Subtidal Soft Bottom Habitats

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Description and distribution

The most extensive subtidal habitat in South Australia is sedimentary, particularly soft sediments that range in depth from intertidal beaches to the lower limit of State waters. They range in particle size from coarse sands on exposed coasts to fine muds in and around mangroves. Subtidal soft sediments are extraordinarily rich in species that live in the bottom (infauna) and on the bottom (epifauna) with the majority of the diversity being invertebrates.

![Red mullet over sandy bottom with polychaete worm burrows.](photograph: Simon Bryars)

The infauna burrow below the sediment surface and include polychaete worms, clams, crabs, prawns, and smaller crustaceans, interstitial organisms that live between the sand grains (forams, copepods), and the tiny fauna, called meiofauna, that include tiny crustaceans, nematodes etc. Yet still smaller than this is the poorly known microfauna of bacteria and protists.

The epifauna live either attached to shell or other firm substrate, rooted in the sediment or are mobile on the bottom. They include ascidians, razor-shells, bryozoans, scallops, sponges, seapens, sea-stars, and crabs. In a survey of Gulf St Vincent and Investigator Strait, Shepherd & Sprigg (1976) described six distinct bottom epifaunal assemblages, including a razor-shell assemblage, an ascidian-scallop assemblage, a bryozoan assemblage, a deep seagrass assemblage, and sponge and hammer oyster assemblages, each of them covering 10s to 100s of square kilometres.

The abundance of the above groups can be extremely high, with polychaete worms, amphipods and tanaid crustaceans the most abundant (e.g. Sergeev et al. 1988; Loo & Drabsch 2008). For example, sediment samples from eastern Gulf St Vincent contained on average >2000 polychaete worms, and >2600 crustaceans, molluscs and nematodes per square metre (Loo & Drabsch 2008); even mobile sand contained >2600 organisms per square metre (Sergeev et al. 1988). The larger epifauna of soft sediments, e.g. razor-shells, hammer oysters, bryozoans, ascidians and sponges, form the structural base for complex bottom communities, creating significant firm habitats in places where rocky substratum is rare.

In places of strong current and deep sediment, as in parts of Backstairs Passage and upper Spencer Gulf, sand waves up to 2 m high can develop (For example see Figure 9), and these form a unique habitat, with an
unusual epifauna adapted to an unstable and highly mobile sediment. The epifauna of sand-wave region in upper Spencer Gulf comprised bryozoans, seapens, and ascidians (Shepherd 1983a).

![Figure 9. Megaripples near Louis Island in Thorny Passage in Spencer Gulf ~8m ~4m (DENR).](image)

**Function**

Soft sediment bottoms contain a rich infauna and epifauna, and the epifauna itself provides a substrate and habitat for a rich fauna. The epifauna also capture the productivity of the water column via its filter feeders, and so help retain the primary production of algae, seagrasses and mangroves within coastal waters. Together the benthic fauna provides an abundant food source for many fish and invertebrates, as well as being a nursery for some benthic species.

The organisms on the bottom are critically important as food for higher levels of the food web, as illustrated in (Figure ), which shows a simplified food web for Gulf waters. They also provide a refuge and breeding ground for mobile fauna, including fish (snapper and whiting etc) and large invertebrates. These organisms are also highly significant for maintaining stability of the bottom, and for the transfer of productivity of the water column to the benthos.

![Figure 10. Simplified food web of Gulf St Vincent, showing the contribution of infauna and epifauna to the food of species at higher levels of the food web (from Shepherd et al. 2008).](image)
Threats
Soft sediment habitats are vulnerable to any activities that disturb the seabed. These can result from urban and industrial development, and include dredging and dumping, storm-water run-off, sewage and industrial discharges, and trawling. The last activity, trawling, has caused major destructive changes in bottom habitats in both Spencer Gulf and Gulf St Vincent. In Spencer Gulf, Svane et al. (2008) described the destruction of epifauna e.g. sponge and hammer oyster beds, and in Gulf St Vincent and Investigator Strait, Tanner (2005) recorded the destruction of hammer oyster beds, bryozoan beds and seagrass (Heterozostera) beds over 100s of km². Trawling both physically removes fauna, and stirs up sediment which later settles on the bottom and smothers any surviving fauna. In the case of seagrass loss in Investigator Strait, the increased turbidity, together with physical damage, was sufficient to cause its demise.

Vulnerability
Several examples exist in the guls of South Australia, in which significant soft bottom communities, occur, and are thought to be unique.
These are:
1. Razor-fish assemblage
This habitat occurs in upper Gulf St Vincent at depths of >10 m north of about Black Point toward Port Wakefield over an area of ~250 km² (Shepherd & Sprigg 1976). The assemblage is dominated by razor-fish at densities of up to 10 per sq. metre, with abundant epizoic sponges, and a rich fauna on the bottom of echinoderms, hammer oysters, scallops, ascidians and crabs. The assemblage also occurs in upper Spencer Gulf, e.g. near Douglas Bank at depths of 5–15 m and at densities of up to10 per sq. metre (Shepherd 1983b). Elsewhere in upper Spencer Gulf razor-fish are common but at lower densities.
2. Hammer oyster beds
Beds of hammer oysters, once common in lower Gulf St Vincent, have disappeared due to prawn trawling (Tanner 2005), but still occur sometimes as isolated reefs in western upper Spencer Gulf, e.g. inshore from Middle Bank at a depth of 10–16 m and at densities of ~10 per sq. metre (Shepherd 1983b). Globally this kind of reef is considered a threatened habitat.
3. Ascidian-soft coral-bryozoan assemblage
Throughout upper Spencer Gulf rare ascidians (e.g. Sycozoa pedunculata), rare soft corals and gorgonians with tropical affinities (e.g. Virgularia mirabilis, Telescopium multiflora, Echinogorgia sp., Scyaltium sp.) occur as well as a number of other rare species of flatworm, nudibranch, and brittle-star (Shepherd 1983).
4. Bryozoan assemblages
Extensive bryozoan assemblages occurred in Gulf St Vincent, at depths of 15 m or more, but have largely disappeared as a result of prawn trawling (Tanner 2005). However, remnants may persist off Black Point in the upper Gulf, and also in deeper water in Investigator Strait at depths of 27–35 m in places of strong current where the rare button bryozoan, Luminites sp. and the more common Parmularia are dominant (Shepherd & Sprigg 1976).

Considerations for MPAs in South Australia
The unique assemblages of soft-bottom fauna described above in the upper Gulfs seem to have been preserved where prawn trawling has historically been excluded. Given the sensitivity of such assemblages to any kind of trawling, they should all be included in habitat-protection or sanctuary zones within the MPA network.
Conclusion

Soft bottom assemblages, notably within the Gulfs, contain a rich infauna and epifauna, and are functionally of great importance as they capture the productivity of the Gulfs and transfer it to the benthos. The benthos supports crustaceans of high economic significance e.g. prawns, blue swimmer crabs, and sand crabs, and also provide food for many exploited fish species e.g. whiting, snapper etc (Figure ). In addition, many rare species are present in these habitats and need to be conserved. It is important therefore to conserve examples in the MPA network.

References


