Assessment Schedule – 2024

Scholarship Biology (93101)

QUESTION ONE: Hector's dolphins

Evidence statements

(B) Discusses how the behaviours of the Hector's dolphins may have contributed to the current small population sizes.

	Evidence		Justification
BP	Promiscuous / polygynandry mating system.	**BP_J**	All males are equally likely to pass on their alleles, which could increase genetic diversity (i.e. good for small populations) / result in less fit alleles being passed on.
BS	Habitat is only to depths of approximately 100 m.	**BS_J**	Only a limited area in which they can forage / breed / inhabit, so anything that negatively impacts that area may reduce population numbers.
BB	Seasonal movement in spring and summer might be to their breeding grounds / abundant food source.		
BC	Hector's dolphins inhabit coastal waters so are more likely to encounter humans / human activity.	**BC_J**	Human activity could interfere with the dolphins' natural behaviours, potentially reducing the population size / dolphins could be hit by recreational vessels, causing death.
BF	High rate of foraging site fidelity / return to same site in consecutive summers.	**BF_J**	Makes dolphins less likely to encounter new individuals for breeding, reducing the potential genetic diversity.
BH	A home range is an area over which dolphins / groups regularly travel for foraging / breeding.	**BH_J**	A small home range limits group size (to fewer than five in a group) because the home range does not have the resources to support a larger group (e.g. not enough food for larger group sizes).
BG	Groups of adults are single sex so a group of the opposite sex must be encountered for breeding to occur / breeding cannot occur within a group.	**BG_J**	Due to reduced population numbers, groups are less likely to encounter each other for breeding, so keeping the population size low / limiting population growth.
BK	*K*-strategists / *K*-selected species.	**BK_J**	The production of fewer offspring (one every 2–3 years / gestational period of 10–11 months) that often require extensive parental care / energy investment (calf stays with female for 1–2 years).
BR	Slow reproductive rate.	**BR_J1**	Leads to slow increase in population size / numbers.
		BR_J2	Maximum of only 3–6 / few calves produced per female, per lifetime.
BM	Not sexually mature until 6–7 years old.	**BM_J**	If they die before sexual maturity is reached (e.g. due to 36% percent mortality in first 6 months), they do not contribute to population increase.
BA	Dolphins are attracted to fishing trawlers because their food / prey species / red cod are frequently in the catch.	**BA_J**	Dolphins are even more likely to be killed by trawlers.

(P) Discusses how external threats may have contributed to the current small population sizes of Hector's dolphins.

	Evidence		Justification
PB	Threats have / fishing has caused a population bottleneck (with over 70% loss of individuals / population).	**PB_J**	An unrepresentative sample of alleles is left in the population.
PC	Interspecific competition with humans for food, leading to smaller population sizes.	**PC_J**	This causes a reduction in food / less energy, leading to less reproductive success / fewer offspring produced.
PG	Smaller populations are more susceptible to genetic drift.	**PG_J**	This can lead to fixation and / or loss of alleles / change in allele frequency by chance.
PI	Inbreeding depression in Māui dolphin.	**PI_J**	Inbreeding can bring together harmful recessive alleles / lethal alleles.
PE	Low genetic diversity in Māui dolphin.	**PE_J**	This population is more susceptible to / less able to adapt to environmental change.
PR	Brucellosis reduces already slow reproductive rate (causing late abortions). OR *Toxoplasma gondii* causes death.	**PR_J**	This disease / these diseases could take the rate below that required for population stability / cause population decline / small population numbers.
PO	Oil spills / sewage / agricultural run-off could lead to contamination of / polluting of dolphin habitats.	**PO_J**	These incidents could indirectly lead to dolphin deaths by causing their food sources (red cod, flatfish, squid) to die off / could lead directly to dolphin deaths.
PA	Sewage / agricultural run-off could increase turbidity of water / particulates in the water.	**PA_J**	Increased turbidity may make it more difficult for dolphin to catch their prey and, as a result, reduce population numbers.
PS	Seismic surveying / boat noise could interfere with echolocation.	**PS_J**	This interference would reduce dolphins' ability to find food / communicate with each other, leading to reduced population numbers.
PM	Seabed mining could cause destruction of habitat, which is already limited to up to 100 m depth in coastal waters.	**PM_J**	Habitat loss could cause further decreases in population size due to increased intraspecific competition for food / less suitable home ranges.
PW	Recreational water activities / tourism could affect dolphins, e.g. tourist boats may hit dolphin / boat strike / boat noise.	**PW_J**	The presence of boats / people in the water may disrupt the dolphins' natural behaviours, causing, for example, reduced mating and so a reducing population size.
PP	Plastic pollution can cause deaths, reducing population numbers.	**PP_J**	Plastic bottles may be mistaken for fish / squid and disrupt digestion / cause a blockage in the digestive system.

(I) Evaluates the interventions that could reduce the threats facing Hector's dolphins.

	Evidence		Justification
IN	Human intervention is needed due to a very slow natural reproductive rate, i.e. 2% increase per year.	**IN_J1**	Without intervention, Māui dolphins would only increase in population size by approximately one dolphin per year (2%) / very slowly.
		IN_J2	Without intervention, it would take decades to increase Hector's dolphin population size back to pre-1970s numbers.
IR	FRMLs could work if they are calculated to account for the low reproductive rate / the population estimates used are accurate.	**IR_J1**	Any reduction in population numbers, however small, will reduce the population growth rate, so it is better to aim for no-dolphin bycatch, rather than a limit.
		IR_J2	Fishing could be ceased in an area if dolphins are sighted, reducing the chances of (by) catching dolphins.
		IR_J3	Lower FRML to reduce bycatch / deaths of dolphins due to actions being implemented sooner.
IF	Gillnet /nylon net / trawl-net fishing bans could be extended.	**IF_J**	Bans may reduce bycatch / dolphin deaths because fishing will not occur, enabling numbers to increase.
IG	*Toxoplasma gondii* / cat faeces / oocytes may get into waterways due to cats living close to waterways / run-off from storm-water drains / cat faeces being flushed down toilets.	**IG_J1**	Feral cats could be culled / cats could be banned as pets to reduce cat faeces getting into waterways, so stopping transmission of the disease.
		IG_J2	A vaccine against *T. gondii* could be developed and given to cats to stop the transmission of the disease.
IB	More research is needed on brucellosis in marine mammals (method of transmission is not known), and findings could then be used to reduce the threat to dolphins.	**IB_J**	A vaccine against brucellosis could be developed to stop the transmission of the disease
IP	Look at controlling the number of predators, with the aim of reducing predation of dolphins by sharks.	**IP_J**	Controlling shark numbers would likely have further knock-on effects to food chains / webs that would make this an inviable option.
IS	Seabed mining / seismic surveying could be banned in areas with dolphins / within 100 km of the shoreline.		
IA	Tighter regulations could be introduced for sewage / agricultural run-off / pollution / oil spills.		
IT	South Island Hector's dolphins could be translocated to the Māui population, thereby increasing that population.	**IT_J1**	There is low aggression between males when breeding, so new males are likely to breed successfully and increase population numbers.
		IT_J2	Group members do not form strong bonds with each other and are known for exchanging members within groups, so South Island Hector's dolphins are likely to be accepted into Māui dolphin groups.

	Evidence		Justification
		IT_J3	Immigration would increase the genetic diversity of the Māui population.
		IT_J4	Reproductive isolating mechanisms (RIMs) may prevent successful breeding between Māui and South Island Hector's dolphins.
		IT_J5	Breeding between Māui and South Island Hector's dolphins would dilute the unique genetics of the Māui dolphin / hybridise the two subspecies, and they would no longer be classified as a distinct subspecies.
		IT_J6	Translocated individuals could carry diseases that are not present in the Māui dolphin population, causing a further reduction in the population size.
		IT_J7	Translocation itself could cause death / trauma to the translocated individual, and so not help to increase population numbers.
		IT_J8	Translocation could make the local population (from which the dolphins were taken) too small to be viable to sustain population numbers.
IC	Captive breeding programmes could help increase reproductive success / survival of offspring.	**IC_J1**	Breeding animals in captivity, away from possible threats, providing a named example (e.g. predators, food scarcity, pollution, etc).
		IC_J2	Breeding in captivity may involve removing offspring and rearing them, so the mother produces another offspring increasing population numbers.
		IC_J3	Genome / DNA / genetic analysis may be used to identify individuals with the most genetic variation / desirable alleles (for disease resistance) / who are unrelated to use in the breeding program.
		IC_J4	These programmes may result in a nursery pod where one female looks after multiple offspring, but the mother may not have the capacity / milk production / nipples available to rear multiple offspring.
		IC_J5	Captive-bred individuals may not be accepted by wild populations because their behaviours may be unrecognisable.
		IC_J5	Captive-bred individuals may be easily accepted into a group due to minimal group bonding.
		IC_J6	Captive-bred individuals may be accepted easily into a group due to minimal group bonding.
ID	For either translocation or captive breeding.	**ID_J**	Disadvantages / costs / risks likely outweigh the benefits / advantages, making this option inviable.

Judgement statement (the three areas are **B**, **P**, and **I**).

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 various factors that have contributed to the current population size of Hector's dolphins and how threats to the population can be mitigated. Presents a well-planned discussion that is fully integrated and coherent. 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 • ideas not already included in the schedule.
7	*Same descriptor as for judgement statement at 8.* 7 Js OR 6 Js and 2 descriptions. Must have 1 J in each area. 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 various factors that have contributed to the current population size of Hector's dolphins and how threats to the population can be mitigated. Relevant evidence is selected and organised to develop and present a well-reasoned response. 6 Js OR 5 Js and 2 descriptions OR 4 Js and 4 descriptions. Must have 1 J in each area. Answer displays: • analysis and critical thinking • integration, synthesis, and application of highly developed knowledge, skills, and understandings • logical development, precision, and clarity of ideas.
5	*Same descriptor as for judgement statement at 6.* Relevant evidence is selected and organised to develop and present a well-reasoned response. 5 Js OR 4 Js and 2 descriptions or 3 Js and 4 descriptions. Must have 1 J in two areas. Answer displays aspects of: • analysis and critical thinking • integration, synthesis, and application of highly developed knowledge, skills, and understandings • 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 Js and 2 descriptions OR 1 J and 4 descriptions.
2	2 Js OR 1 J and 2 descriptions OR 0 J and 4 descriptions.
1	1 J OR 2 descriptions.
0	Lack of relevant evidence.

QUESTION TWO: Olive shells

Evidence statements

(O) Discusses the evolutionary patterns and processes that have resulted in the speciation of New Zealand olive shells.

	Evidence		**Justification**
OP	Describes punctuated equilibrium as rapid speciation between long periods of evolutionary stasis / little or no change.	**OP**$_J$	Explains punctuated equilibrium by linking evidence (from Figure 5) that shows the long periods of little or no change / examples of rapid speciation (uses named example / data for timeframe or number of species).
OF	Describes morphological stasis as corresponding to a stable environment or rapid speciation as linked to rapid environmental / geological change.	**OF**$_J$	Explains significance of morphological stasis: fossil record would show long periods of no change in morphology, followed by rapid change with little or no evidence of intermediated / transitional forms.
ON	Olive shells have undergone adaptive radiation.	**ON**$_J$	Explains a common ancestor as being due to vacant niches.
OD	Olive shells in New Zealand show divergent evolution and have evolved from a common ancestor.	**OD**$_J$	Gives examples of divergent species and common ancestor, using Figure 5.
OA	Defines allopatric speciation as speciation due to a geographical barrier.	**OA**$_J$	Uses examples from Figure 4 to identify possible barriers (e.g. current, oceanic distances or other reasonable example) and (island) species.
OS	Defines sympatric speciation as new species forming while occupying the same geographical area.	**OS**$_J$	Uses examples from Figure 4 to identify possible sympatric species (e.g. Spirit Bay).
OG	The speciation is a result of geographical isolation / ecological isolation.	**OG**$_J$	There is no gene flow between isolated population.
OM	Mutations occurred in each (isolated) population.	**OM**$_J$	Discusses mutations that produce alleles which result in a phenotype that confers a reproductive advantage increase in frequency in the gene pool.
OO	Different selection pressures in each area.	**OO**$_J$	These pressures have caused changes in allele frequency between the populations leading to divergence / speciation.
OR	Reproductive isolating mechanisms (RIMs) develop between olive shell species, preventing successful reproduction / stopping gene flow.	**OR**$_J$**1**	Behavioural isolation, providing an explanation, e.g. different mating displays preventing reproduction.
		OR$_J$**2**	Spatial / geographical isolation: where the species don’t occupy the same area, preventing them from encountering each other and preventing reproduction.
		OR$_J$**3**	Ecological isolation as a result of differences in niche, e.g. different food sources.
		OR$_J$**4**	Temporal isolation, for example, where different populations may become reproductively active at different times, therefore are not able to mate with each other.

	Evidence		Justification
		OR_J5	Mechanical / structural isolation, for example, the reproductive organs may be differently shaped between the different species, leading to no reproduction.
		OR_J6	Gametic isolation: gametes are incompatible, e.g. sperm does not produce the appropriate enzyme to penetrate the egg, **or** e.g. gametes from different species have different numbers of chromosomes and cannot form a viable zygote.
		OR_J7	Hybrid sterility: chromosomes do not have homologous pairs, so the hybrid cannot produce viable gametes.
		OR_J8	Hybrid inviability: the health of the hybrid is degraded, preventing the hybrid from reaching reproductive age.
		OR_J9	Hybrid breakdown: hybrid can have offspring, but there is a declining rate of reproductive success after F2 generation, due to genetic incompatibility.
		OR_J10	RIMs can be pre-zygotic, before fertilization / the zygote or post-zygotic; after fertilization / the zygote (with an example for each).
OT	Natural selection has occurred.	**OT_J**	Different phenotypes / physical features give a survival / reproductive advantage, so alleles are passed on, leading to RIMs forming / speciation.
OZ	RIMs develop between olive shell species, which can be postzygotic, prevent reproduction after the formation of a zygote.	**OZ_J1**	Hybrid sterility: chromosomes do not have homologous pairs, so the hybrid cannot produce viable gametes.
		OZ_J2	Hybrid inviability: the health of the hybrid is degraded, preventing the hybrid from reaching reproductive age.
		OZ_J3	Hybrid breakdown: hybrid can have offspring, but there is a declining rate of reproductive success after F2 generation, due to genetic incompatibility.
OM	Mutations occurred in each (isolated) population.	**OM_J**	Mutations may have been positive or negative in the local area / niche, leading to survival of certain phenotypes.

(D) Discusses why the DNA analysis enabled the acceptance of the punctuated equilibrium model for *Amalda* species in New Zealand and rejection of the alternative model.

	Evidence		**Justification**
DF	Very good fossil record due to soft sediment shoreline.	**DF**$_J$	This allows for comparison of specimens, leading to species identification before DNA analysis was available.
DO	Observable differences / morphology alone may not be a reliable indicator of species.	**DO**$_J$**1**	It is unreliable to base species classification solely on morphology to identify separate species, when it may simply be variation within a species.
		DO$_J$**2**	If based solely on morphology, there may not be clearly observable differences, so separate species would not be identified.
		DO$_J$**3**	Similar morphology may be the result of convergent evolution.
		DO$_J$**4**	Similar morphology may be the result of cryptic speciation.
DD	DNA evidence shows clear differences / similarities between species.	**DD**$_J$**1**	Genetic relatedness can be assessed through DNA base sequencing and analysis of similarities / differences in genes / markers / base sequence.
		DD$_J$**2**	Genetic relatedness can be assessed by using DNA hybridisation, between DNA from one species and another, to analyse the degree of complementary base pairing.
DN	DNA evidence from New Zealand, compared to other known species, shows many differences.	**DN**$_J$	This suggests that New Zealand olive shells are not closely related to other / foreign groups (provides a named example).
DM	DNA-dating technique / molecular-clock / mtDNA analysis shows approximate time frame of speciation events / divergence.	**DM**$_J$**1**	The known rate of mutation can be used to estimate the time of divergence.
		DM$_J$**2**	This time frame would indicate that there were rapid speciation events, followed by periods of stasis, which enables scientists to accept the punctuated equilibrium model and reject the alternative model.
DT	mtDNA can be used as a molecular clock.	**DT**$_J$**1**	The known rate of mutation can be used to estimate the time of divergence.
		DT$_J$**2**	mtDNA is not subject to genetic recombination.
DC	Cladogenesis is the formation of two or more new species from a common ancestor / punctuated equilibrium.	**DC**$_J$	DNA evidence supports speciation of olive shell species by cladogenesis.
DA	Anagenesis is the gradual formation of a species over time / gradualism.	**DA**$_J$	If anagenesis occurred, transitional fossils would be expected in the fossil record; there is no evidence of this in the fossil record for olive shell species.
DG	Gradualism is the other model for the rate of speciation.	**DG**$_J$	Slow / gradual formation of a new species.

Judgement statement (the two areas are **O** and **D**).

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 patterns and processes that have resulted in the speciation of New Zealand olive shells; why the DNA analysis was important in supporting punctuated equilibrium as the model for the current distribution of *Amalda* in New Zealand; and in rejecting long distance dispersal / migration from other parts of the world as the source of the different species. Presents a well-planned discussion which is fully integrated and coherent. 8 Js OR 7 Js and 2 descriptions Must have 1 J from each O and D area. Answer displays: • perception and insight • sophisticated integration and abstraction • independent reflection and extrapolation • convincing communication.
7	*Same descriptor as for judgement statement at 8.* Presents a well-planned discussion which is fully integrated and coherent. 7 Js OR 6 Js and 2 descriptions OR 5 Js and 4 descriptions. Must have 1 J from each O and D area. 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 patterns and processes that have resulted in the speciation of New Zealand olive shells; why the DNA analysis was important in supporting punctuated equilibrium as the model for the current distribution of *Amalda* in New Zealand; and in rejecting long-distance dispersal / migration from other parts of the world as the source of the different species. Relevant evidence is selected and organised to develop and present a well-reasoned response. 6 Js OR 5 Js and 2 descriptions OR 4 Js and 4 descriptions. Must have 1 J from each O and D area. Answer displays: • analysis and critical thinking • integration, synthesis, and application of highly developed knowledge, skills, and understandings • logical development, precision, and clarity of ideas.
5	*Same descriptor as for judgement statement at 6.* Relevant evidence is selected and organised to develop and present a well-reasoned response. 5 Js OR 4 Js and 2 descriptions OR 3 Js and 4 descriptions. Must have 1 J from each O and D area. Answer displays aspects of: • analysis and critical thinking • integration, synthesis, and application of highly developed knowledge, skills, and understandings • 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 Js and 2 descriptions OR 1 J and 4 descriptions.
2	2 Js OR 1 J and 2 descriptions OR 4 descriptions.
1	1 J OR 2 descriptions.
0	Lack of relevant evidence.

QUESTION THREE: The woolly rhinoceros

Evidence statements

(E) Discusses the ecological niche of the woolly rhinoceros.

	Evidence		Justification
ET	Thick enamel / no incisors / only molars suggest an herbivorous diet / an herbivore.	**ET$_{J}$1**	Thick enamel reinforces / strengthens the teeth to resist grinding action during chewing.
		ET$_{J}$2	Large molars for grinding tough / fibrous vegetation grass / herbs / shrubs.
EG	Long, downward-facing head is ideal for grazing grasses / browsing low-lying shrubs.	**EG$_{J}$1**	Enlarged temporalis for chewing strength.
		EG$_{J}$2	Large neck muscles for holding the head up / using head / horn to move snow / soil / vegetation.
		EG$_{J}$3	Analysis of stomach contents could identify whether they were grazers of grass, browsers of shrubs, or both.
EO	Horns may have been used for moving snow / soil to access vegetation.	**EO$_{J}$1**	Ossified nasal septum may have helped support this use of the horn.
		EO$_{J}$2	Horns becoming keeled / worn down over time suggests wear from grazing / using the horn like a plough / to move snow through winter.
EH	Large, hindgut is needed to carry out digestion of plant material.	**EH$_{J}$1**	Bacteria in the hindgut carry out cellulose digestion.
		EH$_{J}$2	As this food was excreted relatively undigested, woolly rhinoceros may have been an important seed disperser for shrubs / grasses (like modern-day elephants).
EC	Adapted to cold environment / mammoth-steppe due to long fur, shorter hair on legs, short tails, and small ears (one example).	**EC$_{J}$1**	Long, thick fur kept them warm / acted as insulation from the cold.
		EC$_{J}$2	Shorter hair on the legs would have made it easier to move through thick snow in winter, preventing snow from sticking to the limbs.
		EC$_{J}$3	Shorter tails / small ears reduced the surface area, i.e. minimised heat loss / cold damage at the extremities.
EB	A seasonal diet of different foods / different quantity of foods at different times of year.	**EB$_{J}$**	The hump was a fat reserve that was stocked up during spring / summer / abundance and was then used to survive the winters.
EL	Isotopes in the horns provide information about diet.	**EL$_{J}$**	Isotope analysis reveals chemical composition of the foods that were eaten.
EM	Horns may have been used for sexual selection of males (front horn largest in males).	**EM$_{J}$1**	The large horn may indicate favourable genetics / greater fitness.
		EM$_{J}$2	Horns may have been part of ritualised / agonistic displays when competing other males for females / mating.
ES	Woolly rhinoceroses show sexual dimorphism, with a larger horn on males.	**ES$_{J}$**	Horns may have been part of ritualised / agonistic displays when trying to out-complete other males for females / mating.
ED	Before fights, agonistic displays of aggression occur.	**ED$_{J}$**	This minimises fighting and, therefore, minimises injury; fighting commonly leads to some injury of both parties.
EU	Two teats on the udder suggests rearing of one or two offspring	**EU$_{J}$**	*K*-strategist / slow reproductive rate / lots of energy / parental care of small number of offspring.

	Evidence		Justification
EF	Damage from rhinoceros' horns / broken-and-healed jaws and ribs indicate damage from fighting.	**EF_J1 <u>or</u> EA_J1**	Fighting is a result of intraspecific competition for resources, e.g. food, mates, breeding sites, etc.
EA	Cave art depicts woolly rhinoceroses fighting.	**EF_J2 <u>or</u> EA_J2**	This competition could have been male-on-male and have occurred during breeding season to determine who got to breed.
ER	Fighting could be related to establishing and / or maintaining territories.	**ER_J**	When resources (e.g. food) are limited, as in the mammoth-steppe, an area containing these resources may be actively defended.
EP	Due to their large size, megafauna / woolly rhinoceros were unlikely to have had any / many predators.	**EP_J**	Skulls with feline-attack trauma suggests they may have been targets for big cats / sabre-tooth tigers / predators.

(H) Discusses what can be inferred about the way of life of the hominins that interacted with woolly rhinoceroses.

	Evidence		Justification
HX	As they were across Eurasia, between 460 000 and 12 000 years ago, woolly rhinoceroses would have co-existed with hominin species.	**HX_J1**	*Homo erectus* would likely have encountered woolly rhinoceros, as they were already present in Europe and Asia (thought to have been in Siberia at least 400 000 years ago).
		HX_J2	*Homo neanderthalensis* were present in Europe from 400 000 years ago / at the same time.
		HX_J3	*Homo sapiens* dispersed into Europe and Asia at least 50 000 years ago and possibly as long as 130 000 years ago / at the same time.
HT	Bones show markings suggesting that hominins were using tools to hunt / kill woolly rhinoceroses.	**HT_J1**	Stone weapons / stone tipped spears were used by *H. neanderthalensis* and *H. sapiens*, suggesting Mousterian or Upper Palaeolithic tool culture.
		HT_J2	Presence of meat in the diet is consistent with a hominin with a larger brain.
HB	Bones showing evidence of being butchered implies tool use.	**HB_J1**	Cut marking is evidence of meat having been cut from bones using a tool.
		HB_J2	Percussion marks suggest bone hit with a stone in order to break the bone open to access the marrow.
		HB_J3	Carcasses may also have been scavenged after being killed by feline predators / cave hyenas.
HP	Hominins (with one named example from *Homo erectus*, *Homo neanderthalensis*, *Homo sapien)* made / used tools.	**HP_J1**	*Homo erectus* made / used Acheulean tools.
		HP_J2	*Homo neanderthalensis* made / used Mousterian tools.
		HP_J3	*Homo sapiens* made / used Upper Palaeolithic tools
HC	Since woolly rhinoceroses are large prey, hominins would have used cooperative hunting techniques.	**HC_J**	Cooperative hunting would suggest developed communication / language method and corresponding enlargement of the frontal lobe / cortex / complex brain.
HF	Hominins (with one named example from *Homo erectus*, *Homo neanderthalensis*, *Homo sapien)* had controlled use of fire.	**HF_J1**	Charred bones show evidence of cooking.
		HF_J2	Cooked food / meat was more digestible / free from bacteria increasing health outcomes / energy / nutrient intake.

	Evidence		Justification
		HF_J3	Warmth from the fire enabled better survival in the cold environment / dispersal to cold places.
		HF_J4	Extending the length of the day enabled tool making / teaching / communication / enhanced cultural evolution.
		HF_J5	Fire light used to exploit caves for cave art / habitation.
HH	Bones / horns made into tools.	**HH_J**	Evidence of cultural evolution and teaching others to make tools; also indicates advanced communication / language.
HA	Hominins were making art, for example (one of): • bone carving • clay model of woolly rhinoceros • cave art.	**HA_J1**	Implies abstract thought, enlarged frontal lobe / complex brain.
		HA_J2	Age (bone carving, 12 000 years; clay model, 29 000–5 000 years; cave art, 36 000 years) implies it was made by *H. sapiens* (both *H. erectus* and *H. neanderthalensis* were extinct by then).
HS	Spear throwers / atlatl made from woolly rhinoceros' bones / horns.	**HS_J**	This Upper Palaeolithic tool technology shows complexity; made by *Homo sapiens*.

Judgement statement (the two areas are **E** 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 ecological niche of the woolly rhinoceros, the ancient hominins that interacted with them and what inferences can be made from this. Presents a well-planned discussion which is fully integrated and coherent. 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 • ideas not already included in the schedule.
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1	1 J OR 2 descriptions.
0	Lack of relevant evidence.

Cut Scores

Scholarship	**Outstanding Scholarship**
13 - 18	19 - 24