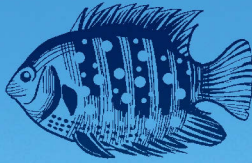
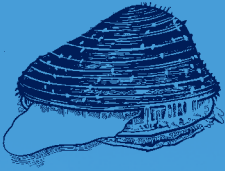
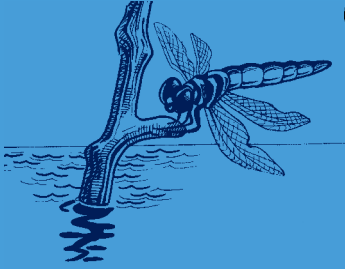


# ***The Sahyādrī***

**(Western Ghats)**

## **Freshwater Biodiversity**



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## What is biodiversity?

The word 'Biodiversity' is the short form of Biological Diversity. Biodiversity is a word used to describe the variety of life found on Earth. Biodiversity includes all living things like plants, animals, fungi, algae, microbes, their habitats and genes. Biodiversity is crucial for the functioning of ecosystems which provide us with products and services without which we could not live.

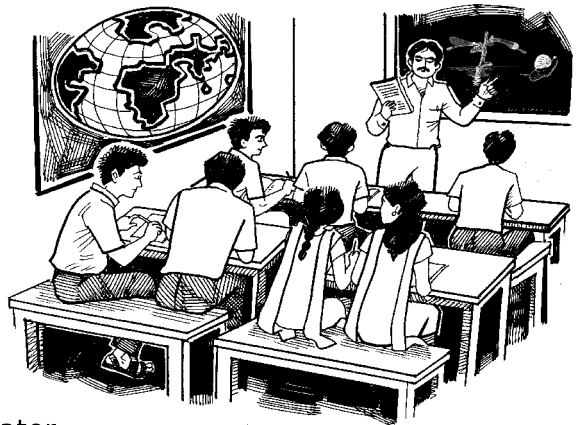
Biodiversity occurs in three levels: 1. Species level 2. Ecosystem level and 3. Genetic level.

Species: Species are all around us and we know that there are about 1.8 million species of them. All species are categorized into 5 groups (kingdoms) eg. Animals, plants, fungi, algae and microbes.

Ecosystem: Species live on the earth, live together interact with each other and for this each species require a particular type of home or habitat for its unique biological characters. Those habitats or homes are called ecosystems.

Genes: The variability in the genetic make up among individuals within a single species. Genes and its diversity are responsible for variation within species. This variation occurs between species (every biological entity), populations and communities.

Water supports all life on Earth.



## What is freshwater?

Freshwater is defined as water having a very low salt

concentration – usually less than one percent. Freshwater is the most important natural resource on the planet. Freshwater ecosystems include streams, lakes, wetlands and underground water, and all the freshwater species that live in.

## What is Freshwater Biodiversity?

Biodiversity within freshwater ecosystems are know as freshwater biodiversity. Freshwater ecosystems are closely interconnected with terrestrial ecosystems.

## Importance of Freshwater Biodiversity?

The freshwater ecosystems provide services to human development. These services include food, fiber, medicine, climate regulation, flood and natural disaster mitigation, nutrient recycling and drinking water purification. These ecosystems are also essential for production of energy, transport, recreation, tourism, and as habitat for animals and plants. These services are very expensive to replace. The biodiversity of freshwater ecosystems is declining faster than that of any other ecosystems.

In order to stop or reverse the decline in freshwater biodiversity, we need to learn more about the importance of this ecosystems.

## Facts about Western ghats (The *Sahyādrī*)

**Length:** 1490 km from Tapi Valley in Gujarat to Kanyakumari in south

**Total area:** Approximately 1,60,000 km<sup>2</sup> (leaving the Palghat gap)

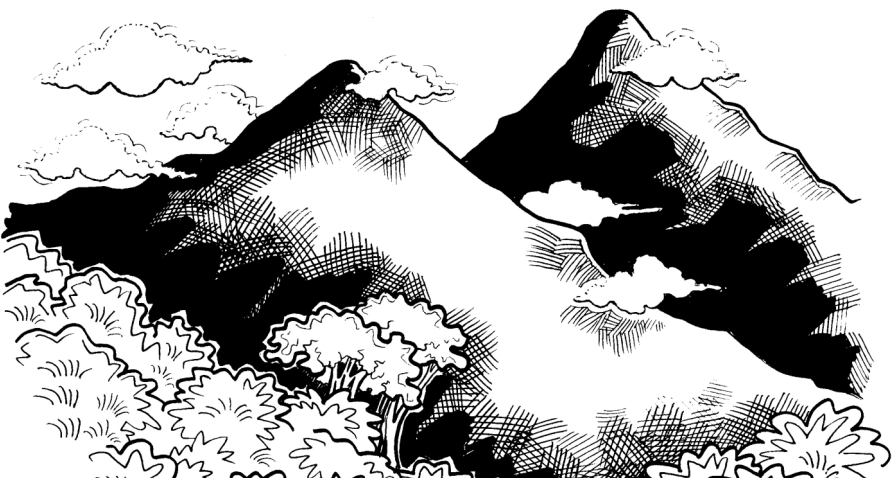
**Palghat gap:** A 30 km break in northern Kerala

**Width range:** 48 km in Maharashtra to 210 km in Tamil Nadu

**States covered:** 6 (Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu)

**Annual precipitation:** 2,000 to 8,000 mm

**Area under protection:** 13,595 km<sup>2</sup>



## Freshwater systems

The freshwater ecosystem biodiversity within the Western Ghats region is highly diverse, unique and of immense importance to livelihoods and economies. Broadly, the freshwater rivers and streams in the Western Ghats fall under five main categories or eco-regions, viz.,



- 1.Narmada-Tapi
- 2.The Northern Deccan Plateau (Godavari River system)
- 3.The Southern Deccan Plateau (Krishna River system)
- 4.The Southern Eastern Ghats (Cauvery River system) and
- 5.The Western Ghats (west flowing rivers).

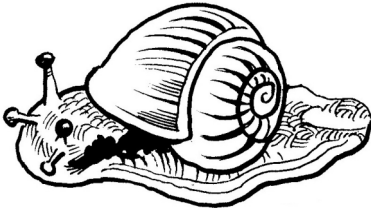
From the Western Ghats 46 east-flowing and 70 west-flowing major rivers originate. The west-flowing rivers originate in the Western Ghats and drain into the Arabian Sea while the east-flowing rivers merge into one of the three major river systems – Cauvery, Krishna or Godavari – before they drain into the Bay of Bengal.



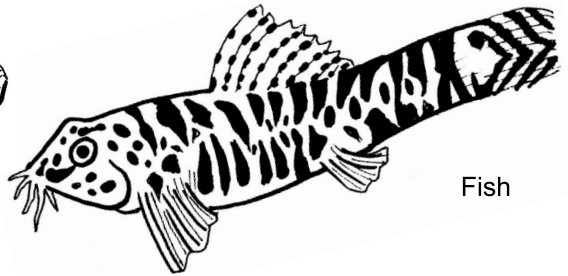
## Freshwater species

The Western Ghats is home to some of the world's most unique plants, animals and fungi. The Western Ghats have lost nearly 50% of forest cover since the early 1900s and the trend is continuing. The freshwater ecosystem biodiversity within the Western Ghats region is highly diverse, unique and of immense importance to livelihoods. Freshwater ecosystems are among the mostly heavily used. The dependence on water and other resources in the environment has placed enormous pressures on the ecosystem resulting in direct impact to species.

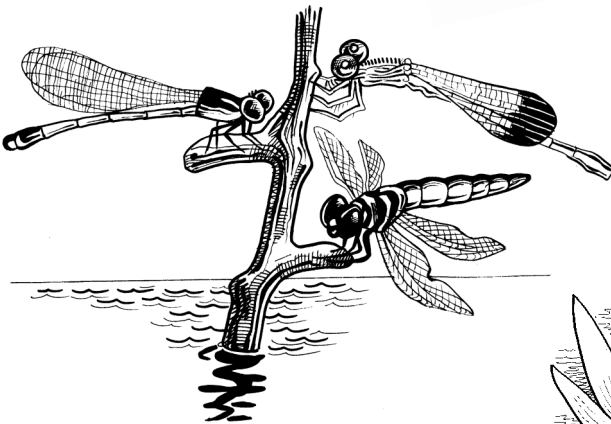
Four major species groups such as dragonflies and damselflies, snails, fish and aquatic plants have been chosen as representative species groups to understand the status of Freshwater species of Western Ghats.



Snail



Fish



Dragonfly and damselfly



Aquatic plant

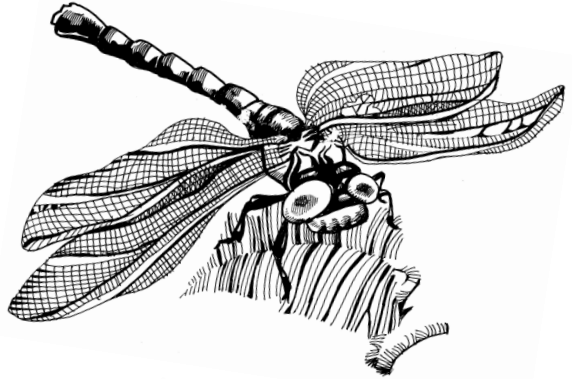
## Odonates

Dragonflies and Damselflies are common insects seen around us flying over water bodies, forests and fields. Both the groups together are termed Odonates. The life history of Dragonflies and Damselflies are closely linked to freshwater habitats and the welfare of odonates is very important since they form an important link in freshwater ecosystems. To help them survive, it is essential that we learn more about them.

### Dragonflies

#### Adult:

- Body long and stout
- Wings spread out at rest
- Forewings and hindwings unequal in size
- Hindwing broad at base
- Strong fliers
- Eyes are large and usually touch each other



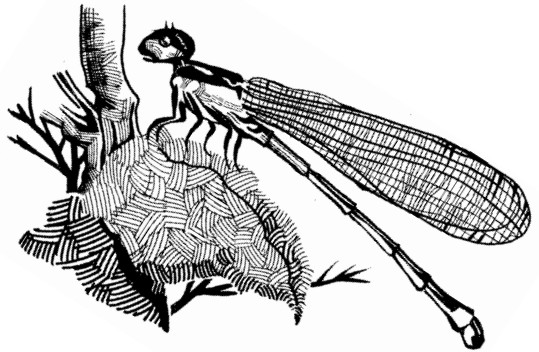
#### Nymphs (Aquatic larvae)

- Stout, robust body
- Respiratory gills not visible externally

### Damselflies

#### Adult:

- Body long, slender and delicate
- Wings usually held together over abdomen
- Forewings and hindwings approximately of the same size and shape
- Wings narrow at the base
- Weak fliers
- Eyes are smaller and separated, never touching



#### Nymphs (Aquatic larvae)

- Slender, fragile body
- 3 gills visible externally (at the end of the abdomen)

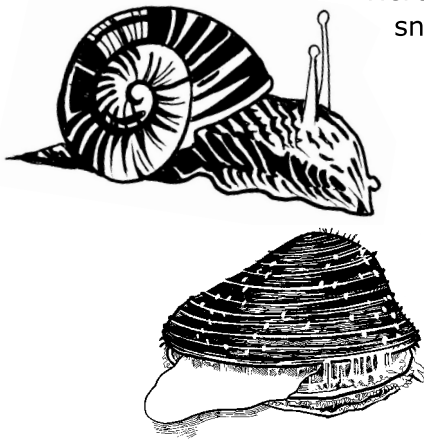
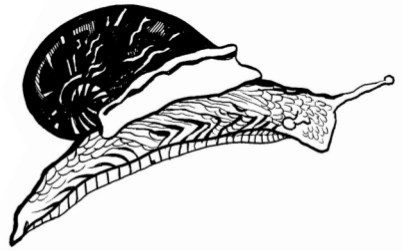
## Mollusc

Molluscs are a group of organisms that have soft bodies. The group includes snails, slugs, mussels, octopuses, squid, clams, scallops, oysters, and chitons.

They are found in a variety of habitats from terrestrial mountaintops to deep sea. Two major groups of Mollusca are Gastropoda (snails, slugs) and Bivalvia (mussels, clams, scallops).

A hard shell covers the bodies of most molluscs. Snails and slugs have distinct "head" and "foot" regions.

Here our focus of interest is on freshwater snails, slugs and mussels.



### Gastropod

One shell, spiralled (snail)

Shell-less, soft slimy body (slug)

Grazers, browsers

### Bivalve

Two shelled

Filter feeders

## Mollusc facts

Globally there are about 5000 species of freshwater molluscs. In India about 214 species have been reported so far. In Western Ghats there are about 60 freshwater molluscs.

Freshwater molluscs are seen in ponds, lakes, streams and rivers, wetlands and marshes. They offer significant service by cleaning harmful bacteria and parasites from water.

Snails have a single, often coiled shell (absent in slugs), while snails, slugs and mussels possess a large muscular foot for locomotion.

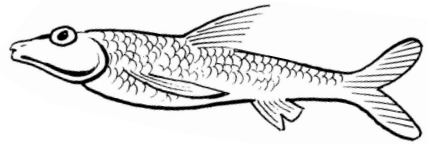
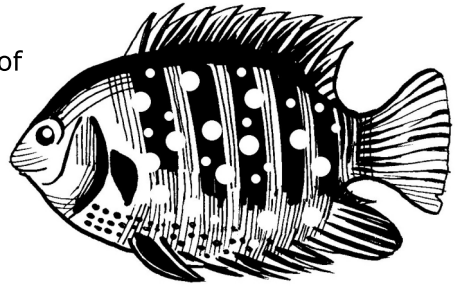
## Threats

Pollution of freshwater habitats: Being filter feeders, mussels are at high risk from pollution.



## Fishes

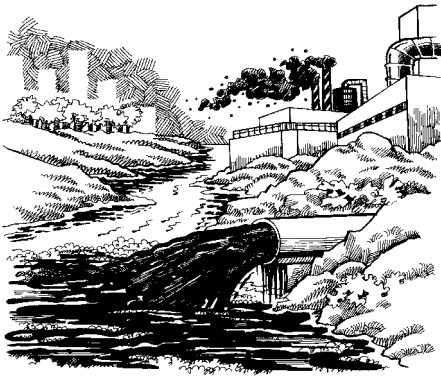
Fish is a very familiar animal to most of us. They come in a variety of shapes, sizes and colours. Fish form a big share of the food consumed by man and also offer aesthetic pleasure as aquarium pets. Fish species have evolved differently for life adapted to different aquatic habitats ranging from marine to brackish to freshwater ecosystems and form a critical link in the food chain of these ecosystems.



## Fish facts

Globally, about 15,000 freshwater fish species are recorded (including brackish water species). In India there are about 760 freshwater fish species of which 73 are in cold freshwaters, 544 are in warm freshwaters and 143 in brackish waters. Western Ghats harbours 290 fish species of which 189 are endemic.

They all live in a variety of habitats such as rivers, streams, ponds, lakes, wetlands, swamps and marshes.



## Threats

Some major threats for freshwater fishes are:

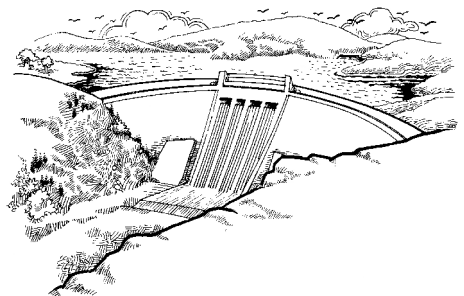
Pollution of freshwater habitats.

Construction of dams and other structures alter the natural flow of the water body, thereby restricting

migration of fishes (anadromous and catadromous fish migrations) for the purpose of breeding.

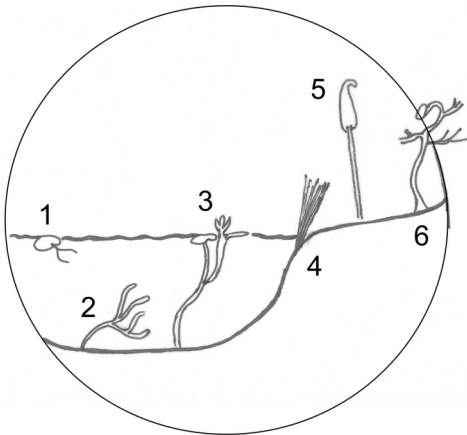
Over-exploitation for food.

Invasive species.



## Aquatic Plants

Water plants are referred to as Hydrophytes (*Hydro* = water; *Phyte* = plant). They grow in water or in soil that is permanently saturated with water. Water plants spend their entire life or at least a critical part of their lifecycle in water, either totally submerged or immersed or floating.



These plants, adapted to live in aquatic environments, are commonly found in wetlands. Water plants play a major role in providing aquatic fauna like fish a safe and nutrient rich habitat. Most of the water plants reproduce by setting seeds but can also reproduce asexually by means of rhizomes and fragments.

Water plants can be classified into:

1. Free floating, 2. Totally submerged, 3. Bottom rooted and 4. Floating, Emergent and rooted, 5. Totally emergent, 6. Stream bank and wet area plants (see line drawing above).

Water plants readily respond to changes in water quality parameters like salinity, nutrient levels (either resulting in loss of water plant diversity or unusual increase in the same), pollution (metals, pesticides, herbicides) and therefore play a crucial role as bio-indicators in assessing the environment or habitat quality.



## Threats

The major threats to freshwater water plants include runoff from agricultural and urban/industrial areas, the invasion of exotic species, the creation of dams and water diversion.

Over exploitation and pollution, land reclamation that threatens groundwater supplies, and grazing.



## Freshwater assessments

Globally many species are under threat and the status of the species that live in the Western Ghats was not known.

In order to understand the species' status, an assessment of freshwater biodiversity of Western Ghats was conducted by the IUCN Global Species Programme's Freshwater Biodiversity Unit and Zoo Outreach Organization.

It reviewed the conservation status and distributions of 1146 freshwater species belonging to four taxonomic groups.

## Freshwater groups and number of species assessed

Freshwater Group	Total species assessed
Fish	290
Snail, slug and mussel	77
Dragonfly and Damselfly	171
Water plants	608
Total	1146

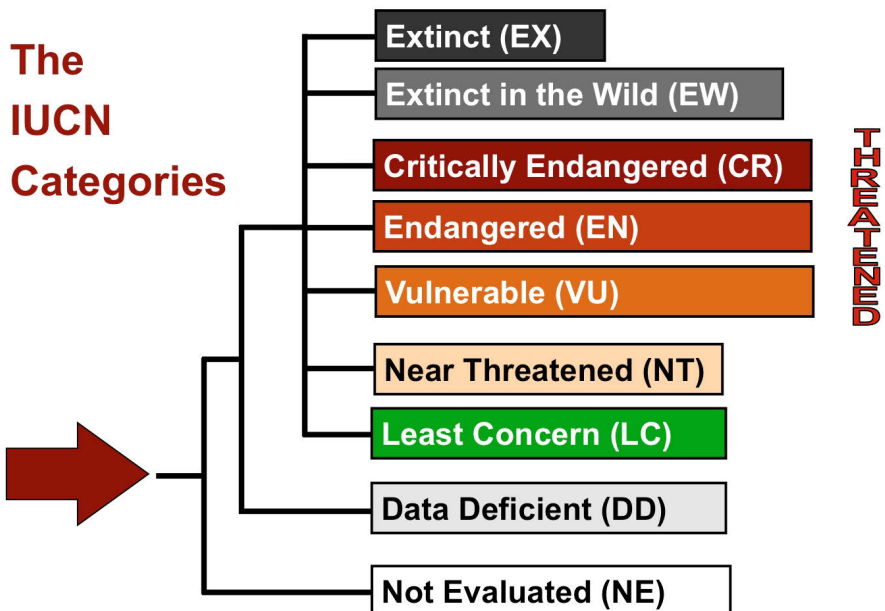


## Results of the Freshwater Biodiversity Assessment

Close to 16% of the 1,146 freshwater taxa assessed are threatened with extinction, with a further 1.9% assessed as Near Threatened. No taxa were assessed as Extinct or Extinct in the Wild. Approximately one-tenth of species were assessed as Data Deficient (10.5%), with the two invertebrate groups contributing more to Data Deficiency (25.8% on average).

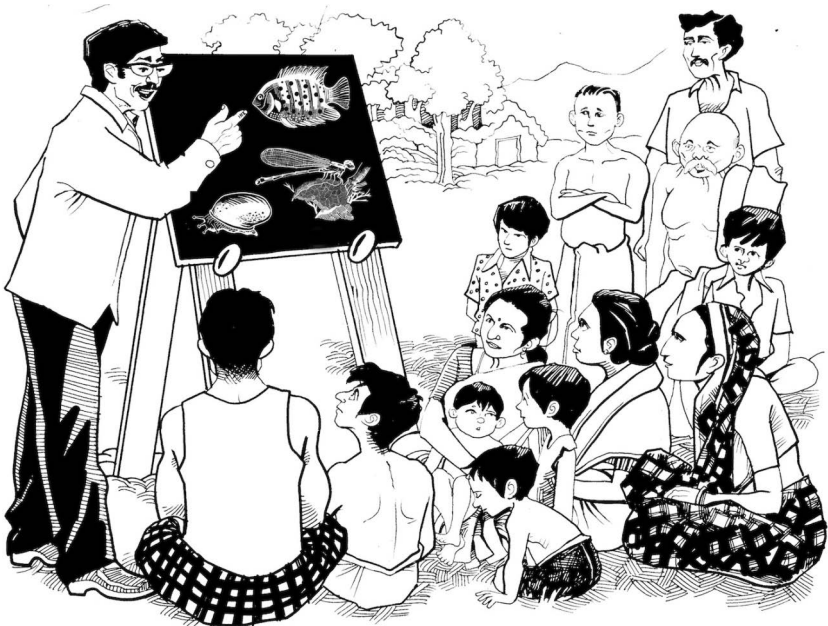
The main threats impacting freshwater biodiversity in the Western Ghats are: **pollution, biological resource use, residential and commercial development, dams and other natural system modifications, alien invasive species, agriculture and aquaculture, energy production and mining.**

Aquatic plants and fishes are the most heavily utilized freshwater groups in the Western Ghats. Twenty-eight percent of aquatic plants are harvested for medicinal purposes, and 14% and 13%, as food for people and animals, respectively. More than half (56%) of the fish species are harvested for human consumption, and a growing percentage (37%) of species are captured for the aquarium trade. Eighteen percent of mollusc species are used as food for humans.



## Recommendations of the Freshwater Biodiversity Assessment

- Promote studies on freshwater plants and animals of the Western Ghats to understand their life history, ecology and populations.
- Endemic species, under threat of extinction, are narrowly distributed. And hence the habitat should be protected.
- Pollution - a key threat to freshwater biodiversity should be controlled.
- Conduct environmental impact assessment of development activities such as construction of dams and roads.
- Conduct education and awareness programmes to instill the urgent need to sustainably use, conserve and manage wetlands and rivers.



## Quick facts:

Only 0.03% of the world's water is available as liquid freshwater on the Earth's surface

Of the 29,000 known fish, about 30% are freshwater species

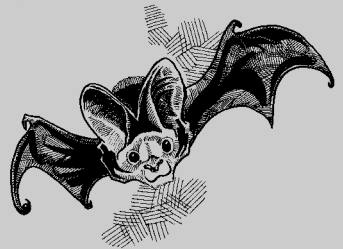
Wetlands, such as mangroves and river floodplains, protect human communities from natural catastrophes such as *Tsunamis* and floods.



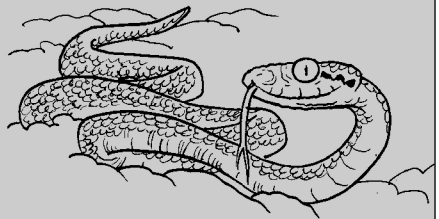
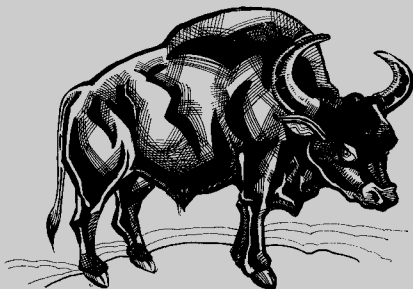
Agriculture accounts for about 70% of all water taken from rivers and is the main cause of wetland loss worldwide, due to cleaning, transformation and drainage, and water abstraction for agricultural development.

About 80% of the world's population currently live in areas lacking water security. By 2025, two-thirds of the world population could live under water-stress conditions and a similar proportion will be without adequate sanitation.

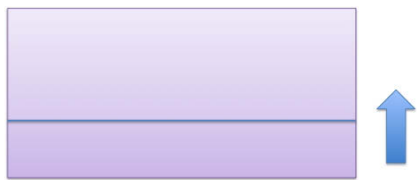
Nearly half of the world's large cities obtain some, if not most, of their drinking water supplies from protected or managed forested areas.



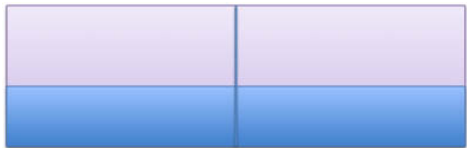
Habitat loss and degradation is the primary cause of extinction of freshwater species.



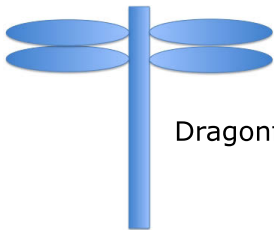
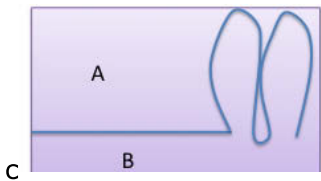
**Freshwater animal origami: Make your animal**



Make two small folds till the line.



After folding, fold the complete paper in half along the vertical line

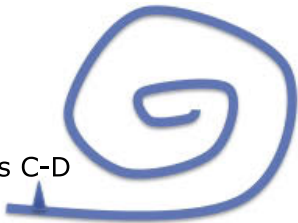
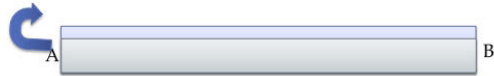


Dragonfly

Remove portion A by cutting it off. After tearing off portion A, twist the C end. Then Bend the wings of the dragonfly to form the shape.

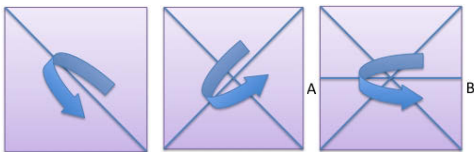


Make small folds so that points A-B meet points C-D

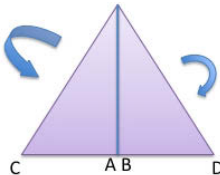


Snail

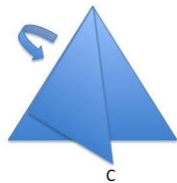
Start rolling the folded paper from point A to B



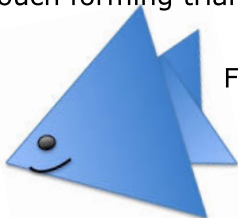
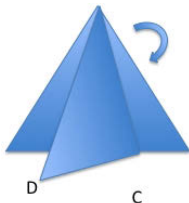
Fold and unfold



Fold in such a way that A & B touch forming triangles on either side



Fold



Fish



The Sahyādri map

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