

A tragedy of the commons - a lesson in conservation issues

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Number of lessons: Two

Year level(s): Year 7 Science

Australian Curriculum content descriptions:

Interactions between organisms, including the effects of human activities can be represented by food chains and food webs (ACSSU112). The activity focuses on the elaboration of 'investigating the effect of human activity on local habitats, such as deforestation, agriculture or the introduction of new species' and then leads into the elaborations of 'using food chains to show feeding relationships in a habitat' and 'constructing and interpreting food webs to show relationships between organisms in an environment' and how these food webs can be impacted by human activity.

Achievement standard:

By the end of Year 7, students describe techniques to separate pure substances from mixtures. They represent and predict the effects of unbalanced forces, including Earth's gravity, on motion. They explain how the relative

positions of Earth, the sun and moon affect phenomena on Earth. They analyse how the sustainable use of resources depends on the way they are formed and cycle through Earth systems. They predict the effect of human and environmental changes on interactions between organisms and classify and organise diverse organisms based on observable differences. Students describe situations where scientific knowledge from different science disciplines and diverse cultures has been used to solve a real-world problem. They explain possible implications of the solution for different groups in society.

Students identify questions that can be investigated scientifically. They plan fair experimental methods, identifying variables to be changed and measured. They select equipment that improves fairness and accuracy and describe how they considered safety. Students draw on evidence to support their conclusions. They summarise data from different sources, describe trends and refer to the quality of their data when

suggesting improvements to their methods. They communicate their ideas, methods and findings using scientific language and appropriate representations.

Lesson 1- Food Webs

Context

This lesson is an introductory lesson to the 'Tragedy of the Commons' lesson and provides an introduction to the human impact on food webs while incorporating Indigenous perspectives and knowledge.

Students who belong to remote Indigenous communities traditionally have a deep connection to their Country; the animals and plant species that inhabit Country form a part of the Indigenous Australian concept of Country and traditionally utilised native and feral species as a food source. Sharing cultural knowledge of local ecosystems and learning western-scientific ecological concepts may aid in preserving traditional ecological knowledge whilst enhancing students understanding of the concept of sustainability.

Specific strategies are used to engage Indigenous students in the curriculum:

- Share stories of personal experiences with some of the animals in the food chains and webs.
- Ask students to share their cultural names for animals and plants in the food chain and web explored.
- Engagement through art

Materials and equipment

Images of local wildlife

Reference food chains and webs from the local ecosystem

Safety Advice

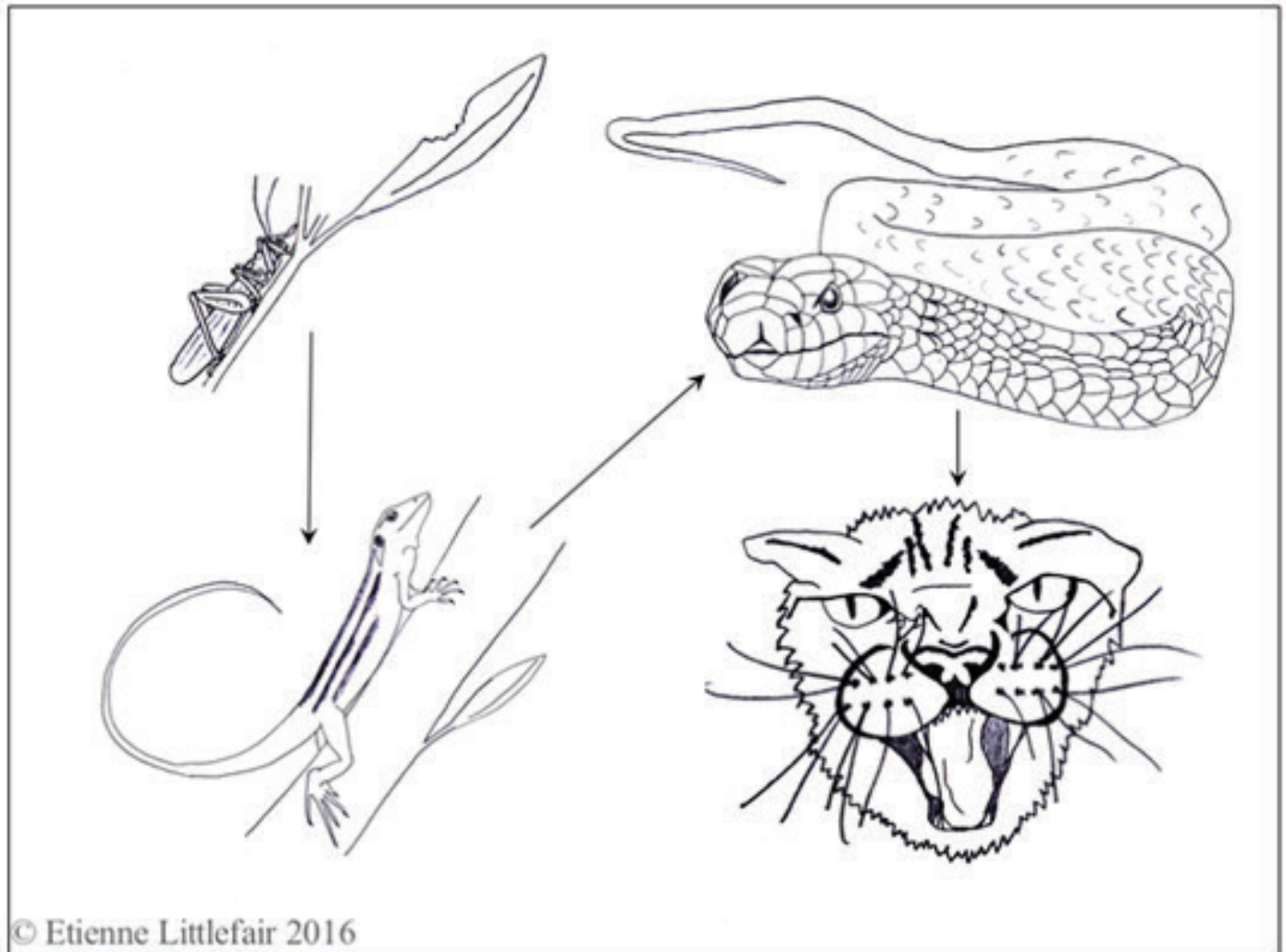
Regular scissor and classroom safety rules should be followed.

Objectives

- Knowledge of inter-species feeding relationships in the local habitat.
- The ability to classify organisms of an environment according to their position in a food chain.
- Knowledge of the threats that feral animals pose to native wildlife.

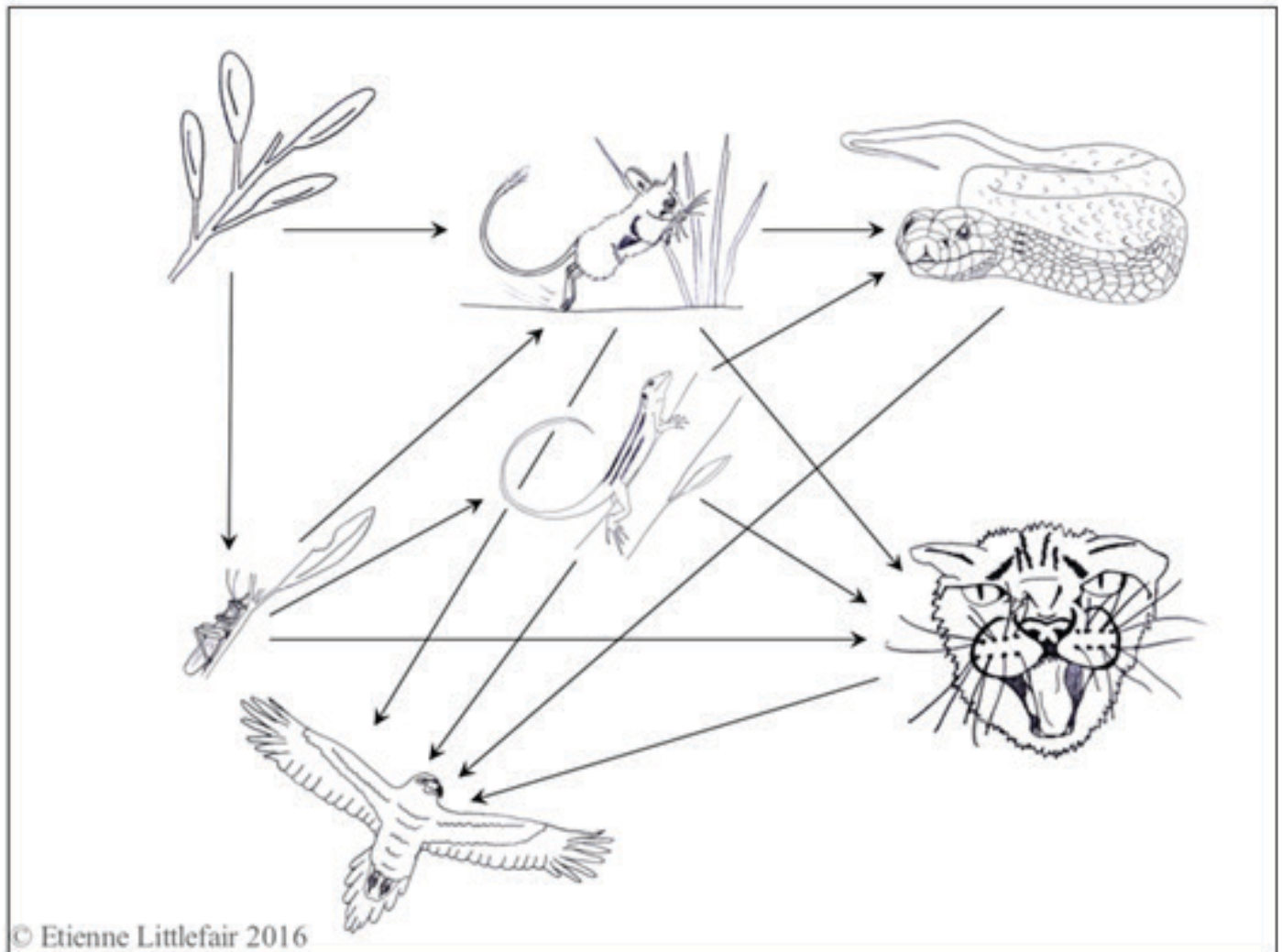
Introduction

1. Visualise the process, show students a food chain (draw on board or show digital image on a smart board). Explain the feeding relationship indicated by the arrows on the diagram.

Worksheet 1: food chains and webs**Fig. 2 – Example food chain**

2. Show and explain food webs. Use the imagery to make connections. Ask students to give Indigenous names for species.

Fig. 2 – Example food chain



3. Link in the concepts of producers, primary, secondary and tertiary consumers using a story narrative. Add these labels to the species in the food web displayed on the board.

Core

4. Give students the hand out (see attached worksheet), a blank sheet of paper, pencils and erasers. Ask students to add to, or draw (depending on abilities and knowledge of individual students) their own food web based upon their own knowledge. Ask the students to label the species according to their position in the food web.
5. Tell the students that their food webs will be displayed on the walls of the classroom – to encourage student artistic effort and creativity

Conclusion

Invite some of the students to talk about their food webs, stories and experiences relating to the creatures.

Conclude by thanking the students for sharing their experiences and knowledge with the class.

Resources

Digital Resources

X Mind- Mind-map creating technology

XMind. (2006-2016). XMind. Retrieved from <http://www.xmind.net/>

See below – images borrowed with permission from Etienne Littlefair (2018)

Useful Links

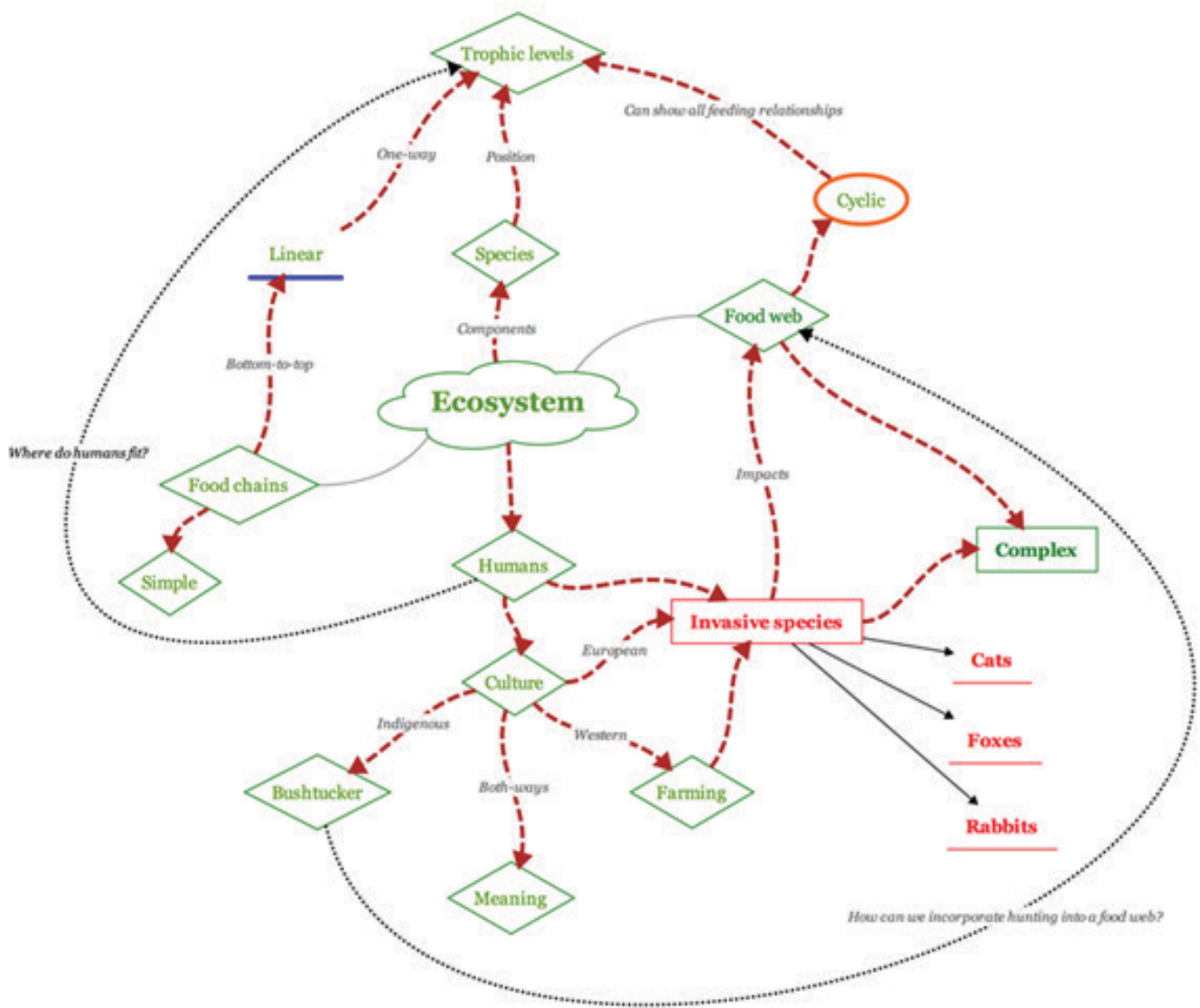
O’Dea, K., Jewell, P., Whiten, A., Altmann, S., Strickland, S. & Oftedal, O. (1991). Traditional diet and food preferences of Australian Aboriginal hunter-gatherers [and discussion]. *Philosophical Transactions of the Royal Society of London. Series B: Biological Sciences*, 334(1270), 233-241.

Robinson, C., Smyth, D., & Whitehead, P. (2005). Bush tucker, bush pets, and bush threats: cooperative management of feral animals in Australia’s Kakadu National Park. *Conservation Biology*, 19(5), 1385-1391.

Smyth, D. (1994). *Understanding Country: The importance of land and sea in Aboriginal and Torres Strait Islander societies*. Canberra: Australia.

Yunkaporta, T. (2009). *Aboriginal pedagogies at the cultural interface* (Doctoral dissertation, James Cook University).

Lesson Plan adapted from a lesson created by Etienne Littlefair 2016



Lesson 2: A tragedy of the commons - a lesson in conservation issues

Context

This activity is intended to be undertaken after the class has been introduced to the concept of sustainability. It is assumed that students have a basic understanding of relationships between organisms in the environment and follows the lesson "Food Webs"

Cross-Curriculum Priority: Sustainability

This activity is designed to allow students to experience and investigate Hardin's (1968) tragedy of the commons phenomenon. It addresses the misconception that there is an unlimited amount of fish in the world's oceans; when in fact fish are a renewable resource only if appropriate numbers

remain to reproduce and fulfill a given species role in a food web. This concept can be applied to the locally appropriate conservation issue such as deforestation, hunting etc. Fishing is chosen for the Darwin region as it is a popular past time and many students have vested interests in fish populations.

Global fish stocks have declined drastically in the past few decades such that some people's livelihoods and wellbeing are now being negatively impacted (Daw et al. 2012). Accepting this information and understanding the causes are essential steps necessary in attempts to rectify the issue. This activity promotes an understanding of sustainable harvesting of fish stocks.

Materials and equipment

- Whiteboard
- Small pieces of scrap paper (draw on paper to represent fish) or small fish toys if available
- Books and writing utensils

Safety advice

No safety issues

Objectives

To have students understand the concept of the tragedy of the commons and how it impacts conservation efforts in fishing, and be able to apply this knowledge to new and unfamiliar contexts.

Introduction

The concept of commons is explained to the class. The class is told that they will be doing an activity that is designed to investigate if there are any potential human impacts upon fish stocks.

Core

Organise class into 5 roughly even groups around tables. Each student is assigned the role of the member of a family responsible for providing food. Place 25 small pieces of ripped paper in the centre of each table. The table represents the local sea that contains the only available food source, the paper represents the fish populations. Have the students record the number of fish in the sea (count the pieces of paper).

- Each table operates in turns, each turn represents one year, students may take between 1-4 fish per turn with the result that:

1 fish = the students family starves **2 fish** = the students family survives **3-4 fish** = the students family is fed and makes a profit

- Have each table add half the number of remaining pieces of paper to the table at the end of each turn. Ask students to record the number of fish in the bowl at the end of each turn.
- After each student completes 5 turns (use a timer as appropriate) the class stops the game and each group is asked to send forth a representative to mark upon the class whiteboard the total number of fish left in their bowl at the end of each of the five turns.

Write the following questions on the board. Groups discuss questions, one person writes down answers:

1. How did your fish stock change over the turns? *Dependent variable*
2. Why do you think that your fish stock changed? *Open ended answer.*
3. Why were fish added to the stock at the end of each turn? Answer: *to represent reproduction*

Students access the website <https://soe.environment.gov.au/theme/biodiversity/topic/2016/importance-biodiversity> and complete the flower template with the 5 core values that humans place on biodiversity.

Conclusion

After the students have had 5 minutes to think about the questions, host a class discussion around their answers. Ask what they think may happen to their fish stocks if they continue to fish at the same rate in the future.

IF there is still time: Ask groups to discuss and devise a way in which they could have altered their fishing practices to maintain their fish stock.

PROMPT: have students to work out the total number of fish they can take without there being a population reduction by the end of the year. Ask groups to discuss the elephant in the room, human population growth. What would happen if humans were added to the population fishing at each table every turn?

PROMPT: how many fish per turn are sustainably available this turn? What about next turn if there are two added people? What would happen if you continued this trend into the future?

Resources

Digital Resources

ABC (2016). ABC Spash. Retrieved from <http://splash.abc.net.au/>

Useful Links

Hardin, G. (1968). The tragedy of the commons. *Science*, 162(3859), 1243-1248.
Adapted from Etienne Littlefair's Lesson Plan (2018)