

# 2

## OCEANS AND MOVEMENTS IN THE OCEAN WATER

### What we have learnt

- About 71 percent of the surface of the earth is covered by water.
- Hydrosphere is that realm of the earth that holds all the water resources.
- The bottom of the ocean comprises of continental shelf, continental slope, abyssal plains, submarine trenches and submarine ridges.

You know that the oceans cover about 71% of the earth's surface. A major portion of the surface of the earth appears blue when observed from space. The influence being exerted by oceans in our life and our physical environment is immense. It is in the oceans that the first forms of life originated. As land, oceans also abound with a variety of minerals, plants and animals. The ocean is as dynamic as the earth's atmosphere. Although we know much about the oceans, many more details are yet to be discovered. The days are not far off when humanity will have to depend more on the oceans to meet its various needs.

The oceans are indispensable for the survival of humanity. Let us try to learn more about the oceans.

○ **Oceans play a vital role in controlling climate.**

Coastal areas experience lower temperature than the interior regions. In what other ways do oceans affect climatic change.

- Onshore winds blowing over the oceans carry moisture and give rainfall.

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○ **Oceans provide fish**

Fish is one of the most widely consumed items of food. In countries like Japan, Maldives and India fishing industry plays a significant role in earning foreign currency. Millions of people the world over depend on fishing and fish processing industries to earn a living. The development of fishing harbours has accelerated the growth of fishing related occupations. The coastline of India, stretching

over 6100 kms, offers unlimited scope for the development of fishing industry.

You have grasped information about important fishing centres of the world, the factors that have helped these centres to flourish and the countries in which these centres are situated.

In addition to fish, highly nutritious algae are also being used as food resources. The drug manufacturing industry has been using certain varieties of sea plants in the production of medicines.

### The Algae

**Sea plants, just like the plants on land, are used for various purposes. Algae are among the most useful marine plants. Some varieties of algae are edible. These marine plants are also used for the manufacture of cattle feed and organic fertilisers. Chemical substances such as sodium, potash, iodine and bromine are also extracted from algae.**

### Storehouse of Minerals

Almost all the minerals found on land have been discovered in the sea. Sea water contains minerals like sodium chloride, bromine and magnesium. Although mineral substances such as petroleum and natural gas, manganese, sulphur, titanium and monazite are known to be present in the sea, only petroleum and natural gas are extensively mined. Mining of other minerals from the sea has not been done so far because it is expensive 20 times more than mining them from land.

### **The salt pans of India**

On the eastern and western coasts of India common salt is manufactured by solar evaporation of sea water. Sea water is collected in flat, enclosed fields and kept exposed to the sun. As the amount of water drains gradually through solar evaporation common salt gets separated from this brine. Places where common salt is produced in this way are called salt pans. There are vast salt pans in the Kachchh region of Gujarat and the Rameswaram area of Tamil Nadu.

### **Gold Mine in the Sea**

Out of the total value of the minerals obtained from the sea, petroleum and natural gas together account for the highest percentage. The energy crisis in recent times has highlighted the urgency of increasing the production of petroleum from the seabed. Petroleum occurring in the continental shelf and the continental slope is pumped out from wells sometimes as deep as 2000 metres. These off-shore wells are located at an average distance of 150 km from the sea coast. Statistical data show that by the end of this century petroleum production from off-shore wells will rise to 40 per cent of the total production of petroleum.

**Bombay High**, which is about 176km northwest of Mumbai, is a good example of off -shore oil fields. Crude petroleum mined from **Bombay High** is pumped to land based refineries.

### **Source of Energy**

Energy can be produced by making use of sea waves, tides and ocean currents. Tides that reach an average wave height of 5 metres or more are ideal for wave energy production. In the Bay of Fundy near Nova Scotia, the tidal range sometimes comes to about 15 metres.

**The first commercially viable tidal energy power plant was set up in France. This electricity generating facility, (Rance Barrage Tidal Scheme) which was built in 1967, exists at the Rance River, near St Malo. Here, electricity is produced by using the flow of water during the rise and fall of tides.**

#### **○ Fresh water from sea water**

The conversion of sea water into fresh water is done by employing mainly two purification processes.

***Sea water Distillation*** : In this process sea water is turned into water vapour by using solar energy. The vapourised water is condensed and fresh water is obtained. In Saudi Arabia, Kuwait, Greece, Pakistan, Australia, India and Chile and in the states of Texas and California (USA), this process is used to produce fresh water from salt water.

***Electrodialysis*** : In this process fresh water is produced by using an electric field to separate salt ions from sea water. This device is used in the desalination plant at Kavarathi in the Lakshadweep.

The distillation process is widely used to produce fresh water from sea water as it is comparatively less expensive.

### ○ Ocean Transport and Trade

The oceans have been serving as a means of transport and trade for centuries. They are especially suitable for transport of cargoes in bulk. Items such as heavy machinery, food grains, petroleum products and mineral ores are carried to all parts of the world by sea. No less is the utility of the oceans as highways for travel. Commercial traffic through the oceans is of vital importance for all nations. Sea routes linking the port cities on the east coast of North America and those in Western Europe are equally important and useful for trade and travel.

Over and above the functions mentioned above, oceans play a significant role in various fields like defence and the diffusion of cultures.

Although the oceans are extremely useful to mankind, human activity is paving the way for the pollution of the seas. This pollution has been found to upset the equilibrium of the oceanic environment.

What can be the causes of marine pollution?

- Oil spillages
- Disposal of radio active materials.
- 

### World Oceans

Observe the globe and list the name of the oceans

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- 

Don't you see that the oceans are connected to one another. The interconnected body of water on the earth's surface, comprising all the oceans, is called the world ocean. Find out from the globe the names of the continents by which each ocean is flanked and write the names in the table.

<i>Oceans</i>	<i>Continents</i>
Pacific Ocean	

Table 2.1

In table 2.2, some characteristics of the oceans are given

Oceans	Area	Average Depth	Deepest Trench	Seas	Bays/Gulfs
Pacific Ocean	165.2 lakh km <sup>2</sup>	4270m	Challenger Deep (11033 m)	<ul style="list-style-type: none"> <li>● Bering Sea</li> <li>● Yellow Sea</li> <li>●</li> </ul>	<ul style="list-style-type: none"> <li>● California</li> <li>●</li> </ul>
Atlantic Ocean	82.4 lakh km <sup>2</sup>	3700m	Puerto Rico Trench (8618 m)	<ul style="list-style-type: none"> <li>● Mediterranean</li> <li>● Caribbean</li> <li>●</li> </ul>	<ul style="list-style-type: none"> <li>● Hudson</li> <li>● Mexico</li> <li>●</li> </ul>
Indian Ocean	73.4 lakh km <sup>2</sup>	3960m	Wharton Trench (7725 m)	<ul style="list-style-type: none"> <li>● Arabian Sea</li> <li>●</li> </ul>	<ul style="list-style-type: none"> <li>● Persian</li> <li>● Bay of Bengal</li> <li>●</li> </ul>

Table 2.2

We can understand more facts about the oceans by analysing the table.

- Which is the deepest ocean?
- Which ocean is Hudson Bay a part of ?
- 
- 

**Bay and Gulf**

**Bay is a wide segment of an ocean extending into land. Gulf is a narrow portion of an ocean extending into land.**

Some other features of the oceans are given below.

The Pacific Ocean is dotted with a large number of islands. There are about 20000 islands in this ocean.

A salient feature of the Atlantic Ocean is the Mid-Atlantic Ridge, a submarine mountain range that lies in a north-south direction for about 14000km across the ocean floor.

Most of the islands in the Pacific and the Atlantic ocean are of volcanic origin.

The number of islands in Indian Ocean is comparatively small. Madagascar and Sri Lanka are examples of continental islands. The Sunda archipelago is about 5000km long. This chain of islands, stretching from Myanmar to Australia, includes the Andaman - Nicobar islands. Coral islands are also found in the Indian Ocean. Coral reefs are formed by accretion of lime secretions and dead remains of the small organisms called polyps. Coral islands have been formed on coral reefs. The Maldives and the Lakshadweep in the Indian Ocean are examples of coral islands. Coral

polyps thrive mostly in the tropical and equatorial seas.

### Ocean Temperature and Salinity

The average surface temperature of the ocean water ranges between 2°C and 33°C. What can be the reasons for the temperature variations?

- Latitude
- Salinity
- 

Find answers to the following questions after analysing the data given in table 2.3.

Latitude	Average Temperature
0° - 10°	26.72°C
- 20°	25.60°C
- 30°	23.16°C
- 40°	17.98°C
- 50°	10.33°C
- 60°	4.56°C
- 70°	2.12°C

Table 2.3

- What changes do you notice in the temperature of sea water according to latitudinal differences?
- In which latitudinal zone is the highest average ocean temperature recorded?
- In which latitudinal zone is the lowest average ocean temperature recorded?

Imaginary lines drawn on maps connecting all parts of the oceans that experience equal temperature are called isonomals. Salinity of the oceans is the amount of salt present in sea water. Salinity is usually expressed as the number of grams of dissolved salts in 1000

grams of sea water. The average salinity of sea water is 35 per 1000 grams. This is expressed as  $35\text{‰}$ . It means that 35 grams of salts are dissolved in 1000 grams of water. It is equal to 3.5%.

Salts other than common salt, present in sea water in very small amounts are:

- *Magnesium chloride*
- *Magnesium sulphate*
- *Calcium sulphate*
- *Potassium sulphate*
- *Calcium carbonate*
- *Magnesium bromide*

Salinity is not the same in all parts of the oceans. The reasons:

- Evaporation increases as temperature increases. When evaporation increases salinity increases.
- Salinity is low in ocean regions that receive heavy rainfall.
- Water in river mouths has comparatively low salinity.
- Water reaching the oceans from melting ice causes salinity to come down.
- In areas where cold and warm currents meet salinity is comparatively low.

### Salinity of Sea Water: High and Low

**In the Red Sea, where rate of evaporation is high, average salinity is between 37 and 41 parts per thousand. On the other hand, the average salinity in the Baltic Sea, which is fed by water from melted ice, is between  $3\text{‰}$  and  $15\text{‰}$  only.**

## Movements of Ocean Water



Have you not noticed the newspaper headlines given here? They highlight the destruction and devastation being caused by violent waves and the resulting sea erosions. You must have read items of news such as these in the newspapers. In which season of the year do reports about sea erosions occur in the Kerala media? It is the powerful waves crashing against the shores that cause the devastations.

What are sea waves? Aren't you desirous of knowing more about them? Waves are the movements in sea water in the form of alternate rise and fall of the sea surface. A wave includes a ridge of water between two depressions.

What is the cause of waves?

Waves are produced mainly by winds. As powerful winds blow along the surface of the sea frictions make the surface water move. Depending upon the power of the wind the moving water takes the shape of waves. The wave motions are pushed forward by the wind. The more powerful the wind is, the bigger the waves will be. Waves generated by very strong winds or storms cause destructive marine erosion.

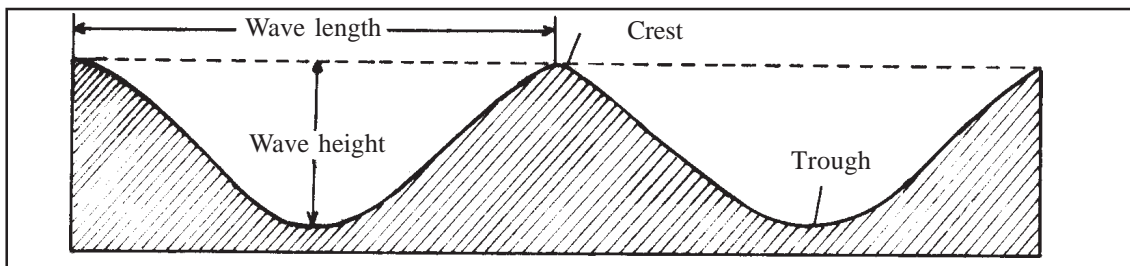


figure 2.1

Complete table 2.4 with the help of figure 2.1.

Description	Term
• The topmost part of a wave	
• The lower part between two crests.	
• Distance between two consecutive crests.	
• Vertical distance between a trough and a crest.	

Table 2.4

Try to collect more information about the coastal areas in Kerala where sea erosion and landslides are being caused by the violent sea. Based on the information you have gathered, prepare an edition of the school magazine. Take care to include relevant pictures, media reports and other illustrations.

### Tsunamis

**Tsunami is a Japanese word meaning harbour waves. They are powerful sea surface waves generated due to submarine disturbances caused by earthquakes and volcanic eruptions. Tsunamis lead to heavy loss of life and property in coastal areas. The most active tsunami belt in the world is the Japan-Taiwan ocean region.**

### Tides

*"It was the most heartbreaking moment during the entire swim. I knew the fierce flood tide was going to start from 8pm. and the moon was already up in the sky....."*

*Soon the "flood" started, a stiff breeze broke out and the choppy sea was transformed into a raging, foaming hell. It was now indescribable agony to face the powerful tide and the ten-foot waves and spray. From this time I kept on through sheer will power".*

**Mihir Sen**

The extract you have just read is from an account of Mihir Sen's experiences during his swim across the Palk Strait, which separates Sri Lanka from India.

Won't you like to know about the natural phenomena of high tides and low tides? Tides are the periodic rise and fall of sea level. Tides comprise high tides and low tides. Two tides usually happen daily in almost every part of the ocean.

Causes of tides:

- The gravitational attraction exerted on the earth by the sun and the moon.
- Rotation of the earth.

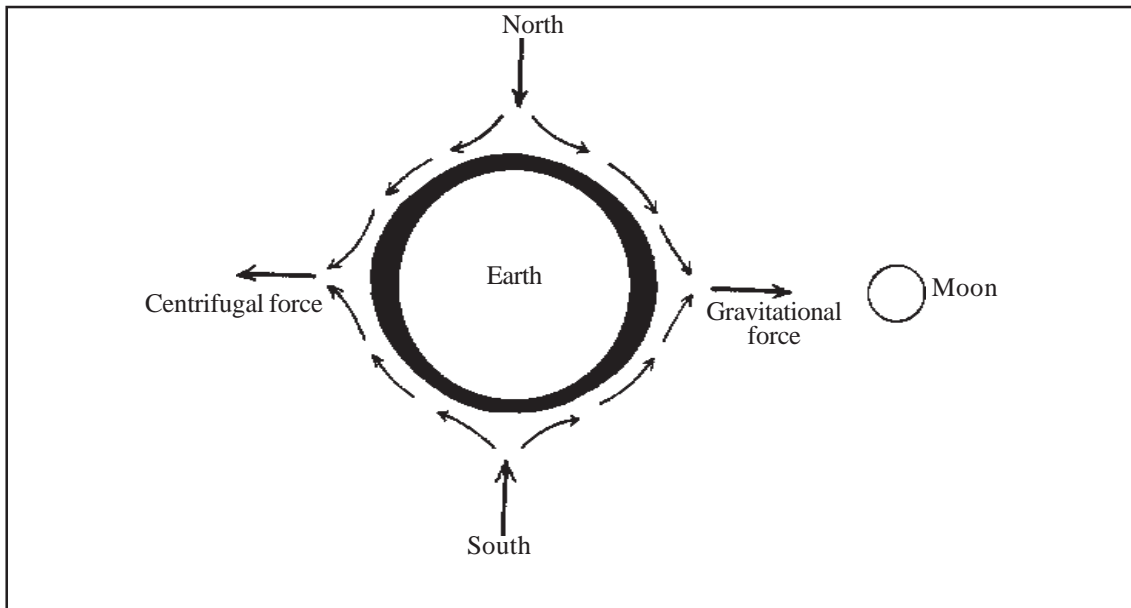


figure 2.2  
Tides and Moon

### Tides and the moon

Figure 2.2 explains the most important cause of tides.

What have you understood from figure 2.2?

- High tide occurs in those parts of the ocean which face the moon.
- Low tide occurs in those parts which are at an angular distance of  $90^\circ$ .
- 

### Tides and the Sun

The sun as well as the moon plays a part in producing tides.

The distance between the earth and the sun is about 400 times the distance between the earth and the moon. Therefore, the sun's gravitational pull exerted on the earth is less than that the moon exerts on the earth.

However, the sun's attraction plays a role in the production of tides.

### Spring Tide and Neap Tide

You have already learned about the phases of the moon during its movement around the earth.

The tides at full moon and new moon rise higher than the tides on other days. The exceptionally powerful tides at full moon and new moon are called spring tides.

When the moon is in the first and last quarters the tide does not rise as high as the usual tides. These tides are called neap tides.

What are the causes of spring and neap tides?

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Figure 2.3 illustrates spring tide and neap tide. Study the figure and complete table 2.5.

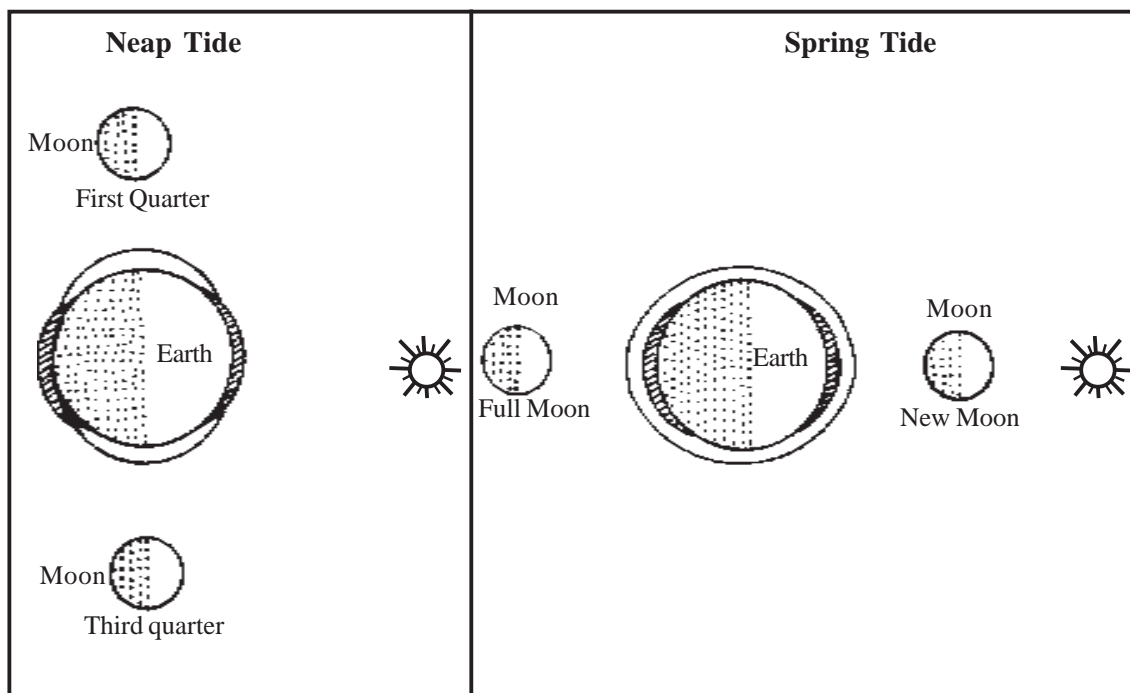


figure 2.3

Formation of Spring and Neap Tides

Let us see what the effects of tides are:

- Tides facilitate the movements of ships at ports and river mouths.
- 
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Learn more about the phenomena of waves, high tides and low tides by direct observation during study tours to sea coasts and also by gathering information from people living in coastal areas.

Day	Type of Tide	Relative position of Sun, Moon and Earth	Nature of Tide
New Moon	Spring Tide	The sun, the moon and the earth are almost in line with each other and the moon lies between the sun and the earth	Rises higher than tides on other days
Full Moon			
First Quarter			
Second Quarter			

Table : 2.5

## Ocean currents

Mankind has been acquiring more and more knowledge of the oceans through the centuries. Rafts made by fastening together tree trunks and logs of timber and canoes were the earliest crafts used for travelling in the sea. Then came the age of sailing ships. Adventurous sailors like Columbus, Vasco Da Gama and Magellan used sailing ships in their voyages of exploration. People of India, even in very ancient days, made daring sea travels to distant parts of the world. The voyages of exploration helped mankind to know more about the oceans.

It is no exaggeration to say that the sea is a storehouse of wonders. Ocean explorers the world over have been trying hard to unveil the mysteries of the sea. Navigators like Christopher Columbus had observed that the oceans transported various floating objects from far and wide.

Waves cannot carry floating objects in this way from far off parts of the oceans. Studies made centuries ago had revealed that flows or currents in the oceans were behind such movements. The flows in the oceans are known as ocean currents.

The continuous flow of ocean water from one direction to another in fairly defined direction is called an ocean current.

Why do currents occur in the oceans?

- Temperature differences in the ocean water
- Density differences
- Salinity
- Coriolis effect
- Global winds

**Prevailing winds and the direction and shape of coastlines are important factors modifying ocean currents. On the basis of the temperature of the water involved, ocean currents can be classified into two types. Currents which have high temperature are known as warm currents and those which have low temperature are known as cold currents. The Gulf Stream and the Kuroshio are examples of warm currents and the Labrador and the Benguela are examples of cold currents.**

There are currents in all the oceans. Let us make a brief study of the chief ocean currents of the Pacific, the Atlantic and the Indian Oceans with the help of the maps.

### Ocean Currents of the Pacific Ocean

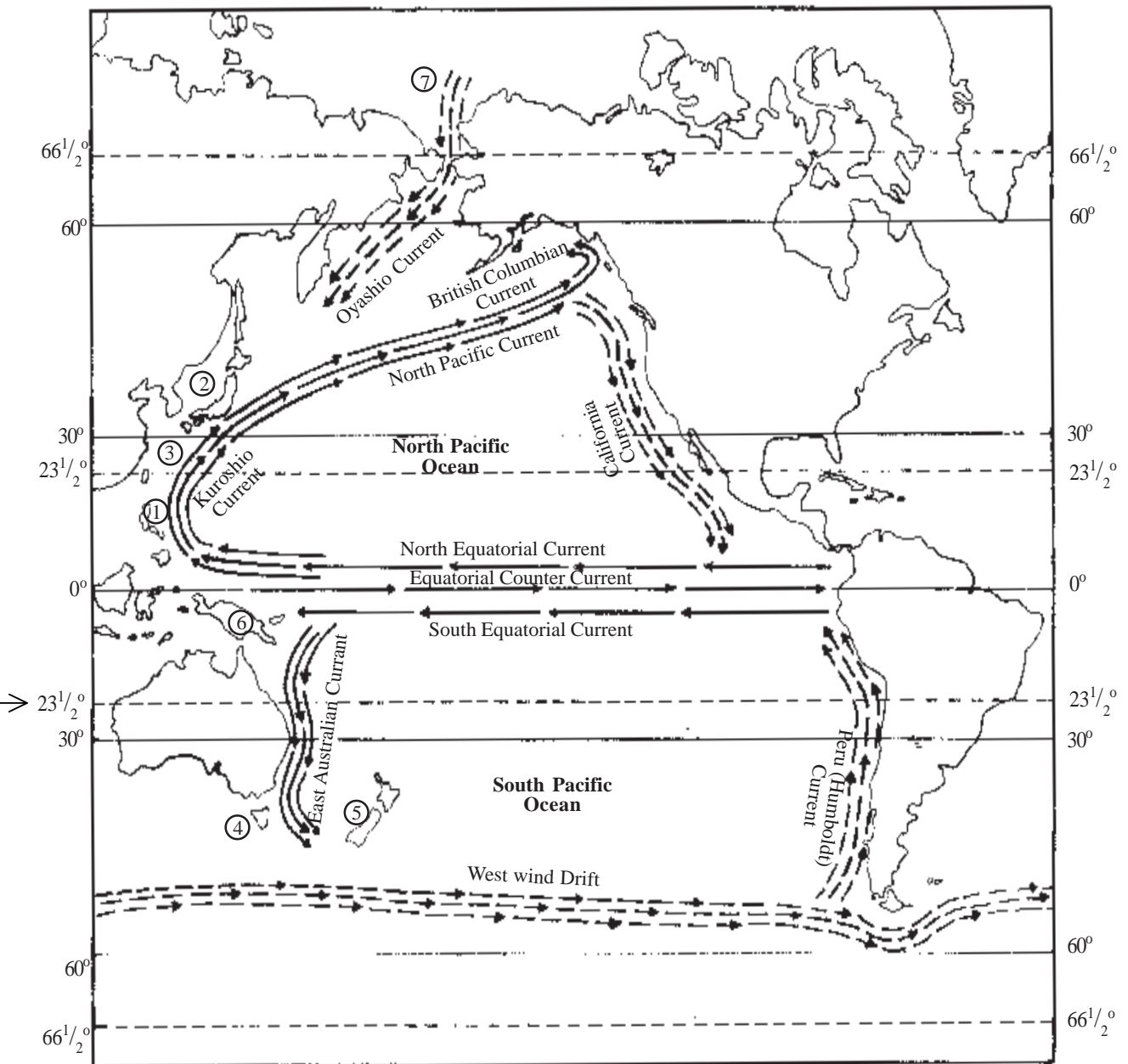
Figure 2.4 shows the important ocean currents of the Pacific Ocean. Mark the direction of global winds by drawing arrows on this map.

Study carefully the map in figure 2.4. Don't you see a current marked on either side of the equator. Find out the names of these two currents.

It can be seen that these currents flow in a westerly direction. Can you find out the reason why these currents flow from east to west? Which global winds blow in this region? Do these winds influence the direction of these currents?

Study the course of the currents you have just observed on the map.

You will see that the North Equatorial Current enters the sea near the Philippine Islands. Here the onward movement of this



———→ Warm Current  
 - - - - -→ Cold Current

1. Philippine Island
2. Japan Island
3. Taiwan Island
4. Tasmania Island
5. New Zealand Island
6. New Guinea
7. Bering Strait

### Currents of the Pacific Ocean

figure 2.4

current is obstructed by land. So it turns in a northerly direction and advances in that direction. It is seen to be flowing along a group of islands. What is the name of this group of islands? Note that this current flows northwards and pass the island of Taiwan. Find out by what name the current is known here.

You can see on the map that this current gets deflected to the right of its course. Which permanent winds cause the deflection? Notice the onward movement of the deflected current. It is advancing towards the northeast of the Pacific Ocean. Find out the name of this current here. What is the name of the continental coast it approaches?

The map shows you that this current, on approaching the west coast of the continent bifurcates. One branch turns north and flows along the coast of Canada. The other branch deviates southwards and flows along the west coast of the USA. Find out the names of the two currents.

Find out from the map where the south flowing branch eventually reaches.

Study the map and locate the Bering Strait. You can see that an ocean current flows south through the Bering Strait and enters the Pacific Ocean. From which ocean does it flow? Find out the name of the current and notice what current it merges with.

It can be seen on the map that the South Equatorial Current flows in the same direction as that of the North Equatorial Current. The arrow you have drawn show which global winds are present in this region. Name these winds. Compare the wind direction with the direction of the current that flows here. What inference do you make from the comparison?

It is clear from the map that the South Equatorial Current, on reaching the sea near the big island of New Guinea, turns south and flows along the coast of Australia. What can be the reason for this deflection? By what name is this current known?

Don't you want to know about the remaining course of this current? When it reaches the sea lying south-east of Tasmania it gets deflected. What is the cause of the deflection?

The map (figure 2.4) shows an ocean current flowing from west to east across the South Pacific Ocean. It advances in the direction of the southern end of the South American continent. As can be seen on the map, the current, on reaching the south-western coast of the continent, changes its course. Which coast does it flow along after getting deflected? Find out the name of the current and the current it meets.

### Peru Current

**The Peru Current is one of the most prominent ocean currents of the Pacific Ocean. The German Scientist Humboldt made an extensive study of this. It brings plenty of nutrients, which attract fish and birds preying on the fish. When the current is pushed into the coastal waters, vast numbers of fish and other marine creatures reach the offshore areas of Peru to feed on the nutrients. It is the Peru current that sustains the sea off the Peruvian Coast as one of the prosperous fishing banks of the world. Millions of birds have settled in this area. They have made it their**

**habitat. They lay eggs on the rocky coasts and multiply. The droppings of the birds - known as guano - is used as a manure.**

Don't you see a current flowing between the two Equatorial currents in the Pacific Ocean. Find out its name and the direction of its movement.

It can be seen that ocean currents that originate in the equatorial seas and flow pole ward are, as a general rule, warm currents and currents which originate in the polar seas and flow equatorward are cold currents.

Fill up the table (2.6) given below.

Name of Ocean current	Warm/cold current	Coast/Islands which the current passes	Direction of Flow
• Noth Equatorial Current	• Warm current	• Philippine Islands	• From East to West
•	•	•	•

Table 2.6

Write a note on the ocean currents of the Atlantic Ocean, based on the facts collected from figure 2.5 and table 2.7.

Name of Ocean current	Warm/cold current	Coast/Islands which the current passes	Direction of Flow
• Noth Equatorial Current	• Warm current	• West Indies	• From East to West
•	•	•	•

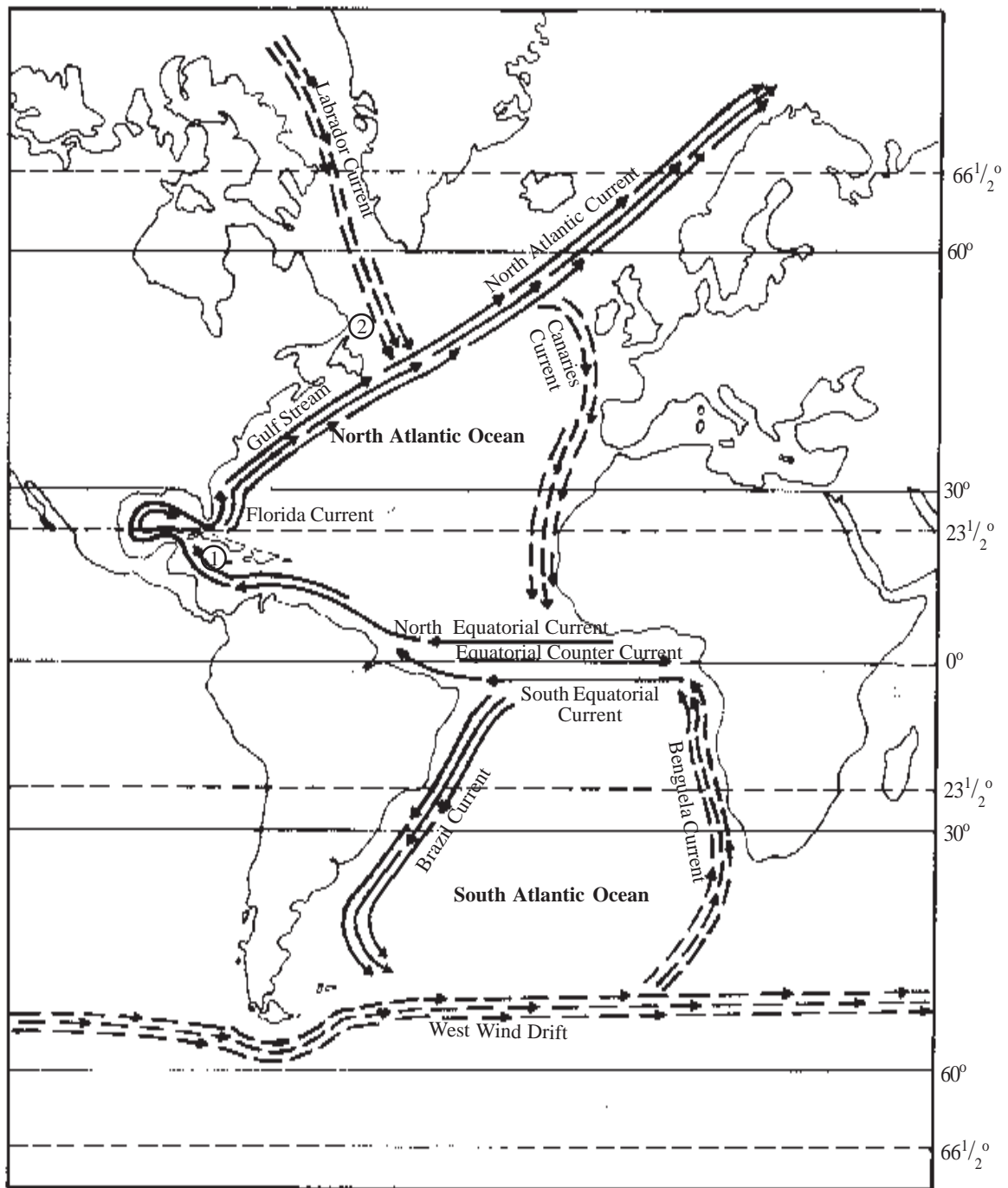
Table 2.7

Prepare a map showing the ocean currents of the Pacific Ocean and include it in the wall magazine of your school. Take care to mark warm currents and cold currents in different colours.

### Currents of the Atlantic Ocean

Look at figure 2.5. The important ocean currents of the Atlantic Ocean are shown on it. Mark the global winds on the map by drawing appropriate arrows.

Fill up the table 2.7. Gather the necessary information about the currents of the Atlantic Ocean from figure 2.5. An atlas will be helpful in doing the activity.



———→ Warm Current  
 - - - - -→ Cold Current

1. West Indies  
 2. Newfoundland

Currents of the Atlantic Ocean

figure 2.5

### Tragedy in the Atlantic

The Titanic was a big luxury liner built in Britain. Its builders had claimed that she would not suffer damages under any circumstances. Sad to say, the Titanic met with a terrible disaster on her maiden voyage itself. The ship was on her way from England to New York City. The disaster occurred in the sea near the island of New Foundland. That part of the Atlantic Ocean has been notorious for gigantic icebergs carried by the cold Labrador Current. The Titanic struck a huge iceberg that had been floating about on the night of 14th April 1912. The collision tore a long gash in the ship's hull. Water rushed into the Titanic and she sank in about 2½ hours.

### The Sargasso Sea

The region in the centre of the North Atlantic Ocean encircled by the North Equatorial, the Gulf stream and the Canaries ocean currents is devoid of currents and is generally calm. This region is called the Sargasso Sea. The name, first used by Portuguese sailors, derived from the word "Sargassum", the name of a sea plant found in abundance in this part of the ocean.

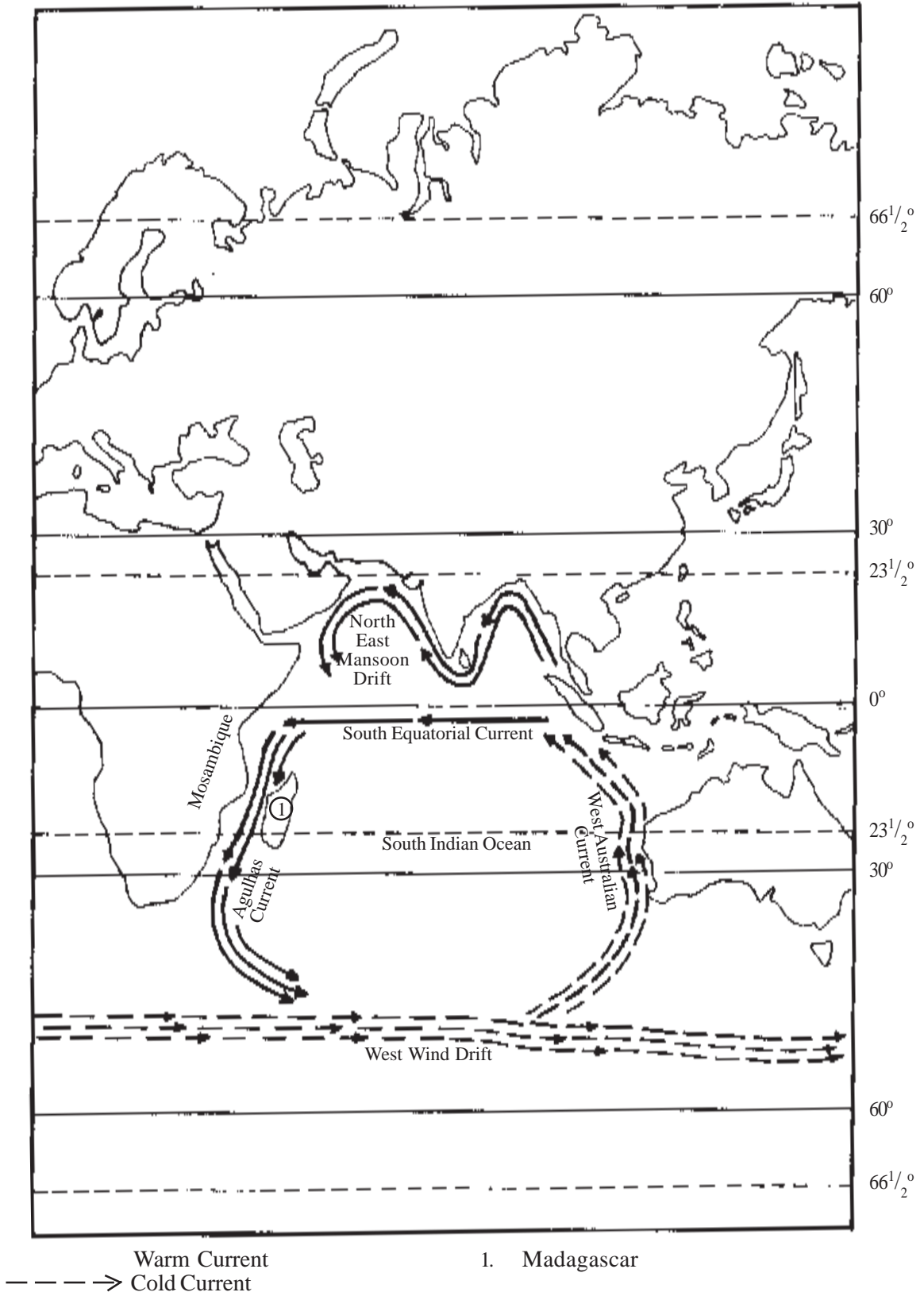
Make an illustrative chart showing the currents of the Atlantic Ocean and include

it in the wall magazine. Use different colours to distinguish between warm and cold currents.

### Currents of the Indian Ocean

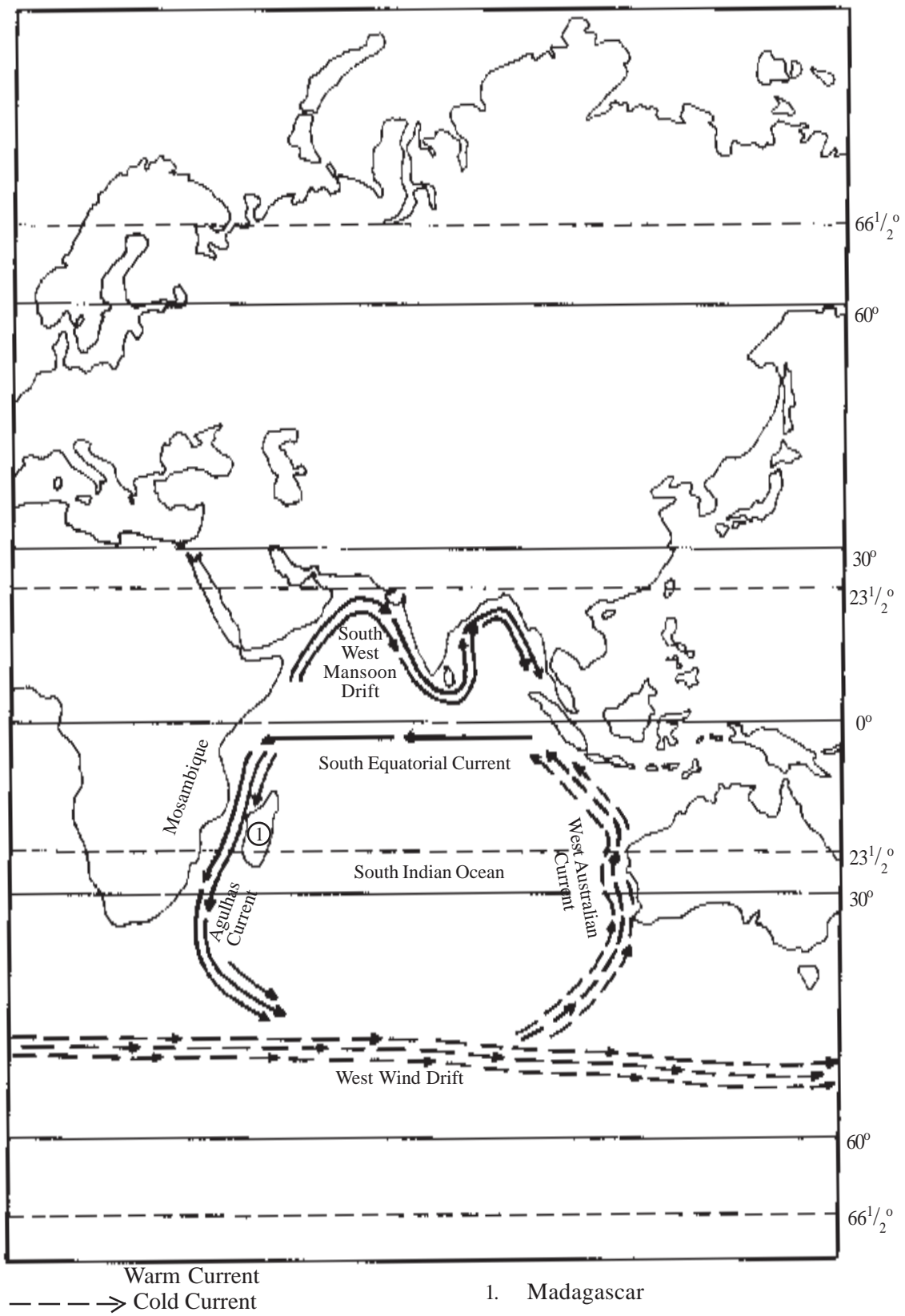
The ocean currents of the Indian ocean are shown in figures 2.6 and 2.7. Draw arrows and indicate the direction of the summer monsoon winds and the global winds on the figure 2.7. Mark the winter monsoon winds and the global winds in figure 2.6.

- It can be seen that in the northern part of the Indian Ocean currents circulate along the coasts from west to east in the summer season and from east to west in the winter season. Can you give the reason for the seasonal reversal of the currents? By what name is the current called in each of the two seasons?
- Find out the name and direction of the ocean current that flows just south of the equator in the Indian ocean. Which global winds influence this current?
- Which continent deflects the South Equatorial Current as it enters the western part of the ocean?
- By what name is the current flowing along the south-east coast of this continent known?
- After reaching the southern tip of Africa, it gets deflected and flows into the West Wind Drift. Find out the name and direction of flow of the ocean current that advances along the west coast of Australia.
- 
-



Currents of the Indian Ocean

figure 2.6



Currents of the Indian Ocean

figure 2.7

Name of Ocean current	Warm/cold current	Coast/Islands which the current passes	Direction of Flow
• Southwest Monsoon Current	• Warm	• Coasts along the Arabian Sea and the Bay of Bengal	• From West to East
•	•	•	•

Table 2.8

Based on the facts already learned, fill up table 2.8 by writing the characteristics of the ocean currents of the Indian ocean.

Give a brief description of the currents of the Indian Ocean on the basis of the facts you have studied.

Draw a chart showing the currents of the Indian Ocean and include it in the wall magazine.

Let us examine the main effects of ocean currents.

- Affect the climate of neighbouring coasts. Eg: The North Atlantic current brings down the intense cold winter conditions experienced in Western Europe and thereby maintains a moderate climate. This current is, therefore, described as the 'Blanket of Europe'.
- Cause mists and fogs in some parts of the ocean.
- Help the healthy growth of fish and other marine creatures.



## SUMMARY

- Oceans are connected together and it can be called as the World Ocean.
- The surface temperature of the sea water is not the same everywhere.
- Waves result from the undulating movements of sea water.
- Tides are the phenomena of rise and fall of the sea surface due to the gravitational effects produced by the moon and the sun.
- Ocean current is the uninterrupted movement of sea water in a fairly defined direction.
- On the basis of temperature, ocean currents are classified into warm currents and cold currents.
- In the Pacific Ocean the two equatorial currents, Kuroshio, North Pacific, British Columbia, East Australian and Equatorial Counter Currents are warm currents and Oyashio, California, Peru and West Wind Drift are cold currents.

- The two Equatorial currents, Gulf Stream, Florida, North Atlantic, Brazil and Equatorial Counter Current are warm currents and Labrador, Canaries, Benguela and West Wind Drift are cold currents of the Atlantic Ocean.
- In the Indian Ocean the two Monsoon Drifts, South Equatorial Current and Agulhas Current are warm currents and West Australian current and West Wind Drift are cold currents.

## QUESTIONS

1. What are the factors that affect the amount of salinity in sea water?
2. "It is said that the sea is a depository of mineral wealth". Why?
3. The moon exerts more influence in producing tides than the sun. Why?
4. Why are spring tides much stronger than usual tides?
5. The names of some ocean currents are given below.

Canaries Current, Agulhas Current, Peru Current, Kuroshio Current, West Australian Current, Brazil Current.

Write the names of these currents in the appropriate columns of the table given below.

<i>Pacific Ocean</i>	<i>Atlantic Ocean</i>	<i>Indian Ocean</i>

6. Explain citing specific examples, how global winds affect the movement, direction and deflection of ocean currents.
7. Ocean currents north of the equator in the Indian Ocean are different from the currents of the other oceans in the Northern Hemisphere. Explain.
8. Suggest effective ways to prevent ocean pollution.
9. Write a description of the currents of the Atlantic Ocean.

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