MAKAHIKI KAI

STUDENT WORKBOOK FOR PALAU

UNIHI-SEAGRANT-MR-81-03
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Adapted from *Makahiki Kai '77 Student Workbook*
(UNIHI-SEAGRANT-MR-77-01)

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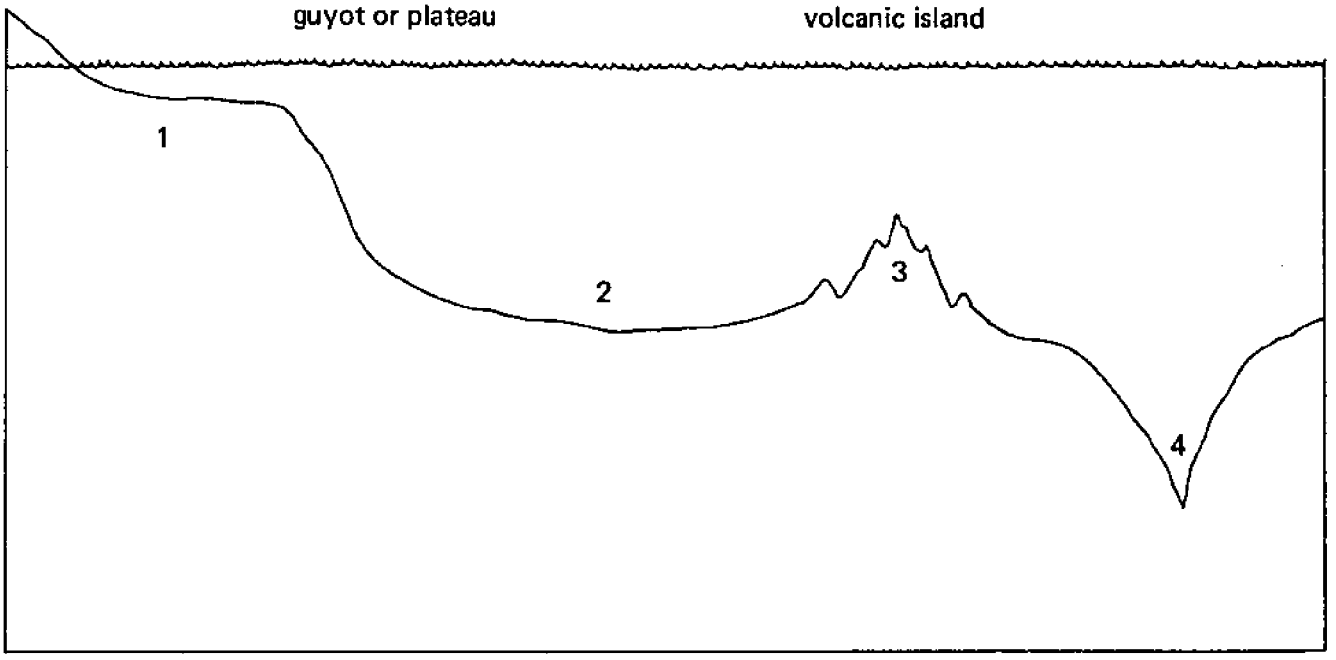
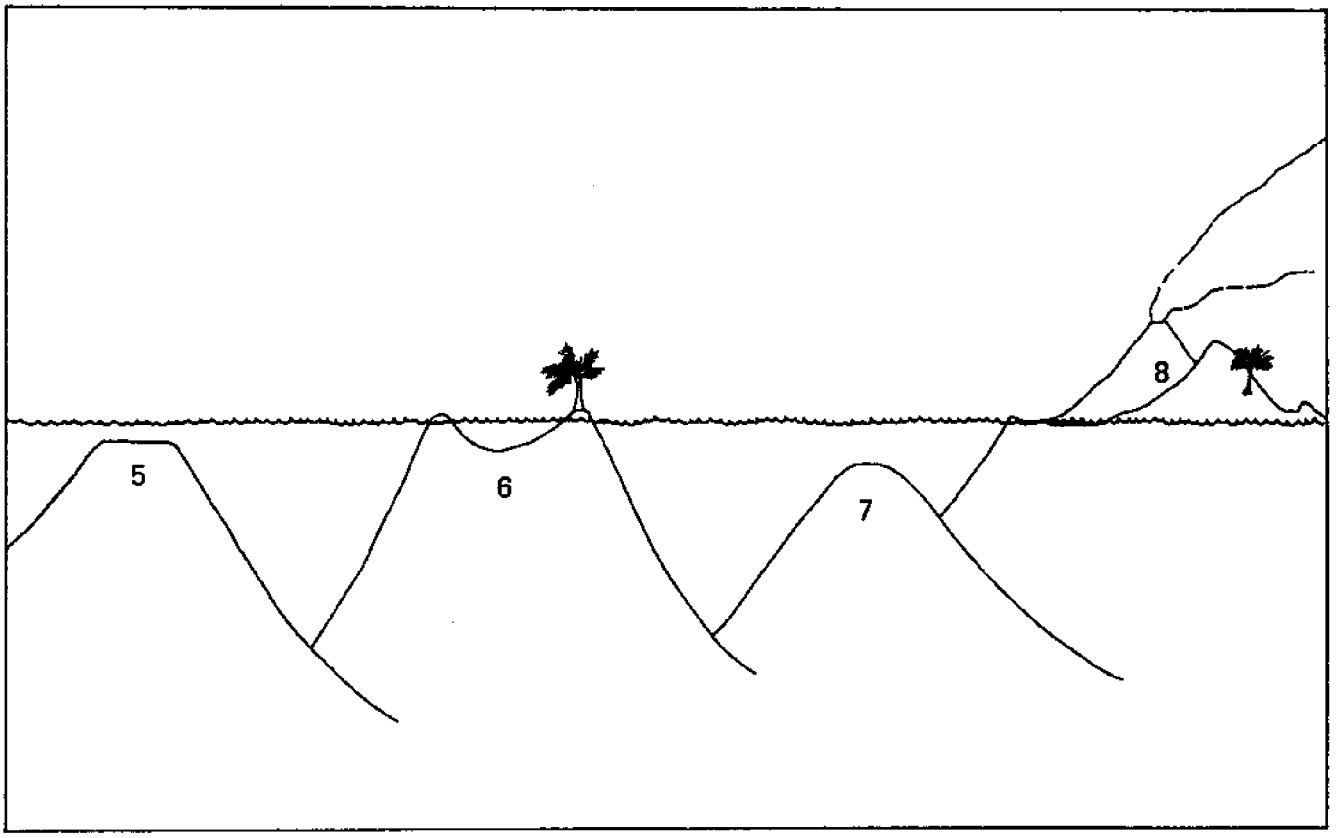
UNDERWATER FORMATIONS

Find and write the number beside the underwater formations listed below:

abyssal plain	ridge
atoll	seamount
continental margin	trench
guyot or plateau	volcanic island





UNDERWATER 'LANDSCAPE'

Scientists have measured the great depths and found that the shape of the ocean floor, or underwater landscape, is very much like that on land. Some of these underwater formations are defined and listed below.

Place the letter in front of each word to the correct definition.

1. abyssal plain
2. atoll
3. continental margin
4. guyot or plateau
5. ridge
6. seamount
7. trench
8. volcanic island

A. a flat topped submarine mountain

B. the seabed that forms a gentle sloping shelf covered by shallow water ranging from a few to hundreds of miles wide. The edge of the shelf has a very steep slope.

C. a submarine mountain that is rounded or has peaks

D. a volcano that has sunken below sea level with a ring of coral growing around it

E. a long, narrow cut in the sea floor with steep slopes

F. a peak formed by lava that rises from the sea floor to above sea level

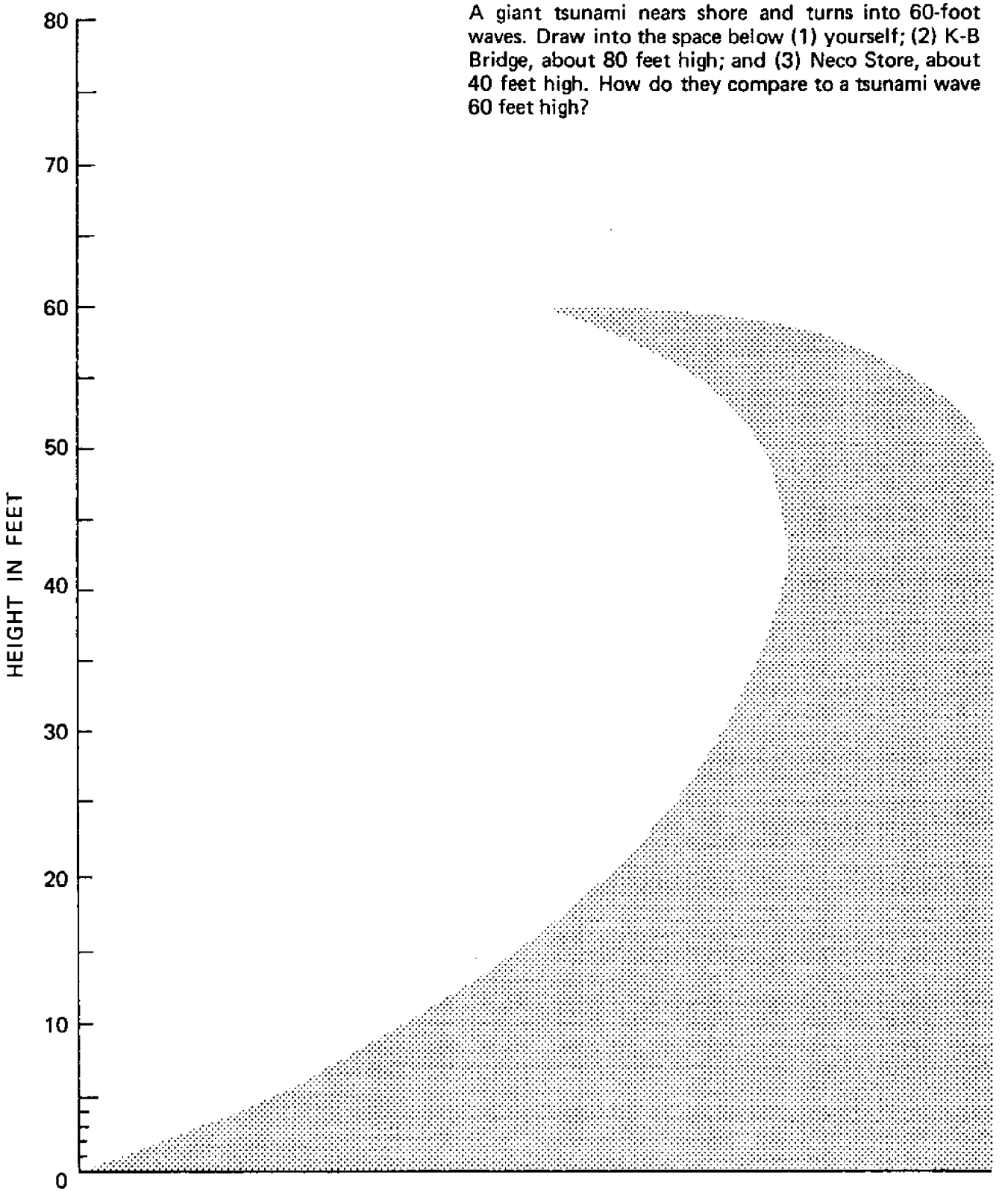
G. a long, narrow rise in the sea floor with steep sides and a bumpy shape

H. a deep flat area often covered with a thin layer of mud

"TSUNAMI!"

Tsunamis are waves made when the sea floor moves because of earthquakes, landslides, or volcanic eruptions. Tsunamis are not just a single wave; they are a series of waves separated by 15 to 60 or more minutes. Most tsunami waves are very small but if there is a large earthquake the waves might be very large. If there is an earthquake that causes you to fall or makes you hold on to something to keep you from falling, this should be a natural tsunami warning. Get to higher grounds right away if you are near the seashore.

A giant tsunami nears shore and turns into 60-foot waves. Draw into the space below (1) yourself; (2) K-B Bridge, about 80 feet high; and (3) Neco Store, about 40 feet high. How do they compare to a tsunami wave 60 feet high?



WAVES

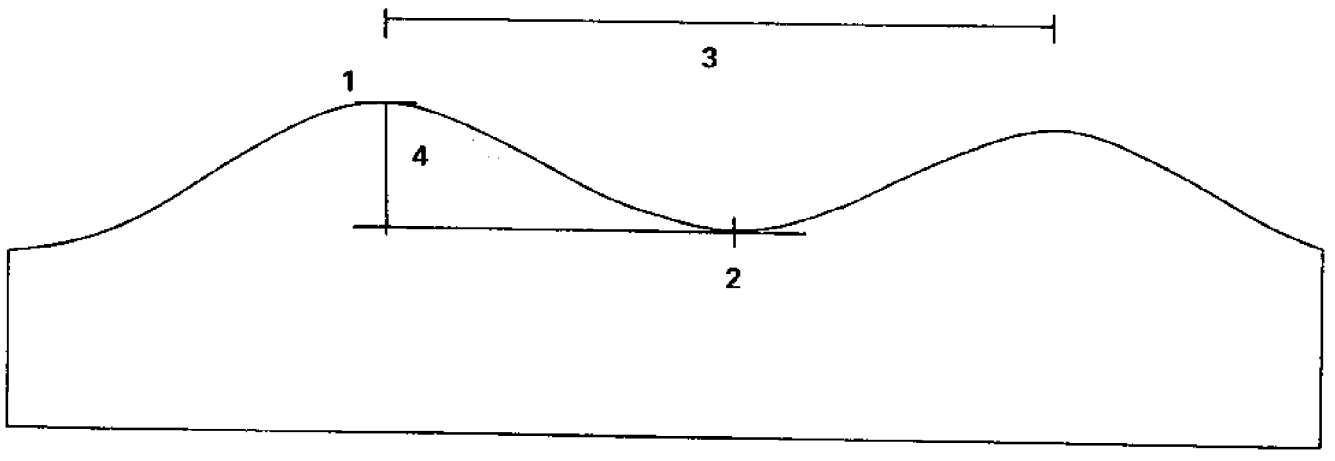
The energy that makes waves comes from the winds that blow across the ocean and movements of the sea floor. The waves you see breaking at the beach are usually made by winds.

The lowest part of the wave is called a TROUGH, the highest part is called the CREST. The WAVE HEIGHT is the distance between the trough and the crest. If the waves are said to be breaking three to four feet, it is the wave height that is being measured. WAVE LENGTH is the time it takes two crests to pass one spot.

In the open ocean, the water does not move forward, only the energy of the waves moves. A person on a boat will feel like he is on a swing—moving up and down but going nowhere. However, when the wave nears the shore and touches the sea bottom it starts to drag. This forces the water to pile up until the wave becomes so steep that it spills over, or BREAKS. Then the water moves towards shore and takes the boat with it.

What would happen to the boatman who drove his boat too close to the shore? Where would be the best place for him to be?

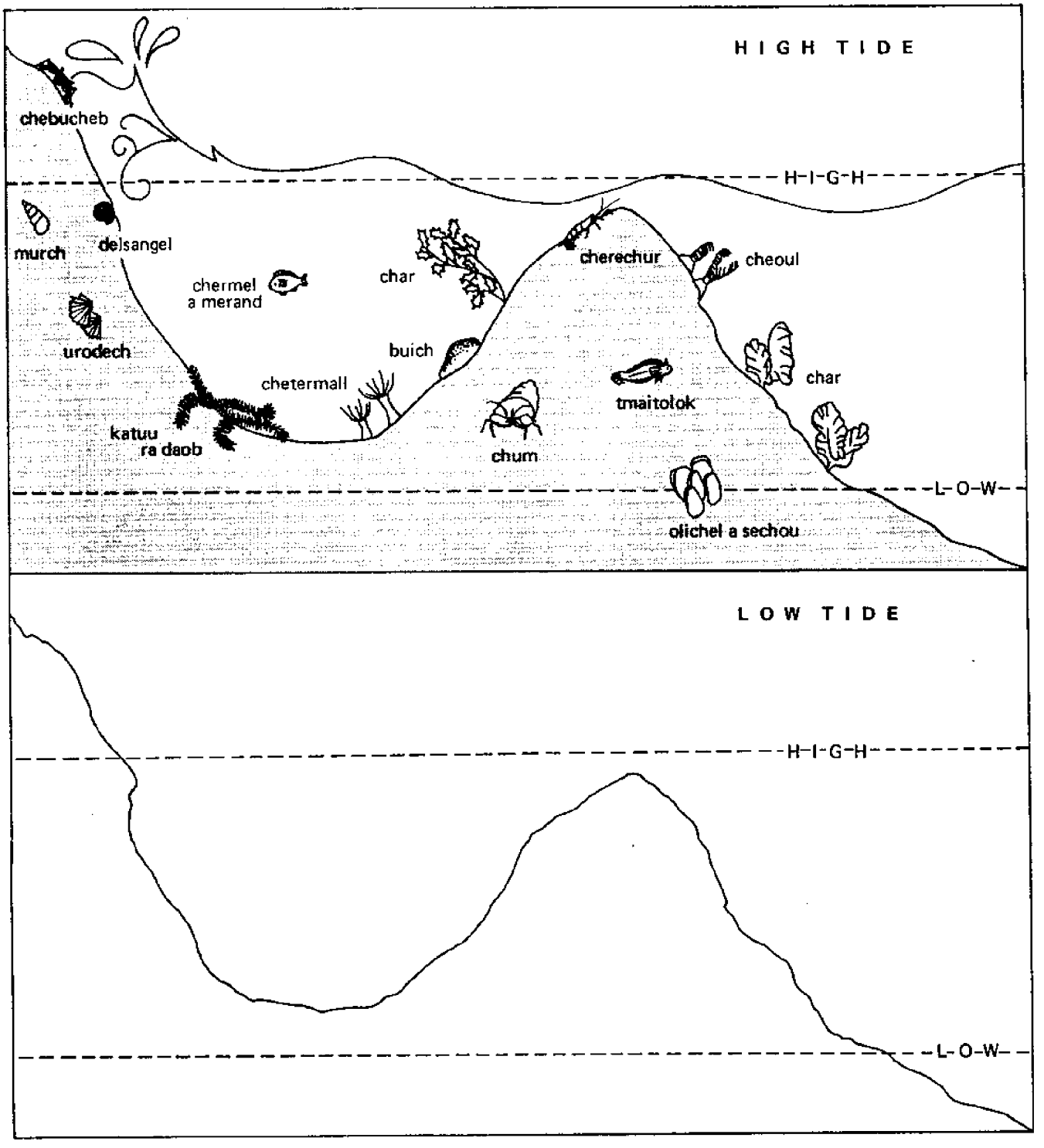
Name the parts of a wave:



THE HIGH AND LOW POINTS OF TIDE POOLS

Below is a diagram of a reef flat tide pool during HIGH TIDE. The tidal pool animals are busy eating, moving about, and enjoying the cool, fresh sea water that is bringing in food and oxygen.

At LOW TIDE the tidal pool zone looks like a different place. Draw in the water and what it would be like in this tide pool at low tide.



SEA LIFE — a word search

Circle all the animals that you can find in this puzzle from the list below.

CHITON (chechui)	N	S	M	U	O	I	X	P	G	R	E	T	S	B	O	L	P	M	I	R	H	S
UNICORN (chum)	U	N	I	H	C	R	U	A	E	S	A	M	T	L	C	G	P	E	R	H	S	O
SQUIRRELFISH (desachel)	D	D	N	W	Y	P	S	R	O	S	U	P	O	T	C	O	N	I	O	E	A	U
BARNACLE (cheoul)	I	E	O	H	I	P	C	R	L	E	H	N	P	O	T	S	W	W	I	E	S	E
BLACK ROCK CRAB (rereek)	B	F	R	E	T	S	Y	O	M	S	H	S	I	F	L	E	R	R	I	U	Q	S
CORAL (merand)	R	S	U	H	C	O	R	T	N	L	A	R	O	C	E	E	S	E	I	D	U	E
COWRIE (buich)	A	C	S	F	E	K	C	F	A	M	U	C	I	B	O	B	R	A	B	E	I	A
CRAB (chemang)	N	T	K	T	E	P	M	I	L	O	E	L	C	A	N	R	A	B	A	M	D	A
EEL (kitelel)	C	U	E	T	E	X	P	S	E	S	S	A	R	W	S	C	N	O	A	U	L	N
OCTOPUS (bukitang)	H	N	O	H	K	R	A	H	S	E	A	M	A	O	R	H	O	X	A	L	E	E
WRASSE (maml)	B	A	R	C	K	C	O	R	K	C	A	L	B	R	A	I	F	F	E	L	O	M
	H	I	P	O	I	L	L	E	R	E	K	C	A	M	M	T	S	I	E	E	T	O
	U	O	I	H	S	A	B	A	R	C	D	N	A	S	I	O	H	S	A	T	C	N
	Y	X	C	S	H	A	D	U	C	A	R	R	A	B	M	N	E	H	B	B	F	E

BOXFISH (riamel)

MULLET (kelat)

CLAM (kim)

PARROTFISH (kemedukl)

NUDIBRANCH (kikila deleb ra daob)

LIMPET (urodech)

OYSTER (yiud)

SAND CRAB (chesechuul)

SEA ANEMONE (chetermall)

SHRIMP (cherechur)

SQUID (luut)

LOBSTER (cheraprukel)

SEA URCHIN (ibuchel)

WORMS (chulad)

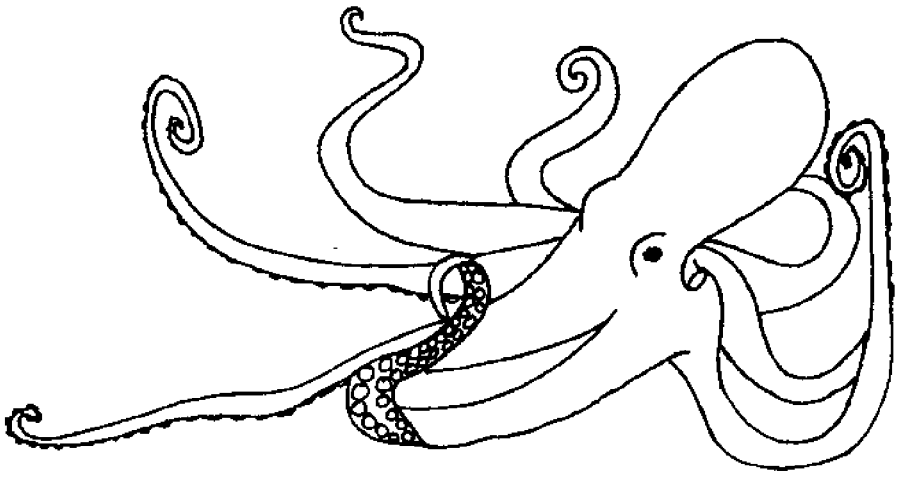
TROCHUS (semum)

TUNA (tuna)

BARRACUDA (ai)

MACKEREL (ngelngal)

SHARK (chedeng)



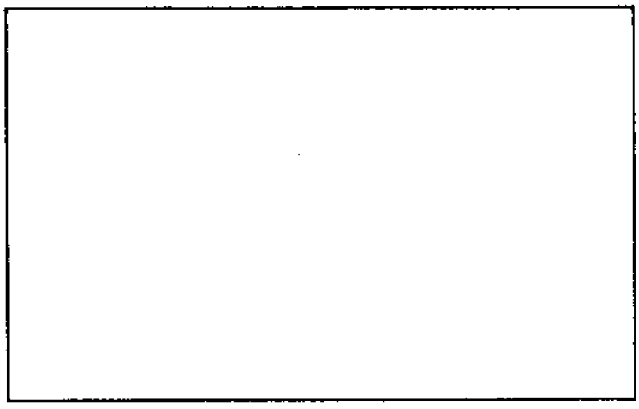
CORAL REEFS

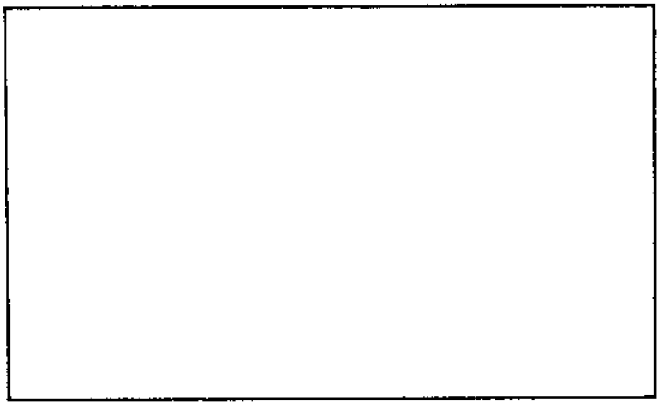
Coral reefs are made by reef corals and coralline algae. These organisms (plants and animals) get chemicals from seawater and make their calcium carbonate (lime) skeletons. The skeletons of these organisms build and cement together the reef. In and around the coral reefs live a complex community of marine animals.

Find and paste or draw in pictures of the different types of coral reefs and label them.

TYPES OF REEFS

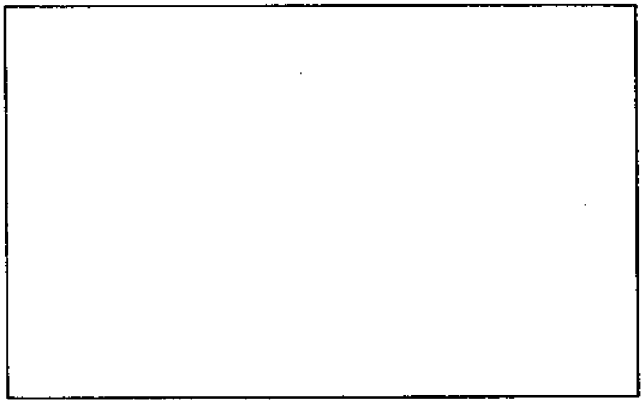
Coral larvae settle on the lava or basaltic rocks. They build a FRINGING REEF that follows the shape of the island. Large, well-developed fringing reefs can be found between Ngerard and Melekeok. This is the kind of reef where you are able to walk from the shore to the reef at low tide.





If these fringing reefs continue to develop and the land erodes, a BARRIER REEF is formed. The barrier reef has a lagoon between it and the shoreline. It protects the newer reefs that are built in the lagoon. Ngerdmau has a barrier reef protecting small circular PATCH REEFS (melekesokl) and the fringing reef from the ocean waves.

Finally, over a great period of time, the island will erode and sink completely below the surface leaving a large lagoon in the center, surrounded by the reefs. Kayangel and Ngerbelas, Ngeriuns, and Orak to the north of Babeldaob are like this and are called ATOLLS.

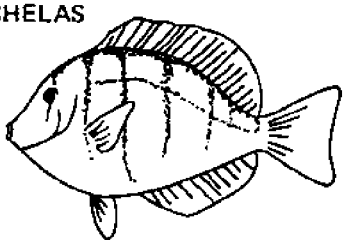


REEF VERTEBRATES AND INVERTEBRATES

Most animals can be divided into two broad groups--the vertebrates and invertebrates. VERTEBRATES are animals with backbones. INVERTEBRATES are animals without a backbone inside their bodies. Some invertebrates "wear their skeletons on the outside of their bodies." Their bodies are supported by hard outer shells.

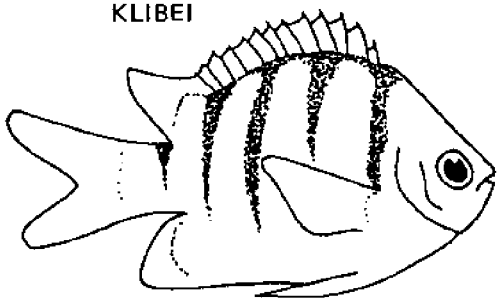
In the blank below each animal, write whether you think the animal is a vertebrate or invertebrate.

CHELAS



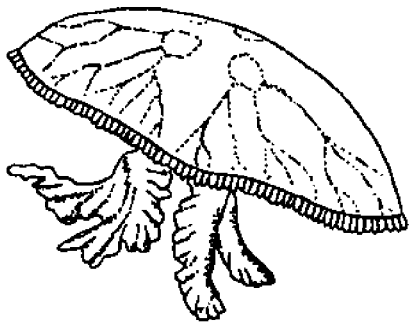
1 _____

KLIBEI



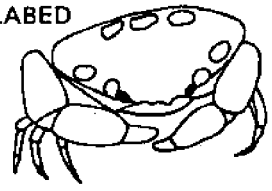
3 _____

CHEDEYAD, DUDEUKE BURS



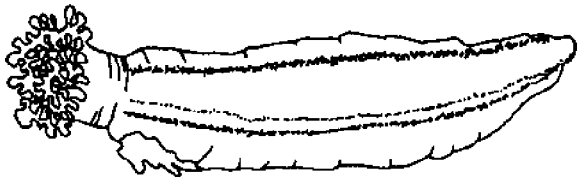
2 _____

CHELLABED



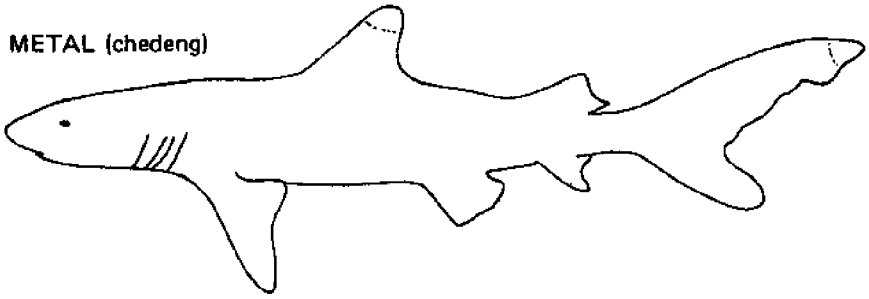
4 _____

CHEREMRUM



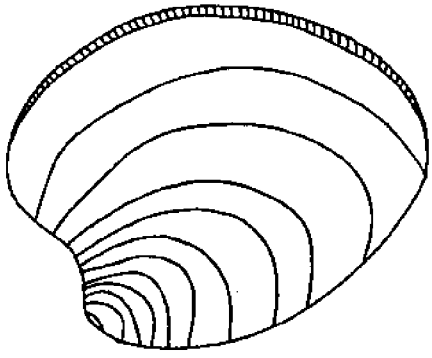
5 _____

METAL (chedeng)



6 _____

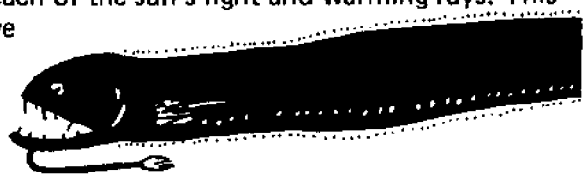
DEBUONGEL KOUIB



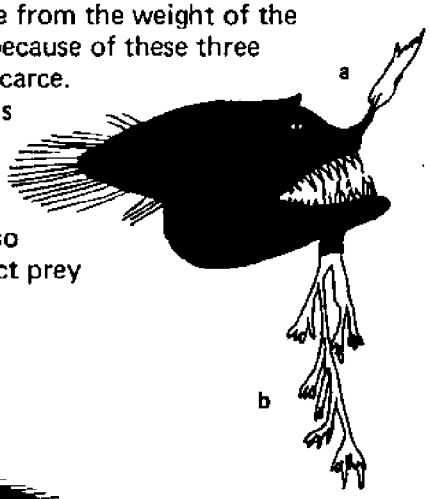
7 _____

ANIMALS OF THE DARKEST DEPTHS

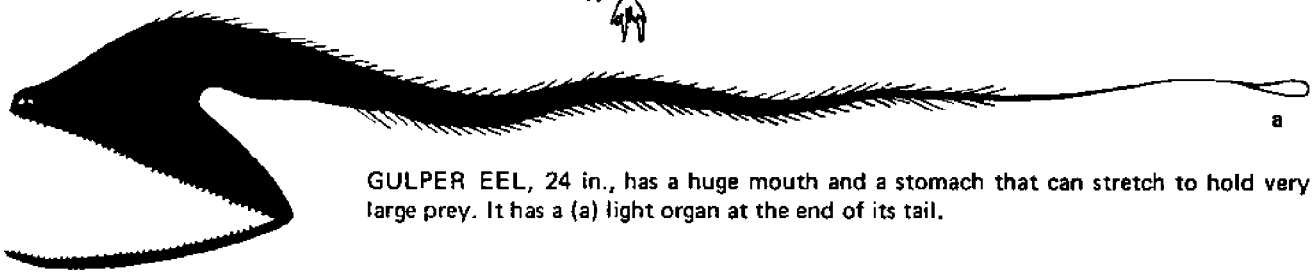
Only animals that are best suited to the place in which they live, survive. The animals of the great depths, or abyss, have to be able to live in a place where no surface animal, including man, can live. The abyss is so far below the ocean's surface that it is out of reach of the sun's light and warming rays. This makes the abyss always pitch black and very cold, just above freezing. Another thing abyssal animals must adapt to is the great pressure from the weight of the water above. Mainly because of these three reasons, food is very scarce. To survive, the animals have adapted themselves so they can eat what comes along and they can also produce light to attract prey and mates.



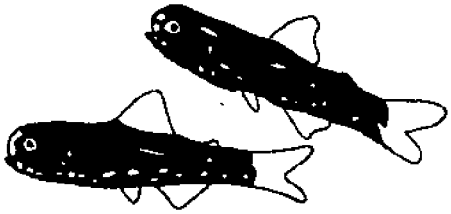
VIPERFISH (above) has a luminous chin barbel and spots. It is 3.5 in. long.



The DEEP-SEA ANGLER (left), 3 in. uses its (a) luminous bait and (b) chin barbel to attract food to it. Unlike most abyssal fish the anglerfish is almost as wide as it is long.

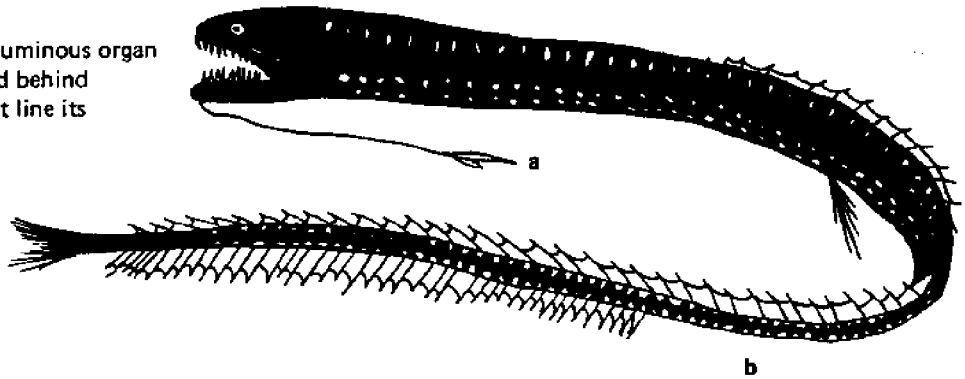


GULPER EEL, 24 in., has a huge mouth and a stomach that can stretch to hold very large prey. It has a (a) light organ at the end of its tail.



LANTERN FISH (left), 1.6 in. has luminous organs on its nose and body. It often comes up to the surface at night to feed.

STOMIATOID FISH has (a) a luminous organ at the end of its chin barbel and behind its eye, and (b) light organs that line its 6-in. long body.



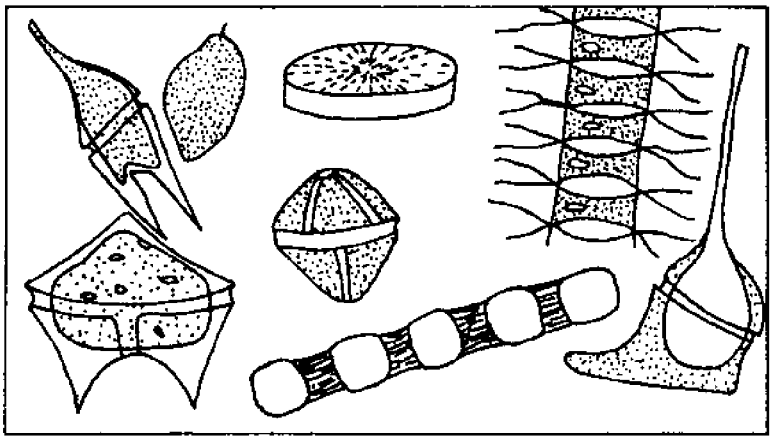
HIGH SEAS DRIFTERS

WHAT ARE PLANKTON?

The word "PLANKTON" means "DRIFTER." True to its name, plankton are tiny plants and animals that drift in ocean currents. Many of them are so small that you need a magnifying glass or microscope to see them. Plankton can also be the larger animals like jellyfish and portuguese man-of-war that are weak swimmers and cannot swim against the wind or currents.

Scientists divide plankton into two groups–PHYTOPLANKTON, which are plants, and ZOOPLANKTON, which are animals.

PHYTOPLANKTON



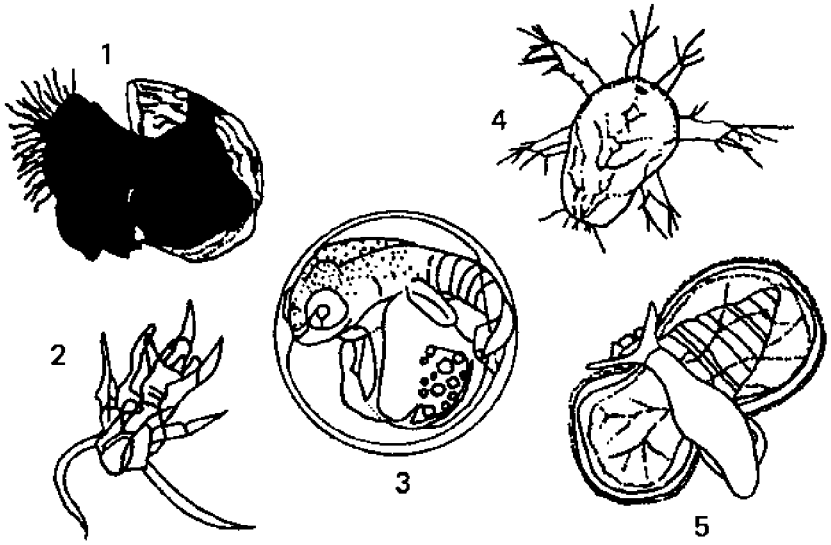
Phytoplankton are microscopic marine plants that use sunlight and minerals to grow like land plants. The most familiar sea plant is char or seaweed, which grows attached to rocks, but phytoplankton spend their whole lives floating near the sunlit surface of the ocean.

Plankton is the beginning of the ocean's FOOD WEB. They are called PRIMARY PRODUCERS and provide food mainly for zooplankton.

ZOOPLANKTON

Zooplankton are tiny animals that drift in the ocean currents like phytoplankton. Some zooplankton float for their entire lives in the ocean. Young PERMANENT ZOOPLANKTON do not change their body shapes when they become adults. Other zooplankton, called TEMPORARY ZOOPLANKTON, spend only part of their lives as plankton. These are the EGGS and young of many kinds of marine animals. As babies, these animals float around but as they grow older, they change their shape and become starfish, sea urchins, crabs, fish, and many other animals.

Can you tell what these young zooplankton will grow into?

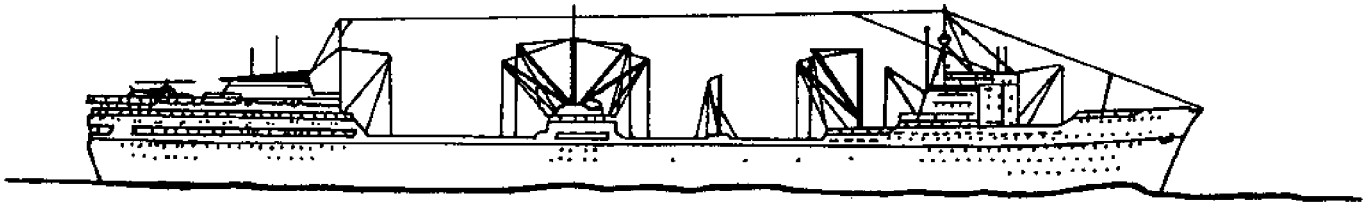


Write the number in the boxes below of the larval form of each animal.

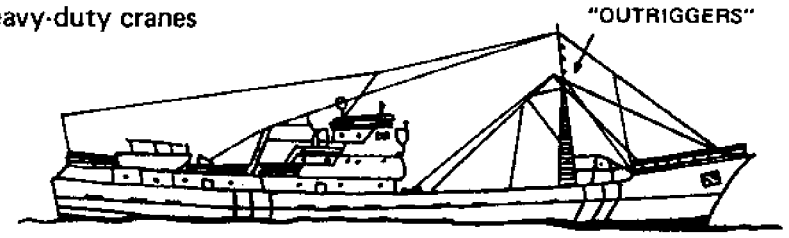
	trochus
	crab
	fish
	snail
	sea urchin

OCEAN HARVESTERS

Each of the boats below is equipped with different kinds of "fishing" gear. Depending upon the habits of each animal and where these animals can be found, different ways to catch them had to be developed. Can you match the animal with the way it is caught?

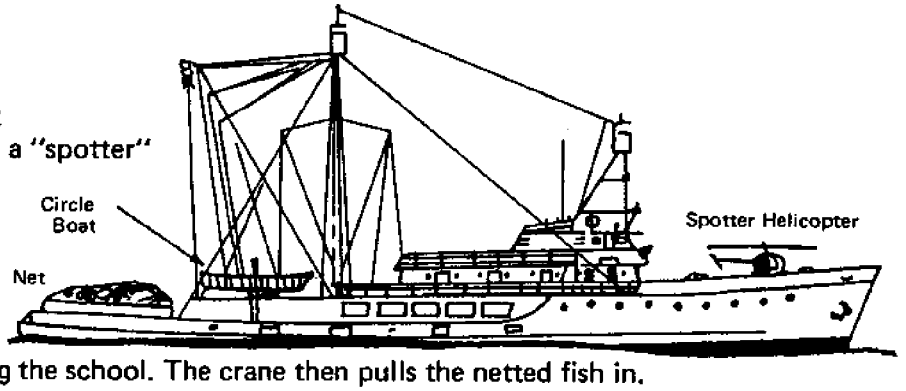


1. FACTORY SHIP, 715 feet
   Extra large ship, fitted with many heavy-duty cranes and a helicopter pad.



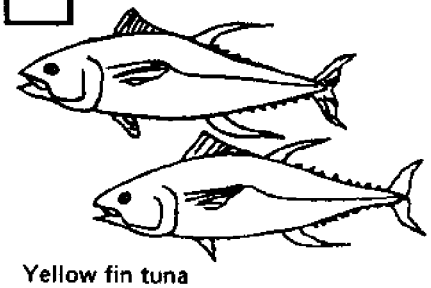
2. SIDE TRAWLER, 195 feet
   Two "OUTRIGGERS" hold one small trawl net each, which are towed behind the ship at great depths.

3. PURSE SEINER, 190 feet
   This boat is outfitted with a "spotter" helicopter, and a small boat to tow net in a circle to surround a school of fish. A crane then pulls the "draw strings" at the bottom of the net to close it, trapping the school. The crane then pulls the netted fish in.



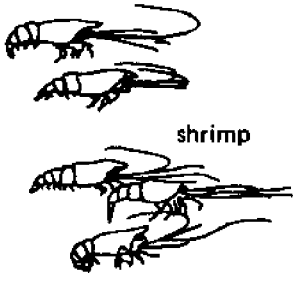
Write the number of the ship in the box next to the animal it catches.

☐



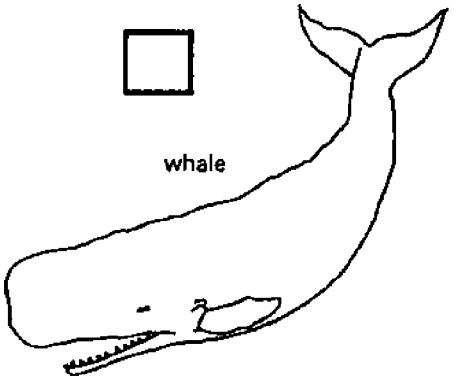
Yellow fin tuna

☐



shrimp

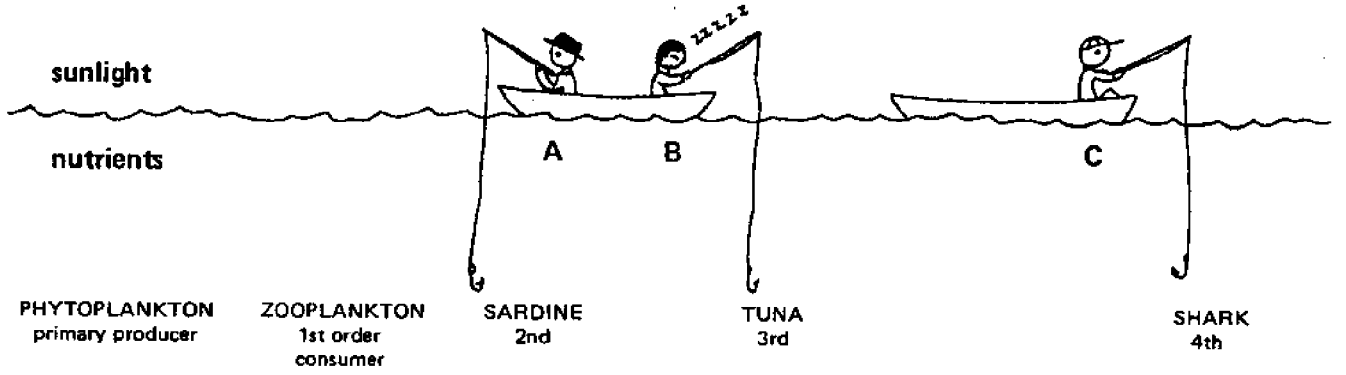
☐



whale

EAT EAT EATERS

Let's imagine you were a tiny phytoplankton. You'd get your food from the sun and nutrients in the water. You'd be called a PRIMARY PRODUCER since you do not eat any other living things. Along comes a zooplankton and gobbles you up! The zooplankton is the FIRST ORDER CONSUMER since he's the first to eat you. There's a sardine swimming by and it eats the zooplankton. The sardine is a SECOND ORDER CONSUMER. A tuna eats the sardine. Here comes a shark and it eats the tuna. You, the tiny phytoplankton, end up feeding a shark! Fantastic!

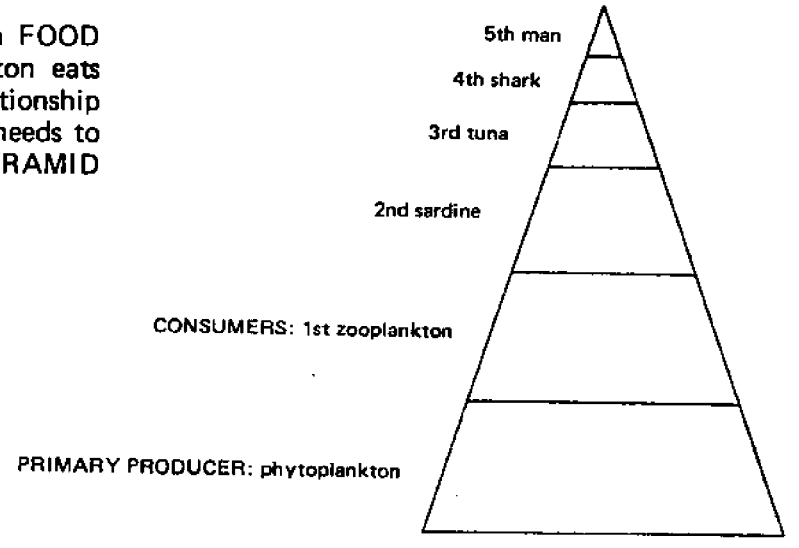


Now let's think about man. Where does he fit? He can eat the sardine, tuna, and shark. This means that man can fit in anywhere in this food web. If fisherman A caught a sardine for dinner, what order consumer would he be? _____

What about fisherman B? _____

and fisherman C? _____

We call this series of "eatings" a FOOD CHAIN. Of course, a zooplankton eats more than one plankton. The relationship of how much food each animal needs to eat can be shown in a FOOD PYRAMID on the right.



The sardine, tuna, and shark aren't the only animals in the ocean. When you consider all the animals and what they eat, a complicated picture of these relationships emerges. We call this picture the FOOD WEB.

TEACHER'S ANSWER SHEET

UNDERWATER 'LANDSCAPE'

1. H
2. D
3. B
4. A
5. G
6. C
7. E
8. F

UNDERWATER FORMATIONS

2 abyssal plain
6 atoll
1 continental margin
5 guyot or plateau
3 ridge
7 seamount
4 trench
8 volcanic island

WAVES

The boat might crash into the shore. He should move his boat into deeper water where the boat will not be carried towards the shore.

Parts of the wave:

1. crest
2. trough
3. wave length
4. wave height

REEF VERTEBRATES AND INVERTEBRATES

1. vertebrate
2. invertebrate
3. vertebrate
4. invertebrate
5. invertebrate
6. vertebrate
7. invertebrate

HIGH SEAS DRIFTERS

1. trochus
4. crab
3. fish
5. snail
2. sea urchin

EAT EAT EATERS

fisherman A = third order consumer
fisherman B = fourth order consumer
fisherman C = fifth order consumer

OCEAN HARVESTERS

3 tuna
2 shrimp
1 whale