

It Takes All Kinds!

Overview

Fish are an incredibly diverse group of animals – the result of numerous adaptations since fish first evolved over 500 million years ago. These adaptations have shaped fish in countless ways, but each form or shape has evolved to allow fish to successfully feed, swim, escape predators, and reproduce in their habitat. These adaptations can be grouped into categories of size, shape of body and tail, coloration patterns, location of mouth and size of teeth, and gill rakers. Close observation of these fish adaptations can lead to predictions about their behavior and choice of habitat within the ocean environment.

This activity begins as small groups of students read and discuss statements about fish adaptations before and after watching a video. They record their ideas and any questions they have about fish on their cooperative group Anticipatory Guide About Fish and share their prior knowledge with the class. Fish Adaptation Charts are then used to present new information and vocabulary about fish adaptations as students find visual representations of the adaptations around the classroom.

In Session 2, students work in cooperative groups to investigate and observe different fresh fish purchased at a fish market. They work together to complete a worksheet about the various fish adaptations using their new vocabulary and then make predictions about where it might have lived and what it captured for food. In Session 3, "The Experts Meet," groups of students make presentations to the class about the fish for which they made a labeled drawing. The activity concludes with Session 4 as students honor the fish with the ancient Japanese art form called Gyoaku- or fish printing. The students discover that fish come in a great variety of forms, colors, and shapes and these adaptations can be used to predict their habitat and lifestyle.

What You Need

For the class

- 30 or more colored pictures of a variety of fish (cutout from magazines or calendars)
- posters of various fish displayed around the room (See Resources)
- videotape of fish (See Getting Ready and Resources)
- colored markers (4-6 colors, wide tip)
- 6 sheets of chart paper (approximately 27" x 34")
- masking tape
- 1 pair of sharp-pointed scissors
- 1 pair of tweezers
- 1 Anticipatory Guide About Fish copied onto large chart paper (See Getting Ready)
- Fish Adaptation Charts (4) for Body Shape, Tail Shape, Mouth/Teeth/Gill Rakers and Coloration Patterns. See sample charts in Getting Ready.
- Optional: reference books on fish (See Resources)

For each group of 5-6 students:

- 1 fresh fish (See Getting Ready)
- 5-6 gallon size plastic freezer bags
- 1 tray for each fish (or newspapers to place fish on)
- 5 - 6 pairs of disposable plastic gloves (See Getting Ready)
- 1 Fish Feature Worksheet Student Sheet
- 1 Anticipatory Guide About Fish Student Sheet
- 6 sheets of blank paper
- 6 pencils
- colored markers (various colors, fine tip)
- a few paper towels

For Session 4: Fish Printing

For the class:






- fresh or frozen fish from Session 2 or rubber fish (See Getting Ready and Resources)
- newspaper to cover table
- 5-6 pieces of cardboard cut about 1' X 2'
- plastic modeling clay
- pins
- 10 paint brushes (an assortment of sizes including some small to 1" in size)
- water-based ink (linoleum block) or liquid tempera paint (See Getting Ready)
- rice paper or newsprint (See Getting Ready)

Getting Ready



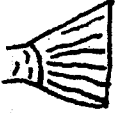


For Session 1

1. Use visual images of various colorful fish to show the tremendous variety in their size, shape, color and habitat. Display the fish posters prominently around the room. Choose a fish video you would like to show to the class. You will only be showing about 10 minutes or so of the video so cue it up to the part that shows the diversity of fish you would like your students to see. Many videos are available for purchase, or check out your local library or video rental. See Resources for poster and video titles and ordering information.
2. Duplicate the Anticipatory Guide About Fish for each small group.
3. Start the class Anticipatory Guide About Fish. Use chart paper and colored markers. The statements shown on this chart refer to footage shown on many different fish videos. You may need to adjust the information depending on what is portrayed on the specific video you are using. You might want to laminate the chart so you can reuse it at a later date. If you decide to laminate, be sure to only use washable markers when recording data. (Mr. Sketch™ wide-tipped markers work well on laminated materials.)
4. Draw the following four Fish Adaptation Charts on chart paper using the colored markers. These charts can also be laminated for future reuse. Alternatively, make an overhead of each of the charts and use an overhead projector to present them to the class. If you choose the latter, the students will either need to have copies for their group to refer to or have them take notes as you present the information to the class.



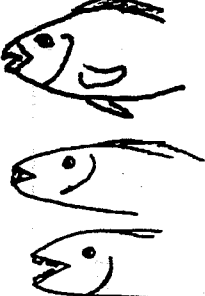
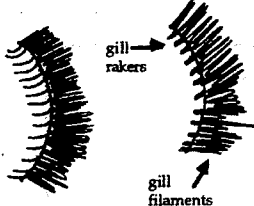
BODY SHAPE

	DESCRIPTION	EXAMPLE
FUSIFORM 	streamlined and cylindrical; very fast and can swim continuously for long distances	bonita, mackerel, anchovy
DEPRESSED 	flattened from back to belly like a pancake; ambush prey with short bursts of speed; burrows into sand	skates, rays, goosefish
SPHERE 	rounded, globe-like; slow swimmers; may attract prey to them with light and lures	porcupine fish, puffer fish, anglerfish
RIBBON 	snake-like; slow swimmers but easily move through crevices; hide under rocks or in cracks, and ambush prey that comes too near their hideout	wolf eels, monkeyface eel
COMPRESSED 	flattened side to side; sharp, quick turns and very maneuverable; viewed head-on they almost seem to disappear	surf perch, opaleye, halibut, flounder




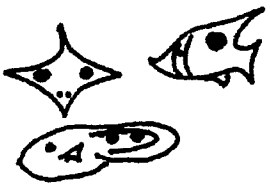
TAIL SHAPE

	DESCRIPTION	EXAMPLE
LUNATE  (fastest)	fastest swimmers, maximum speed with minimum effort over long distances	marlin, mackerel, dolphinfish, swordfish
FORKED 	moderately fast, continuous swimmers	anchovy, herring
SQUARED 	very maneuverable, capable of bursts of speed for short distances	rockfish
ROUNDED 	very maneuverable, capable of bursts of speed for short distances	senorita, goby, flatfish
TAPERED  (slowest)	slow swimmers, use body undulations to swim	moray eel

MOUTH, TEETH and GILL RAKERS

	DESCRIPTION	EXAMPLE
MOUTH ORIENTATION 	1. oriented upwards denotes surface feeder or feeds on prey above it; 2. downwards suggests bottom-grubber	1. stargazer, stonefish 2. sturgeon
MOUTH SIZE & SHAPE 	1. large jaws engulf prey; 2. jaws which can protrude suck in prey; 3. elongate jaws reach into crevices; 4. elongate lower jaw feeds on prey seen above	1. lingcod 2. rockfish 3. butterflyfish 4. halfbeak
TEETH SIZE & SHAPE 	1. fish eaters have pointed, knife-like; 2. snails and clam eaters have plate-like grinders and crushers; 3. choppers on plants and corals have fused, beak-like	1. barracuda 2. bat ray 3. parrotfish
GILL RAKERS SIZE & SHAPE 	1. comb-like gill rakers filter food; 2. large, coarse gill rakers protect gills when they eat from large prey items	1. anchovy 2. lingcod

COLOR PATTERNS

	DESCRIPTION	EXAMPLE
CAMOUFLAGE	match surroundings to blend in and hide	halibut, cabezon
DISRUPTIVE COLORATION 	spots, stripes, and patches of color breakup and diffuse the actual outline	kelpfish, sergeant-major
COUNTER- SHADING 	dark back and lighter belly hides fish from predators as sunlight penetrates from above	anchovy
ADVERTISING 	1. warning to stay away from poisons or spines; 2. attract mates, defend territories 3. clean other fish	1. lionfish 2. California Sheephead 3. señorita
DECEIVING 	1. false eyespots confuse predators into attacking the wrong end or miscalculating size/ shape of fish; 2. fish resembles objects of no interest to enemies; 3. fish mimics something: that is (a) helpful (like a cleaner) or (b) dangerous (like a poisonous seasnake.)	1. Big Skate, butterfly fish 2. stonefish, sargassum fish 3. (a) blenny, (b) snake-eel

For Session 2: The Mystery Fish

1. Purchase 5-6 fresh fish. Choose as many different kinds of fish as you can find including a wide array of species, shapes and colors. Asian markets are a wonderful source for many different local and exotic fish. Make sure that the fish are not scaled or gutted and that they are fresh! The following fish make good examples: mackerel or bonita, salmon, eels, herring, rockfish, flatfish (such as halibut, sanddabs, flounder), pompano or other exotic fish. Rinse the fish, pat dry with paper towels and freeze them in individual plastic ziplock bags. Write the name of the fish on the outside of the plastic bag with a permanent marker.

Sidebar: Some hints about how to be assured the fish you are buying are really fresh:

- Look for fish with clear, not cloudy eyes
- Lift the gill cover - on a fresh fish the gills will still be bright red, not brown
- Smell the fish and lift the gill covers to take a whiff - it should not be stinky!

2. The fish don't need to be thawed all the way through for the activity, just enough so the fins and tail are pliable and the mouth, gill cover and gills are thawed. This can usually be achieved by taking the fish out of the freezer about 2 hours before the class. If you are short on time, run the fish under cool water or place them in the sun for a short period of time.

3. Rinse the partially thawed fish in clear cool water, pat dry and place each on a separate tray or layers of newspaper.

4. Use the following instructions to remove the gill rakers from each of the fish:

1. Lift one of the gill covers to see the soft, delicate gills protected inside. (There is one gill cover on each side of the body and four separate gills under each gill cover.) The gill rakers are just a part of the gill - they are not a separate entity.
2. Use the tweezers and sharp pointed scissors to reach inside and separate the outermost gill from the other three. Snip both ends of the gill and use the tweezers to remove it from the fish.
3. Rinse the gills in clear water and place next to the fish.

5. Cover the fish and gill with a damp paper towel. Number the fish 1-6, placing the number on the tray before distributing them to the students. After the activity, return

the fish immediately to the plastic bags and freezer. The fish can then be reused at a later date.

6. Duplicate the Fish Feature Worksheet for each small group.

7. Purchase plastic gloves from drug stores or see Resources for suppliers. Gloves are optional of course, but they are often very useful in helping squeamish students (or teachers) to participate completely and use **their** hands for this "hands-on" activity.

8. Write out the key concept using large bold letters and colored markers.

Fish come in a great variety of forms, colors, and shapes and these adaptations can be used to predict their habitat and lifestyle.

For Session 4: Fish Printing

1. Decide if you will purchase additional fresh fish for the fish printing. Some teachers prefer to use fish that have not been used and handled by so many students as the fish from "It Takes All Kinds" have. Use your own judgment, but if they seem to be squishy or leaking, you may need a new specimen. Some people even prefer to use rubber fish molds rather than actual fish. They are definitely easier to use (no need for clay or pinning out the fins), but not quite as compelling as an actual fish. You can order the rubber specimens from Nasco at 1-800-558-9595. They have a number of different species including a really cool skate and even a seastar.

2. You will also need to decide if you will use liquid tempera paint or black ink. The ink technique with rice paper is the classic form, but tempera paint on newsprint turns out great! Students often seem to prefer the bright colors of the paint and teachers like the cheaper, easy to obtain newsprint over the more expensive rice paper. It is again up to you.

(Into The Activity)

Session 1: Fishing for Information

Anticipatory Guide About Fish

Making an Anticipatory Guide is an activity structure designed to help students recall information from past experiences and to assist them in clarifying what they want to learn from the activities that follow. In the Anticipatory Guide Activity, students work together in small groups and have opportunities to share their ideas with the larger group.

1. Have students work in small groups for this activity. Distribute one copy of the Anticipatory Guide About Fish student sheet to each small group.
2. Tell the students that as they discuss each of the statements, one person can act as the recorder to mark down the number of students in their group who answer yes, no or don't know. Have them make up some statements for the last two rows of the chart.
3. Tape the class Anticipatory Guide About Fish up near the video monitor. After each group has recorded their responses on their own group chart, turn on the video (**turn down the sound completely**) and encourage the students to quietly discuss the statements with each other.

The vocabulary used in many videos may be given in a too much, too fast mode, which causes many students to lose interest. More often, students perceive videos as an opportunity to relax and daydream - much like television is used. We suggest changing this perception by using videos to take the students on a "virtual" field trip. In order to do this you will first need to turn the sound off and give the students directions in what you want them to look for. Students are more observant when they must look for the action and hypothesize about its relevance, instead of just waiting to hear it described. This also gives the teacher the opportunity to direct the students' attention to specific topics, rather than just going where the voice over directs. The teacher can have the students answer or discuss specific questions, sketch what they observe, and /or describe what they think is happening. You may find it helpful to use "white noise" such as an audio tape of ocean sounds, to get the students over the hurdle of "listening" to the silence of the video.

4. At the end of the video segment (only show about 10 minutes), give each small group the opportunity to review the statements on their sheet and again mark down the number of students in their group who answer yes, no or don't know (or can't tell from the video.)

Student Sheet

Anticipatory Guide about Fish

<i>Statements About Fish</i> <i>Record and Tally your answer as Yes,</i> <i>No or Don't Know (Can't Tell)</i>	Before Video	After Video
1. Fish all seem to have the same tail shape.		
2. Fish with squared tails swim the fastest.		
3. Some fish hide by lying flat on the bottom.		
4. The body shape of fish tells us about where it might live.		
5. Long, skinny fish usually can be found swimming out in the open.		
6. Slow moving fish don't have any protection against being eaten.		
7. There are ways to predict what a fish eats besides watching it catch prey.		

11
No. 11

the first of the year
the second of the year
the third of the year
the fourth of the year
the fifth of the year
the sixth of the year
the seventh of the year
the eighth of the year
the ninth of the year
the tenth of the year
the eleventh of the year
the twelfth of the year
the thirteenth of the year
the fourteenth of the year
the fifteenth of the year
the sixteenth of the year
the seventeenth of the year
the eighteenth of the year
the nineteenth of the year
the twentieth of the year
the twenty-first of the year
the twenty-second of the year
the twenty-third of the year
the twenty-fourth of the year
the twenty-fifth of the year
the twenty-sixth of the year
the twenty-seventh of the year
the twenty-eighth of the year
the twenty-ninth of the year
the thirtieth of the year
the thirty-first of the year

5. Lead a class discussion and record the students' ideas on the class chart. What statements did they add to their charts? Add these statements to the class chart. Ask the students which of the statements on the chart are left unresolved. Then ask them how we might figure out if the statements are true or false.
6. What questions do they now have about fish and fish adaptations? Make a list of these questions. Tell them that observing actual fish may help them to answer many of their questions. Refer back to the list throughout the activity as the students discover new information about fish adaptations.

Silent Mingle

A Silent Mingle is another activity structure designed to determine what is already known about a topic as well as giving the students the opportunity to discover new insights as they investigate the topic in a new way. This structure has the students using language in meaningful ways in a series of orchestrated conversations with changing partners.

1. Distribute six or more fish pictures to each small group of students and ask them to spread them out on their tables so that they are all visible.
2. Have the students walk silently around the room, (as if they were visiting an aquarium) looking at the pictures of fish spread out on the tables and the posters on the walls. As soon as you say Pair-Up, the students will stop and partner up with one or two student(s) nearest them.
3. Ask the first discussion question from the list below, give the partners (or groups of three) a chance to discuss it and then ask for volunteers to debrief the answer. Repeat #2 and #3 until all the questions have been discussed.
 1. Select a fish picture from those in front of you and show it to your partner. What feature of this fish stands out to you? Describe features of this fish to your partner and what you find interesting, different or strange about it.
 2. Choose a fish picture from those in front of you. How do you think this fish captures its food? What do you think it eats?

3. Look at the mouths of the fish around you. How are they different from one another? How many different mouths can you see?

4. Describe the body shape of one of the fish. How many fish with that body shape do you see on the posters/pictures/books near you?

5. Describe the fins that you see. How many fins come in pairs? Look at the different tail fins—how many different shapes can you find?

4. Have the students return to their small group tables.

(Through The Activities)

Fish Adaptation Charts

1. Post the four Fish Adaptation charts you made to describe the body and tail shapes, coloration patterns and mouth shape, size and location including the teeth and gill rakers.

2. Describe each of the charts in turn. As you introduce each color or shape description and vocabulary on the fish charts, have the students locate a fish with that characteristic or feature on the posters, pictures, or books at their table. Have students hold up representative pictures of that feature and share their findings with the class.

3. As the students hold up the pictures of fish, have them hypothesize about the fishes habitat and what it might eat.

4. Tell the students that in the next session they will have the opportunity to use real (albeit dead) fish. They will make predictions and discover what they can about the lifestyle and habitat of a number of diverse fish.

Session 2: The Mystery Fish

Fish Feature Worksheet

1. Pick out one or a few representative fish from the pictures or posters displayed around the room. Have cooperative groups practice using the new vocabulary from the fish charts to describe the features of the chosen fish. Also have them hypothesize about the fishes habitat and what it might eat. Have the groups share their speculations with the class.

2. Distribute a copy of the Fish Feature Worksheet to each cooperative group. Model how to complete the worksheet by using an example of one of the fish chosen from the pictures or posters in #1. Tell them that this is the process they will go through when their group is given the actual fresh fish.

Sidebar: Some teachers prefer to give every student their own Fish Feature worksheet.

3. Distribute a sheet of blank paper and a pencil to each student. Tell them that each of them will be responsible for making a drawing of one of the five to six fresh fish, including the adaptations listed on the Fish Feature Worksheet and two other features of this fish that they find interesting (such as size of scales, fleshy appendages, spines, and/or size of the eye). They are also to label their drawings using the new vocabulary.

Prelude to Distributing the Fish

1. Discuss with the students the sanctity of life, referring back to the video and the beauty and grace of the fish. Tell the students that the fish you purchased were caught for human consumption, and although they are dead, they were once living, breathing organisms. We should show them the respect they deserve.

2. Ask the students what it would look like to show respect to this creature during the activity. [no poking, tearing, etc.; following directions] and that they are a very important food resource for people as well as many other predators around the world.

The Mystery Fish

1. Have each student in a cooperative group number off from 1 to 6. Distribute one numbered fresh fish and its gill raker on a tray, a few paper towels and five to six pairs of plastic gloves to each group.
2. Tell the students that each of them is responsible for making a labeled drawing of the **one** fish whose number corresponds to their number. For example, student #2 is responsible for drawing Fish #2 and student #3 is responsible for drawing Fish #3. As the groups rotate from fish to fish, each student in turn will be responsible for the labeled drawing.
3. The entire cooperative group is responsible for discussing and completing the Fish Feature worksheet for each fish, including where they think it lives and what it eats. Everyone in the group must agree on the label chosen to describe the adaptations and take turns being the recorder.
4. As the students are working, circulate to all the groups helping them to find the gills in the fish and look at the gill/ gill rakers that have been removed.
5. Once the cooperative groups have completed the Fish Feature worksheet for all five to six fish, allow time for each student to complete their drawing. (See page 20 for an example of how students may complete their own Fish Feature worksheet. This example gives information for common fish you are likely to find in a fish market.)
6. After students have finished looking at the fish, place the fish in their individual plastic bags and return them to the freezer.
7. Tell students that in the next session, students responsible for drawing the same fish (those students with the same number) will get together as experts. They will then present their drawings and share their expert knowledge about "their" fish with the rest of the class.

If there is not enough time for each group to rotate to all of the 5 – 6 fish or if time is short and you need to skip Session 3, have the students complete a labeled drawing for the last fish they investigate in the rotation. Then have them present what they learned about that fish to the class, rather than meeting as experts. In this case, you would skip Session 3.

Session 3: The Experts Meet

1. Convene expert groups of students responsible for making the labeled drawing of the same fish (e.g. students from each of the cooperative groups with the same number.) Have these students compare their drawings and descriptions and if reference books or internet access are available, they can add additional information about their species.
2. Have each expert group make a presentation on their fish to the entire class. You may want to display the student drawings around the classroom. See the box below for additional information about the fish described on the example Fish Feature Chart from page XX.

The **mackerel** appears to be an open water fish based on its countershade coloration. Its streamlined body and crescent shaped tail denotes it to be an active, fast swimmer. Its sharp teeth indicates it to be a fish eater.

The **rockfish** is camouflaged to match kelp growing on rocks. The chunky body and squared tail shows it can achieve only short spurts of speed to capture prey that comes too near its hiding place and large mouth.

The **flatfish** is extremely well camouflaged while lying on a sandy bottom. These fish are flattened side-to-side (compressed) with both eyes on one side of their head. It uses quick bursts of speed achieved with its rounded tail and strong tail muscles to capture small fish and shrimp that swim too near.

The **anchovy** is a fast swimming, open water fish based on its countershade coloration, streamlined body, and forked tail. The extremely large mouth, tiny teeth and very fine gill rakers allow it to filter-feed on microscopic plankton.

Making a Mini-Book

What is a Mini-book?

A mini-book is an activity structure designed to help students organize and reconstruct new information and to guide their creativity. This activity also provides

opportunities for students to use written language in meaningful ways and for the teacher to assess the writing skills and science knowledge of individual students.

1. Tell students that they get to become authors of a mini-book about what they learned about fish diversity and adaptations. First they need to make the blank book. Pass out fine-point markers and either 11" x 17" or 8.5" x 11" paper and lead them through the directions below (see pattern on page 24.)

Mini-books should be written in whatever language students are most comfortable using, and the focus should be on content and creativity, not grammar and spelling. Mini-books can be introduced and begun as a whole group activity and then completed during subsequent work sessions or whenever students have extra time. Consider letting students finish during your normal writing time. Mini-books are ideal assessment tools. Collect them, develop an evaluation or scoring system, and include them in student portfolios.

2. Have students fold an 8 1/2" x 11" sheet of plain paper side to side lengthwise and then into thirds. Open it up all the way and cut along two of the folds halfway across the page so a book is formed with three pages that open vertically.

3. Have them label each of the sections in turn: Adaptations, Habitat, and Lifestyle. Now they can flip up each section and draw a picture in one subsection and write text in the other. The drawings can represent the fresh fish or those seen on posters or in books. The written descriptions can be about something they learned from this activity about adaptations, habitat, and/or lifestyles pertaining to the drawing on that subsection.

4. Provide students with time to write and draw pictures that are appropriate for each chapter.

5. Have students share their book with others and check each other for accuracy and understanding. They can then share their mini-books informally with the rest of the class.

Sidebar: Create a mini-book library for students to use in future research projects on the ocean.

6. Hold up the Key Concept and have the students read it aloud. Post it near the Fish Adaptation Charts and the students' drawings.

Session 4: Gyotaku (fish printing)

1. Tell students that this is their opportunity to honor the fish that they have learned so much from. They are going to use the ancient Japanese art form called Gyotaku (pronounced ghio - ta' - koo) or fish printing.

2. Use soap and water to clean the outside of the fish as completely as possible. The cleaner the fish, the better the print. Dry the fish well.

3. Place the fish on a piece of cardboard and then on a table covered with newspapers. Spread the fins out over some clay and pin them in this position - pushing the pins at an angle into the cardboard. Allow the fish to dry further. If the fish appears to be leaking from one or more orifices, stuff the holes with pieces of paper towel. It also works well to stuff the mouth in an open position.

4. Have students brush on a **thin**, even coat of ink or tempera paint, covering the body and each of the fins, including the pelvic fins and tail. **But leave the eye blank.** The thinner the paint, the more details, like scales are apparent in the final print. If you are using tempera paint, students often like to paint the fins and body a different color or make spots, strips etc. Be sure that there are no paint smudges or splatters on the newspaper or cardboard around the fish. These spots may show up on the finished print. A good technique is to tear pieces of newspaper or paper towel and use these to cover the splatters.

5. Have the students carefully place a piece of rice paper or newsprint over the inked or painted fish. Have them use their fingers to gently press the paper over the surface of the fish, touching every inch of the fish. As they touch each of the fins, have them say the name of the fin. Remind them to be careful not to change the position of the paper.

6. Remove the paper from the fish quickly, lifting up one end and peeling it off.

Sidebar: Some teachers like to make fish prints using T-shirts and fabric paint.

7. Use a small brush to paint the eye directly on the paper print.

8. Use the finished prints to show different species adaptations for speed, defense, and food capture. Have the

students label the print with the species name and the name of each of the adaptations and fins.

(Beyond The Activity)

Going Further

Quilt Story

Have each student contribute a quilt square to a class paper quilt representing the vast array of fish diversity and adaptations.

1. Distribute a blank paper quilt square, colored construction paper, and glue to each student and instruct them to make a fish in its habitat. The attributes of the fish should reflect its adaptations to its habitat. They should also name their fish. Be sure to have them leave a 1" border around the outside.
2. Once the blocks are completed, have each student work with a partner to learn about their partner's fish including habitat, adaptations, lifestyle, and name. Have them introduce each other's fish and how it lives to the class.
3. Once all the fish have been described, have the class designate some "master quilters" to piece them together using different colors of book binding tape to form the lattice strips and the border.

Charting Fish Behavior and Movement

If possible, set up a classroom aquarium so students can observe and keep daily logs of behaviors, patterns of movement, individual variations in feeding, growth and breathing patterns. (See *Mapping Fish Habitats*, GEMS, Lawrence Hall of Science, UC Berkeley).

Field Trips

Visit an aquarium, aquarium store, or fish market to observe the great diversity of fish.

Dissection

Dissect the fish used in this activity to compare their internal anatomy. Try to make correlations between the internal anatomy and their lifestyle, e.g. tuna have mostly red muscle, reflecting their ability at long distance swimming, and flatfish have no gas bladder, thereby allowing them to lie motionless on the bottom.

Use the following table as an example of how students may complete their Fish Feature Chart. This example compares the adaptations of four diverse fish you are likely to find in a fish market.

FISH FEATURE CHART EXAMPLE

	Fish #1	Fish #2	Fish #3	Fish #4	Fish #5
BODY SHAPE	Fusiform	it's a compromise: a chunky head & fusiform body	Compres-sed	Fusiform	
TAIL SHAPE	Crescent	Squarish or rounded	Rounded	Forked	
MOUTH, TEETH, GILL RAKERS	Large mouth, sharp teeth, not fine gill rakers	Fairly large mouth & sharp teeth, not fine gill rakers	Small mouth, sharp teeth, not fine gill rakers	Extremely large mouth, tiny teeth, fine gill rakers	
COLORATION PATTERNS	counter-shading	disruptive & camouflage	camouflage	counter-shading	
I PREDICT IT EATS:	fish	fish & crabs	fish, clam siphons & shrimp	micro-scopic plankton	
I PREDICT IT LIVES IN THE (HABITAT):	open ocean	kelp forest, rocks	bottom, sand covered	open ocean	
TWO OTHER INTERESTING FEATURES					
NAME OF FISH	<i>Mackerel</i>	<i>Rockfish</i>	<i>Flatfish</i>	<i>Anchovy</i>	

FISH FEATURE CHART Student Sheet

	Fish #1	Fish #2	Fish #3	Fish #4	Fish #5	Fish #6
BODY SHAPE						
TAIL SHAPE						
MOUTH, TEETH, GILLRAKERS						
COLORATION PATTERNS						
I PREDICT IT EATS:						
I PREDICT IT LIVES IN						
TWO OTHER INTERESTING FEATURES						
NAME OF FISH						

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OF
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OF
THE
DEPARTMENT
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JUSTICE

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It Takes All Kinds Home Activities

TO THE FISH MARKET

Take your family to a local fish market and look for different ways that fish are adapted. Sketch all the different fish you can find and label their mouth and teeth, tail and body shapes, and coloration patterns. Describe your observations to your family. Do you see any of the same kinds of fish that you used in class for the Mystery Fish activity? Where in the world did all these fish come from? Help your family choose one of the fish to take home and cook up for dinner. What kind of fish is it? Where and how was it caught?

TO A RESTAURANT

Choose a fish you would like to eat from the menu. Ask to speak to the owner or chef and tell them you are studying fish in school. Ask them how the kinds of seafood they get has changed over the years. Is it more difficult or expensive to get some popular items? Why? What do they think is causing these changes? What do you think is causing these changes? How do you feel about it and what might you and your family do to help the situation?

GONE FISHING

Encourage your family to take a fishing trip to a local pier or lake. Even if you don't fish, you can look at all the various kinds of fishing gear and bait used by different fisherpersons. Make a sketch of the fish you see being caught and the bait that was used to catch it. Ask the fisherperson if you can take a closer look at their catch. Notice the teeth, fins, tail, coloration and gill rakers. Describe its adaptations to your family. What do you predict the fish eats in the wild? What did the fisherperson use to catch it? Does there seem to be a connection? Take a field guide with you so you can check out information about the fish you see.

A VISIT TO THE AQUARIUM or AQUARIUM/PET STORE

Visit a local aquarium or pet store with fish or find one on your next vacation. Notice all the different fish species and adaptations for survival in different habitats. Which habitats are represented in the aquarium? Do the fish come from all over the world or are only local species shown? Ask if it would be possible to speak to the people taking care of the fish (they work in the husbandry department.) What questions would you like to ask them? Prepare your questions in advance. Some ideas for questions include: how often do you feed the fish, are they hard to take care of, what do they eat, how and where were they caught, how long do they live in captivity, how did the aquarist get his/her job, do they like their job, what prepared them for this job and etc.

DESIGN A FISH

Create a fish that would be adapted to live on your living room carpet. Remember to include all the adaptations for survival that it needs. Challenge your family to create a fish that could live somewhere else in your home e.g. under the refrigerator, in a potted plant etc. Remember, you will have to teach them the rules for survival and that to win they will have to describe its adaptations.

Background

Fish are one of the most successful of the groups of animals with backbones—the vertebrates—and consist of over 50% of all the living vertebrate species. In addition to being one of the most numerous groups, they are also among the most diverse. The incredible variety of forms and behavioral adaptations for survival seen in fish are a reflection of the complex and diverse habitats available to them in their ocean home.

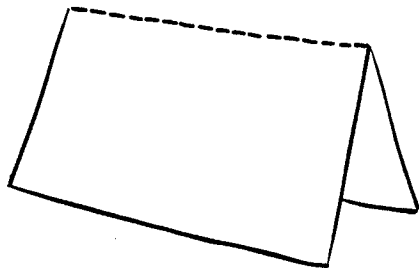
The tremendous diversity in fish is the result of numerous adaptations since fish first evolved over 500 million years ago. The interplay of these adaptations has shaped fish in countless ways, but each form or shape has evolved to allow fish to successfully feed, swim, escape predators, and reproduce in their habitat. These adaptations can be grouped into categories of size, shape of body and tail, coloration patterns, location of mouth and size of teeth, and gill rakers. Close observation of these fish adaptations can lead to predictions about their behavior and choice of habitat within the ocean environment.

The shape and the position of fish fins are related to their body shape and the location of the center of buoyancy of the fish. The differences between fish in their fin shape and location are adaptations for their habitat and lifestyle and are reflected in their locomotion and maneuvering abilities. For example, the lower part of the tail fin in bottom dwellers such as rays is usually reduced, but it is enlarged in the flying fish which may use it to help them jump out of the water. Other examples of adaptations include the dorsal fin of remoras, which is modified as a sucker to allow it to hitchhike on sharks, and the dorsal fin of anglerfishes, which attracts prey to its large mouth.

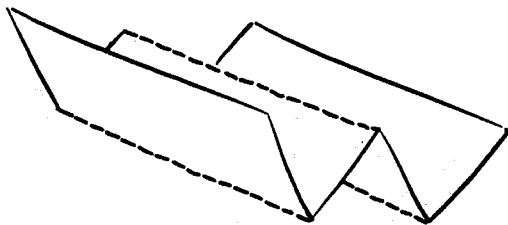
Fish usually have the streamlined—or fusiform—shape, which is very efficient in the water, but they do show a great range of departures from this typical shape. Each of these departures is an adaptation to a specific way of life, which puts a premium on something other than fast swimming.

Mini-book (11" x 17")

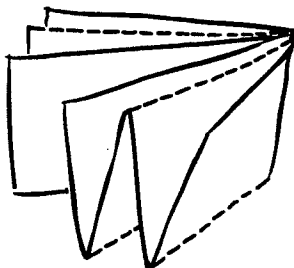
- 1.** Fold the sheet in half crosswise.



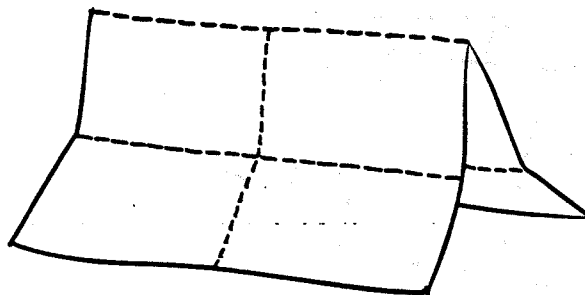
- 2.** Fold up ends separately to form a "W" shape.



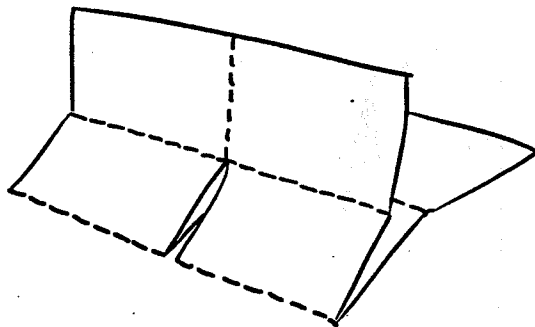
- 3.** Fold the paper in half again to form a small rectangle. Then unfold this last fold, and fold it again back the opposite way, making good, hard creases on each side.



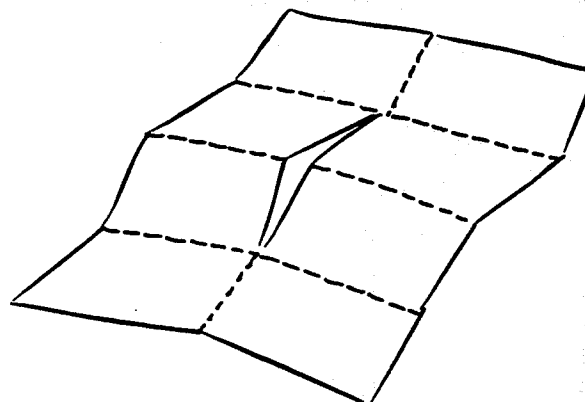
- 4.** Unfold back to step #1, where the sheet is only folded in half.



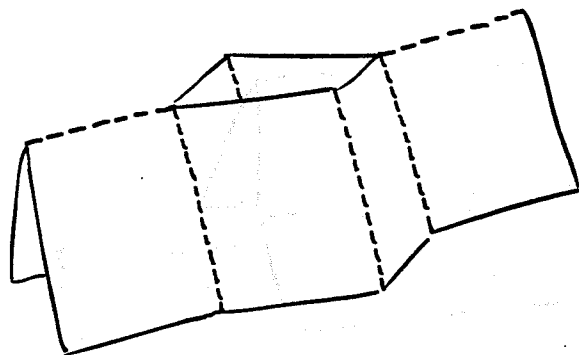
- 5.** Face the folded edge closest to you and cut along the middle fold through both sides to the center as seen in the diagram.



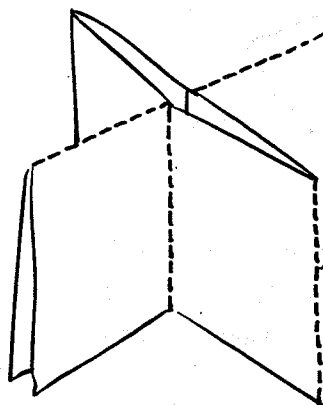
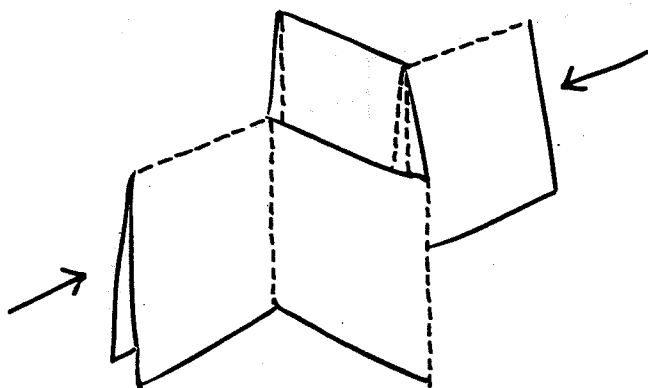
- 6.** Unfold the sheet entirely.



7. Refold the sheet in half, this time lengthwise.



8. Grab the two outside panels and push inward. The part you cut with the scissors should open up and form a diamond.



9. Finally, fold all the pages together to form a small book. Make good, hard creases on all sides.

