



# The Richness and Rarity of Hummingbirds

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## The Richness and Rarity of Hummingbirds

### Half-Earth Guided Inquiry – Background and Framing

**Series created by:**

Dennis Liu, Amanda Briody, and Jenna Adams, with special thanks to Erika Mitkus and Jonathan Bower.

This short video<sup>1</sup> provides a brief introduction to the Half-Earth Project and Map.

Birds are one of the most popular groups of animals for people to observe outdoors. Birds are beautiful ambassadors for biodiversity and nature study. With an estimated 10,000 living species of birds, there is something for everyone: beautiful colors and calls, astounding behaviors like predation, nest-building, pollination, flight, and incredible long-distance migrations. Bird species have adapted to live just about everywhere in the diverse habitats of our planet. Among the nearly 250 families of birds, the hummingbirds are truly exceptional. Hummingbirds have specialized on nectar for food, they are exceptionally colorful and showy, they can hover in flight and can fly very fast and far despite their very small size. This slide deck<sup>2</sup> highlights some of the hummingbirds' amazing adaptations. The slides provide useful background information and can be used as a hook to pique student interest. The diverse species of hummingbirds are the grounding phenomenon for the entire guided inquiry. Students will consider many facets of biodiversity by asking and answering questions about hummingbirds. How many hummingbird species are there? Where do they live? Where in the world is there the most species? Where can I find rare hummingbirds? How can we protect and conserve hummingbird biodiversity?

Each lesson in this guided inquiry can stand-alone and the lessons do not need to be done in the order presented. The lessons focus on online resources that are well-suited for instructor-guided student-inquiry into hummingbirds and by extension, many other species.

The Hummingbird Guided-inquiry series is part of a larger collection of resources developed by the Half-Earth Project for educators and students to explore biodiversity conservation topics across the curriculum. More resources<sup>3</sup> can be found on the Half-Earth Educator Ambassador page. Sign up to be a Half-Earth Project Educator Ambassador<sup>4</sup> to meet other educators interested in biodiversity and conservation and receive a bi-monthly newsletter.

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<sup>1</sup> <https://vimeo.com/566132181> (10:25 run time)

<sup>2</sup> <https://docs.google.com/presentation/d/1nhfb2etbzHSaAygltlXSdJq0DtHOtsa6qMrjOqdet1Q/edit?usp=sharing>

<sup>3</sup> <https://www.half-earthproject.org/half-earth-project-educator-ambassadors/#resources>

<sup>4</sup> <https://www.half-earthproject.org/half-earth-project-educator-ambassadors/#join>

## Activity 1: What Do You Know About Hummingbirds?

### Mentimeter Poll and Wordcloud of Hummingbird Traits

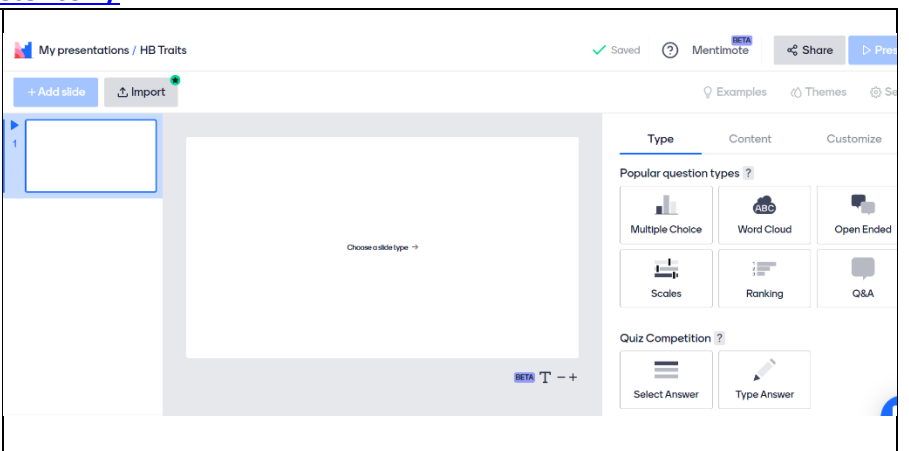
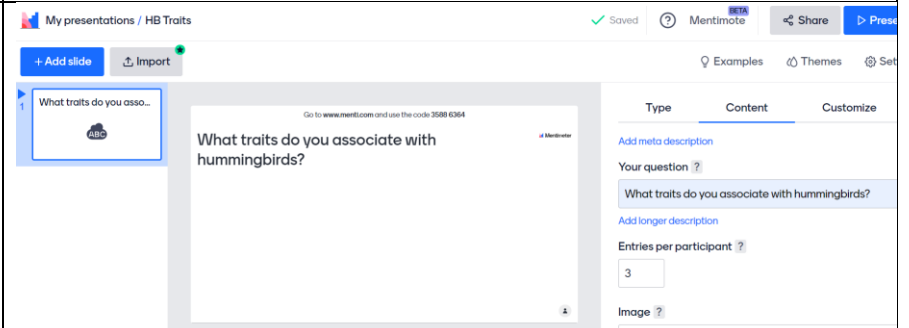
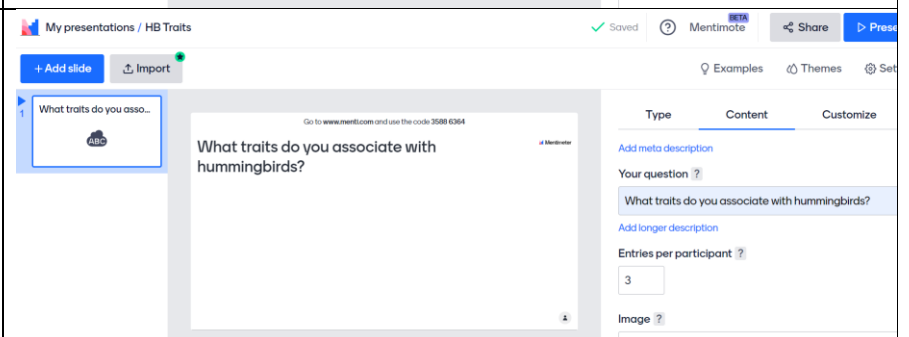
#### Teacher Directions

#### Introduction:

This warm-up activity is useful to find out what students already know about hummingbirds and explore what they want to learn about these birds. Word clouds can help make student thinking visible and are an easy way for students to share thoughts and ideas.

Lesson time frame: Estimated time is from 5 – 15 minutes. You might consider returning to the Menti after doing some of the lessons or make a new one to see how student ideas may have changed.

Website Navigation: <https://www.mentimeter.com/>

<p><b>1</b> Go to mentimeter.com and click “New presentation” then choose the “Word Cloud” option.</p>	
<p><b>2</b> In the “Your Question” section, ask students what traits they associate with hummingbirds.</p>	
<p><b>3</b> During class, click the “Present” button and students will log on to menti.com, using a computer, tablet, or phone, and enter the question code, then submit their responses.</p>	

Here is an example of a Menti generated by a Class.



**Follow up:**

Discuss the results with the class. Students can answer in pairs then share responses as a whole group. Consider showing some of the slides<sup>5</sup> if time allows before proceeding to other lessons.

1. What were some of the most popular traits?
2. What trait surprised you most?
3. Which traits are found in hummingbirds and not typically in other birds?
4. Pick a trait and write a brief explanation of why you think this is an advantage or disadvantage for hummingbirds.
5. How would you determine if the list is complete, or covers the most interesting or important things about hummingbirds?

<sup>5</sup> <https://docs.google.com/presentation/d/1nhfb2etbzHSaAygltlXSdJq0DtHOtsa6qMrjOqdet1Q/edit?usp=sharing>

## Activity 2: Where on Earth Do Hummingbirds Live?

Using the Half-Earth Map to Explore Hummingbird Richness and Rarity

*Teacher Directions*

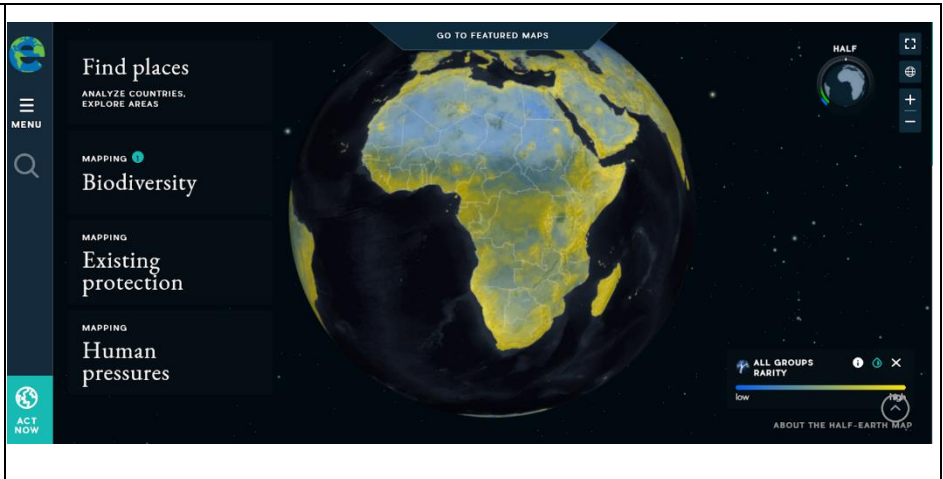
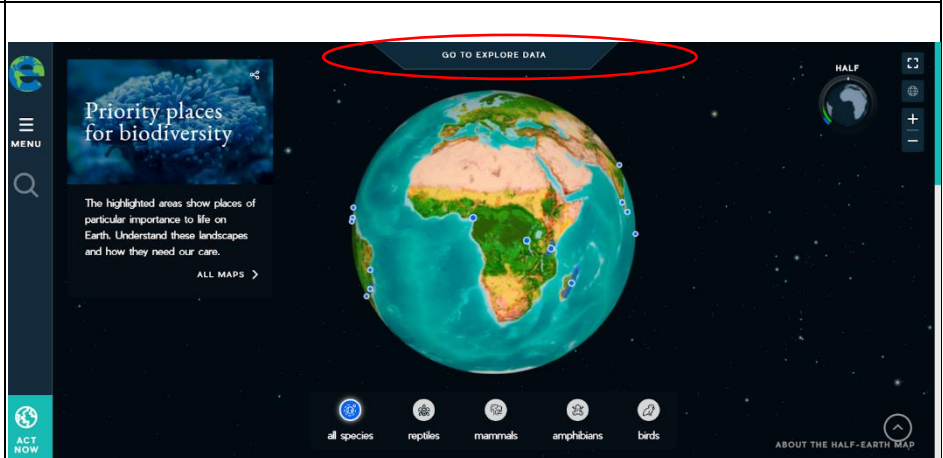
### Introduction:

Video tutorial (0:00-5:06) - <https://vimeo.com/566132728>

This activity focuses on the Half-Earth Map, which presents information in 3 main layers: Biodiversity, Existing protection, and Human pressures. The Half-Earth Map is inspired by E.O. Wilson’s book *Half-Earth: Our Planet’s Fight for Survival*. Overall the map presents data at a 55km resolution, so for example you can see species richness at the level of a town, but not at the level of a schoolyard or small park. However, some data on the map is at the much finer scale of 1km resolution and this is the case for hummingbirds. This means that students can explore the distribution of hummingbird species in great detail. A major purpose of this short lesson is to encourage students to zoom in to explore patterns, as well as zoom back to draw conclusions about global patterns, with a particular focus on the importance and difference between species **richness** and species **rarity**.

Lesson time frame: This lesson is estimated to take 20-40 minutes.

Website Navigation: <https://www.half-earthproject.org/maps/>

<p><b>1</b> Before changing settings, rotate the globe. (click and drag or use the left/right arrows on the keyboard).</p> <p>Direct students to Part 1 of the student worksheet.</p>	
<p>* If your screen looks like the image below instead, please click the “Go to Explore Data” in the center of screen, circle in red, to get to the correct interface.</p>	

2 From the menu on the left-hand side of the screen, click **“Mapping Biodiversity”**

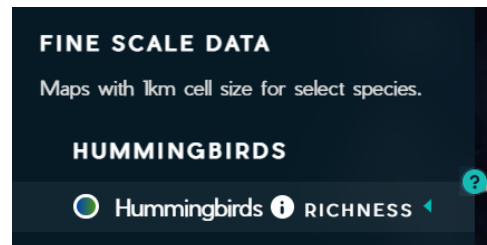
- If “All Groups” is already selected, deselect it, map should go gray.
- Scroll down and under “Fine Scale Data” click on “Hummingbirds”; if you see two scales, like in the image below “x” out of the “All Groups Rarity” scale so you only have Hummingbird data.

Direct students to Part 2 of the student worksheet.



3 Next to the “Hummingbirds” buttons, toggle between **“Richness and Rarity”** options. For both richness and rarity, rotate the globe (click and drag or use the left/right arrows on the keyboard).

Direct students to Part 3 of the student worksheet.





## Activity 2: Where on Earth Do Hummingbirds Live?

Using the Half-Earth Map to Explore Hummingbird Richness and Rarity

*Student Worksheet - Teacher Edition*

**Part 1: Observe the globe on the Half-Earth map. Use what you see to complete the prompts below.**

1. I notice student answers will vary but could include colors, the earth, a map, layered information.  
(What's something that stands out to you?)
2. I wonder student answers will vary; if needed cue students to patterns.  
(What are you curious about or would like to know more about based on what you see?)
3. It reminds me of student answers will vary but could include a globe, Google Maps, animation, video games.  
(What's a connection you can make based on what you see?)

**Part 2: Use the map focused on hummingbirds to answer the questions below.**

1. After selecting hummingbirds under Biodiversity, how did the map change? *Student answers will vary but could include "colors appeared" or "the world turned."*
2. With the changed map, what part of the world are you observing? Americas, North and South America, New world, part of the western hemisphere.
3. Describe the colors you see on this part of the globe. *Student answers will vary.*
4. What do these colors represent? *Correct answer: The colors represent the degree of richness and rarity of hummingbirds across locations. Students may think about a heat map. Allow for all ideas and be sure to address all misconceptions before the activity ends.*

**Part 3: Use the map changes between richness and rarity to answer the questions below.**

1. Can you estimate how many hummingbird species are in a particular place? *Students will make their best numerical guess but their guesses should align with the richness and rarity scale.*
2. Rotate the globe. Describe the patterns you see. *Student answers will vary; cue students to colors.*
3. Where do hummingbirds live and not live? *Cut students to use the map scale and colors to identify where hummingbirds live.*
4. Where do the highest number of species (richness) appear to live? Support answer with evidence from the map. *Example response: The highest number of hummingbirds live in Central America and the northern part of South America. The map shows these locations with the opaquet yellow color showing the highest richness.*
5. Where are there the most, rare species (rarity)? Support answer with evidence from the map. *Example response: The most, rare species of hummingbirds are found in Mexico, Central America, and the west coast of South America. The map shows these locations with the opaquet yellow color showing the highest rarity.*





## Activity 2: Where on Earth Do Hummingbirds Live?

Using the Half-Earth Map to Explore Hummingbird Richness and Rarity

### Student Worksheet

**Part 1: Observe the globe on the Half-Earth map. Use what you see to complete the prompts below.**

1. I notice \_\_\_\_\_.  
(What's something that stands out to you?)
2. I wonder \_\_\_\_\_.  
(What are you curious about or would like to know more about based on what you see?)
3. It reminds me of \_\_\_\_\_.  
(What's a connection you can make based on what you see?)

**Part 2: Use the map focused on hummingbirds to answer the questions below.**

1. After selecting hummingbirds under Biodiversity, how did the map change?
2. With the changed map, what part of the world are you observing? \_\_\_\_\_
3. Describe the colors you see on this part of the globe.
4. What do these colors represent?

**Part 3: Use the map changes between richness and rarity to answer the questions below.**

1. Can you estimate how many hummingbird species are in a particular place?
2. Rotate the globe. Describe the patterns you see.
3. Where do hummingbirds live and not live?
4. Where do the highest number of species (richness) appear to live? Support answer with evidence from the map.
5. Where are there the most, rare species (rarity)? Support answer with evidence from the map.

## Activity 3: Diversity of Hummingbird Species Ranges

### Using the Map of Life to Compare Hummingbird Ranges

#### Teacher Directions

#### Introduction:

Video tutorial (5:30-14:12) - <https://vimeo.com/566132964>

The Map of Life team provides the data that the Half-Earth Map uses. The Map of Life website does not have measures of species richness and rarity or information on protected areas and human impacts. However, it does have fantastic information on individual species, in particular range maps based on where experts say species should be living and point observations of where researchers and citizen scientists have spotted the species. The critical question for students in this lesson is: where does a hummingbird species live? By exploring patterns for several different species of hummingbird, students can draw conclusions about hummingbird diversity and ask questions about why some species have very large ranges while other species live in small, restricted areas. What does it mean when species have overlapping or non-overlapping ranges?

Lesson time frame: This lesson is estimated to take about one class period of 40-50 minutes.

#### Website Navigation: <https://mol.org/>

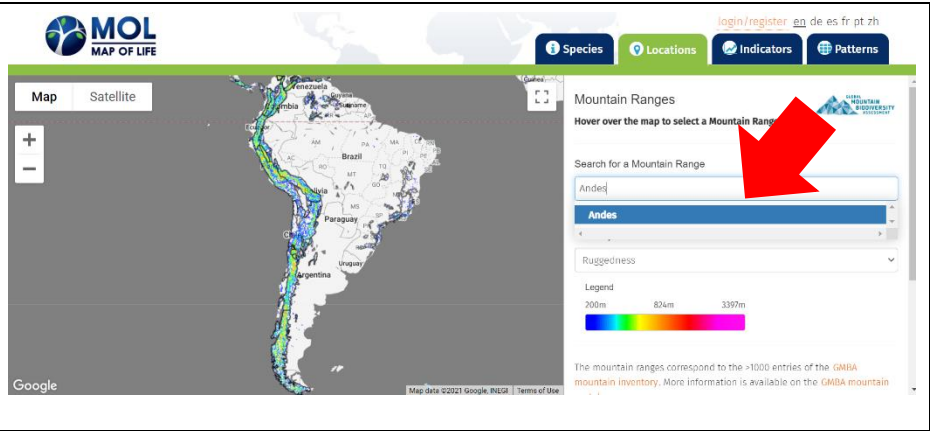
- 1 Select the “Species by Location” box  
  
On the right-hand side under “Global” click on “Mountain Ranges”  
  
Direct students to Part 1 of the student worksheet.



The screenshot shows the Map of Life website interface. At the top, there is a navigation bar with 'contact us', 'login', and 'register' links. Below this is a main menu with four options: 'Map species', 'Project species', 'Species by location', and 'Explore Places'. A red arrow points to the 'Species by location' option. Below the main menu is a map of Africa with a red arrow pointing to the 'Mountain Ranges' option in the 'Other available regions' section.

**2** In the “Search for a Mountain Range” box search for Andes and select.

Direct students to Part 2 of the student worksheet.



**3** On the right-hand side, click on the “Species” tab next to “Information” beneath the Andes heading. Note how many birds there are.

Click “Birds” then search for “hummingbird” in the “Filter birds” search box.

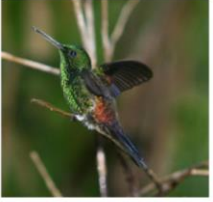

Direct students to Part 3 of the student worksheet.



**4** Select any two hummingbird species by clicking on their name one at a time. Once chosen, a pop-up will appear with a photo, written description, and range map (example shown on right).

Direct students to Part 4 of the student worksheet.

**Copper-Rumped Hummingbird**  
*Amazilia tobaci*

The copper-rumped hummingbird (*Amazilia tobaci*) sometimes placed in the genus *Saucerottia*, is a small bird that breeds in Venezuela, Trinidad and Tobago, and has occurred as a vagrant on Grenada. It is a seasonal migrant in parts of Venezuela. This hummingbird inhabits open country, gardens and cultivation. The female copper-rumped hummingbird lays its eggs in a tiny cup nest on a low branch, or sometimes wires or clotheslines. Incubation takes 16-17 days, and fledging another 19-23, and there may be up to three broods in a season. It is the predominant species of hummingbird in Trinidad and Tobago. The copper-rumped hummingbird is 8.6 cm long and weighs 4.7 g. The bill is fairly long, straight and mostly black with some pink on the lower mandible. The adult has copper-green upperparts, becoming copper-bronze on the rump. The head and underparts are bright green, the thighs are white and the tail and legs are black. The sexes are similar. The subspecies which breeds in Trinidad, *A. t. erythronota*, is smaller and has more bronzing on the upperparts than the nominate *A. t. tobaci*. The latter race has occurred as a vagrant to Grenada. There are several other subspecies in Venezuela differing mainly size and in the colour of the rump and back. The food of this hummingbird is nectar, taken from a wide variety of flowers, and some small insects. Copper-rumped hummingbirds perch conspicuously and defend their territories aggressively against other hummingbirds, bees, and larger bird species; this is especially during mating season, which is early in the year. The call of this species is a chip, and the song is a high-pitched tye-tye-tyoo.

Source: Wikipedia



## Activity 3: Diversity of Hummingbird Species Ranges

### Using the Map of Life to Compare Hummingbird Ranges

#### Student Worksheet - Teacher Edition

**Part 1: Observe the map once “Mountain Ranges” has been selected then complete the prompts below.**

1. I notice *student answers will vary.*  
(What’s something that stands out to you?)
2. I wonder *student answers will vary.*  
(What are you curious about or would like to know more about based on what you see?)
3. It reminds me of *student answers will vary.*  
(What’s a connection you can make based on what you see?)

**Part 2: Use the map focused on the Andes to answer the questions below.**

4. Describe the location of the Andes mountain range. *Student responses should include that this is a north-south mountain range from the top to the bottom of South America. Students can also describe the varying widths of the range and what countries are in the range.*

**Part 3: Use the Species tab to answer the questions below.**

1. Estimate the number of hummingbird species on the list. *Student answers will vary.*
2. Are you surprised by how many species there are? Explain your response. *Student answers will vary. In their explanation, push students to consider the connection between the mountain range size and the number of species.*
3. How do you think this number compares with the total number of species in the world? Explain your response. *Student answers will vary.*

**Part 4: Use the two hummingbird species descriptions to answer the questions below.**

1. Which two species are you investigating? \_\_\_\_\_
2. Compare the physical features of the two species, include similarities and differences. Be as specific as possible! *Students can use the image and description of each species for comparison. If possible, students could do additional research to see the differences in body size and wingspan.*
3. Compare the ranges of these two species, include similarities and differences. Be as specific as possible! *Using the green range maps, students should compare the range for each species and include the location of the range within South America and the overall size.*
4. What connections can you make between a species physical features and their range? *Students should consider how the physical features of the bird allow it to fly the distances within its range. Students should also consider the climate and elevation of the range how the species physical features are suited for that environment.*



## Activity 3: Diversity of Hummingbird Species Ranges

Using the Map of Life to Compare Hummingbird Ranges

### *Student Worksheet*

**Part 1: Observe the map once “Mountain Ranges” has been selected then complete the prompts below.**

1. I notice \_\_\_\_\_  
(What’s something that stands out to you?)
2. I wonder \_\_\_\_\_  
(What are you curious about or would like to know more about based on what you see?)
3. It reminds me of \_\_\_\_\_  
(What’s a connection you can make based on what you see?)

**Part 2: Use the map focused on the Andes to answer the questions below.**

1. Describe the location of the Andes mountain range.

**Part 3: Use the Species tab to answer the questions below.**

1. Estimate the number of hummingbird species on the list. \_\_\_\_\_
2. Are you surprised by how many species there are? Explain your response.
3. How do you think this number compares with the total number of species in the world? Explain your response.

**Part 4: Use the two hummingbird species descriptions to answer the questions below.**

1. Which two species are you investigating? \_\_\_\_\_
2. Compare the physical features of the two species, include similarities and differences. Be as specific as possible!
3. Compare the ranges of these two species, include similarities and differences. Be as specific as possible!
4. What connections can you make between a species physical features and their range?

## Activity 4: How Do We Know Where Things Live?

### Using the Map of Life to Compare Hummingbird Species

#### Teacher Directions

#### Introduction:

Video tutorial (0:00 – 5:30) - <https://vimeo.com/566132964>

The previous activity, Activity 3, focused on the Andes Mountain Range as a particularly rich landscape for hummingbird species, especially for rare species. Hummingbirds live in other places than the Andes Mountain range including Amazonia and the United States. In this activity, students are encouraged to explore hummingbird diversity throughout the entire range of the group, with a focus on the smallest hummingbird, the largest hummingbird, and the most common hummingbird in the US. By comparing expert range maps with point observations, students are encouraged to think about how we know where species live, and to consider their own potential role as a citizen scientist.

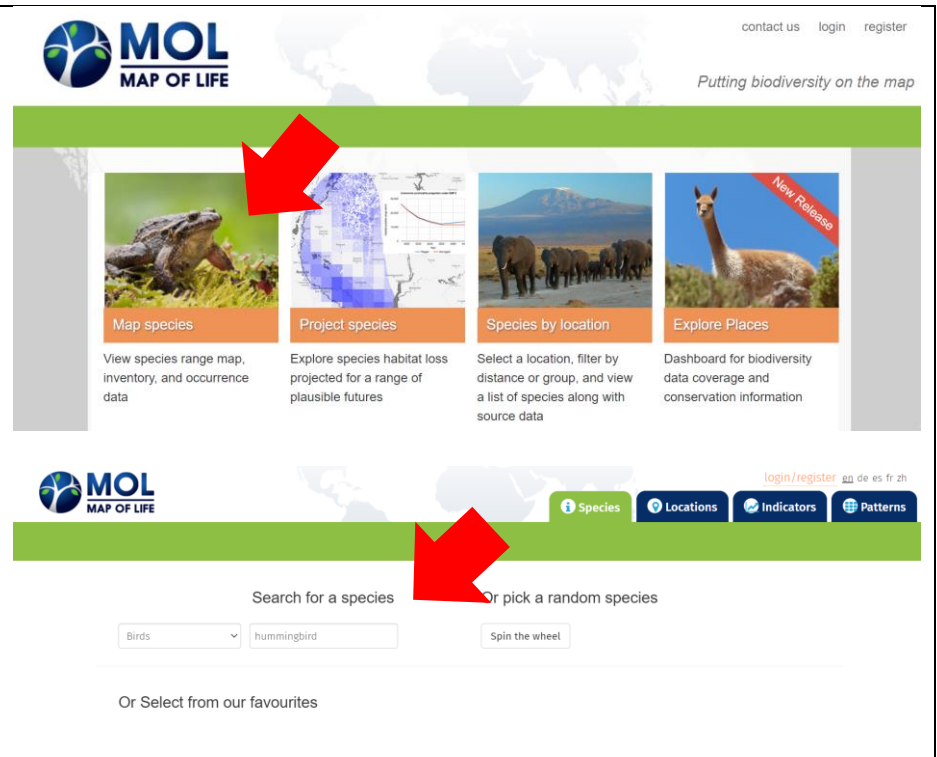
Lesson time frame: This activity is estimated to take a single class period of 40-50 minutes.

Website Navigation: <https://mol.org/>

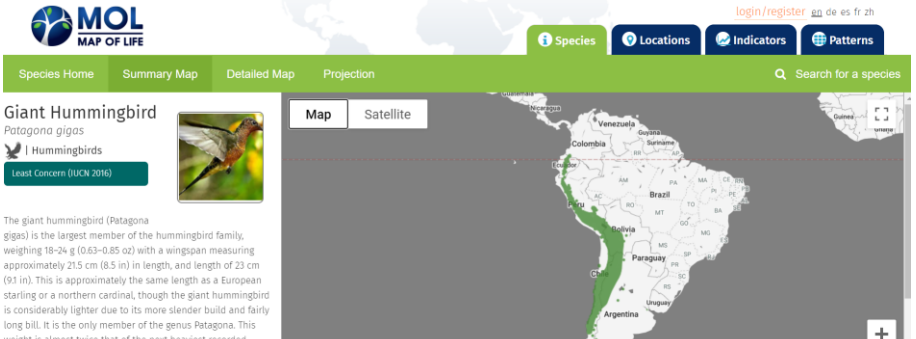

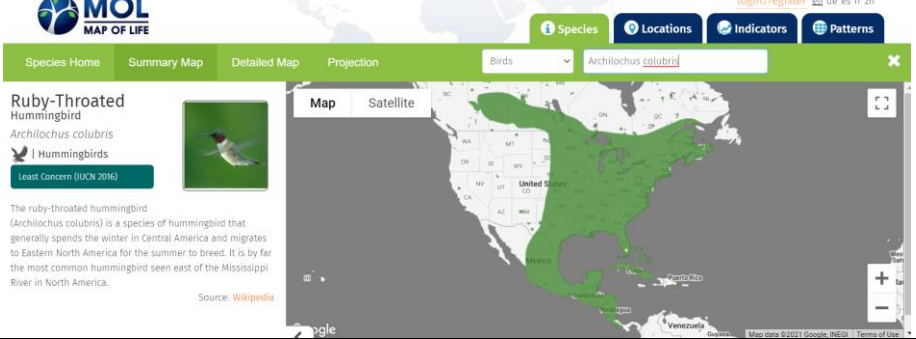
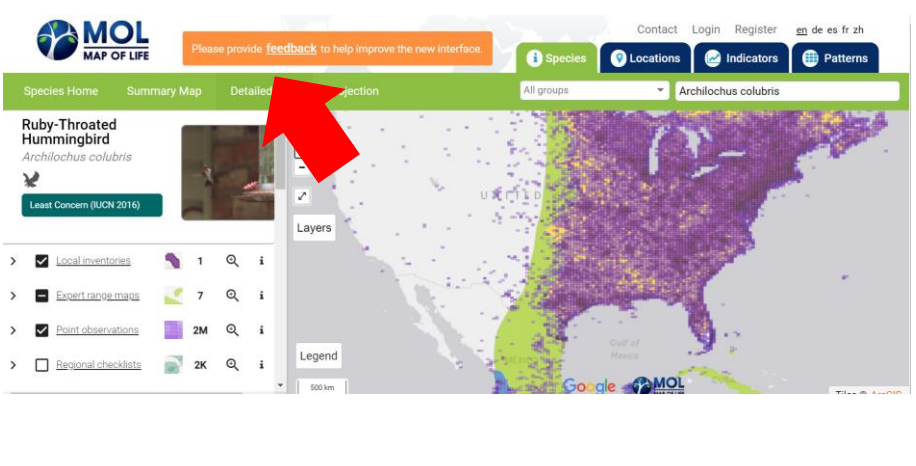
1 Select the “Map Species” box

In the “Search for a species” drop down choose Birds then search “hummingbird” in the text box.

When the list pops up, ask your students, “Do you think this species list has the same, fewer, or more species than the Andes list? Why?”



The screenshot shows the MOL website interface. At the top right, there are links for 'contact us', 'login', and 'register'. Below the navigation bar, there are four main content boxes: 'Map species' (with a frog image and a map), 'Project species' (with a map and a line graph), 'Species by location' (with an elephant image), and 'Explore Places' (with a llama image and a 'New Release' banner). Below these boxes is a search area with a dropdown menu set to 'Birds' and a text input field containing 'hummingbird'. A red arrow points to the 'Map species' box, and another red arrow points to the search input field. The page also includes a 'New Release' banner for a llama and various descriptive text blocks for each feature.

<p><b>2</b> In the “Search for a species” box enter “Giant Hummingbird” and select to go to that species page.</p> <p>Direct students to Part 1 #1-3 of the student worksheet.</p>	
<p><b>3</b> In the upper right corner of the green bar find the “Search for a species” box and search for “bee hummingbird” in. Select and go to that species page.</p> <p>Direct students to Part 1 #4-6 of the student worksheet.</p>	
<p><b>4</b> In the upper right corner of the green bar find the “Search for a species” box and search for “Ruby-throated hummingbird” in. Select and go to that species page.</p> <p>Direct students to Part 2 #1-3 of the student worksheet.</p>	
<p><b>5</b> Click on “Detailed Map” in the upper green bar. There are the actual point observations versus the expert drawn maps.</p> <p>Click on “Point Observations” to see the hundreds of observations from the citizen science eBird platform that have been contributed.</p> <p>Direct students to Part 2 #4 of the student worksheet.</p>	

## Activity 4: How Do We Know Where Things Live?

### Using the Map of Life to Compare Hummingbird Species

#### Student Worksheet - Teacher Edition

#### Part 1: Use the species page of the Giant and Bee Hummingbirds to answer the questions below.

1. Use the image and description (and/or further searching) to describe the Giant Hummingbird. *Student answers will vary. Students can note the description similar to a Cardinal and larger size compared to the smallest hummingbird species.*
2. Use the map to describe the Giant Hummingbird's range. Be sure to zoom out to get the full range context. *The Giant Hummingbird's range is on the western coast of South America. The range runs north to south along the coast. Students can also note the range connection to the Andes Mountains from the last activity.*
3. Use the image and description (and/or further searching) to describe the Bee Hummingbird. *Student answers will vary. Students can note from the description that this species is the smallest bird in the world.*
4. Use the map to describe the Bee Hummingbird's range. Be sure to zoom out to get the full range context. *The Bee Hummingbird's range is only on the island of Cuba. The range does not include the full island but only sporadic and small sections of the island.*
5. The Bee Hummingbird is the smallest bird in the world. What connection can you make between that fact and its range. *Student answers might include a connection between the bird's smaller range and its small body size. The bee hummingbird is probably an example of island (insular) dwarfism. The idea is that being very small requires less food and is adaptive on an island where territories and food are limited.*

#### Part 2: Use the species page of the Ruby-Throated Hummingbird to answer the questions below.

1. Use the image and description (and/or further searching) to describe the Ruby-Throated Hummingbird. *Student answers will vary they can include a size comparison to the Giant and Bee hummingbird to create a reference pint.*
2. Use the map to describe the Ruby-Throated Hummingbird's range. Be sure to zoom out to get the full range context. *The Ruby-Throated Hummingbird's range includes much of Northern and Central America. Specially, the southern portion of Canada, all of the east, south east, and Midwest portion of the United States, the islands off the coast of Florida, Cuba, and almost all of Central America.*
3. How does the Ruby-Throated Hummingbird's range compare to the Giant and Bee Hummingbirds? *The Ruby-Throated Hummingbird is migratory and it's range is extended by having different territories for nesting versus winter feeding. The Giant Hummingbird's range is extensive north and south along much of the Andes mountain range but not a migratory range, and the Bee Hummingbird's range is very small entirely restricted to Cuba.*
4. How do the citizen reported findings compare to the expert range maps? *Student answers will vary; students can note that mostly the point observations follow the same patterns of the expert range but there are some observations outside of the expert map. Out of range observations can occur as refinements to expert maps, or a very rare case of an individual blown off course or otherwise outside of normal range for the species.*





## Activity 4: How Do We Know Where Things Live?

### Using the Map of Life to Compare Hummingbird Species

#### *Teacher Directions*

**Part 1: Use the species page of the Giant and Bee Hummingbirds to answer the questions below.**

1. Use the image and description (and/or further searching) to describe the Giant Hummingbird.
2. Use the map to describe the Giant Hummingbird's range. Be sure to zoom out to get the full range context.
3. Use the image and description (and/or further searching) to describe the Bee Hummingbird.
4. Use the map to describe the Bee Hummingbird's range. Be sure to zoom out to get the full range context.
5. The Bee Hummingbird is the smallest bird in the world. What connection can you make between that fact and its range.

**Part 2: Use the species page of the Ruby-Throated Hummingbird to answer the questions below.**

1. Use the image and description (and/or further searching) to describe the Ruby-Throated Hummingbird.
2. Use the map to describe the Ruby-Throated Hummingbird's range. Be sure to zoom out to get the full range context.
3. How does the Ruby-Throated Hummingbird's range compare to the Giant and Bee Hummingbirds?
4. How do the citizen reported findings compare to the expert range maps?

## Activity 5: Not Just Where, But How Many?

### Using eBird to Study the Abundance of Hummingbirds

#### Teacher Directions

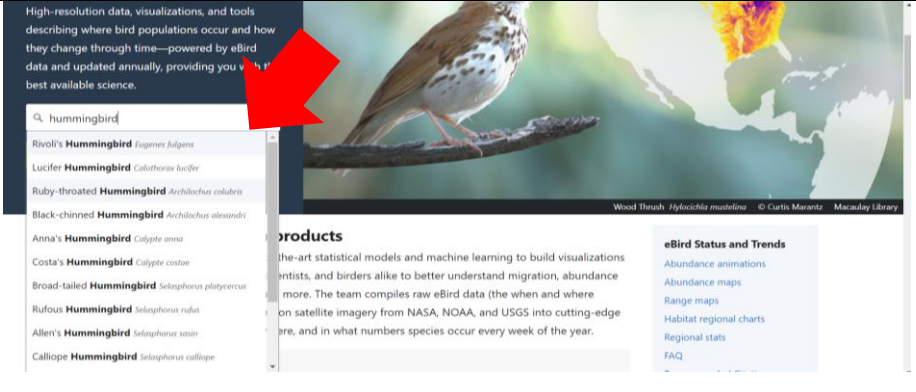

**Introduction:**

Video tutorial (0:00-6:07) - <https://vimeo.com/566133374>

The study of biodiversity has been transformed by apps like iNaturalist that allow individuals without formal training to make observations of where and when they see a species. For the birding world and science of ornithology, eBird is an important app used by researchers and citizen scientists. An extensive network of users coupled with statistical modelling techniques is used by eBird scientists to estimate the relative abundance of birds in a particular location and particular time of year. The Cornell Lab of Ornithology makes this data available at a website they call “status and trends,” which features beautiful maps and dynamic animations on over 800 bird species including many hummingbirds. This activity uses the Ruby-throated Hummingbird to introduce animations and other visual data available for migratory bird species. Why do animals migrate? What are the challenges they face? Which are more important, breeding grounds or feeding grounds? Does migration merit special consideration for taking conservation action?

Lesson time frame: This activity can be very flexible on time. As presented about 20 minutes is needed, but students can explore data on various species in as little as 5 minutes. Students will likely get more out of the activity if they compare data on other species with what they document for the Ruby-throated Hummingbird.

**Website Navigation:** <https://ebird.org/science/status-and-trends>

<p><b>1</b> Type “hummingbird” into the search bar on the right-hand side of the screen.</p> <p>Choose and click the “Ruby-throated” hummingbird” species.</p>	
<p><b>2</b> Choose and click the “Abundance map” option.</p> <p>Direct students to Part 1 of the student worksheet.</p>	

3 Go back to the “Ruby-throated Hummingbird” species page. Choose and click the “Abundance animation” then press the blue play button and run the animation.

Direct students to Part 2 of the student worksheet, \*ask students to answer #1 before playing the animation.



The screenshot shows the eBird website interface for the Ruby-throated Hummingbird. The page title is "Ruby-throated Hummingbird" with the scientific name *Archilochus colubris*. Below the title, there is a section titled "All products" which lists various data visualization options. A red arrow points to the "Abundance animation" option, which is represented by a map of North America with a blue play button icon overlaid on it. Other options include "Abundance map", "Abundance map: Non-breeding", "Abundance map: Pre-breeding migration", "Abundance map: Breeding", "Abundance map: Post-breeding migration", and "Abundance regional stats". There is also a "TRENDS" section with options for "In progress. Learn more", "Trends map: Non-breeding", and "Trends map: Breeding".

## Activity 5: Not Just Where, But How Many?

### Using eBird to Study the Abundance of Hummingbirds

#### Student Worksheet – Teacher Edition

**Part 1: Observe “Abundance map” for the “Ruby-throated Hummingbird” species to answer the questions below.**

1. What does the red color represent on the map? *The red color is where the Ruby-throated hummingbird can be found during the breeding season.*
2. What does the yellow color represent on the map? *The yellow color where the Ruby-throated hummingbird can be found during the pre- and post-migratory times of year.*
3. What does the blue color represent on the map? *The blue color is where the Ruby-throated hummingbird can be found when it is not migrating or nesting.*
4. What months are the Ruby-throated hummingbird’s breeding season? *June and July are the breeding season months.*
5. Describe the geographic location of the Ruby-throated hummingbird’s breeding seasons. *The breeding season location includes over half of the states in the United States! The location includes all of the east coast, south east, and mid-west.*
6. Does the Ruby-throated hummingbird breed where you live? *Student answers will vary, the main point is for them to interpret the map correctly.*
7. What months are the Ruby-throated hummingbird’s non-breeding season? *December, January, and February are the non-breeding season months.*
8. Describe the geographic location of the Ruby-throated hummingbird’s non-breeding seasons. *The non-breeding season location includes southern Mexico and much of Central America.*
9. Research the weather of Central America in December-February. Based on what you find, why do you think the Ruby-throated hummingbird spends its non-breeding season in that location? *Student answers will vary, but hopefully will note mild weather so availability of plants and insect food.*

**Part 2: Use the “Abundance animation” map to answer the questions below.**

1. Relative abundance is the estimated number of individual Ruby-throated hummingbirds detected by an eBirder during a traveling count at the optimal time of day for each species. Before the animation plays, predict how the abundance of the Ruby-throated hummingbird will change over the year. *Student answers will vary. Some students may have noticed that where they live Ruby-throated Hummingbirds are not seen until summer.*
2. Play the abundance animation and describe how abundance changes over the course of a year. *Student answers will vary but should include the description of location and change of abundance colors.*
3. In which months is the relative abundance the highest? *In the US and Canada, the abundance is highest from the end of July to the beginning of September.*



4. Explain the connection between the breeding season (June and July) and the highest relative abundance. *The Ruby-throated hummingbird breeding season is June and July. The relative abundance is highest in the weeks and months following these months because the breeding pairs are most abundant and offspring are hatching.*



## **Activity 5: Not Just Where, But How Many?**

### Using eBird to Study the Abundance of Hummingbirds

#### *Student Worksheet*

#### **Part 1: Observe “Abundance map” for the “Ruby-throated Hummingbird” species to answer the questions below.**

1. What does the red color represent on the map?
2. What does the yellow color represent on the map?
3. What does the blue color represent on the map?
4. What months are the Ruby-throated hummingbird’s breeding season?
5. Describe the geographic location of the Ruby-throated hummingbird’s breeding seasons.
6. Does the Ruby-throated hummingbird breed where you live?
7. What months are the Ruby-throated hummingbird’s non-breeding season?
8. Describe the geographic location of the Ruby-throated hummingbird’s non-breeding seasons.
9. Research the weather of Central America in December-February. Based on what you find, why do you think the Ruby-throated hummingbird spends its non-breeding season in that location?

#### **Part 2: Use the “Abundance animation” map to answer the questions below.**

1. Relative abundance is the estimated number of individual Ruby-throated hummingbirds detected by an eBirder during a traveling count at the optimal time of day for each species. Before the animation plays, describe your prediction for how the abundance of the Ruby-throated hummingbird will change over the year.
2. Play the abundance animation and describe how abundance changes over the course of a year.
3. In which months does is the relative abundance the highest?
4. Explain the connection between the breeding season (June and July) and the highest relative abundance.

## Activity 6: How Do Hummingbirds Depend on Other Species?

Using the Encyclopedia of Life to Explore Trophic Levels

### Teacher Directions

#### Introduction:

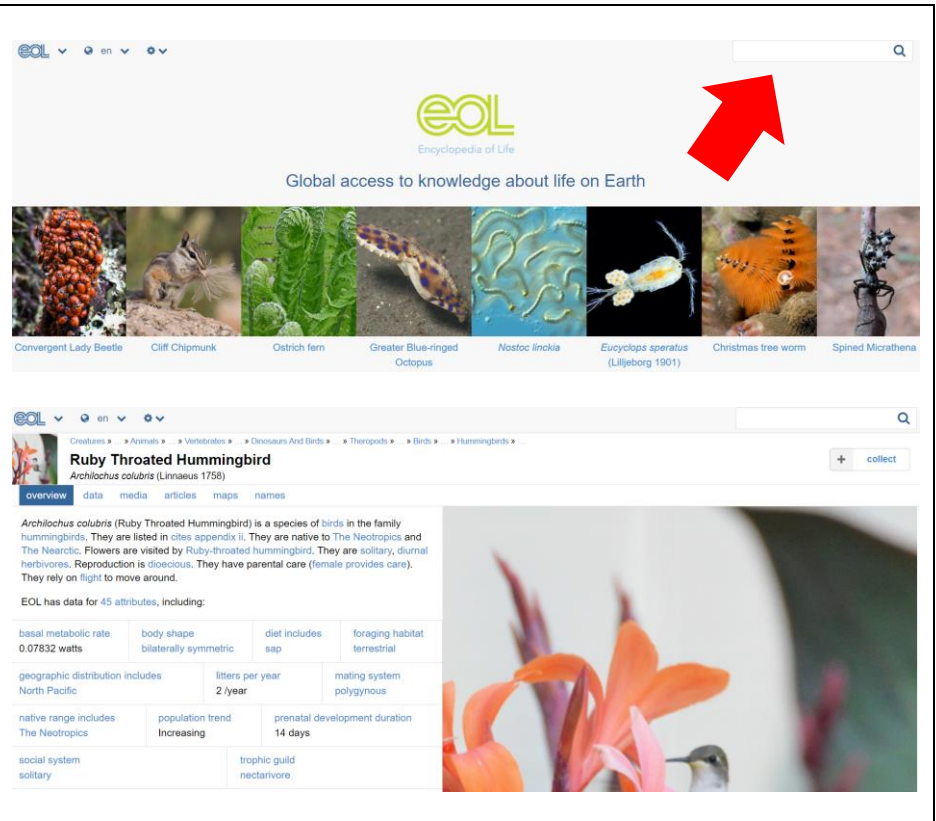
Video tutorial (0:00-6:21) - <https://vimeo.com/566133740>

In 2007 E.O. Wilson gave a TED talk<sup>6</sup> in which he proposed that we create a website with the goal of having a page for every species on the planet. The goal became a project named the Encyclopedia of Life (EOL), built by a community of scientists, educators, technical experts, and species fans. Over the years thousands of individuals have provided information on nearly 200,000 species; impressive but far short of the 1.9 million species identified by science. EOL has added a powerful interactive tool they call the trophic web. Students can place a species in the center of the trophic web and see the network of organisms that interact with that species, emphasizing the important interactions of eating and being eaten. Students can travel from species to species, navigating the trophic web to see how inter-dependent life on our planet is, and to begin to ask questions about ecological functions and the conservation of biodiversity.

Lesson time frame: This activity can be very flexible on time, as presented it is 20-40 minutes of class time, but students can explore in sessions as short as 5 minutes.

Website Navigation - <https://eol.org/>

- 1 Find the search box in the upper right corner. Search for the “Ruby-throated hummingbird” and select to go to the species page.



The screenshot shows the EOL website interface. At the top, there is a search bar with a magnifying glass icon. Below the search bar is the EOL logo and the tagline "Global access to knowledge about life on Earth". A red arrow points to the search bar. Below the tagline is a row of eight small images representing various species: Convergent Lady Beetle, Cliff Chipmunk, Ostrich fern, Greater Blue-ringed Octopus, Nostoc linckia, Eucyclops speratus (Liljeborg 1901), Christmas tree worm, and Spined Micrathena. Below this row is another search bar. Below the second search bar is the species page for the Ruby Throated Hummingbird (*Archilochus colubris*). The page includes a navigation menu with options like overview, data, media, articles, maps, and names. The main content area contains a description of the species and a table of attributes.

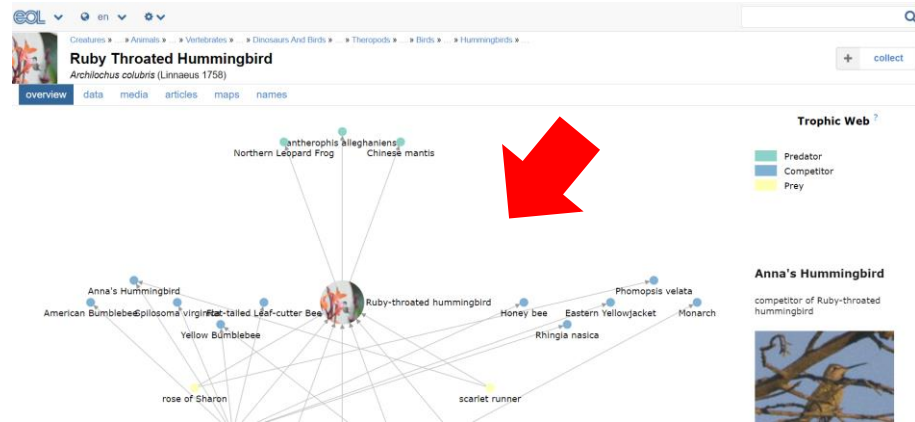
basal metabolic rate 0.07832 watts	body shape bilaterally symmetric	diet includes sap	foraging habitat terrestrial
geographic distribution includes North Pacific		litters per year 2 /year	mating system polygynous
native range includes The Neotropics	population trend increasing	prenatal development duration 14 days	
social system solitary	trophic guild nectarivore		

<sup>6</sup> [https://www.ted.com/talks/e\\_o\\_wilson\\_my\\_wish\\_build\\_the\\_encyclopedia\\_of\\_life/transcript?language=en](https://www.ted.com/talks/e_o_wilson_my_wish_build_the_encyclopedia_of_life/transcript?language=en)

2 On the species page, scroll down to the trophic food web. Note: The trophic web feature is not available for all species.

*By moving the mouse over each organism, a picture will appear. Clicking on the organism will move to that organism's good web. The reset button at the bottom left returns to the original Ruby-throated hummingbird web.*

Direct students to the student worksheet.







## Activity 6: How Do Hummingbirds Depend on Other Species?

Using the Encyclopedia of Life to Explore Trophic Levels

*Student Worksheet - Teacher Edition*

**Use the Ruby-throated hummingbird trophic food web to answer the questions below.**

1. How many predators does the Ruby-throated hummingbird have in this web? Three, a leopard frog, snake, and mantis.
2. Scroll over the organisms that are listed as the Ruby-throated organism's prey. Compare these organisms. What is similar? What is different?
3. Choose 1 organism that the Ruby-throated hummingbird preys on and record here: \_\_\_\_\_  
Student answers will vary; students should be choosing one of the yellow labeled organisms.
4. What other organism(s) does the Ruby-throated hummingbird compete with in order to consume the prey listed above? Student answers will vary and should be aligned to their answer to #2



## Activity 6: How Do Hummingbirds Depend on Other Species?

Using the Encyclopedia of Life to Explore Trophic Levels

*Student Worksheet*

**Use the Ruby-throated hummingbird trophic food web to answer the questions below.**

1. How many predators does the Ruby-throated hummingbird have in this web?
2. Scroll over the organisms that are listed as the Ruby-throated organism's predators. Compare these organisms. What is similar? What is different?
3. Scroll over the organisms that are listed as the Ruby-throated organism's prey. Compare these organisms. What is similar? What is different?
4. Choose 1 organism that the Ruby-throated hummingbird preys on and record here: \_\_\_\_\_
5. What other organism(s) does the Ruby-throated hummingbird compete with in order to consume the prey listed above?



## The Richness and Rarity of Hummingbirds

### A Half-Earth Project Guided Inquiry – Resource Appendix

Videos		
Name	Link	Run Time
Introduction to Half-Earth and the Half-Earth Map	<a href="https://drive.google.com/file/d/1872PS9zTdCH_a_1MU3On_cJzLO5M1uld2/view?usp=sharing">https://drive.google.com/file/d/1872PS9zTdCH_a_1MU3On_cJzLO5M1uld2/view?usp=sharing</a>	10:25
Activity 2 Tutorial Half-Earth Map	<a href="https://drive.google.com/file/d/1RnXV-QZ2rRm1_46fH3zuH1UMn9wTqPYW/view?usp=sharing">https://drive.google.com/file/d/1RnXV-QZ2rRm1_46fH3zuH1UMn9wTqPYW/view?usp=sharing</a>	5:06
Activity 3 Tutorial Map of Life	<a href="https://drive.google.com/file/d/1RnXV-QZ2rRm1_46fH3zuH1UMn9wTqPYW/view?usp=sharing">https://drive.google.com/file/d/1RnXV-QZ2rRm1_46fH3zuH1UMn9wTqPYW/view?usp=sharing</a>	5:30-14:12
Activity 4 Tutorial Map of Life	<a href="https://drive.google.com/file/d/1anWJW-vTHhj8ZaFLutyG8A0EZZ5OMEOf/view?usp=sharing">https://drive.google.com/file/d/1anWJW-vTHhj8ZaFLutyG8A0EZZ5OMEOf/view?usp=sharing</a>	0:00-5:30
Activity 5 Tutorial eBird	<a href="https://drive.google.com/file/d/1TiqP5KZ0MCfaiAj_-LmMosLOGU3vNxdQ/view?usp=sharing">https://drive.google.com/file/d/1TiqP5KZ0MCfaiAj_-LmMosLOGU3vNxdQ/view?usp=sharing</a>	6:07
Activity 6 Tutorial Encyclopedia of Life	<a href="https://drive.google.com/file/d/1FVfVrBge8ihw6HeeeWprS_q8pvqDqs7G/view?usp=sharing">https://drive.google.com/file/d/1FVfVrBge8ihw6HeeeWprS_q8pvqDqs7G/view?usp=sharing</a>	6:21
Activity 6 Optional Viewing E.O. Wilson TedTalk	<a href="https://www.ted.com/talks/e_o_wilson_my_wish_build_the_encyclopedia_of_life/transcript?language=en">https://www.ted.com/talks/e_o_wilson_my_wish_build_the_encyclopedia_of_life/transcript?language=en</a>	22:02

Activity Websites	
Name	Link
Activity 1: Mentimeter	<a href="https://www.mentimeter.com/">https://www.mentimeter.com/</a>
Activity 2: Half-Earth Map	<a href="https://www.half-earthproject.org/maps/">https://www.half-earthproject.org/maps/</a>
Activity 3: Map of Life	<a href="https://mol.org/">https://mol.org/</a>
Activity 4: Map of Life	<a href="https://mol.org/">https://mol.org/</a>
Activity 5: eBird	<a href="https://ebird.org/science/status-and-trends">https://ebird.org/science/status-and-trends</a>
Activity 6: Encyclopedia of Life	<a href="https://eol.org/">https://eol.org/</a>



## Resources

Name	Link
Hummingbird Trait Presentations	<a href="https://docs.google.com/presentation/d/1nhfb2etbzHSaAygltlXSdJq0DtHOtsa6qMrjOqdet1Q/edit?usp=sharing">https://docs.google.com/presentation/d/1nhfb2etbzHSaAygltlXSdJq0DtHOtsa6qMrjOqdet1Q/edit?usp=sharing</a>
Half-Earth Educator Ambassador Resources	<a href="https://www.half-earthproject.org/half-earth-project-educator-ambassadors/#resources">https://www.half-earthproject.org/half-earth-project-educator-ambassadors/#resources</a>
Half-Earth Educator Ambassador Newsletter	<a href="https://www.half-earthproject.org/half-earth-project-educator-ambassadors/#join">https://www.half-earthproject.org/half-earth-project-educator-ambassadors/#join</a>