Assessment Schedule – 2021

Scholarship Biology (93101)

Evidence Statement

QUESTION ONE: CAMELIDS: Evidence Statement

Discusses the ecological and evolutionary processes and patterns that have led to the diversity of the Camelidae family (**E**).

	Evidence		**Justification**
ER	Camelids have undergone **adaptive radiation** in the past	**ERJ**	Availability of a wide range of niches around 45 mya led to the formation of a large number of species from a common ancestor in North America.
EN	Differences in environments in the Old World and New World have meant **different selection pressures** in each location.	**ENJ1** **ENJ2**	**Directional / natural** selection of Old World camelids toward phenotypes best suited to a dry, **desert environment** **Directional / natural** selection in New World camelids has resulted in species adapted to **high altitude**.
EG	**Allopatric speciation** between the Old and New World camelids.	**EGJ**	**Loss of land bridges** meant the Old World and New World camelids became separated by a **geographic barrier** / **geographically isolated** from each other. This has led to a **lack of gene flow** between the populations leading to reproductive isolation.
ES	**Sympatric speciation** (may) have occurred between the different species of camelid in South America.	**ESJ**	All four species of South American camelid are found living in the same location in the Andes mountains.
EC	**Convergent evolution** between an extinct species in North America and the giraffe in Africa.		

Discuss the impact of genetic changes in the evolution of camelids (**G**).

	Evidence		**Justification**
GM	**Mutations** were the source of **new alleles.**		
GW	Genetic changes in Camelinae / Old World relating to water conservation (*answer includes reference to example of a relevant gene* – ERP44, NFE2G2, MGST2, NR3C2, IRS1, AQP1, AQP2, AQP3).	**GWJ**	Changes in genes linked to more efficient kidney function / improved **water retention / conservation**, which allows them to live in a **dry / desert environment**.
GF	Genetic changes in Camelinae / Old World relating to fat storage / metabolism (*answer includes reference to example of relevant gene* – ACC2, DGKZ, GDPD4, NFAT5, GLUT).	**GFJ1** **GFJ2**	Changes in genes responsible for fat storage / fat metabolism allows them to go extended periods without food / water in desert. Metabolism of fat produces water as a product of respiration.

GT	Genetic changes in Camelinae / Old World relating to thermoregulation. (*answer includes reference to example of relevant gene* –ERP44, NFE2G2, MGST2).	**GTJ**	Changes in genes resulted in improved thermoregulation linked to at least one of: • thick coat for insulation / preventing heat gain or loss in temperature extremes in desert • long legs to lift body further away from hot ground in desert allows better air flow and cooling • physiological tolerances to fluctuations in internal temperature due to temperature extremes in desert.
GL	Genetic changes in Laminae / New World camelids relating to low O_2 / fibre / temperature / reproduction / milk production.	**GLJ**	Changes in genes linked to at least one of: • Changes in genes linked to responses to low O_2 levels allowed them to live at higher altitudes. • Changes in genes linked to fibre characteristics / colour for humans to use in clothing / camelids to survive in colder temperatures. • Changes in genes linked to differences in reproduction / social behaviours due to domestication of herds by humans (more docile individuals, more offspring produced). • Changes in genes linked to for milk production gave improved / more food source for humans / camelids own offspring.

Evaluate the role humans have played in their evolution (**H**).

	Evidence		**Justification**
HE	Humans have caused the extinction of camelids in North America.	**HEJ**	Human migration into North America where hunting / human induced changes to the environment led to their extinction.
HA	Human dispersal / translocation of camelids to new regions (Australia).	**HAJ1**	This would have caused a **founder effect** due to a **small** starting population a **non-representative gene pool**
		HAJ2	Geographic isolation AND different selection pressures, there is **the possibility of divergent evolution of Australian camelids in future**.
HH	Hybridisation of different species of camelids.	**HHJ1**	May result in introgression / the loss of distinct species of camelids in future.
		HHJ2	Hybridisation may have lead to hybrid vigour .
HD	Humans have domesticated some species camelids.	**HDJ1**	No longer any wild species of Old World camelids / ancestor of OW camelids has become extinct, as only the two domestic species remain.
		HDJ2	This led to the formation of new species of camelids in North America, producing the llama from the guanaco and the alpaca from the vicuña.
		HDJ3	**Artificial selection / selective breeding** for characteristics desirable to humans.

Judgement statement (the three areas are **E**, **G**, and **H**).

8	Provides an in-depth response, using information in the resource material and Nature of Science and Living World strands up to and including Level 8 in The New Zealand Curriculum to discuss the evolutionary processes and patterns leaning to the diversity in the Camelidae family, and evaluates the role of humans in their evolution. 8 Js or 7 Js and 2 descriptions. Must have 2 Js in each of the 3 areas. Answer displays: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
7	Provides an in-depth response, using information in the resource material and Nature of Science and Living World strands up to and including Level 8 in The New Zealand Curriculum to discuss the evolutionary processes and patterns leaning to the diversity in the Camelidae family, and evaluates the role of humans in their evolution. 7 Js or 6 Js and 2 descriptions. Must have 2 Js in each of the 3 areas. Answer displays aspects of: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
6	Biological evidence is selected and organised into a discussion of the evolutionary processes and patterns leading to the diversity in the Camelidae family, and evaluates the role of humans in their evolution. 6 Js or 5 Js and 2 descriptions or 4 Js and 4 descriptions. Must have 1 J in at least 2 areas. Answer displays: • analysis and critical thinking • integration, synthesis and application of highly developed knowledge, skills, and understanding • logical development, precision and clarity of ideas.
5	Biological evidence is selected and organised into a discussion of the evolutionary processes and patterns leaning to the diversity in the Camelidae family, and evaluates the role of humans in their evolution. 5 Js or 4 Js and 2 descriptions or 3 Js and 4 descriptions. Must have 1 J in at least 2 areas. Answer displays: • analysis and critical thinking • integration, synthesis and application of highly developed knowledge, skills, and understanding • logical development, precision and clarity of ideas.
4	4 Js or 3 Js and 2 descriptions or 2 Js and 4 descriptions.
3	3 Js or 2 J and 2 descriptions. or 1 J and 4 descriptions.
2	2 Js or 1 J and 2 descriptions or 0 Js and 4 descriptions.
1	1 J or 2 descriptions.
0	Lack of relevant evidence.

QUESTION TWO: SEA LIONS: Evidence Statement

Discusses the reasons for the difference in mean mass between the colonies on the Auckland Islands and the Otago Peninsula.

	Evidence		**Justification**
DC	Larger **intraspecific** competition in the Auckland Islands (AI) colony / lower **intraspecific** competition in the Otago Peninsula (OP) colony.	**DCJ**	Intraspecific competition is greater because they are all the **same species**, competing for the **same food resources / occupy same niche**.
DP	The population at the AI is greater at 10 000 compared to OP.	**DPJ**	This means that intraspecific competition is **greater**, at the AI, as the colony is larger and more individuals are competing for the same food source.
DH	The habitat is less abundant in food resources at AI than at OP (or inverse)	**DHJ**	There are more food resources available at OP, as there are barracouta and jack mackerel.
DV	OP population has greater variety of food compared to AI (or inverse)	**DVJ**	Having barracouta and jack mackerel as a food source has improved nutrition leading to greater body mass.
DF	The food resources at OP have a higher energy value / more fat than those at the AI. (or inverse)	**DFJ**	The barracouta and jack mackerel are higher in energy / fat than the squid.
DD	The AI on average dive deeper than the sealions / females at OP (or inverse)	**DDJ**	The sealions at AI dive deeper when foraging for food than those at OP because their food is found at greater depths. This takes more **energy**.
DT	The AI forage for food longer than the sealions / females at OP (or inverse)	**DTJ**	The AI sealions are out longer foraging for food. It takes more energy to forage for longer periods of time.
DM	The AI sealions have smaller body mass than OP sealions (or inverse)	**DMJ1** **DMJ2**	As the females get older the difference in body mass gets less Smaller body mass in AI individuals due to more time diving and deeper dives meaning more energy used while feeding
DG	The Otago population was started by a small number of individuals	**DGJ1** **DGJ2** **DGJ3** **DGJ4**	This population resulted in the **founder effect** whose allele frequencies may be non-representative of the original population with a higher frequency of alleles for bigger body mass. The effect of larger mass may be a combination of genetic and environmental (food availability). Larger body mass unlikely due to selection as OP population only 30 years old. **Genetic drift** may have acted on the **small** OP population leading to **random** fixing of alleles for bigger body mass.

Discusses the breeding behaviours of the sea lions.

	Evidence		**Justification**
BS	Males establish their territories through displays, vocalising, and fighting.	**BSJ1**	This is a form of **sexual selection**, as the dominant male sea lion has access to more mates.
		BSJ2	Female sea lions select who they will mate with, depending on best territory.
		BSJ3	**Agonistic** behaviours reduce risk of harm / saves energy due to less fighting which leads to **greater reproductive success**.
		BSJ4	Males with the alleles best suited to the environment are better able to hold the greatest territory and breed, having the greatest chance of reproductive success.
BH	The smaller-sized females / pups are at risk of being hurt during mating season by the larger males.	**BHJ**	Females / pups are smaller, they can be hurt or killed in when males are competing / defending for territories / mates / being harassed by males.
BP	The populations are larger on AI / OP populations are smaller. *Can't get the DP AND BP points, but can get BPJ*	**BPJ**	Because the breeding population is larger in the AI, more **energy** is expended defending territory by males holding territories. OR inverse. The breeding populations are smaller in OP, so less competition between males to hold territories; therefore less **energy** is expended defending the territories.
BT	The Auckland Islands are smaller / have less area than the Otago Peninsula, so less space for establishing territories	**BTJ**	Due to less space and AI populations being larger there is greater competition for available beach to establish a territory.
BB	Many females to one male / polygyny behaviour / harem.	**BBJ**	The reproductive fitness of the male ensures that their successful alleles will have a greater frequency in future generations.
BK	Sea lions show a K strategy	**BKJ**	Females have few offspring / one pup at a time and care for them to ensure greater survival chances.
BL	Sea lions have a low reproductive rate *with example* eg 11 month gestation / 1 pup every 2 years	**BLJ**	This can result in slow population increase / limit rate of population growth.
BX	Sea lions show sexual dimorphism	**BXJ**	This allows a single male to defend a large group of females / harem.

8	Provides an in-depth response, using information in the resource material and Nature of Science and Living World strands up to and including Level 8 in The New Zealand Curriculum to analyse difference in mean mass and behaviours between sea lion populations in the Otago peninsula and the Auckland Islands, and the possible impacts this may have on the different colonies. 8 Js or 7 Js and 2 descriptions. Must have 2 Js in each area. Answer displays: • perception and insight • sophisticated integration and abstraction • ndependent reflection and extrapolation • convincing communication.
7	Provides an in-depth response using information in the resource material and Nature of Science and Living World strands up to and including Level 8 in The New Zealand Curriculum to analyse difference in mean mass and behaviours between sea lion populations in the Otago peninsula and the Auckland Islands, and the possible impacts this may have on the different colonies. 7 Js or 6 Js and 2 descriptions. Must have 2 Js in each area. Answer displays: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
6	Biological evidence is selected and organised into a discussion of the difference in mean mass and behaviours between sea lion populations in the Otago Peninsula and the Auckland Islands, and the possible impacts this may have on the different colonies. 6 Js or 5 Js and 2 descriptions or 4 Js and 4 descriptions. Must have 1 J in each area. Answer displays: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
5	Biological evidence is selected and organised into a discussion of the difference in mean mass and behaviours between sea lion populations in the Otago Peninsula and the Auckland Islands, and the possible impacts this may have on the different colonies. 5 Js or 4 Js and 2 descriptions or 3 Js and 4 descriptions. Must have 1 J in each area. Answer displays: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
4	4 Js or 3 Js and 2 descriptions or 2 Js and 4 descriptions.
3	3 Js or 2 J and 2 descriptions. or 1 J and 4 descriptions.
2	2 Js or 1 J and 2 descriptions or 0 Js and 4 descriptions.
1	1 J or 2 descriptions.
0	Lack of relevant evidence.

QUESTION THREE: BIOLOGICAL CONTROL: Evidence Statement

The biological features that make M. *paradoxus* and *V. inanis* good biological control agents of *V. vulgaris* and *V. germanica*.

CM	Wasp-nest beetles / hoverfly smell like wasps. OR The hoverfly looks similar to the wasp.	**CMJ**	This is a form of **mimicry** that also leads to the hoverfly's ability to remain **undetected / unharmed / not attacked** by the wasp species.
CE	Both the wasp-nest beetle and the hoverfly are parasites / exploitation.	**CEJ**	They harm the wasp host, causing death by parasitising their larva. The parasite larva benefits, gaining nutrients / feed on / protection from the host.
CR	Wasp-nest beetle / hoverfly are **r-strategist.**	**CRJ1** **CRJ2**	This means that they lay a high number of eggs and do not contribute any energy / care into raising or rearing the young. r-strategy allows for a rapid increase in the control agent population .
CF	*Metoecus paradoxus* – wasp-nest beetle do not feed.	**CFJ**	By not feeding, they do not compete with other insects for food.
CN	Hover fly / wasp-nest beetle produce large number of eggs (numbers OK).	**CNJ**	This leads to a rapid / large decrease in the number of wasps.
CH	One hoverfly larva requires 2 wasp larvae as host **compared** to the wasp-nest beetle only requiring one.	**CHJ**	Hoverfly is a more effective control agent as kills twice as many wasps as the beetle.
CA	Control agents / HF / WNB are host specific / only target wasp species.	**CAJ1** **CAJ2**	This means they are less likely to parasitise / exploit non-target / native species / bees. When wasp population numbers decline the control agent population also decline.

Analyse the possible ecological impacts that scientist need to consider before releasing and possible results of introducing biological controls.

	Evidence		**Justification**
IF	Fewer wasps survive therefore more honeydew available	**IFJ1** **IFJ2**	This means more honeydew available for other / native species which will lead to increased survival / numbers. This makes the soil more nutrient-rich enhancing plant growth.
IN	Improves biodiversity / greater numbers of bellbirds, tūī, kākā, fungi, bacteria, beetles, mites. (either biodiversity OR at least TWO species).	**INJ1** **INJ2** **INJ3**	More food is available for the bellbirds, tūī, kākā, and bats during the winter months as there will be less available nectar from other species of plants. More honeydew will drop, covering the bark and soil, encouraging the growth of black sooty mould fungi. This will cause the **increase** in beetles and moths. Increasing biodiversity [*NOT NUMBERS*] makes food chain / web more stable making the ecosystem more stable. This should lead to greater numbers of New Zealand native species.
ID	Control agents may parasitise / exploit non-target species.	**IDJ**	This will impact number of non-target species which will have flow on effects to food webs / ecosystems.
IH	Hybridisation with native species.	**IHJ**	Low chance of forming hybrid species with other species in New Zealand because they are introduced and unrelated to New Zealand species.

IP	Hoverfly eat pollen / nectar.	**IPJ1** **IPJ2**	The HF could compete with other pollinators for pollen / nectar which reduces food availability for our native species / bees reducing population size / survival / success. More species eating pollen leads to less chance of successful pollination reducing populations of native plant species.
IW	During winter months, the German wasps are more heavily predated by both parasites.	**IWJ**	Because the common wasp colonies die in the winter, the German wasps will be more heavily predated by both the adult wasp-nest beetles / the hoverfly.
IA	Accidental introduction of pathogens / disease along with the control agents.	**IAJ**	These may spread to native / other species which will have flow on effects to food webs / ecosystems.
IM	Introduced agents become a new food source for native species.	**IMJ1** **IMJ2** **IMJ3**	Greater nutrition / more food / energy for native species which would increase their survival. New food sources would have flow on effects on native food webs / ecosystems. This would lead to lower numbers of control agent making it less effective.

8	Provides an in-depth response, using information in the resource material and Nature of Science and Living World strands up to and including Level 8 in The New Zealand Curriculum to discuss features that make *M. paradoxus* and *V. inanis* good biological control agents of *V. vulgaris* and *V. germanica*. And also discusses the biological impacts that might occur. 8 Js or 7 Js and 2 descriptions. Must have 2 Js in each area. Answer displays: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
7	Provides an in-depth response using information in the resource material and Nature of Science and Living World strands up to and including Level 8 in The New Zealand Curriculum to discuss features that make *M. paradoxus* and *V. inanis* good biological control agents of *V. vulgaris* and *V. germanica*. And also discusses the biological impacts that might occur. 7 Js or 6 Js and 2 descriptions. Must have 2 Js in each area. Answer displays: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
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Cut Scores

Scholarship	Outstanding Scholarship
13 – 18	19 – 24