Lesson 1: Food Webs and Energy Flows (Sample Extract)

If you have been studying along with My Homeschool for a while you will be familiar with the term “Nature Notebook” and it is probably likely that you’ve been keeping one for a while. In your Nature Notebook you probably have pictures and notes of plants, flowers, insects and animals and it is likely that each one has its own dedicated entry, rather than you including various plants, animals and insects all in the one entry. Knowing about individual species is great and an important aspect of studying biology, however, knowing about how individual species relate to each other and their environment is also a key part of biology.

By studying and understanding the way organisms interact with their surrounding environment and each other we appreciate ecosystems and their importance. Appreciating and researching the variety of species in ecosystems means understanding how biodiverse those areas are. The loss of just one species within an area may have implications for the rest of the ecosystem because of this inter-connection. One of the ways that ecologists seek to better understand biodiversity is to look at plant and animal species in a systems-based approach, a concept you will revisit again on a larger scale when you examine the issue of climate change in Term Four.

One way ecologists examine ecosystems is to identify the food chains in the ecosystem, called a food web. As the name suggests, the web-like diagram represents the various food chains that occur within the ecosystem, identifying where and how plants and animals access energy (food) and how this flows through the system. The food web is the physical diagram that highlights the research and understanding ecologists have about the flow of energy through the system, effectively identifying who eats who and what. A food web can show what the prey is for a predator, indicating all the possible food and energy choices that predator will consider within the ecosystem. Ecologists use food webs to show how energy moves through an ecosystem because energy moves through an ecosystem through food. An ecosystem that is more biodiverse is going to show more choices within the food web.

At the bottom of a food web are producers. Producers are species which can make their own food and these are often microscopic organisms or simple plants like algae or bacteria. These are what provide a food source for primary consumers and it is in identifying the species in this first, bottom trophic layer of the food web, that you start to tell the story of the network of energy within

the ecosystem and understand how food and energy is passed between and within this space.

Next rung up in the food web you find the secondary consumers. These are the carnivores in the ecosystem. The secondary consumers use the primary consumers as an energy source, eating them, and these secondary consumers may be one food source for many of the predators at the top of the food web: the tertiary consumers.

Viewed in this way, ecologists understand a physical place by examining the various biotic and abiotic components and the way that processes like photosynthesis play in the ecosystem, which provides energy which feeds into the flows of energy and food. The web approach clearly highlights the connectivity and inter-dependence between all components of an ecosystem.

A food web is all about connections and relationships. By following the connections between the various components of the web you can see who is predator and who is prey and the different food choices available within the ecosystem. By examining the relationships within ecosystem as a system we can learn that there can be a delicate balance of these inter-dependencies and connections which can be impacted by external or internal changes. We know, for example, that human disturbances to ecosystems can overwhelm an ecosystem's resilience, destroying its ability to return to equilibrium, as evidenced by the extinction of some species. Yet, there can also be resilience in ecosystems which resist internal or external changes and maintain a stable state or equilibrium. In examining the food web we can better understand how these internal and external changes can affect the components of the ecosystem to be able to see not only the balance within, but also how resilient it is as a whole system.

Defining Key Terms

Biodiversity: the variety of species of biological organisms, including plants, animals, micro-organisms and ecosystems, found within a defined geographical area.

Ecology: the study of the relationships between different living organisms, including their physical environment, in the seeking to better understand inter-relationships and connections between the living organisms and the environments.

Ecosystem: a geographically defined area within which plants, animals and other organisms live, connecting and inter-relating with each other and the

external factors of that area (such as weather and climate). Includes biotic and abiotic components.

Photosynthesis: the process by which plants (including algae and some bacteria) capture and use the sun's energy to convert it into chemical energy.

Biotic: living, or once living, components of an ecosystem; such as animals or plants that consume energy and food.

Abiotic: non-living components of an ecosystem; such as temperature, wind, water and the amount of sunlight.

Pelagic: from the Greek term *pelagos* meaning sea, pelagic means that it occurs or lives in ocean ecosystems.

Zooplankton: small or microscopic animals that live in water.

Case Study

As noted in the Overview, each lesson will provide you with some background reading on the topic in focus and then it will examine that topic in the context of a case study. This is designed to help you apply the information that you learn to your own research project. For this topic of energy flows and identifying the food web, the case study is the Great Barrier Reef. There is information on this in the Complementary Links, including a diagram which shows you who is eating who. Trace the links through the food web to see which animals are on the top of the food chain and what is at the bottom.

Noting the structure of a food web, as outlined above, the primary producers in the Great Barrier Reef include marine algae and phytoplankton. Algae are simple plants and simple organisms and provide food for primary consumers, which eat these primary consumers. These may include parrotfish which eat algae, effectively keeping the Reef clean and intact by grazing on the algae. On the next rung up on the food web are the secondary consumers, including the many fish species that live on the Reef, that eat the primary consumers. On the top of the food web are the tertiary consumers, which are the top predators within the Reef, such as humpback whales, sharks and dugongs.

The Complementary Links also include information about jelly fish, which are an intriguing case study as human activities such as overfishing, habitat modification and climate change have resulted in increased numbers of jelly fish, which, in turn, is affecting the other components of this marine ecosystem. Those resources highlight the need for equilibrium in an

ecosystem and highlight the effects of a shift in the balance due to changes internally and externally.

Your Research Project

This term you will be undertaking a research project for this component of your studies in the field of Biology. The key focus for this research project is to examine an ecosystem of your own choice. Your research will look at the communities within the ecosystem, the way that the different components and organisms in that ecosystem rely on one another and examine what flows through the system. It will overview the species in the selected area, identify who eats who, what potential dangers there are to the resilience of the ecosystem, and help to identify ways that the study area has been, or could be restored. It is an opportunity for you to study just one area in greater detail, applying the concepts you learn within each lesson.

Please choose an ecosystem that you want to study in greater detail. You might pick a site that is close to your home so you can include some field work. This is a great option and greatly encouraged! However, if that is difficult for you for whatever reason, you should be able to choose a site and undertake a lot of the research remotely, using information online. Do note though, that if you cannot visit your chosen site you will only be using secondary data, no primary sources, so your experience won't be quite the same, nor as full.

For this lesson, select your site, keeping practical considerations in mind. For instance, if you live in Broome you may not want to choose to study Mount Wellington, unless you have a trip to Hobart planned this term. Think about what interests you and what information will be available for your site.

Then, once you have picked a site, try to think about what you will expect to find in a food web for your selected site. You don't have to draw all the lines to make the connections between species just yet; the idea here is more that you just should get started thinking about your site and consider what species you are going to examine as a part of your research and how you will discover who eats who. There are some additional resources in the Complementary Links to help with this research work.

You might like to have a look through what topics you will be studying through the term in making your choice, which will include considering what Indigenous ecological knowledge is available for your site, examining

endangered species, the risk of feral pests, migratory species and the role of naturalisation too.

Please also take some time this lesson to discuss with your parents what their expectations are for the project outcomes. You may decide to present your research in a report style format or perhaps give an oral presentation and prepare a visual presentation (like in PowerPoint) to go with your talk. Or, you may decide that including your findings in a poster style format is the best option. If you are interested in information technology then perhaps you might like to set up a website to share your work. Please discuss this with your parents and decide what is the best choice for you.