

A teachers guide to exploring:



# OCEANS

This pack aims to :

aid the pursuit of relevant topics,  
provide information, ideas and resources.

## CONTENTS.

### PAGE

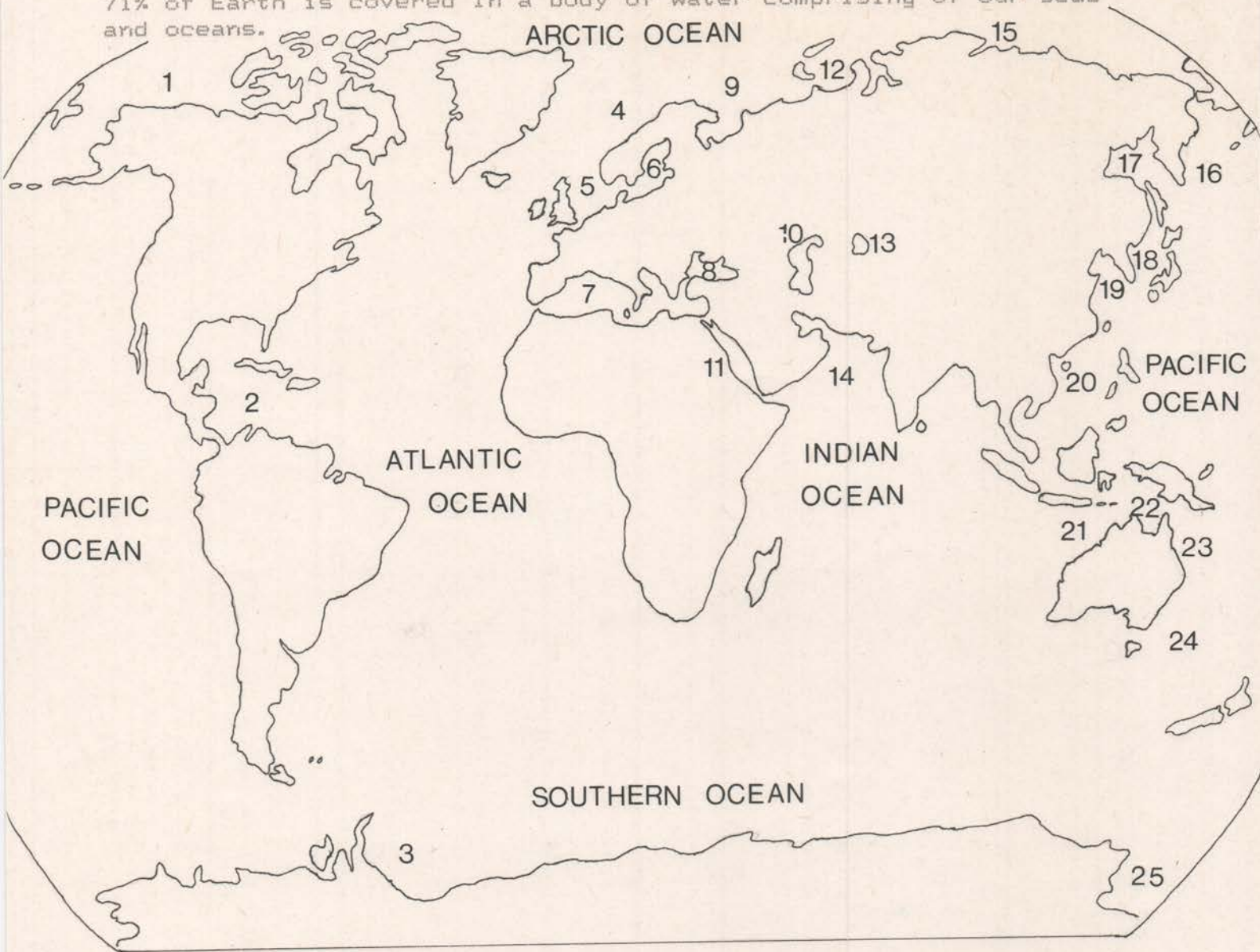
1	Where Are Oceans/Seas?
2	What Is An Ocean/Sea?
3	Shore Life
4	British Coasts
5	Shallow Seas
6	Coral Reefs
7	Open Oceans
8	Deep Seas

### PAGE

9	Back To The Sea
10	People And The Sea
11	Threatened Seas
12	Conservation
13	Sea Animals At Pencyrnor
14	Ocean Activities
15	Ocean Myths And Fables
16	Useful Information

# WHERE ARE THE OCEANS ?

Astronauts looking at Earth from space see a blue globe.  
71% of Earth is covered in a body of water comprising of our seas and oceans.



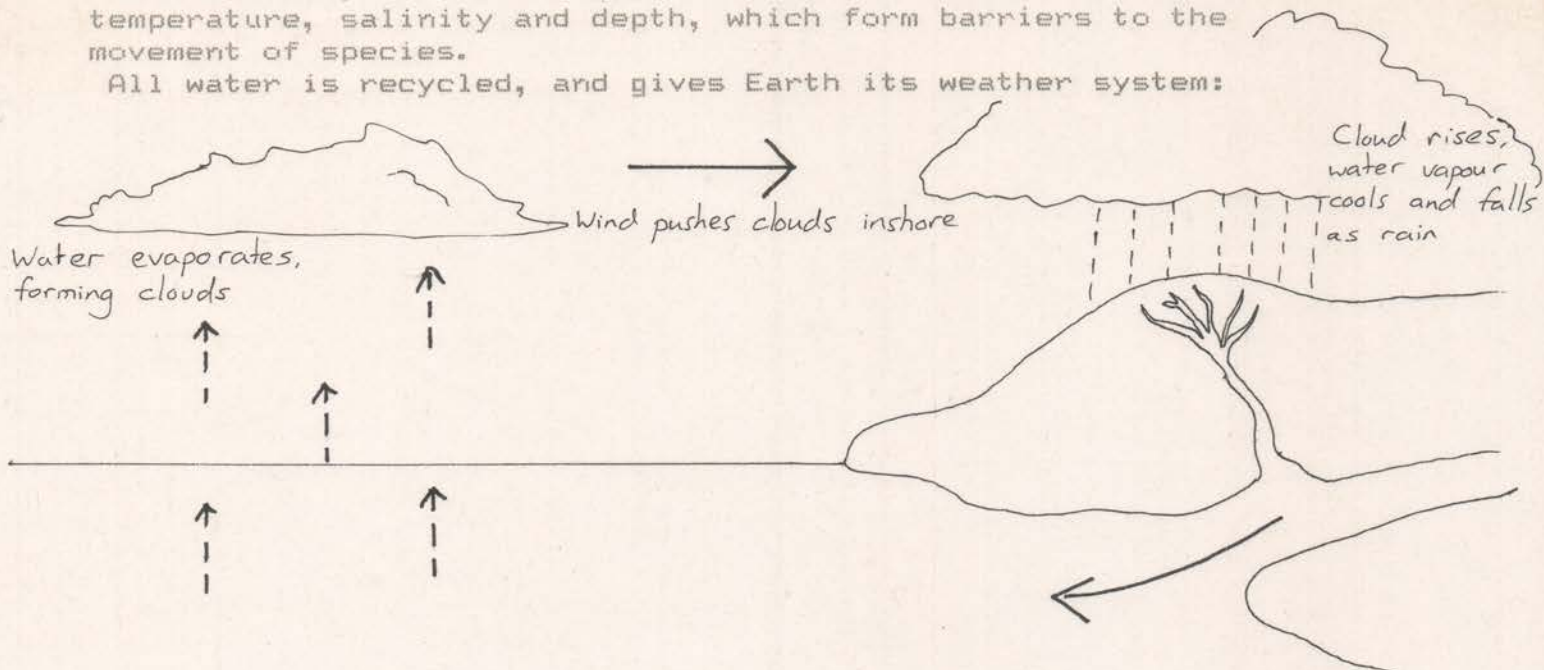
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|----------------------|-----------------|--------------------|
| 1. Beaufort Sea      | 9. Barents Sea  | 17. Sea of Okhotsk |
| 2. Caribbean Sea     | 10. Caspian Sea | 18. Sea of Japan   |
| 3. Weddell Sea       | 11. Red Sea     | 19. Yellow Sea     |
| 4. Norwegian Sea     | 12. Kara Sea    | 20. China Sea      |
| 5. North Sea         | 13. Aral Sea    | 21. Timor Sea      |
| 6. Baltic Sea        | 14. Arabian Sea | 22. Arafura Sea    |
| 7. Mediterranean Sea | 15. Laptev Sea  | 23. Coral Sea      |
| 8. Black Sea         | 16. Bering Sea  | 24. Tasman Sea     |
|                      |                 | 25. Ross Sea       |

Life appeared in the seas some 3500 million years ago, and today seas and oceans hold the majority of life on this planet - from simple single celled bacteria and algae to the largest living animal, the Blue Whale.

# WHAT IS AN OCEAN ?

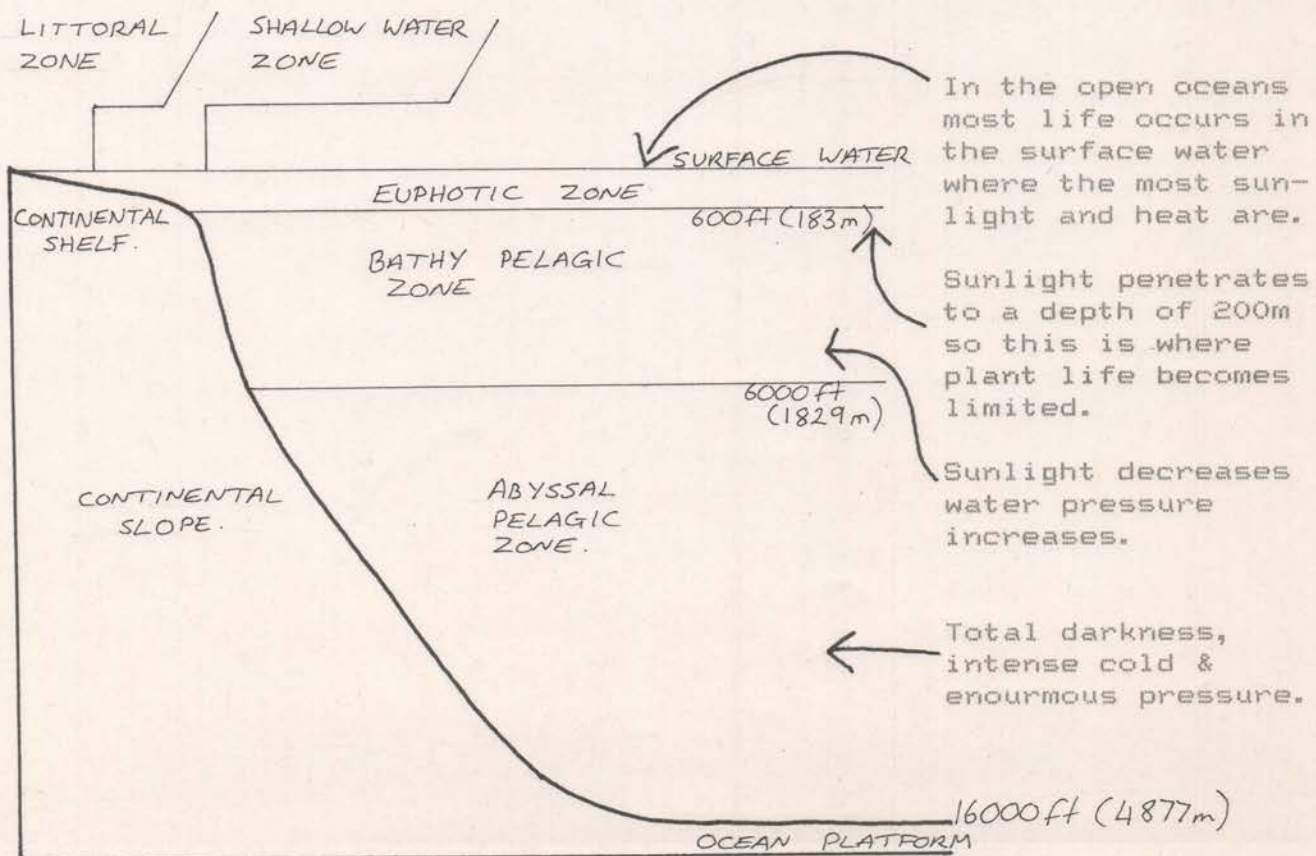
There are many different types of seas and oceans varying in temperature, salinity and depth, which form barriers to the movement of species.

All water is recycled, and gives Earth its weather system:



On average, 1kg of sea water contains 965g of water and the remaining 35g is dissolved salts, mainly sodium chloride (common salt). Salinity is greatest in enclosed seas and near the Equator.

Seas range in depth from the shallow coastal regions to the abyssal depths which would easily cover Mount Everest!



# SHORE LIFE

## TIDES -

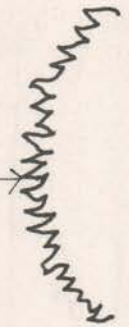
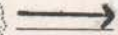
twice a day the shore is exposed for several hours when the plants and animals must be able to withstand long periods out of the water, sometimes under hot sun or in extreme cold.

Tides are caused by the gravitational forces of the sun and moon which pull at the waters of the world.

WHEN THE SUN AND MOON ARE AT RIGHT ANGLES, THE GRAVITATIONAL FORCES TEND TO CANCEL EACH OTHER OUT. PRODUCING THE SMALL RISE & FALL CALLED A NEAP TIDE



WHEN THE SUN AND MOON ARE IN LINE THE PULL IS EXAGGERATED CAUSING EXTRA LARGE SPRING TIDES.



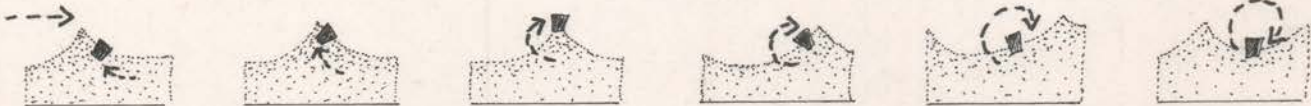
## WAVES -

are created by the wind catching the waters surface, so the stronger the wind the larger and more powerful the wave.

Sometimes waves are created by earthquakes under the sea - these are called Tidal Waves and may have devastating effects on land.

Wave forms travel, but the water itself does not -

A CORK FLOAT SHOWS THIS - THE WAVES BELOW ARE MOVING FROM LEFT TO RIGHT AS THE CORK SIMPLY MOVES IN A CIRCLE MOVING ONLY A FEW CENTIMETRES AS THE WAVE PASSES.



## ROCKY SHORES -

diverse habitats give rise to a diversity of life. Rocks provide a strong foundation for red, green & brown seaweeds with molluscs crustaceans, sea anemones, small fish, soft corals, and sponges. Most life is found towards the lower shore.

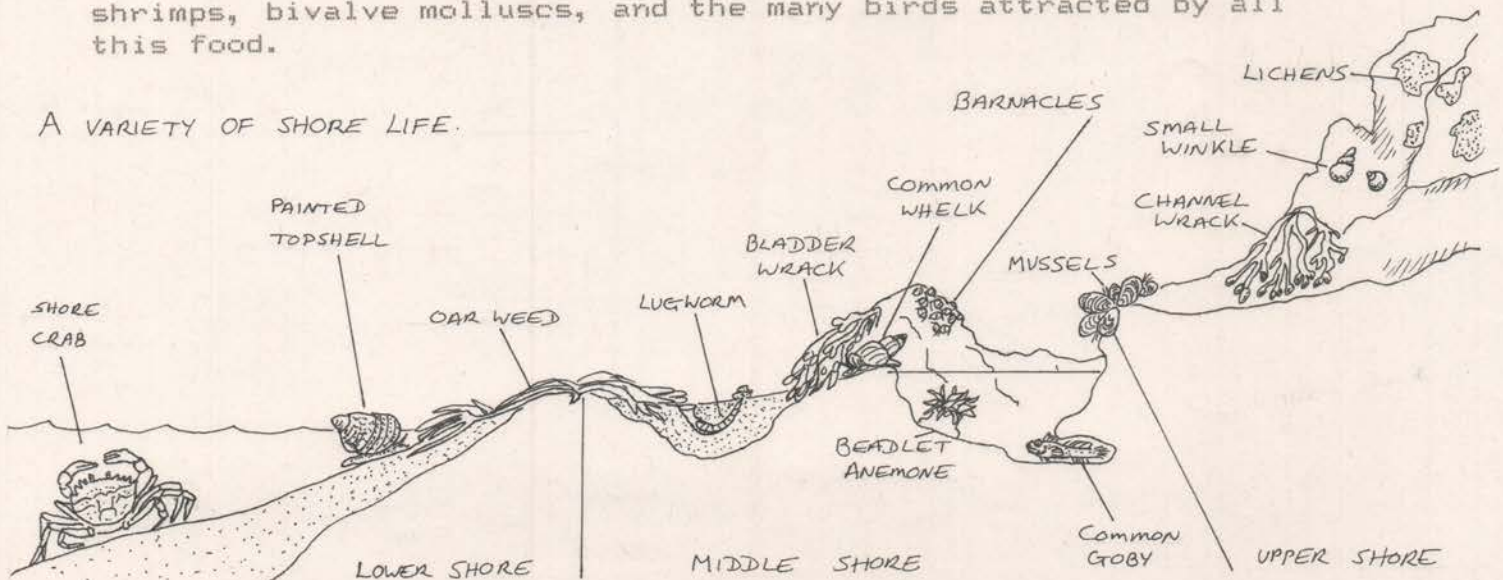
## SAND & PEBBLES -

sand is one of the least productive habitats - constantly moving due to the wind and waves, along with pebble beaches they give no foundation or protection and offer little food.

## MUDDY SHORES -

wander down to the permanently wet, muddy flats where the sand is more stable and you will find a myriad of life - snails, worms, shrimps, bivalve molluscs, and the many birds attracted by all this food.

## A VARIETY OF SHORE LIFE.



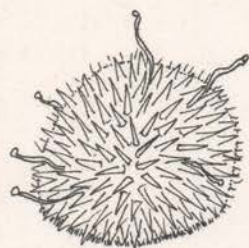
# BRITISH COASTS

Britain has a variety of coastal habitats ranging from dune systems to rocky shores and cliffs, providing diverse habitats for many plants and animals.

//// = sea-cliffs, rocky islands & rocky shores

.... = shingle, sandy beaches & sand dunes

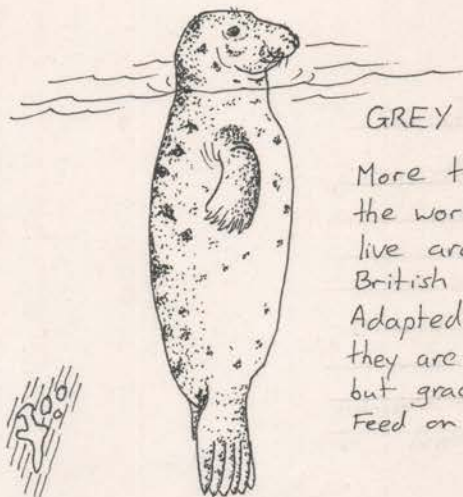
~~~~ = estuarine habitats



## SEA URCHIN

Moves on tube feet, feeding on seaweed and tiny animals scraped off rocks by its five powerful teeth.

Urchins are prey to fish, seals and otters.



## GREY SEAL

More than 60% of the world population live around the British coast.

Adapted for life at sea, they are clumsy on land but graceful in water. Feed on fish mainly.

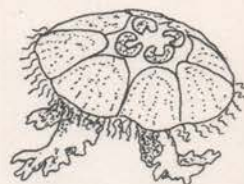
## HERRING GULL

Our commonest gull. Feeds on fish, shellfish, small birds & mammals. Also scavenge on rubbish tips.



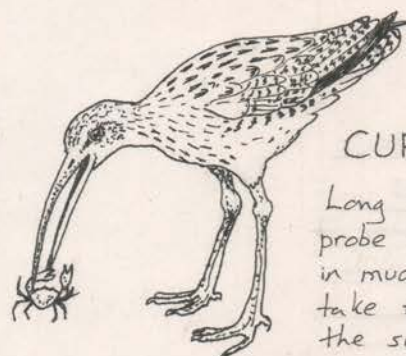
## COMMON JELLYFISH

Moves through water by pulsating its bell. Small prey stunned by fringe of tentacles and pushed into the mouth by four frilly tentacles.



## HERMIT CRAB

Use empty shells to protect their soft bodies.



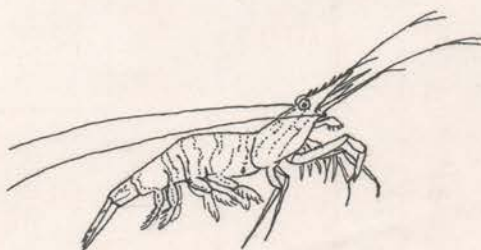
## CURLEW

Long bill used to probe for food in mud. Also take food from the surface.



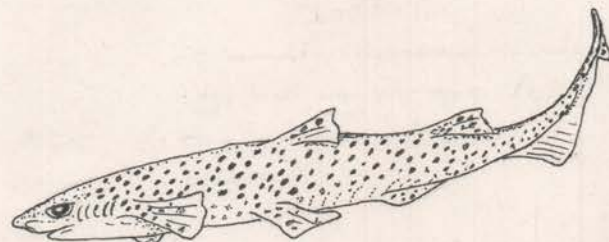
## PUFFIN

Nest in holes in cliff tops, dug out with the beak. Spend winter at sea. Feed on small fish.



## COMMON PRAWN

Most often seen walking the sand in rock pools.



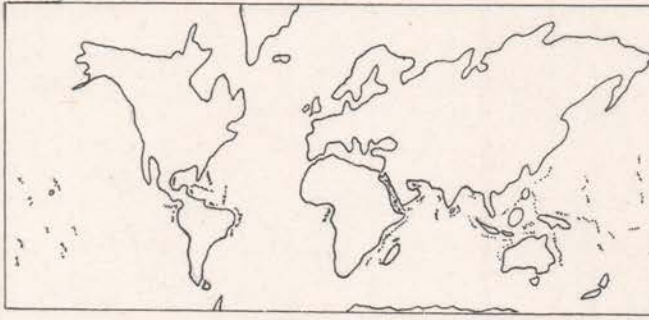
## DOGFISH

Commonest European shark. Eggs laid in rectangular capsule, or "mermaids purse".

# CORAL REEFS

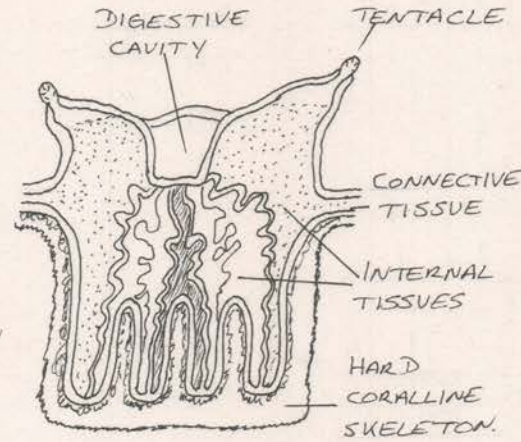
Are found in warm, shallow, clear tropical or sub-tropical seas.

TROPICAL CORAL REEFS



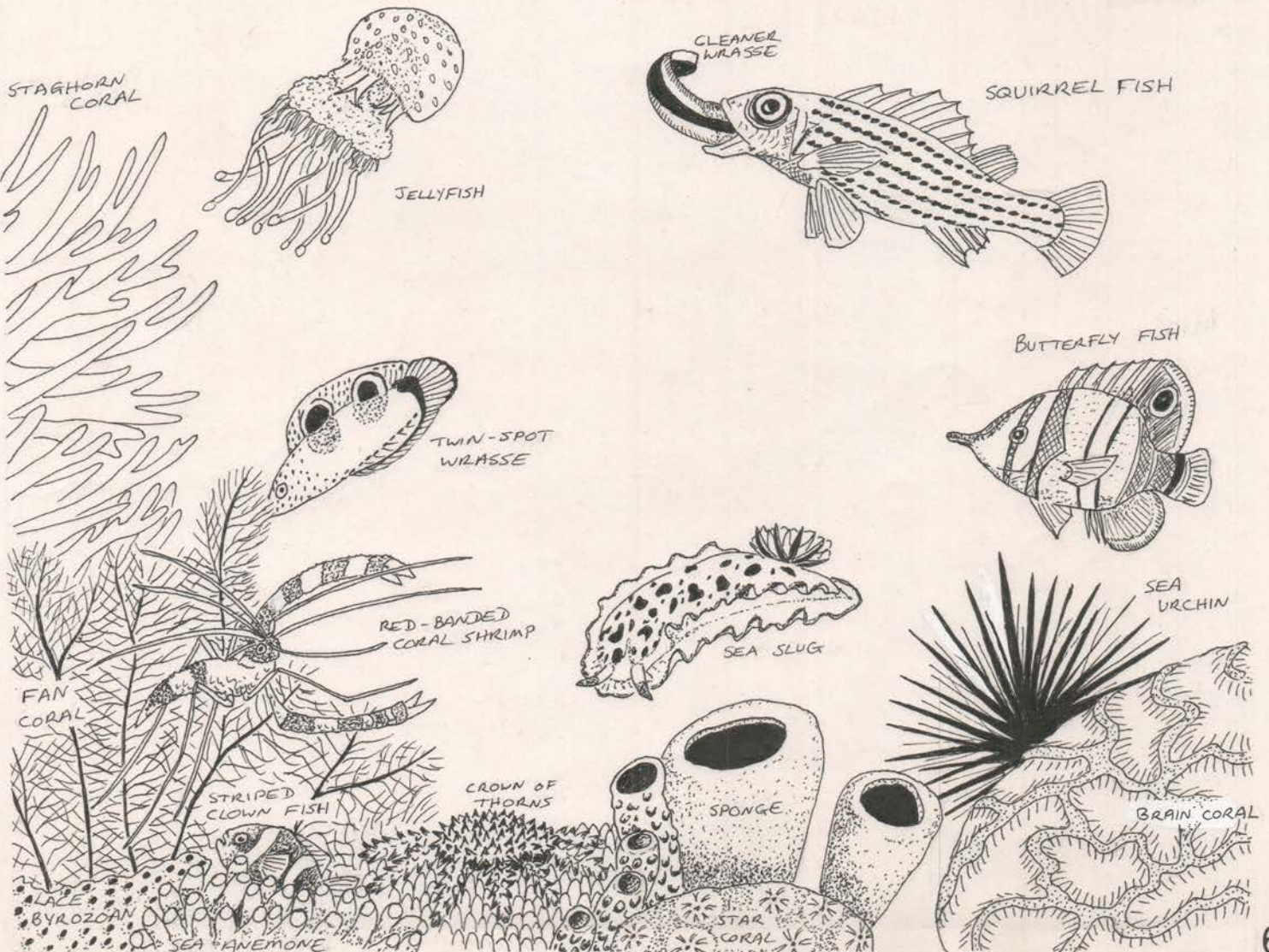
The reefs are calcareous skeletons of millions of tiny animals - the coral polyps - piled on top of each other to form coral growths.

AN ENLARGED CROSS SECTION OF A CORAL POLYP.



The largest coral growth is the Australian Great Barrier Reef, over 1,600km (1,000 miles) long. Only hard coral polyps form reefs, soft coral polyps do not contribute to the reef structure.

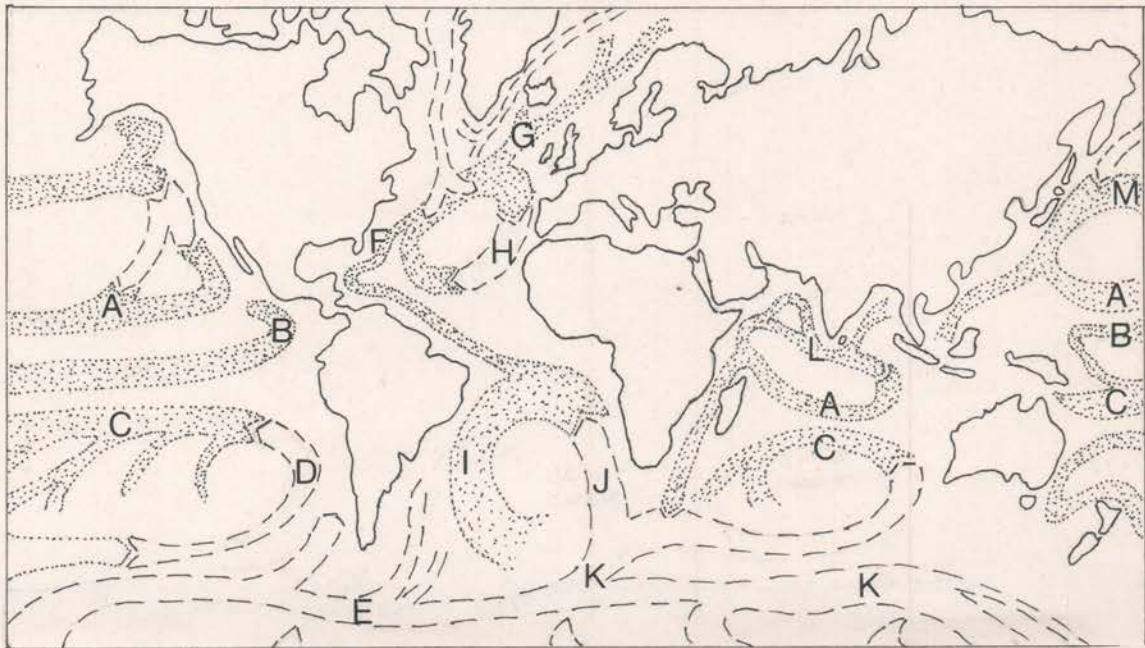
Coral reefs and lagoon are the sea equivalent of tropical rainforests, having a high diversity of life due to the warmth and high rate of nutrient turnover. It has been estimated that the Great Barrier Reef supports more than 3,000 different species of animal.



# OPEN OCEANS

Are constantly moving, and not just the surface. A combination of the sun's heat, Coriolis effect and winds turn the surface currents clockwise in the Northern Hemisphere and anticlockwise in the Southern Hemisphere.

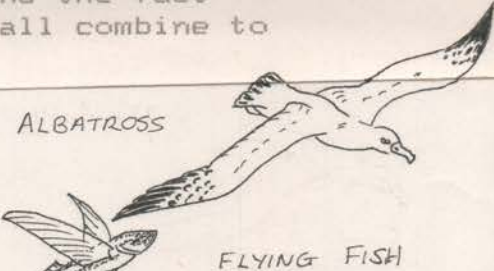
## SURFACE CURRENTS



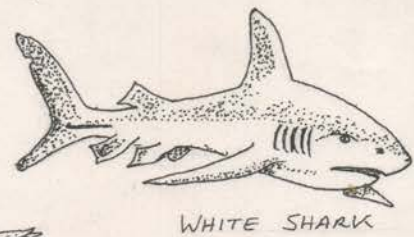
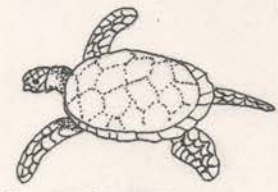
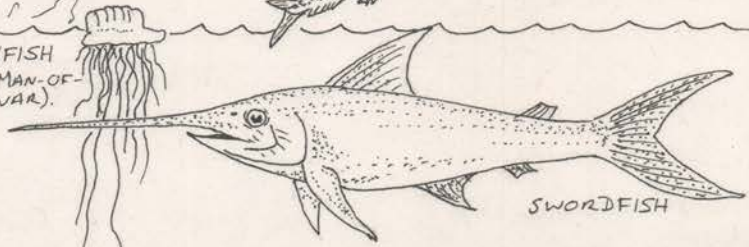
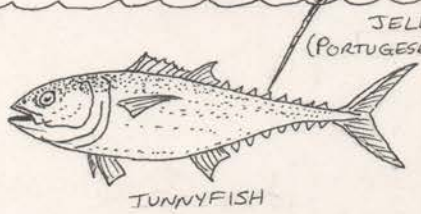
..... WARM CURRENTS  
 - - - - COLD CURRENTS

- A. North Equatorial Current    B. Equatorial Current  
 C. South Equatorial Current    D. Peru Current    E. Cape Horn Current  
 F. Gulf Stream    G. North Atlantic Current    H. Canaries Current  
 I. Brazil Current    J. Benguela Current    K. West Wind Drift  
 L. Indian Counter Current    M. Kuro-Shiro Current

Underneath the surface the water is also moving - the interaction of currents, variation in pressures in the deeps and the fact that cold water sinks (as does more salty water), all combine to keep the waters moving.



ADAPTATIONS TO SURVIVE IN A HABITAT WITH NO COVER INCLUDE :  
 FAST SWIMMERS - EG. TUNNYFISH, SWORDFISH, & SQUID  
 DENSE SHOALS - EG. HERRING & ANCHOVIES  
 ABILITY TO LEAP OUT OF WATER AWAY FROM PREDATORS - EG. FLYING FISH, SQUID & MANTA RAYS.



# DEEP SEAS

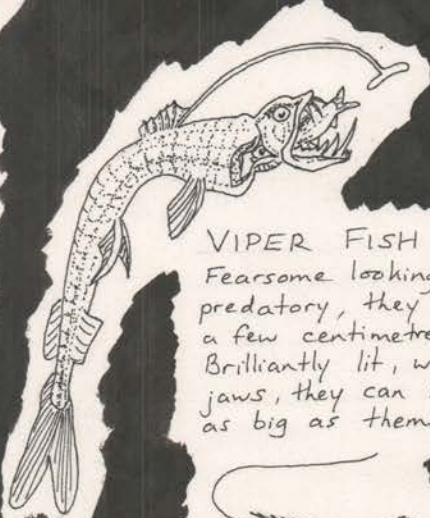
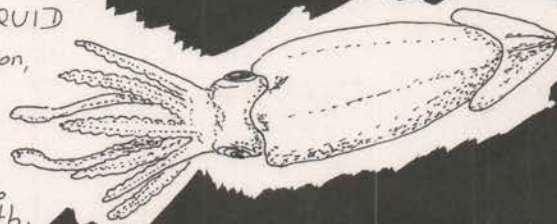
The ocean bed is not flat, it has mountain ranges and deep trenches. The Pacific Ocean has the highest (35,024 ft high peak which forms Hawaii) and the deepest (35,800 ft deep Mariana Trench) and is the largest single feature of the Earth's surface.

In the abyssal regions below 6,000 ft (1,829m) deep, where the water pressure is intense, it is intensely cold and completely dark - plant life does not exist.

Yet animal life can be found - adapted to living in such extreme conditions, most feed on waste matter falling to the sea bed, some equipped with light cells to lure the scarce prey to their jaws.

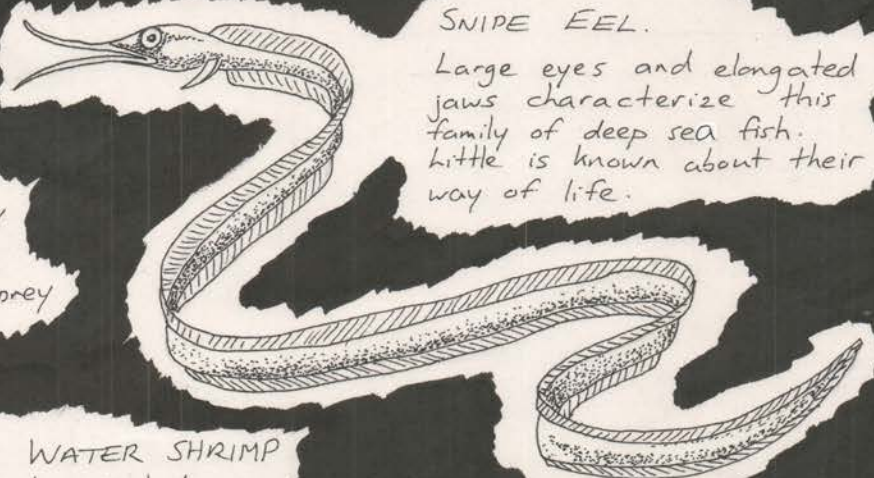
## DEEP WATER SQUID

Move by jet propulsion, squid are found at all depths. Some deep water squid have lights, and the largest grow to 15m (50ft) in length.



## VIPER FISH

Fearsome looking & predatory, they are only a few centimetres long. Brilliantly lit, with huge jaws, they can swallow prey as big as themselves.



## SNIPE EEL

Large eyes and elongated jaws characterize this family of deep sea fish. Little is known about their way of life.



## DEEP WATER SHRIMP

Large claws include a trigger mechanism that clicks loudly when discharged, stunning the nearby fish.



## HATCHET FISH

Large upward-pointing eyes and rows of lights beaming downwards - presumably to signal to other hatchet fish



## MELANOCYTE

5cm long, dark coloured predator. Prey lured toward mouth by light-emitting cells (photophores).

# BACK TO THE SEA

All land animals evolved from marine life and became adapted to a terrestrial life. Some have reverted back to living in the sea, either to live permanently or just to feed.

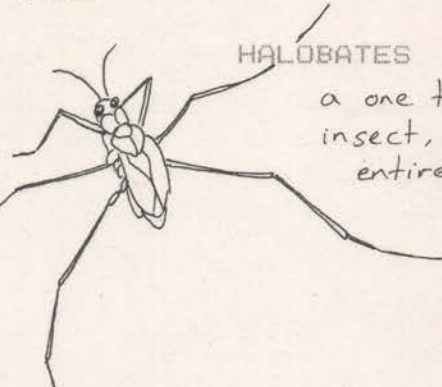
## MARINE IGUANA

Feeds on submerged seaweed. Breeds ashore. Long, sharp claws to aid gripping the rocky shoreline.



## HALOBATES

a one time land insect, now spends entire life at sea.



## PENGUINS



Torpedo shape, small flipper-shaped wings, webbed feet all aid in swimming underwater.

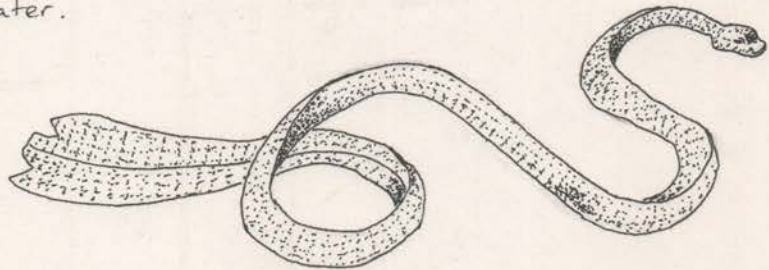
## SEA OTTER



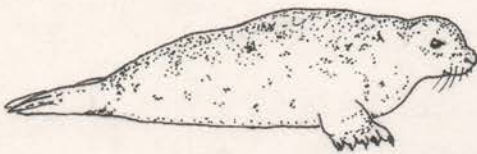
Rarely coming ashore. Has webbed feet and water repellent fur. Feeds on crustaceans, crushing tough shells with stones.

## SEA SNAKE

Living in the warm coral reefs where the eggs are laid, the flattened tail aids its swimming.



## SEALS & SEA LIONS



HARBOUR SEAL

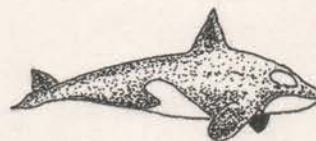


FUR SEAL

## WHALES, DOLPHINS & PORPOISES

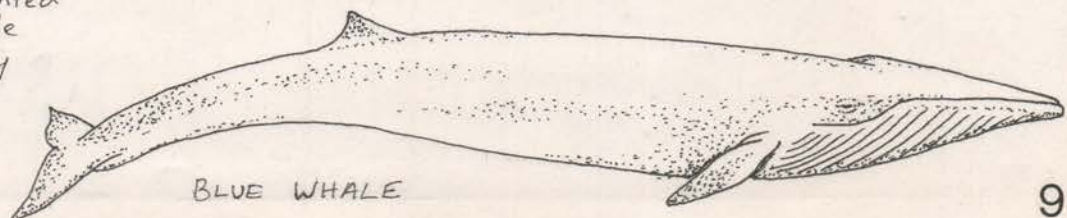
Nostrils evolved into blowhole on top of head, hind limbs into tail and forelimbs into flippers. Most have teeth for feeding on fish, seals etc., some whales have baleen plates for filter-feeding on small fish and krill.

The Blue Whale is the largest living animal - an adult male can reach 31m (90ft) long.



ORCA  
(or Killer Whale)

True seals are unable to raise themselves on the fore-flippers as fur seals & sea lions can. Adaptations include sharp, pointed teeth for eating fish, closeable nostrils and streamlined body with all four limbs modified into flippers.



BLUE WHALE

# PEOPLE & THE SEA

People have taken food from the sea since the earliest times - relying on the upwelling currents and seasonal migrations of the shoals to bring the sea harvest to the nets. With the advent of modern fishing methods and modern navigational techniques more and more fish have been taken each year. Some 70 million tonnes of fish have been taken annually from the sea since the early 1970s. To keep up at this rate some method of generating a sustainable yield must be adopted by the fishing nations before the fish stocks run out.

Today the belief that the rich harvest could last forever has come to a halt - catches are failing due to our greed.



Ancient Egyptian fishing boat.  
Spear fishing close to shore.



Byzantine fishing method using a light to lure fish towards the net.

ANCIENT nomadic peoples harvested the sea, leaving behind mounds of oyster, mussel and other mollusc shells and the bones of inshore fish - which we can still see today.

EGYPTIAN fishermen, 5,000 years ago used a seine or drag-net - a long net operated from land or reed-boats & coracles.

EUROPE began using this method over 1,000 years ago - Wales had hundreds of coracle fishermen.

OTHER traditional fishing methods include spearing from a boat, the stilt fishermen of Sri Lanka (who stand on stilts and cast lines out to sea for sardines), Cormorant fishing in China - where the fisherman uses the expertise of a few cormorants, taking the fish from the bird before it is swallowed and allowing the bird to eat one every now and then.

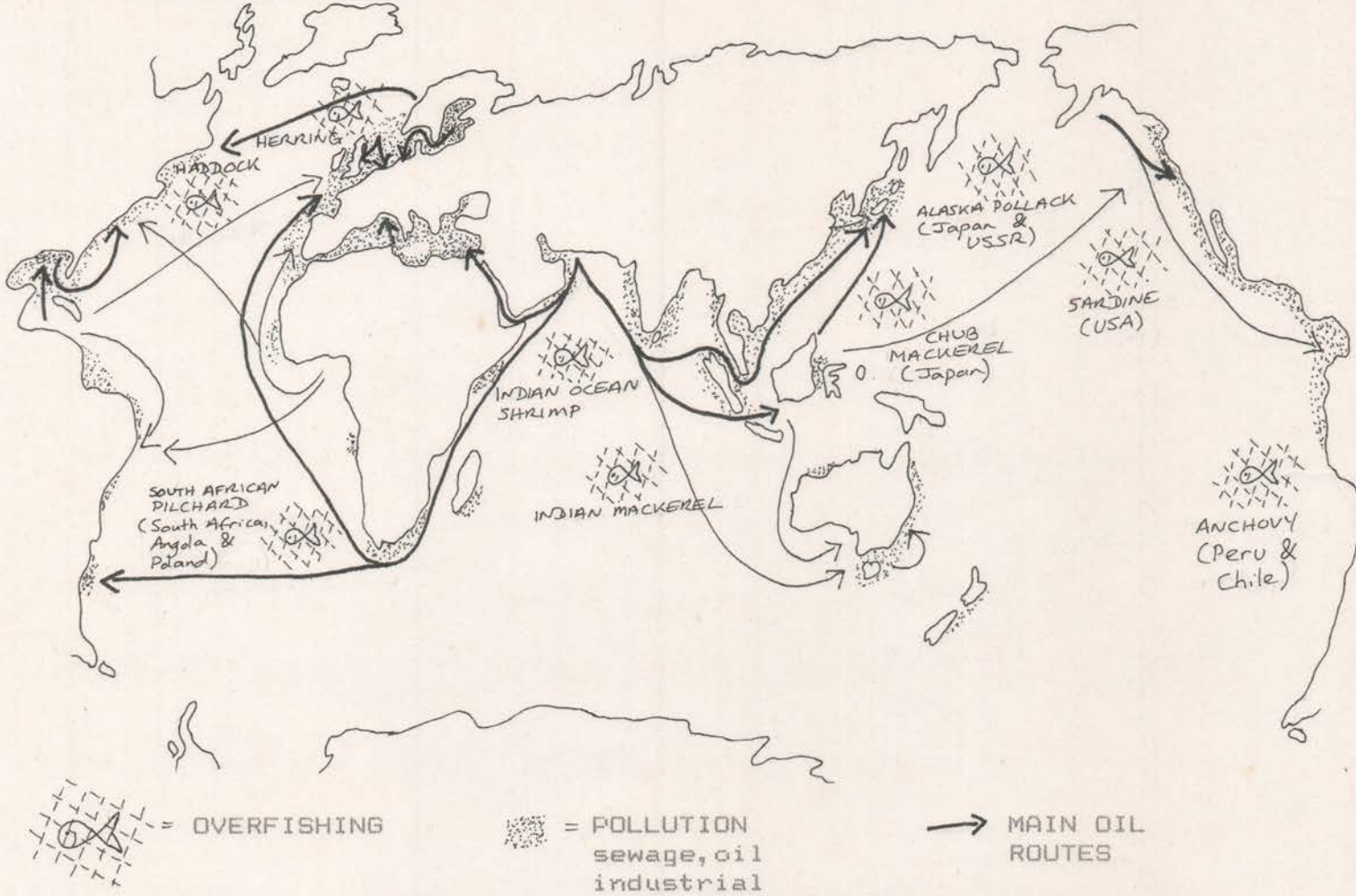
THE Japanese farm seaweed from the shores, traditionally diving without any breathing apparatus.

PEOPLE from the Faeroe Islands have traditionally herded Pilot Whales into bays each year and slaughtered them for food. Hundreds are killed each year, which is today unnecessary as their modern high standard of living provides plenty of food, oil etc.

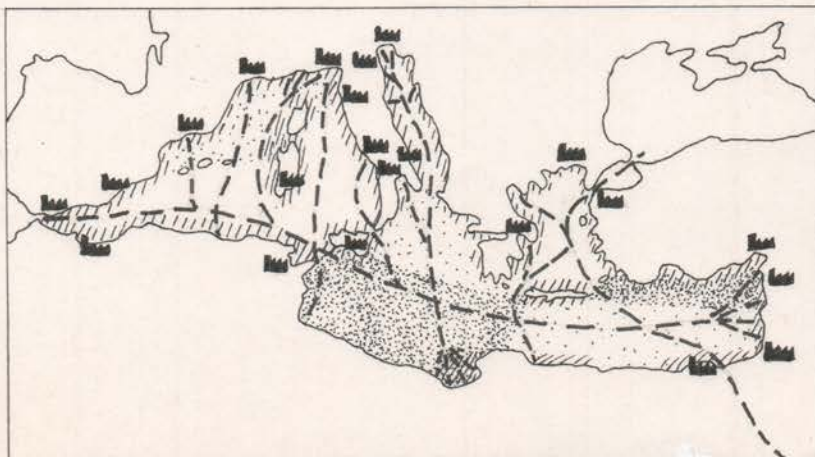
Some ocean-going people include the Ancient Greeks, Vikings, Polynesians.

# THREATENED SEAS

Seas are at risk not just from overfishing. We continually dump waste into the sea - it will not take it forever without terrible consequences. At least 85% of ocean pollution is created by human activities on land - and 90% of that remains in coastal waters (which has been and currently still is the most productive part of oceans and seas).



THE MEDITERRANEAN - a black-spot.



- Oil-tanker routes
- //// High sewage pollution
- Industrial centres
- Oil pollution land based sources.

# CONSERVATION

So 71% of the Earth's surface is covered in water - the oceans can go on forever!

Or can they? If you look at water another way, all of it (fresh and salt) makes up little more than 0.01% of the Earth's volume.

So in this light it is more understandable why we must conserve and cherish this vital resource, as water is life itself.

## THREATS TO OCEANS & SEAS -

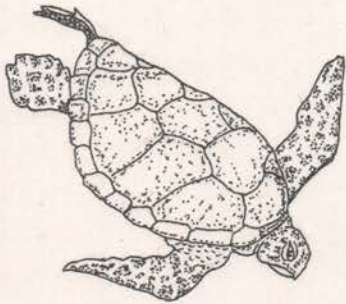
overfishing

overhunting - of whales, dolphins, turtles, sea cows, sea otters, sea lions, some seals and many others.

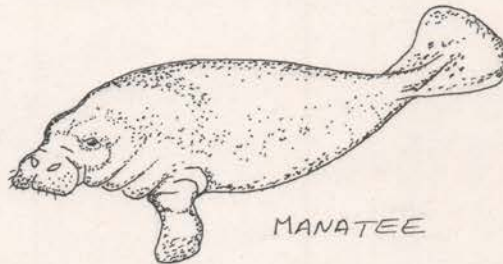
pollution - due to agricultural run off, sewage, industrial wastes, radioactive waste, oil leakage etc.

destruction - of coastal regions for development (housing & industry), waste disposal, salt pond construction.

## SOME ENDANGERED MARINE ANIMALS

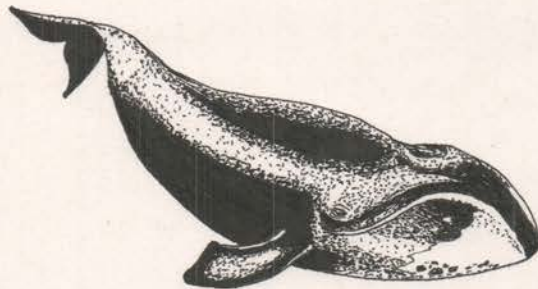


GREEN TURTLE



MANATEE

GALAPAGOS  
FLIGHTLESS  
CORMORANT



BOWHEAD  
WHALE



MONK SEAL

What can be done about it -

International laws protecting species and preventing pollution.

Become aware of what's happening.

Write to conservation organisations to see what is happening.

Make other people aware of what is going on.

Join a marine conservation society.

# SEA ANIMALS AT PENSCYNNOR

1. AQUARIUM - Clown Fish, Anemone, Star Fish, Cleaner Shrimp, Coral, Sponge, Fan Worm, Sea Cucumber. Iguana \*

2. Humboldt's Penguin, Pink-backed Pelican.

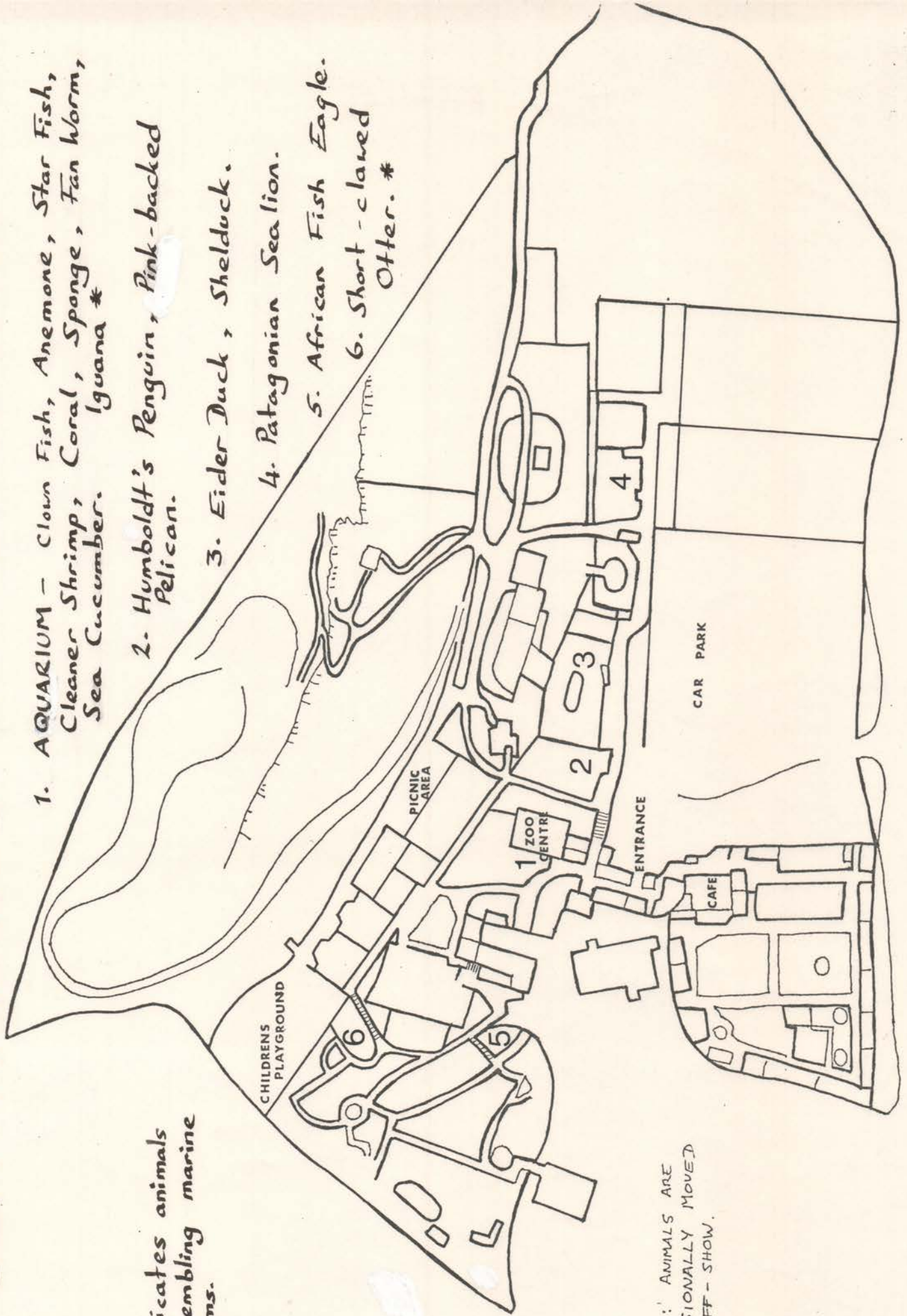
3. Eider Duck, Shelduck.

4. Patagonian Sealion.

5. African Fish Eagle.

6. Short-clawed Otter. \*

\* Indicates animals resembling marine forms.



NOTE: ANIMALS ARE OCCASIONALLY MOVED OR OFF-SHOW.

# OCEAN ACTIVITIES

Draw sea animals at the zoo.

Make a list of the marine animals at Penscynor - draw a part of the body eg. the outline, eyes, front limbs, tails, breathing apparatus etc. Back at school compare them and discuss reasons for differences/similarities.



*lets do the side-step!*



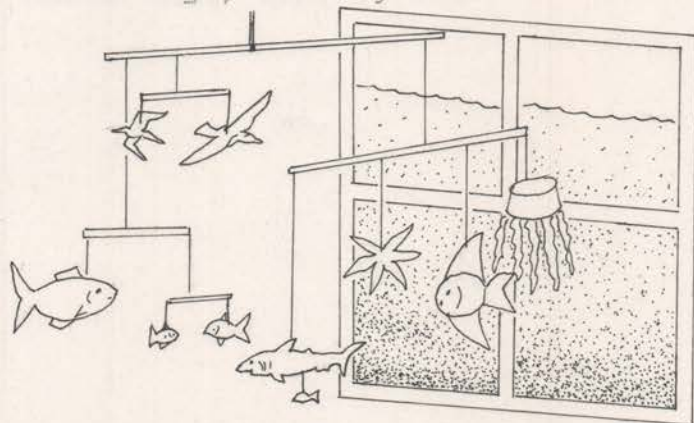
## MOVEMENT -

select a marine animal, then watch it for a while, say 5 mins.

Devise a dance using its movements.

Look at different ways of attack and defence in marine animals. Egs. Shells, claws, teeth, stings, camouflage, mimicry etc.

Make a Marine Mobile - with sea birds, jellyfish, fish, sea snakes, starfish, whales etc. Hang the mobile by a window painted with blue-green washable powder paint for effect.

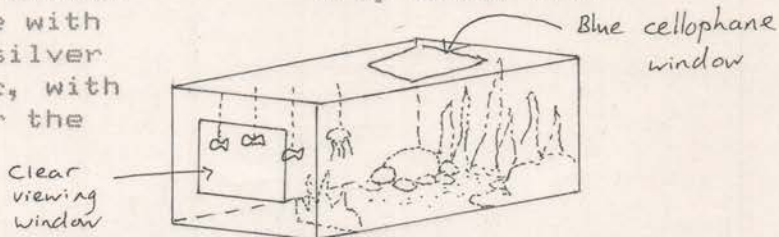


COMPILE reports on the campaign to save the whales.

Compile a report on local marine pollution - how has the coast changed since your parents/grand parents where children?

CREATE shoebox theatre habiats- make an underwater scene with sand, pebbles, shells, silver paper, coloured card etc, with some blue cellophane for the window.

GEOGRAPHY - chart migration routes of Arctic Tern, Brent Goose, Salmon, Humpback Whale, Grey Whale etc.



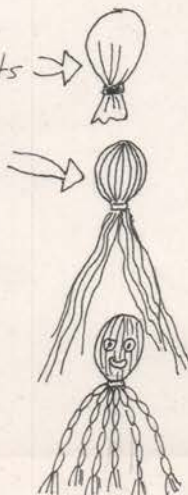
## MAKE MARINE ANIMALS -

### Octopus-

From old tights & a ball of wool. Stuff a toe end with rest of tights Tie tightly underneath. Glue or sew long lengths of wool to top & tie under body.

Plait eight legs and tie ends tightly with spare wool.

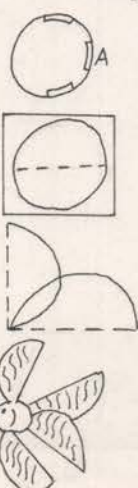
Make eyes & mouth from felt or paper. Glue to head.



### Ping-pong Ball Fish -

Cut 3 slits in the ball with a sharp knife.

Draw four 5cm diameter circles for tail and fins. Cut out & fold in half. Paint patterns on. Glue 2 together in a heart shape. Slide into slit A & glue. Glue other two into remaining slits to make fins. Paint eyes & mouth. Suspend from top fin with cotton thread.



# OCEAN MYTHS & FABLES

The sea has always been mysterious, holding a harvest of food yet full of dangers such as the weather and strange creatures. So many myths and legends have developed from the gods of ancient civilizations to modern films.

## SEA GODS

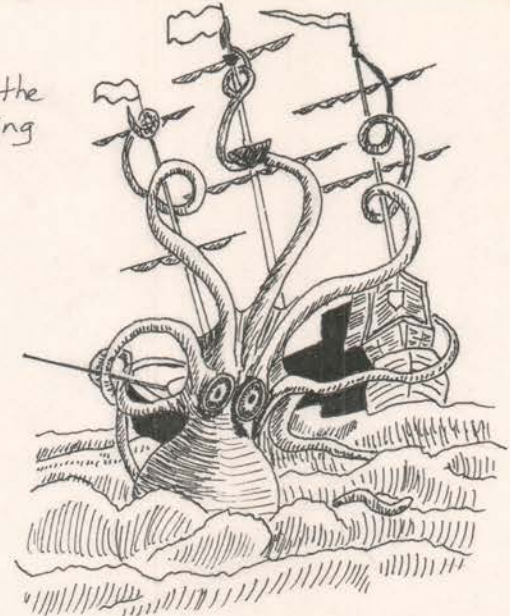
Poseidon - Greek god of the sea  
Neptune - Roman god of the sea  
Ruahato - Tahitian god of the sea  
Manannan - Irish Celtic lord of the sea.

Dressed in invulnerable mail, a helmet which shone like the sun, a magic sword & sailed an enchanted boat which went wherever he willed it.

T'ien Hou - Chinese Empress of Heaven who had authority over the sea.

O-Wata-Tsu-Mi or Shio Zuchi (the Old Man of the Tide) - Japanese god of the sea who rules all fish and sea creatures.

Sea monster, the Kraken, sinking a ship.



## SEA CREATURES

The Kraken - a Norwegian folklore sea monster. A mile and a half in girth, circular, flat shape with many arms. Could this have been a giant squid?

Sirens - Greek sea monsters - half woman, half birds whose singing drove sailors mad causing the ship to become wrecked on nearby rocks and reefs.

Mermaids - a mythical race of half human half fish, living under the seas. Where sailors trying to describe dugongs and sea cows?

Atlantis - mythical underwater city.

## BIBLICAL STORIES

Dolphins saved St. Martin, St. Basil and Cillistratus from martyrdom.

A passage in the Book of Job Ch. 41 vs. 1-34, describes a terrifying sea monster, possibly a whale.

The story of Jonah and the Whale.



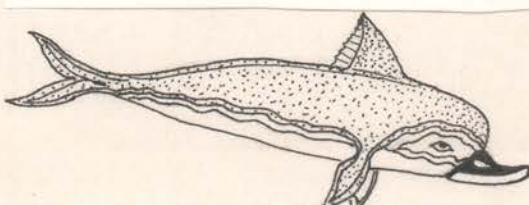
JONAH AND THE WHALE FROM A 1493 WOODCUT.

## JAPANESE FOLKTALE -

the whale is depicted in the same light as the hare in Aesop's fable of the hare and the tortoise. The whale challenges a sea slug to a race.

## BOOKS/FILMS etc -

Sinbad the Sailor, Jason and the Argonauts, Moby Dick, The Ancient Mariner, 20,000 Leagues Beneath The Sea, The Old Man and the Sea, The Little Mermaid, Jaws, Flipper, Tarka the Otter.



DOLPHIN FROM A FRESCO ON THE WALL OF THE QUEENS ROOM AT THE PALACE OF KNOSSOS, CRETE. PAINTED AROUND 1450 - 1400 B.C.

# USEFUL INFORMATION

## GLOSSARY

- Baleen Plates - modified mouth parts of some whales. Made of sheets of fine fibres for filter feeding.
- Calcareous - containing a hard substance called calcium carbonate which makes up shells, coral skeletons etc.
- Coriolis Effect - phenomena caused by the rotation of the planet deflecting winds and currents.
- Crustacean - invertebrate, generally with a hard shelled exterior and eight legs eg. crabs, shrimps, wood louse, lobster.
- Mollusc - invertebrate with soft bodies and usually shell on the outside - includes snails, slugs, limpets, oysters, octopus, cuttlefish.

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