



NATIVE ANIMALS

Concepts

Life cycle
Physical transformation

HCPS III Benchmarks

SC 1.2.2
SC 1.5.2

Duration

1 hour

Source Material

PRISM
Ohia Project

Vocabulary

Life cycle
Hatch
Larvae
Forage
Herbivore
Predator

'O'opu Life Cycle

Summary

In this lesson, students act as 'o'opu (Hawaiian gobies) at different stages of life. An obstacle course begins at the egg stage and students make their way through each step (i.e. larvae, post-larvae, juveniles, adults, etc.), from the ocean to a freshwater stream. Each stage uses a different mode of locomotion, which students enact. Props are used to represent their food resources and eggs.

Objectives

- Students will learn the life stages and the amphidromous (partly sea and partly freshwater) life cycle of 'o'opu by enacting them through an obstacle course.
- Students will be able to describe the cyclic nature of reproduction, and how a complete habitat plays an important role for species conservation.

Materials

“Snack size” plastic bag (1 per student)
1 fish mouth mask and pelvic fins (for students to take turn wearing)
Ribbon (blue and various colors)
1 picture or puppet to represent a fish predator
1 insect net or fish net
1 bowl or bucket
Signs with stakes to label each stage on the course
2 balls (soccer ball size) or just use hard-boiled eggs
6 orange cones or markers
1 bag of green dried peas (represents algae)
Tables or picnic tables (1 table per 4 or 5 students)
1 ladder or jungle gym

Making Connections

Understanding the natural history of a species is important for its conservation. Since 'o'opu spend one part of their lives in the ocean and the other in freshwater streams, it is crucial to protect the stream habitat and its pathway to the ocean. Ahupua'a refers to a management system that considers the complete watershed, and it is a system that makes sense for conservation practices.

Teacher Prep for Activity

- Reserve the playground and construct the circular obstacle course prior to class (see attached diagram of setup).
- Obtain and construct all props and recreational equipment.
- Extension activities can be conducted prior to the life cycle lesson.



Background

‘O’opu, the Hawaiian freshwater stream gobies, are amphidromous. They spend part of their lives in the ocean and the other part in freshwater stream. Breeding females lay their eggs in the freshwater stream by attaching them on the bottom of rocks. After one or two days, the eggs hatch and the larvae (baby ‘o’opu) go down the stream to the ocean. After spending three to six months of larval development in the ocean, the young (post-larvae) return to the freshwater stream, where they mature and reproduce.

Before they start migrating upstream, post-larval and juvenile ‘o’opu must go through some physical transformations. Transparent post-larvae develop colorations and become juveniles. Some species of ‘o’opu will change location of the mouth and length of the intestine in order to adjust for the new diet in the freshwater stream.

Most of the adult ‘o’opu are herbivorous fish that feed on algae. An adult ‘o’opu has a mouth that locates on the bottom of its head, with a row of teeth that line up beneath the upper lip for scraping algae off the rock. It also uses its mouth to climb up rock surface and move upstream. To maintain position in a fast flowing stream, ‘o’opu use suction discs that formed by their pelvic fins (the paired fins that is located on the bottom of the body) to cling onto rocks. Some species of ‘o’opu migrate considerable distances inland and over tall waterfalls against swift current. Finally, ‘o’opu return to their place of birth, where they spawn and start another new generation.



‘O’opu Nopili. Photo by Yamamoto and Tagama

‘O’opu are consumed by people as food, and given to each other as gifts. ‘O’opu nopili, one of the species of Hawaiian gobies, got its name from its ability to cling on rocks. Hawaiians used it as a gift for weaning and housewarming so that the good luck may “cling.”

Vocabulary Explained

Life cycle describes the stages in one generation of an organism.

An ‘o’opu **hatches** or is produced from an egg.

A **larva** (*pl.* larvae) is the earliest life stage for ‘o’opu and many other animals that go through physical changes as they get older.

To **forage** is to look for food and other provisions.

An **herbivore** is an animal that only feeds on plants.

A **predator** is an animal that kills and eats other animals.

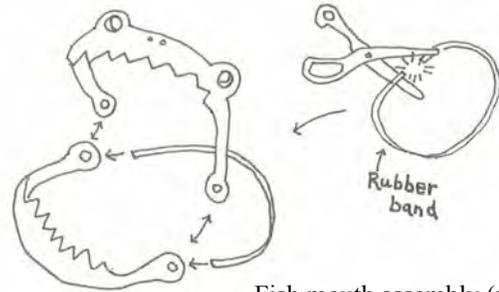
Procedure

1. Introduce new vocabulary while inside the classroom. Show pictures of different developmental stages when you introduce the words (i.e. larva). A life cycle wheel (see “Extension Activity 1”) is provided for this purpose.
2. It might be helpful to introduce basic fish anatomy before the game. O’opu fish model (see “Extension Activity 2”) is provided for this purpose.
3. Have students get in line and go outside to the obstacle course.



4. The first station represents larvae hatching out of the eggs. The students will hide under several picnic tables that represent rocks on the stream bed. Then they will hatch one at a time and get in line as larvae (see **eggs** station in obstacle diagram). SUGGESTION: Have students go through the course one at a time, so it does not become a race!

5. At the larva station, the student will need to put on a fish mouth and make a swimming motion (drifting in the ocean) all the way to the post-larva station. The fish mouth needs to be placed on the top of the head (with the mouth pointing straight up), and students will swim with their head down to mimic a fish so that the fish mouth points forward (see **larva** station).



Fish mouth assembly (p. 6)

SUGGESTION: take some pictures of students at each station and turn them into a class book. This might help to encourage the students to take their time and be accurate.

6. At the **post-larva** station, students keep the fish mouth at the same position. During this stage, post-larvae return to the freshwater stream, but they are depredated by humans. Teacher or an adult helper can act as a fisherman and try to catch the passing ‘o’opu with a net (it might be better to not actually capture the students).

7. Next, at the **juvenile** station, ‘o’opu will go through morphological transformation. They change the position of the mouth (move the mask in front of the face) and obtain disc-shaped pelvic fins. They will then forage on algae by crawling to the rock and picking one bag of green peas from the rock (place the “algae bag on the top of the rock). Students must keep the food bag with them for the rest of the course.

8. They have finally become adults! At the **adult** station, each student will climb over a waterfall (a ladder, a stairway, or a jungle gym decorated with blue ribbon). After climbing over the waterfall, they will have to walk with a ball or a hardboiled egg in their hands. A predator fish (played by the teacher or assistant) will come at them, and they must try to keep the ball and the bag of food.

9. Once the ‘o’opu makes it to the “end” he or she will notice they’re actually at the beginning again by the picnic tables. They have made it around the life cycle! Teachers may give the students a “certificate of life cycle completion” at the end of the course to encourage the students to finish the course.

NOTE: on a raining day, you may set up the course indoors using the same materials. At the adult station, you may set up the waterfall using tables and chairs.

GROUP DISCUSSION: Have the class sit in a circle for the discussion. Here are some discussion-starter questions:

1. What parts of the life cycle did you find to be easy?
2. What parts of the life cycle were more challenging?
3. What threats do ‘o’opu encounter during their life cycle?
4. What will happen to the life cycle if we take away the stream?
5. What can we do to keep the life cycle going?

Assessments

Class discussion after the game



Completion of the life cycle wheel (see extension activity)

Resources

Tomihama, M.T. 1972. The Biology of *Sicydium stimpsoni* Freshwater Goby Endemic to Hawaii. University of Hawaii, Honolulu, Hawaii.

Sim, T. 2005. Hawaiian Stream Gobies ('O'opu). Retrieved August 2008, from <http://www5.pbrc.hawaii.edu/ccrt/taras/site/index.html>.

For kids:

<http://library.thinkquest.org/J0110028/past/water/goby/lifecycle.htm>

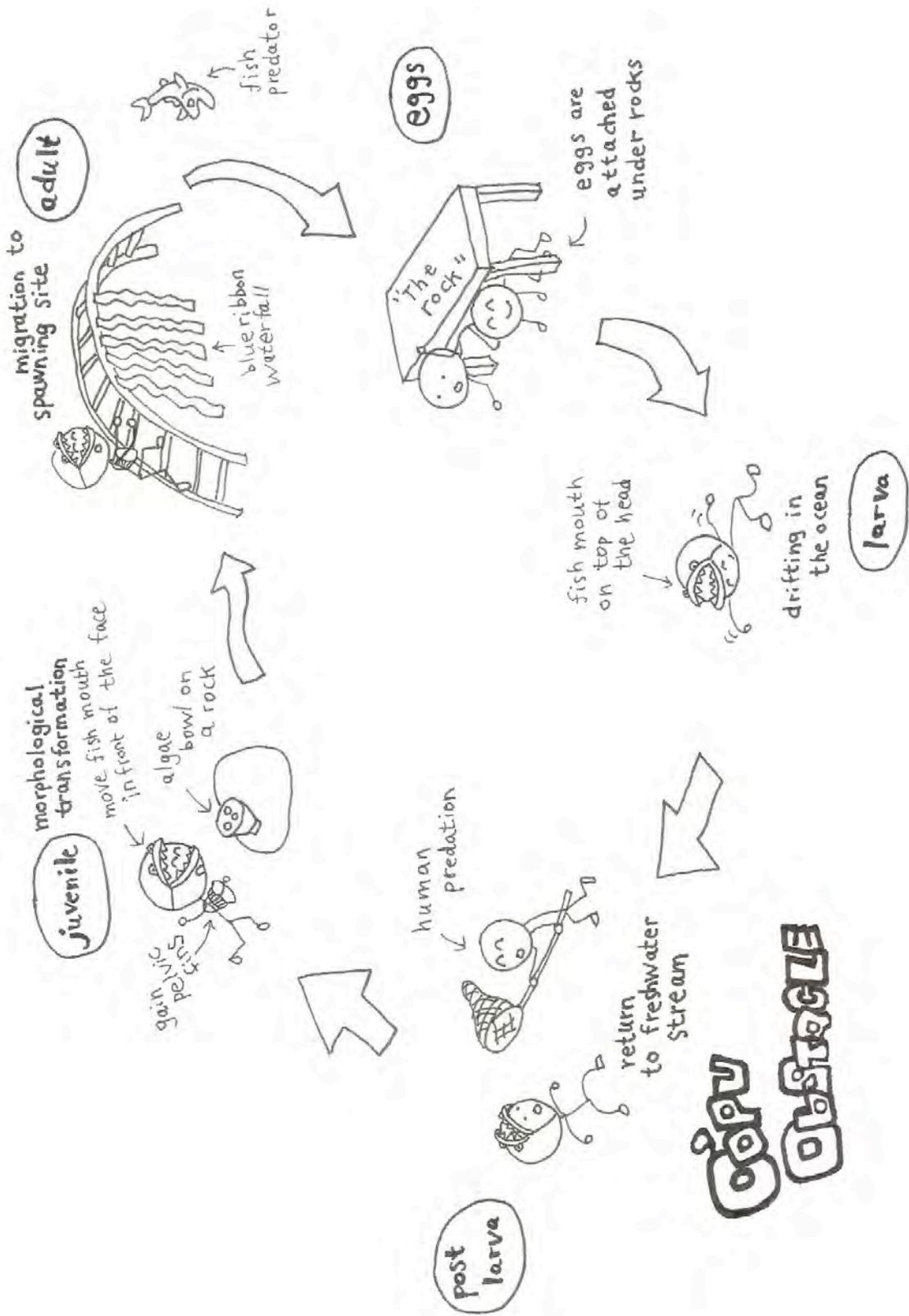
This site explains the o'opu life cycle with animation. It can be explored with help from teacher or parents.

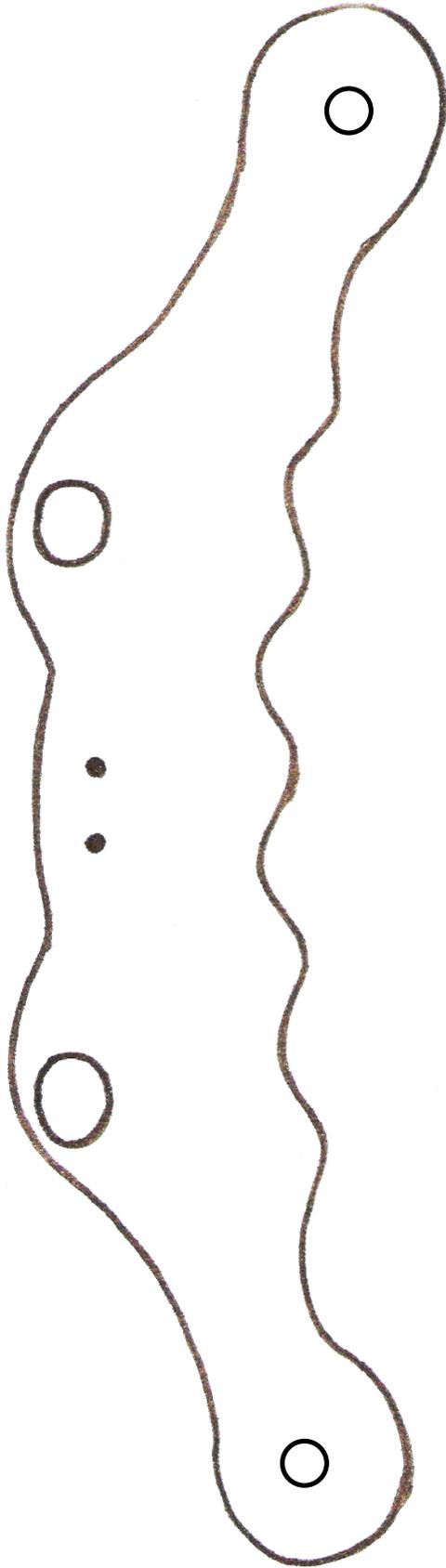
<http://www.youtube.com/watch?v=dgkiBat-OeY>

A movie about 'o'opu written by children.

Native Animals of Hawaii Coloring Book and Endangered Animals of Hawaii, by Patrick Ching

Both books have coloring pictures and information about 'o'opu.



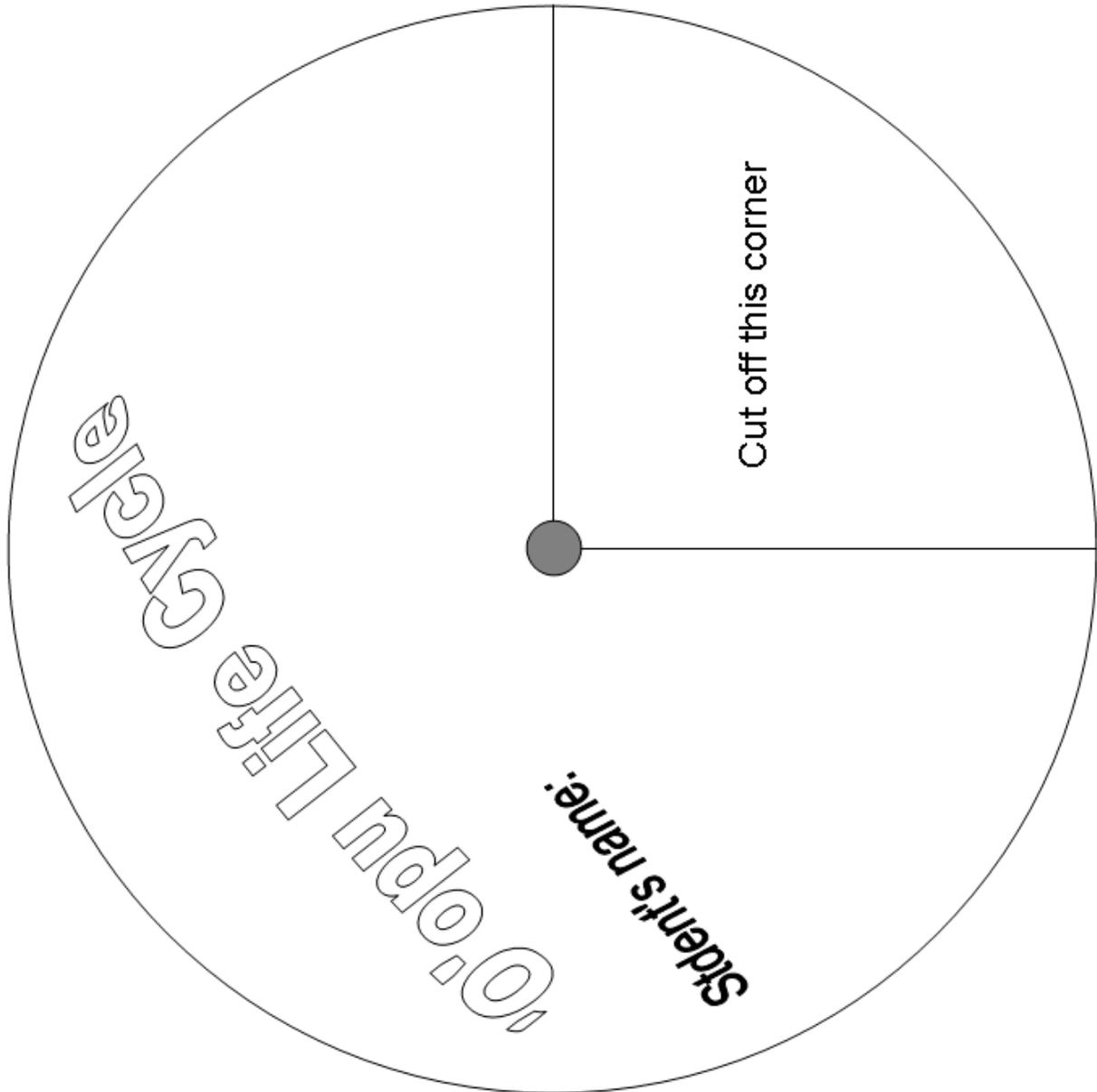


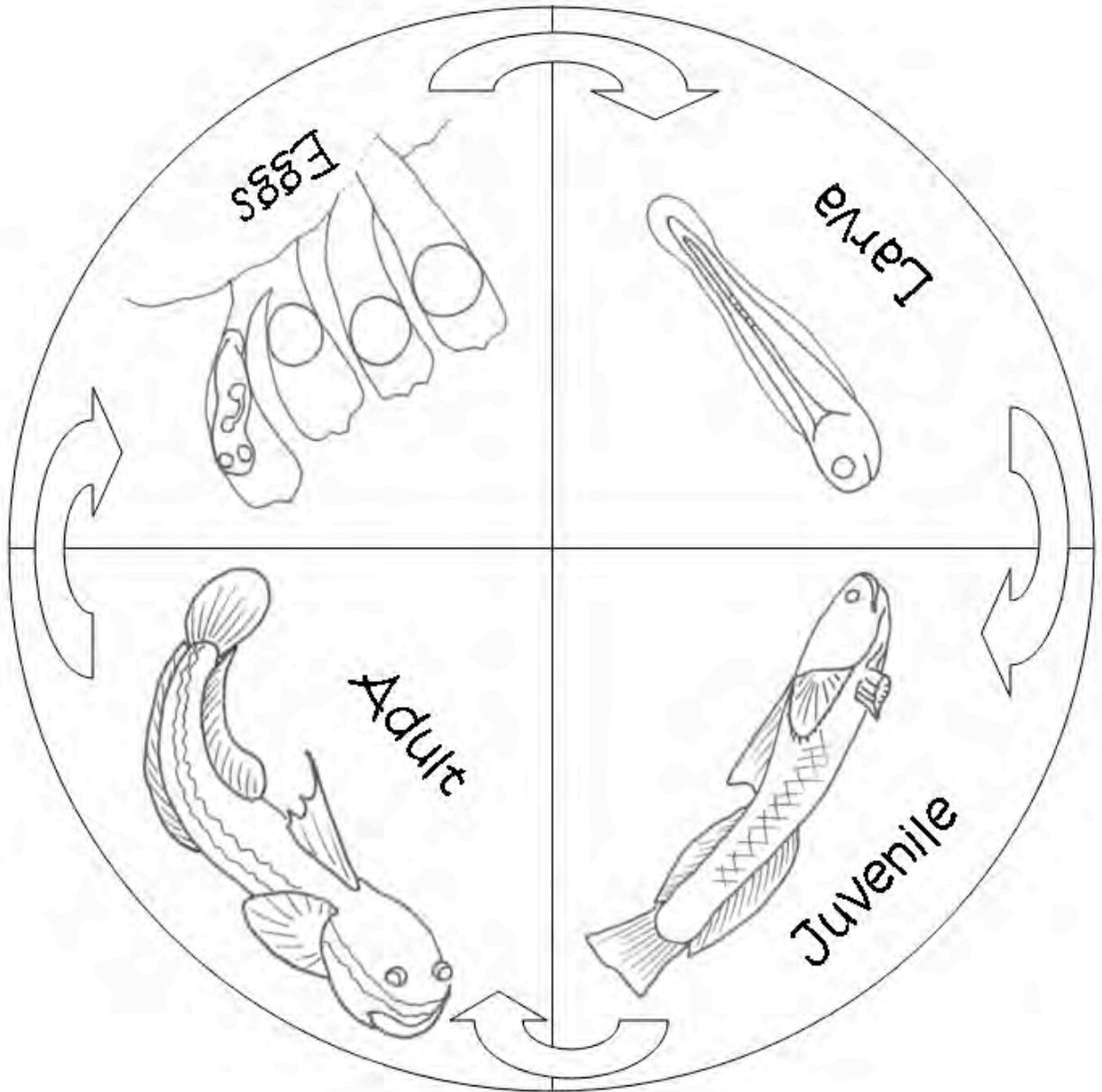
Print them out on a paper of desired color, and paste them on cardboard or cereal box. Cut them out and assemble the fish mouth (see p.3).



Extension Activity 1: O'opu Life Cycle Wheel

1. Students color and put together his/her own 'o'opu life cycle wheel. Cut out two wheels, stack them, and then hold together with a brass fastener. You may choose to print the templates with construction paper.

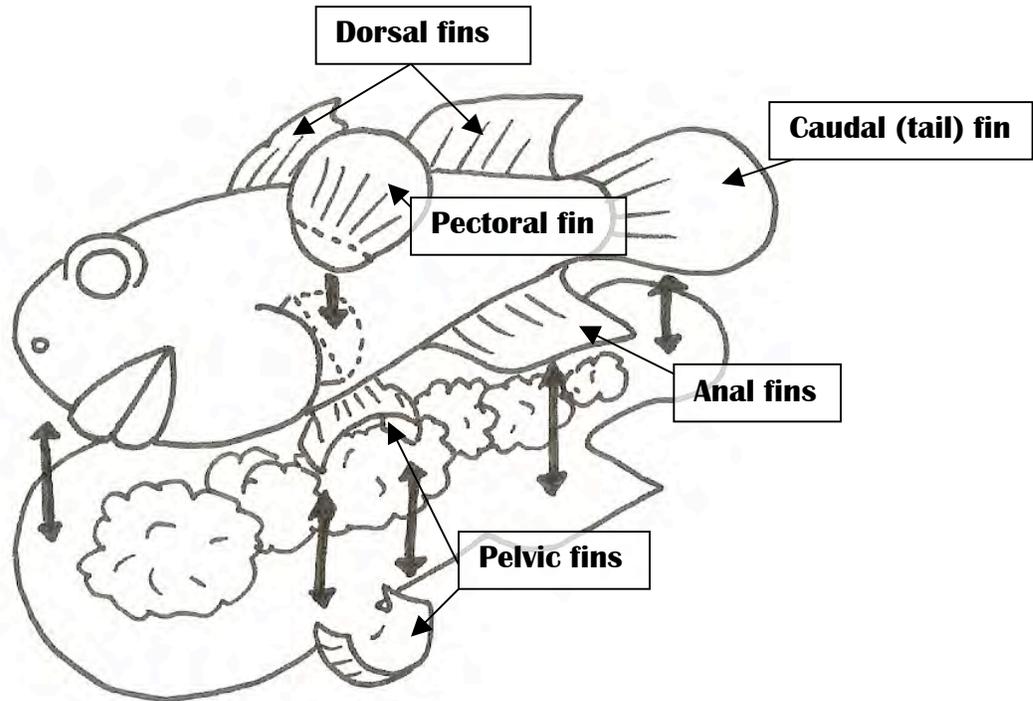






Extension Activity 2: O'opu Fish Model

2. Making an o'opu model is not only a fun arts & craft activity, the model itself can also be used as a tool to explain fish anatomy.



- Copy the template on p.10 using white construction paper (you may want to enlarge the picture if it is easier for the students to construct the fish).
- Color the o'opu (both sides) and cut them out along the solid lines.
- Don't forget the pectoral fins (see graph)!
- Place a few pieces of crumbled paper or cotton between two sides of o'opu and glue along the edge. CAUTION: do not glue the pelvic fins.
- Follow the graph and glue the pelvic fins together to form a disc.
- Done!



O'opu model template

