The Marine Life of Bootless Bay

Papua New Guinea

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Front cover photographs (clockwise from top left): pygmy seahorses, Papuan sea jelly, lacy scorpionfish and coral reef scene.

Back cover photographs (clockwise from top left): electric tailed slugs, ornate ghost pipefish, spiny lobster and white grape coral.

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The majority of the photographs provided in this guide have been taken by the authors. We are also delighted to include contributions from the following individuals, using an index system whereby 43R1L, for example, indicates the photo on Page 43, Row 1, Left Column:

Adam Powell (68R3R, 93R4L, 94R2L, 95R4R, 97R4L, 103R1L, 106R2L, 106R2R, 106R3R, 107R1R, 109R4L, 113R1R, 116R2L, 123R1R, 123R2R, 124R2R, 124R3L, 125R3L, 125R4R, 126R1L, 126R2R, 126R4R, 127R1L, 128R1R, 129R4R, 130R2L, 130R2R, 131R1R, 131R4R, 132R1R, 132R3L, 132R3R, 133R1L, 133R1R, 134R4L, 135R4R); Rickson Lis (9R1R, 9R2R, 10R1L, 10R3R, 10R4R, 11R1L, 11R1R, 11R2R, 11R4L, 12R1L, 12R3L, 12R3R, 14R1L, 14R2R, 14R3L, 16R3R, 19R2L, 22R4L, 30R2L, 33R2R, 35R4L, 37R2R, 39R1L, 47R3R, 55R3/4R, 74R3R, 93R1R); Eddison Silas (6R4L, 7R3L, 7R4L, 7R4R, 19R3R, 21R1L, 25R3R, 35R3L, 61R1R, 65R2R); Stephanie Baine (48R4L, 50R1R, 53R2R, 54R1R, 67R4L, 73R1L); Abby Barrows (15R1R, 57R3L, 65R1R, 83R2R); Jane Wia (8R2R, 39R2R, 82R2L); David von Schill (61R2R); Sascha Schulz (107R3L); and marinethemes.com/Stephen Wong (dolphin images on page 139).

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The authors accept full responsibility for, and welcome notification of, any errors in this publication.

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The Papua New Guinea Institute of Biodiversity (PINBio) co-ordinates nine programmes of action, including those related to biodiversity inventorising and education, all of which address biodiversity matters of local, national and international importance.

The David and Lucile Packard Foundation's Science and Conservation Program seeks to protect and restore our oceans, coast and atmosphere, and enable the pursuit of scientific research towards this goal.

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The University of Papua New Guinea's mission is to be the premier university of the Pacific making available quality education, research and services to Papua New Guinea and the Pacific.

The Project AWARE Foundation conserves underwater environments through education, advocacy and action. It is the dive industry's leading nonprofit environmental organisation.

PROJECT AWARE

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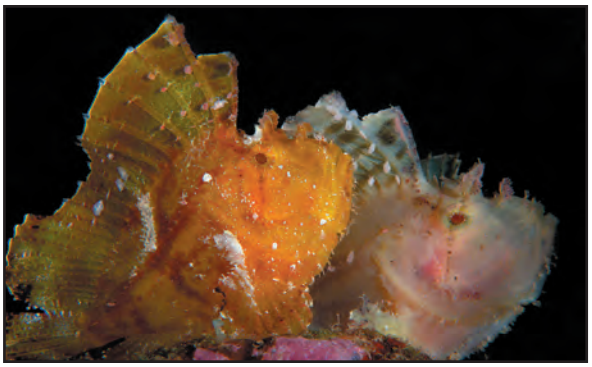


Leaf scorpionfish

The lacy scorpionfish, *Rhinopias aphanes*

Introduction

Bootless Bay and the Papuan Barrier Reef

Bootless Bay is located approximately 20 km to the south-east of Port Moresby. The Bay contains 4 islands: Motupore, Loloata, Manunouha (also known as Lion) and Bunamotu. The largest, Motupore Island, is home to the University of Papua New Guinea's marine research centre, while Loloata Island is home to an internationally renowned scuba diving and holiday resort. Both Manunouha and Bunamotu are uninhabited.

Bootless Bay displays a wide range of major marine habitats, including mangrove forests, seagrass beds, sandy beaches, rocky shores and reefs, intertidal and sublittoral carbonate and mud bottoms, open water, patch and fringing coral reefs. The Bay also has a number of wrecks scattered on its bed, each with their own distinctive biological communities. The adjacent Papuan barrier reef, paralleling the coastline some 5km offshore, is within easy reach and enables access to oceanic waters, deepwater wrecks and some spectacular deeper reef diving including tunnels, walls and bommies.

The wide range of habitats and the diversity of marine organisms found in the Bay and on the barrier reef, make this area an ideal laboratory for scientific study and a must-see destination for diving enthusiasts the world over.

Motupore Island Research Centre

Motupore Island was acquired by the University of Papua New Guinea in 1970 to protect the rich archaeological site discovered on the island which dates back at least 500 years. The Motupore Island Research Centre (MIRC) was originally administered by the Anthropology and Archaeology Department of the University. The teaching and research opportunities offered by MIRC, however, soon attracted the attention of the University's Biology and Geography Departments and so from the beginning MIRC had a multidisciplinary outlook. Gradually, the Biology Department began playing a major role in the administration of the Centre, and today MIRC falls under the School of Natural and Physical Sciences.

MIRC's mission is to build capability and advance knowledge in marine and coastal resource management in Papua New Guinea (PNG) and the Western Pacific, through the fostering of local, national and international links; the adoption of multidisciplinary and proactive approaches to problem solving; and the delivery of the highest standards of research and teaching. Since the 1970s, Bootless Bay, through MIRC, has been the subject of intensive study in a variety of disciplines, resulting in over 350 publications. MIRC is currently focussed on marine biodiversity research through the specialist Motupore Island Marine Biodiversity Unit (MIMBU), established in 2006 with assistance from the David and Lucile Packard Foundation. Amongst its achievements is the development and maintenance of a marine biodiversity database for PNG. For more information on MIRC and MIMBU, visit http://www.mirc.ac.pg.

Loloata Island Resort

The Loloata Island Resort was established in the 1970s. Loloata specialises in the provision of diving services, catering to all interests and levels of experience. The resort has its own dive shop, two dive boats and, experienced and friendly diving personnel. Loloata is able to access over 30 excellent dive sites, all with submerged moorings. Dive sites include walls, open water bommies, channels and superb dives for macro photography enthusiasts. For more information on Loloata Island Resort, visit http://www.loloata.com.

The Importance of Marine Biodiversity

When we use the term 'marine biodiversity', we are basically referring to the variety of biological life (plants and animals) found in our seas and oceans. Biological diversity, for example, reaches astounding levels in the group of animals known as marine invertebrates (animals without backbones). Over 1 million species of animal are thought to inhabit our planet, and of these, approximately 97% are invertebrates. While the majority of these are terrestrial in nature (e.g. insects), there are many different types of marine invertebrates, including single celled organisms (forams), sponges, bryozoans, crustaceans (crabs, lobsters, shrimp and barnacles), cnidarians (soft and hard corals, sea fans, sea pens, hydroids, jellyfish, black corals and anemones), molluscs (nudibranchs, cuttlefish, octopus and sea shells), echinoderms (sea cucumbers, sea stars, sea urchins, feather stars and brittle stars), flatworms and segmented worms. Then there are the ascidians (sea squirts) considered by many scientists to be a link between the marine invertebrates and vertebrates. And we haven't even mentioned marine vertebrates (fish, reptiles and mammals), plants and algae! On a daily basis new species of marine life are being discovered and there are thousands of species still officially undescribed.

But why is marine biodiversity important? There are many reasons, the nature and degree of the importance differing from individual to individual, depending upon personal values. Factors influencing a person's values may include how that person makes a living, and culture and education, all of which govern what a person knows about the surrounding natural world.

Marine biodiversity is often the focus of conservation or management projects and policies, at the local, national or international level. It also plays a significant part in our day to day activities. Biodiversity is seen by many as a major part of our planet's natural beauty. Indeed, many of us have a strong emotional connection with the biodiversity around us.

This beauty has spawned different types of tourism activities, which in turn can create sustainable local employment and revenue (e.g. diving and whale watching, and arts and crafts), often in places suffering harsh economic conditions. In many areas of the world, fish and other marine animals are an essential source of protein, though there is growing global concern at the

rate at which we exploit our seas for food. Scientists also continue to study the life in our seas in the hope of finding a cure for human diseases and cancer.

There is growing appreciation that every component of marine biodiversity has an important ecological role to play in maintaining ecosystem health and function. Some species or groups of marine organisms have particularly important roles, such as in the cycling of elements and the control of the abundance of other organisms through predator-prey relationships. Without some top predators, for example, population numbers of their prey may increase to a level that alters the biological structure of a particular ecosystem.

Scribbled pipefish (*Corythoichthys intestinalis*)

Pollution of our marine environment and natural phenomena or disasters can also impact on important marine habitats, such as mangrove forests, seagrass meadows and coral reefs. It is feared, for example, that the gradual warming of our seas is having a major impact on the health of our coral reefs, with increased levels of coral bleaching. Coral bleaching occurs when the tiny algae that co-exist with corals abandon that relationship as a result of intolerable levels of stress. This has a knock-on effect on fish populations and other organisms normally associated with a healthy coral reef.

Whatever we consider important about marine biodiversity, be it the beauty, the thrill of the unknown, the supply of food, the hope of medical discoveries, or its inherent natural and ecological value, there is one commonality of need: continuing balance and existence. We must strive to understand the environmental processes and socio-economics of resource use that affect this balance and existence. We must act to conserve our marine biodiversity for future generations.

Classification of Marine Life

All animals and plants are organised by scientists into a classification system with 7 main levels (kingdom, phylum, class, order, family, genus and species). Where an organism fits into this system depends upon many factors, including for example, its ancestry, morphology and how it gives birth.

Let's use the Durban hinge-back shrimp, a species of shrimp commonly found on Bootless Bay wrecks, as an example. Its classification follows this path: kingdom Animalia, phylum Arthropoda, class Malacostraca, order Decapoda, family Rhynchocinetidae, genus *Rhynchocinetes* and species *durbanensis*. It is the combination of genus and species names that gives this shrimp its unique identity within the classification system, i.e. *Rhynchocinetes*

Durban hinge-back shrimp (*Rhynchocinetes durbanensis*)

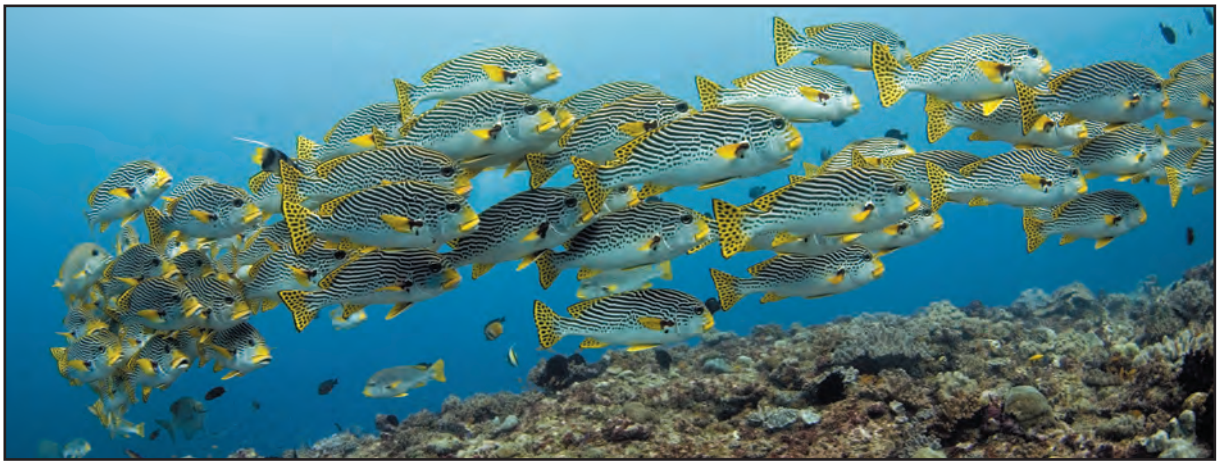
durbanensis. The classification system uses the Latin language universally. While the common name of a species may change from country to country and language to language, the species name does not.

Those species found within the same genus are considered to be more closely related to each other than to species of other genera. Species found within the same family are also considered to be more closely related to each other than to species of other families. The same applies to orders, classes and so on. For example, the Durban hinge-back shrimp is more closely related to swimming crabs (order Decapoda, family Portunidae) than to mantis shrimps (order Stomatopoda).

When we talk about a 'species', we are basically referring to a plant or animal that is able to interbreed with other individuals of that species. While two species of the same genus will share common external and internal features, e.g. the saddleback anemonefish, *Amphiprion polymnus* and the black anemonefish, *Amphiprion melanopus*, they will normally be unable to breed with each other.

Exploring the Guide

This guide is not exhaustive. Its purpose is to provide the reader with an introduction to the diversity of marine life found in Bootless Bay and the adjacent Papuan barrier reef. There are many marine species found in the Bay that do not appear in this guide. The guide focuses on the major taxonomic groups of plants and animals, providing some introductory information on each group, followed by photographic images. It concludes with some thoughts on how we all can help maintain the high level of biodiversity in the Bay.



Schooling yellow banded sweetlips (*Plectorhinchus lineatus*) on Suzie's Bommie

At the top of each page, we provide the main common name of the group along with any sub-groups, e.g. Echinoderms: Sea Cucumbers. Below each photograph we provide the following information where possible: scientific name, common name, family (in capitals) and size. We have tried our best to ascribe common names, but in many instances, they do not exist. Readers

should note that one particular species may have more than one common name depending on where it is found. In this guide we have provided what we feel is the most appropriate common name in usage.

The scientific name is provided where known. In some instances, it is not possible to identify a specimen to species level from a photograph. A particular species may also be undescribed in the scientific literature. Where this is the case we simply identify it as far as possible, to either genus, e.g. *Corythoichthys* sp., or family, e.g. RHYNCHCINETIDAE.

Where possible we have provided a size estimate. For some groups this takes the form of maximum (Max) known size. For all other species, this is the photographer's best estimate at the time of the photograph.

The vast majority of the photographs (91%) in this guide were taken in Bootless Bay or on the adjacent Papuan barrier reef. In some instances we have used photographs from other locations to illustrate a particular species which we know is found here. Where we have used such photographs, we have placed an asterisk (*) beside the name.

Finally, where you see cf. within a scientific name, this basically means compare with, as the specimen closely resembles that particular species. Where we have used auctt., this indicates another scientific name that has been mis-applied to this species by other authors.

Coral Reefs

Coral reefs are generally considered the most beautiful and diverse of all the marine habitats. Over time, up to thousands of years, the skeletons of corals, molluscs, shells and coralline algae help build the reef through cementation. On the surface of the reef a rich variety of living corals and other organisms continue this process of cementation. Worms, sponges, algae and shellfish, for example, all burrow into coral, producing sand which is then cemented into the reef by the encrusting coralline algae. The structure of coral reefs is very intricate, providing crevices, overhangs and shade for thousands of vertebrate, invertebrate and other organisms that make the reef their home. The abundant fish employ a wide range of feeding, reproductive and territorial habits.

There are organisms which do not directly contribute to the structure of the reef, but these reef inhabitants still play important roles, such as in the transfer of energy through the food webs based on the reef. Life on a coral reef involves a complex system of relationships among organisms and between organisms and their environment.

If you pay close attention to the reef when swimming, snorkelling or diving you will not only see an amazing diversity of life, but will also be able to observe the fascinating behaviour of a wide range of organisms, perhaps nudibranchs laying their eggs or anemones hitching a ride on a crab's back.

Muse on how they have adapted to their habitat, marvel at how they defend themselves and know that each individual organism is only a very small part of a much larger thriving system.

Mangroves

Mangroves are coastal trees or shrubs (kingdom Plantae, division Magnoliophyta, class Magnoliopsida) that are adapted to the marine environment and inhabit the intertidal area between land and sea.

Lionfish in mangrove forest

Mangroves have adapted to life in a harsh, often anoxic (lacking oxygen) environment, where there is large amounts of silt and mud. One of the more noticeable mangrove adaptations is in root morphology, which varies according to the local environment. These can include prop roots that arch downward from tree trunks for support, and pneumatophores that are directed upwards into the air.

Mangroves survive in saltwater environments by either excreting the salt through special glands on the leaves, dropping their leaves, or blocking the uptake of salts through the roots. Mangrove seeds (propagules) germinate on the parent tree prior to their release, when they drop into the mud or float away with the tide.

Mangroves provide important feeding and nursery areas for fish and crustaceans. The intricate complexity of mangrove roots make ideal hiding places from predators. The roots themselves display quite a variety of invertebrates, including hermit crabs, nudibranchs, barnacles and shrimp. Further up the tree, the trunks, branches and foliage are also home to other animals, such as bats and insects. The leaves shed by mangroves provide food for a number of organisms, including fiddler and ghost crabs. These crabs create burrows around mangroves, enabling a regular flushing of the mangrove roots by tidal water.

The seeds of the chili mangrove

The following nine species of mangrove can be found on Motupore Island, and represent approximately 33% of the total number of species thought to be present in Bootless Bay.

***Avicenna eucalyptifolia* – White mangrove**
AVICENNIACEAE – 300 cm

Xylocarpus rumphii
MELIACEAE - 150 cm

Excoecaria agallocha – **White sap mangrove**
EUPHORBIACEAE – 300 cm

Aegicerus corniculatum – **Chili mangrove**
MYRSINACEAE – 250 cm

Osbornia octodonta – **Myrtle mangrove**
MYRTACEAE – 250 cm

Aegialitis annulata – **Club mangrove**
PLUMBAGINACEAE – 100 cm

Bruguiera gymnorrhiza – **Oriental mangrove**
RHIZOPHORACEAE – 400 cm

Rhizophora stylosa – **Spider or red mangrove**
RHIZOPHORACEAE – 250 cm

Sonneratia alba – **Starfruit mangrove**
SONNERATIACEAE – 180 cm

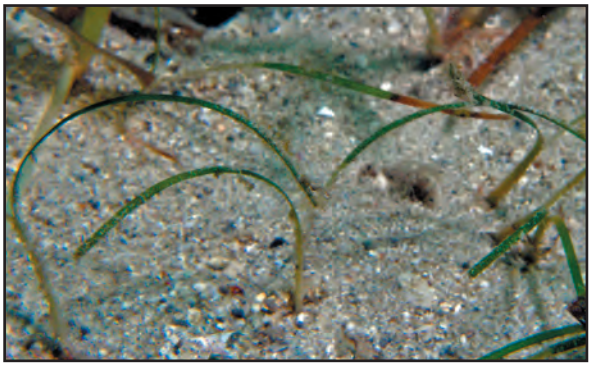
Seagrasses

Seagrasses (kingdom Plantae, division Magnoliophyta, class Liliopsida) are a functional grouping of true flowering plants that have adapted to the marine environment. There are approximately 60 described species globally, the majority of which live totally submerged in seawater, in shallow environments where there is a high availability of light. Seagrasses are anchored by a system of below ground rhizomes and roots through which they obtain nutrients. Seagrasses actually help to stabilise coastal sediments and fight coastal erosion.

Being flowering plants, pollen is produced and dispersed by water currents. Their flowers are, however, rather dull compared with terrestrial flowers. Seagrasses also produce fruits and set seed.

Seagrass meadows provide habitats for many vertebrates and invertebrates, and are nursery grounds for commercially important fish and crustaceans. Seagrasses also act as nutrient sinks, filtering nutrient and chemical inputs to the marine environment.

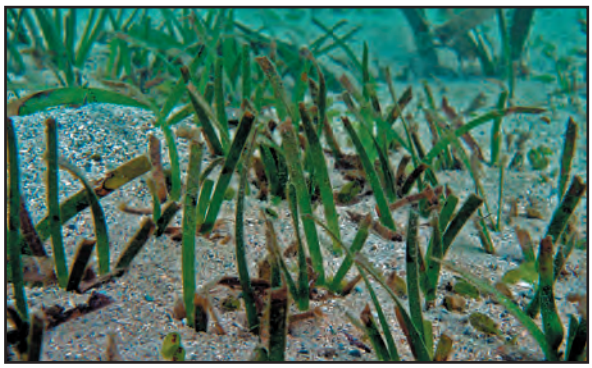
Bootless Bay, more specifically the area surrounding Motupore Island, is the site for some of the earliest studies on seagrass ecology conducted in the Indo-West Pacific. Here we provide photographs of five of the Bay's ten species. There are thirteen reported species found in Papua New Guinea.



Halodule uninervis – **Needle seagrass**
CYMODOCEACEAE – 5 cm

Enhalus acoroides – **Tape seagrass**
HYDROCHARITACEAE – 70 cm

Halophila ovalis – **Paddle grass**
HYDROCHARITACEAE – 1.5 cm



Cymodocea rotundata – **Ribbon seagrass**
CYMODOCEACEAE – 7 cm

Thalassia hemprichii – **Turtle grass**
HYDROCHARITACEAE – 15 cm

Algae

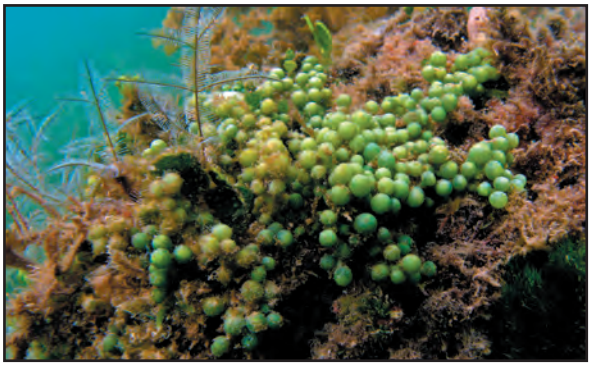
Algae in general are commonly referred to as plants, but this is not true. They do have the major features of plants with cells that carry out photosynthesis. Algae, however, have simpler reproductive organs than plants and lack the embryonic development of plants. They are now often regarded as protists (kingdom Protista) although they function just like plants in the ecosystems where they live. They range in size from the microscopic phytoplankton to the large seaweeds.

Algae show more diversity than plants because they have several colour groups distinguished on fundamental biochemical features such as the pigments they contain. In plants these are relatively uniform.

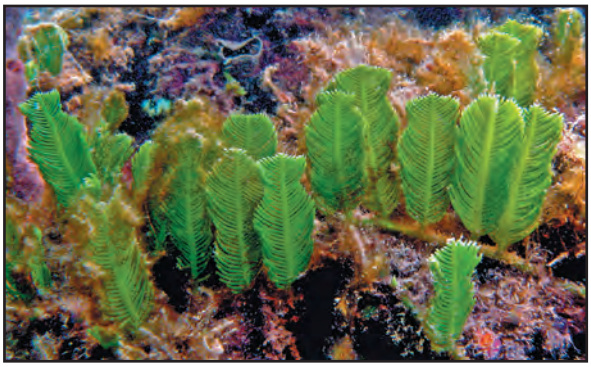
Seaweeds belong to three colour groups: green, brown and red but there are more groups with phytoplankton in them.

Seaweeds differ from plants in that they do not have roots and leaves with systems for saving water and exchanging gases with air.

The blue-green algae are really bacteria, but unlike bacteria they have the photosynthetic mechanism of algae and plants. They are also known as cyanophytes or cyanobacteria. Some of them have forms like seaweeds and live like plants in seashore ecosystems, though the cyanophytes have fewer seashore species compared with other algae.



***Caulerpa racemosa* – Sea grapes**
CAULERPACEAE – 14 cm

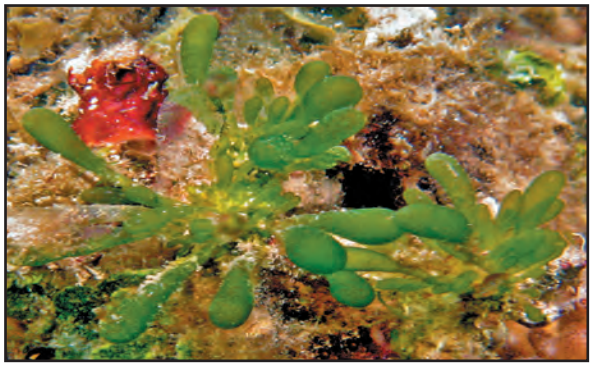


***Caulerpa taxifolia* – Feather algae**
CAULERPACEAE – 3 cm

***Halimeda* sp. – Cactus algae**
HALIMEDACEAE – 10 cm

***Halimeda* sp. – Cactus algae**
HALIMEDACEAE – 4 cm

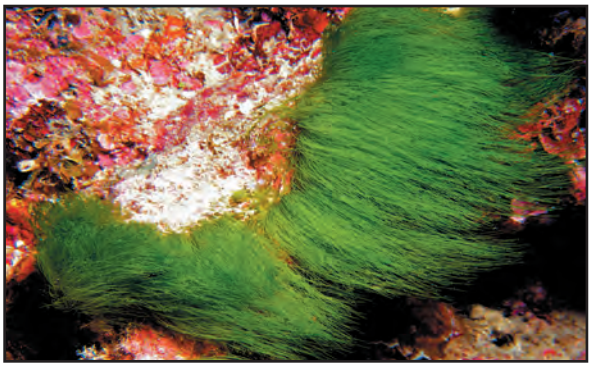
***Halimeda* sp. – Cactus algae**
HALIMEDACEAE – 3 cm



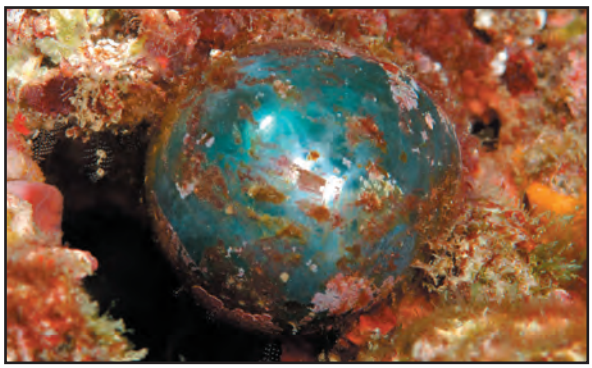
Boergesenia forbesii – **Green algae**
SIPHONOCLADACEAE – 4 cm

Dictyosphaeria versluysii – **Buttonweed**
SIPHONOCLADACEAE – 3 cm

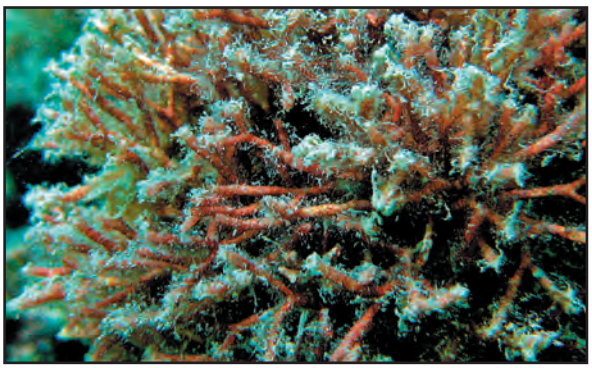
Avrainvillea **sp. – Mermaid's fan**
UDOTEACEAE – 6 cm



Chlorodesmis fastigiata – **Turtle weed**
UDOTEACEAE – 16 cm

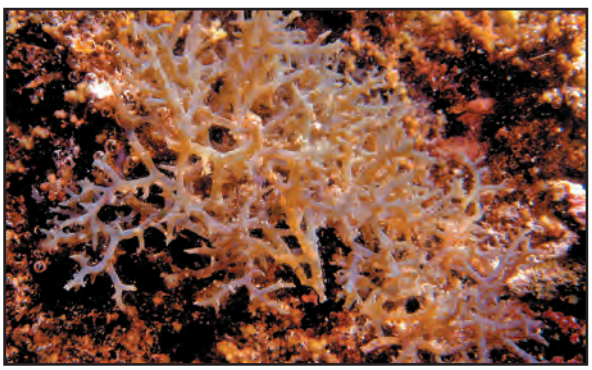


Valonia ventricosa – **Sailor's eyeball**
VALONIACEAE – 4 cm



Actinotrichia fragilis – **Fragile algae**
GALAXAURACEAE – 10 cm

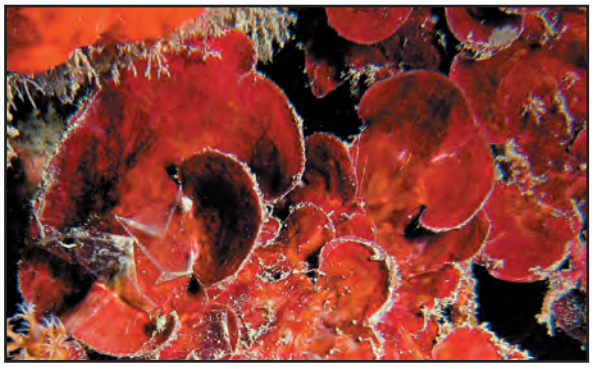
Gracilaria salicornia
GRACILARIACEAE – 45 cm



Hypnea pannosa – **Tattered sea moss**
HYPNEACEAE – 20 cm

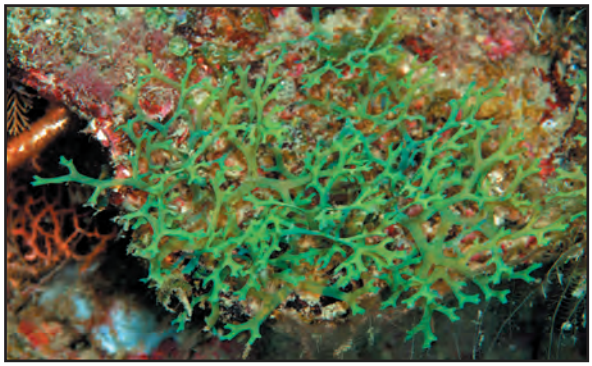
Acanthophora spicifera – **Spiny seaweed**
RHODOMELACEAE – 18 cm

Dasya **sp. – Red algae**
RHODOMELACEAE – 24 cm

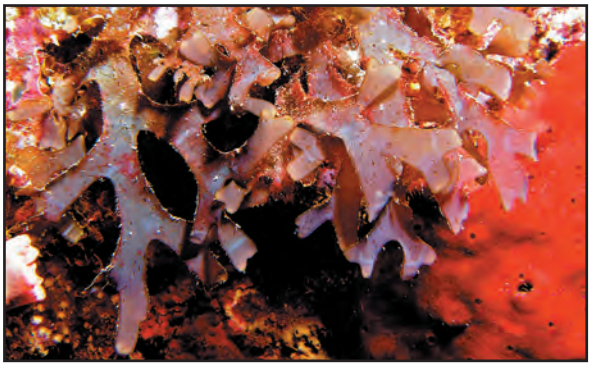


Peyssonnelia **sp. – Red algae**
PEYSSONNELIACEAE – 8 cm

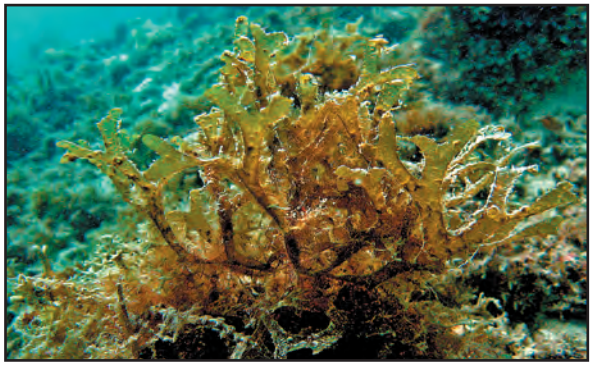
Ahnfeltiopsis **sp. – Ahnfelt's seaweed**
PHYLLOPHORACEAE – 24 cm



Dictyota magneana – **Branched algae**
DICTYOTACEAE – 12 cm



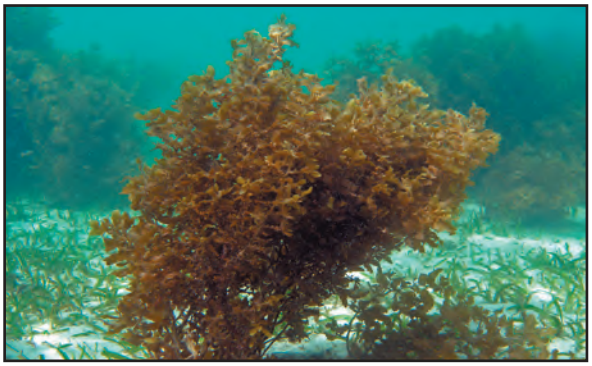
Dictyota **sp. – Branched algae**
DICTYOTACEAE – 6 cm



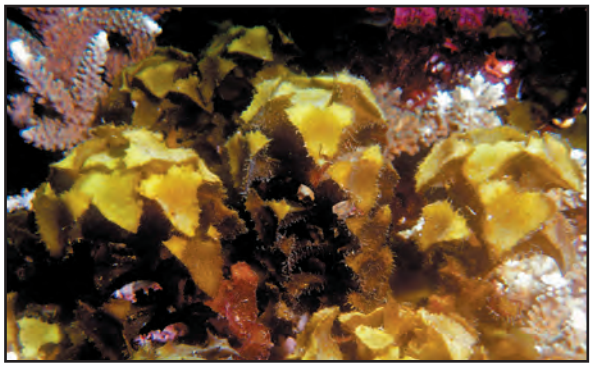
Dictyota **sp. – Branched algae**
DICTYOTACEAE – 24 cm

Padina **sp. – Funnelweed**
DICTYOTACEAE – 28 cm

Sargassum **sp. – Sargassum weed**
SARGASSACEAE – 30 cm

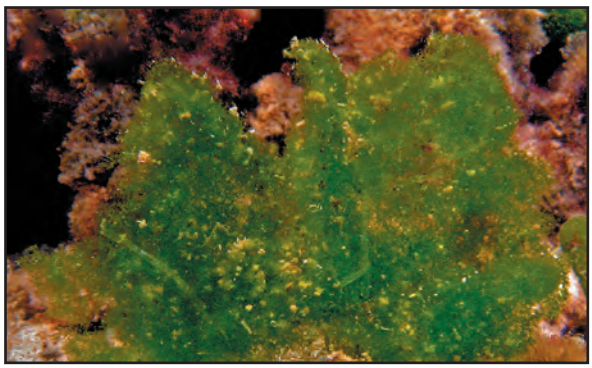


Sargassum **sp. – Sargassum weed**
SARGASSACEAE – 70 cm

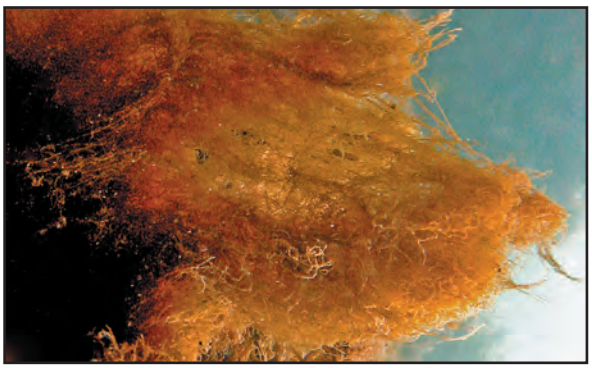


Turbinaria decurrens **– Triangular sea bell**
SARGASSACEAE – 25 cm

Hydroclathrus clathratus **– Netweed**
SCYTOSIPHONACEAE – 18 cm



Boodlea **sp.**
BOODLEACEAE – 22 cm



Microcoleus lyngbyaceus **– Mermaid's hair**
Cyanophyta – PHORMIDIACEAE – 12 cm

Unidentified sp.
Cyanophyta – 4 cm

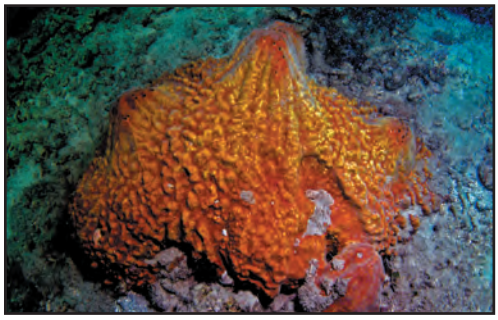
Unidentified sp.
Cyanophyta – 6 cm

Sponges

Sponges (kingdom Animalia, phylum Porifera) display a wide range of shapes and sizes. Their form can resemble barrels, volcanic mounds, tubes, dishes, baskets and encrusting sheets. They range in size from millimetres to metres and exhibit a wide variety of colours. Sponges occur in habitats ranging from deep ocean trenches to shallow waters. Some even live on other organisms such as crabs, providing camouflage and achieving mobility in return.

Sponges do not have muscles, nerves, mouths or body organs. They have many different types of cells which perform their bodily functions. Water is drawn into their body chambers through body pores known as ostia, and pumped through the body using cells, known as choanocytes, that have a whip-like flagella, or hair. The sponge takes up oxygen and captures tiny bits of food from the water before it is expelled, carrying waste products, through the larger exhalent pores called oscules.

Sponge skeletons consist of tiny siliceous, or occasionally calcareous, structures called spicules, and protein fibres. Some can be quite spiny and/or produce noxious chemicals. Sponges do not have many predators but some species are eaten by molluscs, echinoderms, fish and turtles. Some sponges also cause skin irritation in humans, if touched.

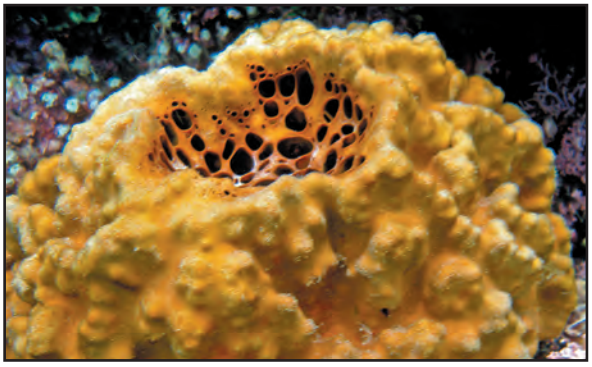


***Spheciospongia vagabunda* mound**

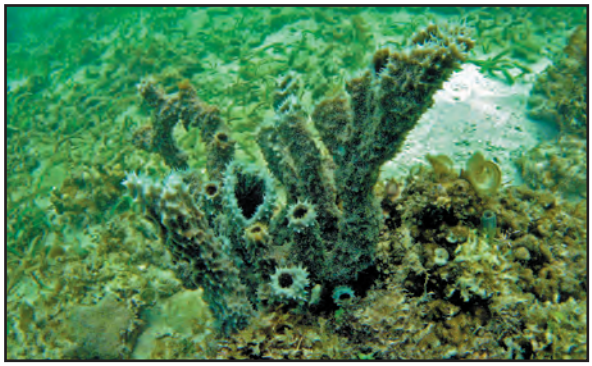
Sponges are mostly hermaphrodites, meaning that they are both male and female. As a male, a sponge will release its sperm into the water column to be taken in by a nearby female, where it is transported to the eggs by cells known as archaeocytes. After fertilisation the eggs develop into larvae which are expelled by the sponge into the water, where they eventually settle and develop into young sponges. Females may also release eggs into the water where fertilisation occurs. Sponges also reproduce asexually. Fragmentation, especially as a result of storms and other disturbances, is thought to be the main means of dispersal and recruitment for local sponge populations.

There are around 9,000 species of described sponges, and an estimated total of over 15,000 species worldwide. Many remain undescribed or undiscovered. Sponges are a major focus of research for anti-cancer and other medical drugs.

***Agelas* sp.**
AGELASIDAE – 20 cm – yellow

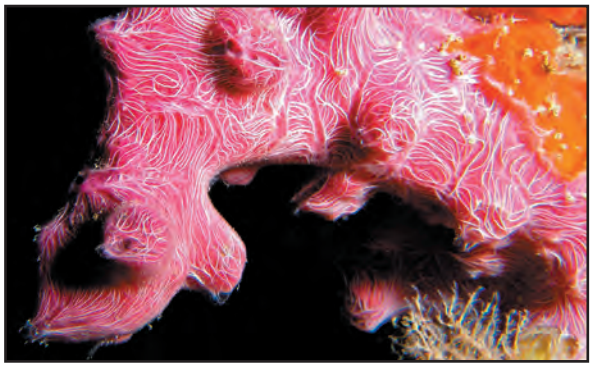


Rhabdastrella globostellata
ANCORINIDAE – 10 cm

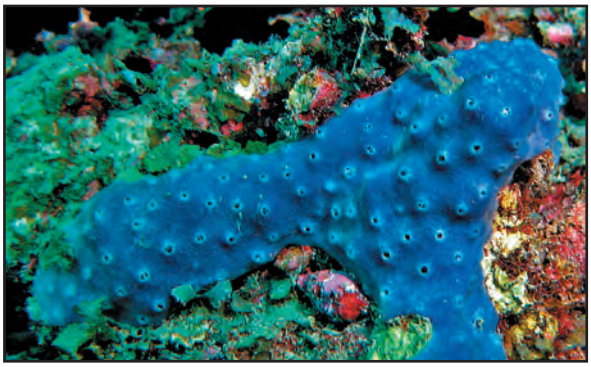


Callyspongia aerizusa
CALLYSPONGIIDAE – 15 cm

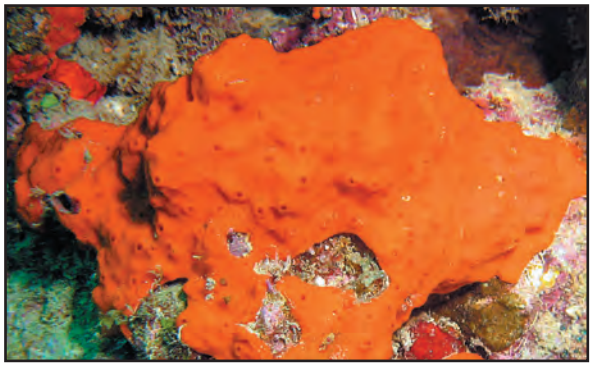
Callyspongia **sp.**
CALLYSPONGIIDAE – 15 cm



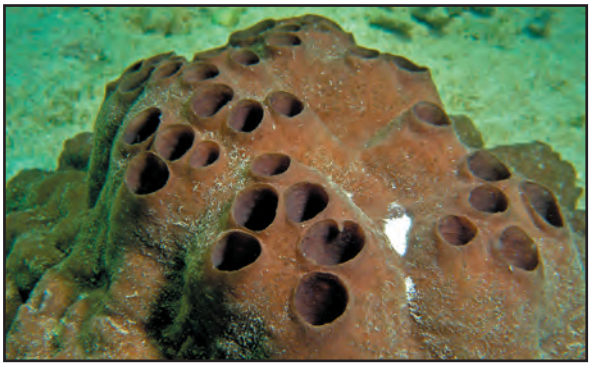
Haliclona nematifera
CHALINIDAE – 10 cm



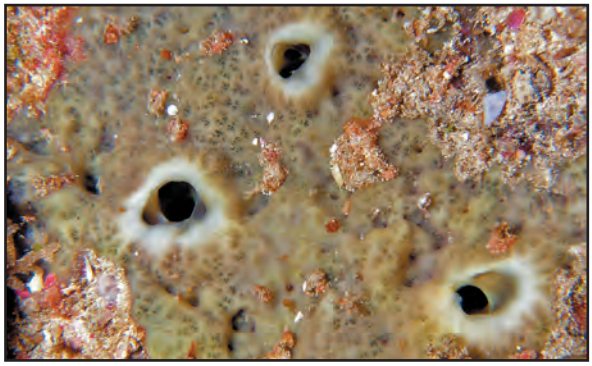
Haliclona velina
CHALINIDAE – 10 cm



Haliclona **sp.**
CHALINIDAE – 20 cm

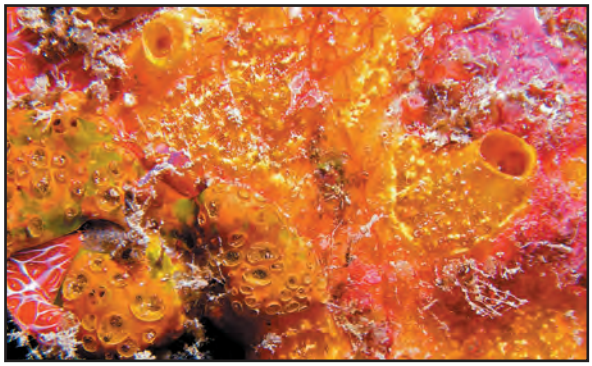


Spheciospongia vagabunda
CLIONAIDAE – 30 cm

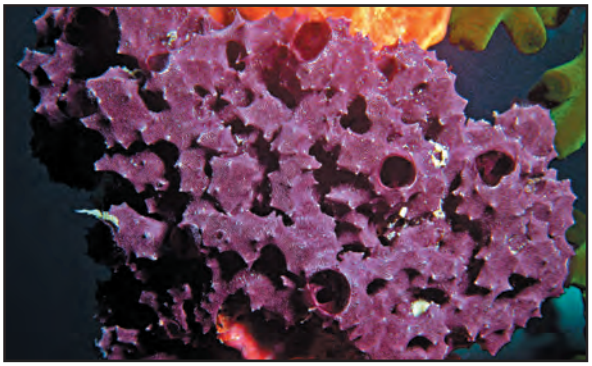


Spheciospongia **sp**.
CLIONAIDAE – 5 cm

Monanchora ungiculata
CRAMBIDAE – 15 cm

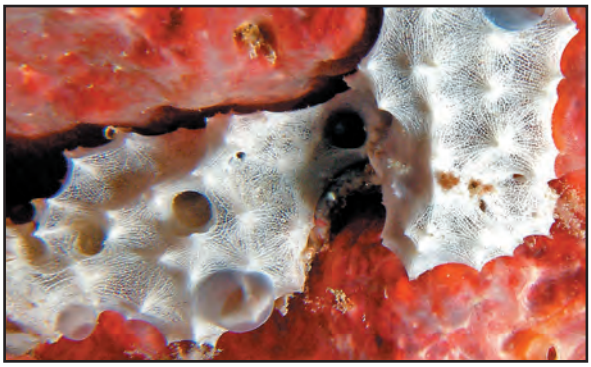


***Crella* sp.**
CRELLIDAE – 5 cm



Chelonaplysilla violacea
DARWINELLIDAE – 15 cm

Liosina granularis
DICTYONELLIDAE – 15 cm



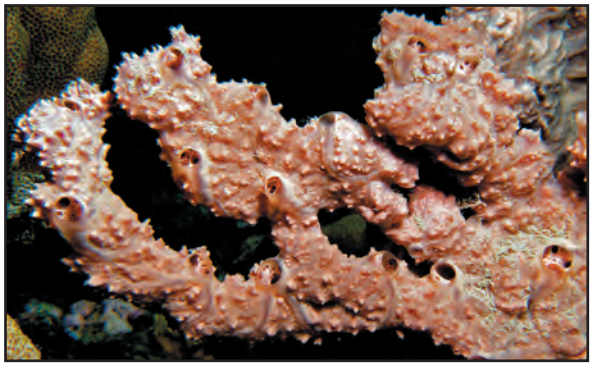
***Dysidea* sp.**
DYSIDEIDAE – 5 cm – white

Leucetta chagosensis
LEUCETTIDAE – 10 cm

***Leucetta* sp.**
LEUCETTIDAE – 10 cm – pink

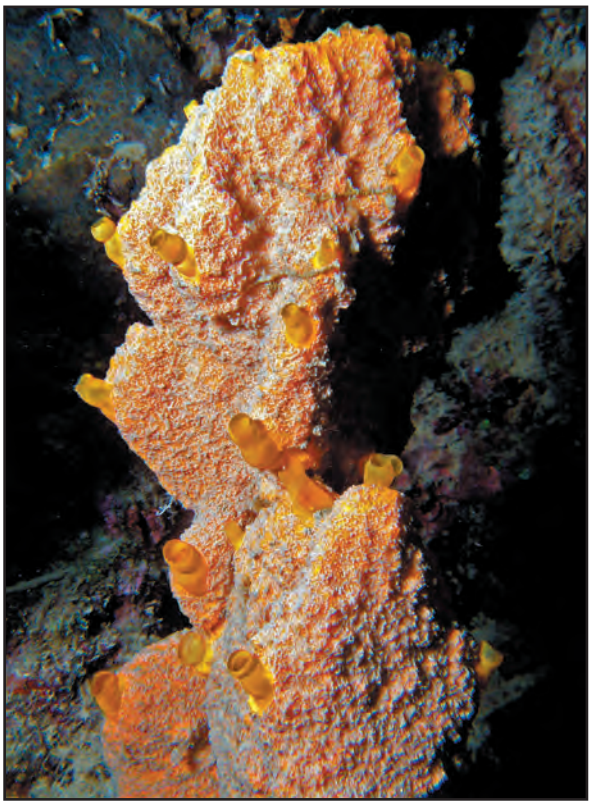
Pericharax heteroraphis
LEUCETTIDAE – 15 cm

Clathria mima
MICROCIONIDAE – 10 cm

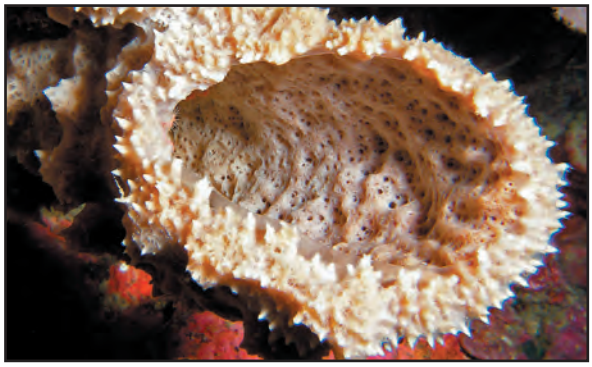


Clathria (Thalysias) reinwardti
MICROCIONIDAE – 30 cm

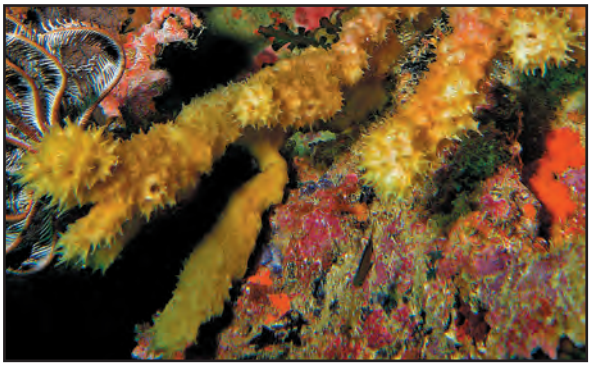
Gelliodes fibulata
NIPHATIDAE – 15 cm



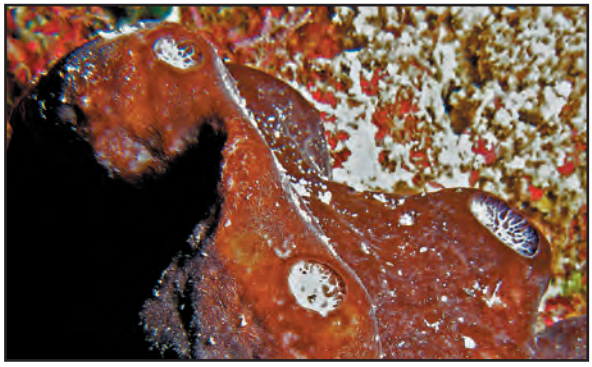
Mycale (Arenochalina) humilis
MYCALIDAE – 45 cm



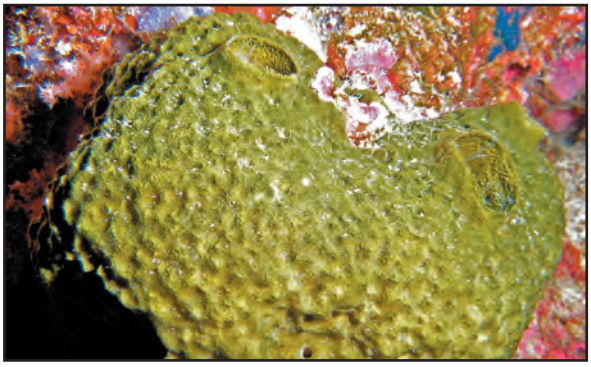
Gelliodes **sp. 1**
NIPHATIDAE – 10 cm



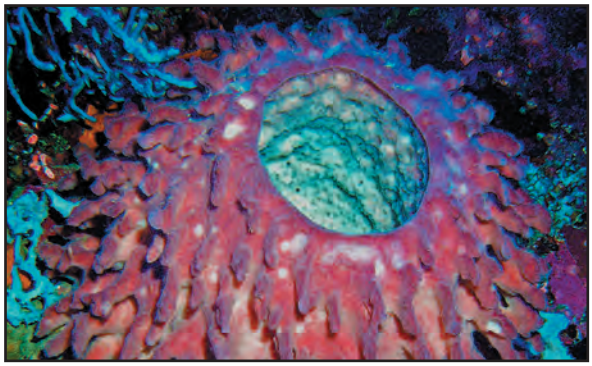
Gelliodes **sp. 2**
NIPHATIDAE – 20 cm



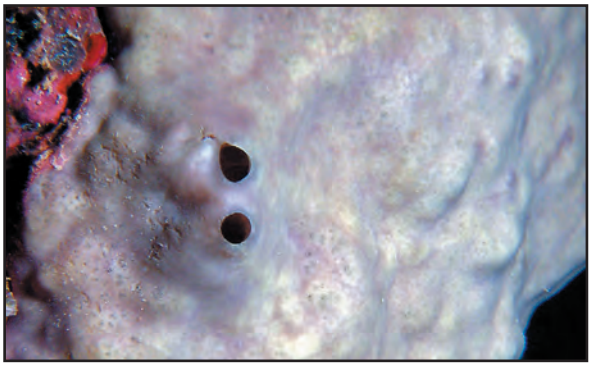
Petrosia **sp.**
PETROSIIDAE – 15 cm



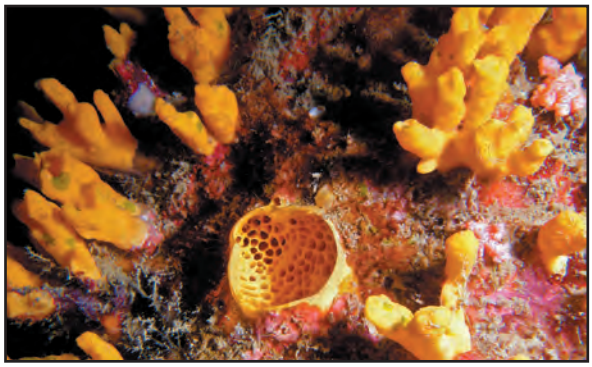
Strongylophora sphaeroidea
PETROSIIDAE – 10 cm



*Xestospongia testudinaria**
PETROSIIDAE – 100 cm



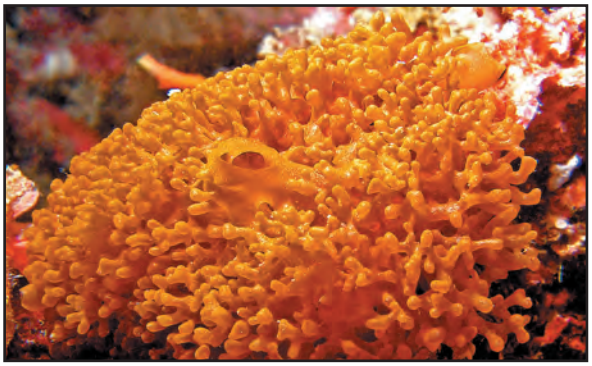
Unidentified sp. 1
PETROSIIDAE – 15 cm



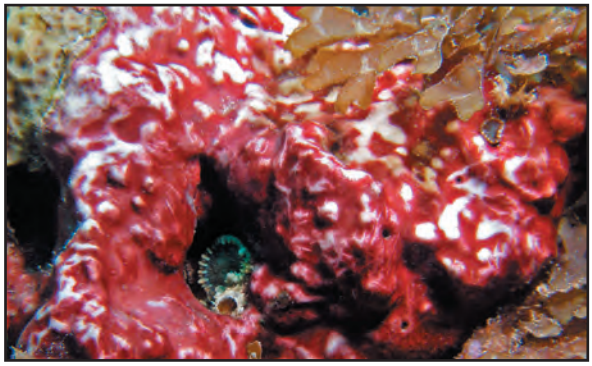
***Aka* sp. 1**
PHLOEODICTYIDAE – 15 cm

***Aka* sp. 2**
PHLOEODICTYIDAE – 15 cm– white

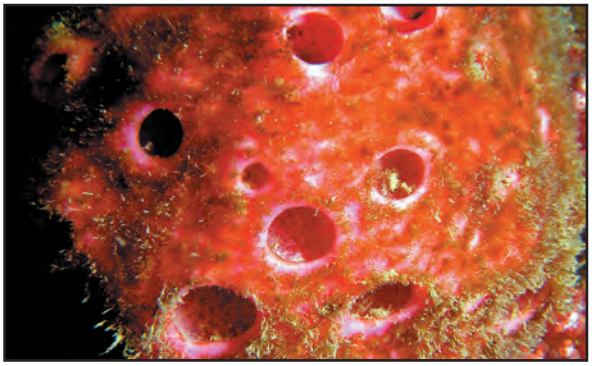
***Aka* sp. 3**
PHLOEODICTYIDAE – 5 cm – orange



***Dendya* sp.**
SOLENEISCIDAE – 10 cm



***Terpios* sp.**
SUBERITIDAE – 10 cm – plum red



Cinachyrella schulzei
TETILLIDAE – 10 cm

Cnidarians

The cnidarians (kingdom Animalia, phylum Cnidaria) is a large group of over 10,000 species that includes hydroids (class Hydrozoa), sea jellies (class Scyphozoa), sea wasps (class Cubozoa), and hard corals, soft corals, sea fans, corallimorphs, sea anemones, sea pens, black corals and zoanthids (class Anthozoa). They possess nematocysts which are special stinging darts that can paralyse or kill predators and prey.

Cnidarians have two main forms: the medusa, present, for example, in the sea jellies, with tentacles and mouth facing downwards; and the polyp which is attached to a surface with the mouth and tentacles facing upwards, as applies to all anthozoans. Some cnidarians, such as the hydroids, exhibit both forms.

Hydrozoans

Hydrozoans include hydrocorals; hydroids, or sea ferns; and floating sea jelly like organisms such as the Portugese man-of-war. They use their nematocysts to capture prey, and can deliver a nasty sting if touched.

Hydrocorals have calcareous skeletons and look like hard corals.

Hydroids are found throughout the oceans attached to rocks, corals, wrecks, and shells. Within a colony different polyps have special jobs: catching food, digesting it, defence and reproduction. Some nudibranchs consume the unfired nematocysts, making use of them when threatened.

Hydroids produce tiny medusae which break away and release either sperm or eggs. Fertilised eggs become larvae which then settle onto hard surfaces and grow.

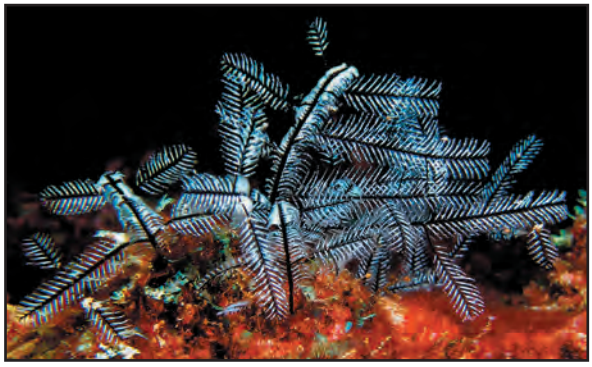
Sea Jellies

Sea jellies basically consist of a bell and tentacles. The bell contains the mouth, gut and sex organs. The number of tentacles can reach hundreds in some species. The tentacles are covered in stinging cells. It is wise to avoid them.

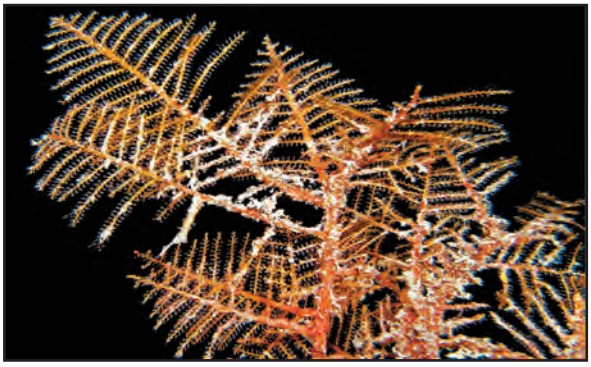
The bell of the Papuan sea jelly

Sea jellies are eaten by some fishes and sea turtles. Unfortunately for turtles, plastic bags discarded into our seas resemble jellyfish and can choke them when consumed.

Sea jellies drift with currents and can also move through the water using jet propulsion.



Macrorhynchia philippinus – **Philippine hydroid**
PLUMARIDAE – 2 cm



Idiellana pristis
SERTULARIIDAE – 4 cm

Millepora **sp. – Fire coral**
MILLEPORIDAE – 50 cm

Millepora **sp. – Fire coral**
MILLEPORIDAE – 80 cm

Distichopora **sp. – Lace coral**
STYLASTERIDAE – 30 cm

Distichopora violacea **– Violet hydrocoral**
STYLASTERIDAE – 25 cm

Stylaster **cf.** *papuensis*
STYLASTERIDAE – 30 cm

Physalia physalis **– Portugese man-of-war**
PHYSALIIDAE – 10 cm

Cassiopea **sp. – Upside down sea jelly**
CASSIOPEIDAE – 10 cm

Mastigias papua **– Papuan sea jelly**
MASTIGIIDAE – 25 cm

Soft Corals

Soft corals are common on reefs. Soft coral polyps have eight tentacles (or mutiples) around its mouth (soft corals, sea fans and sea pens are also collectively known as octocorals), as opposed to six (or multiples) in the hard corals. They do not have the skeletal support of hard corals. Instead each polyp is connected by fleshy tissue and reinforced by calcareous spicules. The shape and size of these spicules is important in species identification. It is very difficult to identify soft corals to species, as they exhibit a large degree of morphological variation, even within a particular species. The majority of soft coral specimens in this book are identified to genus level. We present eight photographs of *Dendronephthya* sp., for example, but are unable to identify how many different species there are within this collection.

Soft corals can adapt their form to changes in the environment, and can be found in shallow and deep waters. They are mainly filter feeders. The colonies can be very beautiful, displaying an array of colours. Soft corals often produce chemicals to deter predators, though there are some butterflyfishes that regularly feed on soft corals.

Soft corals reproduce sexually, releasing sperm and eggs into the water column. The fertilised eggs hatch into larvae and settle on a suitable spot, forming polyps which then bud into colonies.

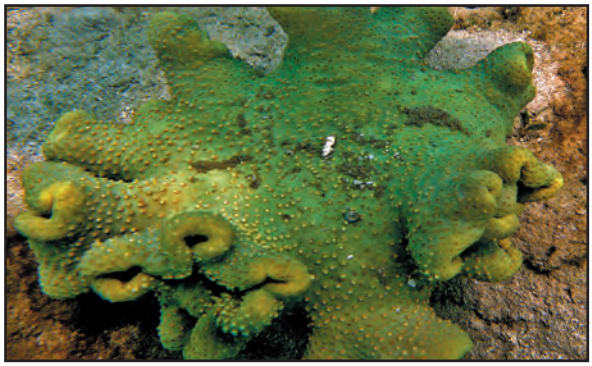
***Lobophytum* sp. – Lobed leather coral**
ALCYONIIDAE – 50 cm

***Lobophytum* sp. – Lobed leather coral**
ALCYONIIDAE – 100 cm

***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 50 cm

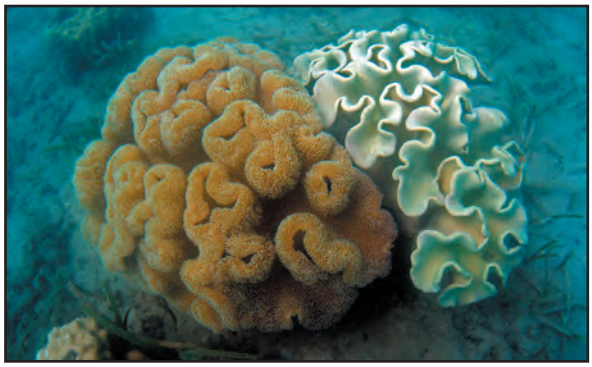
***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 100 cm

***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 45 cm

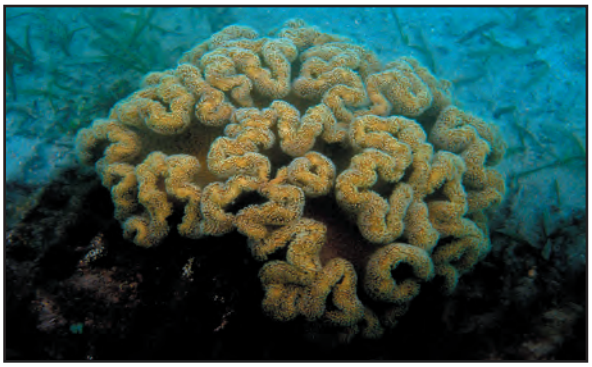


***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 50 cm

***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 20 cm



***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 80 cm



***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 80 cm

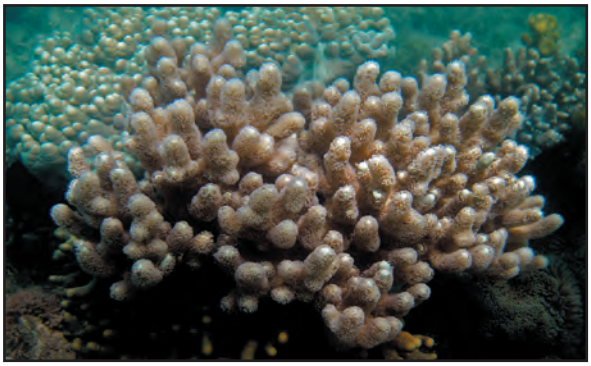
***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 80 cm

***Sarcophyton* sp. – Leather coral**
ALCYONIIDAE – 40 cm

***Sinularia flexibilis* – Flexible leather coral**
ALCYONIIDAE – 60 cm

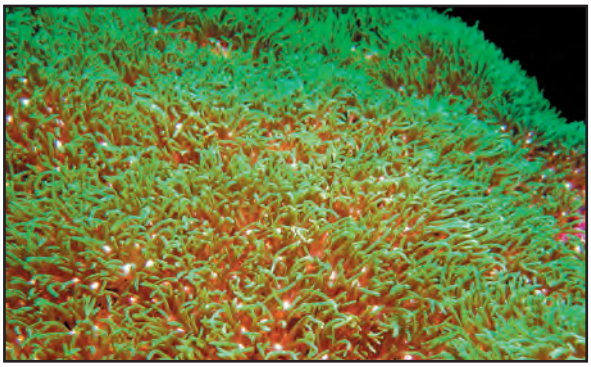
***Sinularia* sp. – Finger leather coral**
ALCYONIIDAE – 80 cm

***Sinularia* sp. – Finger leather coral**
ALCYONIIDAE – 40 cm

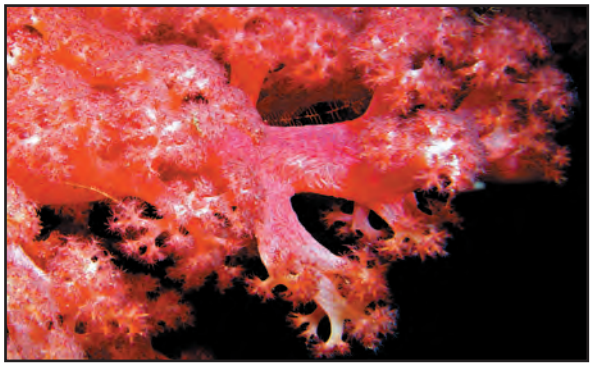


***Sinularia* sp. – Finger leather coral**
ALCYONIIDAE – 30 cm

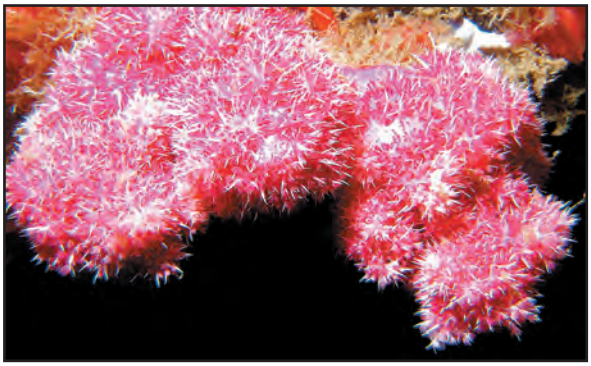
***Sinularia* sp. – Finger leather coral**
ALCYONIIDAE – 25 cm



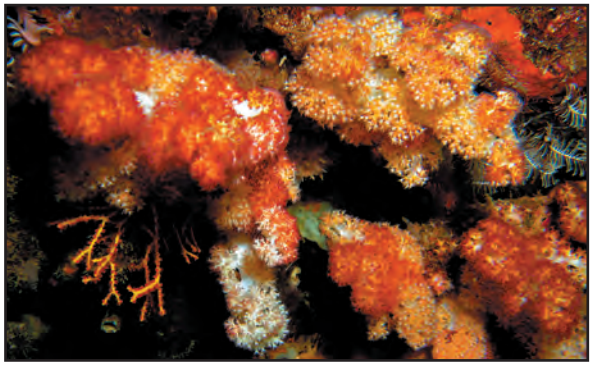
***Briareum* sp. – Green star polyps**
BRIAREIDAE – 100 cm



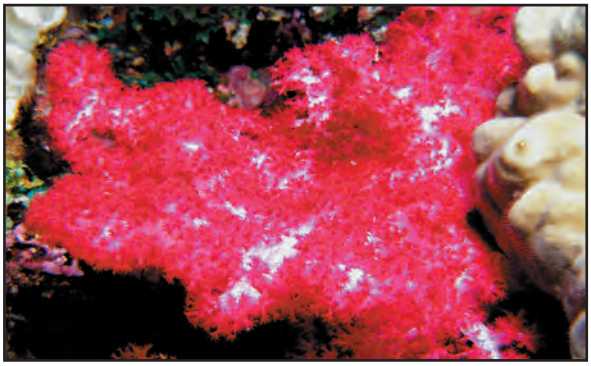
***Dendronephthya* sp. – Tree coral**
NEPHTHEIDAE – 25 cm



***Dendronephthya* sp. – Carnation coral**
NEPHTHEIDAE – 35 cm

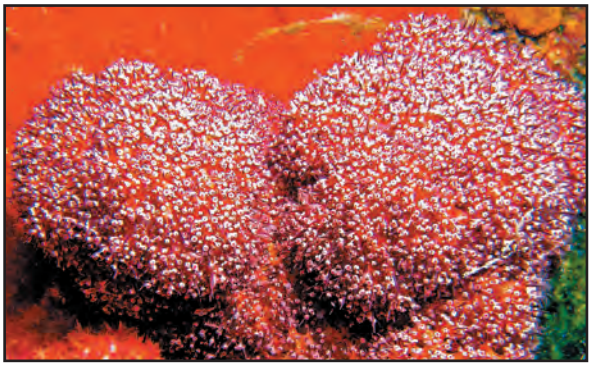


***Dendronephthya* sp. – Carnation coral**
NEPHTHEIDAE – 15 cm

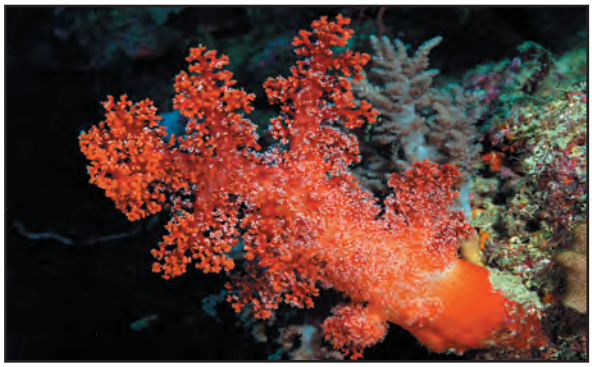


***Dendronephthya* sp. – Carnation coral**
NEPHTHEIDAE – 35 cm

Dendronephthya **sp. – Carnation coral**
NEPHTHEIDAE – 35 cm

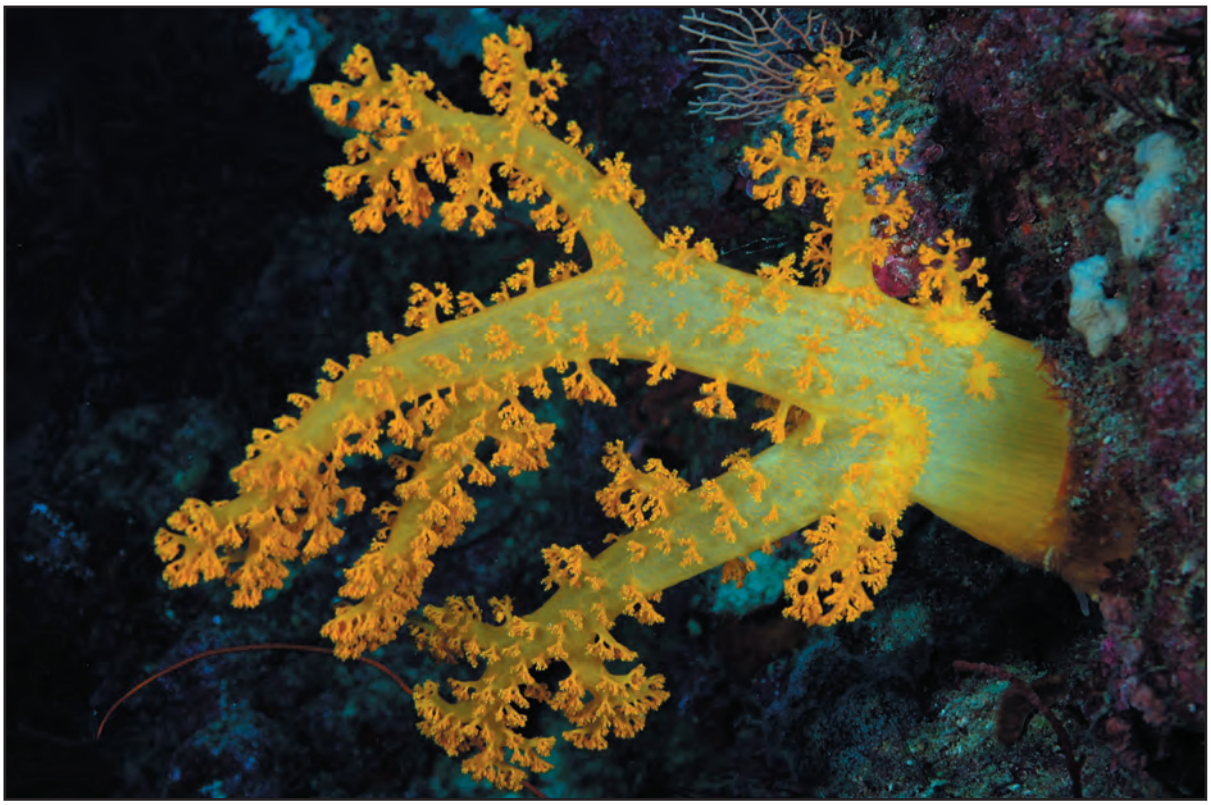


Dendronephthya **sp. – Carnation coral**
NEPHTHEIDAE – 25 cm

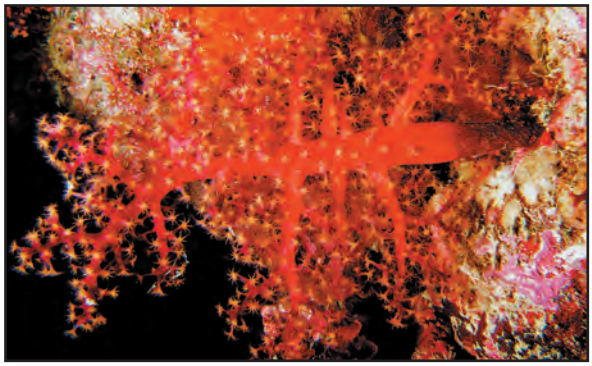


Dendronephthya **sp. – Tree coral**
NEPHTHEIDAE – 25 cm

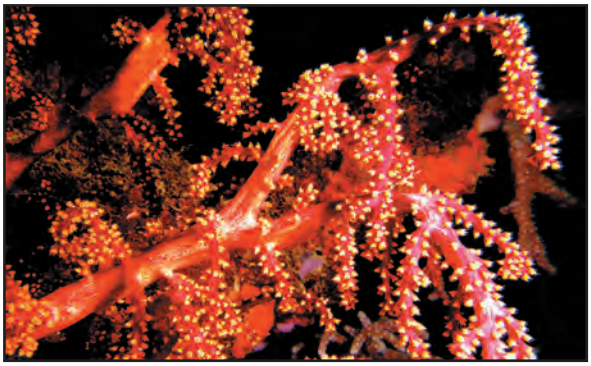
Stereonephthea **sp.**
NEPHTHEIDAE – 15 cm



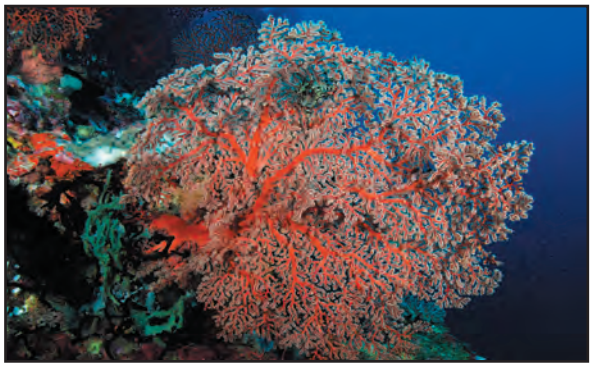
Dendronephthya **sp. – Tree coral**
NEPHTHEIDAE – 20 cm



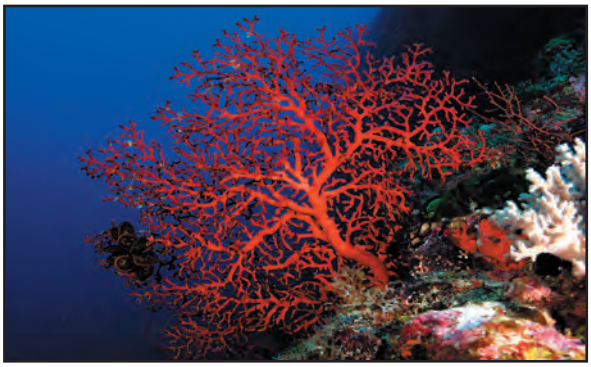
Chironephthya **sp.**
NIDALIIDAE – 15 cm



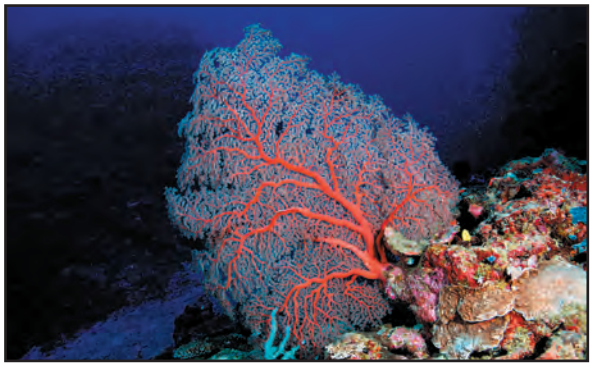
Chironephthya **sp.**
NIDALIIDAE – 25 cm



Siphonogorgia **sp.**
NIDALIIDAE – 50 cm



Siphonogorgia **sp.**
NIDALIIDAE – 45 cm

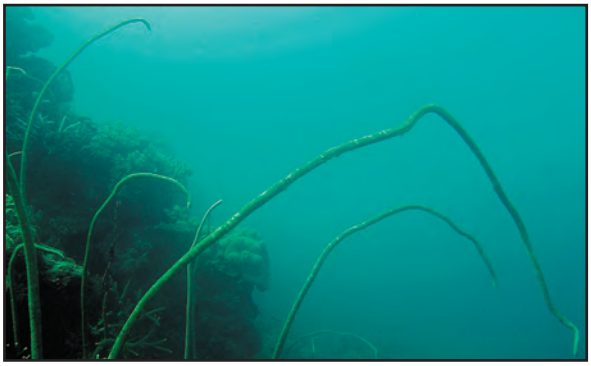


Siphonogorgia **sp.**
NIDALIIDAE – 70 cm

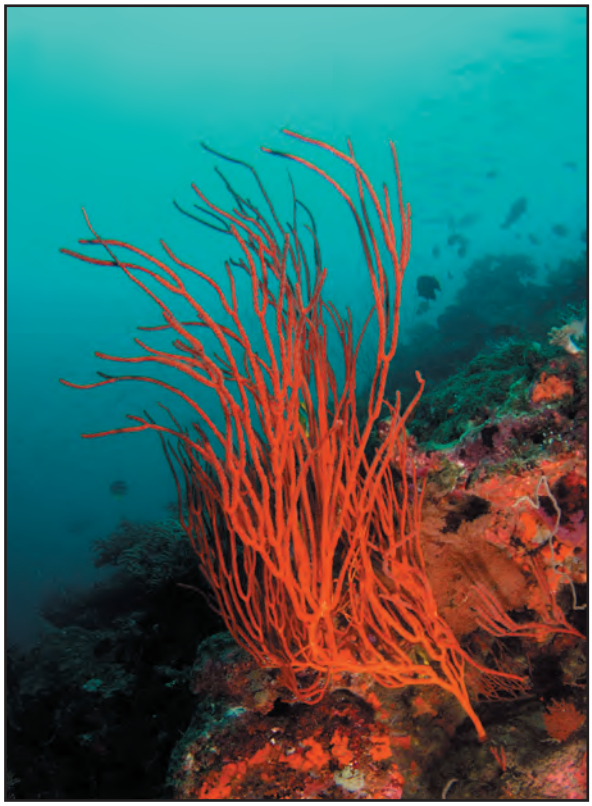
Anthelia **sp.**
XENIIDAE – 25 cm

Sea Whips and Sea Fans

Closely related to the soft corals, sea whips and fans come in a huge variety of colours and sizes. They are composed of colonies of polyps which secrete a firm, though delicate, skeleton to live upon. Tiny algae, known as zooaxanthellae, also live on some fans, providing the polyps with food and contributing to the fan's colour. Sea fans tend to grow across the current, the polyps spreading their tentacles to catch food.



Junceela fragilis **– Delicate sea whip**
ELLISELLIDAE – 100 cm



***Ellisella* sp. – Sea whip**
ELLISELLIDAE – 60 cm

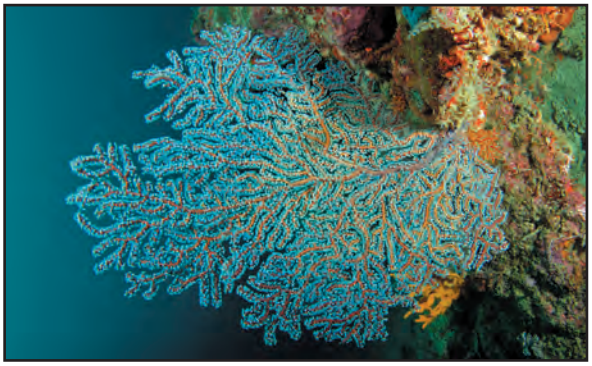
***Ellisella* sp. – Sea whip**
ELLISELLIDAE – 60 cm

***Alertigorgia orientalis* – Bushy gorgonian fan**
ANTHOTHELIDAE – 45 cm

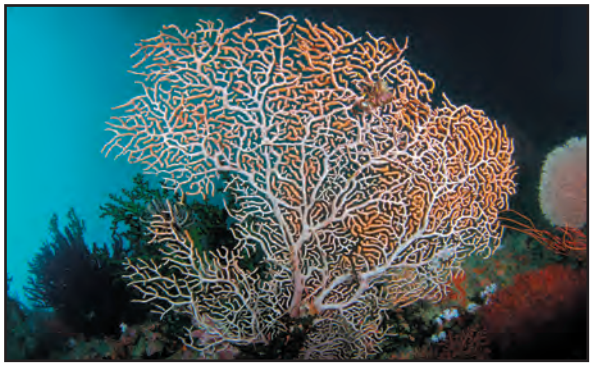
***Rumphella* sp. – Gorgonian fan**
GORGONIIDAE – 60 cm

Unidentified sp.
MELITHAEIDAE – 35 cm

***Astrogorgia* sp.**
PLEXAURIDAE – 10 cm



Unidentified sp.
PLEXAURIDAE – 40 cm



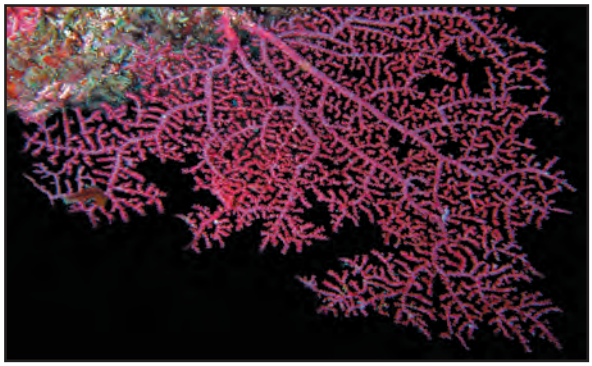
Unidentified sp.
PLEXAURIDAE – 80 cm

***Annella mollis* – Smooth sea fan**
SUBERGORGIIDAE – 130 cm

***Annella mollis* – Smooth sea fan**
SUBERGORGIIDAE – 200 cm

Unidentified sp.
Octocoral – 50 cm

Unidentified sp.
Octocoral - 70 cm



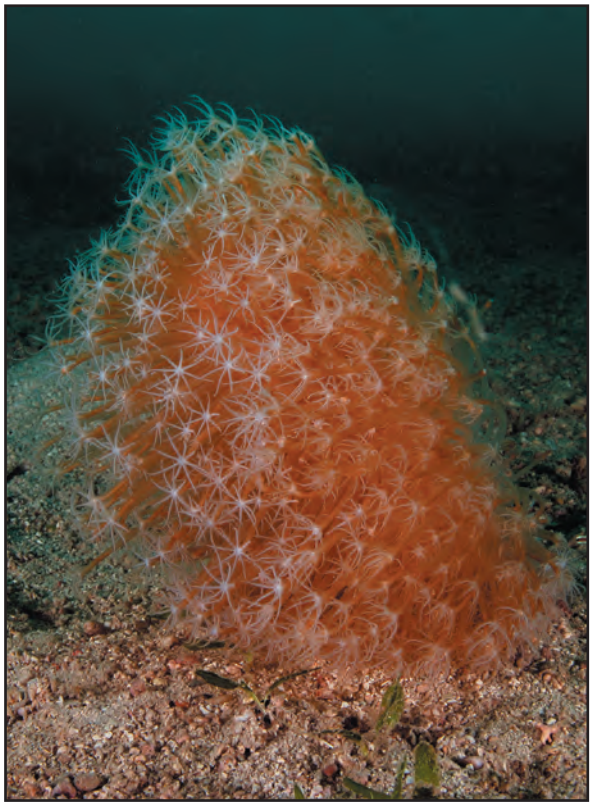
Unidentified sp.
Octocoral - 30 cm

Sea Pens

Sea pens are specialised octocoral colonies that live on branches extending from a central stalk. Their tissue is reinforced with spicules. Some sea pens resemble quill pens, hence their general name.

The colony pulls backs down into the sand as a defence mechanism. Some sea pens are bioluminescent, flashing blue and green colours if disturbed at night.

***Pteroeides* sp. – Sea pen**
PTEROEIDIDAE – 10 cm



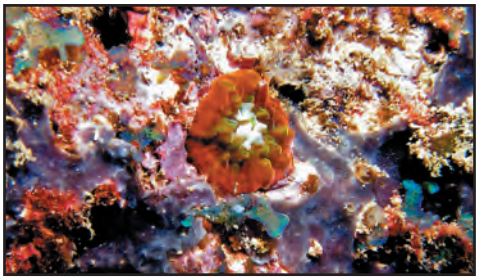
***Cavernularia* sp. – Sea pen**
VERETILLIDAE – 20 cm

Unidentified sp. – Sea pen
VIRGULARIIDAE – 15 cm

Unidentified sp. – Sea pen
VIRGULARIIDAE – 10 cm

Hard Corals

These animals provide habitats, food, protection and shelter for many reef dwelling organisms. Corals come in a variety of shapes and sizes. They can be branched e.g. *Tubastrea* and *Acropora* species; boulder-like e.g. *Favia* species; tabular e.g. some *Acropora* species; and free living e.g. *Fungia* species. When a coral polyp attaches itself to a surface it creates a hard cup known as a corallite. It then begins to divide with each new polyp in turn doing the same, increasing the size of the colony. Some coral reefs are thousands of years old.

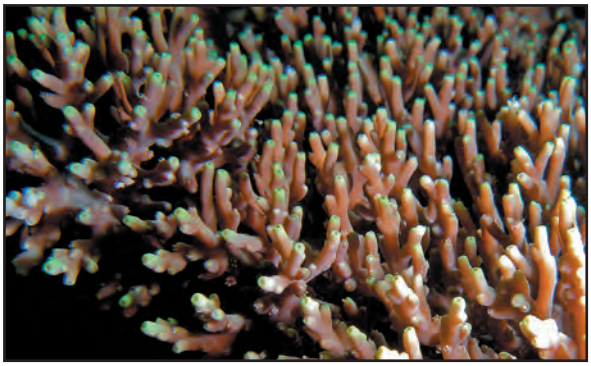


Unidentified juvenile coral (2 cm)

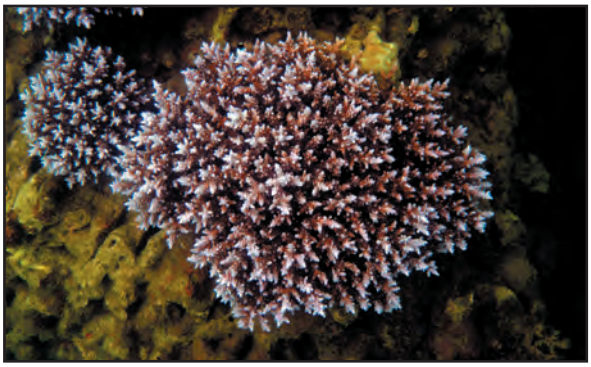
Tiny algae known as zooxanthellae occur in a diversity of reef organisms, including soft corals. They also live in the tissues of most hard corals. The algae gain protection from grazers, and nutrients from the corals, while the corals obtain food in return, in the form of carbohydrates. This relationship is an example of symbiosis.

Corals in a colony act as a team. They feed, generally at night, using their tentacles to capture food, and if threatened will retract them as one. Their bodies are connected, so they share their food. Some corals live alone on the seabed and can even move around with the use of their tentacles.

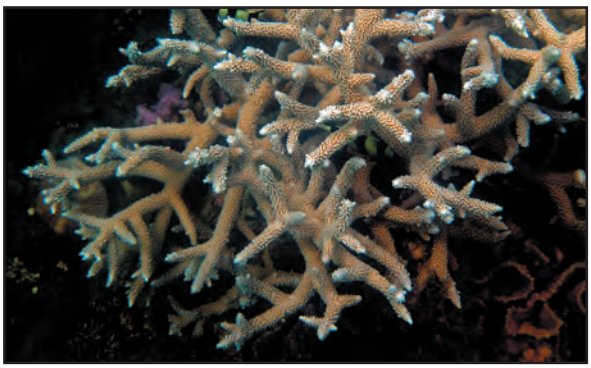
Corals may be male, female or both. Corals can reproduce asexually or sexually. Asexual reproduction often occurs involuntarily where several parts of a fractured colony can form new colonies. Corals reproduce sexually once or twice a year, in mass spawning events.



Acropora* cf. *caroliniana
ACROPORIDAE – 40 cm

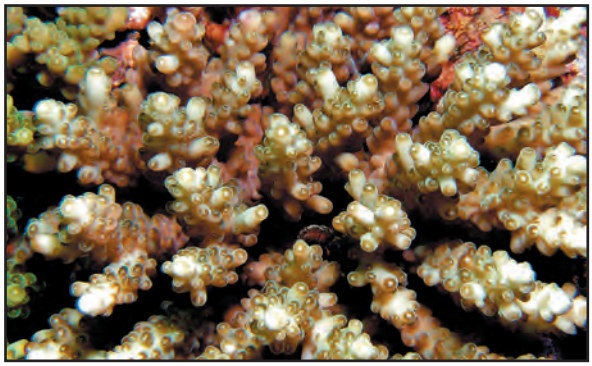


***Acropora* cf. *elseyi* – Christmas coral**
ACROPORIDAE – 50 cm



***Acropora grandis* – Staghorn coral**
ACROPORIDAE – 35 cm

***Acropora intermedia* – Staghorn coral**
ACROPORIDAE – 30 cm



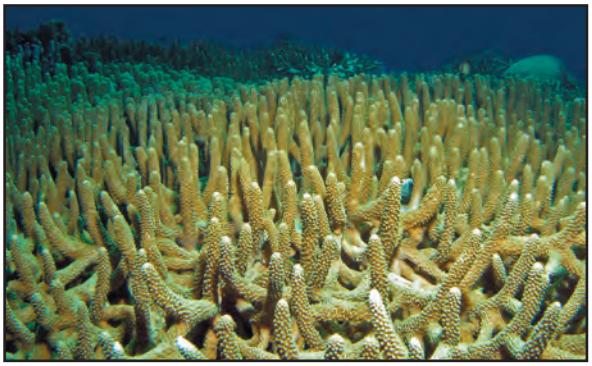
Acropora loripes
ACROPORIDAE – 30 cm

Acropora millepora – **Bushy staghorn coral**
ACROPORIDAE – 35 cm

Acropora millepora – **Bushy staghorn coral**
ACROPORIDAE – 15 cm – juvenile

Acropora muricata – **Staghorn coral**
ACROPORIDAE – 50 cm

Acropora tenuis – **Purple-tipped acropora**
ACROPORIDAE – 50 cm



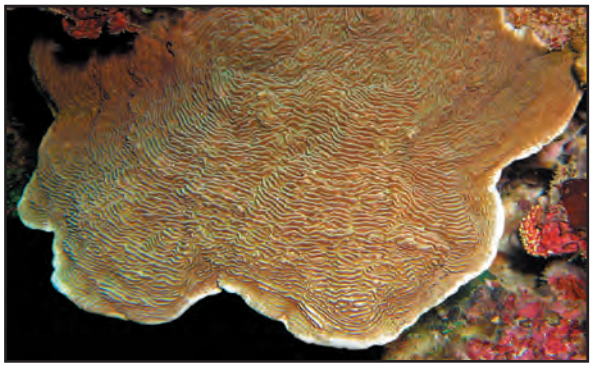
Acropora valenciennesi – **Branching coral**
ACROPORIDAE – 120 cm

Acropora **sp.** – **Bottlebrush coral**
ACROPORIDAE – 70 cm

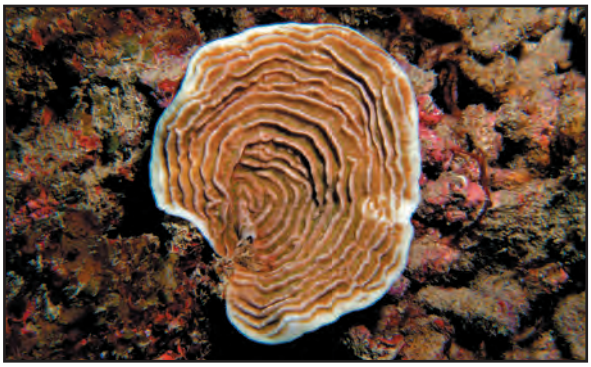
Acropora **sp.**
ACROPORIDAE – 25 cm

Acropora **sp. – Table coral**
ACROPORIDAE – 130 cm

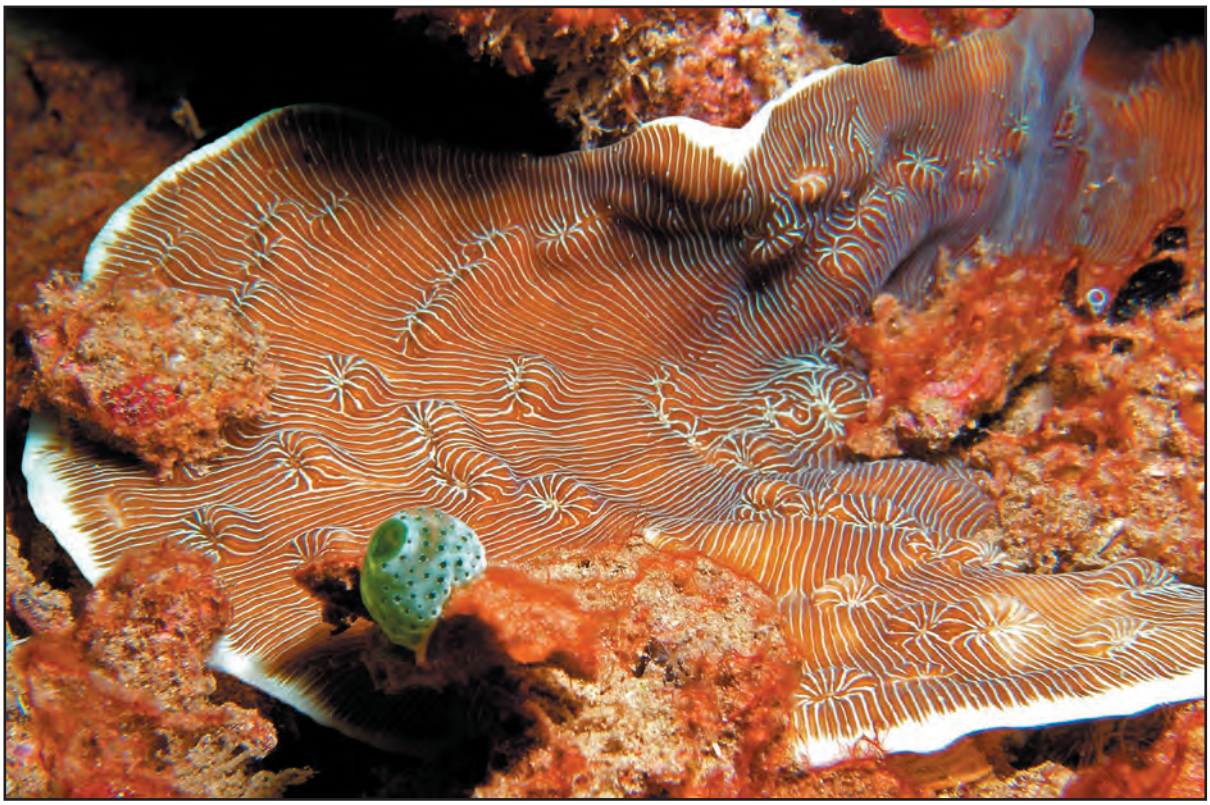
Astreopora myriophthalma **– Moon coral**
ACROPORIDAE – 50 cm



Pachyseris speciosa **– Phonograph coral**
AGARICIIDAE – 50 cm



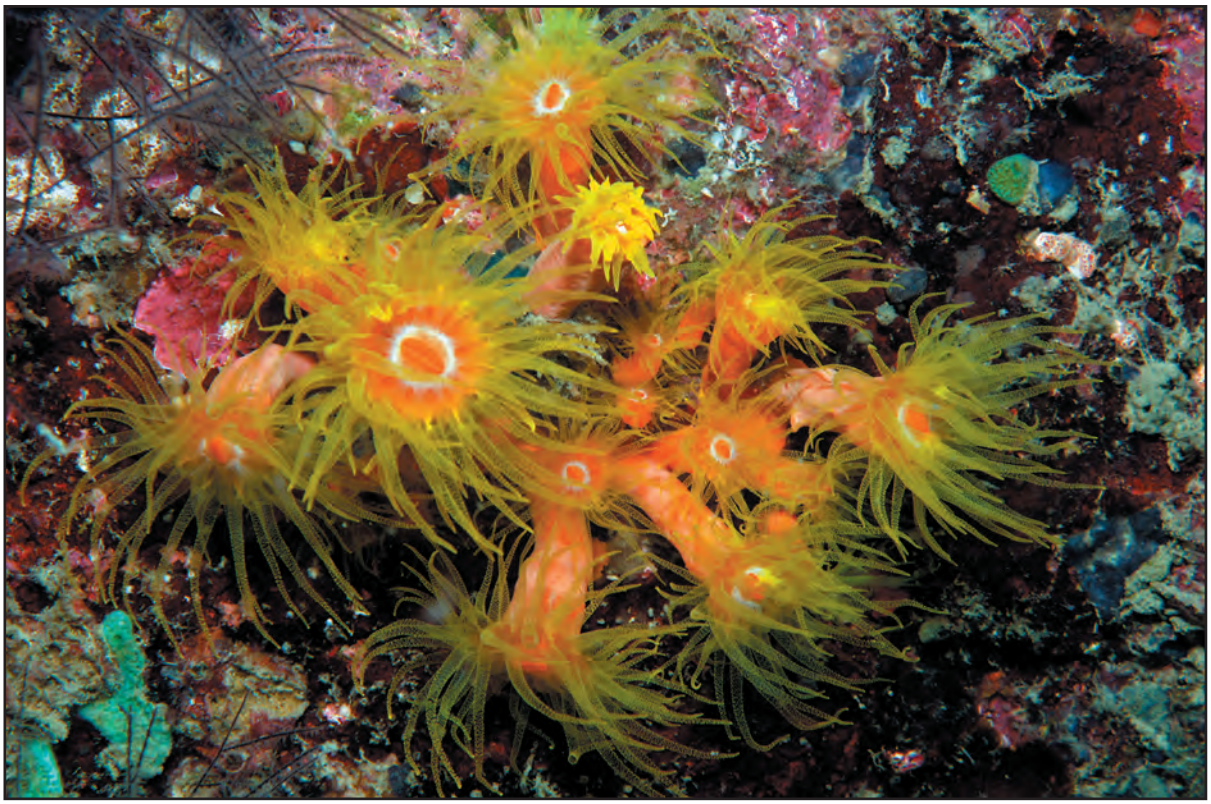
Pachyseris **cf.** *speciosa* **– Phonograph coral**
AGARICIIDAE – 10 cm – juvenile



Leptoseris explanata
AGARICIIDAE – 65 cm

Unidentified sp.
AGARICIIDAE – 50 cm

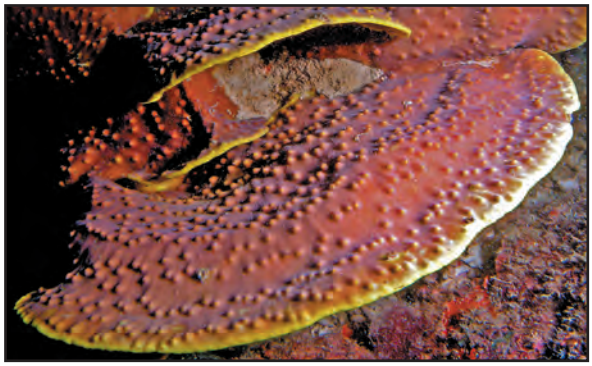
Tubastrea faulkneri – **Sun coral**
DENDROPHYLLIIDAE – 10 cm



Tubastrea faulkneri – **Sun coral**
DENDROPHYLLIIDAE – 10 cm

Tubastrea micrantha – **Black sun coral**
DENDROPHYLLIIDAE – 80 cm

Tubastrea micrantha – **Black sun coral**
DENDROPHYLLIIDAE – 10 cm



Turbinaria frondens – **Cup coral**
DENDROPHYLLIIDAE – 70 cm

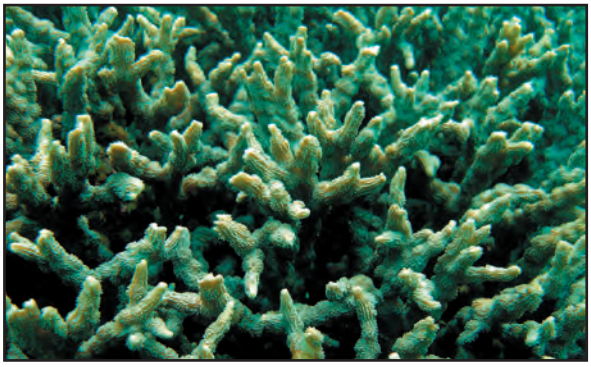
Turbinaria reniformis – **Scroll coral**
DENDROPHYLLIIDAE – 90 cm

Turbinaria **sp. – Vase coral**
DENDROPHYLLIIDAE – 80 cm

Euphyllia cristata – **Whire grape coral**
EUPHYLLIDAE – 15 cm

Physogyra lichtensteini – **Pearl coral**
EUPHYLLIDAE – 15 cm

Diploastrea heliopora
FAVIIDAE – 25 cm

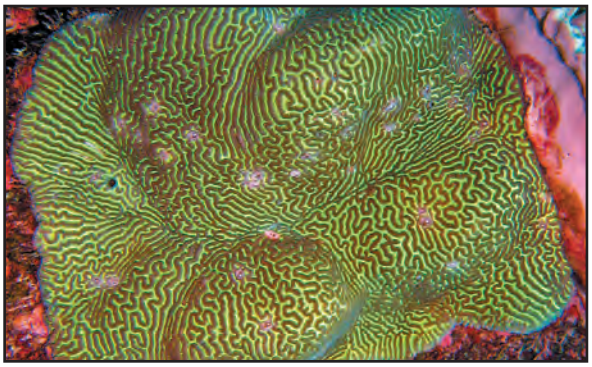


Echinopora horrida
FAVIIDAE – 60 cm

Echinopora lamellosa
FAVIIDAE – 50 cm

Favia **sp. – Moon coral**
FAVIIDAE – 35 cm

Platygyra lamellina **– Maze coral**
FAVIIDAE – 45 cm



Unidentified sp.
FAVIIDAE – 25 cm

Ctenactis echinata
FUNGIIDAE – 45 cm

Fungia **sp.**
FUNGIIDAE – 25 cm

Fungia **sp.**
FUNGIIDAE – 25 cm

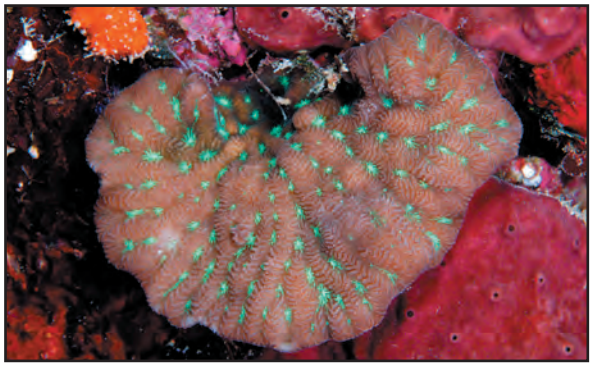
Fungia **sp.**
FUNGIIDAE – 25 cm

Heliofungia actiniformis
FUNGIIDAE – 40 cm

Herpolitha limax – **Tongue coral**
FUNGIIDAE – 40 cm

Herpolitha **sp. – Mole coral**
FUNGIIDAE – 40 cm

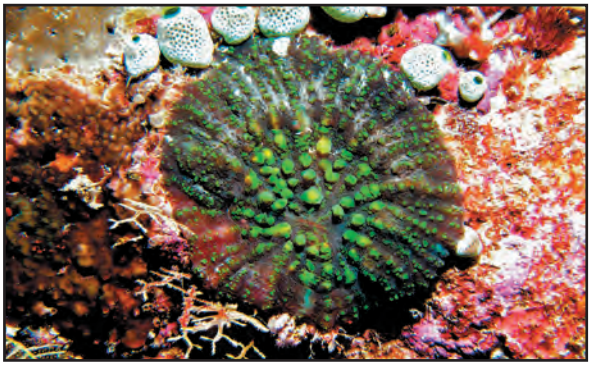
Polyphyllia talpina – **Slipper coral**
FUNGIIDAE – 40 cm



Merulina ampliata – **Ruffled coral**
MERULINIDAE – 30 cm

Lobophyllia hemprichii
MUSSIDAE – 35 cm

Lobophyllia hemprichii
MUSSIDAE – 5 cm



Scolymia **sp. – Disc coral**
MUSSIDAE – 10 cm

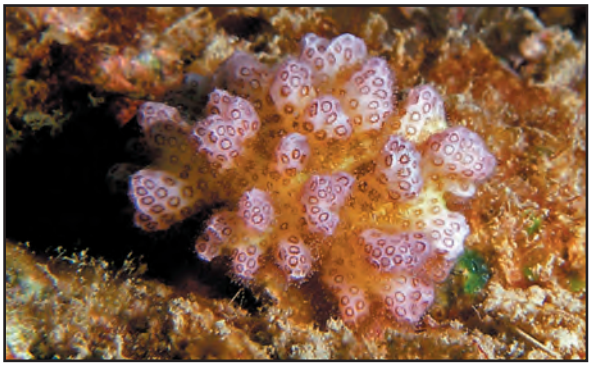
Symphyllia agaricia – **Brain coral**
MUSSIDAE – 30 cm

Symphyllia **cf.** *recta* – **Brain coral**
MUSSIDAE – 40 cm

Galaxea fascicularis – **Crystal coral**
OCULINIDAE – 10 cm

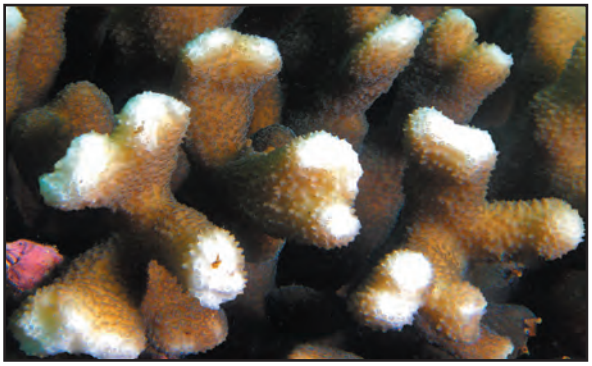
Pectinia paeonia – **Palm lettuce coral**
PECTINIIDAE – 60 cm

Pocillopora damicornis – **Cauliflower coral**
POCILLOPORIDAE – 65 cm



Pocillopora **sp.**
POCILLOPORIDAE – 15 cm

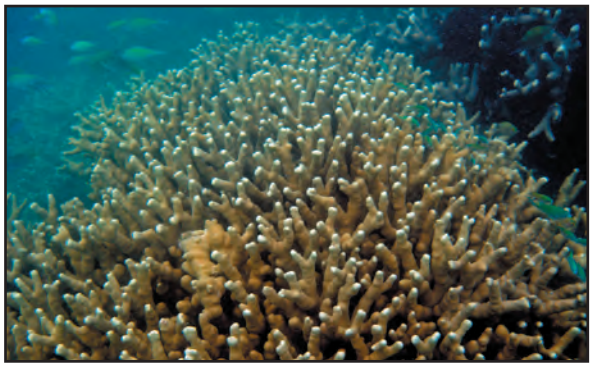
Seriatopora **sp. – Brush coral**
POCILLOPORIDAE – 40 cm



Stylophora pistillata – **Cluster coral**
POCILLOPORIDAE – 40 cm

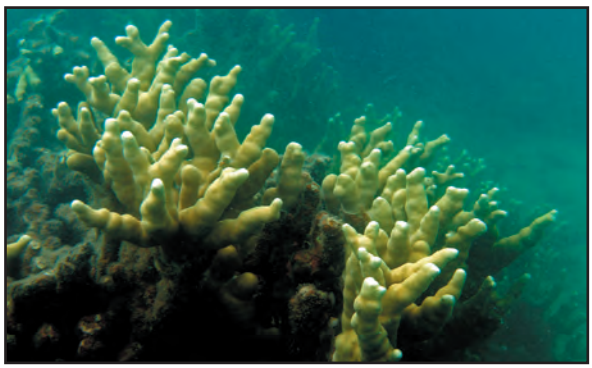
Alveopora **sp. – Daisy coral**
PORITIDAE – 5 cm

Goniopora **sp. – Daisy coral**
PORITIDAE – 15 cm



Porites cylindrica **– Cylinder coral**
PORITIDAE – 80 cm

Porites **sp. – Boulder coral**
PORITIDAE – 40 cm



Porites **sp.**
PORITIDAE – 60 cm

Porites **sp.**
PORITIDAE – 45 cm

Porites **sp. – Boulder coral**
PORITIDAE – 40 cm

Trachyphyllia geoffroyi **– Crater coral**
TRACHYPHYLLIIDAE – 30 cm

Corallimorphs

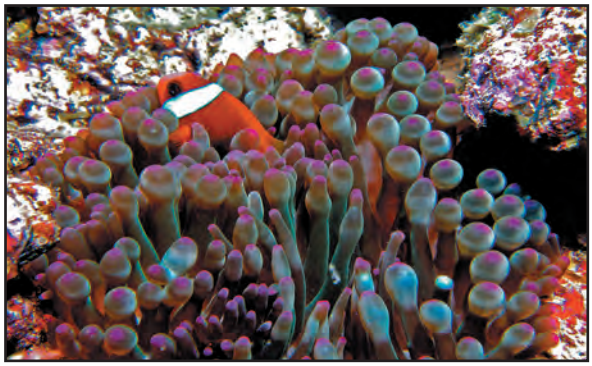
Corallimorphs are, in basic terms, corals without a skeleton. They tend to be solitary animals and are often brightly coloured.

Sea Anemones

Sea anemones are solitary columnar polyps with lots of stinging tentacles which capture prey and push it towards the central mouth. Anemones have a foot at their base which can be used to anchor in sandy habitats or attach to hard substrates including shells of other animals. They also move using this foot. They come in a vast variety of shapes, sizes and colours. Sea anemones are quite common in shallow water environments. Tiny shrimp and crabs are often found among the tentacles of sea snemones. Larger shallow water species also play host to anemone fish. It is thought that these fishes assist the anemones with house-keeping and chasing off predators, and in return receive the protection of the anemone's tentacles.

Unidentified corallimorph sp. 1
Order Corallimorphia – 6 cm

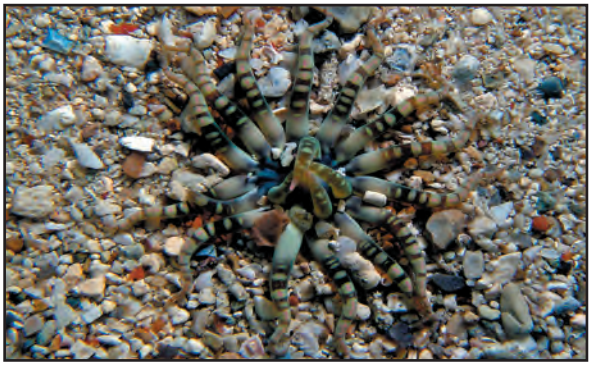
Unidentified corallimorph sp. 2
DISCOSOMATIDAE – 20 cm



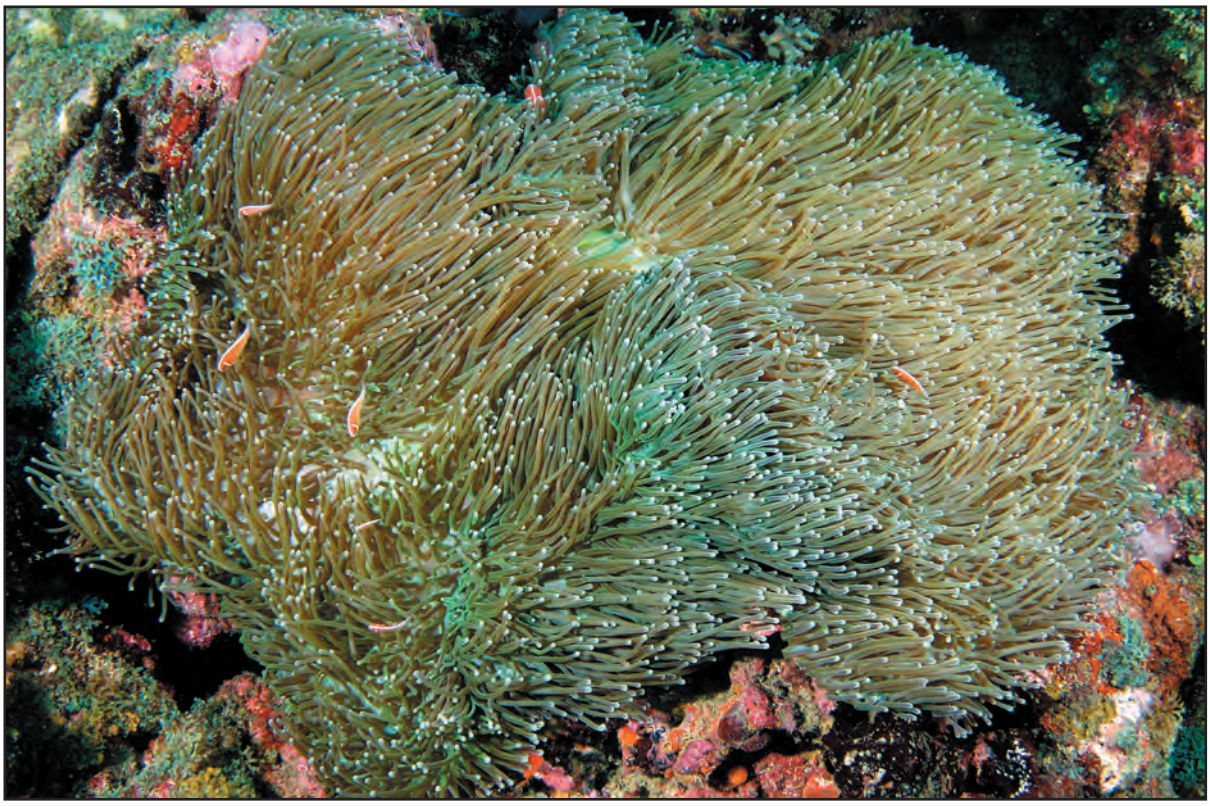
***Entacmea quadricolor* – Bubble-tip anemone**
ACTINIIDAE – 15 cm

***Actinodendron arboreum* – Abominate sea anemone**
ACTINODENDRIIDAE – 20 cm

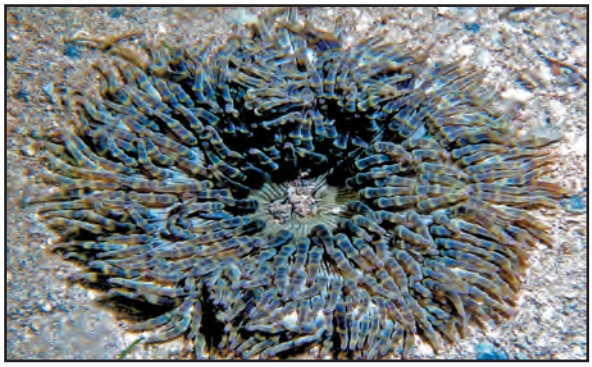
***Actinodendron arboreum* – Abominate sea anemone**
ACTINODENDRIIDAE – 5 cm close-up



Edwardsianthus pudica
EDWARDSIIDAE – 5 cm



Heteractis magnifica – **Magnificent sea anemone**
STICHODACTYLIDAE – 80 cm

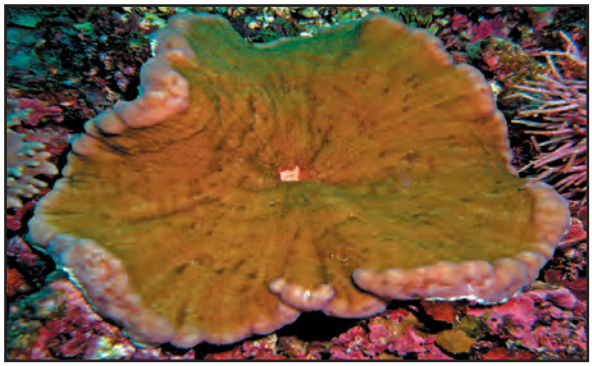


Heteractis aurora – **Beaded sea anemone**
STICHODACTYLIDAE – 30 cm

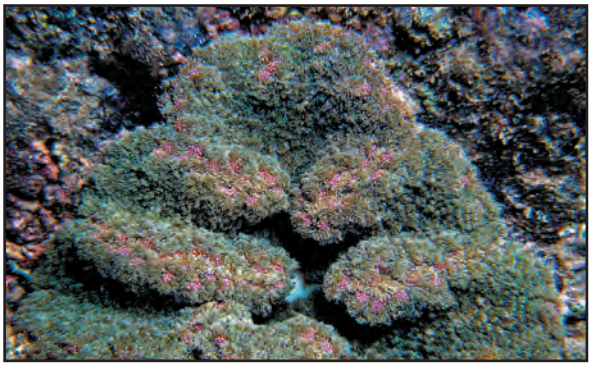
Heteractis **sp.**
STICHODACTYLIDAE – 10 cm

Stichodactyla giganteum – **Gigantic sea anemone**
STICHODACTYLIDAE – 50 cm

Stichodactyla mertensii – **Merten's carpet anemone**
STICHODACTYLIDAE – 40 cm



Cryptodendrum adhaesivum – **Pizza anemone**
THALASSIANTHIDAE – 20 cm



Unidentified sp.
Sea Anemone – 20 cm

Cerianthids

Cerianthids, or tube anemones, are found in an entirely different order from sea anemones. They burrow, living in the sand in tubes. They can be up to several feet in length and retract into the tube when disturbed or threatened. This tube is composed of used nematocysts and sand.

Cerianthus **sp. – Tube anemone**
CERIANTHIDAE – 15 cm

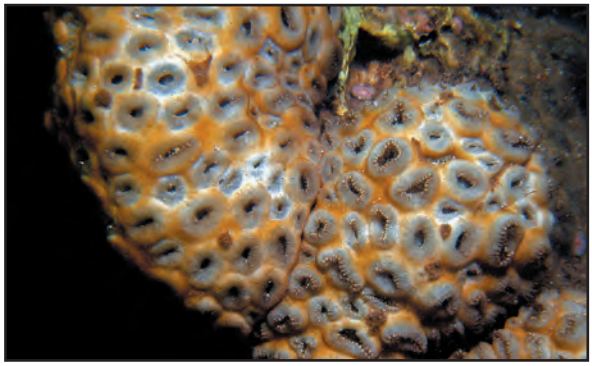
Zoanthids

Zoanthids are mainly colonial, tube-like polyps growing from a tissue-like body which connects all the polyps. They tend to incorporate sediments into their tissues, giving the appearance of a hard coral.

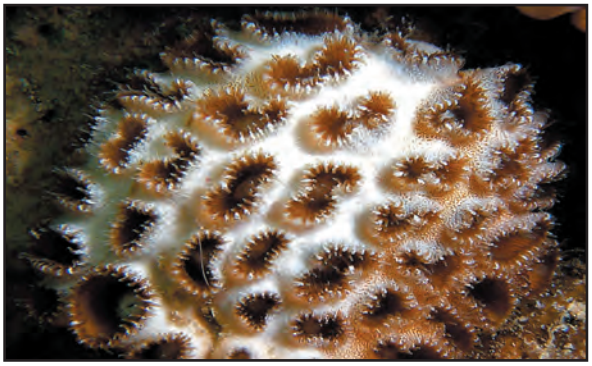
Epizoanthus **sp. – Branching zoanthid**
EPIZOANTHIDAE – 10 cm

Black Corals

The name of these organisms actually refers to the supporting skeleton which is covered by colourful, tentacled polyps and is black when the coral dies. Black corals are more closely related to hard corals, than soft corals, despite their whip and tree-like appearances.

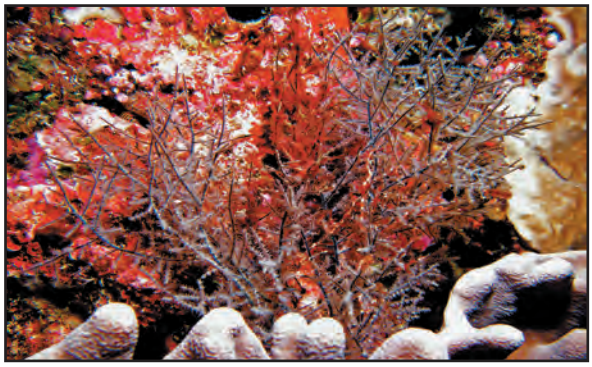


Palythoa caesia **(=** *P. tuberculosa* **auctt.)**
ZOANTHIDAE – 15 cm

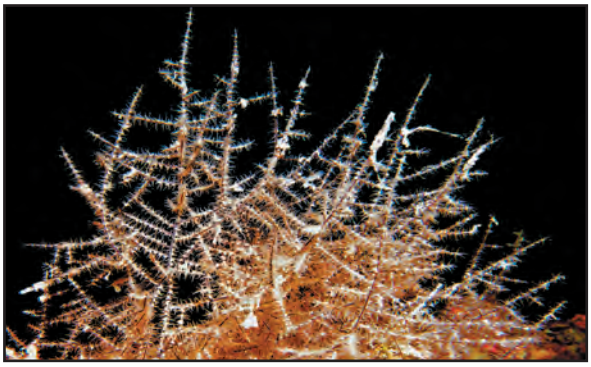


Palythoa caesia **(=** *P. tuberculosa* **auctt.)**
ZOANTHIDAE – 15 cm

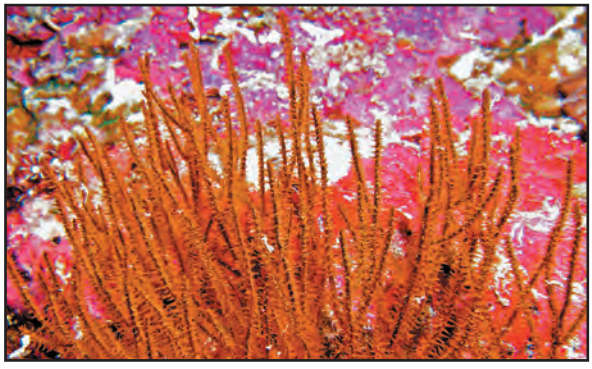
***Cirrhipathes* cf. *contorta* – Corkscrew black coral**
ANTIPATHIDAE – 5 cm



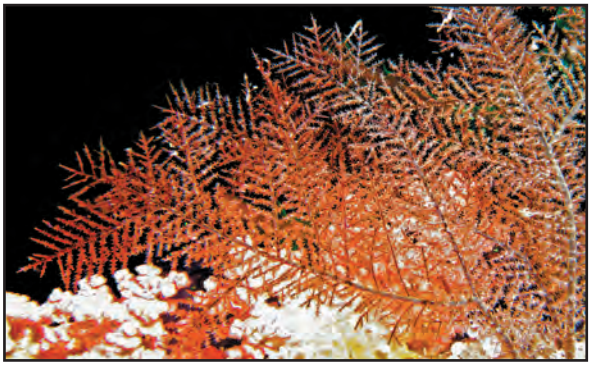
***Antipathes* sp. 1**
ANTIPATHIDAE – 5 cm



***Antipathes* sp. 2**
ANTIPATHIDAE – 5 cm



Unidentified sp.
ANTIPATHIDAE – 5 cm



***Myriopathes* sp.**
MYRIOPATHIDAE – 5 cm

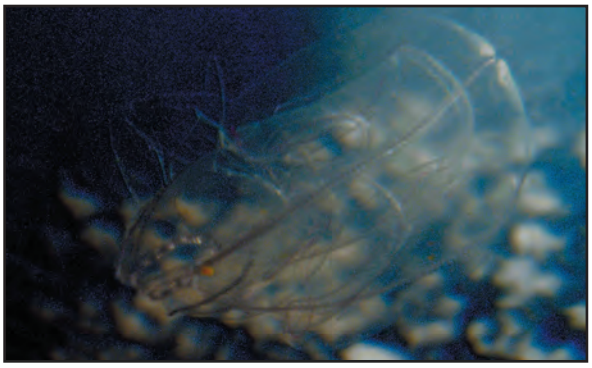
Forams

The Foraminifera (or forams) are single-celled organisms. Their exact taxonomic classification is continuously under debate, though many place them within the kingdom Protista. They have a calcium carbonate shell which, when they die, contributes to the make-up of coral reefs and to sedimentary rock. Forams are abundant throughout our oceans and feed on microscopic organisms. Generally they are found either attached to hard corals, algae, or float in the water column. *Marginopora vertebralis* (pictured) is common in the inshore areas of Bootless Bay.

***Marginopora vertebralis* – Necklace foram**
SORITIDAE – 0.5 cm

Ctenophores

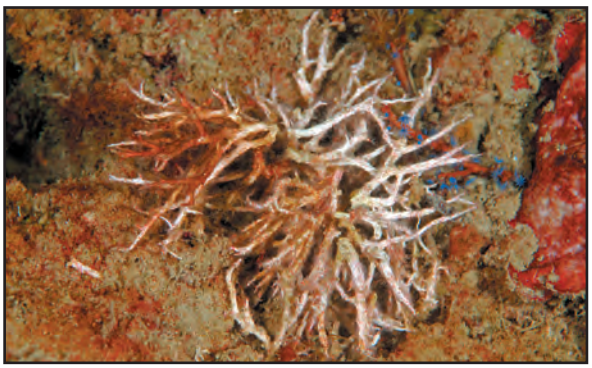
The ctenophores, or comb jellies, look like sea jellies, but belong to their own phylum (kingdom Animalia, phylum Ctenophora). They don't possess stinging cells and are pushed through the water by eight rows of beating hairs, called cilia. Some ctenophores have two sticky tentacles, which capture prey. The pictured ctenophore is common in the coastal areas of Bootless Bay, and is cautiously identified as a *Bolinopsis* sp.



***Bolinopsis* sp. – Ctenophore**
BOLINOPSIDAE – 2.5 cm

Bryozoans

Also known as sea mosses, bryozoans (kingdom Animalia, phylum Ectoprocta) are colonial animals, but each animal (zooid) is independent within the colony and is usually no bigger than about 1 mm. Colonies can be composed of a few or millions of individuals. Bryozoans can be mistaken for other organisms such as sponges, corals or algae. They have a mouth with tentacles, a digestive system and an anus. They are suspension feeders, consuming small food particles in the surrounding water. Within a colony, some animals take on specific roles. There are the specialist feeders, those that are equipped with bristles to clean, those with jaw-like structures to defend the colony, and those that provide structural support.



***Biflustra* sp. – Bryozoan**
MEMBRANIPORIDAE – 10 cm

***Triphyllozoon* sp. – Bryozoan**
PHIDOLOPORIDAE – 1.5 cm

Worms

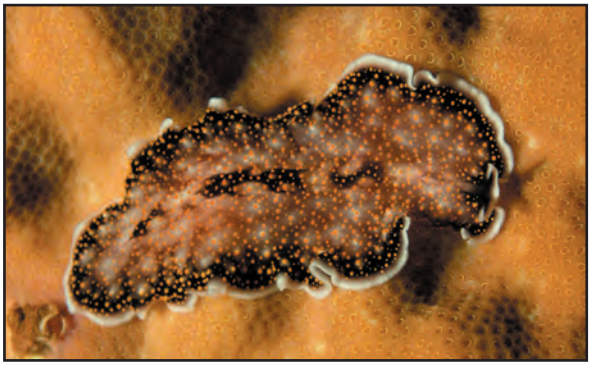
There are many types of marine worms, classified into a number of phyla within the kingdom Animalia. They include flatworms (phylum Platyhelminthes, class Turbellaria) and segmented worms (phylum Annelida, class Polychaeta).

Free living marine flatworms are often confused with nudibranchs, as they share a taste for flamboyant colours. There are, however, fundamental differences in their morphology. The most obvious to the naked eye is that flatworms do not have the gill filaments that are commonly seen on the rear of nudibranchs. Flatworms actually rely on a process of diffusion for respiration. Their flat shape is necessary as all of their cells have to be close to the outside. They are normally found crawling along the seabed or other surfaces, using a covering of tiny ultra-thin hairs called cilia. The flatworm produces mucus to assist this movement. They can also swim by moving the sides of their thin bodies in waves. Flatworms are mainly carnivorous, feeding on soft corals and other invertebrates, as well as dead organic matter. They have a branching gut, but no other body cavity and do not have an anus or a circulatory system. Flatworms eat and defecate through the same body opening. Flatworms are hermaphrodites, but normally they reproduce in pairs, fertilised eggs being deposited as egg masses. There are about 130 species thought to occur in PNG.

Segmented worms, or Polychaetes, include tube worms and bristleworms. Generally they are difficult to see except for the brightly coloured tentacular crowns of Christmas tree worms that dwell in calcareous tubes (family Serpulidae) and those dwelling in sediment tubes (family Sabellidae). As the general name suggests, these worms have a body divided into segments, each segment bearing appendages, known as parapodia, which have bristles that are used for movement, sensory perception and defence. Polychaetes display a variety of feeding mechanisms from ingesting the organic particles found in sediment, to the use of jaws to catch prey. Serpulid and sabellid polychaete worms spread their tentacular crown outwards from their tubes, catching detrital particles suspended in the water. These tentacular crowns are also used for respiration. It is difficult to see the body inside the tube that is often embedded in the reef. Most serpulids also have an operculum, or plug, which they use for sealing the entrance when the worm withdraws into its tube. The tentacular crown can vary in colour, even within the same species, as you can see from the *Sabellastarte* sp. photographs included in this section.

Some polychaetes release eggs and sperm into the water column; others mate and lay their eggs. The fertilised eggs usually develop into swimming larvae which once settled onto the bottom, become juveniles.

***Prostheceraeus* sp.**
EURYLEPTIDAE – 2 cm



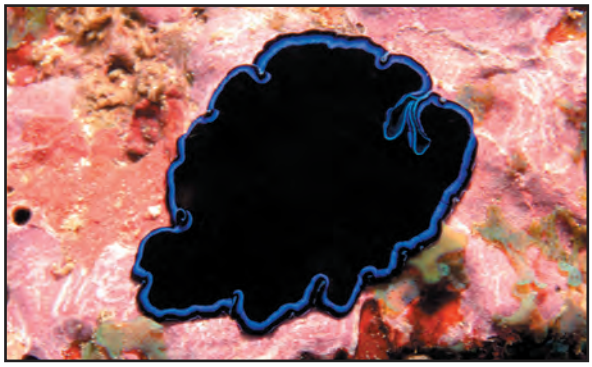
***Acanthozoon* sp.**
PSEUDOCEROTIDAE – 4 cm

Pseudobiceros bedfordi – **Bedford's flatworm**
PSEUDOCEROTIDAE – 6 cm

Pseudobiceros gratus – **Favoured flatworm***
PSEUDOCEROTIDAE – 5 cm

Pseudoceros bifurcus – **Racing stripe flatworm***
PSEUDOCEROTIDAE – 3 cm

Pseudoceros dimidiatus – **Dimidiate flatworm**
PSEUDOCEROTIDAE – 7 cm



Pseudoceros sapphirinus – **Sapphire flatworm**
PSEUDOCEROTIDAE – 4 cm

Asterophilia carlae – **Seastar worm***
POLYNOIDAE – 2 cm

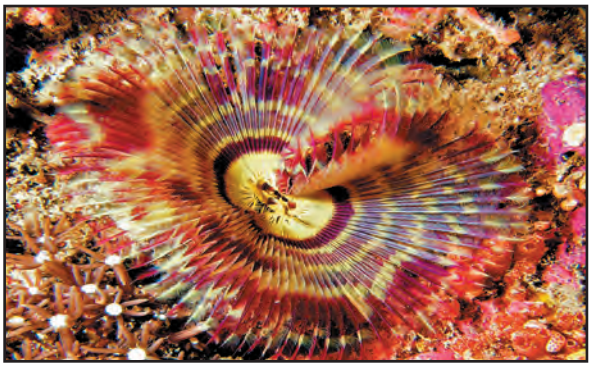
Megalomma **sp.**
SABELLIDAE

Sabellastarte **sp. – Fan worm**
SABELLIDAE

***Sabellastarte* sp. – Fan worm**
SABELLIDAE

***Sabellastarte* sp. – Fan worm**
SABELLIDAE

***Sabellastarte* sp. – Fan worm**
SABELLIDAE



Unidentified sp. 1
SABELLIDAE

Unidentified sp. 2
SABELLIDAE

Serpula* cf. *vasifera
SERPULIDAE – 1 cm

***Spirobranchus* cf. *gaymardi* – Christmas tree worm**
SERPULIDAE – 3 cm

***Spirobranchus* sp. – Christmas tree worm**
SERPULIDAE – 3 cm

Molluscs

Molluscs (kingdom Animalia, phylum Mollusca) comprise four main groups with a total of over 100,000 species, approximately three quarters of which are found in the marine environment. There are the univalves (class Gastropoda), the bivalves (class Bivalvia), the chitons (class Polyplacophora) and the cephalopods (class Cephalopoda). The molluscs display exceptional diversity from microscopic gastropods to giant squid, and also include the colourful nudibranchs.

Kunie's chromodoris – *Chromodoris kuniei*

So what links all these creatures, including the cowries and the octopuses? They are soft-bodied animals with no bones. They all have a muscular foot. Octopuses and squid are able to move by jet propulsion, the tentacles also being used for moving over surfaces. The tentacles have actually developed from the foot. Most molluscs have external shells which they produce, but some have internal shells or have lost them through the processes of evolution and adaptation. Those that have lost the shell have developed other defence mechanisms including nudibranchs using their prey's defences and cephalopods producing ink.

Chitons

There are over 500 species of chitons. Their flattened bodies are covered with eight overlapping plates of shell. They are generally found in shallow, intertidal areas. The foot is used to tightly attach itself to a rock and it becomes very difficult to remove. They graze on algae and are very slow moving.

Univalves

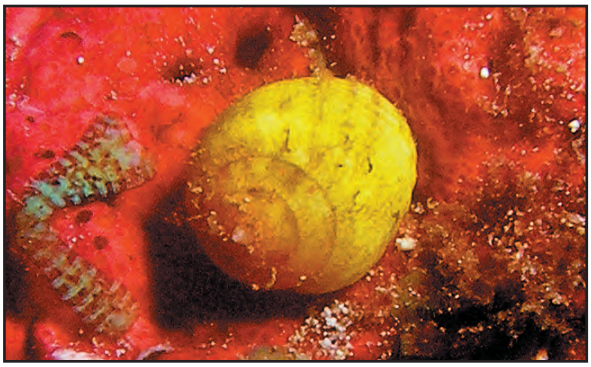
The two main types of gastropod are snails with shells, known as univalves, and those without, known as nudibranchs. Shells are composed of calcium carbonate produced by the snail. The snail is covered in a thin membrane called a mantle, which it uses along with minerals obtained from food and water to build the shell. It gets bigger as the animal grows and houses the soft body parts. Gastropods move by use of the large foot, producing mucous to help. The foot is pulled back into the shell when disturbed, and in some snails there is also an operculum, a kind of cap, which fits tightly into the shell opening. Most snails have a radula, a file-like tongue with rows of tiny teeth, which is used to scrape algae from surfaces. The radula sometimes takes the form of a barbed harpoon as used by cone shells to inject a powerful toxin into its prey and can be very dangerous to humans. Others, such as murex shells, use it to drill holes in shells to get at prey. Gastropods normally mate in pairs, transferring and receiving sperm. Fertilised eggs are then deposited in a bound mass.

***Acanthopleura gemmata* – Gemmulate chiton**
CHITONIDAE – 6 cm

Haliotis ovina – **Ovate abalone**
HALIOTIDAE – 7 cm

Phos senticosus – **Common Pacific phos**
BUCCINIDAE – 4 cm

Pseudovertagus aluco – **Aluco creeper**
CERITHIIDAE – 2 cm



Euplica turturina – **Crouching dove snail**
COLUMBELLIDAE – 1.5 cm

Conus eburneus – **Spotted cone snail**
CONIDAE – 6 cm

Conus marmoreus – **Marbled cone snail**
CONIDAE – 8 cm

Conus virgo – **Virgin cone snail**
CONIDAE – 10 cm

Vexillium caveum – **Ribbed mitre snail**
COSTELLARIIDAE – 2.5 cm

Vexillium exasperatum – **Exasperating mitre snail**
COSTELLARIIDAE – 2 cm

Vexillum luculentum – **Banded mitre snail**
COSTELLARIIDAE – 1 cm

Cypraea annulus – **Gold-ringed money cowry**
CYPRAEIDAE – 2.5 cm

Cypraea arabica – **Arabian cowry**
CYPRAEIDAE – 4 cm

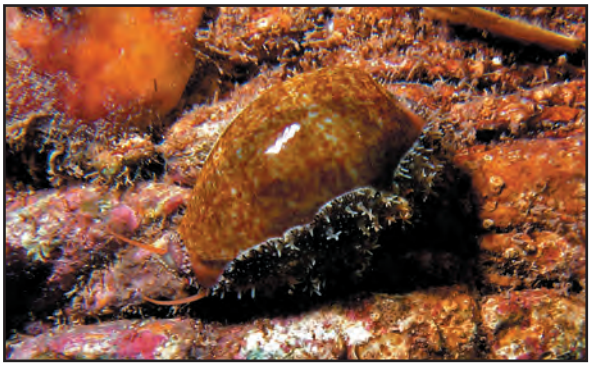
Cypraea arabica – **Arabian cowry**
CYPRAEIDAE – 3.5 cm – juvenile

Cypraea argus – **Eyed cowry**
CYPRAEIDAE – 4 cm

Cypraea carneola – **Carnelian cowry**
CYPRAEIDAE – 2.5 cm

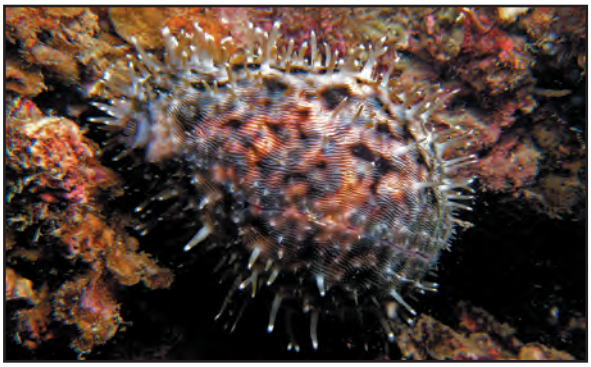
Cypraea carneola – **Carnelian cowry**
CYPRAEIDAE – 2.5 cm

Cypraea humphreysii – **Humphrey's cowry**
CYPRAEIDAE – 4 cm



Cypraea humphreysii – **Humphrey's cowry**
CYPRAEIDAE – 3.5 cm

Cypraea moneta – **Money cowry**
CYPRAEIDAE – 1 cm



Cypraea tigris – **Tiger cowry**
CYPRAEIDAE – 8 cm

Cypraea erosa – **Eroded cowry**
CYPRAEIDAE – 3 cm

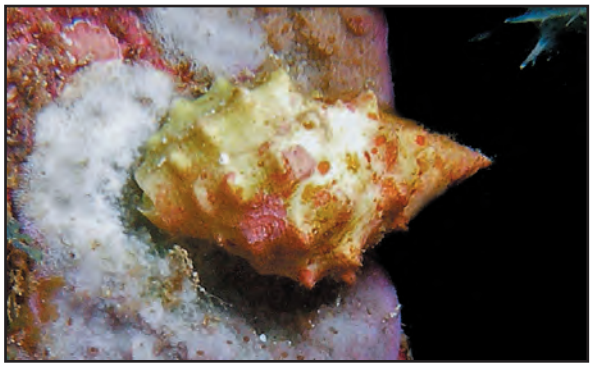
Harpa harpa – **Articulate harp**
HARPIDAE – 9 cm

Littoraria articulata – **Tessellated periwinkle**
LITTORINIDAE – 2.5 cm

Mitra mitra – **Giant mitra**
MITRIDAE – 6 cm

Subcancilla flammea – **Flamed mitre snail**
MITRIDAE – 4 cm

Chicoreus microphyllus – **Short-fronded murex snail**
MURICIDAE – 6 cm



Mancinella echinata – **White rock snail**
MURICIDAE – 2.5 cm

Morula granulata – **Oyster borer**
MURICIDAE – 3.5 cm

Thais tuberosa – **Tuber-like rock shell**
MURICIDAE – 3.5 cm – dorsal

Thais tuberosa – **Tuber-like rock shell**
MURICIDAE – 3.5 cm – ventral

Nassarius arcularia – **Box-like dog whelk**
NASSARIIDAE – 3.5 cm

Naticarius onca – **Spotted moon snail**
NATICIDAE – 2.5 cm

Naticarius orientalis – **Oriental moon snail**
NATICIDAE – 3 cm

Sinum **sp. – Internal-shelled moon snail**
NATICIDAE – 9 cm

Tanea undulata – **Wavy moon snail**
NATICIDAE – 2 cm

Lunella cinerea – **Smooth moon turban snail**
TURBINIDAE – 2.5 cm

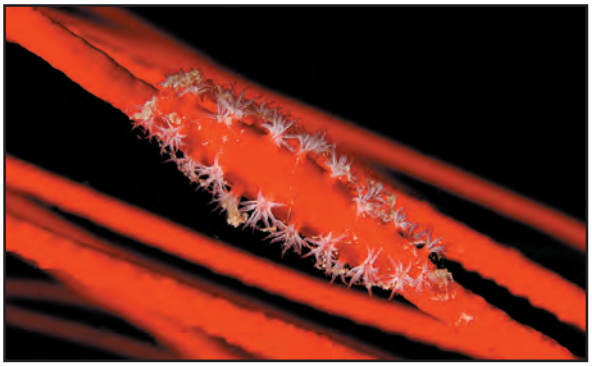
Nerita chamaeleon – **Variable nerite**
NERITIDAE – 2 cm

Nerita polita – **Polished nerita**
NERITIDAE – 2 cm

Oliva miniacea – **Orange-mouthed olive snail**
OLIVIDAE – 6 cm

Oliva reticulata – **Reticulate olive snail**
OLIVIDAE – 4 cm

Cymbovula deflexa – **Canoe spindle cowry**
OVULIDAE – 1.5 cm

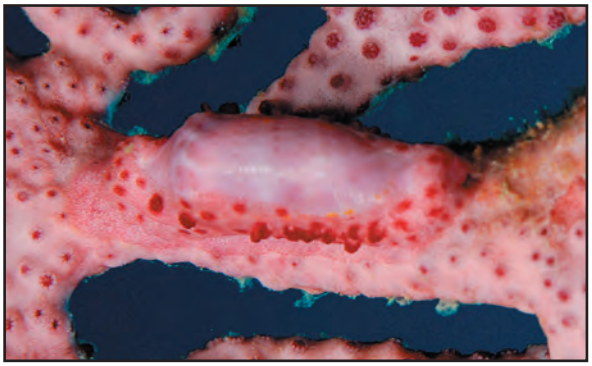


Phenacovolva coarctata – **Compressed spindle cowry**
OVULIDAE – 2 cm

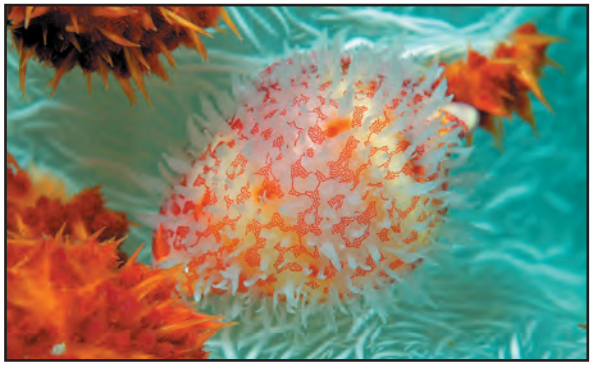
Phenacovolva tokioi – **Tokio's spindle cowry**
OVULIDAE – 6 cm

Phenacovolva **sp. – Spindle cowry**
OVULIDAE – 6 cm

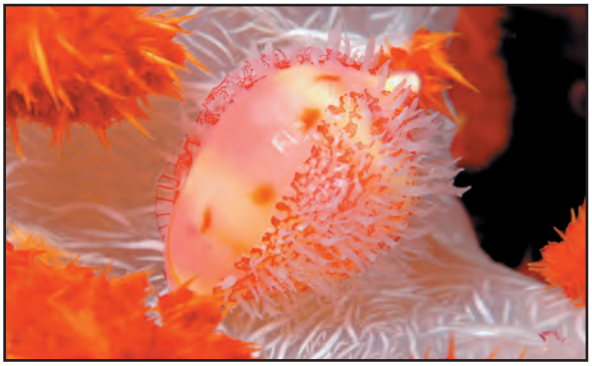
Prionovolva **sp. – Soft coral egg cowry**
OVULIDAE – 1 cm



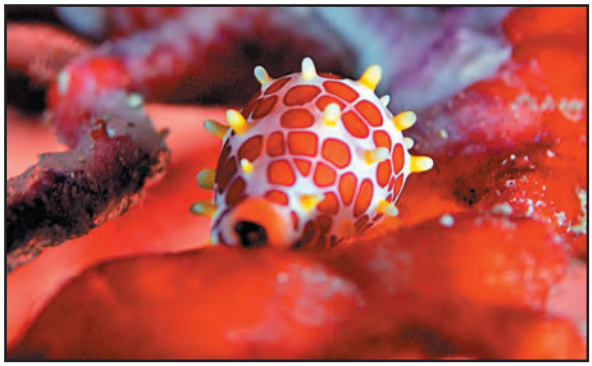
Prosimnia **sp. – Gorgonian cowry**
OVULIDAE – 1.5 cm



Pseudosimnia culmen – **Gold spotted egg cowry**
OVULIDAE – 1 cm



Pseudosimnia culmen – **Gold spotted egg cowry**
OVULIDAE – 1 cm



Pseudosimnia **sp. – Egg cowry**
OVULIDAE – 0.5 cm

Planaxis sulcatus **– Sulcate periwinkle**
PLANAXIDAE – 3 cm

Charonia tritonis **– Triton's trumpet shell**
RANELLIDAE – 25 cm

Conomurex luhanus **– Red-mouthed stromb**
STROMBIDAE – 6 cm

Conomurex luhanus **– Red-mouthed stromb**
STROMBIDAE – 6 cm

Lambis lambis **– Common spider snail**
STROMBIDAE – 12 cm

Lambis scorpius **– Scorpion spider snail**
STROMBIDAE – 11 cm

Strombus aratrum **– Black mouthed stromb**
STROMBIDAE – 4 cm

Strombus gibberulus gibbosus – **Hump-back conch**
STROMBIDAE – 4 cm

Strombus gibbosus – **Hump-back conch**
STROMBIDAE – 5 cm

Strombus vomer – **Vomer stromb**
STROMBIDAE – 8 cm

Hastula albula – **White auger snail**
TEREBRIDAE – 4 cm

Terebra areolata – **Subulate auger**
TEREBRIDAE – 9 cm

Terebra cingulifera – **Girdled auger snail**
TEREBRIDAE – 5 cm

Terebra crenulata – **Crinkled auger snail**
TEREBRIDAE – 6 cm

Terebra dimidiata – **Dimidiate auger snail**
TEREBRIDAE – 7 cm

Terebra subulata – **Spotted auger snail**
TEREBRIDAE – 8 cm

Terebra undulata – **Wavy auger snail**
TEREBRIDAE – 5 cm

Nudibranchs

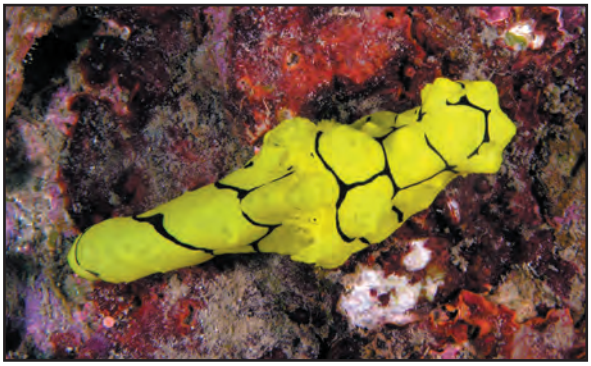
Nudibranchs, the name meaning naked-gills, and sea hares are gastropods, but they lack the characteristic external shell of other members of this group. Instead of the shell, they make a cocktail of toxins which are used in defence. Some even recycle the defence mechanisms of their prey, such as stinging cells. Their prey is varied and includes anemones, corals, hydroids, sponges and ascidians.

Hexabranchus sanguineus – **Spanish dancer***
HEXABRANCHIDAE – 12 cm

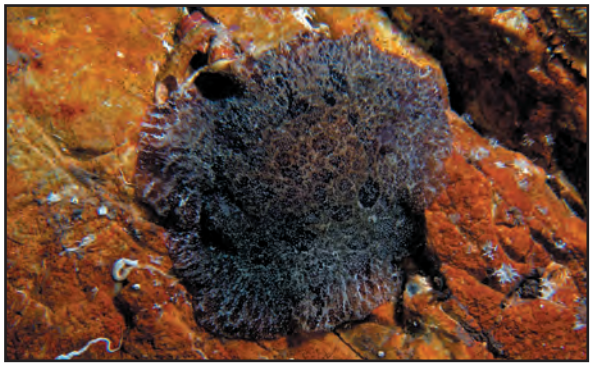
Kentrodoris rubescens **laying eggs**

Nembrotha lineolata – **Lined nembrotha***
POLYCERIDAE – 7 cm

Nudibranch colourations offer camouflage and act as a visual warning to would-be predators of their terrible taste and poisonous potential. Nudibranchs have respiratory organs on their back in the form of feather-like gills or appendages. The head is normally identified by the existence of a pair of antennae like organs, known as rhinophores. Nudibranchs are quite small, ranging from a few millimetres to a few centimetres, but the sea hares can reach sizes of up to 50 cm.



Notodoris minor – **Minor notodoris**
AEGIRIDAE – 8 cm

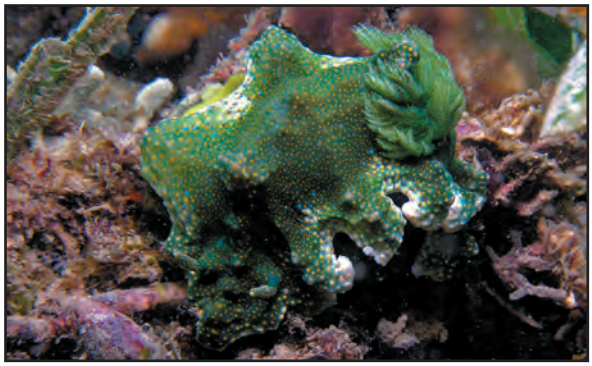


Discodoris fragilis – **Fragile nudibranch**
DISCODORIDIDAE – 5 cm

Halgerda aurantiomaculata – **Gold spotted halgerda***
DISCODORIDIDAE – 7 cm

Jorunna funebris – **Funeral jorunna**
DISCODORIDIDAE – 8 cm

Kentrodoris rubescens – **Reddish nudibranch**
DISCODORIDIDAE – 11 cm



Ceratosoma sinuatum – **Sinuate ceratosoma**
CHROMODORIDIDAE – 5 cm

Ceratosoma trilobatum – **Three horned ceratosoma***
CHROMODORIDIDAE – 8 cm

Ceratosoma sinuatum – **Sinuate ceratosoma**
CHROMODORIDIDAE – 4 cm

Chromodoris annae – **Anna's chromodoris**
CHROMODORIDIDAE – 2 cm

Chromodoris fidelis – **Faithful chromodoris***
CHROMODORIDIDAE – 3 cm

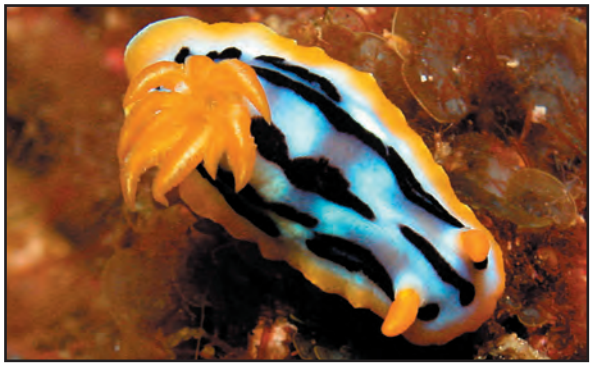
Chromodoris geometrica – **Geometric chromodoris***
CHROMODORIDIDAE – 3 cm

Chromodoris kuniei – **Kunie's chromodoris**
CHROMODORIDIDAE – 4 cm

Chromodoris magnifica – **Magnificent chromodoris**
CHROMODORIDIDAE – 5 cm

Chromodoris lochi – **Loch's chromodoris**
CHROMODORIDIDAE – 3 cm

Chromodoris magnifica – **Magnificent chromodoris**
CHROMODORIDIDAE – 1 cm – juvenile



Chromodoris strigata – **Strigate chromodoris***
CHROMODORIDIDAE – 3 cm

Glossodoris atromarginata – **Black-margined glossodoris***
CHROMODORIDIDAE – 4 cm

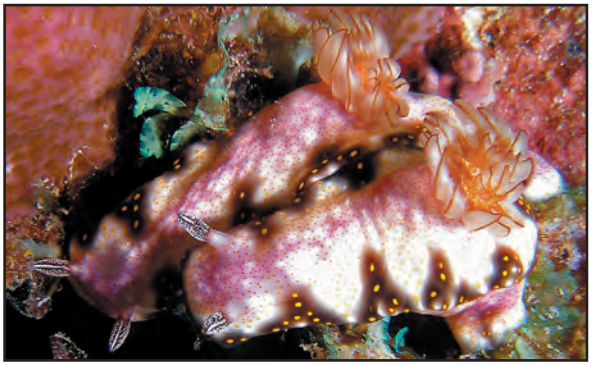
Hypselodoris bullockii – **Bullock's hypselodoris***
CHROMODORIDIDAE – 6 cm

Hypselodoris maculosa – **Spotted hypselodoris**
CHROMODORIDIDAE – 2 cm

Hypselodoris nigrostriata – **Black-striped hypselodoris**
CHROMODORIDIDAE – 3 cm

Hypselodoris infucata – **Inky hypselodoris**
CHROMODORIDIDAE – 2 cm

Mexichromis multituberculata – **Pustuled mexichromis**
CHROMODORIDIDAE – 2 cm



Risbecia godeffroyana – **Godeffroy's nudibranch**
CHROMODORIDIDAE – 4 cm

Risbecia tryoni – **Tryon's nudibranch**
CHROMODORIDIDAE – 4 cm

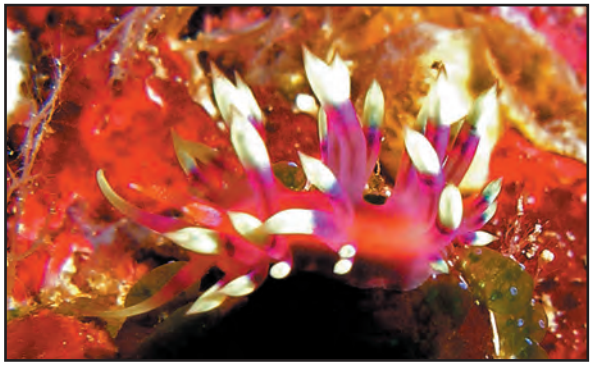
Bornella anguilla – **Eel-like Bornella**
BORNELLIDAE – 4 cm

Phidiana indica – **Indian phidiana**
FACELINIDAE – 2 cm

Phyllodesmium longicirrum – **Long cirri phyllodesmium**
FACELINIDAE – 14 cm

Pteraeolidia ianthina – **Blue dragon**
FACELINIDAE – 3 cm

Flabellina bilas – **Spear-point flabellina**
FLABELLINIDAE – 2.5 cm



Flabellina exoptata – **White-tipped flabellina***
FLABELLINIDAE – 2 cm

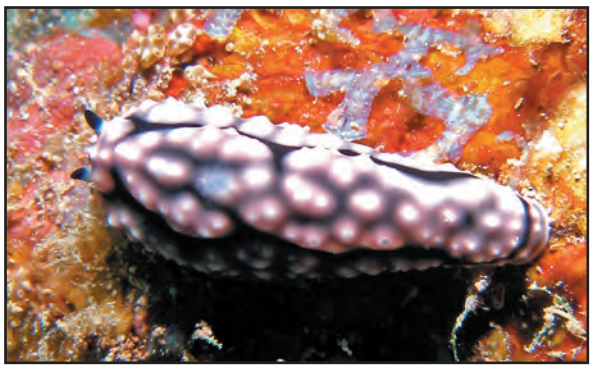
Flabellina rubrolineata – **Red-lined flabellina***
FLABELLINIDAE – 2.5 cm

Phyllidia coelestis – **Celestial phyllidia**
PHYLLIDIIDAE – 5 cm

Phyllidia elegans – **Elegant phyllidia**
PHYLLIDIIDAE – 4 cm

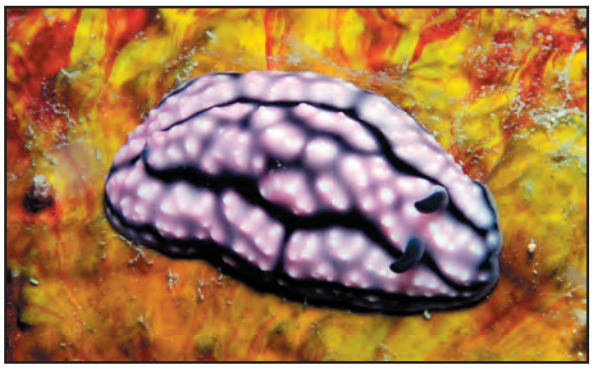
Phyllidia ocellata – **Ocellate phyllidia**
PHYLLIDIIDAE – 5 cm

Phyllidia varicosa – **Varicose phyllidia**
PHYLLIDIIDAE – 5 cm



Phylidiella lizae – **Liz's phyllidiella**
PHYLLIDIIDAE – 3 cm

Phyllidiella nigra – **Black phyllidiella**
PHYLLIDIIDAE – 4 cm



Phyllidiella pustulosa – **Warty phyllidiella**
PHYLLIDIIDAE – 4 cm

Phyllidiella rudmani – **Rudman's phyllidiella**
PHYLLIDIIDAE – 4 cm

Phyllidiopsis pipeki – **Pipek's phyllidiopsis**
PHYLLIDIIDAE – 3 cm

Phyllidiopsis shireenae – **Shireen's phyllidiopsis**
PHYLLIDIIDAE – 7 cm

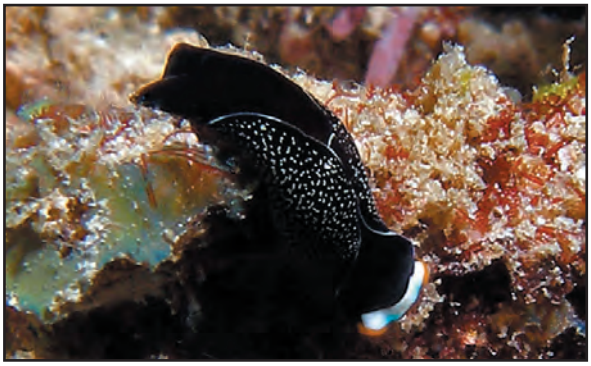
Reticulidia fungia – **Mushroom coral phyllidia**
PHYLLIDIIDAE – 4 cm

Reticulidia halgerda – **Halgerda-like phyllidia**
PHYLLIDIIDAE – 6 cm

Aplysia occulifera – **Eyed sea hare**
APLYSIIDAE – 3 cm

Dolabella auricularia – **Eared sea hare**
APLYSIIDAE – 11 cm

Chelidonura electra – **Electric tailed slug**
AGLAJIDAE – 5 cm



Chelidonura inornata – **Ornate tailed slug**
AGLAJIDAE – 4 cm

Micromelo undata – **Wavy lined bubble shell***
APLUSTRIDAE – 4 cm

Thuridilla bayeri – **Bayer's sap-sucker**
PLAKOBRANCHIDAE – 2 cm

Thuridilla splendens – **Splendid sap-sucker**
PLAKOBRANCHIDAE – 2 cm

Cyerce nigricans – **Black and gold cyerce**
POLYBRANCHIDAE – 2 cm

Berthella martensi – **Martens' berthella**
PLEUROBRANCHIDAE – 4 cm

Pleurobranchus forskalii – **Forskal's side-gilled slug**
PLEUROBRANCHIDAE – 12 cm

Mangrove Slugs

These animals are shell-less molluscs that are found throughout the Indo-Pacific region in the intertidal zone, around mangroves, rubble and on sand/mud flats. They range in size from 10-70 mm long and are usually oval in shape with a hard leathery mantle which ranges from smooth in some species to warty in others. They are often found in large numbers.

Onchidium **sp. – Mangrove slug**
ONCHIDIIDAE – 1.5 cm

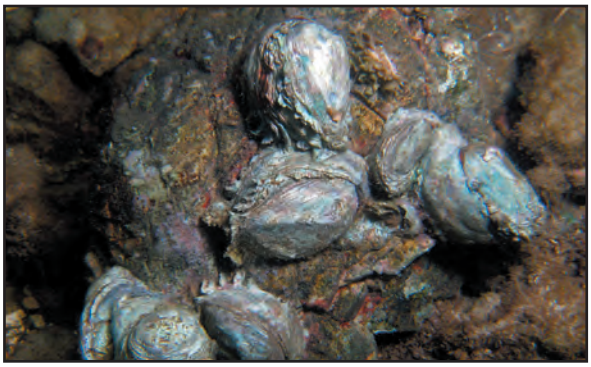
Bivalves

Bivalves are molluscs that have two hinged valves, which are held shut by two muscles on the inside of the shell. Bivalves can be found attached to hard surfaces or in the sand.

The muscular foot is much reduced in the former and is adapted for burrowing in the latter. Bivalves are unique among the molluscs for lacking a radula; they feed by siphoning and filtering large particles from water. Gills are used to extract oxygen from the surrounding seawater. These gills also filter the water for plankton, passing this food to the mouth with the use of beating cilia.

Some bivalves, such as the giant clams, also entertain a symbiotic relationship with tiny algae, which are mostly found in the colourful mantle. These algae require light for photosynthesis, so giant clams are generally found in shallow waters.

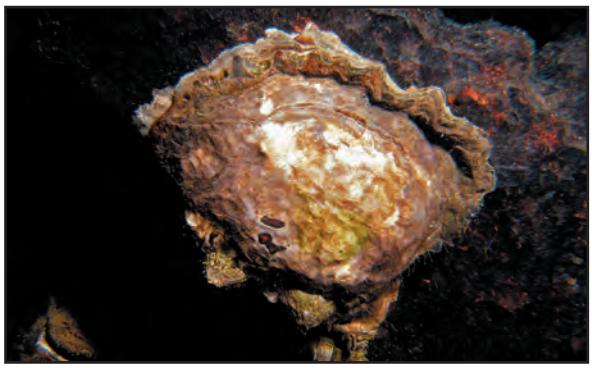
Barbatia foliata – **Leafy ark clam**
ARCIDAE – 4 cm



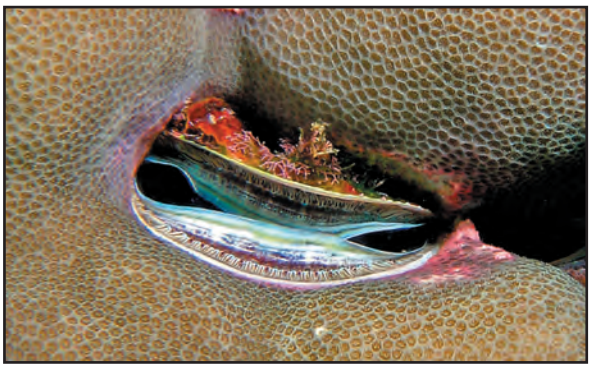
Chama **sp. – Jewel-box clam**
CHAMIDAE – 4 cm

Hyotissa hyotis – **Giant coxcomb oyster**
GRYPHAEIDAE – 8 cm

Lopha cristagalli – **Cock's comb oyster**
OSTREIDAE – 5 cm



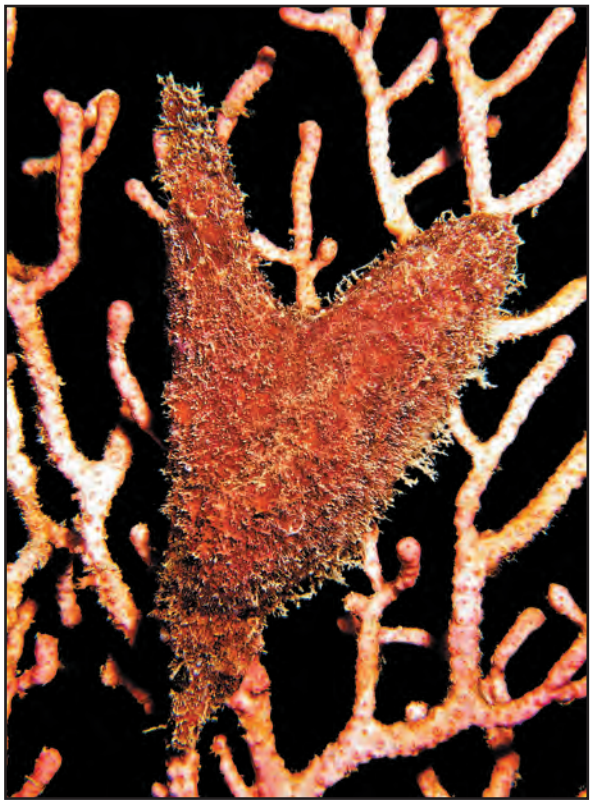
Saccostrea mordax – **Rock oyster**
OSTREIDAE – 5 cm



Pedum spondyloideum – **Coral scallop**
PECTINIDAE – 5 cm

Atrina vexillum – **Black razor clam**
PINNIDAE – 16 cm

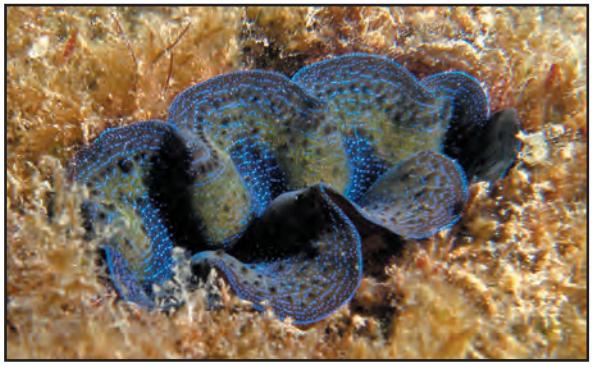
Pinna muricata – **Razor clam**
PINNIDAE – 11 cm



Pteria cypsellus – **Winged oyster**
PTERIIDAE – 5 cm

Spondylus sinensis – **Asian thorny oyster**
SPONDYLIDAE – 5 cm

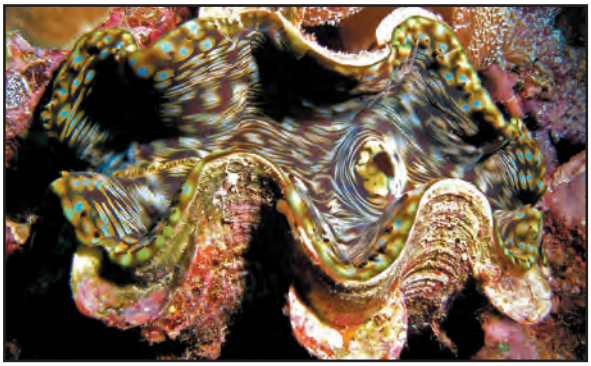
Spondylus **sp.** – **Thorny oyster**
SPONDYLIDAE – 12 cm



Tridacna crocea – **Crocus giant clam**
TRIDACNIDAE – 6 cm

Tridacna maxima – **Elongate giant clam**
TRIDACNIDAE – 8 cm

Tridacna squamosa – **Fluted giant clam**
TRIDACNIDAE – 40 cm



Tridacna squamosa – **Fluted giant clam**
TRIDACNIDAE – 40 cm

Tridacna squamosa – **Fluted giant clam**
TRIDACNIDAE – 30 cm

Tridacna **sp. – Giant clam**
TRIDACNIDAE – 24 cm

Cephalopods

Cephalopod translates as 'head and foot', and this group consists of octopuses, squids, cuttlefishes and nautiluses. Nautiluses are the only member in this group with a shell. Cephalopods are fast moving, and always have tentacles rather than a foot, eight for octopuses or ten for cuttlefish and squid, though in the nautiluses this number can get much higher.

Octopuses tend to prefer the benthic environment, moving about by crawling, though they do use jet propulsion when escaping predators. Squids and cuttlefish are also capable of jet propulsion, but tend to swim leisurely by rhythmically undulating the skin along the side of their bodies. When hunting, the streamlined structure of squid comes in quite handy for quick attacks. Squid, cuttlefish and octopuses also have a body sac that contains a pigment or ink which, when threatened, is released in a cloud to shield the animal's getaway. Cephalopods can change colour which is useful for camouflage from predators, expressions of alarm and intent, and in sexual behaviour.

The males display courtship behaviour, consisting of tentacular movements and colour displays. The animals then embrace using their tentacles, and the male transfers a packet of sperm, called a spermatophore, into the female's mantle cavity, using a special modified arm. The female then lays her eggs, fertilising them with the sperm.

Cuttlefish – ***Sepia*** **sp.**

Sepioteuthis lessoniana – **Common reef squid**
LOLIGINIDAE – 8 cm

Octopus **sp. – Octopus**
OCTOPODIDAE – 20 cm

Sepia latimanus – **Broadclub cuttlefish**
SEPIIDAE – 15 cm

Sepia **sp. – Cuttlefish**
SEPIIDAE – 25 cm

Metasepia pfefferi – **Flamboyant Cuttlefish***
SEPIIDAE – 9 cm

Crustaceans

Crustaceans belong to the kingdom Animalia, phylum Arthropoda along with spiders, centipedes and insects. This is the largest phylum of known animal species on the Earth. The crustaceans comprise about 5% of this group and include barnacles, stomatopods, prawns, shrimps, lobsters and crabs. Isopods, copepods, amphipods and other small microscopic animals are also crustaceans but are not covered in this guide.

Crustaceans have an exoskeleton, an external skeleton which protects a soft segmented body. They shed the exoskeleton periodically in order to allow the animal to grow. While waiting for the new exoskeleton to harden they are vulerable and tend to hide away.

Barnacles

Barnacles (class Maxillopoda) are filter feeding crustaceans that obtain food from the passing water. Generally, they live attached to rocks and other hard surfaces, even whales.

Being generally immobile, sex is a challenge. The barnacle, however, can extend its penis up to 30 times its body size to copulate with a neighbour.

Stomatopods

The stomatopods, or mantis shrimps, are colourful crustaceans with large compound eyes (class Malacostraca). They have an aggressive reputation. Stomatopods possess large feeding and fighting appendages and are known as either smashers or spearers. The appendages of smashers are likened to hammers, while those of spearers are lined with spines. The spearers can impale their victims with an astoundingly quick thrust of their spear. Smashers either surprise or corner their prey, bludgeoning it with the hammer-like appendage.

These animals are also known for their territorial disputes and aggressive sexual relations.

Lepas anserifera – **Goose barnacle**
LEPADIDAE – 4 cm

Tetraclita squamosa – **Common barnacle**
TETRACLITIDAE – 3 cm

Odontodactylus scyllarus – **Peacock mantis shrimp**
ODONTODACTYLIDAE – 15 cm

Unidentified sp. – Mantis shrimp
Order Stomatopoda – 5 cm

Decapods

Decapods (class Malacostraca) have bodies consisting of a head, a thorax containing the stomach, and an abdomen, which is the tail. The thorax has ten large jointed appendages, from which the group gets it name. Decapods may feed on plankton, algae, molluscs, fish and other crustaceans. They include the largest crustaceans, and nearly all those of commercial importance.

Decapods are either male or female, except for some shrimp species which change from male to female as they grow. The female receives sperm from the male and the eggs are fertilised. Penaeid shrimps, also known as prawns, shed the eggs to develop floating in the water, but in all other decapods, eggs are carried under the female abdomen until they hatch. They hatch as swimming larvae and go through a series of developmental stages before they settle and develop into adults.

There is a wide variety of decapods found in our seas. Ghost shrimps are decapods that live in complex networks of burrows, in most sediments. Conical mounds of sediment can indicate the presence of a ghost shrimp. They rarely venture forth, except at night.

On reefs and wrecks you can find cleaner shrimps that offer their services to fishes. They remove parasites and feed on the fish's mucous coating. They have even been known to clamber over a diver's face, in search of business. Look closely at some anemones, sea urchins, sea whips and corals and you will come across some tiny, almost transparent shrimp. Shrimp have pincers that are used to capture prey, burrow, attract a mate and defend itself.

Spiny lobsters are normally found in crevices and reefs. They eat other small crustaceans and invertebrates, feeding mainly at night. They are prized, edible delicacies throughout the world.

Hermit crabs are not true crabs and are more closely related to squat lobsters and porcelain crabs. Hermit crabs live in vacant gastropod shells. Squat lobsters are tiny decapods, some of which can be found living on other animals such as feather stars. Porcelain crabs may also be found living on anemones, sea cucumbers and corals. These groups are collectively known as anomurans, and have also been referred to as false crabs.

True crabs come in many different varieties, but as a group their abdomen is folded under the body and their antennae are small. They have well developed pincers and a flattened body. There are swimming crabs whose last pair of limbs is modified into swimming paddles. There are crabs that clamber over the seabed searching for food, or those who forage in the intertidal zone. There are also mud dwelling fiddler crabs.

Penaeus japonicus – **Kuruma prawn**
PENAEIDAE – 6 cm

Unidentified sp.
PENAEIDAE – 7 cm

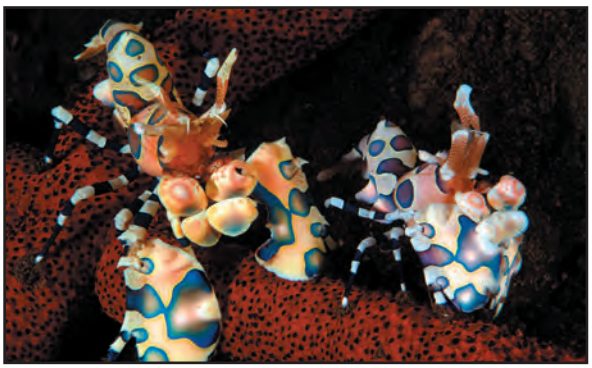
Neocallichirus **sp. – Ghost shrimp**
CALLIANASSIDAE – 11 cm

Alpheus ochrostriatus **– Snapping shrimp**
ALPHEIDAE – 4 cm

Synalpheus **sp. – Snapping shrimp**
ALPHEIDAE – 1.5 cm

Lysmata amboinensis **– White banded cleaner shrimp**
HIPPOLYTIDAE – 5 cm

Thor amboinensis **– Squat anemone shrimp**
HIPPOLYTIDAE – 2 cm



Hymenocera picta **– Harlequin shrimp**
HYMENOCERIDAE – 4 cm

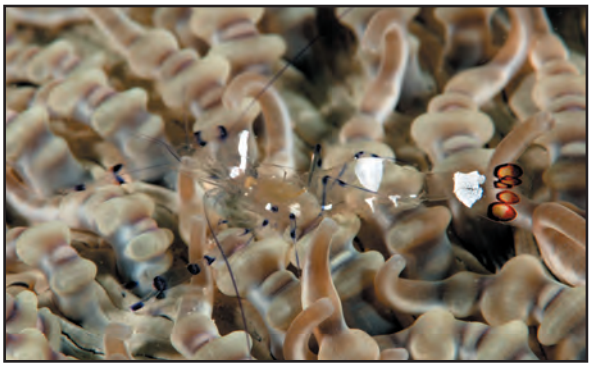
Dasycaris zanzibarica **– Bumblebee shrimp**
PALAEMONIDAE – 1.5 cm

Dasycaris zanzibarica **– Bumblebee shrimp**
PALAEMONIDAE – 1.5 cm

Laomenes **sp. – Crinoid shrimp**
PALAEMONIDAE – 2.5 cm

Manipontonia psamathe **– Commensal shrimp**
PALAEMONIDAE – 2 cm

Periclimenes amboinensis **– Crinoid shrimp**
PALAEMONIDAE – 2.5 cm

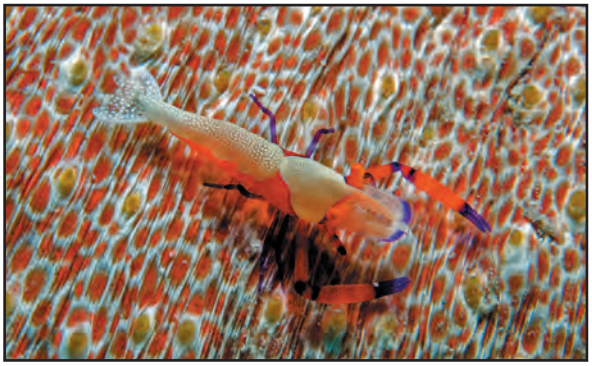


Periclimenes brevicarpalis **– Snow-capped shrimp**
PALAEMONIDAE – 3 cm – male

Periclimenes brevicarpalis **– Snow-capped shrimp**
PALAEMONIDAE – 3.5 cm – female

Periclimenes holthuisi **– Holthuis's shrimp**
PALAEMONIDAE – 2.5 cm

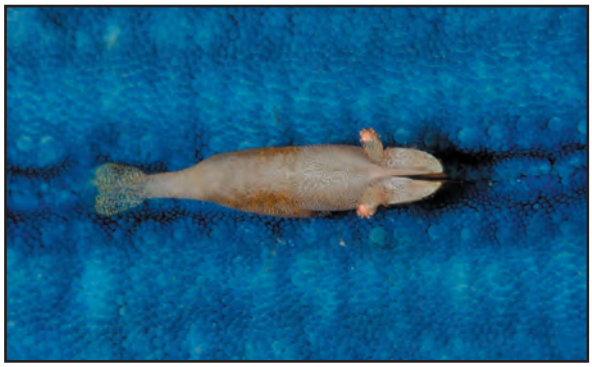
Periclimenes holthuisi **– Holthuis's shrimp**
PALAEMONIDAE – 2.5 cm



Periclimenes imperator **– Imperial shrimp**
PALAEMONIDAE – 2 cm

Periclimenes inornatus – **Mirror shrimp**
PALAEMONIDAE – 1.5 cm

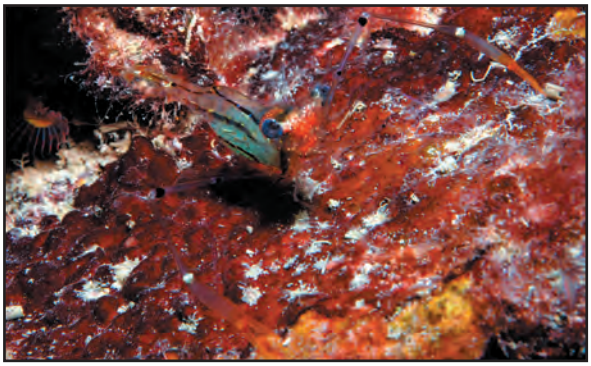
Periclimenes magnificus – **Magnificent shrimp**
PALAEMONIDAE – 2 cm



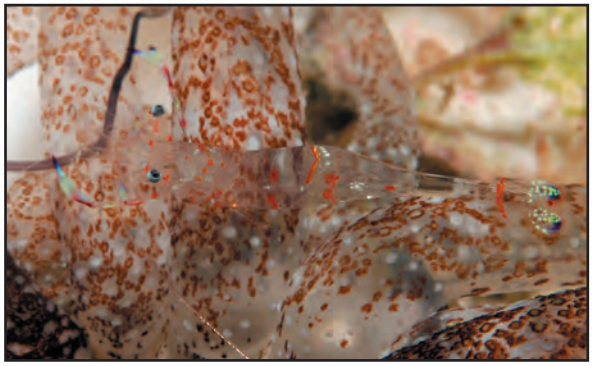
Periclimenes soror – **Sea star shrimp**
PALAEMONIDAE – 1 cm

Periclimenes soror – **Sea star shrimp**
PALAEMONIDAE – 1 cm

Periclimenes tosaensis – **Red-eyed shrimp***
PALAEMONIDAE – 3 cm

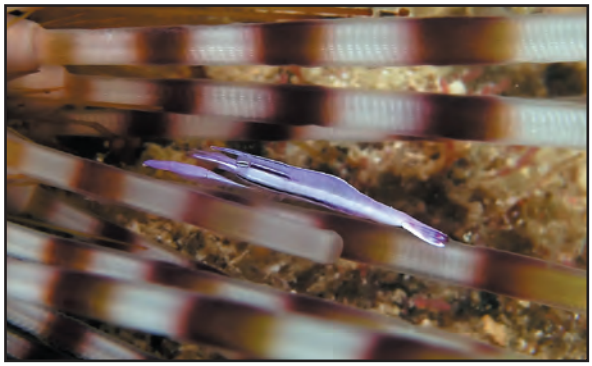


Periclimenes tenuipes – **Glass shrimp**
PALAEMONIDAE – 3 cm

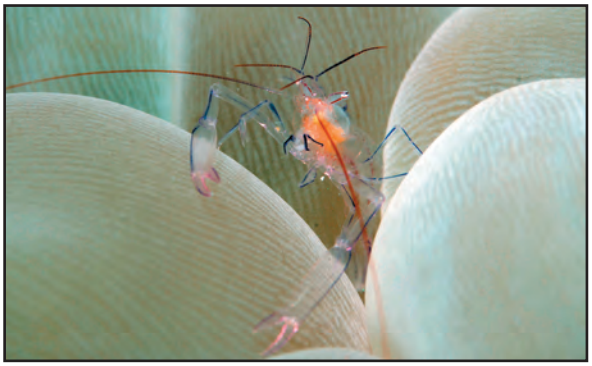


Periclimenes **sp. 1**
PALAEMONIDAE – 2 cm

Periclimenes **sp. 2**
PALAEMONIDAE – 2 cm



Stegopontonia commensalis – **Sea urchin shrimp***
PALAEMONIDAE – 3 cm



Vir philippinensis – **Philippine shrimp***
PALAEMONIDAE – 1.5 cm

Rhynchocinetes durbanensis – **Durban shrimp**
RHYNCHOCINETIDAE – 4 cm

Stenopus hispidus – **Banded coral shrimp**
STENOPODIDAE – 4 cm

Panulirus ornatus – **Ornate spiny lobster***
PALINURIDAE – 50 cm (Max)

Panulirus versicolor – **Painted lobster**
PALINURIDAE – 40 cm (Max)

Calcinus minutus – **Minute hermit crab**
DIOGENIDAE – 2 cm

Clibanarius **sp.** – **Green hermit crab**
DIOGENIDAE – 4 cm

Dardanus lagopodes – **Red hairy hermit crab**
DIOGENIDAE – 9 cm

Dardanus megistos – **White spotted hermit crab***
DIOGENIDAE – 10 cm

Dardanus pedunculatus – **Anemone hermit crab**
DIOGENIDAE – 3 cm

Dardanus **sp.** – **Hermit crab**
DIOGENIDAE – 10 cm

Diogenes **sp.** – **Hermit crab**
DIOGENIDAE – 2 cm

Allogalathea elegans – **Elegant squat lobster**
GALATHEIDAE – 1.5 cm

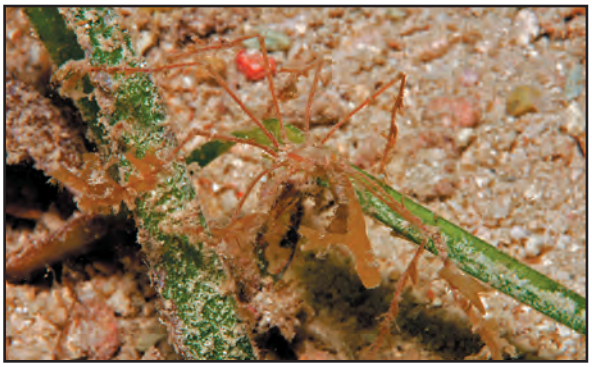
Galathea **sp.** – **Squat lobster**
GALATHEIDAE – 1.5 cm

Neopetrolisthes oshimai – **Oshima's porcellanid crab**
PORCELLANIDAE – 2 cm

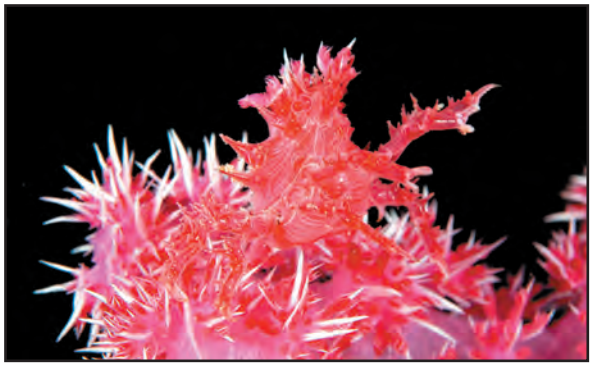
Calappa hepatica – **Livid box crab**
CALAPPIDAE – 5 cm

Calappa **sp. 1 – Box crab**
CALAPPIDAE – 7 cm

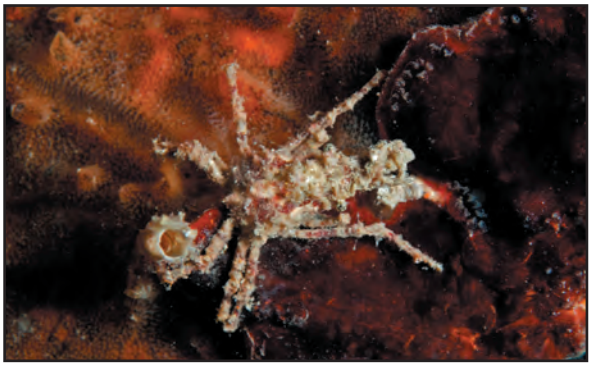
Calappa **sp. 2 – Box crab**
CALAPPIDAE – 9 cm



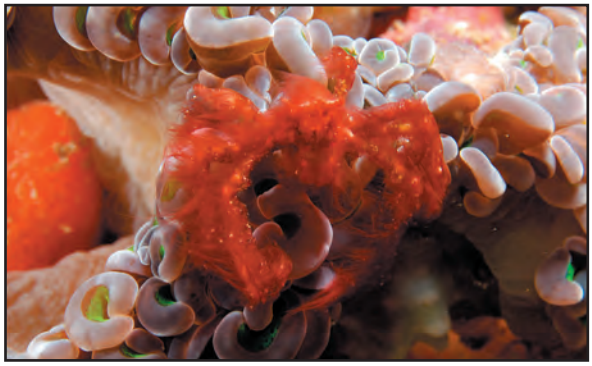
Achaeus **sp. – Delicate decorator crab**
MAJIDAE – 7 cm



Hoplophrys oatesii – **Oate's soft coral crab**
MAJIDAE – 1.5 cm



Hyastenus **sp. – Decorator crab**
MAJIDAE – 3 cm



Oncinopus **sp. – Orangutan crab***
MAJIDAE – 3 cm

Xenocarcinus tuberculatus – **Black coral crab***
MAJIDAE – 1.5 cm

Ashtoret lunaris – **Speckled surf crab**
MATUTIDAE – 5 cm

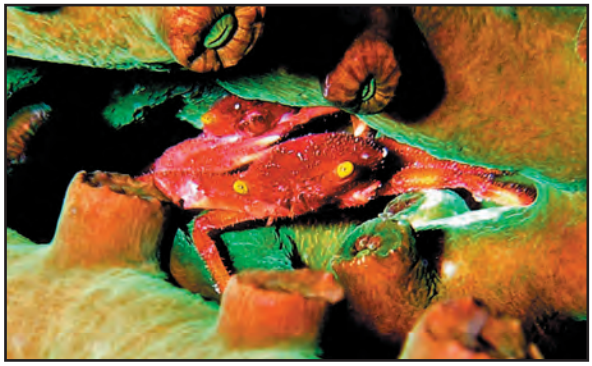
Uca perplexa – **Fiddler crab**
OCYPODIDAE – 1.5 cm

Uca **sp. – Fiddler crab**
OCYPODIDAE – 1.5 cm

Lissocarcinus laevis – **Sea anemone crab***
PORTUNIDAE – 3 cm

Lissocarcinus polyboides – **Sea star crab**
PORTUNIDAE – 3 cm

Portunus pelagicus – **Blue swimmer crab**
PORTUNIDAE – 11 cm



Quadrella boopsis – **Red trapeze crab**
TRAPEXIIDAE – 2 cm

Actaeodes tomentosus – **Velvet reef crab**
XANTHIDAE – 3 cm

Echinoderms

The echinoderms (kingdom Animalia, phylum Echinodermata), whose name translates as 'spiny skins', are common throughout our seas and oceans. They are generally composed of five sections. Each section is identical to the other. Internally, they possess a skeleton which consists of calcium carbonate structures.

***Protoreaster nodosus* in seagrass bed**

Echinoderms operate a unique water vascular system, comprising internal canals that supply tube feet with body fluid. As a result, echinoderms can expand or contract the tube feet. This helps echinoderms move, feed or remain rooted to one spot if they so desire. Generally, echinoderms have separate sexes, with eggs and sperm released into the water column. Once fertilised, they develop as various larval states before settling and growing. Some echinoderms brood their eggs. Echinoderms are also capable of regeneration.

There are five main classes represented in this guide: sea stars (class Asteroidea), feather stars (class Crinoidea), sea urchins (class Echinoidea), brittle stars (class Ophiuroidea) and sea cucumbers (class Holothuroidea).

Sea Stars

Easily recognised, sea stars have five or more arms emanating from a central disc. Underneath this disc, on the oral, or bottom, surface, is the sea star's mouth. The anus is on the aboral, or top, surface. Each identical arm section of the animal has the same set of internal organs. Along each arm, on the oral surface, are a multitude of tube feet with strong suction power.

Sea stars feed on algae, molluscs, worms and other invertebrates. They eject their stomachs through their mouths and actually digest their meal externally. If you lift a sea star, you may see it quickly retract its stomach. The stomach acts by dissolving the prey, the nutrients being absorbed through the stomach wall. Some sea stars even have the strength to pry open molluscs before digesting them. Perhaps the most voracious of sea stars, is the crown-of-thorns starfish, *Acanthaster planci*, which feeds on coral polyps. Sometimes these starfish increase considerably in number and can be responsible for wide-spread destruction of coral reefs.

***Archaster typicus* burying into sand**

Brittle Stars

Brittle stars are quite fragile nocturnal feeders, with five arms radiating from a central disc. They move and swim using these arms.

Their tube feet play an important role in feeding. Their diet consists mainly of detritus and even small organisms, which are captured and passed to the mouth by the tube feet. Some brittle stars are armed with spines which can cause discomfort if touched.

When under attack, they can detach an arm and quickly make their getaway.

Feather Stars

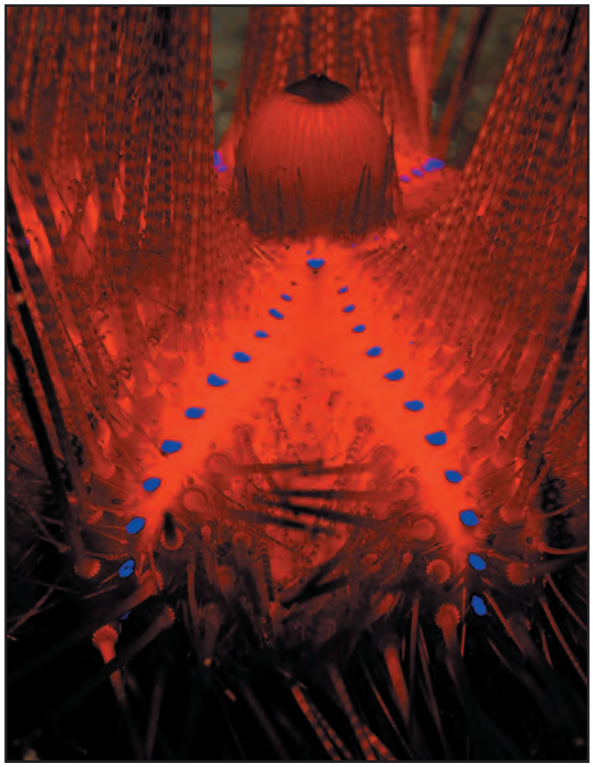
Feather stars have many colourful arms which occur in multiples of five up to hundreds. These organisms are filter feeders, using their arms to capture food from the water, mainly at night. The anus and mouth of a feather star face upwards. Feather stars are normally attached to the reef or other hard surfaces, by means of claw-like arms known as cirri, which may also be used in movement. They can also swim short distances through flapping of their arms.

The arms of feather stars provide a haven for many small animals, such as brittle stars, crabs, fish and shrimp. Feather stars can be quite difficult to identify to species and even genus level, as they exhibit extreme morphological and colour variations within species.

A feather star's central oral disk

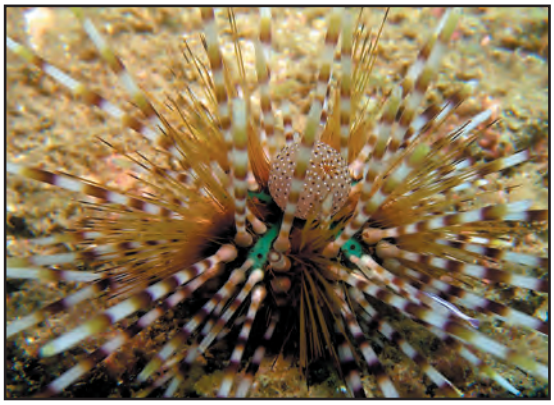
Sea Urchins

A regular sea urchin's body is covered by a round test consisting of 5 plates. This is covered in tube feet and spines of varying sizes. The tube feet are used in locomotion and feeding. The mouth, positioned on the underside, has jaws with teeth used to scrape algae and other encrusting organisms off hard surfaces. The feeding structure is often referred to as "Aristotle's Lantern" in recognition of the Greek philosopher's first description of its form. The food is chewed, digested and passed out through the anus, which is located in the centre of the upper surface.



The striking colours of *Astropyga radiata*

In some species, the cloaca is very visible. This is a bright coloured sac, which collects waste products. The sac is expelled when full.



***Echinothrix calamaris* showing the cloaca**

In amongst the tube feet and spines, some sea urchins also have pedicellariae, which are small jaws on stalks used to fend off parasites and other unwelcome visitors. Some urchins have long spines, with mild toxins, which can be painful to humans upon contact. It is the

flower urchins with their short spines that are more venomous to humans.

Sand dollars are flattened urchins with few spines. They tend to bury themselves and feed on dead animal and plant material as it settles on top of them. The tube feet transport this material to the mouth.

Sea Cucumbers

Sea cucumbers do not resemble other echinoderm groups at all. Their body is composed of five sections and they possess tube feet which assist in movement. Sea cucumbers generally sift through the upper layer of the seafloor: taking in sediment; absorbing the nutrients from organic material; and expelling the waste through the anus.

Some species have tentacles which sweep sand into their mouths. These animals tend to be tubular in shape with thick skin and are known collectively as 'Aspidochirotes'. Many of these species are being harvested at high levels to satisfy Asian markets for trepang. Trepang is the dried body wall of the sea cucumber thought to have many therapeutic properties when consumed. There is global concern at the state of sea cucumber fisheries. Some aspidochirotes will expel a sticky mess of cuvierian tubules to immobilise a predator, though this is only a minor inconvenience to fishers.

***Pearsonothuria graeffei* is common on reefs**

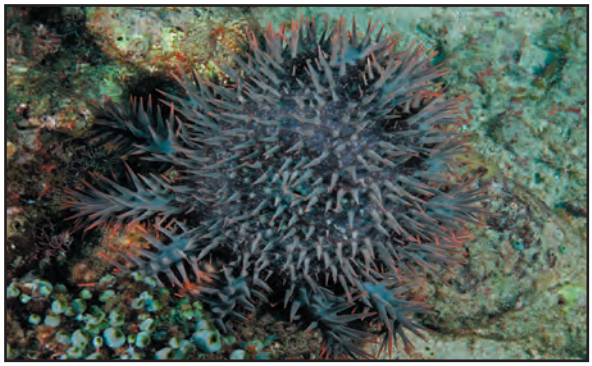
Another group, the 'Dendrochirotes', have sticky tentacles which filter the water to capture organisms.

***Synapta maculata* foraging through seagrass**

The third and final group is the 'Apodus' sea cucumbers, which can range from a few centimetres to metres in length. They have thin skins and long feeding tentacles.

Sea cucumbers have some interesting features and associations. Firstly, they breathe through their anus. When the anus is not passing sand, it takes in water which is pumped into respiratory trees, equivalent to our lungs. Secondly, some pearlfish who feed on the respiratory trees, crab, shrimp and worms can sometimes be found in the anus.

Sea cucumbers only have a single gonad. The aspidochirotes display a particular type of spawning behaviour. They generally come together and rise up on their rear ends, waving their heads like cobras, as the eggs and sperm are released from the genital orifice situated right beside the mouth (the gonad is in the head).



Acanthaster planci – **Crown of thorns starfish**
ACANTHASTERIDAE – 35 cm

Archaster typicus – **Typical sand star**
ARCHASTERIDAE – 10 cm

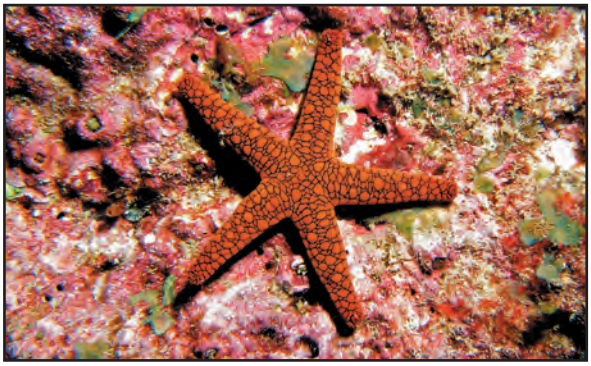
Echinaster callosus – **Thick skinned sea star**
ECHINASTERIDAE – 25 cm

Echinaster luzonicus – **Luzon sea star**
ECHINASTERIDAE – 10 cm

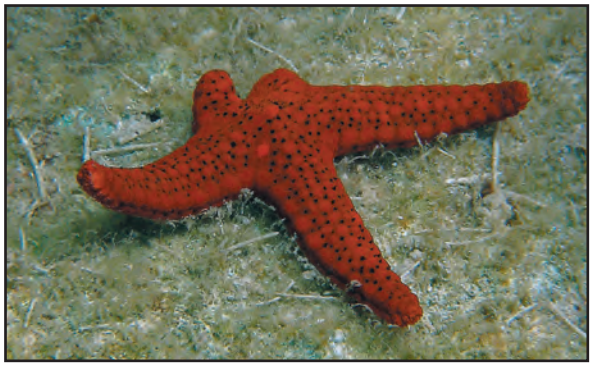
Luidia **cf.** *savignyi* – **Savigny's sea star**
LUIDIIDAE – 20 cm

Celerina heffernani – **Heffernan's sea star**
OPHIDIASTERIDAE – 10 cm

Fromia hadracantha – **Hadra star**
OPHIDIASTERIDAE – 10 cm



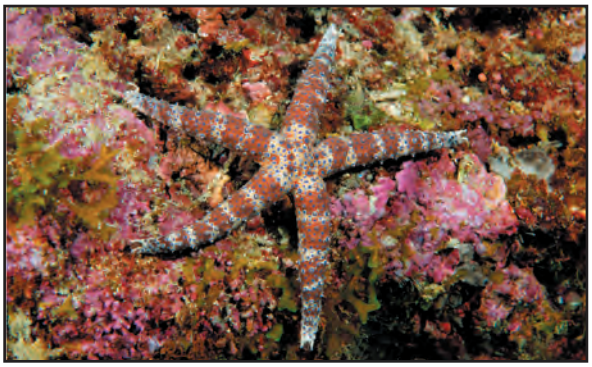
Fromia indica – **Indian sea star**
OPHIDIASTERIDAE – 5 cm



Fromia milleporella – **Thousand-pores star**
OPHIDIASTERIDAE – 2.5 cm

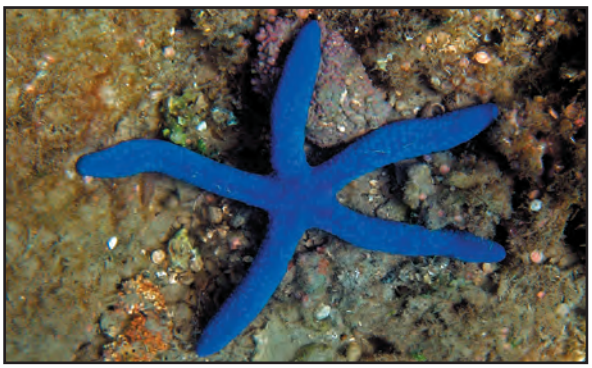
Fromia monilis – **Necklace sea star**
OPHIDIASTERIDAE – 5 cm

Gomophia egeriae – **Egeri's sea star**
OPHIDIASTERIDAE – 10 cm



Gomophia watsoni – **Watson's sea star**
OPHIDIASTERIDAE – 10 cm

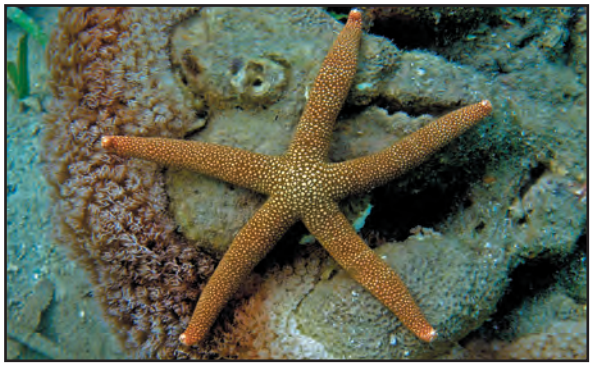
Linckia guildingi – **Yellow sea star**
OPHIDIASTERIDAE – 20 cm



Linckia laevigata – **Blue sea star**
OPHIDIASTERIDAE – 20 cm

Linckia multifora – **Multi-pore sea star**
OPHIDIASTERIDAE – 5 cm

Nardoa novaecaledonia – **Yellow mesh sea star**
OPHIDIASTERIDAE – 15 cm



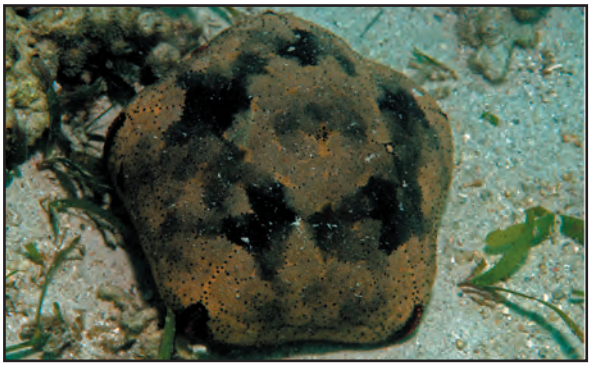
Nardoa tuberculata – **Tuberculate star**
OPHIDIASTERIDAE – 10 cm

Neoferdina cumingi – **Cumming's sea star**
OPHIDIASTERIDAE – 10 cm

Ophidiaster granifer – **Grainy star**
OPHIDIASTERIDAE – 10 cm

Bothriaster primigenius – **Pentagonal sea star**
OREASTERIDAE – 5 cm

Choriaster granulatus – **Pillow sea star**
OREASTERIDAE – 20 cm



Culcita novaeguinea – **Pin-cushion sea star**
OREASTERIDAE – 20 cm

Protoreaster nodosus – **Nodose sea star**
OREASTERIDAE – 30 cm

Protoreaster nodosus – **Nodose sea star**
OREASTERIDAE – 30 cm

Ophiarthrum pictum – **Painted brittle star**
OPHIOCOMIDAE – 15 cm

Ophiarthrum **sp.**
OPHIOCOMIDAE – 15 cm

Ophiocoma erinaceus – **Spiny brittle star**
OPHIOCOMIDAE – 20 cm

Macrophiothrix **sp.**
OPHIOTHRICHIDAE – 25 cm

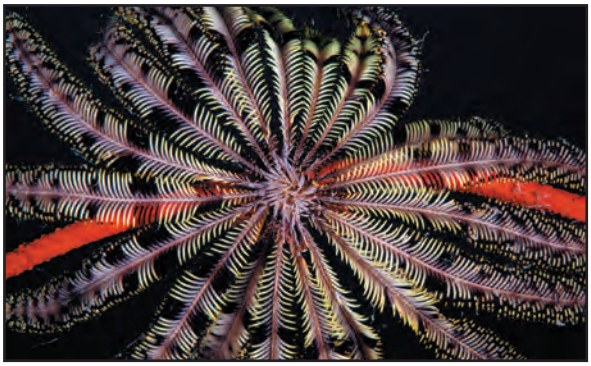
Ophiothrix purpurea – **Purple brittle star**
OPHIOTHRICHIDAE – 10 cm

Ophiothrix **sp. 1**
OPHIOTHRICHIDAE – 20 cm

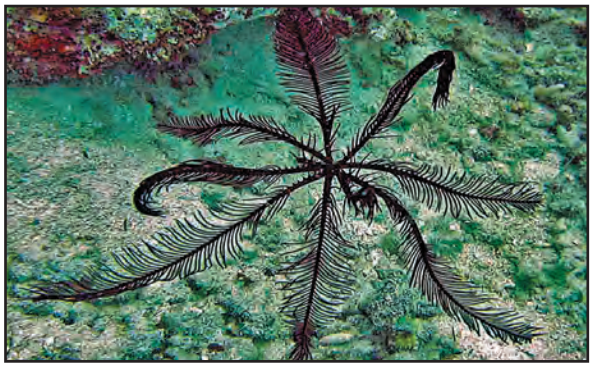
Ophiothrix **sp. 2**
OPHIOTHRICHIDAE – 10 cm

Ophiothrix **sp. 2**
OPHIOTHRICHIDAE – 10 cm (oral view)

Unidentified sp.
Class Ophiuroidea – 15 cm



Cenometra bella – **Pretty feather star**
COLOBOMETRIDAE – 15 cm



Colobometra perspinosa – **Spinose feather star**
COLOBOMETRIDAE – 15 cm

Oligometra carpenteri – **Carpenter's feather star**
COLOBOMETRIDAE – 10 cm

Oligometra serripinna – **Winged feather star**
COLOBOMETRIDAE – 10 cm

Comanthus alternans
COMASTERIDAE – 15 cm

Comanthus suavia
COMASTERIDAE – 20 cm

Comaster **sp.**
COMASTERIDAE – 15 cm

Oxycomanthus bennetti – **Bennett's feather star**
COMASTERIDAE – 20 cm

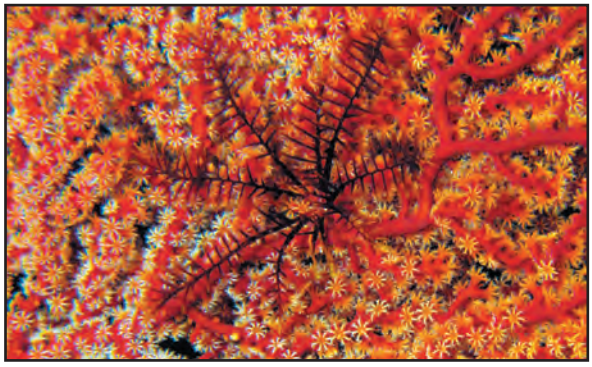
Oxycomanthus bennetti – **Bennett's feather star**
COMASTERIDAE – 20 cm

Oxycomanthus bennetti – **Bennett's feather star**
COMASTERIDAE – 25 cm

Himerometra robustipinna – **Robust feather star**
HIMEROMETRIDAE – 20 cm

Himerometra robustipinna – **Robust feather star**
HIMEROMETRIDAE – 10 cm

Himerometra **sp.**
HIMEROMETRIDAE – 20 cm



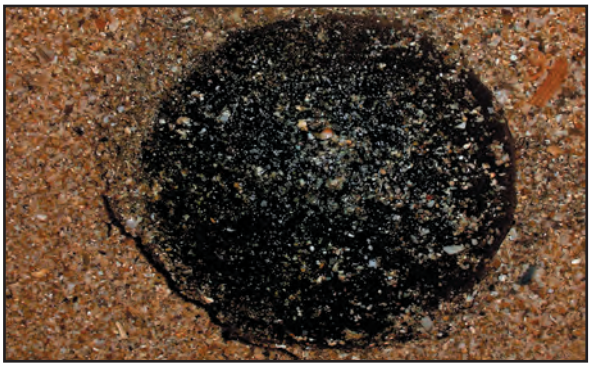
Unidentified sp. 1
Class Crinoidea – 10 cm

Unidentified sp. 2
Class Crinoidea – 10 cm

Unidentified sp. 3
Class Crinoidea – 10 cm

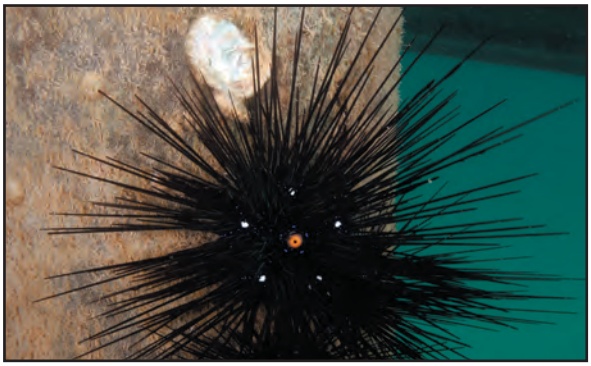
Arachnoides placenta – **Cake sand dollar**
ARACHNOIDIDAE – 5 cm

Echinodiscus auritus – **Pancake urchin**
ASTRICLYPEIDAE – 20 cm

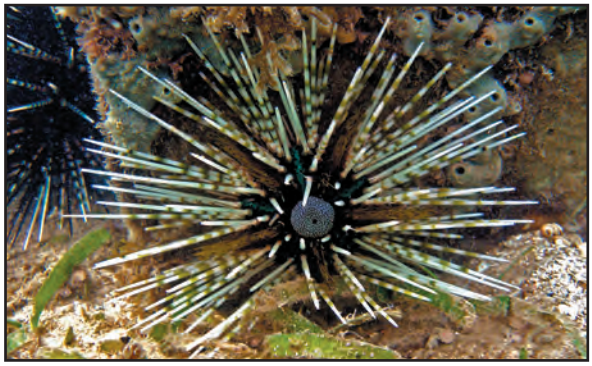


Peronella lesueuri – **Lesueur's sand dollar**
LAGANIDAE – 10 cm

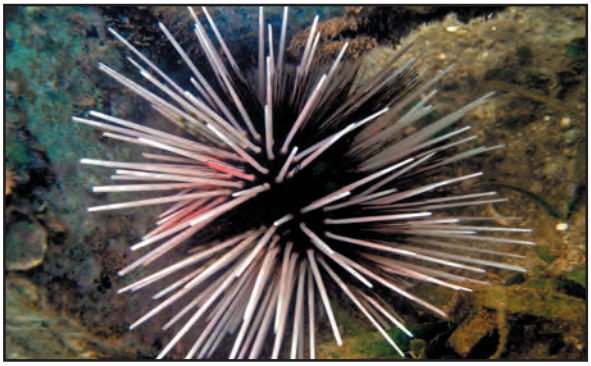
Astropyga radiata – **Radiant sea urchin**
DIADEMATIDAE – 25 cm



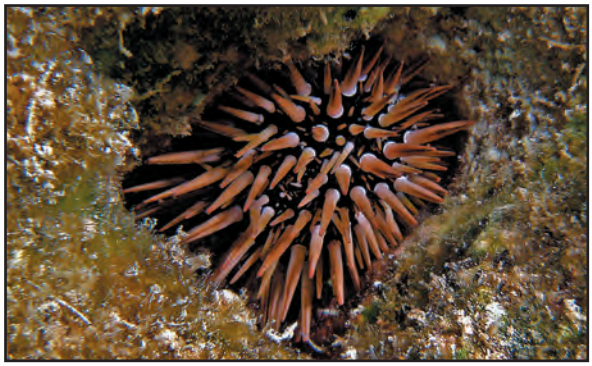
Diadema savignyi – **Savigny's sea urchin**
DIADEMATIDAE – 15 cm



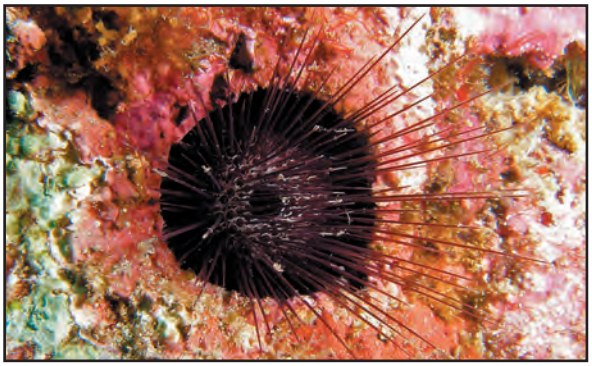
Echinothrix calamaris – **Stinging sea urchin**
DIADEMATIDAE – 20 cm



Echinothrix diadema – **Crowned sea urchin**
DIADEMATIDAE – 15 cm



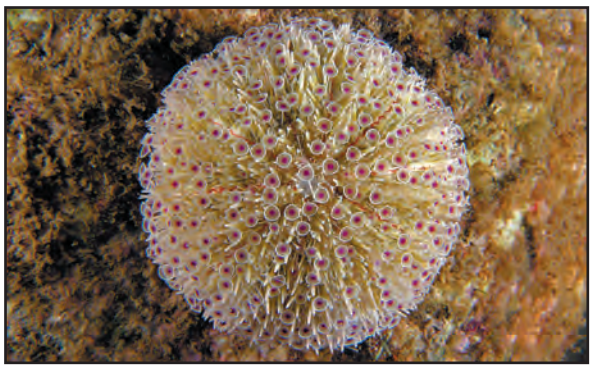
Echinometra mathaei – **Mathae's sea urchin**
ECHINOMETRIDAE – 10 cm



Echinostrephus aciculatus – **Needle spined sea urchin**
ECHINOMETRIDAE – 5 cm

Parasalenia pohlii – **Pohli's sea urchin**
PARASALENIIDAE – 2.5 cm

Salmacis sphaeroides – **Bicolor urchin**
TEMNOPLEURIDAE – 10 cm

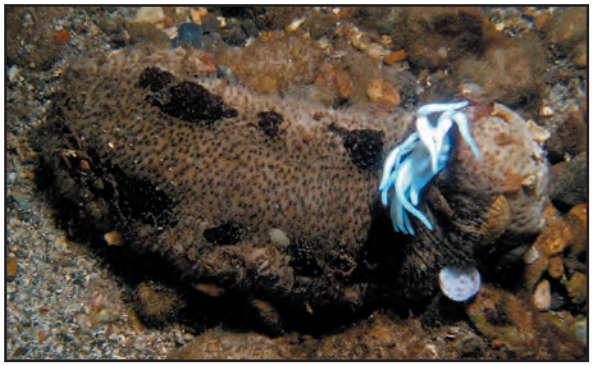


Toxopneustes pileolus – **Flower urchin**
TOXOPNEUSTIDAE – 10 cm

Tripneustes gratilla – **Cake urchin**
TOXOPNEUSTIDAE – 10 cm

Actinopyga **sp.**
HOLOTHURIIDAE – 20 cm

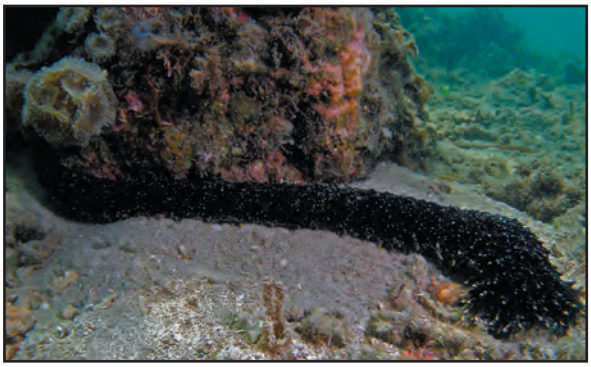
Bohadschia argus – **Eyed sea cucumber**
HOLOTHURIIDAE – 30 cm



Bohadschia similis – **Chalkfish**
HOLOTHURIIDAE – 25 cm

Bohadschia vitiensis – **Brown sandfish**
HOLOTHURIIDAE – 25 cm

Holothuria atra – **Lollyfish**
HOLOTHURIIDAE – 30 cm



Holothuria coluber – **Snakefish**
HOLOTHURIIDAE – 40 cm

Holothuria coluber – **Snakefish**
HOLOTHURIIDAE – 40 cm

Holothuria edulis – **Pinkfish**
HOLOTHURIIDAE – 30 cm

Holothuria fuscogilva – **White teatfish**
HOLOTHURIIDAE – 35 cm

Holothuria hilla – **Papillate sea cucumber**
HOLOTHURIIDAE – 25 cm

Holothuria leucospilota – **Black fringed cucumber**
HOLOTHURIIDAE – 30 cm

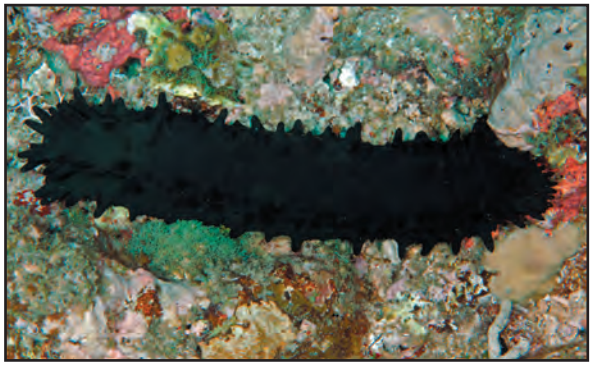
Holothuria scabra – **Sandfish**
HOLOTHURIIDAE – 20 cm

Holothuria (Selenkothuria) erinacea
HOLOTHURIIDAE – 10 cm

Holothuria **sp. 1**
HOLOTHURIIDAE – 10 cm

Holothuria **sp. 2**
HOLOTHURIIDAE – 15 cm

Pearsonothuria graeffei – **Flowerfish**
HOLOTHURIIDAE – 40 cm



Stichopus chloronotus – **Greenfish**
STICHOPODIDAE – 15 cm

Stichopus herrmanni – **Curryfish**
STICHOPODIDAE – 30 cm

Stichopus herrmanni – **Curryfish**
STICHOPODIDAE – 20 cm

Stichopus herrmanni – **Curryfish**
STICHOPODIDAE – 20 cm

Stichopus horrens – **Dragonfish**
STICHOPODIDAE – 20 cm

Thelenota ananas – **Prickly redfish***
STICHOPODIDAE – 50 cm

Thelenota anax – **Amberfish**
STICHOPODIDAE – 45 cm

Thelenota rubralineata – **Red-lined sea cucmber**
STICHOPODIDAE – 30 cm

Euapta godeffroyi – **Godeffroy's sea cucumber**
SYNAPTIDAE – 60 cm

Synapta maculata – **Spotted sea cucumber**
SYNAPTIDAE – 100 cm

Ascidians

Ascidians (kingdom Animalia, phylum Tunicata, class Ascidiacea), commonly known as sea squirts, are considered to be an evolutionary link between invertebrates and vertebrates. They are distantly related to man, the phylum Chordata sharing common ancestry with the phylum Tunicata. Juvenile ascidians have a notochord, similar to the backbone of chordates. On reaching adulthood ascidians lose this notochord.

***Polycarpa aurata*, common in Bootless Bay**

Ascidians consist of a hollow sac with two siphons; one pumping water into the animal with food, the other pumping it out again with waste. The water is pumped through the pharynx where food particles are captured and carried to the stomach.

Some ascidians are solitary species, usually large with well defined siphons, while others are colonial. One of the larger solitary ascidians, *Polycarpa aurata*, is commonly found with other individuals of the same species in the vicinity. They can adjust the position of their siphons so that the incurrent siphons are orientated in the same direction, generally towards the incoming current. The excurrent siphons are positioned in the opposite direction, ensuring that the incoming, feeding currents are not polluted by waste products.

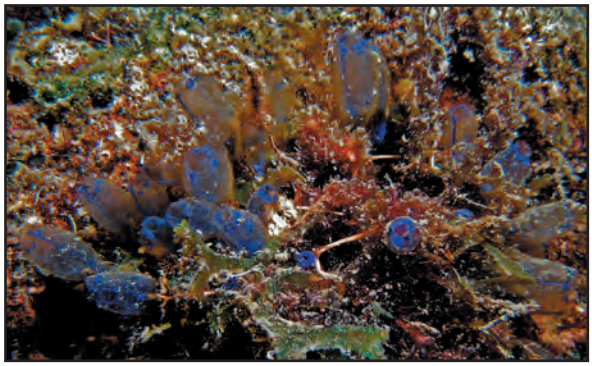
Ascidian colonies may be dominated by large numbers of small inhalant siphons, sharing fewer and larger exhalent siphons. Ascidians occur in a variety of colours, shapes, sizes and patterns, sometimes differing even within the same species. This is evident from our own collection of images. *Pycnoclavella diminuta*, a relatively common species, occurs in Bootless Bay in a number of colour variations. *Perophora modificata* can also be seen here in shades of cream and yellow, the latter being its more typical colour.

Ascidians are hermaphrodites, able to release both eggs and sperm, which they do through the exhalent siphon. In some species fertilisation occurs externally. In other species, fertilisation and brooding occurs within the body, with the eventual release of larvae. The tadpole-like larvae have a tail and change quite quickly over a matter of hours into bottom dwelling ascidians once they have settled.

Colonial species can also reproduce asexually through a process of cloning.

Ascidians are also known to have symbiotic relationships with unicellular algae, which provide the ascidian with nutriment. This occurs in the species *Didemnum molle*; the green colouration related to the presence of *Prochloron* algae in the tissues. This is very noticeable in the large excurrent siphons. The tiny pores visible on this species are the incurrent siphons. The algae accompany the ascidian larvae when released, thus forming a new generation with the symbiotic relationship intact. Sometimes, when disturbed, this ascidian will expel streams of mucus containing the *Prochloron* algae.

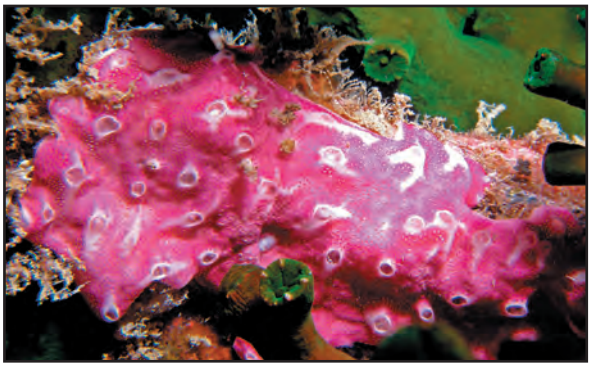
***Didemnum molle* attached to seagrass**



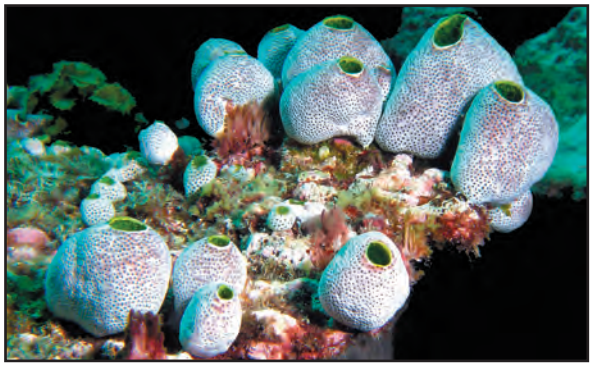
Clavelina moluccensis
CLAVELINIDAE – 1 cm

Nephtheis fascicularis
CLAVELINIDAE – 5 cm colony

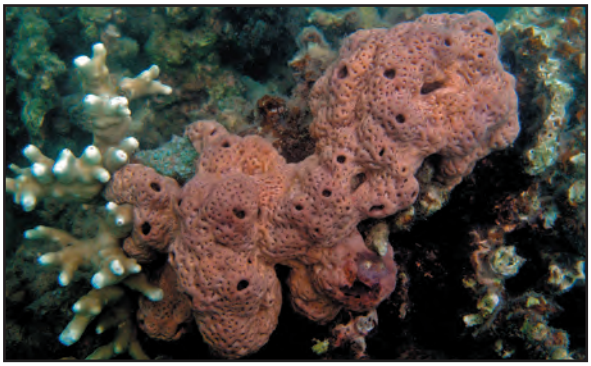
Rhopalaea crassa
DIAZONIDAE – 2 cm



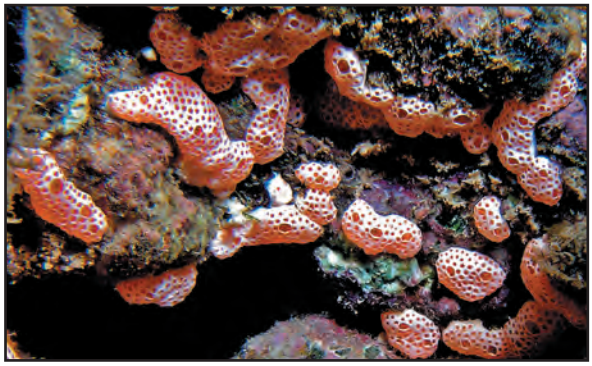
Didemnum membranaceum
DIDEMNIDAE – 20 cm colony



Didemnum molle
DIDEMNIDAE – 3 cm colony

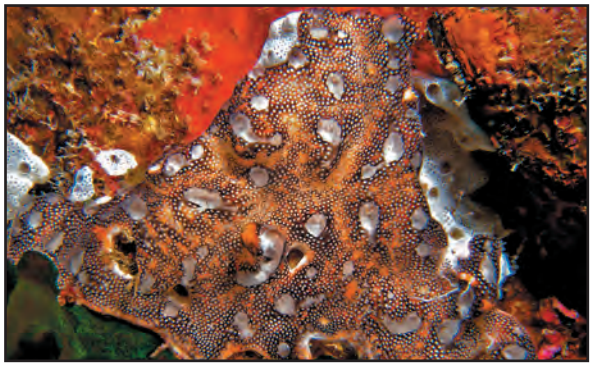


Lissoclinum patella
DIDEMNIDAE – 25 cm colony

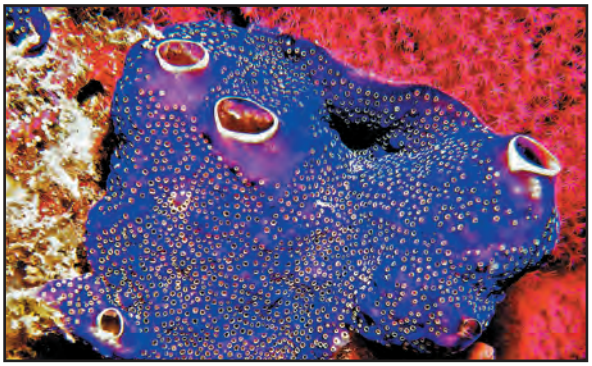


Unidentified sp. 1
DIDEMNIDAE – 10 cm colony

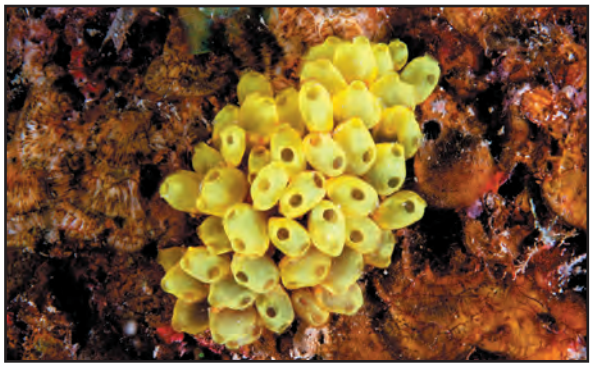
Unidentified sp. 2
DIDEMNIDAE – 10 cm colony



Unidentified sp. 3
DIDEMNIDAE – 15 cm colony

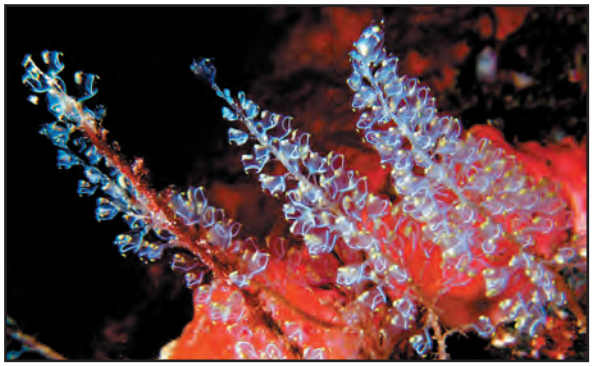


Unidentified sp. 4
DIDEMNIDAE – 10 cm colony



Perophora modificata
PEROPHORIDAE – 5 cm colony

Perophora modificata
PEROPHORIDAE – 5 cm colony



Perophora namei
PEROPHORIDAE – 5 cm colony

Pycnoclavella diminuta
PYCNOCLAVELLIDAE – 5 cm colony

Pycnoclavella diminuta
PYCNOCLAVELLIDAE – 5 cm colony

Polycarpa aurata
STYELIDAE – 10 cm

Fish

Fish (kingdom Animalia, phylum Chordata) have backbones and include sharks and rays (class Chondrichthyes) and bony fishes (class Osteicthyes).

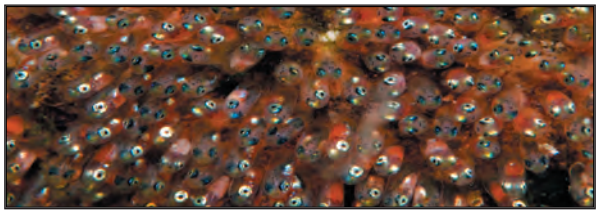
The number of different types of fresh and saltwater fish throughout the world is estimated at around 26,000 species. Discoveries of never-before-seen fish are still frequent. Fish come in all shapes and sizes, but have the same general features: a spinal cord, internal skeleton, and gills. The skeleton of sharks and rays is composed of cartilage rather than bone.

Common Lionfish - *Pterois volitans*

Most fish are covered in scales, but the problem with this large group is that it is dangerous to generalise on anything. Seahorses, for example, don't have scales. Fish feed in a variety of ways, including sucking prey into their mouths; and using their teeth to scrape algae from reefs and crush shells. Fish sometimes have poisonous spines or flesh for protection; some are masters of camouflage; and some puff up to frighten away predators.

Pink anemonefish – *Amphiprion perideraion*

Most fish produce eggs which they release into the water. Fish generally spawn in pairs but this can also occur in large groups. Some fish species lay their eggs on the bottom in rocky crevices, empty sea shells or on the surfaces of invertebrates such as sponges and coral. These can be cared for by one or more of the parent fishes.



Anemonefish eggs

We simply don't have enough space in this guide to go into detail on this very diverse group of animals in terms of feeding, reproduction and other types of behaviour. We have provided information, however, on some of the larger and better known fish groups throughout this part of the guide, which we hope will give you an interesting insight into some of the different types of fish found in Bootless Bay.

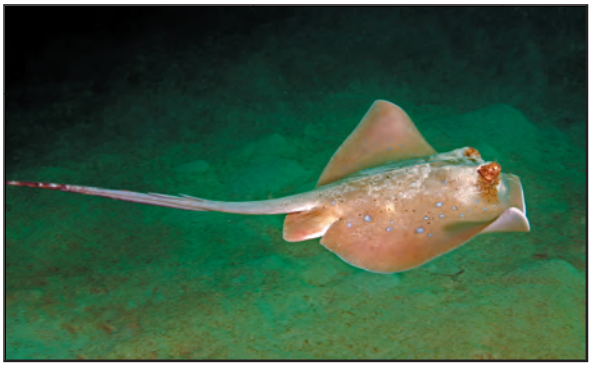
Stegostoma fasciatum – **Leopard shark***
STEGASTOMATIDAE – 235 cm (Max)

Hemiscyllium hallstromi – **Epaulette shark**
HEMISCYLLIDAE – 75 cm (Max)

Eucrossorhinus dasypogon – **Tasselled wobbegong**
ORECTOLOBIDAE – 125 cm (Max)

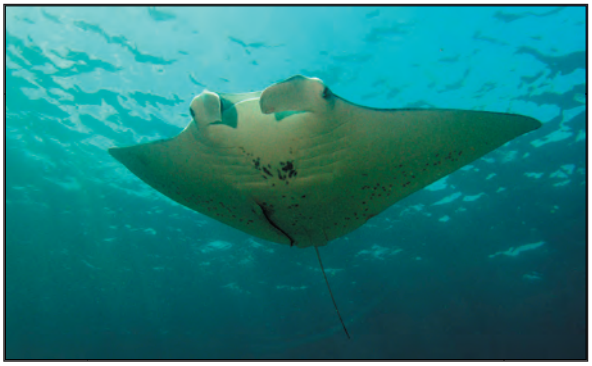
Carcharhinus melanopterus – **Blacktip reef shark***
CARCHARHINIDAE – 200 cm (Max)

Triaenodon obesus – **Whitetip reef shark**
CARCHARHINIDAE – 215 mm (Max)



Dasyatis kuhlii – **Blue spotted stingray**
DASYATIDIDAE – 70 cm (Max)

Taeniura lymma – **Blue spotted fantail ray**
DASYATIDIDAE – 30cm wide (Max)



Manta birostris – **Manta ray***
MOBULIDAE – 670cm (Max)

Eels

Eel species are often seen with their heads poking out of coral reefs displaying ferocious looking teeth. The giant moray (*Gymnothorax javanicus*) can grow to over 2 m in length and should be treated with caution by divers as they can inflict a very painful bite. The snake eels spend most of their time buried beneath the sand and can often be seen with just their head emerging.

Callechelys marmorata – **Marbled snake eel**
OPHICHTHIDAE – 87 cm (Max)

Ophichthus bonaparti – **Napoleon snake eel**
OPHICHTHIDAE – 75cm (Max)

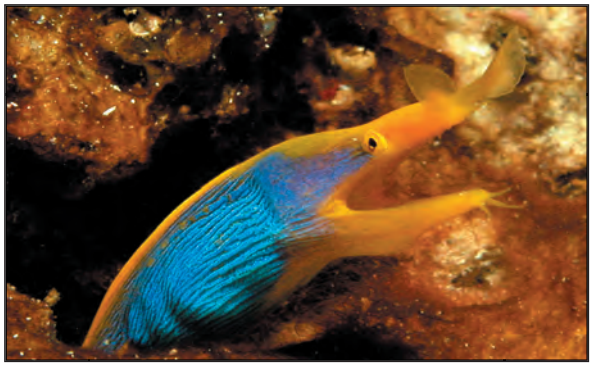
Echidna nebulosa – **Snowflake moray**
MURAENIDAE – 100 cm (Max)

Gymnothorax favagineus – **Blackspotted moray**
MURAENIDAE – 180 cm (Max)

Gymnothorax flavimarginatus – **Yellow edged moray**
MURAENIDAE – 240 cm (Max)

Gymnothorax javanicus – **Giant moray eel**
MURAENIDAE – 300 cm (Max)

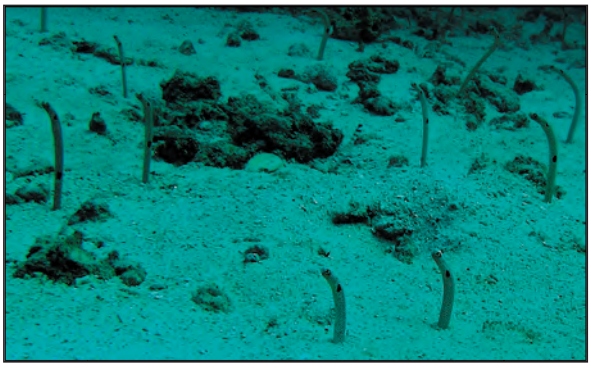
Siderea thyrsoidea – **White eyed moray***
MURAENIDAE – 65 cm (Max)



Rhinomuraena quaesita – **Ribbon moray**
MURAENIDAE – 130 cm (Max)

Rhinomuraena quaesita – **Ribbon moray**
MURAENIDAE – 130 cm (Max) – juvenile

Heteroconger hassi – **Spotted garden eel***
CONGRIDAE – 40 cm (Max)

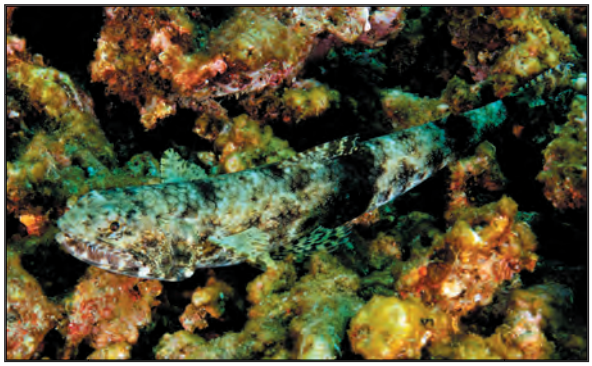


Heteroconger hassi – **Spotted garden eel**
CONGRIDAE – 40 cm (Max)

Antennarius pictus – **Painted anglerfish**
ANTENNARIIDAE – 30 cm (Max)

Histrio histrio – **Sargassum frogfish***
ANTENNARIIDAE – 14 cm (Max)

Plotosus lineatus – **Striped catfish**
PLOTOSIDAE – 32 cm (Max)

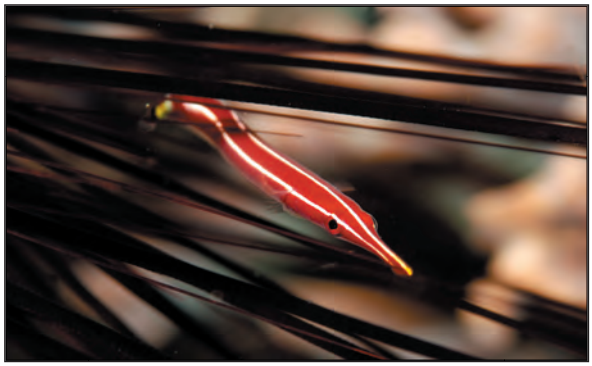


Saurida gracilis – **Gracile lizardfish**
HARPODONTIDAE – 32 cm (Max)

Synodus rubromarmoratus – **Redmarbled lizardfish**
SYNODONTIDAE – 8.5 cm (Max)

Synodus variegatus – **Variegated lizardfish**
SYNODONTIDAE – 40 cm (Max)

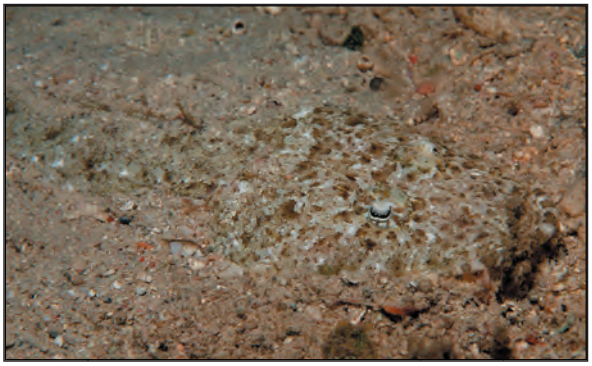
Synodus variegatus – **Variegated lizardfish**
SYNODONTIDAE – 40 cm (Max)



Diademichthys lineatus – **Urchin clingfish***
GOBIESOCIDAE – 5 cm (Max)

Discotrema crinophial – **Crinoid clingfish**
GOBIESOCIDAE – 3 cm (Max)

Cymbacephalus beauforti – **Crocodile fish**
PLATYCEPHALIDAE – 50 cm (Max)



Sunagocia **sp. – Fringe lip flathead**
SCORPAENIDAE – 25cm (Max)

Myripristis berndti – **Blotcheye soldierfish**
HOLOCENTRIDAE – 30 cm (Max)

Myripristis murdjan – **Pinecone soldierfish**
HOLOCENTRIDAE – 60 cm (Max)

Myripristis violacea – **Violet soldierfish**
HOLOCENTRIDAE – 20 cm (Max)

Myripristis vittata – **Whitetip soldierfish**
HOLOCENTRIDAE – 25 cm (Max)

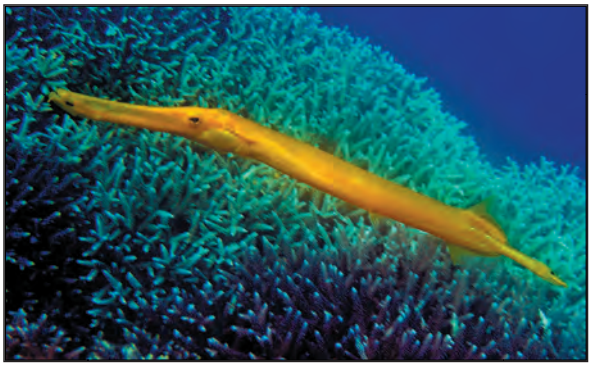
Neoniphon sammara – **Sammara squirrelfish**
HOLOCENTRIDAE – 32 cm (Max)

Sargocentron caudimaculatum – **Silverspot squirrelfish**
HOLOCENTRIDAE – 25 cm (Max)

Sargocentron ensiferum – **Yellow-striped soldierfish**
HOLOCENTRIDAE – 25 cm (Max)

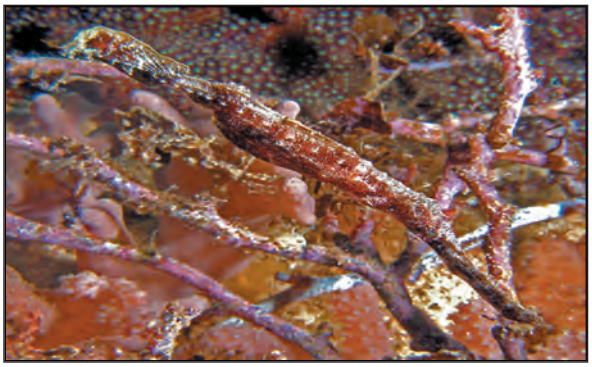
Sargocentron spiniferum – **Sabre squirrelfish**
HOLOCENTRIDAE – 51 cm (Max)

Aulostomus chinensis – **Trumpetfish**
AULOSTOMIDAE – 80 cm (Max)

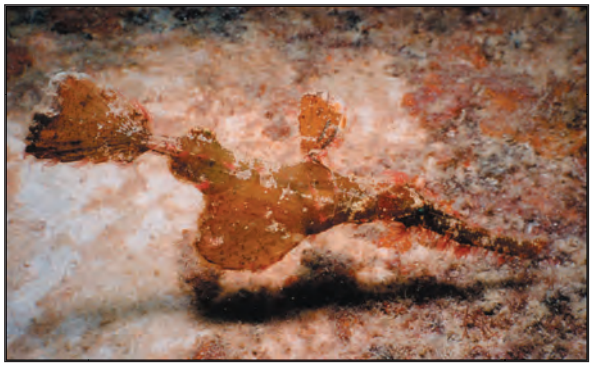


Aulostomus chinensis – **Trumpetfish**
AULOSTOMIDAE – 80cm (Max)

Eurypegasus draconis – **Short dragonfish***
PEGASIDAE – 10 cm (Max)



Solenostomus cyanopterus – **Robust ghost pipefish**
SOLENOSTOMIDAE – 17 cm (Max)



Solenostomus paegnius – **Rough snout ghost pipefish**
SOLENOSTOMIDAE – 12 cm (Max)

Solenostomus paradoxus – **Ornate ghost pipefish**
SOLENOSTOMIDAE – 12 cm (Max)

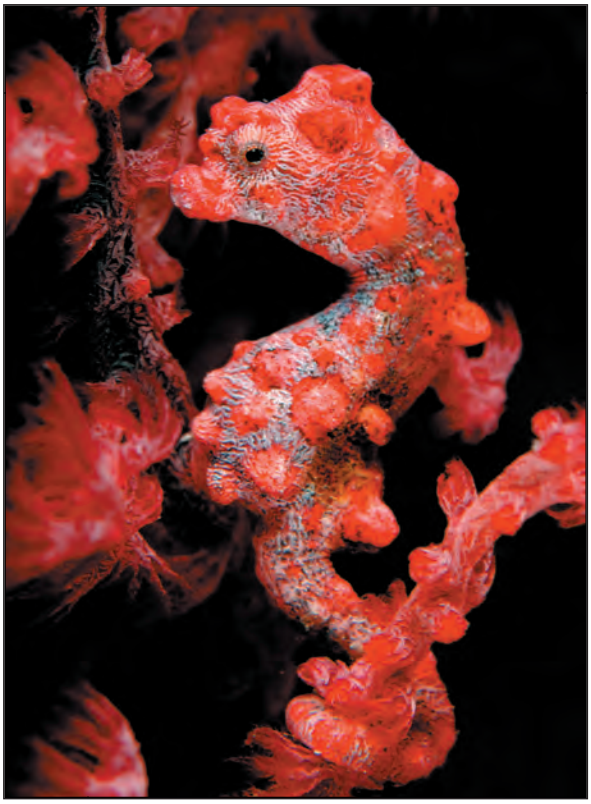
Solenostomus paradoxus – **Ornate ghost pipefish**
SOLENOSTOMIDAE – 12 cm (Max)

Centriscus scutatus – **Rigid shrimpfish***
CENTRISCIDAE – 14 cm (Max)

Seahorses and Pipefishes

Seahorses are an iconic species that belong to the family Syngnathidae, which also includes pipefish, seadragons and pipehorses. They live in a variety of habitats, with most species found in shallow seagrass meadows, sponge gardens or on coral reefs. They are very unusual animals in that the male actually becomes pregnant and gives birth - a unique feat in the animal world. Male seahorses carry their babies in a small pouch whilst male pipefish and pipehorses carry the eggs on the underside of their tails.

There are at least seven species of seahorse known to occur in the waters of Papua New Guinea. One of the more common species within Bootless Bay is the pygmy seahorse (*Hippocampus bargibanti*), which can be found living on gorgonian fans and is smaller than the nail on your little finger. Recent research conducted in Bootless Bay indicates that these seahorses can stay on the same fan for over a year.



***Hippocampus bargibanti* – Pygmy seahorse**
SYNGNATHIDAE – 2.4 cm (Max)

***Hippocampus kuda* – Estuary seahorse**
SYNGNATHIDAE – 30 cm (Max)

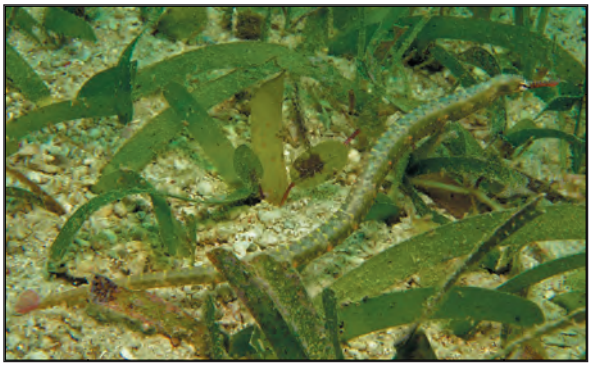
***Hippocampus taeniopterus* – Common seahorse**
SYNGNATHIDAE – 30 cm (Max)

Hippocampus **sp. – Seahorse**
SYNGNATHIDAE – 10 cm

Syngnathoides biaculeatus **– Alligator pipehorse**
SYNGNATHIDAE – 29 cm (Max)

Corythoichthys amplexus **– Brown-banded pipefish**
SYNGNATHIDAE – 10 cm (Max)

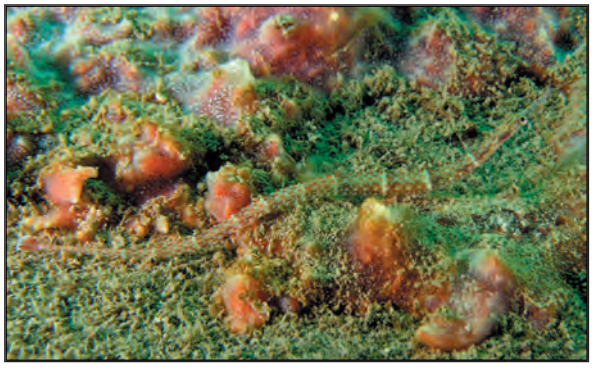
Corythoichthys haematopterus **– Messmate pipefish**
SYNGNATHIDAE – 20 cm (Max)



Corythoichthys haematopterus **– Messmate pipefish**
SYNGNATHIDAE – 20 cm (Max)

Corythoichthys intestinalis **– Scribbled pipefish**
SYNGNATHIDAE – 16 cm (Max)

Corythoichthys polynotatus – **Many spotted pipefish**
SYNGNATHIDAE – 16 cm (Max)



Corythoichthys ocellatus – **Ocellated pipefish**
SYNGNATHIDAE – 11 cm (Max)

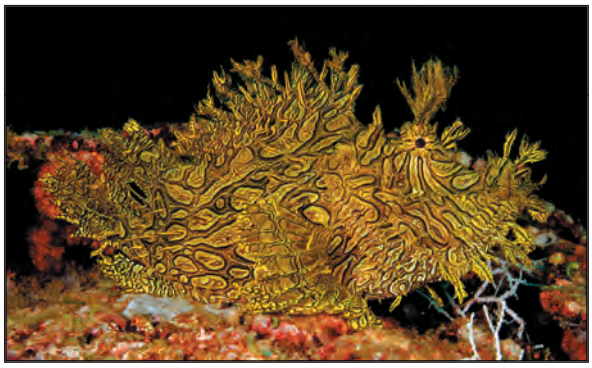
Corythoichthys schultzi – **Schultz's pipefish**
SYNGNATHIDAE – 16 cm (Max)

Doryrhamphus dactyliophorus – **Ringed pipefish***
SYNGNATHIDAE – 19 cm (Max)

Trachyrhamphus bicoarctatus – **Bend stick pipefish***
SYNGNATHIDAE – 40 cm (Max)

Scorpionfishes

The scorpionfish is appropriately named because these fish are very poisonous and cause immense pain if they are accidentally touched. The venom is contained in the fin spines and a sting from a species such as the stonefish (*Synanceia verrucosa*) can lead to hospitilisation. One of the prettier species is the common lionfish (*Pterois volitans*), which can often be seen hovering around coral reefs preying on small fish.



***Rhinopias aphanes* – Lacy scorpionfish**
SCORPAENIDAE – 25 cm (Max)

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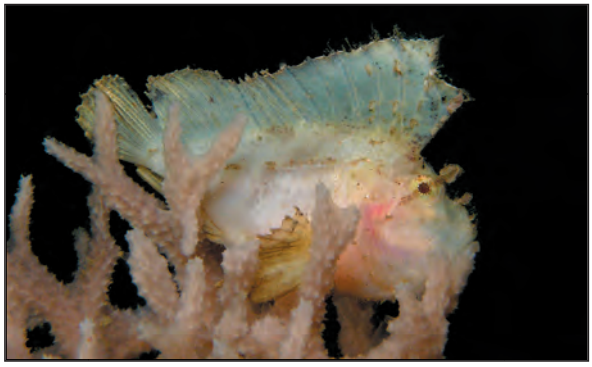
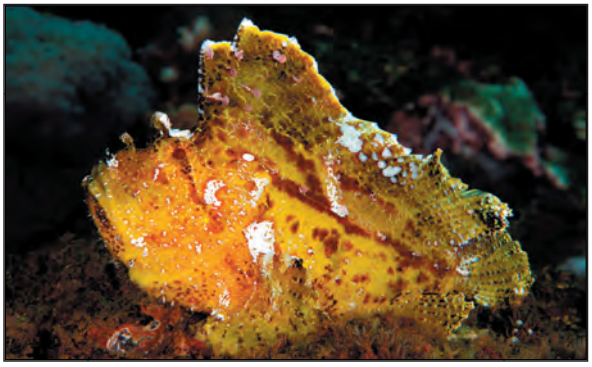


***Taenianotus triacanthus* – Leaf scorpionfish**
SCORPAENIDAE – 10 cm (Max)



***Taenianotus triacanthus* – Leaf scorpionfish**
SCORPAENIDAE – 10 cm (Max)

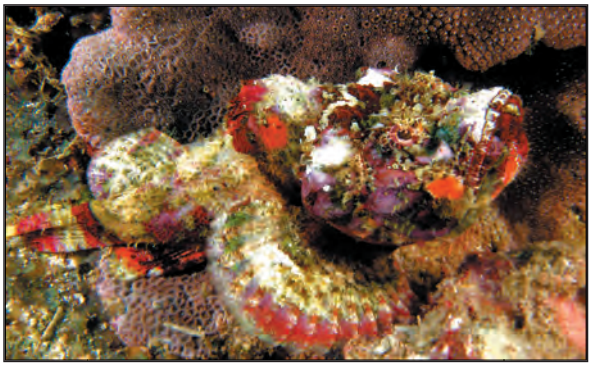
Taenianotus triacanthus – **Leaf scorpionfish**
SCORPAENIDAE – 10 cm (Max)

Dendrochirus brachypterus – **Shortfin lionfish**
SCORPAENIDAE – 17 cm (Max)

Dendrochirus zebra – **Zebra lionfish**
SCORPAENIDAE – 25 cm (Max)

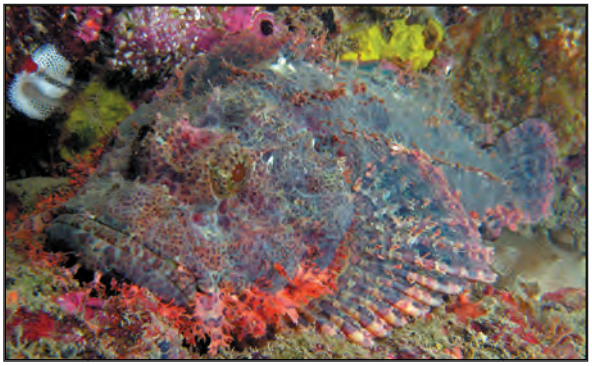
Pterois antennata – **Spotfin lionfish**
SCORPAENIDAE – 20 cm (Max)

Pterois volitans – **Common lionfish**
SCORPAENIDAE – 25 cm (Max)

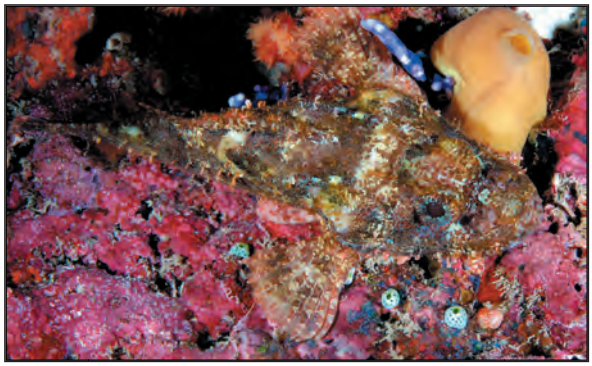


Scorpaenopsis diabolis – **Devil scorpionfish**
SCORPAENIDAE – 28 cm (Max)

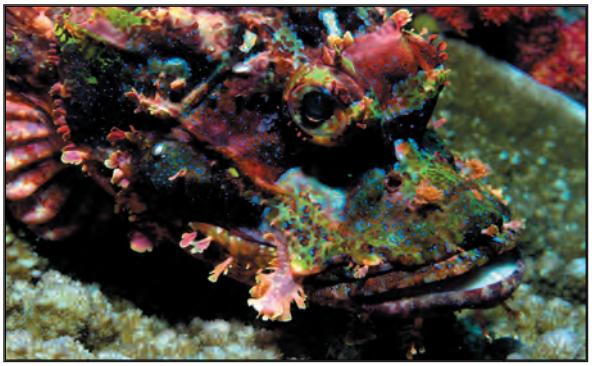
Scorpaenopsis macrochir – **Flasher scorpionfish**
SCORPAENIDAE – 15 cm (Max)



Scorpaenopsis oxycephala – **Tasselled scorpionfish***
SCORPAENIDAE – 36 cm (Max)

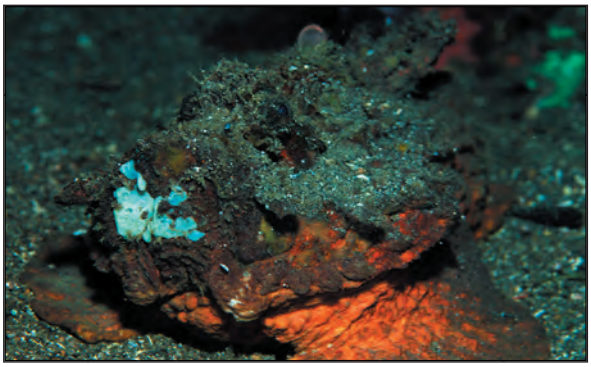


Scorpaenopsis possi – **Poss's scorpionfish**
SCORPAENIDAE – 19 cm (Max)



Scorpaenopsis venosa – **Raggy scorpionfish**
SCORPAENIDAE – 20 cm (Max)

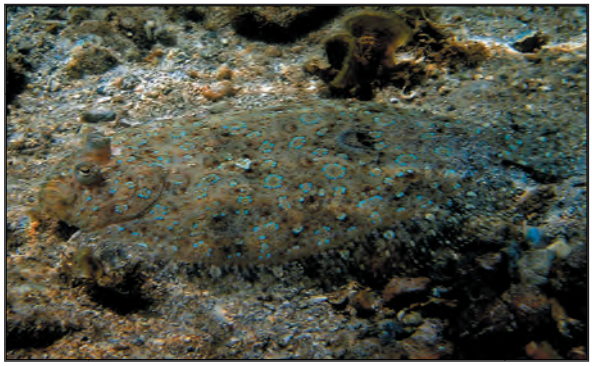
Scorpaenopsis venosa – **Raggy scorpionfish**
SCORPAENIDAE – 20 cm (Max)



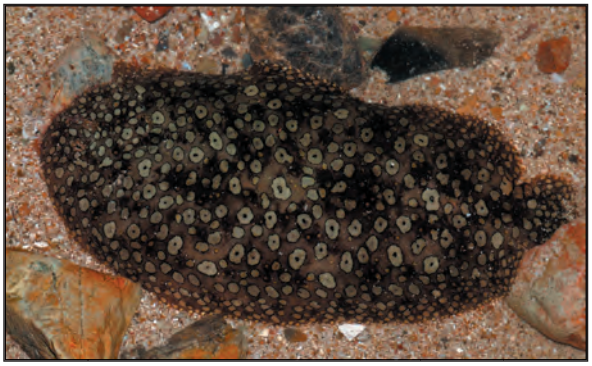
Synanceja verrucosa – **Stonefish***
SCORPAENIDAE – 40 cm (Max)

Ablabys taenianotus – **Cockatoo waspfish**
SCORPAENIDAE – 15 cm (Max)

Dactyloptena orientalis – **Flying Gurnard***
DACTYLOPTERIDAE – 38 cm (Max)



Bothus mancus – **Flowery flounder**
BOTHIDAE – 45 cm (Max)



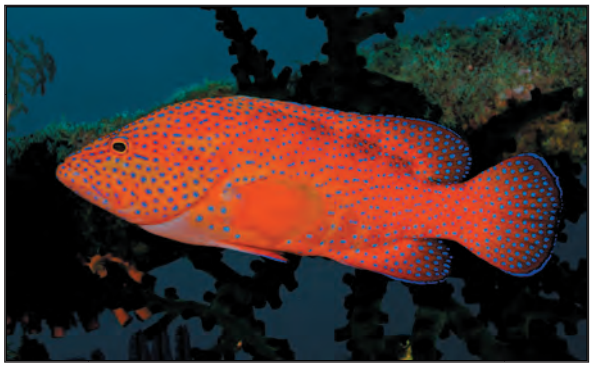
Pardachirus pavoninus – **Peacock sole**
SOLEIDAE – 22 cm (Max)

Cods

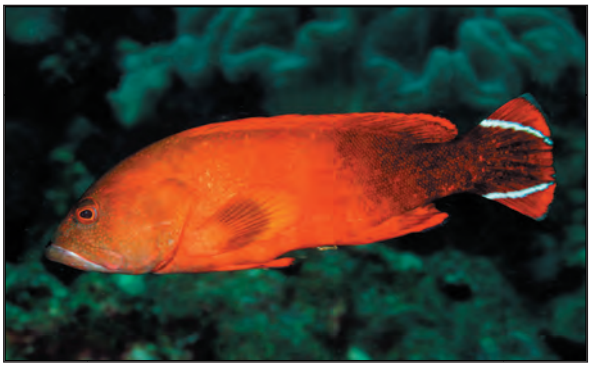
Cod are also referred to as groupers and are the largest types of fish that live on coral reefs. Species such as the Queensland grouper (*Epinephelus lanceolatus*) can grow up to 2 m in length and weigh up to 300 kg!

One of the more common species on the reefs of Bootless Bay is the coral rockcod (*Cephalopholis miniata*) which is considered to be good eating.

Anyperodon leucogrammicus – **White-lined rockcod***
SERRANIDAE – 65 cm (Max)



Cephalopholis miniata – **Coral rockcod**
SERRANIDAE – 45 cm (Max)



Cephalopholis urodeta – **Flagtail rockcod**
SERRANIDAE – 28 cm (Max)

Cromileptes altivelis – **Barramundi cod***
SERRANIDAE – 70 cm (Max)

Epinephelus fasciatus – **Black tip rockcod***
SERRANIDAE – 40 cm (Max)

Epinephelus fuscoguttatus – **Flowery cod***
SERRANIDAE – 100 cm (Max)

Epinephelus maculatus – **Marbled rockcod**
SERRANIDAE – 60 cm (Max)

Epinephalus merra – **Honeycomb cod**
SERRANIDAE – 31 cm (Max)

Epinephelus polyphekadion – **Camouflage cod***
SERRANIDAE – 90 cm (Max)

Plectropomus laevis – **Blacksaddle coral trout**
SERRANIDAE – 125 cm (Max)

Pseudanthias fasciatus – **One-stripe anthias**
SERRANIDAE – 21cm (Max) – male

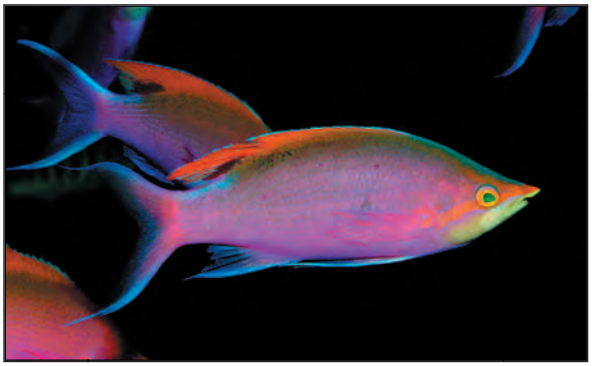
Pseudanthias hypselosoma – **Stocky anthias**
SERRANIDAE – 19 cm (Max) – male

Pseudanthias luzonensis – **Luzon anthias**
SERRANIDAE – 14.5 cm (Max) – male

Pseudanthias pleurotania – **Square-spot anthias**
SERRANIDAE – 20 cm (Max) – male

Pseudanthias pleurotania – **Square-spot anthias**
SERRANIDAE – 20 cm (Max) – female

Pseudanthias squamipinnis – **Scalefin anthias**
SERRANIDAE – 15 cm (Max) – female



Pseudanthias tuka – **Purple anthias**
SERRANIDAE – 12 cm (Max) – male

Pseudanthias tuka – **Purple anthias**
SERRANIDAE – 12 cm (Max) – female

Diploprion bifasciatum – **Barred soapfish**
SERRANIDAE – 25 cm (Max)

Grammistes sexlineatus – **Lined soapfish***
SERRANIDAE – 27 cm (Max)

Pictichromis aurifrons – **Yellow-headed dottyback**
PSEUDOCHROMIDAE – 6.5 cm (Max)

Calloplesiops altivelis – **Comet***
PLESIOPIDAE – 20 cm (Max)

Priacanthus hamrur – **Crescent-tail bigeye***
PRIACANTHIDAE – 40 cm (Max)

Cardinalfishes

The cardinalfishes are a unique fish family as the male incubates the eggs in its mouth. Cardinalfish are generally small and they can be found hiding in amongst branching corals where they are often seen in pairs or small groups.

They are active at night when they forage the reef looking for small bottom dwelling invertebrates and zooplankton.

Apogon aureus – **Ringtailed cardinalfish**
APOGONIDAE – 15 cm (Max)

Apogon cyanosoma – **Yellowstriped cardinalfish**
APOGONIDAE – 8 cm (Max)

Apogon fraenatus – **Bridled cardinalfish**
APOGONIDAE – 10 cm (Max)

Apogon fucata – **Orange lined cardinalfish**
APOGONIDAE – 9 cm (Max)

Apogon kallopterus – **Iridescent cardinalfish**
APOGONIDAE – 15 cm (Max)

Apogon nigrofasciatus – **Black striped cardinalfish**
APOGONIDAE – 8 cm (Max)

Apogon perlitus – **Pearly cardinalfish**
APOGONIDAE – 5 cm (Max)

Archamia zosterophora – **Blackbelted cardinalfish**
APOGONIDAE – 8 cm (Max)

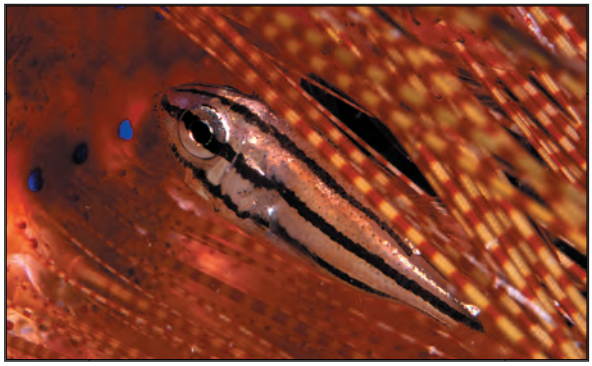
Cheilodipterus alleni – **Allen's cardinalfish**
APOGONIDAE – 11 cm (Max)

Cheilodipterus macrodon – **Large toothed cardinalfish**
APOGONIDAE – 25 cm (Max)

Cheilodipterus parazonatus – **Mimic cardinalfish**
APOGONIDAE – 6 cm (Max)

Cheilodipterus quinquelineatus – **Five-lined cardinalfish**
APOGONIDAE – 13 cm (Max)

Rhabdamia cypselura – **Swallowtail cardinalfish**
APOGONIDAE – 6cm (Max)



Siphamia versicolor – **Urchin cardinalfish**
APOGONIDAE – 4 cm (Max)

Sphaeramia nematoptera – **Pyjama cardinalfish**
APOGONIDAE – 8 cm (Max)

Sphaeramia orbicularis – **Orbiculate cardinalfish***
APOGONIDAE – 10 cm (Max)

Carangoides plagiotaenia – **Barcheek trevally**
CARANGIDAE – 50 cm (Max)

Caranx melampygus – **Bluefin trevally**
CARANGIDAE – 117 cm (Max)

Sphyraena flavicauda – **Yellowtail barracuda**
SPHYRAENIDAE – 55 cm (Max)

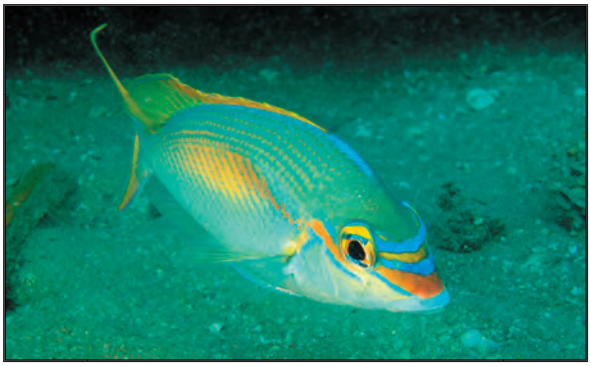
Sphyraena qenie – **Blackfin barracuda***
SPHYRAENIDAE – 100 cm (Max)

Pentapodus trivittatus – **Three-striped whiptail**
NEMIPTERIDAE – 25 cm (Max)

Scolopsis bilineatus – **Two-lined monocle bream**
NEMIPTERIDAE – 23 cm (Max)

Scolopsis ciliatus – **Whitestreak monocle bream**
NEMIPTERIDAE – 19 cm (Max)

Scolopsis margaritifer – **Pearly monocle bream**
NEMIPTERIDAE – 28 cm (Max)



Scolopsis monogramma – **Monocle bream***
NEMIPTERIDAE – 28 cm (Max)

Lethrinus erythracanthus – **Longfin emperor**
LETHRINIDAE – 50 cm (Max)

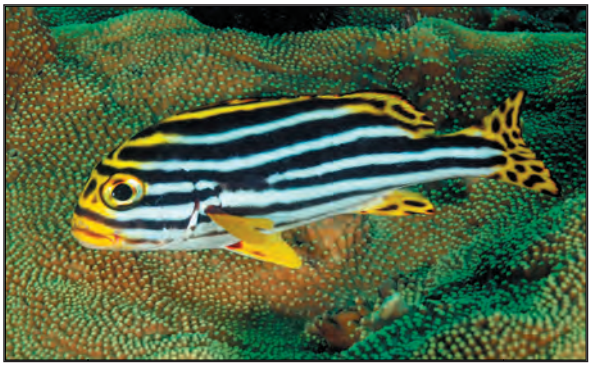
Monotaxis grandoculis – **Humpnose big-eye bream**
LETHRINIDAE – 60cm (Max)

Monotaxis grandoculis – **Humpnose big-eye bream***
LETHRINIDAE – 60cm (Max) – adult

Plectorhinchus chaetodontoides – **Harlequin sweetlips**
HAEMULIDAE – 72 cm (Max)

Plectorhinchus chrysotaenia – **Yellow-striped sweetlips**
HAEMULIDAE – 41 cm (Max)

Plectorhinchus lineatus – **Yellow banded sweetlips**
HAEMULIDAE – 72 cm (Max)



Plectorhinchus vittatus – **Oriental sweetlips**
HAEMULIDAE – 72 cm (Max)

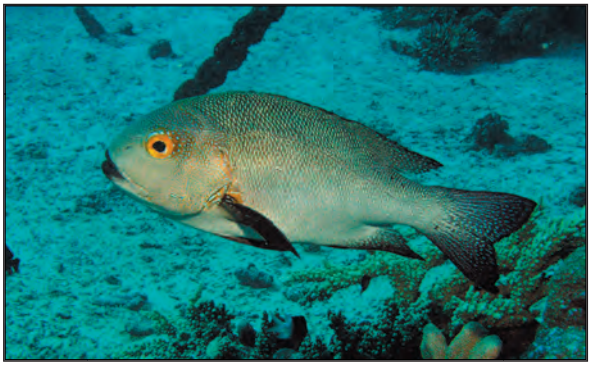
Lutjanus argentimaculatus – **Mangrove jack**
LUTJANIDAE – 90 cm (Max)

Lutjanus biguttatus – **Two-spot banded snapper**
LUTJANIDAE – 25 cm (Max)

Lutjanus fulvus – **Black tail snapper**
LUTJANIDAE – 40 cm (Max)

Lutjanus kasmira – **Common bluestripe snapper**
LUTJANIDAE – 40 cm (Max)

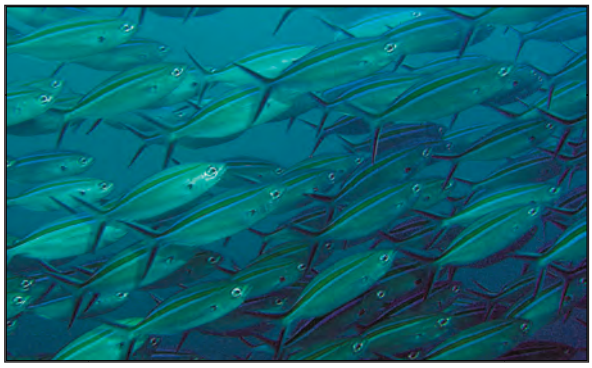
Lutjanus semicinctus – **Black banded snapper**
LUTJANIDAE – 35 cm (Max)



Macolor macularis – **Midnight snapper***
LUTJANIDAE – 60 cm (Max)

Macolor niger – **Black and white snapper**
LUTJANIDAE – 75 cm (Max)

Symphorichthys spilurus – **Sailfin Snapper**
LUTJANIDAE – 60 cm (Max)



Caesio caerulaurea – **Blue and gold fusilier**
CAESIONIDAE – 35 cm (Max)

Caesio cuning – **Yellowtail fusilier**
CAESIONIDAE – 60 cm (Max)

Parupeneus multifasciatus – **Manybar goatfish**
MULLIDAE – 35 cm (Max)

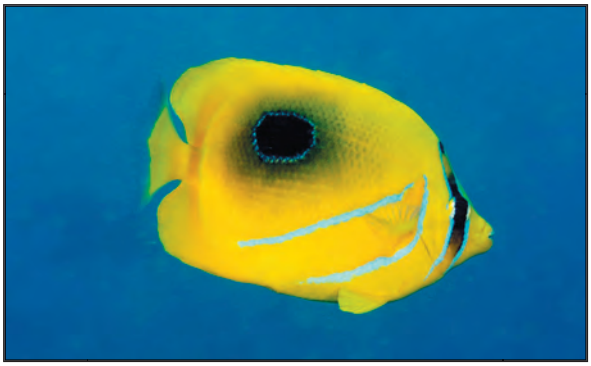
Upeneus tragula – **Freckled goatfish**
MULLIDAE – 30 cm (Max)

Parapriacanthus ranmsoneti – **Yellow Sweeper**
PEMPHERIDIDAE – 10cm (Max)

Zanclus cornutus – **Moorish idol**
ZANCLIDAE – 23 cm (Max)

Butterflyfishes

The butterflyfishes are generally small species that can be found living on coral reefs in tropical waters. They are brightly coloured and many species have unusual patterns such as the sunset butterflyfish (*Chaetodon pelewensis*). Their bodies are generally compressed and they are often seen in pairs darting around coral reefs feeding on exposed polyps, tiny worms or other marine invertebrates.

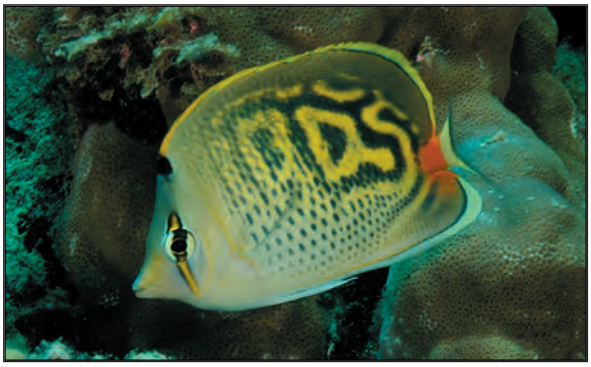


Chaetodon bennetti – **Bluelashed butterflyfish**
CHAETODONTIDAE – 20 cm (Max)

Chaetodon ephippium – **Saddle butterflyfish**
CHAETODONTIDAE – 30 cm (Max)

Chaetodon kleinii – **Brown butterflyfish**
CHAETODONTIDAE – 15 cm (Max)

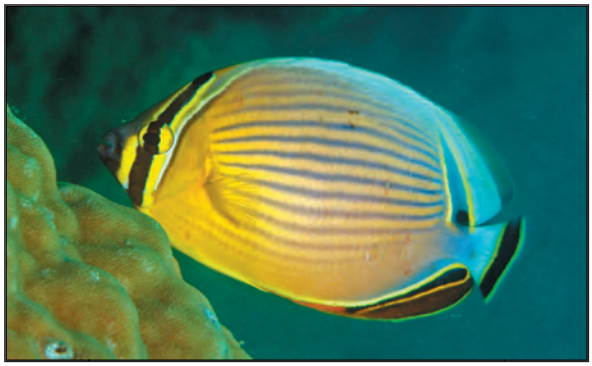
Chaetodon ornatissimus – **Ornate butterflyfish**
CHAETODONTIDAE – 20 cm (Max)



Chaetodon pelewensis – **Sunset butterflyfish**
CHAETODONTIDAE – 12 cm (Max)

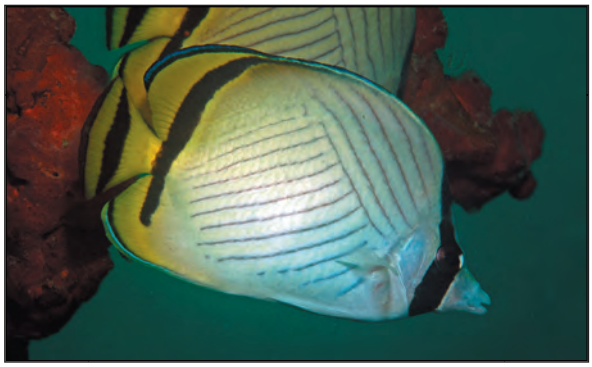
Chaetodon plebeius – **Blue-dash butterflyfish***
CHAETODONTIDAE – 12 cm (Max)

Chaetodon rafflesi – **Latticed butterflyfish**
CHAETODONTIDAE – 18 cm (Max)



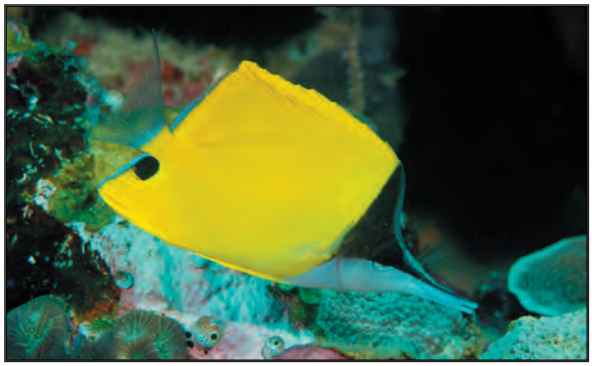
Chaetodon trifasciatus – **Melon butterflyfish**
CHAETODONTIDAE – 15 cm (Max)

Chaetodon ulietensis – **Double-saddle butterflyfish**
CHAETODONTIDAE – 15 cm (Max)



Chaetodon vagabundus – **Vagabond butterflyfish**
CHAETODONTIDAE – 23 cm (Max)

Chelmon rostratus – **Copperband butterflyfish**
CHAETODONTIDAE – 20 cm (Max)



Forcipiger flavissimus – **Longnosed butterflyfish**
CHAETODONTIDAE – 22 cm (Max)

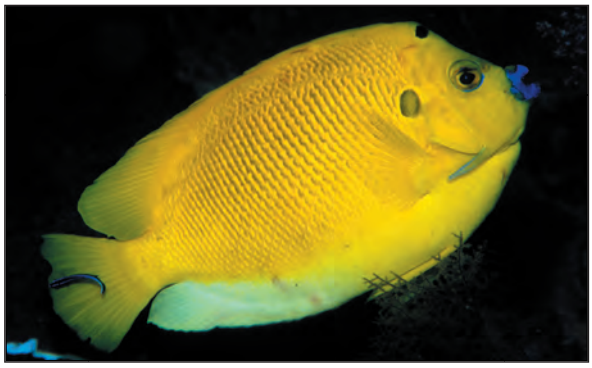
Forcipiger longirostris – **Big longnosed butterflyfish**
CHAETODONTIDAE – 22 cm (Max)

Hemitaurichthys polylepis – **Pyramid butterflyfish**
CHAETODONTIDAE – 18 cm (Max)

Heniochus acuminatus – **Reef bannerfish**
CHAETODONTIDAE – 25 cm (Max)

Heniochus chrysostomus – **Pennant bannerfish**
CHAETODONTIDAE – 18 cm (Max)

Heniochus varius – **Humphead bannerfish**
CHAETODONTIDAE – 19 cm (Max)



Apolemichthys trimaculatus – **Three spot angelfish**
POMACANTHIDAE – 25 cm (Max)

Centropyge bicolor – **Bicolor angelfish**
POMACANTHIDAE – 15 cm (Max)

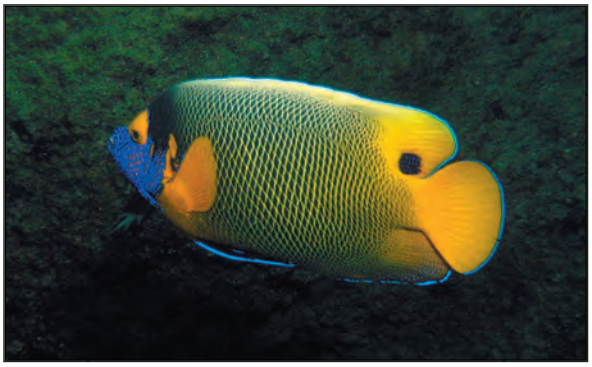
Centropyge bispinosus – **Twospined angelfish**
POMACANTHIDAE – 10 cm (Max)

Genicanthus melanospilos – **Black spot angelfish**
POMACANTHIDAE – 18 cm (Max)

Pomacanthus imperator – **Emperor angelfish***
POMACANTHIDAE – 40 cm (Max)

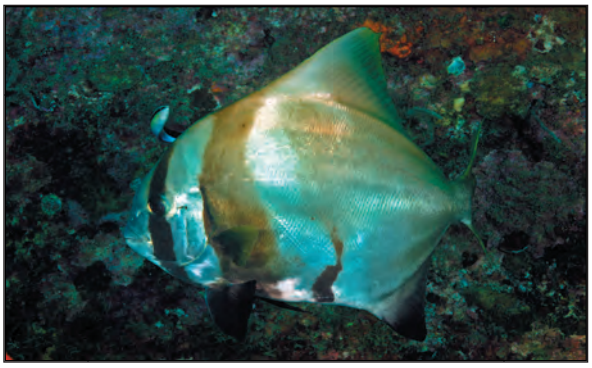
Pomacanthus imperator – **Emperor angelfish***
POMACANTHIDAE – 40cm (Max) – juvenile

Pomacanthus sexstriatus – **Sixbar angelfish**
POMACANTHIDAE – 46 cm (Max)



Pomacanthus xanthometopon – **Yellowface angelfish***
POMACANTHIDAE – 38 cm (Max)

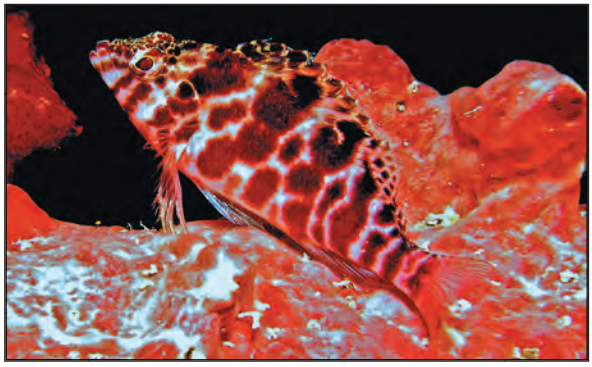
Pygoplites diacanthus – **Royal angelfish**
POMACANTHIDAE – 25 cm (Max)



Platax orbicularis – **Orbicular batfish**
EPHIPPIDAE – 50 cm (Max)

Platax pinnatus – **Dusky batfish**
EPHIPPIDAE – 45 cm (Max)

Platax teira – **Tail-fin batfish***
EPHIPPIDAE – 60 cm (Max)



Cirrhitichthys aprinus – **Spotted hawkfish**
CIRRHITIDAE – 13 cm (Max)

Cirrhitichthys falco – **Dwarf hawkfish**
CIRRHITIDAE – 7 cm (Max)

Cirrhitichthys oxycephalus – **Coral hawkfish**
CIRRHITIDAE – 10 cm (Max)

Oxycirrhitus typus – **Longnose hawkfish**
CIRRHITIDAE – 13 cm (Max)

Paracirrhites arcatus – **Ring-eyed hawkfish**
CIRRHITIDAE – 20 cm (Max)

Paracirrhites forsteri – **Forster hawkfish**
CIRRHITIDAE – 22 cm (Max)

Damselfishes

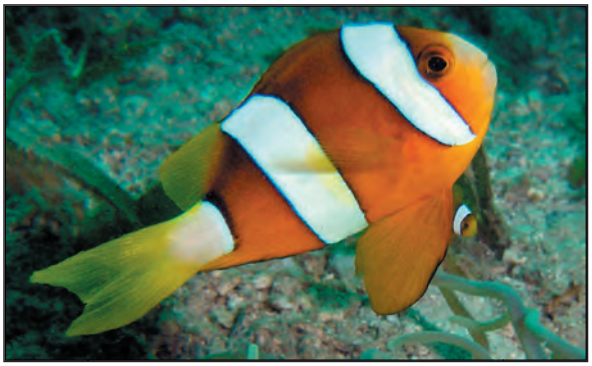
Damselfishes are small species that are generally brightly coloured and they are one of the most common fish groups found on coral reefs. One of the most well known damselfish species is the clown anemonefish (*Amphiprion percula*) made famous through the movie 'Finding Nemo'. Anemonefishes are always found living with an anemone host as the anemone helps protect them from any predators.

Amblyglyphidodon aureus – **Golden damselfish**
POMACENTRIDAE – 13 cm (Max)

Amblyglyphidodon curacao – **Staghorn damselfish**
POMACENTRIDAE – 11 cm (Max)

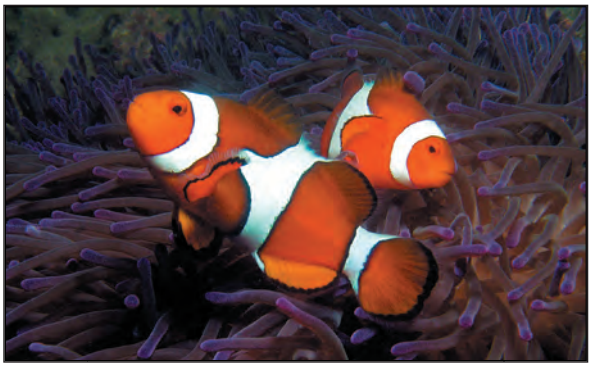
Amblyglyphidodon leucogaster – **Yellowbelly damselfish**
POMACENTRIDAE – 13 cm (Max)

Amphiprion clarkii – **Clark's anemonefish**
POMACENTRIDAE – 15 cm (Max)



Amphiprion clarkii – **Clark's anemonefish**
POMACENTRIDAE – 15 cm (Max) - colour variant

Amphiprion melanopus – **Fire anemonefish**
POMACENTRIDAE – 12 cm (Max)



Amphiprion percula – **Clown anemonefish**
POMACENTRIDAE – 11 cm (Max)

Amphiprion perideraion – **Pink anemonefish**
POMACENTRIDAE – 10 cm (Max)

Amphiprion polymnus – **Saddleback anemonefish**
POMACENTRIDAE – 13 cm (Max)

Chromis amboinensis – **Ambon chromis**
POMACENTRIDAE – 9 cm (Max)

Chromis atripes – **Darkfin chromis**
POMACENTRIDAE – 7 cm (Max)

Chromis retrofasciatus – **Black-bar chromis**
POMACENTRIDAE – 4 cm (Max)

Chromis viridis – **Blue green damselfish**
POMACENTRIDAE – 8 cm (Max)

Chrysiptera rollandi – **Rolland's demoiselle**
POMACENTRIDAE – 8 cm (Max)

Chrysiptera talboti – **Talbot's demoiselle**
POMACENTRIDAE – 6 cm (Max)

Dascyllus aruanus – **Humbug dascyllus**
POMACENTRIDAE – 10 cm (Max)

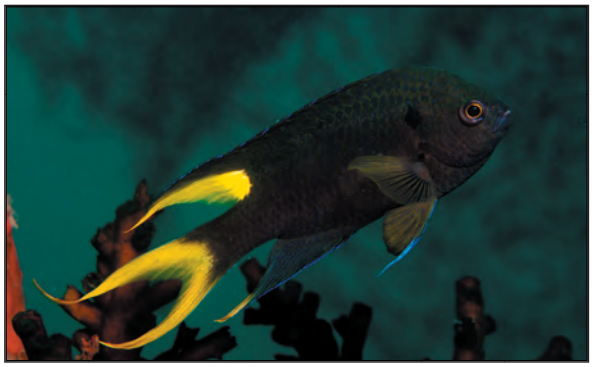
Dascyllus reticulatus – **Reticulate dascyllus**
POMACENTRIDAE – 9 cm (Max)

Dascyllus trimaculatus – **Threespot dascyllus**
POMACENTRIDAE – 11 cm (Max)

Dischistodus prosopotaenia – **Honey-head damsel**
POMACENTRIDAE – 17 cm (Max)

Dischistodus prosopotaenia – **Honey-head damsel**
POMACENTRIDAE – 17 cm (Max) - juvenile

Neoglyphidodon nigroris – **Black and gold chromis**
POMACENTRIDAE – 13 cm (Max)



Neopomacentrus azysron – **Yellowtail demoiselle**
POMACENTRIDAE – 8 cm (Max)

Neopomacentrus azysron – **Yellowtail demoiselle**
POMACENTRIDAE – 8cm (Max) – night colouration

Plectroglyphidodon lacrymatus – **Jewel damsel**
POMACENTRIDAE – 10 cm (Max)

Pomacentrus amboinensis – **Ambon damsel**
POMACENTRIDAE – 10 cm (Max)

Pomacentrus bankanensis – **Speckled damselfish**
POMACENTRIDAE – 9 cm (Max)

Pomacentrus colini – **Colin's damselfish**
POMACENTRIDAE – 9 cm (Max)

Pomacentrus grammorhynchus – **Bluespot damsel**
POMACENTRIDAE – 9 cm (Max)

Pomacentrus grammorhynchus – **Bluespot damsel**
POMACENTRIDAE – 9 cm (Max) - juvenile

Pomacentrus nagasakiensis – **Nagasaki damsel**
POMACENTRIDAE – 10 cm (Max)

Pomacentrus nigromanus – **Goldback damsel**
POMACENTRIDAE – 9 cm (Max)

Premnas biaculeatus – **Spinecheek anemonefish**
POMACENTRIDAE – 17 cm (Max)

Premnas biaculeatus – **Spinecheek anemonefish**
POMACENTRIDAE – 17 cm (Max)

Stegastes nigricans – **Dusky gregory**
POMACENTRIDAE – 14 cm (Max)

Wrasses

Wrasses are one of the more colourful and active groups of fish found on coral reefs. They have a distinguishing swimming style, primarily using their pectoral fins. Their bodies are also very elongate.

As they grow older the females will turn into males depending on their age, growth or whether there are other males present in their territory.

Anampses neoguinaicus – **New Guinea wrasse**
LABRIDAE – 20 cm (Max) – male

Anampses neoguinaicus – **New Guinea wrasse**
LABRIDAE – 20 cm (Max) – female

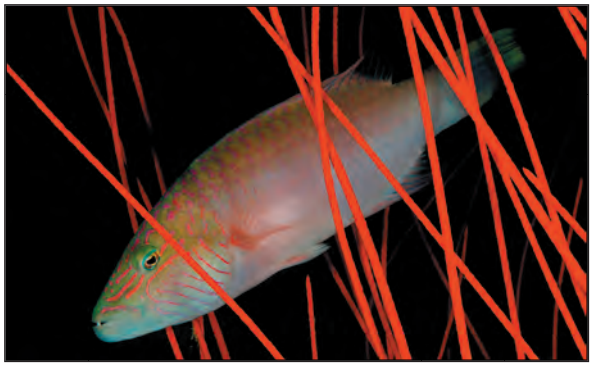
Bodianus anthioides – **Lyretail hogfish**
LABRIDAE – 21 cm (Max)

Bodianus bimaculatus – **Two spot slender hogfish**
LABRIDAE – 10 cm (Max)

Bodianus diana – **Diana's hogfish**
LABRIDAE – 25 cm (Max)

Cheilinus bimaculatus – **Two-spot wrasse**
LABRIDAE – 15 cm (Max)

Cheilinus bimaculatus – **Two-spot wrasse**
LABRIDAE – 15 cm (Max) – juvenile



Cheilinus diagrammus – **Cheeklined wrasse**
LABRIDAE – 40 cm (Max)

Cheilinus fasciatus – **Redbreast wrasse**
LABRIDAE – 40 cm (Max)

Cheilinus undulatus – **Napoleon wrasse**
LABRIDAE – 230 cm (Max)

Cirrhilabrus punctatus – **Dotted wrasse**
LABRIDAE – 13 cm (Max)

Coris gaimard – **Yellowtail coris**
LABRIDAE – 38 cm (Max)

Epibulus insidiator – **Slingjaw wrasse**
LABRIDAE – 54 cm (Max)

Gomphosus varius – **Bird wrasse**
LABRIDAE – 28 cm (Max)

Halichoeres biocellatus – **Red-lined wrasse**
LABRIDAE – 12 cm (Max)

Halichoeres biocellatus – **Red-lined wrasse**
LABRIDAE – 12 cm (Max)

Halichoeres hortulanus – **Checkerboard wrasse**
LABRIDAE – 27 cm (Max)

Halichoeres leucurus – **Greyhead wrasse**
LABRIDAE – 13 cm (Max)

Halichoeres trimaculatus – **Threespot wrasse**
LABRIDAE – 27 cm (Max)

Hemigymnus fasciatus – **Barred thicklip wrasse**
LABRIDAE – 50 cm (Max)

Hologymnosus annulatus – **Ring wrasse**
LABRIDAE – 40 cm (Max)

Labroides dimidiatus – **Blue streak cleaner wrasse**
LABRIDAE – 11.5 cm (Max)

Macropharyngodon meleagris – **Leopard wrasse**
LABRIDAE – 15 cm (Max)

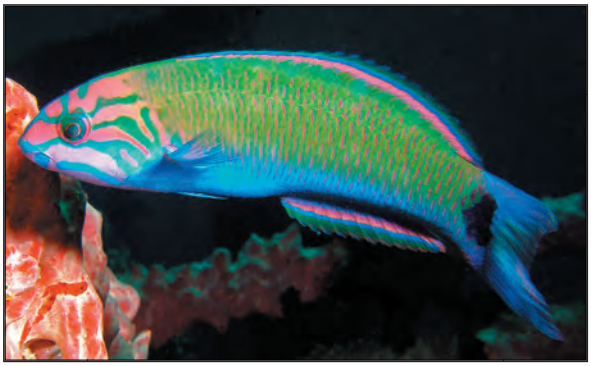
Novaculichthys taeniourus – **Rockmover wrasse**
LABRIDAE – 27 cm (Max)

Novaculichthys taeniourus – **Rockmover wrasse***
LABRIDAE – 27 cm (Max) – juvenile

Pseudodax moluccanus – **Chiseltooth wrasse**
LABRIDAE – 30 cm (Max)

Pteragogus enneacanthus – **Cockerel wrasse**
LABRIDAE – 12 cm (Max)

Thalassoma hardwicke – **Six bar wrasse**
LABRIDAE – 20 cm (Max)



Thalassoma lunare – **Moon wrasse**
LABRIDAE – 25 cm (Max)

Thalassoma lunare – **Moon wrasse**
LABRIDAE – 25cm (Max) – juvenile

Thalassoma lutescens – **Sunset wrasse**
LABRIDAE – 25 cm (Max)

Cetoscarus bicolor – **Bicolour parrotfish**
SCARIDAE – 90 cm (Max)

Chlorurus bleekeri – **Bleeker's parrotfish**
SCARIDAE – 49 cm (Max)

Chlorurus sordidus – **Bullet-head parrotfish**
SCARIDAE – 40 cm (Max)

Scarus niger – **Swarthy parrotfish**
SCARIDAE – 35 cm (Max)

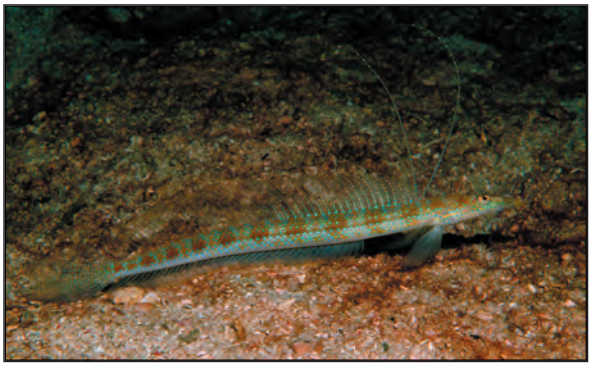
Scarus niger – **Swarthy parrotfish**
SCARIDAE – 35 cm (Max) – juvenile

Parapercis clathrata – **Latticed grubfish**
PINGUIPEDIDAE – 24 cm (Max)

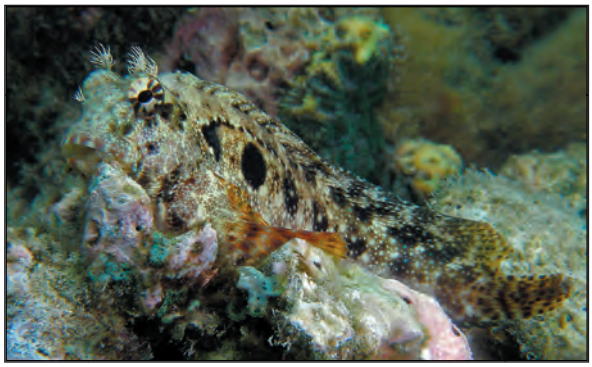
Parapercis linepunctata – **Nose stripe grubfish**
PINGUIPEDIDAE – 24 cm (Max)

Parapercis millepunctata – **Black dotted grubfish**
PINGUIPEDIDAE – 24 cm (Max)

Parapercis xanthozona – **Java grubfish**
PINGUIPEDIDAE – 23 cm (Max)



Trichonotus setiger – **Spotted sand diver**
TRICHONOTIDAE – 15 cm (Max)



Crossosalarias macrospilus – **Triple spot blenny**
BLENNIIDAE – 10 cm (Max)

Ecsenius namiyei – **Black comb-tooth blenny**
BLENNIIDAE – 11 cm (Max)

Ecsenius namiyei – **Black comb-tooth blenny**
BLENNIIDAE – 11 cm (Max)

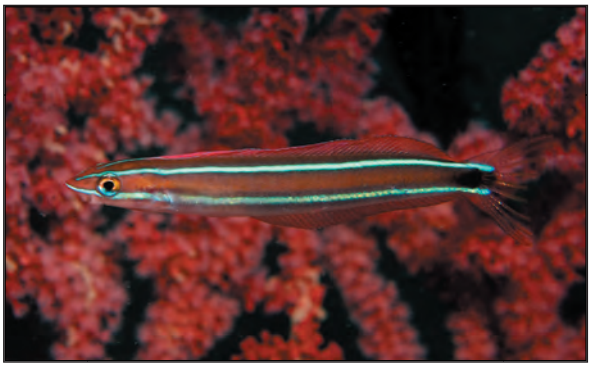
Ecsenius yaeyamaensis – **Yaeyama blenny**
BLENNIIDAE – 6 cm (Max)

Meiacanthus grammistes – **Striped fangblenny**
BLENNIIDAE – 11 cm (Max)

Meiacanthus vittatus – **One-striped fangblenny**
BLENNIIDAE – 8 cm (Max)

Plagiotremus laudanus – **Bicolor fangblenny**
BLENNIIDAE – 7.5 cm (Max)

Plagiotremus **cf.** *laudanus* – **Bicolor fangblenny**
BLENNIIDAE – 7.5 cm (Max)



Plagiotremus rhinorhynchus – **Blue-striped fangblenny**
BLENNIIDAE – 12 cm (Max)

Plagiotremus rhinorhynchus – **Blue-striped fangblenny**
BLENNIIDAE – 12 cm (Max)

Helcogramma striatum – **Striped triplefin**
TRYPTERYGIIDAE – 5 cm (Max)

Dactylopus dactylopus – **Fingered dragonet**
CALLIONYMIDAE – 30 cm (Max)

Synchiropus stellatus – **Starry dragonet**
CALLIONYMIDAE – 6 cm (Max)

Gobies

The gobies are the largest group of marine fish with over 1600 species occurring world wide. These fish are very small in size and are common on coral reefs and on sandy bottoms where they live in small burrows. Some species form a unique relationship with snapping shrimps (*Alpheus* species) as these near blind shrimp clean out the burrow whilst the goby stands guard and warns the shrimp of any approaching predators.

Amblyeleotris arcupinna – **Red banded shrimpgoby**
GOBIIDAE – 11 cm (Max)

Amblyeleotris guttata – **Spotted shrimpgoby**
GOBIIDAE – 9 cm (Max)

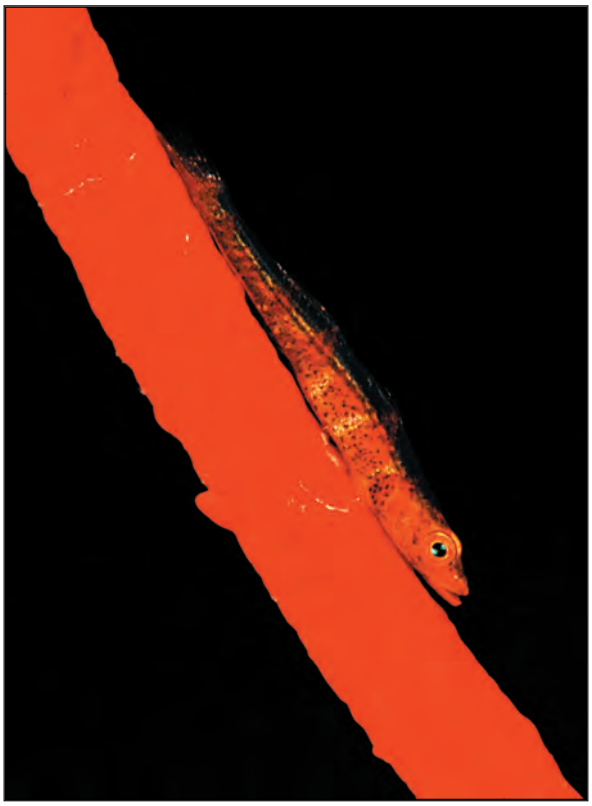
Amblyeleotris randalli – **Randall's shrimpgoby**
GOBIIDAE – 9 cm (Max)

Amblygobius decussatus – **Orange striped goby**
GOBIIDAE – 9.5 cm (Max)

Amblygobius phalaena – **Banded goby**
GOBIIDAE – 13.5 cm (Max)

Amblygobius rainfordi – **Old glory**
GOBIIDAE – 5.5 cm (Max)

Bryaninops loki – **Loki whip goby**
GOBIIDAE – 3 cm (Max)



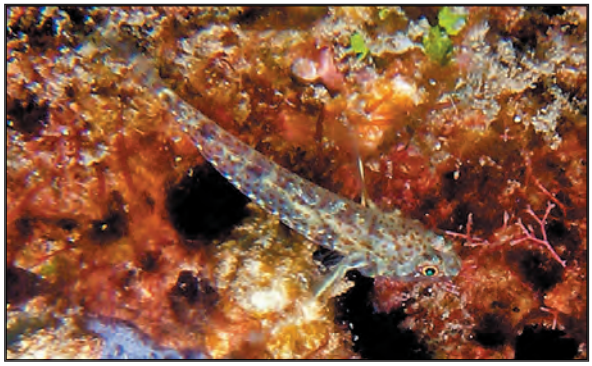
Bryaninops amplus – **Large whip goby**
GOBIIDAE – 4.6 cm (Max)

Coryphopterus inframaculatus – **Blotched goby**
GOBIIDAE – 7.5 cm (Max)

Eviota **sp. – Pygmy goby**
GOBIIDAE – 3 cm (Max)

Exyrias bellisimus – **Beautiful goby**
GOBIIDAE – 13 cm (Max)

Fusigobius **sp. – Goby**
GOBIIDAE – 3 cm (Max)



Fusigobius **sp. – Goby**
GOBIIDAE – 3 cm (Max)

Gobiodon okinawae – **Yellow coralgoby**
GOBIIDAE – 3.5 cm (Max)

Istigobius ornatus – **Ornate goby**
GOBIIDAE – 11 cm (Max)

Oplopomus oplopomus – **Spinecheek goby**
GOBIIDAE – 7.5 cm (Max)

Pleurosicya micheli – **Stony coral ghostgoby**
GOBIIDAE – 2.5 cm (Max)

Pleurosicya mossambica – **Common ghostgoby**
GOBIIDAE – 3.5 cm (Max)

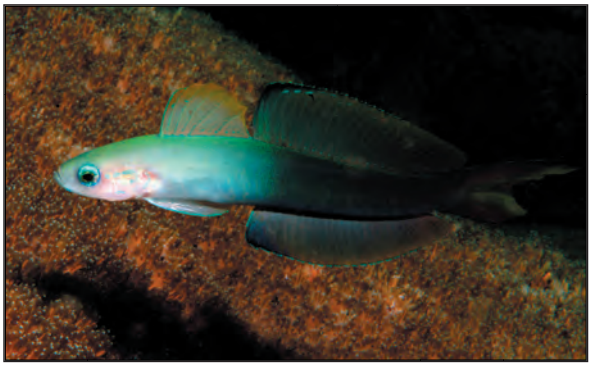
Signigobius biocellatus – **Signal goby**
GOBIIDAE – 6.5 cm (Max)

Trimma caesiura – **Dwarf goby**
GOBIIDAE – 2.5 cm (Max)

Valenciennea helsdingenii – **Two-stripe goby**
GOBIIDAE – 25 cm (Max)

Valenciennea puellaris – **Maiden goby**
GOBIIDAE – 20 cm (Max)

Valenciennea strigata – **Bluestreak goby**
GOBIIDAE – 15.5 cm (Max)



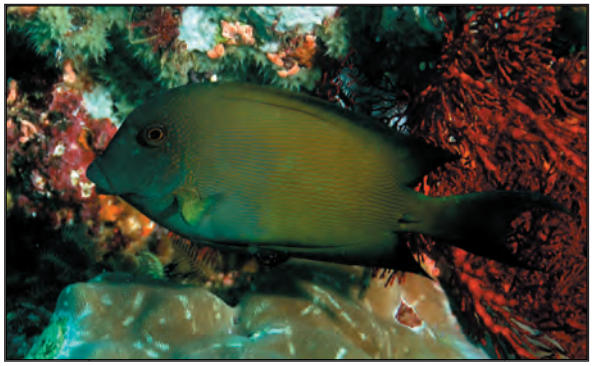
Ptereleotris evides – **Arrow goby**
PTERELEOTRIDAE – 13.5 cm (Max)

Nemateleotris decora – **Purple fire goby**
PTERELEOTRIDAE – 9 cm (Max)

Nemateleotris magnifica – **Fire goby**
PTERELEOTRIDAE – 9 cm (Max)

Acanthurus lineatus – **Striped surgeonfish**
ACANTHURIDAE – 38 cm (Max)

Acanthurus pyroferus – **Mimic surgeonfish**
ACANTHURIDAE – 25 cm (Max)



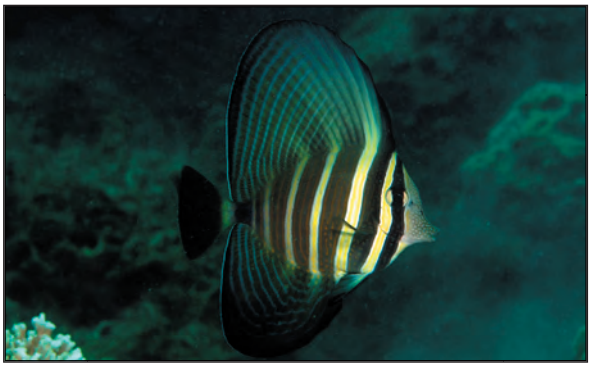
Ctenochaetus striatus – **Striated surgeonfish**
ACANTHURIDAE – 26 cm (Max)

Ctenochaetus striatus – **Striated surgeonfish**
ACANTHURIDAE – 26 cm (Max) – colour variant

Naso brevirostris – **Spotted unicornfish**
ACANTHURIDAE – 50 cm (Max)

Naso lituratus – **Orange-spine unicornfish**
ACANTHURIDAE – 46 cm (Max)

Zebrasoma scopas – **Twotone tang**
ACANTHURIDAE – 40 cm (Max)



Zebrasoma veliferum – **Sailfin tang**
ACANTHURIDAE – 40 cm (Max)

Siganus canaliculatus – **White-spotted rabbitfish**
SIGANIDAE – 29 cm (Max)

Siganus javus – **Java rabbitfish***
SIGANIDAE – 53 cm (Max)

Abalistes stellatus – **Starry triggerfish**
BALISTIDAE – 60 cm (Max)

Balistapus undulatus – **Orange-lined triggerfish**
BALISTIDAE – 30 cm (Max)

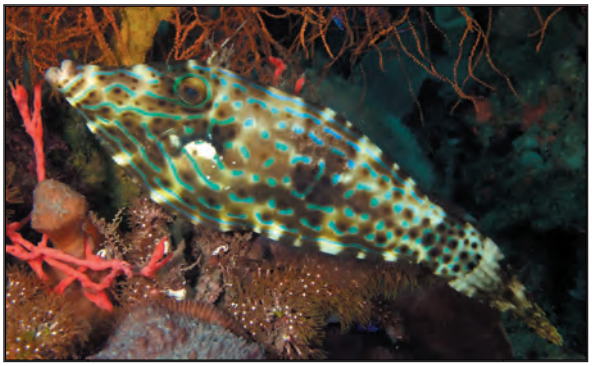
Balistoides conspicillum – **Clown triggerfish**
BALISTIDAE – 50 cm (Max)

Balistoides viridescens – **Titan triggerfish***
BALISTIDAE – 75 cm (Max)

Rhinecanthus aculeatus – **Blackbar triggerfish**
BALISTIDAE – 30 cm (Max)

Sufflamen bursa – **Boomerang triggerfish**
BALISTIDAE – 25 cm (Max)

Sufflamen chrysopterus – **Flagtail triggerfish**
BALISTIDAE – 22 cm (Max)



Aluterus scripta – **Scrawled filefish***
MONACANTHIDAE – 110 cm (Max)

Oxymonacanthus longirostris – **Harlequin filefish**
MONACANTHIDAE – 12 cm (Max)

Rudarius minutus – **Minute filefish**
MONACANTHIDAE – 3 cm (Max)

Pufferfishes

Pufferfishes have an unusual body shape which they are able to expand in size by sucking water into their stomach. This makes them look bigger and also makes it harder for predators to eat them. They are a very poisonous group of fish as they contain a deadly toxin (tetrodotoxin) that can be fatal if consumed. The small tobies are also a member of this group.

Arothron hispidus – **White spotted pufferfish**
TETRAODONTIDAE – 50 cm (Max)

Arothron manilensis – **Narrow-lined pufferfish**
TETRAODONTIDAE – 31 cm (Max)

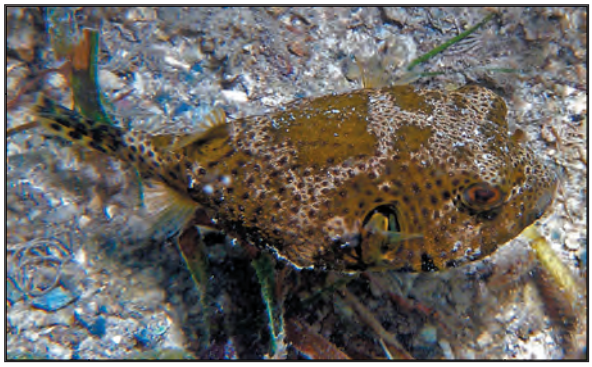
Arothron mappa – **Map pufferfish***
TETRAODONTIDAE – 65 cm (Max)

Arothron mappa – **Map pufferfish***
TETRAODONTIDAE – 65 cm (Max) - juvenile

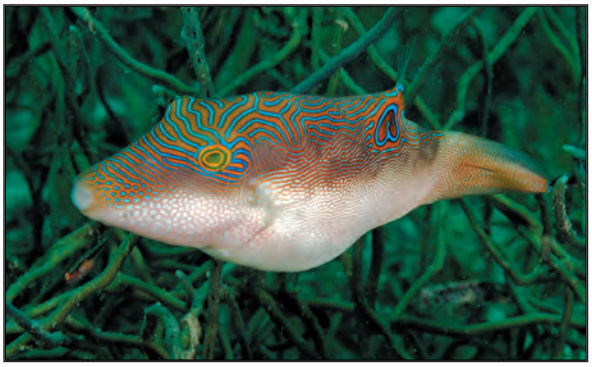
Arothron nigropunctatus – **Black-spotted pufferfish**
TETRAODONTIDAE – 75 cm (Max)

Arothron nigropunctatus – **Black-spotted pufferfish**
TETRAODONTIDAE – 75 cm (Max) - colour variant

Arothron stellatus – **Starry pufferfish***
TETRAODONTIDAE – 120 cm (Max)



Arothron stellatus – **Starry pufferfish**
TETRAODONTIDAE – 120 cm (Max) - juvenile



Canthigaster compressa – **Compressed toby**
TETRAODONTIDAE – 12 cm (Max)

Canthigaster janthinoptera – **Honeycomb toby**
TETRAODONTIDAE – 9 cm (Max)

Canthigaster papua – **Papuan toby**
TETRAODONTIDAE – 10 cm (Max)

Canthigaster valentini – **Valentini's sharpnose toby**
TETRAODONTIDAE – 11 cm (Max)

Lactoria cornuta – **Long-horned cowfish**
OSTRACIIDAE – 46 cm (Max)

Ostracion meleagris – **White spotted boxfish***
OSTRACIIDAE – 25 cm (Max)

Ostracion solorensis – **Reticulate boxfish**
OSTRACIIDAE – 12 cm (Max)

Reptiles

Marine dwelling reptiles (kingdom Animalia, phylum Chordata, class Reptilia) are vertebrates and breathe air through lungs.

Turtles

In the Western Pacific there are six types of turtle: loggerhead, green, hawksbill, olive ridley, flatback and leatherback. While the first five have a hard, bony carapace, the leatherback turtle has a leathery carapace. Turtles eat algae, seagrasses, sea cucumbers, soft corals, sea jellies, urchins and crabs. Loggerheads have strong jaws for feeding on shelled prey. Green turtles tend to be herbivorous. Turtles use their front flippers to propel themselves through the water, while the back flippers act like rudders. They are quite streamlined and speedy in water, though appear cumbersome on land. It is only the female turtle that visits land to nest and lay eggs.

Sea Snakes

Sea snakes have flat, paddle-like tails for swimming. They can normally stay underwater for up to two hours before needing air. Some come ashore quite often to digest their food, mainly fishes, or to lay their eggs. Others don't even venture on to land and can give birth to live young underwater. While venomous, they tend not to attack humans, and bear only small fangs. They are curious and may approach you for a closer look.

Caretta caretta – **Loggerhead turtle***
CHELONIDAE – 100 cm

Chelonia mydas – **Green turtle***
CHELONIDAE – 80 cm

Eretomochelys imbricatus – **Hawksbill turtle***
CHELONIDAE – 70 cm

Aipysurus laevis – **Olive sea snake**
HYDROPHIIDAE – 140 cm

Laticauda **sp. – Banded sea snake**
LATICAUDIDAE – 100 cm

Mammals

Sea mammals (kingdom Animalia, phylum Chordata, class Mammalia) include dugongs, dolphins and whales. They breathe air and give birth to live young, often involving a high level of parental care. Marine mammals have thick layers of blubber used to insulate their bodies and prevent heat loss.

Dolphins are the most common sea mammal group found in Bootless Bay. They are small cetaceans of up to 4 m long and weighing up to 650 kgs. They use their teeth to grip fishes, squids and other marine life, before swallowing them whole. Dolphins have good eyesight and hearing, but also use use echolocation to find prey and 'see'. Hunting can be solitary or in groups.

Dolphins have a gestation period of around 12 months and they are one of the groups of animals that are known to have sex for fun.

Delphinus delphis – **Common dolphin***
DELPHINIDAE – 2 m

Stenella longirostris – **Spinner dolphin***
DELPHINIDAE – 2 m

Tursiops truncatus – **Bottle-nosed dolphin***
DELPHINIDAE – 3 m

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Protecting Our Marine Biodiversity

The authors hope that you enjoyed this guide and found it to be an attractive and informative introduction to the marine life of Bootless Bay. We offer the following simple guidelines on how we can all try to protect the Bay's biodiversity and its beauty.

When diving or snorkelling, we should try our best to adopt a no-touch approach to the marine life around us, as our environment is very fragile.

We should avoid throwing rubbish such as plastic bags, cigarette butts and other items into the sea. It only takes a few moments to dispose of it properly, or store and dispose of it later.

When in charge of a boat, we should pay attention to our seamanship skills. All of the following will help: anchoring away from important habitats such as corals and seagrasses; using moorings when available; starting engines in deep enough water; and properly stowing engines when not in use.

When fishing, we should avoid using destructive methods such as small mesh sized nets, dynamite and cyanide. We should release the small fish and let them grow older to reproduce. The result will be more fish for the future.

Before cutting down the mangroves, we should consider what we actually need, and only take what is necessary. We can also plant mangrove seedlings to replace those we have taken.

MIRC and its marine biodiversity unit, MIMBU, are here to help. If you want to learn more about marine biodiversity or the small things we can all do to help protect it, please contact us on 325 4172, or write to MIMBU, c/o MIRC, PO Box 320, University 134, NCD.

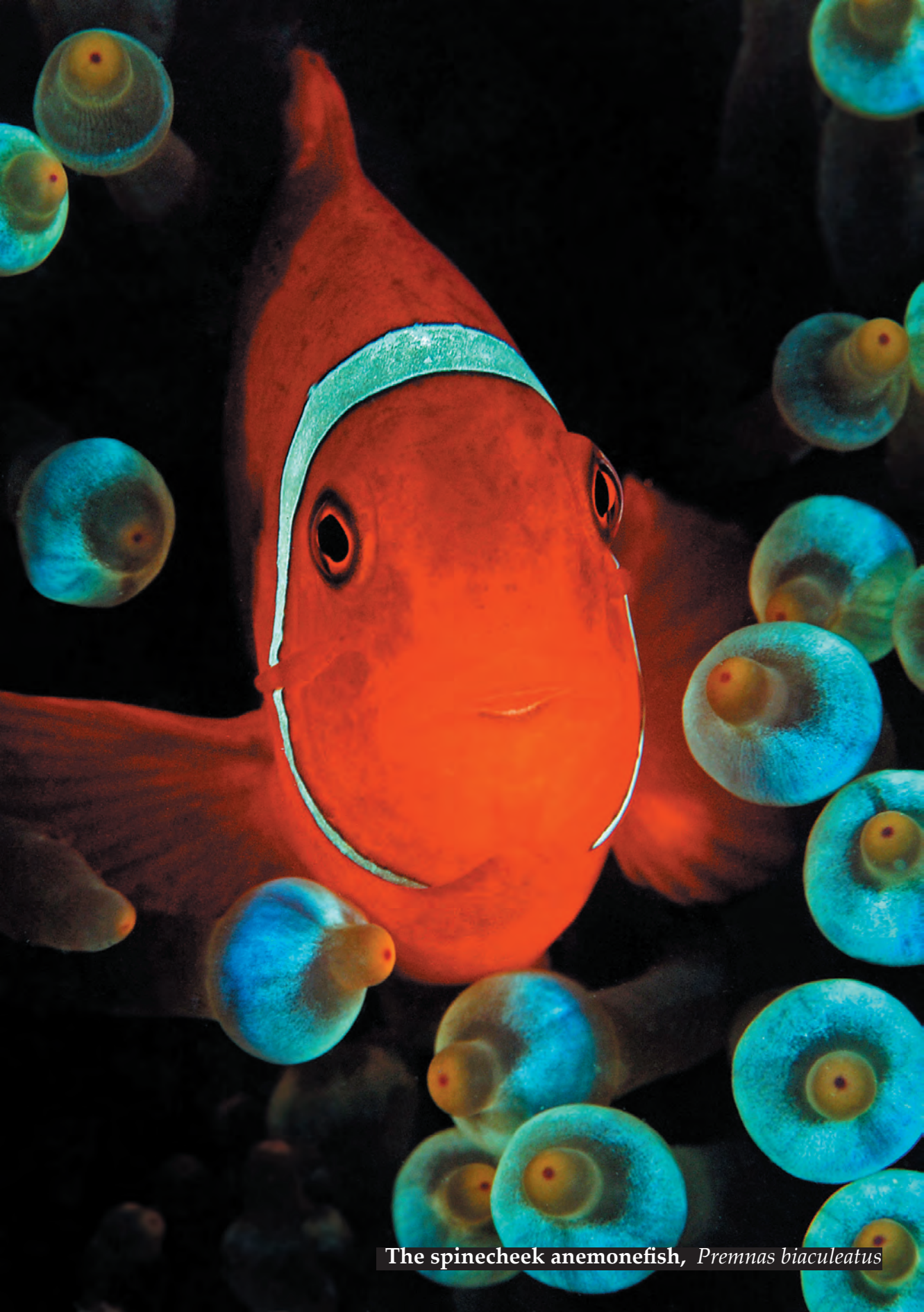
About The Authors

Mark Baine

Mark has over 16 years of experience in marine scientific research, marine resource management and tertiary education. He has managed projects in South America, the Caribbean, Europe and South-East Asia. In 2003, Mark joined the University of Papua New Guinea as Director of its Motupore Island Research Centre. Mark's obsession with underwater photography took root in 2006 and for this he lays the blame entirely at his co-author's feet.

Dave Harasti

Dave is an avid underwater photographer who has spent the past decade documenting and photographing the oceans' weird and wonderful creatures. When he is not diving he works on marine conservation issues and in his spare time he is conducting PhD research on the protection of his favourite marine animal, the seahorse. Bootless Bay is one of his regular diving destinations where he still continues his search for the elusive *Hippocampus harastii*! For more of Dave's imagery, visit www.daveharasti.com.



The spinecheek anemonefish, *Premnas biaculeatus*

This is an essential reference guide to the marine life of Bootless Bay, Central Province, Papua New Guinea. The guide is illustrated with over 900 photographs and includes brief narratives on the biology and ecology of all major taxonomic groups, from algae and sponges to fish and reptiles. It is primarily aimed at those who live by, study or visit this remarkable area, which is home to a wealth of beautiful and unusual organisms. Many of the featured organisms are also found throughout Papua New Guinea, the guide therefore having national appeal.

MOTUPORE ISLAND MARINE BIODIVERSITY UNIT