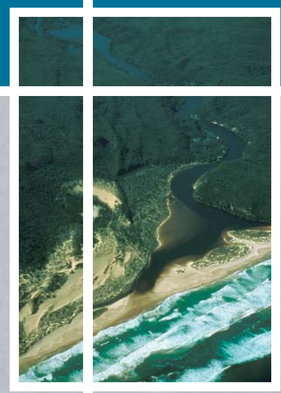
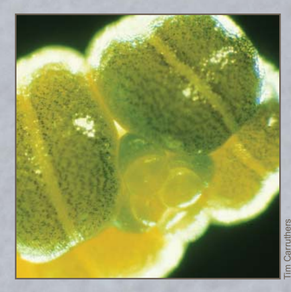
Seagrasses of southwest Australia: Estuaries



Estuaries are transition zones where rivers meet the ocean, creating an environment with large seasonal fluctuations in temperature, salinity, and light. These difficult growing conditions provide some unique challenges for seagrasses. In southwest Australia, estuaries are usually closed by a sand bar at the mouth, cutting them off from the ebb and flow of the tide for long periods. Winter rains flow down-river into the estuaries, raising the water level until it breaks through the sand bar. Seawater then starts to flow in and out with the tide until movement of sand along the beach by waves will once again close the sand bar, usually in late summer. Because of these seasonal changes, only a few types of seagrass such as *Ruppia*, *Halophila*, and *Zostera* grow in these estuaries. However, they are very important as they provide shelter and food for many species of fish, crabs, shellfish, and prawns.

Dieter Tracey



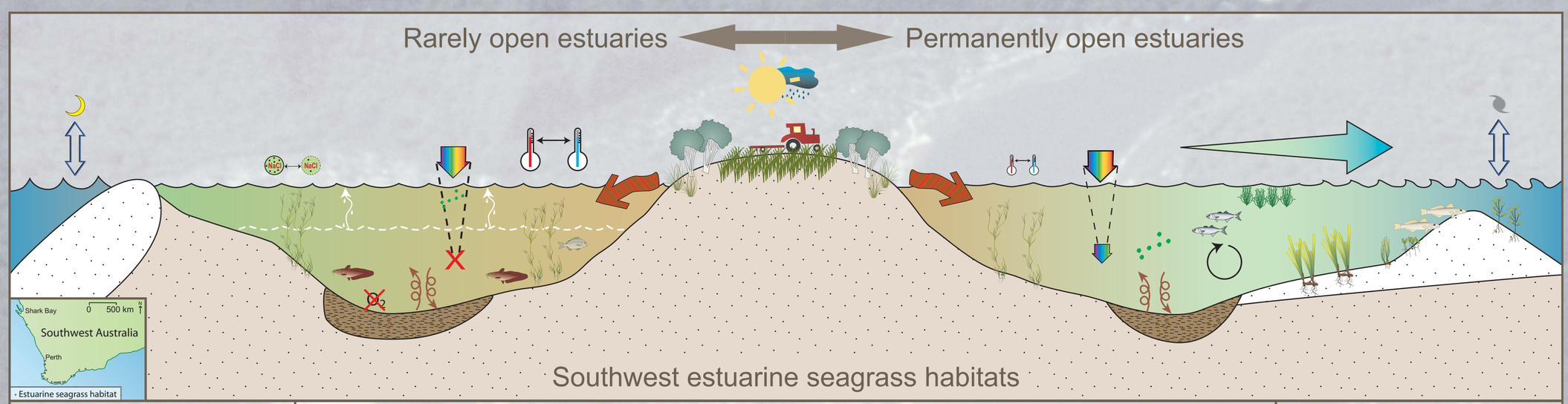
Tim Carruthers

Tim Carruthers

Estuaries are often surrounded by Melaleuca *wetlands which add tannins to the water, resulting in a characteristic orange colour (top).*

A Ruppia megacarpa *flower with four male pollen sacs surrounding eight female carpels (large pollen sacs approximately 2 mm) (middle).*

The mouth of Wilson Inlet, one day after opening of the sand bar, showing the estuary water flooding out into the ocean (bottom).



Simon Neville

Dempster estuary

To the east of Cape Leeuwin, annual rainfall decreases. As there is less water flowing into the estuaries, the sand bars at the mouth of the estuaries are very rarely open (e.g., Dempster Estuary).

Seagrass species	*Ruppia megacarpa* dominates and has highly variable biomass and aerial extent. Light, salinity, and water depth affect *Ruppia* growth at different time scales. A diversity of species from stable *Posidonia australis* and *Zostera sp.*, through to variable *Halophila ovalis* and *Ruppia megacarpa*.
Light availability	Sediment resuspension, phytoplankton blooms, and tannins result in low and variable light levels. Light levels are high, but phytoplankton and macroalgal blooms can occur with high nutrient loading, reducing light.
Physical stressors	Large seasonal differences in water temperature (8–30°C), desiccation, and salinty, driven by rainfall and opening of the sand bar. Ocean flushing driven by tidal exchange is the main influence on water temperature and desiccation. Commonly a salinity gradient forms.
Tidal influence and waves	When the sand bar is open, influence is from daily lunar tides. Waves form from wind only. Largest tides driven by atmospheric pressure systems, waves influenced by tidal currents and wind.
Fish communities	Low diversity fish communities, mostly composed of moderate salinity species that complete their life cycle within the estuary. Diverse fish communities that are dominated by 'marine straggler' species.

organic rich silica sand

oozy, organic-rich mud

coarse carbonate (west coast) or silica (south coast) sand

Sediment and nutrient inputs from urban and primary industry sources accelerate sediment buildup and often may favour macroalgal or phytoplankton growth over seagrass growth.

Many southwest estuaries have a very characteristic orange hue to the water. This results from tannins which leach out of plants growing in wetlands and marshes upstream from estuaries.

The catchments of many southwest estuaries contain extensive agricultural land which, through land erosion and fertiliser, can incease sediment and nutrient input to estuaries.

Southwest Australia has a Mediterranean climate with hot, dry summers (Dec–Feb), and cool, wet winters (Jun–Aug).

Simon Neville

Oyster Harbour

Some estuaries have a permanent opening to the ocean (e.g., Waychinicup Inlet and Oyster Harbour) creating a more stable habitat which can support larger seagrass species such as *Posidonia australis*.

Management issues

Agricultural inputs

Southwest estuaries are heavily impacted by agricultural activities, especially nutrient enrichment and increased siltation through loss of riparian vegetation and erosion due to catchment clearing. Nutrients cause blooms of algae which, along with increased sediment inputs, reduce light and can eventually lead to seagrass die-off.

Simon Neville

Urban expansion

People enjoy living close to the water and, as a result, there is an increase in nutrients flowing into estuaries, e.g., from fertilised lawns. There is also high nutrient pressure from the sewage produced from large populations. These increased nutrients can lead to excess microalgae and macroalgae, resulting in seagrass die-off.

Dieter Tracey

Estuaries with maintained permanent openings

Some southwest estuaries have a managed, permanent opening to the ocean to reduce the effects of high nutrient input and improve boat access. However, these openings permanently change the ecology of habitats within the estuary and surrounding wetlands. Construction of associated developments may also impact seagrasses.

Management responses

Better catchment management

To reduce inputs to estuaries, changes need to be made in the catchment. Revegetation and fencing of streams will reduce erosion and slow water flow into the estuary, reducing sediment and nutrient inputs.

Better wastewater and surface water management

Reducing nutrient delivery from urban areas to estuaries can be achieved by improving sewage treatment, avoiding use of septic systems, and minimising impervious surfaces to reduce overland flow.

Consideration of habitat changes

Monitoring of habitat changes resulting from permanent openings and the effects of construction is essential to assess long-term effects on seagrass. Other issues such as nutrient inputs should also be effectively managed.

Background photo:
Aerial of the Donnelly estuary
Photographer: Simon Neville

'Seagrasses of southwest Australia: Estuaries' – October 2005
Text: Tim Carruthers, Tracey Saxby, Malcolm Robb, and Marion Cambridge
Illustrations: Tim Carruthers, Tracey Saxby, and William C. Dennison
Design and layout: Tracey Saxby
Further information: UWA: www.plants.uwa.edu.au
IAN: www.ian.umces.edu

Coastwest
The University of Western Australia
Botanic Gardens & Parks Authority
Government of Western Australia
Department of Environment
Integration Application Network