



Observe and Ask



**Left Photo – 2 animals - questions**

**Right photo questions**

<p>1. Describe what you see in the photo (left photo).</p>	<p>5. Make some observations about the anatomy of this animal (right photo).</p>
<p>2. Compare the two animals anatomically, for instance their eyes and limbs.</p>	<p>6. Based on your observations, where do you think it lives? How does it move in its environment?</p>
<p>3. Where do you think these animals live? What evidence supports your hypothesis (educated guess)?</p>	<p>7. Looking at both the right and left photo, can you list any features that the two insects have in common?</p>
<p>4. How do you think these two animals move about their environment? You might be able to describe each of their movements with a single word.</p>	



### Compare and Conclude

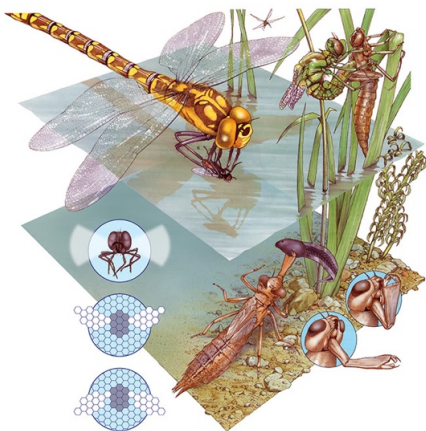
The images are of the same species, a dragonfly called the Common Green Darner, *Anax junius*. Although we may think of dragonflies as amazing flying insects, all of the thousands of dragonfly species start life in the water, then metamorphose into flying adults.

1. List what you think could be advantages of starting out life in the water.

2. All animals need to find food to survive and grow, and a way to produce offspring to continue the species. In view of these factors, list some ideas on how it could be an advantage for an aquatic insect to have the ability to leave the water and fly as an adult.

### Resources:

- Half-Earth Project Dragonfly Storymap, [storymaps.arcgis.com/stories/4c1b5d8db11245fd934e720123b8de56](http://storymaps.arcgis.com/stories/4c1b5d8db11245fd934e720123b8de56)
- The Map of Life (mol.org) has lots of information on where species live all over the planet. Here's the map for where the Common Green Darner lives, [mol.org/species/Anax\\_junius](http://mol.org/species/Anax_junius).
- The Half-Earth Map for exploring the global distribution of biodiversity, [map.half-earthproject.org/](http://map.half-earthproject.org/)
- Genetic Analysis of Dragonfly Population Structure, [onlinelibrary.wiley.com/doi/epdf/10.1002/ece3.4255](http://onlinelibrary.wiley.com/doi/epdf/10.1002/ece3.4255)  
The genetic analysis is very technical but the paper offers good information on aquatic vs terrestrial life.



Dragonfly Lifecycle



## Instructor notes

Thinking about dragonfly metamorphosis is an opportunity for students to deepen their questions and concepts of life cycles, adaptations, and habitats. Dragonflies are a great subject for exploring questions in genetics, evolution, animal behavior, migration, and ecology. Insects are especially useful for extending thinking on migration beyond more familiar birds and mammals. The life cycle of dragonflies sparks many interesting why questions.

### Observe and Question notes:

1. Describe what you see in the left photo.  
*Students should be focused on what they are seeing, not only how it makes them feel. Nearly all students will recognize a fish, most will not recognize the other animal specifically but may see insect features, or even compare it to a cockroach or beetle for example.*
2. Compare the two animals anatomically, for instance their eyes and limbs.  
*Insect eyes have a very different structure than vertebrate eyes, in this case the dragonfly nymph eyes are much bigger than the small fish and may be hard to recognize. The legs are visible, the shell, and what looks like wings.*
3. Where do you think these animals live? What evidence supports your hypothesis (educated guess)?  
*The fish provides a big clue to a watery environment, but students might also be thinking about urban vs rural and what type of water such as pond, stream, puddle.*
4. How do you think these two animals move about their environment? You might be able to describe each of their movements with a single word.  
*Many movement behaviors can be described with a single word such as: crawl, swim, jump, prey, grab, jet, ambush.*
5. Make some observations about the anatomy of this animal (right photo).  
*Observations such as "pretty" or "colorful" are appropriate, but more specific observations about anatomy, such as the presence of wings or legs, are more useful for thinking about how the animal lives.*
6. Based on your observations, where do you think it lives? How does it move in its environment?  
*The fact that the animal has wings and is perched on a plant are big clues. It's not in the water, but maybe it's near water. It's not unreasonable to suggest the animal eats plants, but in fact it catches prey by flying.*
7. Looking at both the right and left photo, can you list any features that the two insects have in common?  
*We just want to compare the insects here, not the fish. Both have large eyes and many (6) legs, one has wings, one may have small wings. One live in water, one on land maybe flies.*



Compare and Conclude notes:

1. List what you think could be advantages of starting out life in the water?

*Students might suggest advantages such as; places to hide from predators, food sources not on land, different seasonal conditions from the land during winter for example.*

2. All animals need food to survive and grow, a way to produce offspring to continue the species, and many animals have a way to spread out in their territory. In view of these factors, list some ideas on how it could be an advantage for an aquatic insect to have the ability to leave the water and fly as an adult.

*Students might think of flying as a good way to hunt widely, spread out to find mates, migrate to other areas, avoid predators, or adapt to weather changes.*

Extension idea:

From the Green Darner page on Map of Life, [mol.org/species/Anax\\_junius](https://mol.org/species/Anax_junius), clicking on the “Detailed Map” tab, takes you to this page, [mol.org/species/map/Anax\\_junius](https://mol.org/species/map/Anax_junius).

From there click on “point observations”

Ask students to look at the map and describe where the majority of the point observations are found. Point observations are a recorded sighting of an individual animal with time and place recorded. The popular app iNaturalist for example allows any user to make a point observation. Why are there so many point observations in these particular locations and few in others?

We want to know where members of species such as the Green Darner are found, all those places combined, are called the **range** of the species. We also want to know how many individuals are found in a given place, called **abundance**. It’s important to understand that a place may have many point observations because the animals are abundant there, but there can also be lots of observations in a place because many people are making observations there. For example, a very popular public park may have lots of observations of just a few individual dragonflies because many people are making observations. In contrast, a remote lake may have many individual dragonflies but not many people visiting to observe and record their presence.