

13.3 INTERTIDAL ECOLOGY

13.3.1 Overview of Intertidal Ecology from Existing Data Sources

The distribution of benthic fauna in the estuary has been described by Brazier *et al.* (1998). They recorded that in the outer estuary, areas of hard substrata are formed by the North and South Piers and a sandstone bedrock platform, known as Black Middens. These support algal dominated communities which are typical of areas of hard substrata in mid to lower estuarine zones. The South Pier is constructed of stone blocks alongside which runs a strip of coarse sediment. The upper eulittoral zone of the South Pier is characterised by the spiral wrack (*Fucus spiralis*) and the black lichen *Verrucaria maura*. On the mid-eulittoral the bladder wrack *Fucus vesiculosus* occurs, which is replaced by the serrated wrack *Fucus serratus* further down the shore. Adjacent to the pier is a stretch of highly mobile poorly sorted sand. This is characterised by the polychaetes *Anaitides maculata*, *Spio martinensis* and *Magelona mirabilis*.

The North pier is more sheltered than the south and contains a higher recorded number of species per habitat. Rock pools are found in the lower eulittoral at Priors Haven adjacent to the North Pier with serrated wrack *Fucus serratus*, kelp *Laminaria digitata*, sea lettuce *Ulva* spp. and a limited fauna. The lower eulittoral between the estuary mouth and mussel scarp is characterised by the red filamentous algae *Audouinella* spp. Sandflats are found at Priors Haven and Mussel Scarp which are composed of stable fine sand with the polychaetes *Eteone longa*, *Anaitides mucosa*, *Scoloplos armiger*, *S. martinensis*, *Chaetozone setosa* and *Capitella capitata*. In addition, the bivalves *Angulus tenuis* and *Fabulina fabula* are found on the lower shore at Priors Haven.

Approximately 5km upstream of the river mouth is situated the River Don, which is a small river which flows into the River Tyne just to the east of the proposed tunnel site. The wildlife and habitats of the river corridor have been described by Young (Appendix 15). At low tide, several areas of mud flat are exposed on the banks of the river Don. The banks are steeply sloping and have mud and cobbles on which several algal species attach including the bladder wrack *Fucus vesiculosus* and the green alga *Enteromorpha*. Lining the mudflats is a narrow fringe of saltmarsh.

Towards the upper reaches of the Tyne estuary, Brazier *et al.* (1998) recorded that the shore comprises silted cobbles and rubble characterised by algal communities with an impoverished faunal community interspersed with fluid anoxic mud. The seaweeds bladder wrack *Fucus vesiculosus*, green alga *Enteromorpha* and sparse barnacles *Semibalanus balanoides* occur on the hard substrata as far as Newburn. The anoxic mud is colonised by the polychaete *Hediste diversicolor* and oligochaetes *Heterochaeta costatus*, *Tubificoides benedii* and *T. pseudogaster*.

One nationally scarce marine species is recorded as occurring in the area. The sea squirt *Molgula oculata* has been recorded off Sleaton Sluice, Tynemouth. The sea squirt is found partially protruding in sublittoral sediments (Barne *et al.*, 1995).

13.3.2 Results of Intertidal Survey

Multivariate analysis of the sample data was carried out using the PRIMER (Plymouth Routines in Multivariate Ecological Research) computer software package. Using this package a Bray–Curtis similarity index was calculated which provides a measure of the similarity of the faunal composition of different samples. By representing the similarity index graphically either in the form of a dendrogram (Figure *13.4.2) or a multi-dimensional scaling (MDS) plot (Figure *13.4.3), it is possible to distinguish groups of samples which are similar

in faunal composition. From Figure *13.4.2 it is possible to distinguish the following three groups of samples which have relatively similar compositions of benthic invertebrates:

Group A: This community is found at Tynemouth, on the north shore of the River Tyne entrance, mid way between Mussel Scarp and Black Middens. The sediment type in this area is fine sand with a small proportion of mud. The community is dominated by the polychaete worms *Spio martinensis*, *Scoloplos armiger*, *Pygospio elegans* and *Nephtys hombergii*. A few individuals of species which are characteristic of sandy environments are also present such as *Lanice conchilega*. A mean wet weight biomass of 26g/m² and a mean number of species of 7.11 per 0.1m² over the three sampling stations was recorded.

Group B: This community is essentially composed of three different sub-communities, all of which are associated with muddier environments than group A and C and have a higher abundance of opportunistic polychaetes and oligochaetes, such as *Capitella capitata* and *Tubificoides benedii*.

The two sampling sites in the vicinity of the works, TC5 and JS1 comprise sandy mud and muddy sand respectively. The communities at both sites are dominated by polychaete worms with a small molluscan component. This species composition is typical of muddy shores subject to variable salinity. Both sites have a particularly high abundance of *Capitella capitata*, for example a maximum abundance of 60,100 individuals per m² was recorded at the site TC5, where it made up over 87% of the number of individuals in each replicate. *C.capitata* is typical of sites exposed to high levels of organic pollution, as might be expected on the Tyne. A high level of biomass was observed at this site with a mean of 5151.7 g/m².

The samples from the eastern transect at Tynemouth (TM4 to TM6) had a variety of sediment types from muddy sand to sandy gravel. The community of this transect was dominated by the oligochaetes *T.benedii* and *T.pseudogaster*, with the polychaete *C.capitata*. The level of biomass at these sites was lower than at Jarrow Slake with a mean of 88.8 g/m². The mean number of species at these sites is 16.3.

Group C: This community is found in the intertidal zone at South Shields, which lies on the south bank of the River Tyne entrance. The community at this site comprises polychaetes and crustaceans only, with far fewer species than found elsewhere. Spionidea larvae are very common, as is the amphipod *Atylus swammerdamei*, which is often common on sand on the lower shore (Hayward & Ryland, 1995). The sediment in this area comprised medium sand. Biomass at these sites is much lower than found elsewhere with a mean of only 4.23 g/m². The species richness is also low with a mean number of species at each sampling station of 4.

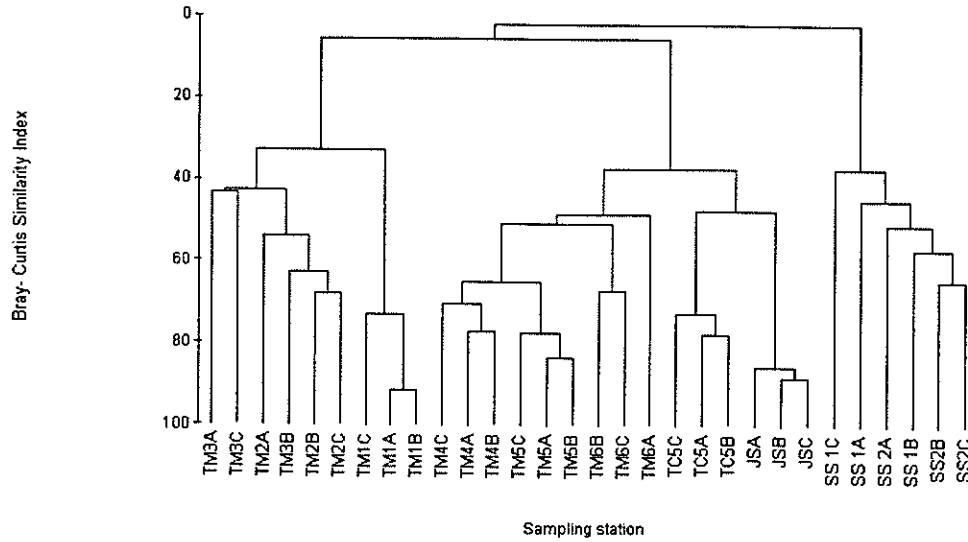


Figure 13.3.2 Dendrogram of Bray-Curtis similarity index ($\log(x+1)$) for intertidal sampling stations on the River Tyne. TM= Tynemouth; TC= Tyne Crossing; JS= Jarrow Slake; SS= South Shields.

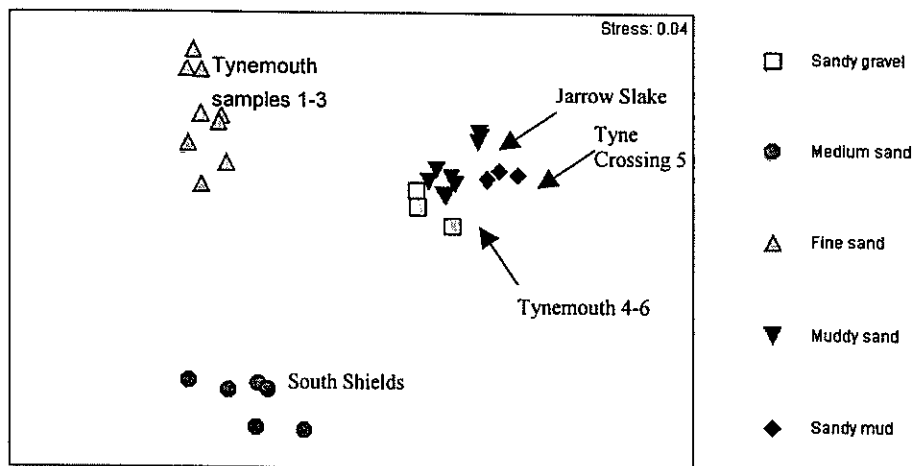


Figure 13.3.3 Multi-dimensional scaling plot of Bray-Curtis similarity index ($\log(x+1)$) for intertidal sampling stations on the River Tyne, showing sediment type present at each site.

At each sampling station a sediment sample was taken for particle size analysis. The particle size distribution at each sampling station is presented in Figure 13.4.4 and the type of sediment found at each sampling station plotted on Figure 13.4.3. Figure 13.4.3, shows that a different type of sediment is associated with each community. This suggests that sediment type is a causative factor in determining the type of community present at each site.

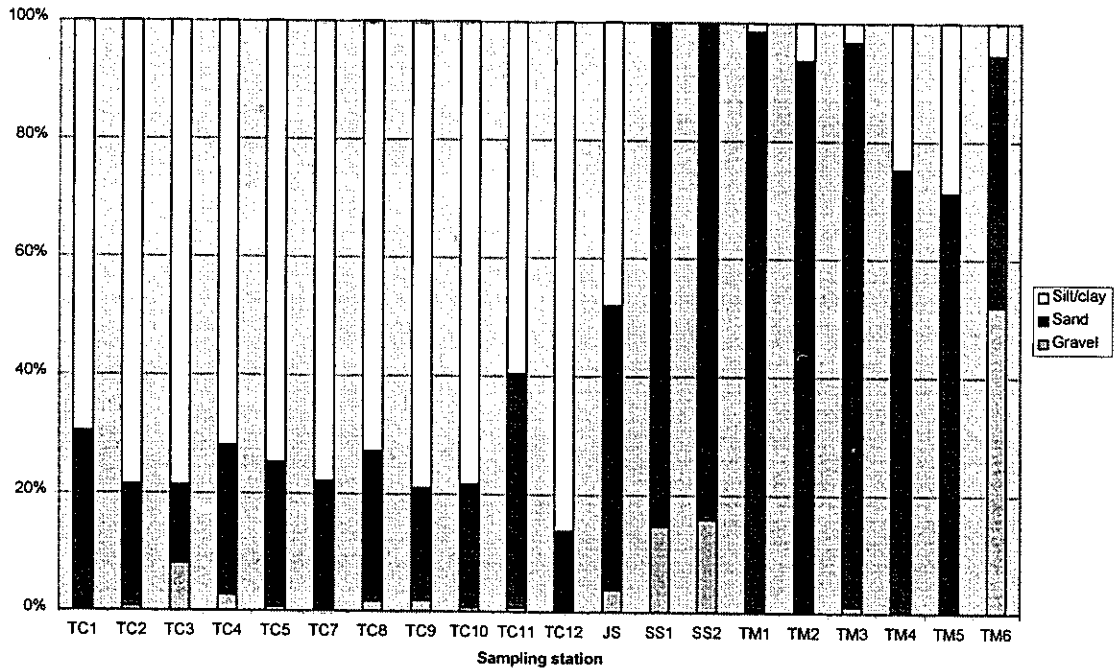


Figure 13.3.4 Particle size distribution of sediment from intertidal and subtidal sampling stations on the River Tyne.

Calculation of a Shannon-Weiner index for each site allows comparison of the biological diversity of the different sites and can be used to provide some indication of the ‘health’ of a community (Boaden & Seed, 1985). The Shannon-Weiner index takes account of the number of species in a sample and the evenness with which they are represented. The higher the value the more diverse the site (i.e. it has more species and/or they are more evenly represented). Analysis of the Shannon-Weiner diversity at the intertidal sampling stations revealed that Jarrow Slake had the lowest diversity index of all the intertidal sites (0.21) followed by TC5 (0.50). This is due to the dominance of the samples by *C.capitata*. The Shannon-Weiner diversity index of the remaining intertidal sites varied between 1 and 2 (see Figure 13.4.5).