Bookshelf

*" **The Environmental Effects of Prawn Trawling in the Great Barrier Reef Marine Park: 1991-1996**
I. Poiner, et al
CSIRO Marine Research, GBRMPA, DPI, Fisheries Research and Development Corporation.

The final report is in two volumes but a briefer version — summary, conclusions and recommendations — is available.

Proceedings of the 6th International Coral Reef Symposium, Townsville, 1988 3; 325-332
*' **Distribution of trophic groups of epifaunal echinoderms and molluscs in the soft sediment areas of the central GBR shelf.**
Birtles A. and Arnold P.

*≈ **Stratification of seagrasses in the GBRWHA, Northeastern Australia, and the Implications for Management**
Robert Coles, Warren Lee Long, Len McKenzie, Anthony Roelofs and Glen De'ath.
In press

Australian Fisheries Resources
Patricia J. Kailola, et al.
DPI/ Fisheries Research and Development Corporation (1993)

Ecos No. 98 January-March 1999
Secrets of the lagoon
Katherine Johnson

An article about the Effects of Prawn Trawling study*" .

Australian Coral Reef Society Autumn Newsletter, March 2000
A brief look at prawn harvesting: Different strokes for different folks
Andrew Chin

Prawn trawling in Queensland, America and Canada.

Reef Research Vol 9 No 3 December 1999
Inner v Outer routes
This article on shipping routes is part of larger feature: Oil spills ... our greatest fear.

This newsletter was produced by the Environmental Protection Agency with funding from the Wet Tropics Management Authority and the Great Barrier Reef Marine Park Authority.

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Tropical Topics

An interpretive newsletter for the tourism industry

In the lagoon No. 62 June 2000

Notes from the Editor

Compared with the coral reefs, the lagoon and inter-reefal areas are relatively unknown. They have not attracted the curiosity of exploring scuba divers for whom it is too deep, too dark and too dull. However, the diversity of plants and animals discovered in trawler bycatch — the unwanted organisms brought to the surface along with the targeted prawns — alerted scientists to the fact that the sea floor was by no means devoid of life.

Currently, the Queensland Government is proposing to implement a plan to ensure trawl fishing effort in Queensland waters is contained and reduced, producing a sustainable fishery. The proposal aims at containing fishing effort at 108,346 days — roughly 1996 levels — and reducing days over time. Since the beginning of March, it has been compulsory for trawlers to use Bycatch Reduction Devices inside the Great Barrier Reef Marine Park. This should reduce the amount of bycatch by at least 20 percent.

While the trawling issue is of vital importance to the future of the lagoon, the aim of this newsletter is not to tackle this controversial topic but to simply direct awareness to what is in the huge section of the Great Barrier Reef Marine Park which is not coral reef.

I would like to thank Dr. Roland Pitcher of CSIRO Marine and Russell Kelley of Watermark Films Pty for their kind help with this issue.

Journeys in the blue lagoon

As we cruise impatiently across the stretch of water which separates the mainland from the outer reefs, we generally give little thought to what is in the lagoon below us. The focus is on the coral reefs and the diverse animals and plants which inhabit them rather than the inaccessible and uncharismatic bit between. Only recently have scientists given serious consideration to what may be down there — and gained an appreciation of the importance of the zone.

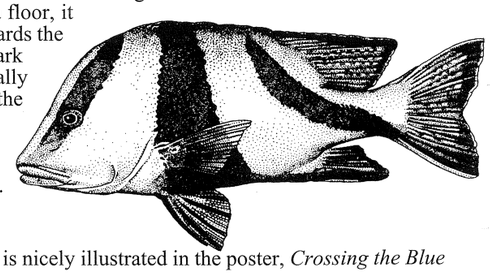
Although the Great Barrier Reef Marine Park is famous for its coral reefs, they actually make up only 6 percent of the 350 000km" area. Seventy percent of the area consists of the main lagoon and the deeper waters between the reefs. The remaining 24 percent is taken up with deep ocean waters outside the reefs.

Tourists are not the only creatures making a trip of a lifetime when they cross the lagoon. Far below them and well out of sight, a number of animals are moving in the same direction, but at a different pace, taking a lifetime to make the return trip. The red emperor fish is a good example*. As a junior fish it spends its early years close to shore, mainly in seagrass beds, some living among the spines of sea urchins.

As it grows older, the red emperor, now garbed in broad stripes of dark purple and white, begins a journey across the lagoon. Moving between isolated 'islands' of life, gathered around collections of corals and sponges dotted along the sea floor, it gradually makes its way towards the outer reefs. Meanwhile the dark stripes change to red eventually fading almost completely as the fish becomes fully mature. During the warmer months, between October and April, these fish pair up and spawn. They are fecund fish, a large female producing at least 5-7 million eggs per season.

The lagoon functions as a nursery for the tiny larval fish which hatch from the fertilised eggs. Moving away from the surface during the day, like many other planktonic animals, they surface again during the night when predators are less likely to catch them. Eventually, some of these little fish make their way to the coast to spend their youth in nearshore waters. Later they will follow the trail of their parents on the trip of a lifetime back to the Reef.

Red emperors are by no means the only fish which traverse the lagoon during their life. Spanish mackerel and mangrove jack make similar journeys, growing up in coastal creeks and estuaries and moving back to the reef environment as they mature. Eels too cross the lagoon during their epic journeys from freshwater lakes and rivers to deep sea breeding grounds. All of them are travellers in the blue lagoon.

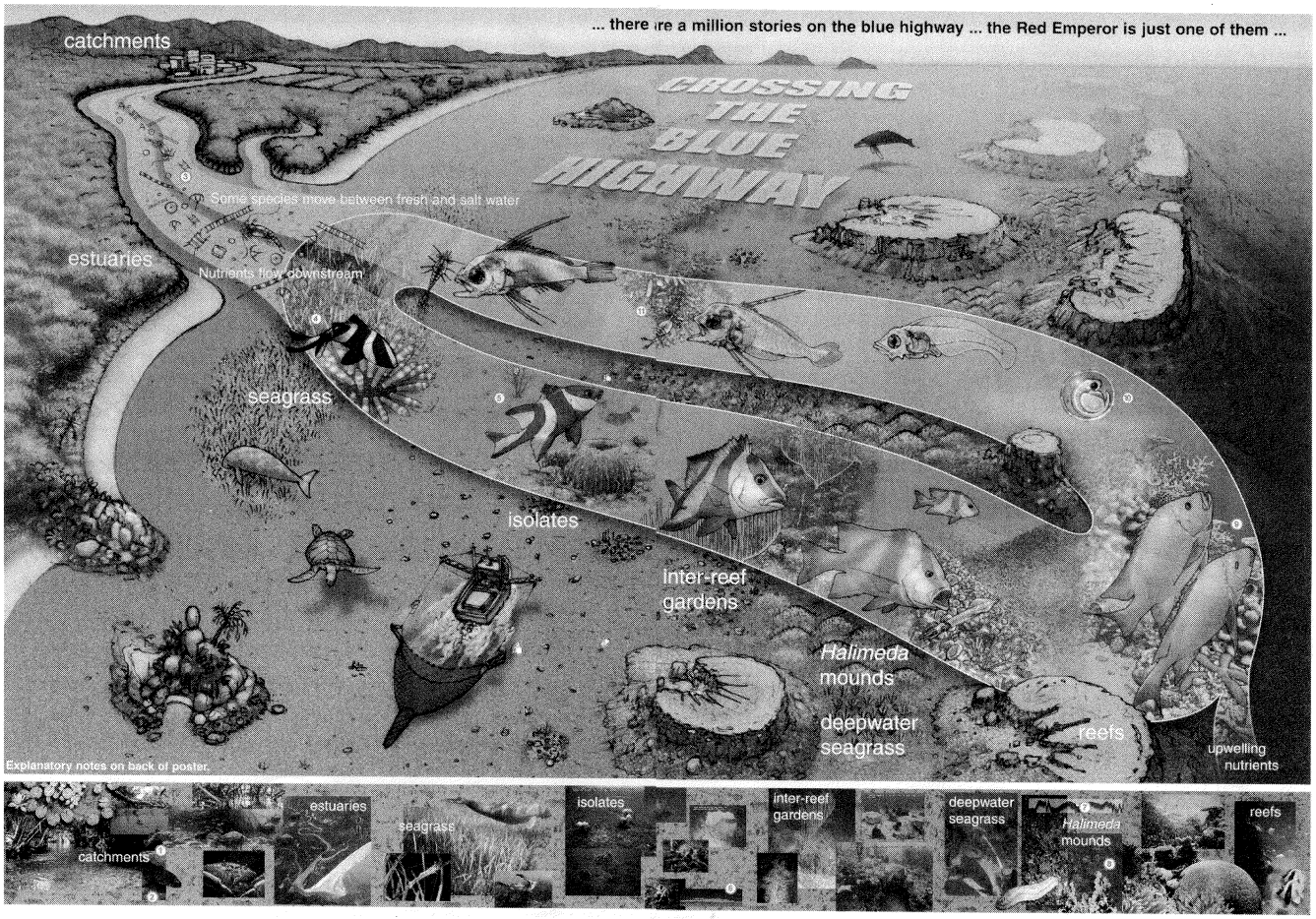


* The red emperor's journey is nicely illustrated in the poster, *Crossing the Blue Highway*. Details on page 7.

Marine Parks — Great Barrier Reef Marine Park Authority — Queensland Parks and Wildlife Service

Crossing the blue highway

We cannot think of coral reefs as closed ecological systems functioning in isolation. As the story of the red emperor's journey (p1) demonstrates, there are many links between the coast and the Great Barrier Reef. What happens on land, in the river catchments, and in the lagoon can often have consequences for the distant coral reefs.



A new poster, produced by the Australian Coral Reef Society with the assistance of AIMS, DPI, GBRMPA and CSIRO Marine Research, focuses on these links by examining the different habitats which the red emperor utilises during its lifetime journey from the reef (as a larval fish) to the estuaries and then, as a maturing adult, back to the reef.

On the front of the poster we are given a bird's eye view, from catchment to Reef. Superimposed are magnified pictures of the red emperor showing its various life stages.

The habitats through which the fish journeys are summarised at the bottom of the poster. On the reverse these are expanded upon in seven segments with detailed text and appropriate photos explaining the river catchments and their estuaries, the shallow and deepwater seagrass beds, the isolated 'islands' of life on the lagoon floor, the gardens between the reefs, the *Halimeda* mounds and, finally, the coral reefs

These posters, which are A3-sized and in full colour, are packed with interesting facts and pictures and would be particularly useful for school projects. They are available, free of charge, from the QPWS office in Cairns, Ph 4046 6600 and from the GBRMPA office in Townsville, Ph: 4750 0700. Alternatively, send a stamped addressed A4-sized envelope to the *Tropical Topics* editor — address on page 8. (The poster will have to be folded in two to be sent by post.)

Saving Representative Areas

The Great Barrier Reef World Heritage Area is best known for its 2900 coral reefs. However, these account for only 6 percent of the 350 000km″ of the Area and represent just part of its diversity. Also included are not only sand cays, continental islands, mangrove estuaries and deep ocean troughs but also the less charismatic seagrass beds, sandy or muddy bottom communities, algal and sponge gardens featured in this issue of *Tropical Topics*.

In recent years there has been a growing realisation of the need to identify and protect representative examples of the diversity of habitats upon which all species depend, rather than focusing on specific habitats or individual species. To ensure all habitat types are adequately protected, GBRMPA is using a 'representative areas' approach to identify the different habitat types, assess threats and identify an appropriate level of protection. This review is part of GBRMPA's 'Representative Areas Program' which contributes to a nationwide review of marine and terrestrial areas, aimed at protecting Australia's biodiversity.

The Representative Areas Program will involve a broad base of stakeholders. Input will be sought through meetings, workshops, written documents and invitations for submissions. If you would like more information, contact the Representative Areas Planning Team at GBRMPA on (07) 4750 0700 or write to: PO Box 1379, Townsville M.C., QLD. 4810. E-mail: registry@gbrmpa.gov.au

Window into the lagoon

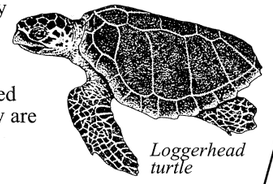
The Great Barrier Reef lagoon varies in depth from 15-20m in the shallower inshore zone to an average 40m offshore. Between the reefs, channels may be as deep as 70m. We are just beginning to get a picture of what is down there.

Vast areas of the seafloor appear fairly bare, but there are occasional islands of life, known as isolates or garden patches. These may occur where a sponge or coral has been able to attach itself to a hard surface — a piece of rubble or even a shell — or where the sediments are more stable. Large sponges or ascidians (sea squirts) often attract other animals to shelter within them and if any of the settlers produce a calcium skeleton a fairly substantial 'island' of life may become established

There are quite distinct differences between inshore and offshore zones. The sediment in inshore areas is dominated by fine mud of terrestrial origin and the water is not clear. Fewer species of animals have been found here, the majority of them deposit feeders. It is thought that the low densities are due to lack of food and the difficulties posed for many animals living where the sediments are constantly being disturbed.

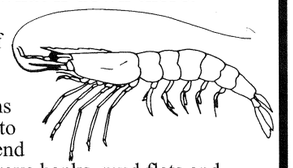
Further offshore the amount of mud declines quite suddenly because river sediment is driven north by currents and normally settles within a few kilometres of land. Beyond this the bottom is increasingly dominated by coarse sand and rubble with a biological origin. That means it is derived from calcareous algae, forams, molluscs, bryozoans and corals. This change is reflected in an increase in numbers and types of animals found, usually beyond about 20-25m depth. A greater variety of habitats in these sandier and harder areas, with more suitable sites for settlement of larval organisms, is thought responsible for the greater diversity. Here the dominant animals are filter feeders, scavengers and carnivores.

Turtle species frequent areas which suit their various dietary requirements. Greens hang around the seagrass and algal fields while hawksbills seek out sponges. Loggerheads target molluscs and crustaceans in sandy areas and are the turtle most likely to be scooped up by trawlers. Flatbacks feed on a variety of crustaceans and other sea floor animals. They are rarer and therefore not caught so frequently.



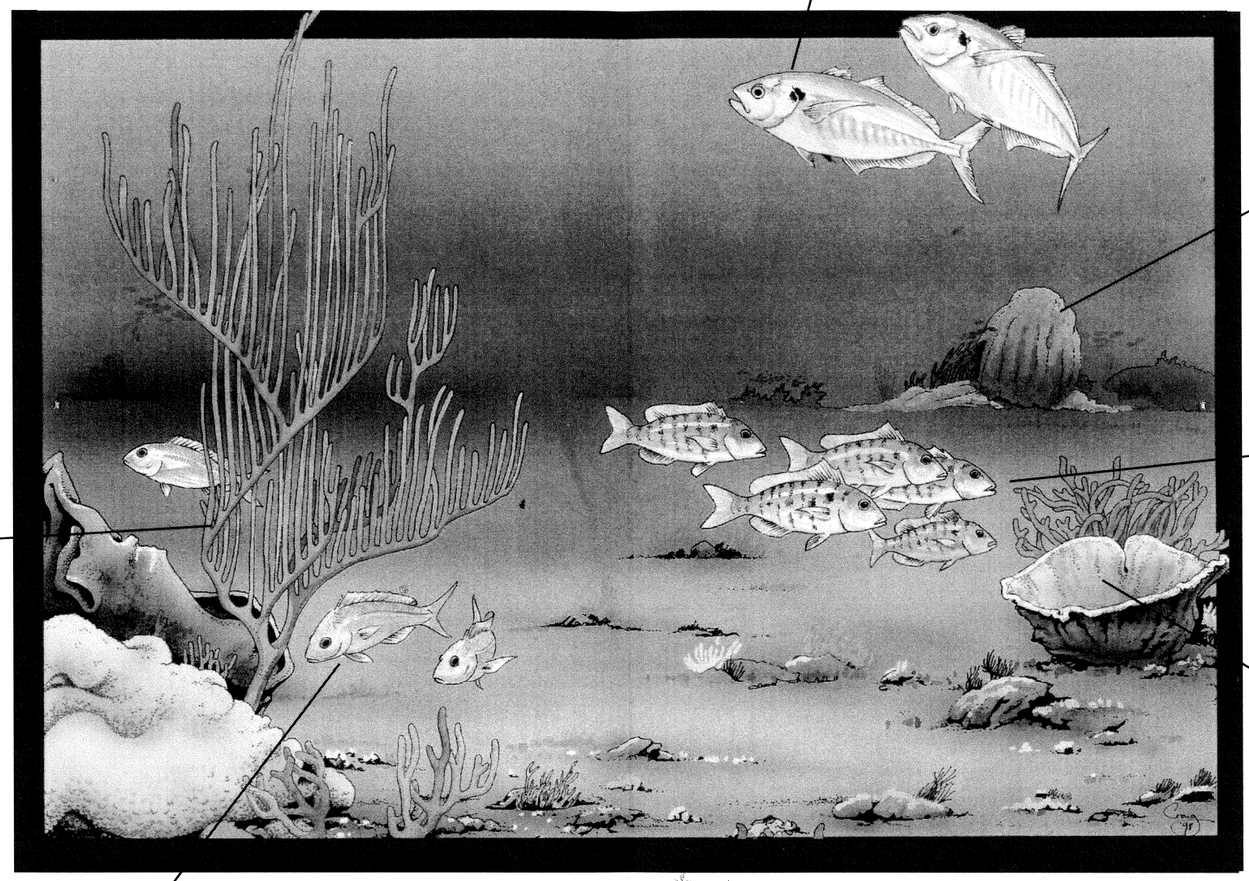
Loggerhead turtle

Large schools of the **smooth-tailed trevally** (*Selariodes leptolepis*) hunt in the water above the sea floor and in the study area*″ were caught in large numbers in fish trawls, which are positioned higher than the seafloor prawn trawls.



Commercially important species of **prawns** are found mainly in inshore areas on sandy and muddy areas although red-spot king prawns inhabit inter-reefal channels down to 60m. Juveniles of other species spend their youth in seagrass beds, mangrove banks, mud flats and even creek beds. The adults move away from these areas and feed on small crustaceans, molluscs, worms and so on. They are preyed upon by squid, cuttlefish, fish and humans.

Bay lobsters, known better as bugs, are caught in the lagoon. Mud bugs (*Thenus orientalis*) prefer muddy conditions and are found from 10m to 30m depth. Other species are found further from the coast.

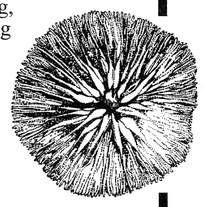


Gorgonians are related to soft corals but are constructed of a tough horny material called gorgonin. They grow in the form of fans and whips, their polyps filtering food from the water. They, and other filter-feeders, grow particularly well in the inter-reefal areas where tides force strong currents, carrying abundant particles of food, between the reefs. Their flexible skeletons make some gorgonians more resilient to trawling than other large attached animals such as sponges, hard corals or soft corals. Many of these gorgonians are bright red. Possibly this helps them to absorb those wavelengths of light which penetrate to the sea floor but this is unproven

Sponges are a feature of diverse seabed habitat patches. Barrel sponges (*Xestospongia* sp) can grow to over a metre in height and are very similar to the barrel sponges of the Caribbean. The hard ridged surface makes a good home for many other animals and numerous crustacean species are found inside. Other sponges such as the elephant-ear sponge (*Ianthella basta*) are fan-like or conical in form and grow up to a metre in height and across. Colour varies from yellow to purple. Little gobies often live on this sponge.

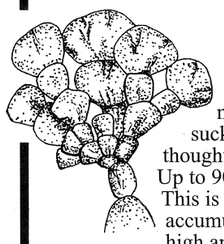
The **threadfin emperor** or **lancer**, (*Lethrinus genivittatus*), is found on sandy areas and in seagrasses and is common in coastal areas, including estuaries and trawling grounds. It is less common in the midshelf area and again abundant offshore. Along with the rosy threadfin bream (see below left), this fish dominated the bycatch in the area studied*″, these two species alone making up almost a quarter of fish caught by trawls in the lagoon and in the inter-shoal area by weight.

Turbinaria corals are adaptable enough to grow in the low light levels and murky conditions of the lagoon floor. Corals in this group differ markedly in growth form depending on their situation and available light. Those growing near the surface are convoluted while those in deep water flatten out. On the lagoon floor they typically form open vase-shaped colonies which earn them the name flower-pot corals. Curiously these corals spawn in autumn, when water temperatures are dropping, instead of early summer, the usual coral spawning time.

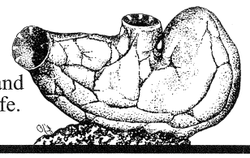


Solitary corals also grow on the seafloor. Some just the size of a 20¢ coin and others growing to slipper (size 8) proportions, they are dotted around the sandy seabeds.

Lots of different species of **soft corals** live on the sea bed. Those growing on soft sediment sometimes look like fields of little cauliflowers.

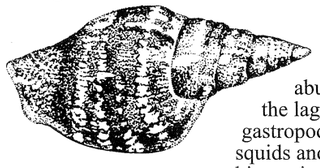


Dense beds of **algae**, mainly *Caulerpa* and *Halimeda* (left) are found on the outer shelf north of Cooktown. Upwelling nutrients sucked inside the reef wall by tidal currents are thought to be responsible for this abundant growth. Up to 90 percent of *Halimeda* is calcium carbonate. This is left behind when the plant dies allowing the accumulation of huge mounds up to 20 metres high and tens of metres across. *Halimeda* growth took place before coral growth, when sea levels began to rise, and some of the mounds date back 10 000 years.



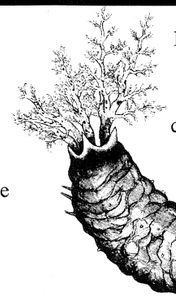
Ascidians of various types can give shelter to numerous other organisms and form the basis of a isolated patch of life.

The **rosy threadfin bream** (*Nemipterus furcosus*) is one of the most abundant fish species found in the lagoon, particularly in inshore areas, and is often caught in trawls. Other common fish in inshore areas are the redspot monocle bream (*Scolopsis taeniopterus*), the hair-finned leatherjacket (*Paramonacanthus choirocephalus*), ponyfishes (*Leiognathus* sps) and the cardinalfishes, *Apogon ellioti* and *A. fasciatus*. The gulf damsel (*Pristotis jerdoni*) is more common in the outer lagoon while the heart-headed flathead (*Sorsogona tuberculata*) is found throughout.



Various stromb species are common deposit feeders.

Molluscs are among the most abundant and diverse creatures on the lagoon floor. Bivalves and gastropods are common and various squids and their relatives make a living in this particular habitat. Some are suspension feeders and others carnivores while a large number simply browse on algae or feed on organic material deposited on the surface.



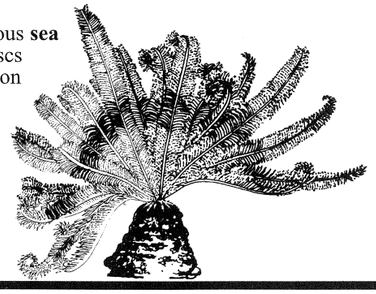
Many types of **echinoderms** do well in the lagoon habitat. In the study of the northern reef*″, heart urchins accounted for 48 percent of all echinoderms caught in the lagoon.

Heart urchin

This **sea cucumber**, *Pentacta anceps*, (left) lives on the sea floor, obtaining its food by filter feeding. Although deposit-feeding sea cucumbers are also found, the majority are filter feeders.

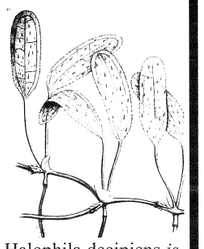
Carnivorous **sea stars** feed largely on molluscs while other species browse on the surface of the sea floor.

Featherstars are more common in offshore areas. Filter feeders they thrive in inter-reefal areas where currents bring them food.



Seagrasses grow in extensive meadows in shallow waters and in recently-discovered meadows as deep as 61m*≈. These deep meadows, comprised of five *Halophila* species, are most common in the central narrow shelf region. Highest densities occur between Princess Charlotte Bay and Cairns. They are sparse north of this area and south of Mackay due to the effects of strong tides.

Dugongs depend entirely on seagrasses for food and along with algae they are a staple for green turtles. Seagrass meadows also harbour larval prawns, squid, crabs and fish, including many commercially important ones such as snappers, emperors and sweetlips.



Halophila decipiens *is the most commonly found seagrass at all depths.*

Main illustration by Craig Smith, courtesy CSIRO Marine

Sea cucumber illustration courtesy Queensland Museum

**″/*≈See Bookshelf for reference*

Questions & Answers

Q Can please you tell me the names of books dealing with Australian tropical rainforest trees?

A In order, from the least complex to the most detailed:

Australian Rainforest Plants
Books I - IV
Nan and Hugh Nicholson
Terania Rainforest Publishing

Growing Australian Tropical Plants
Peter and Ann Radke & Garry and Nada Sankowsky
Frith and Frith Books (1993)

These are small paperback books, with good photos, aimed at the general reader and gardener .

Plant Life of the Great Barrier Reef and Adjacent Shores
A.B. Cribb and J.W. Cribb
University of Queensland Press (1985)

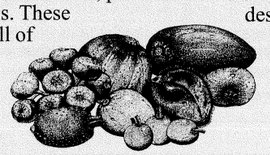
Sadly this wonderful guide to shore vegetation, seaweeds and flotsam is out of print but it may be possible to find copies in libraries.

Rainforest Plants
David Jones
Reed Books (1991)

This is a more comprehensive hardback book (but with some out-of-date names).

Native Plants of Queensland
Keith A.W. Williams

There are several volumes, published in the 1970s/80s. These books look at all of Queensland, not just rainforest.



Fruits of the Rain Forest; a guide to fruits in Australian Tropical Rain Forests
Wendy Cooper and William Cooper
Sydney Geo Productions (1994)

This is a gorgeous book of exquisite paintings of 626 fruits. Mostly life-sized, these are breathtakingly realistic down to the insect nibblings on the skin. Text includes details of the fruit and leaf size, with a sketch of the leaf, fruiting season, distribution, and so on.

Australian Tropical Rain Forest Trees and Shrubs
An Interactive Identification System for Trees and Shrubs
CD Rom (for Windows 95 or better) and Manual
B.P.M. Hyland, T. Whiffin, D.C. Christophel, B.Gray, R.W. Elick and A.J. Ford
CSIRO Plant Industry/La Trobe University/University of Adelaide (1999)

This interactive system covers 1733 trees and shrubs of northern Australian rainforests and can be used to identify a plant even with only part of the plant available. It includes illustrations from *Fruits of the Rain Forest* (see above) as well as coloured illustrations of flowers and leaves and leaf x-rays. It incorporates the Leaf Atlas, produced a few years ago. There is a combination of images and information on features of leaves, fruits, flowers, bark, seedlings, family classification, geographic distribution and detailed descriptions of each species. Costs $130. Available from CSIRO; Ph:(03) 9662 7666 or through their website: www.publish.csiro.au

Tourist talk

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Facts and stats

on the lagoon

Red emperors grow to about 20-21cm in length in their first year and by three they are about 40cm long. They can live for at least 10 years and grow to over 100cm.

A red emperor taken from the GBR, when gutted, weighed 32.7kg.

In 1980-81 red emperors made up 17 percent of the total commercial fish catch around Cairns, 4 percent around Townsville and 5 percent around Mackay. They are known, along with saddle-tailed snapper and red snapper, as 'redfish' in the fishing industry.

Of the 770 trawlers which operate in the Queensland East Coast Trawl Fishery, 630 operate inside the Great Barrier Reef Marine Park.

Each pass of a trawl removes about 5-25 percent of seabed life, seven repeated trawls remove about half and 13 trawls remove 70-90 percent. In the GBR 70 percent of trawled grounds receive less than one pass per year.

For every tonne of prawns caught by trawlers without Bycatch Reduction Devices, 6-10 tonnes of other unwanted species are discarded.

Fish are not the only creatures whose life cycle takes them across the blue lagoon. The eggs and larvae of blue swimmer crabs drift as far as 80km out to sea, where they live as plankton before returning to settle in shallow, inshore waters. As they get older they move to deeper waters. They are carnivores and scavengers eating a variety of invertebrates.

Young mangrove jacks, tagged in estuarine creeks behind Hinchinbrook Island, were later recaptured as adults on offshore reefs 60km to the northeast.

A number of seabird species, notably crested terns, brown boobies and lesser frigatebirds as well as dolphins and sharks benefit from trawling by feasting on the discarded bycatch. Numbers of crested terns in the region have doubled because of this.

A total of 33 river basins with a combined catchment area of 411,000km″ drain eastwards into the coastal waters of the GBRMP. The largest in area is the Fitzroy catchment, at 143,000 km″.

Out and about

Winter has definitely arrived, the sudden change in the weather affecting different animals and plants in different ways. A number of birds prefer the dry season for nesting and some are noticeably more voluble as they sing to attract mates. The rich musical chattering of **brown honeyeaters** is a delightful feature of this season. Although we see these birds all year round, further south they are migratory. About May or June some move south to coastal New South Wales, north of Newcastle, to breed in the mangroves.

There have been a number of queries about the first *Tropical Topics* compilation booklet since it was announced that the second compilation booklet is now on sale. The first compilation booklet was published early in 1998. It contains the theme-based information from the first 12 issues of *Tropical Topics* dealing with Wet Tropics themes. The chapters, in order, are: The Gondwana connection, Light in the rainforest, Wet Tropics webs, Rainforest possums, Cassowaries, Bats, Frogs, Mangrove plants, Mangrove animals, Fire and Caring for country.

The second compilation contains material from the first 12 Great Barrier Reef issues: Coral growth, Fish colours and patterns, Dugongs, seagrasses and turtles, Echinoderms, Crown-of-thorns starfish, Sharks, Reef relationships, Whales and dolphins, Cyclones and El Nino, Spawning on the Reef, Water quality and Marine hazards.

Each booklet sells for $10 (or $5 each for orders for 11 or more copies, plus postage). The first one is available from the Wet Tropics Management Authority in Cairns, Ph: (07) 4052 0555, and the second from the Queensland Parks and Wildlife Service, Cairns, Ph: (07) 4046 6600.

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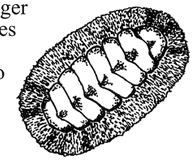
It was recently discovered that **chitons**, those inconspicuous and very ancient molluscs which can frequently be seen stuck fast to rocks above the low tide mark, have teeth of iron. Beneath their scaly and leathery exterior, their teeth are arranged in a conveyor belt system, the new teeth moving forward as the old ones wear out. At the beginning of production a scaffold of calcium phosphate is produced and as the tooth moves forward, towards active service on the front line, various iron minerals are laid down. The teeth in the top layer are coated in magnetite which is the hardest substance created by any living organism. The result is a set of gnashers stronger than kitchen knives which allow the animals to eat into rock. They could even eat steel if they were so inclined.



We humans are only able to manufacture a low-grade version of magnetite under extreme conditions. It is a mystery how chitons produce it but if researchers can understand the process then it could perhaps be copied. It would be useful for coating small components which tend to wear out easily.

This discovery was featured on ABC's Quantum program on 18 May.

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E-mail: AmphibianConference@jcu.edu.au

Please note that **telephone numbers** for Environmental Protection Agency and Queensland Parks and Wildlife offices have changed. Numbers in this newsletter have been updated. Others can be found in the 2000-2001 telephone directory.

Funding applications for **moorings at Fitzroy Island and Offshore Cairns** were recently approved by the Commonwealth Minister for Environment. This means that Fitzroy Island will be getting four public moorings followed by reef protection markers in the second year of funding and another four public moorings in the third year. The details of the offshore Cairns application are not fully defined but there should be around 10 new public moorings on offshore reefs where needed.

An **osprey** pair in Cairns has moved house. Their nest, off Greenslopes St, fell victim to Cyclone Steve in February and they have now built a new one, not far away as the osprey flies, at the top of the Ambulance Station communication tower, next to Anderson St.