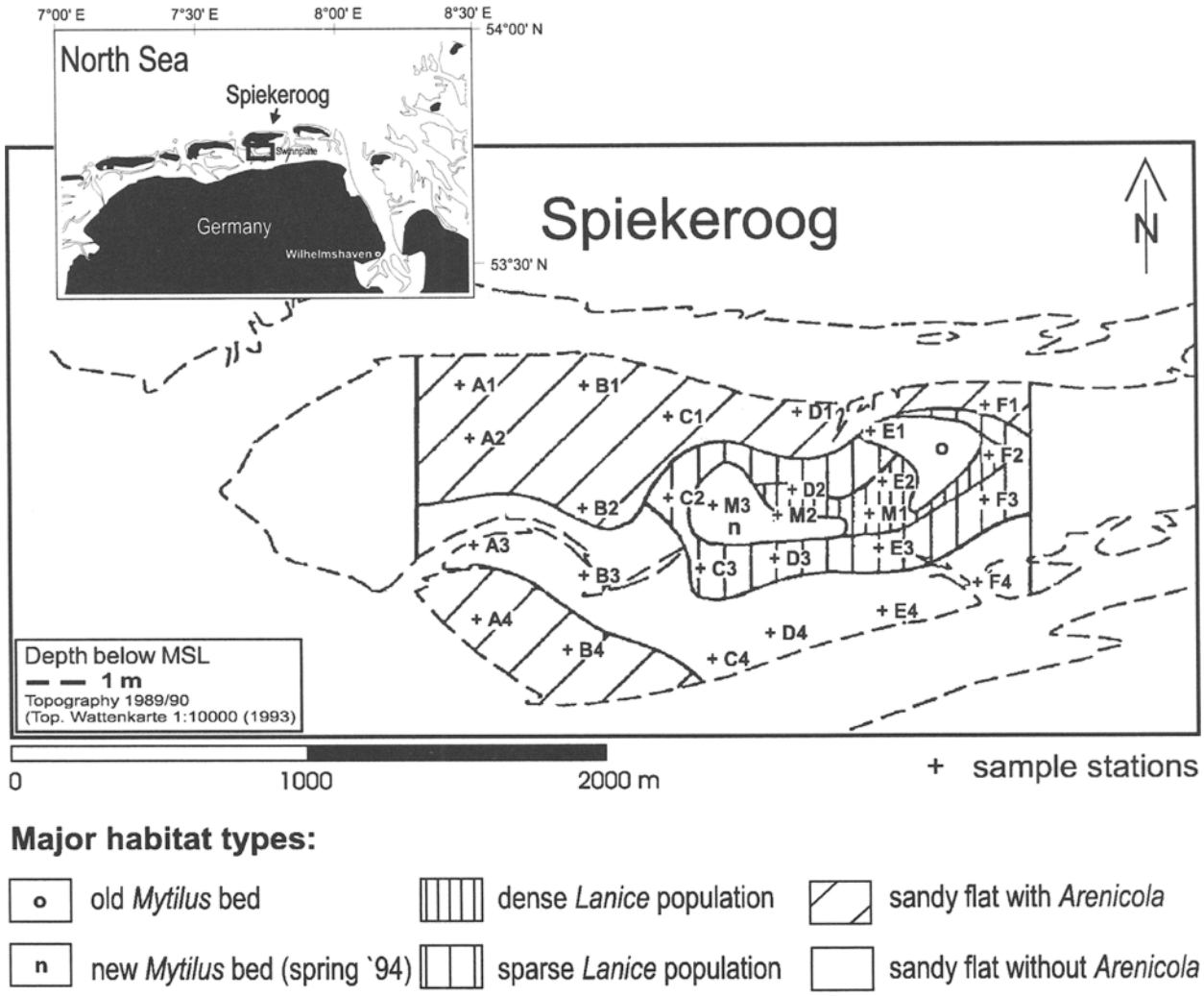

Fig. 1. The area of investigation located in the backbarrier environment of the East Frisian island of Spiekeroog, southern North Sea, showing major habitat types on the Swinnplate, Oct. 1994.

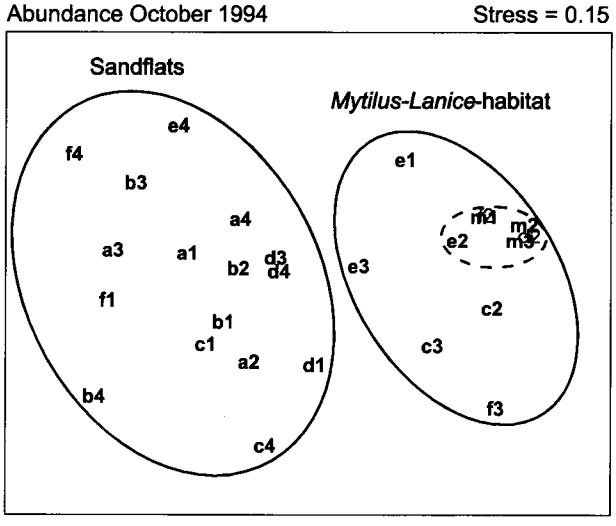

Fig. 2. MDS-plot comparing mean abundances of all 27 Swinnplate stations using the Bray-Curtis similarity of the $\log^2$-transformed data. – Solid circles indicate the communities of the sandflats and of the *Mytilus-Lanice* habitat. Broken circle marks the group of stations in the *Mytilus* beds and the dense *Lanice* population.

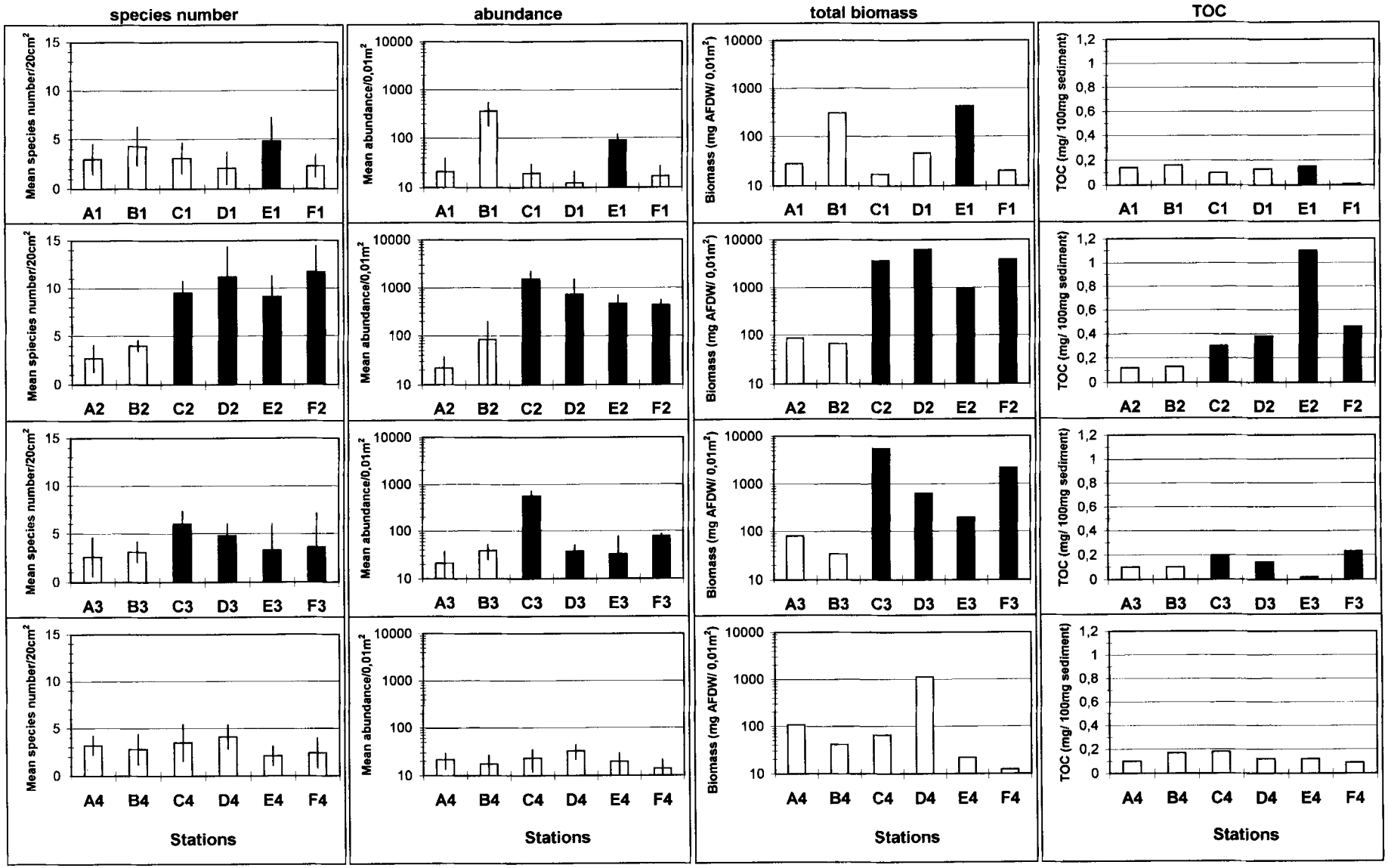

Fig. 3. Mean species number, mean abundance, total biomass and total organic content of the surface sediment (0.5–1.0 cm) on the Swinnplate, Oct. 1994. – Dark bars indicate the stations in the *Mytilus-Lanice* habitat, white bars the sandflat stations.

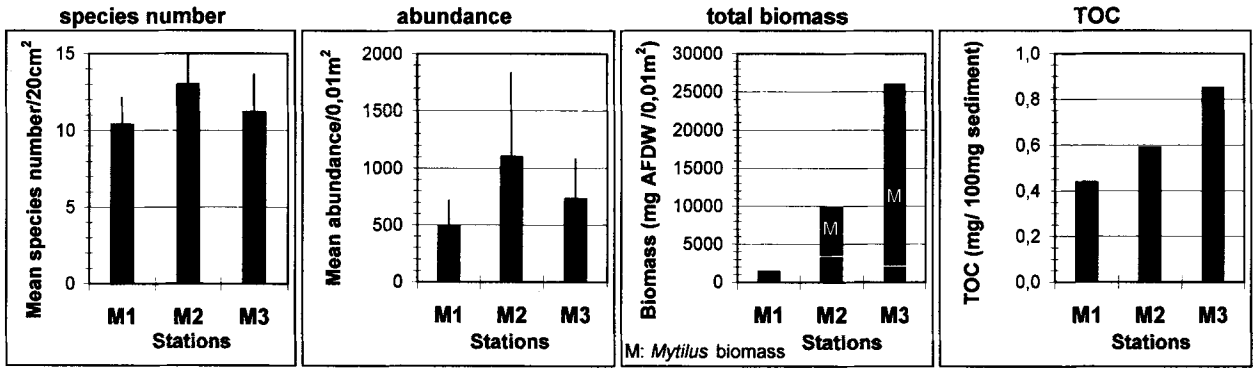

Fig. 4. Mean species number, mean abundance, total biomass and total organic content of the surface sediment (0.5–1.0 cm) along three transect stations from the center of a new *Mytilus* bed (M3) to its edge (M2) and to the adjacent *Lanice*-habitat (M1), Oct. 1994.

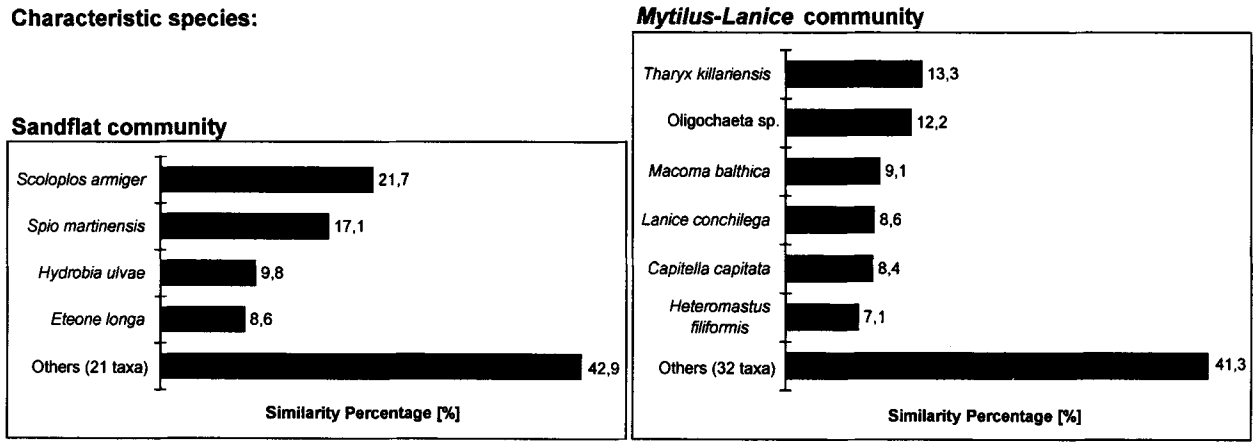

Fig. 5. Characteristic species of the sandflat community and the *Mytilus-Lanice* community on the Swinnplate, Oct. 1994. – Similarity percentage calculated by SIMPER, Primer Program Package.