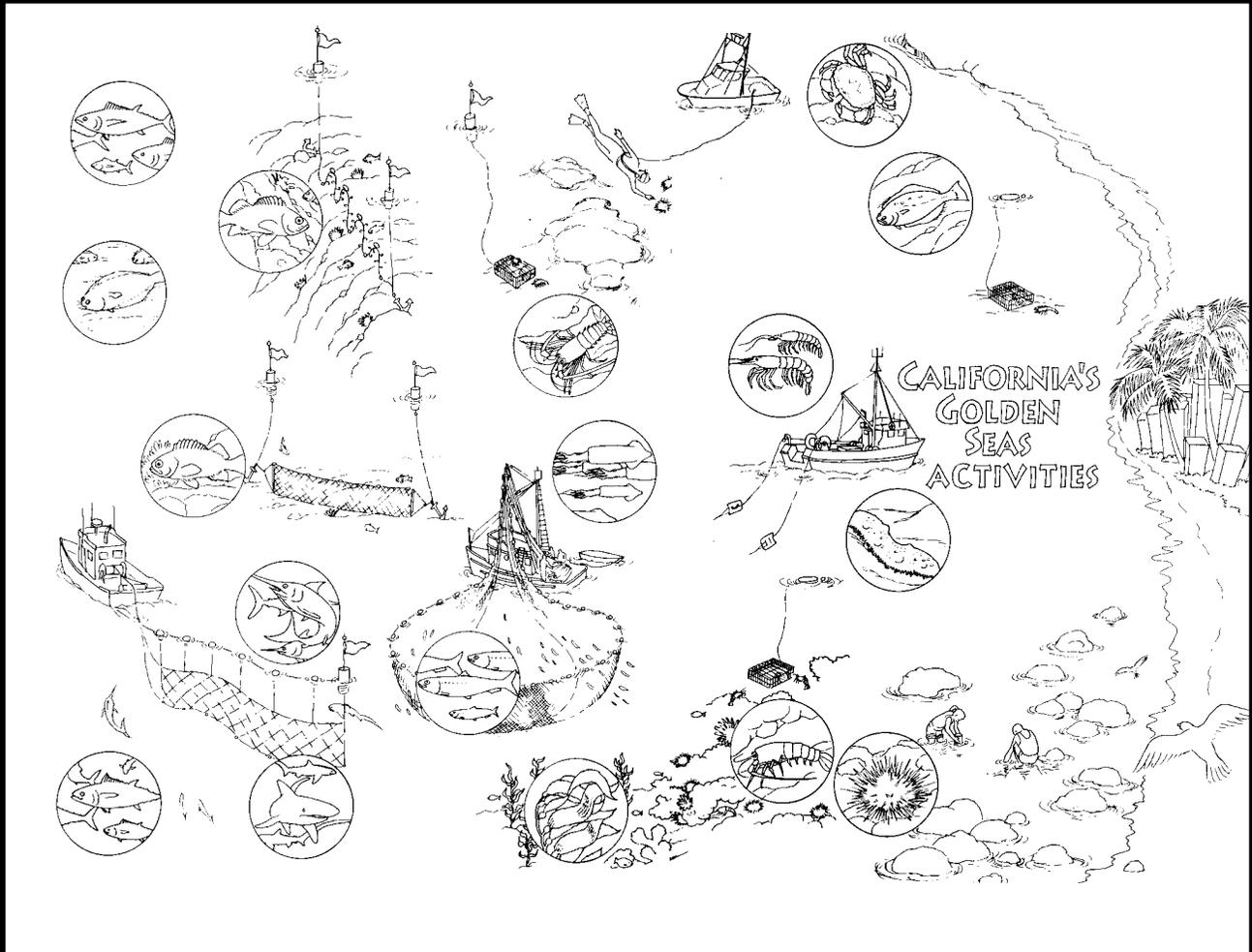


California's Golden Seas Activities



California Seafood Council

P.O. Box 91540 Santa Barbara California 93190 805•569-8050
e-mail seafood@ca-seafood.org



Dear Educator:

We are pleased to present you with an integrated, comprehensive learning packet that helps children learn about and care for one of our vital environments — the sea.

This packet of 27 activities is designed to be easy-to-use and integrate into California State Board of Education's curriculum frameworks. The activities are divided into three age groups: 9-year olds, 10-year olds, and 11-year olds. Each activity lists the materials needed for the activity. The format is Get set, Go catch, and Sailing.

Get set	lists the advance preparation and set up activities;
Go catch	lists the implementation steps;
Sailing	offers extended learning activities that often involve families, communities and school child nutrition and food service personnel.

The poster and stickers that complement the Golden Seas Activity Kit are included in several activities. (For information on how to order these elements, refer to the order form or contact the California Seafood Council.) The Appendix includes background information and "further reading" about California's Golden Seas.

We would appreciate your taking a minute to complete and return the enclosed Feedback and Evaluation Form once you have had an opportunity to review and try some of the activities. Your feedback is important to us.

We hope that you and your students will enjoy learning about California's Golden Seas.

Sincerely,

Diane Pleschner, Manager
California Seafood Council

California's Golden Seas



Acknowledgements

California's Golden Seas, integrated curriculum for ages 9, 10, and 11, was developed by the California Seafood Council with support from the Local Marine Fisheries Impact Program, California Department of Fish and Game Marine Resources Division, under Contract #FG3366MR.

Many people contributed a great deal of time and effort to create and develop this program. Grateful thanks go to the CSC's fishing advisors, who provided insight and much of the technical information contained herein. Many thanks also to the men and women who donated their time, fuel, and expertise, sharing via videotape their knowledge and love of the ocean: Vince Aliotti, Tim Athens, Craig Barbre and Marlisse Battistella, Phil Beguhl, Ken Bortolazzo, Travis Evans, Rick Gutierrez, Fred Hepp, Brian Jenison, Allison McCeney, Mike McCorkle, Cathy Novak, Pietro and Joan Parravano, Mike Ricketts, Bruce Steele, John and Moreen Szostak, Frank Vuoso, Tony West and any others whose names have been missed inadvertently.

Thanks to Tom Ancona for his original gear diagrams, which were the inspiration for the fishing artwork. We also extend thanks and appreciation to Dr. Milton Love, who consulted with the CSC on this project, and to Dr. Craig Fusaro, who critiqued the major iterations. Many thanks also to the CSC Education Committee for their long hours of review and comment throughout the process of development: Chair Aiden Coburn, Carol Noelting, Marciel Klenk, Cathy Novak, Travis Evans, Cathy Cordero, and Pietro Parravano.

Very special thanks to Deborah Lane Beall, of Lane Beall Associates, for her enthusiasm and creativity in developing activities that will inspire children to learn about and care for the ocean.



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Curriculum Framework Connections

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- √ Gone Fishing
- √ Personal Pyramid
- √ Seafood Safety Headlines
- √ Fact Finders
- √ Golden Treasures
- √ Sealore
- √ Seastyle
- √ Journey Game
- √ Balance and Care

Age 10 Activities

- √ Building Blocks
- √ Seaward Bound Passport
- √ Hooked on Quality
- √ Track Me on Land or Sea
- √ Chart the Harvest
- √ Current Event
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- √ On Course – Tides and Waves
- √ SAVE Project

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CONTENTS - 2

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- √ The Seafood Review
- √ Seafood Safety Temperature Guide
- √ California's Golden Seas Booklet
- √ California's Golden Seas Glossary
- √ A Brief Look at the Use and Capture of Seafood by the Native Americans of California
- √ Effects of Water Movement and Other Parameters on Fishes and Fisheries
- √ Industry Challenges

California's Golden Seas Poster

California's Golden Seas Stickers

California's Golden Seas



Curriculum Framework Connections

Lesson	Sci.	Math	Soc.Sci.	Lang.Arts	Health	Vis.Arts	Type of Activity	Group	Indiv.
Age 9									
Gone Fishing	X			X	X		X		
Personal Pyramid	X	X		X	X	X			X
Seafood Safety Head.	X		X	X	X	X	X		X
Fact Finders	X		X	X	X	X	X		X
Golden Treasures	X	X	X	X	X	X	X		X
Sealore			X	X		X	X		X
Seastyle	X	X		X	X	X	X		X
Journey Game	X	X	X	X			X		
Balance and Care	X		X	X		X	X		X
Age 10									
Building Blocks	X	X		X	X		X		
Seaward Bound P.port	X	X		X	X	X	X		X
Hooked on Quality	X			X	X	X	X		X
Track Me on Land/Sea		X	X	X					X
Chart the Harvest	X	X	X	X			X		X
Current Event	X			X			X		X
Net (Web) of Life	X		X		X		X		
On Course	X	X		X			X		X
SAVE Project	X		X	X			X		
Age 11									
Seafood Health Scr.	X			X	X		X		
Solving the Label Puzzle	X	X			X		X		X
Eye on Quality	X		X	X	X		X		X
Detective Cal C.Food			X	X	X		X		X
Mark My Channel	X		X	X	X		X		X
Gear-Up Sit. Solvers	X	X	X	X		X	X		X
Creating a Seascape	X		X			X	X		
Mystery of El Niño	X		X	X			X		
Crossword	X	X	X	X	X		X		X



Feedback and Evaluation Form

Please help us evaluate and improve the effectiveness of the *California's Golden Seas* integrated, collaborative learning packet of activities. THANK YOU.

I am a _____ from _____
(title) (organization)

1. What were the ages of the children involved with these activities? (Please circle one or more)

under 9 9 10 11 over 11 mixed ages (from ___ to ___)

2. Please comment on the following about this learning packet:

Age-appropriateness	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Ease of use	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Augments frameworks	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Children's interest level	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Format of activities	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Handouts/other materials	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Number of activities	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Readability	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Encourage cooperative learning	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Culturally sensitive	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Information useful	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Easy-to-find activities	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Poster	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor
Stickers	<input type="checkbox"/> Excellent	<input type="checkbox"/> Good	<input type="checkbox"/> Fair	<input type="checkbox"/> Poor

Comments:

3. Please give us feedback on the activities you used: (If more space is needed, please use separate sheet of paper.)

Name of activity

Comments

Feedback and Evaluation Form – 2

4. Which activities did you feel were the best? Why?

5. What activities and/or handouts do you recommend for a Spanish-language version of the learning packet?

6. What were the strong points of this learning packet?

7. Did you use this learning packet for specific subject matter (science, health etc.)?
Yes _____ No _____
If yes, what was/were the subject(s)?

8. What do you think is the best way for us to make this learning packet available to teachers?

9. How can this learning packet be improved?

PLEASE RETURN YOUR FEEDBACK AND EVALUATION FORM TO:

CALIFORNIA'S GOLDEN SEAS
c/o California Seafood Council
PO Box 91540
Santa Barbara, CA 93190

or e-mail your comments to: [seafood @ ca-seafood.org](mailto:seafood@ca-seafood.org)

THANK YOU for your help.



Building Blocks

Age 10, group or independent

45 minutes, indoors or outdoors

Objective: Evaluate nutrients in seafood that are necessary for good health and growth.

Materials: Building block, question & answer sheets, game directions, scissors, tape

Get set

- ✓ Duplicate the building block and question & answer sheets.
- ✓ Assemble the building block.

Go catch

- ✓ Divide group into two teams.
- ✓ Select a reader for each team to read questions and determine correct answers.
- ✓ Select a scorekeeper on each team.
- ✓ Read directions to the group.
- ✓ Play the building block game.
- ✓ Declare a winning team.
- ✓ Review the correct answers.

Sailing

- ✓ Play the game with another group of team members next week.
- ✓ Compare the results and scores.



Building block questions and answers

Protein

- ✓ Give one reason why we need to eat foods that contain protein.
ANS: Protein is necessary for growth, maintenance and repair of our bodies.
- ✓ Name one good source of protein.
ANS: Seafood, beef, poultry, pork, dry beans and legumes, lamb, game meat
- ✓ How much protein should we eat every day to be healthy?
ANS: Two 3-ounce servings. (A 3-ounce piece of fish is the size of a deck of cards.)

Carbohydrates

- ✓ Why do we need carbohydrates in our diet?
ANS: Carbohydrates give us energy for work or play. They keep our bodies running.
- ✓ Name a good food source of carbohydrates that you could eat with a seafood dinner.
ANS: Bread, rice, pasta, beans, fruits, vegetables, milk
- ✓ Name at least one food group in the food guide pyramid that includes foods with a lot of carbohydrates?
ANS: 1) Bread, Cereal, Rice and Pasta Group; 2) Vegetable Group; 3) Fruit Group

Fat

- ✓ What is the good type of fat that seafood contains?
ANS: Omega-3 fatty acids.
- ✓ Why do we need a small amount of fat in our diet?
ANS: It stores energy and some vitamins and keeps some of our organs healthy.
- ✓ Why is too much fat in the foods we eat unhealthy?
ANS: Too much fat can increase the risk of obesity, some forms of cancer and heart disease later in life. Seafood is a good low-fat food to eat at least twice a week.

Building block questions and answers – 2

Vitamins

- ✓ What vitamin helps keep our vision healthy?
ANS: Vitamin A
- ✓ Name at least one vitamin that is found in seafood?
ANS: 1) Vitamin A; 2) Vitamin B; 3) Vitamin D
- ✓ What vitamin is in herring and mackerel that helps bones and teeth to grow and be strong?
ANS: Vitamin D

Minerals

- ✓ Fish swim in a sea of this mineral, yet contain no more of it than other muscle protein. What is the mineral?
ANS: Sodium
- ✓ Name at least one mineral that is found in seafood.
ANS: 1) Sodium; 2) Iron; 3) Magnesium; 4) Copper; 5) Iodine
- ✓ What mineral do you want to limit in your diet because it can cause high blood pressure?
ANS: Sodium

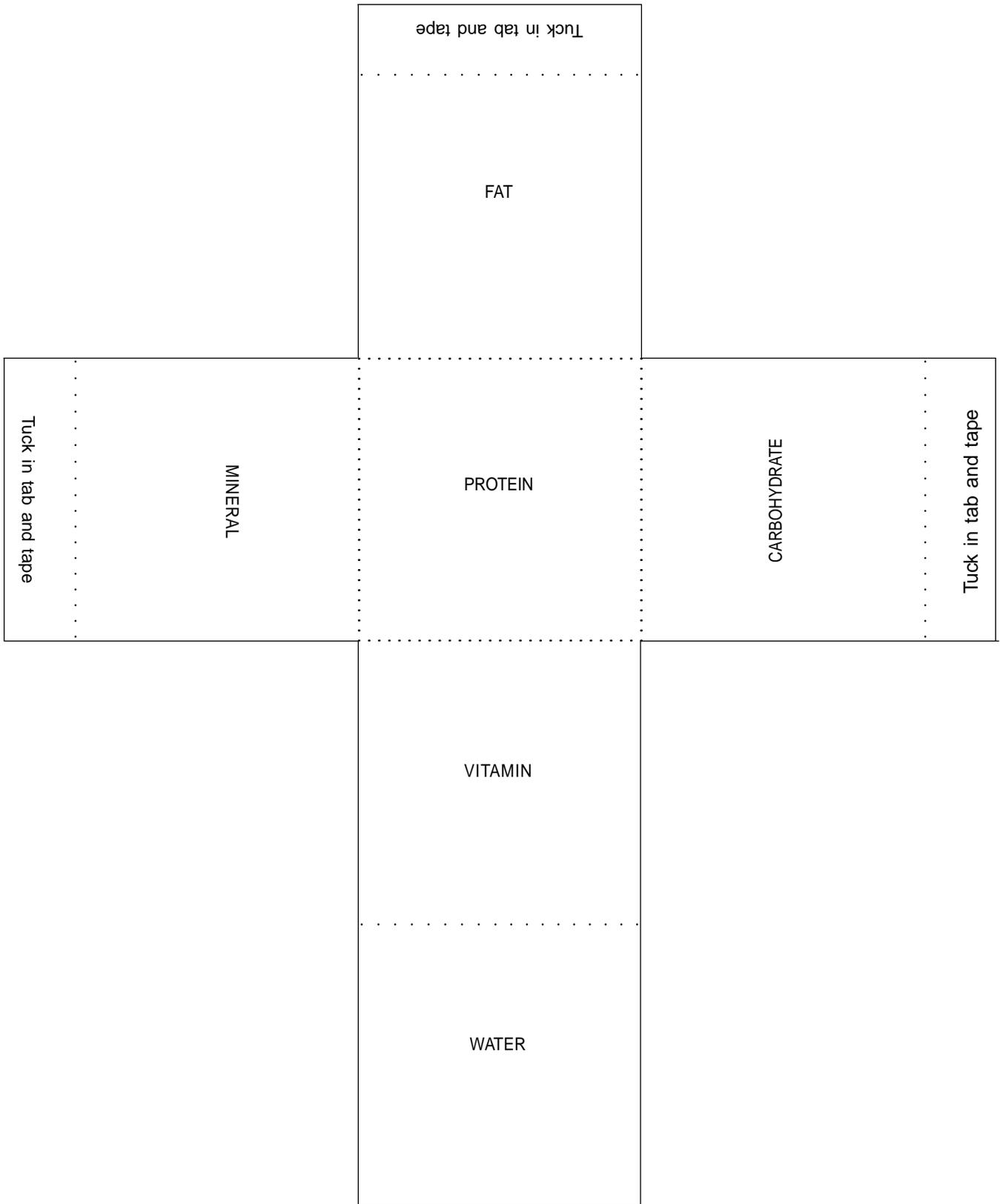
Water

- ✓ Why do you need to drink water every day?
ANS: To keep your body cells and tissue lubricated and prevent them from becoming dehydrated.
- ✓ Why can't you drink ocean water?
ANS: It has too much sodium (salt) in it and would be dangerous to your health.
- ✓ What animals are able to drink ocean water?
ANS: Animals that live in the ocean – fish and shellfish.



Building block game directions

- √ Each side of the block names a major nutrient that we need to grow and be healthy.
- √ Team members take turns rolling the building block.
- √ The leader uses the Question & Answer Sheet to ask the individual who rolled the block a question related to the word that comes up on the block.
- √ If the question is answered correctly, that person's team receives one point and another team member rolls the block.
- √ If the question is answered incorrectly, the other team rolls the block and has an opportunity to answer a question.
- √ The game continues until all the questions have been answered correctly.
- √ If all questions for a particular word have been asked and correctly answered, roll the block again to get a different word.



Directions:

Cut out box on solid line and fold on dotted lines. Fold the four squares together first to form box shape, tuck in tab and tape. Then fold in two remaining squares, tuck in tabs and then tape together to form cube.



Seaward Bound Passport

Age 10, group or independent

90 minutes, indoors or outdoors

Objective: Evaluate personal eating habits by recording and discussing daily food consumption.

Materials: Gyotaku directions and materials, Seaward Bound Passport, crayons, pencils, scissors, stapler

Get set

- √ Duplicate and distribute a seaward bound passport for each individual.

Go catch

- √ Assemble passports.
- √ Use the passport to review the U.S. Department of Agriculture's *Food Guide Pyramid* and the food groups.
- √ Explain that the food guide pyramid is a passport to good health and growth. It should guide what we eat every day.
- √ Emphasize that honesty is the best policy for keeping passports in good shape.
- √ Have individuals take their passports home to record what they eat in the My Day's Pyramid.
- √ Have individuals complete For I'm Staying Healthy (F.I.S.H.) menus with foods that they like.
- √ Ask individuals to compare how their eating record and menu selections compare with the food guide pyramid's recommended servings.
- √ Review completed passports and how easy it is to follow the pyramid guide. Suggest healthy changes. Note that diets may be different and still be healthy.
- √ Ask what would happen to the amount of saturated fat or calorie content if fish was the main source of protein.
- √ Follow Gyotaku directions to make fish stamps for passports.

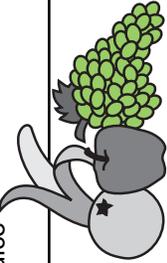
Sailing

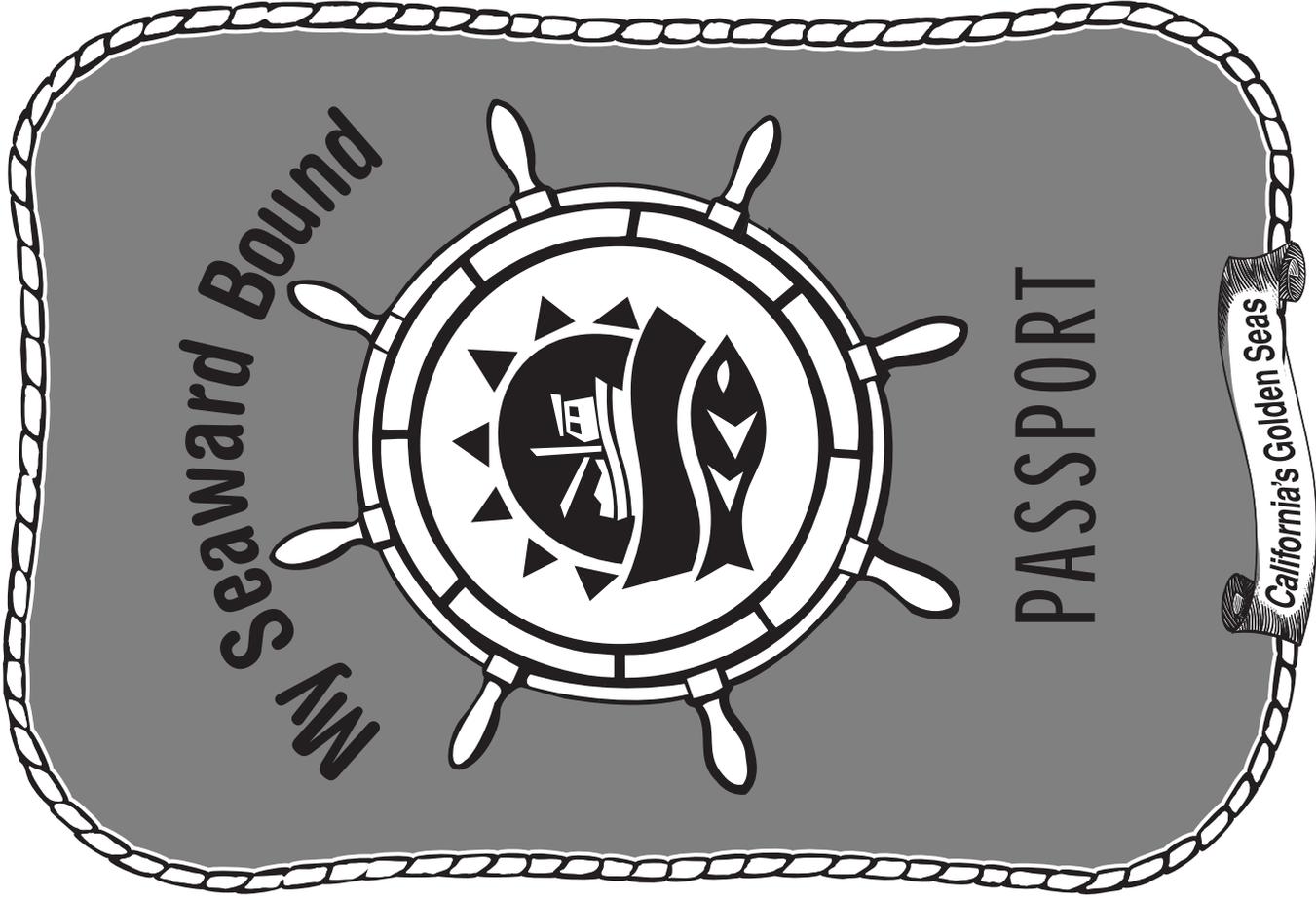
- √ Plan a menu that features fish for a Smooth Sailing Bon Voyage Party.
- √ Ask participants to determine if the menu meets at least 1/3 of the food guide pyramid's daily serving requirements.
- √ Ask class to evaluate a dinner at home and discuss healthy changes.

INSTRUCTIONS: Cut out pages along dashed line. Place pages 3-4 face up on top of pages 1-6, then fold both in half along dotted line.

CUT ALONG DASHED LINES

FOLD ALONG DOTTED LINE

<h2 style="text-align: center;">Food Groups</h2>		<p>Milk, Yogurt and Cheese</p> <ul style="list-style-type: none"> 1 cup of milk or yogurt 1 1/2 ounces of natural cheese 2 ounces of processed cheese 		<p>Meat, Poultry, Fish, Dry Beans, Eggs and Nuts</p> <p>2-3 ounces of cooked fish, shellfish, lean meat or poultry 1/2 cup of cooked dry beans, 1 egg or 2 tablespoons of peanut butter count as 1 ounce of lean meat</p>		<p>Vegetable</p> <ul style="list-style-type: none"> 1 cup of raw leafy vegetables 1/2 cup of other vegetables, cooked or chopped raw 3/4 cup vegetable juice 		<p>Fruit</p> <ul style="list-style-type: none"> 1 medium piece, for example apple or orange 1/2 cup of chopped, cooked or canned fruit 3/4 cup of fruit juice • 1/4 cup dried fruit
		<p>Bread, Cereal, Rice and Pasta</p> <ul style="list-style-type: none"> 1 slice bread • 1 ounce of ready-to-eat cereal 1/2 cup of cooked cereal, rice or pasta 						



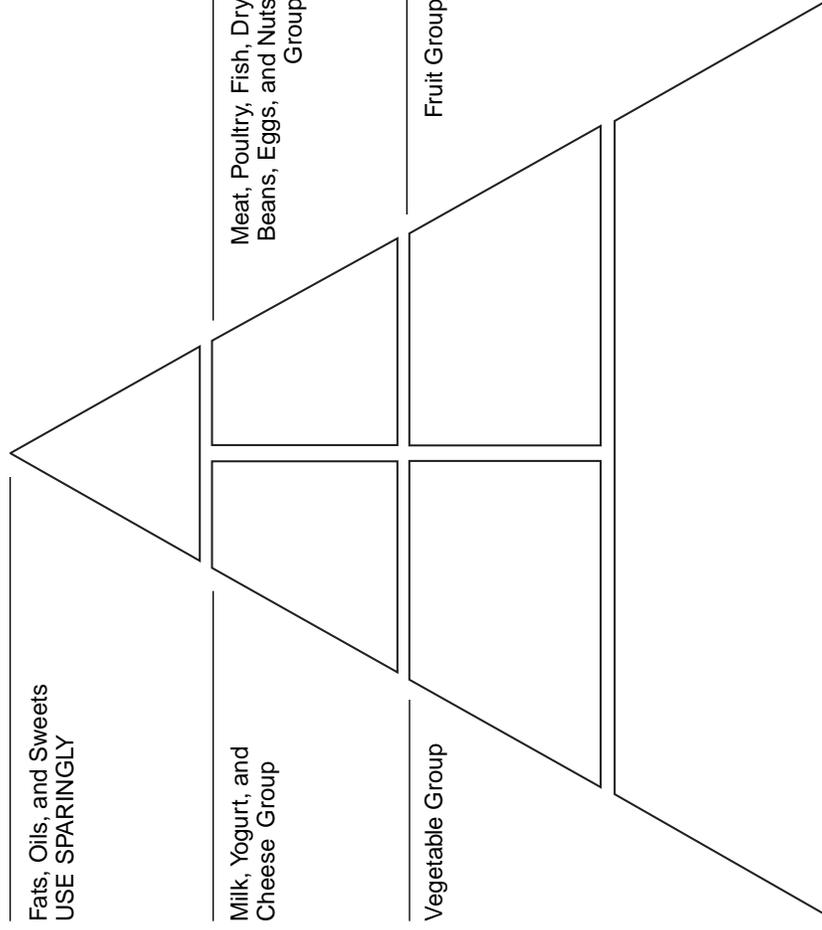
INSTRUCTIONS: Cut out pages along dashed line.
Place pages 3-4 face up on top of pages 1-6, then
fold both in half along dotted line.

For I'm Staying Healthy

(F.I.S.H.)		PYRAMID FOOD GROUPS		
DAILY SERVINGS	GRAIN 6-11	FRUIT 2-4	VEGETABLE 3-5	
Menu 1	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____	1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____	
Menu 2	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____	1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____	
Menu 3	1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____	1. _____ 2. _____ 3. _____ 4. _____	1. _____ 2. _____ 3. _____ 4. _____ 5. _____	

My Day's Pyramid

Write in the Foods in Each Food Group
That Were Eaten



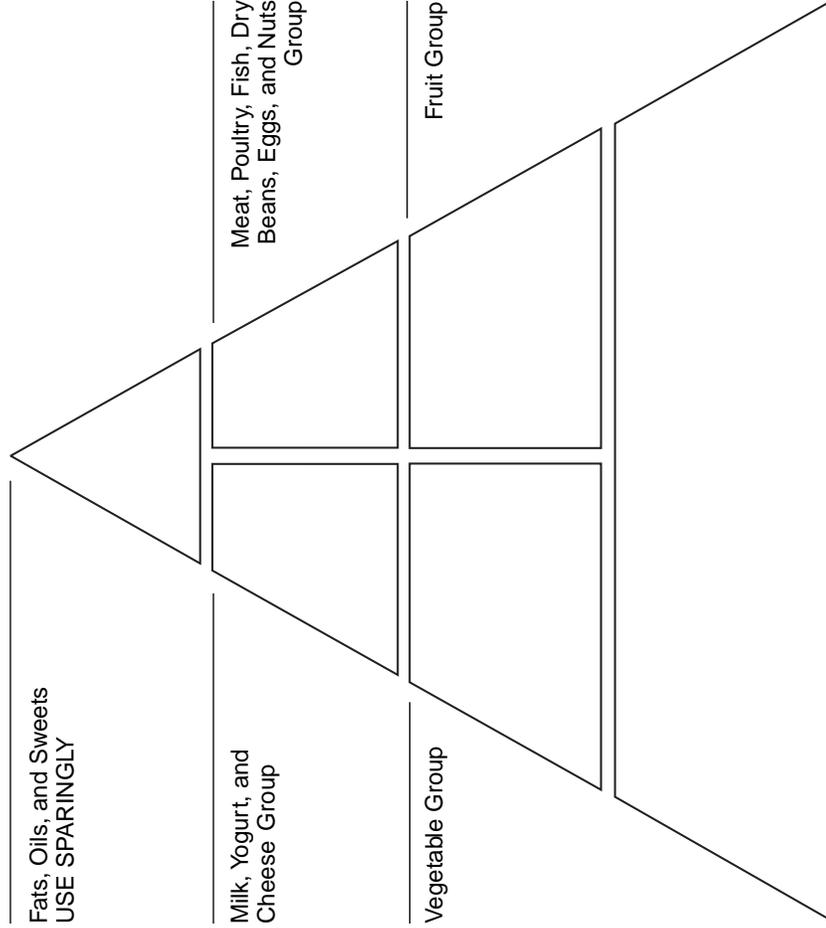
Bread, Cereal, Rice, and Pasta Group
6-11 SERVINGS

Breakfast and Morning Foods

INSTRUCTIONS: Cut out pages along dashed line.
Place pages 3-4 face up on top of pages 1-6, then
fold both in half along dotted line.

My Day's Pyramid

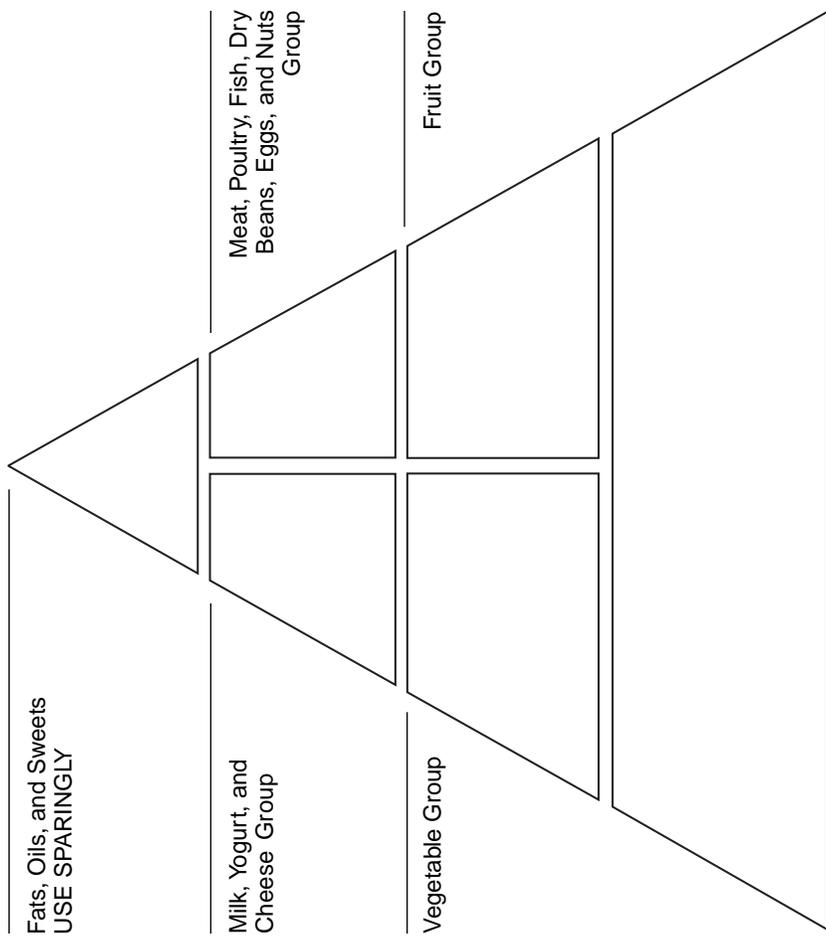
Write in the Foods in Each Food Group
That Were Eaten



Lunch and Afternoon Foods

My Day's Pyramid

Write in the Foods in Each Food Group
That Were Eaten



Dinner and Evening Foods



GYOTAKU directions

GYOTAKU, Japanese fish painting, is an excellent way to make fish stamps or fish art.

Materials

Small frozen fish, such as smelt, are excellent for stamps. (Larger fish work well for art on larger surfaces.)

1/2" to 1" brush, paper towels, ink, passports or absorbent paper or other absorbent material.

Steps

- ✓ Pat dry the frozen fish.
- ✓ Place the fish on newspapers.
- ✓ Paint the fish from head to tail with a thin coat of ink. Be sure to leave the eyes unpainted.
- ✓ Reverse the direction and stroke the fish with ink from tail to head.
- ✓ Place paper on the fish.
- ✓ Rub the paper so that the ink is absorbed into the paper. When you are finished rubbing, remove the paper.
- ✓ Let the ink dry.
- ✓ Sign your Gyotaku as the Japanese do by putting the date and your initials.

Note: You can prepare a variety of Gyotaku with different species of fish. Be sure to label the species, their habitat, and what they like to eat.



Hooked on Quality

Age 10, group or independent

90 minutes, indoors or outdoors

Objective: Evaluate quality in seafood and develop a song, rap or poem using key quality words.

Materials: *The Seafood Review* (see appendix), paper, pencils

Get set

- ✓ Duplicate *The Seafood Review* and distribute with paper and pencils.

Go catch

- ✓ Announce that each individual should have an eye on quality for health, safety and good flavor when it comes to seafood.
- ✓ Read *The Seafood Review* individually or as a group.
- ✓ Ask individuals to identify five key words for seafood quality and write them at the top of their papers. (For example, Refrigeration, Temperature, Storage, Container, Preparation.)
- ✓ Discuss the importance of each of the key words as an issue in seafood quality.
- ✓ Ask individuals to write a song, rap or poem to emphasize key points for seafood quality.
- ✓ Ask each individual to read or perform the song, rap or poem for the group.

Sailing

- ✓ Ask individuals to share the song, rap or poem with the person at their home who prepares and buys the food.
- ✓ Ask individuals to print the song or poem and place it on their refrigerators at home.
- ✓ Have some of the songs, raps or poems announced over the public announcement system at school.



Track me on Land or Sea

Age 10, small groups

90 minutes, indoors or outdoors

Objective: Summarize the seafood industry's impact on California's economy, coastal communities, food supply and livelihoods by investigating the state's past and present seafood industry.

Materials: Stickers, California map, track-me sheet, top landing sheet, California Seafood Index, California's Golden Seas poster, *California's Golden Seas* booklet (see appendix), Facts in Brief, clear self-adhesive contact paper (optional)

Get set

- ✓ Duplicate and distribute materials.
- ✓ Cut out species stickers and place them in a shoe box.
- ✓ Place the map where it is easily accessible. Protect the map with the clear self-adhesive contact paper.
- ✓ Form small groups.

Go catch

- ✓ Have groups take turns drawing a sticker out of the box.
- ✓ Brainstorm and answer the questions on the track-me sheet that correspond to the species drawn. (Use *California's Golden Seas* booklet and poster, top landing sheet, and California Seafood Index.)
- ✓ Place the sticker on the area of the map where the species is caught.
- ✓ Discuss jobs directly and indirectly provided by the fishing industry (fisher folk, processing crews, boat builders, gear manufacturers, restaurants, fish markets etc.)

Sailing

- ✓ Play Track Me at home with family and friends.
- ✓ Learn if there are, or ever were, fishermen or fisherwomen in the family. If so, Who? When? What did they fish for? How did they do it? Any special stories?



Track-Me Sheet

Name _____

Species:

Do other states or countries harvest this species? Yes _____ No _____

If yes, what states or countries?

What California coastal ports land this species?

When is this species in season?

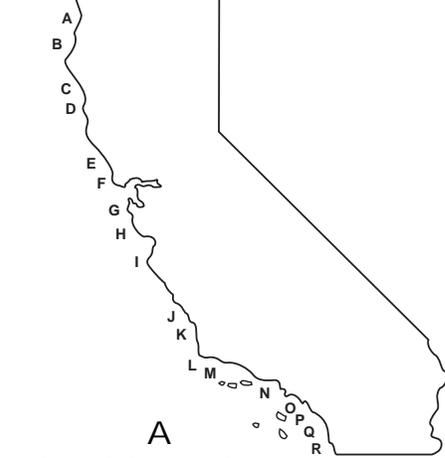
How is this species sold? Fresh _____ Frozen _____ Canned _____

For every dollar earned by commercial fisher folk, the value is multiplied more than four times through fish processing, handling, selling and industries that provide equipment. If fisher folk no longer had this species to catch, how would it affect the community and the state? (In addition to direct impacts to fisher folk and fish processing plants, think about jobs in restaurants, boat and gear manufacturers, transportation, and supporting industries such as paper companies that supply materials for packing.)

What jobs and health benefits are provided by seafood?

Top Landings by Port

CALIFORNIA



A
CRESCENT CITY
Pacific Ocean Shrimp
Dungeness Crab
Pacific Whiting
Thornyhead

B
EUREKA
Dungeness Crab
Sablefish
Rockfish

C
FORT BRAGG
King Salmon
Sablefish
Dover Sole
Sea Urchins

D
ALBION
POINT ARENA
Sea Urchins
Dungeness Crab
King Salmon

E
BODEGA BAY
King Salmon
Dover Sole
Dungeness Crab
Sea Urchins

F
SAN FRANCISCO
Pacific Herring
King Salmon
California Halibut
Swordfish
Dungeness Crab

G
HALF MOON BAY
King Salmon
Dungeness Crab
Market Squid
Rockfish

H
MOSS LANDING
King Salmon
Swordfish
Rockfish
Dover Sole

I
MONTEREY
Market Squid
King Salmon
Swordfish
Rockfish

J
MORRO BAY
King Salmon
Swordfish
Thornyhead
Dover Sole

K
AVILA
Dover Sole
Rockfish
King Salmon
Rock Crab

L
SANTA BARBARA
Sea Urchins
Spiny Lobster
Rock Crab
Ridgeback Prawns

M
VENTURA-OXNARD
CHANNEL ISLANDS
Sea Urchins
Spot Prawns
Market Squid
California Halibut

N
SAN PEDRO
LOS ANGELES
Tuna
Mackerel
Sardines
Squid

O
LONG BEACH
Spot Prawns
Spiny Lobster
Sheephead

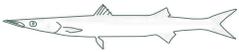
P
NEWPORT BEACH
Sablefish
Spot Prawns
Rockfish

Q
DANA POINT
Spiny Lobster
Sea Urchins
Swordfish

R
SAN DIEGO
Swordfish
Sea Urchins
Spiny Lobster
Thresher Shark

CALIFORNIA SEAFOOD INDEX

Availability Flavor Texture Processed Forms Preparation Tips
(Season)

Barracuda  Calories: 120/Protein: 22 gm/Fat: 2 gm		F	t		Well suited to grilling and broiling. Try serving grilled barracuda with a creamy, nonfat cucumber sauce or avocado salsa.
Californi Halibut  Calories: 120/Protein: 22 gm/Fat: 2 gm		<i>f</i>	t		Thick fillets and steaks are great grilled or BBQ'ed. Baste during cooking. Small fillets are good sautéed, steamed or poached. Thin fillets can be rolled, with or without stuffing.
Mackerel  Calories: 190/Protein: 21 gm/Fat: 12 gm		F	t		Bake whole fish in spicy tomato sauce. Fillets and steaks can be grilled, BBQ'ed or broiled. Try marinating in teriyaki, Italian or Jamacian jerk sauce first.
Rockfish  Calories: 100/Protein: 20 gm/Fat: 2 gm		<i>f</i>	t		A versatile fish that adapts well to any cooking method: bake, steam, grill, BBQ, poach, or pan fry. Whole fish are great steamed in foil or parchment.
CA King Salmon  Calories: 153/Protein: 17 gm/Fat: 9 gm	 (May 1–Sept. 31)	F	t		Whole fish or fish roasts are excellent for poaching or BBQ'ing. Steaks and fillets can be broiled, grilled, poached or BBQ'ed. Great with dill, lemon or cucumbers.
Sanddab Sole  Calories: 100/Protein: 21 gm/Fat: 1 gm		<i>f</i>	<i>t</i>		Small whole fish may be pan fried or steamed in foil or parchment. Fillets are great poached or sautéed. Fillets may also be rolled and baked in sauce.
Sardine 		F	<i>t</i>		Pan fry, saute or bake in a spicy sauce. This full-flavored fish is especially tasty when served fresh.
Shark  Calories: 111/Protein: 18 gm/Fat: 4 gm	 (Aug. 15–Dec. 15)	<i>f</i>	T		Steaks or fillets can be grilled, BBQ'ed, broiled, batter fried, poached, steamed, stewed, or baked in sauce. A good choice for shish kabobs. Great poached, chilled and served with citrus.
Surfperch 		<i>f</i>	T		This moderate-flavored, firm-textured fish is also called sea perch. Poach, steam, sauté or pan fry. When pan frying, coat pan with cooking spray.
Swordfish  Calories: 132/Protein: 22 gm/Fat: 4 gm	 (Aug–Jan. 31)	<i>f</i>	T		A favorite for grilling, BBQ'ing and smoking. Steaks may also be broiled, baked, or steamed. Cut into chunks for stir fry dishes and kabobs. A good choice for robust flavored sauces.
Tuna  Calories: 158/Protein: 23 gm/Fat: 7 gm		<i>f</i>	T		Fresh or frozen tuna is great BBQ'ed. A good choice for kabobs. May also be poached, steamed, grilled or broiled. Avoid overcooking: tuna dries out easily.

Note: Nutritional Values listed are for 3-ounce portion.

CA Crab (Rock/Dungeness)  Calories: 73/Protein: 15 gm/Fat: 1 gm	 (Rock: Yearlong Dun: Nov.–July)	<i>f</i>	<i>t</i>		Boil or steam live crabs. After cooking, remove meat from shell and serve with lemon or drawn butter. Also great in salads, soups, stews and casseroles.
CA Spiny Lobster  Calories: 100/Protein: 20 gm/Fat: 1 gm	 (Oct.–Mid March)	<i>f</i>	T		May be boiled or broiled. Serve plain with lemon or drawn butter, or use cooked meat in salads, stir-fry dishes, casseroles, soups or stews. Especially good with citrus.
Prawn  Calories: 110/Protein: 22 gm/Fat: 2 gm		<i>f</i>	t		Cook with shells on or peeled off. Shrimp cook quickly: do not overcook. May be boiled, steamed, stir fried, sautéed, baked, or grilled. An excellent filling for crepes or omelettes. Cook quickly for best results. Tubes may be stuffed and fried or sautéed. Great in cioppino. Add rings and tentacles the last minute or two before serving. Also may be fried or steamed.
Squid  Calories: 78/Protein: 13 gm/Fat: 1 gm		<i>f</i>	T		
 California Seafood Council	 Winter Spring Summer Fall =Peak Season =Available	<i>f</i> =Mild <i>t</i> =Delicate f =Moderate t =Med. Firm F =Full T =Firm		 Fresh  Smoked  Canned  Smoked	



California Seafood Facts in Brief

California's Seafood Harvest:

California's fishing industry ranks among the top four producing states in the United States in volume of seafood harvested.

1996 Landings:

Pounds landed:	458.6 million pounds (up from 424.7 million pounds in 1995)
Dockside value:	\$183.6 million ex-vessel (up from \$158.5 million in 1995)
Multiplied value:	\$826 million (approximate wholesale value), up from \$713 million in 1995)

Consumption trends:

National consumption of seafood declined slightly in 1996: per capita seafood consumption nationwide was estimated at 14.8 pounds per person (down from 15 pounds per person in 1995).

California seafood trends:

√ According to a statewide survey, there was no significant difference among respondents as to where they are more likely to eat seafood: one third prefer home over away from home, another third prefer away over home, and the final third indicate no preference. Heavy seafood consumers are more likely to eat seafood at home. Where do you most often eat seafood?

√ 7 out of 10 Californians reported eating fresh or frozen seafood at least once a month. Almost half of this group said they eat seafood at least once a week. How often do you eat seafood?

√ According to a 1993 consumer survey, favorite seafoods reported, in order of popularity, include: shrimp, salmon, halibut, Pacific snapper, crab, trout, lobster, sole, catfish, cod, tuna, shark, swordfish.

Regional differences: Northern Californians favor salmon, crab, trout and sole
Southern Californians favor halibut, shark, swordfish, mahi

1994 Consumer Expenditure Survey

√ U.S. Average	\$89		
√ Northeast	\$123	South	\$86
Midwest	\$62	West	\$96

(Source: Average annual expenditure compiled by the Bureau of Labor Statistics)

California Seafood Facts in Brief – 2

California's Fishing Industry

- √ California's fishing industry is one of the oldest industries in California. Commercial fishing is a traditional industry, steeped in history. Immigrants from Europe and Asia, as well as early pioneers who settled in California, played a major role in the development of fishing ports in coastal communities, from Crescent City in the north to San Diego in the south.
- √ Today's commercial fishing industry may be characterized as a traditional industry with a contemporary outlook.

Fishing Techniques

- √ Steeped in tradition, California's commercial fishermen use a variety of gear types to catch more than 300 species of fish and shellfish in our coastal waters.
- √ Major gear types include hook and line, traps or pots, harpoons, roundhaul nets, trawl nets and gill nets. California fishermen and their gear are among the most heavily regulated in the world.

Seafood Consumption

- √ California ranks as one of the the highest seafood-consuming areas in the U.S. and is known to have one of the largest seafood markets in the country. Seafood producers worldwide target California's seafood market. As a result, California supermarkets and restaurants offer a variety of seafood from all over the world, in addition to fish and shellfish produced in California.
- √ Consumer surveys indicate that Californians place high value on "fresh, local" seafood. Which local seafoods have you eaten, and which do you like best?



Chart the Harvest

Age 10, group or independent

45 minutes, indoors or outdoors

Objective: Summarize gear used for harvesting different seafood species and the locations along the California coast where the different species are found and harvested.

Materials: California's Golden Seas Gear Harvest Chart, California plotting map, stickers, pencils.

Get set

- ✓ Duplicate and distribute materials.
- ✓ Cut out stickers, one set for each individual or group.

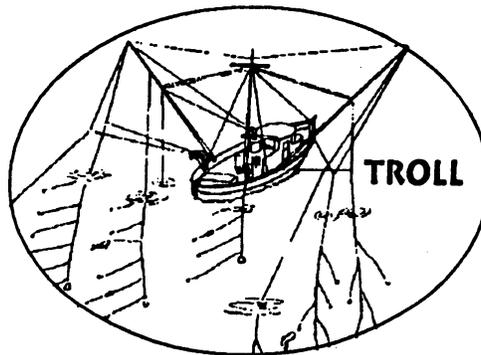
Go catch

- ✓ Review California's Golden Seas Gear Harvest Chart.
- ✓ Explain that seafood is the harvest of the sea, just as other foods are the harvest of the land. Ask what harvest gear is used on land (tractors, mechanical harvesters, ladders, sacks, etc).
- ✓ Locate on the map an area where a species might be harvested and the gear that fisher folks would use to harvest it.
- ✓ Plot the location by placing the gear sticker and the species sticker on the proper map location.
- ✓ Check to see if the placement is correct by reviewing the chart.
- ✓ Discuss as a group the gear type used for each species and the advantages of that particular gear type.

Sailing

- ✓ Visit a harbor when seafood is being delivered and processed.
- ✓ Note the different species, the location of the harbor, and the time of year.
- ✓ Ask a fisherman or fisherwoman how far out they traveled and how deep they fished.
- ✓ Discuss why the catch included certain species OR visit a retail seafood market or restaurant.
- ✓ Observe how seafood is prepared for eating.
- ✓ Ask about different forms of processing, such as whole, fillets, steaks, etc.

California's Golden Seas gear-harvest chart



Description

One of many ways to fish with hook and line, troll gear consists of as many as six stainless steel lines that unwind from spools, called gurdies, mounted on the fishing boat. Poles on each side of the boat help spread out the lines. Lines have leaders and hooks attached to them at 3 fathom (18-foot) intervals when fishing for salmon. The hooks are baited with herring or anchovies or manmade "hardware" (called spoons, plugs and hoochies) that attract fish.

Fisher folk who use this type of gear are called trollers. They "troll" for fish at a speed of 2 to 2 1/2 miles an hour for salmon; 4 to 6 miles per hour for albacore.

Harvest

King salmon

Bocaccio rockfish

Albacore tuna

California halibut

Location

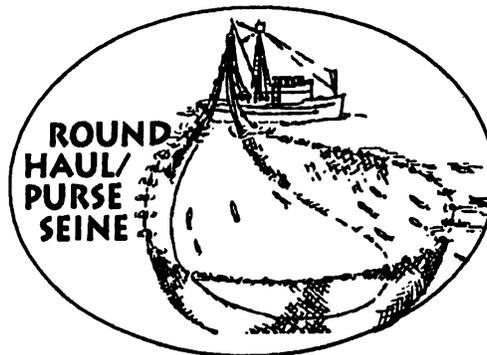
Northern and central California. Near shore in water up to 400 feet deep. Cloudy, green upwelled water.

Along the California coast in water 150 to 1,000 feet deep. Rocky, hard ocean bottom. Rockfish also are caught with longlines.

Subtropical and temperate ocean waters from the Philippines and Hawaii, along the California coast to Alaska.

Central and southern California. Sandy bottom near rocky reefs, kelp beds, mouth of streams, in cloudy water. Harvested near shore in spring and summer in water to approximately 100 feet deep.

California's Golden Seas gear-harvest chart



Description

Round-haul purse seine and lampara nets are often pulled by a small motor skiff to quickly encircle fish, catching them in a bag of webbing. Lampara nets act like a big scoop. Purse seine nets have a drawstring on one end that pulls the net closed, much like the drawstring of a purse.

Purse seine nets have been used in California since the mid-1800s when Chinese fishermen used them in Monterey Bay to catch squid.

Sicilian fishermen introduced another type of round-haul net, the lampara, in Monterey and San Pedro in the early 1900s. This fishing technique evolved to the modern methods used to catch schooling fish such as squid, sardines, mackerel and tuna.

Harvest

Market squid

Pacific sardines

Pacific mackerel

Bluefin tuna

Location

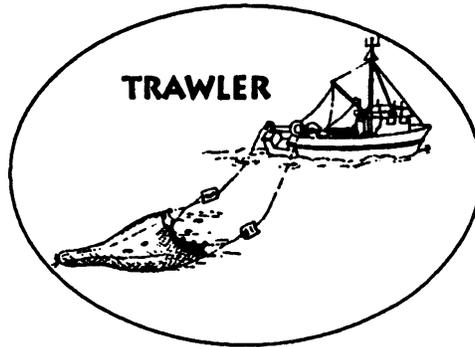
Fished in central and southern California. Close to the ocean bottom from near shore to depths of 800 feet or more on sandy bottom.

Fished along California coast in warm water cycles. Up to 100 miles from shore at depths of 150 feet or less.

Fished in central and southern California. Usually within 20 miles from shore at depths ranging from near surface to 300 feet.

Found in subtropical and temperate ocean waters from the Philippines and Hawaii to southern and central California. Occasionally appear in Southern California Bight.

California's Golden Seas gear-harvest chart



Description

Fisher folk use funnel-shaped "trawl" nets to catch fish that live on the ocean bottom at depths from 50 to 400 feet.

The small end of the net is the "codend." The large end (called wings) trails behind heavy steel doors, called "otter boards" that spread open the mouth of the net.

The mesh of the net is regulated and varies with the target species. Shrimp and prawns are caught with small-mesh nets. Halibut nets have larger mesh.

Trawl nets skim along the ocean bottom and are very effective in catching fish. Trawl nets also can be used to catch fish that group up in the water column. This type of net is called a "midwater" trawl.

Harvest

California halibut

Sea cucumber

Spot prawns (ridgeback prawns also caught in S.CA.)

Pacific Ocean (pink) shrimp

Rockfish

Dover sole

Location

Fished San Francisco to San Diego. Sandy bottom, near reefs. Harvested 1 to 8 miles from shore.

Fished in southern California. Muddy, sandy, rocky bottom 300 feet or more deep. Harvested 1 to 10 miles from shore.

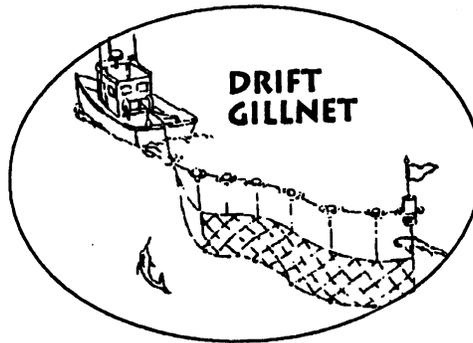
Fished in southern and central California. Ocean canyons in water 150 to 1,600 feet deep. Harvested 3 to 12 miles from shore.

Fished in northern and central California. Muddy-sand bottom 240 to 750 feet. Harvested outside 3 miles.

Fished coastwide. Rocky bottom 150 to 1,000 feet deep. Harvested 3 to 10 miles from shore.

Fished in northern and central California. Muddy bottom 1,000 to 4,500 feet.

California's Golden Seas gear-harvest chart



Description

Swordfish drift gillnets are up to 1 nautical mile (1,000 fathoms) long. They are set at dusk and allowed to drift 6 to 10 fathoms (36 to 60 feet) below the ocean's surface until dawn.

Gillnets may be set on the bottom or may be deployed to drift beneath the surface, attached to the boat.

Gillnets are one of the most size-selective fishing tools. Mesh sizes are regulated to control the size of fish caught: 4 1/2" to 5" for rockfish; 18" to 22" for swordfish and shark. Barracuda and white seabass also are caught with gillnets.

Besides mesh size, numerous seasonal and area closures also govern the use of gillnets.

Harvest

***Thresher shark
(drift net)***

***Swordfish
(driftnet)***

***Rockfish
(set net)***

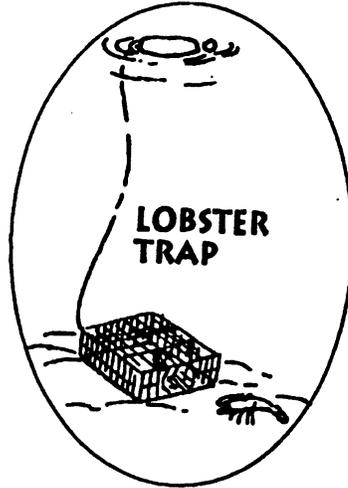
Location

Fished California to South America. Rarely more than 70 miles from shore. Colder, green-water side of ocean temperature fronts.

Fished Canada to Chile, most commonly from Oregon south. Warm, blue-water side of ocean temperature fronts. Surface waters to depths of 2,000 feet.

Fished along the California coast in water 150 to 1,000 feet deep. Rocky, hard ocean bottom. Harvested 3 to 100 miles from shore.

California's Golden Seas gear-harvest chart



Description

Traps, or pots, are typically constructed of wire, sometimes vinyl coated. Escape ports or rings allow undersized crabs, lobsters and other small species to escape. Trap doors are fastened with metal that dissolves in sea water.

If the traps become lost or can't otherwise be retrieved, the doors come off and the crabs or lobsters can escape.

The traps are attached to buoys marked with the fisherman's or fisherwoman's license number

Harvest

California spiny lobster

Rock crab

Dungeness crab

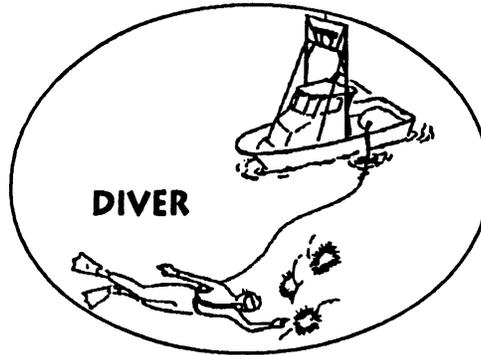
Location

Southern California. Sand, near rocky reefs. Muddy water where streams feed into the ocean. Found in shallow water during summer and up to 300 feet deep in winter. Fishing is prohibited from mid-March to early October to protect spawning stocks.

Central and southern California. Open sandy or rocky bottom. Found in water 30 to 240 feet deep.

Northern and central California. Intertidal to 300 feet deep on sandy or muddy bottom. Fishing season in the San Francisco area: November – June; in northern California above Bodega Bay: December – July

California's Golden Seas gear-harvest chart



Description

Divers use fast boats and “hookah” gear. The boat has an air compressor mounted on the deck. It pumps air through a long hose to the air regulator worn by the diver underwater. The air hose may be 600 feet or more long.

Divers use a two-pronged rake to pluck sea urchins off the rocks and reefs. The urchins are placed in net bags that can hold up to 300 pounds. When a bag is full, it is pulled up to the boat by a line tender on deck.

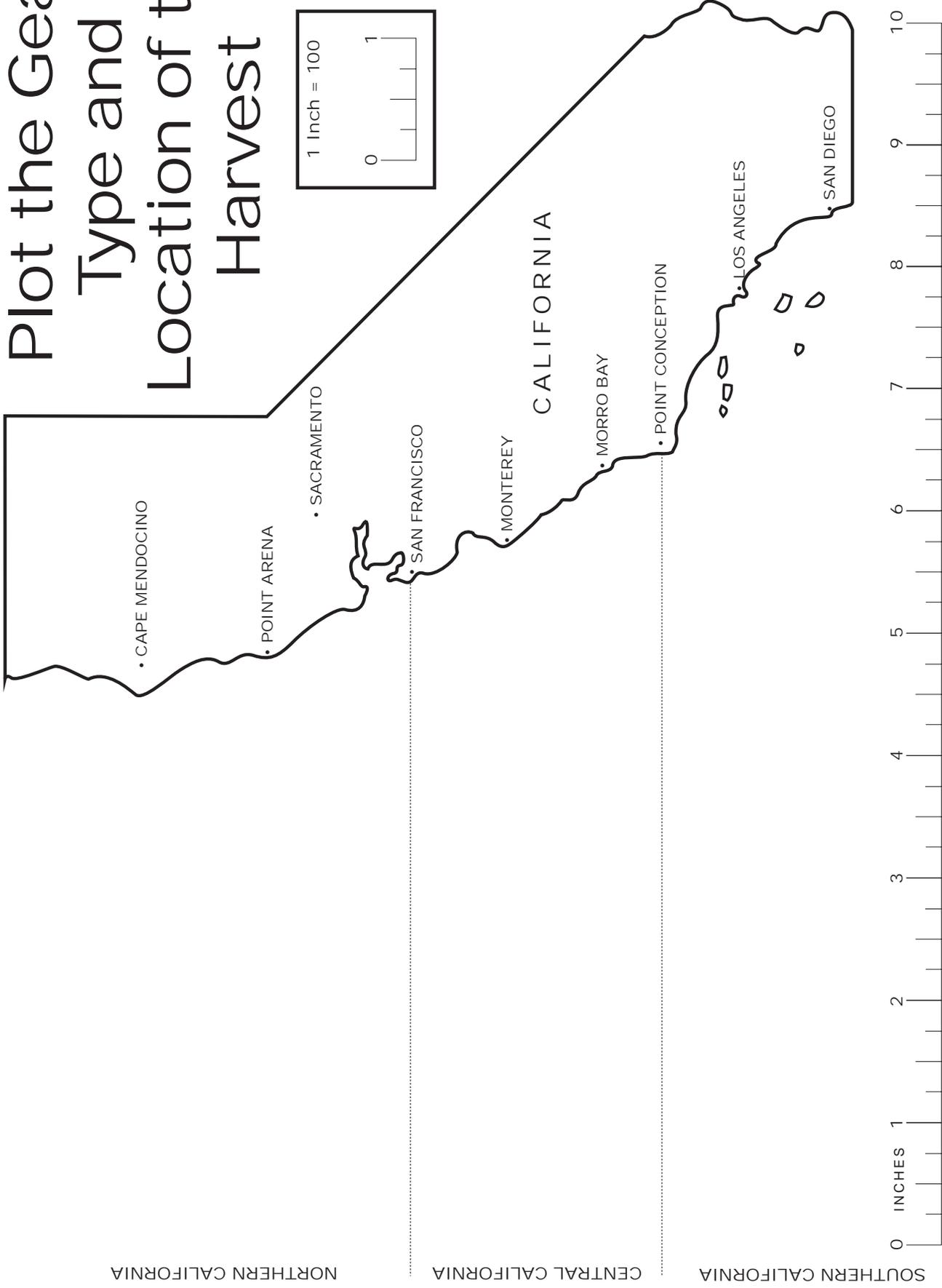
Harvest

Red sea urchins

Location

All along the California coast. Shallow intertidal zone to depths of 90 feet or more. Rocky areas, near ledges and crevices. Usually harvested at depths of 20 to 60 feet. Other species harvested by divers: purple sea urchins, sea cucumbers.

Plot the Gear Type and Location of the Harvest





Current Event

Age 10, group or independent

45 minutes, indoors or outdoors

Objective: Discover the effect that ocean currents have on seafood and fisher folk.

Materials: *A Current Event*. For sailing activity: current event experiments, rotating stool or lazy susan tray, basin, baking pan, Bunsen burner, food coloring

Get set

- √ Duplicate and distribute *A Current Event*.

Go catch

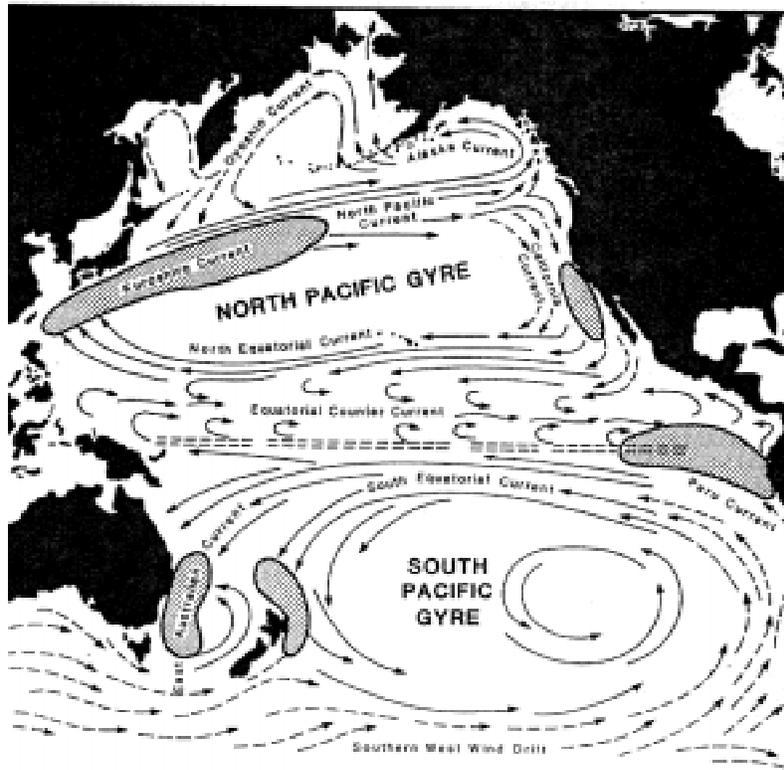
- √ Review *A Current Event*.
- √ Brainstorm how currents affect marine life and influence fisher folk in their decisions about where to fish.

Sailing

- √ Conduct experiments to determine the effect of the earth's rotation and the sun on currents.



A Current Event



Currents

Fisher folk know that the ocean has many streams of moving water. These streams are called **Currents**. A current is a flowing body of water or air. Like rivers on land, ocean currents usually, but not always, keep the same course. There are warm-water currents and cold-water currents.

Fisher folk know the directions that the warm and cold water currents flow. A warm water current called the **Davidson Current** flows northward along the southern California coastline. A cold-water current called the **California Current** flows from north to south along the coast to Point Conception, then offshore into the central Pacific. When the Davidson Current meets the California Current, the Davidson Current turns counterclockwise, forming a gyral current flow that circulates around the Southern California Bight.

A Current Event – 2

Movement of Currents

The earth is like a huge ball. If we divide the ball into two equal parts, we have the Northern and Southern hemispheres. The major currents flow around these hemispheres in circular patterns called gyres (JY-urz).

North of the equator, the movement of the currents is usually in a clockwise direction. (The Southern California Bight is one exception to this rule.)

South of the equator, the movement is generally counter clockwise.

There are two other special water movements that fisher folk track to help them make decisions about where they should look for fish and which species they should target.

Upwelling

The first special water movement is upwelling. In California, upwelling occurs in spring and fall when water on the ocean surface is displaced by strong northwest winds. When the winds push away the surface waters, deep, cold water rises to take its place, carrying with it nutrients from the deep ocean. These nutrients (primarily nitrogen and phosphorus) provide food for microscopic plants and animals (phytoplankton and zooplankton), and the plankton in turn provide food for larger fish and shellfish. Upwelled water is often green or coffee colored due to the abundance of microscopic life it harbors. Bait fish congregate in the upwelled water to feed on the plankton, and predator fish such as salmon and shark follow to feed on the bait fish. The result of upwelling is abundant and healthy sea life. Fisher folk seek out areas of upwelling to help them find fish.

Upwelling also helps to cool the California coast during summer. Upwelling causes summer fog along the coast as warm winds pass over the cold, upwelled water. Without upwelling, San Francisco would be as hot as Sacramento in the summer.

El Niño

El Niño is another special water movement that fisher folk watch carefully. El Niño is a warm-water flow that originates south of California and moves northward along the California coastline. The warm water of El Niño causes fish populations that prefer cooler water to move north, away from the El Niño influence. This shift also causes fisherfolk to move their fishing grounds or target other species.

Bait fish generally move north to cooler waters in an El Niño cycle, and larger fish follow. Albacore, swordfish, mackerel and halibut are usually abundant in southern California waters, but during El Niños their numbers increase in northern California and even farther north and decline in southern California. Fisher folk must be able to find and follow the fish in order to be successful in their business.



Current Event Experiments

Experiment 1 - Spinning Earth and Spinning Water

The sun warms up different parts of the earth faster or slower than other parts. Hot air rises and colder air moves in to take its place, creating winds. The earth's rotation affects the direction and speed of these winds. The wind creates currents. To see how this works, place a basin of water on a lazy susan tray or on a rotating piano stool. Spin the basin gently in a counterclockwise direction (right to left). Observe. Let the water rest until it is still. Rotate the basin in the opposite direction. What happens?

Experiment 2 - The Sun and the Ocean's Currents

The equator of our earth receives direct sunlight. This makes water near the equator warmer than water near the North or South poles. Fisher folk call the warm water "tropical waters." These differences in water temperature also create currents. The warm water near the equator expands and moves toward the poles. The colder, heavier water near the poles sinks and moves toward the equator. Currents caused by temperature changes are called convection currents. To see how convection currents work, fill a baking pan with water and gently heat one end of the pan with a Bunsen burner. Place several drops of food coloring on the cool side of the pan. Which way does the cold water move? When the colored water reaches the warm end of the pan, which way does it move?



Net (Web) of Life

Age 10, group

45 minutes, indoors or outdoors

Objective: Analyze the food chain through a game.

Materials: Food chain cards, "I Consume" list, 21 pieces of yarn or string (each 6 to 8 feet long), 21 cardboard anchors, tape

Get set

- ✓ Duplicate and cut out food chain cards.
- ✓ Tie one end of each piece of yarn to cardboard anchor.
- ✓ Distribute one piece of yarn with anchor to each player.

Go catch

- ✓ Have each individual tape a card on his/her chest.
- ✓ Form a circle.
- ✓ Read "I Consume" list.
- ✓ The person representing the species doing the consuming throws the anchor end of the string to the person representing the species that is being consumed. (If more than one species is being consumed, choose one.)
Individuals representing plankton, kelp, copepods and other food sources throw the yarn to a species that consumes that food.
- ✓ Continue until the list is done.
- ✓ Discuss the food chain concept:
 - Creatures at the bottom of the food chain are more plentiful because so many other creatures depend on them.
 - Each strand of yarn or string is a link in the food chain.
 - What would happen if one of the links were broken?
 - How do fishermen and fisherwomen make sure they do not disrupt the food chain? (regulations, licensing, permits, etc.)

Sailing

- ✓ Visit an aquarium and discover an ecosystem.
- ✓ Inventory creatures in the food chain.



I Consume List

- ✓ I am a **thresher shark**, and I consume anchovies, Pacific sardines and other small bait fish.
- ✓ I am a **California halibut**, and I consume anchovies, squid and other small fish.
- ✓ I am an **anchovy**, and I consume plankton and anchovy eggs.
- ✓ I am a **king salmon**, and I consume krill, anchovies, Pacific sardines and Dungeness crab larvae.
- ✓ I am a **rock crab**, and I consume clams, barnacles, snails, abalone and oysters.
- ✓ I am a **Pismo clam**, and I consume (filter feed on) plankton and other minute food particles.
- ✓ I am a **bocaccio rockfish**, and I consume smaller rockfish, anchovies and squid.
- ✓ I am a **Pacific mackerel**, and I consume small fish, squid and tiny crustaceans (shellfish).
- ✓ I am an **albacore tuna**, and I consume small fish, squid and crustaceans.
- ✓ I am a **California spiny lobster**, and I consume algae, small sardines and red sea urchins.
- ✓ I am a **red sea urchin**, and I consume kelp (mainly drift kelp).
- ✓ I am a **California market squid**, and I consume small crustaceans.
- ✓ I am a **swordfish**, and I consume squid, mackerel, anchovies, sardines and small crustaceans.
- ✓ I am a **red sea cucumber**, and I consume mud, sand and detritus (decaying organic matter).
- ✓ I am a **spot prawn**, and I consume shrimp and plankton.
- ✓ I am a **Pacific sardine**, and I consume copepods and plankton.
- ✓ I am **plankton** (microscopic plant or animal), and I produce food from nutrients in the water.
- ✓ I am **kelp**. I absorb nutrients from water and produce food for plant-eating species such as sea urchins.
- ✓ I am a **Dover sole**, and I consume shrimp, brittle stars and polychaete worms.
- ✓ I am a **copepod** (a tiny marine crustacean). I am consumed by many creatures, including mackerel and squid.
- ✓ I am **detritus** (organic particles in decaying marine life). I am consumed by scavenger fish and shellfish and sea cucumbers.

Food Chain Cards

✂ CUT ALONG DASHED LINES

✂ CUT ALONG DASHED LINES

ALBACORE
TUNA

BOCACCIO
ROCKFISH

CALIFORNIA
HALIBUT

DOVER
SOLE

KING
SALMON

PACIFIC
MACKEREL

PACIFIC
SARDINE

SWORDFISH

ROCK CRAB

THRESHER
SHARK

CALIFORNIA
MARKET SQUID

✂ CUT ALONG DASHED LINES

✂ CUT ALONG DASHED LINES

CALIFORNIA
SPINY LOBSTER

RED SEA
CUCUMBER

RED SEA
URCHIN

PRAWNS
(SHRIMP)

✂ CUT ALONG DASHED LINES

✂ CUT ALONG DASHED LINES

ANCHOVIES

PLANKTON

CLAMS

KELP

 CUT ALONG DASHED LINES

 CUT ALONG DASHED LINES

DETRITUS

COPEPODS



On Course

Age 10, group or independent

Tides & Waves

45 minutes, indoors or outdoors

Objective: Discover the effect that weather, moon phases, and time of day and year have on water movement (tides and waves), as well as on the decisions of fisher folk.

Materials: *On Course* facts and trivia sheets, *On Course* questions, pencils.
Sailing activity: Waterscope (see waterscope directions for materials.)

Get set

- ✓ Duplicate and distribute *On Course* facts and trivia and questions.

Go catch

- ✓ Read and review *On Course* facts and trivia.
- ✓ Answer *On Course* questions.
- ✓ Discuss the answers.

Sailing

- ✓ Share the *On Course* trivia and questions with family members and friends.
- ✓ Visit the seashore and make a “waterscope” to view what fishermen and fisherwomen can see at low tide.
- ✓ Review the plant and animal species that might be observed during low tide near a rocky shore area.



On Course Facts & Trivia

What are tides?

Ancient mariners thought tides were caused by the breathing of an earth monster. Later in history when humans began recording the events around them, they found that tides were closely related to the movements of the moon and the sun.

Tides are caused primarily by the gravitational pull of the moon. Although the sun is much larger than the moon, the moon is closer to the earth and exerts more gravitational pull than the sun. The moon's gravitational pull causes a movement of water like a massive "wave." One such movement occurs on the side of the earth facing the moon and other "wave" occurs on the opposite side of the earth.

The earth makes a complete revolution once every 24 hours. This constant motion puts different sections of the earth's oceans under the moon's gravitational influence during the course of a day, resulting in a daily cycle of two high tides and two low tides. However, this tidal cycle occurs (on the average) not every 24 hours, but every 24 hours and 50 minutes. The extra 50 minutes is due to the rotation of the moon around the earth once each month, moving in the same direction as the earth revolves. Therefore, the moon has changed position in relation to a spot on the earth during the 24 hours in which the earth makes a complete revolution. As a result, it takes an average of 50 minutes extra each day for a spot on the earth to "catch up with" (or pass under) the moon.

Spring tides are the highest and the lowest of the tides. **Neap tides** are the opposite of the spring tides and show the least difference between high and low tide. The change from spring tides to neap tides is gradual, depending on the positions of the moon and the sun in relation to the earth.

Spring tides occur at the time of the **new moon** and the **full moon**. Neap tides occur when the moon is in the **first quarter** and the **last quarter**. At these times, the sun and the moon form a 90-degree angle with each other, resulting in the least amount of gravitational pull on the water.

On Course Facts & Trivia – 2

What is the Intertidal Zone?

The waves, tides, air and sun create a special environment along the seashore that is known as the intertidal zone. The intertidal zone is the area that is between the high tide line and the low tide line. It is alternately covered with water and exposed to air. The intertidal zone is habitat, or home, for animal and plant life that can live in sunlight, breaking surf and waves and changing tides. Most of the animals hide or hang onto rocks or other things in the sea because of the crashing surf. Most of the animals and plant life adapt well to changing environmental conditions.

Tidepools are formed in the intertidal zone during low tides. Tidepools are very delicate areas, and care should be taken when exploring tidepool areas. In California, tidepools are protected by law. Anyone caught removing or harming tidepool life may be fined as much as \$500.

Tide Trivia

During low tide, intertidal creatures (organisms) are exposed to the air. They must not dry out, and they must withstand air temperatures which vary from hot in summer to bitter cold in the winter. Some organisms have adapted to prevent drying out. How do you think they protect themselves to keep from drying out?

- √ Did you know that snails withdraw into their shells, and some snails then secrete a mucus seal to protect themselves?
- √ Did you know that anemones gather in large masses to reduce the body surface area exposed to the air?
- √ Did you know purple sea urchins retain water inside their shells (known as a test) during low tide so their internal organs do not dry out?
- √ Did you know that seaweeds are protected by their vast numbers? The upper layers of seaweed shelter the lower layers so that only a few plants are sacrificed to protect the entire group.
- √ Did you know that mussels close their shells tightly to retain water to protect themselves?

On Course Facts & Trivia – 3

What are waves?

Waves are swells of water that eventually end their journey on some beach where they become breakers, or surf. Waves have a crest and a trough. The crest is the highest part; the trough is the lowest. The vertical distance between crest and trough is the wave height. Waves you commonly see at the seashore are wind waves. They are caused by wind blowing across the water. The size of wind waves depends on three factors: the distance over which the wind blows, the strength of the wind, and the length of time the wind blows. If all three factors are large, the waves are large.

Waves affect the behavior of sea life. Large waves cause sea urchins and abalone to clamp down on rocks. Large waves and crashing surf create turbulence and cause crab and lobster to move to deeper water offshore.

The most spectacular kind of wave is the seismic wave, or tidal wave. Seismic waves are caused by earthquakes, usually underwater but sometimes on land. Seism means earthquake in Greek. The scientific name for a seismic wave is tsunami (soo-nah'-mee), the Japanese word for seismic wave.

People on a ship at sea would hardly notice a tsunami because the crest and the trough are so far apart. But the situation changes in shallower water where the waves may become breakers as high as 100 feet. When a seismograph station detects an earthquake, a warning is sent to all areas that might be hit by a tsunami.

Wave Trivia

Intertidal plants and animals must survive the action of the waves. Intertidal organisms protect themselves from being smashed against rocks or cast up and stranded on beaches in different ways.

- √ Did you know that animals such as abalones secure themselves to rocks with their strong muscular feet?
- √ Did you know that plants such as kelp secure themselves to the ocean floor with their holdfasts?
- √ Did you know that marine animals hide from the waves by crawling under or between rocks or plants?
- √ Did you know that crabs and lobsters crawl into crevices in rocks, and small animals hide in kelp?
- √ Did you know that some algae grow under rock ledges to protect themselves?
- √ Did you know that some crabs burrow into sand?
- √ Did you know that mollusks, such as mussels, clams and abalones have shells to protect themselves?

On Course Questions & Answers

1. What can a fisherman or fisherwoman with a permit or license harvest in the low tide zone near rocky areas? **ANSWER:** *Sea urchins, mussels*
2. If a fisher folk goes to sea at high tide and leaves at 5 a.m., what time will he/she leave the next day to leave at high tide? **ANSWER:** *5:50 a.m.*
3. If wind from winter storms causes large waves near shore, where would you go to catch spiny lobster? **ANSWER:** *Offshore*
4. If a tidal wave occurs when a diver is gathering sea urchins near shore and a fisherman is fishing 20 miles offshore, who would most likely feel the tidal wave, the diver or the fisherman?
ANSWER: *The diver, because offshore where the water is deeper the crest and trough of waves are much farther apart. In shallow water they are closer together and the waves could be 100 feet high during a tidal wave.*
5. California halibut eat anchovies. If anchovies like cloudy, green water caused by plankton blooms, would you fish for halibut in clear water or in water with plankton? **ANSWER:** *In water with plankton.*
6. If tuna like clear, blue water so they can see other fish that they want to eat, would you fish for tuna in deep water or shallow wavy water?
ANSWER: *Clear, deep blue water that is sometimes called tuna water.*
7. Spiny lobsters do not like rough water in winter when storms come. Lobster move to deep waters in stormy weather. If you were a fisherman or fisherwoman, where would you put your lobster traps, if you know a storm was coming? **ANSWER:** *In deeper offshore water.*
8. Sardines migrate north along the coast in spring and summer. The largest fish go as far north as Canada. In fall, schools of sardines return to Southern California waters. If you wanted to catch sardines during winter, where would you fish? **ANSWER:** *In Southern California because that is where sardines concentrate in winter.*
9. Some fishes are active at dawn and at dusk. Gillnets catch active fishes that swim into the net. What times may be best for fishing with a gillnet?
ANSWER: *Either dawn or dusk.*
10. Squid are attracted to light. Fisher folk shine bright lights from their boats at night to attract squid to the surface. When is the best time to catch squid?
ANSWER: *At night.*

Tides



○
MOON

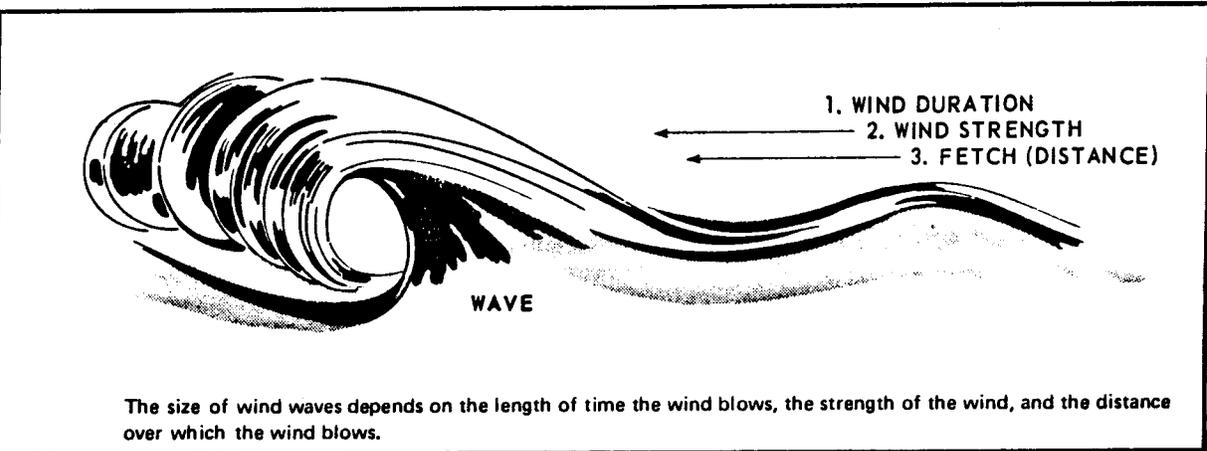
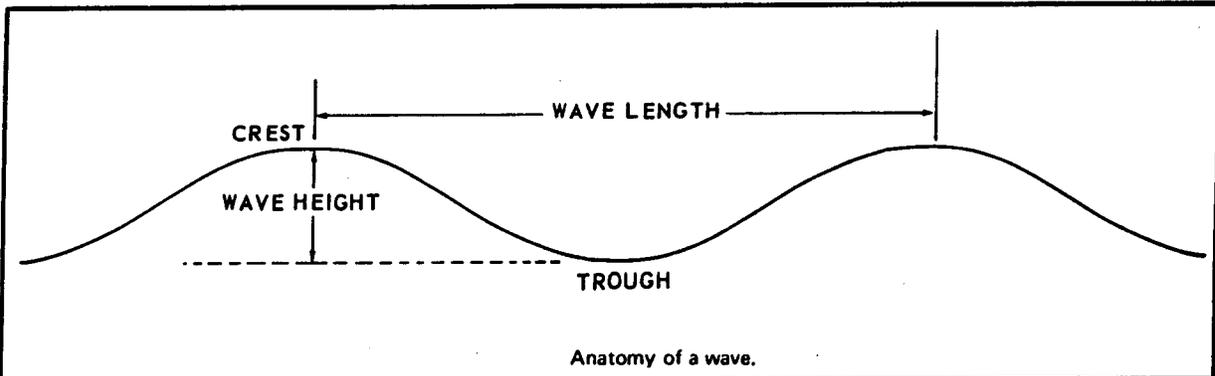
The moon's gravity causes two movements of water on the earth's surface—one on the side toward the moon and one on the opposite side of the earth.



↖
○
MOON

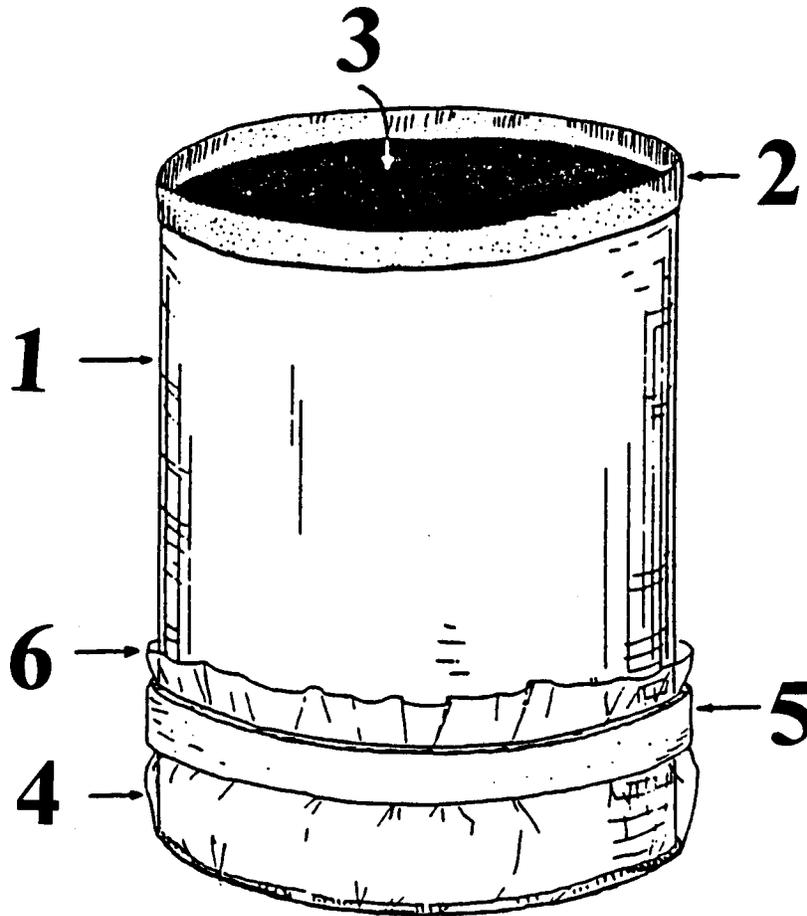
While the earth makes a complete revolution every 24 hours, the moon also moves around the earth. To pass directly under the moon again, California must travel an extra 50 minutes or so each day. Thus, the tides are about 50 minutes later each day.

Waves



The size of wind waves depends on the length of time the wind blows, the strength of the wind, and the distance over which the wind blows.

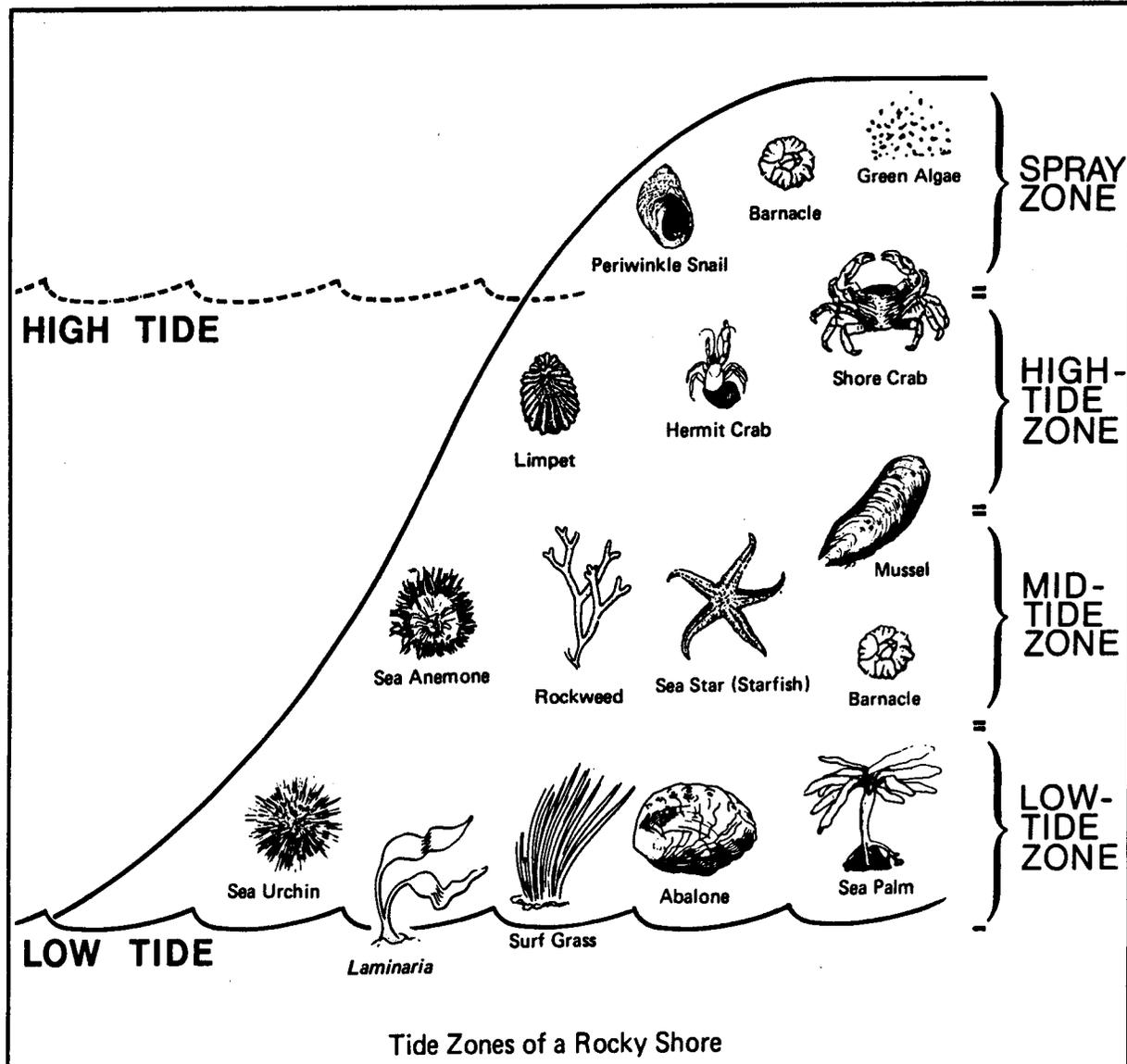
Waterscope



SIX EASY STEPS TO MAKE A WATERSCOPE

1. Use a big (No. 10) can with both ends removed.
2. Put cloth or plastic tape over sharp edges.
3. Paint inside of can black to improve viewing.
4. Place a clear plastic bag or wrapper over one end of can.
5. Secure bag or wrapper with a large rubber band.
6. Further seal edges with waterproof tape.

What I might see with my waterscope





SAVE Project

Age 10, group

*Three 45-minute periods,
indoors or outdoors*

Objective: Apply environmental principles to the sea.

Materials: SAVE (Sea: A Vital Environment) project form,
SAVE strategies, pencils

Get set

- ✓ Duplicate and distribute the SAVE strategies and SAVE project form.
- ✓ Form small groups.

Go catch

- ✓ Review SAVE strategies.
- ✓ Discuss the four major strategies for maintaining and saving an environment – precycle, recycle, reuse and reduce.
- ✓ Brainstorm how to help protect and SAVE our sea environment.
- ✓ Write an idea for each strategy.
- ✓ Develop a community outreach SAVE project from the ideas.
(Projects could include a take-home tip sheet or community bulletin board flyer on saving the sea, letters to the editor, a 30-second public service announcement to a local radio station, a poster, and/or a presentation or skit to a group of younger children.)
- ✓ View “Protecting the Ocean” video.

Sailing

- ✓ Complete as many SAVE ideas as possible.
- ✓ Publicize the SAVE projects on menus or in the school cafeteria.
- ✓ Feature a Healthy Sea topic on the menu.



SAVE Strategies

Everyone can help!

- ✓ Keep the ocean, rivers and land, including beaches, as close to natural as possible.
- ✓ Keep water clean and free from toxins and chemicals. Don't put chemicals down household drains and into sewer systems. The drain water will eventually make its way back to rivers and then the ocean.
- ✓ Keep the beaches and ocean free from plastics, cans, tires, paper, styrofoam and other manmade materials.
- ✓ Keep paint, oil or other chemical pollutants away from streams, rivers, bays and oceans.
- ✓ Keep the water and beaches clean. Put garbage in waste containers. Fisher folk help keep the ocean clean by properly disposing of garbage and refuse that they find when they are fishing.

The ocean is protected

- ✓ Regulations on fishing gear such as minimum net mesh sizes and number of lines used for fishing protect against overharvesting of fish and shellfish.
- ✓ Seasons and closed areas limit fishing times and areas where fish can be caught. These limitations protect spawning populations and nursery grounds.
- ✓ Quotas limit the number of some marine species, such as Dover sole, that can be caught.
- ✓ Regulations place minimum size limits on many species. This allows the species to mature and reproduce before harvesting. For example, fisher folk have escape holes on traps and pots so small crabs and lobsters can escape. Nets must have a mesh large enough to let small and juvenile fish escape.
- ✓ Limited entry and licenses control the number of fisher folk allowed to harvest certain species such as salmon and sea urchins. Fisher folk can only enter a limited-entry fishery through a lottery or by buying someone else's permit.

These and other regulations are designed to protect a balance of sea life for the future.

Save Project Form

NAME OF SAVE PROJECT _____

NAME OF GROUP _____

SEA ENVIRONMENTAL CHALLENGE _____

SAVE IDEA _____

SAVE STRATEGIES

Precycle _____

Recycle _____

Reuse _____

Reduce _____

RESULTS _____
