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Do dolphins

SLEEP?

**Questions and Answers
About the *Sea***

MIT Sea Grant College Program

Do dolphins

sleep?

Questions and Answers About the Sea

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MIT Sea Grant College Program
Cambridge, Massachusetts
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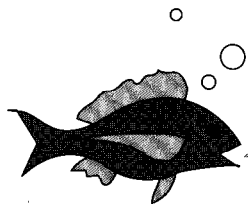


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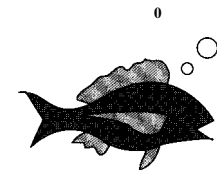
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Introduction



We receive a steady stream of letters in our office, with all manner of questions about the sea and those creatures that call it home. For the most part, these queries come from young and curious enthusiasts — often with a science project due the next day.

In this book, we've included some of the questions that kids ask most frequently. Of course, there are endless ways of wondering about the sea. We hope this book will answer a few of your questions — and inspire you to wonder about a few more.

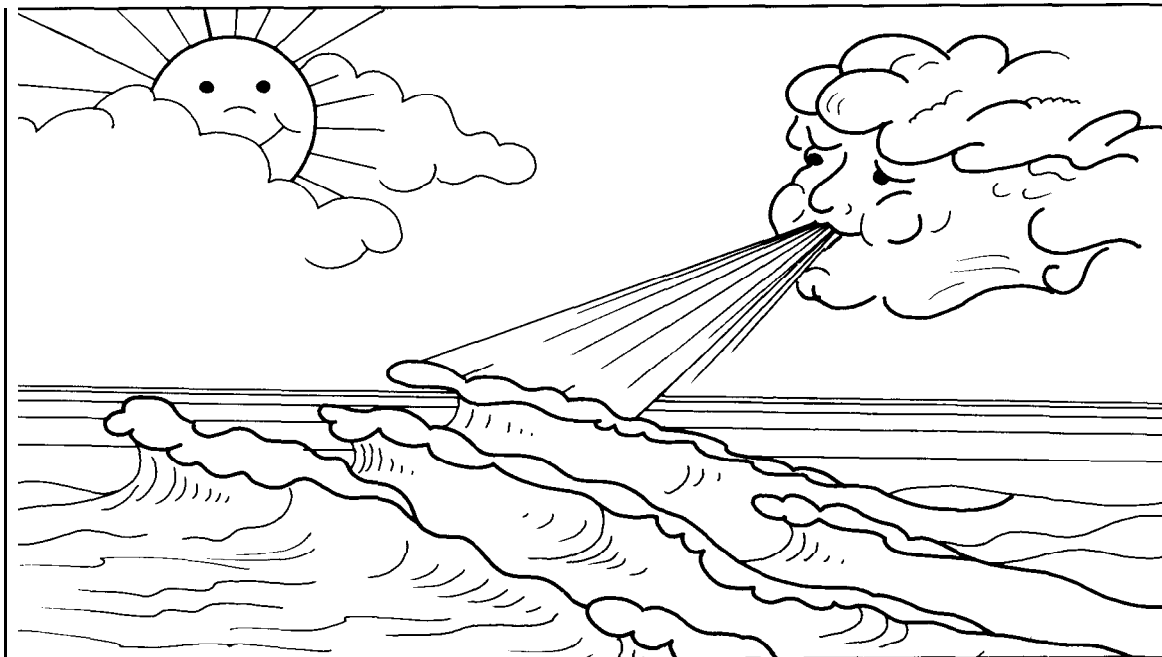


Why are there **WAVES** in the ocean?

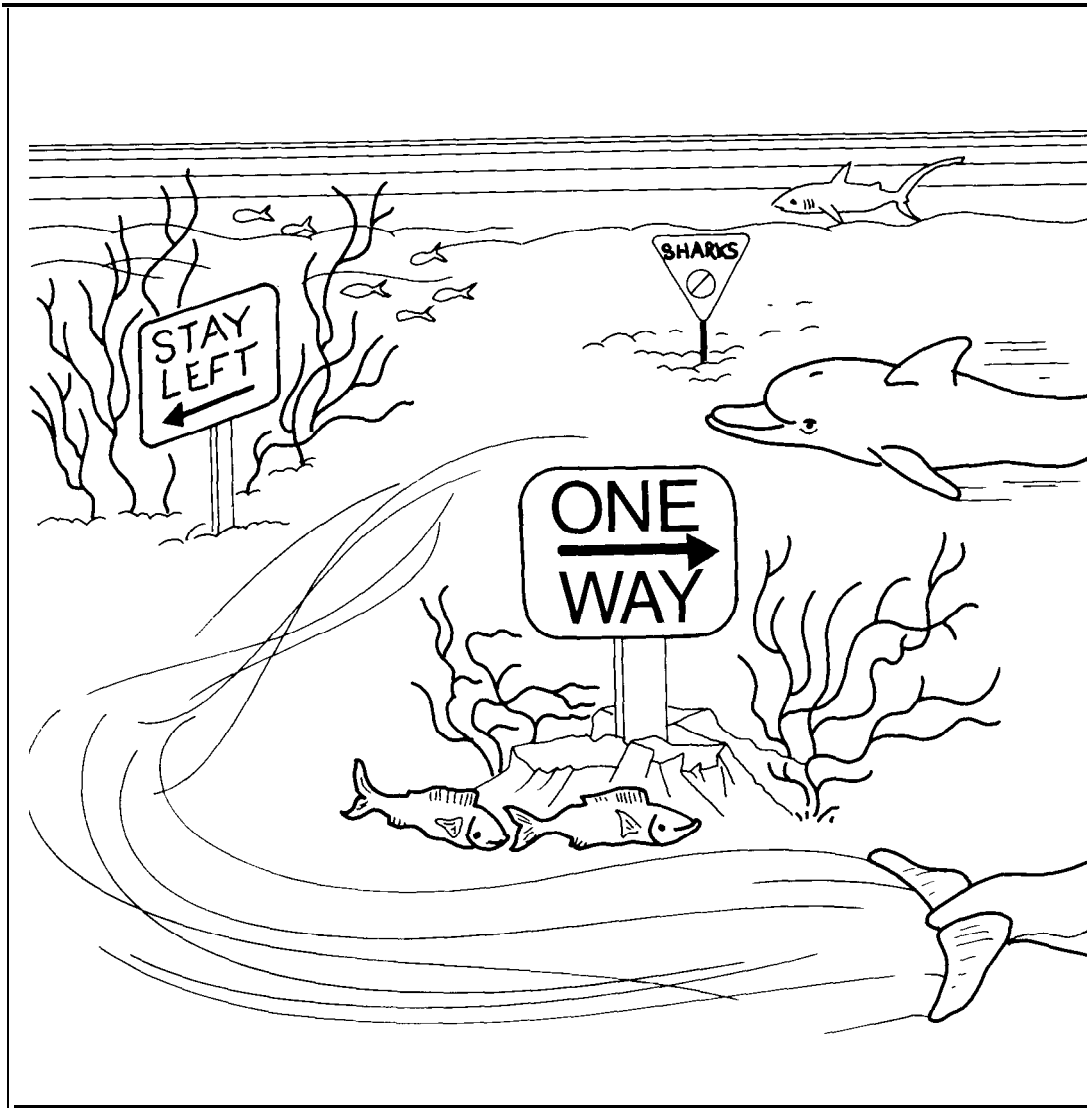


Most waves are caused by wind moving across the surface of water. If you take a pan of water and blow on it, you will see, on a smaller scale, what happens in the ocean. Waves also are caused by things other than wind. Moving anything through the water, such as a boat, causes waves. An underwater earthquake can create an extremely large, long wave called a tsunami. In the open ocean, tsunamis can travel at up to 500 m.p.h. By the time they reach shore, they slow down to about 70 m.p.h. — and reach heights of up to 200 feet. Imagine a wall of water that's as tall as a 20-story building and moving faster than cars on the highway!

The foam that you see when a wave breaks is made up of tiny air bubbles. In freshwater, these bubbles stick together, but in the ocean, they bounce off each other. The salt spray that you feel when on a boat or at the beach is caused by these bubbles bursting.



Q. *How do dolphins navigate?*



A.

Dolphins, a kind of small whale, find their way (and their dinner) by sending out high-pitched sounds (too high for us to hear). The dolphins listen for returning echoes as they bounce off objects. This is called "echolocation," and it lets dolphins know what is around them. On land, bats use this same method to navigate at night, when they feed.

Even when they are miles away from land, dolphins seem to know where they're going. This may be because they are able to read magnetic signals, much the way a compass does.



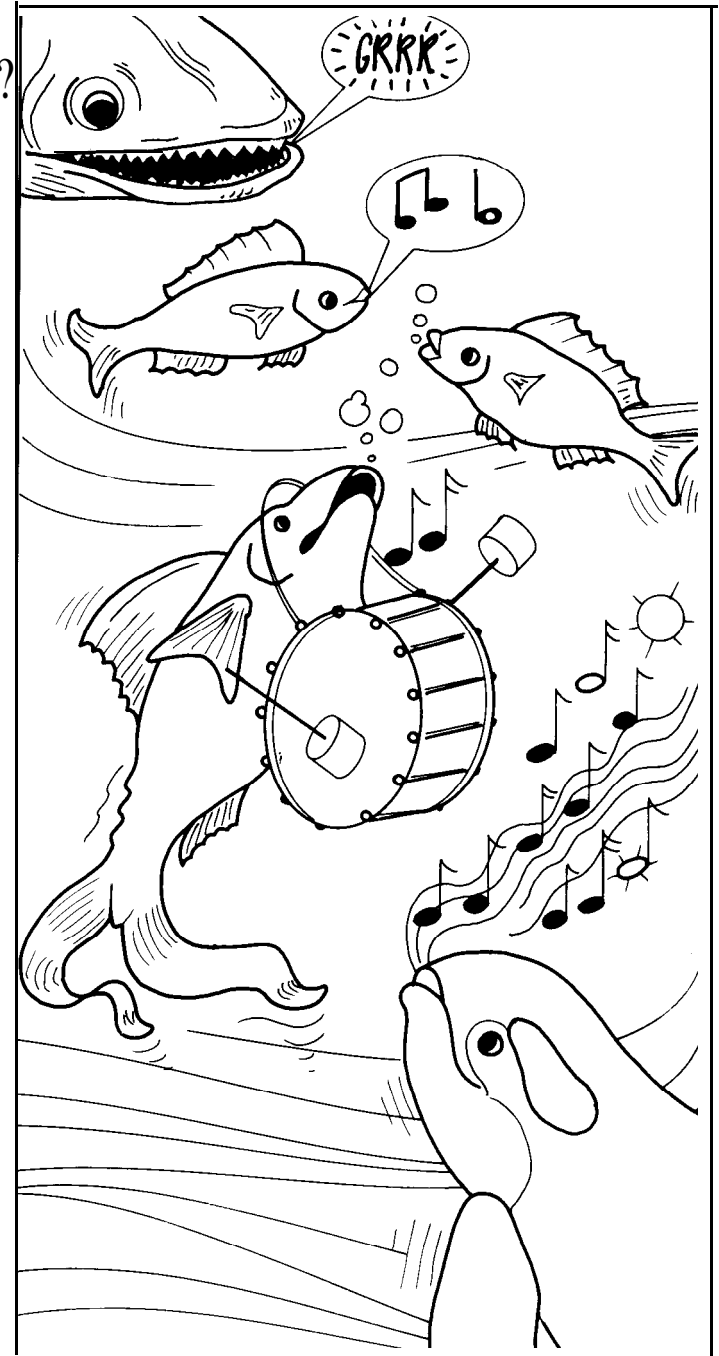
Do sea animals other than dolphins talk to each other?



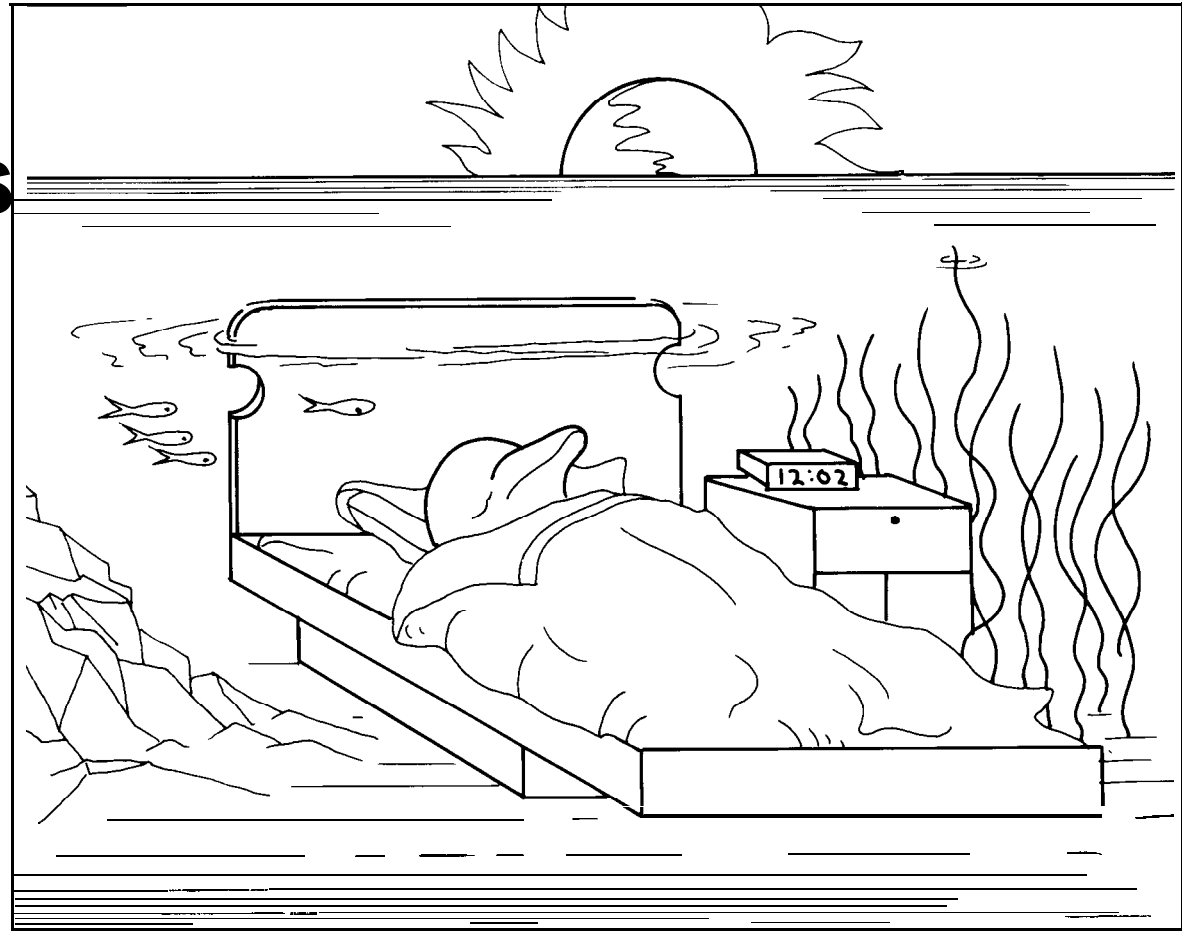
Yes. Aside from dolphins and porpoises, many larger whales have been heard “talking” or “singing” to each other. Both male and female whales make sounds, but the males are known for their singing. Scientists believe this singing is part of their mating behavior. With underwater listening devices, researchers can listen to whales singing. By following these sounds, scientists can track the path, or migration, of whales.

Many fish also make many different sounds, either as part of mating or to show that they are tough fish. Among toadfish, which are common around New England, males make a whistling sound known as a “boat whistle” to attract females. This is similar to what nesting male blackbirds do on land. Cichlids, a kind of freshwater fish often found in aquariums, threaten other fish with a frightening growl.

Fish make many different sounds, either as part of mating or to show that they are tough fish.



Q. Do dolphins sleep?



A.

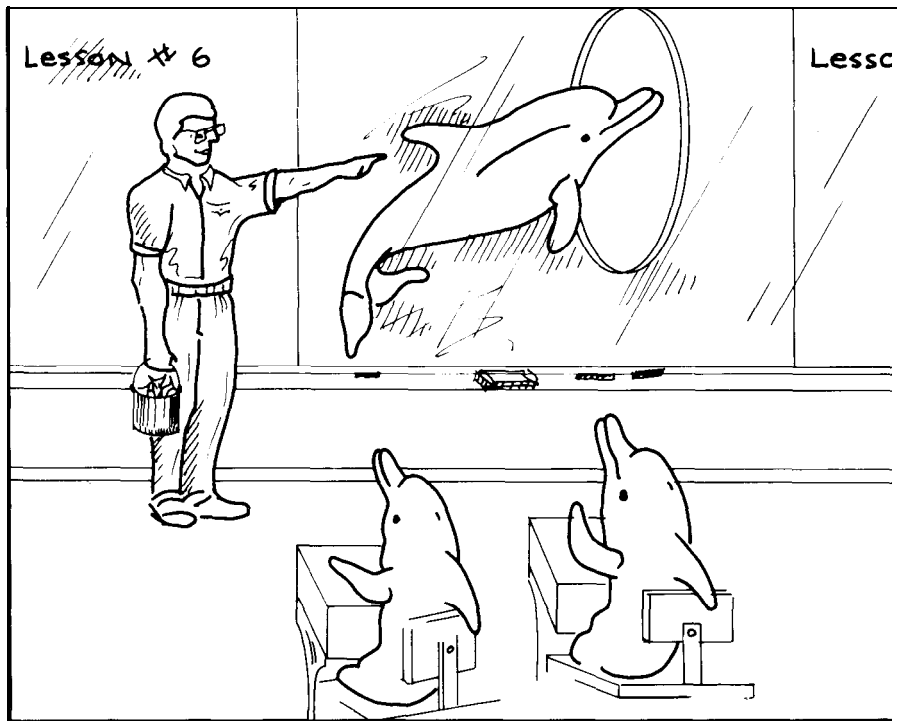
Dolphins do sleep, but not quite in the same way that people do. They sleep with one half of the brain at a time and with one eye closed. Dolphins rest this way on and off throughout the day, switching which side of the brain they shut down. During these periods, everything inside the dolphin slows down, and the animal moves very little.

Q. Which dolphins are the most endangered?

A.

More than 30 kinds of dolphins live in the world's oceans and rivers. Those in greatest danger are freshwater river dolphins living in China and South America. As with most wild animals, living very close to people is dangerous for dolphins.

One big danger is fishing nets. Many fishermen use gill nets, which are flat nets that go straight down in the water, with large holes in the netting. These nets trap a fish by tangling its gills. When a dolphin's tail or flipper is caught in a gill net, the animal drowns. Although a dolphin may learn how to protect itself from a first encounter with a shark or ship, the first encounter with these nets is usually fatal.



Q.

How can I become a dolphin trainer?

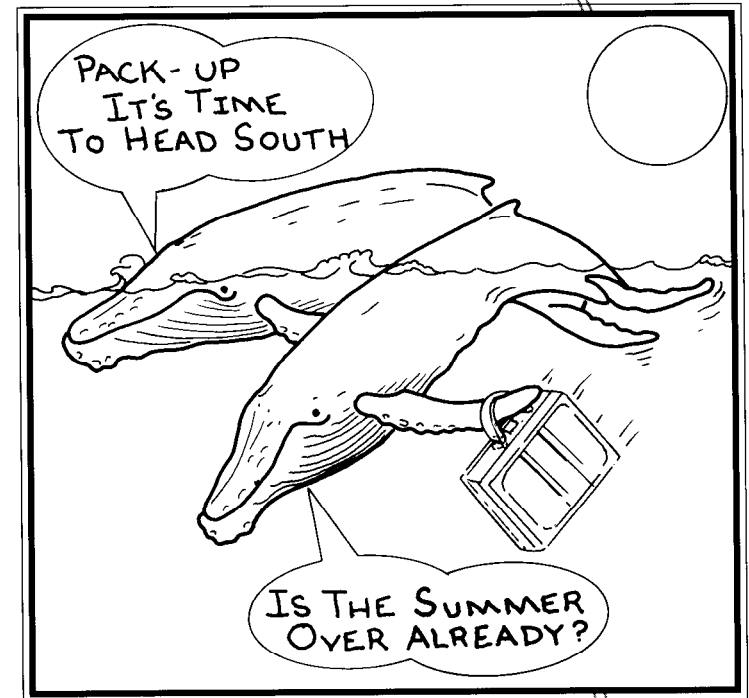
A.

Dolphin trainers, who often work at an aquarium or zoo, are usually people who study mammals that live in the sea. Mammals are warm-blooded animals that nurse their young. They may live on land — such as people, dogs and cats — or in the sea — such as dolphins, seals and whales. People who train dolphins also usually study them and take care of many kinds of marine animals. Most dolphin trainers study science or psychology in college or have spent a lot of time with marine animals. Studying math and science is a good way to start preparing. You can also get a good start by volunteering at an aquarium, helping out with feeding and cleaning the animals, and getting hands-on experience.

Q. do whales live in all oceans?

A. Yes. Most larger whales are found throughout the world's oceans, except for bowhead and gray whales, which live only in the Northern hemisphere. With the changing seasons, most whales migrate between feeding and breeding grounds, generally within the same ocean. The spring, summer and autumn months are spent feeding in the colder parts of oceans, with whales heading towards the Arctic or the Antarctic. Winters are spent breeding (and fasting) in the warmer portions of oceans, closer to the equator. A whale will return year after year to the same feeding area it was first taken to by its mother. The humpback whale holds the record for the longest seasonal migration, traveling more than 5,000 miles from feeding grounds in the Antarctic to the Pacific coast of Columbia, and then another 5,000 miles back south.

The whales most commonly sighted off the northeastern coast of the United States are the right, humpback and fin whales. The best understood whales are humpbacks. They are the easiest whales to study because they feed and mate in fairly shallow waters, where scientists can watch them. Scientists also can identify and follow humpbacks because they have unique black and white markings on the undersides of their flukes (the end of the whale's tail). Researchers take photographs of the flukes to identify a whale and follow it.





Is there less whale hunting now? Who still hunts whales?



Whale hunting has decreased throughout the world. However, except for minke whales, which number about 1,000,000, all populations of whales that were once hunted are much smaller than they used to be. Blue, bowhead and right whale populations are each believed to be under 10,000.

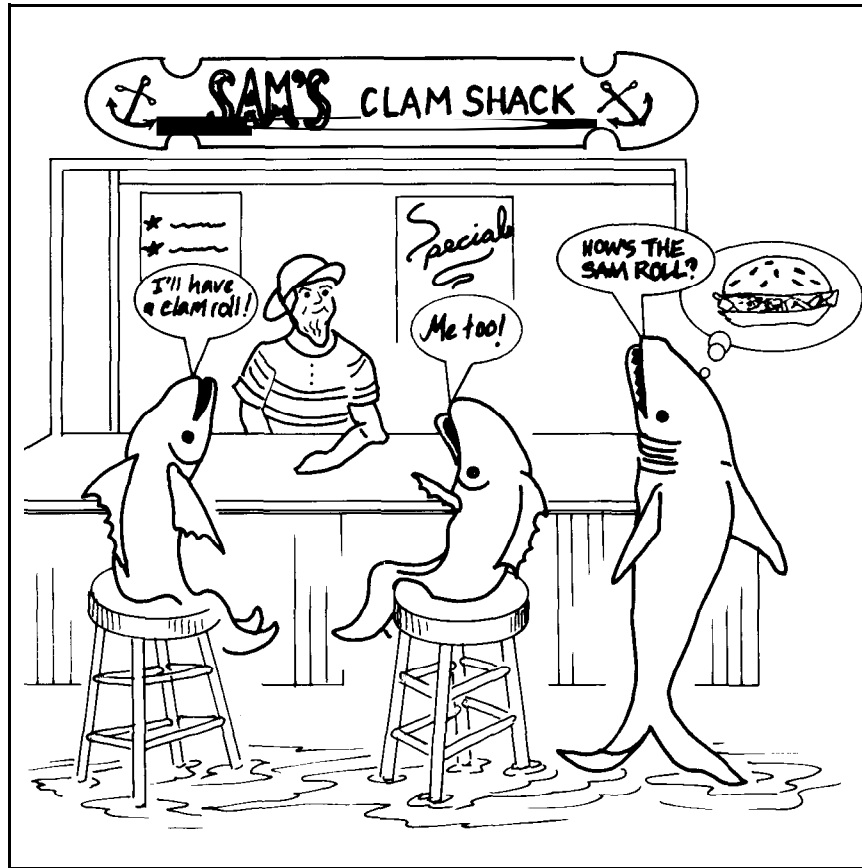
Rules for whale hunting are made by the International Whaling Commission. Although there is a worldwide rule against all commercial whaling (whaling as a business), some whaling still continues. In Japan and Norway, hunters get around the rule through an exception that allows whales to be killed for scientific studies. In these cases, the hunters write up scientific reports about the whales they catch before selling the meat from these whales.

The International Whaling Commission still allows some whaling by people who have traditionally relied on whales for food, such as Eskimos. This is allowed in Greenland, Siberia and Alaska, and in the islands of Tonga, in the Southwest Pacific, and Bequia, in the Caribbean.

In Alaska, bowhead whales are hunted in the spring, when the whales' migration brings them close to shore. Eskimos who hunt whales there wear white clothing as camouflage and set up an ice camp from which they can watch for whales. When a whale is sighted, the hunters launch their small boats and go after the whales with harpoons, much as they have done for hundreds of years. The meat and blubber are used for food, as is the whale oil, which is considered a special treat.

Some illegal whaling continues, with hunters using large fishing boats and explosive harpoon devices. The illegally gotten whale meat and oil are then sold — which is also illegal.

Q. Are all sharks *dangerous*?



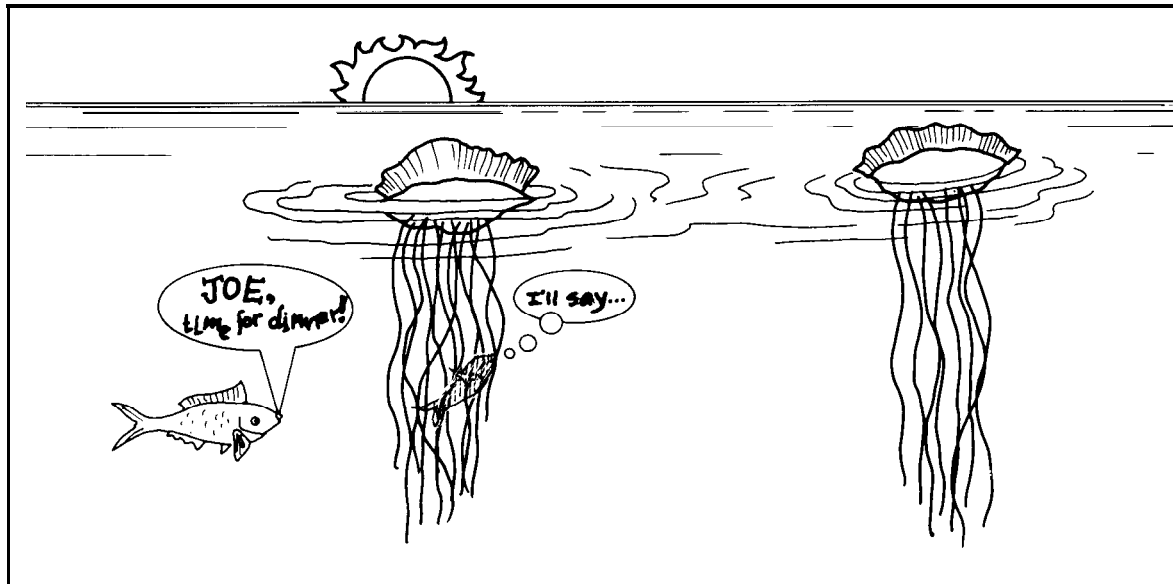
A.

No. There are around 300 different species of sharks, only 40 of which are known to have attacked people. One of the most dangerous sharks in North America is the great white shark, found along the Pacific coast between Mexico and southern Canada. Another one to watch out for is the tiger shark, which lives in the warmer Atlantic waters off the coast of Florida and around the islands of Hawaii.

Shark attacks really are pretty rare. For instance, there are usually only two or three reported in Hawaiian waters each year. There are different ideas as to why sharks attack people. Tiger sharks, it seems, may attack because they get confused in cloudy water — and mistake surfers in black wet suits for seals. Reef sharks seem to attack because they are territorial animals, protecting their piece of the sea.

The whale shark, which has 5,000 teeth and can grow up to 50 feet long, is the largest type of shark. However, it prefers food such as small fish, shrimp and plankton, and therefore is not dangerous to people.

Q. *How do jellyfish sting?*



ouch!

eek!

OW!

hey!

oh!

A.

Getting stung by a jellyfish is kind of like getting shot with lots of little poison arrows. Each jellyfish has tentacles that contain stinging cells. The top of the animal, called the bell or umbrella, also has some of these cells, which house little poison-tipped stingers. When something — such as a fish — brushes against the jellyfish, these harpoon-like stingers are released. The stinging either kills or stuns a fish. Then, the jellyfish can reel the fish in with its tentacles and eat it.

Jellyfish also use stinging to protect themselves. If a large fish rubs against a jellyfish, a reflex action will cause the jellyfish to sting it. The same is true when a jellyfish stings a person. Of course, the jellyfish isn't trying to eat a human, it's just trying to protect itself.



How can I know if there are jellyfish in the water and whether it's safe to swim?



The best thing to do is look around for any jellyfish. However, these invertebrates (animals without a spinal column) can be transparent and thus hard to see unless you look underwater and are very close to them.

Some areas are known to have lots of jellyfish. The Chesapeake Bay, an inlet of the Atlantic Ocean, becomes full of jellyfish — a type called the sea nettle — every summer. Because this happens every year, swimmers know to stay out of the water or to be very careful. In other areas, such as Cape Cod, Massachusetts, jellyfish show up less regularly.

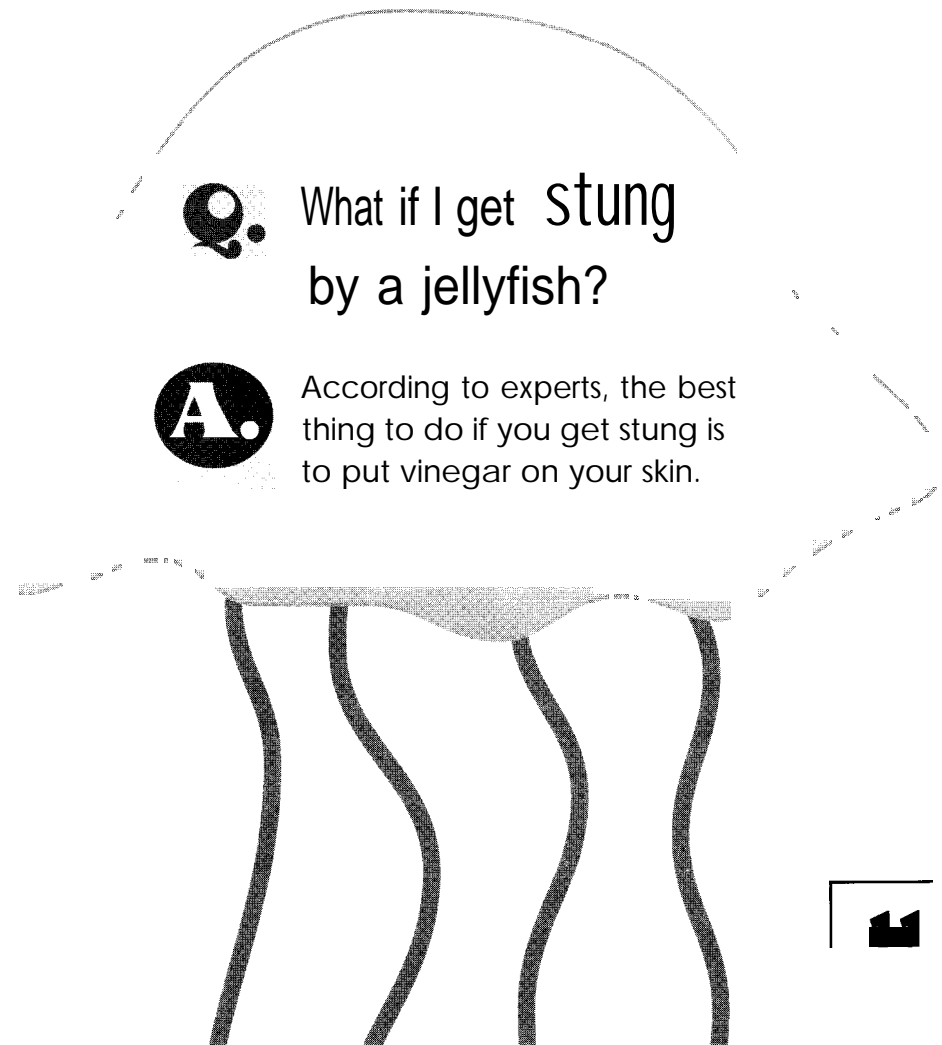
Jellyfish generally die at the end of summer and are carried onto the beach by the currents. If you see what looks like a cloudy lump of jelly on the beach, chances are it's the jellyfish's bell, which the animal uses to float. These bells are usually harmless, unless they are colored a bright blue or purple and belong to a Portuguese man-of-war. Those are dangerous.



What if I get stung by a jellyfish?

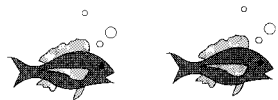
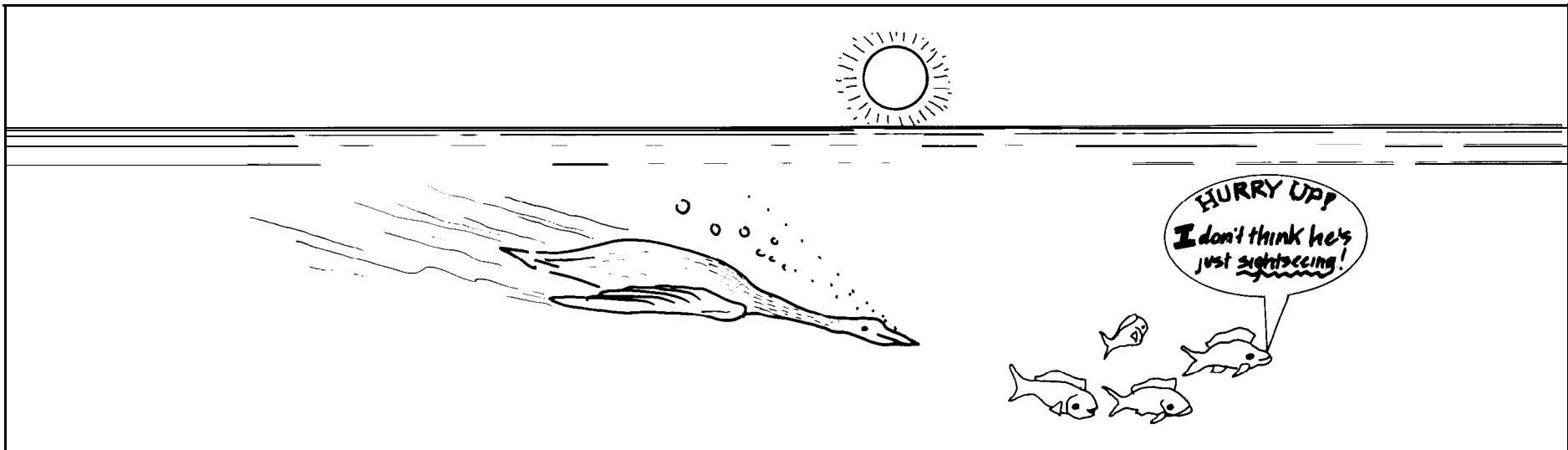
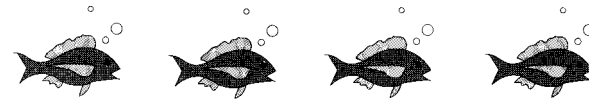


According to experts, the best thing to do if you get stung is to put vinegar on your skin.



Q.

How do cormorants see and fly UNDERWATER to catch fish?



A.

Cormorants, which are diving birds, have eyes that let them focus underwater in the same way they see above water. Cormorants don't fly underwater. Instead, they swim with strong thrusts of their feet. They may use their wings to help them along, or they may tuck their wings in tightly so that they can slip easily through the water. These birds can swim underwater for two to three minutes. Cormorants also have a handy throat pouch — sort of like a grocery bag — in which they can store what they've caught for a meal later on.

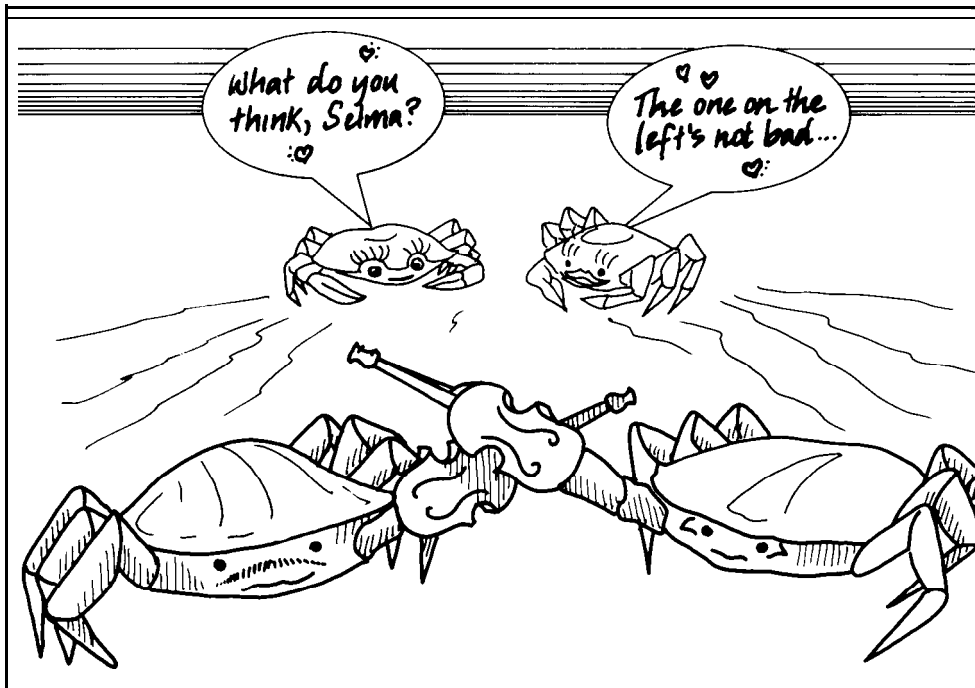
Some birds, such as penguins, puffins and murs, do fly underwater with their flipper-like wings, using their feet to steer.

Q. *How do the boy and girl crabs tell each other apart?*

A.

One way crabs tell each other apart is by their appearance. The male crab generally has a narrow body. The female crab is much rounder. Crabs also tell each other apart by scent. For instance, when ready for mating, female blue crabs release a special chemical. Male crabs detect that chemical through receiving devices on their feet.

In fiddler crabs, the female has two small claws, whereas the male has only one large claw. Much like a cricket, the male uses its claw to make creaking noises. This is a mating signal for females. The big claw also is used to fight with other males during mating season.



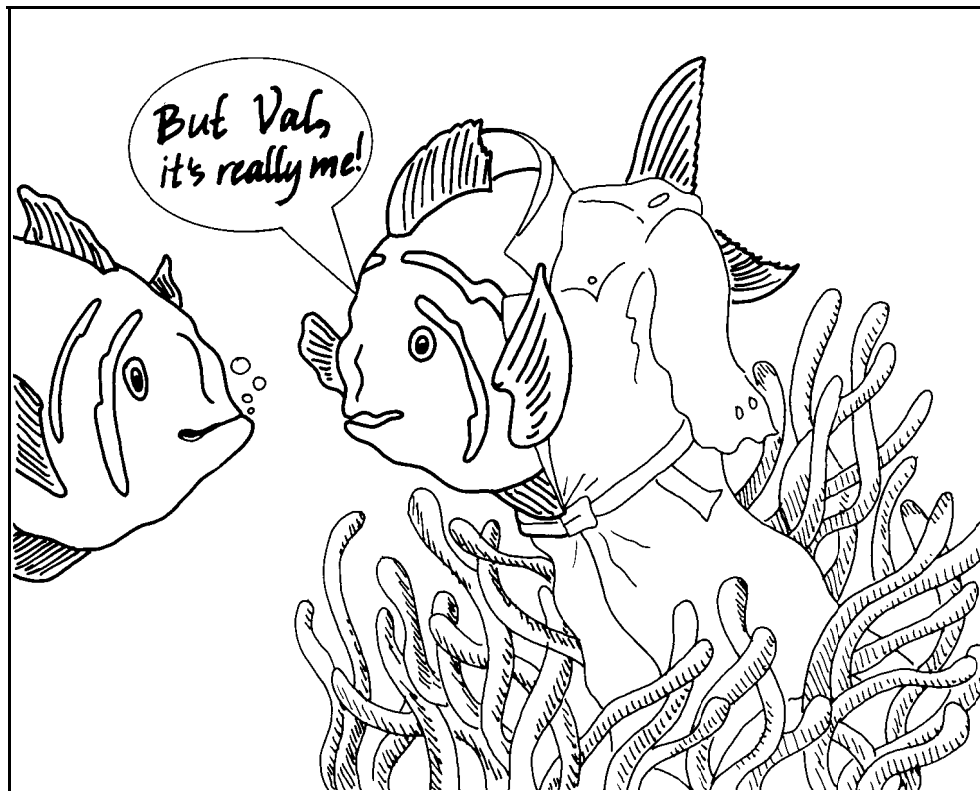
Q.

With their skeletons on the outside, how do crabs grOW?

A.

Crabs grow by periodically shedding, or molting, their shell. Sometimes crabs will eat their own old shells, which have lots of calcium and are nutritious. During a lifetime of about one and one-half years, a blue crab will molt about 20 times.

Q. How do **fish** tell each other apart?



A.

Fish that live in areas with many different species — such as around coral reefs — have developed bright, elaborate patterns and colors to tell each other apart.

But sometimes a fish needs to recognize one particular other fish, much as people need to recognize each other. The anemone fish has only one mate, which it recognizes by its head markings. This was discovered by scientists who took a fish out of its tank and dressed it in a kind of green "overcoat." When the fish was put back in its tank, its mate was no longer able to recognize it and attacked its partner immediately.

Q. How do fish use *camouflage*?

A.

Many fish use camouflage to blend into their surroundings. Camouflage has two purposes: it helps fish avoid being eaten and allows them to make sneak attacks on unsuspecting prey.

The scorpion fish lives in coral reefs and looks like a rock. However, unlike a rock, it has an extremely large mouth for gulping down fish that swim right up to it. The trumpet fish, which is three feet long and only two inches wide, can turn from brown to yellow in just a second. So when a school of yellow fish appears, it simply turns yellow and hides among its next meal. Flounder hide from predators by taking on either a dark or light color, depending on what's needed at the moment. Sea horses camouflage themselves with fins that look like the seaweed in which they live.



Fish also use other tricks to obtain lunch or escape becoming someone else's lunch. The female angler fish "fishes" for its prey with what looks like a fishing rod and worm dangling in front of its head. When the prey gets close enough, the angler fish simply opens its mouth and swallows.

Some fish survive by mimicking other fish. For instance, the butterfly fish has a big blotch in front of its tail that looks like an eye. This eye spot makes the fish seem bigger than it is. The spot also confuses predators into attacking the back instead of the front of the butterfly fish. This makes a surprise attack impossible. When the butterfly fish sticks its head into a hole, the visible part of its body resembles an eel — which makes would-be attackers stay away.

Q. Do fish and other sea creatures ever change from **male** to *female* or **female** to *male*?

A.

Yes. In the marine world, changing from one gender to another is perfectly natural. For instance, oysters usually begin their lives as males and eventually turn into females. Among fish, it is more common for females to change into males.



Anemone fish are born as hermaphrodites, which means that they have both male and female organs. These fish live in small groups in which the dominant fish develops into a female. The second most dominant fish becomes a male and pairs off with the female. Meanwhile, the other fish do not develop sexually. However, when the female dies, the male fish immediately begins changing into a female, and within 24 days it can produce young. The next dominant fish in the group then develops into a male to pair off with the new female — a cycle that repeats itself over and over again.

Some fish, like the hamletfish, are simultaneous hermaphrodites, which means that they are both male and female at the same time. These fish will change roles as they spawn at dusk, switching between the male and female roles from one minute to the next.



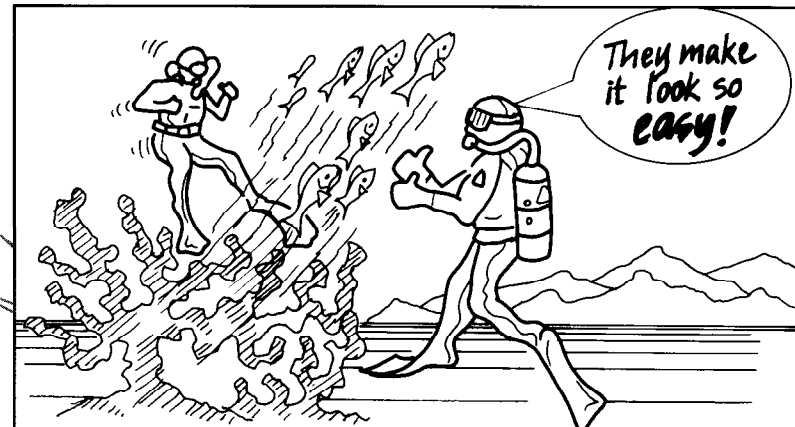
Why do people who go deep-sea diving have to be very careful not to surface too quickly?



When people (and other animals) breathe, some of the nitrogen in the air dissolves in their bodies. Divers have to breathe air under pressure because of the pressure of the surrounding water. The higher the water pressure, the higher the air pressure a diver needs. And the higher the pressure, the more nitrogen dissolves. If a diver goes back up to the surface too fast, some of that nitrogen forms bubbles, like the bubbles that fizz up when you open a can of soda. Inside a human body, those bubbles can cause considerable damage — including joint pain, paralysis and even death. This very painful problem is called “the bends.” To avoid getting the bends, a diver must go up gradually, letting nitrogen in the tissues escape very slowly. Divers also have to make sure to keep breathing out and not to hold their breath as they go up. This lets expanding air escape from their lungs.

Divers using scuba (self-contained underwater breathing apparatus) equipment are able to safely dive to depths of 130 feet using a tank of compressed air. With a special tank mixture of helium and air, experienced divers can go to depths of 500 feet or more. The record for the deepest scuba dive belongs to Jim Bowden, who dove 925 feet deep in Zacaton, Mexico in 1994.

Humans must rely on manned and unmanned submarines to explore the further depths. The deepest point in the ocean is an area called the Mariana Trench in the Pacific Ocean. There, the ocean bottom is some 11 kilometers (nearly seven miles) from the ocean’s surface.

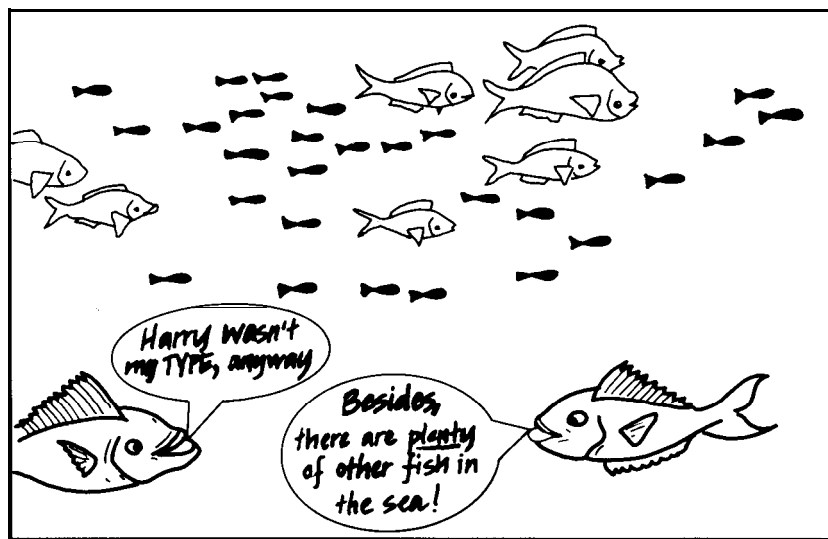


Q. Why don't fish and whales have to worry about the bends?

A.

Whales and other diving mammals, such as seals, breathe only at the surface. Since they don't breathe underwater, they aren't breathing pressurized air. Thus, these animals don't have extra air dissolving in their tissues. As an additional safety valve, they breathe out before diving to get rid of extra air, using oxygen already in their blood for the rest of the dive. Deep-diving whales, such as sperm whales, can travel a mile down.

Most fish don't have lungs, so they can't take up an excess of air. However, many fish do have an air-inflated swim bladder that they use to control how they float, rise and descend in the water. These fish have to go up and down very slowly.



Q.

How many SPECIES of fish are there in the world?

A.

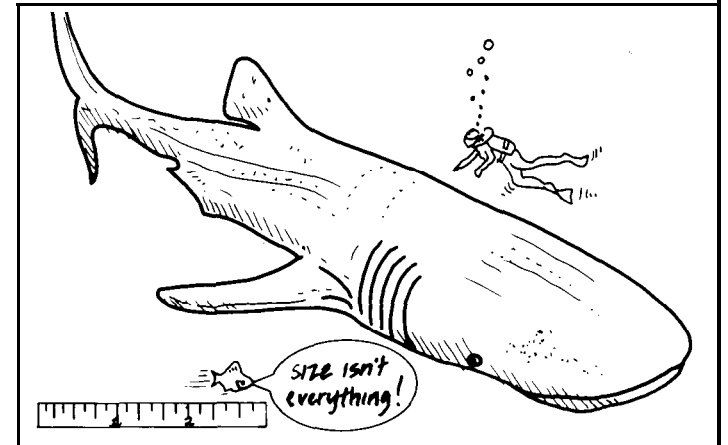
Scientists believe there are between 20,000 and 40,000 different species of fish.

Q. What is the **BIGGEST** fish? What is the SMALLEST fish?

A.

The whale shark is the biggest fish. It can grow to be more than 50 feet long and weigh several tons.

The smallest fish known is the goby *Trimmatom nanus*, which lives in lakes in the Philippines and grows to less than one-half inch.



Q. How can you tell the **AGE** of a fish?

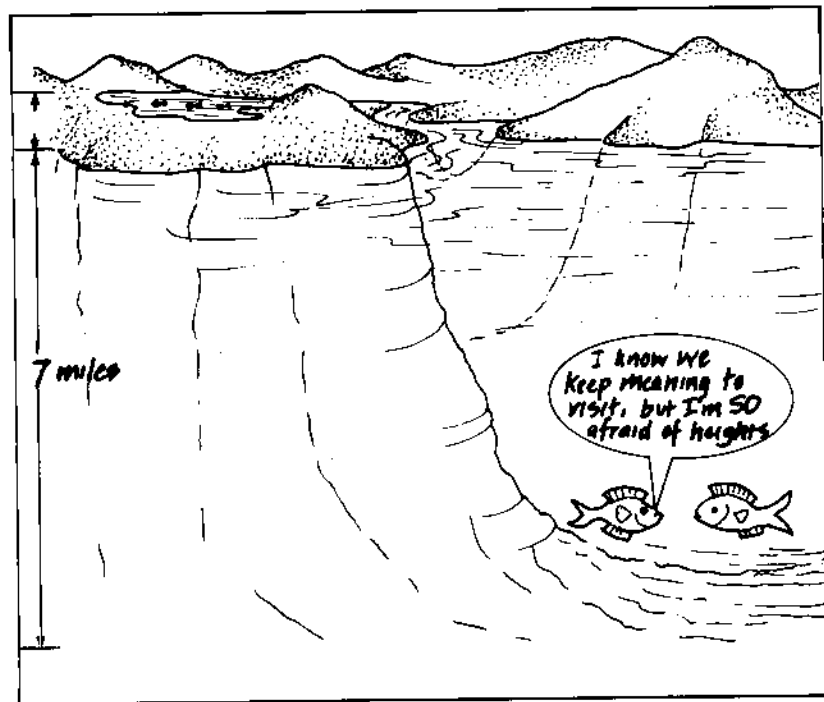
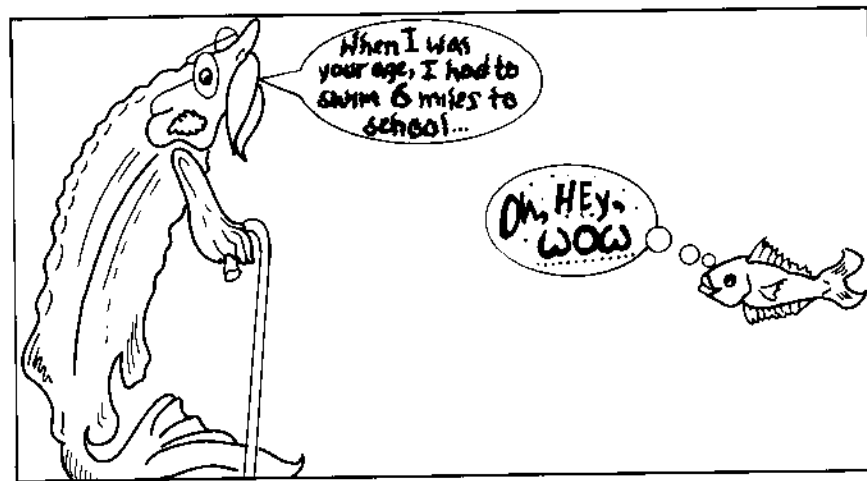
A.

You can tell the age of a fish in much the same way that you tell the age of a tree — by counting rings. Growth "rings" on fish are counted either on the fish's scales or its small inner ear bones. The rings correspond to changes in the seasons, with fish growing a new set of rings each year. These rings grow faster in summer, when the space between two rings is wider apart, and slower in winter, when the rings are closer together.

Q. How long do fish live?



Some small fish that live on reefs live only for a few weeks or months. Sturgeons can live for 50 years or more.



Q.

How deep can fish live?



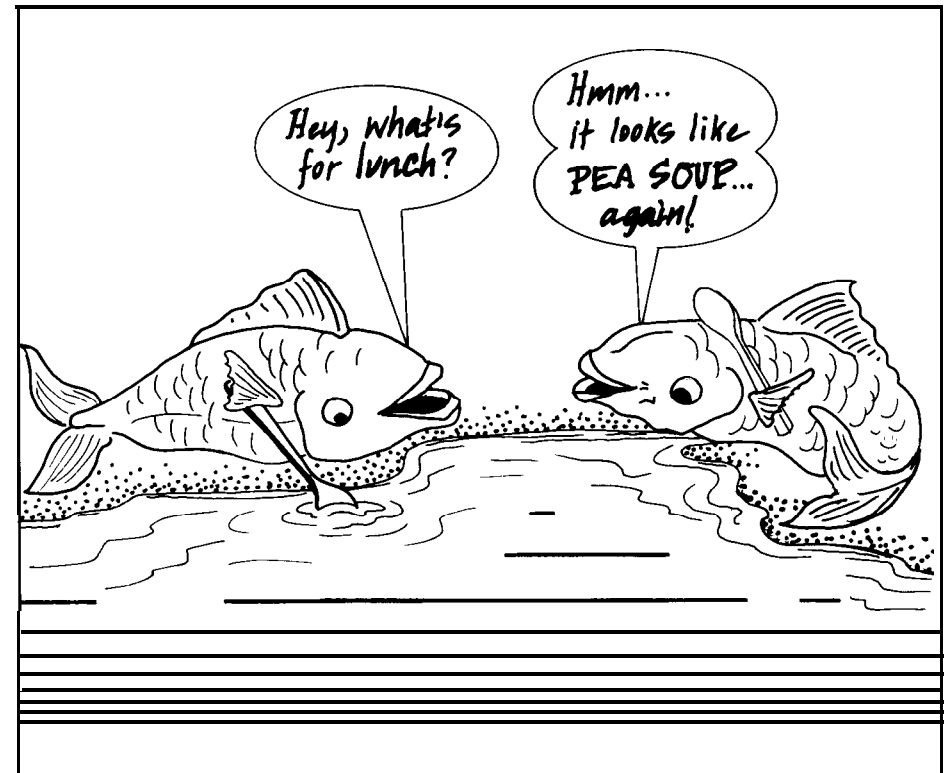
Fish are found in practically all waters of the earth, from four kilometers (2.5 miles) above sea level in South America's Lake Titicaca, to 11 kilometers (nearly seven miles) deep in the Pacific Ocean's Mariana Trench. One of the most common fish in the world is a deep-sea fish called *Cyclothone microdon*. Also known as a "bristlemouth," this minnow-sized fish is found in large numbers in all the oceans except near the North and South Poles.

Q. How does pollution affect plankton?

A.

Plankton is the name given to a wide variety of small plant or animal marine organisms. These organisms are crucial to life in the oceans because they make up the base of the marine food chain. Pollution can drastically alter the way this food chain works.

Pollutants often act as fertilizers because they provide nutrients. They can be found in human sewage, farm runoff and air pollution. When nutrients enter a marine environment, they cause a big growth in algae. This growth upsets the delicately balanced marine ecosystem. If there are enough algae in the water, they can use up the oxygen in the water, killing coral, sea grasses, and other marine life. Fish and shellfish that depend on the coral and sea grasses then also die. Coastal ponds can become so overgrown with algae that they resemble a pea soup.



Q.

How does pollution affect lobsters and clams?

A.

Pollution affects lobsters and clams in many ways. In their early stages of development, these animals live near the water's surface and are thus particularly vulnerable to pollution on the surface. So, a ship that spills oil into the ocean can be very dangerous to them. Lobsters, clams and other shellfish are also harmed because when they are older they live on the bottom of the ocean, where a lot of pollution settles.

You may have seen signs posted along the shore warning against fishing for shellfish. This is sometimes due to a red tide, which occurs when there is a big increase in red-colored algae, often a type called dinoflagellates. These single-celled organisms don't kill shellfish. However, people who eat shellfish that have eaten these algae may get seafood poisoning — which can cause serious illness and even death.

Pollution plays a big part in red tides because it provides the food, or nutrients, that algae need to grow.



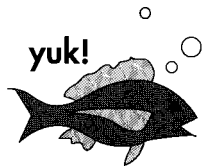
Q.

What are other ways that pollution affects **sea life**?

A.

Some 14 billion pounds of trash are thrown into the sea every year. Aside from looking and smelling bad, pollution often kills birds, fish, turtles, marine mammals and other animals that live in and around the sea.

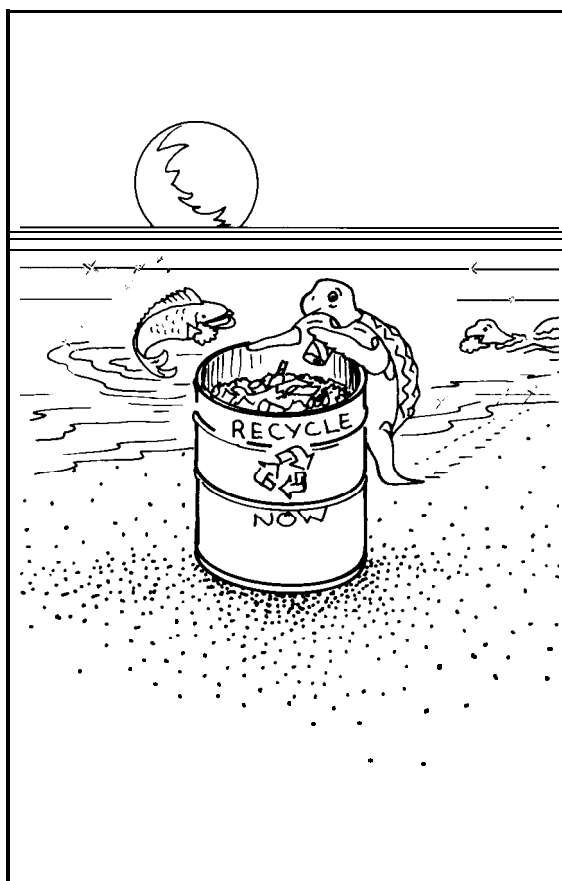
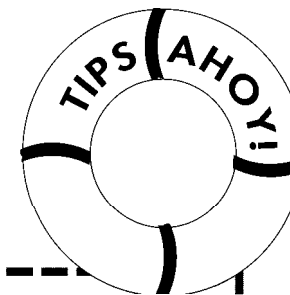
Pollution comes in many forms, including air pollution, sewage and fertilizers that wash into waterways. Other pollution includes spilled oil, poisonous chemicals and things that are pretty harmless on land – such as plastic bags, plastic six-pack rings and old fishing nets. Because plastic does not break down naturally, it simply builds up in the environment. Plastic swallowed by animals cannot be digested. What it can do is damage stomach linings and poison animals with chemicals. Also, many animals that swallow plastic are fooled into thinking they've eaten real food. They then lose their appetites, stop eating and starve. Fish, crabs, birds and seals get tangled in abandoned fishing nets known as "ghost nets" and may be strangled, unable to get food or defend themselves against predators.



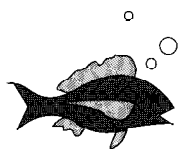
Q. *What can I do about pollution?*

A.

You can do a lot. Setting an example and letting people know about the dangers of pollution will encourage others to do their part in keeping beaches and oceans clean. Here are just a few ways to help cut down on pollution:



- **Recycle and dispose of your own trash properly – and pitch in by picking up trash that others have left behind.**
- If there is no recycling program in your area, you can work with other students and teachers at your school to start one.
- Whenever possible, walk, ride a bicycle, or take public transportation instead of going somewhere in a car. Car exhaust dumps a lot of pollution into our oceans.
- **Conserve water.** Turn off the tap when brushing your teeth. Make sure leaky faucets get fixed. Find out if water-saving devices are in place at you home and school.
- Use less chemicals around the house and in the garden.
- Don't flush chemicals down the toilet.



Help preserve and protect the oceans - and all of us who live in them.!

Q. I'm interested in a career in **marine science**. What should I do?

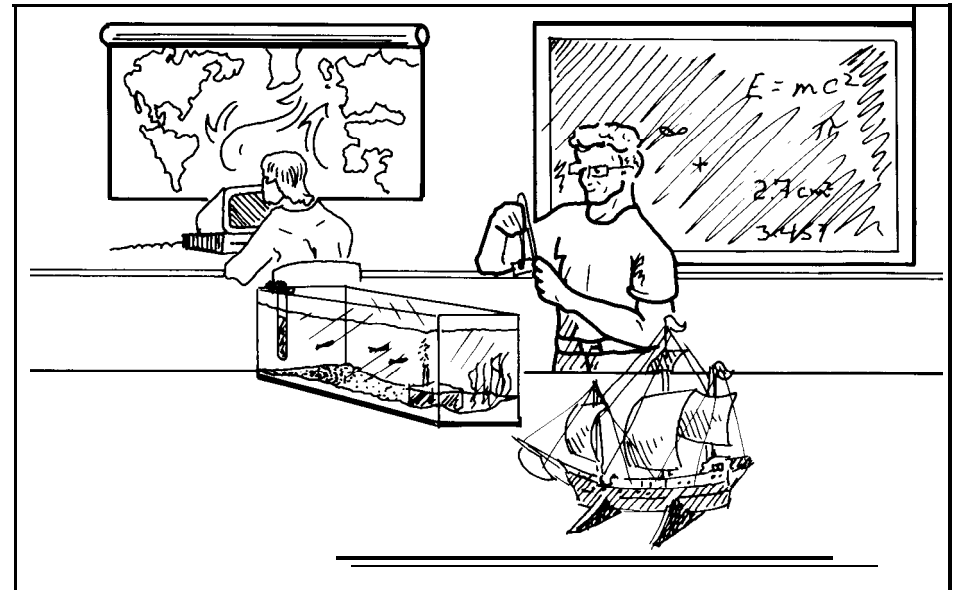
A.

There are many marine-related careers. Marine biologists study the plants and animals living in marine habitats and their relationship with the changing environment. Oceanographers specialize in several areas. Physical oceanographers, for instance, study waves and currents, while geological oceanographers study the sea floor and its origins. Oceanographic engineers design and build research equipment, including submarines, research ships and electronic instruments.

If you know that you're interested in a marine-related career, you can volunteer to work at a local aquarium, zoo or veterinarian's office. In school, be sure to study hard in your computer, science and math classes, which will help prepare you for college classes. Develop your writing skills; these will be important in any career you choose.

Becoming a marine biologist or research oceanographer means earning a master's or doctoral degree, which takes from two to five years after an undergraduate college degree. However, many positions, including those for computer specialists, technicians and administrative assistants, can be obtained without advanced degrees. There are also many other marine-related careers to consider. Here are just a few:

- commercial fishermen
- shipbuilders
- marine science teachers
- coastal engineers
- marine science writers
- marine architects
- photographers
- marine science librarians
- aquatic veterinarians
- maritime lawyers
- fisheries managers
- cartographers (map makers)
- harbormasters
- underwater filmmakers



The beauty, power, and mystery
of the ocean and its inhabitants have
captured imaginations throughout history.

Marine science offers one way of
exploring the sea; art and literature
offer another. In this poem by
Elizabeth Bishop, the speaker takes a
magnifying glass to the fish —
and discovers a whole world.

The Fish

**I caught a tremendous fish
and held him beside the boat
half out of water, with my hook
fast in a corner of his mouth.
He didn't fight.
He hadn't fought at all.
He hung a grunting weight,
battered and venerable
and homely, Here and there
his brown skin hung in strips
like ancient wallpaper,
and its pattern of darker brown
was like wallpaper
shapes like full-blown roses
stained and lost through age.
He was speckled with barnacles,
fine rosettes of lime,
and infested
with tiny white sea-lice,
and underneath two or three
rags of green weed hung down.
While his gills were breathing in
the terrible oxygen
—the frightening gills,
fresh and crisp with blood,
that can cut so badly—
I thought of the coarse white flesh**

*packed in like feathers,
the big bones and the little bones,
the dramatic reds and blacks
of his shiny entrails,
and the pink swim-bladder
like a big peony.*

*I looked into his eyes
which were far larger than mine
but shallower, and yellowed,
the irises backed and packed
with tarnished tinfoil
seen through the lenses
of old scratched isinglass.
They shifted a little, but not
to return my stare.*

*—It was more like the tipping
of an object toward the light.
I admired his sullen face,
the mechanism of his jaw,
and then I saw
that from his lower lip
—if you could call it a lip—
grim, wet, and weaponlike,
hung five old pieces of fish-line,
or four and a wire leader*

*with the swivel still attached,
with all their five big hooks
grown firmly in his mouth.
A green line, frayed at the end
where he broke it, two heavier lines,
and a fine black thread
still crimped from the strain and snap
when it broke and he got away.
Like medals with their ribbons
frayed and wavering,
a five-haired beard of wisdom
trailing from his aching jaw.
I stared and stared
and victory filled up
the little rented boat,
from the pool of bilge
where oil had spread a rainbow
around the rusted engine
to the bailer rusted orange,
the sun-cracked thwarts,
the oarlocks on their strings,
the gunnels—until everything
was rainbow, rainbow, rainbow!
And I let the fish go.*

— Elizabeth Bishop

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