AUSTRALIANS TOGETHER

TEACHER GUIDE
Y7 SCIENCE

Biological sciences: Indigenous classification and understanding food webs

Warning – Aboriginal and Torres Strait Islander teachers and students are advised that this curriculum resource may contain images, voices or names of deceased people.

Biological sciences: Indigenous classification and understanding food webs

Australian Curriculum Link

Science/Year 7/Science Understanding/Biological sciences/ACSSU111

Science/Year 7/Science Understanding/Biological sciences/ACSSU112

Science/Year 7/Science as a Human Endeavour/Nature and development of science/ACSHE119

Science/Year 7/Science as a Human Endeavour/ Nature and development of science/ACSHE223

Science/Year 7/Science as a Human Endeavour/Use and influence of science/ACSHE121

Science/Year 7/Science Inquiry Skills/Planning and conducting/ACSIS125

Australian Curriculum Content Description

ACSSU111: Classification helps organise the diverse group of organisms.

ACSSU112: Interactions between organisms, including the effects of human activities can be represented by food chains and food webs.

ACSHE119: Scientific knowledge has changed peoples' understanding of the world and is refined as new evidence becomes available.

ACSHE223: Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures.

ACSHE121: People use science understanding and skills in their occupations and these have influenced the development of practices in areas of human activity.

ACSIS125: Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.

Australian Curriculum Elaboration

ACSSU111: Investigating classification systems used by Aboriginal and Torres Strait Islander Peoples and how they differ with respect to approach and purpose from those used by contemporary science.

ACSSU111: Using provided keys to identify organisms surveyed in a local habitat.

ACSSU111: Using scientific conventions for naming species.

ACSSU111: Classifying using hierarchical systems such as kingdom, phylum, class, order, family, genus, species.

ACSSU111: Grouping a variety of organisms on the basis of similarities and difference in particular features.

ACSSU111: Considering the reasons for classifying such as identification and communication.

ACSSU112: Investigating Aboriginal and Torres Strait Islander Peoples' responses to the disruptive interactions of invasive species and their effect on important food webs that many communities are a part of, and depend on, for produce and medicine. 

ACSSU112: Investigating the effect of human activity on local habitats, such as deforestation, agriculture or the introduction of new species.

ACSSU112: Using food chains to show feeding relationships in a habitat.

ACSSU112: Constructing and interpreting food webs to show relationships between organisms in an environment.

ACSHE119: Investigating the contributions of Aboriginal and Torres Strait Islander Peoples' knowledge in the identification of medicinal and endemic plants.

ACSHE223: Investigating how land management practices of Aboriginal and Torres Strait Islander Peoples informs sustainable management of the environment to protect biodiversity.

ACSHE223: Identifying the contributions of Australian scientists to the study of human impact on environments and to local environmental management projects.

ACSHE121: Investigating how the knowledge and experience of Aboriginal and Torres Strait Islander Peoples are being used to inform scientific decisions, such as the care of Country/Place.

ACSHE121: Researching the different scientific responses to the rabbit plagues in Australian agricultural areas.

ACSIS125: Collaborating with Aboriginal and Torres Strait Islander communities and organisations to conduct research investigations about ecosystems, ensuring mutually beneficial outcomes.

Essential Question

Why do people classify organisms, and how can it help us to understand the interactions between them?

Australians Together Learning Framework

Tells Australia's narrative through the lens of 5 Key Ideas that inform teachers and students about Aboriginal and Torres Strait Islander perspectives.

The Wound

Injustice from the impact of colonisation

Students will recognise the pain and disadvantage many First Nations people experience, that started at colonisation and continues today.

Our History

A past that shapes our story as a nation

Students will critically engage with Australia's stories and understand the impact our history continues to have on Aboriginal and Torres Strait Islander people and all who call Australia home.

Why Me?

What's it got to do with me?

Students will explore why Aboriginal and Torres Strait Islander histories and cultures are relevant to them today.

Our Cultures

Everyone has culture. Know about your culture and value the cultures of others

Students will learn more about their own culture and identity, and gain a better understanding of, and respect for, Aboriginal and Torres Strait Islander cultures.

My Response

Steps we can take to build a brighter future

Students will gain an understanding that a brighter future is possible for all Australians, but to get there we each need to play our part.

Glossary

Terms that may need to be introduced to students prior to teaching the resource:

animistic: a spiritual way of seeing natural phenomena as being alive and interconnected.

biological classification: the process of grouping living or ancient organisms. Also referred to as 'taxonomy'.

classification: the arrangement of objects or ideas into groups or categories.

colonisation: the act of one country invading and taking over another. The British began the colonisation of Australia in 1788.

consensus: a general agreement in opinion among a group of people.

conservation status: a worldwide listing system describing how close a species is to extinction.

Country: the lands where Aboriginal or Torres Strait Islander communities have always lived.

denigrated: to have made something seem unimportant, untrustworthy and not worth paying attention to.

ecological: the relationships between living things and their surroundings.

First Nations Peoples: Aboriginal and Torres Strait Islander Peoples.

food chains: series of organisms each dependent on the next as a source of food.

food webs: systems of interlocking and interdependent food chains.

herbariums: places where collected dried plant specimens are kept as a reference for scientific study.

kinship systems: systems of social organisation and family relationships within First Nations cultures. A person's position in the kinship system determines their relationship to others and the universe, and their responsibilities towards other people, land and natural resources.

Linnaean system: the current system for biological classification used in Western science.

moiety: the first level of kinship in which everything, including people and the environment, are split into two halves.

objectivity: a lack of favouritism or bias towards one side or another.

obligated: to be committed or bound to do something.

organisms: living creatures, such as animals, plants, fungi or single-celled life forms.

phenonmena: in the scientific sense, something that is observed to exist such as natural processes like tides, gravity; or physical objects like rocks, animals and plants.

sacred: objects or places that are considered worthy of spiritual respect or devotion.

secular: not spiritual or sacred. Not connected to religion.

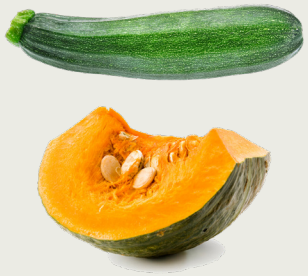
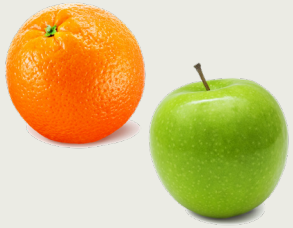
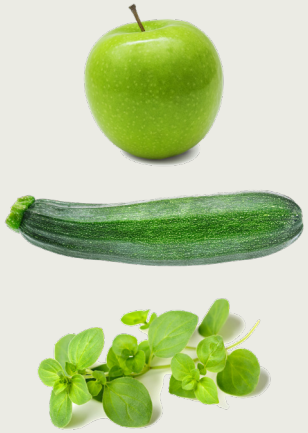
skin name: the third level of kinship that is similar to a surname. A skin name indicates a person's blood line and conveys information about how generations are linked and how they should interact.

totem: a natural object, plant or animal that's inherited by members of a group or family as their spiritual emblem.

	Teacher guidance	Ideas for student activities
Introduction	*Before beginning the study, ask students to access their prior knowledge about the topic with an introductory question or activity.* **Resource overview** In this resource, students compare and contrast First Nations Peoples' different approaches to classifying organisms and the Western scientific approach known as the Linnaean system. They explore how different classification systems might inform our knowledge of the ecological interactions between organisms, including food chains and food webs. The Indigenous concept of caring for Country is explored in the context of managing biodiversity. Where possible, consider using the pedagogical framework created by 8 ways (www.8ways.online) in your teaching. Using Indigenous learning techniques allows you to include Indigenous perspectives in your classroom. As they explain in their resources, "Teaching through Aboriginal processes and protocols, not just Aboriginal content validates and teaches *through* Aboriginal culture and may enhance the learning for *all* students" (8 ways 2012). This resource has incorporated (and noted where applied) the following ways of Indigenous learning as guided by the pedagogy: • Community Links: where possible, try to collaborate with the local community to apply learning for the benefit of that community. • Land Links: place-based learning, linking the content to local land and place. • Story Sharing: approaching learning through narrative. • Learning Maps: explicitly mapping/visualising processes. **Useful resources** To find out more about the 8 Aboriginal Ways of Learning, take a look at: • the 8 ways website: https://www.8ways.online/ • the 8 Aboriginal Ways of Learning fact sheet (2-minute read): https://www.inclusionagencynswact.org.au/WWW_NSWIA/files/30/30a02eff-8394-4ac8-a39b-862726136bba.pdf	**Classify this! worksheet** *Teacher's note*: This worksheet has been designed as a diagnostic assessment task to help gauge any prior knowledge students have about **classification**. Be aware, the page of photos will need to be printed single-sided. **Classify this! How would *you* group organisms?** In small groups of three or four, decide how to group the **organisms** picutured on the 'Classify this!' worksheet (*see* p. 21). You can make as many groups as you like, as long as you can explain your choices. *Teacher's note:* As an alternative to using the pictures on the worksheet, students could instead decide how to group the following: • photos of up to 20 plants and animals, taken by students themselves within the school grounds (8 ways: Land Links) • cuttings taken from plants around the school grounds (8 ways: Land Links) • the contents of their pencil case (if you prefer to remove prior knowledge bias of **biological classification**). **Classify this! Explain your thinking** Choose one person from each group to explain the decisions behind your groupings to the class. • What were the main characteristics used to categorise the organisms across the whole class? • Was there a general **consensus** on how to go about this task?

	Teacher guidance	Ideas for student activities
		Classify this! What do you know? On a spare piece of paper, with the knowledge that you already have, answer the following questions as best as you can: • What do you think is the purpose of classification? • What do you know about how scientists use Western tradition of science classify organisms? • What do you know about the ways **First Nations Peoples** classify organisms? Hand in your work once you've finished. *Teacher's note:* This could be returned to students at the end of the unit to help them to reflect on their learning.
 **Our Cultures**	*Help students connect with and acknowledge the importance of culture and examine the living cultures of First Nations Peoples, which have adapted and survived since colonisation.* **Classification through spirituality and kinship** There are three hierarchical levels to kinship: **moiety**, **totem** and the **skin name**. *Moieties* include animals and plants, and they guide people in their roles, responsibilities and obligations of social life. It's the responsibility of the people of the moiety to maintain knowledge about the plants and animals of that moiety and the ceremonies associated with them (New South Wales Government 2008). Moieties are used often in classification for First Nations people. For more on this topic, see 'Useful resources'. **Student Handout content** **How and why do we classify?** Our world is full of information. You may not have realised at the time, but when you were born you began a sense-making journey to try to understand all of the information you received. Part of this process involved grouping or 'classifying' things to create a sense of order about the world. Humans have many diverse classification systems for different types of things, and they can overlap. For example, you can group edible plants into categories, such as 'vegetables', 'fruits' and 'herbs', but you could also group them by their predominant colour (see the tables below).	**Classification: an Aboriginal perspective** As a class, work through the activity from Nalderun Aboriginal Services, Classification – an Aboriginal Perspective, prepared by Julie McHale, to gain a better understanding of how complex Indigenous classification systems can be. **Student Handout: how and why do we classify?** As a class, read 'How and why do we classify?' and 'Comparing and contrasting different classification methods' on the Student Handout. Next, the class will be divided into two groups. One group will be assigned to read the section of the Student Handout named 'First Nations Peoples systems of classification', and the other group will read 'Western scientific classification'. In pairs, you will share what you've learnt from your text with a student who read the opposite text.

Teacher guidance

Vegetables	Fruits	Herbs
		
Green	**Orange**	**Purple**
		

Different ways of classifying the same things can be used for different purposes. When reading the Australian Dietary Guidelines, it's useful to be able to recognise what's actually considered to be a vegetable or a fruit because they give specific recommendations on the amount of each you should eat per day (e.g. "consuming at least five serves of vegetables each day", "consuming at least two serves of fruit per day") (National Health and Medical Research Council 2013, p. 42). But it's also helpful to categorise food into colour groups for different dietary reasons. To ensure you're eating a wide variety of nutrients from different types of fruits and vegetables, you should 'eat a rainbow' of colours. This is because:

> Each colour carries its own set of unique disease fighting chemicals called phytochemicals. It is these phytochemicals that give fruits and vegetables their vibrant colour and of course some of their healthy properties (Nutrition Australia 2021, para. 1).

Ideas for student activities

Finally, using sticky notes or by directly writing your ideas on the board under the headings 'Western scientific classification' and 'Indigenous classification systems', you'll work as a class to summarise the main features of each of the classification systems you've explored.

Class discussion

- What were the similarities?
- What were the differences?
- What do you think are the purposes of each type of system?

Find a finch! worksheet

Follow and complete the 'Find a finch' worksheet (*see* p. 23).

Teacher's note: Worksheet answers are provided (*see* p. 25).

	Teacher guidance	
	Now can you think of different ways of classifying a group of animals? You can use the same organisms from the 'Classify this!' worksheet. **Comparing and contrasting different classification methods** Different cultures have different systems for classifying things. There's no right or wrong way to create a classification system, but different systems may be suited for different purposes. **First Nations Peoples' systems of classification** First Nations Peoples have many varied and complex ways of classifying natural **phenomena**. They incorporate the spiritual elements of societies, such as **kinship systems**, as well as the natural characteristics of organisms themselves. To understand this better, First Nations Elder, Uncle Graham Paulson (2021, para. 4) explains how Aboriginal spirituality informs how every single thing interacts with everything around it. First Nations spirituality is '**animistic**': > In an animistic world every thing is interconnected; people, plants and animals, landforms and celestial bodies are part of a larger reality. In this world, nothing is inanimate, everything is alive; animals, plants, and natural forces, all are energised by a spirit. As such, humans are on an equal footing with nature, are part of nature and are morally **obligated** to treat animals, plants and landforms with respect. In this world, the invisible and the visible pulse with the same life and the **sacred** is not separated from the **secular**, they are interconnected and interactive. But also in this world, the unseen spiritual forces are stronger and hold sway over all nature. A person's position in the kinship system describes their responsibilities towards other people, the land and natural resources (Australians Together 2021a). Yolngu People of north-eastern Arnhem Land have two moieties within their kinship system: Dhuwa or Yirritja. Everything in the Yolngu universe has been assigned by the ancestral beings to one of these two groups. For example, the black cockatoo is Dhuwa, while the white cockatoo is Yirritja (Australians Together 2021a). Mark Linkson (1999, p. 44) explains his encounter with this classification system: > As a teacher education lecturer in Arnhem Land, I watched a science lesson being taught in a junior primary classroom at Galiwinku. Students had the task of sorting a pile of shells. Now, how could this be done? Colour, shape, size? I watched bemused as students made two piles that I could not identify. Their Yolngu teacher was quite pleased. Her explanation to me afterwards was that the shells were sorted by moieties, Dhuwa and Yirritja, the two halves into which Yolngu people place just about everything: people, plants, animals, landforms and physical phenomena. This approach to classification applies to other ways in which First Nations Peoples classify organisms. For example, it's very useful to know which plants and animals are 'edible' or 'inedible'. You may think that these categories may only relate to whether something might be poisonous or toxic to ingest, but 'inedible' foods will always include any plants or animals of spiritual importance to an individual. There are also complex rules that determine whether men or women are able to eat a particular plant or animal, and similar rules based on age and social rank within the community (McHale 2018).	

Teacher guidance

Western scientific classification

Western scientists classify things using one particular system for each branch of science. Geologists classify rocks as either sedimentary, igneous or metamorphic; chemists describe compounds as either organic or inorganic; and physicists classify particles as either leptons or hadrons. One of the reasons scientists all insist on following the same set of rules to form their classification systems is to make communication about a topic clear for everyone across the world, even across different languages.

The current system of biological classification is known as the **Linnaean system**, named after its creator Carl Linnaeus. It has been used by Western scientists since 1758 (Encyclopaedia Britannica 2021). Before this, some organisms had several different names, making it difficult to know exactly what organism a scientist was referring to. It's a hierarchical system, which means that each group has many smaller sub-groups within it. The organisation of all living (and extinct) things is structured into the following groups: Domain > Kingdom > Phylum > Order > Class > Family > Genus > Species. Scientists continue to debate and challenge this system, with 'Domain' being an addition to the system in 1990 (López-García 2011).

An example is how we classify a dog. The eight levels of classification are:

- Domain: Eukarya
- Kingdom: Animalia
- Phylum: Chordata
- Class: Mammalia
- Order: Carnivora
- Family: Canidae
- Genus: Canis
- Species: *Canis lupis*

Despite the amazing variety we see across different breeds of dogs, they're all considered to be of the same species. A Great Dane and a Chihuahua are both *Canis lupis*! Domesticated dogs descended from wolves, which are also known as *Canis lupis*, but because dogs have been domesticated they're sometimes grouped as a sub-species known as *Canis lupis familiaris* (Lumen Learning 2021).

	Teacher guidance	
	As precise as this system is, it can still cause confusion and debate. For example, disputes about whether the dingo should be considered its own species have raged for decades. In 2014, scientists declared the dingo to be a separate species to the wolf (Outred 2014), but the scientific name they proposed (*Canis dingo*) has been inconsistently applied. This has real world consequences in terms of the **conservation status** of the dingo, and whether farmers are legally allowed to control the number of dingos found on their land (Smith et al. 2019). Universal codes for plants and animals have been introduced as a further measure to combat classification confusion, particularly for collections of specimens in **herbariums** and museums across the gllige (New World Encyclopedia 2008). **Understanding First Nations people's connection to Country** When analysing Indigenous science practices, it's important to understand the views that Aboriginal and Torres Strait Islander Peoples hold about the land (Australians Together 2021b, para. 2): > For many Indigenous people, land relates to all aspects of existence – culture, spirituality, language, law, family and identity. Rather than owning land, each person belongs to a piece of land ... That person is entrusted with the knowledge and responsibility to care for their land, providing a deep sense of identity, purpose and belonging. This intimate knowledge of the land and ways of relating to it are also reflected in language, including many words and concepts that have no English equivalent. This deep relationship between people and the land is often described as 'connection to **Country**'. Where Western scientists try to distance themselves from the observed in order to attempt to create **objectivity**, First Nations people place themselves as part of the observed. **Image sources** Zucchini: Wealthylady / Shutterstock.com Pumpkin: kariphoto / Shutterstock.com Orange: Tim UR / Shutterstock.com Apple: CGi Heart / Shutterstock.com Basil: Ivaschenko Roman / Shutterstock.com Oregano: AmyLv / Shutterstock.com Dog: K.A.Willis / Shutterstock/com	

	Teacher guidance	Ideas for student activities
	Useful resources The following links provide further useful information about First Nations classification systems, First Nations spirituality and kinship. • *Classification – An Aboriginal Perspective* (8-minute read): https://nalderun.net.au/wp-content/uploads/2018/08/Classification-an-Aboriginal-Perspective.pdf • *Aboriginal Spirituality* (5-minute read): https://australianstogether.org.au/discover/indigenous-culture/aboriginal-spirituality/ • *Indigenous Kinship* (4-minute read): https://australianstogether.org.au/discover/indigenous-culture/kinship	
 **The Wound**	*The story of our nation's past is hard to face but it's important; it's left a wound that can be seen in the inequality between Aboriginal and Torres Strait Islander people and non-Indigenous Australians. Help students understand how this wound continues to have an impact today.* **Student Handout content** **The effect of colonisation on Indigenous knowledge** Before Europeans arrived, Aboriginal and Torres Strait Islander Peoples occupied every part of Australia (Dorey 2021), farming and looking after Country. European **colonisation** had devastating impacts on Aboriginal and Torres Strait Islander communities and cultures, and on the environment. First Nations Peoples were displaced from ancestral lands and were not allowed to care for Country (Victorian Public Sector Commission 2021). **In the face of adversity** Today, many Aboriginal and Torres Strait Islander cultures continue to thrive, in both urban and remote areas, despite the destruction caused by colonisation. In the face of the challenges presented by colonisation, First Nations people have fought to protect and practise Indigenous cultures, and to integrate and adapt them to new experiences in ways that are culturally appropriate and acceptable. **Indigenous knowledge and science** Since colonisation, the knowledges First Nations Peoples have about the land has been **denigrated** and made to seem inferior to Western knowledge. This opinion continues to circulate today; however, as Indigenous science gains wider recognition, its uses and audience also grows, for example, through the Australian science curriculum. All Australians are realising that it can help address a wide range of current issues and enhance our understanding of the world more broadly.	**Displacement from Country** Watch the video *The Importance of Land* (02:18) to gain a sense of why Aboriginal and Torres Strait Islander people's displacement from ancestral lands was and is very disruptive to culture and negatively impacts wellbeing. *Teacher's note*: You might like to conduct a discussion afterwards by walking students through the visible thinking routine 'Connect, Extend, Challenge'. **Indigenous knowledge is Indigenous science** Watch the Albert Wiggan TEDx Talk (Sydney), *The Case to Recognise Indigenous Knowledge as Science* (10:26), and have a yarning circle to discuss. (8 ways: Story Sharing) **Environmental issues research** What do you know about the current environmental problems in your area? They may be issues that are widespread across Australia, or very specific to your location. Some examples include littering, species extinction, the spread of native plant or animal diseases, bushfires, weeds, pests or salinity.

	Teacher guidance	Ideas for student activities
	An example in biological classification involves our understanding of Australian plants. Carl Linnaeus was Swedish, so his research was based on observing Swedish plants wait until springtime to bloom. The reason they do this is because winter is far too cold and frosty in Sweden for pollinators (insects and birds) to be active and spread the flower's pollen around. As a result, Linnaean plant naming systems focus on physical details relating to a plant's flower. Due to the warmer and drier conditions, Australian plants have to perform a different set of transformations over the seasons than Swedish plants do. As a result, rather than observing a tree's flowers, First Nations people observe the bark on stems and trunks to identify and classify a plant most accurately. The focus is on how each plant's skin responds to the harsh Australian sun (The Haddon Library 2012, para. 18). **Environmental issues** Australia's current environmental problems started to develop in the years after Europeans arrived and when First Nations Peoples were displaced (Department of Agriculture, Water and the Environment 2004). For example, sheep overran Nari Nari, Paakantyi, and Mutti mutti lands, badly degrading the environment and driving many native animals to extinction, such as the pig-footed bandicoot, lesser stick-nest rat and the eastern hare-wallaby, were driven into extinction. Vegetable foods were suppressed, and previously reliable water-places were contaminated by unconstrained stock. The people of these nations had to quickly adapt in an effort to survive the damage to Country (Kean 2009). Although many environmental issues have resulted since colonisation, there are many solutions and existing success stories, some of which we will explore later in this unit. **Useful resources** **Displacement from Country** In this video, *The Importance of Land* from Australians Together, Indigenous people from Victoria, Queensland and the Northern Territory share about the way they understand and relate to land. They help us understand why land is important to them, and how it's relevant to all people living in Australia today (02:18): https://australianstogether.org.au/discover/indigenous-culture/the-importance-of-land/#video The 'Connect, Extend, Challenge' visible learning routine is by Project Zero at Harvard University. It's explained in detail here (1-minute read): http://www.pz.harvard.edu/resources/connect-extend-challenge **Indigenous knowledge and science** This Albert Wiggan TEDx Talk (Sydney), *The Case to Recognise Indigenous Knowledge as Science* provides arguments as to why Indigenous knowledge should be considered a part of scientific knowledge, and not given its own category such as Traditional Ecological Knowledge (10:26): https://www.youtube.com/watch?v=X5QON5l6zy8 This information from the Queensland Curriculum and Assessment Authority explains how to conduct a yarning circle (3-minute read): https://www.qcaa.qld.edu.au/about/k-12-policies/aboriginal-torres-strait-islander-perspectives/resources/yarning-circles	As a class, create a detailed list of all of the environmental issues in your area by connecting with and interviewing some local people. Choose one of the following research options and report back to the class: 1. Interview an elder from your local community and ask what environmental changes they've observed over their lifetime. An *elder* is technically anyone who's older than you, but you should try to speak with someone who has been around for long enough to experience multiple decades pass while living locally. This could be a grandparent, parent, teacher, family friend, or a First Nations Elder from your local community. If speaking to a First Nations Elder, make sure that they're remunerated for their time and expertise. (8 ways: Story Sharing and Community Links) 2. Contact a local environmental group, such as the Landcare group in your area, and ask them about their current projects and their aims. (Story Sharing and Community Links)

	Teacher guidance	Ideas for student activities
	This additional video on Indigenous science, *Australia's Science Channel: Why is Indigenous science important?* provides a variety of opinions from contemporary scientists on why Indigenous science is important to recognise and use (04:04): https://australiascience.tv/vod/why-is-indigenous-science-important/ **Environmental issues research** Connecting with First Nations people in your local area is positive step towards building a brighter future for our country. The page entitled *Connecting locally with Indigenous communities* on the Australians Together website provides some practical tips on how to do this (4-minute read): https://australianstogether.org.au/resources-2/connecting-locally-with-indigenous-communities-2/ The National Landcare Directory's a listing of community environmental care groups across Australia. You can search the directory to find your local Landcare group here (1-minute read): https://landcareaustralia.org.au/landcare-get-involved/findagroup/ If you want to find out which species are endangered in your local area, the Atlas of Living Australia has a helpful step-by-step user guide on how to find endangered species from a records list (1-minute read): https://support.ala.org.au/support/solutions/articles/6000195923-how-to-find-the-endangered-species-from-a-records-list	
 **Our History**	*There are many stories that make up Australia's history. It's important to use resources that include perspectives and voices of First Nations people, such as those contained in this resource.* **Student Handout content** **How our language shapes how we think about nature** The language or languages you speak have an impact on how you think and form concepts about the world around you. Differences between Indigenous languages and the English language affect how we see ourselves in relation to nature. In addition, the information stored in language affects our knowledge of the natural world. Indigenous languages contain the accumulated observations of thousands of generations living in the natural world. Studying them can inform us about the complex **ecological** interactions within a particular environment. **Interconnectedness of nature** You've now learnt about some aspects of Aboriginal and Torres Strait Islander peoples' kinship structures, connection to Country, and how language can affect the way we view nature. With these learnings, you can begin to comprehend the deep understandings and knowledges First Nations people have of how the environment interconnects. How might your understandings of **food chains** and **food webs** relate? It's because of this deep knowledge that Western scientists and First Nations Peoples are collaborating around Australia to address some of the environmental challenges created since colonisation.	**Language structure as classification** Listen to the Radio National podcast *Indigenous Language and Perception* (09:47–16:00). As a class, discuss the following talking points: • Why are some words in Indigenous languages used to describe more than one thing? In the podcast, some examples given from Arnhem Land include the word 'bokorn' for both a tree and a fish, and 'yamidj' for both a yam and a grasshopper. • Dr Tyson Yunkaporta mentions that Indigenous totems come in pairs. Do you remember why? Can you recall some examples that he gives? • What is 'patterned thinking'? Can you remember some examples in the environment that he gives of this?

	Teacher guidance	Ideas for student activities
	Useful resources **Ecological interactions: food chains and food webs** The Radio National podcast, *Indigenous Language and Perception*, is an valuable resource for teachers to understand a multitude of aspects of Indigenous knowledges and understandings, and the historical context of how colonisation has affected our perception of those knowledges. Students will listen to six minutes of this podcast in the activity, but you may wish to listen to the full episode (29:07): https://www.abc.net.au/radionational/programs/allinthemind/indigenous-language-and-perception/11457578 **Scientific investigation: species survey of your local area** Connection to land is an important concept for students to understand, and it's only able to be actualised when experiencing nature locally. So ideally, this survey would be conducted by allowing students to make their own observations either within the school grounds or at nearby local parklands and getting them to record their data over several points in time. You could connect with local First Nations groups to collaborate in this investigation. If working with a First Nations person for this investigation, make sure they're remunerated for their time and expertise. Here are some useful resources to aid this activity: • The Atlas of Living Australia has a number of helpful user guides. This one takes you through, step-by-step, how to find species recorded in your local area (1-minute read): https://support.ala.org.au/support/solutions/articles/6000195203-how-to-find-the-species-recorded-in-your-area • If your students have never conducted an observational study before in nature, this page from the Melbourne Museum gives simple step-by-step instructions along with a worksheet to record their observations (4-minute read): https://museumsvictoria.com.au/melbournemuseum/at-home/play/backyard-bioblitz/ • Students could even conduct this investigation at home, as a longer-term project and the class results could be collated and analysed over time. You may find this rewarding if you take the time to demonstrate and teach students how to record abundance information. This document from the University of Hawaii has some detailed information on how to do this (11-minute read): https://www.hawaii.edu/gk-12/opihi/classroom/measuring.pdf **Constructing food chains and food webs** This topic will need to be introduced with some direct instruction and explanation of the terms *producer* and *consumer*, including the concept of first, second and higher order consumers. Here are some resources that might help students understand these concepts: • This Khan Academy video helps students to identify the roles of different organisms in a food web (02:11): https://www.khanacademy.org/science/high-school-biology/hs-ecology/trophic-levels/v/example-identifying-roles-in-a-food-web • Interactive simulators are popular with students. This one by eduMedia is simple to use and at a suitable level for students: https://www.edumedia-sciences.com/en/media/746-building-a-food-web	**Species survey of your local area** To understand the ecology and food webs of your local area or school grounds, conduct a biological survey. Your class will: • make observations of plants and animals, by simply looking or taking photos. You will record information about the type of organism you see (recall your work on classification), its location and anything else that you think is significant! (8 ways: Land Links) • use the Atlas of Living Australia to search their database of species observed in your local area • both make observastions *and* use the atlas. If you choose this option, you'll be able to compare the results of the two types of surveys. **Constructing food chains and food webs** Using the information from the local species survey you conducted, construct food chains and food webs by placing the organisms under the three categories: producer, first order consumer, second order consumer (and higher), and then draw the food chains and food webs from there. (8 ways: Learning Maps) **Case study reading: Indigenous hunters vital to robust food webs in Australia** Read the article *Indigenous Hunters Vital to Robust Food Webs in Australia* and write down your answers to the three whys: 1. Why might this case study matter to me? 2. Why might it matter to people around me – family, friends, city, nation? 3. Why might it matter to the world?

	Teacher guidance	Ideas for student activities
	Case study: Indigenous hunters vital to robust food webs in Australia The resources connected to the case study reading activity are listed below: • The article, *Indigenous Hunters Vital to Robust Food Webs in Australia*, describes a case study that demonstrates that humans are in fact part of food webs too, therefore removing them has resulting consequences, just like any other organism in the web (4-minute read): https://news.mongabay.com/2019/03/indigenous-hunters-vital-to-robust-food-webs-in-australia/ • The Three Whys is a visible thinking routine that helps students to foster intrinsic motivation by understanding why a topic matters. Gauging the significance of something is a capacity seldom taught. Significance isn't a fixed quality of objects, places or events. Rather it's attributed, constructed by learners. Assessing global and local significance requires the mind to operate at several levels at once. This thinking routine invites learners to move step-by-step across personal, local and global spheres. Read more about how to conduct this activity here (3-minute read): http://www.pz.harvard.edu/resources/the-3-whys **Indigenous science collaborations: case studies project** You may want to allow your students to conduct research entirely on their own, but if you wish to point them in the direction of some clear examples, these resources will help: • The National Environmental Science Program (NESP) recognises and values the experiences, perspectives and cultures of Aboriginal and Torres Strait Islander people. Program researchers are working with First Nations experts and Traditional Custodians to achieve improved outcomes for the environment. This involves caring for Country and embedding Indigenous knowledge systems into the protection of biodiversity, including helping threatened species. This booklet showcases some of the research and partnerships. It highlights some of the key outcomes achieved by the program across the five years to 2020 (3-minute read): https://www.environment.gov.au/science/nesp/publications/indigenous-collaboration-australia-environmental-science-brochure • The World Wildlife Fund webpage provides articles on First Nations rangers protecting Country and cultures: https://www.wwf.org.au/news/blogs/my-story-meet-the-indigenous-rangers-protecting-country-and-culture#gs.wdovzm • The Central Land Council describes a project where 'Indigenous ecological knowledge' is being recorded and archived through video stories (2-minute read): https://www.clc.org.au/articles/info/indigenous-ecological-knowledge#! • The National Indigenous Australians Agency provides an excellent article, *Stories from Country 2015–2017: how Indigenous rangers and Indigenous protected areas are strengthening connections to Country, cultures and community* that will help students to find examples of collaboration (25-minute read): https://www.niaa.gov.au/sites/default/files/publications/stories-from-country2015-17.pdf • This article from The Nature Conservancy Australia explains how humans have impacted Australia's nature over time. It provides a general overview of many of the topics raised in this unit and could be used as set reading (10-minute read): https://www.natureaustralia.org.au/what-we-do/our-insights/perspectives/human-impact-nature-australia/	**Case study project: Indigenous science collaborations** In small groups, research a case study that explains how First Nations Peoples have collaborated or are currently collaborating with Western scientists to combat an environmental challenge. You can display the information you find on a poster and present it to the class, briefly summarising what you found in two minutes.

	Teacher guidance	Ideas for student activities
Why Me?	*Help students understand that because they call Australia home this relates to them. Explore what's happening, or has happened, around your local area that's relevant to this topic.* **Student Handout content** **Why are First Nations ideas and perspectives important in biology?** This continent is home to the world's oldest living cultures. This is an incredible fact on its own, but it also means that we have access to an ancient resource of information and knowledges that can allow us to understand and connect with this land on a much deeper level. In order to resolve the injustices of the past it's possible to become part of making things right. It starts with understanding that we're all connected and recognising that creating a better future happens together. One way in which non-Indigenous Australians can do this is by learning as much as possible about First Nations cultures. **Useful resources** The 'I used to Think … Now I Think …' visible learning routine is by Project Zero at Harvard University. It's explained in detail here (2-minute read): http://www.pz.harvard.edu/resources/i-used-to-think-now-i-think This page on the Australians Together website explains many viewpoints on why learning about Indigenous cultures and perspectives is important. It may be useful for students to read it through (10-minute read): https://australianstogether.org.au/discover/my-part/why-me/	**Reflection: 'I used to Think … Now I Think …'** Reflect on what you've learnt over the course of this unit by working through the I used to Think … Now I Think … visible learning routine. *Teacher's note:* If you collected your students' responses to the questions on the 'Classify this!' diagnostic assessment, this is a good opportunity to give them back to each student to enhance their reflection.
My Response	*Help students critically and creatively process and demonstrate their learning on this topic by exploring meaningful ways to respond. Ask students to come up with their own ideas about what they can do.* **Student Handout content** **What might you investigate further as a class?** Think about which parts of this unit have really interested you. What else might you like to know? How will you find out? Here are some ideas: • Consider learning more about the local Indigenous languages in your area (Victorian Aboriginal Corporation for Languages 2021, p. 2): > Language is important to Aboriginal people because it is a way for them to express their identity and be proud of where they come from and who they are. If a person knows a word in their language he/she is maintaining a link that has lasted thousands of years. • Find out how you and your school can better care for the environment. • Go on an excursion to visit local Indigenous sites of significance. • Share what you've learnt with your family, and allow them to share their knowledge with you.	**Individual response** Write down your answer to the 'Essential Question' of this unit: Why do we classify organisms, and how can it help us to understand the interactions between them? **Connecting with language** Using the biological survey you conducted of your local area, learn the local Indigenous names for as many of the recorded organisms as you can. Find somewhere in your science classroom, or on a poster wall within your school, to make a display of these names. You could also display the Map of Indigenous Australia to help your peers understand the diversity of Indigenous languages.

	Teacher guidance	Ideas for student activities
	Useful resources This map of Indigenous Australia from the Australian Institute of Aboriginal and Torres Strait Islander Studies will enable your students to visualise the vast diversity of First Nations languages across the continent (2-minute read): https://aiatsis.gov.au/explore/map-indigenous-australia To learn more about Aboriginal and Torres Strait Islander languages, and in particular to learn more about your local Indigenous languages, contact First Languages Australia: https://www.firstlanguages.org.au or if you're in Victoria you can contact the Victorian Aboriginal Corporation for Languages: https://www.vacl.org.au This resource, from Atlas of Living Australia, discusses the collaboration with First Nations Peoples that resulted in the three Kamilaroi languages (Kamilaroi/Gamilaroi/Gamilarray, Yugaalaraay and Yugaal) being the first Aboriginal and Torres Strait Islander languages included in their records (9-minute read): https://www.ala.org.au/blogs-news/indigenous-language-names-in-the-ala/ This booklet from the Australian Institute of Aboriginal and Torres Strait Islander Studies offers information about the benefits of caring for Country (44-minute read): https://aiatsis.gov.au/sites/default/files/research_pub/benefits-cfc_0_3.pdf	**Caring for Country collaboration** Consult the list of local environmental issues that you made earlier as a class. Get in touch with your local Indigenous land council to discuss how to collaborate and learn the local Indigenous ways of caring for Country in order to address the environmental problem. (8 ways: Land Links and Community Links)
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Acknowledgements	**Classify this! pp. 22** Koala: slowmotiongli / Shutterstock.com Shearwater: Karel Bartik / Shutterstock.com Ladybird: RainyTam / Shutterstock.com Pelican: Ryan Yee / Shutterstock.com Echidna: Vicki Cain / Shutterstock.com Saltbush: THP Creative / Shutterstock.com Leatherjacket: Jesus Cobaleda / Shutterstock.com Snake: Joel Everard / Shutterstock.com Seagull: Wicher Bos / Shutterstock.com Wallaby: Martin Pelanek / Shutterstock.com Shark egg cases: HollyHarry / Shutterstock.com Penguin: EQRoy/ Shutterstock.com Snapper: Al McGlashan / Shutterstock.com Plover: Marcin Perkowski / Shutterstock.com Fox: Sandra Standbridge / Shutterstock.com Squid: nekomamire / Shutterstock.com Magpie: to.mar / Shutterstock.com Rabbits: William Booth / Shutterstock.com Geese: Mehdi Photos / Shutterstock.com Seal: Leah-Anne Thompson / Shutterstock.com **Find a finch! p. 23** Figure 1: Davis, S, Ganambarr, M & Traynor, S/ Northern Territory Department of Education . Reproduced with permission..	

	Teacher guidance	
	The 8 ways, '8 Aboriginal Ways of Learning', viewed 8 July 2021, www.8ways.online is used and referred to throughout this unit with permission. The 8ways or Aboriginal Pedagogy belongs to a place, not a person or organisation. They came from country in Western New South Wales. Baakindji, Ngiyampaa, Yuwaalaraay, Gamilaraay, Wiradjuri, Wangkumarra and other nations own the knowledges this framework came down from.	

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Y7 SCIENCE

Biological sciences: Indigenous classification and understanding food webs

Classify this!

There are a vast number of organisms in our world with a wide range of characteristics. How do we make sense of them all? Biological classification is the process of grouping living organisms.

How would you group organisms?

In small groups of three to four, look at the photos of living organisms (over) and decide as a group how to classify them. You can cut them out and place them into groups, or simply number them on the page. Make as many or a few groups as you like, as long as you can explain your choices. The main goal is to understand your group's decisions as to how you chose to group them. Be prepared to explain your decisions to the rest of the class.

AUSTRALIANS TOGETHER

Y7 SCIENCE

Biological sciences: Indigenous classification and understanding food webs

Biological sciences: Indigenous classification and understanding food webs

Find a finch!

Western scientists try to give everything a scientific name so they can group the ones which are alike. Indigenous people will usually only give a specific name to those things that have a special use or are significant to them in some way.

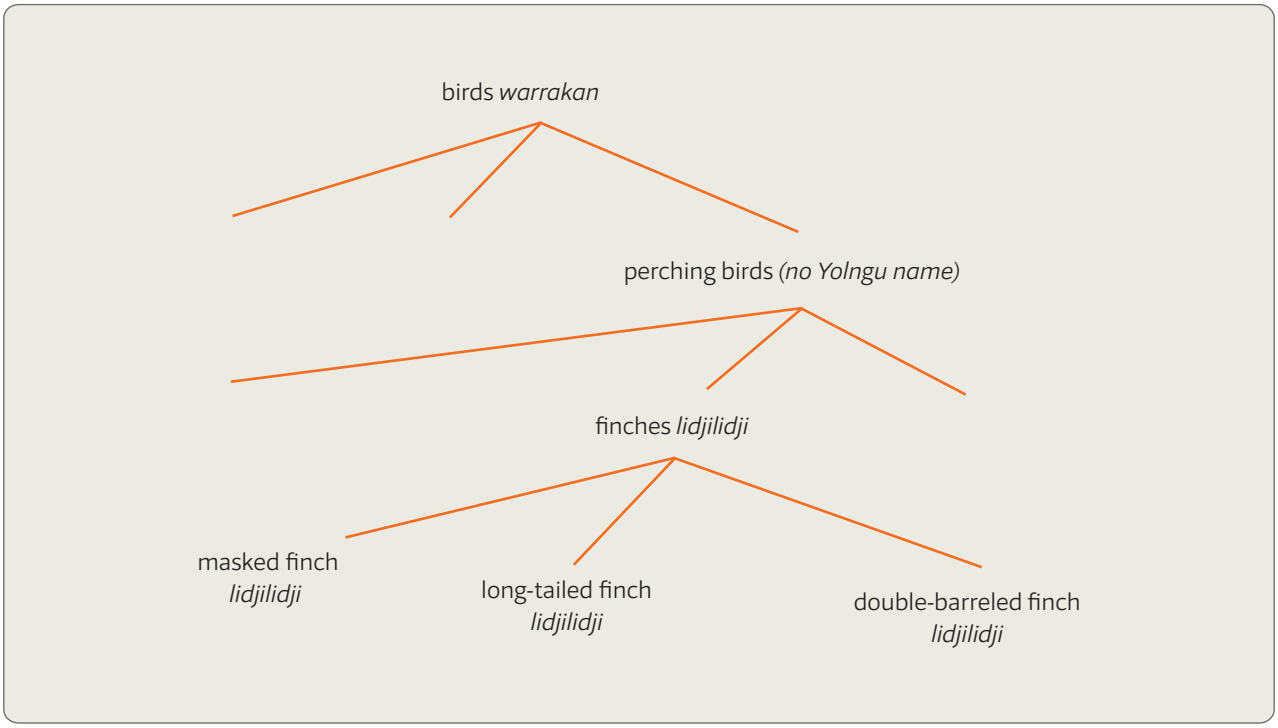

Figure 1: A tree diagram showing the differences between the way Western scientists classify finches, and the way Yolngu People classify them in their language (Davis, S, Ganambarr, M & Traynor, S 1982).

The diagram above shows that Yolngu People of Milingimbi in Arnhem Land recognise birds as *warrakan*, and they call finches *lidjilidji* in their language Gupapuyngu (Davis, S, Ganambarr, M & Traynor, S 1982). Western scientists have grouped the finches from this region into three separate species with the common names: Masked finch, Long-tailed finch and Double-barred finch. Yolngu People also know these three finches, but don't give each of them their own name.

Find a finch!

Research activity

1. Choose one of the three finches to research: Masked finch, Long-tailed finch or Double-barred finch.
2. Find its scientific classification for each of the seven groups:
   Domain > Kingdom >Phylum > Order > Class > Family > Genus > Species.
   Check this information on a few trusted websites to confirm accuracy.
3. For each of the seven groups, find out what makes that grouping scientifically unique. For example, Passeriformes are the Order known as the perching birds. Perching birds have three unwebbed toes in the front and one strong, flexible toe in the back that isn't reversible (New Hampshire PBS 2021). This is what allows them to perch on tree branches. Record this information in your exercise book.
4. Compare your results with a classmate who researched a different finch. How similar are the classification groups? What are the differences?

Questions

1. What defines a species? Why are some groups of animals considered different at the species level, and other groups just natural variation within a population?
2. Why do Western scientists classify these finches as three separate species?
3. Why do you think Yolngu People only gave one name to these birds?

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TEACHER NOTES

Find a finch!

Research activity answers

2. Scientific classifications for each of the seven groups:
Domain > Kingdom >Phylum > Order > Class > Family > Genus > Species.

- Masked finch:
  Domain: Eukarya; Kingdom: Animalia; Phylum: Chordata; Class: Aves; Order: Passeriformes; Family: Estrildidae; Genus: Poephila; Species: *P. personata*
- Long-tailed finch:
  Domain: Eukarya; Kingdom: Animalia; Phylum: Chordata; Class: Aves; Order: Passeriformes; Family: Estrildidae; Genus: Poephila; Species: *P. acuticauda*
- Double-barred finch:
  Domain: Eukarya; Kingdom: Animalia; Phylum: Chordata; Class: Aves; Order: Passeriformes; Family: Estrildidae; Genus: Taeniopygia or Poephila*; Species: *T. bichenovii*

* There's inconsistency in the naming here based on the location of where the information has been published. See: Consistency in the Scientific Name of the Zebra Finch (unm.edu)

3. For each of the seven groups, find out what makes that grouping scientifically unique:

i. Domain: Eukarya; They possess eukaryotic cells (basic definition).
ii. Kingdom: Animalia; Multicellular organisms that don't possess cell walls and obtain their nutrition from organic sources (they are heterotrophic).
iii. Phylum: Chordata; Animals that possess a backbone (or a notochord).
iv. Class: Aves; Warm-blooded animals that possess wings (modified forearms) and feathers. They have a toothless beak, are scaly with clawed feet and lay an amniotic egg with a hard shell.
v. Order: Passeriformes; Perching birds have three unwebbed toes in the front and one strong, flexible toe in the back that isn't reversible.
vi. Family: Estrildidae; Small finches of the Old-World tropics and Australasia.
vii. Genus: Students will find it difficult to find the defining characteristics of the genus depending on whether they've found either Taeniopygia or Poephila; the latter has some available information easily found on the internet, but not the former. The lack of consistency around naming will make for an interesting point of discussion on the real limitations of biological classification.

Question answers

1. **What defines a species? Why are some groups of animals considered different at the species level, and other groups just natural variation within a population?**
   A species can be defined as "a group of individuals that actually or potentially interbreed in nature" (University of Berkeley 2021, para. 1). Some definition along these lines is to be expected and accepted from students, but this question is really designed to get them to think more philosophically and question the validity of using species as a category. The actual reality of how this definition is applied is often blurry as we now see taxonomists using multiple lines of evidence to define species, known as 'integrative taxonomy' (Sangster 2018).

2. **Why do Western scientists classify these finches as three separate species?**
   Scientists classify these finches separately because each group of birds is unable to reproduce viable offspring with another group.

3. **Why do you think Yolngu People only gave one name to these birds?**
   First Nations people will usually only give a specific name to those things which have a special use or are significant to them in some way, so we must assume that these different species of finches are not needed for daily life or ceremony by Yolngu People.

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