



Field Guide to

Maldivian Mangroves

with Minna Mas



Developed for Educational Development Centre, Ministry of Education,
Republic of Maldives by:



March 2008

Adapted for children by Elaine Glen, Jady Smith, Zameela Ahmed, Mariyam Shazna and Fathimath Shafeeqa and Meg Parker.

Proofed by: Mausooma Jaleel and Beverly McAloon

Support and critical review from: Dr. Margaret Card, Dr. Valeria Bers, Mohamed Zahir, Ian Montgomery, Reinhard Kikinger and Ravishankar Thupalli.

Illustrated by: Afzal Shaafiu Hasan and Mariyam Omar

Design and layout by: Karen Young

Photography by: Live & Learn Environmental Education, Anke Hofmeister, Ahmed Riyaz Jauhary, Ahmed Saleem (Environment Research Centre), Reinhard Kikinger and Gayle Seddon.

© Copyright: UNICEF and Educational Development Centre

Disclaimer: This document was prepared by consultants for UNICEF. The findings, interpretations, and conclusions expressed in it do not necessarily represent the views of UNICEF or those of its member governments. UNICEF does not guarantee the accuracy of the data included in this report and accepts no responsibility for any consequences of their use.

ACKNOWLEDGEMENTS

This Field Guide was developed with the assistance and support from many organizations, teachers, government departments and individuals. The principal authors of these field guides are Elaine Glen, Jady Smith, Zameela Ahmed, Mariyam Shazna and Fathimath Shafeeqa. A special mention must be given to Karen Young from Live & Learn who dedicated many hours to the outstanding graphic design of this field guide.

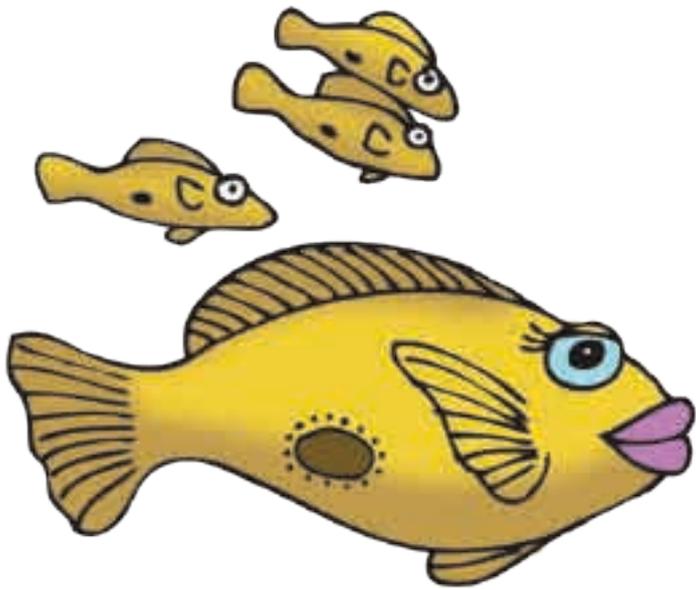
Substantial contributions were also provided by Dr. Sheema Saeed, Ahmed Riyaz Jauhary, Fathmath Nahid Shakir, Aminath Ismail, Hidayah Mohamed Zahir, Gulfishan Shafeeu and Aminath Mohamed from Educational Development Centre to review and strengthen this field guides and their linkages to the Environmental Studies curriculum. Ken Maskall, Johan Fagerskiold, David Proudfoot, Shadiya Adam and Mohamed Latheef from UNICEF also provided ongoing support and advice on the development of this field guide.

Appreciation is extended to Fathimath Farina, Aminath Niyaza and Ismail Abdul Haadhed at K. Huraa for their assistance in visiting and photographing mangroves on K. Huraa and to Shafiya Naeem from the Marine Research Centre for help with the Dhivehi names. Thanks also go to the teachers of Seenu Hithadhoo for actively participating in the pre-testing of these materials which has only served to strengthen the final products. Finally appreciation is expressed to many individuals who have contributed their photos for inclusion in this field guide, including Anke Hofmeister, Ahmed Riyaz Jauhary, Ahmed Saleem (Environment Research Centre), Reinhard Kikinger and Gayle Seddon.

Information summarized from several botanical and zoological websites and books including:

<http://mangrove.nus.edu.sg/guidebooks/index.htm>, <http://www.aims.gov.au/pages/reflib/fg-mangroves/pages/fgm-qld-index.html>, http://www.seagrasswatch.org/id_seagrass.html, www.fiddlercrab.info, <http://www.mangrovecrabs.com/>, www.mesa.edu.au/friends/seashores/nerites.html, Coast Conservation Department Sri Lanka's mangroves, <http://en.wikipedia.org/wiki> and <http://encyclopedia.thefreedictionary.com>.

Information from the Maldives summarized from the State of Environment Report Maldives (2004), First National Report to the Conference on the Parties to the Convention on Biological Diversity (2002), Ministry of Fisheries and Agriculture (1992) Catalogue of Plants, UNEP and WI information sheet 'Mangroves of Maldives', Dr Valeria Bers 'Biodiversity Assessment for Maldives' Baa Atoll, 2005, for UNDP/MEEW, 'Coral reef animals of the Indo-Pacific' by TM Gosliner, DW Behrens and GC Williams; Sea Challengers, 1996, Mangrove map on ERC website www.erc.gov.mv.



Contents

Section 1: Introduction 2

What is a Mangrove?	3
Benefits of Mangroves	4
Mangrove Plants	4
Mangrove Roots	5
Mangrove Leaves	5
Mangrove Seeds	6
Mangrove Flowers	8
Mangrove Names	8
Mangrove Ecosystem	9
Threats to Mangroves	9
Taking Care of the Mangroves	10

Section 2: Common Mangroves .. 11

Mangroves in the Maldives	11
1. Tall-Stilted Mangrove.....	12
2. Red Mangrove	13
3. Small-Leafed Orange Mangrove	14
4. Large-Leafed Orange Mangrove, Oriental Mangrove	15

5. Yellow Mangrove	16
6. Black Mangrove	17
7. Mangrove Apple	18

Section 3: Other Species Found in the Mangroves 19

Sea Grass	19
Fungi	20
Birds of the Mangroves	21
Fish of the Mangroves	22
Invertebrates of the Mangroves	23
1. Crabs	23
2. Hermit Crabs	24
3. Nerites	25
4. Upside Down Jellyfish	26

Section 4: Final Comments from Minna Mas..... 27

Further Reading	27
Table 1: Summary of Mangrove Names	28
Dhivehi Glossary	28
Glossary	29

FUN PAGES 30

Word Puzzle	30
Colouring Page	31

Introduction

My name is Minna Mas.
I am a fish that lives
in the mangroves.

You might have seen me swimming
in between the roots of the
mangrove trees.

The mangroves are my home
so I know them very well. In this field guide
I am going to share some of what
I know about the different types of
plants and animals that can be
found in the mangroves.



Minna Mas

What is a Mangrove?

'The term mangrove may be used to refer to both an individual mangrove plant and to the habitat, or ecosystem, in which it lives' (Lovelock 1993).

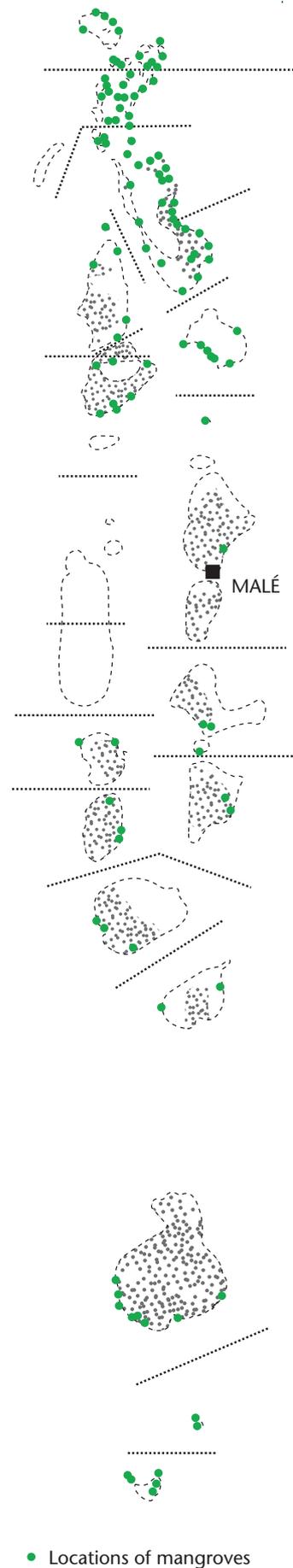
In this field guide the term Mangrove will be used in both ways: 1) to refer to a mangrove plant (e.g. Tall-Stilted Mangrove/Thakafathi) and 2) to a mangrove habitat or ecosystem (e.g. the mangroves on K. Huraa).

Where are Mangroves found?

Mangroves are found in the subtropical and tropical parts of the world, especially in muddy areas which are protected from the waves. The greatest biodiversity of mangroves occurs in South East Asia in Indonesia, Malaysia and Papua New Guinea.

There is very little documented information available on mangroves in the Maldives. With very little land area and no major fresh water to support such ecosystems, the mangroves of the Maldives are not well developed. The mangrove habitats of most islands are of a closed type, in the depressions of islands with large quantities of organic matter. However some islands have fringing type of mangroves along brackish water regions.

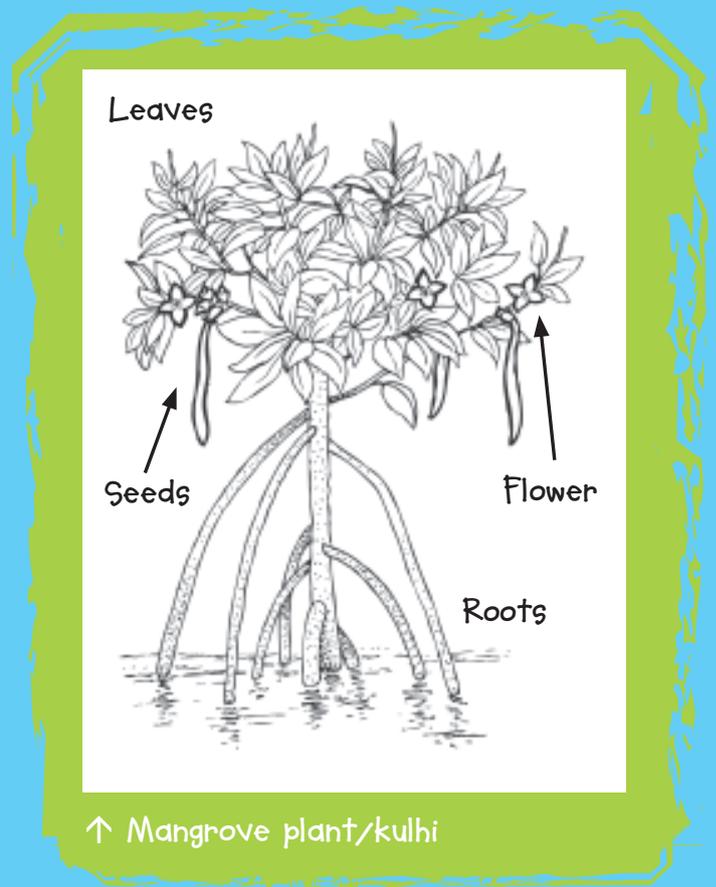
The distribution of mangroves is not even across the archipelago. Mangroves are generally regarded as being more abundant and diverse in the southern atolls. However larger mangrove habitats are also found in Shaviyani and Haa Dhaalu atolls. Some of the mangrove habitats in the Maldives are protected such as in Hithadoo in Seenu Atoll and in Huraa, in Kaafu Atoll. Look at the map showing the distribution of mangroves in the Maldives. Are there any mangroves near where you live?



Benefits of Mangroves

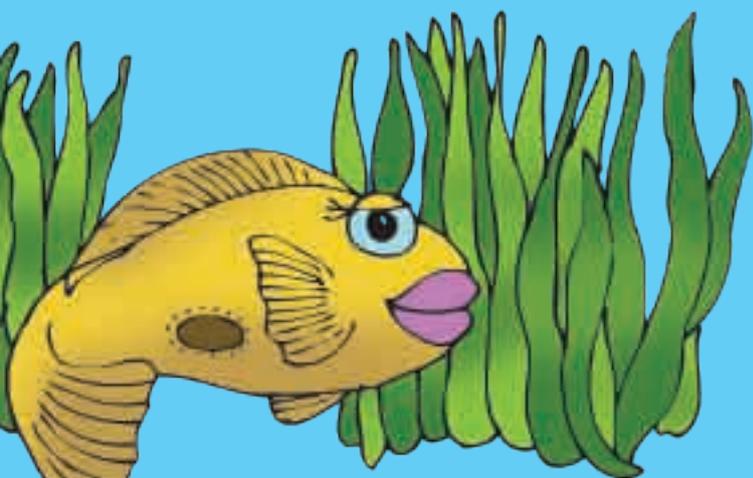
Mangrove habitats are important because:

- They have murky muddy water that give young fish a place to hide, making it difficult for predators, like birds and big fish, to catch young animals.
- Mangrove root systems anchor soil and prevent erosion in the coastal zones.
- Mangroves act as wave breakers and thus protect the coasts and the communities from strong wind, high waves and even tsunamis.
- Mangrove tree root systems trap and reduce the amount of sediment entering the lagoon and smothering the coral (silt sedimentation).
- Mangrove areas are good for breeding, feeding and nursery grounds for many fish and other animals like crabs, shrimps and shellfish.
- They provide good sources of food and income for communities.
- They provide recreation areas where children play or people might fish.
- They provide areas that may be an attraction for students or tourists to visit.



Mangrove Plants

A wide variety of plant species can be found in mangrove habitats, but of the recognized 110 species only about 54 species are 'true mangroves'. Mangrove plants have special adaptations that allow them to grow in soft, salty, oxygen low soils - something most other plants cannot do (Lovelock 1993). They have special root systems that can help them to hold tight in the mud and absorb oxygen. As mangroves are in water some or much of the time they also have special seeds – some of which can float across the ocean – that is how the first mangroves arrived in the Maldives.



Mangrove Roots

Mangroves live in mud and water all the time so they have developed special roots that absorb water from the surroundings and exclude most of the salt (from the salt water). The extensive root system also reduces erosion by holding the soil together so it does not wash away.

The roots:

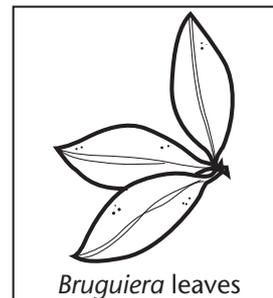
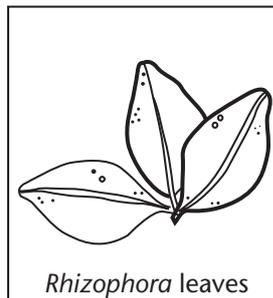
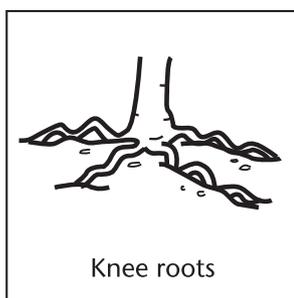
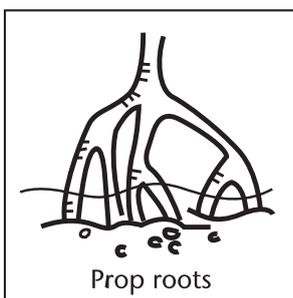
- Anchor the plant
- Absorb minerals
- Exchange gases (oxygen and carbon dioxide)

Some trees have prop roots and they can take in air through holes in their bark (called lenticels), whilst other mangroves have snorkel or peg type root-like structures (called pneumatophores) which stick up out of the soil like straws for breathing. Other trees have knee roots that look like a bent knee, whilst others have buttress roots (big roots that come out from the base of the trunk).

Mangrove Leaves

Like other plants, the green leaves of the mangrove use the light of the Sun to make food; this process is called photosynthesis. When dead leaves fall into the water, they break down providing nutrients for the soil and food for animals like crabs, prawns and some fish.

Due to the limited availability of freshwater in the salty soils, mangrove plants have developed ways of limiting the amount of fresh water that they lose through their leaves. Mangroves have a medium-sized, thick waxy leaf that helps minimize water loss. They also change the direction of their leaves to avoid the harsh midday sun, and in this way reduce evaporation from the leaves.



The *Rhizophora* has 'prop roots'. These roots can sprout from very high in the tree. The older the tree the higher the roots are located. The *Cerriops* has 'knee roots'. These roots come in and out of the soil.

The *Rhizophora* leaves have blunt tips while *Bruguiera* have pointed tips.

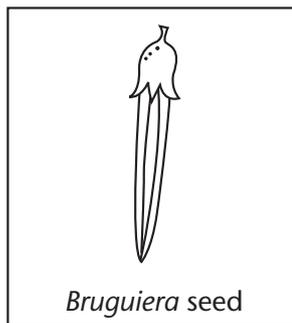
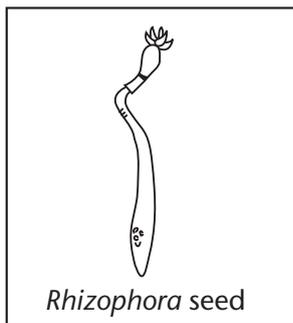
Mangrove Seeds

Mangroves usually grow in flat, soft muddy ground. When the long, thin and pointed mangrove seeds fall vertically to the ground, they are able to stick upright in the soft mud. Some mangrove trees have seeds that start to grow while they are still on the tree (called a propagule). When the young plant is big enough to survive it falls into the water or mud. Those young plants float around until they find a muddy area to grow. The seeds can float which help them spread out and

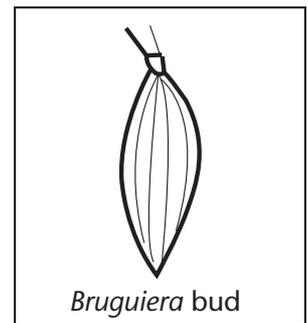
grow in new areas. Mangrove trees are constantly exposed to strong wind and waves. The new plants, when established in the soil, are able to withstand wave action.

Mangrove Flowers

The flower is often the most beautiful part of a plant. Like other plants, mangrove plants have flowers to attract pollinators (e.g. insects or birds) so that seeds can be produced that will grow into new plants. When identifying a plant it is important to look at the flower.



The *Rhizophora* seed curves at the top, while the *Bruguiera* seed is straight.



The flower of the *Rhizophora* is small and yellow, while the *Bruguiera* flower is bigger and can be white or pink.



↑ *Bruguiera gymnorhiza* (Bodavaki oh)
Mangrove seeds float in the water until they find a place to grow.



↑ *Rhizophora apiculata* seedlings
(Thakafathi oh)

Mangrove Names

All plants and animals have many names:

- 1 An official common name e.g. Red Mangrove
- 2 A scientific name written in italics e.g. *Sonneratia caseolaris*
- 3 Unofficial local names e.g. 'Kulhlhavah'

Scientists give all living things on the planet a unique name- called a scientific name. In fact they are given 2 names to identify them **using the binomial classification system**. The classification system starts from largest to smallest: Kingdom, Phylum, Class, Order, Family, Genus, Species.

For example: **Kingdom:** Plantae, **Class:** Magnoliopsida, **Order:** Myrtales, **Family:** Lythraceae, **Genus:** *Sonneratia*, **Species:** *Caseolaris*.

Mangrove Ecosystem

Mangroves are an important habitat for many plants and animals. However 'few animals use mangroves as their only habitat. Some live mainly in the mangroves, while others move in and out of the mangroves seasonally, at different stages of their life cycle or even depending on the tide' (Lovelock, 1993). A simplified diagram of a food chain to be found in the mangrove area is illustrated below:



Decaying leaves → crabs → heron

Mangrove habitats are good for breeding, feeding and nursery grounds for many fish and other animals like crabs, shrimps, insects and shellfish. Many fish from the ocean (such as barracudas, bream etc) come into the mangroves to breed and raise young fish before they go back out into the ocean. Mangroves also have a lot of organic matter for fish to eat. Mangroves have murky muddy water and root systems in the water that give young fish a place to hide, making it difficult for predators, like birds and big fish, to catch young animals. These nurseries for fish and other marine life are very important to the Maldives commercial fisheries.

Also many other animals live in the mangroves, such as crabs (kakuni). Crabs have been shown to be very important animals in the Mangroves (keystone species).

Some crabs are leaf eaters, while others eat algae or organic matter in the soil (Lovelock, 1993). Crabs scoop up chunks of sediment into their mouth and sift through the contents. After anything edible is eaten, be it algae, or other decaying organic matter, the remaining sediment is replaced in the form of a little ball. One of the most conspicuous species is the Fiddler Crab which has an enlarged orange claw. Scientists have found that when crabs are removed the mud is not as aerated and this affects the health of the mangroves. Molluscs, like nerites (golhaa), are often visible on the muddy soil around the base of Mangrove trees (Lovelock, 1993).

Many species of birds, such as Grey Herons (Maakana) and Maldivian Pond Herons (Huvadhoo Raabond'hi), can also be seen in the mangroves, usually with their head in the water eating fish. Birds may also be seen nesting in tall mangrove trees or walking between the roots of trees looking for small crabs and shellfish. Mangroves are also important for migratory birds that visit the Maldives from time to time, as well as for mammals such as flying foxes (Vaa) that can be seen roosting during the day (Lovelock, 1993).

Relationship between Mangroves and Coral reefs

In the Maldives, most of the mangroves grow in areas protected by a coral reef. The mangroves and the coral reefs have a special relationship. The coral reef breaks and reduces the force of the waves providing the Mangroves with calm waters, while the Mangrove roots act as a sieve filtering water and dirt, which can harm the coral reefs.

Human uses of Mangroves in the Maldives

In the Maldives people use Mangroves in a variety of ways. These include:

- Mangrove wood can be used in cooking, heating and constructing shelters. Mangrove wood can be used to produce charcoal, tannins for dyeing and leather protection, medicinal products, furniture, construction of fishing gear, some food and drinks, and many other products.
- Mangroves provide food in the form of fish, crabs and mussels from the mangrove waters. Vinegar and cooking oil could also be obtained from the mangrove plants.
- Bridges and poles for fish traps are also made using the mangrove timber.



↑ Mangroves have many beneficial uses.



↑ Mangroves are important ecosystems for many plants and animals.

Threats to Mangroves

Mangroves are an important part of our island environment. Many plants and animals live in them and depend on them. Sadly many people consider the mangroves to be dirty, useless and mosquito ridden places, without understanding that the destruction of these areas endangers our way of life.

Threats to the mangroves include:

- **Poor land management** – when land is cleared for construction or agricultural purposes the soil is easily washed away during heavy rains. If this soil and sediment reaches the mangrove forest it can cover the roots and kill the trees, which in turn will affect the animals that live in the water.
- **Cutting the mangrove forest** – large areas of mangroves are being cleared and filled. These reclaimed areas alter or stop the amount of fresh water entering the mangroves. Mangroves need a mixture of fresh and sea water to grow, any changes in this mixture will affect the growth and health of the trees.
- **Water pollution and rubbish** – oil from boats and spills create a thin film that sticks to the mangrove roots. Household waste like plastic bags and containers cover the mangrove areas endangering the wildlife that lives there. In some areas sewage is disposed in the mangroves, which results in algal growth that can kill the other marine life.
- **Dredging in marine areas** – leads to increased sedimentation in mangroves.

Taking care of the Mangroves

One of the greatest challenges we face in taking care of mangroves is to balance the needs of people that use it or live nearby, and the future of the mangroves as a habitat for plants and animals.

One of the most important things that we can do for the mangroves is to take responsibility for them and get involved with caring for them. Teachers, students and communities can help restore and maintain mangrove areas.

Some suggestions for taking care of the mangroves:

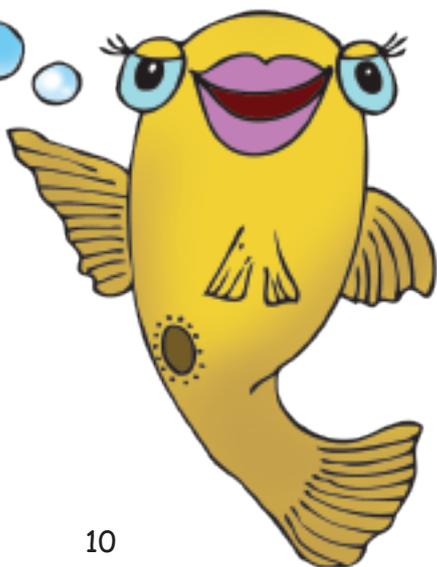
- **Education** – visit the mangrove, invite people to speak to the class, give the students awareness projects that involve people in their homes and the community, such as developing posters or information pamphlets.
- **Monitoring** – this means keeping an eye on the health and wellbeing of the mangrove forest and its animals. Check the way people are using it. Observe if the trees and other plants and animals are healthy, or if the numbers have changed. If possible keep a record of the data in the island office.
- **Awareness** – community awareness activities can be done in schools, in meetings with different groups and the local authorities. You can teach with your actions and provide a good example by the way you use and respect the mangroves.
- **Reforestation** – many mangrove areas have been destroyed. Replanting mangroves can be an interesting and good teaching and learning activity. Cuttings can be taken of the plants and grown in a nursery area in the school to be replanted in the mangrove.
- **Mangrove reserves** – the creation of mangrove reserves will ensure protection of the mangroves for the future.
- **Protection of endangered species** – healthy mangroves provide a home for endangered and protected species such as the Little Heron/Dhivehi Raabond’hi.

SAFETY ISSUES WITH STUDYING PLANTS & ANIMALS

Don't touch animals
in the mangroves; you can hurt them if you pick them up. Let them live peacefully. Watch them with your eyes – not your hands!

If you are going into the mangroves to study, **take water**, put on a hat and **mosquito repellent** and tell someone where you are going.

Don't damage plants
– it took a long time for them to grow and it might be a home for an animal, just like me!



SECTION 2

Common mangroves

In the Maldives there are 13 species of mangroves, 6 species of plant and 37 species of fungi associated with mangroves in the Maldives. The mangrove species are listed below:

Scientific name	Local name	Common name
<i>Rhizophora mucronata</i>	Ran'doo	Red mangrove
<i>Ceriops tagal</i>	Karamana	Yellow mangrove
<i>Lumnitzera racemosa</i>	Burevi	Black Mangrove
<i>Rhizophora apiculata</i>	Thakafathi	Tall-stilted mangrove
<i>Avicennia marina</i>	Baru	Grey Mangrove
<i>Bruguiera cylindrica</i>	Kandoo	Small-leafed orange Mangrove
<i>Bruguiera gymnorhiza</i>	Bodavaki	Large-leafed Orange Mangrove, Oriental mangrove
<i>Excoecaria agallocha</i>	Thela	Milky Mangrove, Blind-your eye Mangrove
<i>Heritiera littoralis</i>	Kaharuvah	Looking glass Mangrove
<i>Sonneratia caseolaris</i>	Kulhlhavah	Mangrove apple
<i>Xylocarpus moluccensis</i>	Marugas	Puzzlenut tree/Canonball tree
<i>Acrostichum aureum</i>	Maakeha	Mangrove Fern
<i>Derris heterophylla</i>	-	Mangrove Vine/Climber

Features	<i>Rhizophora</i> species	<i>Ceriops</i> species	<i>Lumnitzera</i> species	<i>Bruguiera</i> species
Height	Grows to 20 m tall.	Grows to 5 m tall.	Grows to 6 m.	Grows to 25 m tall.
Bark	Rough, brown to dark grey bark.	Cream coloured bark with dark brown spots.	Grey and fissured bark.	Dark and rough bark.
Leaves	Tips of the leaves are blunt.	Rounded leaf point, light green in color.	Small (about 7 cm long) light green, fleshy leaves with an indentation at the end.	Large (10-20 cm) leaves which occur in clumps at the end of branches.
Flowers	Small, white flowers.	Flowers are very small (<1 cm, usually 0.5 cm). Propagules are slender and long,	Small five petaled white flowers	The flowers can be red or white and remain attached to the propagule when it falls.
Seeds	1-2 cm in diameter, 20-40 cm long and tapered at one end.	Long thin brown seed.	Fruits are about 2 cm long, green and capsule-shaped.	Green and cigar-shaped, between 10 and 20 cm long.
Roots	Prop roots, mostly above the ground.	Buttress and knee roots.	Small knee type above-ground roots.	Buttresses at the base of the trunk and knee roots.
Where it is found	Occurs low in the intertidal zone, where its roots are submerged during high tides.	Often occurring as short, stunted trees, they may grow to 5 m high in areas having some freshwater influence.	Landward edge of the mangroves.	Often occurs in areas that have some freshwater input.

The *Rhizophora* species (Thakafathi & Rando) have 'prop roots'. These roots can sprout from very high in the tree. The older the tree the higher the roots are located. I love to swim around these roots as they can protect me from predators!



1. Tall-stilted Mangrove

Scientific name: *Rhizophora apiculata*
(family Rhizophoraceae)

Dhivehi name: Thakafathi

Distribution: The Tall-stilted Mangrove is found in Southeast Asia to Micronesia in the Pacific Ocean. In the Maldives it is found in Huraa (Kaafu). This species is usually found low in the intertidal zone where its roots are flooded from time to time.

Description: This tree grows up to 20 m tall, has rough, brown to dark grey bark and prop roots. The leaves are pointed with a reddish vein on the back of the leaf. The flowers are cream in colour in pairs, on a short stalk (sessile). The fruit are brown, upside-down pear-shaped. The green seed is about 30 cm long, smooth, with a rounded tip.

↑ Roots/Moo



↑ Back of leaf with reddish vein - Fathuge fahai



↑ Flower/Maa



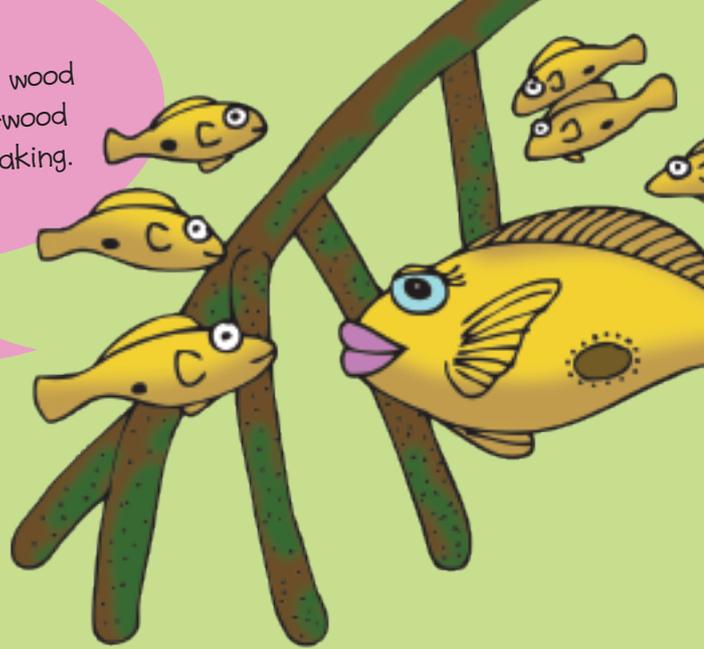
↑ Seeds/Oh

2. Red Mangrove

Scientific name: *Rhizophora mucronata* (family Rhizophoraceae)

Dhivehi name: Ran'doo

In Singapore the wood is used for firewood and charcoal-making.



Distribution: The Red Mangrove is found in East Africa to Australia. In the Maldives it is found on Huraa (Kaafu) and Baarah (Haa. Alif).

Description: The tree grows to 3 m with smooth, brown or blackish bark. The tree can have both prop roots and stilt roots coming from the trunk. The leaves have red or black dots on the underside. The flowers are yellowish white along

a slender, yellow stalk. Usually the stalk contains more than 1 flower (inflorescence). The seedling is long and straight (about 60 cm long or more), has a warty appearance with a pointed tip.



↑ Seeds/Oh



↑ Roots/Moo



↑ Flower/Maa

In the Maldives people eat the **young seedlings** as a vegetable or preserve them after boiling. The bark produces a bad smell which frightens away fish.



3. Small-leafed Orange Mangrove

Scientific name: *Bruguiera cylindrica*
(family Rhizophoraceae)

Dhivehi name: Kan'doo

Distribution: The Small-leafed Orange is found from Southeast Asia to Australia. In the Maldives it is found on Hoeddhoo (Gaaf Dhaal), Baarah, Filladhoo (Haa Alif), Huraa (Kaafu).

Description: This tree grows up to 20m tall with buttress roots and oval shaped knee roots. The leaves are light green, thin and oval shaped. The flowers (calyx) are greenish white in colour and usually grow in groups of three. The seeds are thin and slender up to 15cm long like a green or purplish pencil and often slightly curved. The bark is grey and smooth.

↑ Roots/Moo



↑ Seeds/Oh



↑ Leaf/Faiy



↑ Flower/Maa

4. Large-leafed Orange Mangrove, Oriental Mangrove

Scientific name: *Bruguiera gymnorhiza*
(family Rhizophoraceae)

Dhivehi name: Bodavaki

Distribution: This species often occurs with the Tall-stilted Mangrove (*Rhizophora apiculata*, *Thakafathi*) in areas that receive some freshwater. In the Maldives it is found in Hoeddhoo (Gaaf Dhaal), Filladhoo (Haa Alif), Gan (Laamu), Huraa (Kaafu).

Description: This tree has a dark, rough bark and may grow up to 25m tall. This tree grows with buttress roots at the base of the trunk and knee roots. This species has large leaves (10-20cm) which occur in clumps at the end of branches. The red flowers (calyx) are very brightly coloured and stand out amongst the green foliage, making it easy to identify this tree. The seeds are thick, green and crayon-shaped, between 10 and 20cm long.



↑ Bark



↑ Buttress roots/Moo

↓ Seed/Oh



When this mangrove is flowering it is very beautiful. The red calyx stands out against the green leaves. If you see this seed floating on the water you will notice that the red calyx remains attached to the seed when it falls.

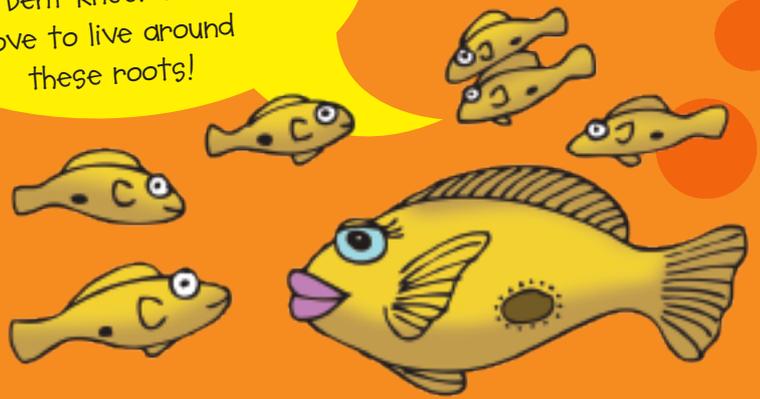


5. Yellow Mangrove

Scientific name: *Ceriops tagal*
(family Rhizophoraceae)

Dhivehi name: Karamana

The Ceriops has 'knee roots'. These roots come in and out of the soil and look like a bent knee. The crabs love to live around these roots!



Distribution: The Yellow Mangrove is found in Eastern Africa to Southeast Asia, Australia and Melanesia. It grows on well-drained soil, where tides only reach from time to time. Often occurring as short, stunted trees (especially in very salty environments), they may grow to 5 m high in areas having some freshwater.

Description: The Yellow Mangrove is a shrub or tree that can grow up to 7m tall. The tree has a smooth, cream coloured bark with dark brown spots. This tree has buttress roots at the base of the trunk and knee roots. The leaves are small (up to 7cm long), yellow-green in colour, with a blunt tip, occurring in groups at the end of branches. The leaves often face straight up in the air to avoid strong midday sunlight. There are small green-brown flower buds with pale orange petals. The Yellow Mangrove has a very long and thin seed with a yellow band at the top of the seed.



↑ Whole seed



↑ Seed/Oh



↑ Flower/Maa



6. Black Mangrove

Scientific name: *Lumnitzera racemosa*
(family Combretaceae)

Dhivehi name: Burevi

Distribution: The Black Mangrove is found from Eastern Africa to Southeast Asia, Australia and Polynesia. In the Maldives it is found in Hoededhdhoo (Gaaf Dhaal), Hithadhoo (Seenu), Kulhudhuffushi (Haa Dhaal). This mangrove likes to live near the land side of the mangrove forest.

Description: The Black Mangrove is a small tree with grey fissured bark that grows up to 6 m, with knee type above-ground roots. The fleshy leaves are light green in colour, approximately 7cm long with an indentation at the end. The flowers are white with 5 petals with many flowers growing on a stalk. The seeds are about 2 cm long, green and capsule-shaped.

↑ Flower and leaf/Maa adhi faiy



↑ Seeds/Oh



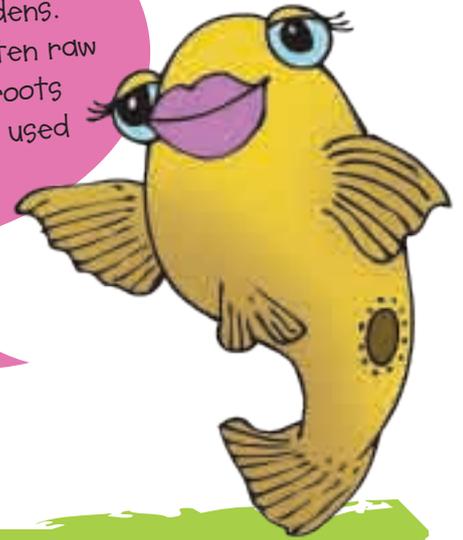
↑ Close up of leaf showing indentation at the end

7. Mangrove Apple

Scientific name: *Sonneratia caseolaris*
(family Sonneratiaceae)

Dhivehi name: Kulhivahavah

The people of Kulhudhuffushi grow this tree in their gardens. When ripe, the fruits are eaten raw or cooked. The peg type roots from this tree can be also used as corks and floats.



Distribution: The Mangrove Apple is found from East Africa to Australia, Micronesia and New Caledonia. These trees can survive in water with different amounts of salinity (saltiness). Only one of the three species of Mangrove Apple occurs in Maldives. In the Maldives it is found in Kulhudhuffushi.

Description: Mangrove Apple trees are a very tall straight tree (up to 15m) with grey-brown rough bark. This tree has thick, tall snorkel or peg type above-ground roots as shown on this page. The leaves are about 7 cm long, rounded and opposite each other on the branches. The tips of the leaves are slightly turned under. The tree can be easily identified by the dark red flowers which only open for one night. The seeds are large (4 cm wide), green and shaped like a star.

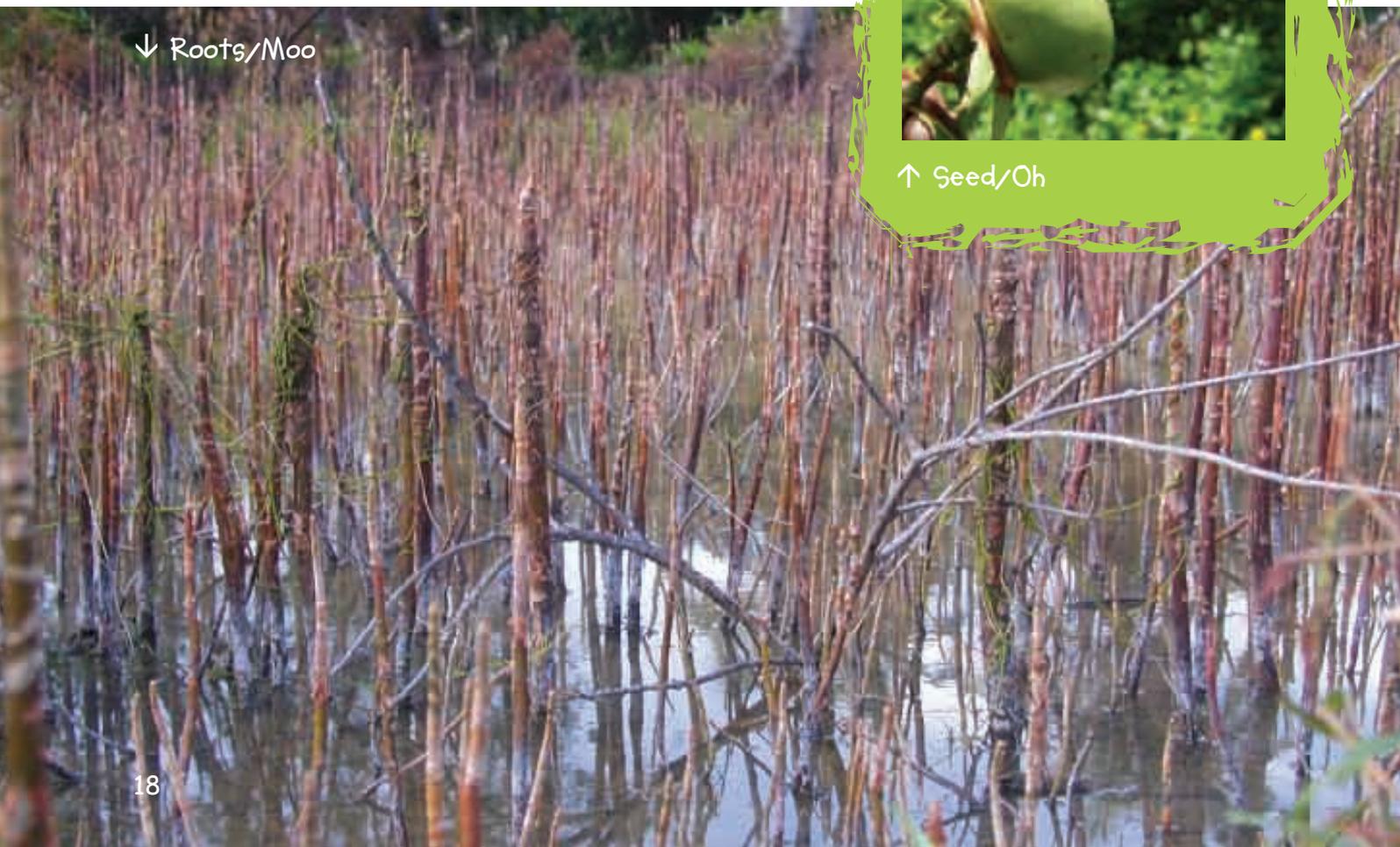


↑ Flower/Maa



↑ Seed/Oh

↓ Roots/Moo



SECTION 3

Other species found in the mangroves

Many other species of living things are found in the mangrove habitat, including both marine and land animals. Few animals use mangroves as their only habitat. Some live in the mangroves most of the time, while others move in and out of the mangroves, at different stages of their life cycle or even depending on the tide. For example barracuda and sting rays come into the mangrove habitat to breed and raise their young, and then return to the coral reef.

Sea grass/Moodhu vina

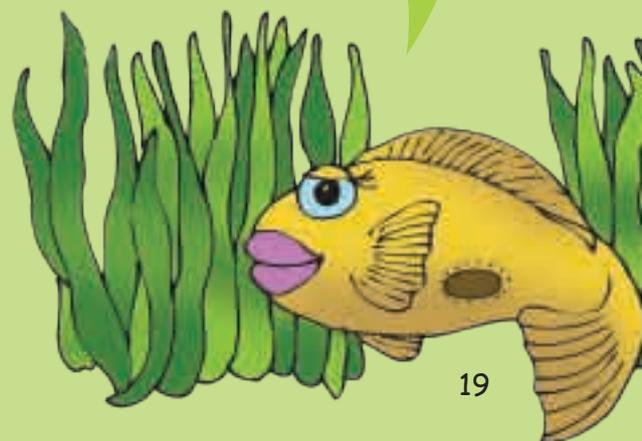
Distribution: Sea grasses are marine plants that live in seawater. They grow in sandy soils and form large underwater fields in coastal regions of the world. In the Maldives there are 5 recorded species of sea grasses, but *Thalassia hemprichii* is the most common. In the Maldives it is common on shallow reef flats and can be found in mangrove habitats, such as near Haa Alif Baarah, near Thuludhoo in Baa atoll and in Laamu atoll.

Description: This species has short black bars of tannin cells on leaf, thick roots (rhizome) and hooked/curved shaped leaves (10-40cm long).

↑↓ Sea grass/Moodhu vina



Sea grasses are not a true "grass", but are named for their ribbon-like grass appearance. These plants provide habitat, breeding, and feeding grounds for many species of fish. Just like me!



For a long time scientists believed that fungi belonged to the Plant Kingdom. However, the fungi are now considered a separate kingdom, because they have many different features to plants.



↑ Mushroom/Handi kuda

Fungi/Fungus

Distribution: Fungi can be found all over the planet and grow in a wide range of habitats. Most fungi grow in land environments, but several species occur only in aquatic habitats. Worldwide there are an estimated 1.5 million fungal species, of which around 70,000 have been described.

Description: Fungi come in many different sizes, shapes and colours. Some look like mushrooms or plate like, as in the pictures on this page. The majority of fungi are poisonous, so do not eat any fungi that you may find! Fungi along with bacteria break down most of the organic matter in almost all ecosystems worldwide. So they play a major role in many food webs, helping to recycle nutrients which can be used by other plants and animals.



↑ White Fungi



↑ Orange Fungi

Birds of the Mangroves

Birds, such as the Maldivian Little Heron can be found in mangrove habitats. The mudflats offer a rich feeding ground for birds, especially migratory birds, providing worms and shellfish for the many species that come to stay or stop

over to feed before continuing on their journey. Please refer to the field guide on birds and beaches for more information on the birds commonly found in the mangroves of the Maldives.

Birds found in mangroves	Dhivehi name	English name
<i>Amaurornis phoenicurus</i>	Dhivehi Kan'bili	Maldivian Water Hen
<i>Anas querquedula</i>	Reyru	Garganey
<i>Ardea cinerea (rectirostris)</i>	Maakanaa	Eastern Grey Heron
<i>Ardeola grayii (phillipsi)</i>	Huvadhoo Raabon'dhi	Maldivian Pond Heron
<i>Arenaria melanocephala</i>	Rathafai	Black Turnstone
<i>Bubulcus ibis (coromandus)</i>	Iruvaahudhu	Cattle Egret
<i>Butorides striatus albidulusi</i>	Dhivehi Raabond'hi	Maldivian Little Heron
<i>Egretta garzetta</i>	Kuda iagana	Little Egret
<i>Phoenicopterus ruber</i>	Gudi gudaa dhooni	Flamingo
<i>Tringa hypoleucos</i>	Fidhana	Common Sandpiper
<i>Numenius phaepus</i>	Bulhithun'bi	Whimbrel

↓ Maldivian Little Heron/Dhivehi Raabon'dhi



↓ Grey Heron/Maakanaa





↑ 1. Mullet/Mekunu 2. Milk Fish/Beyngu
 3. Tilapia/Futumas 4. Bream/Filolhu

The mangroves are also an important fish breeding habitat, so if you visit the mangroves you are likely to see different types of fish, just like me!



Fish of the Mangroves

Many fish are found in the Mangroves. These may include mullets (Dhivehi name: Mekunu) which tend to travel in groups and are recognised by their flat dorsal surface, blunt snout and a pair of large pectoral fins. They feed mainly on algae and micro-organisms. Tilapia (Dhivehi name: Futumas) are also a common fish, although they originate from East Africa. Bream (Dhivehi name: Filolhu) can also be found in the mangroves. Bream is a general term

(not a scientific name) for a number of species of freshwater and marine fish. Fish termed “bream” tend to be narrow, deep bodied species. Milk Fish (Scientific name: *Chanos chanos* Dhivehi name: Beyngu) can also be found in the mangroves. Milk fish are an important food source in South East Asia, tending to school around coasts and islands with reefs. The young fish (called fry) live at sea for 2–3 weeks, and then migrate to mangrove swamps, returning to sea to mature and reproduce.

Invertebrates of the Mangroves

More than 95% of the world's animals are invertebrates; that is they do not have a backbone. In the Maldives there have been few studies of invertebrates. However to date it has been estimated that there are 92 species of bivalves, 24 species of hermit crabs and 145 species of crabs.

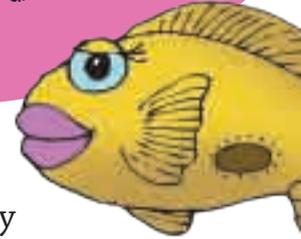
1. Crabs

Class: Crustacea (from many species)

Dhivehi name: Kakuni

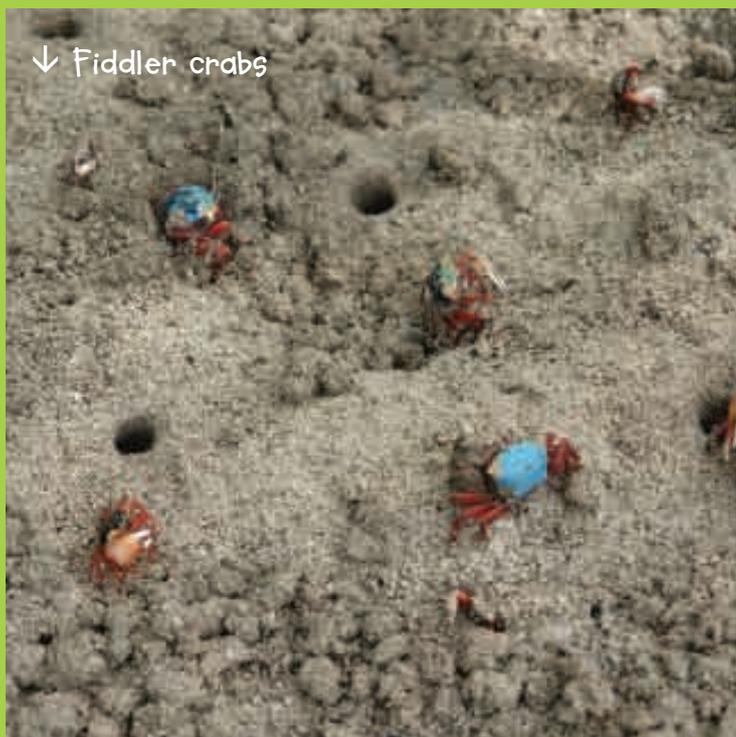
Description: Mangrove crabs as the name suggests are crabs that live in the mangroves, but may belong to many different species. Crab larvae are the major source of food for juvenile fish inhabiting the adjacent waterways, indicating that crabs play an important role in the food web. The crabs themselves are food for many birds such as the Crab Plover.

The blue crab shown in the picture is called a fiddler crab. Male Fiddler crabs are easily recognized by their oversized claw. The movement of the smaller claw from ground to mouth during feeding inspired the crabs' common name; it appears as if the animal is playing the larger claw like a fiddle (a violin type of musical instrument).



They have been shown to be very important animals in the mangroves (keystone species). The crab picks up a chunk of sediment and brings it to its mouth, where it sifts through the contents in the sediment. After anything edible is eaten, be it algae, microbes, fungus, or other decaying organic matter, the sediment is replaced in the form of a little ball. Scientists have found that when crabs are removed, the mud is not as aerated and this affects the health of the mangroves.

↓ Fiddler crabs



↑ Crabs/kakuni

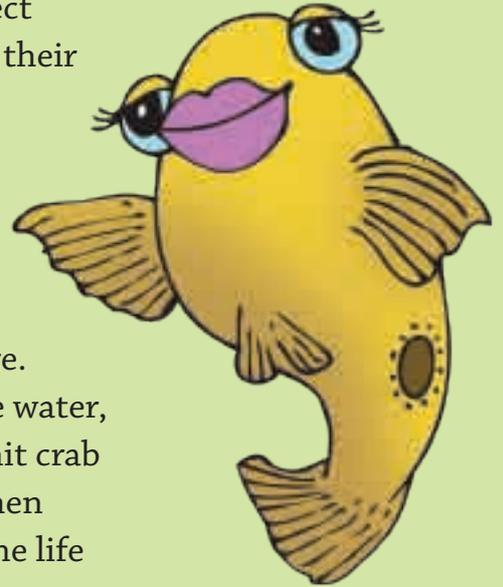
2. Hermit Crabs

Class: Crustacea, (many species names)

Description: Hermit crabs are crustaceans that have 10 legs, but they are not closely related to true crabs. Most hermit crabs pick up empty seashells to shelter and protect their soft abdomens (soft bodies) - this is where they get their name 'hermit crab'. There are about five hundred known species of hermit crabs in the world, most of which are aquatic (i.e. live in water). Hermit crabs live in the wild in colonies of 100 or more. These hermit crabs are scavengers eating algae and other organic matter.

Hermit crabs are usually born in the ocean, near the shore. After the crabs are born, they move inland away from the water, where they search for abandoned shells to live in. A hermit crab can lose its shell (molt) as often as every other month when they're young, or every 18 months when they're older. The life span of the hermit crab in the wild is up to 30 years.

As hermit crabs grow, they must exchange their shell for a larger one. There is frequently strong competition for the available shells, with hermit crabs fighting over shells. A hermit crab with a shell which is too tight cannot grow as fast as hermit crabs with well-fitting shells.



↓ Hermit Crabs





↑ Nerites/Golhaa

3. Nerites

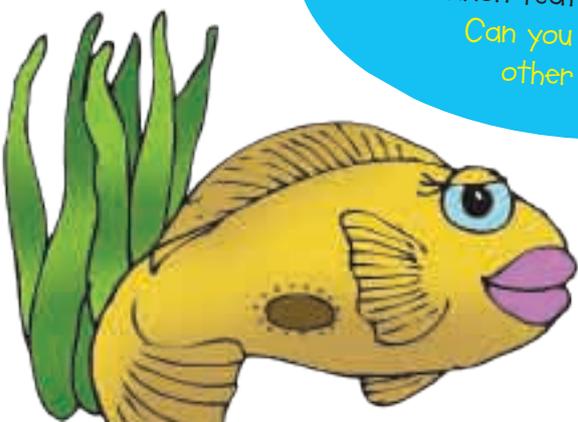
Scientific name: *Nerita species*
(family Neritidae)

Dhivehi name: Golhaa

Description: Nerites are a group of small, univalve molluscs that live in tropical waters, on rocky surfaces in mangroves. Nerites have thick shells with one opening which contains a muscular foot. The colours and markings on the shells varies from species to species. Nerites are herbivorous molluscs and feed on algae growing on the shore surface.

The Nerites is a mollusc and it moves by the help of a wide and very strong foot. This muscular foot is a common feature of all molluscs.

Can you think of any other molluscs?





↑ Upside Down Jellyfish/Firuaunu mudhaa

4. Upside Down Jellyfish

Scientific name: *Cassiopeia species*
(class Scyphozoa)

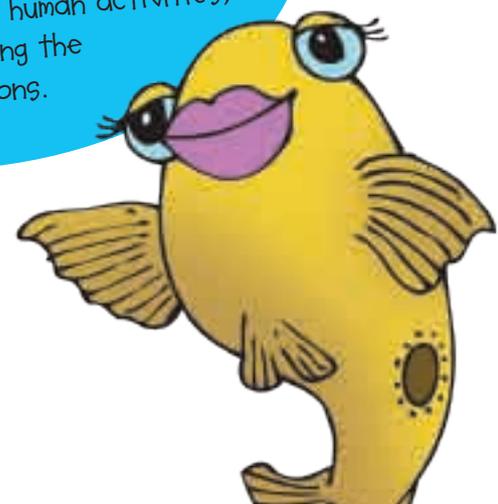
Dhivehi name: Firuaunu mudhaa

Description: The jellyfish is disc-shaped with eight-branching arms that are very fringed. Colour is brown, grey or greenish with white triangular markings around the edge of the bell. It lies upside down in shallow water, usually in calm sandy areas, taking in sunlight for photosynthesis by the symbiotic algae in its tissue which provide a steady source of oxygen and nutrients. On B. Goidhoo the Upside Down Jellyfish occurs in great numbers in the shallow mangrove bays. Furthermore they are an important food source for certain fish and turtles.



↑ Crab eating an Upside Down Jellyfish/Firuaunu mudhaa

The Upside Down Jellyfish faces great danger from the effects of global warming. Slight temperature changes cause bleaching, i.e. the loss of the symbiotic algae. Environmental change and degradation, caused by human activities, is threatening the populations.



SECTION 4

Final comments

From this field guide you can see that mangrove habitats are very special places. In fact without them many fish species like me would not have a place to live! So don't forget to look after the mangroves and animals that live there. Remember to keep learning about them at school and from your family and friends. We hope you enjoyed reading this field guide.

See you around...

Minna Mag

I told you I knew a lot about the plants and animals living in the mangroves of the Maldives. Now so do you! Next time you are walking around your island with your friends or classmates, have a close look at the mangroves and the animals that live there and see if you can name them.



Other books in this series

Field guide to Maldivian Plants with Bakuru and Basheera Bon'du

Field guide to Maldivian birds and beach ecosystems with Baaree Baraveli

Further Reading

V. Selvam (2007) 'Trees and Shrubs of Maldives' Ministry of Fisheries, Agriculture and Marine Resources, and Food and Agriculture Organisation

Environment Research Centre (2008) 'Identification of Mangroves in the Maldives'

Ministry of Fisheries and Agriculture (1992) 'Catalogue of Plants'

Weblinks:

<http://mangrove.nus.edu.sg/guidebooks/contents.htm>

- Guide to mangroves of Singapore

<http://www.aims.gov.au/pages/reflib/fg-mangroves/pages/fgm-qld-index.html>

- Field Guide to the mangroves of Queensland (AIMS, Catherine Lovelock)

<http://www.mangrovecrabs.com/>

Glossary

Biodiversity	The variety of life on earth.
Buttress root	Big roots on all sides of a tall or shallowly rooted tree.
Calyx	The group of sepals, usually green, around the outside of a flower that encloses and protects the flower bud or seed.
Decay	To rot or become rotten; decompose or break down.
Ecosystem	A community of plants, animals and micro-organisms that are linked and that interact with each other and with the physical environment.
Endangered	Threatened with extinction, as a species of plant or animal; be placed in a dangerous situation.
Foliage	The leaves of a plant or a tree.
Germinate	To start to grow from a seed or spore into a new individual, or cause a seed or spore to do this.
Habitat	The area where an animal, plant or micro-organism, lives and finds the nutrients, water, sunlight, shelter and other essential needs for survival.
Herbivore	An animal which eats only plants.
Inflorescence	A flowering structure that consists of more than one flower.
Intertidal zone	An area of the shore that is exposed during low tide and under water at high tide.
Invertebrates	Animals without a backbone, such as insects.
Keystone species	A species so critical to an ecosystem that its removal could potentially upset or destroy the entire system.
Molting	The process during which an animal sheds all or part of its shell, feathers, hair, or skin.
Migratory	Moving from one region to another, usually at the same time every year, in order to breed or avoid unsuitable weather conditions.
Nutrients	Substances found in nature that animals and plants need to survive.
Organism	A living thing such as a plant or animal.
Photosynthesis	The process by which green plants or algae use sunlight to produce carbohydrates (starch). Oxygen is released as a by-product of photosynthesis.
Propagule	A seedling ready to go which can produce its own food via photosynthesis.
Species	A group of organisms that has a unique set of characteristics that distinguishes them from other organisms.
Symbiotic	A close association of animals or plants that is often of mutual benefit.

Now that you know all about the plants and animals that live in the mangroves, see how many words you can find **hidden** in the following puzzle. There are more than 20 hidden words.

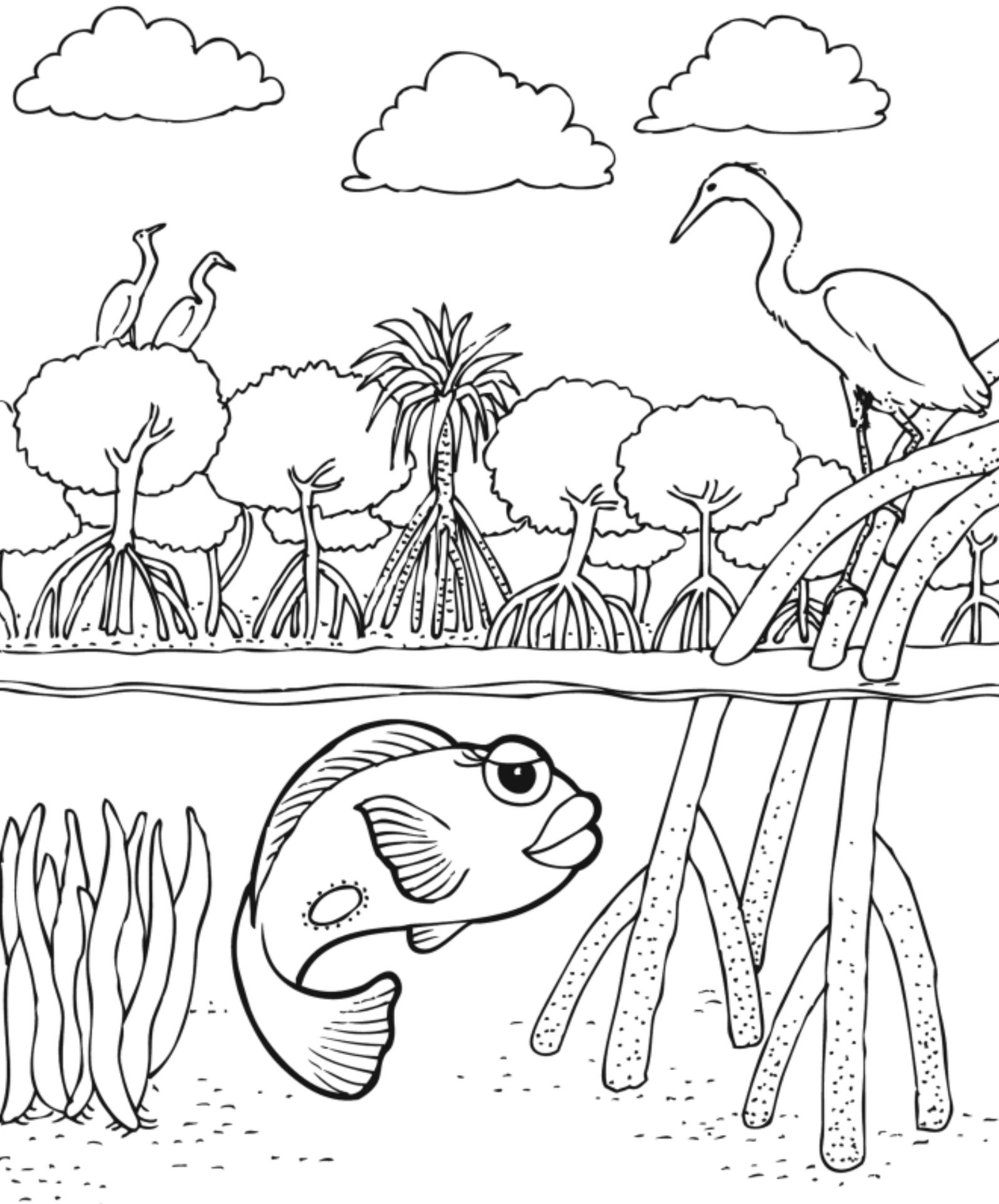


FUN PAGE:

MANGROVE WORD PUZZLE

C	Q	G	R	H	I	Z	O	P	H	O	R	E	W	M
R	I	R	A	N	D	O	O	U	Y	T	R	E	A	A
A	W	E	O	P	B	A	R	K	L	K	J	S	H	L
B	E	Y	L	C	I	X	Z	A	S	H	D	F	G	D
V	T	M	U	B	R	N	M	L	A	K	J	H	G	I
E	L	A	M	K	D	W	Q	B	A	S	S	D	F	V
R	A	N	N	N	T	Y	I	U	O	R	P	I	Y	E
P	N	G	I	U	E	T	R	S	E	I	C	E	P	S
R	D	R	T	R	A	A	S	W	R	C	V	B	N	M
O	S	O	Z	T	D	F	O	G	O	O	D	N	A	K
P	F	V	E	S	A	L	A	Z	X	C	V	B	N	M
R	E	E	R	T	F	N	M	B	V	C	X	Z	C	A
O	U	T	A	R	N	E	W	Q	L	E	A	V	E	S
O	I	O	T	I	R	T	Y	U	I	H	G	D	R	S
T	J	L	M	U	L	L	E	T	G	F	D	S	I	A
S	T	O	O	R	S	S	E	R	T	T	U	B	O	Z
S	I	S	E	H	T	N	Y	S	O	T	O	H	P	X
Q	W	E	R	T	Y	S	S	A	R	G	A	E	S	C
R	M	A	N	G	R	O	V	E	A	P	P	L	E	V
G	H	J	K	L	O	M	A	N	G	R	O	V	E	S
Q	S	E	E	D	S	A	S	D	F	G	H	J	K	L

Answers to word puzzle on page 28.



See you around...
Minna Mas

