ENERGY SOURCES OF THE MUDFLATS OF ROEBUCK BAY AND THE EIGHTY MILE BEACH

At the Kimberley Society meeting of 6 October 2004, the audience heard from Dr Andrew Storey, an Adjunct Senior Lecturer in the School of Animal Biology at the University of Western Australia. His illustrated talk, which described the connections between the food and foraging birds on the mudflats to the south of Broome, revealed the intricate web of interactions that occur in that environment. Dr Storey's summary of the talk is presented below, with a list of material for further reading.

Roebuck Bay is one of approximately 20 locations worldwide characterised by extensive soft bottom intertidal mudflats supporting large numbers of migratory shorebirds. It is the foremost internationally important site for shorebirds in the Asia-Pacific flyway system, providing a key migratory stopover in spring and autumn, and is home for up to 150,000 birds in the non-breeding season. The ability of the bay to support large numbers of shorebirds, and to facilitate their annual migration, appears to relate to the particularly abundant and diverse food source residing in the mudflats.

Surveys of the mudflats have revealed a preliminary total in excess of 200 species of benthic invertebrates, indicative of a very rich food source for resident and migratory shorebirds. However, current knowledge of the benthic fauna is largely descriptive. An understanding of the food web of the mudflats, especially the main energy (*viz*. carbon) sources supporting the benthic invertebrate fauna will assist in the sustainable management of this system.

A preliminary study of the food web of the benthic fauna, using stable isotopes of carbon and nitrogen, has identified the main carbon sources assimilated by the invertebrate fauna to be mangroves and their detritus, near-shore planktonic algae and mud-dwelling unicellular micro-algae (diatoms). Of these sources, planktonic algae appear to act as the dominant carbon source assimilated by benthic invertebrates. Species with known feeding modes were used to track the carbon signatures of the different sources through the food web. Suspension feeders (i.e. barnacles, sponges, fan worm, and bivalves) reflected the carbon signature of planktonic algae (-10 to -18 del13C). Deposit feeders (i.e. crabs, mud skippers, bivalves, isopods, and sea cucumbers) showed a greater contribution from mud-dwelling unicellular algae (-5 to -10 del13C). And species known to consume mangrove leaves (i.e. mangrove snails) reflected the carbon signature of mangroves (-24 to -28 del13C).

Analyses also showed that the phytoplankton and filamentous algal sources from the bay had an elevated del15N signature (approx 6 del15N), which is usually indicative of nutrient enrichment. The source of this enrichment is unknown but could relate to naturally-enriched tropical waters, direct or diffuse nutrient inputs from the township of Broome, or enrichment from other sources such as pearl fisheries in the bay.

This initial study suggests that near-coastal plankton play an important role in supporting the benthic invertebrate fauna of the mudflats, although mud-dwelling unicellular algae and mangroves also play a role in providing energy. The primary sources supporting the food web need to be protected to ensure the sustainable management of this important ecosystem. Future work on food webs will determine carbon signatures of a greater range of benthic invertebrates of dietary importance to shorebirds, and will attempt to link these carbon sources through to the shorebirds. It is also intended to examine seasonal changes in sources and their utilisation.

Further reading (on energy sources on mudflats):

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Rounick, J S and Winterbourn, M J (1986). ‘Stable carbon isotopes and carbon flow in ecosystems’. *BioScience*, 36, pp. 171–7