

STATE OF MAINE DEPARTMENT OF MARINE RESOURCES

# MAINE STATE AQUARIUM

## FIELD TRIP GUIDE



**194 McKown Point Road  
West Boothbay Harbor, Maine**



## A Message to Educators

The staff of the Maine Department of Marine Resources Education Division looks forward to welcoming you and your students to our public aquarium. We invite your class to learn about the ocean and the richness of life that it supports through our collection of regional fish and invertebrates on display, and we look forward to your participation in one of our educational programs in helping to enrich your experience.

The aquarium building was constructed in 1994 along with the new research facility. The floor plan and exhibits were designed by the staff of the Education Division and the support systems for the aquarium were built by the staff of the Maintenance and Operations Division. The new Marine Resources Aquarium opened to the public on June 10, 1995. In 2006, we changed our name to the Maine State Aquarium to better identify who and what we are. As a state non-profit we do not receive taxpayer money, but are supported through generous donations, grants, admissions, and gift shop sales. We appreciate your contribution to our facility by choosing to visit with us and we look forward to continued operation and education of Maine's citizens and guests to our beautiful region.

The goal of the Education Division is to develop a citizenry that has awareness and an appreciation of the marine environment and its resources. In order to accomplish this goal, school children, educators, and visitors to the aquarium are provided with current information pertaining to Maine's marine resources. The Education Department is also building a teacher resource center in which we help to provide marine related lessons and resources to Maine teachers. If you need help finding lesson plans or want to ask questions about specific resources, consider giving us a call.

This packet is provided in order to help you and your students have a successful visit with you. Included in it you will find:

- General Information about the Aquarium
- Information on some commonly found animals at our facility
- Guide for Teachers and Chaperones
- Pre-visit Activities
- Activities to assist in making your visit educational and focused
- Time-Fillers (Post-visit Activities)
- Additional information on fisheries or other related topics for use in your classroom

We hope that you and your students will gain an understanding of the State of Maine's connection to the sea through your visit to the Maine State Aquarium.

Sincerely yours,

The Aquarium Staff

# Planning Your Field Trip to the Maine State Aquarium

A field trip to the Maine State Aquarium is an exciting addition to your curriculum. This information, and the *Chaperone Sheet* that follows, will assist you in planning your trip.

## Reservations

Reservations for each calendar year start on January 1 of that year. Please make your reservation electronically on our web site at <http://www.maine.gov/dmr/rm/aquarium/fieldtrips.htm> to download the **Reservations Form**. You will find the link to our online reservation calendar to check reservation availability and confirmations. If you are unable to do this you can:

- ☛ Call the Education Division line at 633-9542 to request a paper reservation form or to ask questions.
- ☛ Email us at [aquarium@maine.gov](mailto:aquarium@maine.gov) with any questions or to request a reservations form.

Please do not consider your reservation approved and confirmed until an aquarium staff member has responded to your request and confirmed the dates with you. Due to limited space, reservations are on a first-come, first-serve basis. Please consider having an alternative date in mind in case your desired time slot is filled. We cannot guarantee that all requests will be fulfilled due to the amount of visitors each season.

## Admission

The Maine State Aquarium is a non-profit state facility that does not receive state taxpayer (general fund) money or support. We operate solely on awarded federal grant money through the U.S. Fish & Wildlife Sportfish Restoration Fund, donations, admissions, and gift shop purchases. As a self-supporting facility, these admissions fees are necessary to continue operations and support our mission.

### *School Group Rate*

We will be charging the group admission (for pre-reserved groups) for students (**\$2.50pp**) but **teachers will get in free** at 1 per every 10 students, not to exceed 5 teachers per group. All additional chaperones will be charged the group rate.

**Homeschools** will receive 1 free adult, but must have 5 or more students with them. Otherwise, standard rates will apply for the entire group. **Please note:** Homeschool groups must have a copy of their Letter of Intent to Homeschool, or other documentation that supports homeschool recognition in the State of Maine and by the Department of Education. Without this supporting documentation, any discounted or free admissions will not apply. ***We will not keep copies of this documentation, so please provide them with each planned visit.***

**To receive the group rate, schools must book at least 2 weeks in advance.** This allows us to prepare adequately for your visit and ensure your student's safety.

Schools wishing to participate in addition educational programs (*beyond the basic aquarium tour*) will need to add a fee of \$0.50 per student (3-16) or \$2.50 per paying adult. The Shark or Lobster Presentations are **exempt** from this fee and are considered part of the basic aquarium tour. Schools have a choice of which program they would prefer. If you are looking for a more in-depth program or class for your students, please contact the Natural Science Educator, Aimee Hayden-Roderiques, to see what is currently available and to discuss a time frame that would be suitable for your group.

### *Financial Assistance*

As a way to assist schools in continuing to visit with us, we will be providing a field trip assistance waiver through our "Free to Visit" initiative to a designated number of schools each season. Schools may apply for this admissions waiver application and decisions will be based on the percentage of students eligible for the free federal or reduced lunch program. Homeschools, private care facilities (preschools, daycares, etc.) and recreational programs are not eligible for this waiver. Head Start programs will still be eligible.

Schools interested in this option must plan a visit between school opening in May through late June, and post-Labor Day through closing. It will not apply in July and August. Applications will be available starting in January of each year.

There are also a number of field trip assistance grants available through various outside organizations that are worth looking into.

A few of these are:

- ☛ Maine Environmental Educator Association (<http://www.meeassociation.org/fieldtrip.html>)

➤ Target Field Trip Grants (<http://sites.target.com/site/en/company/page.jsp?contentId=WCMP04-03188>)

➤ MELMAC Grant Services (<http://www.melmacfoundation.org/about/Default.aspx>)

Remember, many local businesses are also willing to help schools with financial needs for field trips.

## Pre-Trip Plans

- Our Field Trip Checklist is provided on the following page to assist you with planning.
- Incorporate this **Field Trip Guide** into your curriculum so that your class focuses on Maine's marine life before and after your visit. The enclosed information and activities will help your students get the most out of their Aquarium experience.
- One adult chaperone is recommended for every ten students. Organize your small groups prior to your arrival. Please have each student wear a nametag.
- The **Chaperone Sheet** that follows this page should be copied for each chaperone. They should carry this sheet with them during your visit. The **Chaperone Sheet** contains Aquarium rules and educational tips to help successfully lead students through the Marine State Aquarium. Please send the **Chaperone Sheet** out in advance of the trip, so chaperones can familiarize themselves with the information.
- Before your Aquarium visit, explain to your chaperones what you would like the students to learn from the field trip. Assure them that they will not need to know the answers to all the students' questions. They are there as guides to encourage students to ask questions.
- You may want to copy the **Aquarium Activities** sheets for your students to work on while they are at the Aquarium.

## Directions to the Aquarium

You can find directions to our facility by going online to: <http://www.maine.gov/dmr/directions/directions.html>

**Take Route 1 to Route 27 South** that leads to Boothbay Harbor. **Continue on Route 27 South** towards Southport. Following the signs for the hospital, **take a left 6/10 of a mile past St. Andrews Hospital. Follow the McKown Point Road to the very end.** You will pass by the Coast Guard Station and Bigelow Laboratory before reaching the Maine State Department of Marine Resources and the Maine State Aquarium. The correct parking is located in the last lot before the water.

## Arrival at the Aquarium

- Limited bus parking is available in front of, or along the road to the Aquarium.
- Gather students and have them wash their hands in the bathrooms.
- Once hands are washed, please have group sit on the benches outside the facility for review of Aquarium Rules with a staff member.
- Please have groups, if necessary, pre-divided and prepared for rotation schedule.

## Aquarium Facilities

- A public rest room is available
- A water fountain is located near the rest rooms.
- The Aquarium does not have food available- please plan accordingly.
- Picnic tables are available on a first-come, first-serve basis. Please plan to pick up your own trash and utilize our dumpster facility or carry it home.
- If planning on eating at our facility please be prepared for inclement weather as there is no inside place for visitors to utilize for this purpose.
- There is no longer a public telephone available at our facility.

# Teacher & Chaperone Sheet

Dear Chaperone,

Your role as a chaperone is crucial while your group visits the Maine State Aquarium. You will have the opportunity to help us make your group's visit a fun, memorable and educationally rewarding experience. Keeping students busy and engaged is the key to a successful visit.

The information on this sheet will help you guide students through the Aquarium. As a chaperone, you will be responsible for ensuring that Aquarium rules are followed. The best way to do this is to keep the students actively learning, and to make sure that they know the rules before the trip, with consistent reminders during your visit. **Remember- it is your responsibility to model good behavior and encourage active participation while at the Aquarium facility.** AQ Staff are not responsible for student behavior, but have the right to ascertain when behavior is not appropriate for our facility and will act accordingly.

## Rules:

1. **RUNNING is NOT allowed** in the building or on the Aquarium porch for safety reasons.
2. **TAPPING or BANGING** on the glass **is NOT allowed**. Animals are disturbed and stressed when this occurs and can lead to resulting health issues and even death.
3. There is **NO CLIMBING** on exhibits. Steps are provided in appropriate locations.
4. **ANIMALS & INFORMATIONAL TAGS** must **remain** at their **exhibit locations**.
5. **MISHANDLING or MOLESTING** animals will not be tolerated. We have specific guidelines on how to hand animals, including with **2 HANDS** while **IN THE WATER**.
6. **SHARKS & SKATES** are **NOT to be pulled on or stopped** from **swimming**. You may touch with **2 FINGERS ONLY**.
7. **ALL TRASH** must be placed in the appropriate **trash, dumpster, or recycling bins**.
8. **CHILDREN MUST REMAIN** with Chaperones at all times.
9. There is a **DESIGNATED SMOKING AREA** for those that need it. Please place butts in the appropriate container and **NOT** on the ground.
10. **NO FEEDING** of aquarium or local animals. **Human food is not animal food** and must remain in your car, bus, or designated storage area.

**The Aquarium Staff have the right to ask anyone not following these rules to leave the aquarium facility.** It is our duty to protect our animals and other guests and will do so with warning, and then with removal. If a situation warrants immediate dismissal due to a safety issue for either a person or an animal, a chaperone will be required to accompany the offending student out of the facility. *If it becomes a group issue, consideration will be given to removing a group from our acceptance list the following year.*

## Your role as a chaperone:

Children will be fascinated by the animals in the Aquarium. They will become most interested in the touch tank and the shark tank spending only a few seconds at the other tanks. The best service that you can provide is to focus their attention on the tanks located in the rock wall and get them to look, think, and ask questions. You do not need to know the answer to all of their questions but say "I don't know - how could we find out?" (Further observation? Other students? Graphic panels? Aquarium Guide? or Research?)



**At any tank you can ask the students to:**

- **Identify** the animals by using the touch screen panels at or near each tank.
- **Observe** the animals in the tanks. Find the ways that they are adapted to feeding, moving, holding on, protecting themselves, and to their environment. Find an animal that is camouflaged.
- **"Adopt"** one animal and watch it for three minutes. How did it behave? How much time would it take scientists to observe an animal and become an expert on every aspect of its behavior?
- **Guesstimate** and then count how many animals are in each tank. This might take a few minutes as many animals may be hiding!



**At the elasmobranch tank, the students can get up close and personal with the sharks and skates *but do not allow them to grab these fish by their tail or fins*. A 2-finger touch is all that is allowed.**

- What are these small sharks called? Why are they called that? How do you know they are sharks?
- Gently touch the sharks skin- what does it feel like? Did it feel like you thought it would?
- If a skate is swimming at the surface, **gently touch it using 2 fingers**. Does it feel like the shark? What are the holes behind its eyes used for?

- A skate's egg case is often called a mermaid's purse; can you find one in the facility? How old do you think the baby inside is? What is it doing?

😊 **At the touch tank, the students may pick up and release the animals gently.** Support them with 2 hands and hold them in the water at the tank. Assist students where necessary.

🐞 Discover **Mollusks:** A mollusk is a soft-bodied animal usually with some kind of shell. Can you find them all? *Ex. Moon Snails, Mussels, Surf Clams, Scallops, and Oysters.*

- **Moon Snail:** What is the gooey, muscular part? Touch its foot until it pulls it completely into its shell.
- **Scallop:** What are all of the blue and black dots on the inside of the scallop? Why does it clap its shells and squirt water? *Be careful not to point the opening at your face, students have gotten saltwater in the eye because of this.*

🐞 Discover **Arthropods:** An arthropod is a jointed-bodied animal with an exoskeleton. Can you find them all? *Ex. Horseshoe crabs, Hermit crabs, Lobsters, Shrimp, and Barnacles.*

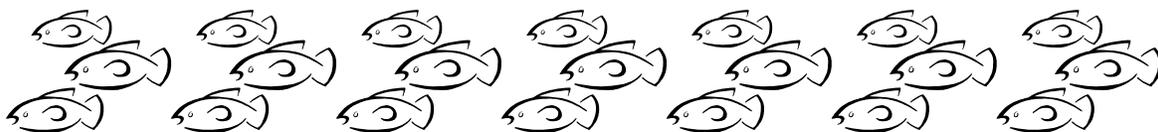
- **Horseshoe Crab:** Watch it carefully- what is the tail used for? How are its claws different then a lobster or a crab? (*When holding, make sure to support both sections of the body*)
- **Lobster** (*Hold carefully, supporting its middle*): What are the antennae used for? Why do you think their claws are banded?
- **Crab:** Identify the green crab, rock crab, hermit crab, and toad crab. (*Be careful, they all have claws!*) Which one is living in a snail's shell? Which one looks like a spider? What is different about the way that they move?
- **Barnacles:** Can you find some of these? Watch them carefully, how do think they get food?

🐞 Discover **Echinoderms:** An echinoderm is a spiny skinned animal, sometimes with hidden or soft spines. *Ex. Seastar, Sea Urchin, Sand Dollar, and Sea Cucumbers.*

- Other than spines, what else do these animals have in common? Compare.
- **Sea Star:** How many suction cup tube feet does it have? What do you think the orange spot is for? Can you find the eyes located at the tip of each arm?
- **Sea Urchin:** What are all the spines used for? Can you find its mouth and teeth?
- **Sea Cucumber:** What does it feel like? Can you find 5 rows of tube feet? How does the cucumber change shape? Why is it squirting water? *Please do not squeeze these animals, they are fragile.*

#### SEVEN ESSENTIAL GUIDELINES FOR CHAPERONES:

1. **Encourage students to explore and make their own discoveries and connections.**
2. **Focus your students with particular themes, concepts, or activities.**
3. **Take time to really look at each exhibit with observational periods and reflection. Children often miss what is happening in the tanks because of overexcitement and rushing.**
4. **Get interested! If you appear interested, students will be too. If you appear bored, so will they.**
5. **Ask questions! Our educators and volunteers are more than happy to assist you and your students with any questions that you might have.**
6. **Give feedback about your visit to our facility. Did you particularly enjoy a program or staff member? Is there something in particular you didn't see that you want to? Using this feedback helps us to improve from year to year.**
7. **Have fun! Our small educational facility can be a great time and a positive learning experience!**



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# **Pre-Trip Activities**

# Pre-Activity: Learning About Fish

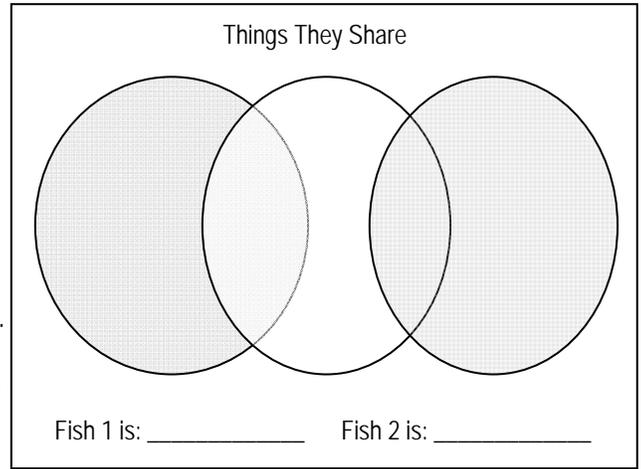
*Student Worksheet Example:*

## Materials Needed:

- ☞ Diagram of unlabeled fish
- ☞ Labeled fish parts on sticky notes
- ☞ A series of different fish pictures
- ☞ Student Observation Worksheet

## Directions:

- Teach students about the different fish parts.
- Using the unlabeled diagram, label the parts as you go.
- Using the completed diagram, discuss the importance of each part. What might it tell us about the fish? What does each part do for the fish? (*Think sailboats...*)
- Using a photo of a fish, discuss shape, color, etc. What shape does it resemble? Where would a fish of that shape live? Would it be a fast swimmer or a slow swimmer? How would you know? What sorts of patterns does it have on it? Why might that be important? Look at the eyes- are the small or large? Why is this important? Does it have teeth? What would it eat? Do this for several types of fish.
- Once students are comfortable looking at a fish, have them choose 2 fish to compare. With younger kids, this is better in pairs.
- Using a similar worksheet, have students compare their fish to find characteristics that both fish share, and characteristics that they don't share. Comparing bony fish (ex. Bass) with a cartilage fish (ex. Shark) would be a good one.
- Once complete, have students share what they found with their class.



## Extension:

After students are comfortable identifying various fish parts and contrasting fish species, have students create their own fish! They have to be responsible for where the fish lives, what it eats, how it defends itself, etc. Have each student present their fish to the class. For older kids, researching a certain fish species and presenting it to the class is positive learning experience as well. See the **AQUATIC INVESTIGATIONS** for related visit activity.

## Alternative (for younger students):

Using a **KWL** chart, discuss with students what they **ALREADY** know about fish. You can supplement the provided information with either a book on fish, or a video. Fill in the **WE KNOW** section of the KWL chart together as a class. Emphasizing words and characteristics that you are particularly interested in, ask the class to think about what they **WANT TO KNOW** about fish. Fill in this section on the chart. The last section will be utilized **AFTER** the class returns from their Aquarium field trip visit. Provide students with the comparison chart and have them compare 2 different fish at the aquarium using information they have learned. You could add in a draw section for the 2 fish species, adding to their observation time, as well as a space to describe habitat. Questions to further consider at the Aquarium:

- How did your fish behave? Did they interact with one another?
- Where did you fish live in the tank? Did it stay in one place or move around?

Once children have returned from the field trip, fill in the **WHAT WE LEARNED** section of the KWL chart. You could add to this by having children present their findings, research more about their chosen species, or write a story about their fish and how they think they live each day.

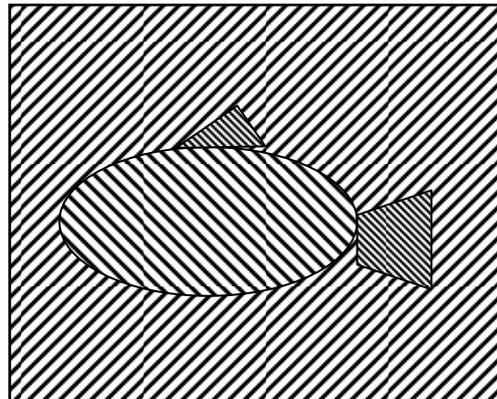
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*Adapted from New England Aquarium's Take a Closer Look Guide*

# Pre-Activity: Sea Creature Camouflage

## Materials:

- ☞ Different colored and patterned pieces of paper
- ☞ Ocean animal shapes and stencils
- ☞ Tape
- ☞ Pencils
- ☞ Crayons (optional)



## Directions:

- Using the shapes and stencils, have students cut out animal shapes.
- Using the paper, have them try and MATCH their animal to something in the room or hallway. You can also use blank paper and have kids COLOR their animal shapes to match the room.
- Using the pencils, make sure student names are on the back of shapes.
- Choose one student (or teacher) to be either a "SCIENTIST" (or a shark, etc.) who will be trying to discover their animal in the ocean. You can also do this with more than one SCIENTIST.
- Have the SCIENTIST hide, and students tape their animal creations around the room and hallway, trying their best to blend the animal into its surroundings.
- Send out the SCIENTIST to find the animals! Set a time limit on this, so that students can rotate location and a chance to be the SCIENTIST. Animals that are "discovered" are set aside and cannot be hidden again, but can be specially named by the SCIENTIST and taped to the front board (or eaten by a shark).
- After set time or rotations, discuss with students about why certain animals were found and others weren't.

## Extension:

Once students have grasped the basics of camouflage, you could supplement this activity by watching a video on more specific types of ocean camouflage. National Geographic has a great video on this called "Life in the Sea: Survival", best viewed by middle school students or older. While watching the video, you could ask students to find particular types of camouflage examples. You could also read a book on the subject, and have kids create their own fish or create a poem describing a fish that uses camouflage. See **AQUATIC INVESTIGATIONS** for related visit activity.

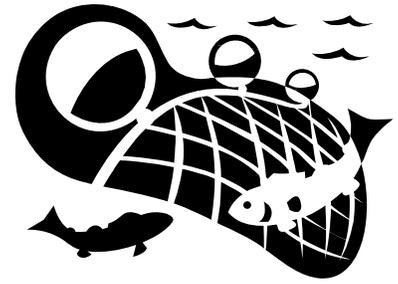
## Alternative:

This game is best played outside! You can take animal cut-outs outside and try to match surroundings, or you can simply use crayons, colored toothpicks, or alternative colored source to use as an animal. A human version is to set boundaries and have students hide! Have one student (or teacher) be the center, and students can hide (safely) where they want to, but must be able to see the center without the center seeing them! The center will count to 20 to allow students to hide and once done, will look around (without moving) to find all the students he/she can. Students that are found must sit to the side for remainder of round. Do this 3 times, allowing students to reposition each time getting closer to you each time. On the final round, give students the 20 seconds to tag the center person! The first person to reach the center without having been seen is the Camouflage Champion! This game is addicting to students, so beware!

# Pre-Activity: A Fisherman's Catch

## Materials:

- ☞ 1 Large Bowl
- ☞ 2 bags of large fish shaped crackers
- ☞ 1 bag of small fish shaped crackers
- ☞ A card for each student depicting a role: *First Generation Fisherman, Second Generation Fisherman, Third Generation Fisherman, and Fourth Generation Fisherman*- divided so that there are a few of each role in the class.



## Directions:

- Lead a class discussion on renewable resources and resource depletion.
- Lead discussion into fisheries as renewable resources. The Gulf of Maine is one of the most productive fishery areas in the world- why and how can we ensure that it stays that way?
- Discuss with students why fishing is important for our region- who is involved? How does it affect communities? How many students know someone who is involved in fishing-commercially or recreationally? Students may not connect community roles like shopkeepers, doctors, teachers, etc. that work in the fishing communities in addition to the fisherman themselves or people who work on the boats and docks. What would happen to all these people if the fishing stopped in a fishing community?
- Discuss with students what fish need to survive- good habitats, food, shelter, space to move, and a clean environment.
- Have students role play by handing out role cards and telling them that they all are involved in a community that has fished for 200 years. Each generation represents 50 years of fishing.
- Pour the contents of 1 large bag of fish shaped crackers into the large bowl. The fish represent an important species in the community. (If you use colored fish they can represent several species).
- Let each group of students go to the bowl and take what they want from it, starting with the First Generation Fisherman and ending with the Fourth Generation Fisherman. By the time you get to the Fourth, there will probably be no fish left.
- Ask the students what are we forgetting? Fish can reproduce.
- Play again with the second bag of large fish, and add one handful of small fish for each generation. Let kids decide how much to take each time.
- What happened this time? Look at the bowl and see what is left? How many big fish are there? How many little fish are there? What happens if it is all little fish or all big fish? How does this effect future generations of fisherman and the fish species?
- Discuss with students how we could change our fishing methods to make sure that there are both big and little fish left after each time that we fish. Could you change the method (use only 2 fingers) or limit amount to be taken? How about choosing a time limit for taking the fish out of the bowl? Would this help? What other ways could you make sure there are fish left for the next generation and for the species to survive?

## Extensions:

For older students, you could have them look up a particular species and the historical catch information. Have them look at a certain time frame (like a decade or two) and graph the trends in the fishery. How does it change? What factors can contribute to these changes? How does your state regulate these fisheries and how to they make sure that fisherman follow the regulations? You could even further the study by looking at other factors like weather information or changes in fishery technology and human impacts on the oceans to determine specific factors on target species. Some good websites to utilize for this are:

- ☛ Maine State Department of Maine Resources- Historical Fisheries Data ([www.maine.gov/dmr/commercialfishing/historicaldata.htm](http://www.maine.gov/dmr/commercialfishing/historicaldata.htm))
- ☛ GOMOOS- Gulf of Maine Ocean Observing Systems ([www.gomoos.org](http://www.gomoos.org))
- ☛ National Buoy Data Center (<http://www.ndbc.noaa.gov/hmd.shtml>)

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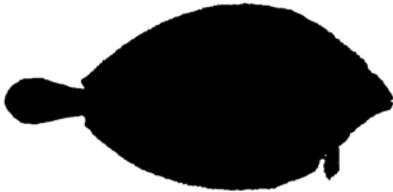
**Aquarium  
Activities**

# AQUARIUM MATCH-UP

Find these animals in the aquarium. Match the animal with the right name by drawing a line to connect them.



flounder



sea urchin



sculpin



crab



dogfish



lobster

**My Favorite Exhibit Sketch**

Name of Aquarium Exhibit \_\_\_\_\_

Animals \_\_\_\_\_



Name of Artist \_\_\_\_\_

Date \_\_\_\_\_

# Aquarium Scavenger Hunt



Can you find the answers to all the clues below? A good way to explore the Maine State Aquarium, this activity may require that you read the information panels on the exhibits and in some instances you may need to ask a staff member or volunteer for help. Bonus questions can be used for older children.

1. I am way too big to fit on your dinner plate, although some people would like to try. With my 2 large claws I can be a big bully, and I use my long antennae to smell around my tank for food.

Who am I? \_\_\_\_\_

*Bonus:* Why is my kind sometimes blue? \_\_\_\_\_

2. I am a fish whose body looks like an eel. With my big teeth I crush open food like sea urchins, but I have a face that sometimes looks scarier than I really am.

What am I? \_\_\_\_\_

*Bonus:* How does my eel-like body help me in my habitat? \_\_\_\_\_

3. I am a fish that can blend into my surroundings and am often hard to find. As I grow my eyes start to move to the same side of my body, and because I'm flat, predators have a hard time finding me.

What am I? \_\_\_\_\_

*Bonus:* Can you find another fish just like me? \_\_\_\_\_

4. I am one of many animals that can grow on an ocean farm, although I am usually attached to rocks or pilings. I sift the water that goes through my body in order to find food, and I am a tasty treat when steamed and eaten.

What am I? \_\_\_\_\_

*Bonus:* Can you name 2 other animals that grow on ocean farms? \_\_\_\_\_

5. I am a fish with a whisker growing under my chin. I was once plentiful in the Gulf of Maine but was over-fished, so now I am being grown in a hatchery to help restore my numbers. There is a statue of me out in front of the buildings.

Who am I? \_\_\_\_\_

*Bonus:* What is my whisker used for? \_\_\_\_\_

6. I am a microscopic plant that lives in ocean water. I am an important food source for the animals in the ocean and I provide up to 80 % of the earth's oxygen. I can sometimes be toxic if I'm swallowed, but I can also glow when I am disturbed!

What am I? \_\_\_\_\_

*Bonus: What are the microscopic animals in the ocean called?*

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7. Some people are a bit hesitant to touch me because movies made me look bad. I am actually quite smart, have a great sense of smell, and although I might have lots of teeth to eat my favorite foods- humans are not one of them.

Who am I? \_\_\_\_\_

*Bonus: Why do I have 2 small holes behind my eyes and others of my kind do not?*

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8. I have at least 50 eyes that surround the perimeter of my shell. I will squirt water at visitors when they least expect it as I try to swim away by clapping my shells together.

What am I? \_\_\_\_\_

*Bonus: Although we look different, name 2 animals I am related to at the aquarium?*

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9. Some people say I look like a sea dragon. I am really just a fish who likes to blend into the seaweed and ocean bottom so that I can surprise the animals I like to eat. I make a funny noise when I'm caught, and I don't seem to taste very good to fisherman.

Who am I? \_\_\_\_\_

*Bonus: What is it called when I can blend into my environment to hide from other animals?*

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10. Find the sculptured bench outside the aquarium that has a number of ocean creatures carved into it. Can you name 5 of the animals that are displayed?

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

11. Name one fact that you learned from the porch flip-board exhibit:
-

# Activity: My Aquarium ABC's and 1,2,3's

## Description:

What's more important than learning your basics? Even younger kids can have a more involved aquarium experience using basic skills. There is plenty of opportunity for counting and for language skills while visiting with us. The chaperone sheets are on the next page.

## Ideas:



**ABC's:** Find animals (or plants!) that begin with each letter of the alphabet. Make a sheet that allows each student (or chaperone for very young children) to fill in what they find next to the appropriate letter. *For harder letters, like Q- have children try to make up an ocean animal or think of animal in the ocean that starts with the letter, but may not be displayed at our facility. Perhaps it could be just an ocean related word, if it gets too hard.* You could even make it more fun and do rhyming games with ocean words (Find an animal that rhymes with *wish!*). For older students, you could modify this to include specific vocabulary words or scientific names. Coming up with a list of specific ocean words to find in the aquarium also works for any age. It also forces children to take their time at each exhibit and read the informational tags.

\*Related activities could include students making an ocean alphabet book; writing a journal entry using all the words (think role play- like a Day in the Life of an Marine Biologist, etc.); or for older students- finding definitions to specific words or figuring out the meaning of Latin based scientific names and using them in a story is another good option.



**1,2,and 3's:** Counting is always a good activity in the aquarium, and there are a variety of ways to do it. You could have students count all the animals in each exhibit; count specific numbers of species in each exhibit; find characteristics (like 4 spots or stripes); count specific body parts; a number fact find; have a number scavenger hunt finding something for each number 1-20! Make a sheet for each student (or chaperone for smaller children) to fill in during their visit. \*Students can take their information back to the classroom and make counting books; make charts or graphs to display their information; compare species numbers; or for older students this can lead to a discussion of population counts done by scientists that can be extended to the woods or fields around the school.



## MY OCEAN ABC's

A: \_\_\_\_\_

N: \_\_\_\_\_

B: \_\_\_\_\_

O: \_\_\_\_\_

C: \_\_\_\_\_

P: \_\_\_\_\_

D: \_\_\_\_\_

Q: \_\_\_\_\_

E: \_\_\_\_\_

R: \_\_\_\_\_

F: \_\_\_\_\_

S: \_\_\_\_\_

G: \_\_\_\_\_

T: \_\_\_\_\_

H: \_\_\_\_\_

U: \_\_\_\_\_

I: \_\_\_\_\_

V: \_\_\_\_\_

J: \_\_\_\_\_

W: \_\_\_\_\_

K: \_\_\_\_\_

X: \_\_\_\_\_

L: \_\_\_\_\_

Y: \_\_\_\_\_

M: \_\_\_\_\_

Z: \_\_\_\_\_

## AQUARIUM COUNTING

At the Aquarium, I found:

ONE \_\_\_\_\_ (1)

TWO \_\_\_\_\_ (2)

THREE \_\_\_\_\_ (3)

FOUR \_\_\_\_\_ (4)

FIVE \_\_\_\_\_ (5)

SIX \_\_\_\_\_ (6)

SEVEN \_\_\_\_\_ (7)

EIGHT \_\_\_\_\_ (8)

NINE \_\_\_\_\_ (9)

TEN \_\_\_\_\_ (10)

# AQUARIUM BINGO

## Materials:

- Copies of Bingo Sheet- one for each student or group
- Stickers
- Clipboard or other sturdy material
- Prize or incentive for BINGO winners
- Pencils (if using extension activity)

## Directions:

- Using the aquarium BINGO sheet, have students search the aquarium exhibits to find animals and seaweeds.
- Using the stickers, have students covers the animals that they find.
- Once students have found animals across, horizontal, or diagonal to complete a row on their sheet, give them a prize. Students could also have incentive to find ALL the animals on the sheet completing a “blackout” sheet.
- Students who have the first “blackout” could win prize or alternative incentive at the aquarium (like first to eat lunch in their group!).

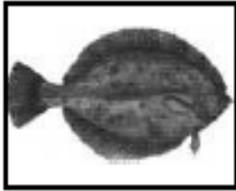
## Extension:

Expand the BINGO sheet to include a “fact sheet”. Students must not only find the selected animals, but must also find a fact pertaining to that animal and record the information. This will ensure that students take time at the exhibits and read the informational cards rather than rushing from tank to tank trying to find the next specimen.

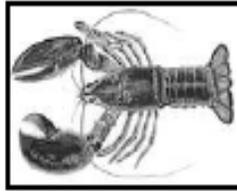


# AQUARIUM BINGO

*Find the animals listed below and connect them horizontally, vertically, diagonally, or with a BLACKOUT!*



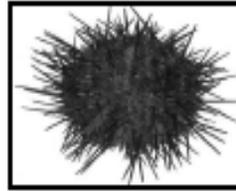
HALIBUT



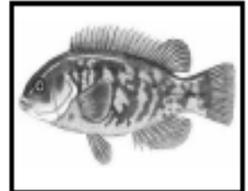
LOBSTER



CATSHARK



SEA URCHIN



TAUTOG



MUSSEL



COD



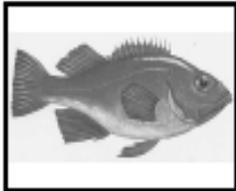
SEAWEED



SEA RAVEN



SEA ANEMONE



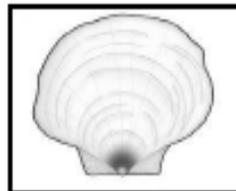
RED FISH



GREEN CRAB



**FREE**



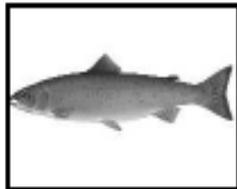
SCALLOP



MUMMICHUG



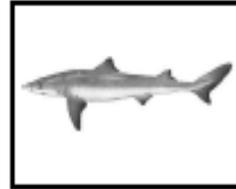
BARNACLE



SALMON



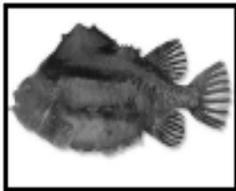
SURF CLAM



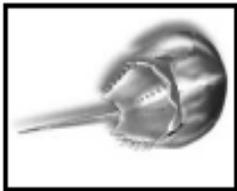
DOGFISH



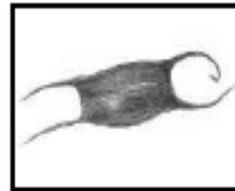
SPIDER CRAB



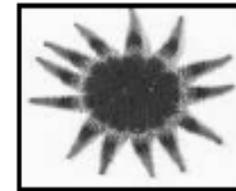
LUMPFISH



HORSESHOE CRAB



SKATE EGG



SUNSTAR



WOLF FISH

*Use the back of the page to write down animal facts that you learn as you find them!*

# AQUATIC INVESTIGATIONS

## Materials:

- Copies of Observation Sheet for each student or group
- Pencils/Pens
- Clipboard or other hard materials to support writing



## Directions:

- Discuss adaptations of animals and behavior prior to visiting the aquarium. Adaptations are any physical characteristics or behaviors that allow an animal to survive in a habitat. *See chart below for examples.*
- Discuss aquatic groups: vertebrates (bony and cartilaginous); mollusks; arthropods; echinoderms; cnidarians; and porifera.
- Discuss ocean habitats and what animals need to survive.
- Using the student Observations Sheet, have students complete information by observing a species from each listed group of animals.
- Students should plan on observing each animal for 1-3 minutes.
- Once sheets are completed, have students discuss their findings. How did they come up with their answers? What information did they use to find their information?
- Using the information found, have students choose a group of animals and design their own animal from that group. Factors to consider are:
  - Where does your animal live? How does it live there?
  - How does your animal protect itself?
  - What does your animal eat?
  - How does your animal move?
  - How does your animal interact with other animals?

## Extensions:

Students could use the information from the observation sheet to make a journal of a particular animal's life. Have them choose one animal that they observed to do this. Older students could choose this particular animal to do a report on- comparing the information that they observed in captivity with known wild behaviors or traits.

| Adaptation:          | Used for:  | Example:          |
|----------------------|--|-------------------|
| Tail Shape: Round    | For slow swimmers who need short speed bursts              | <i>Lumpfish</i>   |
| Tail Shape: Forked   | For fast swimmers or distance swimming                     | <i>Shark</i>      |
| Body Shape: Sleek    | Fast moving  | <i>Pollack</i>    |
| Body Shape: Flat     | Slow. Lives on bottom                                      | <i>Halibut</i>    |
| Body Shape: Ribbon   | Might be slow or fast. Easily hides or moves in holes      | <i>Eel</i>        |
| Color: Bright        | Warning: Might taste bad or be poisonous                   | <i>Sunstar</i>    |
| Color: Shiny         | Reflects sunlight to blend into surface waters             | <i>Anchovy</i>    |
| Color: Patterned     | Breaks up body line to confuse prey/predators              | <i>Orca</i>       |
| Defense: Spines      | Protect slower fish from predators                         | <i>Sculpin</i>    |
| Defense: Camouflage  | Blend into habitat to hide from predators or surprise prey | <i>Green Crab</i> |
| Big Eyes             | To see in low light- hunts at night or lives at depth      | <i>Squid</i>      |
| Teeth                | Predator   | <i>Wolf fish</i>  |
| Mouth: Upwards       | Eats at surface  | <i>Alewife</i>    |
| Mouth: In Front      | Chases food or sucks in food                               | <i>Bass</i>       |
| Mouth: Downward      | Eats on bottom   | <i>Skate</i>      |
| Behavior: Group Swim | Looks like one big animal to confuse predators/protect all | <i>Smelt</i>      |

# AQUATIC INVESTIGATIONS OBSERVATION PAGE

*Observe each animal for 1-3 minutes.*

| Group                             | Choose Animal: | What kind of ocean habitat does this animal live in? | How does it protect itself? | What might it eat? How does it get food? | Does it move? If so, how? Slow or fast? | How does it interact with other animals? |
|-----------------------------------|----------------|--|-----------------------------|--|---|--|
| Choose a BONY fish                |                |  |                             |  |   |  |
| Choose a CARTILAGINOUS fish       |                |  |                             |  |   |  |
| Choose an invertebrate MOLLUSC    |                |  |                             |  |   |  |
| Choose an invertebrate ECHINODERM |                |  |                             |  |   |  |
| Choose an invertebrate ARTHROPOD  |                |  |                             |  |   |  |
| Choose an invertebrate CNIDARIAN  |                |  |                             |  |   |  |

Name of student: \_\_\_\_\_

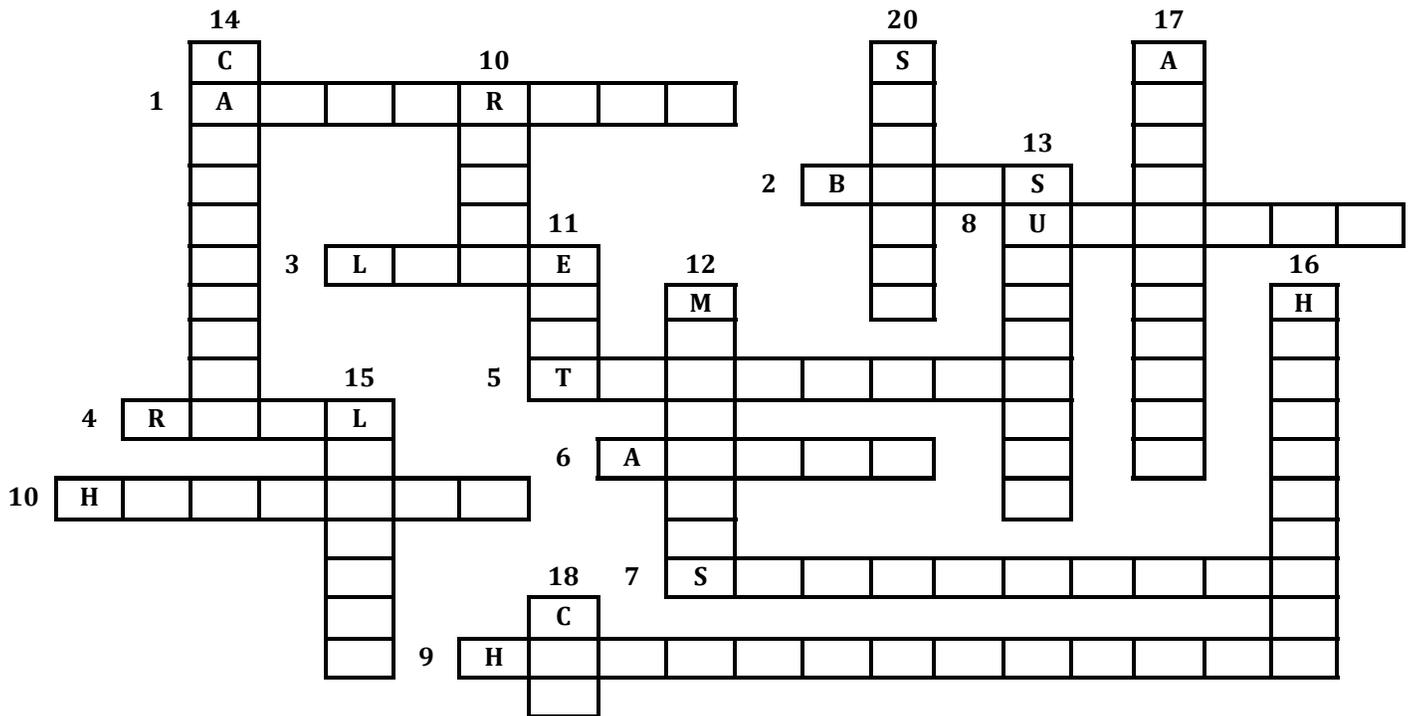
Grade: \_\_\_\_\_

Date: \_\_\_\_\_

# **3.**

# **Post-Visit Activities**

# AQUARIUM CROSSWORD PUZZLE



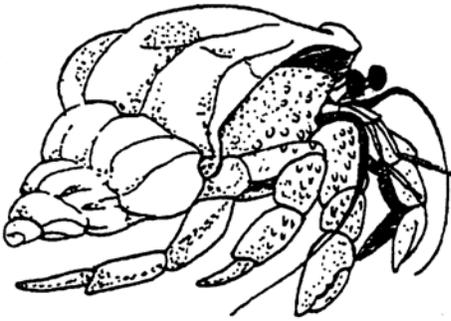
## ACROSS

1. Ocean animals can be visited at the Maine State \_\_\_\_\_.
2. A type of fish called the Striped \_\_\_\_\_ is commonly caught by fisherman.
3. A fake object used to catch fish attention is called a \_\_\_\_\_.
4. A fishing pole has a rod and a \_\_\_\_\_, which holds the line.
5. A water habitat formed when the tides get caught in holes on the rocks or beach is called a \_\_\_\_\_.
6. Another name for seaweed is \_\_\_\_\_.
7. Contrary to its name, a \_\_\_\_\_ is not worth any money.
8. A spiny skinned animal, the Sea \_\_\_\_\_ can protect itself.
9. Surviving millions of years, the \_\_\_\_\_ is related to the spider.
10. A flat fish that has 2 eyes on the same side and buries in the sand is a \_\_\_\_\_.

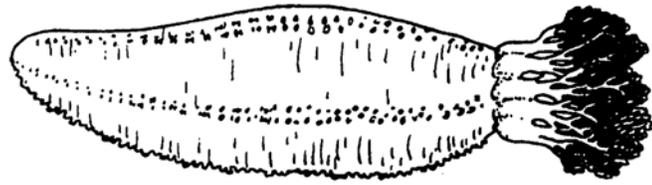
## DOWN

11. Salmon spawn by going up the \_\_\_\_\_ where they were born.
12. Directions: North, South, \_\_\_\_\_, & West.
13. Clams and worms are dug out on the \_\_\_\_\_.
14. The largest clam in Maine is called a \_\_\_\_\_, but is also known as a "hen" clam. (Plural)
15. The word used to describe when animals can blend into their surroundings is \_\_\_\_\_.
16. This 2-clawed crustacean is a favorite of Maine tourists in the summer.
17. A type of intertidal crab that lives in someone else's discarded shell!
18. Ocean farming is called \_\_\_\_\_.
19. Once very abundant in northern waters, this fish was over harvested by early fisherman.
20. A seastar that has lots of arms and resembles an object is called a \_\_\_\_\_.

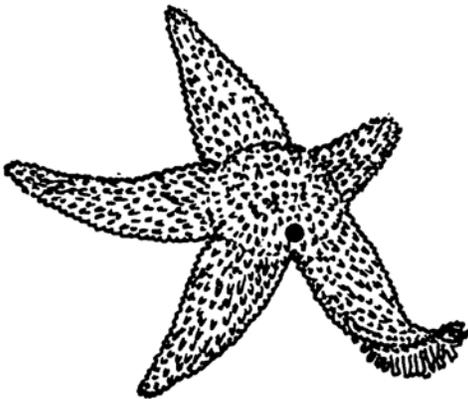
# Coloring Sheet



hermit crab



sea cucumber

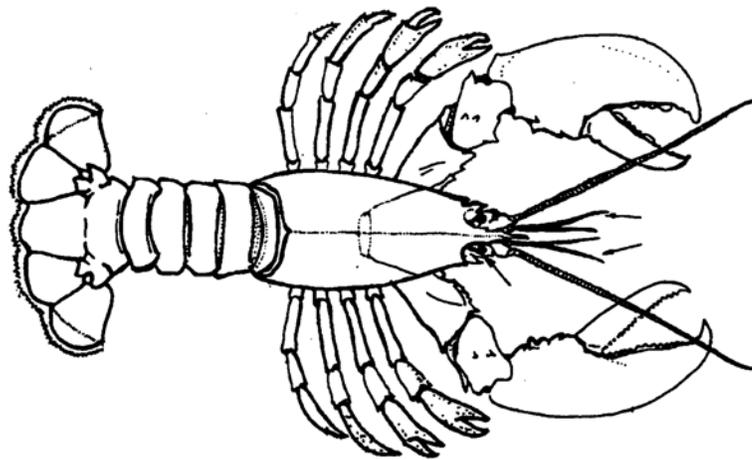


sea star

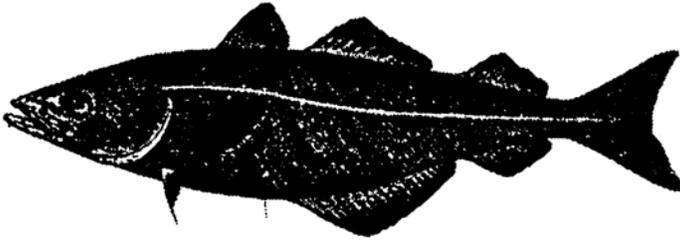


sea anemone

lobster



**Coloring Sheet**



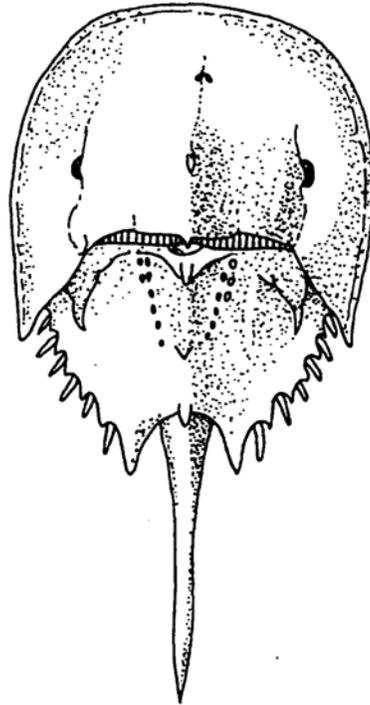
**pollock**



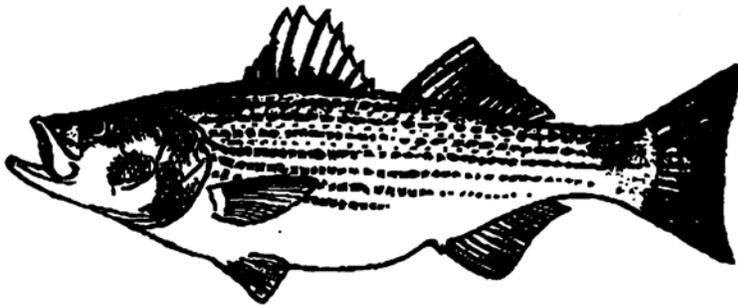
**mussels**



**sea urchin**



**horseshoe crab**



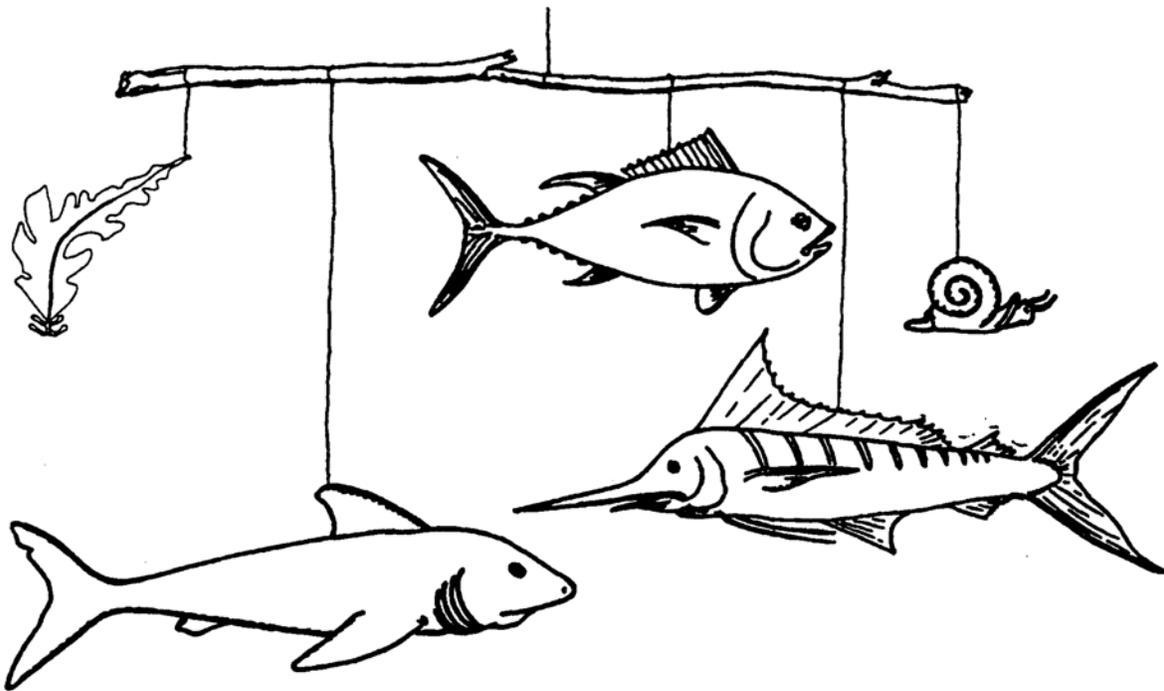
**striped bass**

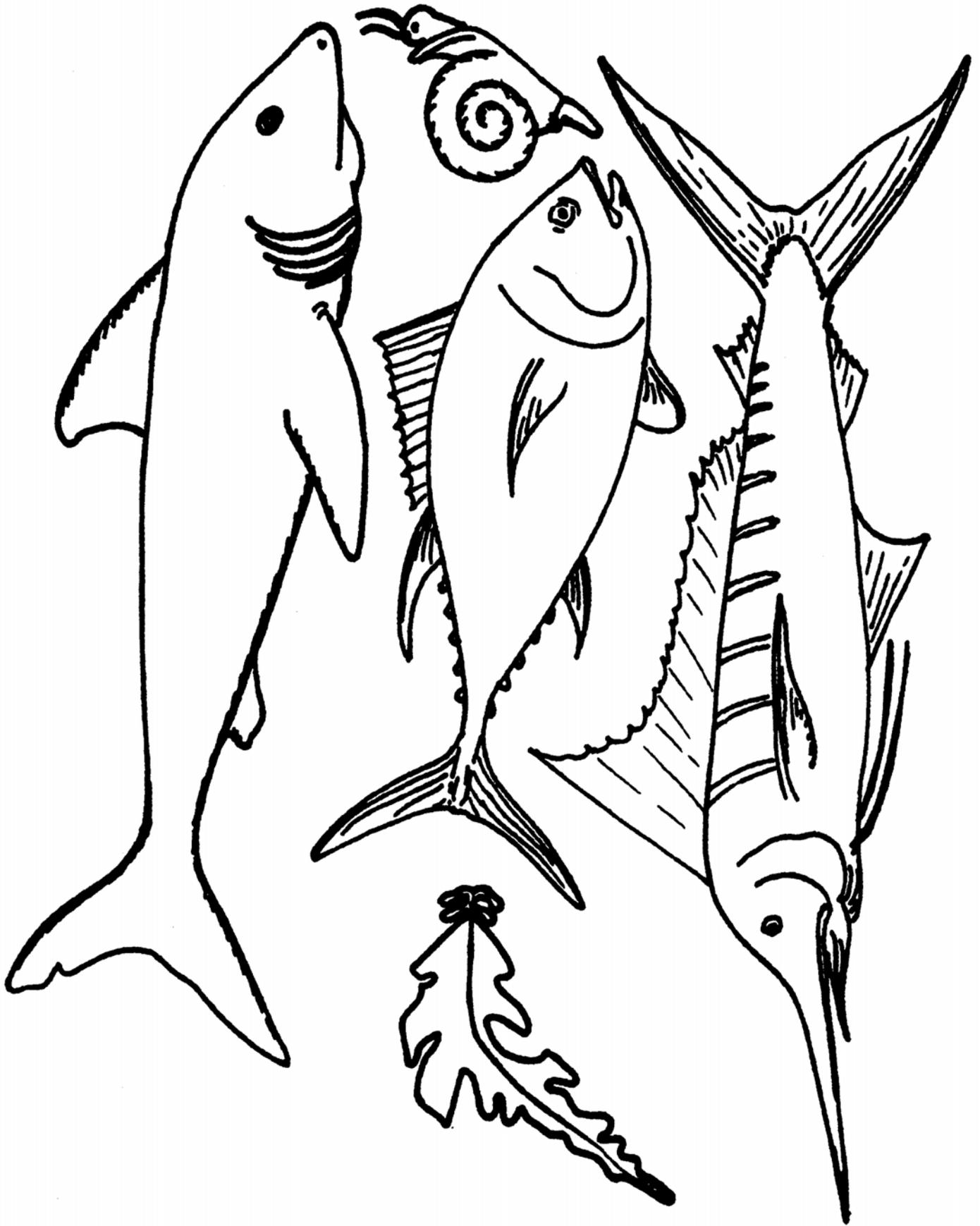
## Mobile

In the environment, everything is connected. If pollution kills the plants, then the little fish die. If the little fish die, then the big fish die. If all the fish and plants die, then what kind of environment will we have to live in? We must respect nature and take care of it. These objects below can be cut out and made into a mobile, to remind you of the balance of nature. Don't forget.... your environment is your responsibility.

### How to Make a Mobile

Get an old stick from the ground, some string, yarn, or fishing line, and your crayons. Paste the pictures to a piece of construction paper, color the objects and then cut them out. Punch a hole in the top of each object and use the yarn to tie the object on the stick. Remember, a mobile must be balanced. So make sure that each object is spaced out properly. Try hanging the plant and animals at different levels. Tie a piece of yarn on the top of the stick so that you can hang it. Hang your mobile up and let it remind you to take care of the environment.

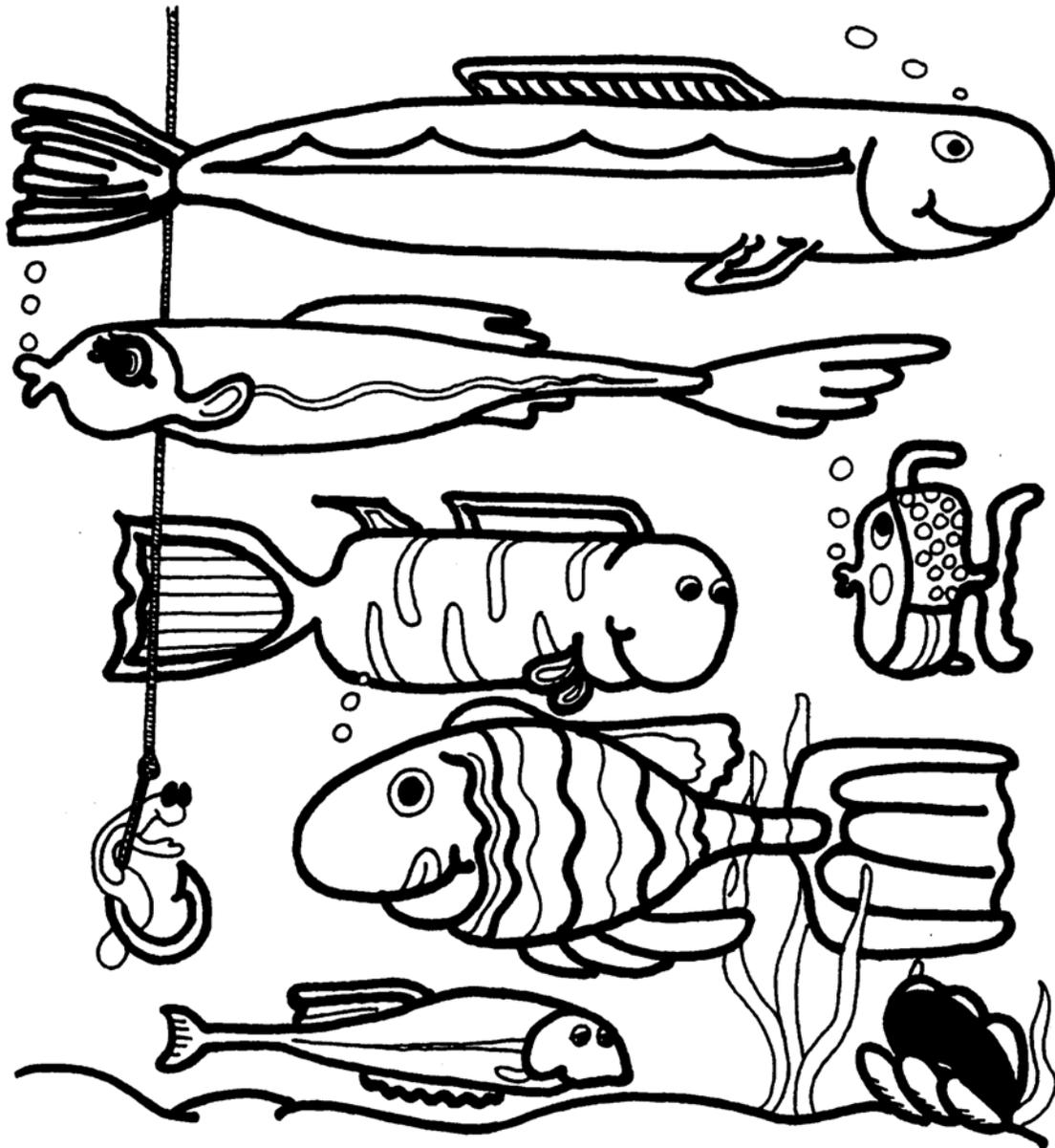




Adapted from the U.S. Fish & Wildlife Service Sportfish Restoration Program's *National Fishing Week Educational Activity Book*. The Maine State Aquarium and its programs are funded, in part, by the Dingle-Johnson Sportfish Restoration Grant administered by the USFWS.

## WHICH FISH ARE “KEEPERS”?

In Maine, fish have to be a certain length to be considered a “keeper.” It is very important to know the rules of fishing! In this activity, the rule is that fish must be 4 inches long. Measure all of the fish. Color the fish that are “keepers.”



Adapted from the U.S. Fish & Wildlife Service Sportfish Restoration Program's *National Fishing Week Educational Activity Book*. The Maine State Aquarium and its programs are funded, in part, by the Dingle-Johnson Sportfish Restoration Grant administered by the USFWS.

# AQUARIUM WORD SEARCH

Find the 20 listed words in the puzzle below.  
They could be vertical, horizontal, or diagonal!

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

**Anemone**  
**Barnacle**  
**Cod**  
**Dogfish**  
**Eels**  
**Flounder**  
**Hermit Crab**  
**Jellyfish**  
**Lumpfish**

**Mussel**  
**Nets**  
**Ocean**  
**Periwinkle**  
**Rockweed**  
**Seastar**  
**Toadfish**  
**Urchin**  
**Wolfish**

**4.**

# **Background Information**

# Something Fishy...

## What's a fish, anyway?

Fish are a group of animals that have a backbone (*vertebrate*) and can live in water their entire lives. Fish are also cold-blooded, which means that their body temperature will vary based on the temperature of the water around them. Fish also have scales to protect their bodies, fins to help them move, and breathe using gills. Fish come in different sizes, shapes, colors, and can live in very different habitats.

Some fish live in fresh water, and some fish live in saltwater. It is not very common for a fish in either habitat to be able to live in the opposite type of water. In order to live in saltwater, fish must have a special kidney that helps them to regulate the balance of salts in their system. Freshwater fish do not need to do this. The few species of fish that can move freely between saltwater and freshwater are called either an *anadromous* fish (fresh water to saltwater) or *catadromous* (saltwater to freshwater), and usually do this during spawning times. They have very special systems in order for their bodies to adapt quickly to the changing habitat.

Fish have been around for an estimated 400 million years, which is longer than most other living creatures on earth! The earliest fish looked a lot different than fish we might see today, and had a very strong armor of overlapping scales to protect their bodies from fierce predators. Although fish do share some common characteristics, each one has its own special adaptations. Learning about fish anatomy can tell you a lot about the life of a fish including where it lives, what it eats, and how it fast it might swim.

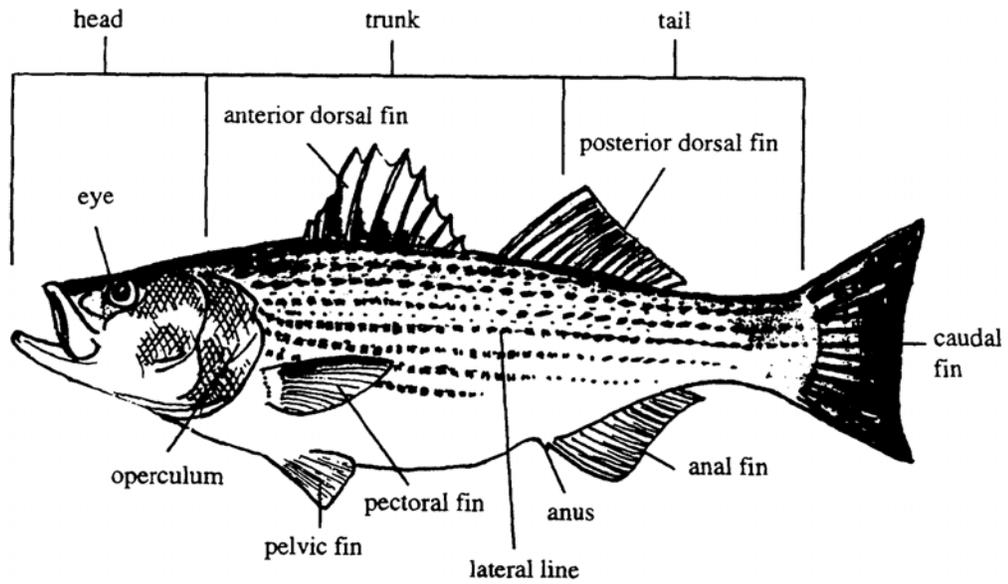
Similar to many other animals in nature, a fish's color is important in telling us a lot about where the fish might live and whether or not it is poisonous! Many fish use a type of camouflage to protect themselves from predators, or a predator might use a type of camouflage to confuse its prey. There are many types of camouflage that might be used by fish including: *mimicking* (resembling its habit or another animal); *countershading* (the body is divided into light and dark sections); *disruptive coloring* (when the pattern breaks up the outline of the animal body); *reflective coloring* (when the body reflects sunlight to confuse animals); and warning coloration like *aposematic coloring* (when an animal's colors indicate poison or warning). Color is also important in recognition of species.

Fish, like most animals, have 2 names to identify them. The easiest, or common name, is the name most recognized by fisherman and hobbyists, but may be different from region to region or country to country. The scientific name of a fish only matches one species and is used in Latin, a common scientific language, so that scientists all over the world will not get confused. The name is divided into 2 parts- the first describes the fish's family and can tell a scientist what other fish it might be related to. The second word describes a particular fish, or in some cases the scientist who discovered it. An example is the Spiny Dogfish, a shark, whose scientific name is *Squalus acanthias*. The word "Squalus" refers to the family of sharks it belongs to and means "sea fish", and the word "acanthias" means "prickly thing". So the Spiny Dogfish is a "prickly sea fish", which is appropriate since this shark carries with it two spines on its back!

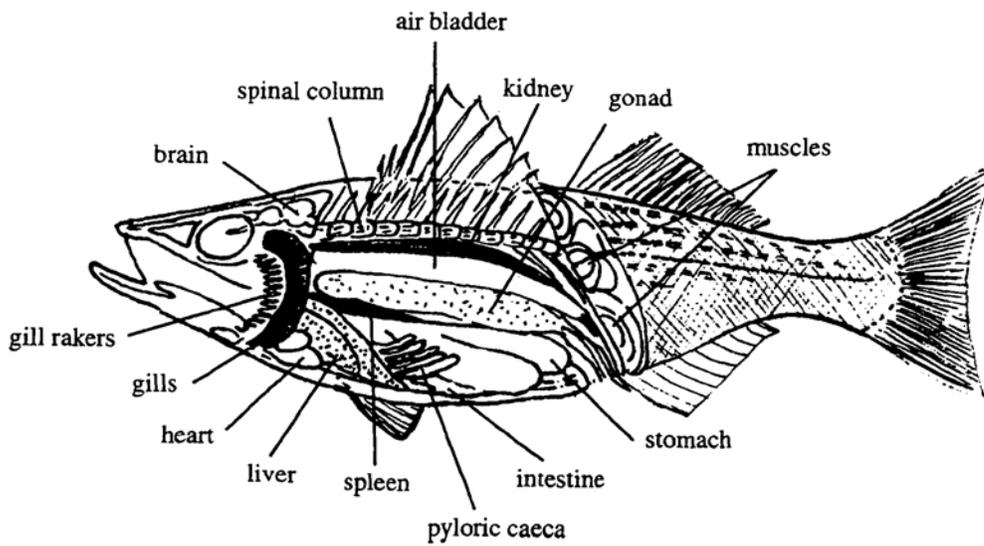
## The de-tails..

- Shape:** A fish's shape allows it to survive in a particular environment and can tell us a lot about how it lives. A ribbon shaped fish would be able to live where there are lots of cracks and holes and move easily in and out of them.
- Fins:** Fins are used to help a fish move in the water. Each fin has a special purpose that might include helping with balance, direction, propelling, or specialized fins to help them feel around in areas they couldn't get into.
- Scales:** Scales are used to protect a fish from predators, but also from diseases, infections, and parasites.
- Color:** Color helps to hide a fish, to warn a fish, or identify other species. Some fish can change their color.
- Backbone:** Fish need a skeleton like we need one- to help us support our muscles and move freely, and to protect our internal organs.
- Gills:** Gills are used for breathing.
- Mouths:** Fish have different shaped mouths in different positions depending on what they eat. A long tube mouth will suck in food- even in holes, and a mouth on the bottom will eat animals that live on the bottom of the ocean. A front facing mouth might be used to chase down swimming animals, and an upward mouth will eat things nearer to the surface or wait for food to come to it.
- Lateral Line:** The line down the side of most fish bodies helps the fish to detect movement in the water using a series of special sensory pores. A shark is even more special because they also have additional pores to detect electricity and magnetism.

## External Anatomy



## Internal Anatomy

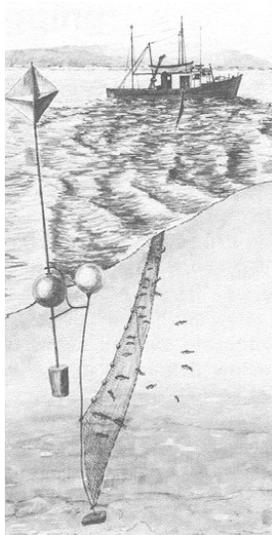


# Types of Commercial Fishing in Maine

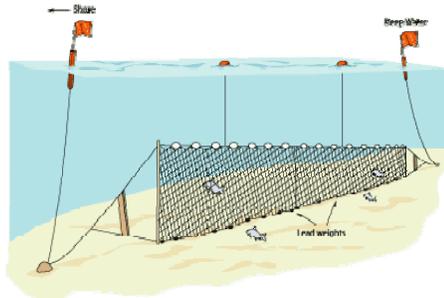
## Gill Netting

Gill-nets are used to catch many types of fish, including, but not limited to, herring, mackerel, cod, flounder, and hake. Fish are caught when their gills become entangled in the webbing as they attempt to swim through it. The size of the mesh may differ depending on the type of fish being sought. Nets can also be placed at different water depths, depending where the fish are located. Gill-netting is probably the most widely used method of catching fish, but it is also very difficult to ensure that a high catch quality is maintained. Also, if the nets are not able to be emptied at least once a day, the fish may die while in the net, which results in the value of the catch being seriously lowered. Driftnet or drift gillnet (fixed gear) is another type of gill net.

A drift net consists of a large net (up to 40 miles/64 kilometers long) that is suspended by floats rather than anchored to the seabed. It drifts freely and ensnares fish non-selectively in upper waters. The United Nations bans the use of driftnets in international waters, and the United States limits the length of driftnets to 1.5 miles/2.4 kilometers in its waters.



<http://collections.ic.gc.ca/peifisheries/scitech/methods.asp>

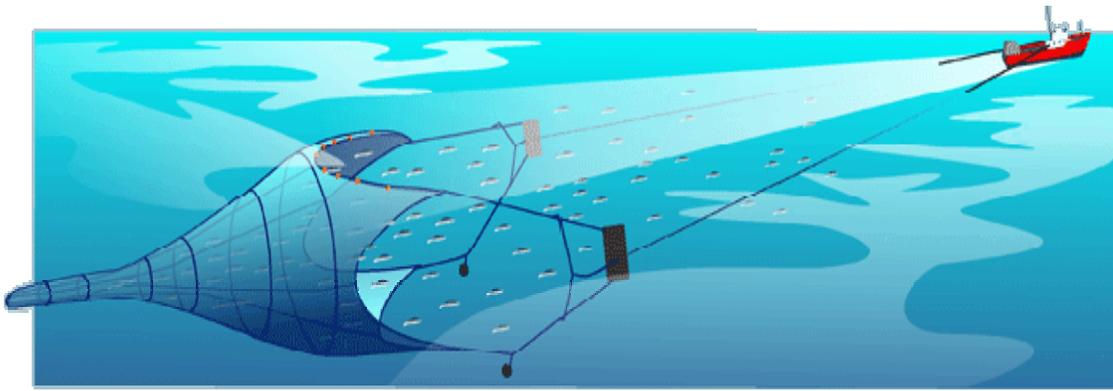


<http://www.miseagrant.org/nets/gillnets.html>

## Mid-Water Trawl

Mid-water trawling is commonly used to catch mackerel, herring, redfish, pollack, capelin, and shrimp. The trawl is similar to the otter trawl, except that it has fewer weights, which means that it can be adjusted for towing at various depths. This adjustment is made by varying the speed of the boat towing the trawl, or by increasing the length of the cable between the boat and the net. Large mesh, typically 1.6m on the east coast of North America, is used at the front end of mid-water trawl nets. This allows for very large net openings compared to wide, but vertically narrow bottom trawls. The large front end of the net "herds" schooling fish toward the back end where they become trapped in the narrow "brailer". Independently swimming fish leave the trawl net at will.

To set the trawl, net is unrolled from a "net reel" until completely in the water. The net is held open along the bottom with 1000 to 5000 pounds of "wing-tip" weights and "foot chain" under the "foot rope" which connects the wing tips. The sides of the deployed net are spread horizontally with two large metal foils, called "doors", positioned in front of the net. As the trawler moves forward, the doors, and therefore the net, are forced outward. Alternatively, two vessels working together as "pair trawlers" can pull a single net between them, enabling the use of a large net due to reduced drag from not using doors to keep the net open. Net depth and position are controlled using both speed of the boat and amount of wire released. A good analogy is flying a kite where wind speed and line released determine height.

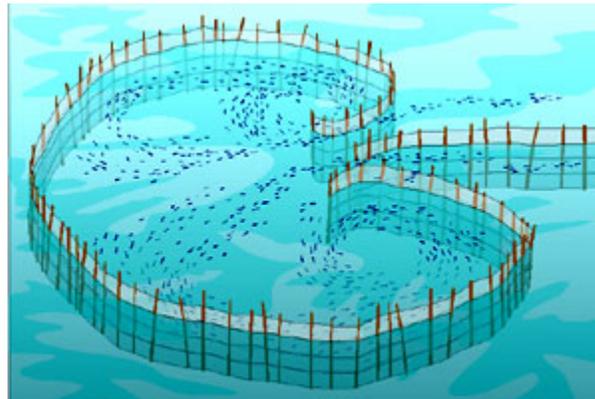


[http://octopus.gma.org/herring/harvest\\_and\\_processing/trawling/default.asp](http://octopus.gma.org/herring/harvest_and_processing/trawling/default.asp)

## **Herring Weir**

Native Americans were the first weir (fixed-gear coastal trap) fishermen along the Gulf of Maine coast. Centuries ago, Native Americans in Maine saw thousands of silver fish swimming along their shores. The fish they saw were coastal Atlantic herring swimming into Maine's many coves and bays during the late summer spawning season.

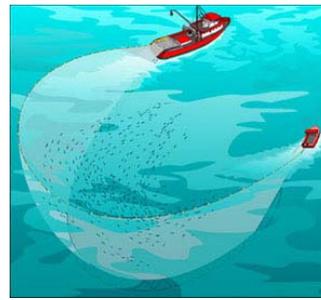
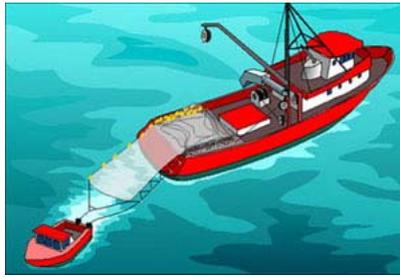
The herring were difficult to catch by traditional hook or spear, so the fishermen devised a method to trap them without ever needing to leave dry (or at least muddy) ground. At low tide, the Native American fishermen constructed traps of sticks plunged into the soft bottom with bushes and branches woven in between. The fish would swim into an opening in the trap as they swam along the shoreline at night. When the tide receded they lay stranded high and dry, easy picking for the fishermen.



[http://octopus.gma.org/herring/harvest\\_and\\_processing/weirs/default.asp](http://octopus.gma.org/herring/harvest_and_processing/weirs/default.asp)

## **Purse Seine**

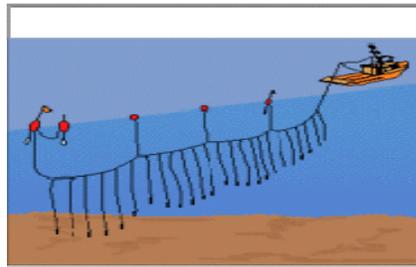
Purse seining is the process of catching schooling fish near the ocean surface by circling them with a net. Once the fish have been encircled, a wire (purse line) running through the bottom of the net is winched tight to "close the purse" from below. Purse seining for herring can be especially tricky as the entire process is run in the dark of night when herring swim to the surface to feed on rising phytoplankton. No lights are used until the seine is closed. The net is put out when a school of fish has been found. Once the fish have drawn close enough, the wire cable is pulled tight, closing the bottom of the seine in an ever smaller space. The net is then brought alongside the boat and the contents placed in boxes on the boat. The entire process starts with the release of the seiner's "bug boat". The bug boat, which holds one end of the net, motors in place while the larger seiner encircles the herring school (generally clockwise by convention in the Gulf of Maine). As the seiner encircles the herring, net is released. The top of the net stays at the surface, buoyed by a "float line". The bottom of the net is connected to the purse line by large, metal clips called "rings". These also act as weights that sink the net to depths of up to 100 meters.



[http://octopus.gma.org/herring/harvest\\_and\\_processing/seining/default.asp](http://octopus.gma.org/herring/harvest_and_processing/seining/default.asp)

## Longlining

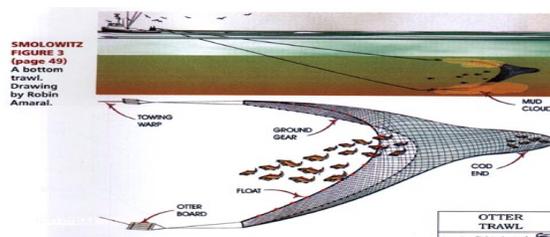
Longlining is a type of fishing gear in which short lines carrying baited hooks are attached to a longer main line at regular intervals. The main lines can be as long as 80 miles and have several thousand hooks. Longlines can target bottom-dwellers or top/mid-ocean dwellers. Originally, the line was pulled in and baited by hand, but there are now mechanized retrieval systems which do most of the work. These devices allow a fisherman to fish more lines and increase his productivity. Longlining is a popular method of catching fish such as cod, hake, haddock, tuna, swordfish, and sharks.



[http://www.wwf.org.nz/earthsaver/earthsaver\\_images/longlining.gif](http://www.wwf.org.nz/earthsaver/earthsaver_images/longlining.gif)

## Otter Trawls

Otter trawls are cone-shaped nets which are towed along the ocean floor. Rectangular "doors" or "otterboards" attached to the towing cables keep the mouth of the net open during the operation. It is towed on the bottom of the sea by a trawler or a pair of trawlers. The fish are trapped in the closed end of the net, which has a mesh size that allows only the smaller fish to escape. The species targeted with the otter trawl method groundfish, including cod, haddock, plaice, flounder, and hake. Trawls are used from shallow, inshore depths of 50 feet to extreme depths of 6,000 feet on the continental slope.

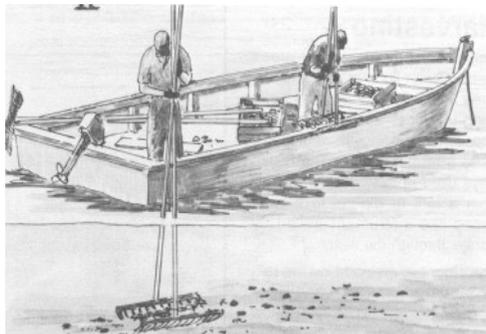


<http://www.fishingnj.org/jpegs/smaltwrlsml.jpg>

## **Oyster Harvesting**

The Damariscotta River estuary used to be prolific with oysters. Indian middens, or shell heaps, along the Damariscotta date back 2,000 years and are as high as 30 feet. Oyster habitat was lost through the 19th century, however, with the accumulation of sawdust on the bottom from neighboring sawmills. There are currently (June 2002) six commercial shellfish hatcheries in Maine that send seed in April and May from their broodstock to nurseries from Maine to Florida. American oysters grow well from Canada to the Honduras, with the taste varying by region. On the Damariscotta, it takes the next seven months for the oysters to grow to about 2 inches in flat, rectangular wire cages suspended on the surface. Wooden trays were once used, but were devastated a few years ago by ship worms. In November and December, the young oysters are sown 10 or 12 to the square foot on the bottom, just the right number for the food available without too much competition. The oysters are sown, essentially, by casting them out from the boat and using the prop wash to spread them. After another 12 to 18 months, they are ready to be hand-harvested by divers. Then they spend 24 hours in a holding car, where their natural filtering process purges their innards of lingering grit. Early experiments with oyster farming were done in the '70s at the UM's Darling Marine Center. These days, there are seven commercial oyster farms and a couple of start-ups on the Damariscotta.

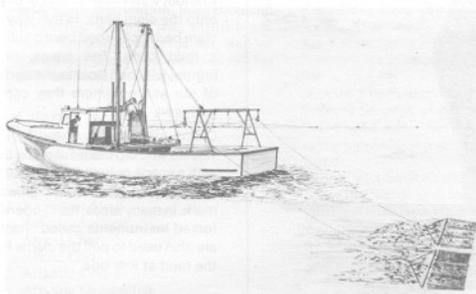
Hand-digging with spades and forks was the most common method for wild oysters. Oysters are taken from natural beds with tongs, which are pairs of rakes at the end of wooden handles 3 meters to 8 meters long joined together like scissors. The tongs are brought together with short lifting movements which scrape the oysters off of the bottom.



<http://collections.ic.gc.ca/peifisheries/scitech/methods.asp>

## **Scallop & Urchin Dragging**

Scallops are usually caught using a device called the "Digby Drag". This is a metal frame with teeth to which a chain-mesh bag is attached. The drag is towed through scallop beds and the catch is raked into the bag. The drag is taken on board, the bag emptied, and the newly acquired scallops are shucked while the drag is being towed again. Shucking involves the removal of the shells or valves and all of the soft body parts or viscera. The only edible part is the adductor muscle, which is sometimes called the eye. Urchins are often caught in the same manner and the "roe", or reproductive organs, is taken out to be shipped off to market. Urchins and scallops are also recreationally dived for.



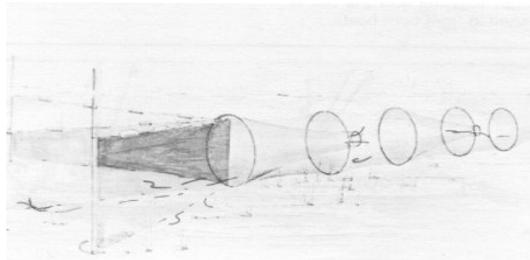
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[www.glf.dfo-mpo.gc.ca/.../rf-pr/photo-scallop-dredge-e.html](http://www.glf.dfo-mpo.gc.ca/.../rf-pr/photo-scallop-dredge-e.html)

## Eel Fishing

The American Eel (*Anguilla rostrata*) has a catadromous life cycle, that is, it spawns in the ocean and migrates to fresh water to grow to adult size. As adult eels mature, they leave the brackish/freshwater growing areas in the fall (August to November), migrate to the Sargasso Sea, and spawn during the late winter. The Sargasso Sea is a large area of the western North Atlantic located east of the Bahamas and south of Bermuda. After spawning, the adult eels die. The eggs hatch after several days and develop into a larval stage (*leptocephalus*) which is shaped like a willow leaf. The larvae drift in the ocean for several months and then enter the Gulf Stream current to be carried north toward the North American continent. As they approach the continental shelf, the larvae transform into miniature transparent eels called "glass eels". As glass eels leave the open ocean to enter estuaries and ascend rivers they are known as elvers. This migration occurs in late winter, early spring, and throughout the summer months. Some elvers may remain in brackish waters while others ascend rivers far inland. Eels may stay in growing areas from 8-25 years before migrating back to sea to spawn. Three distinct fisheries relate to the three different life stages. The glass eel & elver fishery harvests small eels returning to rivers from their ocean spawning areas. These fisheries utilize fine mesh fyke nets (a funnel shaped net) or dip nets to collect elvers as they ascend to fresh water. The elver fishery is relatively recent, having begun in the early 1970's to 1978 and recommenced in the early 1990's. The fishery was nonexistent from 1979 to the early 1990's due to a collapse in market demand for elvers. In the past three years, market demand has increased dramatically. Elvers are highly valued in the Far East (Japan, China, Taiwan, and Korea) where they are cultured and reared to adult size for the food fish market.



<http://collections.ic.gc.ca/peifisheries/scitech/methods.asp>

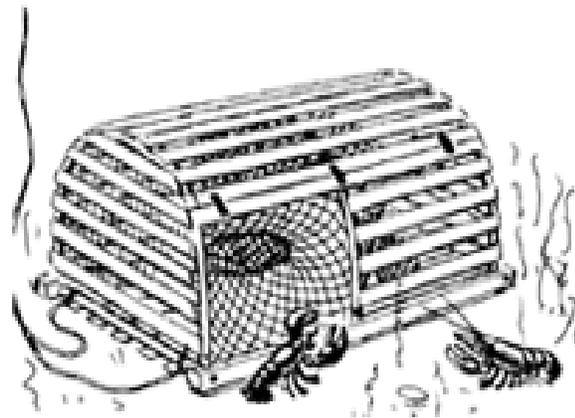
## Lobstering

When one thinks about the State of Maine, lobsters come to mind. Historically, this resource has dominated the ranks as Maine's most valuable commercial fishery. In the year 2007, over 63 million pounds were harvested in the State at a value of over 280 million dollars. Lobsters were once so plentiful that Native Americans used them to fertilize their fields and to bait their hooks for fishing. In colonial times, lobsters were considered "poverty food." They were harvested by hand along the shoreline and served to prisoners and indentured servants, who exchanged their passage to America for seven years of service to their sponsors. In Massachusetts, some of the servants finally rebelled. They had their contracts state that they would not be forced to eat lobster more than three times a week.

The first official Maine lobster landings were reported by James Rosier, a member of Captain George Weymouth's crew. In a sense, the Maine lobster fishery began with Rosier's account, and it is therefore probably the oldest, continuously operated industry on the North American continent. Actual development of the fishery, of course, did not take place until many years later. It is not entirely clear when Maine lobsters were first marketed. The commercial importance of the fishery in supplying out-of-state markets did not come about until after 1840. Massachusetts dealers began looking to Maine lobster grounds for a continuing supply of the species. A demand for fresh lobsters in the large marketing areas of New York and Boston was a strong incentive for fishermen to specialize in these crustaceans. The spreading fame of Maine lobsters and the lack of adequate facilities for distribution of fresh product were the factors that stimulated the beginning of the canning industry in 1840. During the early years of this new industry, lobsters were brought by smacks (sailing vessels with live wells) to the Eastport cannery from the western part of the state. Before long, the success of the new venture led to the construction of 23 factories scattered along the coast as far west as Portland. The canneries were so efficient at processing that they were soon forced to work with smaller lobsters. In 1860, James P. Baxter recalled that four-to five-pound lobsters were considered small and two-pound lobsters were being discarded as not worth the effort to pick the meat for canning. Only 20 years later, the canneries were stuffing meat from half-pound lobsters into the tins for processing, a sign that the fishery had been exploited by 1880. The canning industry made obvious the need for conservation and law enforcement if the fishery was to survive. Following the collapse of the canning industry, the fresh lobster industry took over the commercialization of the fishery. The first lobster pound appeared on Vinalhaven in 1875 and others quickly followed. Originally in deep tidal creeks, today they are more common on docks floating in the harbor. Using the pound, dealers can wait for the price of lobster to increase or allow a newly-molted lobster time to harden its shell. These live-storage facilities became the backbone of the modern lobster industry.

By the 1930s, the traveling smackmen were being replaced by local, land-based buyers who served as the link between the harvesters and the public. The buyer purchased lobsters from a harvester who in turn bought fuel, bait, and other gear from the buyer. The local buyer then either sold the lobsters to people who came down to the docks or turned them over to a regional dealer who sent the lobsters out of state. Tidal pounds and other holding devices have made possible the development and maintenance of more stable marketing conditions. Records of annual harvest and the value of the catch to the State's fishermen have been kept with varying degrees of regularity since 1880. More accurate and detailed records have been compiled annually since 1939. Throughout the 1990's through now, there have been significant record high landings. Whether this is due to increased catch effort, or a stronger lobster population due to increasing regulations and restrictions, scientists are now working hard to find out.

Lobsters are generally caught in a lobster trap or "pot", now generally made of plastic coated wire, as opposed to the original wooden models. Each pot can contain one or more "kitchens" and "parlors"- a kitchen to hold the bait and the parlor to hold the trapped lobsters. Each trap is linked to a color coded buoy identifying the lobsterman who owns them, and the traps have matching codes to ensure that a pot does not get mistaken for another fisherman's. Every few days, depending on weather and season, the lobsterman haul their traps on board the boats to collect their catch. The catch is measured to identify legally sized or "berried" (egg-bearing) females and non-legals are thrown back into the water. It is estimated that only 1 lobster for each trap is of legal size per haul. This can vary depending on a variety of factors. "Keepers", or legal lobsters, are banded and put into live wells or crates. Once the traps for the day are cleared, the lobsters are taken back to the docks and sold through a cooperative fisherman effort at the docks, or to dealers who will sell and distribute them to outside buyers. (Adapted from *The Maine Lobster Book*, Maine Department of Marine Resources).



## THE HISTORY OF FISHING IN MAINE

**Early 1600s:** Fishermen from Europe come to the Maine coast each year, establishing seasonal fishing camps on the islands to clean, salt, and dry their catches.

**1614:** Capt. John Smith sails to Monhegan and explores the Maine coast. According to history books he says that the fish "can afford as good gold as the mines of Guiana with less hazard and more certainty and felicity."

**1622:** Fishermen from Damariscove Island give fish to the colonists in Plymouth, Massachusetts, who are in need of food just to survive.

**1600s to mid-1800s:** Fishermen fish close to shore aboard schooners by dropping lines over the side and pulling them by hand.

**1700s:** Lobster is used as bait, for fertilizer, and scorned as a poor man's food.

**1760s:** More than 60 vessels with 230 fishermen aboard them are fishing for cod and catching 3 million pounds a year.

**Early 1800s:** Fishermen develop the river fisheries, catching salmon, smelt, alewives, shad and sturgeon in bag nets and weirs set up in rivers.

**Early 1800s:** Herring (sardines) emerge as a fishery in eastern Maine, where the fish are smoked and pickled.

**1816:** Abraham Lurvey of Mount Desert Island invents the mackerel jig, beginning the commercial mackerel fishery.

**1820s:** Lobsters are caught commercially for the first time for coastal markets.

**1830s:** Fishermen fish for whales near shore. The small industry ends in the 1840s.

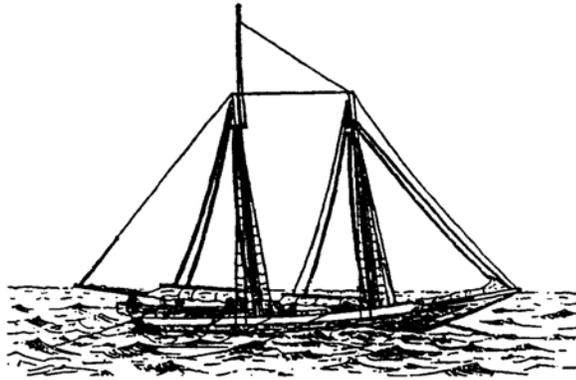
**1840s:** Canning factories are built to can lobsters, revolutionizing the lobster industry by allowing dealers to ship lobsters to inland markets.

**Mid-1800s:** The purse seine is developed and revolutionizes the mackerel fishery. Fishermen can catch tons of fish at a time by circling them and catching them with a drawstring-like net.

**1858:** The first trawl line is developed. Rather than dropping single lines over the sides of boats, fishermen fish with lines with many hooks that are anchored and pulled every few days. Trawl lines don't replace handlines completely until the 1890s.

**1860s:** The pogy industry starts after the Civil War. Factories are built to turn the fish into oil and fertilizer.

**1860s:** Clams are sold commercially for the first time. Previously, they were harvested only for bait.



**1870-71:** The herring industry booms during the Franco-Prussian War. The war cuts off the supply of "Russian sardines" for the Germans, and the American herring becomes a substitute.

**1889:** Lobstermen catch 24 million pounds of lobster, a record that stands until 1990.

**1900:** Seventy-five sardine canneries are operating on the coast of Maine.

**1910:** Scallop landings from the Gulf of Maine reach more than 1.8 million pounds, a record that stands today.

**1920s:** Engines replace sails on fishing boats, making fishing more efficient.

**1949:** Forty-seven sardine plants are operating in Maine. The number has declined every year since then.

**1950:** Maine fishermen harvest 356 million pounds of fish, a record that stands today.

**1960s:** Foreign fishing boats from Canada, Russia, Poland, East Germany and other countries pound the fishing grounds of Georges Bank and the Gulf of Maine, coming as close as 12 miles to shore.

**1976:** Congress passes the Magnuson Act, a national fish management plan that establishes the 200-mile American fishing zone and kicks out foreign fishing vessels.

**1984:** The World Court in the Hague establishes a fishing boundary, known as the Hague Line, that divides the Gulf of Maine and Georges Bank fishing grounds between Canada and the United States. The decision takes prime fishing areas away from New England fishermen.

**1994:** Fish stocks hit all-time lows and several stocks are deemed scientifically "collapsed." Scientists recommend closing Georges Bank to commercial fishing. Strict new groundfishing laws go into effect that will cut by half the number of days fishermen can catch groundfish.

Information cited from "Empty Nets, Sinking Hopes," Portland Press Herald, September 18, 1994.

## Tidepools

### What is a tidepool?

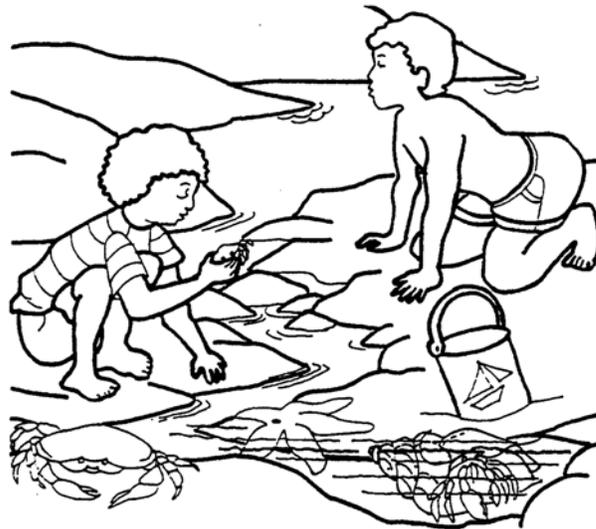
Along the rocky shores of Maine, the tide rises and falls twice each day creating a strip of land called the intertidal zone. This zone is covered by water during high tide and exposed to the air when the tide is low. As the tide recedes, pools of water called tidepools are left behind in the cracks and crevices of the rocky shore.



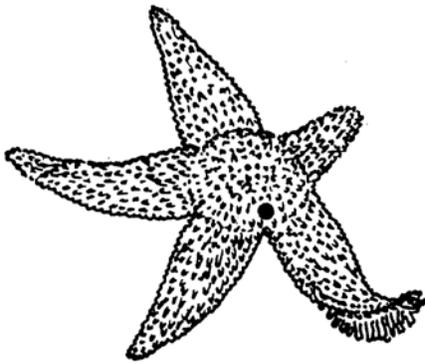
### What lives in a tidepool?

Most of the animals in a tidepool are animals without backbones called invertebrates. These animals include sea stars, sea urchins, crabs, sea anemones, periwinkles, barnacles, and mussels. Tidepools are also filled with a variety of seaweeds such as sea lettuce, rockweed, knotted wrack, and Irish moss. The plants and animals that live in the tidepools are well adapted to the harsh conditions of this environment. They must be able to withstand the drying effects of low tide, crashing waves, and rapid changes in temperature and salinity.

Animals and plants live in different areas of the rocky shore according to their needs. Animals that must be wet, like sea anemones and sea urchins live below the low tide mark. Others, like periwinkles, mussels, and barnacles, hold water in their shells and can live in areas uncovered at low tide. Crabs and sea stars move to follow the tide or hide among seaweeds and under rocks to stay wet.



## Tidepool Animals



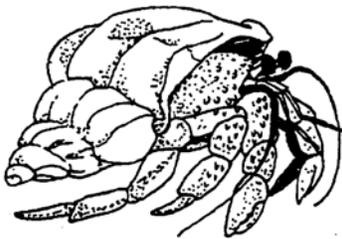
### Sea Star

Though a sea star is sometimes called a starfish, it is not a fish at all. It belongs to a special group of ocean animals called "echinoderms," or animals with spiny skin. A sea star has five eyespots, one at the end of each arm, to detect light. Along the underside of a sea star are hundreds of flexible feet, called tube feet. Each of these tube feet has a suction cup on the end for crawling and holding on. These tube feet are also used to pull apart the shells of mussels and clams, which a sea star likes to eat. When feeding, it sticks its stomach out of its mouth which is centrally located on the underside.



### Sea Urchin

A sea urchin has a hard, round skeleton covered with spines for protection. Slender feet, called tube feet, are found between the spines. Each tube foot has a suction disk on the end for crawling and holding on. Its mouth is centrally located on its underside. A sea urchin uses its five teeth to chew on seaweeds and scrape algae off the rocks for food.



### Hermit Crab

While most crabs grow their own shell for protection, the hermit crab borrows one. This crab lives inside an empty snail shell. When threatened, it pulls its body completely inside the shell for protection of its soft tail or abdomen. As the hermit crab outgrows its borrowed home, it searches for a larger shell to move into.



### Barnacles

Barnacles are found high on the rocks at the edge of tide pools. They have hard, rock-like shells that protect them from enemies. When the tide is low, barnacles close their shell-like casing to protect themselves from drying out. At high tide, they open their shells to feed on plankton. They use their 6 pairs of feathery legs to capture the tiny plants and animals.

## Tidepool Animals



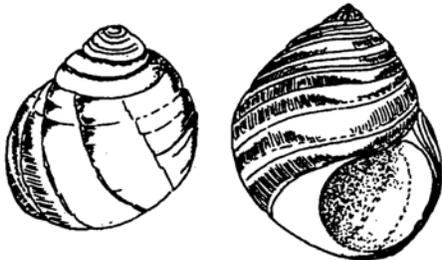
### Green Crab

The green crab has four pairs of legs for walking sideways, a pair of claws for feeding and self-defense, and a hard shell for protection. As the crab grows, its shell becomes too small and it must molt or shed its shell. After molting, the crab hides for a few days until its new shell has hardened. The green crab is a scavenger. It will eat dead animals, live worms, and even other crabs.



### Mussels

Mussels belong to a group called mollusks. Their soft bodies are protected by two hard shells. At high tide, mussels slightly open their shells to feed. They filter tiny plants and animals from the water. At low tide, their blue-black shells close tightly to prevent them from drying out. In Maine, there are several fish farms that raise mussels in a process called aquaculture.



### Periwinkles

Three types of periwinkles live in the intertidal zone; common, smooth, and rough. They all have a large, muscular foot that attaches firmly to rocks and seaweeds. Periwinkles have a tongue that is covered with small teeth. In order to eat, they scrape algae off from the rocks.



### Sea Anemone

The sea anemone is a soft bodied animal that some people say looks like an undersea flower. Even though it attaches itself to the bottom, it is capable of moving slowly. It, along with its relative the jellyfish, has tentacles that surround its mouth. It uses these tentacles to trap its food.

## Seaweeds

There are many types of seaweeds that grow along the coast of Maine. They are called algae and are grouped according to color (red, green, and brown). In the tidepool, seaweeds provide food and hiding places for many small animals.



### Sea Lettuce

Sea lettuce is a bright green algae. Its blade is lettuce-like in shape and texture. In the Orient, sea lettuce is used to make soup. In Scotland, it is used for salads.



### Irish Moss

Although you might expect Irish moss to be green, it is usually a deep red color. Sometimes there is so much Irish moss in one place that it looks like a thick red carpet. Many people use this seaweed to make a pudding called "blancmange."



### Rockweed

As its name suggests, this brown seaweed holds on tightly to rocks in the intertidal zone. The bubbles, or air bladders, in its blades keep it afloat during high tide. During low tide, crabs may be found hiding under bunches of rockweed.



### Kelp

Kelp is the largest form of algae that grows along the coast of Maine. It's long, flat blade is attached to a tube-like stalk. This brown seaweed can be seen only at the low tide mark or below low tide.

Adapted from *Life on Rocky Shores*, New England Aquarium.