Science Skills

Topic

Using mangrove bio-indicators

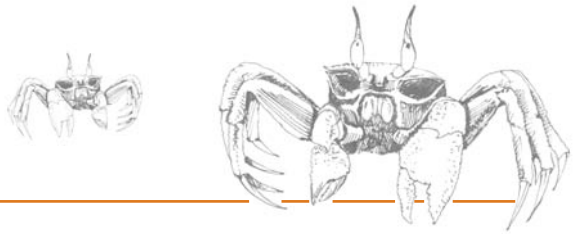
Organisms that show scientists when an ecosystem is degraded are called bio-indicators. Usually, degraded ecosystems have reduced numbers of species of organisms (lower biodiversity), and sometimes only tolerant species survive. They may also have reduced numbers of any organism that lives there. Healthy mangrove ecosystems have live mangrove pneumatophores on which algae grow, a high density of crab holes and healthy mangrove seedlings.

Crabs

Crabs are some of the most obvious and important animals in the mangroves. They are almost entirely from either of the families Grapsidae or Ocypodidae. Grapsid crabs, found mainly in the upper intertidal zone, have short eye stalks and square carapaces. Ocypodid crabs have long, mobile, folding eye stalks; they include the large-clawed fiddler crabs.

Crabs are important to mangrove ecosystems. Through their burrowing activity, large grapsid crabs bring organic matter to the surface and add oxygen-rich water to the mud. They are mainly herbivores, and feed on the leaves and seedlings of mangroves. Smaller crabs, both grapsid and ocypodid, recycle matter as they scavenge for decaying plant material in the mangrove mud.

Most crab holes seen in upper part of the intertidal zone are likely to be made by grapsid crabs, because they are adapted to breathing out of water. They are a favourite food of the Water Mouse.



Common Grapsid Crabs

Scarlet Three-spined Mangrove Crab,
Neosarmatum trispinosum. QM

They are active at dawn and dusk, so are rarely seen. Any very large crab holes you find are likely to be made by this species.

Red-fingered Marsh Crab,
Parasesarma erythodactyla. QM

They are active during the day, and often very common. Turn over rocks or wood and you might see them, running away quickly.

(Source: *Wild Guide to Moreton Bay*, Queensland Museum)

Pneumatophores

Pneumatophores, or the spongy aerial roots, of mangroves vary in shape, according to the species of mangrove. *Avicennia* (Grey Mangroves) have slender, upright pneumatophores that do not break when bent. Algae often grow as epiphytes on their pneumatophores. As epiphytes, they do not harm mangroves, and they benefit as they grow on one of the few stable surfaces in the shifting mangrove mud.

Before you start

Stand quietly for five minutes in the mangroves before you lay out your transect lines and start your field study. Crabs often emerge from their burrows, and start feeding. Are they grapsid or ocypodid crabs? Use the field notes to identify them.

What bio-indicators to use

>> Pneumatophore density

Count the total number of pneumatophores in your quadrat.

Record the pneumatophores without algae. Calculate this as a percentage of total pneumatophores.

>> Seedling density

Count the number of seedlings in each of your quadrats. Find seedling density per square metre.

>> Crab-hole counts

Sediment deposits or 'workings' at the entrances of burrows show crab activity. These holes are considered to be occupied.

Count the number of occupied crab holes in each of your quadrats. Find average density per square metre.

This method can under- or over-estimate crab numbers — crabs sometimes share burrows or their burrows can have more than one entrance.

Counts of bio-indicators

To sample bio-indicators in your large (10 m x 10 m) quadrat:

1. Throw the smaller quadrat (50 cm x 50 cm) over your shoulder into the larger quadrat.
2. Count the bio-indicators you want to measure. Repeat this three times, within the same large quadrat.
3. Find the average per quadrat (divide by three).
4. Convert to density per square metre (multiply by four).

Analysis of results

To make sense of your results you need to compare this study area with another area you have studied. Do you think your mangrove area is healthy? Explain your results.

Avicennia seedling grows surrounded by *Avicennia* pneumatophores.
QM

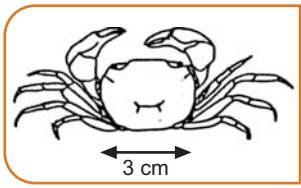
Using a small quadrat to sample pneumatophores, seedlings and crab holes at Nudgee Beach, Queensland.

Algae, *Catanella nipae*, growing on *Avicennia* pneumatophores.
QM

Crab field notes

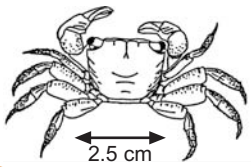
(Source: *Wild Guide to Moreton Bay*, Queensland Museum)

upper intertidal



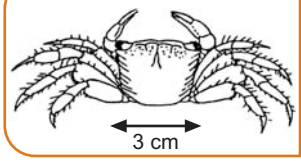
Heiograpsus haswellianus — Family Grapsidae
Haswell's Shore Crab

Brown-bodied; has small notch in carapace behind eyes. Legs are smooth and slender, without bristles.
Found in saltmarsh, above the high water mark.



Parasesarma erythodactyla — F. Grapsidae
Red-fingered Marsh Crab

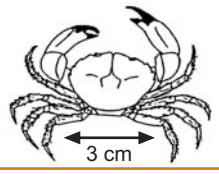
Large males have green carapaces, with red-tipped claws. Herbivore; climbs trees and eats mangrove leaves. Burrows.



Metograpsis frontalis — F. Grapsidae
Broad-fronted Mangrove Crab

Carapace tapers towards the back; smooth and mottled; colour varies. Walking legs have spines. Though usually much smaller. Active in the intertidal zone.

middle intertidal

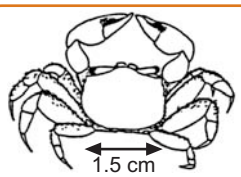


Pilumnopeus serratifrons — F. Pilumnidae
Smooth-handed Crab

Oval, brown to purple crab with stout, black-fingered claws; sides of the carapace and walking legs fringed with hair.

Paracleistostoma wardi — F. Ocypodidae
Ward's Hairy-legged Crab

Wider than long, with a smooth carapace, except for patches of short hair near the bases of short, furry legs; edges of it behind the eyes are orange. Burrow in mud, in and near mangroves. Very abundant.



Australopax tridentata — F. Ocypodidae
Furry-clawed Crab

Adult males have blue claws with a large round patch of fur at the base of the fingers (the movable parts of the claws). Females have very small claws. Abundant in mangroves.

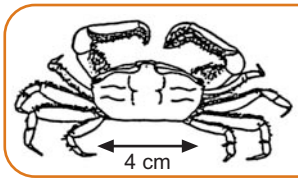
lower intertidal

Heloecius cordiformis — F. Ocypodidae
Semaphore Crab

Has equal-sized purple claws, used in waving display of courtship and territorial behaviour.

Uca vomeris — F. Ocypodidae
Two-toned Fiddler Crab

Large male claw with bottom finger and lower half of hand orange, upper part of hand is whitish. Very common mangrove species. Carapace 3cm.



Macrophthalmus crassipes — F. Ocypodidae
Orange-spined Sentinel Crab

Carapace wider than long; claws of males have an orange spine on hands and wrists. Burrows in the soft mudflats, and in mangrove fringes. Very abundant.

Peter Davie