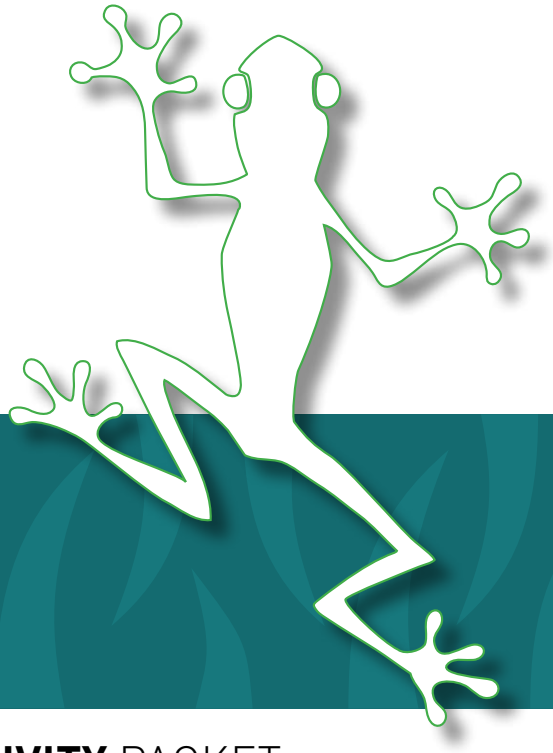
FABULOUS Frogs OF PANAMA



TEACHER ACTIVITY PACKET

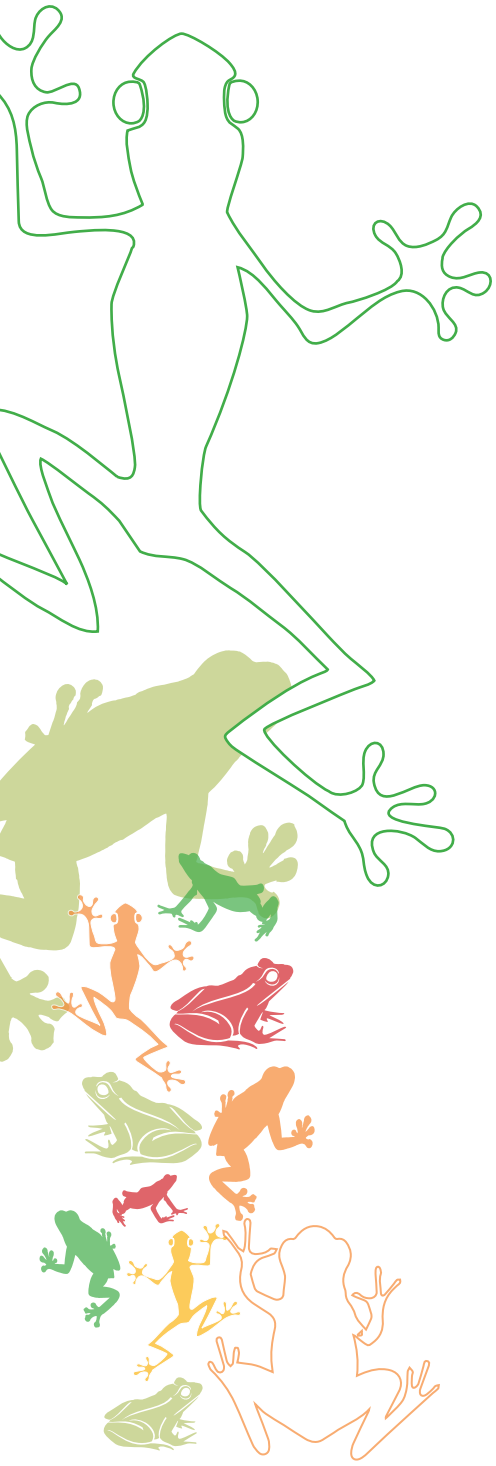
Disney WORLDWIDE CONSERVATION FUND

Smithsonian Tropical Research Institute

NSF National Science Foundation WHERE DISCOVERIES BEGIN

AMPHIBIAN RESCUE & CONSERVATION PROJECT PANAMA

E.V.A.C.C. EL VALLE AMPHIBIAN CONSERVATION CENTER



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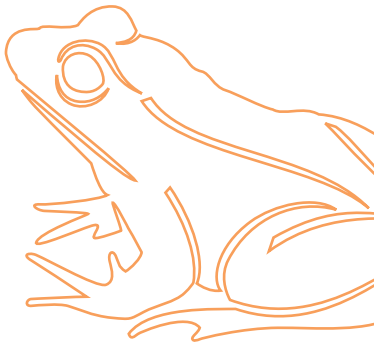


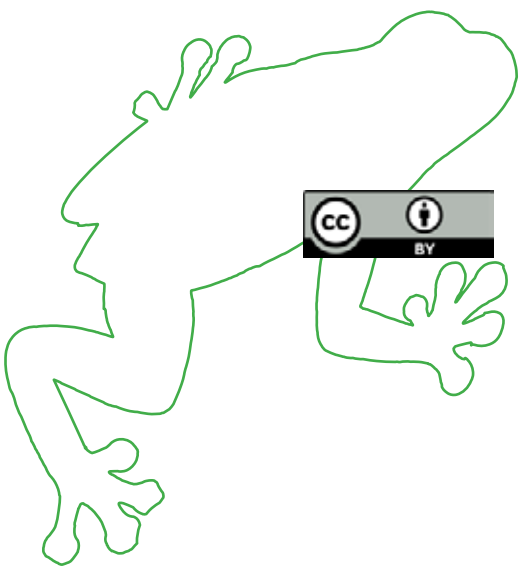
WELCOME!

In this packet you will find 4 inquiry-based lesson plans about Panamanian amphibians that fit into a standard science curriculum. You can use them as stand-alone activities, or as an introduction to the amphibian exhibits at Punta Culebra Nature Center in Panama City and the El Valle Amphibian Conservation Center at the El Nispero Zoo in El Valle de Anton. The exhibits display many frog species native to Panama in replicas of their natural habitat and feature ongoing research and conservation efforts that are underway in Panama.

These activities encompass a variety of age and ability levels, and introduce students to key concepts covering natural history, the amphibian life cycle, and conservation. We include suggestions to adapt lessons for beginning learners, or for more advanced audiences seeking a challenge. These activities are designed for classrooms with minimal materials. We hope that this will be a tool to help students engage in biodiversity and conservation issues in fun ways!

ACKNOWLEDGEMENTS

This curriculum was developed by scientists, educators and volunteers. We are grateful to the following volunteers who helped conceptualize and develop this curriculum: Hannah Arney, Lanki Cheucarama, Angie Estrada, Brian Gratwicke. Myra Hughey, Roberto Ibáñez, Meryl Monfort, Cori Richards, Sharon Ryan, Meredith Swartwout, Jamie Voyles, Elizabeth Wade and Simone Welch. Funding for the production of this curriculum was provided by the Disney Worldwide Conservation Fund, National Science Foundation, the research project of Rachel Page of the Smithsonian Tropical Research Institute, and Michael Ryan of the University of Texas.



This curriculum, reference materials and images for PowerPoint can be downloaded electronically www.amphibianrescue.org/es/education

1

LESSON PLAN

WHICH AMPHIBIAN IS WHICH?

CORRESPONDING UNITS IN PANAMANIAN CURRICULUM:

5th, 6th, 8th Grade: Living beings and their environment, Diversity of living things. 10th Grade: Biodiversity of species endemic to Panama.

GENERAL OBJECTIVE:

Learn about the diversity of frogs that exist in Panama.

SPECIFIC OBJECTIVE:

Be able to identify the frogs using a dichotomous key.

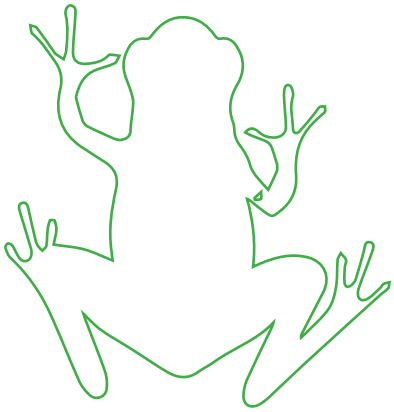
INTRODUCTION

Look at the different frogs on exhibit at the Punta Culebra Nature Center or the El Valle Amphibian Conservation Center; alternatively, look at the poster amphibians of Panama. There are more than 200 amphibian species Panama that include frogs and toads, salamanders and caecilians, it is a biodiversity hot spot for amphibians! In this activity, students will become familiar with just a few of the species. At the same time they will learn to use a dichotomous key to identify them. A dichotomous key is a tool that scientists use to tell species apart, especially if they look similar. It consists of a series of questions with two possible responses. The response to each question will lead you to the following question, until you arrive at the name of the species you are attempting to identify. When you succeed at this activity you will have successfully identified 7 amphibians that are native to Panama.

YOU WILL NEED

- Dichotomous key of amphibian species
- Amphibian worksheet with images of:
  - Cocle Salamander (*Bolitoglossa schizodactyla*)
  - Banded horned treefrog (*Hemiphractus fasciatus*)
  - Rainforest rocket frog *(Silverstoneia flotator)*
  - Pratt's rocket frog (*Colostethus pratti*)
  - Spiny-headed treefrog (*Anotheca spinosa*)
  - La Loma treefrog *(Hyloscirtus colymba*)
  - Panamanian Golden Frog (*Atelopus zeteki*).

1



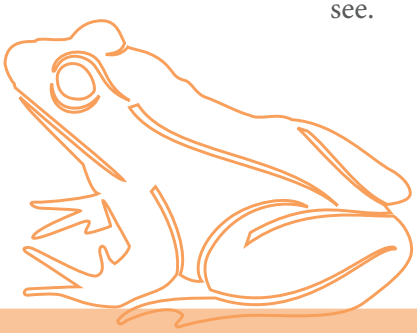
PROCEDURE

- Form groups of 2-3 students, and give each group the amphibian worksheet and ask the groups to discuss which frogs have shared characteristics.
- Discuss the dichotomous keys and how scientists use them to identify species.
- Give each group a dichotomous key of frog species and use it to identify the frogs.

ADAPTING FOR OTHER AGE GROUPS

For younger groups you could simply give the students the frog pictures and ask them to describe them verbally. Guide the discussion with questions such as: Are all of the amphibians in these pictures the same? What differences do you see? What similarities? Which frog is your favorite? Why?

For older students, after finishing the activity you could give 5 or 6 new pictures to each group so that they can create their own dichotomous key and invent names for the amphibians according to the characteristics they see.



Be a frog scientist!
Help us monitor wild frogs taking photos and recording sounds of frogs and share them as part of the Global Amphibian BioBlitz http://www.inaturalist.org/projects/global-amphibian-bioblitz . Scientists need your help to find out which frogs are still surviving in the wild. Anyone with a camera and internet access can now be a citizen scientist. The best time to look for frogs is at night near a stream or pond after it has rained, you will be able to hear the frogs calling! If you go out at night, make sure that you are accompanied by an adult, that you have a good headlamp and wear rain boots.

1

DICHOTOMOUS KEY OF AMPHIBIANS

1. DOES THE AMPHIBIAN HAVE A TAIL?

Yes ◯ The Cocle Salamander (Bolitoglossa schizodactyla)

No ◯ go to 2

2. DOES THE AMPHIBIAN HAVE A TRIANGULAR HEAD WITH A SHARPLY POINTED NOSE?

Yes ◯ Banded Horned Treefrog (Hemiphractus fasciatus)

No ◯ go to 3

3. IS THE AMPHIBIAN MOSTLY YELLOW IN COLOR?

Yes ◯ Panamanian Golden Frog (Atelopus zeteki)

No ◯ go to 4

4. DOES THE AMPHIBIAN HAVE A ROW OF BONY LUMPS ON THE BACK OF ITS HEAD?

Yes ◯ Spiny-headed Treefrog (Anotheca spinosa)

No ◯ go to 5

5. DOES THE AMPHIBIAN HAVE A BLACK STRIPE ON ITS SIDE?

Yes ◯ go to 6

No ◯ La Loma Treefrog *(Hyloscirtus colymba)*

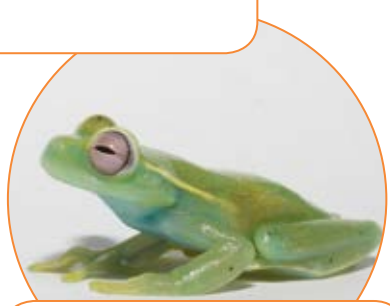
6. ON THE SIDE IS THERE A PALE STRIPE EXTENDING FROM THIGH ALL THE WAY TO THE EYE?

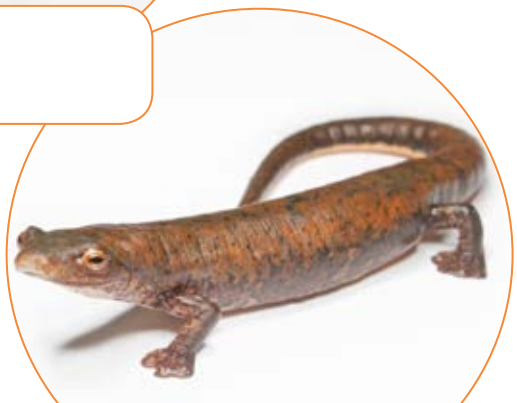
Yes, pale stripe beginning at thigh & extends to the eye ◯ Rainforest Rocket Frog (Silverstoneia flotator)

No, pale stripe begins at thigh and ends half way up the body ◯ Pratt's rocket frog *(Colostethus pratti)*

1

AMPHIBIAN WORKSHEET





2

LESSON PLAN

FANTASTIC FROGS AND TERRIFIC TOADS

CORRESPONDING UNITS IN PANAMANIAN CURRICULUM:

3rd Grade: Living things and their environment – Amphibians,
5th Grade: Diversity of living things,
6th Grade: Tropical biodiversity, 8th Grade: Biodiversity of aquatic and terrestrial ecosystems, 10th Grade: Biodiversity of species endemic to Panama

GENERAL OBJECTIVE:

Know the external characteristics of anurans (frogs and toads)

SPECIFIC OBJECTIVE:

Know the differences and similarities that anurans (frogs and toads) posess

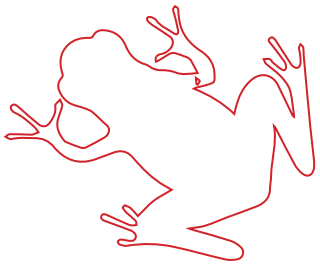
YOU WILL NEED

- Amphibians of Panama poster, or amphibian exhibit at the Punta Culebra Nature Center or the El Valle Amphibian Conservation Center.
- Worksheets; "Fantastic Frogs vs Terrific Toads"

PROCEDURE

- Give a brief introduction about amphibians, and with the aid of the poster or the amphibian exhibit, introduce the concept of the differences and similarities between frogs and toads.
- Form groups of 4 or 5 students and give them the fantastic frogs and terrific toads worksheet. Ask the students to hypothesize the difference between a frog and a toad, and organize these characteristics into a table. They may get frustrated if they don't know if their answers are "right" but not knowing is okay. For younger students you can give them the categories for the table, for older students, have them attempt to come up with the categories on their own.

2



- Discuss their answers as a class, and correct as necessary using the following information:

  All frogs are tailless carnivores (as adults), they have glandular skin without scales, and they lay eggs that have no shell. Toads are a diverse family of amphibians that are distinguished from other frogs because they are generally larger, heavy-bodied animals with short legs, rough skin and large poison glands on the head. There are about 500 species of toads in the world and more than 6,000 species of other frogs. In Panama alone there are 20 species of toads and 150 species of other frogs!

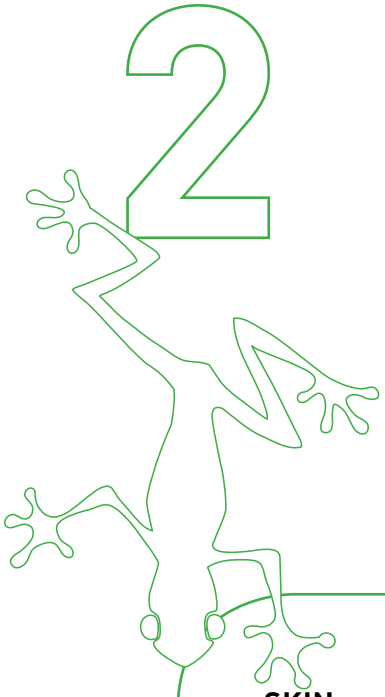
ADAPTING FOR OTHER AGE GROUPS

For younger students you could describe the difference between frogs and toads, and show them pictures of each, asking them to compare similarities and differences.

For older students you could ask them to investigate examples of frogs and toads that live in their area, either by going on the internet, or going outside and observing and taking pictures. Remember not to pick up frogs or remove them from their environment. They have the right to be left alone! Then write several paragraphs describing their similarities and differences between the species.

Cultural significance!

In Panama many children only have contact with the cane toad (Bufo marina) and grow up with the idea that toads are males and frogs are females of that species. The goal of this activity is that children begin to see similarities and differences, which is the basis of classification. The subject of amphibians, particularly frogs or toads, remains taboo for many people, associated with witchcraft, fear and disgust, and pests. We hope that this activity will help children begin to see amphibians as fascinating animals, without misconceptions and prejudices.



TEACHERS KEY

	FROGS	TOADS
SKIN	Moist and usually smooth. Frogs need to spend most of their time in or near water so that they do not dry out.	Much drier and bumpier. This means that they do not need as much time in the water to keep their skin just right.
TEETH	Most frogs have teeth on their upper jaw.	Toads do not have teeth
EGGS (BOTH LAID IN WATER)	Frogs lay their eggs in a disorganized clump.	Toads lay their eggs in a string that looks like a necklace.
TOXINS THAT SAY "STAY AWAY"	Some frogs make "toxins" or poisons in their skin to keep predators from eating them.	Only toads have large glands on their heads that produce toxins that make themselves not tasty or even dangerous to other animals that may want a toad snack.

2

FROG OR TOAD?

Sometimes it is hard to tell. What do you think are some of their distinguishing characteristics? Fill in the chart below with your hypotheses.

	FROGS	TOADS

Did you know that the Panamanian golden frog is actually a toad? Can you think of some reasons why it could be confused with a frog?

3

LESSON PLAN

FROG LIFE CYCLE

CORRESPONDING UNITS IN PANAMANIAN CURRICULUM:

1st-3rd grade: Reproduction of living things.

GENERAL OBJECTIVE:

Learn that most amphibians live in two different environments their tadpoles are usually aquatic and adults are usually terrestrial.

SPECIFIC OBJECTIVE:

Recognize the distinct phases of the life cycle of a tungara frog, and introduce students to the concept of metamorphosis.

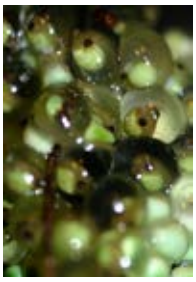
INTRODUCTION

Look at the tungara frog reproduction exhibit at the Punta Culebra Nature Center. Alternatively, find a roadside puddle with white foamy tungara frog nests on them and look for tadpoles. Most frogs reproduce by laying eggs, either in or near the water. Tungara frogs lay eggs in puddles and the males whisk the eggs into a white floating foam nest that can often be seen floating on puddles. The foam protects the eggs from drying out and from hungry predators. Once the tadpoles hatch they leave the foam mass and swim out to feed on algae and plant matter in the water. Tadpoles have gills for breathing and tails they use for swimming. At the end of the tadpole stage, a frog undergoes a process called metamorphosis in which its body makes a sudden transition into the adult form and they turn into froglets. The tadpole loses its gills for breathing in water and gains lungs for breathing in air. It also grows legs for walking on land. At the very end of the process it loses its tail, reabsorbing it into the body and the tadpole has finally turned into a frog! The froglets then leave the water and move to the land where they eat small insects and grow into adult frogs.

YOU WILL NEED

Tungara frog life cycle worksheet, scissors

3



PROCEDURE

- Present the subject of the amphibian life cycle using the the diagram of the tungara frog life cycle.
- Ask the students where they think each stage occurs. For example: Where do frogs and toads lay their eggs? Why does a tadpole have a tail?
- Form groups of 3 to 5 students and give them the worksheet life cycle stages. Ask them to form the life cycle with their cut-outs.

ADAPTING FOR OTHER AGE GROUPS

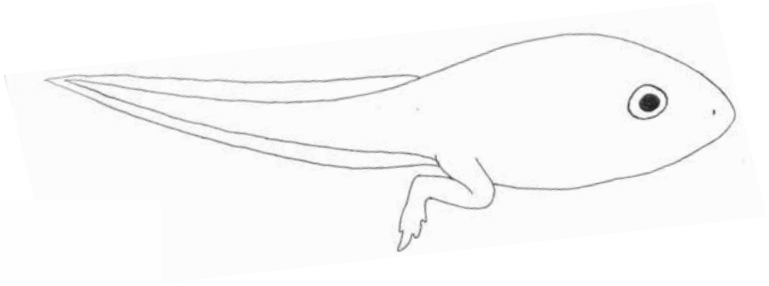
Discuss what other animals undergo metamorphosis. What changes in body type adapt them for the different life stages? Advanced students may want to research other types of amphibian reproductive modes. Compare the following species: Red eyed tree frog *(Agalychnis callidryas)* lay eggs on leaves, tadpoles drop into water below; Horned marsupial frogs *(Gastrotheca cornuta)* carry eggs in pouch on mother's back; Rainforest rocket frog *(Silverstoneia flotator)* lays eggs in leaf litter, male transports tadpoles on back to the stream where they continue to develop; Strawberry poison dart frog *(Oophaga pumilio)* female carries tadpole to a water-filled tree hole and feeds them unfertilized eggs; Common rain frogs *(Craugastor fitzingeri)* lay eggs that hatch directly into frogs. What are the advantages of each reproductive strategy?

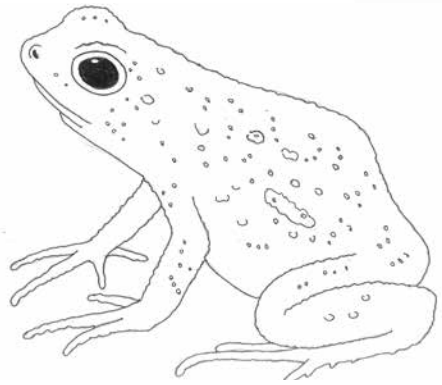
Panama Amphibian Rescue and Conservation Project

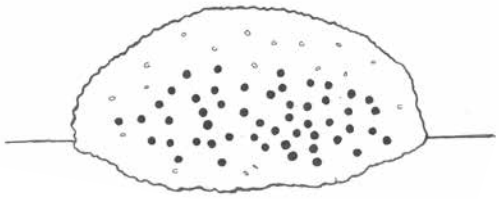
Scientists at the Panama Amphibian Rescue and Conservation Project try to breed endangered frogs in captivity. Studying the different kinds of amphibian reproduction and behavior is very important to help save these species! If we breed frogs for the first time in captivity those are known as first generation frogs (F1). If those frogs then have their own babies, they are called second generation frogs (F2). It is very important to get second generation frogs because it means that we have successfully completed a full frog life cycle in captive conditions from an egg all the way through to a new egg.

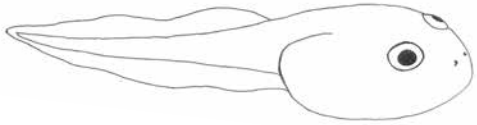
3

TUNGARA LIFE CYCLE









4

LESSON PLAN

HIDING IN PLAIN SIGHT

CORRESPONDING UNIT IN PANAMANIAN CURRICULUM:
4th Grade: Animal adaptations for survival.

GENERAL OBJECTIVE:
Students learn about strategies that animals have evolved to survive.

SPECIFIC OBJECTIVE:
Students learn strategies that frogs use to avoid predation.

INTRODUCTION

Look at the different frogs on exhibit or on the amphibians of Panama poster and discuss how each animal might avoid being eaten by a hungry snake, bird or lizard. Here are some strategies to consider:

Camouflage: Some animals are camouflaged like the Leaflitter toad Rhinella alata which looks just like a leaf laying on the forest floor.

Mimicry: Some frogs mimic other animals, the Columbian Four-Eyed Frog Pleurodema brachyops is normally camouflaged, but it has markings on its thighs that it can reveal if it threatened that make it look like a much larger animal or snake which can startle any potential predators long enough for the frog to escape!

Aposematism: Many diurnal, brightly colored frogs like the strawberry poison dartfrog Oophaga pumilio are a bright color that warns predators – if you eat me I will make you sick!

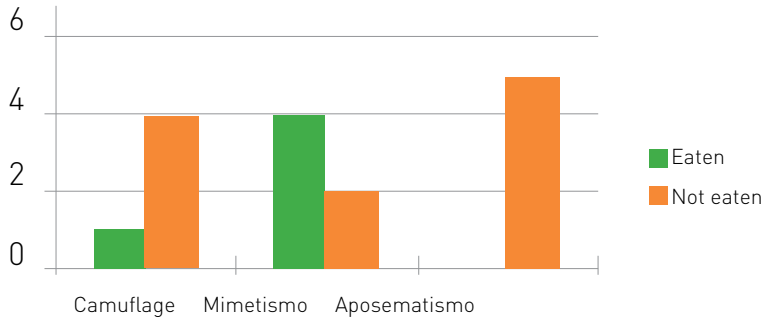
Ask the students to hypothesize which strategy will be the most successful.

YOU WILL NEED

Paper outlines of frogs, crayons ,markers, or colored pencils, scissors, paper, glue or clear tape

PROCEDURE

- Pass out frog outlines.
- Give students a few minutes to survey the room for good "hiding" spots. Advise the students that they must choose spots to hide their frogs in plain sight.
- Tell them to decorate their frogs using one of the strategies they learned
- Once frogs are decorated turn half of the class into "snakes". Send them out of the room while the frogs are taped around the room, hidden in plain sight.
- Allow snakes to come back and "hunt" frogs for 1 minute. Remind them that bright colored frogs are likely poisonous. Repeat with the other half of the class.
- Collect the frogs that remain "uneaten" around the room. Discuss with the students which strategies were most successful, and why they think that was true. Was their hypothesis true or false?
- Ask to students to write about the technique that they chose and reflect on the pros and cons of this type of defense strategy. They could also graph their results on a simple bar graph something like this:



4

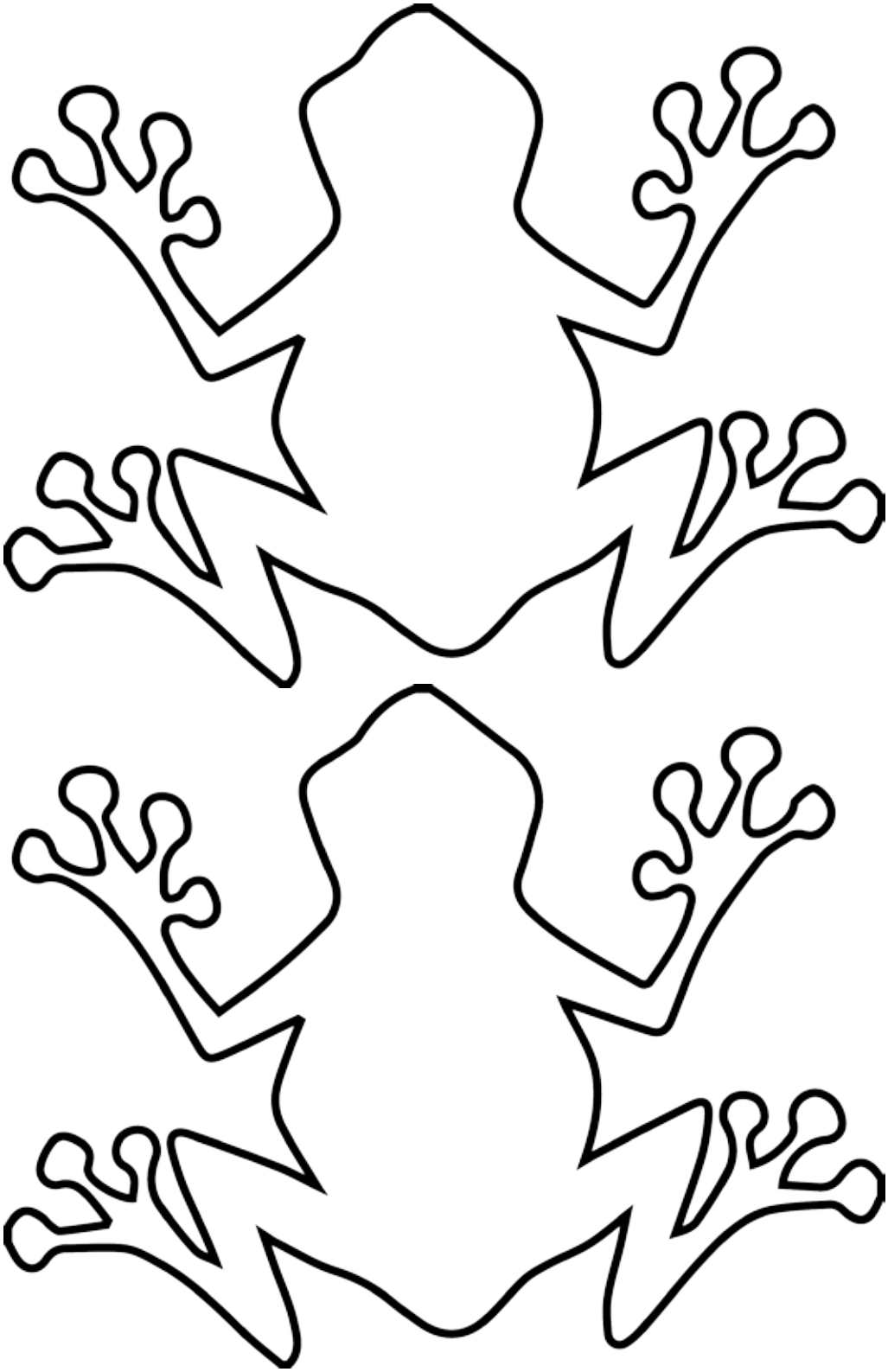
Brightly colored poisonous frogs like the green and black poison dart frog Dendrobates auratus and the Panamanian golden frog Atelopus zeteki have several kinds of toxins on their skin. Biologists studying these toxins have found that these species become less toxic in captivity, where they are fed on fruitflies and crickets. There is evidence that at least some of these poisons come from their food, and some may come from certain bacteria growing on the frog's skin and in their gut. What do you think this means for the Panama Amphibian Rescue and Conservation Project if we want to put an endangered aposematically colored frog back into the wild that has no 'ammunition' behind its bright warning colors?

Aposematismo

Camuflage

Mimetismo

CUT OUT THE PICTURES OF THE FROGS, AND DRAW THEM ACCORDING TO THE STRATEGIES LEARNED .



PROJECT

PANAMA AMPHIBIAN RESCUE AND CONSERVATION PROJECT

Amphibians in Panama and around the world are in danger for a variety of reasons, including habitat loss, habitat degradation, collection for the pet trade, and the amphibian chytrid fungus.

The Panama Amphibian Rescue and Conservation Project is an effort by the Cheyenne Mountain Zoo, Houston Zoo, Smithsonian Institution and Zoo New England to build an amphibian ark for endangered Panamanian amphibians. We have two centers in Panama where we maintain and breed endangered frogs, the El Valle Amphibian Conservation Center (EVACC) and the Gamboa Amphibian Rescue Center. We now maintain a combined living collection of more than 1,500 frogs from 15 priority conservation species that are in danger of extinction from the frog-killing chytrid fungus.

We collect frogs in danger of extinction and treat the frogs we bring in from the forest with anti-fungal medicine. We keep them in a separate room from the rest of the frogs called quarantine and test them for the fungus using special swabs, and then we analyze the swabs to look for the dna of the fungus. This helps us to stop the spread of diseases from the wild animals to our healthy captive frogs. We grow crickets, fruit flies and springtails to feed the frogs and if we are lucky the frogs will breed!

We are also working on research to find a cure for the disease, or a way to breed frogs that can resist the fungus so that one day we can put the frogs back into nature where they belong.

AUGUST 14TH IS PANAMANIAN GOLDEN FROG DAY!

The Panamanian golden frog is a national symbol of the environment so dress like a frog on golden frog day! Participate in the annual golden frog parade in El Valle de Anton and share your photos on social media with the hashtag #RanaDorada. Don't want to wait for golden frog day? No problem, bake golden frog cupcakes and have a bake sale fundraiser to raise money to help us save the frogs! Share your fundraising ideas and events and pictures on our facebook page www.facebook.com/amphibianrescue.

MANY **THANKS** TO OUR **SPONSORS**