

Year 12 Ecology - suggested teaching programme – context: conservation, with internal assessment

Achievement Standard Biology 91158: Investigate a pattern in an ecological community, with supervision

Resource title: Where have all the Takahē gone? **Credits:** 4

Note: this outline is not intended to be prescriptive or exhaustive but is a suggested approach.

Curriculum Links:

Living World

Life Processes: Explore the diverse ways in which animals and plants carry out the life processes.

Ecology: Explore ecological distribution patterns and explain possible causes for these patterns.

Ecology and Evolution: Explain how the interaction between ecological factors and natural selection leads to genetic changes within populations.

Nature of Science

Understanding about Science: Understand that scientists have an obligation to connect their new ideas to current and historical scientific knowledge and to present their findings for peer review and debate.

Investigating in science: Develop and carry out investigations that extend their science knowledge, including developing their understanding of the relationship between investigations and scientific theories and models.

Communicating in science: Use accepted science knowledge, vocabulary, symbols, and conventions when evaluating accounts of the natural world and consider the wider implications of the methods of communication and/or representation employed.

Participating and contributing: Use relevant information to develop a coherent understanding of socio-scientific issues that concern them, to identify possible responses at both personal and societal levels.

Main Concept	Key content	Suggested learning activities/resources	Worksheets and Activities/Assessment	Vocabulary
Introduction to Ecology	<ul style="list-style-type: none">● Intro to the course● What is Ecology?● Levels of biological	<ul style="list-style-type: none">● What is ecology?● Starter Activity: Use an article to provoke conversation around conservation and the	Mind map, spider diagram etc as a pre-test of what they already know about	Ecology Ecosystem

	<p>organisation</p> <ul style="list-style-type: none"> ● Binomial system of classification ● Introduction to NZ endemic species and NZ geological history ● Importance of biodiversity 	<p>importance of looking after our unique ecosystems and endemic species.</p> <ul style="list-style-type: none"> - You could include questions which encourage students to discuss conservation action, predator control, impact of loss of keystone species on ecosystems and biodiversity (play Jenga), whose right is it to say what species to preserve etc, role of tangata whenua as kaitiaki, the place of Te Tiriti o Waitangi in conservation - There are many articles which you can source through Forest and Bird, New Zealand Geographic and Stuff articles that address the impact of people and their practises, impact of introduced species on our endemic species and ecosystems, the range of conservation action including pest trapping and large-scale eradication programmes, habitat restoration and the role of offshore islands, mainland sanctuaries and pest free corridors. <p>Some examples of useful articles are found below:</p> <ol style="list-style-type: none"> 1. Forest and Bird Issue 368 Winter 2018 about kauri dieback ‘Can we save them?’ https://www.forestandbird.org.nz/campaigns/kauri-dieback <p>KQ: What are the main contributors to the</p>	<p>ecology</p> <p>Begin Worksheet for Teachers 1: ‘Biodiversity in New Zealand’</p>	<p>Communities</p> <p>Species</p> <p>Populations</p> <p>Endemic</p> <p>Native</p> <p>Introduced</p> <p>Gondwana and Zealandia continent</p> <p>Geological Isolation</p> <p>Scientific names</p> <p>Biodiversity</p>
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		<p>spread of kauri dieback disease?</p> <p>KQ: What strategies could be used to tackle the problem?</p> <p>KQ: What value do you see in investing resources to control or eradicate this invasive disease?</p> <p>KQ/Action: Design a campaign (pamphlet/on line/social media) to engage and educate the public on this issue.</p> <p>2. 'When the cat's away, the rabbits devastate island sanctuary'</p> <p>https://www.smh.com.au/environment/conservation/when-the-cats-away-rabbits-devastate-island-sanctuary-20090114-7g7d.html</p> <p>KQ: Draw up a time line of all events mentioned in article, and food chains for as many species as you can.</p> <p>KQ: Why did the cat eradication programme not work? In hindsight what could have been done?</p> <p>KQ: What needed to happen in subsequent years following this eradication?</p> <p>KQ/Action: Much discussion is held around the issue of monitoring and control of pet and feral cats, and Trap, Neuter and Release programmes. Investigate the issue, then choose a position and write a letter to your local Member of Parliament, proposing an</p>		
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		<p>action and justify your viewpoint.</p> <p>3. 'The ark and the algorithm'</p> <p>https://www.stuff.co.nz/environment/103568532/the-ark-the-algorithm-and-our-conservation-conundrum?rm=m</p> <p>KQ: Check out the quiz on the 'priority' species list. What species surprised you? What factors contribute to a species' ranking in the list?</p> <p>KQ: Explain why maintaining New Zealand's endemic biodiversity is so important.</p> <p>KQ/Action: Choose ten species you think are important. Design a questionnaire to gather information about how people within your school and social community view these species in terms of importance and why.</p> <p>Present your findings to the class.</p> <p>4. 'Facts' don't give scientists a monopoly on the truth'</p> <p>https://www.stuff.co.nz/the-press/108533174/Facts-don-t-give-scientists-a-monopoly-on-the-truth</p> <p>on the role of values and science.</p> <p>KQ: How can scientists better communicate their concerns to the general public in a 'legitimate and reasonable' manner?</p> <p>KQ; With contentious issues such as the aerial use of 1080, how do we take into</p>		
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		<p>account different opinions and values and yet still work together for the good of our endemic species?</p> <ul style="list-style-type: none"> ● Notes and definitions on Ecology and biological organisation ● Documentaries on NZ endemic species and NZ geological history e.g. 'Ghosts of Gondwana' (Natural History New Zealand) 		
<p>Classification: mammals vs birds linked to geological and biological history</p> <p>Biodiversity</p>	<p>NZ flora and fauna</p> <ul style="list-style-type: none"> ● Why is NZs biodiversity important? – endemism ● Paucity of mammals ● Long period of isolation --> endemism and naivety ● Geologic and climatic changes ● Introduced pests and disruption of food webs 	<ul style="list-style-type: none"> ● Find / research information on introduced mammalian pests. Can use a range of examples including those impacting takahē i.e. stoat and red deer. Include comparisons of habitat, ecological niche, adaptations (physiological, structural, behavioural). ● Find/research endemic predators and competitors before the introduction of mammals into New Zealand. How did they impact takahē and other endemic species? ● Why have many of NZ's endemic birds lost the power of flight? 	<p>Worksheets for Teachers 1: 'Biodiversity in New Zealand'</p> <p>Worksheets for Teachers 5: 'Demography of takahē'</p>	<p>Biodiversity</p> <p>Endemic</p> <p>Nocturnal</p> <p>Naive</p> <p>Camouflage</p> <p>Ecological niche</p> <p>Adaptations</p> <p>Habitat</p>
<p>What can ecologists measure in populations and communities?</p>	<ul style="list-style-type: none"> ● Counting numbers ● Measuring biodiversity ● Measuring damage/impact of species ● Diet ● Migration/dispersal ● Reproductive rate 	<p>Examples can be linked to NZ endemic species and takahē – see resource information</p> <ul style="list-style-type: none"> ● Sampling bird numbers – methods used e.g. 5-minute bird counts ● Sampling introduced mammal numbers e.g. capture, tag and release ● Tracking tunnels 	<p>A number of websites have information about survey methods – DOC is a good place to start although may be above students' level.</p> <p>Other good sites include:</p>	<p>Density</p> <p>Distribution (of population/species OR of individuals in the population) – clumped, random, uniform</p> <p>Population</p>

	<ul style="list-style-type: none"> ● Why? Density, distribution, numbers, comparisons ● Sampling. How? ● How does this information help in managing species under threat? 	<ul style="list-style-type: none"> ● Radio transmitter surveys ● Ground truthing of aerial surveys ● Scat and browsing patterns/observations <p>If this information to decide on options for management include trapping/poisoning pests, protecting endemic species through fences, establishing island populations, breeding programmes</p>	<p>- Predator Free NZ http://www.wildaboutnz.co.nz/ http://www.landcare.org.nz/files/file/1218/module</p> <p>Worksheets for Teachers 5 'Demography of the takahē' & 6: 'Stoats and takahē'</p>	<p>Abundance</p> <p>Limiting factors</p>
<p>Basic terminology linked to examples from endemic species</p> <p>Introduced mammals as pests</p>	<ul style="list-style-type: none"> ● Types of ecosystems ● Biotic and abiotic (environmental) factors ● Concepts of habitat and e/ niche ● Adaptations – structural, behavioural, physiological ● Interrelationships – interspecific and intraspecific ● Why is NZ biota unique? ● What makes introduced mammals pests? ● Why is it important that we control them? 	<p>Find examples linked to NZ endemic species</p> <ul style="list-style-type: none"> ● <u><i>Field trip to ZEALANDIA or another advocacy site– fits early or later in your study depending on how much prior teaching you want to do e.g. end of week 3/4 or week 7/8</i></u> ● Have group brainstorms on the <i>environmental factors</i> in different ecosystems. Note that we will focus on the alpine ecosystem (takahē – Fiordland) <ul style="list-style-type: none"> - Give examples of <i>abiotic and biotic</i> factors in the Murchison Mountains ● Habitat and ecological niche <ul style="list-style-type: none"> - Look at <i>ecological niches</i> of takahē, stoat, red deer and snow tussock - Use photos in resource ● Endemic plant and animal species linking <i>adaptations</i> to their habitat 	<p>Worksheets for Teachers 2: 'Takahē at ZEALANDIA' (print off copies for students and bring on trip)</p> <p>Useful Thinking Tools for Students 4: 'Compare and Contrast Murchison Mountains v Offshore Islands'</p> <p>Worksheets for Teachers 3: 'Interrelationships in the Murchison Mountains'</p> <p>Useful Thinking Tools</p>	<p>Biotic factors</p> <p>Abiotic factors</p> <p>Habitat</p> <p>Ecological niche</p> <p>Interspecific / intraspecific competition</p> <p>Predation</p> <p>Herbivore</p> <p>Adaptations: structural, physiological, behavioural</p>

	<ul style="list-style-type: none"> ● How do we control them? ● Why do introduced and native species cope better with introduced mammals than endemic ones do? 	<ul style="list-style-type: none"> - Use worksheet in resource to identify structural, behavioural and physiological adaptations of species in the Murchison Mountain community - Use worksheet in resource to identify what <i>interrelationships</i> exist and any common adaptations. ● Discuss <i>abiotic and biotic factors</i> in the Murchison Mountains in comparison to other parts of New Zealand (some off shore islands are more suited to takahē than others). Note that biotic factors include interrelationships <p>Note: Takahē power point presentation can be used for revision after visit to takahē site.</p>	<p>for Students:1 & 2 'Ecological Niches'</p> <p>Useful Thinking Tools for Students: 5 'Adaptations'</p> <p>Worksheets for Teachers 4: 'Takahē Recovery Plan 2007-2012'</p> <p>Useful Thinking Tools for Students 5: 'Adaptations' and 6: 'Interrelationships in the Murchison Mountains'</p> <p>Worksheets for Teachers 6: 'Stoats and takahē'</p>	
<p>Population growth and survivorship</p> <p>Tolerance</p>	<ul style="list-style-type: none"> ● population attributes ● population regulation ● carrying capacity ● population growth ● age structure and factors that affect it e.g. predation ● predator-prey relationships ● reproductive rate linked to food quality/availability 	<p>Interpretation of population/community related data:</p> <p>Examples linked to NZ endemic species and takahē – see resource information</p> <p>Graphs and tables for abiotic factors in an area</p> <ul style="list-style-type: none"> ● Population graphs and tables – interpretation <p>Note: Up to date data on takahē, deer and stoat numbers will be provided each year from the Takahē Recovery Programme –</p>	<p>Data in the resource relates to many of the concepts studied here.</p> <p>Data Appendices 3-7 and 16 are particularly useful for covering basic ideas.</p> <p>Worksheets for Teachers 11 and 12 help students to</p>	<p>Natality</p> <p>Population growth rate</p> <p>Density</p> <p>Distribution</p> <p>Mortality</p> <p>Sex ratios</p> <p>Fertility</p> <p>Emigration</p>

	<p>and competition</p> <ul style="list-style-type: none"> ● limiting factors ● impact of bottleneck/founder effect on small populations in terms of genetic diversity and viability. 	Department of Conservation (Te Anau office)	summarise their findings.	<p>Immigration Regulation Limiting factors Recruitment</p>
Competition	<ul style="list-style-type: none"> ● Limiting factors e.g. temperature, nutrients.... in an alpine context ● Same habitat ● Inter vs intraspecific ● Similar vs same niche – one species loses ● Effect on natality and mortality 	<ul style="list-style-type: none"> ● Takahē and red deer ● Takahē versus takahē ● Pūkeko versus takahē 	<p>Worksheets for Teachers 7: 'Interrelationships impacting the takahē'</p> <p>Useful Thinking Tools for Students 4: 'Compare and Contrast Murchison Mountains v Offshore Islands'</p> <p>Useful Thinking Tools for Students 5: 'Adaptations' and 6: 'Interrelationships in the Murchison Mountains'</p> <p>Useful Thinking Tools for Students 8: 'The ecological niche of takahē'</p> <p>Worksheets for Teachers 9: Milestone Checkpoints</p>	<p>Natality Mortality Competition: Interspecific Intraspecific Adaptations Niche differentiation</p>

Producers and Predation	<ul style="list-style-type: none"> ● Snow tussock and fern rhizomes, beech seeds ● Interpreting predator – prey graphs 	<ul style="list-style-type: none"> ● Snow tussock, beech seeds (masting) ● Effect of temperature on productivity ● Takahē and stoat – predator-prey interactions <p><i>All food chains/webs start with a producer. Energy ultimately comes from the Sun.</i></p> <p>Compare and contrast: link to adaptations</p> <ul style="list-style-type: none"> ● Difference between herbivory and predation ● Difference between carnivore and predator 		<p>Producer</p> <p>Consumer (primary, secondary, tertiary)</p> <p>Herbivore]</p> <p>Carnivore</p>
Community Patterns	<p>Main effect:</p> <ul style="list-style-type: none"> ● Impact of introduced mammals on population/community numbers over time ● Impact of abiotic factors on the communities studied <p>Lesser effects:</p> <ul style="list-style-type: none"> ● Effect of temperature in Fiordland ● Effect of beech masting 	<ul style="list-style-type: none"> ● Comparison of data between Fiordland and sanctuaries/offshore islands ● Comparison of data between stoat controlled and uncontrolled areas in Fiordland ● Relationship between takahē numbers and temperature in Fiordland / offshore islands ● Relationship between temperature in Fiordland and snow tussock masting ● Relationship between takahē numbers and competition with red deer in Fiordland. 	<p>Useful Thinking Tools for Students 4: ‘Compare and Contrast Murchison Mountains v Offshore Islands’</p> <p>Useful Thinking Tools for Students 7: ‘Management Options’</p> <p>Worksheets for Teachers 10: Final Help Sheet</p>	<p>Abiotic factors</p> <p>Biotic factors</p> <p>Predation</p> <p>Interspecific competition</p>
AS: 91158 Final Assessment			Students to complete assessment task to be	

			downloaded from BEANZ website. Time allowed 2-3 one- hour periods.	
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