

MANGROVES



This book
is a part of the
Honavar coastal
ecosystem series

Activities in a mangrove by
Dakshin Foundation

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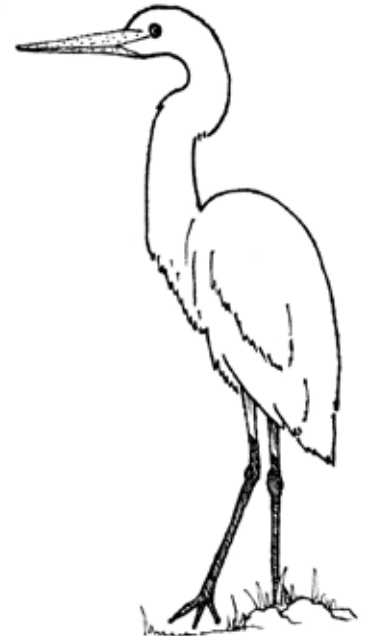


MY NAME IS: _____

I LIVE IN: _____

I AM IN CLASS: _____

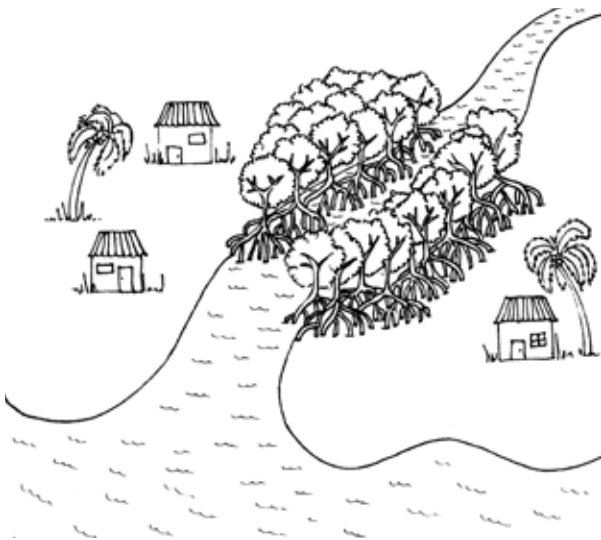
I GO TO SCHOOL: _____



INDIA'S MANGROVE ECOSYSTEM

Have you walked through a mangrove forest and thought about how the mud feels between your toes? Mangrove swamps are usually found in areas where fresh water sources like streams, rivers or rivulets mix with seawater. The river constantly deposits clay and silt resulting in the squishy black mud beneath your feet. These swamps also experience tides from the sea, alternatively being covered by water and being exposed to air. This means that these communities need to thrive in salty water and coastal soils.

Of the world's total mangrove cover, India has the 4th largest cover of these fascinating and productive systems. In fact, the world's largest, single continuous stretch of mangrove forest is the Sundarbans, and is shared between India and Bangladesh. Of the total mangrove cover in India however, the west coast has only 27%, found in patches all the way from Kutch to Kerala.



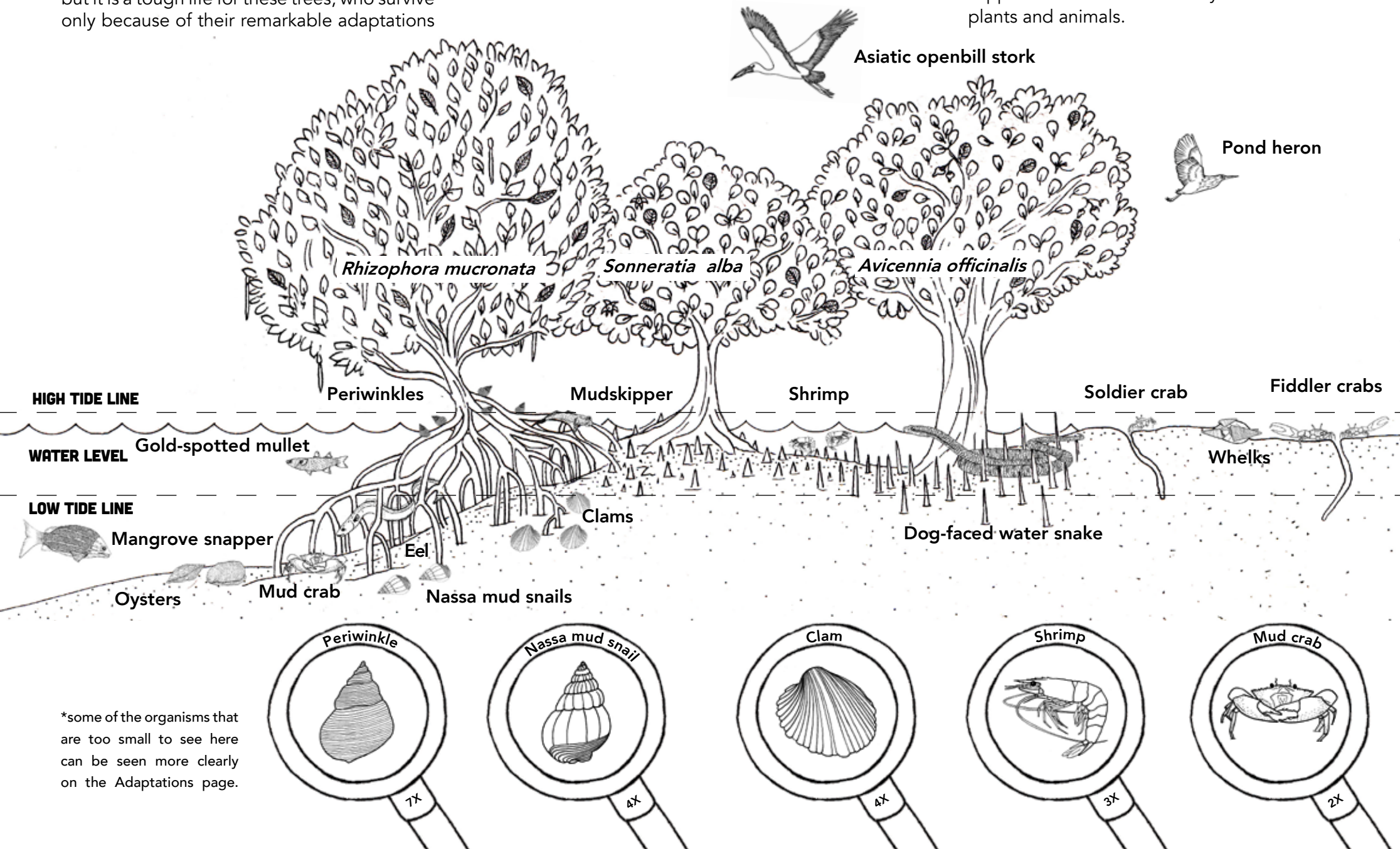
Distribution of mangroves in India



LIVING IN A MANGROVE

Mangrove trees characterise a mangrove forest but it is a tough life for these trees, who survive only because of their remarkable adaptations

to grow in salty, sticky, waterlogged soil that has very little oxygen. Not only are they able to make the best of it, but are also able to support a diverse community of associated plants and animals.



*some of the organisms that are too small to see here can be seen more clearly on the Adaptations page.

WHAT DO YOU SEE?

Walk around the mangroves and name different things that you see that fit the clues on the list. If you don't know what they are, draw them in the space provided. You will be surprised to see how much you notice when you look closely!

1. Something pointy.
2. Something that is soft and squishy.
3. An animal with more than 2 legs.
4. Something man-made – where did it come from?
5. Something that can only live in the water.
6. Something that looks like it should live in water.
7. Something that is hiding. Describe how it is hiding.
8. Something that has bumps on it.
9. An interesting smell. Describe it.
10. Something that hangs onto the roots and is hard to lift off.
11. Something that can make its own food.
12. Something in a cluster or a group.
13. Something that you are scared of.
14. Something that is brightly coloured.
15. Something that isn't already on this list!

Compare your answers with the students in your class to see how differently people observe the world!

HOW MANGROVE TREES COPE

Mangrove trees are masters of adaptation, and seem to have developed superpowers in order to ensure their survival and growth in this harsh landscape.

Over the next two pages, we will look at some of the challenges they have to face and the ways in which they overcome these.

Mangrove roots

One of the most obvious and unusual aspects of trees in the swamp are their pronounced, exposed roots. Mangrove trees grow in water-logged soil with low oxygen levels and the constant movement of water.

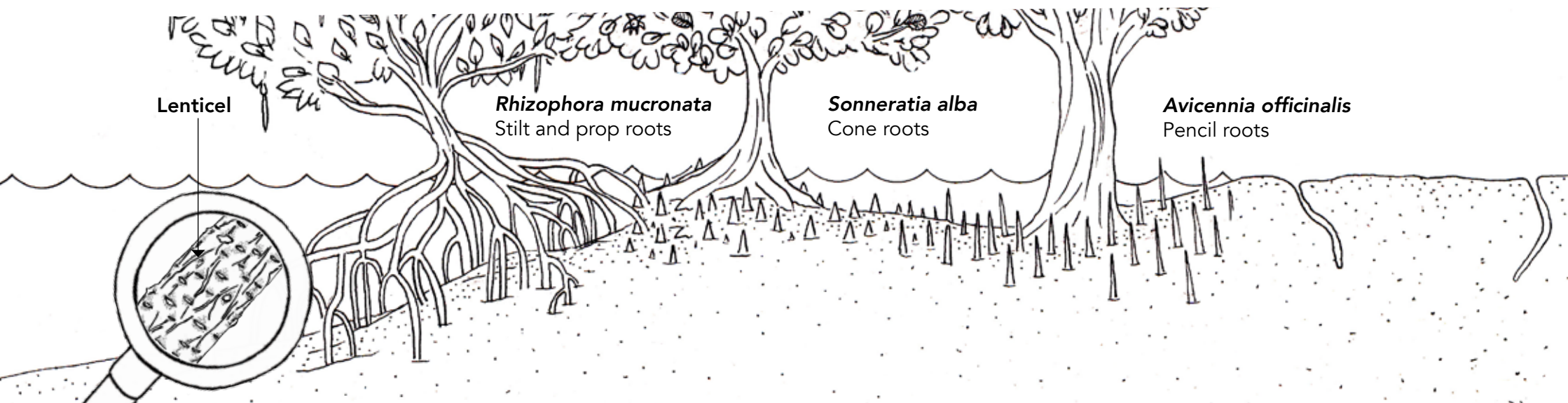
They have specialised root systems that form a maze that help them to anchor firmly to the ground and prevent them from toppling over with the moving tide and shifting soil. Little bumps that are breathing pores called lenticels on these aerial allow gas exchange/ breathing in water logged soil. During high tide, water is unable to enter these pores and

no gas exchange occurs.

The wide, arched roots or stilt roots of *Rhizophora* are the sturdiest of them all. These trees are additionally supported by prop roots that grow down from the branches and anchor themselves into the soil. It is for this reason that *Rhizophora* are found fringing parts of the coastlines which are prone to the harsher action of waves.

Avicennia trees have an underground root system that grow outwards from the tree. This helps stabilise the tree but can't be used to breathe in the water-logged soil. Instead, from these roots emerge pencil roots at regular intervals. Pencil roots or pneumatophores function like snorkels for the tree, allowing the tree to breathe. Since the pencil roots are only about 15 cm above the ground, they lie in areas where they get complete exposure to air every 6-8 hours.

Like *Avicennia*, *Sonneratia* also have pneumatophores, except theirs are cone-shaped!



Dealing with excess salt

Too much salt can kill plants but the roots of mangrove trees have an inbuilt water filtration system that allows them to draw in mostly freshwater. They are able to filter out as much as 90% of the salt in sea water as it enters their roots.

The leaves of mangrove trees have a waxy coating to prevent loss of water through the leaves, much like desert plants. They also have salt glands underneath the leaves to make sure that any salt that enters the plant can be removed. If you lick the underside of leaves (don't do it without adult supervision!) you will notice a slight saltiness to them.

Some ingenious plants store excess salt in old leaves and bark. When the leaves drop or the bark sheds, the extra salt gets removed with them!

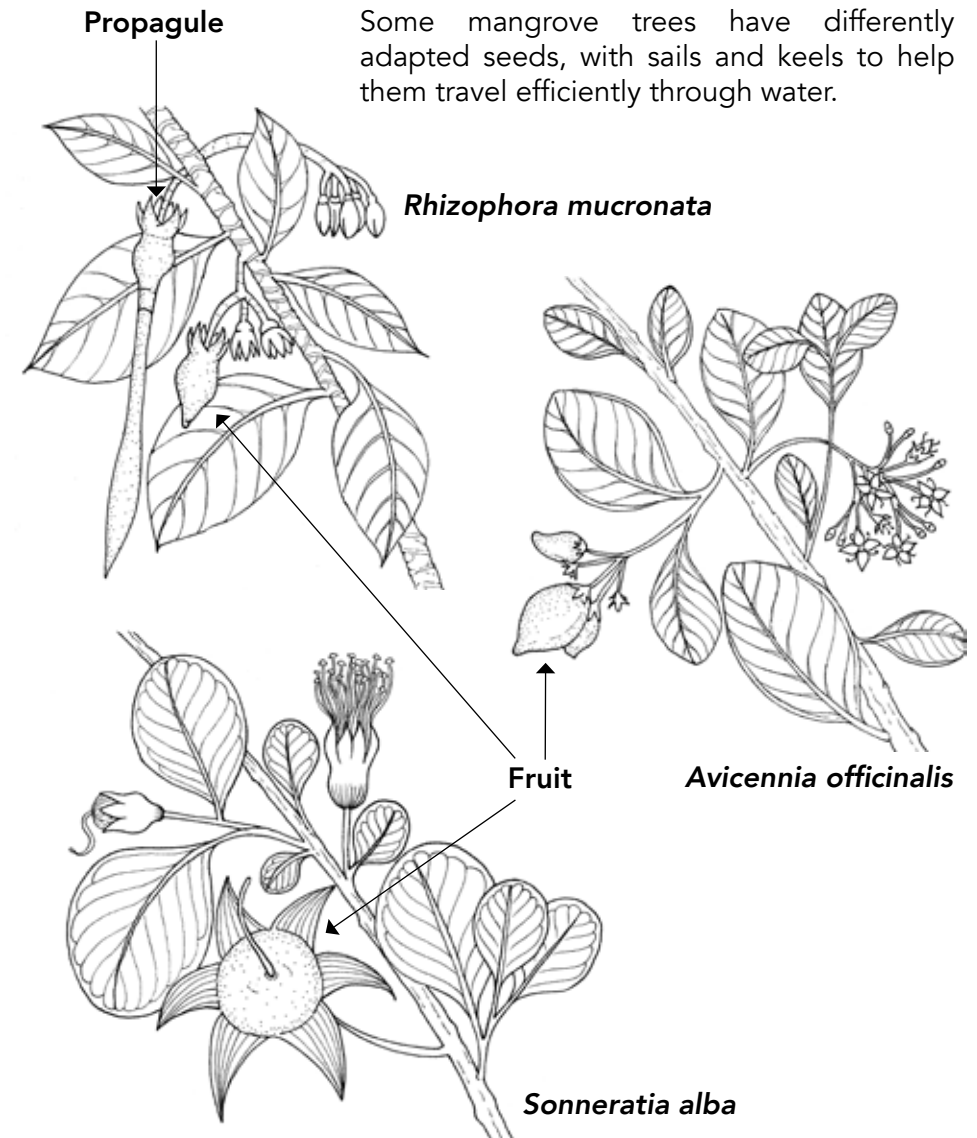
Reproduction

Mangrove trees produce flowers, fruit and seeds like all other flowering plants do. The interesting difference though, is that these seeds do not fall to the ground or get carried away, to then sprout and grow, as one might expect. Instead, after flowering, the seed remains on the tree, and continues to grow or germinate while it is still attached to its mother! This is called vivipary.

Only once the seedling has developed does the baby tree or sapling drop. It often drops straight into the mud or at times it floats along creeks and coastal waters, until it touches soil to anchor itself. The seedling is called a propagule. The propagule is designed with

an additional bean-like growth that functions as its float and anchor; this is weighted in a manner that ensures the sapling remains upright while afloat. This strategy increases the chances of survival of the seed and sapling in a habitat that is flushed by sea water every day.

Some mangrove trees have differently adapted seeds, with sails and keels to help them travel efficiently through water.

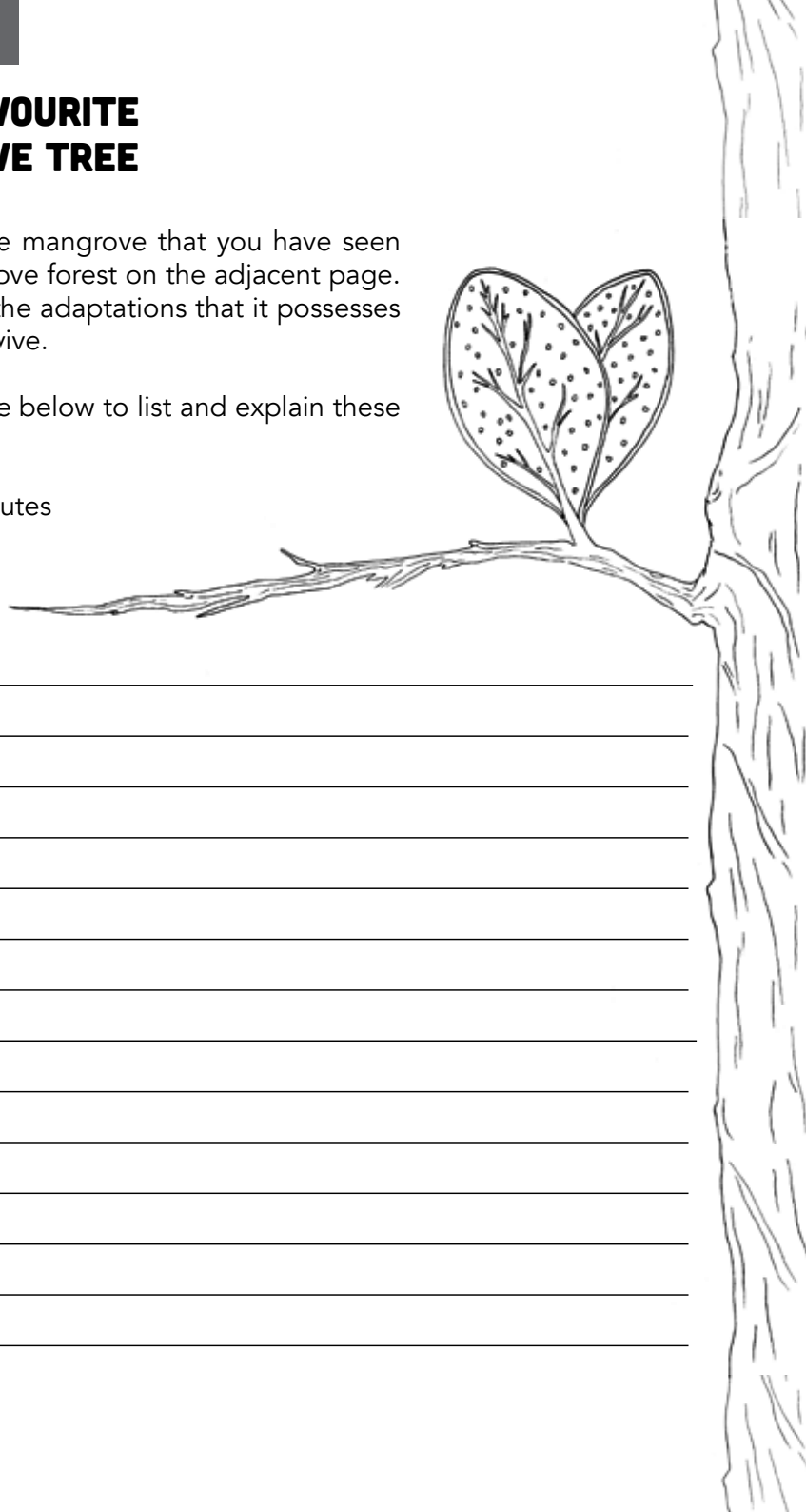


YOUR FAVOURITE MANGROVE TREE

Draw any one mangrove that you have seen in the mangrove forest on the adjacent page. Mark out all the adaptations that it possesses to help it survive.

Use the space below to list and explain these adaptations.

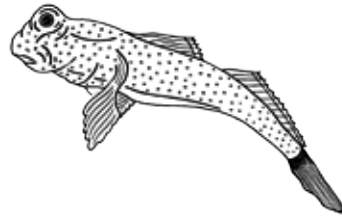
Time: 30 minutes



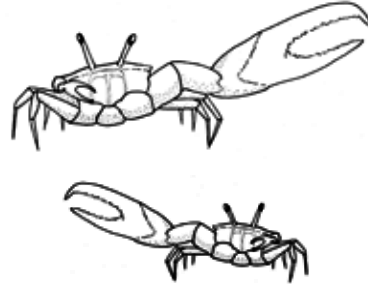
ADAPTATIONS OF MANGROVE CRITTERS

Animals in a mangrove forest have also adapted themselves to live in a mangrove forest.

Mudskippers have fins in the front that have developed in such a way that they allow them to hop when outside the water. They also have water storage sacs behind their eyes that keep their gills moist and oxygenated when on land.



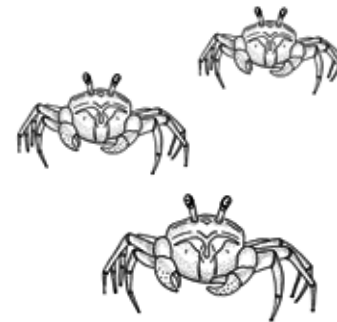
Fiddler crabs are mostly terrestrial and are most active at low tide, which is when they feed. They make burrows in to which they retreat during high tide, plugging the opening with mud or sand.



Mangrove whelks are often seen in large clusters to help them keep cool and moist. They can close the opening to their shell, called the operculum, to retain moisture when out of the water.

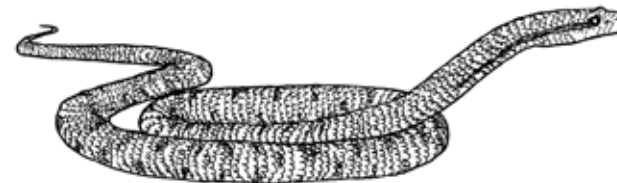


Oysters are bivalves - an organism with two shells that are jointed at one end. One shell is cemented to mangrove roots, snail shells or rocks and the other that can close tightly shut to retain moisture when the tide goes out.



Soldier crabs, much like fiddlers, also come out in large numbers to feed at low tide. They possess hair that absorbs moisture and modified leg segments that can absorb oxygen from the air. During high tide, they burrow into the sand or mud, taking a small bubble of air with them to last them through the high tide.

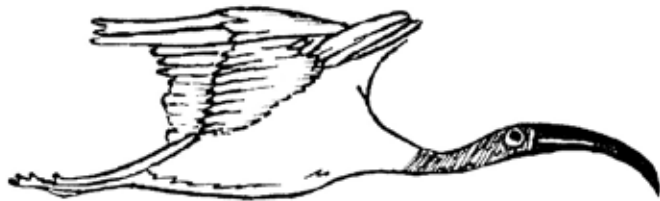
Dog-faced water snakes have nostrils that can be closed by a valve-like structure. They also have salt-secreting glands that help them deal with excessive salt water.



BIRDS IN THE MANGROVES

Mangroves attract birds that fly in and out to feed and to breed.

Across these two pages are some common birds that you are likely to spot in the mangroves. Mark the ones you have seen.

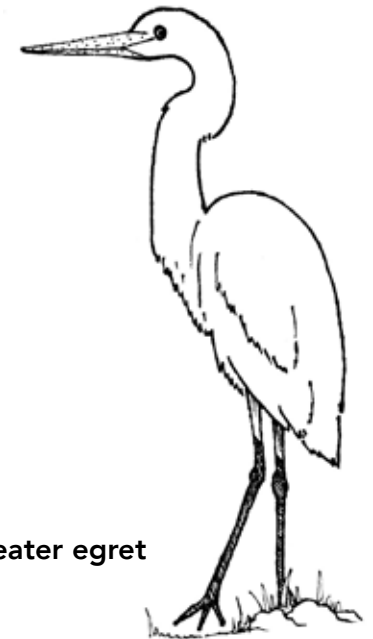


Oriental white ibis

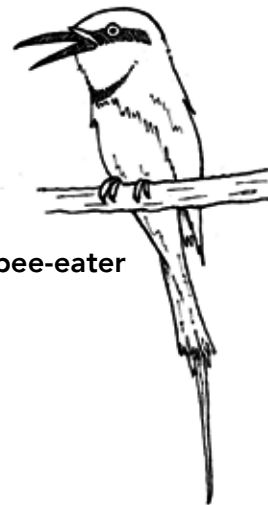
White bellied kingfisher



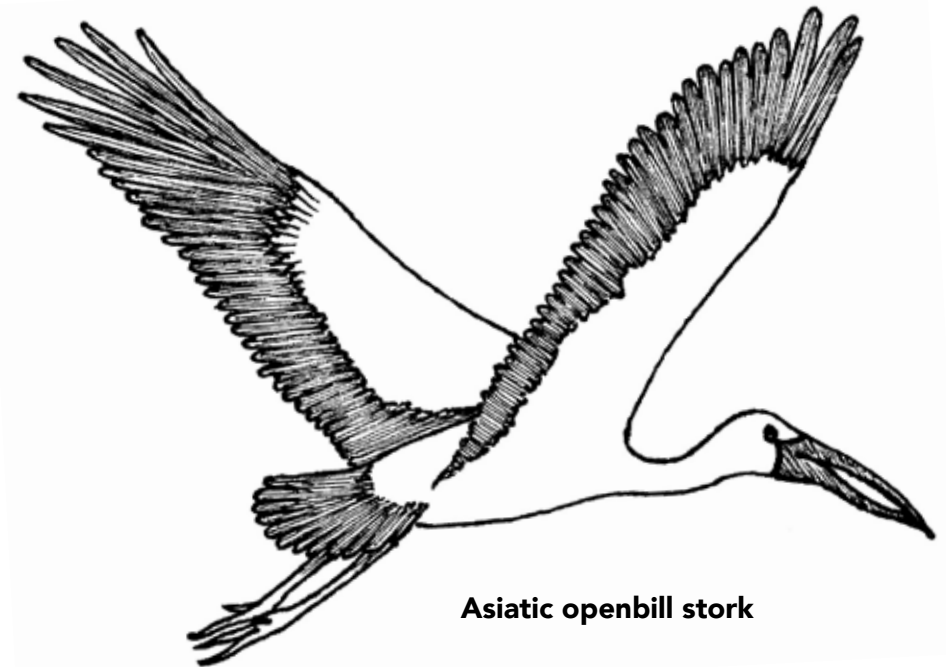
Greater egret



Green bee-eater



Little cormorant



Asiatic openbill stork

WHAT ARE THE BIRDS UP TO?

One way of distinguishing birds is by listening to their call. This is especially useful when you are unable to see them. The goal of this activity is to sit in silence and listen to what the birds have to say.

Time: 40 minutes

Materials Required:

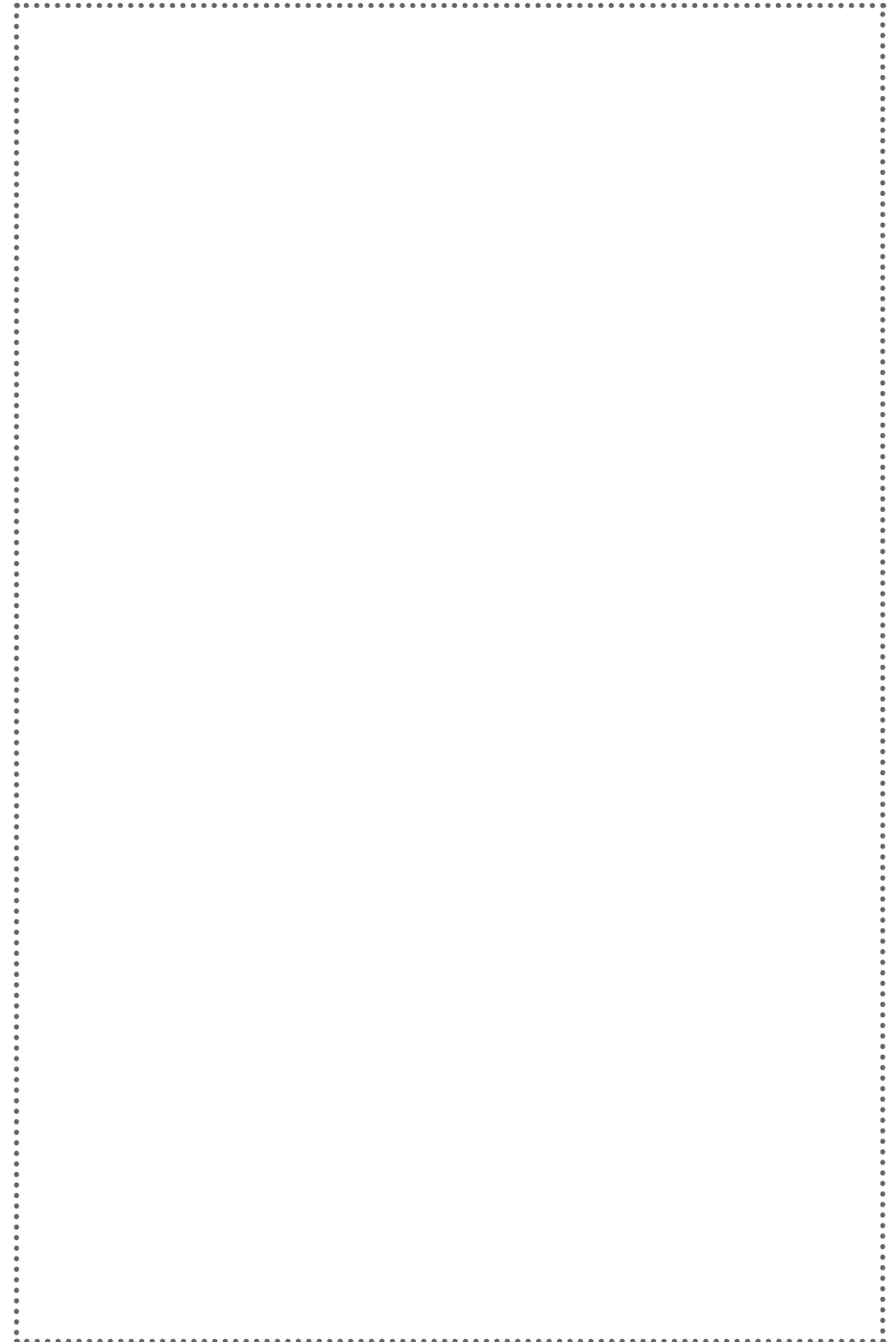
- Bird identification guide

Mark an 'x' on the adjacent page, representing where you are standing or sitting in the mangrove. Wait in silence. When you hear a sound, mark the location from where you think the sound is coming on the page, turn towards it without moving from your spot and try and spot the bird.

If you are able to see the bird, write down its name or its description next to its location on the page with the help of the identification guide. If you can't identify it, try and describe the sound it made.

Once done, discuss the following questions with your classmates:

1. How many different sounds did you hear?
2. How many sounds were you able to link to a specific bird?
3. Which sounds did you like best?
4. Which sounds did you like least?
5. Were there sounds you had never heard before?



IMPORTANCE OF MANGROVES

Mangroves are hard workers and are an irreplaceable link to maintain stability between land and sea. The mangrove swamp depends on the mangrove trees that create large amounts of food in the form of dead leaves, branches and seeds, and provide shelter for a variety of animals. Some of the important functions they serve, that often go unnoticed by us are:

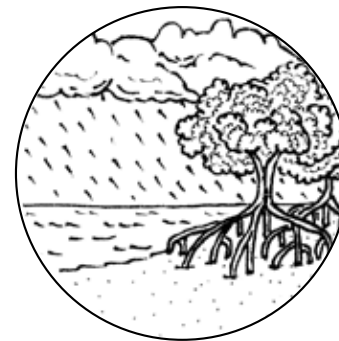
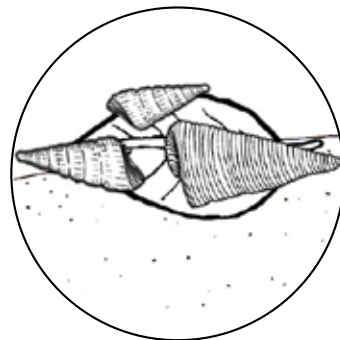
Supporters of biodiversity

Mangroves are rich and important feeding grounds for a wide range of animals from various habitats, who visit this area to eat. Birds, snakes and predatory fish are some of the animals that come here to hunt and feed.

Fish, prawns, and crabs find mangrove waters safe to breed in. Their young ones have a better chance to survive and grow here – with plenty of food from strong ocean currents and and shelter from large predators.

Sites of nutrient cycling

Fallen mangrove leaves are the beginning of an important food chain called the detritus food chain. Detritus means dead and decaying matter. These fallen leaves are food for many species of worms, insects, crabs, molluscs and fish. Bacteria and fungi first decompose this dead matter, which in turn, form the food for larvae and juvenile fish growing in the mangroves. Animals like crabs and snails feed on everything that falls on the wet ground. These smaller animals are then eaten by larger fish, birds, reptiles and other carnivores thus supplying the mangrove food chain with nutrition at every level.



Many of these processes are invisible to us and take place at a microscopic level beneath our feet. In fact, the strange smell that you might notice when your feet sink into the slushy ground is from gases that are produced during decomposition that often remain trapped underground. The nutrients that are created during the process of decomposition however, are used by the plants in the area to provide them with supplements to grow.

Protection of the coasts from storms, erosion and floods

Fresh water that flows from land to sea carries with it fine mud called silt, along with leaves and other nutrients. The complex root systems of the mangroves act like a sieve, trapping a large amount of these. If this silt were to flow into the ocean, it could blanket offshore coral reefs and sea grass meadows, causing damage to them.

This depositing silt causes land to grow and expand into the sea. The nutrients that get trapped in the bargain become food for the numerous plants and animals of the mangroves.

In the case of floods, water flowing into mangroves spread out into these giant bowl-like features, losing their speed and force. The thick vegetation also helps prevent the erosion of river banks and damage to sea grass beds and coral reefs.

Additionally, mangroves act as shields that protect the coast from huge waves, mighty winds and cyclones, protecting what lies beyond it.

THREATS TO MANGROVES

Mangroves are often considered unproductive and smelly and more than 35% of the world's mangroves are already gone. Threats to mangroves and their habitats are manifold.

Clearing

Mangroves around the world are reducing as coastal areas are cleared for urban and industrial development including agricultural land, settlements and harbours.

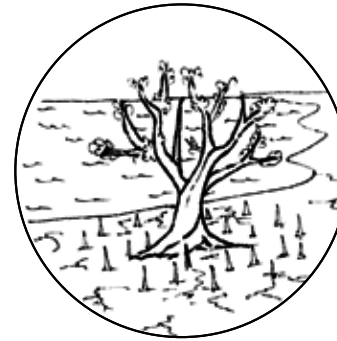
Mangroves are also actively cleared to make space for aquaculture and for tourism based development for quick economic returns.

Mangrove wood is known to be hardy, and mangrove trees are routinely cut down to be used as firewood and matches, to make ropes using its bark, and to make pillars for jetties and other small structures that are exposed to water.



Overfishing

Overfishing in some areas can greatly affect the balance of mangrove systems. Since it used as nursery ground, removal of young fish can have a strong negative impact on the marine food web.



Water supply changes

Construction can block off sea water and/or fresh water flow causing the salinity or the amount of salt in the water in the mangroves to change. A very high salinity can cause mangroves to die and too little fresh water can cause mangrove forests to dry out.

Additionally, increased erosion due to land deforestation can increase the amount of sediment flowing into rivers, causing mangrove forests to suffocate and die.



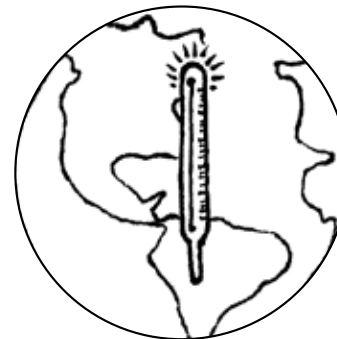
Pollution and trash

Pesticides, fertilizers and other man-made chemicals carried by rivers can kill animals living in mangrove forests. Litter can also cause the death of animals living here due to choking or entanglement.

Global warming

Global warming and change in weather patterns are a huge threat to the mangrove ecosystem. Because of a rise in sea level the water gets saltier and their exposure to air decreases.

Extreme weather events such as typhoons and floods become likely to occur more often, thus causing greater destruction of the mangrove forests.

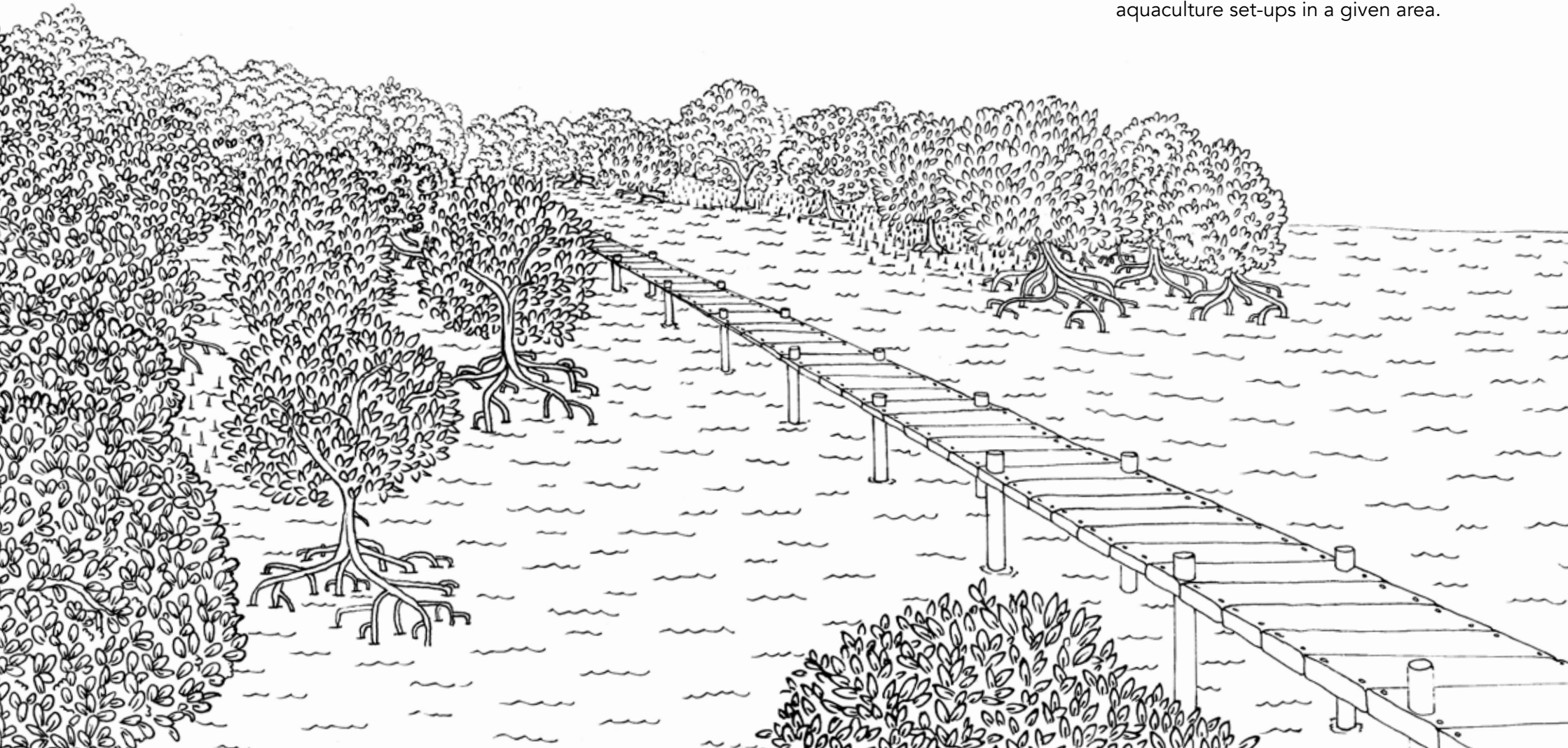


BRINGING THE MANGROVES BACK TO LIFE

Even in the Honnavar region, mangroves have been reclaimed for various reasons, as mentioned already. However, in recent years, efforts have been made by the forest department to restore degraded mangroves by establishing nurseries and to replenish degraded mangrove areas through artificial regeneration.

More can be done in the form of:

- Building mangrove walkways that allow tourists and locals to observe and explore mangrove ecosystems without causing them damage.
- Stopping mangrove wood extraction and sale of mangroves thus resulting in a reduction in dependence on mangroves for resources.
- Consulting with experts and setting policies to control the number of aquaculture set-ups in a given area.



TRACKING CHANGES

Everything changes over time, and mangroves are no exception. How have mangroves in your locality changed over time? Interview elders in a village to understand what has changed and what this means for them.

If you are conducting this interview as a class, set-up a meeting with only one person so all of you can ask questions together. Make sure you maintain order while asking your questions as a group, ask questions in turn and pay attention while others are speaking. Don't forget to introduce yourself before the interview and thank the person for giving you their time!

Remember, conducting an interview is hard work so prepare a list of questions before your interview and try to capture the importance of the mangroves for your community.

Given below are a list of sample questions. What would you like to ask in addition to or instead of these? Remember to record your answers so you can share your findings later.

Sample questions:

1. Are the mangroves of importance to you?
2. How do you use them?
3. Do you see them being mis-used?
4. What is being done to prevent this?

Additional questions:



Answers:

After the activity, spend 10 minutes to share and discuss your findings with your classmates, friends or family.



FEEDBACK

Attached is a postcard addressed to *Dakshin Foundation*, the organisation that put this activity booklet together. We would love to hear about your experience at the beach. Complete the activity and write us a note at the back. Mail it to us from the nearest post office. We look forward to hearing from you!

There are five things that are wrong with this picture. Circle the parts that are incorrect and write one word next to it to indicate why.

POSTCARD

Dakshin Foundation, Flat no
A-001, Samvridhdi Gardenia
Apartments, 88/3 Byataranapura,
near Sahakar Nagar A Block,
Bangalore 560092

