

WATERFALL WIZARDS



Grade 2

Lesson at a Glance

Students make three-dimensional goby (‘o‘opu) models and explore the life cycle of this native freshwater fish.

Key Concept

Native stream organisms have adapted to fresh water and spend part of their life cycle in the sea.

Objective

Students will be able to describe the life cycle of the native Hawaiian goby and its dependence on the sea.

Time

two to three class periods

Subject Areas

science, art, language arts, Hawaiian studies

Materials

student activity sheet (provided)
‘o‘opu pattern (provided)
cotton balls or tissue paper
construction paper (various colors)
scissors
glue or paste
toy dart, toilet plunger or other suction cup (optional)



Preparation

Make a model ‘o‘opu as described in the student activity sheet. Copy the ‘o‘opu outlines onto construction paper or colored paper.

Teacher Background

Ancestors of most native stream animals in Hawai‘i originally came from the sea. Native ‘o‘opu (goby fish), snails and shrimp adapted to live in fresh water but still spend part of their young larval stage in the ocean. Adult oopu range from 20–30 cm (8–12 in) long. The five native species vary in color but are typically bluish or grayish with darker eyes. They were once common in our streams and are considered good to eat.

The female ‘o‘opu lays hundreds of tiny (less than 1 mm) eggs on a rock in a stream, where they are fertilized by a male. When the small **larvae** hatch about a day later, they are carried out to sea. Two species are believed to remain at sea for an average of 155 and 170 days before returning to a stream as tiny ‘o‘opu called *hinana*. Scientists are not sure how long the other species remain at sea.

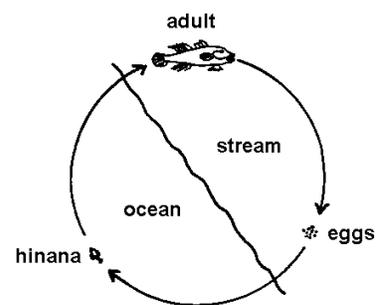
The *hinana* have clear bodies and large eyes near the top of their heads. The small *hinana* (less than 2 cm, or .78 in) rest in the calm, shallow waters along the margin of the stream. As they mature, they make their way upstream (and sometimes up waterfalls) by a special adaptation. Their pelvic fin has fused and flattened to become a suction cup! The juveniles cling to rocks with their pelvic fin and then push themselves up with their tails. They have been observed climbing waterfalls at a rate of 45 cm (18 in) in 20 seconds! With this special adaptation, these juveniles make their way upstream where they eventually mature into adult 'o'opu.

Gobies are the most typical stream fishes of oceanic islands. Scientists believe that the ancestors of our native gobies were carried from other Pacific islands as larvae in ocean currents. They are easily dispersed throughout the Hawaiian Islands by the same method.

There were many 'o'opu in Hawai'i before people began to divert water from streams or channelize streambeds with concrete. Hawaiians watched for the large schools of *hinana* and caught them with nets as the fish returned to the streams. One kind of 'o'opu the 'o'opu *nōpili*, was a symbol of good luck. It was symbolically fed to babies as their first solid food so that good luck would cling to the child like the fish clings to rocks. (*Pili* means "to cling.")

Teaching Suggestions

1. Tell the class that long before any people came to Hawai'i, fish called 'o'opu lived in the Islands' freshwater streams. Ask students how they think freshwater fish could have made it to Hawai'i. Counter their suggestions. (Freshwater fish cannot fly or survive in the belly of a bird or live in a saltwater ocean.) It's a mystery that can be solved by understanding the 'o'opu life cycle.
2. Read "The Waterfall Wizard" to the class. Discuss the special adaptation that allows the 'o'opu to climb waterfalls. Demonstrate with a real suction cup, if available.
3. Draw a large circle on the board, and ask students to help you fill in the life cycle of the 'o'opu. Draw the line between the freshwater stage and the saltwater stage. (See diagram.) Explain that freshwater fish probably arrived in Hawai'i as larvae drifting in the ocean. They have adapted to spend part of their youth in the sea, and their adult life in streams.
4. Distribute the student activity sheets, and place 'o'opu patterns and craft materials on various work tables. Display the 'o'opu prepared earlier, and help students make their own 'o'opu models.
- ✓ 5. Ask students to draw a picture that shows the life cycle of the 'o'opu. Have them write a few sentences to describe the 'o'opu life cycle and its dependence on the sea.



6. Display the completed 'o'opu models with students' drawings and descriptions in the classroom.

Extended Activities

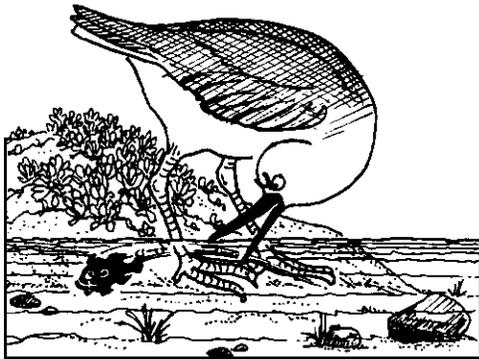
- Use the 'o'opu as tokens to mark student progress in reading, spelling or math. Staple long strips of blue paper to a bulletin board to represent waterfalls, and move the 'o'opu models up them as different goals are accomplished.
- Have students create a large stream mural, using the color poster provided as a reference. Staple blue paper to a large piece of cardboard or bulletin board and have students make paper cutouts of stream animals, rocks and plants. Staple the cutouts in place to create a stream community.
- Make a poster of the 'o'opu life cycle. Use glitter to present eggs, and a small (2 cm) fish cutout to represent the *hinana*. Draw a line between the freshwater and saltwater stages of the lifecycle. Glue different colored tissue paper on each side to represent the sea and the stream.
- Have students write their own mythical stories explaining how the 'o'opu came to live in Hawaiian streams.
- Teach the class a song about the 'o'opu (see Unit Resources).

Hinana was a wizard. The gentle green turtles, the playful dolphins, the jellyfish and all the other animals of the sea knew this. He was a rascal sometimes, playing tricks and casting magic spells just for fun. Once he made a shark turn bright pink for a day so it couldn't sneak up on other fishes. Another time Hinana changed a whale's voice so it sang like a rock star. This made all the other whales laugh, until the spell wore off. The shark and the whale were very angry at Hinana, but they were never able to find him. You see, Hinana was very small, smaller than your baby finger. His body was clear and he was difficult to see, unless you had very good eyes.



One day Hinana was playing near an island shore where a stream flowed into the sea. He knew that sharks sometimes swam nearby, and they were so much fun to tease. The cool fresh stream water mixing with the seawater felt good to Hinana. The stream was carrying all sorts of things into the ocean. Hinana moved a little closer and began to explore.

There were waxy seeds bobbing in the water, and pretty flowers and leaves floating by. Some tiny fish larvae drifted past, and little fish darted about, trying to escape the sharp beak of a large grey bird with yellow legs. Every now, and then, the bird would stop and whistle so Hinana decided that must be her name. She was running up and down the shore snatching little snails and bashing their shells against the rocks or swallowing fish whole! Hinana had never seen such a bird before and decided to have some fun.



‘Ūlili had moved deeper into the stream, and it took Hinana a while to fight against the current and sneak up behind her. “‘Ūlili,” he called, “betcha can’t catch me!” ‘Ūlili snapped her head around and stared straight at Hinana. He could see that this bird had good eyes! Hinana wasn't worried though. He had good spells! He called out, “Your legs sure are yellow. Don’t you ever take a bath?” Hinana laughed and darted between the yellow legs. ‘Ūlili turned again and lunged for Hinana. She didn’t even know if he would taste good, but enough was enough.

Just as Hinana was about to be snapped up, he darted behind a rock and sang:

*Abacadabra, seashells and sun,
You had a mouth, but now there is none!*

Hinana watched eagerly, waiting for ‘Ūlili to lose her mouth. Instead, she jumped upon the rock and lunged for him again. He escaped by dashing through a small opening beneath the rock. He

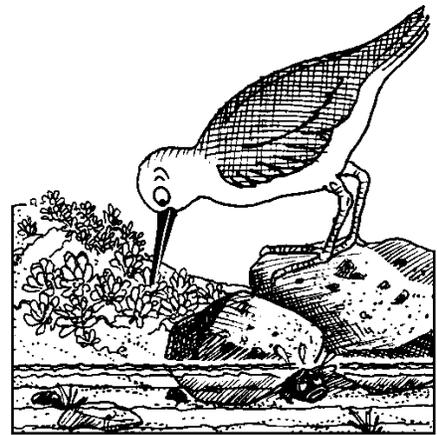
was hidden in a shadow, but ‘Ūlili was waiting for him. Hinana tried the spell again, using the word “beak” instead of mouth:

*Abracadabra, seashells and sun,
You had a beak, but now there is none!*

Hinana waited a moment and peeked out cautiously to be sure the black beak was off. No sooner did he leave the safety of the shadow than ‘Ūlili lunged again, this time only barely missing him. Hinana was afraid. The spell hadn’t worked. Perhaps his spells only worked on animals in the sea. Perhaps there was a different spell for shorebirds. There was no time to think! ‘Ūlili was coming closer. Hinana was trapped. Even if he got out, he couldn’t swim upstream fast enough to hide in the deeper water. In the other direction was a long stretch of shallow stream and surf—he wouldn’t make it halfway.

There was only one thing to do. His magic spells wouldn’t work on ‘Ūlili, but they may still work on him. He glanced down at the fin on his chest and chanted a new spell:

*Abracadabra, seashells and sun,
‘Ūlili is angry, and I have to run.
The deep water stream is the best place to hide,
Away from ‘Ūlili, away from the tide.
A new body part is what I will need.
The fin on my chest will do fine indeed.
Let it grow strong like a suction-cup fin.
Abracadabra, now I can win!*



As Hinana chanted the final words, the fin on his chest began to flatten and widen until it looked like a tiny suction cup. He felt the muscle getting stronger. He had never cast a spell on himself before, and he was scared.

Just then, ‘Ūlili plunged into the shadow and snapped her beak. Hinana jumped away into the flowing stream. He clung to a rock with his special fin and pushed himself forward with his tail. He dove to the deepest part of the stream. ‘Ūlili’s shadow was just behind Hinana. He grabbed onto a rock and pushed and swam away from ‘Ūlili as fast as he could. It was a long time before he began to feel safe again.

Hinana swam to the edge of the stream where the current was not as strong. There he rested in some soft green algae, hidden from the other animals in the stream. He was so tired. Never in his life had he worked so hard or been so frightened. He knew that he would not have survived without his special fin that helped him cling to rocks in the rushing water. Hinana also knew it might never be safe to return to the sea since his spells didn’t seem to work anymore.

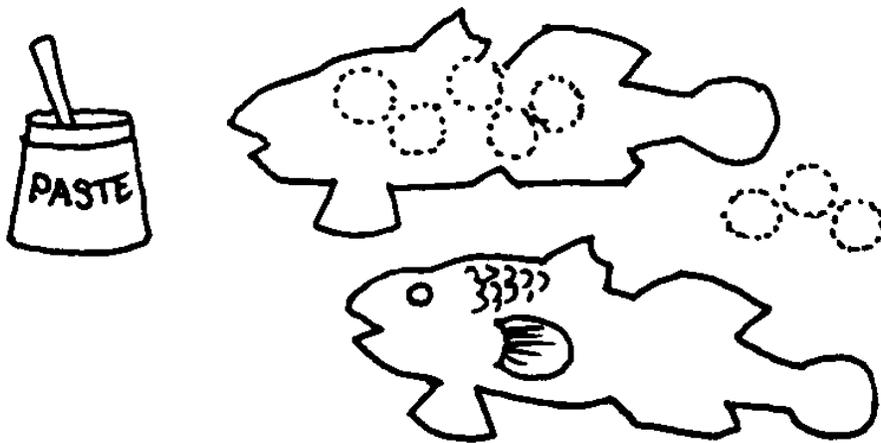
Hinana lived for the rest of his life in that stream. He was so good at climbing waterfalls with his special fin he became known as the Waterfall Wizard. He grew to be almost as big as ‘Ūlili, over 25 cm (10 in) long.

Today, small Hawaiian fish called *hinana* still swim from the salty ocean to freshwater streams using their special suction-cup fins. *‘Ūlili* sometimes catch them near the shore and in the streams. When *hinana* grow into adults they are called *‘o‘opu*. The eggs they lay in streams hatch into tiny larvae that are carried out to sea, where they grow into *hinana*. The adult *‘o‘opu* never return to the sea. Their magic is lost, but they are still the wizards of the waterfalls!

THE END

Make a Model 'O'opu!

1. Draw scales on the fish. Color in the eyes.
2. Cut out the 'o'opu along the solid lines.
3. Put paste on the blank sides of the fish. Do not paste the small fin at the bottom.
4. Stick cotton balls or tissue on the fish.



5. Press together and staple the fish.
6. Write your name on the tail. Your 'o'opu is now ready to climb a waterfall.



