

Unit 6: Energy! From Food to Forces
LESSON 1 Chemical Energy and
FOOD CHAIN

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FOOD CHAINS AND WEBS SHOW THE FLOW OF CHEMICAL ENERGY THROUGH AN ECOSYSTEM. FROM THE SUN TO TERTIARY CONSUMERS. STUDENTS LEARN ABOUT THE TRANSFER OF CHEMICAL ENERGY AND HOW PRODUCERS AND CONSUMERS DEPEND ON EACH OTHER. THEY ALSO LEARN SCIENTISTS CLASSIFY LIVING THINGS BASED ON WHAT THEY EAT.



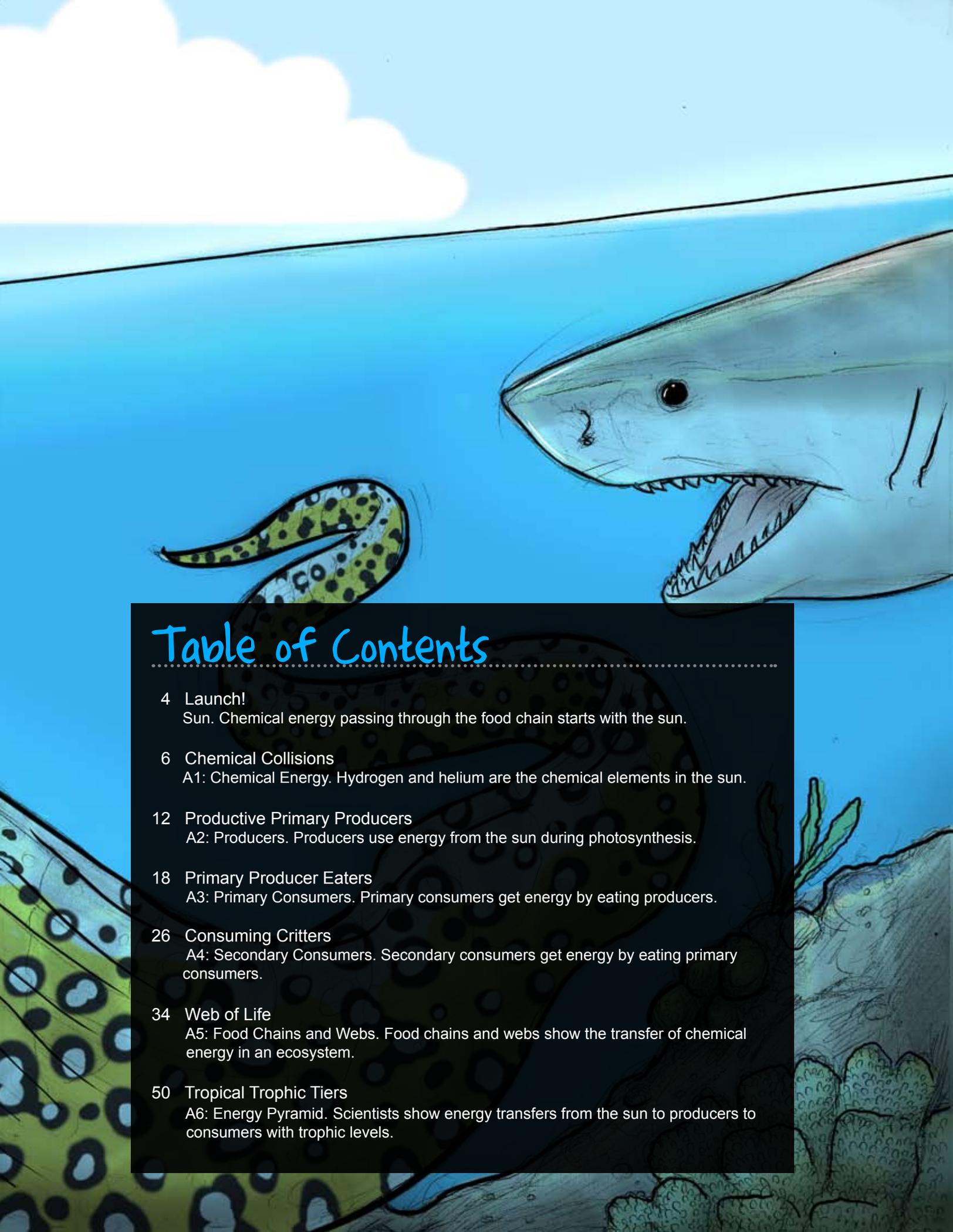
An illustration of an underwater scene. A large shark is on the right, swimming towards the left with its mouth open, showing sharp teeth. A spotted eel is on the left, swimming towards the right. The background is a blue ocean with a white cloud in the sky above the surface. The text is overlaid on a dark grey rectangular box.

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Launch!

(Sun)



CHEMICAL ENERGY PASSING THROUGH THE FOOD CHAIN STARTS WITH THE SUN.

Materials

Sticky notes
Pencil

Hawaii Standards

SC.K.3.1

SC.1.3.1

SC.2.3.1

Ready?

Nothing to prepare.

Set?

- Unit 4-Lesson 1-All Activities: Sun
- Unit 6-Lesson 1-Activity 1: *Chemical Collisions* (Chemical Energy)
- Unit 6-Lesson 1-Activity 2: *Productive Primary Producers* (Producers)
- Unit 6-Lesson 1-Activity 3: *Primary Producer Eaters* (Primary Consumers)
- Unit 6-Lesson 1-Activity 4: *Consuming Critters* (Secondary Consumers)
- Unit 6-Lesson 1-Activity 5: *Web of Life* (Food Chains and Webs)
- Unit 6-Lesson 1-Activity 6: *Tropical Trophic Tiers* (Energy Pyramid)

Go!

Develop Know-Wonder-Learn chart with students.



Think about it...

Why is the sun important?

Launch!

Brainstorm why the sun is important as a class.

- Suggest ideas why the sun is important.
Write each idea on a sticky note and stick to wall.
- Group ideas on wall by moving sticky notes.
- Name groups.
Example: Gives heat. Provides light. Makes plants grow.
- Discuss why the sun is important.
Why is the sun important to plants? Why the sun is important to animals?
Why do scientists consider the sun as the beginning of the food chain?

Activity Extension

Read *Energy from the Sun* by Allen Fowler (J 333.7923 Fo).

How it works

Light, heat, and energy! The sun provides heat to keep us warm, light for us to see, and light energy for plants to grow. Plants use the sun's energy to produce its own food. Then some animals eat the plants to get their energy. Other animals will eat the plant eating animals to get their energy! Without the sun, life would be impossible!

Keiki Storytime!

Living Sunlight: How Plants Bring the Earth to Life by Molly Band and Penny Chisholm (J 572.46 Ba)

Interesting Fact

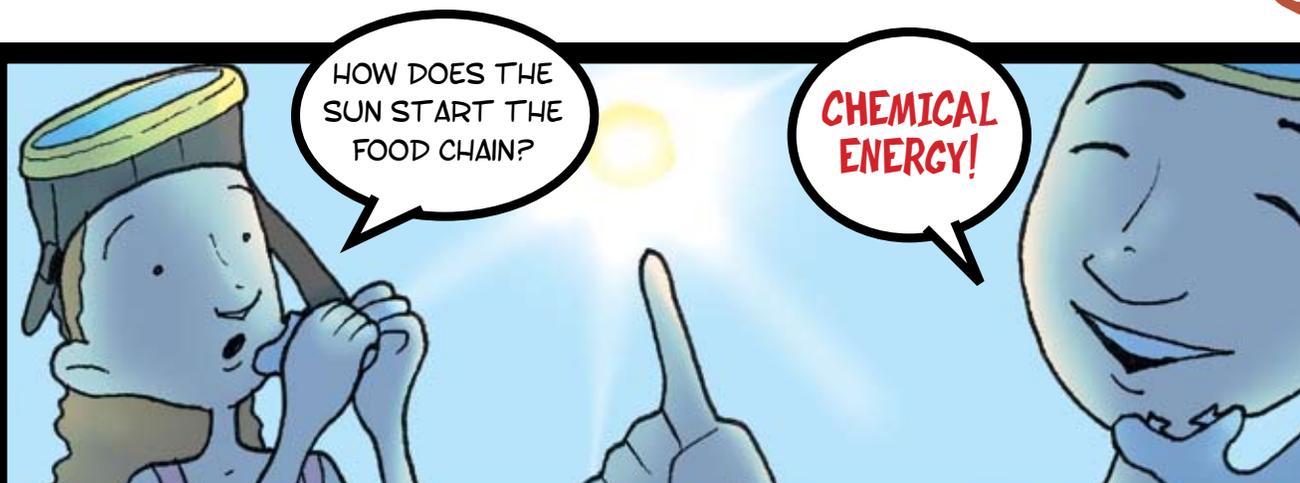
The sun is about 330,000 times the size of Earth!

Hawaii Nei

Hawaii gets an average of 3,172 hours of sunlight per year. That is why many plants can grow here all year long!

Chemical Collisions

(Chemical Energy)



HYDROGEN AND HELIUM ARE THE CHEMICAL ELEMENTS IN THE SUN.

Materials

Flour (3 cups)
Salt (1½ cups)
Cream of tartar (½ Tbsp)
Boiling water (3 cups)
Mixing bowl
Mixing spoon
Tray
Spinning tops or jacks
Party Snaps (e.g., Pop-pops)

Hawaii Standards

SC.K.3.1

SC.1.3.1

SC.2.3.1

Ready?

Explore

Make salt dough.

Put flour, salt, and cream of tartar in a large bowl. Pour boiling water into bowl all at once. Stir carefully with spoon to combine water.

Let it cool for ten minutes. Then, knead by hand until uniformed.

Set?

- Unit 6-Lesson 1-Activity 2: *Productive Primary Producers* (Producers)
- Unit 6-Lesson 1-Activity 3: *Primary Producer Eaters* (Primary Consumers)
- Unit 6-Lesson 1-Activity 4: *Consuming Critters* (Secondary Consumers)
- Unit 6-Lesson 1-Activity 5: *Web of Life* (Food Chains and Webs)
- Unit 6-Lesson 1-Activity 6: *Tropical Trophic Tiers* (Energy Pyramid)

Go!

Develop Know-Wonder-Learn chart with students.

Think about it...

What chemical elements make up the sun?

Engage

Play *Hydrogen, Hydrogen, Helium!* (Duck, Duck, Goose) as a class.

- Review instructions for “Duck, Duck, Goose.”
Choose one student to be “it.”
- It: Walk around circle tapping heads of your classmates.
Say “hydrogen” as you tap each head. Say “helium” as you tap the head of the student you choose.
- Helium: Chase “it” around the circle!
Try to tag them before they sit down in your empty space. Helium becomes new “it” unless he catches the previous “it.”
- Continue.

What's in a Word?

Helium comes from the Greek word for sun, *helios*.

Scientists Say...

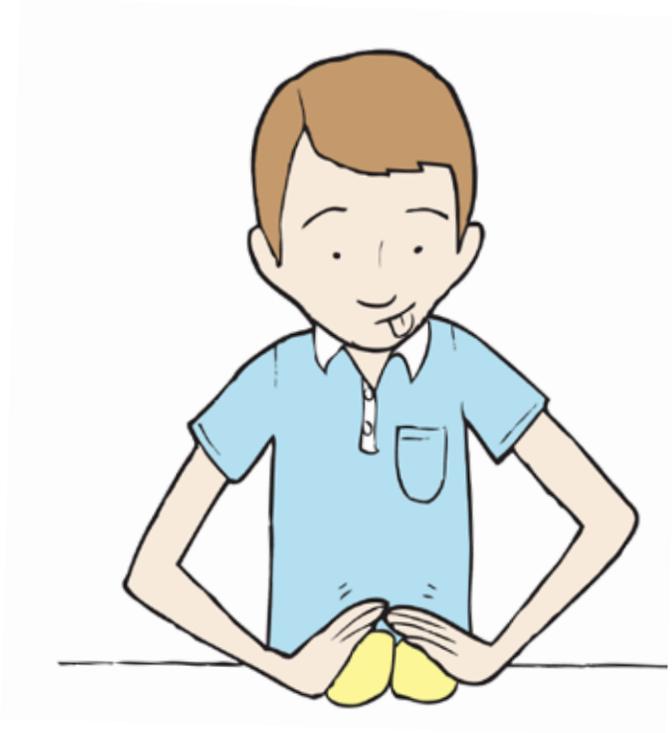
...*heliologist* for someone who studies the sun.

Historical Note

Pierre Janssen discovered helium in the sun during a solar eclipse in 1868.



Chemical Collisions



Think about it...

What do collisions in the sun produce?

Explore

Pretend to create energy individually.

- Roll salt dough into two balls.
These are your hydrogens.
- Roll hydrogens around desk.
- Crash your two hydrogens together!
Smash and roll them into one ball. This new ball has transformed into helium.

Explain

Sunlight provides the main source of energy on Earth. It provides light energy for us to see and for photosynthesis in plants. It also gives us heat energy for warmth. But did you ever wonder, from where does the sun get all its energy? Chemical reactions! Reactions happen deep in the center of the sun.

What chemical elements make up the sun?

Hydrogen and helium! Like other stars, hydrogen and helium gases make up the sun. Think back to learning about the tiny building blocks of all matter (atoms) in Unit 1. Hydrogen and helium are two kinds of atoms.

What do collisions in the sun produce?

Energy! Two hydrogens collide to become one helium. Normally hydrogens do not want to combine. Aunty says remember from Unit 1, how more heat energy equals faster atoms? Because the incredible heat in the center of the sun, hydrogens zoom all over the place. Sometimes they crash into each other, which makes helium! This reaction releases a huge amount of energy. We can feel that energy all the way from the sun as radiant (heat) energy and see it as light energy.

Did you know?

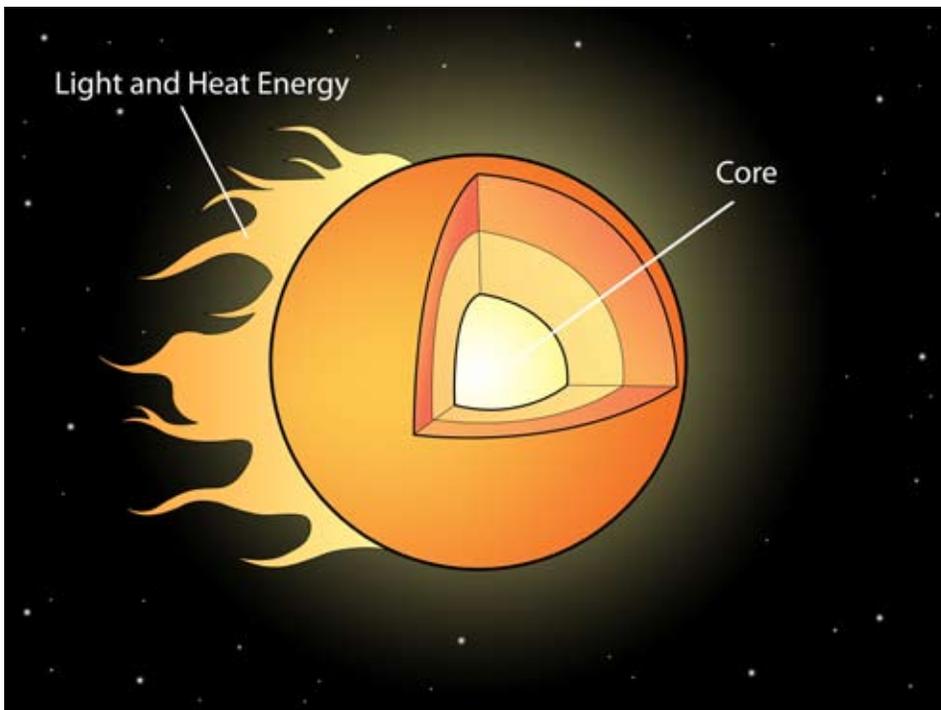
The sun is 74% hydrogen, 25% helium, and 1% mix of other elements.

Interesting Fact

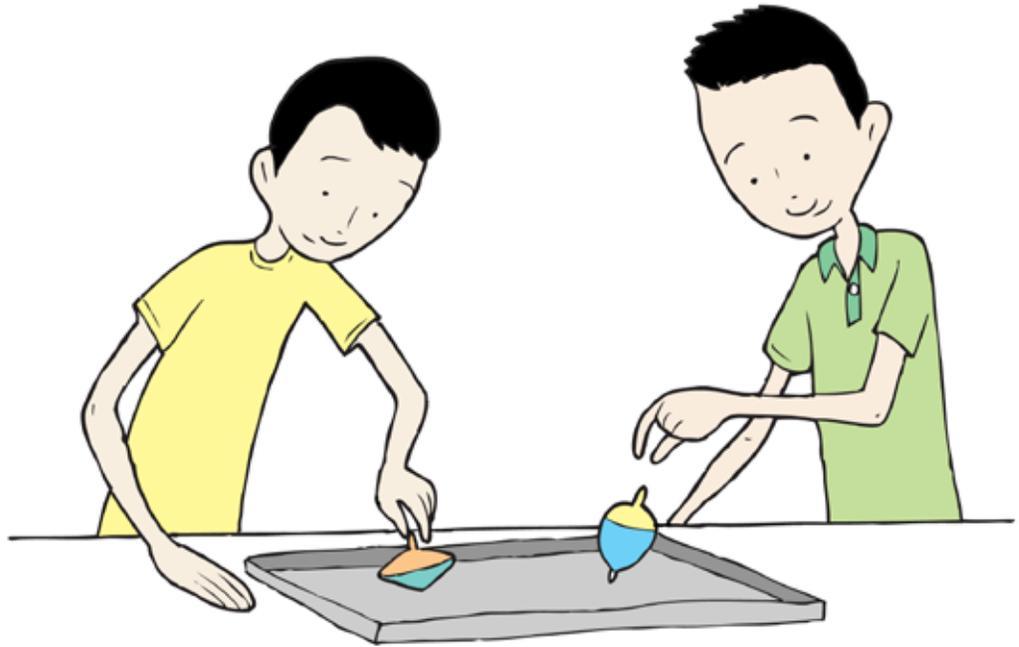
Solar flares are large explosions on the sun. Gigantic flares of burning gas leap out from the sun's surface!

Scientists Say ...

...nuclear reaction for what happens in the center of the sun.



Chemical Collisions



Think about it...

Is light and heat energy stronger at the sun or Earth?

Elaborate

Create collisions in small groups.

- Gather around smooth, flat surface.
Example: table or tray
- Spin a number of tops on the same surface at the same time.
- Watch as they spin and collide.
Observe any speed changes when one top crashes into another.
- Repeat several times.

How it works

Sun! As energy travels out from the sun's core, it bounces off of more hydrogens. Each time it bounces, it loses energy. Your top lost energy each time it crashed too. By the time energy reaches Earth, it is mostly visible light.



Invention Center

Scientists can make hydrogen collide in highly controlled environments. The energy these collisions create can be used for electricity.

Did You Know?

Party snaps contain a few grains of sand coated with silver fulminate wrapped in thin paper. When the snaps hit a hard surface, the friction between the sand and fulminate cause a tiny explosion.

NOAA Link

Learn about solar events caused by chemical reactions in the sun at NOAA's Office of Oceanic and Atmospheric Research.

www.oar.noaa.gov

Search "Solar Events"

Evaluate

How does the sun start the food chain?

Create reactions individually.

- Go outside and throw two party snaps on the sidewalk at the same time.
- Discuss how the party snaps are like the elements in the sun.
Talk about the chemical reactions in the snaps compared to those in the sun.

Where do producers get energy when there is no sunlight?

Assess

SC.K.3.1 Identify similarities and differences between plants and animals.

SC.1.3.1 Identify the requirements of plants and animals to survive (e.g., food, air, light, water).

SC.2.3.1 Describe how animals depend on plants and animals.

Productive Primary Producers

(Producers)



PRODUCERS USE ENERGY FROM THE SUN DURING PHOTOSYNTHESIS.

Ready?

Nothing to prepare.

Set?

- Unit 3-Lesson 3-Activity 3: *Get a Grip* (Tide Pool Producers)
- Unit 3-Lesson 3-Activity 5: *Reef Restaurants* (Coral Reef Producers)
- Unit 3-Lesson 3-Activity 6: *Hello Halimeda* (Halimeda Producers)
- Unit 4-Lesson 1-Activity 2: *Food Factory* (Photosynthesis)
- Unit 5-Lesson 2-Activity 1: *Growing Goodness* (Producers)
- Unit 5-Lesson 2-Activity 2: *Capturing the Sun* (Chlorophyll)
- Unit 6-Lesson 1-Activity 1: *Chemical Collisions* (Chemical Energy)
- Unit 6-Lesson 1-Activity 3: *Primary Producer Eaters* (Primary Consumers)
- Unit 6-Lesson 1-Activity 4: *Consuming Critters* (Secondary Consumers)
- Unit 6-Lesson 1-Activity 5: *Web of Life* (Food Chains and Webs)
- Unit 6-Lesson 1-Activity 6: *Tropical Trophic Tiers* (Energy Pyramid)

Go!

Develop Know-Wonder-Learn chart with students.

Materials

Paper
Pencil
Scissors
Potted plants (4)
Tape
Jar with lid
Tea bags

Hawaii Standards

SC.K.3.1

SC.1.3.1

SC.2.3.1

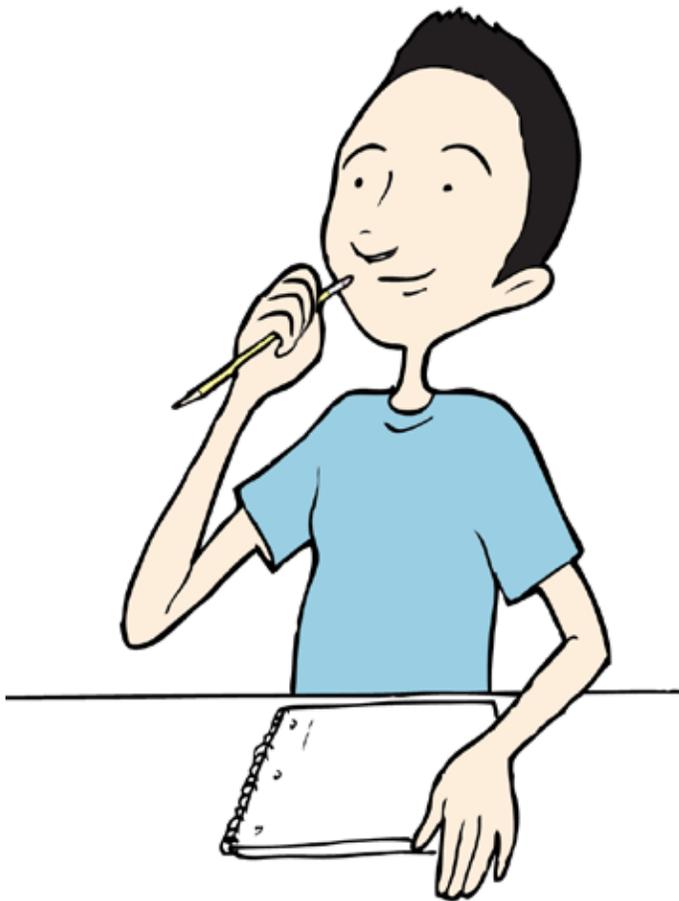
Think about it...

What is a producer?

Engage

Make up tongue twisters about the word *producer* in pairs.

- Compose a sentence using *produce*, *producer*, and *to produce*.
Example: Planting producers in pairs helps to produce plenty of produce.
- Teach it to your partner.
Share with the class.



Reading Resource

Photosynthesis: Changing Sunlight into Food by Bobbie Kalman (J 572.46 Ka)

What's in a Word?

Produce comes from the Latin word *producere*, which means "bring forth."

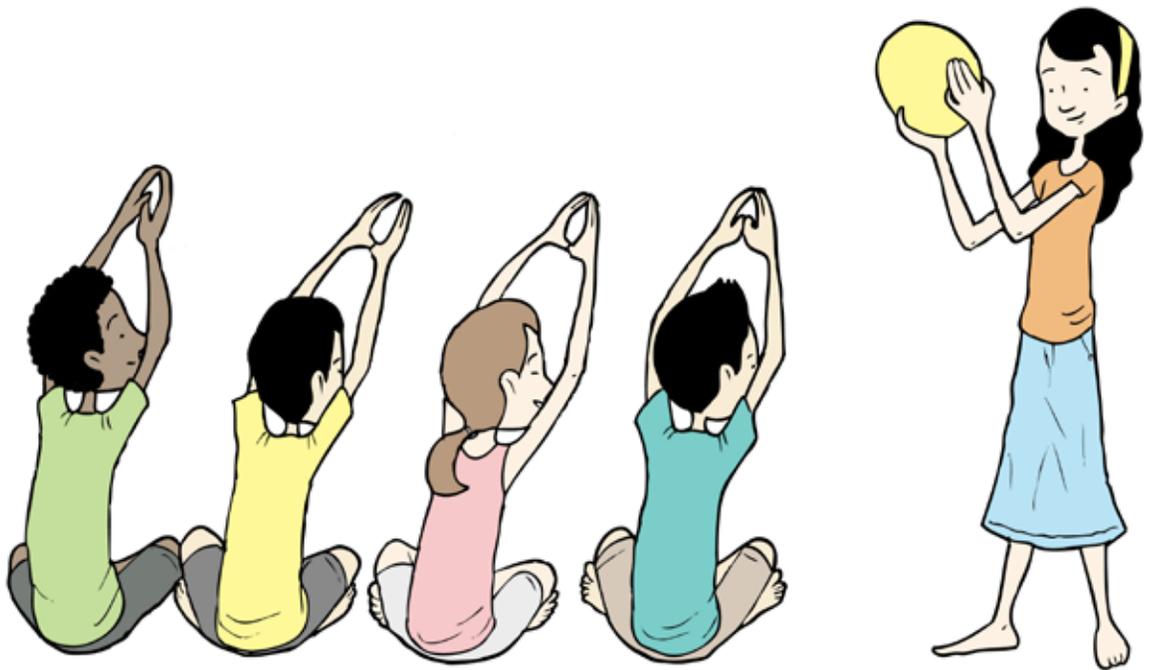
On a Related Note

Product, production, produce, and productive all come from the same root word (*producere*). What do their English meanings have in common?

Scientists say...

...*autotrophs* for living organisms that produce their own food.

Productive Primary Producers



Think about it...

Where does the chemical reaction (photosynthesis) in plants occur?

Explore

- One student: Draw a sun on a paper.
Hold the sun and walk around the room.
- Remaining students: Pretend to be plants in the sun.
Sit in one place. Do not move legs.
- Reach arms in the air and make a circle with your hands (leaves).
Twist your body so your leaves always faces the sun.

****Activity Extension****

Sing *Algae Photosynthesis* again! (U5.L2.A1)

Explain

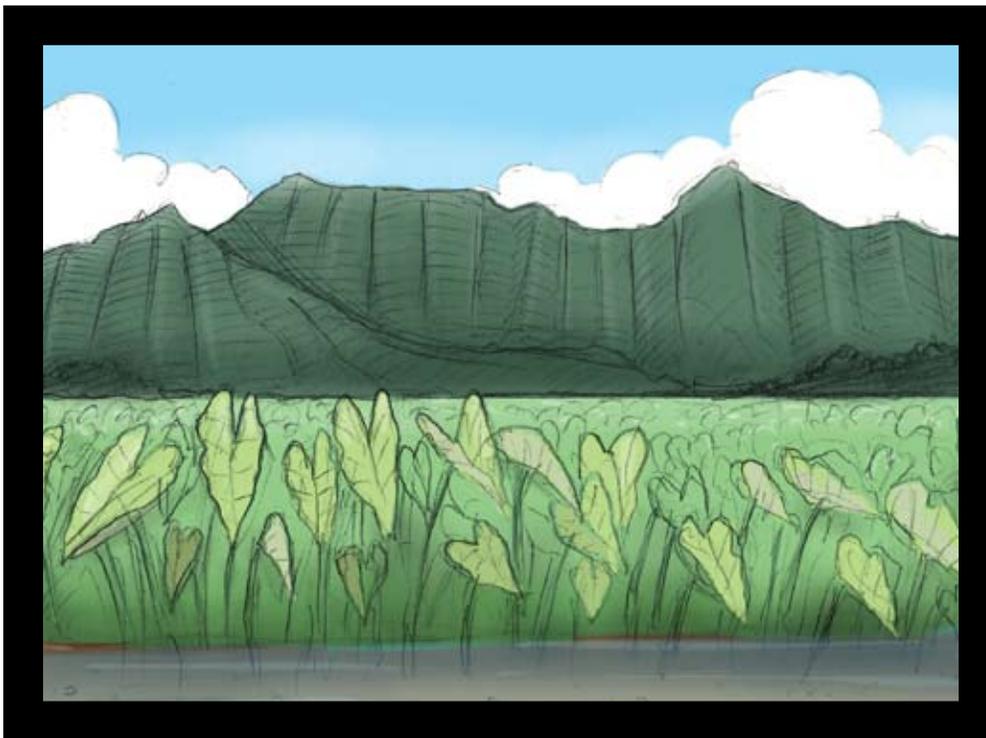
What if your body could feed itself with only water, air (carbon dioxide), and sunlight? Producers do exactly that everyday! They do so through a chemical reaction called photosynthesis.

What is a producer?

Plants, algae, and phytoplankton! All three produce (make) their own food through a chemical reaction. Remember U5.L2.A1 and A2? Plants need sunlight to make their own food or they will die.

Where does the chemical reaction (photosynthesis) in plants occur?

Leaves! Special cells, called chlorophyll, transform light energy into chemical energy (food). The leaves face toward the sun to capture sunlight during the day. Scientists call this chemical reaction, photosynthesis. Tutu says chemical reactions combine several substances to create new substances.



Scientists Say ...

...*phototropism* for the growth or movement of a plant toward or away from light.

Think About It

How are plant leaves and solar panels alike?

Answer: Both turn toward the sun to capture its energy.

On a Related Note

The new international space station under construction has solar panels that are arranged like the leaves on a plant!

Web Resource

Watch real plants follow the path of the sun.

www.youtube.com

Search >"Phototropism in tomatoes-timelapse"

Productive Primary Producers

Think about it...

What do producers need for photosynthesis?

Elaborate

Observe plants as a class.

- Label four identical potted plants.
#1: Sun, water, and carbon dioxide. #2: Sun only.
#3: Water only. #4: No sun or water or carbon dioxide.
- Pot #1: Water and place near window.
Water as needed and talk to your plant while you water it.
- Pot #2: Place near window.
Do not water.
- Pot #3: Water and put under a close lid box or in a closet.
Do not give sunlight. Water as needed.
- Pot #4: Place in a box or closet.
Do not give water or sunlight.
- Observe and record changes for two weeks or until it dies.

Activity Extension for Older Kids

Change activity into an experiment.

- Make a hypothesis.
What do producers need for photosynthesis?
- Create a control and variables.
Pot #4 becomes your control and remaining pots are your variables.
- Record observations.
Create a data collection sheet.
- Explain results.

How it works

Sunlight, water, and carbon dioxide! Pot #1 should have survived and grew the best because it had all three things needed for photosynthesis: sunlight, water, and carbon dioxide. Tutu says chemical reactions combine several substances to create new substances.





Evaluate

What living things can create their own food from the sun?

Make **Sun Tea** as a class.

- Place tea bags (algae) in jar of water.
Close lid.
- Place jar in sun (light energy).
- Monitor changes at the end of the day for three days.
- Discuss how the tea bag, combined with water and sunlight created something new (tea).
- Discuss how algae, uses water, sunlight, and carbon dioxide to create something new (sugar).
- OPTIONAL: Add sugar and ice to your tea.
Enjoy!

How does chemical energy in the sun transfer to producers?

Assess

SC.K.3.1 Identify similarities and differences between plants and animals.

SC.1.3.1 Identify the requirements of plants and animals to survive (e.g., food, air, light, water).

SC.2.3.1 Describe how animals depend on plants and animals.

Scientists Say ...

...*glucose* for the sugar producers make. This is the source of chemical energy animals eat to get their energy.

Did You Know?

Phytoplankton perform two-thirds of all Earth's photosynthesis.

NOAA Link

NOAA's Coastal and Oceanic Plankton Ecology, Production and Observation Database emphasizes the vital role of plankton in the ocean's food webs.

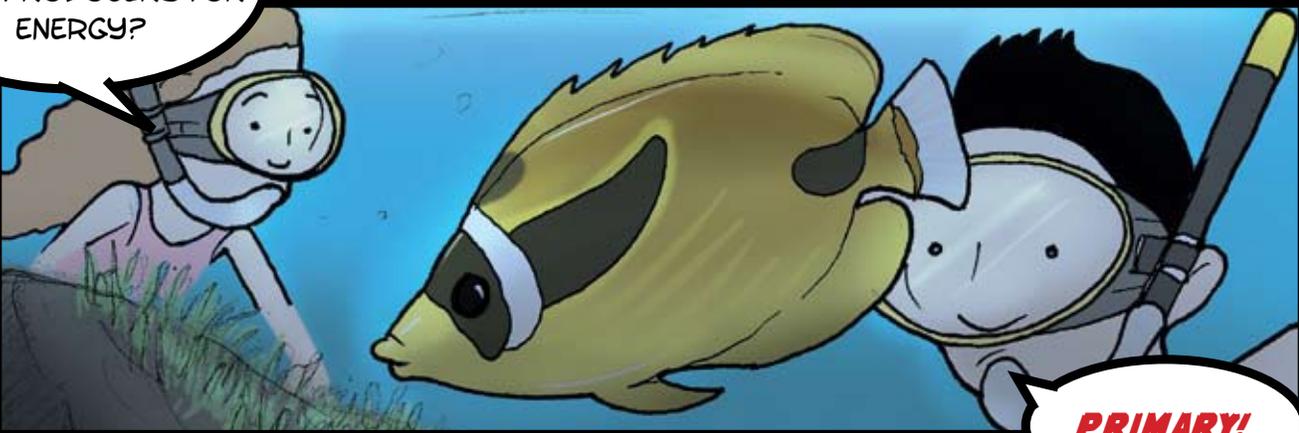
www.noaa.gov

Search "NMFS-COPEPOD"

Primary Producer Eaters

(Primary Consumers)

WHAT CONSUMER EATS PRODUCERS FOR ENERGY?



PRIMARY!

PRIMARY CONSUMERS GET ENERGY BY EATING PRODUCERS.

Ready?

Explore

Copy limu and honu drawing instructions onto board (U6.L1.A3-pages 24-25).

Set?

- Unit 5-Lesson 2-All Activities: *Alive and Eating*
- Unit 6-Lesson 1-Activity 1: *Chemical Collisions* (Chemical Energy)
- Unit 6-Lesson 1-Activity 2: *Productive Primary Producer* (Producers)
- Unit 6-Lesson 1-Activity 4: *Consuming Critters* (Secondary Consumers)
- Unit 6-Lesson 1-Activity 5: *Web of Life* (Food Chains and Webs)
- Unit 6-Lesson 1-Activity 6: *Tropical Trophic Tiers* (Energy Pyramid)

Go!

Develop Know-Wonder-Learn chart with students.

Materials

- Paper
- Drawing materials
- Drawing instructions (U6.L1.A3-pages 24-25)
- Leaves (Green)
- Dictionary
- Construction paper
- Bleach pen

Hawaii Standards

- SC.K.1.1
- SC.K.3.1

- SC.1.3.1

- SC.2.3.1

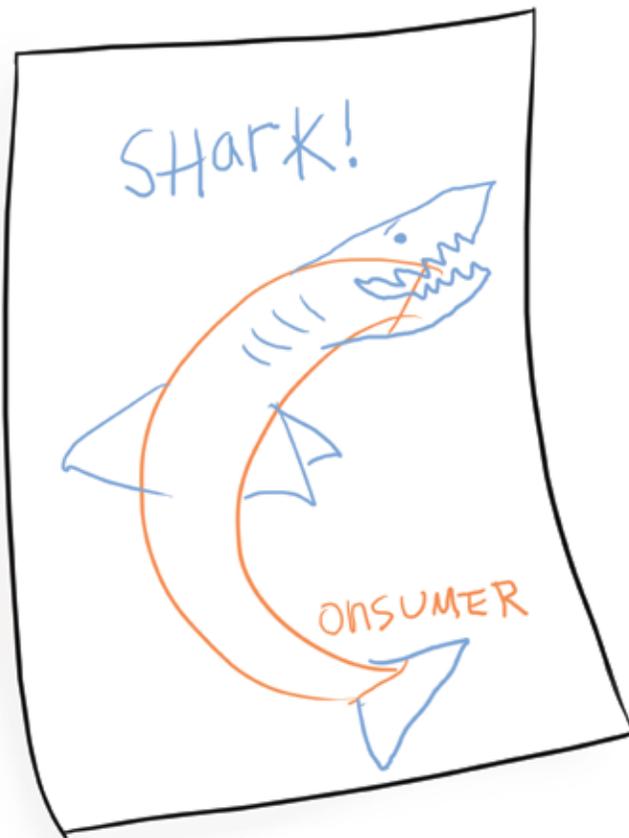
Think about it...

What is a consumer?

Engage

Discuss what the word *consumer* means as a class.

- Draw an outline of a “C” on your paper.
- Make your “C” into a creature.
Add background characters and scenery.
- Explain what your “C” creature consumes to the class.



Keiki Storytime

Where Does Your Food Go?
by Wiley Blevins (J 612.3 BI)

What's in a Word?

Consume comes from the Latin word *consumere*, meaning “to use up, eat, waste.”

Did you know?

Herbivores receive only about 10% of available energy from producers.

Primary Producer Eaters



Think about it...

What is a primary consumer?

Explore

Make an *Herbivorous Honu* grass drawing individually.

- Collect soft green leaves or grass outside.
- Draw a producer (limu) on paper.
Instructions on how to draw a limu found on (U6.L1.A3-page 24).
- Draw a primary consumer (honu) eating the limu.
Instructions on how to draw a honu found on (U6.L1.A3-page 25).
- Use your leaves or grass to color.
Rub them on your limu and honu drawings.

Explain

Animals need energy to move, grow, and breathe. They get their energy by eating (consuming) food.

What is a consumer?

Anything that consumes (eats) food! All animals are consumers, because they cannot produce their own food like plants, algae, and phytoplankton.

What is a primary consumer?

Plant eater! Primary consumers, also called herbivores, eat producers to get energy. Through eating, energy transfers from producer to consumer, just like you transferred the green color from the leaves to your honu drawing.

Scientists Say...

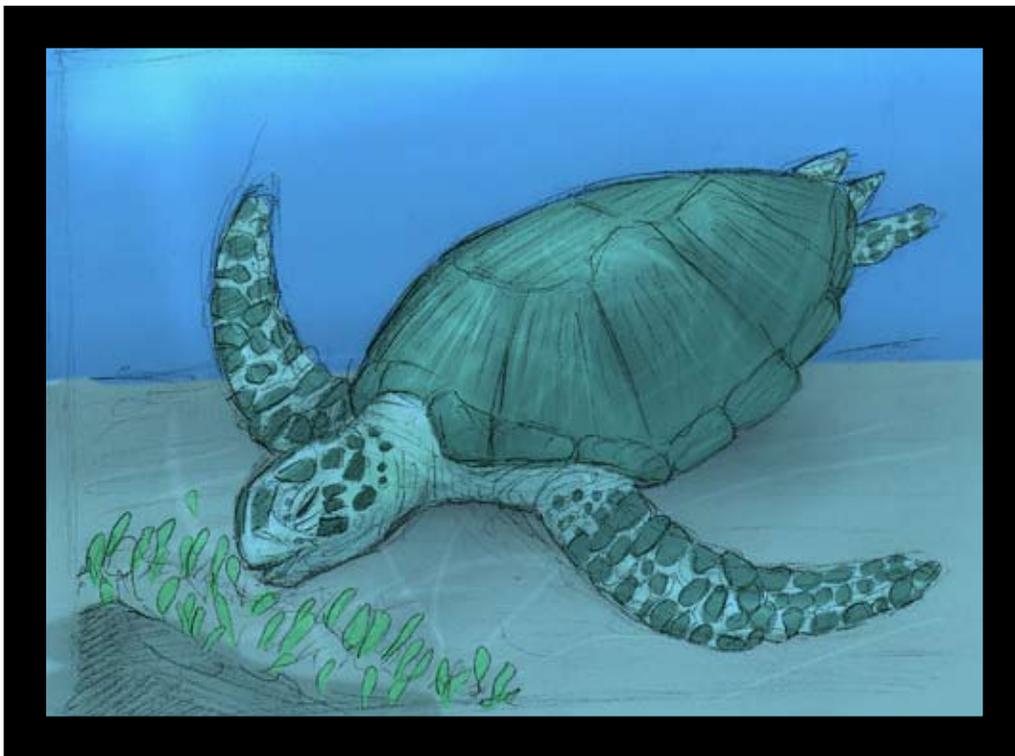
...primary for first. Primary consumers act as the first consumer in the food chain.

Interesting Fact

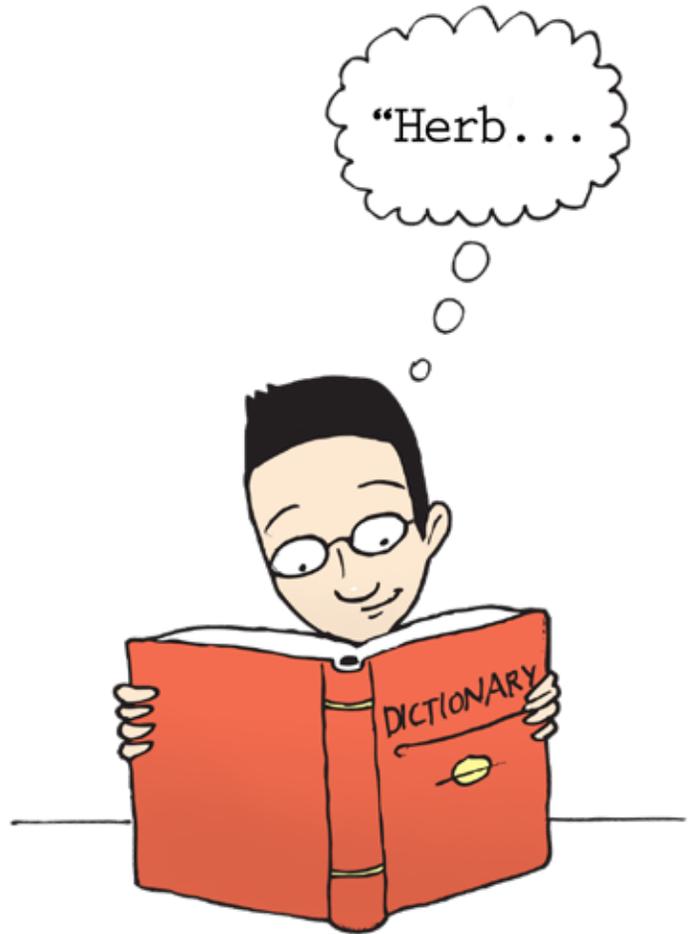
Algalores eat only algae.

Did you know?

The algae and seagrass that *honu* eat turns their flesh green. This gives them their name, green sea turtles, too!



Primary Producer Eaters



Think about it...

Why do we call plant eaters herbivore?

Elaborate

Search through a dictionary as a class.

- Brainstorm why we call producer eaters herbivores.
- Write "herb."
Look up its definition.
- Write "vore."
Look up its definition.
- Write the word "herbivore."
Look up its definition.

How it works

Word definitions! *Herb* means a "flowering plant" and *-vore* means "to devour or swallow". Herbivore means a plant devouring animal.

Evaluate

What type of animal eats producers for energy?

Explain by drawing a diagram individually.

- Draw a picture of a sun, producer and primary consumer.
Use marker on construction paper.
- Draw arrows in pencil to show from where chemical energy comes.
Use a bleach pen to trace your arrows.
- Continue to decorate your drawing with markers and bleach pen.

How do consumers depend on producers?

Reading Resource

What is a Herbivore? by
Bobbie Kalman (J 591.54
Ka)

Did You Know?

You can consume different parts of producers!
Leaf: lettuce, spinach
Stem: celery, rhubarb
Fruit: apples, mango
Flowers: broccoli, cauliflower
Roots: carrots, turnips
Seeds: pea, beans

NOAA Link

Read about consumers in an estuary at NOAA's National Estuarine Research Reserve System.

www.estuaries.gov

Search "Life in an Estuary"
>> Cycle of Life

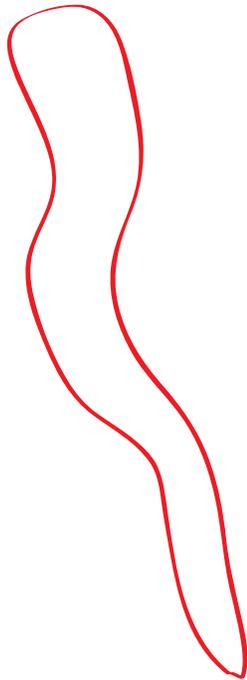
Assess

- SC.K.1.1 Use the senses to make observations.
SC.K.3.1 Identify similarities and differences between plants and animals.
- SC.1.3.1 Identify the requirements of plants and animals to survive(e.g., food, air, light, water).
- SC.2.3.1 Describe how animals depend on plants and animals.

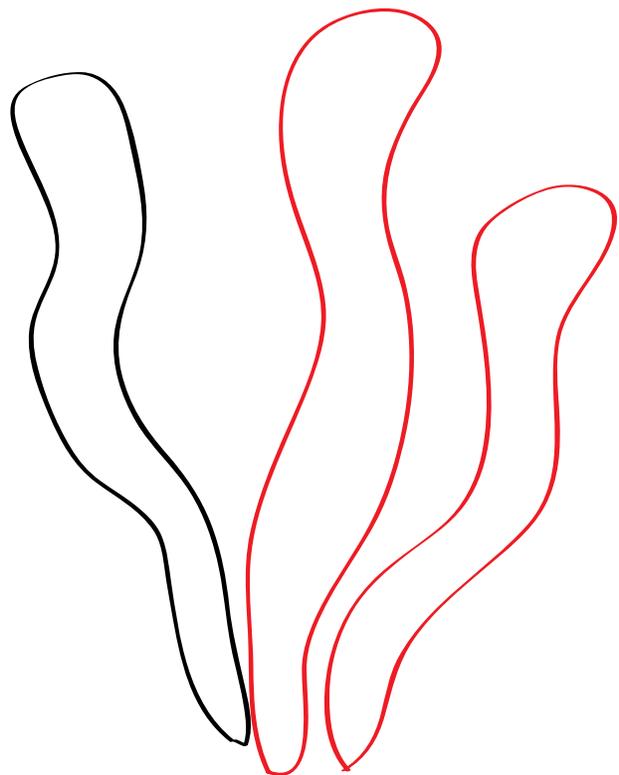
Limu Drawing Steps

U6.L1.A3 Primary Producer Eaters (Explore)

1.



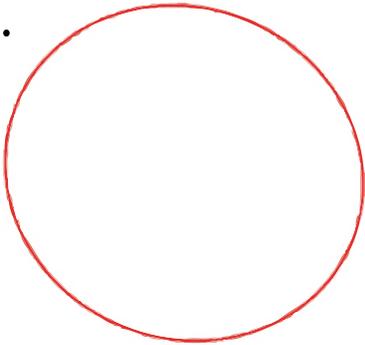
2.



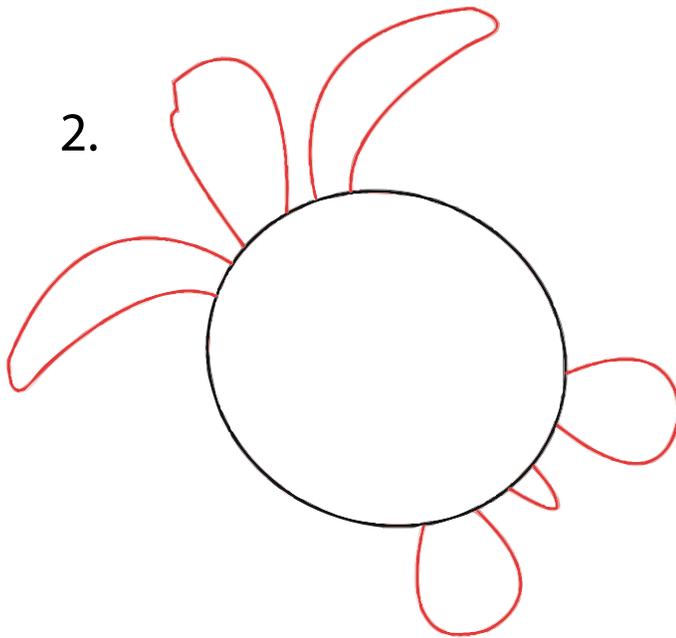
Honu Drawing Steps

U6.L1.A3 Primary Producer Eaters (Explore)

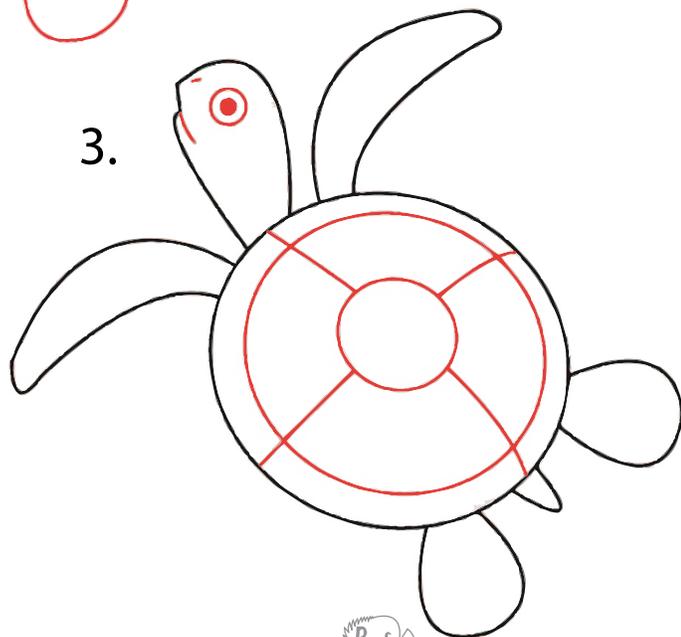
1.



2.



3.



Consuming Critters

(Secondary Consumers)

WHAT TYPE OF ANIMAL EATS PRIMARY CONSUMERS FOR ENERGY?



SECONDARY CONSUMERS GET ENERGY BY EATING PRIMARY CONSUMERS.

Ready?

Engage

Cut string, four-inches (two per student).

Explore

Label cups with different colored permanent pens (one color per group): Producers (eight cups), Primary consumer (three cups), Secondary consumer (two cups). Tertiary consumer (one cup).

Elaborate

Familiarize yourself with the *Going on a Fish Hunt* lyrics (U6.L1.A4-page 30).

Evaluate

Photocopy *Eat Em' Up* nesting activity (one per student) (U6.L1.A4-page 32).

Set?

- Unit 5-Lesson 2-All Activities: *Alive and Eating*
- Unit 6-Lesson 1-Activity 2: *Productive Primary Producers* (Producers)
- Unit 6-Lesson 1-Activity 3: *Primary Producers Eaters* (Primary Consumers)
- Unit 6-Lesson 1-Activity 5: *Web of Life* (Food Chains and Webs)
- Unit 6-Lesson 1-Activity 6: *Tropical Trophic Tiers* (Energy Pyramid)

Go!

Develop Know-Wonder-Learn chart with students.

Materials

- 9" paper plate (1 per student)
- 6" paper plate (1 per student)
- Green construction paper
- Scissors
- Glue
- Hole punch
- String
- Drawing materials
- Plastic cups (14)
- Permanent markers
- Going on a Fish Hunt* (lyrics and mp3)
- Eat Em' Up* (U6.L1.A4-p.32)

Hawaii Standards

- SC.K.3.1
- SC.1.3.1
- SC.2.3.1

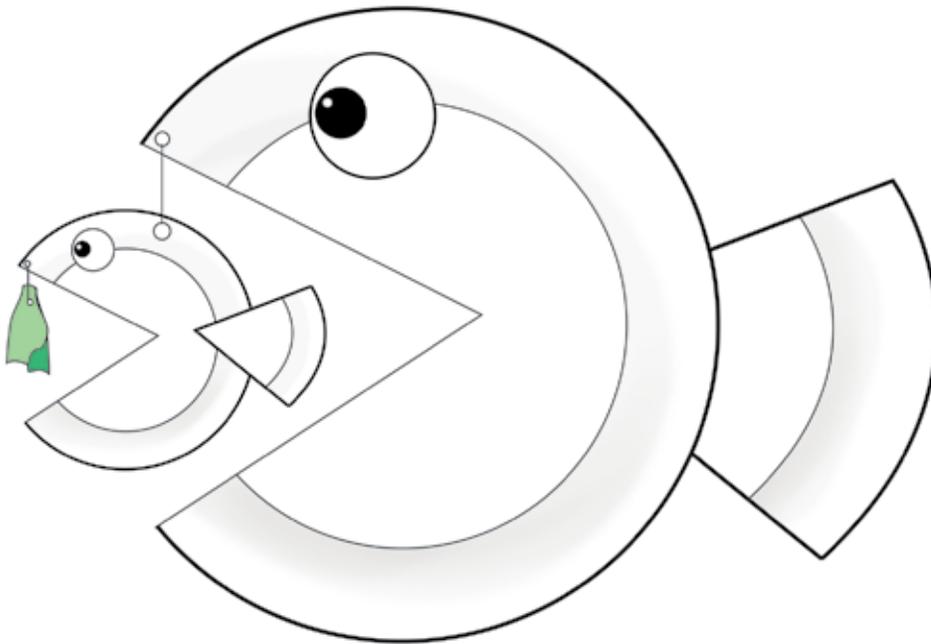
Think about it...

What is a secondary consumer?

Engage

Make an secondary consumer individually.

- Cut wedge out of large paper plate.
Opening becomes your fish's mouth.
- Glue wedge to opposite side of mouth.
Point of wedge faces inwards, forming a tail.
- Repeat steps with small paper plate.
Decorate your fishes with eyes and gills.
- Cut algae from green construction paper.
- Hang the algae inside mouth of smaller fish.
What do you call this consumer?
- Hang the small paper plate fish inside mouth of larger fish.
What do you think you call this consumer?



Keiki Storytime

Seashore Food Chains by
John Crossingham and
Bobbie Kalman (J 577.69919
Cr)

Scientists Say...

...*carnivore* for an animal that
eats other animals.

On a Related Note

Scientists also say *omnivore*
for a consumer that eats both
plants and animals.

What's in a Word?

Caro: Flesh (Latin)
Omni: All (Latin)
Herba: Herb (Latin)
Vorare: To devour (Latin)

Consuming Critters



Think about it...

What is a tertiary consumer?

Explore

Play Rhythm Consumer Cup Stack as a class.

Pick three volunteers.

- **Class:** Call out "Primary!" "Secondary!" or "Tertiary!" to the rhythm: clap, clap, slap.
Example: Clap, clap, "Primary!" (slap) Clap, clap, "Secondary!" (slap). Clap, clap, "tertiary!" (slap).
- **Volunteers:** Stand in line behind a desk.
Set out eight producer cups, three primary consumer cups, two secondary consumer cups, one tertiary consumer cup.
- **Volunteers:** Use cups (consumers) to cover (eat) the other cups.
If class calls, "Primary," cover a producer cup with a primary consumer cup. Then, grab that stack and cover three more producer cups.
- **Volunteers:** Repeat similar steps with other consumers.
If class calls, "Secondary," cover two primary cups with a secondary consumer cup. When you hear, "Tertiary," cover a secondary consumer cup with a tertiary cup.

Explain

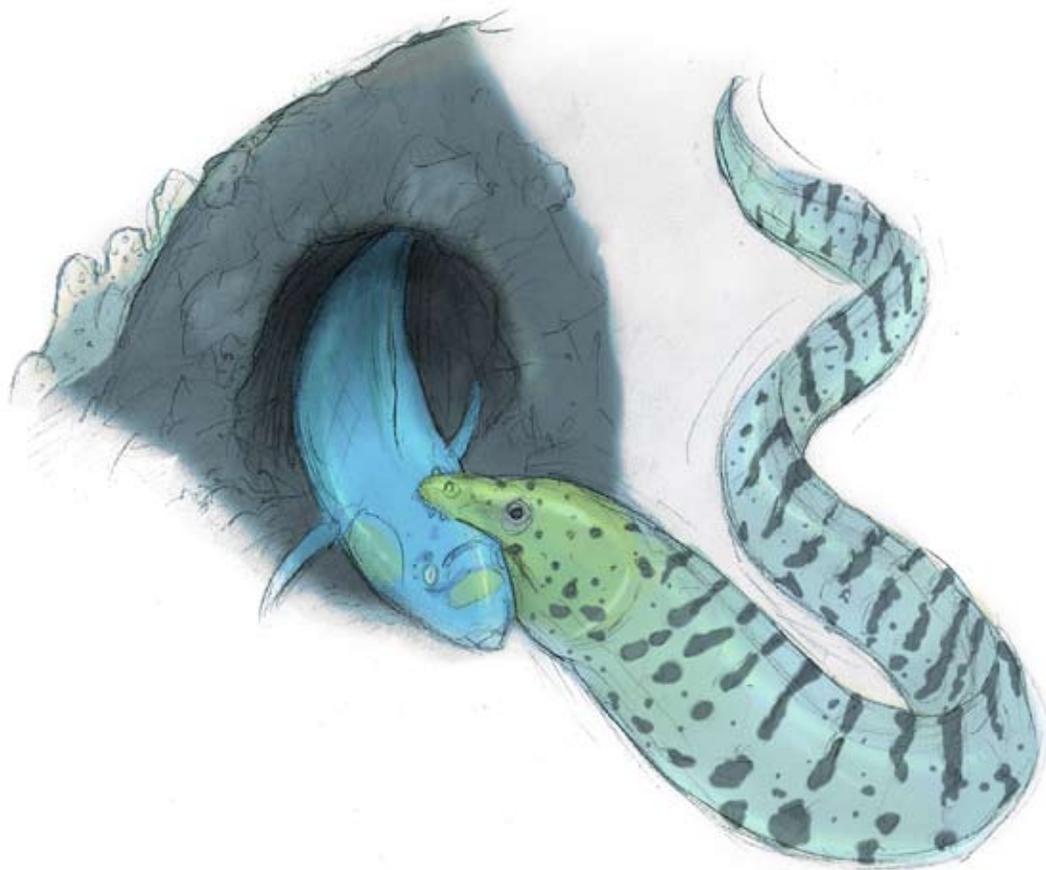
Tutu kane says scientists consider all animals consumers. They consume food for its chemical energy.

What is a secondary consumer?

Primary consumer-eater! These animals receive their energy from eating a primary consumer (herbivore). We also call them carnivores.

What is a tertiary consumer?

Secondary consumer-eater! These animals eat other carnivores. These hunters require a lot of energy to move quickly to capture their prey. They get that energy from the chemical energy stored in the bodies of their prey.



Scientists Say ...

...*tertiary* for third and *quaternary* for fourth.

Think About It

Are you primary, secondary or tertiary consumer?

Interesting Fact

We often think of carnivores as large animals, like sharks. Some carnivores are actually quite small, like coral polyps and copepods. They both eat zooplankton (tiny floating animals).

On a Related Note

Coralinavores eat coral. *Planktivores* eat plankton. Both coral and plankton are animals.

Consuming Critters

Think about it...

Why do we call secondary consumers carnivores?

Elaborate



Chant and do actions to *Going on a Fish Hunt*.

Listen for different types of consumers in the ocean.

Going on a fish hunt (repeat)

Going to catch a big one (repeat)

I'm not afraid! (repeat)

Got my fins. (repeat)

Got my teeth. (repeat)

Sun has set. (repeat)

Going on a fish hunt (repeat)

Going to catch a big one (repeat)

I'm not afraid! (repeat)

Coming to green seagrass. (repeat)

Yuck! I'm not herbivore! (repeat)

I'm carnivore! (repeat)

Can't go around it! (repeat)

Can't go under it! (repeat)

Got to go through it! (repeat)

Swish, Swash (repeat)

Whew! Made it!

Going on a fish hunt (repeat)

Going to catch a big one (repeat)

I'm not afraid! (repeat)

Coming to a large reef. (repeat)

Yuck! I'm not a corallinavore! (repeat)

I'm a carnivore! (repeat)

Can't go through it! (repeat)

Can't go over it! (repeat)

Got to go around it! (repeat)

Splish, Splash (repeat)

Whew! Made it!

Going on a fish hunt (repeat)

Going to catch a big one (repeat)

I'm not afraid! (repeat)

Coming to a mass of plankton. (repeat)

Yuck! I'm not a planktivore! (repeat)

I'm carnivore! (repeat)

Can't go around it! (repeat)

Can't go under it! (repeat)

Got to go through it! (repeat)

Slurp, Slurp (repeat)

Whew! Made it!

Going on a fish hunt (repeat)

Going to catch a big one (repeat)

I'm not afraid! (repeat)

Coming to dark waters. (repeat)

Got to sneak inside! (repeat)

Tip-toe, Tip-toe (repeat)

Whew! Made it!

Look to the left. (Shade eyes)

Look to the right. (Shade eyes)

Look up. (Shade eyes)

Look down. (Shade eyes)

I think I see some big eyes!

(Circle fingers around eyes)

I think it's a really big FISH!

(Throw arms back!)

Out of the dark...

Through the plankton...

Around the reef...

Across the seagrass...

Whew! Made it!

Going on a fish hunt,

And we weren't afraid!!!

How it works

Meat eater! Remember? Scientists call herbivores primary consumers, so carnivores must be secondary (or tertiary) consumers! Uncle says we know the hunter in your song is a carnivore because it eats fish

Evaluate

What consumer eats primary consumers for energy?

Answer by doing the *Eat Em' Up* Nesting Activity (U6.L1.A4-page 32).

- Color and cut each part of the nesting template.
Sun, producer, primary consumer, secondary consumer
- Form a ring. Tape.
- Nest the smaller ring inside one larger. Repeat.
- Discuss as a class.
- Optional: Glue pictures of appropriate animals or draw on each ring.

How do tertiary consumers (carnivores) depend on producers?

Assess

- SC.K.3.1 Identify similarities and differences between plants and animals.
- SC.1.3.1 Identify the requirements of plants and animals to survive (e.g., food, air, light, water).
- SC.2.3.1 Describe how animals depend on plants and animals.

Reading Resource

Read *What is a Carnivore?* by Bobbie Kalman (J 591.53 Ka)

Scientists Say...

...*predator* for the hunter and prey for the eaten. Predator-prey relationships describe the food chain in a habitat.

NOAA Link

Many more tertiary consumers live in the Northwestern Hawaiian Islands than the main Hawaiian Islands.

www.noaa.gov

Search "large carnivores nwhi" >> NOAA Magazine Online

Eat Em' Up

U6.L1.A4: Critter Eaters (Evaluate)



Sun

Producer

Primary Consumer (Herbivore)

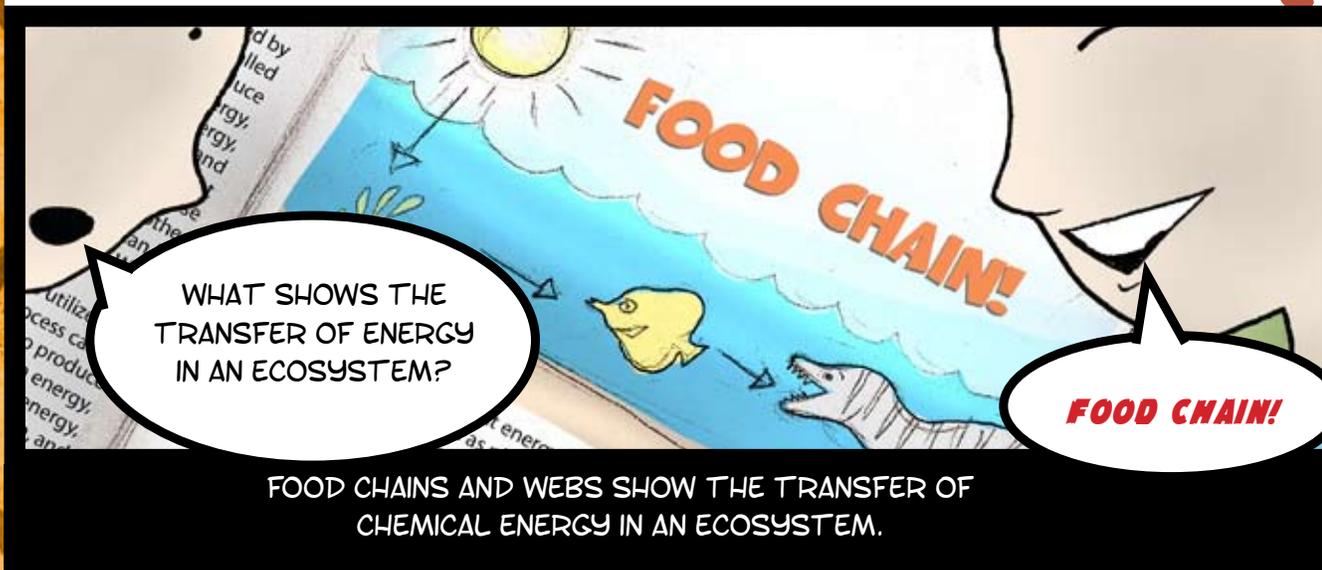
Secondary Consumer (Carnivore)

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Web of Life

(Food Chains and Webs)



Ready?

Engage

Photocopy *Food Chain Links* strips (one of each set per group) (U6.L1.A5-pages 40-43).

Elaborate

Photocopy and cut *Food Web Twister* cards (U6.L1.A5-pages 44-47).
Print *Food Web List* (U6.L1.A5-page 48).

Set?

- Unit 5-Lesson 2-All Activities: *Alive and Eating*
- Unit 6-Lesson 1-Activity 1: *Chemical Collisions* (Chemical Energy)
- Unit 6-Lesson 1-Activity 2: *Productive Primary Producer* (Producers)
- Unit 6-Lesson 1-Activity 3: *Primary Producer Eaters* (Primary Consumers)
- Unit 6-Lesson 1-Activity 4: *Consuming Critters* (Secondary Consumers)
- Unit 6-Lesson 1-Activity 6: *Tropical Trophic Tiers* (Energy Pyramid)

Go!

Develop Know-Wonder-Learn chart with students.

Materials

Food Chain Links
(U6.L1.A5-pp.40-43)
Coloring materials
Scissors
Tape
Yarn
Food Web Twister cards
(U6.L1.A5-pp.44-47)
Food Web List
(U6.L1.A5-p.48)

Hawaii Standards

SC.K.3.1

SC.1.3.1

SC.2.3.1

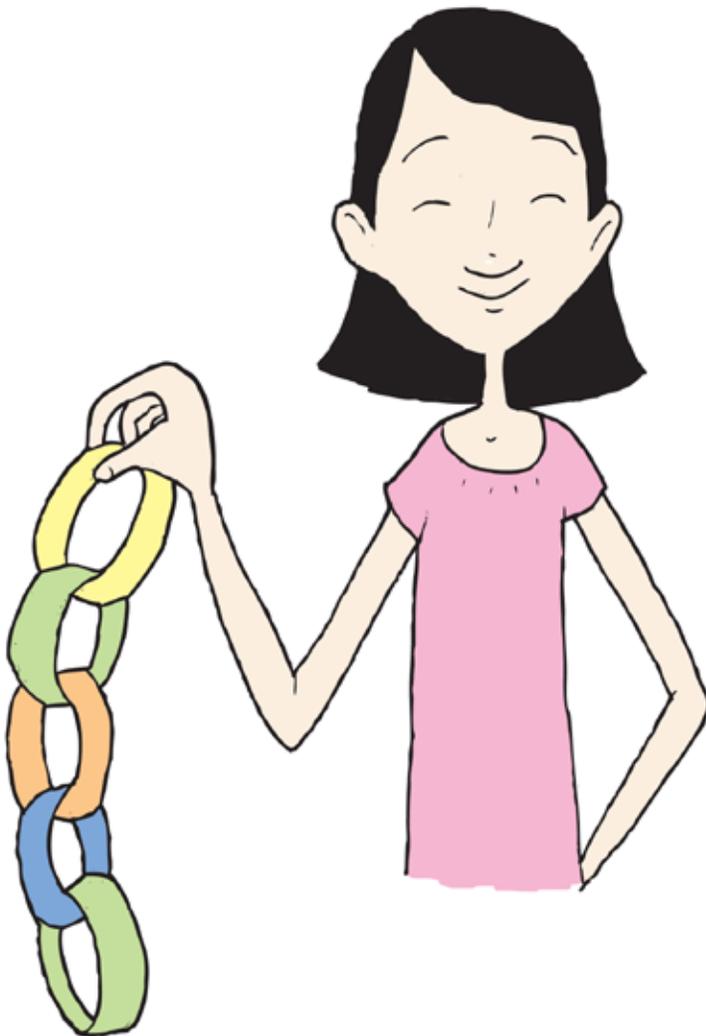
Think about it...

What is a food chain?

Engage

Make a food chain in small groups.

- Color and cut out food chain link from template.
Sun, producer, herbivore, and one or two carnivores
- Link together to form a food chain in the order they pass energy.
Glue or tape ends together.



Reading Resource

Coral Reef Food Chain by Kelley Maculay and Bobbie Kalman (J 577.78916 Ma)

Scientists Say ...

...*apex carnivore* for carnivores at the top of the food chain. They are in the fourth or fifth level and have no predators.

NOAA Link

Make a food chain mobile from the *Why is Hawaii's Ocean Important: A Keiki Activity Book*, sponsored by NOAA's National Ocean Service.

www.noaa.gov

Search "Why is Hawaii's Ocean Important"

Web of Life

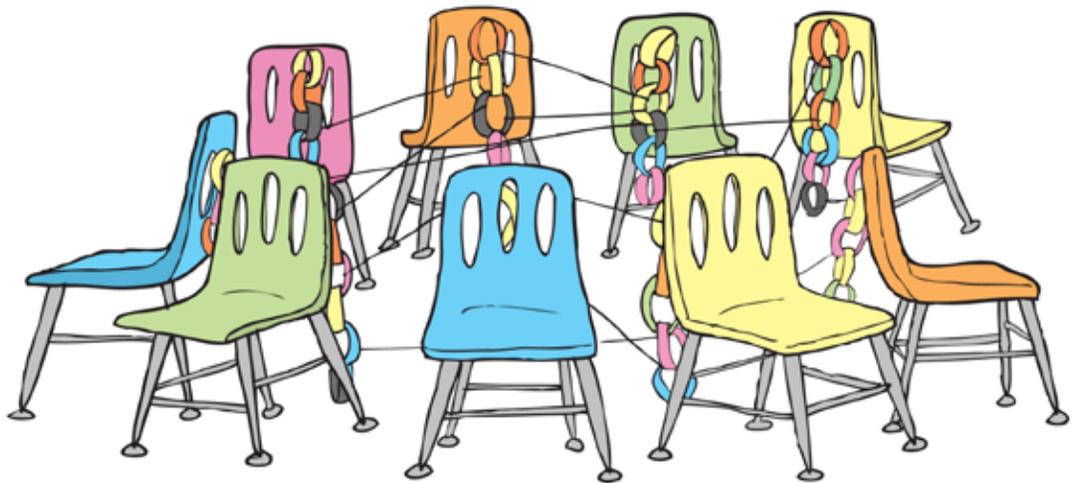
Think about it...

What is a food web?

Explore

Build a *Food Web* in small groups.

- Hang your food chain on the back of a chair.
Repeat with other chairs for the other food chains (one chain per chair).
- Link animals in each food chain to other things they eat on other food chains.
Cut and tape yarn to connect links.
- Discuss why scientists call this a food web.



Explain

You have learned how energy passes along an ecosystem. How can you keep track of all the different relationships? Food chain or food web!

What is a food chain?

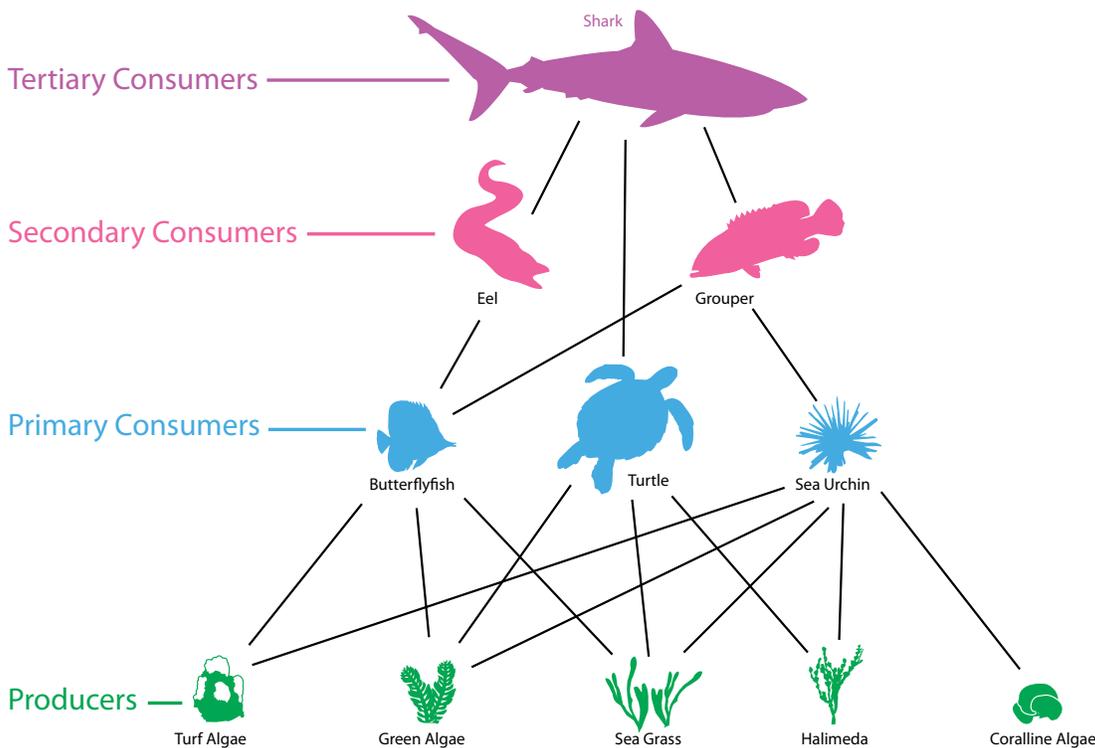
Model showing what eats what in a habitat! It tells us how energy flows from the sun to tertiary consumers. Food chains highlight relationships, such as how animals depend on plants.

What is a food web?

Multiple food chains! Most animals eat more than one prey and have more than one predator. Aunty says to think of a food web as a bunch of food chains woven together, like a spider's web!

Some connections in your food web: turtles eat sea grass, green algae, and halimeda; urchins eat turf algae, algae, halimeda, and crustose coralline algae; butterflyfish eat turf algae, algae and seagrass; groupers eat urchins and butterflyfish; eels eat butterflyfish and urchins; sharks eat turtles, eels, and groupers.

Hawaii Food Web:



Did You Know?

Each link in the food chain loses chemical energy. For example, by the time a puihi eats an uhu, the uhu has already used much of its algae energy in swimming and other activities.

Hawaii Nei

Scientists consider most deep ocean waters around Hawaii as biological deserts. Why? Food chains tend to be long, complex, and inefficient.

On a Related Note

Due to these biological deserts, predators spend more time and effort searching for food.

Web of Life

Think about it...

How many different ways can energy pass through a food web?

Elaborate

Play *Food Web Twister* as a class.

- Take a *Food Web Twister* card (U6.L1.A5-pages 44-47).
Tape to your shirt.
- Teacher: Read and fill in the blanks in this statement:
_____ gets its chemical energy from _____. Use food web list (U6.L1.A5-page 48).
Example: Algae gets its energy from the sun.
- Students: Place your hand on shoulder (or, foot touching foot) from what you get your energy.
Only do so after teacher calls out the pair. Example: Algae place your hand on shoulder of Sun.
- Teacher: Choose from the food web list at random to get the kids really twisted.
- Students: Start a new chain or link to an existing chain if the animal you eat has already been called.

How it works

Lots! The sun uses chemical energy to create light and heat energy. Producers change light energy into chemical energy during photosynthesis. Chemical energy passes from one consumer to the next when consumers eat.



Evaluate

What shows the transfer of energy in an ecosystem?

Answer by creating a food chain play in small groups.

- Use the *Food Web Twister* cards to assign roles (U6.L1.A5-pages 44-47).
- Practice telling a story about your food chain.
- Perform your story.

How does a food chain show how animals depend on plants?

Keiki Storytime

Who Eats What? by Patricia Lauber (J 574.53 L)

Just for Fun

Untangle a human web! Stand in a circle in groups of four or five. Take hold of two hands (not directly next to you). Untangle your circle without letting go of any hands

NOAA link

Learn about NOAA's National Marine Fisheries Service's Food Web Dynamics Program.

www.nefsc.noaa.gov

>>Site Index >> Food Web Dynamics Program

Assess

SC.K.3.1 Identify similarities and differences between plants and animals.

SC.1.3.1 Identify the requirements of plants and animals to survive (e.g., food, air, light, water).

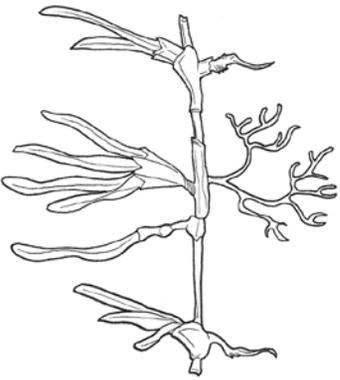
SC.2.3.1 Describe how animals depend on plants and animals.

Food Chain Links

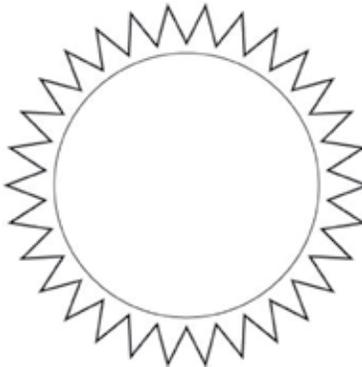
U6.L1.A5: Web of Life (Engage)



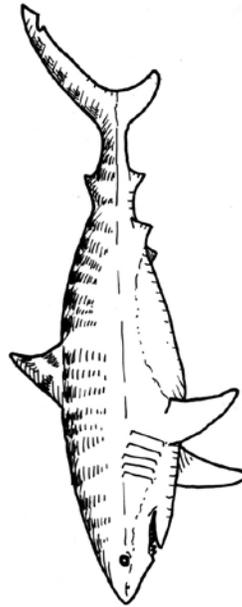
Producer - Seagrass



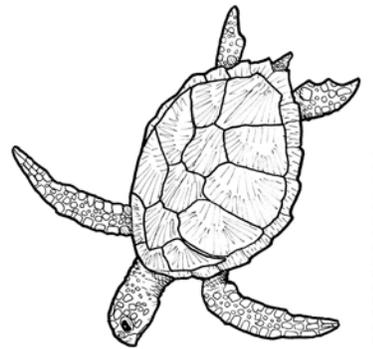
Sun



Secondary Consumer
(Carnivore) - Tiger Shark



Primary Consumer
(Herbivore) - Honu

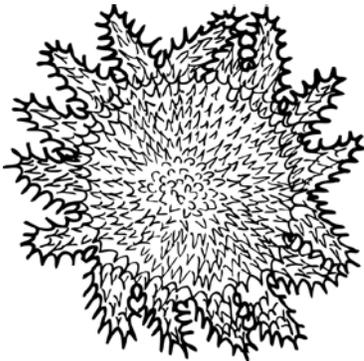


Food Chain Links

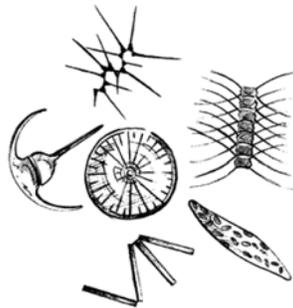
U6.L1.A5: Web of Life (Engage)



Secondary Consumer
(Carnivore) - Crown-of-Thorn Seastar



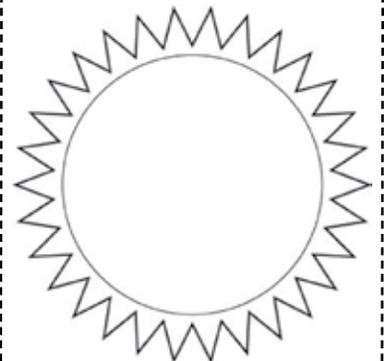
Producer - Phytoplankton



Primary Consumer
(Omnivore) - Coral



Sun

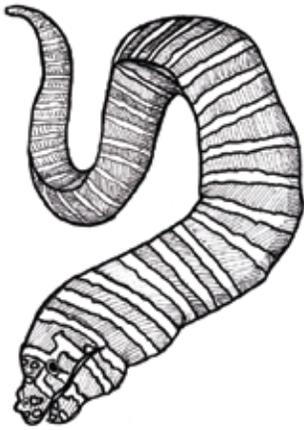


Food Chain Links

U6.L1.A5: Web of Life (Engage)



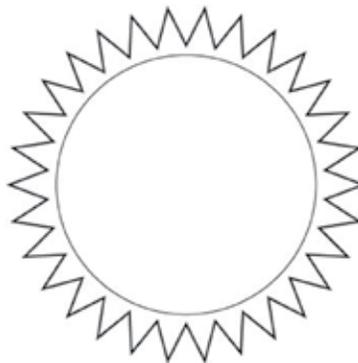
Secondary Consumer
(Carnivore) - Moray Eel



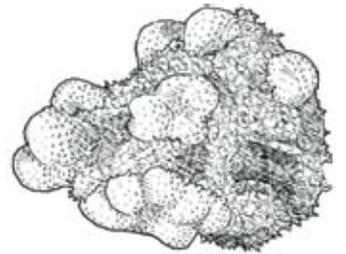
Primary Consumer
(Herbivore) - Ornate Butterflyfish



Sun



Producer - Turf Algae

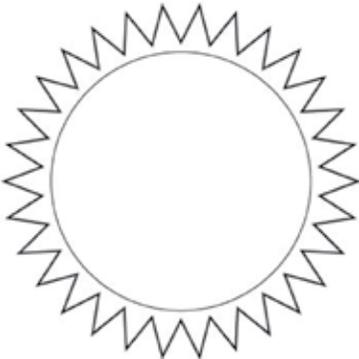


Food Chain Links

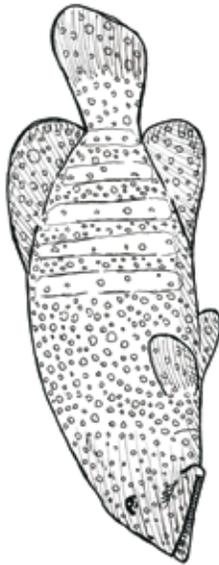
U6.L1.A5: Web of Life (Engage)



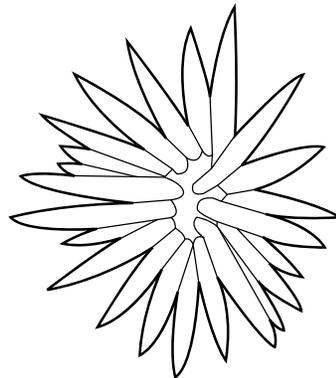
Sun



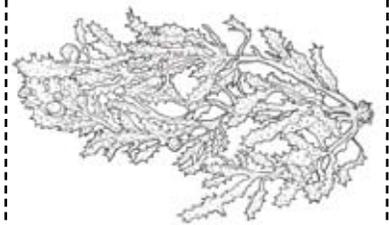
Secondary Consumer
(Carnivore)- Grouper



Primary Consumer
(Herbivore) - Urchin

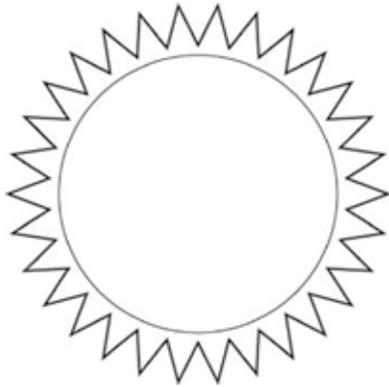


Producer - Algae



Food Chain Twister Cards

U6.L1.A5: Web of Life (Elaborate)



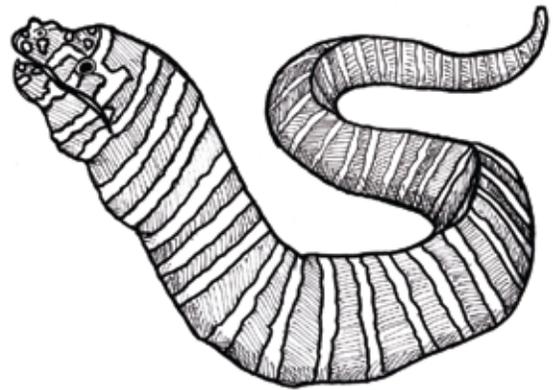
Sun



Algae



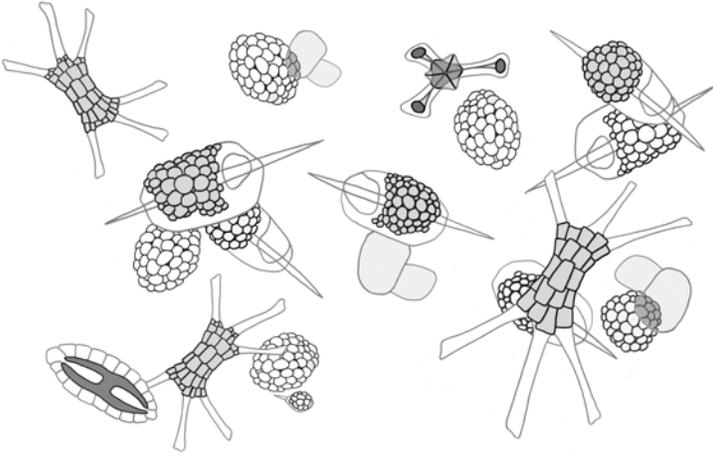
Urchin



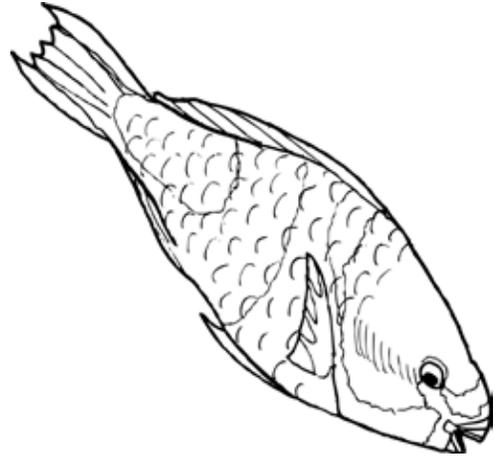
Eel

Food Chain Twister Cards

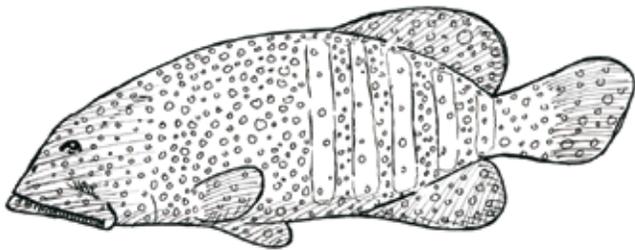
U6.L1.A5: Web of Life (Elaborate)



Phytoplankton



Parrotfish



Grouper

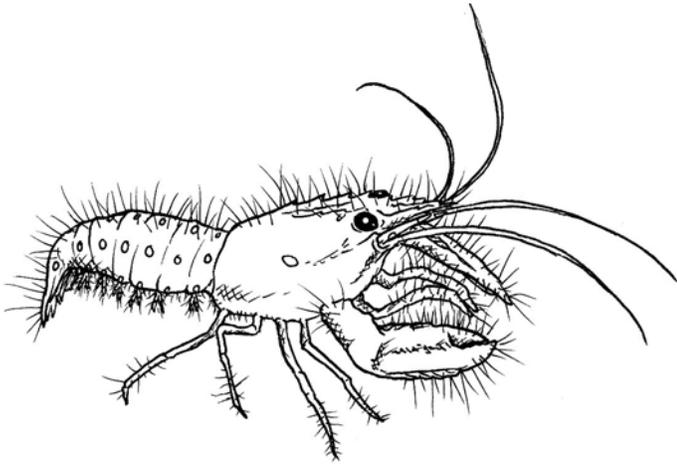


Sea Star

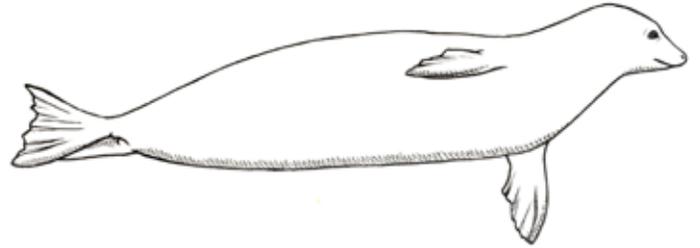


Food Chain Twister Cards

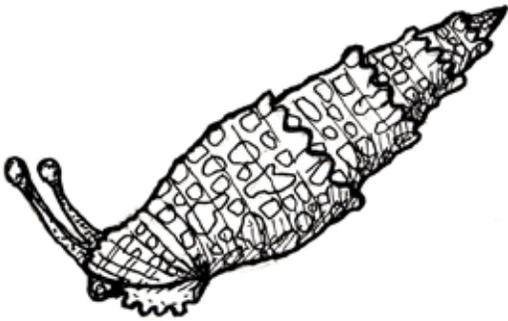
U6.L1.A5: Web of Life (Elaborate)



Lobster



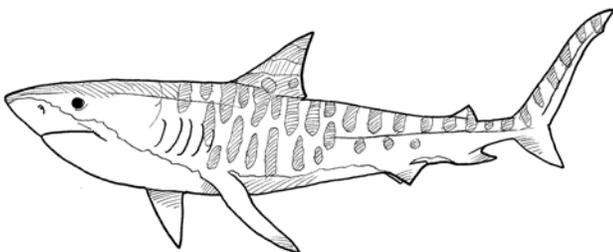
Monk Seal



Triton - Trumpet Seal



Butterflyfish



Shark



Octopus

Food Web List

U6.L1.A5: Web of Life (Elaborate)

Read and fill in the blanks in this statement:

_____ gets its chemical energy from _____.

Example: Algae gets its energy from the sun.

Algae << sun

Phytoplankton << sun

Parrotfish << algae

Urchin << algae

Zooplankton << phytoplankton

Oyster << phytoplankton

Eel << parrotfish

Grouper << parrotfish

Grouper << urchin

Sea star << urchin

Coral polyp << zooplankton

Crab << zooplankton

Sea star << oyster

Lobster << oyster

Shark << eel

Monk seal << eel

Triton trumpet snail << sea star

Sea star << coral polyp

Butterflyfish << coral polyp

Octopus << crab

Grouper << crab

Monk seal << lobster

Loggerhead turtle << lobster

Shark << monk seal

Grouper << butterflyfish

Shark << octopus

Human << parrotfish

Human << octopus

Intentionally Left Blank



Tropical Trophic Tiers

(Energy Pyramid)



SCIENTISTS SHOW ENERGY TRANSFERS FROM THE SUN TO PRODUCERS TO CONSUMERS WITH TROPHIC LEVELS.

Ready?

Engage

Make a bowl of popcorn.

Explore

Familiarize yourself with the origami box instructions (U6.L1.A6-pages 56-57).

Cut paper into squares. Each group gets twelve yellow, six green, three blue, two pink, one purple.

Photocopy *Energy Pyramid Producers and Consumers* (U6.L1.A6-pages 58-59) Each group receives one of each page.

Evaluate

Create a large triangle template on a sheet of paper.

Trace the triangle on three different color papers (one paper per student).

Draw two horizontal lines to create three tiers on each triangle. Students will cut on lines.

Set?

- Unit 5-Lesson 2-All Activities: *Alive and Eating*
- Unit 6-Lesson 1-Activity 1: *Chemical Collisions* (Chemical Energy)
- Unit 6-Lesson 1-Activity 2: *Productive Primary Producer* (Producers)
- Unit 6-Lesson 1-Activity 3: *Primary Producer Eaters* (Primary Consumers)
- Unit 6-Lesson 1-Activity 4: *Consuming Critters* (Secondary Consumers)
- Unit 6-Lesson 1-Activity 5: *Web of Life* (Food Chains and Webs)

Go!

Develop Know-Wonder-Learn chart with students.

Materials

Popcorn

Bowl

Paper (12 yellow, 6 green, 3 blue, 2 pink, 1 purple) (per group)

Energy Pyramid Producer and Consumers

(U6.L1.A6-p 58-59)

Construction paper (3 colors)

Scissors

Glue

Markers

Hawaii Standards

SC.K.3.1

SC.1.3.1

SC.2.3.1

Think about it...

How many producers do primary consumer need to eat?

Engage

Play *How Full Are You?* as a class.

- Wash your hands then sit in a circle.
- Pass a bowl of popcorn around and take one popcorn each.
Eat your piece of popcorn.
- Pretend you are an herbivorous fish that just munched on a popcorn size piece of algae.
Would you still be hungry? Discuss how much algae you would need to eat to be full.



Think About It

If the primary consumer (*herbivore*) is small, its food chain tends to be longer. The larger the primary consumer, the shorter the food chain.

Interesting Fact

Because the energy in plants delivers less chemical energy than in animals, herbivores have to eat a lot of plants in order to live.

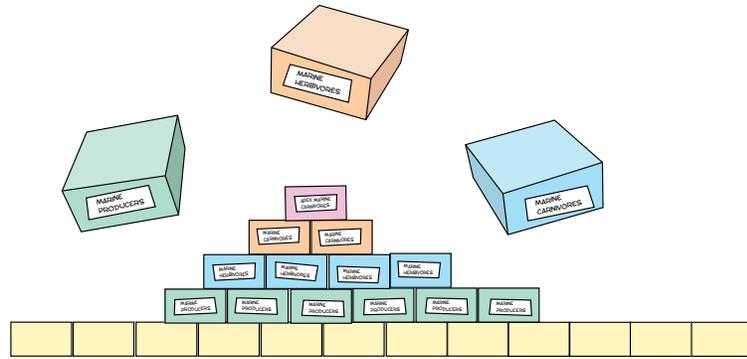
On a Related Note

Manatee (very large herbivore) have to eat ten to fifteen percent of its weight every day. That equals two hundred pounds a day for an adult manatee. That's a LOT of vegetables.

Hawaii Nei

The humpback whale may be Hawaii's largest secondary consumer, but they do not eat while here! Rather, they live off of their stored fat (blubber).

Tropical Trophic Tiers



Think about it...

What is an energy pyramid?

Explore

Create a *Tropical Trophic Pyramid* in small groups.

- Fold 12 yellow origami boxes (U6.L1.A6-pages 56-57).
Draw a sun on boxes.
- Fold 6 green origami boxes.
Cut and paste algae (U6.L1.A6-page 58) onto green boxes or write “producer.”
Look at www.marinelifephotography.com for other examples from Hawaii.
Examples: red, green, brown algae, seagrass, phytoplankton
- Fold 3 blue origami boxes.
Cut and paste herbivores (U6.L1.A6-page 59) onto blue boxes or write “herbivore.” Look at www.marinelifephotography.com for other examples from Hawaii.
Examples: angelfish, anthias, blennies, boxfish, butterfly fish, damelfish, dart fish, chubs, sea urchins
- Fold 2 pink origami boxes.
Cut and paste carnivores (U6.L1.A6-page 59) onto pink boxes or write “carnivores.”
Look at www.marinelifephotography.com for other examples from Hawaii.
Examples: barracudas, bigeyes, bonefish, cowfish, eels, filefish, flatfish, frogfish, goatfish, milkfish, seahorse, triggerfish, trumpettfish
- Fold 1 purple origami boxes.
Cut and paste apex carnivore (U6.L1.A6-page 59) onto purple box or write “apex carnivore.” Look at www.marinelifephotography.com for photo examples from Hawaii.
Example: shark
- Build your trophic pyramid.
Line up sun boxes in a row. Stack green marine producer boxes on sun boxes. Next stack the blue herbivore boxes, then pink carnivore boxes, and last the purple apex carnivore box on very top of pyramid. Stagger boxes.

Explain

Energy pyramids show the food chain in a different way. They divide the food chain into steps, called trophic levels.

How many producers do primary consumer need to eat?

Lots! An herbivore needs to eat lots of plants or algae in order to get enough chemical energy from the producer. The consumer uses energy from the producers to move, breathe, and grow, so they need to eat a lot in order to have enough energy to pass on to the animal that eats them.

What is an energy pyramid?

Flow of energy! All life on Earth depends on the sun for energy. Therefore, the sun forms the base of the pyramid. Trophic level one includes the producers, level two herbivores (primary consumers), and level three carnivores (secondary and tertiary consumers). Level four has the apex carnivores. The levels become smaller and smaller as you move upwards, because only 10% of energy from one trophic level moves to the next. Producers and consumers use most of their energy themselves to digest, grow, breathe and reproduce.

Did you know?

Producers capture only 1% of the available light energy from the sun for photosynthesis.

On a Related Note

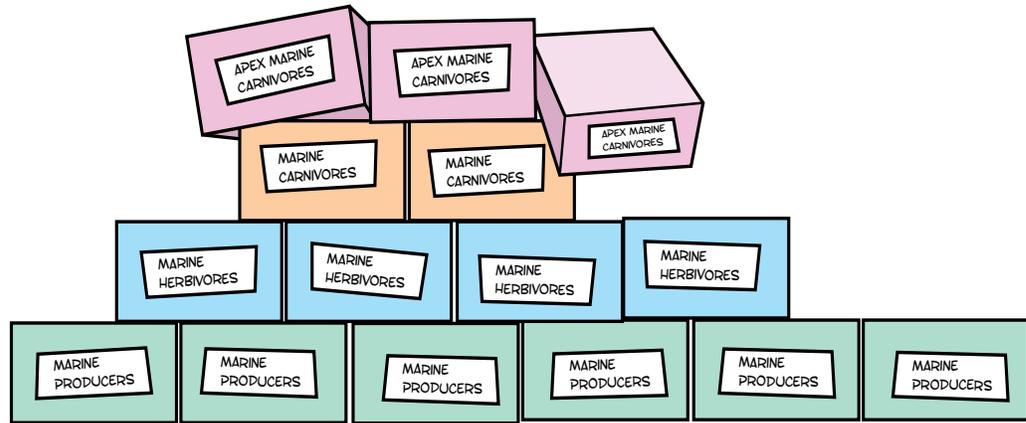
About 80-95% of chemical energy is lost at each trophic level.

Just for fun

Write *Tropic Trophic*. They are spelled almost the same, but the "ph" in trophic sounds like an "f" and not a "p".



Tropical Trophic Tiers



Think about it...

What would happen if there were more herbivores than producers?

Elaborate

Build and topple your energy pyramid.

- Build your food pyramid again (without sun boxes).
- Demonstrate what would happen if there were more herbivores than producers. Carefully remove some producer boxes.
- Could there ever be more apex carnivores than regular carnivores? Create and add more apex carnivore boxes.

How it Works

Pyramid would readjust! In the winter on the mainland, plants die or become dormant. This creates food shortages for herbivores. Thus, weaker herbivores begin to die. As the winter progresses, carnivores do not have enough to eat, so weaker ones die too. Tutu says, even though we place producers at bottom of the pyramid, they play an important role for consumers!

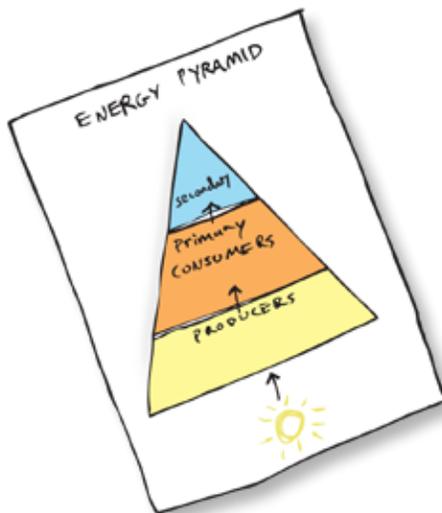
Evaluate

How do you show how much energy passes through food change?

Answer by designing your own food pyramid individually.

- Cut your pyramid template and group pieces by sizes.
Pile 1: Base of pyramid, pile 2: middle of pyramid, pile 3: tops of pyramid.
- Take one piece of pyramid from each pile.
Mix up the colors.
- Form a pyramid (with three different color pieces) and glue to blank paper.
- Label each level.
- Draw the sun below your pyramid.
- Draw the energy path from the sun to each section.
- Describe the flow of energy.

How do consumers provide producers with energy?



Assess

- SC.K.3.1 Identify similarities and differences between plants and animals.
- SC.1.3.1 Identify the requirements of plants and animals to survive (e.g., food, air, light, water).
- SC.2.3.1 Describe how animals depend on plants and animals.

Did You Know?

You learned that plants keep animals alive by creating food for them to eat. But did you know animals help keep plants alive too? Their poop gives plants nutrients to grow bigger and stronger.

Interesting Fact

Decomposers, animals who break down dead plants, animals, and even poop are important to the ecosystem too. Without them, dead matter would pile up and plants would not get the nutrients from poop!

NOAA link

View a marine food pyramid chart at NOAA's National Climatic Data Center.

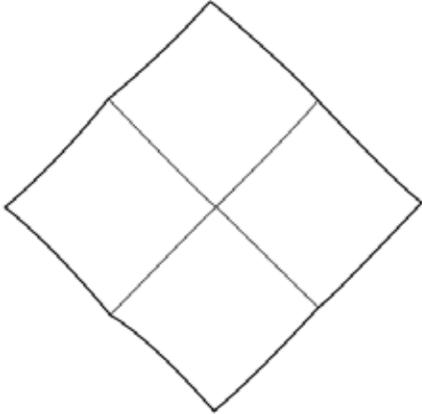
www.ncdc.noaa.gov

Search "Food pyramid transfer of energy"

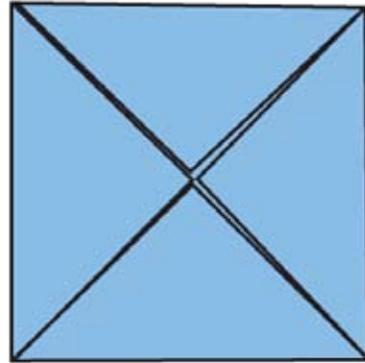
Origami Box Instructions

U6.L1.A6: Tropical Trophic Tiers (Explore)

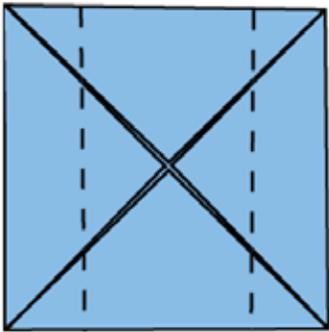
<http://www.origami-instructions.com/origami-box.html>



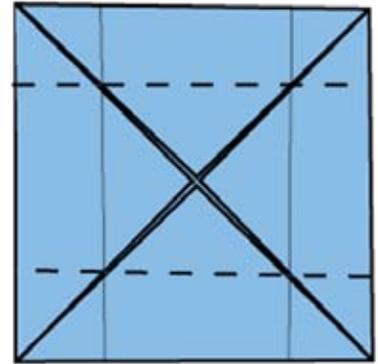
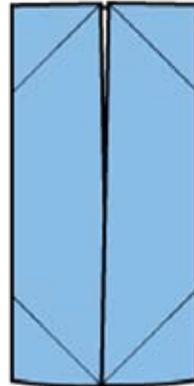
1. Fold the paper in half. Open.
Fold the paper in half the other way. Open.



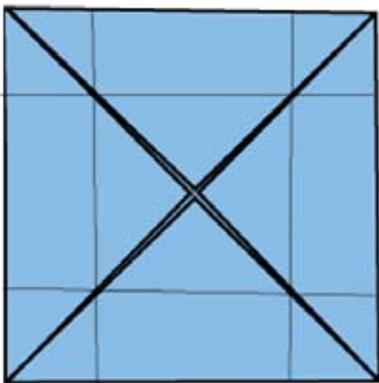
2. Using the fold lines as guides, fold the four corners of the paper into its center.



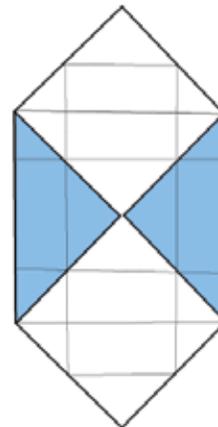
3. Fold the right edge and the left edge into the centerline. Open.



4. Repeat fold to the centerline by folding the top edge down and the bottom edge up. Open.



5. The unfolded paper should like this.

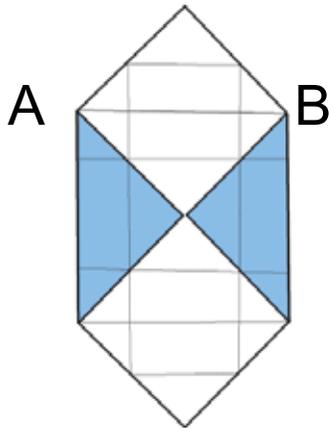


6. Unfold the top and bottom flap.

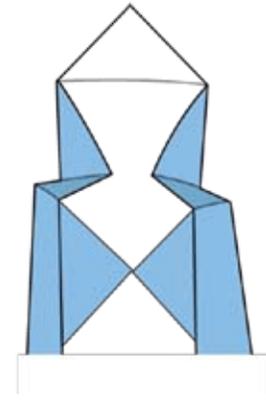
Origami Box Instructions (continued)

U6.L1.A6: Tropical Trophic Tiers (Explore)

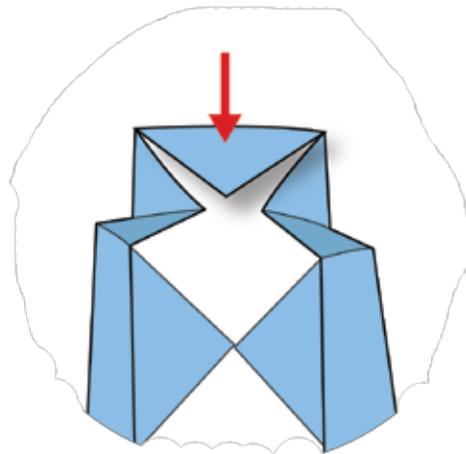
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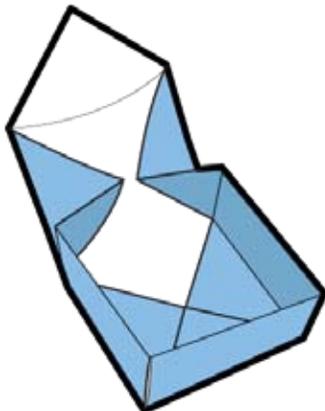
7. Put your finger behind point A and do a reverse fold. As shown in step 9. One side of the box will be formed as you do this.



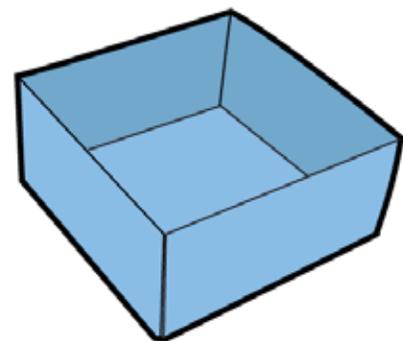
8. Do the same for point B.



9. Now tuck in the flaps as shown to form the third side of the box.



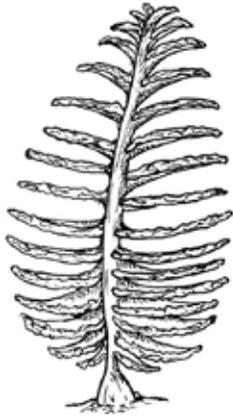
10. Turn the box around and repeat the sequence of the last 3 photos. You can tape flaps down inside box.



11. Done!

Energy Pyramid Producers

U6.L1.A6: Tropical Trophic Tiers (Explore)



Producer
Caulerpa (Green alga)



Producer
Limu kohu (Red alga)



Producer
Limu kala (Brown alga)



Producer
Padina (Brown alga)



Producer
Limu manuea (Red alga)



Producer
Halimeda (Green alga)

Energy Pyramid Consumers

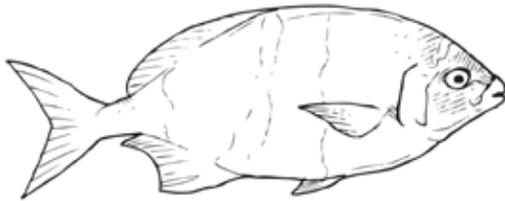
U6.L1.A6: Tropical Trophic Tiers (Explore)



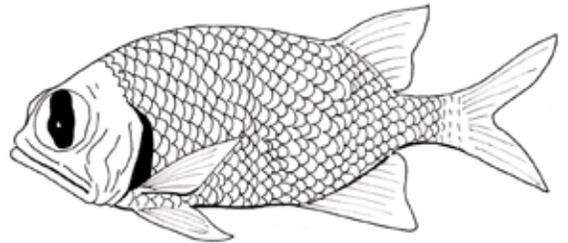
Herbivore
Kikakapu (Butterflyfish)



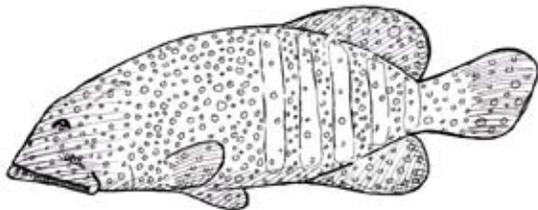
Herbivore
Wana (urchin)



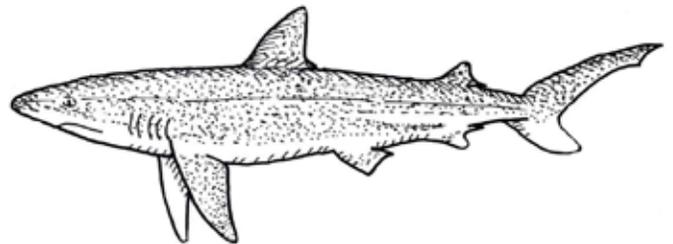
Herbivore
Nenuē (Hawaiian Chub)



Carnivore
Menpachi or Uu (Soldierfish)



Carnivore
Roi



Apex Carnivore
Mano (Reef shark)