PLANET OCEAN

How inappropriate to call this planet Earth when it is quite clearly Ocean.
Arthur C. Clarke

Visible in the foreground is the island of Andros in the Bahamas, surrounded by azure-colored shallow waters, looking out to the continental shelf and the deeper blue of the Atlantic Ocean.

NASA 2011

Why We Live *Here*

Imagine you are flying in

from a distant galaxy to our solar system. You come through the icy debris of the Kuiper Belt, past Neptune and Uranus, on by the gas giants, Saturn and Jupiter. Then, after making it through a belt of asteroids, you hover over little, red, rocky Mars for a look. Next you see a lovely, bright blue orb partially shrouded in white clouds. It looks like no other place in the neighborhood. What gives it its distinctive look?

liquid water

Billions of years ago according to most scientists, Earth materialized out of collisions of dust, gas, and water that resulted from a gigantic cosmic explosion called the "Big Bang." The origin of earth's water is not entirely known but several theories exist to explain it. As our planet coalesced out of this dust cloud, it grew very hot, and volcanic eruptions happened frequently. The eruptions brought water to the surface as well as magma. The earth's gravity increased and more water from the inner solar system was captured by our growing planet. In addition, comets—largely made of ice—collided with the young Earth. These are proposed sources are proposed for Earth's water.

Our nearest planetary neighbors, Venus and Mars had similar formative experiences, but the position of their orbits around our Sun may have prevented them from becoming liquid water worlds. Venus is closer to the Sun, and Mars farther from the Sun than Earth. Venutian water may have boiled off because its surface temperature is so hot. Martian water may once have flowed, but now is thought to be locked up as ice, mostly below the planet's rocky, red surface.

So we live on this blue planet—because life, as we know it, requires liquid water to form. By three billion years ago, the ocean basins were filled with water to about their current depths, and the first living things probably formed in warm, shallow, ocean water. Inside, you can learn more about our oceans and our connections to them.

Inside

Please use caution when recreating near or in the Pacific Ocean. The Point Reyes beaches are subject to rip currents and rogue waves that pose significant dangers.

Visit the Point Reyes Lighthouse, walk the stairs and get a stamp to prove you did it!

Page 8 has activities for kids and you can collect some animal stamps!

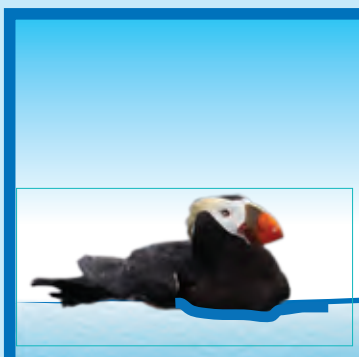
Why The Ocean Matters

1. The Earth has one ocean with many basins.
2. The ocean covers about 70% of the Earth's surface, and contains about 97% of the Earth's water.
3. Half of Earth's oxygen is produced in the sunlit ocean layers, and half of the carbon dioxide in the atmosphere is absorbed by the ocean.
4. Most rain, the source of much of our drinking water, comes from the ocean.
5. The ocean is a major influence on weather and climate.
6. The ocean and ocean life shape the shoreline features of the Earth.
7. Life in the ocean is diverse. The smallest known virus and the largest animal live in the ocean.
8. Many geologic and geochemical cycles begin in the ocean.
9. Most of our knowledge of the ocean comes from shallower waters. Less than 5% has been explored.
10. Humans and all living things are inextricably connected to the ocean.

It's the blue heart of the planet — and we should take care of our heart. It's what makes life possible for us.

—*Sylvia Earle*

In The Zone



The Atmosphere—(an ocean of water, in the air):

- Tufted Puffins can dive up to 196 feet (60 m)
- Pigeon Guillemots can dive up to 212 feet (65m)

Epipelagic Zone—To 650 feet (200 m) below the surface—The sunlit upper layer of the ocean

- Moon Jellyfish
- Many Sharks
- Dolphins

Mesopelagic Zone—To 3300 feet (1000 m) below the surface—The twilight zone

- Swordfish
- Wolf Eel

Bathypelagic Zone—To 13,000 feet (4,000 m) below the surface—The midnight zone (no sunlight)

- Anglerfish
- Many Octopus

Abyssopelagic Zone—To a known depth of 36,067ft or 6.831 mi (10, 993 m)—The abyss

- Microbes
- *

Intertidal Zone
(In Epipelagic Zone)

Splash Zone
organisms depend on sea spray for moisture, adapted to long periods of exposure

- Barnacles
- Ribbed Limpets

High Tide Zone
organisms covered at most high tides

- Turban Snails
- Chiton

Mid Tide Zone

- Ochre Sea Star
- Green Anemone

Low Tide Zone
most protection from desiccation; inhabited by the most number of species

- Dungeness Crab
- Sea Hare

* The Abyssopelagic zone continues to yield its secrets. In December 2014 a snailfish was found 5 miles (8 km) deep in the Mariana Trench!

Land and Water In Motion

Land and Water

Continental crust 15–45 miles (25-75 km) thick
Oceanic crust 4.5–6.3 miles (7-10 km) thick

Our planet's surface is divided into thin, stiff plates that move around on molten magma. If all of the plates were made of the same material, and the surface of the earth was smooth, the oceans would cover the earth to an average depth of 6500 ft. (2000 m)! But there are two plate types: denser, thinner, balsalt oceanic rocks and lighter, thicker, granitic, continental rocks. If you put a wooden block and a styrofoam block in a swimming pool, both would float, but the denser wood would float lower than the styrofoam. Similarly, the dense basalt sinks deeper into the mantle, creating basins where the water collects to form the great oceans of the world.

Water evaporates from the ocean and falls over land as rain. As the ocean water evaporates, the minerals—mostly salt—remain behind in the sea. These ocean minerals originally came from rain water flowing over continental rocks, dissolving minerals from those rocks, and flowing out to sea. Deep in ocean trenches, there are hydrothermal vents that also release minerals into the oceans. This is why ocean water is on average seventy times more salty than fresh water.

Because of the extra minerals, saltwater is denser than fresh water. When you see large rivers flowing out into the ocean, the fresh water floats on top which causes color variations of the nearshore waters.

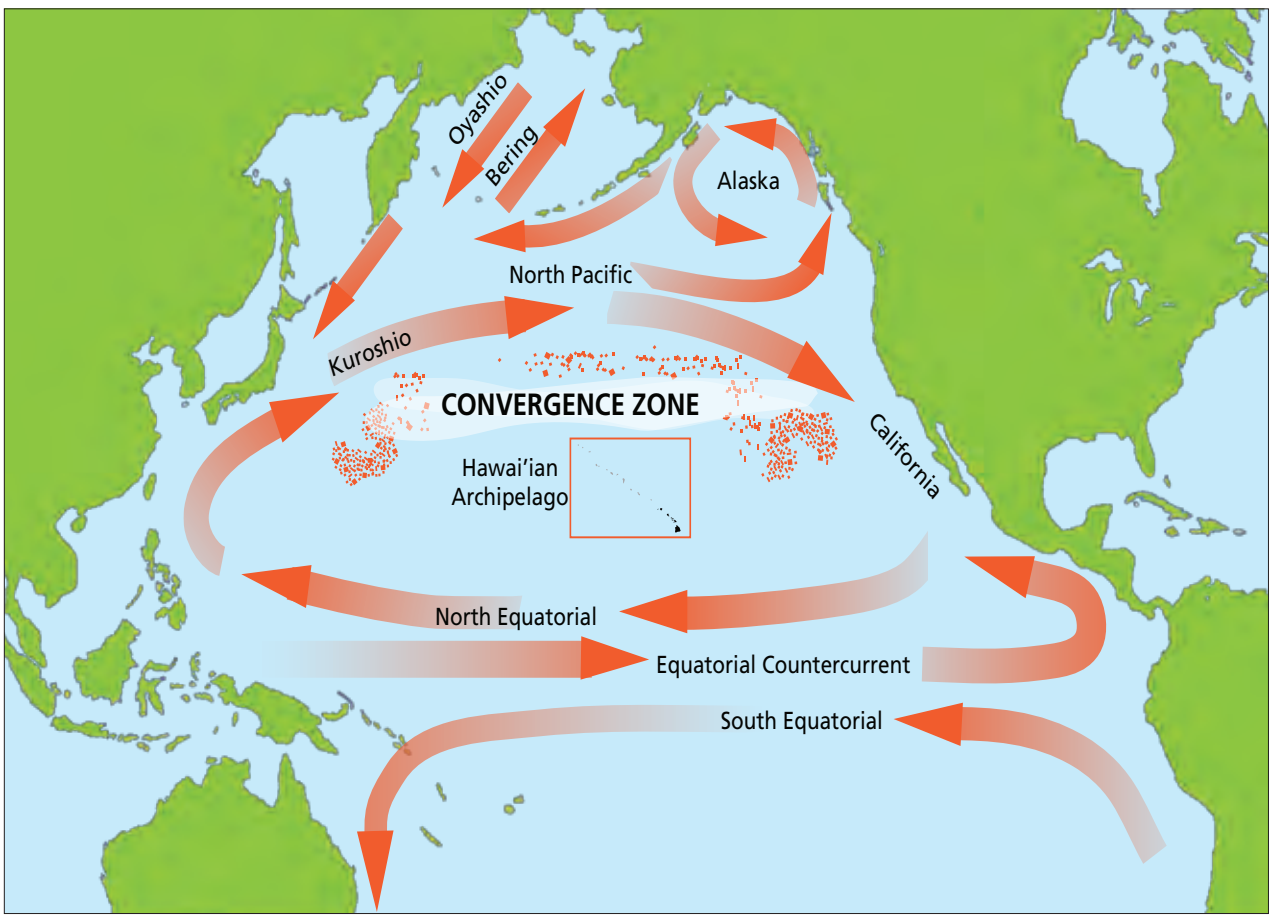
Oceans and Climate

Earth rotates eastward, contributing to the circular movement of air across the oceans. Relative to this rotation, the air is deflected to the right in the Northern Hemisphere, and to the left in the Southern Hemisphere, causing winds to develop. These global winds drag on the oceans' surface causing surface currents, and the currents form ocean-circling spirals called gyres.

The oceans strongly impact the world's climate. Energy from the sun is absorbed and then circulated around the world in warm surface currents.

Ocean Motion

Water in the ocean is constantly moving. A deep, global conveyor current underlies the surface currents. These are the thermohaline currents. These currents are density driven, resulting from differences in temperature and salinity. Dense, cold, salty water sinks while warm, less salty water rises to the surface. The "start" of the ocean conveyor belt is in the northern polar regions. Cold arctic water sinks to the ocean bottom, and is carried south, eventually flowing all the way to Antarctica! Over time this water warms up again, rises to the surface and flows back north, where warm water currents carry water from the equator to the north, and heat is lost again to the atmosphere in the northern latitudes. This motion forms a globe-encircling oceanic conveyer belt. One drop of water spends about 1000 years making a round trip of over 25,000 miles!

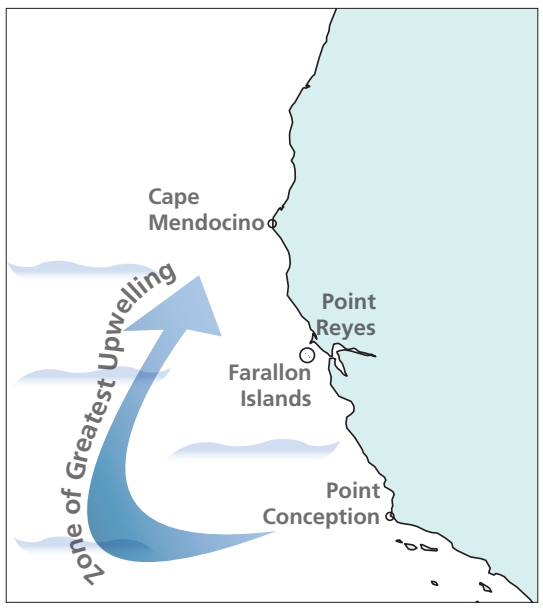


Ocean currents like the California Current, circulate the cold waters in the polar regions back to the equator. This helps to re-oxygenate these warmer waters. This movement creates gyres that can draw in, concentrate, and trap debris, such as plastic trash and fishing nets. More information on page 6.

The California Current

The California Current flows south from along British Columbia's shoreline as part of the North Pacific gyre. This river of water flows along the coast from north to south and before ending off southern Baja California Peninsula. Additionally during the spring months, prevailing northwesterly winds push the warmer surface waters away from shore, which allows colder water from the sunless depths to rise to the surface. This process, known as upwelling, is responsible for the very nutrient-rich waters off the California Coast.

Since the cold waters are rich with nutrients and more saturated with oxygen, they support a rich community of plankton (more on page 4) , the basis of the marine food chain. In general, the strongest upwelling happens between Point Conception and Cape Mendocino. The largest seabird rookery south of Alaska, the Farallon Islands, is situated in the middle of this area.



Ocean Waves

A wave is a disturbance that carries energy from one place to another. What we are witnessing when we look at waves is the energy moving through the water, not the water moving horizontally any significant distance. The waves we see breaking on the beach come from winds blowing over the ocean's surface, along with deeper internal waves. Underwater earthquakes also cause waves—big waves called tsunamis.

Arrival on Shore

As ocean waves approach a shore, the motion they generate deep down begins to interact with the sea floor. This slows the waves down and causes the crests in a series of waves to bunch up—an effect called shoaling. The period of the waves does not change, but they gain height as the energy each contains is compressed into a shorter horizontal distance, and eventually break. Ocean waves can also refract, or bend, as they reach a coastline. This concentrates wave energy onto headlands and helps to shape the shoreline.

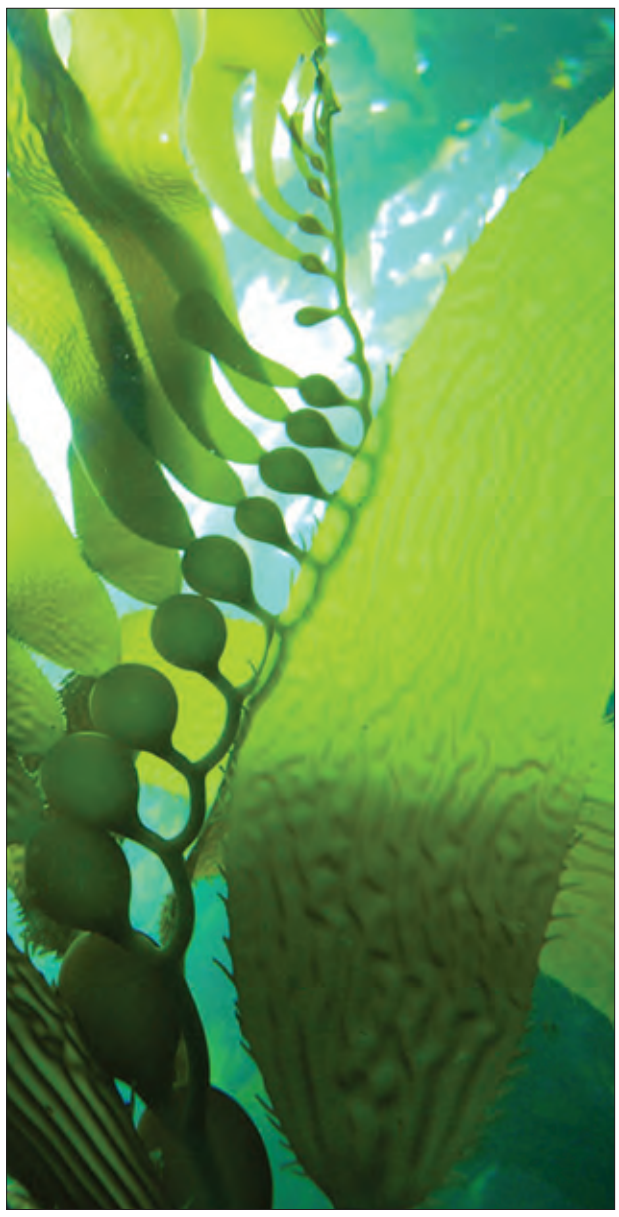
The Base of the Food Chain

Giant Kelp

Giant kelp (*Macrocystis pyrifera*) is the largest seaweed on Earth. It can grow 24 inches (60 cm) per day and up to 100 ft (30 m) in a year. It grows at a depth of 30–100 ft (10–30 m), but in clear water can grow much deeper. The huge "root" called a holdfast is firmly attached to the seabed and when mature, can grow to 2 feet (60 cm) in circumference. Several long, flexible stalks stretch toward the surface, have straplike fronds, buoyed by gas-filled bladders. The giant kelp's fronds continue to grow after reaching the surface, floating as a dense canopy.

In kelp forests, including giant kelp and other species, invertebrates such as bristle worms, snails, feed on the holdfasts. A wide range of important fish, including many types of rockfish, are found in kelp forests. Marine mammals inhabit kelp forests for protection and food. These include sea lions and seals that feed on the fish. Sea otter and their pups use kelp forests as a safe haven from predators, and feed on the abundant invertebrates associated with the kelp.

Gulls, terns, loons, grebes and cormorants dine on the many fish and invertebrates living in the kelp. Flies, maggots, and small crustaceans that are abundant in the kelp that is washed ashore provide a smörgåsbord for birds such as shorebirds including the federally protected western snowy plover.



NOAA Photo

NPS Photo

In winter storms, massive piles of kelp wash up on the beaches at Point Reyes. At this point, fly larva, amphipods, bacteria, and fungi feast on the piles, working quickly to decompose them.

Krill

Krill are small, shrimplike crustaceans which occur worldwide in all of the oceans. They are near the bottom of the food chain. Their main food is phytoplankton. Krill are eaten by whales, penguins, seals, squid, fish, and also by people.

One defense krill have against predation is swarming, during which densities of 20,000 individuals per cubic foot occur. This behavior confuses some predators. Krill also spend their days in the deeper parts of the ocean to avoid most predators and rise to the surface at night. Although krill have many predators, some species can live to be up to six years old!

Blue whales feed almost exclusively on krill, even though they are the largest animal that has ever lived. Blue whales grow to be as much as 100 (30 m) feet long, larger than the biggest dinosaur that ever lived on earth! These whales weigh up to 150 tons, and due to their immense size, they need to eat up to four tons of krill each day.

NOAA Photo

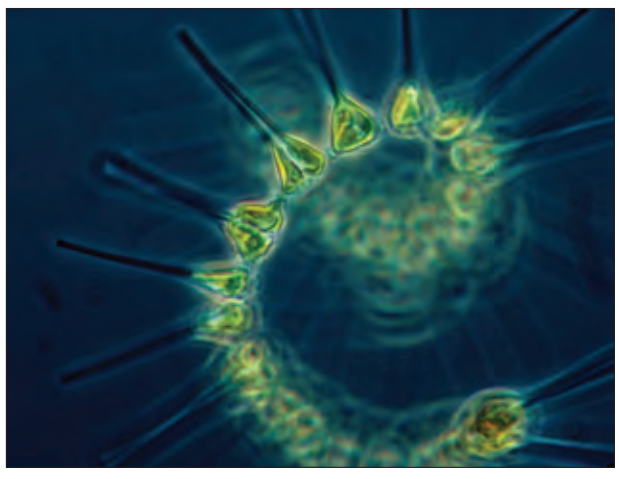
Plankton

The complex relationships between producers and consumers in food webs on land are mirrored in our oceans. Plankton are organisms that drift in bodies of water. Their name comes from the Greek word *planktos* (πλαγκτός), meaning wanderer or drifter. The base level of the ocean food web are phytoplankton—tiny, sometimes microscopic plants—that live in the epipelagic zone, the top layer of the ocean. This layer extends to 660 feet (200 meters) the depth at which enough sunlight penetrates for photosynthesis to occur, and phytoplankton are therefore rarely found beneath this layer.

Also living in the epipelagic zone are zooplankton, usually microscopic animals that forage on the phytoplankton and also prey on each other. This is a very diverse group, from members that are primitive protozoans to the larvae of more complex creatures such as jellies and squid. One type of zooplankton, copepods, were made famous by Spongebob Squarepants' archenemy, named Plankton.

Adaptations to avoid predators include gathering in large swarms, being transparent, and producing bioluminescence. Bioluminescence is the production and emission of light by living organisms, and is an adaptation of some marine invertebrates and fish. Plankton may bioluminesce to distract, confuse, or discourage prey.

Dinoflagellates are a type of marine plankton that are not plants or animals, but have qualities of both. Dinoflagellates are a type of marine plankton that are not plants or animals, but have qualities of both. Some of these creatures are responsible for the algal blooms we call red tides, and for the sparkling bioluminescence in breaking waves at night.



NOAA Photo

Photoplankton release oxygen as a by-product of photosynthesis. Algae and phytoplankton provide over half of oxygen we breathe—more than all land plants combined. One type of phytoplankton, called *Prochlorococcus*, may be the single most abundant species on earth!

Did you know scientists are studying kelp on the West Coast to determine the radiation levels from the Fukushima reactor fallout? Kelp takes in elements including radioactive Cesium, Strontium, and Iodine and concentrates it in its tissues. Scientists can analyze kelp tissue samples for traces of these elements.

Journeys

Migrations

Why do animals migrate? Available resources vary seasonally, for example, food that is abundant in the summer is not in winter. Temperature variations mean some areas are only hospitable for mating and giving birth during one season. The place and season that is best for breeding may not be optimal for finding food. This means that some animals travel great distances searching for feeding and breeding grounds.

Gray whales undertake one of the longest migrations of any mammal, traveling up to 13,000 miles (21,000 km) from feeding grounds to breeding grounds and back every year. They reach their northern and southern destinations within 49 to 55 days. The Point Reyes lighthouse is a great location for gray whale observation during their migration, because the peninsula juts out 10 miles (16 km) west, into the Pacific Ocean.

Pinnipeds, such as seals, sea lions, and fur seals, are also known for making long journeys. Each year, the northern elephant seal migrates farther than most other marine mammals in the world, traveling as many as 14,000 miles (about 22,500 km). It is also the only mammal known to undertake two migratory journeys each year.

About 1,800 of the world's bird species are migratory. The record for the longest migration of any animal belongs to sooty shearwaters and Arctic terns, each of which migrate over 40,000 miles (64,000 km) a year!

NOAA Photo / Sophie Webb

Phenomenal long-distance migrants, the sooty shearwater (*Puffinus griseus*) migrates between the subarctic and the South Pacific each year.

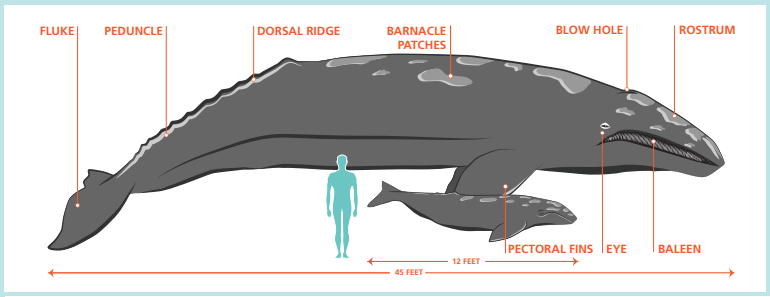
Many shark species travel thousands of miles through open water every year, scouring the ocean for food. Some white sharks travel across the Indian Ocean, from South Africa to Australia and back again and from California to Hawaii, over the course of a year.

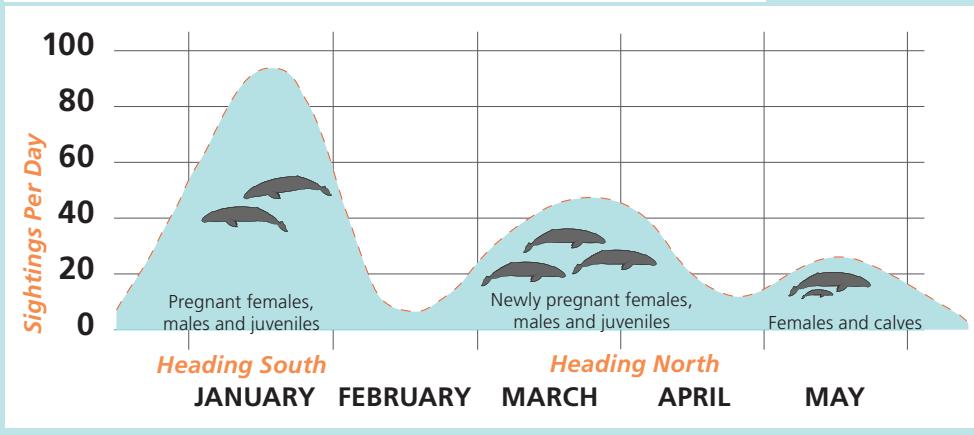
Salmon are impressive for their ability to traverse both seawater and freshwater during their journey. They can travel hundreds of miles inland via rivers and waterways—sometimes ascending thousands of feet as they migrate upstream—to spawn in the rivers where they were born.

Leatherback sea turtles have been recorded traveling across the Pacific Ocean between Asia and North America, a distance of over 12,000 miles (19,000 km) in less than two years. Similar to salmon, they navigate back to the beach where they were born to dig a nest in the sand and lay their eggs.

Zooplankton float in the water column of the world's oceans and seas and include creatures as diverse as jellies, copepods, krill, larval worms and snails, and juvenile fish. Theirs is a vertical migration of thousands of feet each day—up in search of food, and then back down to avoid predators.

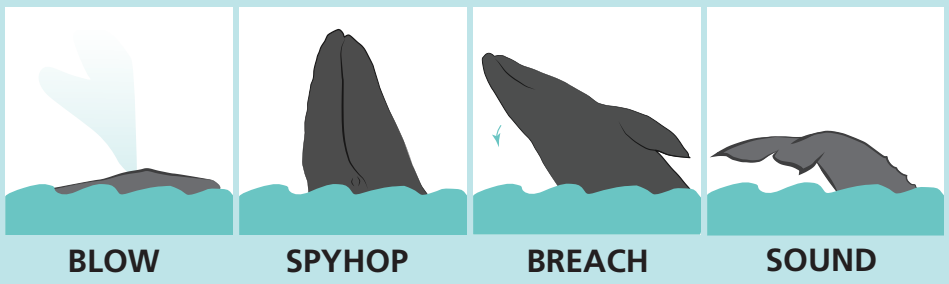
12,000 mile migration





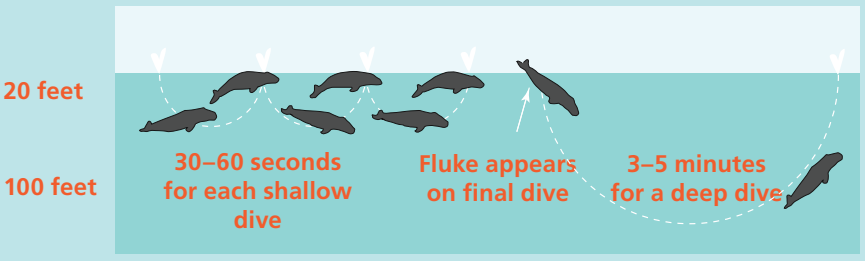
Surface Behavior

Gray whales are often found traveling alone or in small groups of two to four. They are a coastal species, usually found within 6 miles (~10 km) of shore.



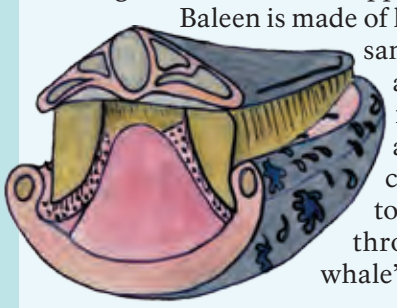
Diving Behavior

Gray whales rarely pause on their migration, resting for only a few hours per day. They slowly swim to their destination following a somewhat predictable diving pattern at speeds of 3–5 mph, covering up to 115 miles (184 km) per day.

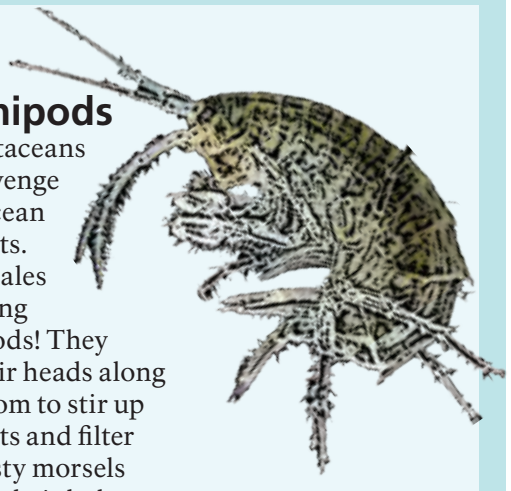


Anela Ramos

Baleen hangs from the upper jaw of the mouths of some whale species. The whale takes water into its mouth, then pushes the water out with its tongue. Animals such as amphipods, krill, and small fish are filtered through the baleen and trapped inside. Baleen is made of keratin, the same substance as human fingernails and hair, and continues to grow throughout the whale's life.

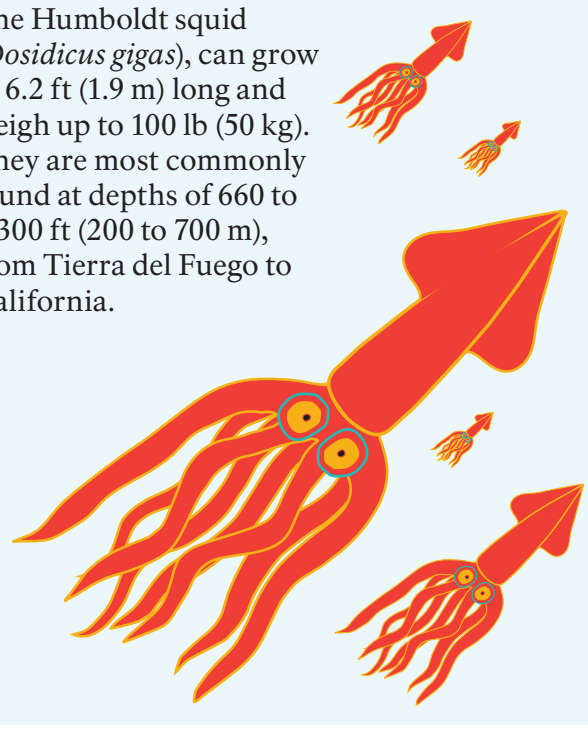


Amphipods are crustaceans that scavenge in the ocean sediments. Gray whales love eating amphipods! They drag their heads along the bottom to stir up sediments and filter these tasty morsels through their baleen.



Want to learn more about the ocean?

The Humboldt squid (*Dosidicus gigas*), can grow to 6.2 ft (1.9 m) long and weigh up to 100 lb (50 kg). They are most commonly found at depths of 660 to 2,300 ft (200 to 700 m), from Tierra del Fuego to California.



Bodega Marine Laboratory
University of California at Davis
https://marinescience.ucdavis.edu/bml/about

MarineBio Conservation Society
https://marinebio.org

Monterey Bay Aquarium & Research Institute
https://www.montereybayaquarium.org
https://www.mbari.org

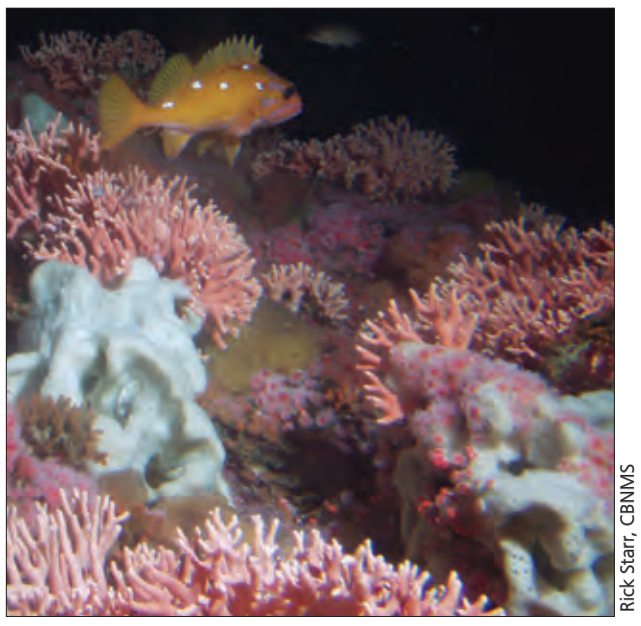
National Oceanic and Atmospheric Administration
https://www.noaa.gov
https://sanctuarysimon.org

National Park Service
https://www.nps.gov/subjects/oceans/index.htm

Scripps Institution of Oceanography, UC San Diego
https://scripps.ucsd.edu

Woods Hole Oceanographic Institution
https://www.whoi.edu

Humans and Oceans



Rick Starr, CBNMS

Rosy rockfish on top shallow reef of Cordell Bank National Marine Sanctuary. Slow growing reefs are vulnerable to contact with fishing gear.

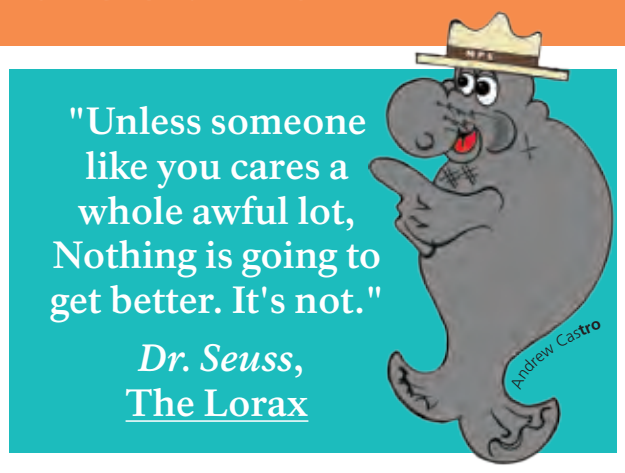
The Ocean is a Giant CO_2 Sponge

The ocean has always absorbed $C0_2$, playing an important role in stabilizing global climate. Since the Industrial Revolution, human activity such as burning of fossil fuels and deforestation has put excess $C0_2$ into the atmosphere creating carbon pollution. More $C0_2$ in the atmosphere means more C02 in the ocean. The excess $C0_2$ (carbon pollution) is rapidly changing the ocean. When $C0_2$ dissolves in seawater, carbonic acid is formed. This chemical reaction leads to ocean acidification. Ocean acidity has increased by 30% since the beginning of the Industrial Revolution. This increase is 100x faster than any change in acidity experienced by marine organisms for at least the last 20 million years. With acidic ocean conditions, shelled animals have to work harder using more energy to make their carbonate shells and structures and in some areas of the ocean, the corrosive waters affect their reproduction and physiology. Human actions have accelerated ocean acidification, but human actions can also slow down the process. Any and all actions to reduce the use of fossil fuels also reduces the amount of carbon pollution added to the atmosphere and to the ocean. Choosing to use less energy- to burn less fossil fuel, emitting less $C0_2$ will help ocean animals and plants. With our help ocean plants and animals may have time to adapt to the changing ocean.

Overfishing

Overfishing is the taking of marine species such as fish, shellfish and even mammals at a rate that is not sustainable and can disrupt ecosystems. In the 1800s, we nearly obliterated several species of whales to harvest whale blubber for lamp oil and lubricants for our machines. With the passage of the Marine Mammal Protection Act in 1972, several species have rebounded in populations. Some fish, including California's sardines, were also harvested to the brink of extinction by the 1950s, but their population was coindicentally affected by changes in climate.

The damage done by these industrial, deep-water trawlers, long-lines and gillnets has been large and broad. Nets can entangle and break coral, decimating reefs that take decades to form. Prized fish go to market, but unmarketable fish (also known as bycatch) die in the same nets, and are thrown back.



Also trapped and killed are seabirds, seals, dolphins, and sea turtles which, unable to reach the water's surface and breathe, drown in the nets.

Some scientists predict that if these practices continue, it is possible that ocean fisheries could collapse by 2050 or sooner. With larger fish removed from the seas, jellyfish may become dominant in the food web. Jellyfish, anyone?

Like to eat fish? If you enjoy seafood, consider where it came from and how it was caught. The Seafood Watch card produced by the Monterey Bay Aquarium helps consumers make choices for seafood that have the least impact on the environment. https://www.seafoodwatch.org

Of Sharks And Men

Sharks belong to a group of animals called elasmobranchs whose skeletons are made of cartilage, not bone. There are over 500 species of sharks in the world and they come many sizes. The smallest sharks, called dogfish, are just 8-10 inches (20-25 cm) long, while the largest shark, the whale shark, can grow to over 40 ft (12 m) and weigh almost 50,000 lbs (22 metric tons)! Many sharks don't begin breeding until they are teenagers, and some live to be 70 years old.

Few shark species attack people. The white shark, tiger shark, bull shark, and oceanic whitetip shark are involved in most attacks. Worldwide, between 1580 and 2014 less than 600 fatal human shark attacks have been documented. Compare that with over 3,500 drowning deaths in 2011 in the U.S. alone! If *galeophobia* (fear of sharks) keeps people out of the water, sharks may actually save lives.

In comparison, shark researchers estimate that humans kill over 100 million sharks every year. Many are killed just for their fins. Once their fins are cut off the sharks are frequently thrown back into the ocean. Unable to swim, they bleed to death or succumb due to suffocation or starvation. Many sharks take so long to reach reproductive age, some species are now threatened with extinction. complex communities from disappearing from our world.

KQED Quest

An employee of the National Oceanic and Atmospheric Administration (NOAA) inspects confiscated shark fins.

Anela Ramos

Mola mola, or sunfish, can grow up to 11 ft (3.3 m) and weigh over 5,000 lbs (2,250 kg). They LOVE lion's mane jellyfish, but do you?

Too Many Bottles In The Sea

Sailing home to California from Hawai'i in 1997, Charles Moore discovered an enormous mass of largely plastic fragments, which was later dubbed the Great Pacific Garbage Patch. No precise measurements are available, because the ocean is always moving, but may be twice the size of the continental US. There are "garbage patches" in all 5 ocean basins.

Most of the garbage is plastic—nearly two million bits per square mile. Where did it all come from? The sad answer is us. Disposable plastics are the greatest source of plastic pollution. Plastic bags, straws, bottles, utensils, lids, cups offer a small convenience, but remain on this planet forever. Trash on the ground could eventually get transported to a river ultimately leading to the ocean and carried around via currents. Hundreds of ocean animals, including birds, have been documented with plastic in their bellies.

Follow the "4 Rs" of sustainable living: Refuse, Reduce, Reuse, Recycle. Join the "Bring Your Own" revolution and bring your own grocery bags, utensils, coffee cup and more and you'll be amazed at how much less plastic you use.

While visiting the beach, consider lending a hand and picking up trash at the beach and disposing it in a garbage can when you leave. Each individual action does make a difference.

NOAA Photo

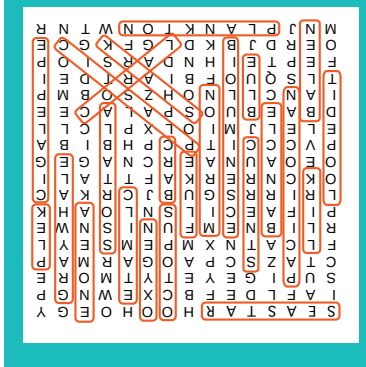
A Laysan albatross chick surrounded by brightly colored plastic trash on a beach on Midway Island.

Kids Page Answers

What Will I Be When I Grow Up?

1—C 4—F
2—A 5—E
3—B 6—D

308 steps
1,800,000 krill
leatherback sea turtle
gray whale
shark
ocher seastar
octopus
the ocean
kelp



Food For Thought

U.S. Fish and Wildlife Service

U.S. Fish and Wildlife Service biologist Rachel Carson and USFWS artist Bob Hines surveying the Atlantic Ocean in Maine, 1951.

"It is a curious situation that the sea, from which life first arose should now be threatened by the activities of one form of that life. But the sea, though changed in a sinister way, will continue to exist; the threat is rather to life itself."

— Rachel Carson,
The Sea Around Us

"The poet Auden said, 'Thousands have lived without love; none without water.' Ninety-seven percent of Earth's water is ocean. No blue, no green. If you think the ocean isn't important, imagine Earth without it. Mars comes to mind. No ocean, no life support system. I gave a talk not so long ago at the World Bank and I showed this amazing image of Earth and I said, 'There it is! The World Bank!' That's where all the assets are! And we've been trawling them down much faster than the natural systems can replenish them."

— Sylvia Earle,
Marine Biologist

"All the king's horses and all the king's men will never gather up all the plastic and put the ocean back together again."

— Charles Moore, Oceanographer

POINT REYES NATIONAL SEASHORE
1 Bear Valley Road
Point Reyes Station, CA 94956

Bear Valley
Visitor Center
415-464-5100

Lighthouse
Visitor Center
415-669-1534

Kenneth C. Patrick
Visitor Center
at Drakes Beach
415-669-1250

www.nps.gov/pore

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PRINTED WITH FUNDING FROM:
The Marin County Wildlife and Fisheries Commission

Printed on recycled paper

Wind, Fog, Whales—Oh My!

Point Reyes is the windiest and foggiest place on the Pacific Coast, and conditions presented a major hazard to shipping. In the 1900s, many ships went aground or sank, necessitating the establishment of the Point Reyes Lighthouse in 1870. Lighthouse keepers living here then struggled with long hours, harsh working conditions, isolation, and depression. A few were driven to drinking the metal cleaners, and at least one was carted away to an institution.

Today the Point Reyes Headland is still an adventure at any time of year. Winter and early spring the gray whales migrate by (see chart on page 5) and northern elephant seals are abundant on the beaches near Chimney Rock. Spring is the windiest time of year, when 40-plus mile-an-hour winds commonly pummel the promontory, and the stairs to the lighthouse close. Hold on to your hats!

Spring and summer are the seasons when one can view the nesting Common Murres below the Point Reyes Lighthouse, and admire the abundant wildflowers blooming along the Chimney Rock Trail. Summer days tend to be foggy and relatively cold, but if you are looking for an air-conditioned retreat from triple digit temperatures in California's Central Valley, come on by. In autumn, temperatures are warmer, and migratory birds—some blown wildly off course—rest in the Monterey cypress trees along the path to the Lighthouse Visitor Center.

Just offshore are two national marine sanctuaries, the Gulf of the Farallones National Marine Sanctuary and Cordell Bank National Marine Sanctuary. Extending out to the edge of the continental shelf, these ocean preserves have protections that prevent oil and gas leasing and discharges into the waters. The craggy Farallon Islands, a National Wildlife Refuge, and the rocky submarine peaks of Cordell Bank rise from the floor of the Pacific Ocean. This network of marine protected areas also includes Point Reyes National Seashore, which embraces the only congressionally designated marine Wilderness south of Alaska, and several California State Marine Protected Areas that further limit fishing and protect species in the nearshore waters of the coast.

The oceanographic conditions combined with diverse seafloor features such as islands, banks, canyons and seamounts create a unique "hotspot" that supports a diverse community of marine life above and below the surface. In addition to sustaining a vibrant ecosystem year round, the region is a migratory destination for seabirds, whales, seals, sea turtles and fish that travel thousands of miles annually to feast on the seasonal bounty of these waters.

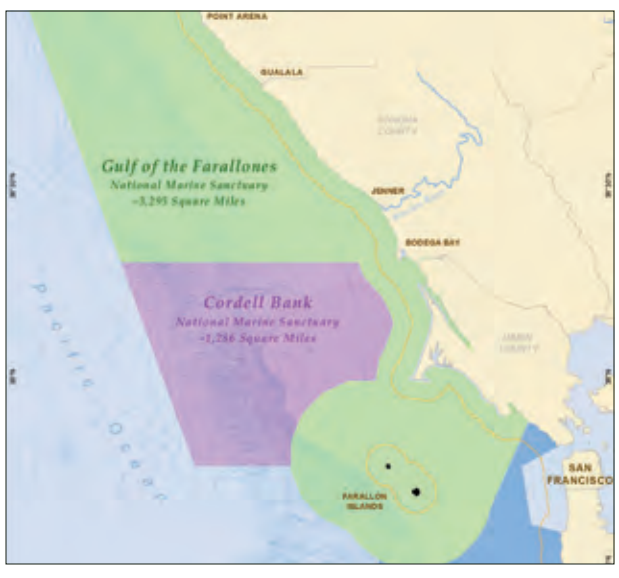
PRNS Archives

Anela Ramos

NPS Photo

NPS Photo

NPS Photo



NOAA

The Top Five Questions At The Lighthouse

1. Is it always this foggy? About a third of the year, most notably in late summer, persistent fog envelops the lighthouse area. Some days it lifts in the afternoon, but not always.

2. Is it always this windy? Wind speeds of up to 133 miles-per-hour have been measured at the lighthouse. Spring is the windiest time, when, in 40+ mph winds, the stairs close for visitor safety reasons.

3. What causes all the foam on the ocean? Sea foam is created by the agitation of seawater that contains high amounts of dissolved organic matter. These compounds, churned up by breaking waves, form bubbles that stick to each other.

4. What time do the whales go by? Whales don't sleep for long periods like humans do. Instead they nap at the surface, and during their migration can be swimming by Point Reyes any time of day.

5. **What is that concrete dome across from the visitor center?** That is a cistern that was used for gathering and storing water.

Kid's Activities

What Will I Be When I Grow Up?

Draw a line between the adult animals and the baby animals

1. Abalone

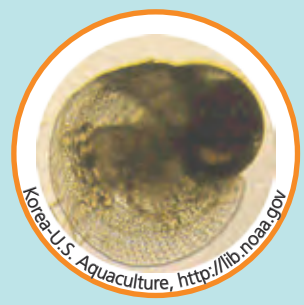
A

2. Coho Salmon

B

3. Dungeness Crab

C



4. Pacific Giant Octopus

D

5. Sea Cucumber

E

6. Sea Urchin

F

Ocean Word Search

S	E	A	S	T	A	R	H	O	O	H	O	E	G	Y
I	A	F	L	D	E	F	B	C	X	E	W	N	G	P
S	U	P	I	G	E	Y	E	T	Y	T	M	O	R	E
C	T	A	Z	S	C	P	A	O	G	A	R	M	A	P
F	L	C	A	T	N	X	M	P	E	M	S	E	Y	L
R	L	I	B	N	E	M	F	U	N	I	S	N	W	E
P	I	F	A	E	C	I	L	S	N	L	O	A	H	K
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P	V	C	C	C	I	T	P	C	P	H	B	I	B	A
E	L	E	L	J	M	I	O	L	X	P	L	C	L	L
D	B	A	E	B	U	O	S	P	A	L	A	C	E	E
I	A	N	C	L	L	N	O	H	Z	S	O	B	M	P
T	L	S	Q	U	O	F	B	I	A	R	T	D	E	I
F	E	P	T	E	I	H	N	D	A	R	S	I	O	P
O	E	R	D	J	B	K	D	L	G	F	K	G	C	E
M	N	J	P	L	A	N	K	T	O	N	W	T	N	R

gray whale
climate
plankton
kelp
krill
migration
blue
bioluminescence

seastar
Pacific Ocean
currents
tidepool
anemone
barnacle
shark
baleen

epipelagic
octopus
plastic
coral
fluke
albatross
crab
oxygen

Did you walk the stairs at the Point Reyes Lighthouse? How many steps are there?

Lighthouse Stamp

If an average krill weighs 2 grams, how many krill can a blue whale eat in a day? (Hint: there are about 450 grams to 1 pound).

What reptile swims about 6,000 miles in one year?

What whale species migrates past the Point Reyes Lighthouse and gives birth to their calves in the warm lagoons of Baja California?

Name an endangered animal that humans kill just for their fins.

Name an animal living in the mid-tide zone.

Name an animal living in the Bathypelagic zone, down to 13,000 feet.

Where does most of our rain come from?

What is the world's largest seaweed?

Get Stamped!

Go to a visitor center, answer five of the questions above, , and get a stamp for each correct answer.