**Draft Exercise using idigpaleo.org**

Developed by participants of the iDigPaleo Workshop

Yale Peabody Museum, July 20-21, 2015

http://peabody.yale.edu/collections/invertebrate-paleontology/idigpaleo-teacher-workshop-2015

NGSS addressed:

MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms

throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

Crosscutting Concepts (Patterns)

Graphs, charts and images can be used to identify patterns in data.

Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system’s structure or performance.

Science and Engineering Practices

Analyze and interpret data to interpret similarities and differences among findings.

One of the problems scientists face in reconstructing long-extinct animals is that fossils rarely preserve the whole animal. Often all you have is a few pieces.

**Ancient Insects**

One way to deal with this is to compare the extinct animal with its living relatives. So for example, by measuring the dimensions of the part of the animal that has been fossilized, and comparing those measurements with the same dimensions on a living relative, you can get some idea of how big the extinct animal might have been when it was alive.

Of course, its living relatives may belong to many different species and come in a number of different shapes, so the dimensions of the reconstructed animal may change depending on which living species you base your reconstruction on.

Animals are shaped by evolution depending on factors like their habitat, behavior, and diet. So, you would expect an animal that ambushed its prey to look different from an animal that pursues its prey for a long time until the prey is exhausted. ***Are you able to think of living examples of pursuit and ambush predators? In what ways are your examples different from each other?***

What this means is that if you only have a fossil preserving one part of an extinct animal, you might have to make lots of different reconstructions. But as you find more parts, you can begin to see which reconstruction looks most like the extinct animal. And because you know which living species that reconstruction was based on, and its lifestyle, you can make some hypotheses about how the extinct animal may have lived.

Sometimes the extinct animal may have features that are different from all its living relatives. These differences may give you some clues about the environment when it lived compared to the world of the day.

In this exercise, you’re going to work with a fossil of an extinct type of insect called a griffenfly.

Griffenflies lived between 320 and 250 million years ago. There are no living griffenflies today. But they do have living relatives, called dragonflies and damselflies.

Damselflies are small, slender insects. The scientific name for their group is the suborders Zygoptera and Anisoptera. Like all insects, their body has three parts:

Head: damselflies hunt other insects by sight, so they have large compound eyes.

Thorax: this is the middle part of the body. It carries the damselfly’s three pairs of legs and two pairs of wings. When the damselfly is resting, the wings fold back along the body.

Abdomen: this is the rear part of the body. It’s very long and narrow.

**Activity: use the scientific name for damselflies to search iDigPaleo for a specimen. Save it to your collection. Use the labeling tool to mark the head, thorax, and abdomen.**

Dragonflies look similar to damselflies but they are larger and more heavily built. The scientific name for their group is the suborder Anisoptera. ***Zygoptera and Anisoptera are closely related groups that comprise the order Odonata.***

Other than size and weight, the main difference between dragonflies and damselflies is that dragonflies hold their wings flat and away from the body when they are resting.

Dragonflies are also much stronger fliers than damselflies. They are very agile in flight, where damselflies appear weak and fluttery.

There are many different types of dragonflies, and they adopt different tactics when hunting:

Hawkers spend most of their time airborne when hunting. They have large wings and long, thin abdomens. The scientific name for the largest group of hawkers is the family Aeshnidae.

Skimmers, darters, and chasers perch on plants and wait for their prey to fly past. They then pursue it at high speed, capture it in the air, and fly back to their perch to eat it. Chasers tend to have shorter, broader abdomens than hawkers. They belong to the family Libelluloidea.

**Activity: use the scientific names for hawkers and skimmers/darters/chasers to search iDigPaleo for a specimen from each group. Save it to your collection. Use the labeling tool to mark the ways in which the two types of dragonfly are different.**

Now it’s time to look at the fossil. We’re going to study a wing from a griffenfly called *Megatypus schucherti*. It was found rocks that were almost 300 million years old.

**Activity. Use iDigPaleo to search for the specimen. Its catalog number is YPM IP.01021. Where was the fossil found? Use iDigPaleo to plot the site where it was discovered (its locality) on a map.**

**Activity. Study the wing carefully. Use the labeling tool to mark the tip of the wing and the base (the point where it meets the thorax).**

**Activity. Compare the wing to the wings of the modern dragonflies you found on iDigPaleo. Do you think the fossil is one of the front or back pair of wings? Use the labeling tool to mark the features on the fossil that support your idea.**

**Activity. Use the measuring tool to measure the distance from the base of the wing to the tip. Choose one of the modern dragonflies and measure the same distance. Is the fossil wing bigger or smaller? How many times bigger or smaller is it compared to the modern wing?**

The number of times bigger or smaller is called the “scaling factor” – write it down as a decimal number; for example if the fossil is twice as big as the recent dragonfly’s wing, the scaling factor will be 2. If the recent wing is twice as big as the fossil wing, the scaling factor is 0.5.

We only have one wing for the griffenfly. So how can we figure out how long the animal was, or how big the second pair of wings was? One way is to assume that the griffenfly had the same proportions as one of the living dragonflies.

If this is true, then we can use the size relationship between the fossil and recent wings, and the dimensions of the living dragonfly, to estimate the size of the parts of the griffenfly that we don’t have.

**Activity. For the specimen of modern dragonfly that you chose in Activity --, use the measuring tool to record the following dimensions in the first column of the table.**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Modern dragonfly | Scaling Factor | Griffenfly |
| Length of wing 1 |  |  |  |
| Greatest width of wing 1 |  |  |  |
| Length of wing 2 |  |  |  |
| Greatest width of wing 2 |  |  |  |
| Length of head |  |  |  |
| Width of head |  |  |  |
| Length of thorax |  |  |  |
| Width of thorax |  |  |  |
| Length of abdomen |  |  |  |
| Width of abdomen |  |  |  |

**Now add the scaling factor in column two, based on your measurements of the wings. This will be the same number for each measurement. Remember – if the fossil is bigger than the modern dragonfly, the scaling factor will be >1. If it is smaller, it will be <1.**

**Finally multiply each measurement from the modern dragonfly by the scaling factor to get the equivalent measurement for the griffenfly, Write this number down in the third column.**

**Based on your estimates, what was the total length of the griffenfly? What was its wingspan?**