Activity 6: predators

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| VCE Key knowledge | * Interdependencies between species as represented by food webs, including impact of changes to keystone species
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| VCE key science skills | * Access secondary data, including data sourced through the internet that would otherwise be difficult to source as raw or primary data
* Draw conclusions consistent with evidence and relevant to the question under investigation
* Critically evaluate various types of information related to biology from journal articles, mass media and opinions presented in the public domain
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| Learning outcomes | * Describe how Ecologists work towards the conservation of species and ecosystems
* Describe how Ecologists conduct a wide range of experiments to learn about the ecosystem
* Compare a wide range of biotic and abiotic factors and explain how they influence the size and distribution of the population of a particular species
* Explain how apex predators can be considered keystone species and how they structure the entire ecosystem
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| Approximate time | * 45-60 minutes
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This activity explores the relationship between dingoes as apex predators and foxes as mesopredators in the ecosystem. Students consider whether a range of data from the Arid Recovery program supports the mesopredator release theory in the case of dingoes and foxes. Students see how important the dingo is for the ecosystem and consider the reintroduction of wolves in Yellowstone.

Students will encounter some key terms in this activity and should ensure they have clear definitions written in their notes. These terms are highlighted in bold where they are introduced in the activity and should be defined at that point.

* **Apex predator**: *a predator that is at the top of the food chain on which no other species preys*
* **Keystone species:** *a species that has a disproportionately large effect on its environment relative to its abundance*
* **Trophic cascade:** *dramatic changes in an entire ecosystem that result from the removal of an apex predator*
* **Mesopredator**: *a medium-sized, mid-trophic level predator, which both predates and is predated upon*
* **Mesopredator release theory:** *the theory that when an apex predator is removed from an ecosystem, the mesopredator population dramatically increases*

# Step 1: keystone species

Students watch a film that looks at the role of apex predators as keystone species. The 20-minute film interviews the scientists that discovered these ecological principles in their famous experiments on sea urchins and star fish.

<https://www.hhmi.org/biointeractive/some-animals-are-more-equal-others-keystone-species-and-trophic-cascades>



After watching the film, students should write definitions of **apex predator** and **keystone species** in their books. They should describe the effects of a **trophic cascade**. They should be able to identify that dingoes are an apex predator in the arid zone ecosystem.

In the film we see how removal of an apex predator causes populations of predators in lower trophic levels to explode, changing the structure of the whole system. These mid-trophic level predators are called **mesopredators**. Definethis term, and identify foxes and quolls as mesopredators. This explosion of mesopredators that happens with the removal of apex predators is called the ‘**mesopredator release theory**’. In the next step, students will review evidence of the mesopredator release theory in the arid zone ecosystem.

# Step 2: Dingoes at the top

Explain to students that we will look at whether dingoes have a dramatic impact on lower trophic levels, like the star fish and otters in the film. Explain that ecologists have also been wondering this, and have conducted a number of studies that explore dingoes and the impact they have on the ecosystem.

Distribute the handouts for students to read through and answer the questions. The data for this worksheet are summarised from:

***(Questions 1-5)*** Letnic, M & Koch, F. (2010) Are dingoes a trophic regulator in arid Australia? A comparison of mammal communities on either side of the dingo fence. *Austral Ecology,* **35,** 167-175

***(Question 6)*** Moseby, K.E., H. Neilly, J. Read, Crisp, H. (2012) Interactions between a Top Order Predator and Exotic Mesopredators in the Australian Rangelands. International Journal of Ecology, 2012

**Teacher explanation of student handout:**

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| 1. Given what you know about dingoes, what do you think might happen to these species in the **presence** of dingoes? Explain your reasoning.

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| Red kangaroo: *decrease due to predation by dingoes*  |
| Rabbit: *increase due to lower predation by foxes* |
| Native mouse: *increase due to lower predation by foxes*  |
| Fox: *decrease due to predation and competition from dingoes*  |

1. Below are the results of this study. The numbers in the table are a ‘mean abundance’ based on sightings per kilometer.

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| Species | No dingoes | Dingoes |
| Dingo | 0.00 | 0.05 |
| Fox | 0.20 | 0.00 |
| Red kangaroo | 0.51 | 0.00 |
| Rabbit | 0.42 | 1.55 |
| Dusky hopping mouse (native) | 0.00 | 0.10 |

 Which animals **increase** in the **presence** of dingoes? *Rabbits and native mouse*  Which animals **decrease** in the **presence** of dingoes? *Foxes and red kangaroos* 1. Are those results what you were expecting? If you got any wrong, have another go at explaining why you think the ecologists saw these results.

*Students may have hypothesized that rabbits and/or the native mouse would decrease with the presence of dingoes because dingoes prey on them. In fact, because fox numbers flourish when there is no competition by dingoes, these small mammals are predated on more when there are no dingoes. This is partly due to the fact that dingoes have a large home range and so their population density in relatively low compared to foxes. Kangaroos do decrease in the presence of dingoes because foxes tend not to hunt them, whereas dingoes do.**It is important to ensure students have understood this before continuing.*1. Why might you be cautious when interpreting this data?

*There could be errors in data collection. Although we don’t have all the details, relying on sightings could be unreliable, particularly for some animals that are shy and hide away. This data shows a correlation between dingo numbers and numbers of other animals, but it does not tell us that dingoes are definitely the cause of this difference. It might be, for example, that there are other differences between the dingo and non-dingo areas that cause the differences in animal abundance.*1. If this data is correct, then removal of the dingo is an example of a trophic cascade and ‘mesopredator release’ theory. Explain how.

*Dingoes are an apex predator that keep the numbers of foxes down. When dingoes are removed, there are cascading effects through the trophic levels. In particular, foxes (the mesopredators) quickly increase in numbers.* 1. Ecologists working at Arid Recovery wanted to test this idea further. The following is an exert from an article in a scientific journal written by these ecologists.

Does this support the theory of mesopredator release in the case of dingoes and foxes? *This study found that dingoes appear to directly kill foxes that they encounter, supporting the idea that dingoes suppress foxes when they are present.* Feral cats are another invasive species that wreak havoc in the ecosystem. Does this study support the theory of mesopredator release in the case of cats?*Not really. While dingoes were involved in a few cat deaths, and no cat survived very long in the reserve, cats were not killed at the rate that foxes were. This does not mean that dingoes do not suppress the numbers of cats, just that this specific study offered only minimal support for this theory. More data would be needed to understand the relationship between cats and dingoes.*1. This study was conducted in a fenced reserve, with the foxes and cats being introduced one at a time over a year. What might the limitations of this study be?

*Because it was a fenced reserve, animals couldn’t escape so this may have increased the chance that the dingoes would kill the foxes. As one small study, it should be repeated in other similar reserves.*1. Do you think we can describe dingoes as a ‘keystone species’?

*Yes because keystone species have a large impact on the whole ecosystem and the evidence suggests that dingoes impact the entire ecosystem.* |

# Step 3: wolves

Explain to students that in many places in the world, apex predators have been removed from the environment for similar reasons that people in Australia don’t like having dingoes around. But there is a movement now calling for the reintroduction of apex predators. In Yellowstone National Park in America, wolves were reintroduced in 1995. This 5 minute film describes the incredible cascading impacts they have had on the whole landscape.

<https://www.youtube.com/watch?v=ysa5OBhXz-Q>

