जहाँ है हरियाली ।
वहाँ है खुशहाली ॥

सत्यमेव जयते

ZOOLOGICAL SURVEY OF INDIA 1916

22 May 2012
INTERNATIONAL DAY FOR BIOLOGICAL DIVERSITY
Marine Biodiversity

MARINE BIODIVERSITY IN INDIA

Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj CR

Zoological Survey of India

सत्यमेव जयते

MARINE BIODIVERSITY IN INDIA

Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj CR

Zoological Survey of India

CITATION
Venkataraman K, Raghunathan C, Raghuraman R, Sreeraj CR; 2012. Marine Biodiversity : 1-164 (Published by the Director, Zool. Surv. India, Kolkata)

Published : May, 2012

ISBN 978-81-8171-307-0

Printing of Publication Supported by NBA

Published at the Publication Division by the Director, Zoological Survey of India, M-Block, New Alipore, Kolkata-700053
Printed at Calcutta Repro Graphics, Kolkata-700006.

Dr. Balakrishna Pisupati
Chairman

NATIONAL BIODIVERSITY AUTHORITY
भारत सरकार
Govt. of India

FOREWORD

The marine ecosystem is home to the richest and most diverse faunal and floral communities. India has a coastline of 8,118 km, with an exclusive economic zone (EEZ) of 2.02 million sq km and a continental shelf area of 468,000 sq km, spread across 10 coastal States and seven Union Territories, including the islands of Andaman and Nicobar and Lakshadweep. Indian coastal waters are extremely diverse attributing to the geomorphologic and climatic variations along the coast. The coastal and marine habitat includes near shore, gulf waters, creeks, tidal flats, mud flats, coastal dunes, mangroves, marshes, wetlands, seaweed and seagrass beds, deltaic plains, estuaries, lagoons and coral reefs. There are four major coral reef areas in India-along the coasts of the Andaman and Nicobar group of islands, the Lakshadweep group of islands, the Gulf of Mannar and the Gulf of Kachchh . The Andaman and Nicobar group is the richest in terms of diversity.

Mangrove ecosystems are found along both the east and west coasts of India, covering an estimated area of 4,120 sq km. Important mangrove areas are in the Sundarbans, Bhitarkanika, Krishna and Godavari delta of Andhra Pradesh, Andaman and Nicobar Islands, Gulf of Kachchh, and the Pichavaram-Vedaranyam area of Tamil Nadu coast. Seagrass beds are found along the coasts of Tamil Nadu, Lakshadweep islands, Andaman and Nicobar Islands, and the Sundarbans. Eight hundred and forty four species of seaweeds are found in shallow waters all along the Indian coast, particularly in Tamil Nadu, Gujarat, Goa, Maharashtra and Lakshadweep.

The biodiversity of marine habitats is under threat around the world oceans. Although , seas cover majority of our planet's surface, far less is known about the marine biodiversity than the terrestrial systems. Conservation of marine biodiversity has become an international issue since the extinction of the Steller's sea cow in 1868. Until we have complete information about the diversity of marine habitats and the impact of human activities etc. on them , the conservation of marine biodiversity remains a distant dream.

Considering the significance of marine biodiversity conservation, the Zoological Survey of India has brought out this book on "Marine Biodiversity in India" as an informal and non-technical prose depicting illustration of marine biotic communities in Indian seas, towards the understanding and benefit of the general public. This book brings together the representative of most of the faunal groups including few floral communities of marine realm. Real life pictures of underwater creatures taken by the authors, presented in this book, would definitely form a source of invaluable source of awareness.

More and more knowledge about the seas of India would evolve with time as new generations of people interact with the seas around . Humans are continuously and rapidly reducing the number of marine species resulting in depletion of their habitats and communities, leading to the destruction of the marine ecosystem.

In this milieu , I appreciate Drs K Venkataraman, Director and C. Raghunathan, Scientist C, Zoological Survey of India, in bringing out this valuable source of information on Marine Biodiversity to public domain. I sincerely hope that this effort succeeds in creating an awareness to conserve the marine ecosystem for the future generation of India.

April 30, 2012

(Balakrishna Pisupati)
Chairman,
National Biodiversity Authority

5th Floor, TICEL Biopark, CSIR Road, Taramani, Chennai - 600 113. Tamilnadu, India.
✆ +91 44 22541805; 🖷 +91 44 22541073 ✉ chairman@nbaindia.in Web: www.nbaindia.org

Dr. K. VENKATARAMAN
Director

सत्यमेव जयते
Government of India
Ministry of Environment and Forests
ZOOLOGICAL SURVEY OF INDIA
M-Block, New Alipore, Kolkata – 700 053

PREFACE

Homo sapiens have a very biased view of planet Earth; its proper name should be *Oceanus* or *Water* (J.Hope and M. Zacharias, 2011). The oceans are the dominant feature of our planet covering nearly 71 per cent of its surface. The oceans are responsible for the regulatory control of conditions on land; the oceans modulate and moderate the terrestrial climate. It is no exaggeration that life in the oceans are self sustainable and not dependent on land of our dear planet. The oceanic realm is an inexhaustible cornucopia for the humankind. Oceans provide great wealth and diversity of food, medicines and raw materials. Oceanic resources like fish, seaweed and other organisms serve as an important means of livelihood to millions of people.

Marine ecosystem encompasses coastal areas, sea and thousands of diverse living organisms, which are interdependent. In the three dimensional classification of water and seabed, the water mass is technically called the pelagic zone consisting of the neritic and the oceanic provinces. The marine environment, as a whole, comprises of living and non-living resources, which are presently being exploited by maritime nations. Out of the total 32 animal phyla, 15 are represented by the taxa covering 12856 species in marine ecosystem of India. They may constitute either migratory or resident species. The migratory organisms include pelagic crustaceans, coelenterates, cephalopods, fishes, reptiles, birds and mammals. The benthic macro fauna comprises resident species of polychaetes, bivalves, gastropods, sipunculates and mud burrowing fishes. Free swimmers or nekton are important components of marine biodiversity. Out of the total 22,000 described finfish species, about 4000 species occur in the Indian Ocean, of which 1800 species are reported in Indian seas.

There are potentially many ways to collate and discuss threats to marine biodiversity, but threats can be broadly categorized as a result of over harvesting, pollution, habitat loss, introduced species and global climate change. Many marine areas have a range of biota rivaling or exceeding that of tropical forests. However, the diversity of life in our oceans is now being drastically altered by increasing irreversible anthropogenic activities. Humanity's response to our deteriorating marine environment has been predictably slow, reactive and piecemeal. Delays in responding to this environmental crisis are exacerbated due to the fact that most marine environments area still viewed as a global common resource, where there is little incentive to any one nation to address these issues, and those problems must be solved at an international level.

Amidst the burgeoning threats, it is mandatory to understand our own marine bio-resources at layman level. Hence it is aimed at bringing out this book on Marine Biodiversity with the pictures of undersea life for the benefit of commons. I hope this book will be useful for students and general public to understand our marine wealth.

May, 2012

(K. Venkataraman)

CONTENTS

CONTENTS

Introduction

From bacteria to baleen whales, our planet is home to tens of millions of different life forms at least; biologists can only guess at the true number of species. Everywhere you look in the ocean there are living things. How many and what kind of organisms there are depend on where you go— that is, on the specific nature of the habitat. Every habitat has distinct characteristics that determine which organisms live there and which do not. The amount of light, for example, determines whether algae and plants can grow. The type of bottom, the temperature and salinity of the water, waves, tides, currents, and many other aspects of the environment profoundly affect marine life.

There are so many different living things in the sea that it almost boggles the mind. From microscopic bacteria to gigantic whales, marine organisms come in all shapes, sizes, and colors. The ways in which they live are just as varied. Making sense of all this diversity might seem a hopeless task. Fortunately, there is a unifying concept that helps make the bewildering diversity of life comprehensible. This concept is the theory of evolution. Remember that scientists do not use the term "theory" lightly. Evolution, the gradual alteration of a species' genetic makeup, is supported by a vast body of evidence. It is as well established as the theory of gravity. The way in which evolution occurs, on the other hand, never ceases to fascinate biologists. In most simple form marine biodiversity is 'Life on Earth', including plants, animals and microorganisms, the genes that they contain and the ecosystems that they form.

Accelerated loss of coastal and marine biodiversity components over the last few decades has been of great concern. Environmental changes, over exploitation and habitat loss are among the major causes of species loss that, according to certain estimates, is of the order of a species a day. Equally important as knowledge of what lives in the seas, is a prediction of what would live there in the future. This is especially true of regions where rapid loss of habitats and decline in water quality could be drastically altering the species diversity.

Marine biologists are often frustrated by how hard it is to actually see what is going on in the ocean. They can collect samples with nets and dredges, make measurements with automated instruments, and do experiments in the laboratory, and in these ways have learned a great deal about marine life.

We humans are visual creatures, though, and no amount of sampling, measurement, or experimentation can completely substitute for actually watching organisms in their natural habitats. One solution is to enter the ocean and observe with our own eyes. Scuba and research submersibles have tremendously aided the study of the ocean, allowing us not only to see the organisms we study, but also to conduct experiments in the natural environment. These methods have their limitations, though. Scuba divers can penetrate only the shallowest parts of the ocean, and then only for short periods on the order of a few hours. Even though SCUBA diving has dramatically expanded the possibilities for the study of the sub tidal environment by marine biologists. The present booklet elucidate the few examples of marine biodiversity of India attempted by the researchers of Zoological Survey of India.

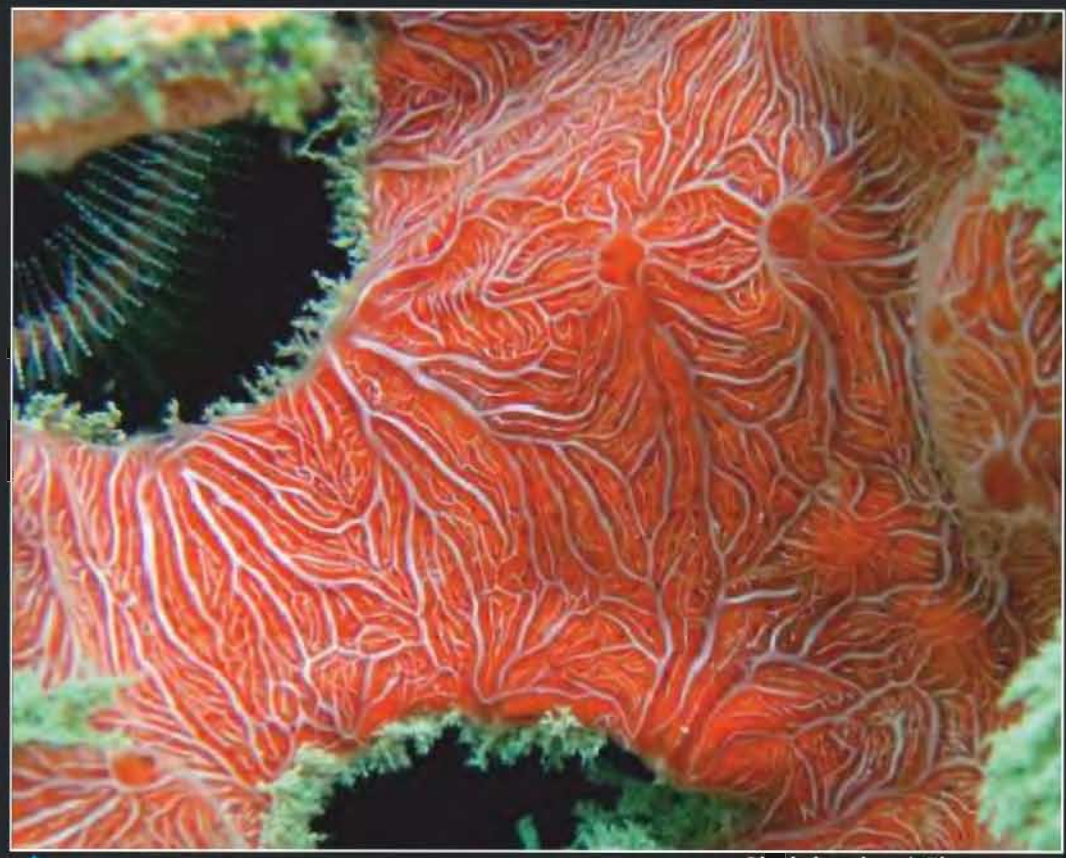
Zooplankton

Plankton (Singular plankter) literally mean animals which cannot swim against water currents. They keep drifting in the aquatic environment in the direction of the wind or water current. Zooplankton are the heterotropic component of the plankton community, which range from microscopic to few feet in size. Even though there are many permanent members, much of its composition is made by the juveniles of some animal groups. They form an important link in the aquatic food chain as 'secondary producers' accumulating the carbon for transferring to the other level of food chain, the consumers. Interestingly many large animals like some whales are exclusively dependent on this group of animals for their sustenance.

Microsettela norvegica

Acartia sp.

Sponges



Clathria mima | Fire sponge

One of the common encrusting sponges seen throughout the Indo-Pacific region. The species is easily recognized by the white veined pattern branching from the oscula (opening).

Phylum : Porifera

The animal consists of jelly-like matrix sandwiched between two thin layers of cells. Sponges do not have nervous, digestive or circulatory systems. All are sessile aquatic animals. More commonly, the mesohyl is stiffened by mineral spicules, by spongin fibers or both. Demosponges use spongin, and in many species, silica spicules and in some species, calcium carbonate exoskeletons.

Seen in wave-exposed or shaded, vertical and overhanging locations, the species is sheet-like, although a bushy form occurs in protected or deeper environments.

Monanchora arbuscula | Red encrusting sponge

There is one large osculum (opening) and many smaller ostia (pores). The ring of branched papillations around the orifice gives the appearance of octopus suckers.

Crella cyathophora | Honey comb sponge

Haliclona fascigera | Pink tube sponge

Chalinula nematifera | Coral encrusting sponge

This is almost exclusively finding on corals, and is great competitor for the corals. This species kills the coral colony in due course of time.

Colonies of this species form yellow puffy balls with large craters on the surface.

Paratetilla bacca | Golf ball sponge

Acanthella klethra | Orange ball sponge

Stylissa massa | Mango sponge

A tough leathery sponge, it grows in a plate like, laminar shape or crescent shaped form.

Carteriospongia foliascens | Fan sponge

The exterior surface is smooth and fleshy resulting from the lack of large spicules.

Plakortis simplex | Chicken liver sponge

Colonies are solitary black ball with a large central cavity. Outer surface often heavily encrusted with epizoic organisms.

Ircinia strobilina | Black ball sponge

This is one of the largest and easily recognized sponges. Attains the height of more than a meter.

Xestospongia testudinaria | Barrel sponge

The polyps are trumpet shaped or funnel shaped each with one whorl of narrow tentacles. The aeolid nudibranch Flabellina rubrolineata feeds on this hydroid.

Eudendrium sp. | Funnel hydroid

Phylum : Cnidaria

Class : Hydrozoa

Hydroids are mostly benthic feather like colonies, in which the polypoid generation predominates. Many species have a jelly fish like sexual stage known as hydromedusa.

Hydroids

Macrorhynchia philippina | Fire or stinging hydroid

Hydrocorals

Phylum : Cnidaria

Hydrocorals are common constituents of coral reefs. The fire corals are often associated with reef flats while the lace corals are mostly restricted to caves and vertical walls.

Frequently encountered in caves and shaded vertical surfaces.

Distichopora sp. | Lace coral

A copiously branched stylasterid with slender ultimate branches. Commonly encountered in shaded locations.

Stylaster sp. | Lace coral

Due to toxins injected by the stinging cells, this species is capable of inflicting very irritating stings to scantily dressed divers.

Millepora sp. | Branching fire coral

Soft corals

Sarcophyton sp. | Mushroom leather coral

Phylum : Cnidaria

Class : Anthozoa

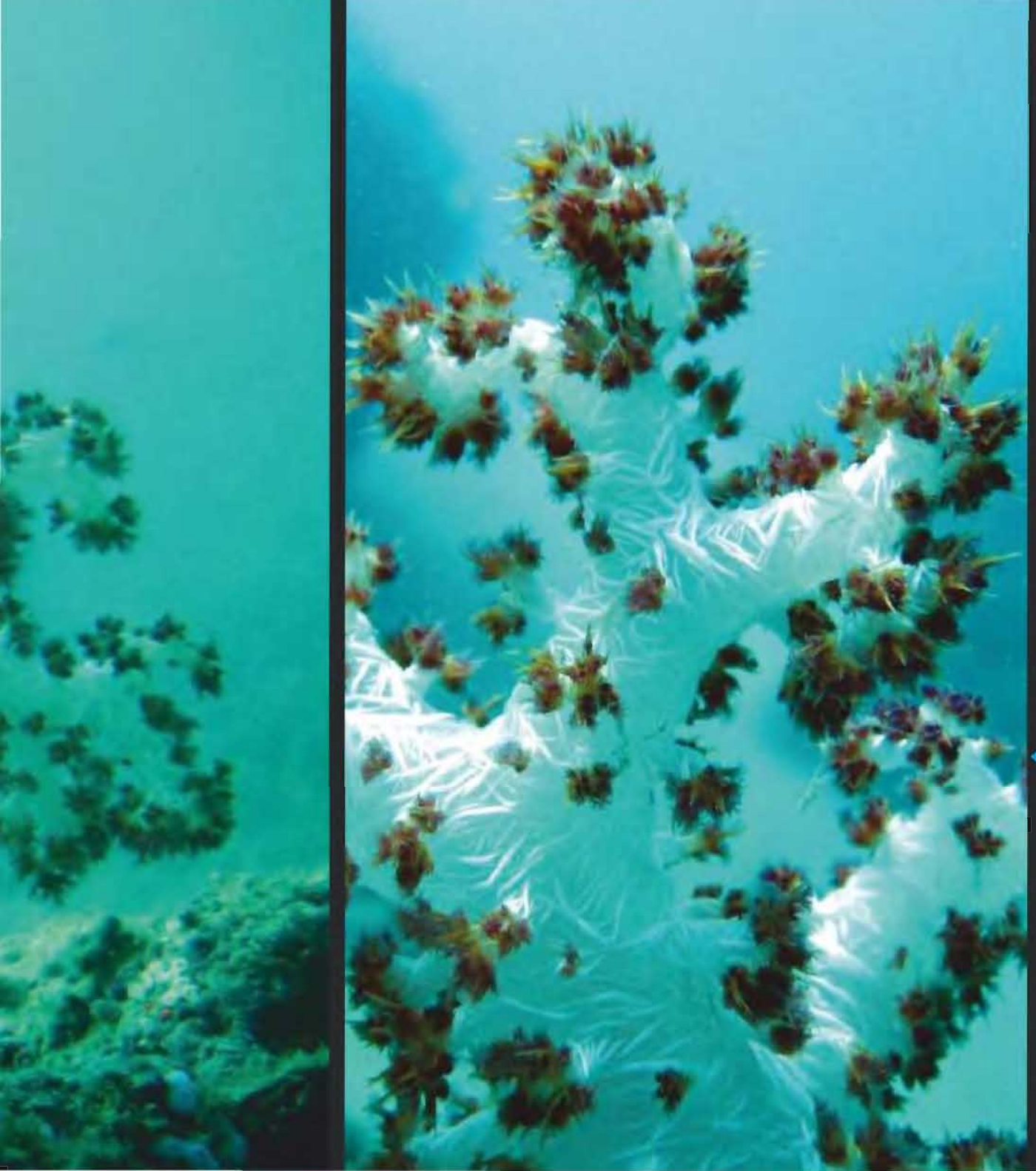
Subclass : Octocorallia

Order : Alcyonacea

The soft corals are an order of cnidarians which do not produce calcium carbonate skeletons and so are neither reef-building corals nor do they lay new foundations for future corals. Instead they contain minute, spiny skeletal elements called sclerites. Aside from their scientific utility in species identification, sclerites give these corals some degree of support and give their flesh a spiky, grainy texture that deters predators.

The polyp bearing capitulum arising from a smooth basal stalk. When the larger polyps are retracted, the colony takes on a very smooth leathery appearance.

Dendronephthya sp. | Divaricate tree coral



In this species each polyp is incapable of totally withdrawing into the branches of the coral. The colonies have a prickly appearance due to sharp supporting bundles of sclerites on each polyp.

The upper surface is mostly lobed, the lobes being rounded or finger type. The polyps can retract completely into the body of the coral. Very common in the reef areas.

Lobophytum sp. | Lobed leather coral

The upper surface is bumpy or has many round fingers like lobes.

Cladiella australis | Knobby leather coral

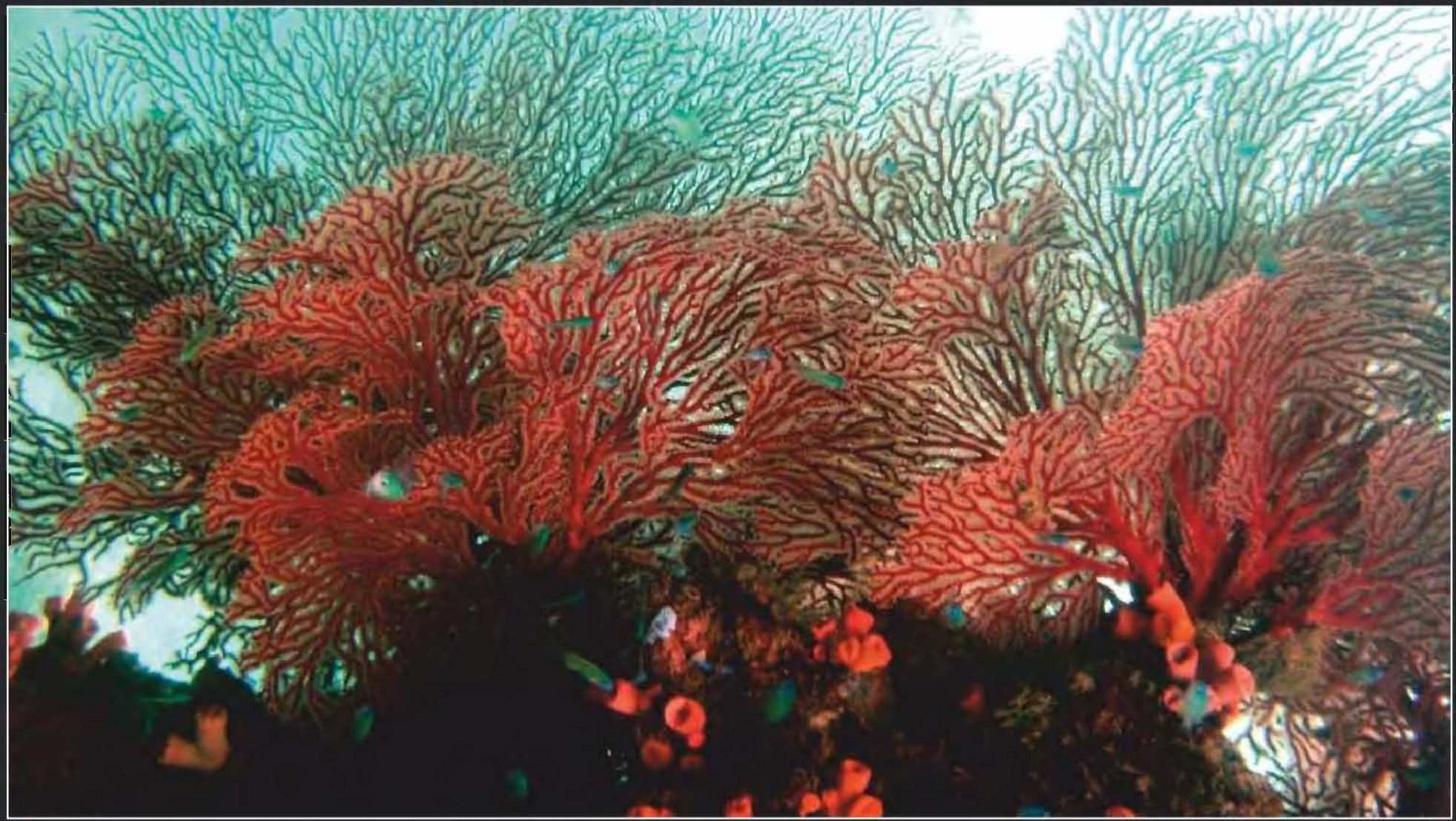
Verrucella sp.

Order: Gorgonacea

A sea fan, also know as gorgonian, is an order of sessile colonial cnidarian found throughout the oceans of the world, especially tropics and subtropics. Gorgonians are similar to the sea pen, another soft coral. Individual tiny polyps form colonies that are normally erect, flattened, branching, and reminiscent of a fan. They may be brightly coloured, often purple, red or yellow.

Sea fans

Mopsilla sp.



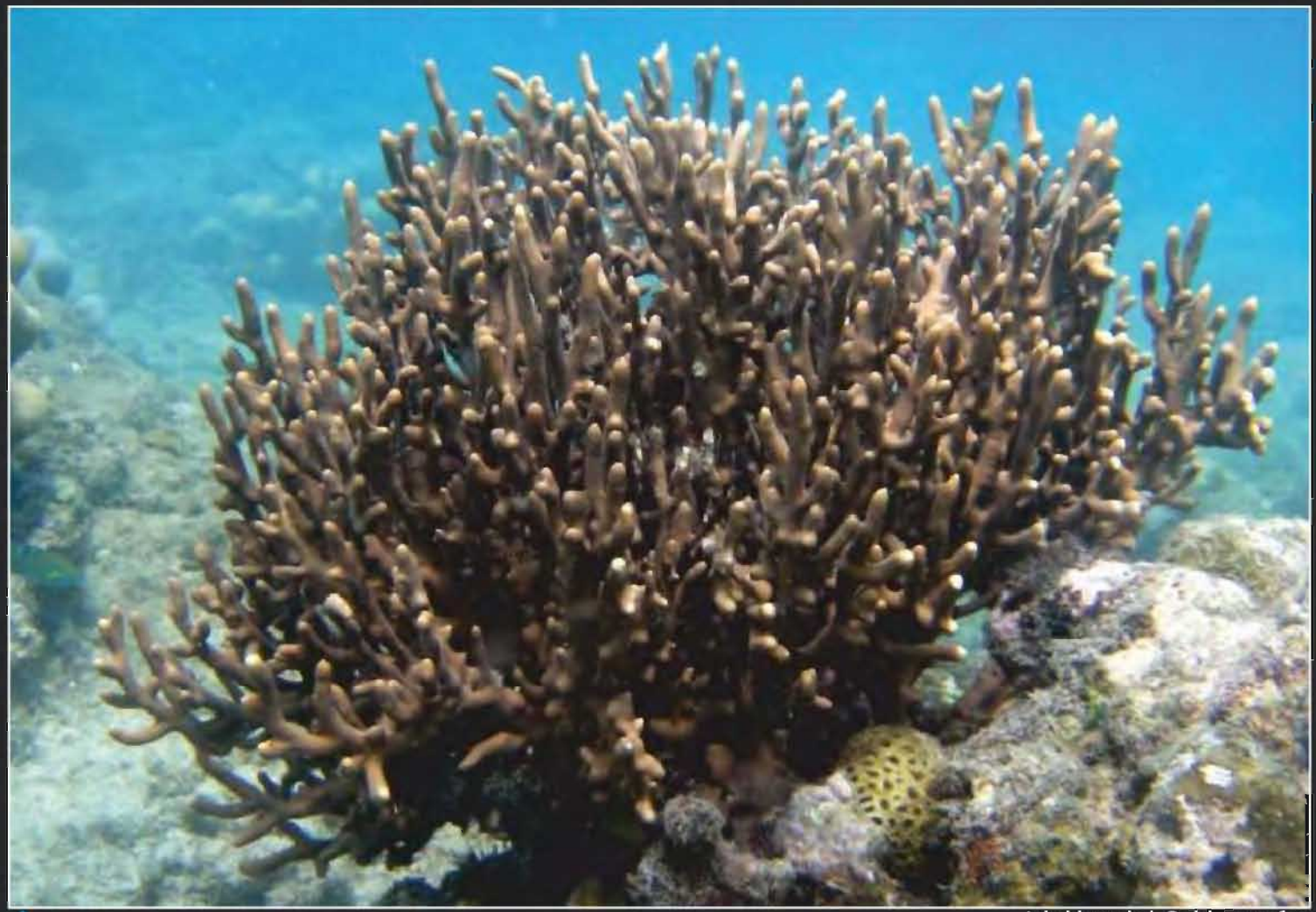
Melithaea ochracea | Neon coral sea fan

Large colorful and picturesque sea fan up to one meter or more in height. This is perhaps the most well know species of sea fan.

Nicella flabellata

Echinogorgia flora

Verucella sp.



Isis hippuris | Golden sea fan

This is a species of sea fan found in the Indo-West Pacific region. It produces hippuristanol, a molecule with apparent anti-cancer functions.

Sea pens

Cavernularia pusilla | Flower sea pen

Order : Pennatulacea

Sea pens are highly specialized octocorals that are well adapted for life in soft sediments such as sand or mud. Many sea pens are nocturnal.

Veretillum sp.

Virgularia gustaviana

Virgularia sp.

They have earned the name because many species, but certainly not all, look like an antique quill pen.

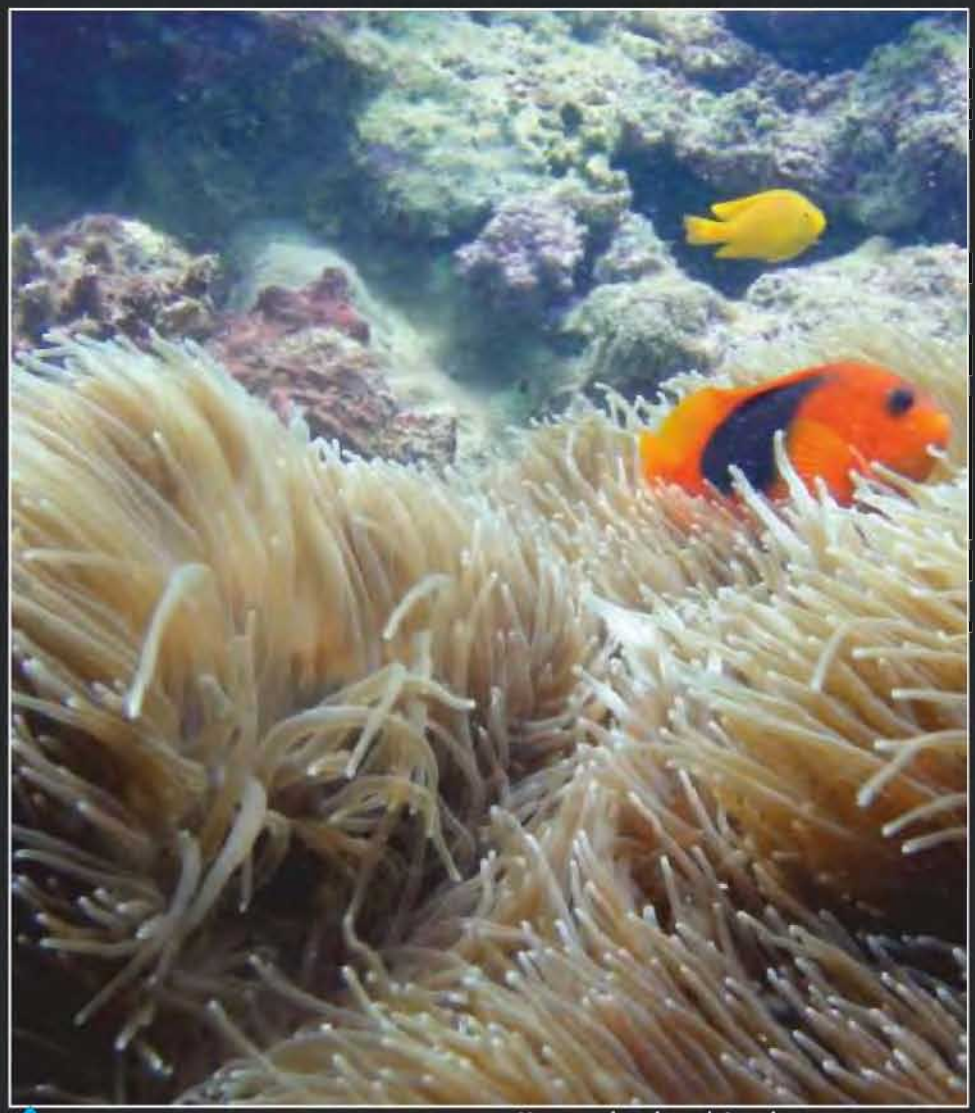
Sea anemones

Subclass: Hexacorallia

Order: Actiniaria

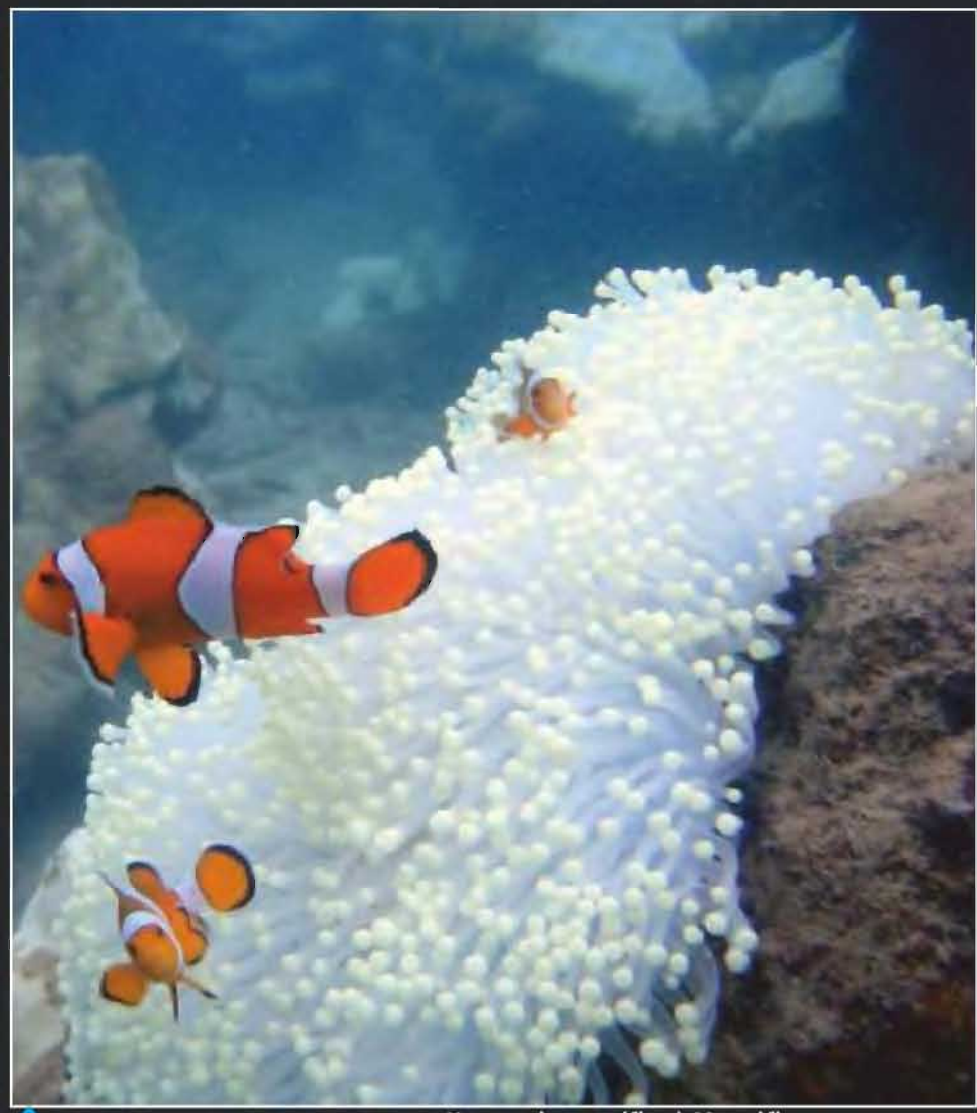
Sea anemones are a group of water-dwelling, predatory animals of the order Actiniaria; they are named after the anemone, a terrestrial flower. Sea anemones and hard corals are anatomically similar, differing mainly in the presence of a calcium carbonate skeleton in the latter. Majority of them in the reef have symbiotic associations with anemonefishes.

Entacmaea quadricolor | Bulb tentacle sea anemone



Heteractis crispa | Leathery sea anemone

Large anemones sometimes over 1.5 meters in diameter.



Heteractis magnifica | Magnificent sea anemone

A beautifully colored anemone. Perhaps the most commonly photographed of all reef anemones. It prefers exposed locations with sufficient current and surge.

Actinostephanus sp.

Triactis sp.

Cryptodendrum adhaesivum | Adhesive sea anemone

These are usually differently colored with blue, yellow, pink, green or brown.

Boloceroides sp.

Heteractis sp.

The tentacles have ring like swellings at intervals along the length giving them a bead like appearance.

Heteractis aurora | Beaded sea anemone

Individual anemones are attached to the shells of hermit crabs. They are symbiotic with hermit crabs of the genera Dardanus and Eupagurus.

Calliactis miriam | Hermit crab anemone

Tube anemones

Class: Anthozoa
Subclass: Ceriantipatharia
Order: Ceriantharia

Tube-dwelling anemones or cerianthids look very similar to sea anemones, but belong to an entirely different subclass of anthozoans. They are solitary, living buried in soft sediments. Tube anemones live and can withdraw into tubes, which are made of a fibrous material.

Palythoa sp.

Subclass: Hexacorallia

Order: Zoantharia

Small anemone like animals. Most are colonial, being connected by a basal stolon or a common membranous mat.

Zooanthids

Protopalythoa sp.

Corallimorpharians

Amplexidiscus fenestrafer | Giant mushroom anemone

Subclass: Zoantharia

Order: Corallimorpharia

Corallimorpharians are cnidarians closely related to the true sea anemones. They are mostly tropical, with a narrow column topped with a wide oral disc. The tentacles are usually short or very short, arranged in rows radiating from the mouth. Many species occur together in large groups.

Fully expanded animals form plate like discs. Contracted individuals are rounded and bowl like.

This corallimorpharian has numerous large mammiform to cylindrical tubercles on the face of the disc. Infrequently encountered in cracks or depressions.

Discosoma sp. | Disc anemone

Hard corals

Phylum: Cnidaria

Class: Anthozoa

There is something special about coral reefs. The warm, clear water, spectacular colors, and multitude of living things captivate almost everyone who sees a reef. Coral reefs rival that other great tropical community, the rain forest, in their beauty, richness, and complexity. Tropical rain forests and coral reefs are also similar in that the basic physical structure of both communities is produced by organisms. Both reef-building corals and the giant trees of a rain forest create a three-dimensional framework that is home to an incredible assortment of organisms.

Coral reefs are made of vast amounts of calcium carbonate ($CaCO_3$), limestone that is deposited by living things. Of the thousands of species in coral reef communities, only a fraction produces the limestone that builds the reef. The most important of these reef building organisms, are corals.

Although corals can catch small fish and animals, such as plankton, using stinging cells on their tentacles, most corals obtain the majority of their energy and nutrients from photosynthetic unicellular algae called zooxanthellae. Such corals require sunlight and grow in clear, shallow water, typically at depths shallower than 60 meters.

Brush coral | Acropora hyacinthus

Briar coral | Anacropora reticulata

Thorn coral | Stylocoeniella armata

Thorn coral | Stylocoeniella guentheri

Birds Nest Coral | Seraitopora hystrix

Cauliflower coral | Stylophora pistillata

Pearl Bubble coral | Physogyra lichtensteini

Torch coral | Euphyllia glaberescence

Fluorescence grass coral | Galaxea fascicularis

Galaxy coral | Galaxea astreata

Porcelain coral | Leptoseris explanata

Stony pillar coral | Psammacora digitata

Lettuce coral | Pavona cactus

Elephant skin coral | Pachyseris ruguosa

Mushroom coral | Fungia scutaria

Stone-leaf coral | Lithophyllon undulatum

Spiny Cup Coral | Pectinia pectinata

Elephant nose coral | Mycedium elephantotus

Ruffled coral | Merulina ampliata

Velvet horn coral | Hydnophora microconos

Tree coral | Dendrophyllia robusta

Pagoda coral | Turbinaria mesenterina

Sinuous cup coral | Symphyllia radians

Brain coral | Lobophyllia hemprichii

Knob coral | Favia lacuna

Honey comb coral | Favites abidita

Massive stony coral | Porites arnaudi

Flower pot coral | Goniopora tenuidens

Black Corals

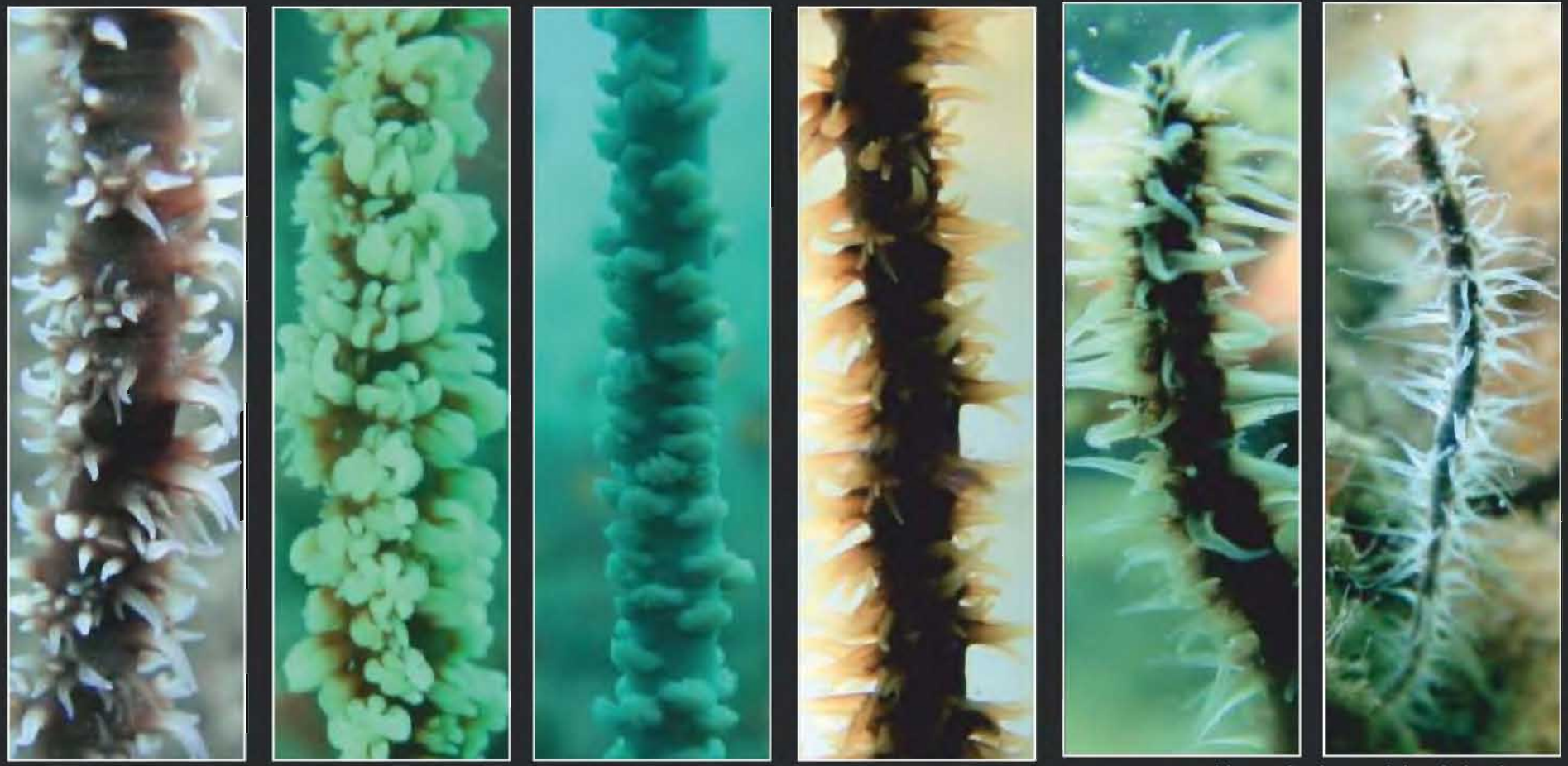
Class: Anthozoa
Subclass: Ceriantipatharia
Order: Antipatharia

They normally occur in the tropics. Though black coral's living tissue is brilliantly colored, it takes its name from the distinctive black or dark brown color of its skeleton. Also unique to black coral are the tiny spines that cover the surface of the skeleton, the origin of the nickname little thorn coral. Black coral is listed in Appendix II of the Convention on International Trade in Endangered Species (CITES).

Feather black coral | Plumapathes pennacea

Can be sparely or densely branched with pinnulated colonies and is less than half a meter in height.

These black corals are long, slender and whip like. Frequently encountered in deeper reefs.



Whip coral/Wire coral | Cirripathes sp.

Whip coral | Cirripathes anguina

Mainly encountered in the deeper areas of reef flats.

Wire coral | Stichopathes sp.

Unbranched and sinuous colonies. Frequently encountered on reef margins.

Aurelia sp.

Jelly fishes

Phylum : Cnidaria

Subphylum : Medusozoa

Jellyfish are found in every ocean, from the surface to the deep sea. Some hydrozoan jellyfish, or hydromedusae, are also found in fresh water; freshwater species are less than an inch in diameter, are colorless and do not sting. Large, often colorful, jellyfish are common in coastal zones worldwide.

The tentacles are capable of inflicting an intense sting, which can last for many hours.

Upside down jelly fish Cassiopeia Andromeda

It lies upside down in shallow waters usually in sandy areas, absorbing sunlight for photosynthesis by the symbiotic algae in its tissues.

Moon jelly fish Aurelia aurita

Aurelia aurita is one of a group of more than ten morphologically nearly identical jellyfish species in the genus Aurelia. In general, it is nearly impossible to identify Aurelia medusae without genetic sampling.

Siphonophores

Portuguese Man of War | Physalia physalis

Class: Hydrozoa

Order: Siphonophora

They are colonial, but the colonies can superficially resemble jellyfish; although they appear to be a single organism, each specimen is actually a colony of Siphonophora. The best known species is the dangerous Portuguese Man of War.

Despite its outward appearance, the Man o' War is not a true jellyfish but a siphonophore, which differ from jellyfish in that they are not actually a single creature, but a colonial organism made up of many minute individuals called zooids. The Portuguese Man of War is responsible for up to 10,000 human stings in Australia each summer, particularly on the east coast. Stings usually cause severe pain to humans, leaving whip-like, red welts on the skin that normally last 2 or 3 days after the initial sting, though the pain should subside after about an hour.

Comb jellies

Benthic comb jelly | Ceoplana meteoris

The threads like tentacles are long and feather like. Usually found on soft sediment.

Phylum : Ctenophora

Their most distinctive feature is the "combs", groups of cilia that they use for swimming, and they are the largest animals that swim by means of cilia. Ctenophores may be abundant during the summer months in some coastal locations, but in other places they are uncommon and difficult to find. In bays where they occur in very high numbers, predation by ctenophores may control the populations of small zooplanktons such as copepods, which might otherwise wipe out the phytoplankton.

Ceoplana sp.

Flat worms

Phylum: Platyhelminthes
Class: Turbellaria
Order: Polycladida

Polyclad flatworms include some of the most flamboyant colorful animals of the sea. As thin as a leaf and usually oval in shape, these animals may first catch your attention by their spectacular color patterns.

Cycloporus venetus

Often found feeding on colonial ascidians from the reef slope.

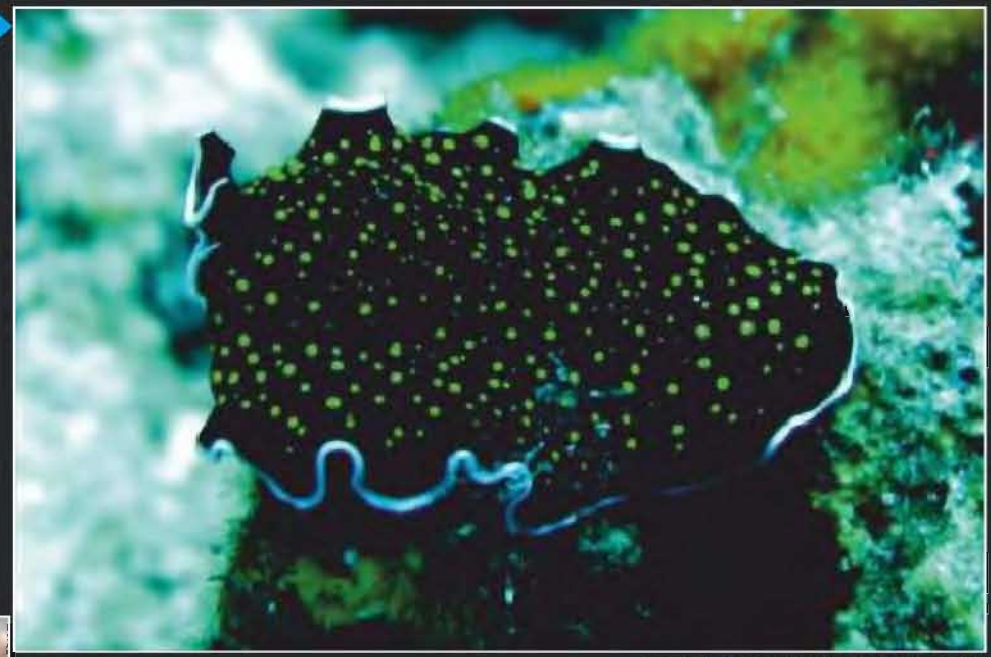
Commonly encountered species, but as yet unnamed and undescribed.

Acanthozoon sp.

Found out and about on reef crest and reef slope, sometimes swimming in the water column.

Pseudobiceros bedfordi

Velvety black colored species. Commonly found feeding on tunicates.



Thysanozoon nigropapillosum

Pseudobiceros stellae

Found under rubble on the reef crest; animal active at night.

Found on the reef crest and intertidal areas under rocks and rubble.

Pseudoceros gamblei

Found under rubble on the reef crest.

Pseudoceros concinnus

Due to the color pattern this species is very difficult to be get noticed in the reef.

Pseudoceros goslineri

Ribbon worms

Five lined ribbon worm | Baseodiscus quinquelineatus

Usually the adult is more than a meter in length. It is nocturnal inhabiting shallow, sandy habitats.

Phylum : Nemertea

Although most are less than 20 centimetres long, one specimen has been estimated at 54 metres, which would make it the longest animal ever found. A few live in the open ocean while the rest find or make hiding places on the bottom. Most are carnivores, feeding on annelids, clams and crustaceans, and may kill annelids of about their own size. They sometimes take fish, both living and dead.

Barred ribbon worm *Baseodiscus hemprichii*

This slender nemertean exceeds one meter in length when fully extended.

Segmented worms

Phylum : Annelida

Class : Polychaeta

Polychaetes are a class of annelid worms, generally marine. Each body segment has a pair of fleshy protrusions called parapodia that bear many bristles, called chaetae, which are made of chitin. Polychaetes are extremely variable in both form and lifestyle and include a few taxa that swim among the plankton. They are the indicator group of the marine ecosystem health.

Fan worm | Sabellastarte indica

The tentacular crown is horseshoe shaped. The tubes are generally buried in sandy substrata.

The tube of this species is largely embedded in sand at the edge of a shallow patch reef.

Social feather duster | Bispira brunnea

Christmas tree worm | Spirobranchus giganteus

The tentacles are extremely variable in color: yellow, blue, purple, red, orange or brown. Lives in calcareous tubes which penetrate living coral heads (Mainly Porites sp.). An indicator species about the eutrophication in the reef.

Polynoid worm Asterphilia sp.

A commensal species found on the asteroids and holothuroids.

Scale worm | Gastrolepida clavigera

This species is an obligate commensal on sea cucumbers, especially species of Bohadschia and Thelenota.

Sand worm | Nereis sp.

Nereis possesses setae and parapodia for locomotion. Locomotor chaetae are for crawling, and are the bristles that are visible on the exterior of the polychaeta.

Thread polychaete

Peanut worms

Phylum: Sipuncula

Sipunculids are relatively common, and live in shallow waters, either in burrows or in discarded shells like hermit crabs do. Some bore into solid rocks to make a shelter for themselves. Although typically less than 10 cm long, some sipunculids may reach several times that length. Sipunculid worm jelly is a delicacy in the town of Xiamen in Fujian province of China.

This species inhabits dead and living reefs and forms burrows in blocks of coral.

Sipunculus sp.

This species is found on the underside of coral rubble that is partially buried in coarse coral gravel on shallow patch reefs.

Themiste sp.

Acanthopleura spinosa

Chitons

Phylum: Mollusca

Class: Polyplacophora

Chitons are primitive, flattened mollusks with eight shell valves. These plates overlap somewhat at the front and back edges, and yet the plates articulate well with one another. Because of this the plates provide good protection for impacts from above.

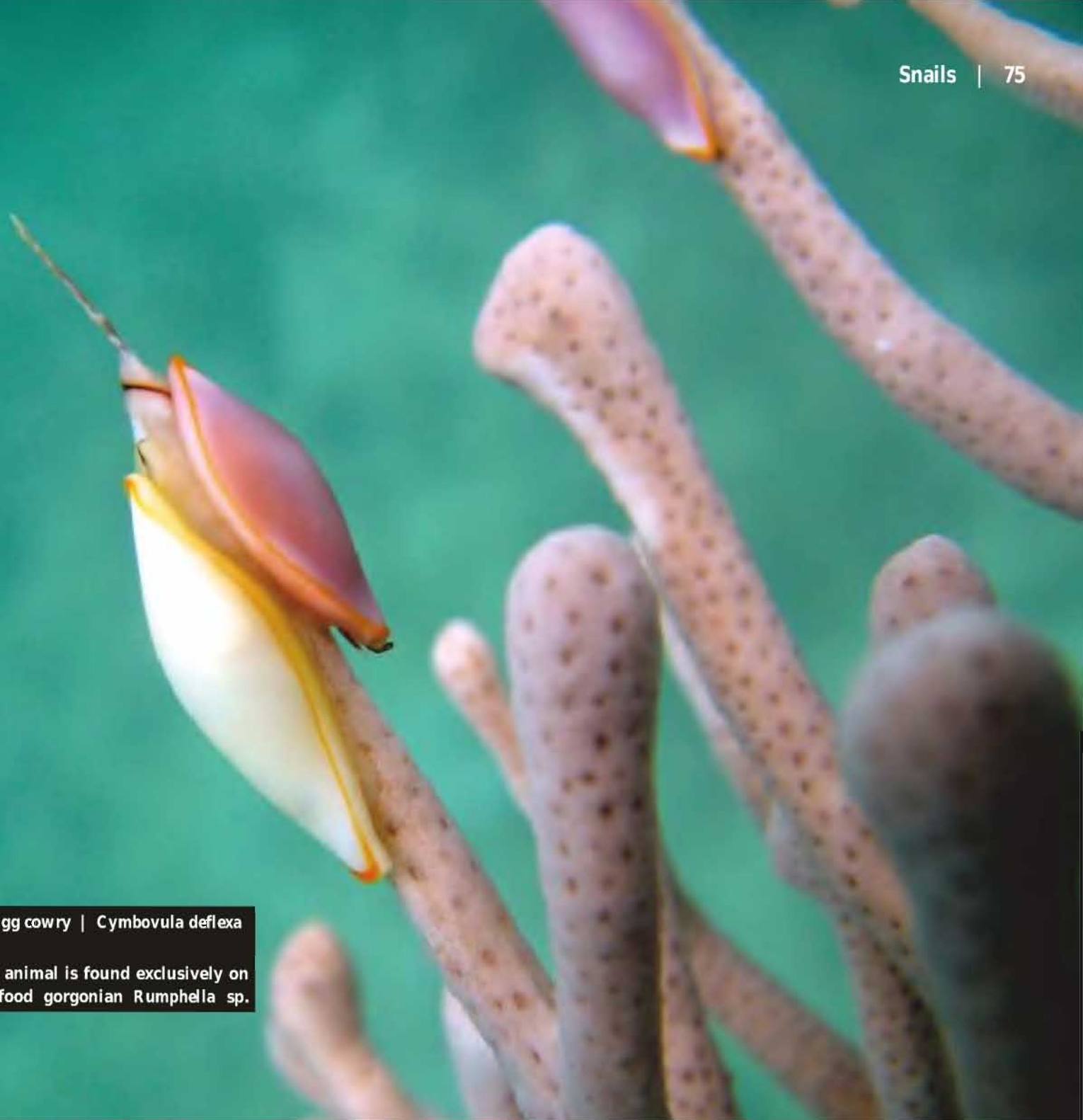
Worm chiton | Cryptoplax larvaeformis

Owing to the reduction of the shell plates and increased girdle, this species looks more like a worm than a mollusk.

Snails

Phylum : Mollusca
Class : Gastropoda

The class gastropods contain a vast total of named species, second only to the insects in overall number. The fossil history of this class goes all the way back to the Late Cambrian. Although the name "snail" can be, and often is, applied to all the members of this class, commonly this word means only those species with an external shell large enough that the soft parts can withdraw completely into it. Those gastropods without a shell, and those with only a very reduced or internal shell, are usually known as slugs.



Egg cowry | Cymbovula deflexa

The animal is found exclusively on its food gorgonian Rumphella sp.

Funnel hydroid | Mitra stictica

Kettle mitre | Mitra cucumerina

Nassarius snail | Nassarius sp.

Isabelle's Mitre | Cancilla Isabella

Gnawed or eroded cowry | Cypraea erosa

Lynx Cowrie | Cypraea lynx

Money cowry | Cypraea moneta

Tiger cowry | Cypraea tigris

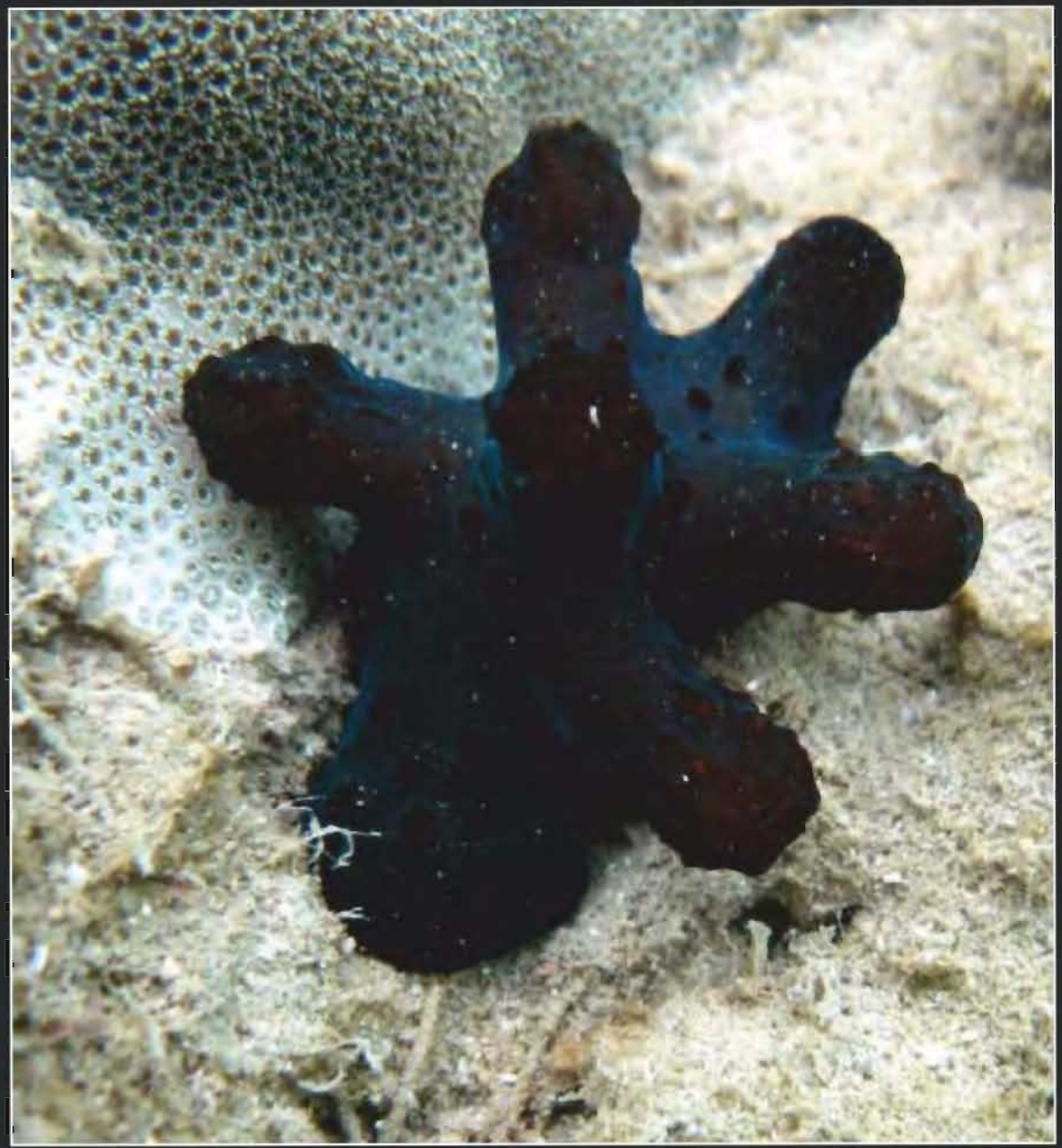
Yellow Helmet | Cassis cornuta

Emperor/Queen Helmet | Cassis madagascariensis

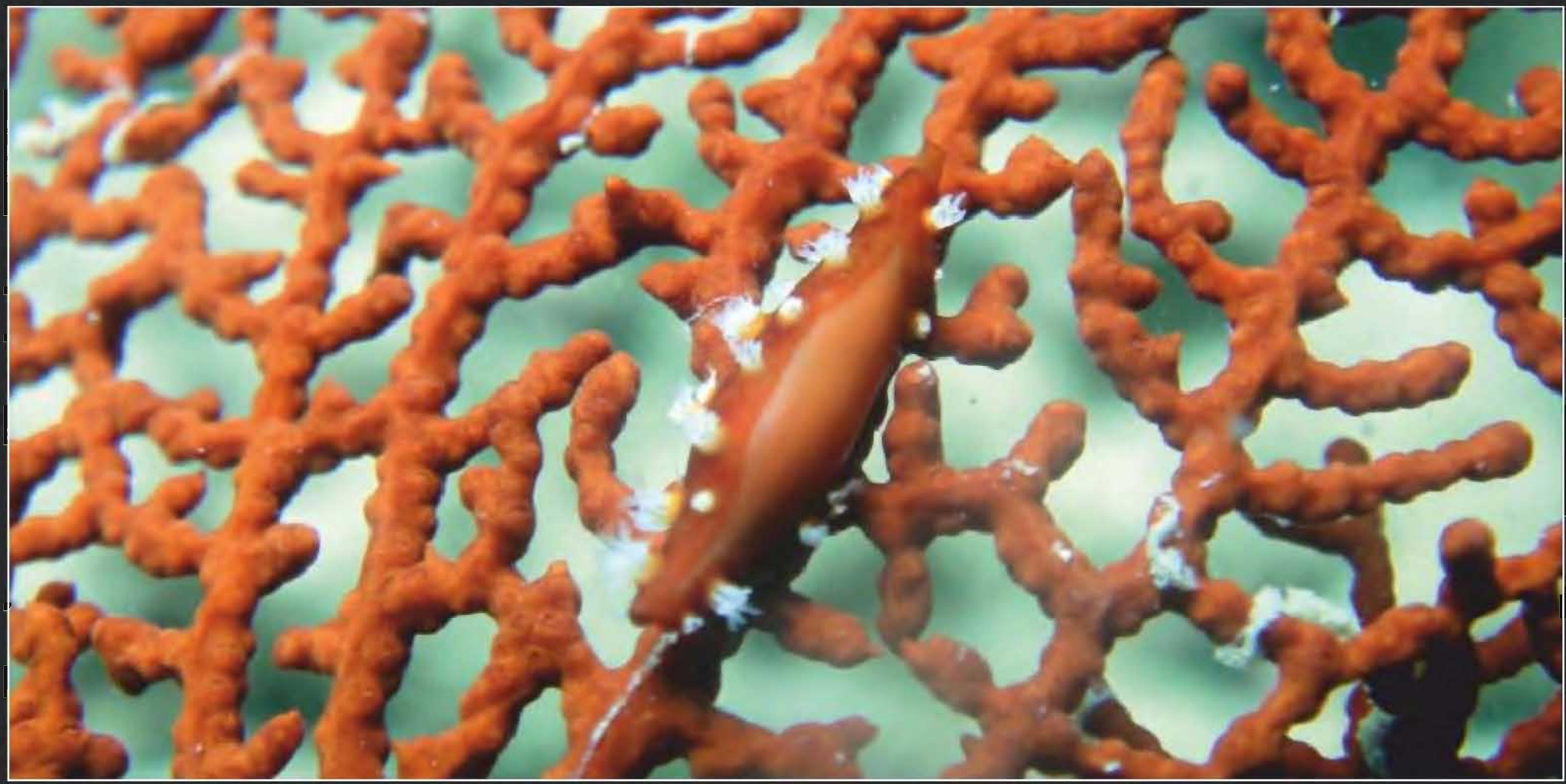
Chank shell | Turbinella pyrum

Brown turban | Turbo bruneus

Top shell | Trochus niloticus



Velvet snail | Coriocella hibyae



Oblong ovulid cowry | Phenacovolva tokioi

Variable thorny oyster | Spondylus varians

It is found cemented to walls and open reef faces in shallow to deep areas.

Phylum : Mollusca

Class: Bivalvia

Bivalves have a shell consisting of two asymmetrically rounded halves called valves that are mirror images of each other, joined at one edge by a flexible ligament called the hinge. The shell is typically bilaterally symmetrical, with the hinge lying in the sagittal plane. Bivalves are unique among the molluscs, having lost their odontophore and radula in their transition to filter feeding.

Bivalves

Pen shell | Atrina pectinate

The animals are largely embedded in coarse sand and rubble with only top of the shell and mantle visible. Generally found in shallow waters.

Lives in crevices of living corals. Only the shell opening and mantle visible.

Coral bivalve | Pedum spondyloideum

Commonly found under rocks in sandy and rubble habitats. Swims actively with the siphoning of shells when disturbed.

File shell | Limaria orientalis

Fluted giant clam | Tridacna squamos

Crocus giant clam | Tridacna crocea

Giant giant clam | Tridacna gigas

GIANT CLAM

The giant clam is the largest living bivalve mollusc. This is one of the most endangered clam species. One of a number of large clam species native to the shallow coral reefs of the South Pacific and Indian oceans, they can weigh more than 200 kilograms measure as much as 120 cm across, and have an average lifespan in the wild of 100 years or more.

Sea slugs

Phylum : Mollusca
Class : Gatropodaa
Informal group : Opisthobranchia

Sea slug is a common name used for several different groups of saltwater snails that either lack a shell or have only an internal shell, in other words this name is used for various lineages of marine gastropod mollusks that are either not shell-bearing or appear not to be. The phrase "sea slug" is often applied to nudibranchs, members of the order nudibranchia within the opisthobranch gastropods. Many nudibranchs are colorful and are a noticeable part of the underwater fauna. However the phrase "sea slug" is also applied to various other groups within the Opisthobranchia including the sea hares, the sacoglossans, various families of bubble snails (Cephalaspidea) and others, some of which have reduced shells, and many of which are shell-less.

Phyllidiella zeylanica

Chelidonura pallida

Cerberilla annulata

Aldisa erwinkoehleri

Chromodoris striatella

Costasiella paweli

Chromodoris colemani

Chromodoris fidelis

Discodoris boholiensis

Flabellina rubrolineata

Elysia grandifolia

Glossodoris cincta

Fryeria marindica

Gastropecten bicornutum

Halgerda bacalusia

Gumnodoris striata

Hypselodoris nigrostriata

Spanish Dancer | Hexabranchus sanguineus

This species of very large, strong-swimming nudibranch is one of the largest of all nudibranchs: specimens of well over 40 cm in length have been reported. The species name, sanguineus, refers to its bright red coloration, but a yellow variant also exists.

Egg mass
The egg mass of Spanish dancer is commonly known as Sea rose. To protect its egg cluster from predators, the Spanish dancer deposits with its eggs some of the toxins that it produces for its own defense.

Jorunna rubescens's Egg Mass

Jorunna rubescens

Phyllidia ocellata

Phyllidiella zeylanica

Hypselodoris bullockii

Thuridilla caerulea

Phyllaplysia engeli

Philinopsis pilsbryi

Thorunna africana

Cephalopods

Phylum : Mollusca
Class : Cephalopoda

These exclusively marine animals are characterized by bilateral body symmetry, a prominent head, and a set of arms or tentacles modified from the primitive molluscan foot. Fishermen sometimes call them ink fish, referring to their common ability to squirt ink.

This species can be recognized by a black spot surrounded by another thin black ring on the base of the arm web. This animal is active during day and is found in shallow reefs.

Common octopus | Octopus cyanea

Cuttlefish | Sepia sp.

This small species is characterized by large branched papillae over its surface. This species is found in shallow sandy areas. The internal shell of cuttlefish is a calcium supplementary feed for pet birds.

Broad club cuttlefish | Sepia latimanus

This is the only large cuttlefish in most of the tropical Indo-Pacific. Mostly singles or pairs are often observed active during the day time.

Acorn barnacle | Balanus sp.

Shaped like a volcano. When submerged, the thoracic feeding appendages or cirri may be observed reaching out of the orifice, in a grasping motion.

Barnacles

Subphylum: Crustacea
Class: Maxillopoda
Subclass: Thecostraca
Infraclass: Cirripedia

Barnacles are exclusively marine, and tend to live in shallow and tidal waters, typically in erosive settings. They are sessile and suspension feeders. Barnacles are encrusters, attaching themselves permanently to a hard substrate. Barnacles are of economic consequence as they often attach themselves to man-made structures, sometimes to the structure's detriment. Particularly in the case of ships, they are classified as fouling organisms.

Pelagic goose-neck barnacle | *Lepas* sp.

Though it seems to be a bivalve, the species is made up of five white plates. Found attached to floating objects such as buoys, boat hulls and driftwood.

Mantis shrimps

Observed in coral rubble bottoms.

Lysiosquilla sp.

Pseudosquilla sp.

Burrows in sand and gravel on coral reefs and sand flats.

Subphylum : Crustacea
Class : Malacostraca
Order : Stomatopoda

Mantis shrimps are marine crustaceans. They are neither shrimp nor mantids, but receive their name purely from the physical resemblance to both the terrestrial praying mantis and the shrimp. Mantis shrimp appear in a variety of colors, from shades of browns to bright neon colors.

Shrimps

Order : Decapoda
(Shrimps, Crabs and Lobsters)

Decapods, like other crustaceans have hard, jointed exoskeletons. Their growth involves molting. The decapods (ten-footed) are an order of crustaceans, including many familiar groups, such as crabs, lobsters, prawns and shrimp. Most decapods are scavengers.

Banded Coral cleaner Shrimp | Stenopus hispidus

This common cleaner shrimp waits in crevices or out in the open at its cleaning station, waving its antennae to attract fishes. As fish approach to be cleaned, the shrimp touches them with the antennae until the fish becomes quite, allowing the shrimp to move about its body in search of parasites.

Sexy anemone shrimp | Thor amboinensis

It lives on corals, sea anemones and other reef communities. They perform a dance like movement which they are famous for.

Found in association with sea anemones, especially Cryptodendrum adhaesivum.

Anemone shrimp | Periclimenes brevicarpalis

Hinge beak prawn | Rhynchocinetes durbanensis

Lives deep in crevices and holes. Usually occurring in large numbers together.

Crabs

Ghost crab | Ocypode ceratophthalma

This species can be distinguished from other related crabs by the eyestalks extending beyond the eyes into long points. They can run very fast in the intertidal sandy areas.

Coral Crab | Tetralia nigrolineata

This crab is often seen associated with stag horn corals (Acropora sp).

This species is associated with soft corals environment.

Stone crab | Liomera rugata

Red spotted coral crab | Trapezia rufopunctata

This species is obligate symbionts of pocillporid corals.

Elephant squat lobster | Allogalathea elegans

Found in association with feather stars. The color of the individual mimics the host, so color depends on the host feather star's color.

Spotted porcelain crab | Neopetrolisthes maculates

Lives in the shelter of sea anemones. Individuals can enter and leave the mouth of the anemone freely.

Fiddler crab | Uca tetragonon

Ghost crab | Ocypode cordimana

Hermit crabs

Dardanus sp. | Hermit crab

Order: Decapoda
Infraorder: Anomura
Superfamily: Paguroidea

Hermit crabs are decapod crustaceans. Most of the species possess an asymmetrical abdomen which is concealed in an empty gastropod shell that is carried around by the hermit crab. The vulnerable abdomen is protected from predators by a salvaged empty seashell carried by the hermit crab, into which its whole body can retract. Most frequently hermit crabs use the shells of sea snails (although the shells of bivalves and scaphopods and even hollow pieces of wood and stone are used by some species).

Lobsters

Painted crayfish | Panulirus versicolor

This species is nocturnal and hiding in crevices during the daylight.

Order: Decapoda
Infraorder: Astacidea
Family: Nephropidae

Lobsters are economically important as seafood, forming the basis of a global industry that nets more than US $ 1 billion annually. They are also revered for their flavor and texture.

Feather stars

Phylum: Echinodermata
Class: Crinoidea

Crinoids are characterized by a mouth on the top surface that is surrounded by feeding arms. They have a U-shaped gut, and their anus is located next to the mouth. Although the basic echinoderm pattern of fivefold symmetry can be recognized, most crinoids have many more than five arms.

Robust Feather Star Himerometra robustipinna

Green Feather Star Himerometra sp.

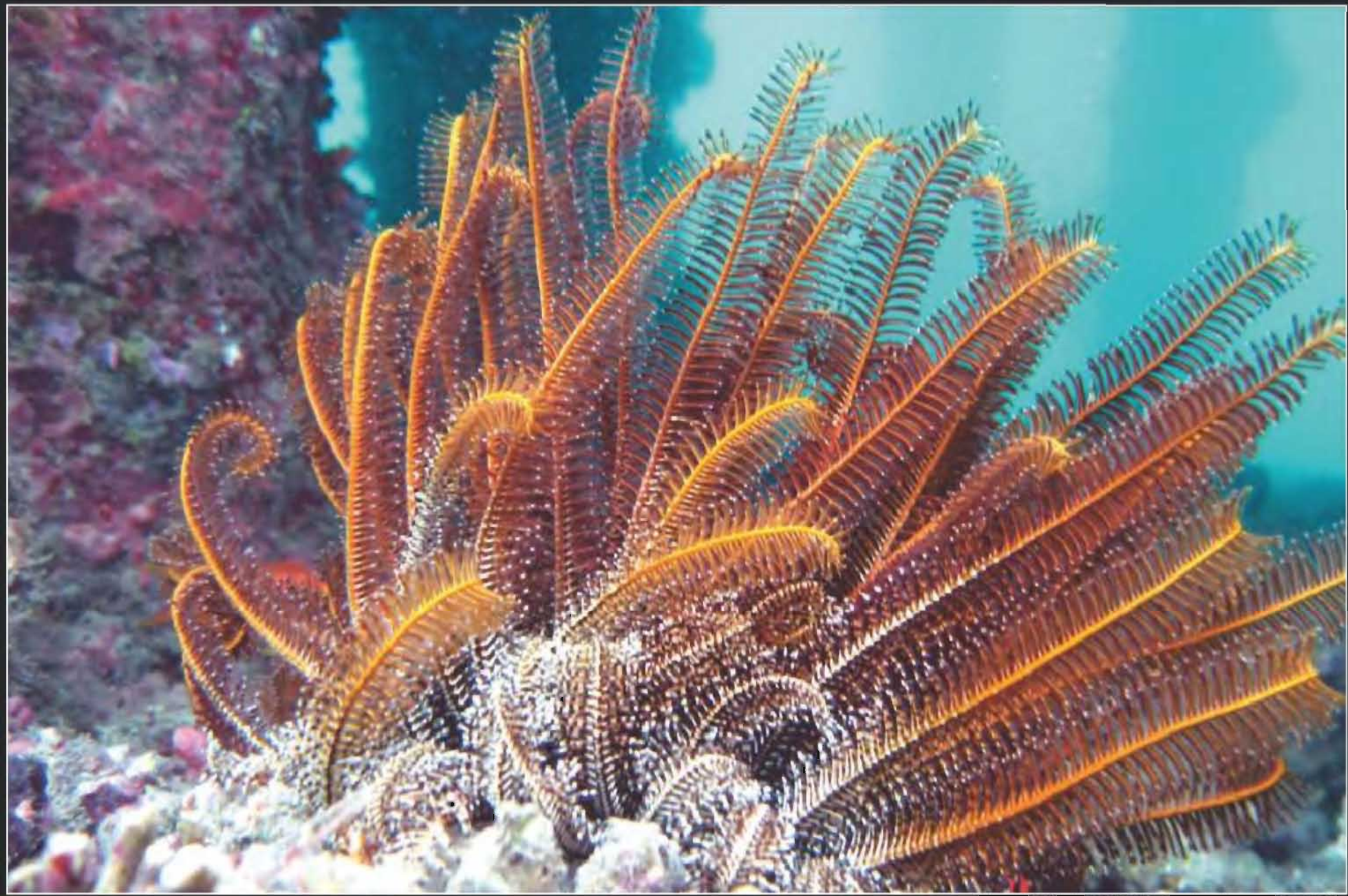
Noble Feather Star | Comanthina nobilis

Variable Bushy Feather Star | Comanthina schlegeli

Many-armed Feather Star | Comaster multibrachiatus

Comaster multifidus

Common Feather Star | Comanthus sp.



Bennett's Feather Star | Oxycomanthus bennetti

Crevice crinoid | Comanthus parvicirrus

Sea stars

Phylum : Echinodermata

Class : Asteroidea

Starfish occur across a broad depth range from the intertidal to abyssal depths (>6000 m). Starfish are among the most familiar of marine animals and possess a number of widely known traits, such as regeneration and feeding on mussels. Starfish possess a wide diversity of body forms and feeding methods. Sea stars and other echinoderms pump water directly into their bodies, via the water vascular system, as they find it. This makes them vulnerable to all forms of water pollution, as they have little ability to filter the water of toxins and contaminants. Oil spills and similar events often take a toll on echinoderm populations that carry consequences for the ecosystem.

Brown mesh sea star | Nardoa galathae

Warty mesh sea star | Nardoa tuberculata

Cushion star | Choriaster granulatus

Indian Sea Star | Fromia indica

Crown-of-Thorns | Acanthaster planci

Potential predator of corals and prey upon the coral polyps. Out breaks of crown-of-thorn star fish often leads considerable damages to the corals of Indo-Pacific.

Brittle stars

Phylum : Echinodermata
Class : Ophiuroidea

They crawl across the seafloor using their flexible arms for locomotion. Brittle stars use their arms for locomotion. They do not, like sea stars, depend on tube feet, which are mere sensory tentacles without suction. Brittle stars move fairly rapidly by wriggling their arms which are highly flexible and enable the animals to make either snake-like or rowing movements. Brittle stars live in areas from the low-tide level downwards.

Banded Brittle Star | Ophiacantha indica

Green Brittle starfish | Ophiarachna incrassate

Toothed Brittle Star | Ophiocoma dentata

Sand dollars

Phylum : Echinodermata
Class : Echinoidea
Order : Clypeasteroida

The term sand dollar refers to the species of extremely flattened, burrowing echinoids. Some species within the order, not quite as flat, are known as sea biscuits. Coordinated movements of the spines enable sand dollars to move across the seabed. The velvety spines of live sand dollars appear in a variety of colors—green, blue, violet, purple—depending on the species. The tests of dead individuals are often found on beaches, the textured skin missing and the skeleton bleached white by sunlight.

Laganum Sand Dollar | Laganum depressum

Sand Dollar | Peronella lessueri

Sea urchins

Subphylum: Echinozoa
Class: Echinoidea

Sea urchins are small, spiny, globular animals which inhabits all oceans. Common colors include black and dull shades of green, olive, brown, purple, and red. They move slowly, feeding mostly on algae. Sea otters, wolf eels, triggerfish, and other predators feed on them. Population density varies by habitat with more dense populations being found in barren areas as compared to kelp stands. Even in these barren areas, greatest densities are also found in shallow water. Populations are also generally found in deeper water if wave action is present.

Diadem Urchin | Echinothrix diadema

Pencil Urchin | Phyllacanthus imperialis

Crown Urchin | Prinocidaris verticillata

Burrowing Urchin | Echinometra mathaei

Hatpin Urchin | Echinothrix calamaris

Lance urchin | Phyllacanthus imperialis

Pincushion Tuxedo Urchin | Mespilia globulus

Sea cucumbers

Phylum : Echinodermata
Subphylum : Echinozoa
Class : Holothuroidea

They are marine animals with a leathery skin and an elongated body containing a single, branched gonad. Sea cucumbers are found on the sea floor worldwide. There are many commercially important species of sea cucumber that are harvested and dried for export for use in Chinese cuisine as Hoi sam. Some varieties of sea cucumber (known as gamat in Malaysia or teripang in Indonesia) are said to have excellent healing properties.

Blotched Sea Cucumber | Bohadschia graffei (Juvenile)

This species mimics the nudibranch Phyllidia ocellata; which helps them from predators. This species when juvenile has this colorful phase, but as it grows it becomes a typical boring brownish sea cucumber.

Edible sea cucumber Holothuria edulis

As the name suggests this is one of the edible species of sea cucumbers served as "trepang" or "beche de mer".

Most common sea cucumber of Indo-Pacific region. Animals may form dense aggregations in shallow waters.

Black lolly fish | Holothuria atra

It is called Curry fish as it is among the sea cucumbers that are edible and harvested for the restaurant trade. Found in shallow water rubble and sandy habitat.

Curry fish | Stichopus hermanni

Pineapple sea cucumber | Thelenota ananas

This is a large species, reaching half a meter in length. It inhabits the interface between reefs and sand.

Spotted Worm Cucumber | Synapta maculata

This is the longest sea cucumber which may exceed even 2 meter in length. Found in shallow sandy habitats and grass beds.

Sea squirts

Phylum : Chordata

Subphylum : Tunicata

Tunicates, also known as urochordates, are members of the subphylum Tunicata, a group of underwater sac like filter feeders with incurrent and excurrent siphons that is classified within the phylum Chordata. Tunicates begin life in a mobile larval stage that resembles a tadpole, later developing into a barrel-like and usually sedentary adult form.

Clavelina moluccensis

Atriolum robustum

Botriloides leachi

Perophora modificata

Didemnum molle

Didemnum sp.

Phallusia Arabica

Clavelina sp.

Fishes

Kingdom : Animalia
Phylum : Chordata
Clade (Unranked) : Craniata

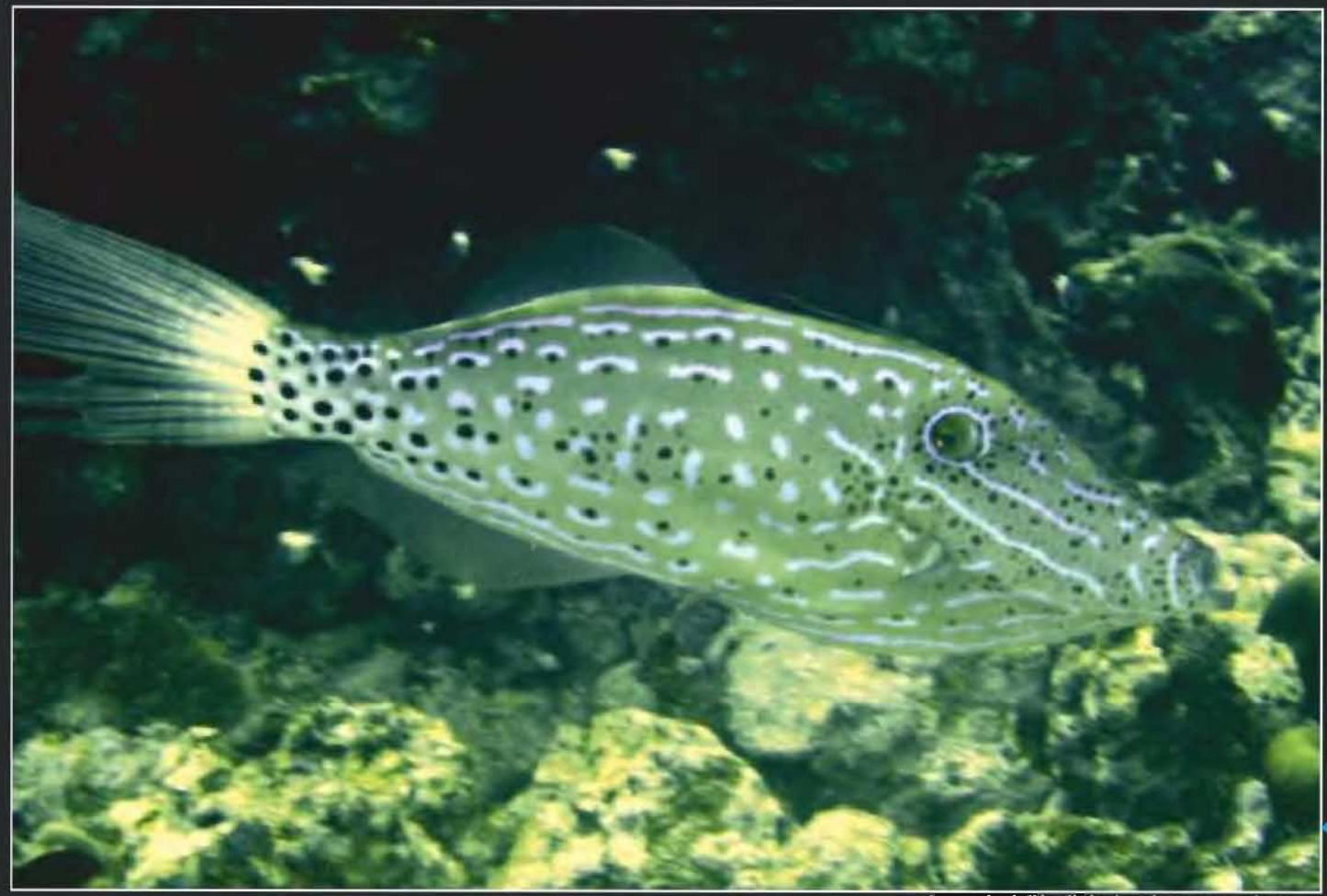
A fish is any gill-bearing aquatic vertebrate (or craniate) animal that lacks limbs with digits. Most fish are "cold-blooded", or ectothermic, allowing their body temperatures to vary as ambient temperatures change. Fish are abundant in most bodies of water. Fish, especially as food, are an important resource worldwide. Commercial and subsistence fishers hunt fish in wild fisheries or farm them in ponds or in cages in the ocean. They are also caught by recreational fishers, kept as pets, raised by fish keepers, and exhibited in public aquaria.

Forms large feeding groups in the inshore and outer reefs.

Powder blue surgeonfish | Acanthurus leucosternon

Yellow back fusilier | Caesio xanthonota

Form large aggregations often mix with other fusiliers.



Scrawled file fish | Aluterus scriptus

Solitary fish, seen in the coastal, lagoon and outer reefs.

Group of parrot fishes feeding on the corals (*Chlorurus* sp.)

Titan triggerfish | *Balistoides viridescens*

Anemonefishes

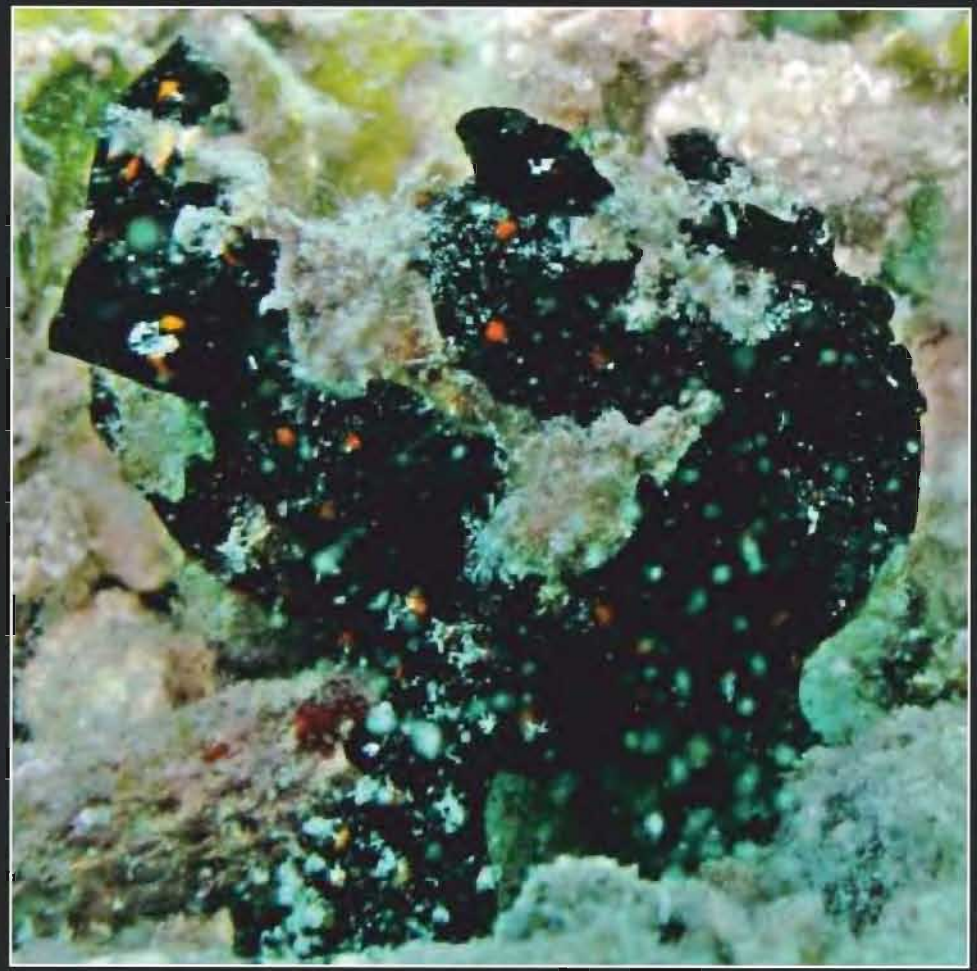
Twenty-eight species are recognized, one in the genus Premnas, while the remaining are in the genus Amphiprion. In the wild they all form symbiotic mutualisms with sea anemones. The clownfish feeds on small invertebrates which otherwise potentially could harm the sea anemone, and the fecal matter from the clownfish provides nutrients to the sea anemone

Spine cheek anemone fish | Premnas biaculeatus

Clown anemone fish | Amphiprion percula

A. akallopisos, like A. percula, is nearly always associated with Heteractis magnifica and Stichodactyla gigantea. It resides in shallow inshore reefs as deep as 15 m with a moderate to strong current. The skunk clownfish can also be kept in captivity by aquarists.

Skunk anemone fish | Amphiprion akallopisos



Painted frogfish | Antennarius pictus

Frogfishes

Frogfish have a stocky appearance, a typical of fish. They are often brightly colored, white, yellow, red, green, or black or spotted in several colors in order to blend in with their coral surroundings. Coloration can also vary within one species, making it difficult to differentiate between them.

Giant frogfish | Antennarius commersoni

Dragon sea moth | Eurypegasus draconis

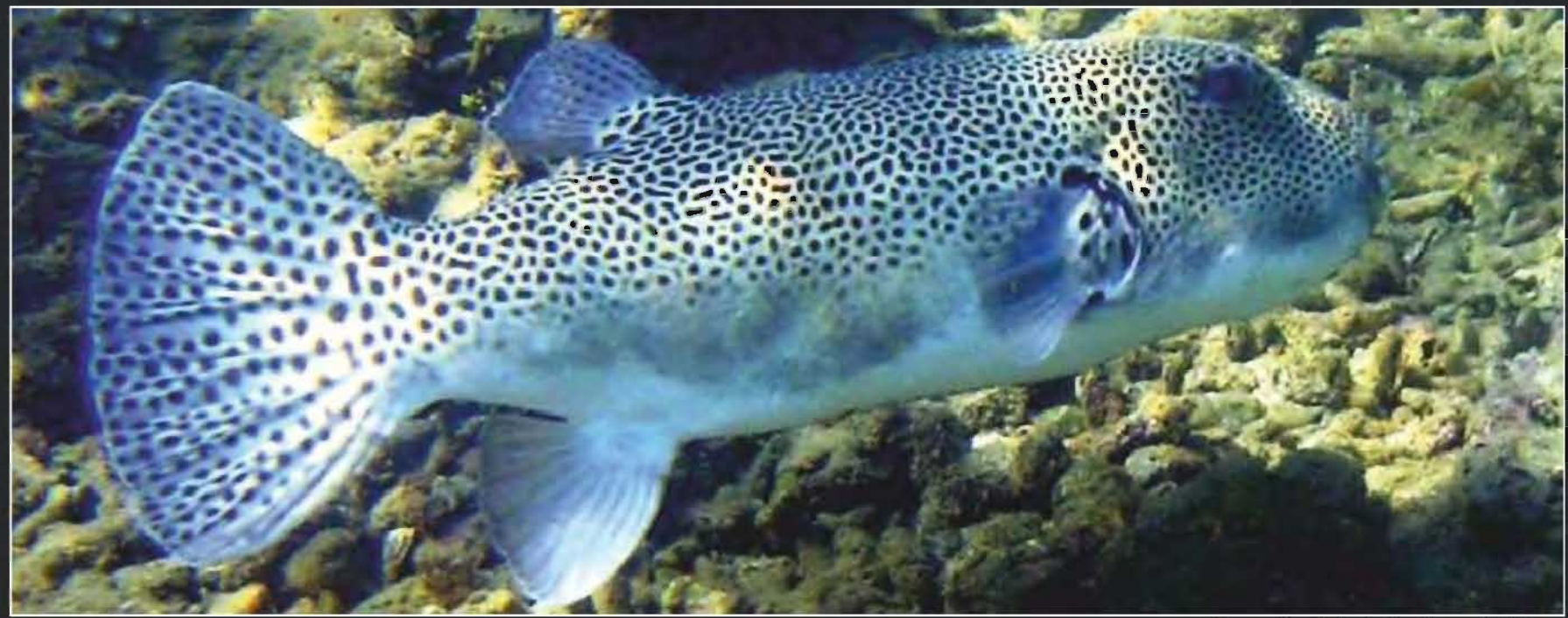
Twin spot lionfish | Dendrochirus biocellatus

Common lion fish | Pterois volitans

Porcupine fish | Diodon hystrix

Puffer or Porcupine fishes

Puffer fish are generally believed to be the second-most poisonous vertebrate in the world, after the Golden Poison Frog. Certain internal organs, such as liver, and sometimes their skin are highly toxic to most animals when eaten, but nevertheless the meat of some species is considered a delicacy in Japan, Korea and China.



Star puffer fish | Arothron stellatus

Butterfly fishes
Butterfly fish look like smaller versions of angelfish but unlike these lack pre-opercle spines at the gill covers. The conspicuous coloration of butterfly fish may be intended for interspecies communication. Butterfly fish have uninterrupted dorsal fins with tail fins that may be rounded or truncated, but are never forked.

White collar butterfly fish | Chaetodon collare

Black coral goby | Bryaninops tigris

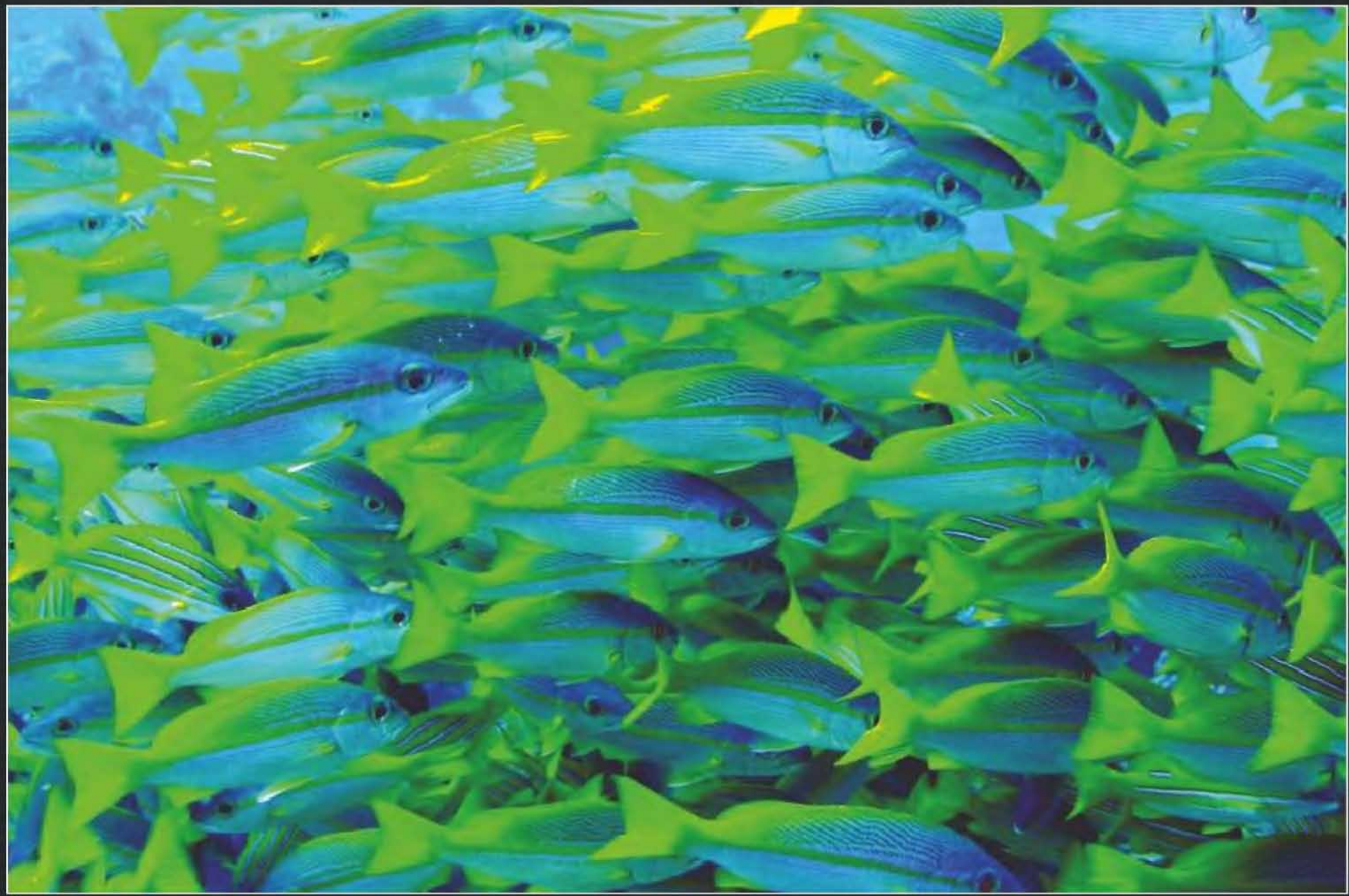
Red finned triple fin | Ucla xenogrammus

Three lined blenny | Ecsenius trilineatus

Striped triple fin | Helcogramma striatum

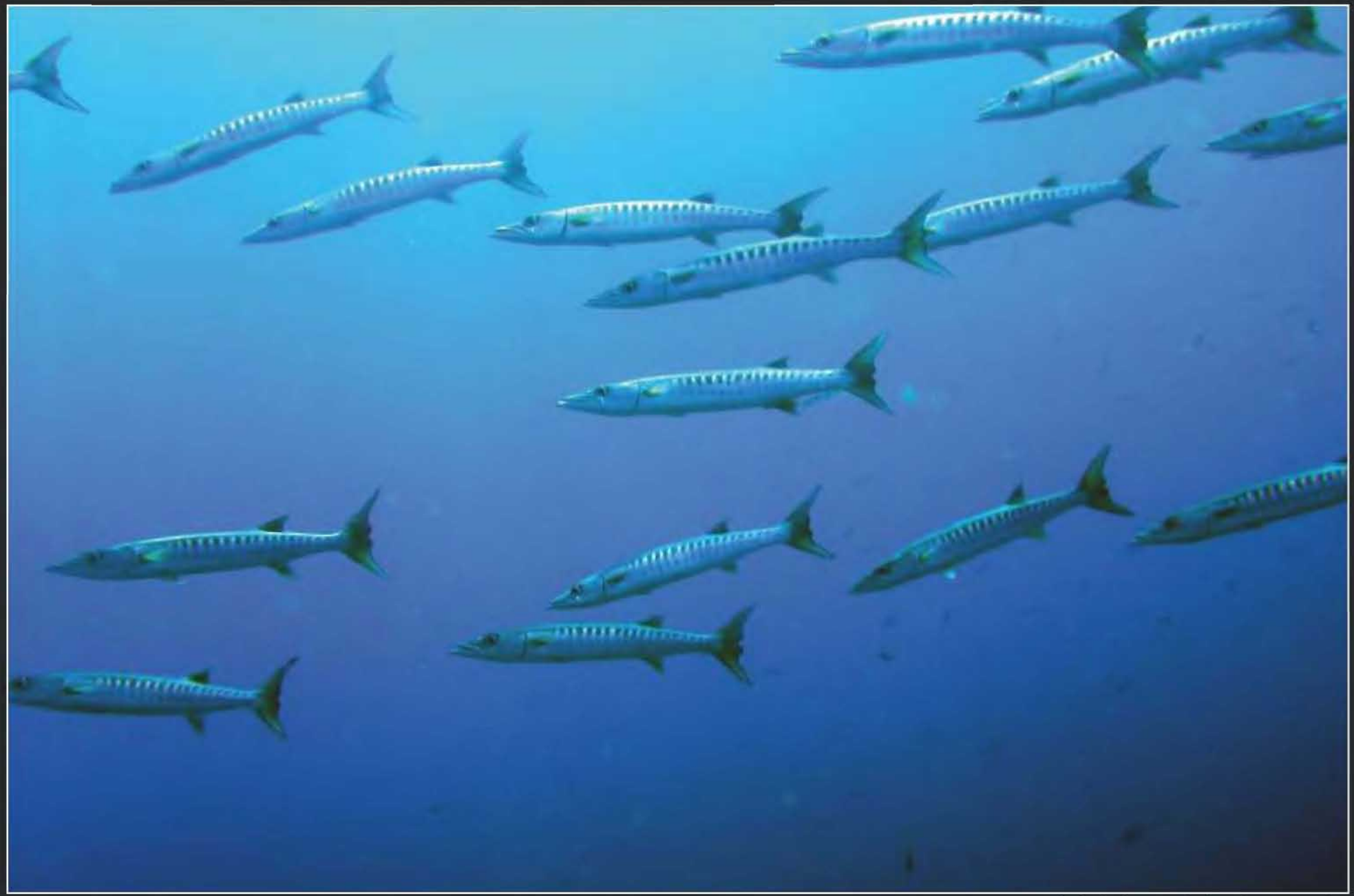
Black fin sand | perchParapercis snyderi

Reef lizard fish | Synodus variegatus



Forms large drifting aggregations in the coastal reefs and outer slopes.

Big eye snapper | Lutjanus lutjanus



Black fin barracuda | Sphyraena qenie

Robust ghost pipefish | Solenostomus cyanopterus

Ornate ghost pipefish | Solenostomus paradoxus

Ghost pipefishes

Ghost pipe fishes must rank among the most exotic creatures inhabiting the earth's shallow seas.

Dwarf hawk fish | Cirrhitichthys falco

Black belt hog fish | Bodianus mesothorax

Tomato grouper | Cephalipholis sonnerati

Saddle grouper | Cephalopholis sexmaculata

Black spotted moray | Gymnothorax favagineus

Emperor angelfish | Pomacanthus imperator

Long fin spade fish | Platax teira

Marine reptiles

Phylum: Chordata
Clade: Amniota
Class: Reptilia

Marine reptiles are reptiles which have become secondarily adapted for an aquatic or semi-aquatic life in a marine environment. Some marine reptiles, such as ichthyosaurs and mosasaurs, rarely ventured onto land and gave birth in the water. Others, such as sea turtles and saltwater crocodiles, return to shore to lay their eggs. Some marine reptiles also occasionally rest and bask on land.

Yellow lipped sea krait | Laticauda colubrina

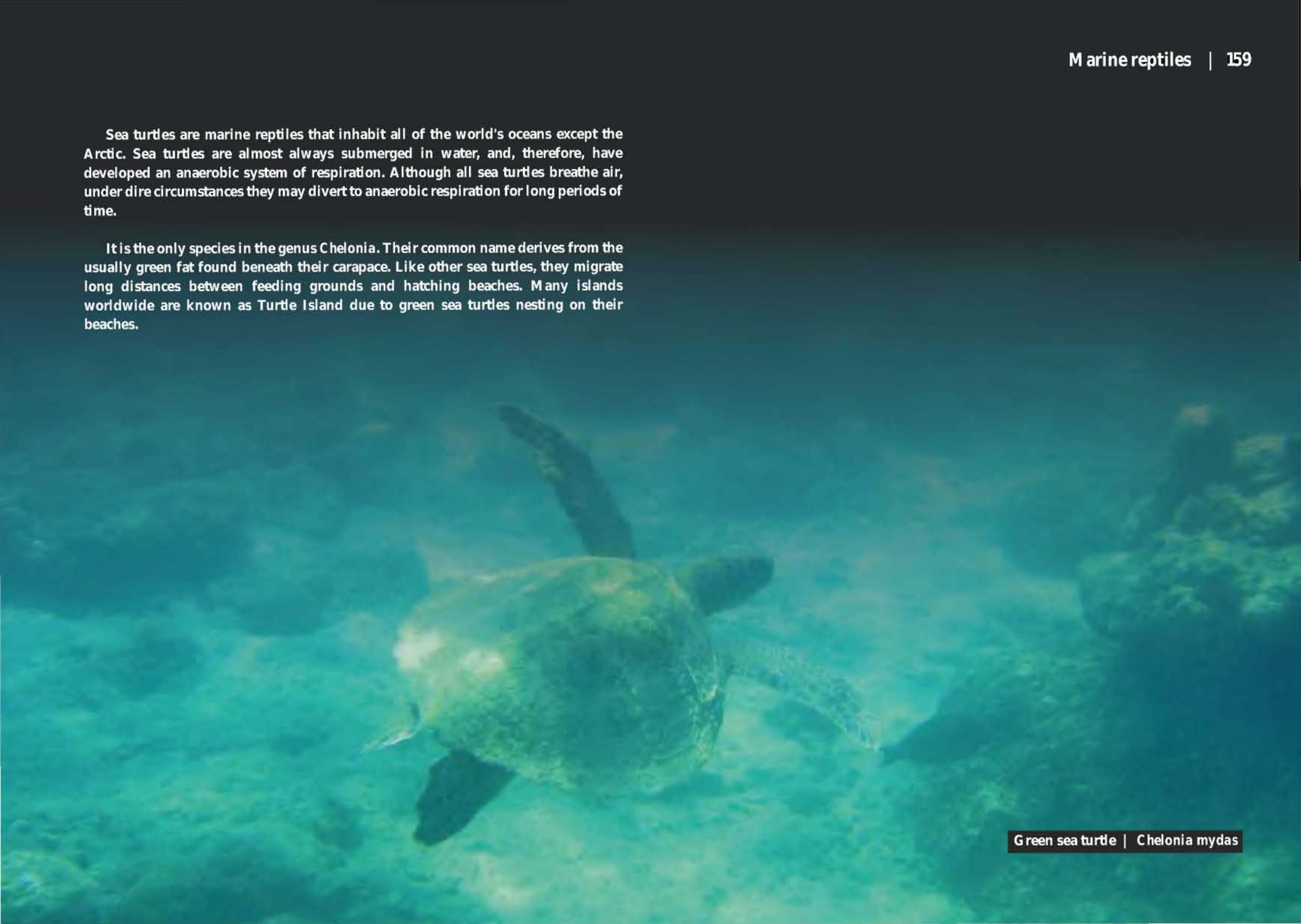
Sea snakes are venomous elapid snakes that inhabit marine environments for most or all of their lives. All have paddle-like tails and many have laterally compressed bodies that give them an eel-like appearance. Unlike fish, they do not have gills and must surface regularly to breathe.

Member species of the family Crocodylidae are large aquatic reptiles that live throughout the tropics in Africa, Asia, the Americas and Australia. Crocodiles tend to congregate in freshwater habitats like rivers, lakes, wetlands and sometimes in brackish water.
This is the largest of all living reptiles. It is found in suitable habitats in Northern Australia, the eastern coast of India and parts of Southeast Asia.

Saltwater crocodile | Crocodylus porosus

Sea turtles are marine reptiles that inhabit all of the world's oceans except the Arctic. Sea turtles are almost always submerged in water, and, therefore, have developed an anaerobic system of respiration. Although all sea turtles breathe air, under dire circumstances they may divert to anaerobic respiration for long periods of time.

It is the only species in the genus Chelonia. Their common name derives from the usually green fat found beneath their carapace. Like other sea turtles, they migrate long distances between feeding grounds and hatching beaches. Many islands worldwide are known as Turtle Island due to green sea turtles nesting on their beaches.



Green sea turtle | Chelonia mydas

Marine mammals

Phylum: Chordata

Class: Mammalia

Marine mammals are a diverse group of 120 species of mammal that are primarily ocean-dwelling or depend on the ocean for food. Marine mammals evolved from land dwelling ancestors and share several adaptive features for life at sea such as generally large size, hydrodynamic body shapes, modified appendages and various thermoregulatory adaptations. Whales are the largest mammals ever. Different species are, however, adapted to marine life to varying degrees.

Bottlenose dolphin | Tursiops truncatus

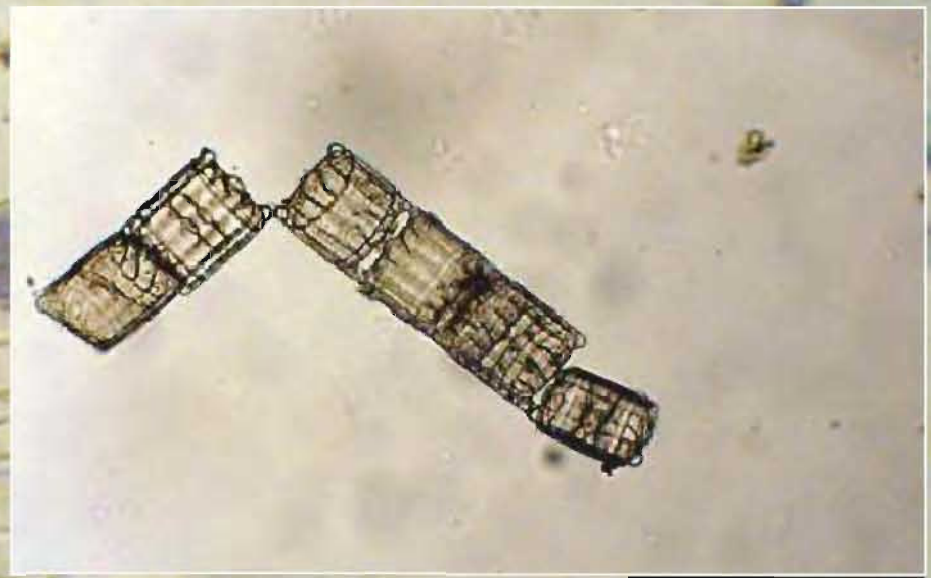
It is the only living representative of the once-diverse family Dugongidae; its closest modern relative, Steller's sea cow (Hydrodamalis gigas), was hunted to extinction in the 18th century. It is also the only sirenian in its range, which spans the waters of at least 37 countries throughout the Indo-Pacific, though the majority of dugongs live in the northern waters of Australia between Shark Bay and Moreton Bay. The dugong is the only strictly-marine herbivorous mammal, as all species of manatee utilize fresh water to some degree.

The IUCN lists the dugong as a species vulnerable to extinction, while the Convention on International Trade in Endangered Species limits or bans the trade of derived products. Despite being legally protected in many countries, the main causes of population decline remain anthropogenic and include hunting, habitat degradation, and fishing-related fatalities.

Sea cow | Dugong dugon

Phytoplankton

Phytoplankton are the autotrophic component of the plankton community. Most phytoplankton are too small to be individually seen with the unaided eye. However, when present in high enough numbers, they may appear as a green discoloration of the water due to the presence of chlorophyll within their cells. Phytoplankton are photosynthesizing microscopic organisms that inhabit the upper sunlit layer of almost all oceans and bodies of fresh water. They are agents for "primary production," the incorporation of carbon from living organisms, a process that sustains the aquatic food web.



Grammatophora undulata

Oscillatoria margarilifera

Seagrasses

Turtle grass | Thalassia sp.

Paddle grass | Halophilia sp.

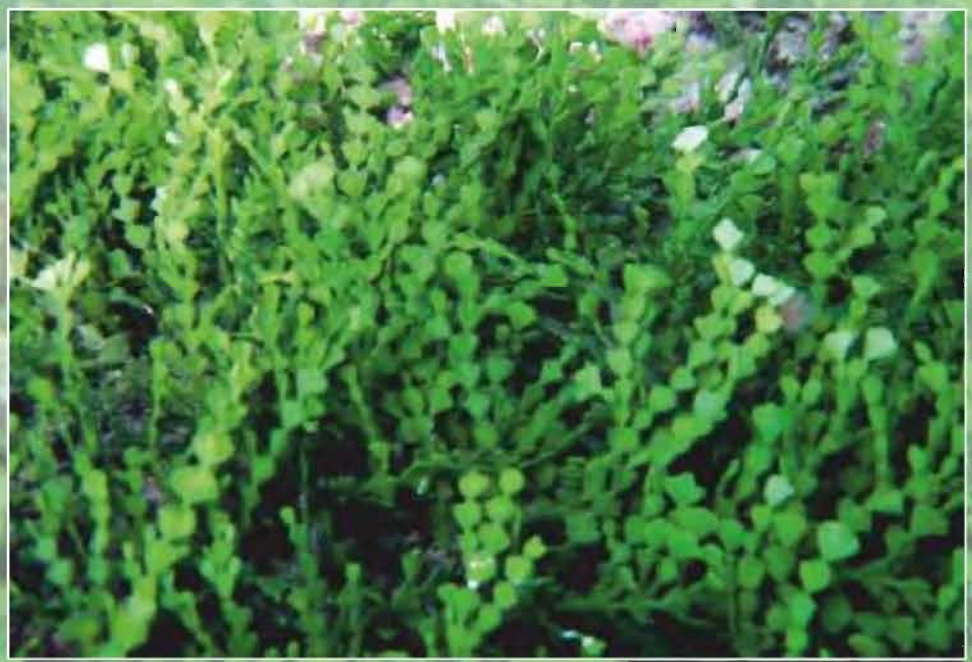
Kingdom: Plantae
Clade: Angiosperms
Clade: Monocots
Order: Alismatales

Sea grasses are flowering plants which grow in marine, fully-saline environments. These unusual marine flowering plants are called sea grasses because the leaves are long and narrow and are very often green, and because the plants often grow in large "meadows" which look like grassland: in other words many of the species of sea grasses superficially resemble terrestrial grasses.

Seaweeds

Kingdom : Protista

Seaweed is a loose, colloquial term encompassing macroscopic, multicellular, benthic marine algae. The term includes some members of the red, brown and green algae. Seaweeds can also be classified by use (as food, medicine, fertilizer, industrial, etc.). In addition, some tuft-forming bluegreen algae (Cyanobacteria) are sometimes considered as seaweeds — "seaweed" is a colloquial term and lacks a formal definition.



Cactus algae | Halimeda sp.

Mermaid's wine cup | Acetabularia sp.

Peacock seaweed Padina sp.

Spiny-leaf seaweed | Turbinaria sp.

Cactus algae | Halimeda sp.

Button seaweed | Dictyosphaeria sp.

Mangroves

Mangroves are various kinds of trees up to medium height and shrubs that grow in saline coastal sediment habitats in the tropics and subtropics. The mangrove biome, or mangal, is a distinct saline woodland or shrub land habitat characterized by depositional coastal environments, where fine sediments (often with high organic content) collect in areas protected from high-energy wave action. Mangroves dominate three quarters of tropical coastlines. About 110 species are considered mangroves. However, a given mangrove typically features only a small number of tree species.

Small to medium sized trees grow upto 15 m tall. Occur in less saline parts of mangrove forests on deeply muddy soil, along tidal creeks with slow moving water. Found along rivers, occurring upstream to where the tidal influence is still felt.

Mangrove apple | Sonneratia caseolaris

Large tree grows to 20 m tall. Found solitary at the front of the mangrove belt and usually on sandy soil and sometimes mixes with seaward Avicennia marina individuals. Occasionally prefers rock and gravel and can tolerate the full strength of seawater.

Mangrove apple | Sonneratia alba

Long fruited stilted red mangrove | Rhizophora mucronata

Most important and widespread mangrove species; may grow upto 15 m tall and more tolerant of sandy and firmer ground than any other species of Rhizophora. Grows well in soft mud too and is believed to be among the few that can survive complete daily inundation.

Large leafed orange mangrove | Bruguiera gymnorrhiza

Straight stemmed tall tree may grow upto 15 - 25 m. Thrives under a wide range of inter tidal conditions, including salinity levels from near freshwater to full strength seawater and tolerates wide range of soil types. Typically, the most common in middle and upper intertidal zones.

There are so many different living things in the sea that it almost boggles the mind. From microscopic bacteria to gigantic whales, marine organisms come in all shapes, sizes, and colours. It is estimated that more than 2 lakhs species may be available in the seas of the world, of which 80,000 has been identified and in India so far 15000 has been identified. This is a comprehensive book to the fascinating marine life of India. Forty six different categories of marine life are illustrated with more than 300 underwater photographs. This book can serve as a perfect reference material for marine enthusiasts, divers, students, underwater photographers' etc. The book provides the identifications of species, based on the collective experience of the authors, who have been working for many years on the marine animals. All the groups are illustrated with few photographs of those animals which are common in Indian Seas. The illustrations of the book are a perfect source to learn about the life of the ocean. This book can help an aficionado to become underwater photographer. Almost all photographs are taken by the authors from Andaman and Nicobar Islands with few exceptions which were contributed by expert underwater photographers.