

DAMSELS AND DRAGONS



Grade 2

Lesson at a Glance

Students make models of dragonfly and damselfly eggs, larvae and adults and place them on a stream habitat diorama.

Key Concept

The larval stages of some endemic Hawaiian insects have unique adaptations found nowhere else in the world.

Objectives

Students will be able to:

- 1) Make models of dragonflies and damselflies (*pinao* and *pinao 'ula*) in three stages of development.
- 2) Place the models in the appropriate place on a stream scene.
- 3) Write a paragraph describing unique adaptations of Hawaiian *pinao* and *pinao 'ula*.

Time

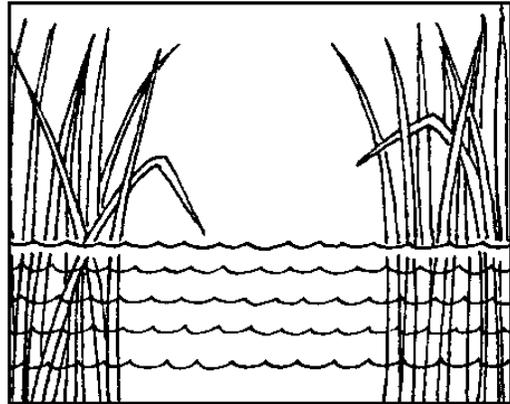
two to four class periods

Subject Areas

science, art, language arts, Hawaiian studies

Materials

student activity sheets (provided)
popsicle sticks
red or white cotton swabs
colored markers
glue
scissors
string
construction paper (various colors)
brown or gold glitter or glitter glue party blower (optional)



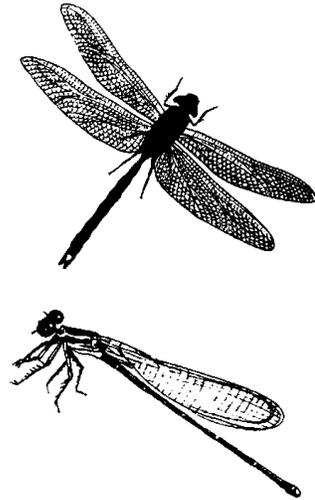
Advance Preparation

Make the background for a stream scene on a bulletin board or large piece of paper using the illustration above as a guide. If desired, glue or tape paper plants, such as ferns or mosses, to the scene. Make a model of *pinao* eggs, naiads and adults as suggested in the student sheets. If possible, duplicate the cutout sheet on to heavy paper to facilitate gluing.

Teacher Background

Dragonflies and damselflies belong to the insect order Odonata. They are believed to be the earliest winged insects, having evolved about 300 million years ago. At one time in Earth's evolution, they developed a wingspan of 70 cm (28 in)! Of course, that particular species no longer exists, but dragonflies are still among the largest insects on Earth.

Dragonflies have two pairs of wings with simple joints. The wings can move up and down, but cannot be folded back. Dragonflies are accomplished fliers that can dart over a stream or pond at up to 30 kph (19 mph). The huge compound (multiple-lens) eyes on either side of their heads provide highly detailed and accurate vision that helps them see and catch their prey. Because dragonflies rely so heavily on sight, they are not active at night. They hunt during the day, trapping smaller insects in their six legs, which they hold together like a tiny basket.



Damselflies are similar to dragonflies, but are smaller, slower and less active. In addition, damselflies are able to fold their wings back against one another when not in flight, and are frequently seen resting this way. Early Hawaiians called dragonflies *pinao* and damselflies *pinao 'ula*. The juvenile damselflies, or **naiads**, are called *'ōlopelope*.

Dragonflies and damselflies typically deposit tiny oblong eggs in water or in a slit in grass or plant tissue. In a few weeks the eggs hatch and tiny aquatic naiads emerge. They look similar to adults, but are smaller, wingless and proportionally stockier. The naiads catch their prey by shooting out a tiny grasping “tongue.” They do not leave the water until they have molted many times and are ready to metamorphose into a winged adult, which usually takes place in the morning hours. This type of insect life cycle is called incomplete metamorphosis. Complete metamorphosis, which occurs in most insects, involves four phases—egg, larva, pupa and adult. Larvae of insects undergoing complete metamorphosis look entirely different from adults.

There are about 3,500 living species of dragonflies and damselflies. About 39 species are found in Hawai'i. Seven of these were recently introduced. The remaining 32 are **native** (arrived without the aid of people) and evolved to become **endemic** (unique) to the Islands. One of the largest dragonflies in the world is endemic to Hawai'i. It has a blue or sometimes green patch on its back. A common introduced dragonfly is orange and somewhat smaller. Native damselflies are usually red or greenish-brown.

An unusual characteristic of Hawaiian damselflies is that they play possum! When a shadow passes overhead, they will fold their wings, drop to the ground and lie still. One group of Hawaiian damselflies (belonging to the genus *Megalagrion*) has evolved to an even more unusual characteristic—the naiads have adapted to live on land! They crawl about in damp leaf litter and ferns searching for their prey. Some have even adapted to live in forest plants where debris and water collect! These Hawaiian damselfly naiads have adapted to the terrestrial environment by undergoing physical and behavioral changes. For example, the long, delicate

gills of the aquatic naiads have evolved to the short, thick, hairy gills of the terrestrial species and some species are actually unable to swim! Only in Hawai‘i have damselflies developed these unique characteristics.

Some scientists believe that the damselfly evolved these unusual characteristics in response to a food shortage. Prior to the arrival of people, freshwater streams in Hawai‘i contained fewer species of tiny insects and mollusks than did their continental counterparts. Food was more abundant on land.

When humans arrived in Hawai‘i they dramatically changed life for damselflies and dragonflies by introducing mosquitoes and other insects that have increased food availability for both juveniles and adults. Frogs, toads and other animals introduced to control the mosquitoes also eat dragonfly and damselfly naiads and have greatly reduced their populations.

Teaching Suggestions

1. Display the pictures of *pinao* and *pinao ‘ula*. Point out the major differences between dragonflies and damselflies (size, speed, wing position). Be sure students understand that these are different species, not males and females of the same species!
2. Ask the class what type of animal the *pinao* and *pinao ‘ula* are (insect). Review the parts of an insect: abdomen, thorax (where six legs and wings, if present, are attached) and head. Point out that *pinao*, like most insects, have large compound eyes.
3. Explain that the *pinao* are believed to be the oldest type of winged insect on Earth. They arrived in the Islands long before people did. Draw a circle on the board, and review the damselflies’ and dragonflies’ life cycle: eggs (in or near water), naiad (usually in water) and adult (on land and air). Describe how the mother *pinao* drops her eggs in water or leaf slits. If available, use a party blower to show how the naiads shoot out their tongues to catch food in the water.



dragonfly



damselfly with terrestrial naiad

4. Explain that 32 native species of dragonflies and damselflies in Hawai‘i have changed over time to become special. For example, our dragonfly is one of the largest in the world, our damselflies play possum, and some of them even have naiads that live on land! Ask students to suggest why these changes may have occurred.
5. Show students the stream scene and ask them to help you complete it. Have half the class make dragonflies and the other half make damselflies. Each student should have an instruction sheet and a cutout sheet. Distribute materials for making insect models. Explain that the adult models are about twice the size of the actual insects.
6. Have students glue or tape their models to the appropriate place on the diorama:
 - Adults: hovering over the water;
 - Dragonfly naiads: in the water;
 - Damselfly naiads: on plants on land;
 - Eggs: in the water or in leaf slits near the water.
7. Conclude by asking students to write a paragraph or poem describing what the Hawaiian *pinao* or *pinao ‘ula* look like, where they live, and why they are special (their unique adaptations).

Extended Activities

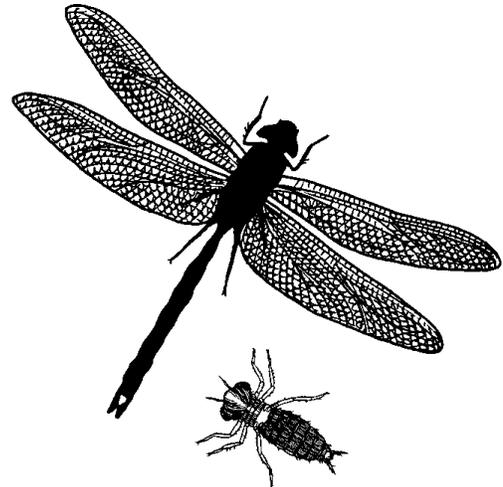
- Have students draw lines on the adult models to designate the head, thorax and abdomen.
- Visit a stream or grassy area near a stream and look for *pinao* and *pinao ‘ula*. Try to find the tiny naiads on the stream banks or in the water.
- Ask students to identify another winged insect, and compare and contrast the life cycles of that insect and the *pinao*.
- Make mobiles out of the *pinao* and *pinao ‘ula* and hang them from the ceiling.
- Rather than using a class mural, have students make individual dioramas for their *pinao* models.
- Have students make a chart outlining the differences between *pinao* and *pinao ‘ula*.

Dragonfly

The largest species of dragonfly in the United States, with a wingspan from 70–140 mm (3–6 in) wide, is endemic to Hawai‘i! The dragonfly catches its prey while flying.

Dragonfly Naiad

The dragonfly inserts its eggs into submerged plant material. The eggs are small, ovate and pale. When the dragonfly naiad hatches it is 2–3 mm (0.1 in) long. When it is full grown, it is 24–54 mm (1–2 in) long. The dragonfly naiad feeds on a variety of organisms, including other dragonfly naiads, fly larvae, worms, mollusks and other small animals that fall into the water.

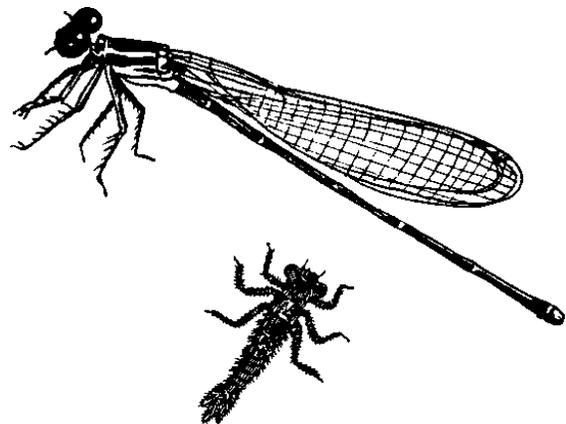


Damselfly

The damselfly’s body is often brightly colored, ranging from blue to green to yellow or red. It has a wingspan of 55–80 mm (2–3 in), and catches its prey while flying.

Damselfly Naiad

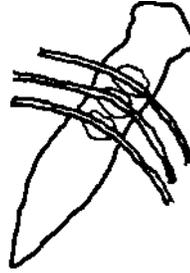
Depending on the species of damselfly, eggs may be inserted under water in plant stems or leaves or in the leaf axils of plants on land. The damselfly naiad is 1–2 mm (.075 in) long after hatching, and 14–25 mm (0.5–1 in) long when full grown. It eats other naiads, fly larvae, worms, mollusks and other small animals that fall into the water. The species that live on land also eat flying or crawling insects.



Instructions: Dragonfly Model

A. Make dragonfly (*pinao*) eggs.

1. Color the leaf green.
2. Cut out the leaf shape.
3. Glue glitter to the slit.

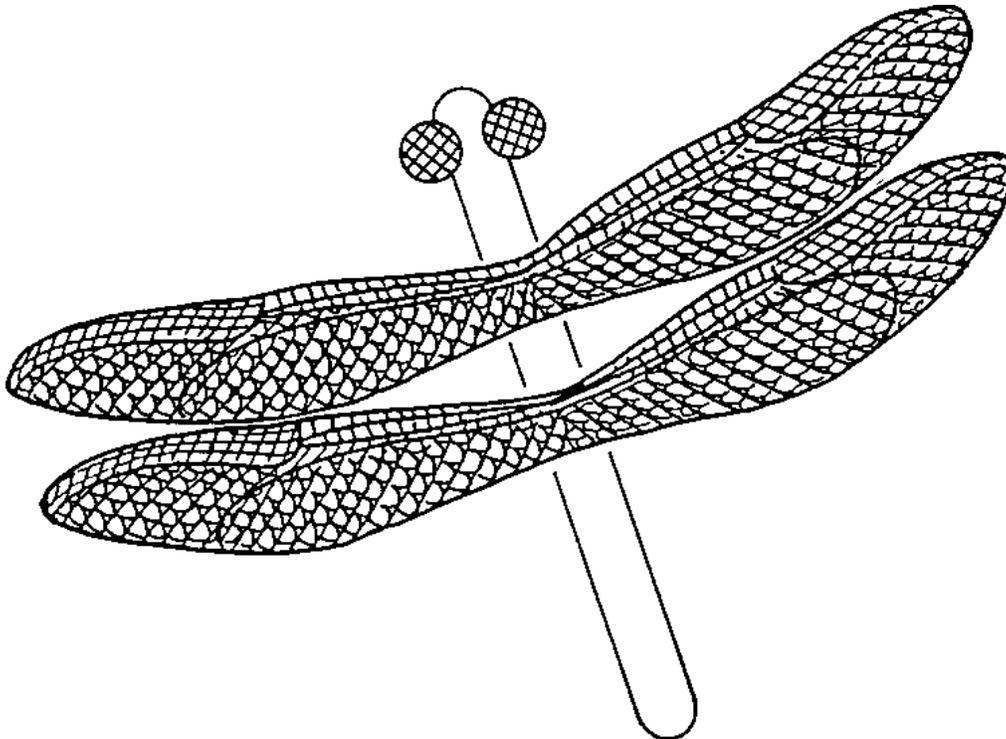


B. Make dragonfly naiads (*'ōlopelope*):

1. Color the naiad brown.
2. Cut it out.
3. Glue three pieces of string to the blank side of the naiad to make legs.

C. Make adult dragonflies:

1. Color a popsicle stick blue.
2. Cut out the dragonfly wings.
3. Glue the wings near one end of the stick, like the picture above.
4. Cut out the eyes and glue them onto the end of the stick.



Instructions: Damselfly Model

A. Make damselfly (*pinao 'ula*) eggs:

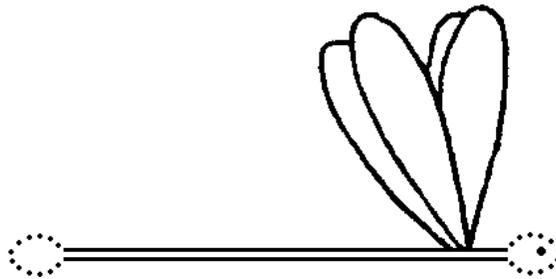
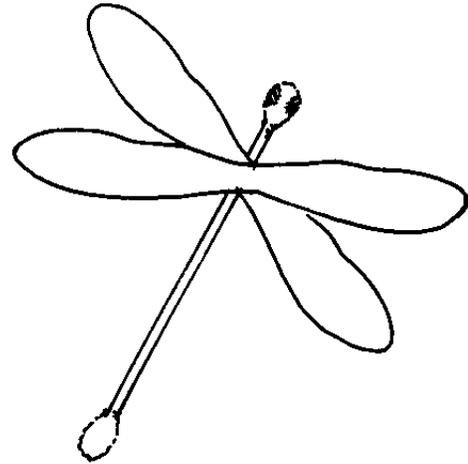
1. Color the leaf green.
2. Cut out the leaf shape.
3. Glue glitter to the slit.

B. Make damselfly naiads:

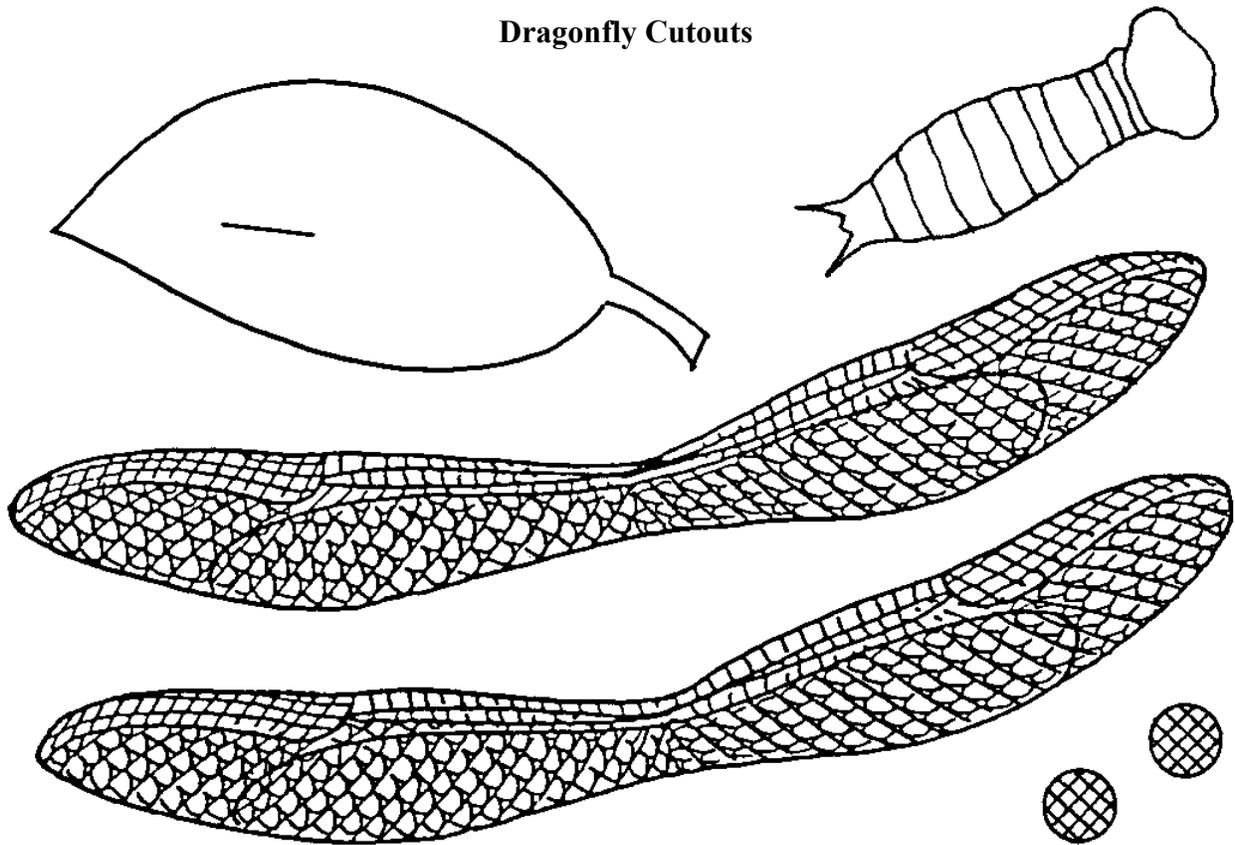
1. Color the naiad brown.
2. Cut it out.
3. Glue three pieces of string to the blank side of the naiad to make legs.

C. Make adult damselflies:

1. Color a cotton swab red.
2. Cut out the damselfly wings.
3. Glue the wings to the swab. Let the glue dry.
4. Draw two black eyes on the cotton swab.
5. If you like, fold back the wings to show the damselfly at rest.



Dragonfly Cutouts



Damselfly Cutouts

