| Student Worksheet | *Interpreting Fossil Evidence* |
|---|---|

It is possible to tell a great deal about the life of a fossil organism and its habitat. This is done by carefully studying the fossil itself and the surrounding rock. Even a single tooth, bone, or footprint may tell something of the life of the animal.

The ***structure*** of part of a fossil refers to its physical features and what it looks like. Its ***function*** refers to how it worked or what it did. Often the structure of a particular body part helps the organism to perform a certain function or job. That is, the structure of a body part is an ***adaptation*** for a specific function.

***Purpose:*** To infer (suggest) details about an organism and it environment by studying its fossil remains.

**Procedure:** This activity looks firstly at the interpretation of present-day organisms before considering the evidence of fossil organisms.

## PART A: *Comparison of Unfamiliar and Familiar Living Organisms*

Except for differences in colour, birds often seem to be very much alike. However, there are many differences between them. These include differences in the structure of their beaks and feet. The structure of these seems to be closely related to their function. Some beaks are suited to a diet of seeds, some to tearing at prey, and so on.

1. Examine the illustrations of familiar birds in Figure 1. Decide the food type and locomotion (method of movement) of each. Record your interpretations in Table 1. (Ticks will do.)
2. Look at Figure 2. Suggest the type of food eaten and the way the feet are used by each of these unfamiliar birds. (Remember what you have learned about the relationships between structure and function from Question 1.) Record your results in Table 2.

The type of evidence we are using to describe aspects of the life of these unfamiliar birds is called ***indirect evidence***. This means we are not using actual observation of a structure to suggest its function. We are suggesting the function of an unfamiliar structure. We do this by comparing it with similar, familiar structures whose functions we *do* know. That is, we are ***inferring*** a function.

Fossil organisms are unfamiliar. We have no direct evidence of how a fossil organism lived. In most cases we don't know what it looked like. However, there are many organisms that are familiar to us that have structures similar to those found in fossils. By observing the familiar organisms we can make inferences about the unfamiliar, fossil organisms.

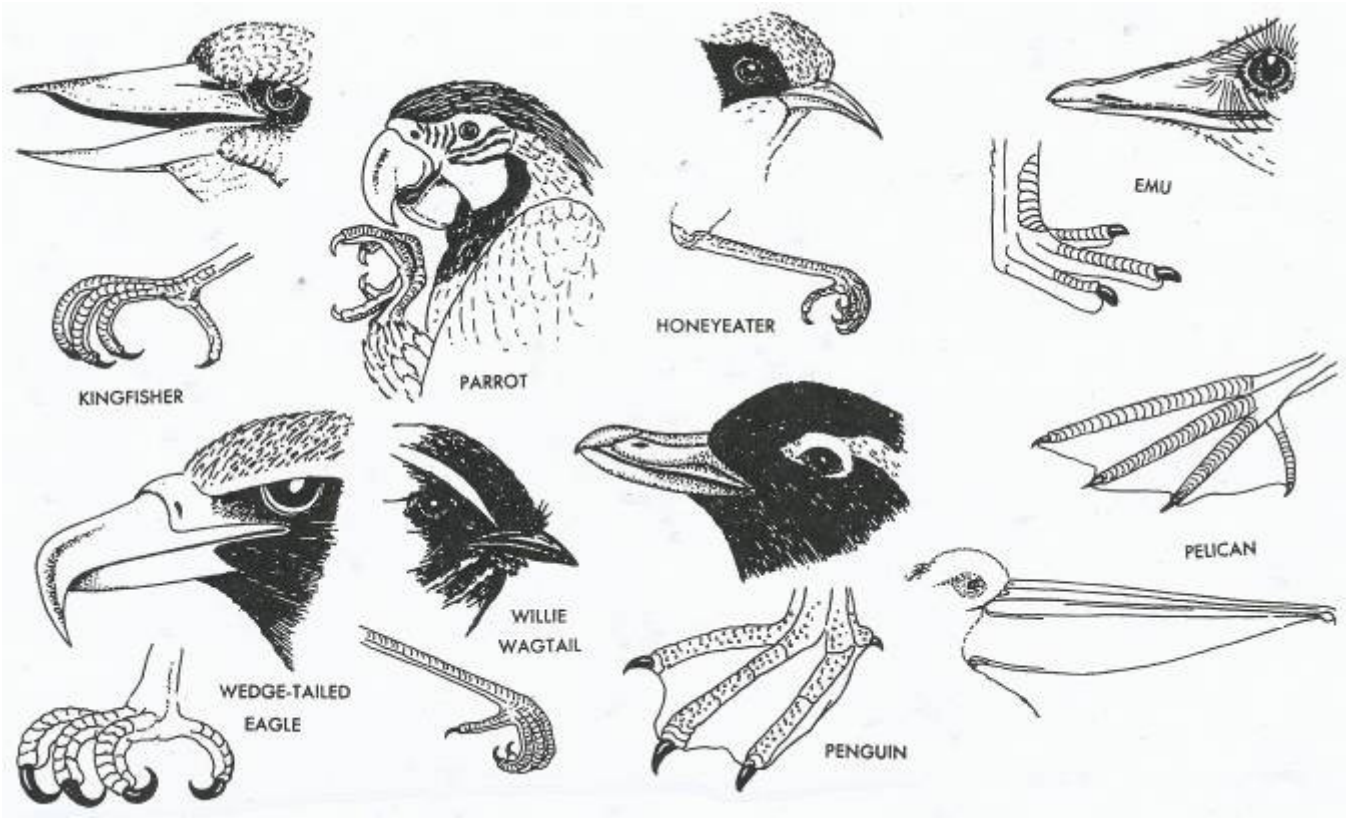


**FIGURE 1: Beaks and feet of familiar birds.** (Image: Australian Academy of Science, Creative Commons licence BY-NC-ND)

| BIRDS | FOOD | | | | | LOCOMOTION | | | |
|---|---|---|---|---|---|---|---|---|---|
| | seeds | meat | insects | nectar | fish | flyer | swimmer | ground-dweller | paddler |
| Kingfisher | | | | | | | | | |
| Parrot | | | | | | | | | |
| Honeyeater | | | | | | | | | |
| Wedge-tailed Eagle | | | | | | | | | |
| Willie wagtail | | | | | | | | | |
| Penguin | | | | | | | | | |
| Pelican | | | | | | | | | |
| Emu | | | | | | | | | |
| Hummingbird | | | | | | | | | |

*Paddlers use their feet as paddles; Swimmers use their wings to propel themselves through water.

**TABLE 1: DATA TABLE – Beaks and feet of familiar birds**

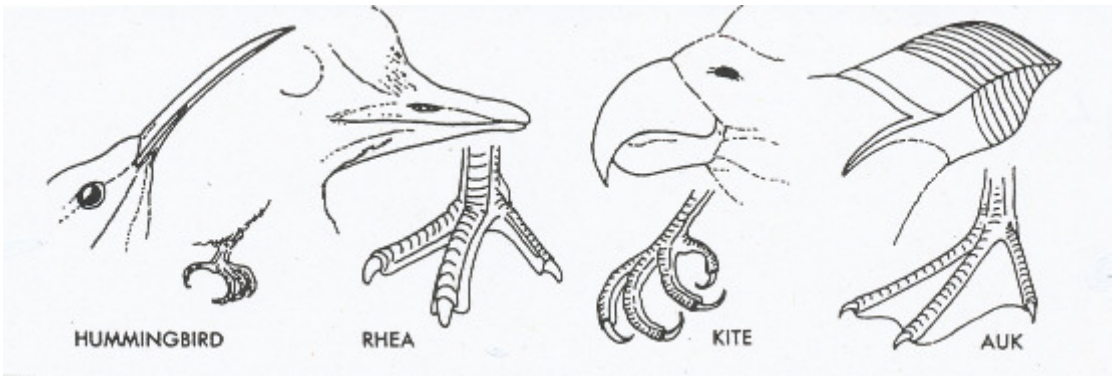


**FIGURE 2: Beaks and feet of unfamiliar birds.** (Image: Australian Academy of Science, Creative Commons licence BY-NC-ND)

| BIRDS | FOOD | | | | | LOCOMOTION | | | |
|---|---|---|---|---|---|---|---|---|---|
| | seeds | meat | insects | nectar | fish | flyer | swimmer | ground-dweller | paddler |
| Rhea | | | | | | | | | |
| Kite | | | | | | | | | |
| Auk | | | | | | | | | |

*Paddlers use their feet as paddles; Swimmers use their wings to propel themselves through water.

**TABLE 2: DATA TABLE – Beaks and feet of unfamiliar birds**

Reasoning:

……

……

……

……

……

……

## PART B: *Comparison between Fossil and Living Organisms*

Consider now what we can infer about the *ways of life* of fossil organisms.

Teeth are useful pieces of fossil evidence. They often remain after the rest of an animal has been eaten. The protruding surfaces of the teeth are adapted to handle the kind of food mainly eaten by the animal. This is especially true of the premolars and molars towards the back of the mouth. The exposed surfaces have protuberances (or ridges) called *cusps.* The shape of the cusps can be related to the type of food eaten.

- ***Herbivores*** feed on hard, fibrous grasses. They usually have cusps that are folded, long and continuous. They form cutting surfaces suitable for macerating (or chewing) grass.
- ***Insectivores*** such as bats, feed largely on insects. These organisms have cusps that are separate and pointed. This is suitable for crushing the hard exoskeleton (outer covering) of insects.
- ***Carnivores*** feed largely on meat. They tend to have sharp cusps arranged in a single row. This forms a 'knife' which cuts the meat.
- ***Omnivores*** have a varied diet and together with *fruit-eaters* usually have separate, rounded cusps.

3. Examine the cusp arrangement on the molar teeth of the familiar mammals featured in Figure 3. Each tooth is drawn *as seen from above.* Relate the shape of the cusps to the type of food each eats. Suggest the type of food eaten by each of the mammals represented by the fossilised teeth. Give a reason for each of your suggestions. Note: do not expect that every tooth of the familiar animals will match a fossil tooth. Record your results in Table 3.

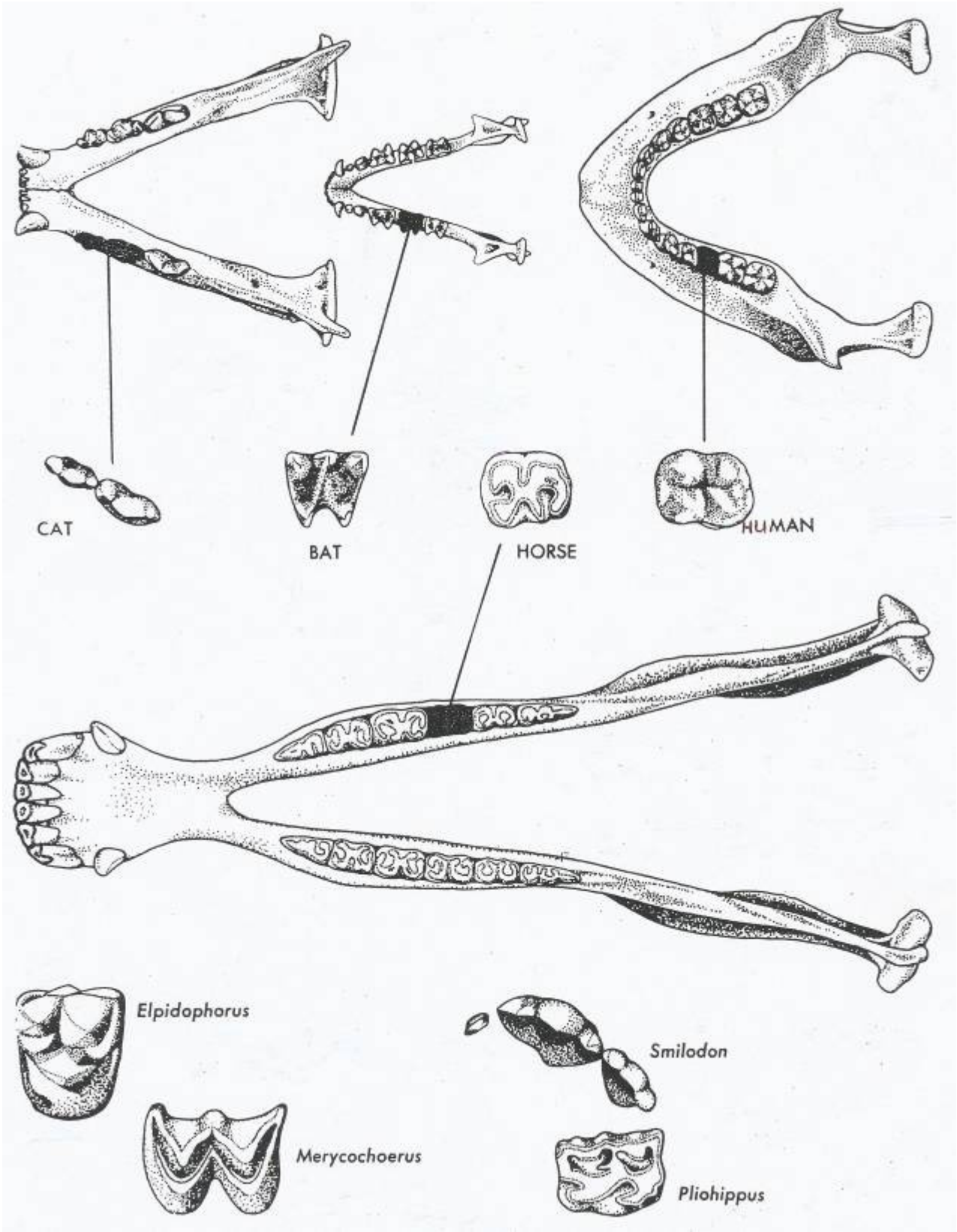


**FIGURE 3: Teeth and cusp arrangement of familiar mammals (above) and fossilised teeth (below).** (Image: Australian Academy of Science, Creative Commons licence BY-NC-ND)

| Mammal | Description of Teeth | Type of diet | Reasoning |
|---|---|---|---|
| Cat | | | |
| Bat | | | |
| Horse | | | |
| Human | | | |
| *Elpidophorus* | | | |
| *Merycochoerus* | | | |
| *Smilodon* | | | |
| *Pliohippus* | | | |

**TABLE 3: DATA TABLE – Analysis of teeth of familiar mammals and fossilised specimens**

Figure 4 shows a reconstruction of the skeleton of the large fossil reptile *Dimetrodon. Dimetrodon* had an extraordinary row of tall spines down its back. These spines are thought to have supported a thin membrane containing many blood vessels.

Many reptiles are known to bask in the sun to obtain heat. Many present-day lizards flatten their bodies and display the flattened dorsal (upper) surface towards the sun. By exposing more surface area to the sun, the lizards are able to increase the amount of heat absorbed.

Large reptiles like *Dimetrodon* have a special problem as they have relatively little body surface compared with the mass of the body they requite to heat.

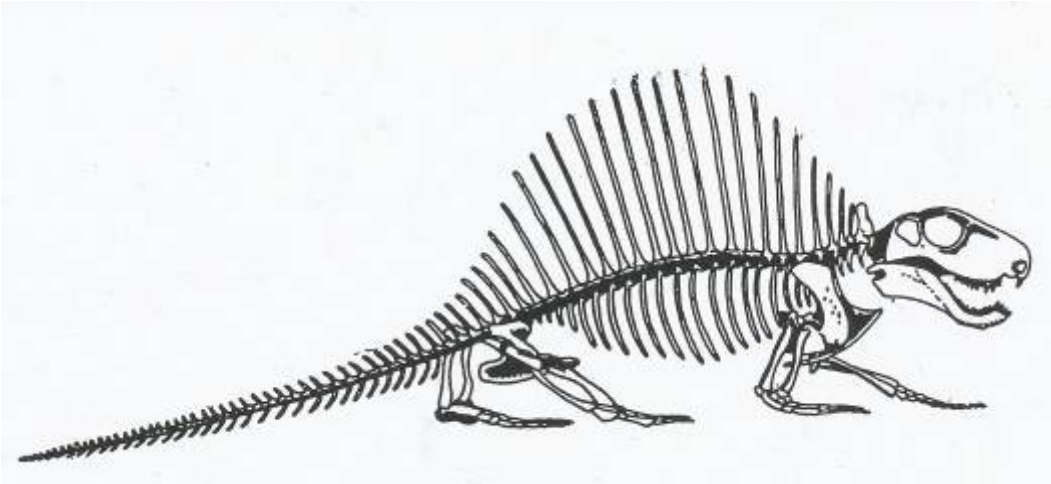

**FIGURE 4: Skeleton of *Dimetrodon.*** (Image: Australian Academy of Science, Creative Commons licence BY-NC-ND)

4. Suggest a function for the 'sail' of *Dimetrodon*.

.....

.....

.....

.....

.....

5. Suggest whether the animal lived in water or on land and what type of food it might have eaten. Why do you think so?

.....

.....

.....

.....

.....

A description of a fossil and a list of some of the organisms found in the same sediment appear below.

6. Write a paragraph on the *life* of the unknown fossil. That is, where it lived, how it moved, what sort of food it ate, and so on. Include your reasons for making each inference. If you can, offer alternative suggestions for the use of a structure.

   'The fossil has a pointed snout with a long row of dagger-like teeth. The skull is rounded with a single nostril opening on the top of the head. The neck is very short. The limb-bones in the forelimbs are very short and in the hind-limbs only remnants. Bones of the hands are elongated and flattened. The vertebrae have large flat discs without inter-locking devices. There is a long series of tail vertebrae. The skeleton as a whole is relatively heavy. Associated animals at the fossil site include penguins, albatrosses, and fishes.'

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

**Conclusion**

7. How does a study of the living organisms help in finding out about organisms from the past?

.....
.....
.....
.....

8. What guarantee have you that your inferences in this exercise are correct?

.....
.....
.....
.....
.....

(Adapted from *Biological Science: Web of Life,* Part 2, Australian Academy of Science, Canberra.1989)