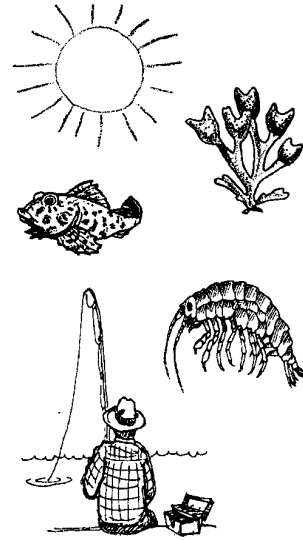


Interdependence

Lesson by Laura Erickson, Poulsbo, WA

Key Concepts

1. Animals and plants depend on each other for the things they need to survive.
2. Plants and animals are sources of food for other plants and animals. These interrelationships are described in diagrams called food chains or food webs.
3. Aquatic plants convert solar energy to food energy.



Background

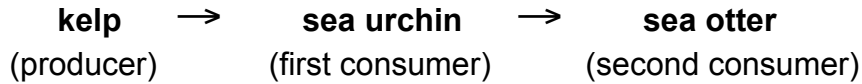
All life in the sea is interrelated, every organism is dependent upon other organisms. In a balanced environment, plants and animals interact and depend on each other in a stable, predictable fashion. The plants provide food and oxygen for the animals, and the animals provide nutrients and carbon dioxide for the plants. Dead and decayed tissue provide some of the nutrients for the plants. Energy from the sun drives all of these interactions.

In the sea, seaweeds and microscopic plant plankton use the sun's energy and nutrients in the water to produce their own food. These seaweeds and plant plankton (phytoplankton) form the basis of food for almost all of the animals in the sea. Seaweeds provide food directly to some animals, like turban snails which graze on kelp fronds. Others, like abalones and urchins, feed on fronds that have detached (drift kelp) and have drifted to the bottom. Drift kelp that is not eaten is decomposed by bacteria. The resulting material is eaten by filter-feeders, like sponges, which take the food particles from the water, or by deposit-feeders, like sea cucumbers, which eat the food particles which have settled on the sea floor. Many of these animals are eaten by larger predators like crabs, rock fish, or sea stars. Kelp and other seaweeds that pile up on the beach are eaten by shrimp-like creatures called beach hoppers which, in turn, provide food for shore birds. These relationships may be represented in diagrams called "food chains".

All food chains follow this general pattern:

Producer → Herbivore → Carnivore → Higher Order Carnivores

In a food chain, plants are called the **producers**. Producers make, or “produce” food using the sun’s energy. Herbivores, animals that eat the plants, are called **first consumers**. First consumers are “first” to eat the producers. Carnivores that eat the first consumers are called **second consumers** and so on up the chain. An example of a simple food chain is:



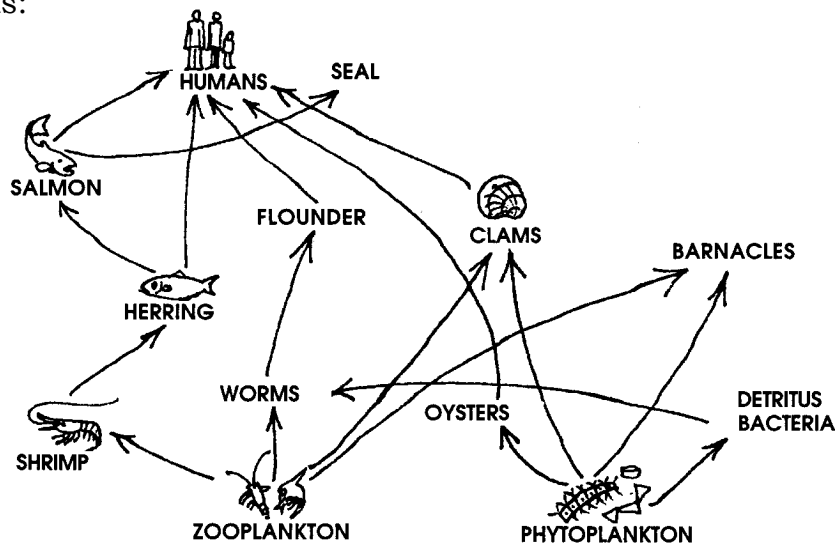
Other food chains are:



Arrows in a food chain show the direction of the movement of the food energy and matter.

Note that although many food chains in the intertidal zone and the near shore areas of the sea are based on seaweeds, most food chains in the ocean are based on plant plankton rather than on the larger seaweeds.

Within a kelp forest or any other defined area of the sea, many food chains may exist. A food web integrates all of these individual chains into one diagram which may have a very intricate and complex pattern. A food web may describe as many as a hundred or more food chains. A simple food web might look like this:



Materials

For the class:

- “Interdependence” card set (30 total cards)
- ball of yarn or string
- 3" x 5" cards for names/sketches
- marking pen
- scissors

Teaching Hints

In “Interdependence”, the class models a kelp forest food web. Note that “Interdependence” builds upon the previous activity “Food Chains in the Kelp Forest”, in which students make a variety of food chains to see how kelp forest creatures transfer energy and matter in the form of food from one organism to another.

Procedure

1. Have students sit in a circle on the floor. Start the food web by using land animals with which the children are familiar.

Example: “I am the sun. What needs the sun to grow? Grass! Good I will roll the ball of yarn to Fred and he will be our grass. Here is the word “Grass” for Fred to hold. (On a 3" x 5" card or slip of paper, write the word “Grass” and make a quick sketch of grass.)

Now, what needs grass to grow? A cow! Great, Susie can be our cow. Fred will roll the ball of yarn to Susie and we will give her a card with the word “Cow” on it.

What else eats grass? Horses! Right, we now need to cut the string that went from our grass to cow, and start the string at the grass again and lead it to Jake, our horse.

Does anything eat a cow or a horse? People eat cows. Let’s give Sally the word “people” and put a string between the cow and our people. Now we are starting to make a web, etc.”

2. Once students understand how to make this food web model, begin all over with kelp forest creatures. Give each student a picture card from the “Interdependence” picture set. Once again, start the food web with the sun. Remind students that the plants in the kelp forest also obtain their energy from the sun. Then go on to animals that need seaweed to grow. Then to what eats those animals. The picture cards help eliminate confusion regarding what has already been said.

You may find several animals that will eat the same thing. Be sure that separate pieces of yarn go to each animal before the yarn goes to the next food source.

You should end up with a spider-like web on the floor. Tell the students that a food web is many food chains that are interconnected. (Show what this means by pulling up on part of the web and having students notice that the other parts of the web move also.)

3. Choose one of the animals in the food web. Say:

“Let’s see what will happen to (name of the animal) if the food web changes.”

Observe the links to the chosen animal and discuss with students the problems that animal would face if one, or all, of its food sources were to die off. Ask questions like:

“What would happen if the animal only ate one type of food and that food was all destroyed?”

“What would happen, then, to the animals that eat this animal?”

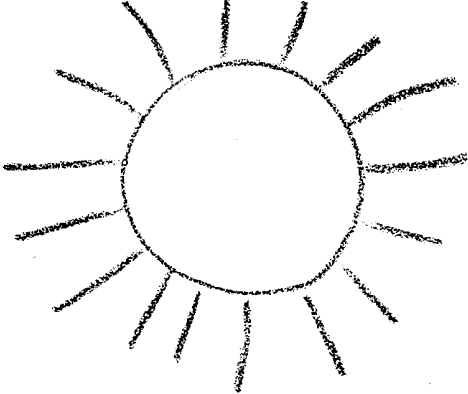
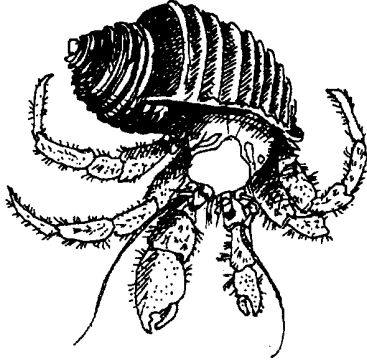
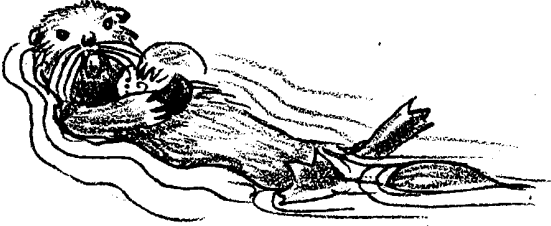
4. Move the web to a bulletin board so that students can continue to add links as you study more marine animals and plants. Have students decide on the organisms to include and where the strings will need to go. Students may want to make pictures or 3-D models of the plants and animals to place on the bulletin board.

Key Words



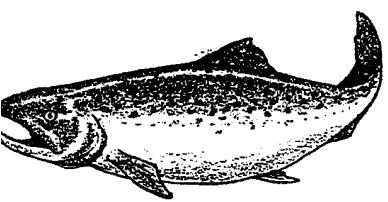
food chain - a diagram showing relationships among plants and animals based on who eats whom

food web - a diagram showing interconnected food chains


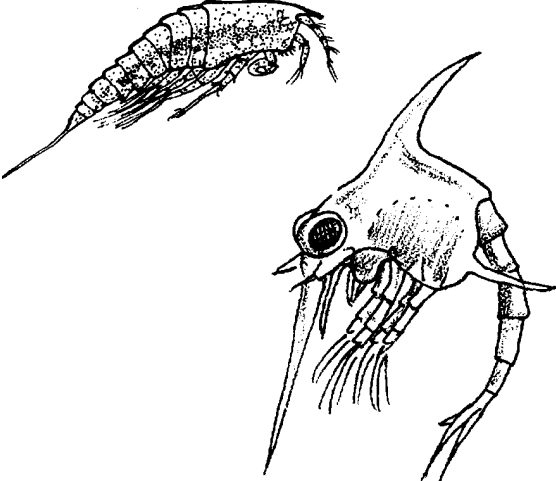

"Interdependence" Cards

	<p>SUN</p>
	<p><u>Hermit Crab</u> EATS: dead plants and animals EATEN BY: shiner perch herring sunflower star octopus</p>
	<p><u>Sea Otter</u> EATS: salmon herring shiner perch Red Rock crab shrimp sea urchin sea cucumber EATEN BY:</p>

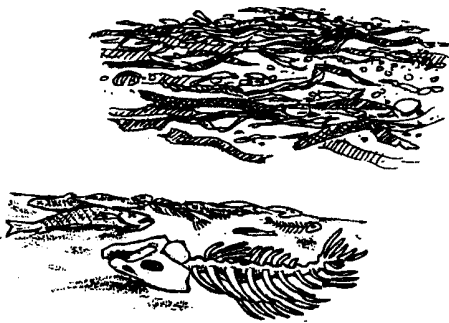
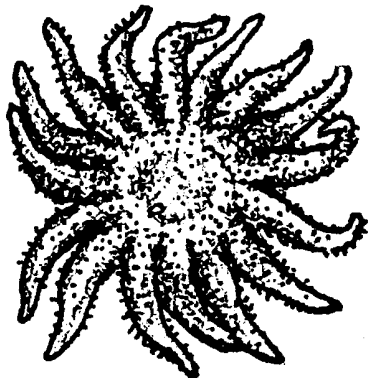
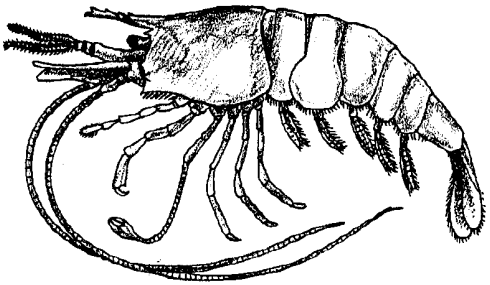
"Interdependence" Cards

	<p><u>Human</u></p> <p>EATS:</p> <ul style="list-style-type: none"> shiner perch herring salmon oyster shrimp cockle clam Red Rock crab octopus <p>EATEN BY:</p>
	<p><u>Barnacle</u></p> <p>EATS:</p> <ul style="list-style-type: none"> zooplankton phytoplankton <p>EATEN BY:</p> <ul style="list-style-type: none"> moon snail sunflower star shiner perch herring Red Rock crab oyster drill gull
	<p><u>Salmon</u></p> <p>EATS:</p> <ul style="list-style-type: none"> zooplankton herring <p>EATEN BY:</p> <ul style="list-style-type: none"> harbor seal Great Blue heron sesa lion orca sea otter human

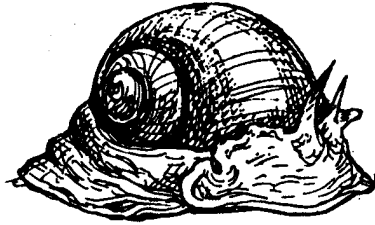
"Interdependence" Cards

	<p><u>Herring</u></p> <p>EATS: zooplankton hermit crab barnacle</p> <p>EATEN BY: salmon Great Blue heron sea otter human harbor seal shrimp</p>
	<p><u>Zooplankton</u></p> <p>EATS: phytoplankton</p> <p>EATEN BY: shrimp salmon herring barnacle sea anemone oyster cockle clam</p>
	<p><u>Oyster</u></p> <p>EATS: phytoplankton zooplankton dead plants and animals</p> <p>EATEN BY: human oyster drill Red Rock crab sunflower star octopus</p>

"Interdependence" Cards

	<p><u>Dead Plants and Animals</u></p> <p>EATS:</p> <p>EATEN BY:</p> <ul style="list-style-type: none"> hermit crab oyster cockle clam shrimp sea cucumber gull Purple Shore crab
	<p><u>Sunflower Star</u></p> <p>EATS:</p> <ul style="list-style-type: none"> limpet moon snail hermit crab sea urchin barnacle oyster cockle clam sea cucumber <p>EATEN BY:</p>
	<p><u>Shrimp</u></p> <p>EATS:</p> <ul style="list-style-type: none"> zooplankton herring dead plants and animals <p>EATEN BY:</p> <ul style="list-style-type: none"> sea otter human Great Blue heron

"Interdependence" Cards



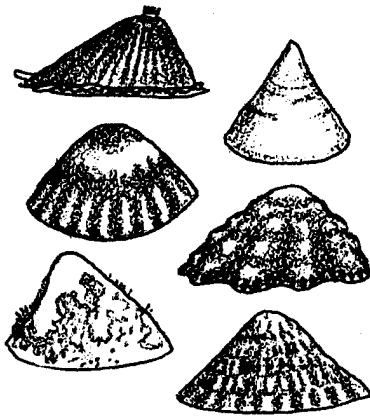
Moon Snail

EATS:

cockle clam
oyster drill
barnacle

EATEN BY:

sunflower star
octopus



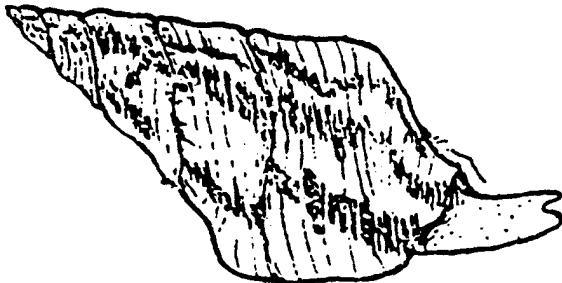
Limpet

EATS:

kelp seaweed

EATEN BY:

shiner perch
sunflower star
Red Rock crab



Oyster Drill

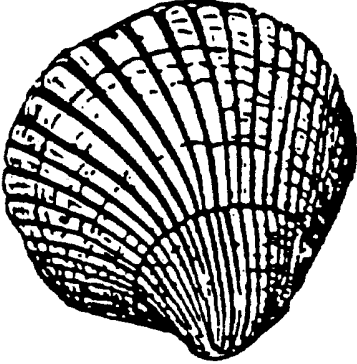
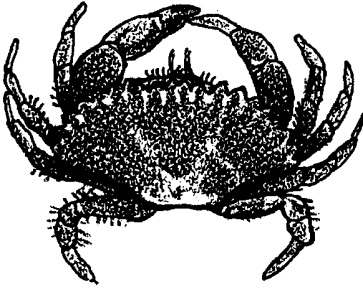
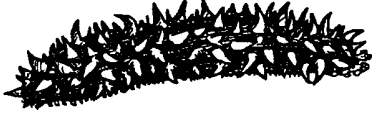
EATS:

cockle clam
oyster
barnacle

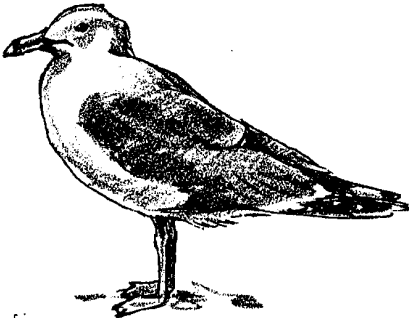
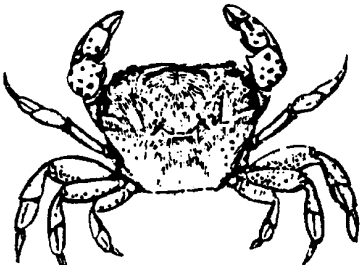
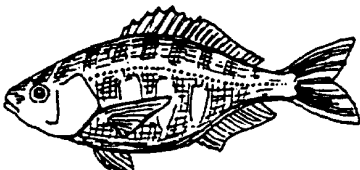
EATEN BY:

Great Blue heron
moon snail
Red Rock crab
octopus

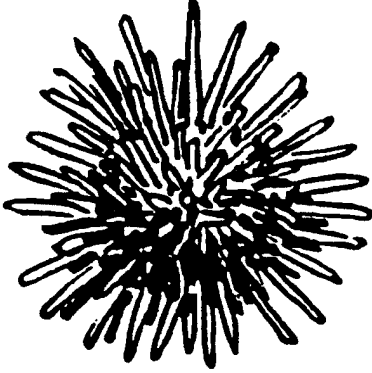
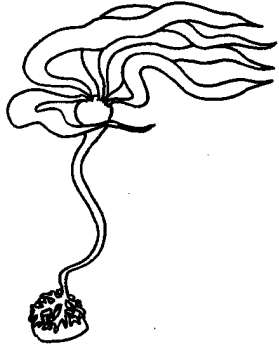
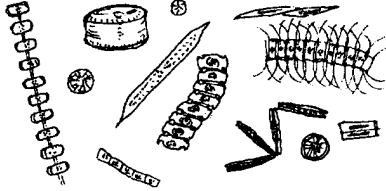
"Interdependence" Cards

	<p><u>Cockle Clam</u></p> <p>EATS: phytoplankton zooplankton dead plants and animals</p> <p>EATEN BY: moon snail oyster drill sunflower star human</p>
	<p><u>Red Rock Crab</u></p> <p>EATS: oyster barnacle oyster drill chiton limpet Purple Shore crab</p> <p>EATEN BY: sea otter Great Blue heron human octopus</p>
	<p><u>Sea Cucumber</u></p> <p>EATS: phytoplankton kelp seaweed dead plants and animals</p> <p>EATEN BY: sunflower star shiner perch sea otter</p>

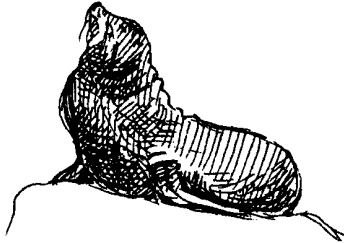
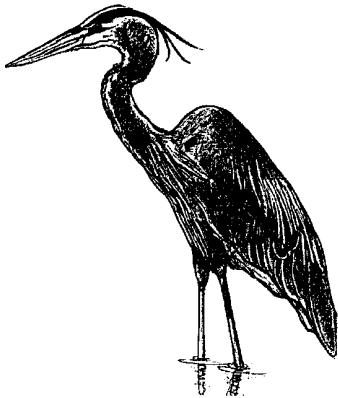
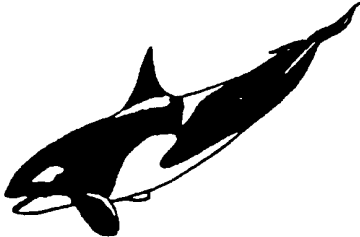
"Interdependence" Cards

	<p><u>Gull</u></p> <p>EATS:</p> <ul style="list-style-type: none">sea urchincrabbarnacledead plants and animalsPurple shore crab <p>EATEN BY:</p>
	<p><u>Purple Shore Crab</u></p> <p>EATS:</p> <ul style="list-style-type: none">dead plants and animalskelp seaweed <p>EATEN BY:</p> <ul style="list-style-type: none">Great Blue heronRed Rock crabgull
	<p><u>Shiner Perch</u></p> <p>EATS:</p> <ul style="list-style-type: none">hermit crabbarnaclelimpetsea cucumbersea anemone <p>EATEN BY:</p> <ul style="list-style-type: none">Great Blue heronsea otterhumansea lionharbor seal

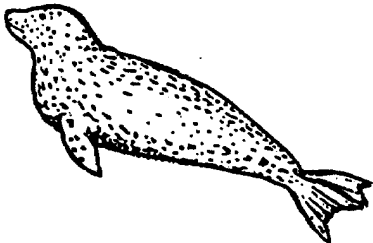
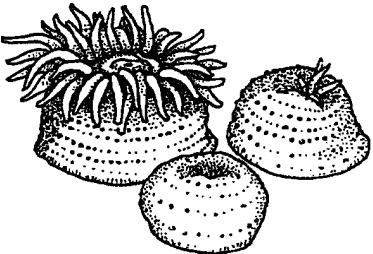

"Interdependence" Cards

	<p><u>Sea Urchin</u></p> <p>EATS: kelp seaweed</p> <p>EATEN BY: sunflower star gull sea otter</p>
	<p><u>Kelp Seaweed</u></p> <p>EATS: makes its own food</p> <p>EATEN BY: sea urchin limpet sea cucumber Purple Shore crab</p>
	<p><u>Phytoplankton</u></p> <p>EATS: makes their own food</p> <p>EATEN BY: zooplankton barnacle cockle clam sea anemone oyster sea cucumber</p>

"Interdependence" Cards

	<p><u>Sea Lion</u> EATS: salmon octopus shiner perch EATEN BY: orca</p>
	<p><u>Great Blue Heron</u> EATS: shrimp Red Rock crab herring shiner perch oyster drill Purple Shore crab salmon EATEN BY:</p>
	<p><u>Orca</u> EATS: salmon harbor seal octopus sea lion EATEN BY:</p>

"Interdependence" Cards

	<p><u>Harbor Seal</u></p> <p>EATS: salmon herring shiner perch octopus shrimp</p> <p>EATEN BY: orca</p>
	<p><u>Sea Anemone</u></p> <p>EATS: zooplankton herring</p> <p>EATEN BY: shiner perch</p>
	<p><u>Octopus</u></p> <p>EATS: Red Rock crab oyster drill moon snail hermit crab cockle clam</p> <p>EATEN BY: orca harbor seal human sea lion</p>