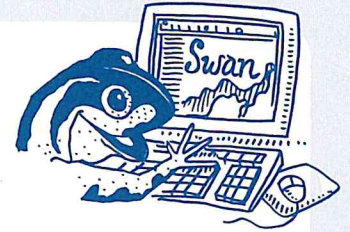


Adaptations for life in an estuary



Estuaries are productive environments for aquatic life. They are rich in nutrients compared with rivers and oceans, and they are also good animal refuges, offering protection from storms, competitors and parasites. However, estuaries do experience sudden and often widespread changes in salinity, temperature and dissolved oxygen levels, so aquatic organisms must find ways to cope with these changes.

Salinity

Salinity is perhaps the most important factor affecting aquatic species. Most aquatic animals are adapted to life in sea water. These animals vary in terms of the degree to which they are able to tolerate the lower salinities of the estuary. A smaller number of animals are adapted to life in fresh water, and few of these species tolerate salinities in excess of 2 ppt (parts per thousand). Ocean salinity is 35 ppt.

The salinity level of the estuary varies along its length, with depth and with the seasons. There are extreme changes in salinity from almost freshwater conditions in winter to saline (or almost hypersaline) conditions in summer. This change in salinity causes a change in the concentration of dissolved gases (fresh water contains more oxygen than sea water at the same temperature) and in the density and viscosity of the water.

Adaptations to changing salinities

Estuarine organisms possess adaptations or behaviours that enable them to cope with changing salinities. Few organisms remain in an estuary for the whole of their life cycle. Some fish are truly estuarine, spending their whole lives in the estuary. Some use it as a nursery habitat only and others are marine visitors, coming in when the salinity suits them. Mobile animals like fish and crabs can swim away from unfavourable conditions. Prawns and crabs move out of the estuary in winter when waters are less saline. However, less mobile (sedentary) animals such as barnacles and worms have to either seal themselves inside their shells or adapt to the conditions. Many sedentary animals die when conditions are unfavourable and must recolonise when conditions change. Many algae and seagrasses die off during winter periods when salinity levels become too low.

Some organisms are able to tolerate extreme conditions for a short time only. A sudden change, such as an unusual heavy summer fall of rain which produces a freshwater flow into the estuary, or extreme conditions of

salinity, will produce a variety of responses. For example, worms, molluscs and fish produce slime or mucus to cover and protect their sensitive body surfaces. Some polychaete worms and crabs retreat into holes or burrows, plugging them. Other animals withdraw their sensitive body parts, or close their shells.

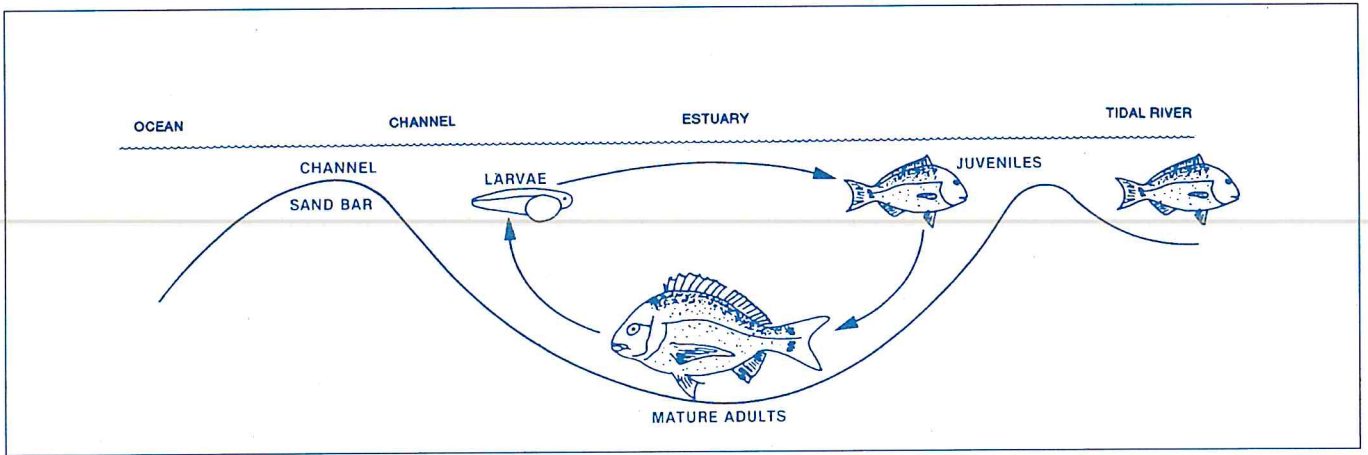
If an organism cannot escape or reduce contact with the water during times of abnormal salinity it must use a physiological response. Many animals are able to reduce the concentration of their internal body cells and fluids (using a process called osmosis) until they are the same as (iso-osmotic with) estuarine water. Alternatively, an animal may modify its metabolic rate or change its patterns of activity.

The physiological response of an animal to salinity changes takes time to complete, so it is often supplemented by a behavioural response that enables it to either delay or moderate exposure to unfavourable conditions, completely avoid them, or slowly adapt their body to the new saline environment. For example, some bivalves close their shell valves when sea water suddenly becomes diluted. After a while they become used to these conditions.

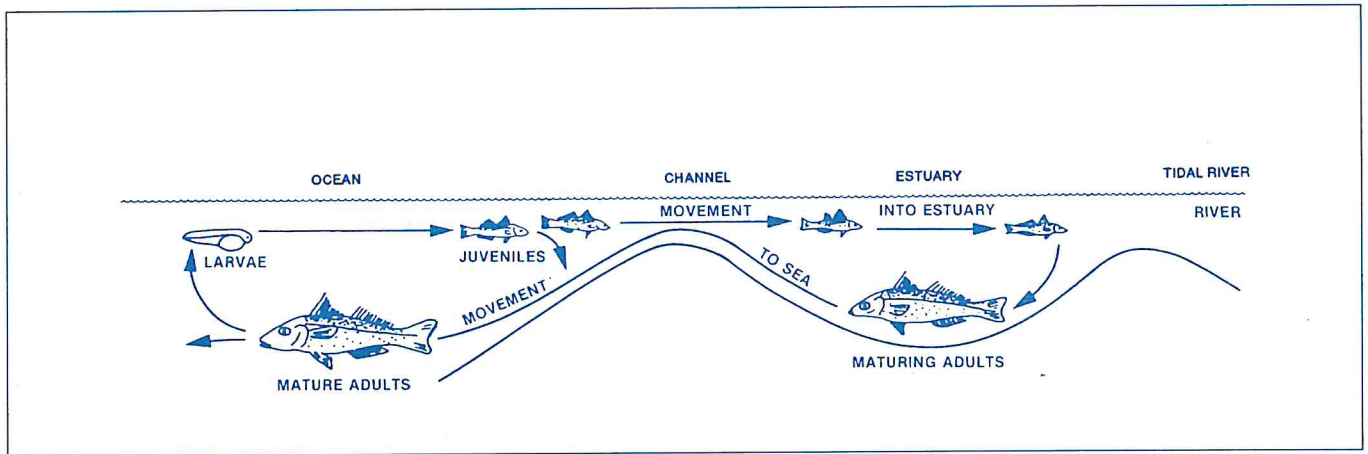
Adaptations to changing temperatures

Temperatures are more variable in the estuary than they are in the ocean. In winter the estuary is colder than the ocean, and in summer it is warmer. Daily temperature fluctuations can also be extreme, especially in the shallows. Also, the solubility of oxygen depends on temperature. (More oxygen dissolves in cold water than in warm water.)

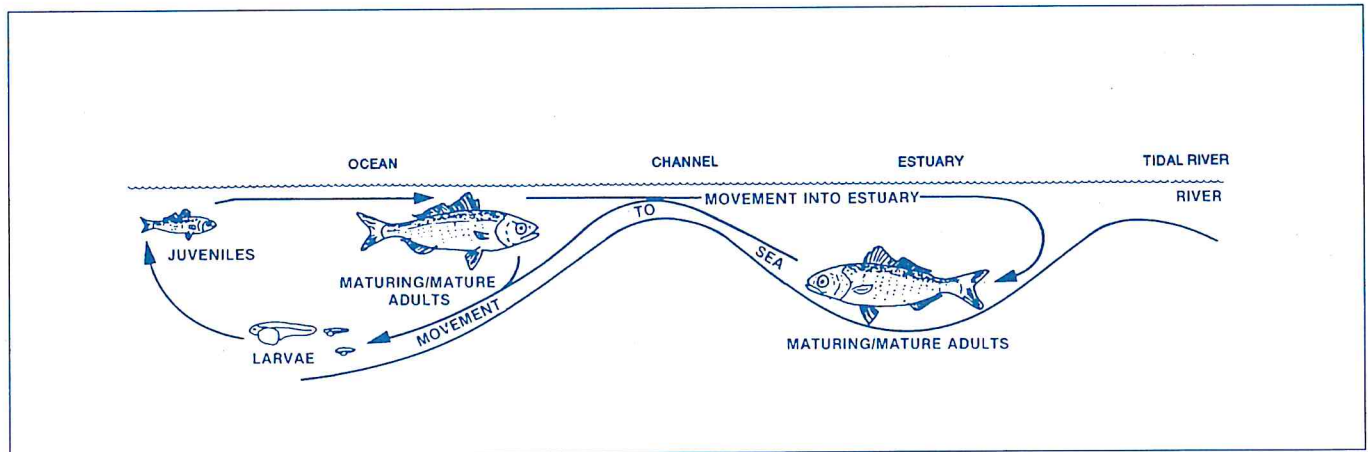
Adverse temperatures may cause responses of avoidance and escape. One of the most common mechanisms that certain organisms use to cope with conditions in the cold winter months is to transform into a resting stage. Another habit is to burrow into the mud or sand on the bottom of the estuary. Fortunately in the Swan-Canning system temperatures are rarely extreme, never reaching freezing in the winter or going above 40°C in the summer.



1. Truly estuarine species



2. Nursery habitat for juveniles



3. Marine visitors

The diagrams above have been adapted from Peel-Harvey Estuary Progress No 3, *The Algae and the Fishery* (Department of Conservation and Environment 1983).

Further reading: *Managing our Rivers - a guide to the nature and management of the streams of south-west Western Australia* (Chapter 5: River animals and their habitats) by Dr Luke Pen, Water and Rivers Commission, 1999.



SWAN RIVER TRUST



WATER AND RIVERS COMMISSION

THIS RESOURCE SHEET IS ONE IN A SERIES ADAPTED FROM THE SWAN RIVER EDUCATION KIT, WATER AND RIVERS COMMISSION, 1999. FOR MORE INFORMATION, CONTACT THE SWAN RIVER TRUST LEVEL 3, HYATT CENTRE, 87 ADELAIDE TERRACE, EAST PERTH, WA 6004, TELEPHONE (08) 9278 0400 www.wrc.wa.gov.au/srt

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