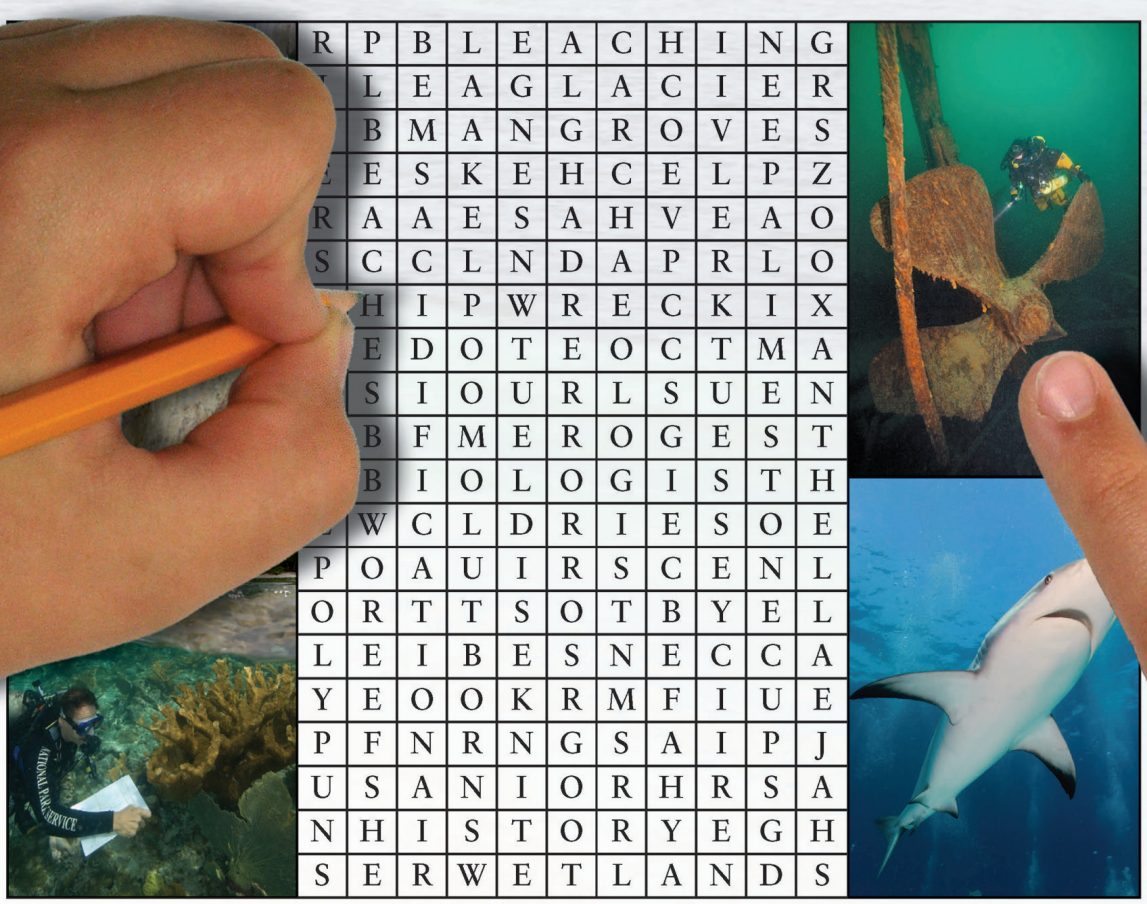
Submerged Resources Center
National Park Service
U.S. Department of the Interior

Junior Ranger
Underwater Explorer

An explorer's activity guide to the underwater world

Water Word Search



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ACIDIFICATION	CORAL POLYP	LIONFISH	SHIPWRECK
ARCHAEOLOGIST	GLACIER	MANGROVES	WATERSH[illegible]
BEACHES	HISTORY	REEFS	WETLA[illegible]
BLEACHING	KELP	RIVERS	ZOOXA[illegible]
BIOLOGIST	LIMESTONE CUP	SHARKS	

The unused letters in the puzzle spell out a hidden message. Begin using the letters in the top left corn[illegible] and go across, ending in the bottom right corner. After solving the puzzle, the message will be revealed b[illegible]

Welcome to the Junior Ranger Underwater Explorer Booklet!

Look for the Junior Ranger logo on the page to learn more about a topic on the National Park Service's WebRangers at: www.nps.gov/webrangers/. Remember to ask your parent's permission before you visit the website.

Red colored boxes are activities to do at home.

This booklet is full of fun activities to help you discover what is underwater. Dive with us as we explore different environments, animals, and the people who work beneath the surface.

The best way to use this booklet is by completing a few pages at a time. Everyone will get an Underwater Explorer badge, so complete as many activities as you can. Ask your parents or siblings to go through the booklet with you so they can learn also!

To receive a Junior Ranger Underwater Explorer Badge and Park Ranger's signature, please present your signed pledge in the back of the booklet to a participating National Park Visitor Center or mail it to:

National Park Service, Submerged Resources Center: Junior Ranger, 12795 W. Alameda Pkwy, Lakewood, CO 80228.

All images are by the National Park Service unless indicated otherwise.

The Junior Ranger Motto:

"Explore, Learn, Protect."

1. **Explore.** Be adventurous! Go see and do all the exciting things that America's National Parks have to offer.
2. **Learn.** Find the facts! There are a lot of really cool things that you can learn from our National Parks, including information about America's history, culture, ecosystems, and national treasures.
3. **Protect.** Be a friend of the National Parks! Do what you can to make sure other people can enjoy the park after your visit.

The Junior Ranger Program is found throughout the National Park Service and online with WebRangers. You can be a park-specific Junior Ranger or a specialized Junior Ranger, like an Underwater Explorer.

Most importantly.....

What Does a Park Ranger Do?

Park Rangers care for and protect over 400 National Park units all over the country, which include some of the most beautiful, interesting, and historically important places in the United States.

How many National Parks have you visited? _____

Maybe you will become a Park Ranger when you grow up. Listed below are just a few jobs that Park Rangers can do, but there are many more as well!

Circle or color in the arrowheads with the jobs that you would like to do. Think of a job that is not listed here and fill in the empty arrowhead below.

Rangers plan fun activities for visitors.

Rangers study and protect ecosystems.

Rangers answer visitors' questions.

Rangers keep parks clean and safe.

Rangers can be scientists.

Rangers interpret the past.

Rangers study shipwrecks.

Rangers fight forest fires.

Rangers help maintain hiking trails.

Rangers protect underwater resources.

Rangers enforce the law.

Rangers protect historic buildings.

Rangers design web pages.

Rangers rescue people.

Rangers patrol parks with cars, boats, and horses.

Fun 'Flat Hat' Fact:
The hats that Park Rangers wear have a curved or pinched top. If a Ranger is caught in a rainstorm, the curved top helps keep the Ranger's head dry.

What Are Water Resources?

Water resources are bodies of fresh and salt water that have recreational, economical, environmental, household, farming, or industrial uses. The National Park Service manages its water resources to protect the environment and promote recreation. These water resources provide homes for many different organisms. They are also a major part of the history of an area and are found throughout the United States. All water resources play an important role in the water cycle. Even the streams or ponds around your house and neighborhood are water resources, which are a part of the water cycle. The map below highlights a few National Parks and their water resources.

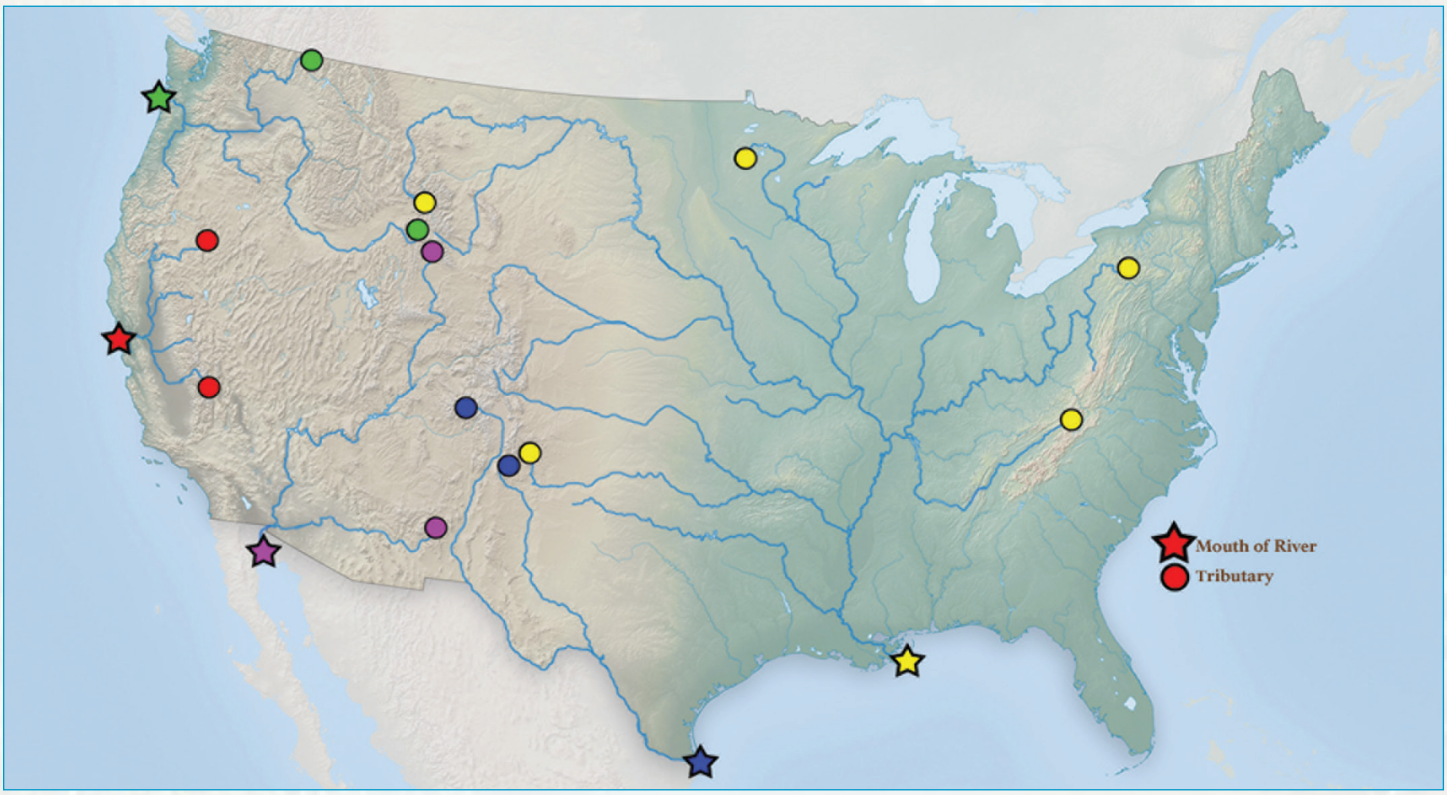
Circle two of the parks shown above that you would like to visit. Write a sentence below explaining why you chose those two parks.

_____

_____.

Fresh Water is an everyday necessity for things like drinking, growing plants, and raising animals. In fact, access to fresh water is one of the main influences on where people choose to live. For thousands of years, until the arrival of Europeans, Native American tribes lived all over the country and used the same freshwater sources we rely on today: springs, rivers, lakes, and groundwater. Fresh water forms rivers or natural highways that stretch across the continent. Native Americans used hand-made canoes and rafts to travel and trade goods along these waterways.

River highways and the land around them make up a watershed. At the beginning of a river, or its headwaters, small streams combine to form rivers called tributaries. Eventually, tributaries come together making an even larger river that becomes the main river channel. The main channel ends at the mouth of the river where fresh water meets with salt water in the ocean. In America, the Mississippi River is the largest watershed and is colored with yellow in the map. It creates part of the Lewis & Clark National Historic Trail that connects over 11 states to each other by waterway. The National Park Service protects and studies watersheds making sure they are clean and healthy.



Use a pen or marker to follow the watershed paths from the colored round dots representing river tributaries to the matching star marking the mouth of the river. The main river channel is where lines overlap towards the mouth of the river.

1. Which colored dot can take the most river pathways while staying in the same watershed?

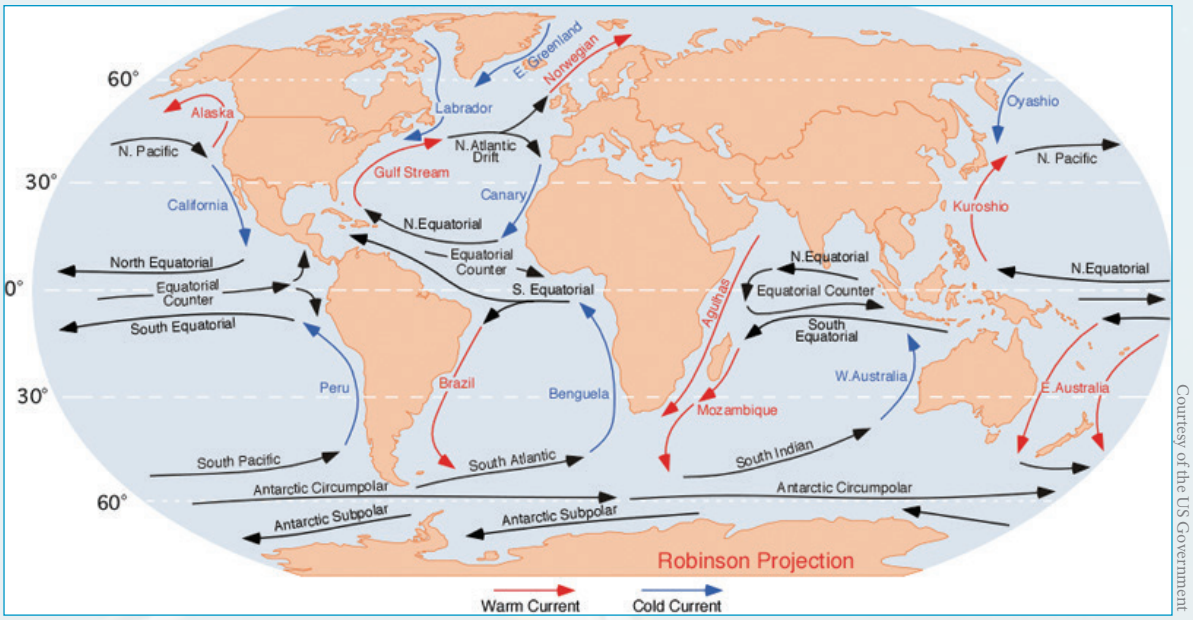
_____

2. How many individual watersheds (with tributaries and river mouths) are shown on this map? _____

Answers: 1. Yellow 2. Five colored river watersheds.

Salt Water covers 70% of the Earth's surface and is the reason it is called the Blue Planet. There are five major oceans interconnected around the world through currents. Currents are rivers in the oceans generated by differences in water temperature, amounts of dissolved salt (called salinity), and wind direction. Heat makes water less dense, which causes warm water to rise above cold water. Salinity makes water more dense. Water with more salinity will sink to the bottom. The direction and strength of the wind can push water in a certain direction. The combination of heat, salt, and wind keep the oceans constantly moving.

Ocean currents flow on known pathways and have allowed travelers to explore the world. Currents also shape ocean ecosystems by carrying rich food sources to fish and other organisms. Different animal species follow the ocean currents into park habitats. For example, Channel Islands National Park in California is surrounded by several different currents ranging in strength and direction. These combine to create many habitats for a wide range of plants and animals. The arrows and colors on the map below indicate the direction and temperature of major currents worldwide.



Courtesy of the US Government

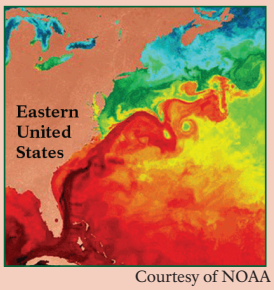
Current Activity!

Explore how currents work at home! Have your parents help you with these experiments.

Items needed:

1. Pie tin or container
2. Straw
3. Salt
4. Food coloring
5. Oregano (or other floating herb)
6. Small cup

Wind Experiment: 1) Fill the tin or container up to the brim with cold water. 2) Add oregano or similar herb to water. 3) In one location of the container, like the center or a side, use the straw to blow the herbs around the container. Notice the pattern of the herbs as they move.



Courtesy of NOAA

Temperature & Salinity Experiment: 1) Remove a tablespoon of water from the wind experiment container. 2) In a small cup, mix together a tablespoon of warm or hot water, a tablespoon of salt, and a few drops of food coloring. 3) Pour the small cup of salt and food coloring into the container with cold water. Watch how the warm colored water mixes with the cold water and herbs. The yellow and green colors in the image on the right show how water is mixing in the ocean as warm water from the Gulf Stream Current (in red) mixes with cold water of the Labrador Current (in blue).

Environment Matching

Draw a line from the numbered environment description to the lettered picture that represents it!

1. I am a flowing, natural waterway full of freshwater. I can be very big, like the Mississippi, or small, like something you could find in your neighborhood.

2. I am a mixture of both fresh and salt water, where rivers connect to the ocean. I can be called many things such as bay, inlet, sound, or wetland. I provide homes for many species of plants and animals.

3. I am created by colonies of hard skeleton animals and provide a great home for fish. I cover less than 0.1% of the ocean and am threatened by climate change, but I am still a popular and beautiful place to visit.

4. I am a large body of freshwater that stays relatively still even though I am usually connected to a stream or river. I can be a great place to fish and always play a vital role in the watershed.

5. I am a group of trees and shrubs that live with my roots in salt water along the coastline, sometimes making small islands. Tides change the level of water around me. My roots provide protection for baby ocean fish.

6. I am a massive body of ice made from a large reservoir of frozen water. I can be found in the polar regions and in tall mountains around the world. When I melt, a process called calving, the pieces that fall off are called icebergs.

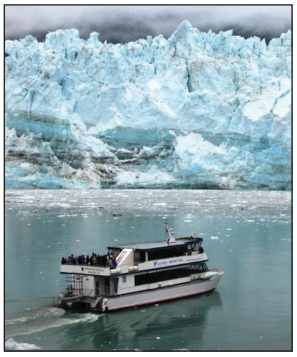
7. I am made of tiny pieces of sand and rocks found on a shoreline. I make a great place for summer vacations and sand castles, but remember to wear a hat and use sunscreen!

8. I am a group of large seaweed plants that grow from the sea floor to the surface. Some plants have gas-filled bladders, like balloons, that help me grow towards the sunlight. Sea otters and sea lions like to play in my plant maze!

9. I am an underground aquifer full of crystal clear, blue water. I travel through caves and come out through rock openings. I provide drinking water for many people and a warm home for manatees, so it's important that I stay clean.

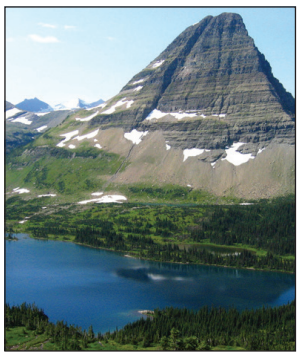
10. I am a fissure in the earth's crust and push out extremely hot water. I can grow in the shape of towers or spires. I am found in both salt and fresh water.

A. Estuary

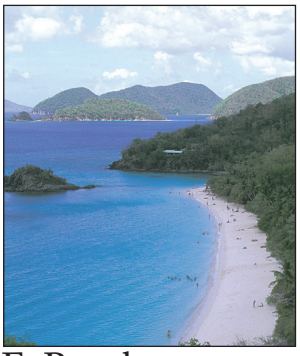


B. Glacier

C. Kelp Forest



D. Lake



E. Beach

F. Coral Reef

G. River

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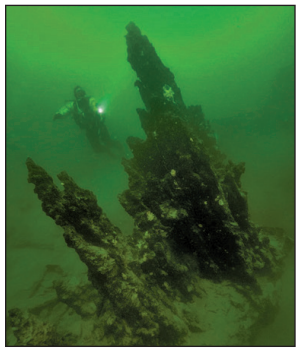
H. Freshwater Spring

I. Mangroves

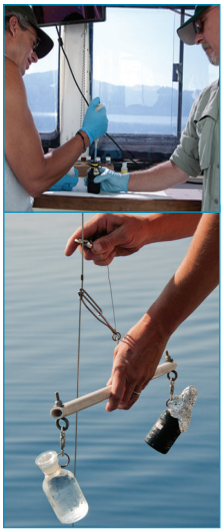


J. Hydrothermal Vents

Answers: 1.G; 2. A; 3.F; 4.D; 5.I; 6. B; 7. E; 8. C; 9.H; 10.J

How Do We Know What's Underwater?

Currently, we know more about the surface of the moon than we do about many of our water resources! The National Park Service along with many other agencies, organizations, and educational institutions actively work underwater to research and monitor different aquatic environments, organisms, and cultural artifacts. Because we are still learning about our water resources, there are endless opportunities for underwater research. Take a look at the page below and the rest of this Junior Ranger Booklet to find examples of what National Park Service scientists are studying. Maybe one day you will help the National Park Service conduct research underwater!



Scientists like those from Oregon's Crater Lake National Park study water itself. They look at chemicals in the water to track the water quality in the lake. It is a very important job of Park Rangers and scientists to help keep all of our National Parks clean from unwanted chemicals and other possible pollutants.

Near coast lines, boaters accidently drive in the shallow areas and damage seagrass with their propellers causing prop scars. Biologists in Florida's Biscayne National Park document and restore damaged seagrass that grow in the shallow water around the park. Seagrass is replanted in the scars and then monitored for health and density. Without the help of the scientists, the grass may not grow back.

Archaeologists are scientists who study people from the past through artifacts or objects left behind. Some archaeologists, like those from the Submerged Resources Center, specialize in researching artifacts that are found underwater. These artifacts can be small like pottery, or big like a tank or shipwreck! Documenting and researching these objects can help us learn about the way people in the past worked and lived. Submerged artifacts act like a time capsule, preserving a moment in history, which may have otherwise been lost if on land.

Not everyone can go underwater to see what lies below the surface. Photographers help archaeologists and other scientists document submerged resources by taking photographs and videos including cool 3D video. This helps us see how things change over time such as how shipwrecks are impacted by storms or how corals are growing on a site. The work of underwater researchers, like archaeologists and photographers, helps the National Park Service share what is underwater with people across the country and the world.

The National Park Service has scientists and researchers that use specialized equipment to work underwater. The most important equipment that people use underwater is called SCUBA (Self Contained Underwater Breathing Apparatus) equipment. It includes an air source, which is usually a tank full of compressed air (or a mixture of gases), a regulator for breathing, and a buoyancy compensator device that will hold the tank and regulator in place. Take a look at the scientific diver and the SCUBA equipment that she uses to work underwater.

Let's get ready to dive! Write the equipment description number on the line next to its matching letter on the diver diagram.

1. **A Wetsuit**- keeps a diver warm in the water and can protect them from stinging jellyfish. Wetsuits come in all sorts of colors and sizes and are worn underneath all of the equipment.

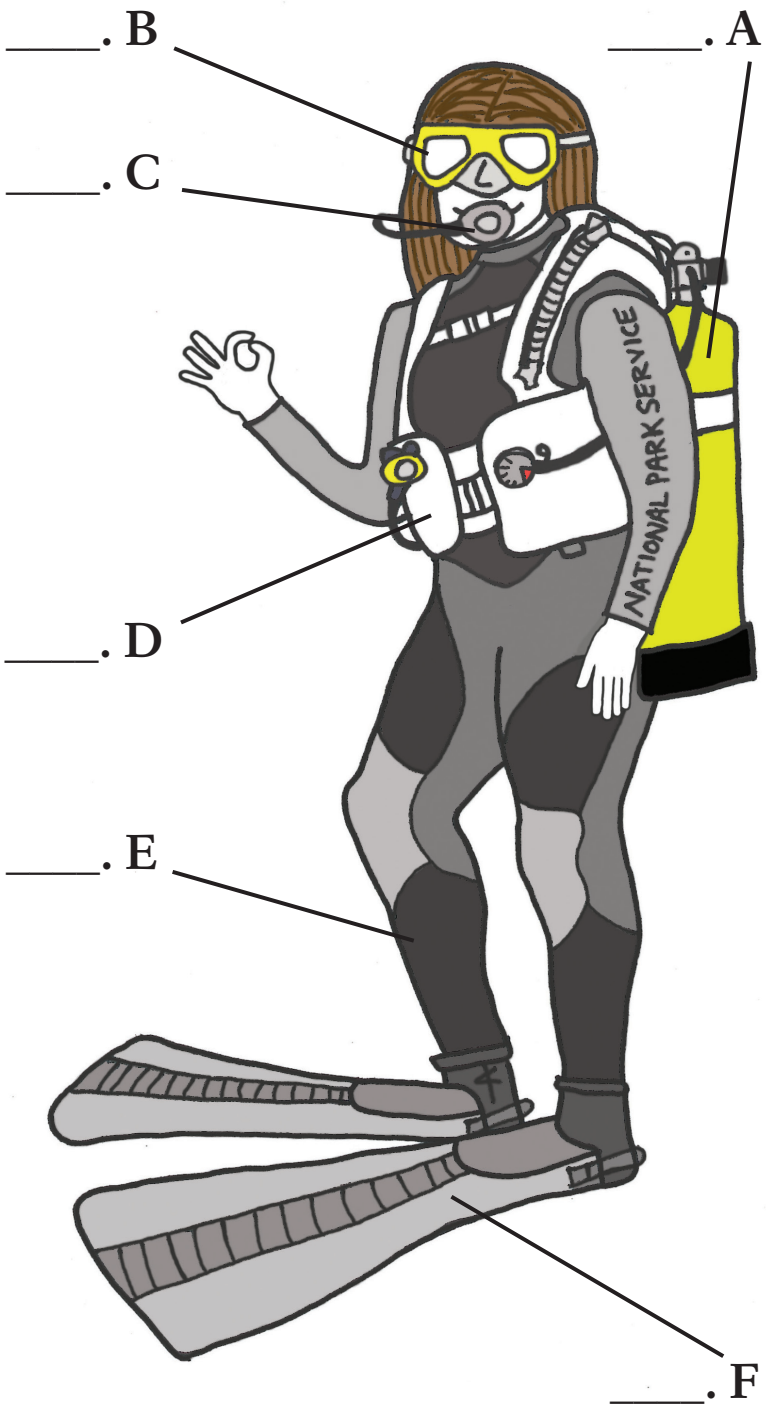
2. A **Regulator**- helps a diver breathe underwater. It is a series of valves that control the flow of compressed air from the tank into a diver's mouth.

3. A **Tank**- holds compressed air a diver breathes while underwater and is carried on a diver's back. Also called a cylinder, a tank is the heaviest part of a diver's equipment.

4. A **Buoyancy Compensator Device (BCD)**- is a jacket or vest that helps a diver ascend or descend underwater when air is added or removed, and it keeps the tank on the diver's back.

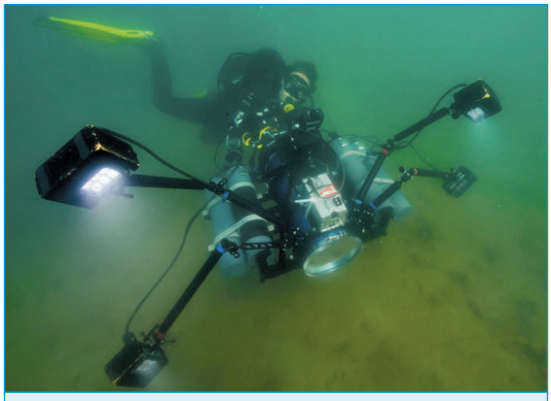
5. A **Diving Mask**-helps a diver to see clearly underwater. Masks include a nose pocket, so no water goes up a diver's nose.

6. **Fins**- fit over a diver's feet and help the diver swim and kick effectively through the water.



Answers: 3.A; 5.B; 2.C; 4.D; 1.E; 6.F.

In addition to SCUBA equipment, National Park Service scientists use underwater cameras, metal detectors, and other cool gadgets to help find and document underwater resources!



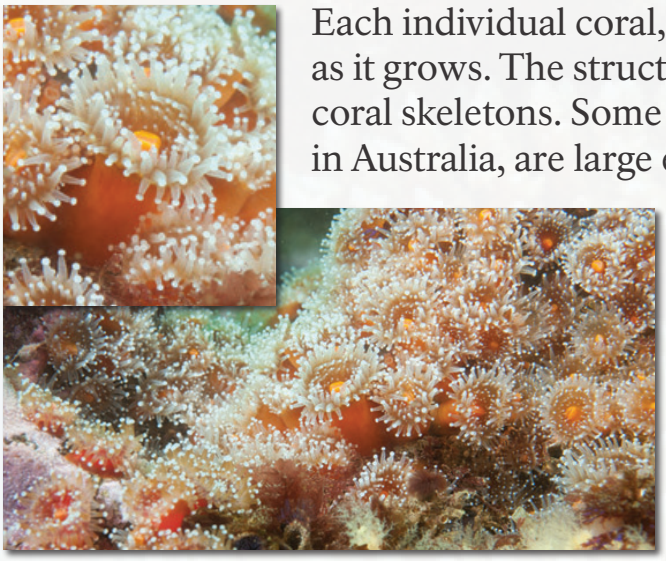
Cameras can go underwater when they are placed in an underwater housing (a waterproof case). Some housings have lights or strobes to help shine extra light on their subjects.

At times, archaeologists use metal detectors to reveal hidden objects beneath the sand. If metal is found, the detector gives off a sound to alert the scientist of its presence.

Scientists use a regular pencil and special waterproof paper to document all types of submerged resources. Will you help park archaeologists map a section of this shipwreck located in Michigan's Isle Royale National Park? Use the blank space below to draw the tugboat shown on the left.

Corals are tiny animals that grow together in colonies or groups to form beautiful coral reefs. Coral reefs provide homes for many other creatures, while protecting the coastline from big waves and storms. There are four coral identification groups: hydrocorals, gorgonians, stony corals, and black corals.

Hydrocorals, pictured on the right, have stinging cells that protect them from animals that get too close. Gorgonians look like leaves or fuzzy, flexible plants with beautiful colors. Stony corals are hard like rocks and are the most recognizable corals, since their large structures act as building blocks for the reef. Black corals, named for their dark color, normally live in deeper water and grow slowly.

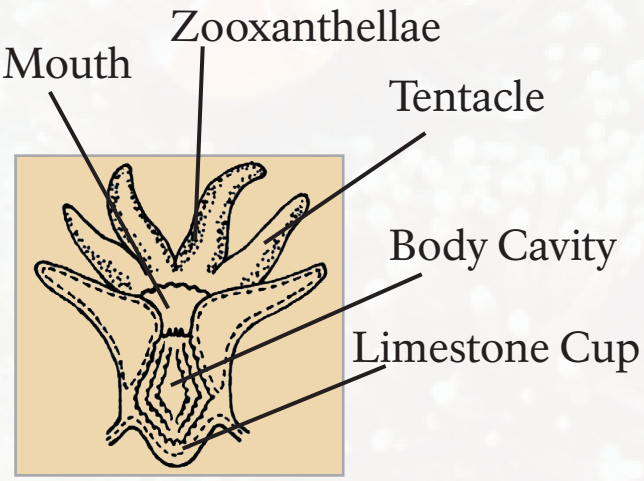


Each individual coral, or polyp, forms a skeleton as it grows. The structure of a reef is made up of millions of these coral skeletons. Some coral reefs, such as the Great Barrier Reef in Australia, are large enough to see from space.

Inside most coral polyps are zooxanthellae (zoo-zan-thel-ee), which are tiny algae that give coral its color and food. Like plants on land, zooxanthellae harness energy from the sun to make food. Coral polyps need the food produced by zooxanthellae to survive, while the zooxanthellae need the protection of the coral's hard skeleton.

During a visit to a beautiful coral reef, such as Buck Island Reef National Monument in the U.S. Virgin Islands or War In The Pacific National Historical Park in Guam, you can see colorful fish and other animals that call coral reefs their home. You never know what may swim by!

Diagram of Stony Coral Polyp



Use the decoder box to the left to find the hidden message above!

Make Your Own Coral Polyp

Use the Stony Coral Polyp diagram on the previous page to help with this activity!

Items needed:

1. Plate= limestone base
2. Marshmallow= coral polyp body
3. Red licorice= tentacles
4. Cake frosting= limestone cup
5. Sprinkles= zooxanthellae

1. Place the plate, or limestone base, on a table then put the marshmallow in the center.
2. Use a toothpick or something similar to help guide in the tentacles of red licorice into the sides of the marshmallow.
3. Cover the outside of the marshmallow and licorice with frosting as the limestone cup and sprinkles as the zooxanthellae.
4. Act like a parrotfish and eat your coral polyp!

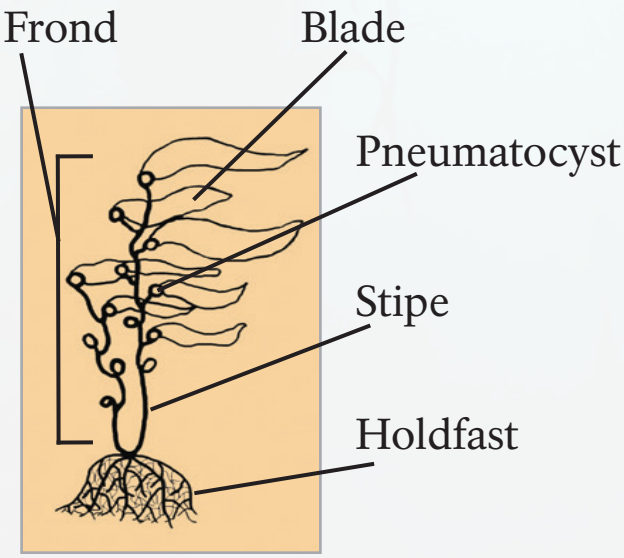
Decoded answer: Help keep coral reefs healthy; put trash in bins.

Kelp Forests are made up of different types of seaweeds, or algae. The largest type of algae in this forest is giant kelp. Giant kelp can live at depths below 100 feet and grow almost two feet per day! Like tropical rainforests, kelp forests are diverse and support over 1,000 different species! The kelp canopy offers protection for small organisms by slowing down the water movement and providing refuge from predators.

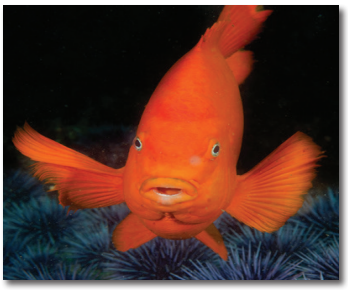
Kelp use holdfasts, which are root-like structures, to anchor themselves to the seafloor. From the holdfast, a stem-like structure called the stipe grows towards the surface and supports numerous blades that look like leaves. Gas-filled bladders called pneumatocysts (new-mat-oh-sists), similar to small balloons, support the blades by floating them towards the surface. Kelp blades need to be close enough to the surface in order to absorb sunlight and nutrients.

Kelp forests, such as those found in Channel Islands National Park, are unique since they experience both warm water currents from the south and cold water currents from the north. This mixing of currents creates a highly productive ecosystem supporting a diversity of organisms only found along the California coast. The next page highlights a few organisms that call kelp forests home.

Diagram of Giant Kelp



Residents of a Kelp Forest

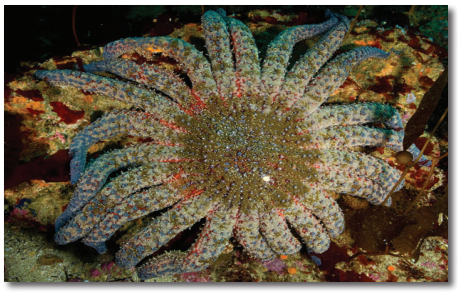


Garibaldi Fish

Sea Lions

Sea Urchins

Pacific Electric Ray



Sunflower Star

Bat Star

Can you find the differences between the kelp forest residents below? Circle five differences between the right picture and the left picture.

Answers: No tail on sea lion; Garibaldi facing opposite direction; different sunflower star; extra sea urchin; sea star for sea urchin.

Sunk!

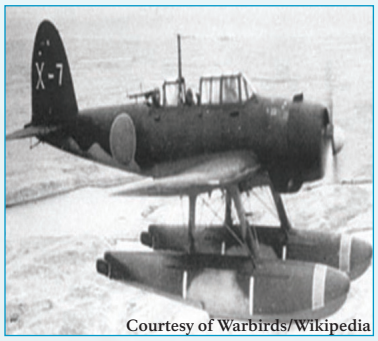
There are things underwater that we might not expect to find. People throughout history have used water for a variety of needs including travel and trade. Just like vehicles

breaking down on highways, ships and boats ,as well as airplanes flying over the water, are occasionally lost. When they sink, many of the objects they carry go down with them. The result is a collection of items, including the ships themselves, that end up on the bottom providing homes for coral, fish, and algae, along with objects for National Park Service scientists to study.

Help archaeologists identify these sunken objects found within National Parks! Use the scrambled letters next to the pictures on the left to fill in the blank letters on the right.

N I L

A__R
P__A__E



Courtesy of Warbirds/Wikipedia

H A

__NC__OR

L U C

S__HOO__
B__S

Courtesy of William Grimes

K T H

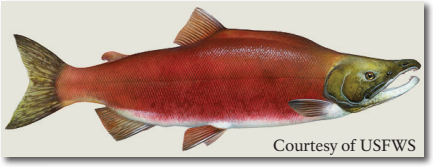
S__ERMAN
__AN__

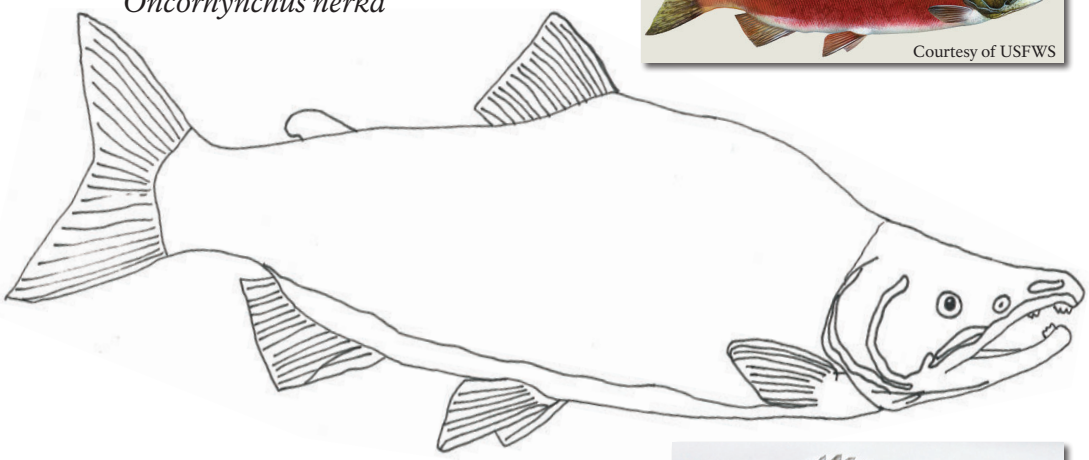
Courtesy of US Army

Answers: Air Plane; Anchor; School Bus; Sherman Tank

Color the Freshwater Fish

Sockeye Salmon
Oncorhynchus nerka


Courtesy of USFWS

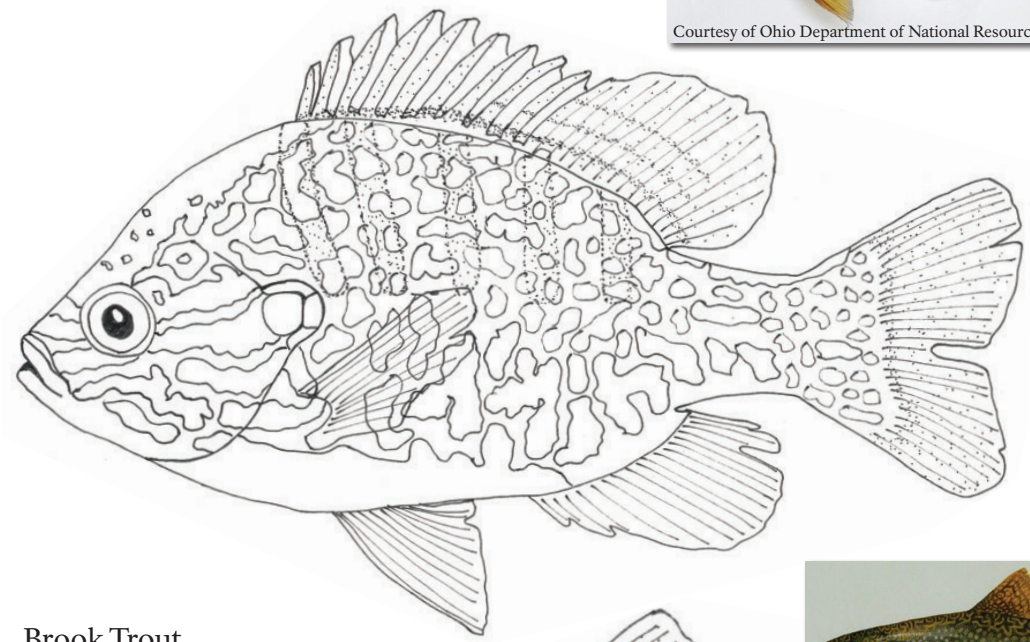


Salmon begin their lives in freshwater rivers, like rivers found in Olympic and Katmai National Parks in Washington State and Alaska. Eventually, they swim downstream and out to sea, living in the ocean for one to seven years depending on the species. Salmon return, swimming against the current of fresh water to reach their spawning grounds, which is the same place where they were born. After spawning, most male and female salmon die, providing food and nutrients for the river's ecosystem.

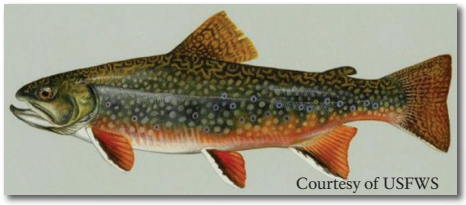
Helpful Hint:
Common Name
Scientific Name

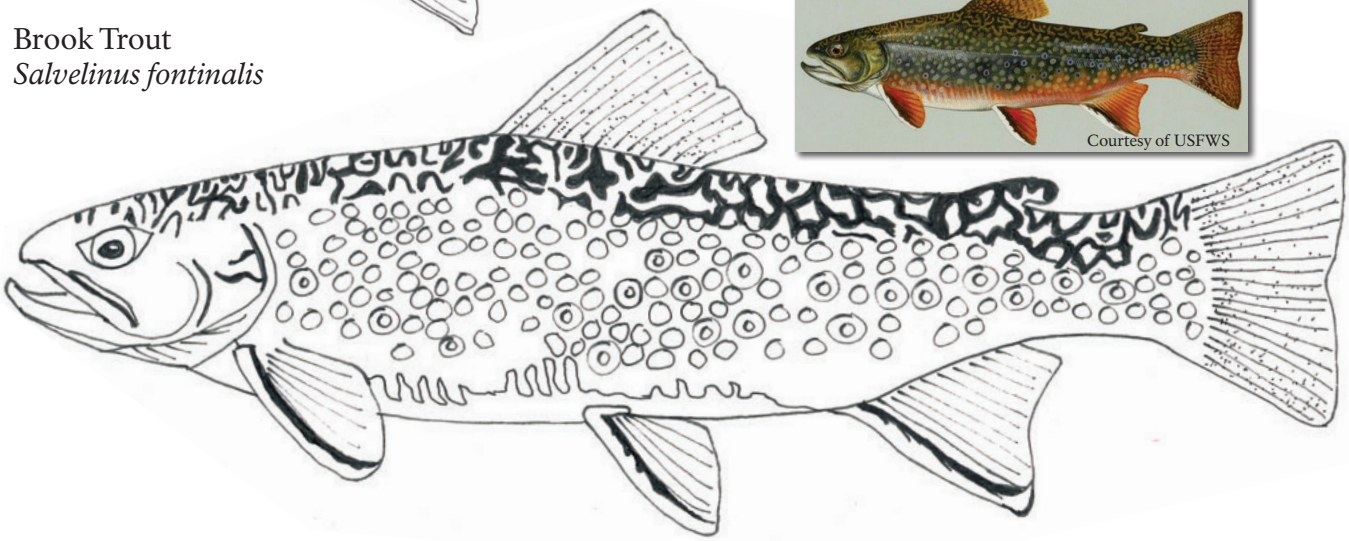
Pumpkinseed Sunfish
Lepomis gibbosus

Courtesy of Ohio Department of National Resources



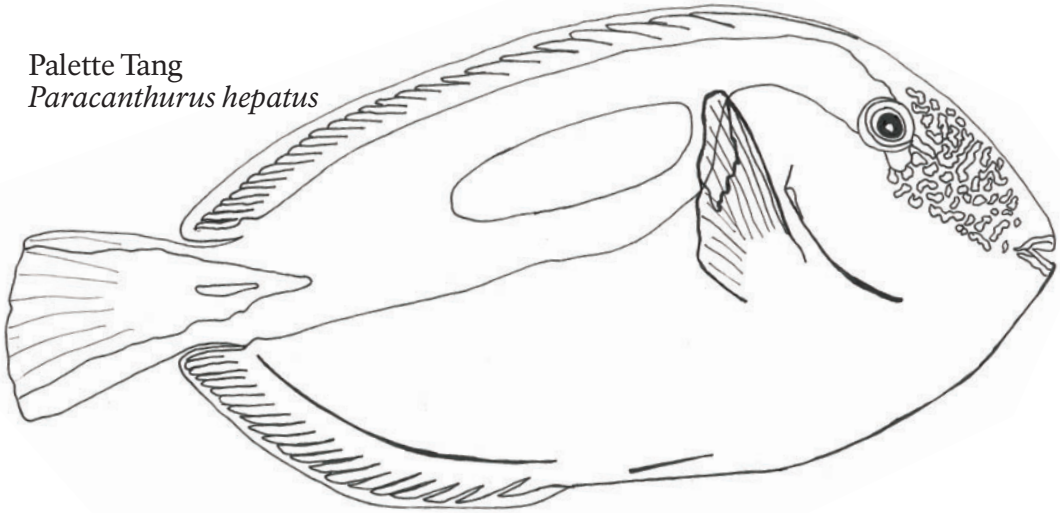
Brook Trout
Salvelinus fontinalis


Courtesy of USFWS

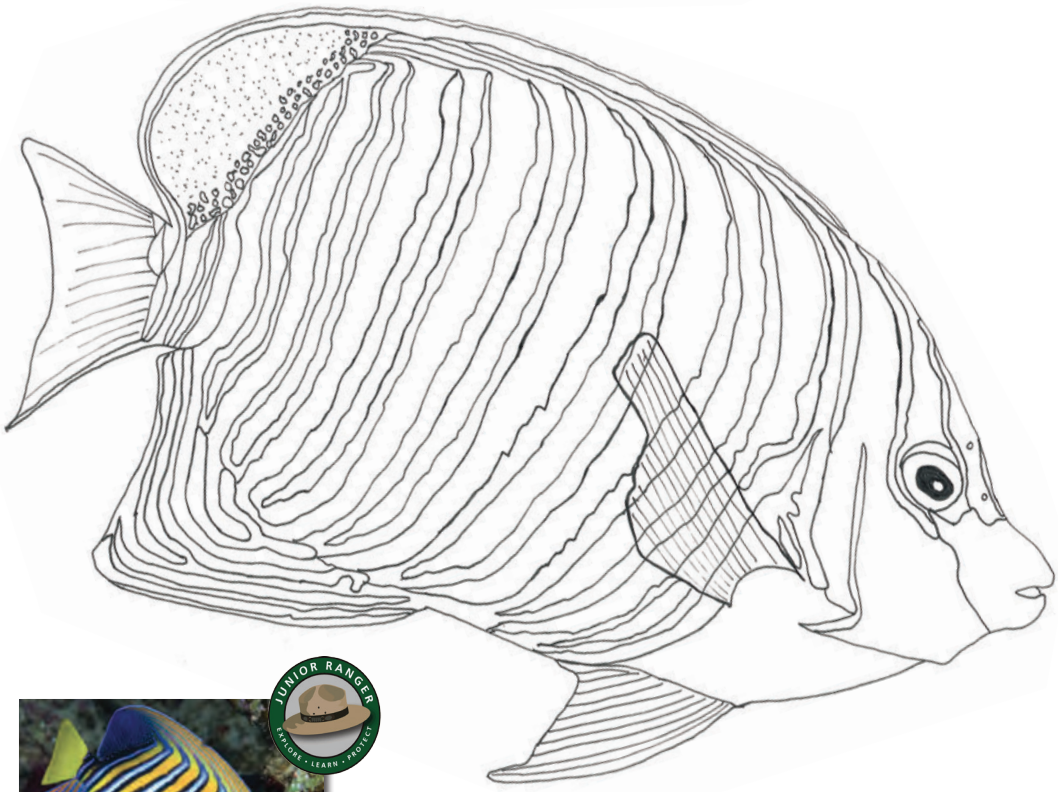


Color the Pacific Ocean Fish

Palette Tang
Paracanthurus hepatus

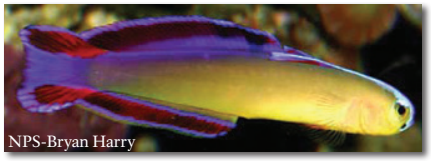


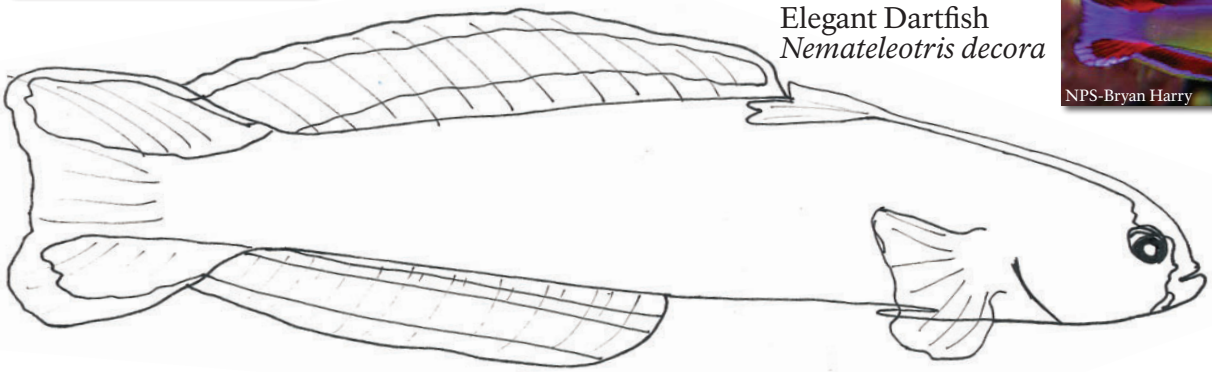
A Palette Tang is a type of Pacific surgeonfish and a popular movie character. There are over 80 species of surgeonfish! They can be found in numerous parks like the National Park of American Samoa. Surgeonfish have two hard spines at the base of their tail, one on each side. The spine lies in a groove until the fish feels threatened, then the spine sticks out like a small knife or surgeon's scalpel to scare off danger. Surgeonfish like to eat algae that grows attached to coral.



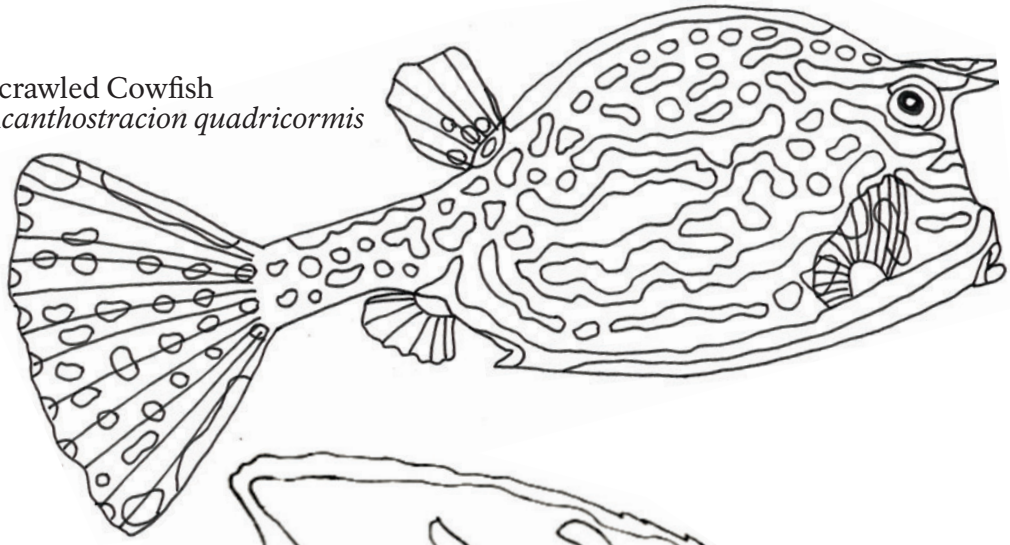
Regal Angelfish
Pygoplites diacanthus

Elegant Dartfish
Nemateleotris decora



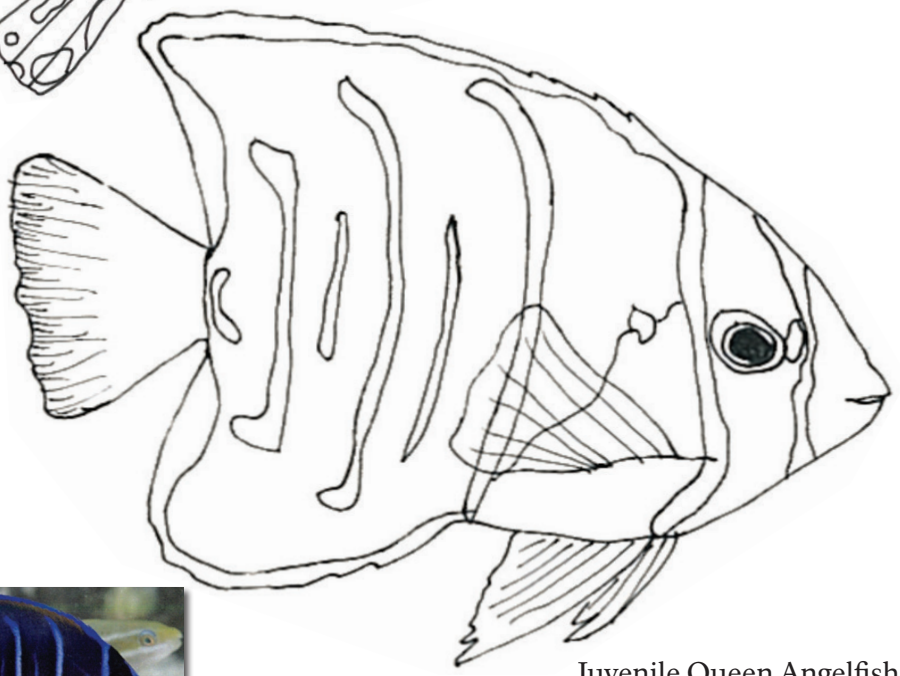


Color the Atlantic Ocean Fish

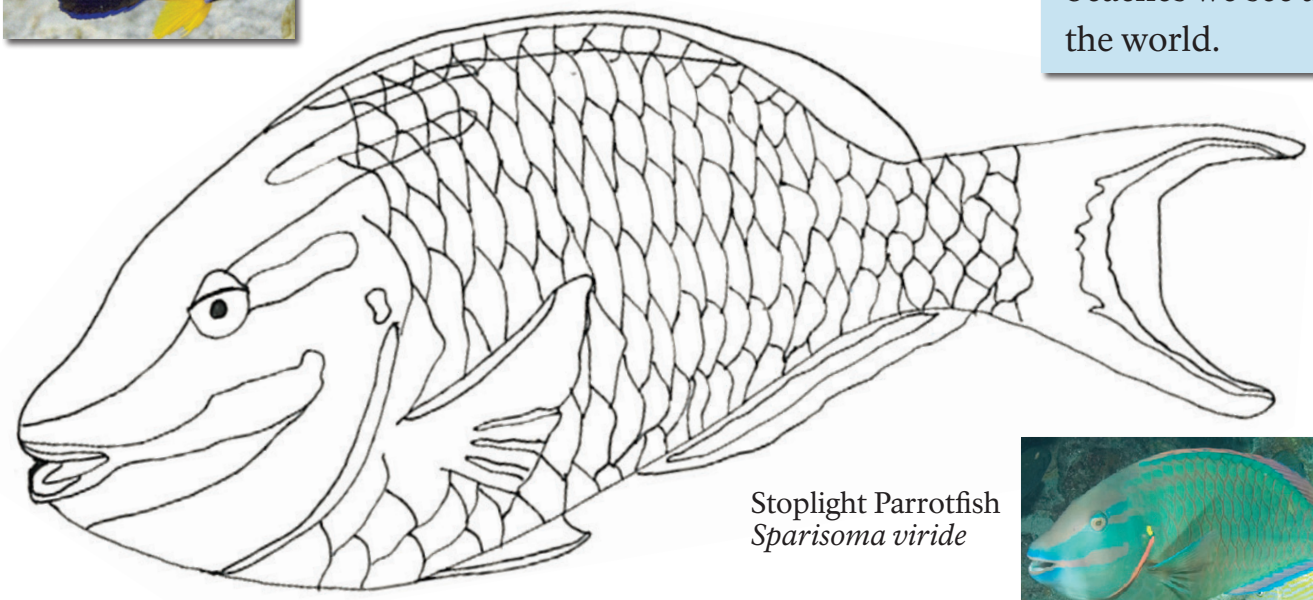


Scrawled Cowfish
Acanthostracion quadricormis

Parrotfish like to munch on coral polyps to get to the zooxanthellae (zoo-zan-thel-ee), which are the tiny algae living inside coral. Eating coral is very loud! You can hear the parrotfish munching while you are snorkeling or diving in parks like Virgin Islands National Park. Parrotfish digest the coral and turn it into sand. Thanks goes to the hungry parrotfish for making some of the most beautiful sandy beaches we see around the world.



Juvenile Queen Angelfish
Holacanthus ciliaris



Stoplight Parrotfish
Sparisoma viride

Sharks are one of the most recognizable predators in the ocean. Unlike humans, sharks do not have bones for their skeletons; instead they have flexible cartilage skeletons, which give them the ability to withstand pressures at deep depths. Over the past 400 million years, shark bodies have become streamlined and built for speed. Sharks and rays have a special organ on their head called the ampullae of Lorenzini that senses other animals through an electromagnetic field. Low visibility in the water can make prey hard to find with eyesight alone, but with the help of the ampullae of Lorenzini, finding food is easier.

There are over 470 different species of sharks that live in our waters and there is still much to learn about them. Many shark species visit National Parks during part of their lives. Sharks tend to be misunderstood and are perceived as dangerous; however, shark attacks on humans are rare when compared to the millions of people swimming in the ocean. The National Park Service is studying sharks to learn new information and keep visitors safe.

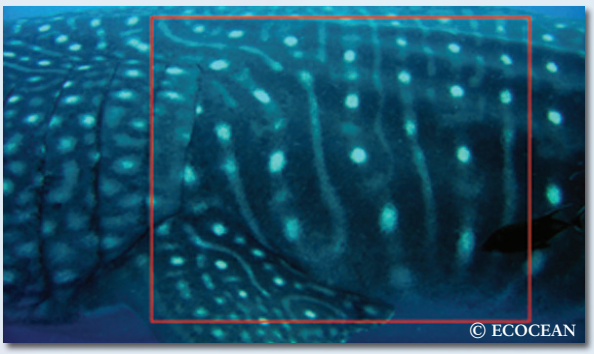
Sadly, shark populations are dropping quickly because of by-catch (getting caught in fishing nets by accident) and the shark finning industry. Scientists all over the world are trying to learn as much as possible about sharks so we can better protect them.

In the finning industry, thousands of sharks are killed each year for only their fins. Their fins are sold in stores as an expensive ingredient in shark fin soup.

Courtesy of Stephen Sanchagrin

Identifying and Tagging Sharks

Whale sharks are the largest sharks, averaging 40 feet in length and weighing around 33,000 pounds! These large sharks eat plankton, which are tiny, microscopic organisms in the water. Individual whale sharks can be identified by their unique spot patterns on their sides as shown in the red box to the right.



This is an example of a left side spot patterning. The spots needed to identify an individual are behind the shark's gills and above the pectoral fin. Look at the next page for shark anatomy.

Background Image: © Jonathan Bird

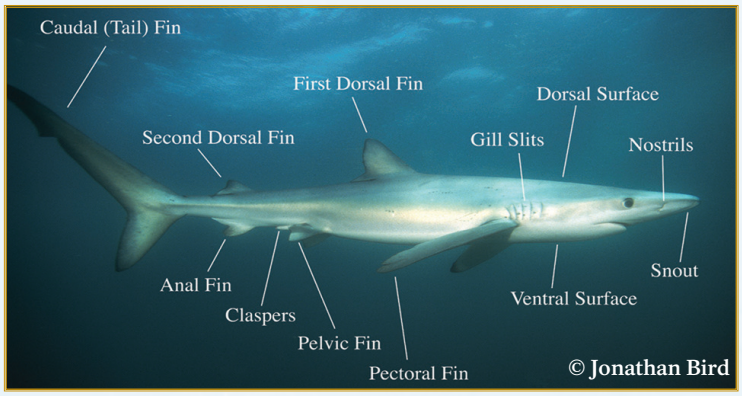
For shark identification, scientists and researchers take pictures of different species of sharks with their unique scars and dorsal fins. Some researchers, like those working in California's Point Reyes National Seashore and Florida's Dry Tortugas National Park, place satellite tags on the shark's first dorsal fin or its dorsal surface to track each of their movements throughout the ocean.

Shark Matching!

Match the shark silhouette and description with the correct shark picture on the right. Use the diagram on the right for shark anatomy.

Shark images brought to you by:

JONATHAN BIRD'S BLUE WORLD



Scalloped Hammerhead Shark: distinctly curved, wide head with eyes located at each end; pointy fins; white ventral surface.

Oceanic Whitetip Shark: rounded fins with white markings on each end; very large pectoral fins for fast swimming; thick snout.

Blue Shark: slim, sleek body with long pointy snout; very blue dorsal surface and white ventral surface; pointed fins; small first dorsal fin; long, pectoral fins.

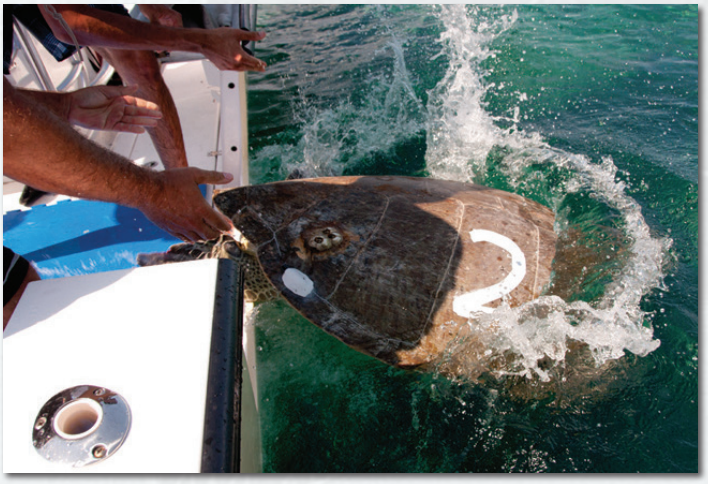
Basking Shark: second largest shark; wide mouth to filter water for plankton through gill rakers; pointed snout; grey/black in color; crescent shaped caudal fin.

Tiger Shark: thick, square head; blunt snout; light spots turn to stripes along its side as the shark ages; average 9-14 feet in length, but can be over 20 feet long.

Order of shark images from top down: Basking, Hammerhead, Tiger, Whitetip, and Blue.

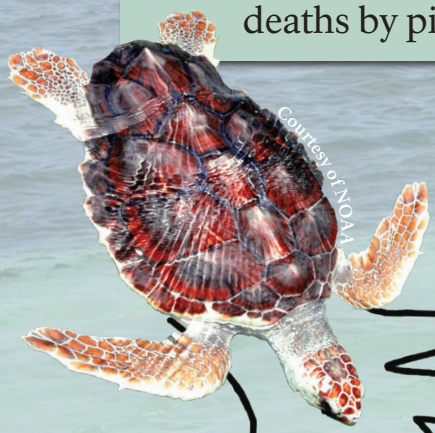
Sea Turtles are air-breathing reptiles that spend most of their lives in the water. They can hold their breath for as long as five hours. Hawksbill turtles only come to shore to lay their eggs. Green turtles come to shore to lay their eggs and also to rest. Their eggs are laid in sandy beach nests like those found in Gulf Islands National Seashore located in Mississippi and Florida, and typically take about seven weeks to hatch. Sea turtles grow very slowly, and won't breed until they are between 15 to 50 years old. It is still unknown how long sea turtles live, but scientists estimate between 80-100 years and maybe more. When they're ready, the female travels back to the beach where she was born, digs a nest with her flippers, and lays up to 150 ping-pong ball sized eggs.

There are seven living species of sea turtles. All six species found in U.S. water are listed as endangered or threatened. The majority of sea turtles eat jellyfish, but they can mistake trash like plastic bags for food and become very sick or die. That is why it is very important to pick up trash and bring reusable bags to the grocery store. You could save a sea turtle's life!



Scientists from Dry Tortugas National Park and Padre Island National Seashore in Texas are pictured here gathering information such as shell size, weight, and gender before placing tracking devices and numbers on each turtle's back. The numbers and satellite tags are used for identification and tracking, similar to the devices scientists use to study sharks.

Help this turtle find her way back to the beaches of Florida's Cape Canaveral National Seashore where she was born. Beware of plastic bags, nets, and trash! Even though it may take many years, trash floating within inland water may eventually end up in the ocean. You can prevent turtle deaths by picking up trash in your neighborhood.



Invasive Species are organisms, like plants and animals, that are not native to a particular environment. These invasive creatures take resources such as habitat and food from the native species that need them to survive. Certain types of mussels, Asian carp, and lionfish are among the most prominent aquatic invasive species in the United States. They can grow fast, reproduce often, and adapt well to new environments. This means invasive species can quickly disrupt an ecosystem if we are not paying attention!

The National Park Service is working hard to inform visitors of problems with invasive species and how each visitor can help keep them from spreading. Invasive species are extremely difficult to get rid of once they arrive, so Park Rangers need your help to keep them out and avoid new invaders from being introduced.

Quagga and Zebra Mussels are invasive species found in freshwater like Arizona's & Nevada's Lake Mead National Recreational Area and Michigan's Sleeping Bear Dunes National Lakeshore. Quagga and zebra mussels originated from parts of Europe and Russia. Both mussels are striped and about the size of an adult person's thumbnail. Mussels are filter feeders, which means they pull water into their shells to eat algae or plankton and then push out the food-free water. They are so good at filtering water that other native filter-feeding animals do not have enough food to eat!

Both quagga and zebra mussels reproduce very quickly. Take a look at the brick experiment in the pictures below and see just how fast mussels grow! If you leave a boat in the water long enough, they will grow on the bottom of the boat as well. National Parks are doing their best to make sure boats and recreational vehicles are properly washed and cleaned when visiting park waters to avoid the spread of these invasive species.

Credit: U.S. Geological Survey

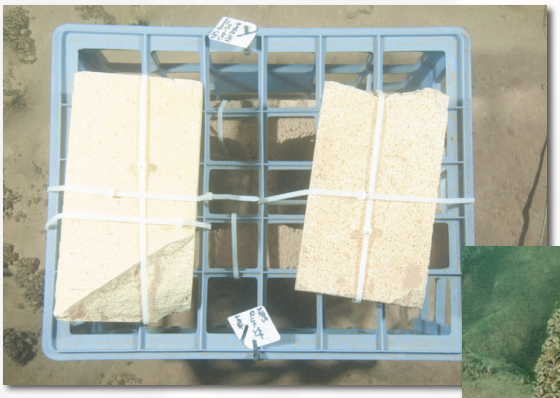
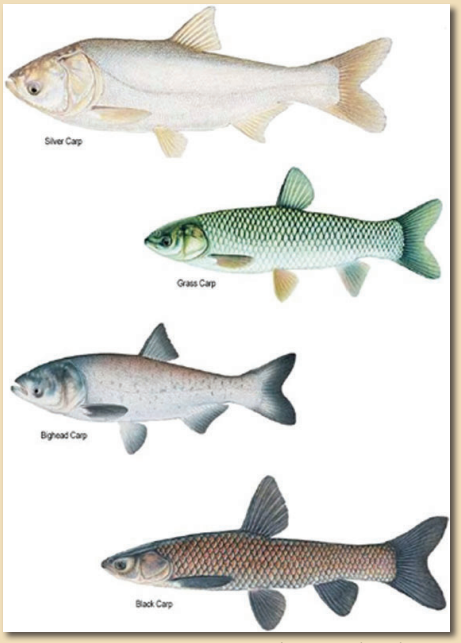


Image taken November 2007.

Image taken December 2009.

Asian Carp is a general name for a few invasive species of freshwater carp. The different types of Asian carp include the silver, bighead, black, and grass carp that are outcompeting native fish in lakes and rivers, mainly throughout the Midwest and Southeast regions of the United States. Asian carp were introduced to America during the 1970s to help fish farmers filter and clean the water their small lakes and ponds, but floods released them into the wild.



Credit: U.S. Geological Survey

Asian carp have now taken over waterways, like the Mississippi River. Parks such as the Mississippi National River and Recreational Area are working hard to keep them from becoming permanently established. First, they love to eat: Asian carp can eat 20-40% of their body weight each day. Second, they reproduce very fast and, in some areas, are 97% of the fish found in the water! Finally, Asian carp are dangerous. These carp can jump up to 10 feet out of the water! Watch out! The National Park Service and other agencies are using many different methods to keep from spreading.

Can you jump like an Asian Carp?

Let's see how high can you jump!

Items needed:

1. Pieces of tape 2. Tape measure 3. Pencil and Paper

1. Mark how tall you are by standing next to a wall and place a piece of tape at the top of your head to show your height before starting.
2. Have your parents or a tall friend stand beside you to mark how high you jumped into the air with another piece of tape.
3. Jump as high as you can!
4. Use the tape measure, starting at the floor, and measure up to both pieces of tape. Write down both numbers on your piece of paper.
5. Take your jumped height minus your standing height for your answer.

How high did you jump? _____

Credit:U.S. Geological Survey

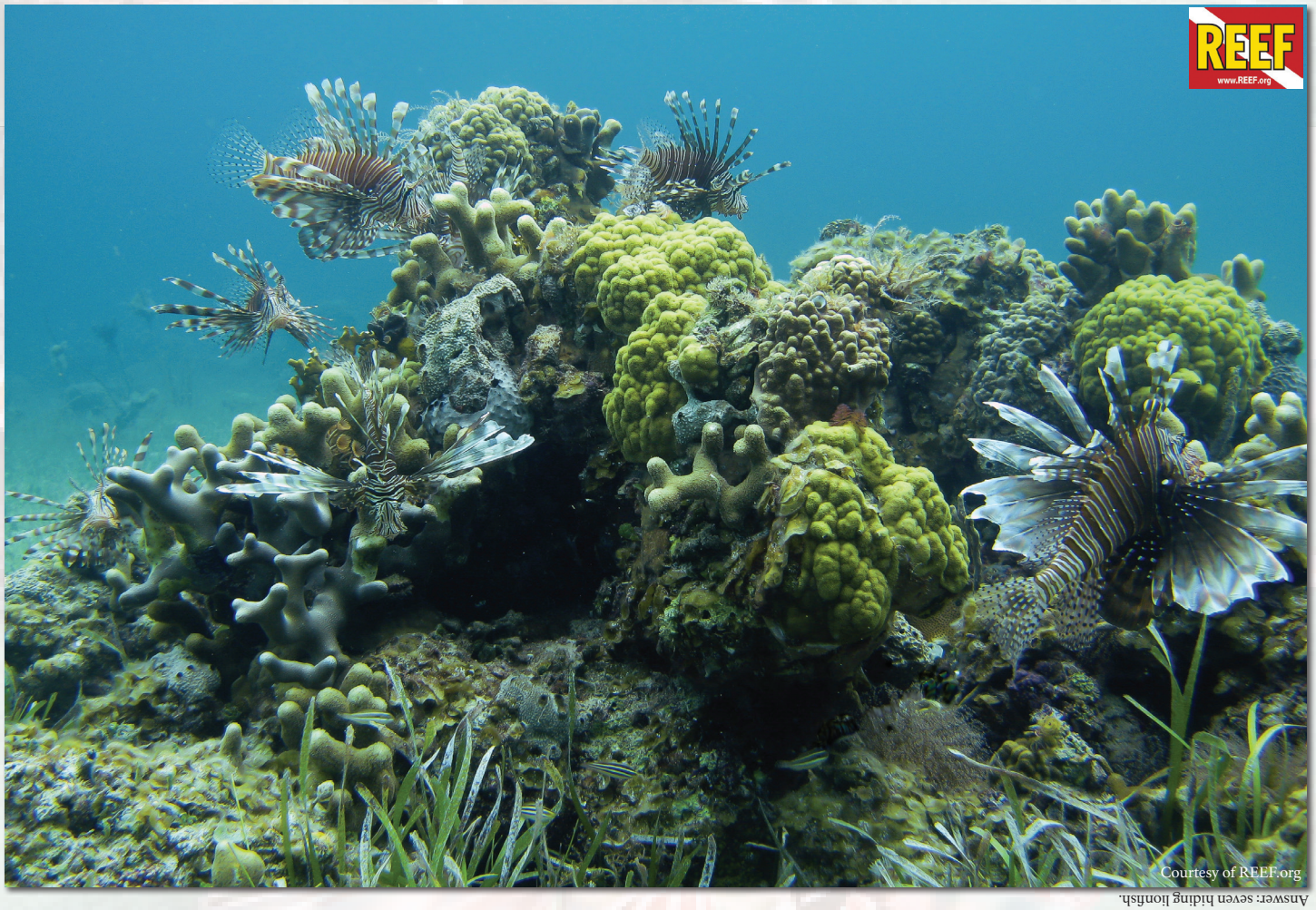
Credit: U.S. Geological Survey

Background Images: Credit: U.S. Geological Survey

Lionfish are venomous creatures native to the South Pacific Ocean, but they have invaded the Atlantic Ocean, Caribbean Sea, and the Gulf of Mexico through the aquarium trade. For protection against predators, lionfish have venomous spines on their back and underside. In some areas, lionfish have been known to eat 90% of the other fish species on the reef and live up to 15 years!

Female lionfish can produce over two million eggs per year. That's a lot of lionfish! Here, lionfish do not have many predators to limit their population. As a result, you can find hundreds of lionfish in a single acre. Lionfish are a problem in National Parks like Biscayne, because they have big appetites and produce many offspring. Park Service divers are actively monitoring and removing lionfish. There is good news; lionfish tastes great! Some restaurants are now serving lionfish. By removing lionfish from the reef, native fish have a chance to survive and reproduce, which keeps our coral reefs healthy.

Can you help find all of the lionfish hiding on the coral reef below? Lionfish like to hide behind coral, and even float with their tails up towards the surface to help them ambush their prey. Circle all of the lionfish you see.

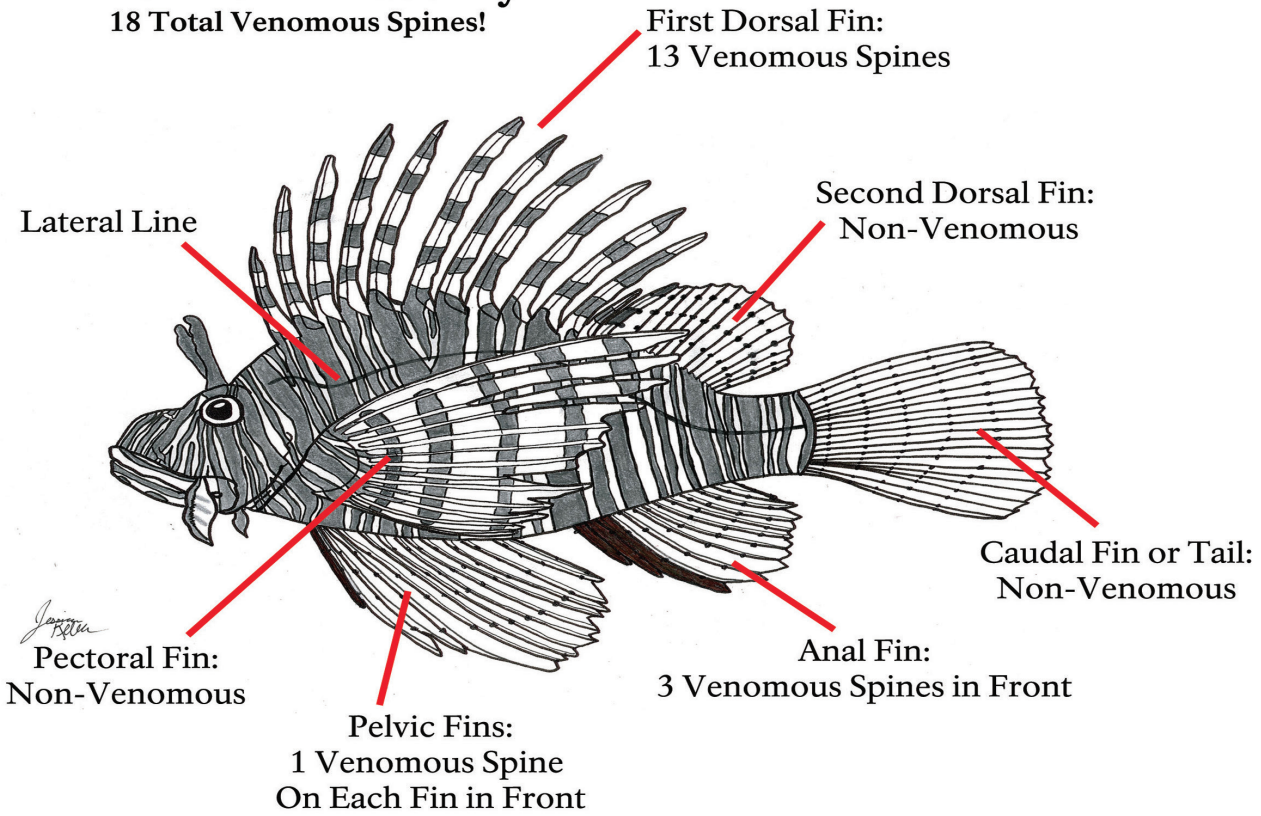


Courtesy of REEF.org

Answer: seven hiding lionfish.

Lionfish Anatomy

18 Total Venomous Spines!



Make Your Own Lionfish

Use the lionfish diagram above for the correct location of fins and spines. Have your parent or an adult help you on this activity.

Items Needed:

1. Potato = fish body 2. Toothpicks = spines 3. Parchment Paper =fins 4. Markers = stripes

1. Ask your parents to help you cook a potato. Make sure the potato is cooled before you begin.
2. With supervision, use a knife to shape the potato into the body of a lionfish.
3. Color the ends of 18 toothpicks used for the venomous spines. This will identify which spines are poisonous. Begin sticking the toothpicks into the potato for the fins and spines. Remember to use the diagram for help!
4. Color parchment paper with lionfish stripes before cutting into strips or fin-sized pieces, then weave the paper through the toothpicks.
5. Eat your potato lionfish! Eating lionfish is a great way to help remove this invasive species from the reefs. Remember to carefully remove the fins and venomous spines before you eat it!

Background Image Courtesy of REEF.org

Climate Change refers to atmospheric imbalances occurring as the average global temperature rises resulting in altered weather patterns and extreme weather events. Carbon dioxide and other greenhouse gases are building in the atmosphere from burning fossil fuels, like gasoline and coal, and from deforestation (cutting down forests). Increased greenhouse gases cause the atmosphere to retain more of the sun's heat resulting in rising temperatures. Humans around the world are responsible for causing these changes. In the past, these changes have occurred naturally, but much slower, giving the environment time to adapt. Big cities, factories, and technology have sped up this process and it is impacting the world, especially our water resources. For example, glaciers are melting causing sea levels to rise, the oceans are getting warmer, and extreme weather is causing droughts, floods, and stronger storms systems.

National Parks across the country are researching and monitoring the changes to our climate so we can understand how it is affecting our parks and predict what may happen in the future. Even though climate change is occurring on a global scale, YOU can make a difference by being aware of the changes and understanding the impact of the decisions you make everyday! The next two pages have great ideas on how you can make a difference.

Climate change is warming ocean temperatures, which can cause coral bleaching. When the water is too warm, coral polyps force their zooxanthellae to leave, resulting in a bleached or discolored appearance. Climate change also impacts coral reefs through ocean acidification, which is increased amounts of carbon dioxide absorbed by the ocean. This can affect a coral's ability to make their strong limestone cup. Monitoring programs are in place at parks, like Virgin Islands National Park, to document and study the health of the reefs.

Courtesy of NOAA

Courtesy of USFWS

Rising water temperatures are also affecting fish that live in freshwater streams and rivers. In places such as North Cascades National Park in Washington State, trout and salmon need cool water to safely lay their eggs. Warmer temperatures are heating the water and it is becoming too hot for fish to breed or live there.

Background Image Courtesy of Megan Cook

How You Can Reduce Climate Change

Draw lines to connect the boxes that list the ways you can help National Parks by reducing climate change around your home. Do your changes form a circle around the Earth?

Ask your parents to help you plant a fruit or vegetable garden. Eating local food saves gasoline during food transportation.

Ask your parents about carrying reusable grocery bags. You can help them remember to take the bags into the store.

Ask your parents to walk into a fast food restaurant instead of using the drive-thru.

Turn off your TVs, computers, and lights when you aren't actively using them.

Plant a tree.

Recycle.

Turn off and unplug your electronic gadgets. Even if electronics are turned off, they still use energy unless they are unplugged from the outlet.

Create a compost pile in your yard for leaves, grass clippings, and plant-based kitchen waste.

Save clean, fresh drinking water by drinking from the tap instead of buying bottled water. This way you save water and reduce plastic waste.

Make Your Own Reusable Bag

Ask your parents to help with this activity.

Items needed:
1. T-shirt 2. Scissors 3. A sewing kit or sewing machine

1. Take an old T-shirt: feel free to decorate with iron-on graphics, paint, or dye.
2. Lay the shirt flat and cut off the sleeves for bag handles.
3. Cut the neck out for the bag opening-make sure the opening is not too big! You can make the opening square, rounded, or V-like.
4. Turn the shirt inside out and hold the bottom together. Have an adult sew the shirt closed to seal the bottom of the bag. Flip with design back to the outside.

Now you have a great reusable bag to take to the grocery and elsewhere!

Water Word Search

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

ACIDIFICATION	CORAL POLYP	LIONFISH	SHIPWRECK
ARCHAEOLOGIST	GLACIER	MANGROVES	WATERSHED
BEACHES	HISTORY	REEFS	WETLANDS
BLEACHING	KELP	RIVERS	ZOOXANTHELLAE
BIOLOGIST	LIMESTONE CUP	SHARKS	

The unused letters in the puzzle spell out a hidden message. Begin using the letters in the top left corner and go across, ending in the bottom right corner. After solving the puzzle, the message will be revealed by writing the letters in order below:

_____

_____!

Hidden message: Please help save and protect our submerged resources by becoming a junior ranger.

Trash! Litter! Marine Debris!

Trash can sometimes be left carelessly on the ground. That trash can end up in flowing through a watershed and eventually, into the ocean. The National Park Service works daily to pick up trash, but we could use your help both inside and outside each park.

Help us keep all of our parks and surrounding environments clean and safe by picking up the trash you see. Visitor Centers at National Parks can provide you with a trash bag if needed. As you pick up trash, write down in the space below the kind and number of trash pieces you find. Be careful not to pick up sharp objects or unidentifiable trash unless an adult is with you.

_____ Food Wrappers/Containers _____ Fishing Line

_____ Beverage Cans/Bottles _____ Plastic Bags

_____ Cigarettes/Packaging _____ Other

Show you care by not littering. Thank you for your help!

You Can Help At Home!

Walk around outside your house and pick up any trash you see. You can use the activity space above to keep track of the trash you collect.

Can you do this each month for 6 months or longer? Try it! You will help the environment with this good habit.

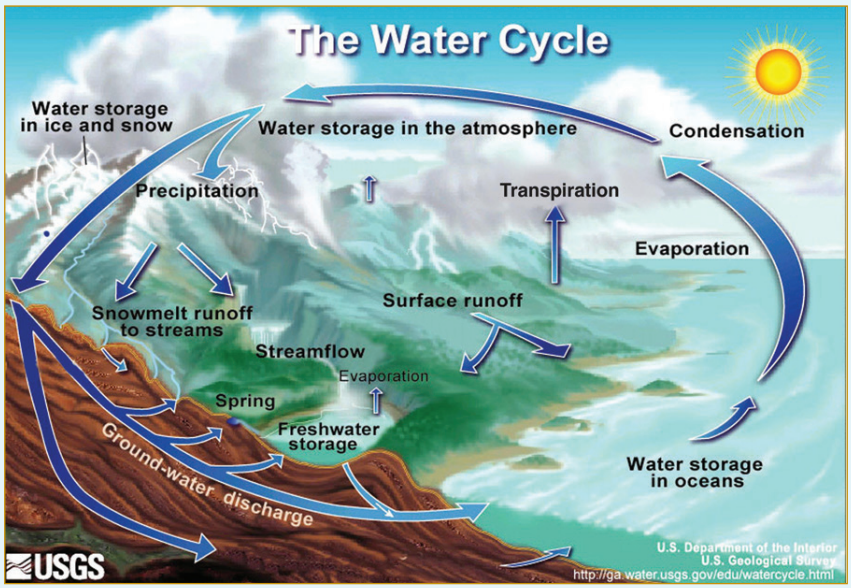
Did You Know?

How long does it take your everyday trash to turn back into soil? Look at the chart below to see the length of time for those things you use most every day.

Paper Towel..... 2-4 weeks
Apple Core.....2 months
Cigarette Butt..... 1-5 years
Plastic Bag.....10-20 years
Aluminum Can..... 80-200 years
Plastic Soda Bottle.....450-500 years
Monofilament Fishing Line.....600 years
Glass Bottle..... 1,000,000 years

Recycling one aluminum can will save enough energy to run your TV for three hours.

The water cycle is vital to our lives. Things we do to the water around us impact other stages of the water cycle. It is important to the National Park Service to understand how all of our environments are part of this water cycle. The water around a park or your home flows into your local watershed and eventually into the ocean. Keeping water around your house clean from trash and pollution will help keep water clean for others!



12 Things You Can Do at Home & School to Save Water

By Jill Heinerth, Underwater Explorer and Documentary Director of *We Are Water*

1. Use a refillable water bottle for drinking. Not only can you take it with you to stay hydrated, but you can put cool stickers on them too.
2. Turn off water while brushing your teeth. This can save around 360 liters or 95 gallons per week.
3. Use your bathroom towel more than once after your shower.
4. Eat less meat. Animals use a lot of water for daily drinking and growing their food.
5. Drink tap water if it is safe in your area. The water from your faucet tastes the same as from the store and it reduces plastic.
6. Recycle or reuse glass, plastic, and aluminum. You can reduce trash or make great crafts at home by reusing these items.
7. Donate your toys and clothes. This will help save the water used to make new ones.
8. Use less paper at home and at school. Remember to write and print on both sides of each piece.
9. Report leaking faucets and toilets to teachers at school. This could save 300 gallons of water!
10. Put up posters to remind other students to turn off faucets in the bathroom.
11. Learn how to read a water meter to see how much water is used each week at your school or home.
12. Ask your teacher to help locate and learn more about your local watershed.

Can you think of two more ways that you could help save water?

1. _____
2. _____

Ask your parents if they can think of two more ways to help save water.

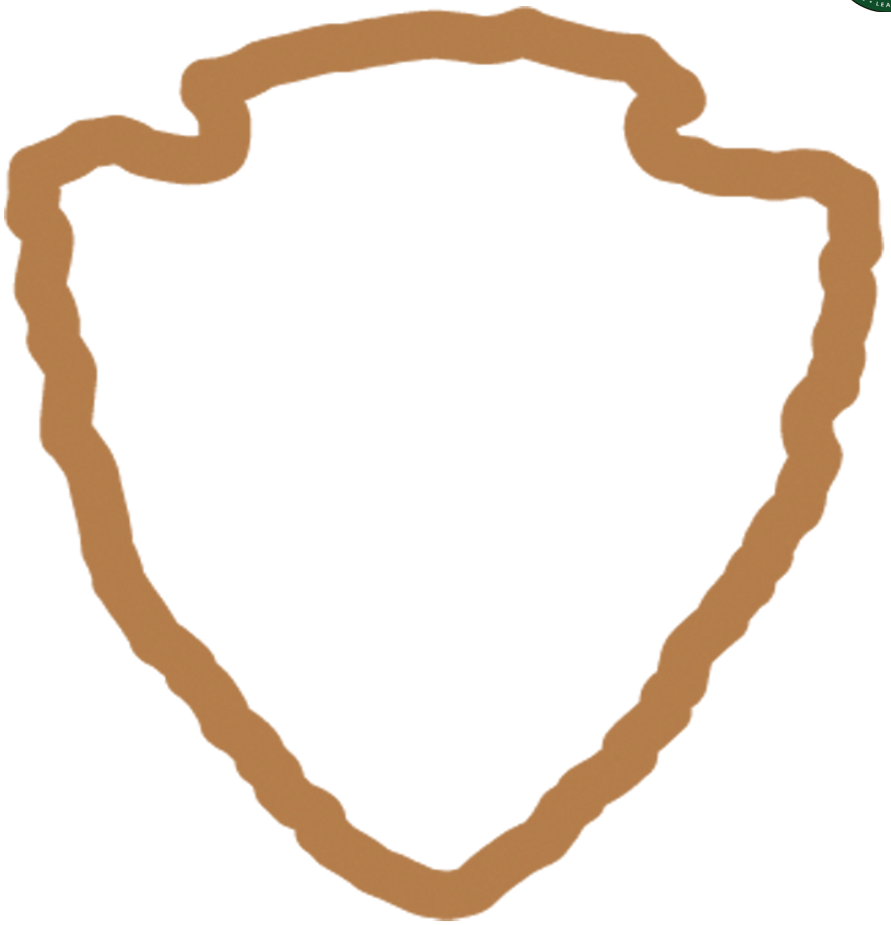
1. _____
2. _____

For more information, check out the documentary *We Are Water* by Jill Heinerth and Robert McClellan.

Protecting Our Saltwater and Freshwater Resources

- To better protect our water resources, we need to know more about them.
- We are all connected to water; water connects the world.
- Our lives depend on both fresh and salt water.
- The health of our oceans and freshwater systems has declined, which means their future is threatened.
- The ocean is vast, yet one person can make a difference.
- Fresh water is limited, so we need to conserve water when we can.
- National Parks protect our water resources for future generations.
- The National Park System has more than 400 park protected units that play a vital role in local watersheds and water cycles.

Here is the National Park Service arrowhead symbol. Each item in the arrowhead represents a feature protected within national park sites. The ***sequoia tree*** represents all plants; the bison represents all animals; the ***mountain*** represents all land forms; the ***lake*** represents all waters; and the ***arrowhead outline*** represents culture and history.



If you were going to design your own patch just for Underwater Explorer, what would it look like? Use the blank arrowhead to design yours.

As Underwater Explorers, we have discovered different environments, animals, and things we all can do to help save water and the environment. Even though our water resources are having a few challenges with invasive species and trash, there are great things happening at the same time like researching animals and investigating shipwrecks. Dedicated Park Rangers and Junior Rangers are helping National Parks everyday by exploring, learning, and protecting all of the resources.

Take a look at your fellow Junior Rangers who are living by the Junior Ranger motto of explore, learn, and protect. What can you do to live by the Junior Ranger Motto?

_____

Courtesy of Dan Johnson

SUBMERGED RESOURCES CENTER

National Park Service
U.S. Department of the Interior

As a Junior Ranger, I _____, promise to:

1. Protect and preserve both natural and cultural resources underwater and on land for my generation and generations to come.

2. Do my best to keep our environment free from litter and trash.

3. Explore my National Parks and teach others what I have learned.

Congratulations! You are now an Underwater Explorer, and have successfully completed the Junior Ranger Underwater Explorer Program.

_____
Junior Ranger Signature

_____
Park Ranger Signature

Special Thanks to:

National Park Service; Submerged Resources Center; Ocean and Coastal Resources Branch; Women Diver's Hall of Fame; Jill Heinerth & Robert McClellan; Jonathan Bird and Jonathan Bird's Blue World; Naomi Blinick; Angel Lopez; Bonnie Toth; ECOCEAN Whale Shark Photo-Identification Library; LaTish Bonar Smith; Becky Kagan Schott & Liquid Productions, LLC; U.S. Geological Survey; NOAA; Lad Akins, Keri Kenning, and REEF.org; Megan Cook; and Stephen Sanchagrin.

To receive a Junior Ranger Underwater Explorer Badge and Park Ranger's signature, please present your signed pledge in the back of the booklet to a participating National Park Visitor Center or mail it to:

National Park Service, Submerged Resources Center: Junior Ranger, 12795 W. Alameda Pkwy, Lakewood, CO 80228.

For more information, please visit our website: www.nps.gov/submerged/

Junior Ranger Underwater Explorer Booklet designed by Jessica A. Keller of the National Park Service's Submerged Resources Center.