STRUCTURE & FUNCTIONING – CHARACTERIZATION AND IMPORTANCE FOR MANAGEMENT

HABITAT: Intertidal mud flats

Severn Estuary mudflats. Image: Kathryn Birch/CCW.

Mudflats that include gravel may be particularly rich in species. Tosnos Point, Salcombe Harbour. Image: Keith Hiscock.

Key: Very High ✓✓✓✓, High ✓✓✓ , Low ✓✓, Very Low ✓ Not Relevant NR, Not possible to manage NP

	Importance to biological community	Likelihood of change	Management priority
PHYSICAL & CHEMICAL PROPERTIES & PROCESSES			
Wave action	✓✓✓✓	✓	NP*
Tidal flow strength	✓✓✓	✓	NP*
Immersion / emersion	✓✓✓✓	✓	NP*
Salinity	✓✓✓✓	✓	NP*
Supply of nutrients	✓✓✓✓	✓✓✓	✓✓✓
Supply of oxygen to the sediment (both through bioturbation / burrows and the availability of oxygen in the water column)	✓✓✓✓	✓✓✓	✓✓✓
Availability of suitable substratum	✓✓✓✓	✓✓	✓
Light	✓✓✓	✓✓	✓✓
Contaminants	✓✓✓	✓✓✓	✓✓✓
Sedimentation	✓✓✓	✓✓✓	✓✓✓
STRUCTURE	✓✓✓✓		
Physical (sediment size, degree of sorting)	✓✓✓✓	✓✓	✓✓
Biological (burrows, casts)	✓✓✓✓	✓✓	✓✓
Biological - the presence / absence of particular species	✓✓✓	✓✓	✓✓
FUNCTIONING (AS PROCESSES)			
Food supply remote (suspended particles, detritus, dissolved organic matter)	✓✓✓✓	✓✓	✓✓
Food supply local (predation, deposit feeding)	✓✓✓✓	✓✓	✓✓
Primary productivity	✓✓✓	✓✓	✓✓
Connectivity (larval dispersal & recruitment)	✓✓✓	✓✓	✓✓

Citation: Hiscock, K. & Marshall, C. 2006. Dossier on Ecosystem Structure and Functioning – Characterization and Importance for Management: Intertidal mudflats. In: Hiscock, K., Marshall, C., Sewell, J. & Hawkins, S.J., 2006. The structure and functioning of marine ecosystems: an environmental protection and management perspective. Report to English Nature from the Marine Life Information Network (MarLIN). Plymouth: Marine Biological Association of the UK. [English Nature Research Reports, ENRR No. 699.]

- Intertidal mudflats are heavily influenced by biological, chemical *and* physical processes including predation, nutrient cycling and tidal movement respectively.
- Many processes in and on the mudflats are strictly influenced by the state of the tide. For example, predation by fish will occur at high tide whilst predation by birds will occur at low tide.
- Much of the infauna are deposit feeders, taking advantage of the high levels of organic material in the sediment. Organic material is degraded by microorganisms and recycled.
- Due to high organic content of muds (which results in the presence of large microbial populations that use lots of oxygen) and the small and compact nature of the sediment particles, oxygen within the sediment is limited. The sediment profile can crudely be divided into an overlying oxygenated later at the top and a black anoxic layer underneath. This affects the distribution of infauna since many are restricted to the oxygenated layer although others penetrate deeper in irrigated burrows or extend their burrows upwards into the oxygenated layer there is a high oxygen demand within the sediment.
- Unlike rocky shores, which may experience huge fluctuations in salinity, pH and temperature over the course of the tidal cycle, the sediment in mudflats act as a buffer against these large changes and provide a relatively stable environment for the associated flora and fauna. The sediment is often relatively highly stable too, although the top layers may get removed depending on the height of the tide / wave action, and on the level of cohesion within the sediment.
- The loss of intertidal mudflats due to habitat reclamation and colonization by saltmarsh plants such as *Spartina anglica*, has led to the loss of this vast feeding are for many important wading and over-wintering birds.
- Large macroalgae are rare and generally restricted to pebbles and rocks on the mudflat. Filamentous algal mats, especially *Ulva* sp., may be common in summer months, especially as a result of high nutrient levels which can result in the 'suffocation' of the habitat. Unicellular algae can produce brown or green films on the surface of the mud.

The most likely change in the character of intertidal mudflats will be as a result of chemical factors, such as eutrophication (excess nutrient loading), oil pollution or synthetic chemical contamination. Consented sewage discharges (commonplace in many estuaries) have the potential to cause large changes in the levels of ammonia, pH and suspended material in the water column. Because the water column and sediment are so intrinsically linked, this can have a direct impact on the mudflats. The effluent has a high Biological Oxygen Demand (BOD), meaning that the work involved breaking down all the organic material within it is such that the organisms responsible would use high amounts of oxygen in the process. As a result, there would be less oxygen the water column available for exchange with the sediment. Furthermore, metals such as mercury, cadmium and lead can be found within the effluent. These metals, and others, bind strongly with the suspended sediment in the effluent and settle out, introducing the contaminants to the mudflats.

Citation: Hiscock, K. & Marshall, C. 2006. Dossier on Ecosystem Structure and Functioning – Characterization and Importance for Management: Intertidal mudflats. In: Hiscock, K., Marshall, C., Sewell, J. & Hawkins, S.J., 2006. The structure and functioning of marine ecosystems: an environmental protection and management perspective. Report to English Nature from the Marine Life Information Network (MarLIN). Plymouth: Marine Biological Association of the UK. [English Nature Research Reports, ENRR No. 699.]

NP* indicates that under normal conditions, these factors would not be manageable but, in extreme circumstance, such as the construction of tidal barrages, it is possible that they will change, leading to drastic and permanent changes in the community dynamics and functioning of the ecosystem.