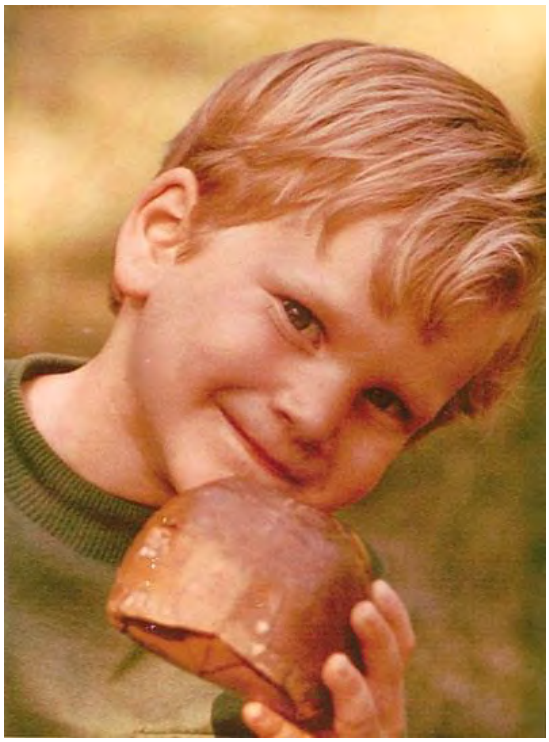
The Singing Zoologist!

Study Guide

What on earth is a "singing zoologist?"



Lucas' first turtle discovery

A zoologist is someone who studies animals and you already know what singing is, right? That makes a "singing zoologist" someone who sings songs about animals, and that's what Lucas Miller does.

Lucas fell in love with animals as a preschooler; frogs and turtles were his favorites. He also adored listening to his dad picking folk songs on his banjo and guitar.

As he got older, he became a musician himself, starting saxophone in 6th grade and then guitar in high school. He dreamed of being a rock star!

He loved science too, though, so he studied zoology at Miami University by day, and rocked out with his noisy band by night.

After graduation, Lucas planned to be a sea turtle scientist, but his first job was as an educator and "ship's musician" on a sailboat called *The SoundWaters,* that took schoolkids out on eco-field trips. He *loved* it. It gave him a way to combine his loves of wildlife and music. *The Singing Zoologist* was born!

Now living in Austin, Texas, Lucas travels the nation, literally "singing the praises" of wildlife at schools, concert halls, festivals and more. He's inspired two generations of kids and he's not done yet!

What's it all about?

Animals are cool, yes, but they're also important, and that's what Lucas Miller aims to show you with his songs, stories, videos and multimedia programs.

Lucas' corny jokes, crazy hats, and bad dancing will get you giggling, moving and making some pretty weird noises while you're learning solid life science concepts. You'll also discover ways you can help wild things thrive, because you know what? Wild things help *you* thrive!

Get ready for *The Singing Zoologist!*

This guide features multi-disciplinary activities, projects, videos, and more to help you prepare for the big day, get more from the show itself, and get involved in science and conservation projects afterward.

You can find an electronic version of this guide and much more in the "fun stuff" section at www.singingzoologist.com., an ever-growing collection of pages and resources for deepening the learning with your students or family. You should definitely check it out…

Get in touch!

Lucas loves hearing from fans, so send your comments, videos, pictures, requests, and questions to him via social media:

Facebook public page: Lucas Miller, the "singing zoologist"
Twitter: jlucasmiller
Instagram: singingzoologist
Pinterest: singingzooloist
email: jlucasmiller@gmail.com

Look him up on YouTube!

If you do nothing else before the show, play a *couple* of Lucas' videos from his YouTube channel, "Science Up with the Singing Zoologist." Your kids will arrive excited to have fun and sing along.

These playlists will get you right to the best stuff:

Recommended videos for grades K-2:
https://goo.gl/JievbT

Recommended for grades 3-5:
https://goo.gl/FChQ7M

Monarch Butterflies

Videos:

"Going Down to Mexico," Lucas' beloved song about a monarch butterfly's migration to Mexico, is sung by school children across the continent. There are several versions on YouTube so pick one (or more) and play it for your kids:

- High-gloss music video: no expense was spared on this, Lucas' first ever music video, featuring the CD version of the song
- "Unplugged" version, a "live" performance video featuring illustrations from Lucas' book, *Going Down to Mexico/Rumbo a México*
- Spanish version sung by fellow kids' artist Sue Young
- Lucas' explanation of metamorphosis might be a good one, too...
- And here's Lucas explaining incomplete vs. complete metamorphosis
- And you have to behold the masses of monarchs in Mexico!

If you're looking at a paper version of this guide, there are links to each video at singingzoologist.com/monarchs.

Take the monarch quiz!

You can read these questions from this guide or download a Jeopardy-style PowerPoint at https://singingzoologist.com/monarchs/. It features some helpful animations and images, too, so, yeah, you should do that…

1) Monarchs are found throughout the US and southern Canada in the summer, but in the winter, they are found in:

a) Michoacán, Mexico
b) The coast of California
c) Florida
d) All of the above

It's actually d), all of the above. Monarchs east of the Rocky Mountains mostly go to south central Mexico. Monarchs west of the Rockies, go to various places along the California coast.

There are also some monarchs in Florida in the winter, but it's not certain whether they migrate to Florida for the winter or if they are just there all year long and don't need to migrate.

While you're discussing this, get a globe or map to show the kids the Rockies, California, Florida, and Michoacán, Mexico ,and have them trace the monarchs' routes with their fingers.

2) Milkweed plants are the only plants where monarch butterflies will:

a) make a milkshake
b) sleep
c) lay eggs
d) collect nectar

A monarch egg on a milkweed leaf

Monarch butterflies will slurp nectar from many kinds of flowers, but they will only lay their eggs on milkweed plants. This is because monarch caterpillars will only eat milkweeds. If you want to have monarchs, you must have milkweeds!

This is called being a "host plant," and many kinds of butterflies and moths depend on a certain kind of plant like this.

3) Milkweeds are called milkweeds because:

a) They tend to grow near milkcows
b) They taste like milk
c) They have a sap that looks like milk
d) They taste good on cereal.

It's c), their milky sap. If you tear off a stem and squeeze it, you can see white "sap" oozing out. Don't eat it, though, it's mildly poisonous and tastes disgusting!

4) Monarchs can store milkweeds' poison in their own bodies to protect themselves from some predators. If most birds eat a monarch, they will:

a) Vaporize
b) Get sick
c) Lose all their feathers
d) Turn into a toad

Monarchs aren't deadly, but they will make many predators sick if they eat one. After that, many predators will recognize a monarchs' bold markings and avoid them in the future. It's not perfect, however, as some orioles, mice, wasps and other creatures can eat monarchs without being harmed.

5) Which body parts have been shown to help monarchs navigate to Mexico?

a) Antennae
b) Legs
c) Proboscis
d) abdomen

Monarchs' antennae seem to have "built-in GPS!" Considering their brains are about the size of a kiwi seed, it's truly amazing they can find their ways 2000 miles to Mexico!

Science activities: How to host a visiting monarch

The number of monarchs making it to Mexico has dropped precipitously over the last decade and biologists are asking the public for help with conservation efforts. Here are some great ways to "support your monarch."

Grow milkweed plants!

Put out a milkweed, and you give female monarchs a place to lay her eggs. You can either grow milkweeds from seeds or get mature milkweeds at your local nursery, but avoid the "big box" home stores, as there have been some accounts of their milkweeds harming monarchs (it's probably the pesticides they use).

Your local nursery should be able to suggest good, native species or you can go to https://monarchbutterflygarden.net/milkweed-plant-seed-resources/

Monarchs adore tropical milkweeds, but this species is non-native to the US and may be doing some harm to monarchs, so its' best to go with a mix of three or four native species. If all you can find are tropical milkweeds, use them but don't let the plant survive through the winter.

Create a monarch way station!

Monarch caterpillars need milkweeds to munch but butterflies are fueled by flower nectar.

You can make a monarch "way station," a little garden of nectar-rich flowers, that work like a highway convenience mart for migrating monarchs!

Learn more about this fun, simple project at https://www.monarchwatch.org/waystations/

Be a "citizen scientist!"

Most of what we know about monarch migrations has come through a decades-long tagging program, and YOU can help! There are only so many scientists, so "regular folks" are essential in catching, tagging and releasing monarchs each fall.

The tags are a small sticker with a tracking number and contact info (no, they don't make monarchs fly in circles!).

Kids as young as four can help (their little hands are actually great for this task). You can order monarch tags at https://shop.monarchwatch.org/

Another great resource is Journeynorth.org. They provide up-to-date information on monarch sightings and migrations. Seriously, check it out!

Language arts activity: Butterfly DIY Poem

In this activity, you and your kids will make a butterfly poem. It's kind of like *MadLibs*, but with a bit more guidance to make sure you get something sweet/fun rather than absurd/silly.

Step 1: Ask the kids to name four things you've seen butterflies doing (use the gerund form, that is, a verb ending in 'ing) and write them in blanks 1, 2, 3 and 4 in the form below

Step 2: Have three students name their favorite color and write these in blanks 5, 6 and 7 (just make sure the colors are DIFFERENT).

Step 3: Name three adjectives to describe the taste of juice and enter in blanks 8, 9 and 10

Step 4: Choose a student and write their name in blank 11

Step 5: Have a student name a part of the head or face and enter in blank 12

Step 6: Ask for two things you do when you're happy and enter in blanks 13 & 14

Got it? Now read your poem and prepare to smile.

(1) _____, (2)_____, (3)_____ butterfly in my garden

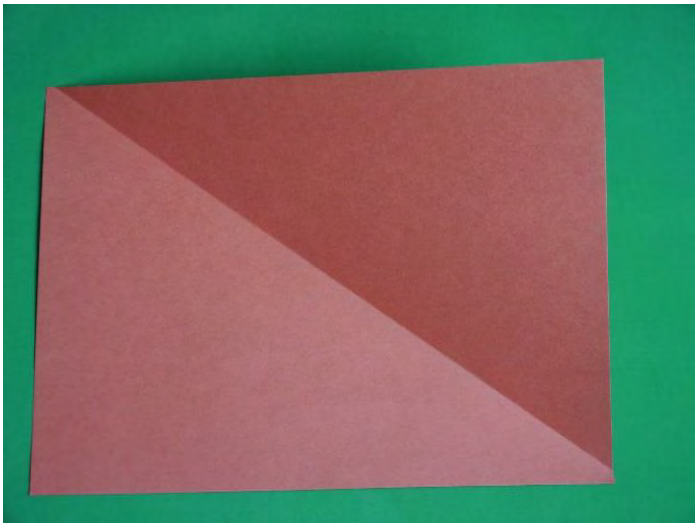
I watch you (4)_____ among the (5)_____, (6)_____, and (7)_____ flowers

Sipping (8)_____, (9)_____, (10)_____ nectar in the sunshine

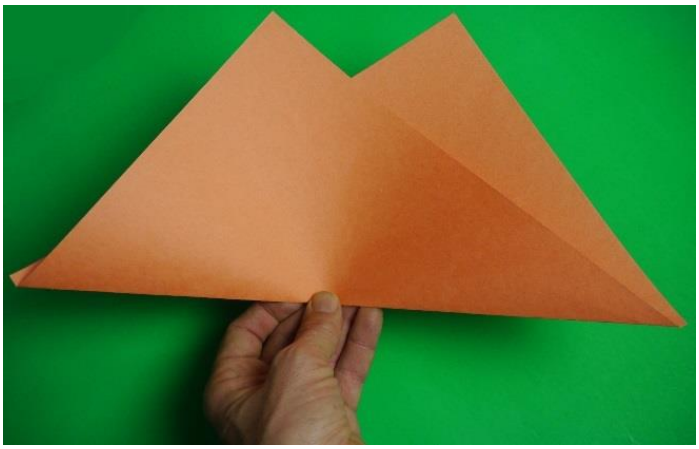
Come land on (11)_____'s (12)_____, little butterfly, and

see them (13)_____ and (14)_____

Craft: The Amazing, Two-fold Origami Butterfly!

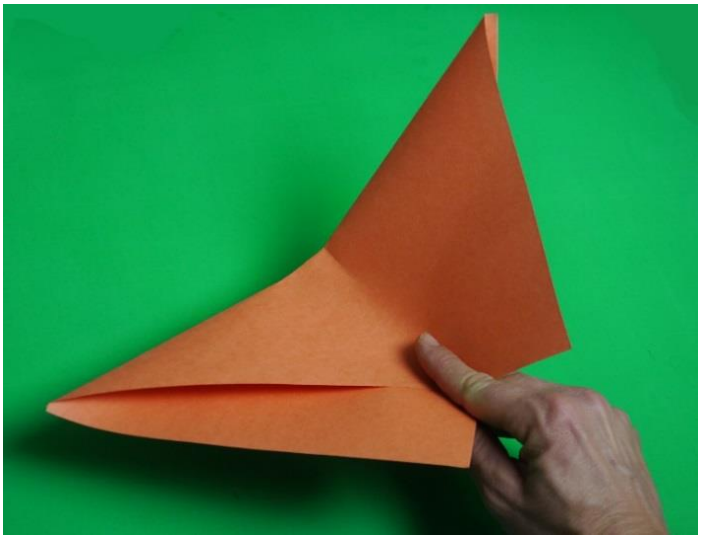


Step 1: Fold a *half* sheet of construction paper (office paper works fine too, it's just not as colorful) *diagonally*, from corner to corner, creasing hard to make it as flat as possible.



Step 2: Crease more lightly from the middle (where the thumb is in that photo) to the "V" between the wings.

You can color or decorate the butterflies if you like or just keep them plain and simple.



Step 3: Play the butterfly song and everyone can hold up their butterflies and make them "fly, fly, fly!"

Vocabulary:

Arthropod: the largest group of animals by far. All have exoskeletons and jointed limbs. Insects, spiders, crabs, millipedes are all arthropods (and there are many more). See "Baby, You're an Arthropod"

Exoskeleton: literally an "outside skeleton." It's a hard, external covering that forms the body shape of an arthropod and some other animals. There are no bones inside a creature with an exoskeleton. It's a bit like a suit of armor. Here's a video!

Insect: an arthropod with three body segments (head, thorax and abdomen) and six legs. Nearly all go through a complete or incomplete metamorphosis.

Thorax: the middle part of an insect's body. The wings and legs attach to the thorax

Abdomen: the "tail" section of an insect's body. The stinger of a bee or wasp is at the end of its abdomen.

Metamorphosis: growth by "transforming" from one body plan to another. Body parts will appear and/or disappear in a metamorphosis. Occurs in most insects, amphibians, and many other animal groups. Here's a video!

Complete metamorphosis: (refers only to insects) growing in three distinct stages: larva, pupa and adult. Wings present only in final stage. Examples: butterflies, mosquitos, beetles, ants, and bees Here's a video!

Larva: the "baby" form of an insect that goes through a complete metamorphosis, e.g. a caterpillar or grub.

Pupa: the "middle stage" the life cycle of an insect that goes through a complete metamorphosis. A butterfly's chrysalis is a kind of pupa.

Incomplete metamorphosis: (refers only to insects) a life cycle where the "baby" form more closely resembles the adult form and wings appear in earlier stages, becoming gradually larger with successive molts. Examples: praying mantids, grasshoppers, and dragonflies.

Nymph or naiad: the "baby" form of an insect that goes through an incomplete metamorphosis (e.g. dragonfly or cricket). In general, a naiad lives in the water and a nymph lives on land

Molt: a sudden and distinct growth event where the creature "sheds" its hard exoskeleton and forms a new one, often a bit larger. The animal

"breaks out" of its old exoskeleton and, for a short time, has a wet, soft exoskeleton. Once it has reached the intended size and shape, the exoskeleton dries and hardens. A butterfly emerging from a chrysalis is an example molting.

Proboscis: (pronounced "pro-BOS-iss" or "pro-BOS-kiss"). An extended, highly flexible mouth- or nose-part. Examples include a butterfly's probing mouthpart and an elephant's trunk.

Nectar: a sugary "juice" some flowers make to attract animals so that they will inadvertently pick up pollen

Pollen: tiny grains produced by the male part of a flower that can fertilize an ovule, or female part of a flower, to make a seed.

Pollination: the transfer of pollen to an ovule by animals or wind. Here's a fun, stop-motion video

Amphibian: a group of animals including frog, toads, salamanders and some rarer creatures. They have thin, non-scaly skins and generally go through a metamorphosis (although some retain "juvenile" gills and body plans).

Species: a type of animal, plant or other organism. In scientific terms, a population of individuals that can reproduce and create fertile offspring.

Habitat: the space an organism lives in during its lifetime; the space they use to find food, water and, if needed, shelter.

Ecosystem: A community of interacting organisms and their non-living environment (e.g. water, air, soil). Ecosystems can be defined on large scales, like a rainforest, or small scales, like a rotting log.

Endangered species: an organism whose population is declining and in danger of going extinct

Adaptation: an inherited "special feature" that helps an organism survive. Adaptations may help animals defend themselves (such as a porcupine's quills), move in a particular way (such as a duck's webbed feet), deal with conditions of an ecosystem (such as a polar bear's thick fur) or eat (such as a tiger's sharp teeth). Adaptations are normally "modifications" to structures rather than "inventions" of something entirely new.