Assessment Schedule – 2010

Scholarship Biology (93101)

Evidence Statement

Question One

Processes (P) that have led to NZ's two species of pohutukawa

	Evidence		Justification
PA **PD**	Allopatric speciation described eg **geographical barrier** of ocean / sea. Divergent evolution / divergence of the two species from a common ancestor.	**PA_J**	NZ / Kermadec populations are **isolated / no gene flow** between the populations in NZ and Kermadecs.
PN	Natural selection / different selection pressures (eg temperature) described.	**PN_J**	Populations become phenotypically different (eg leaves) resulting in a change in allele frequencies / populations become reproductively isolated.
PF	Founder effect described eg limited number of pohutakawa / seeds introduced to Kermadecs or NZ	**PF_J**	The first pohutakawa / seeds to arrive in the Kermadecs (eg rafting) from a common (pohutakawa) ancestor in NZ may have had different combinations of alleles / allele frequencies to the population left in NZ. OR • The first pohutakawa / seeds to return to NZ (by Maori) may have had different combinations of alleles / allele frequencies to the population left in Kermadecs.
PM	Mutation(s) occur in (gene pool) of the population.	**PM_J**	Creates new alleles / phenotypes / variations which can be selected for / against by the different selection pressures in the two areas. (eg warmer in Kermadecs).
PG	Genetic drift described eg a random change in allele frequencies.	**PG_J**	The small gene pool of founder population in Kermadecs will have increased chance of alleles being lost / fixed / changed frequency.
PP	Polyploidy described eg when homologous chromosomes fail to separate / non-disjunction in meiosis.	**PP_J**	Instant speciation / new species formed as the number of chromosomes has changed preventing successful fertilization / causing reproductive isolation.

Genetics (G) responsible for creating three different coloured varieties of *M. excelsa*

	Evidence		Justification
GM_J	Mutation(s) changes alleles / enzymes / proteins / metabolic pathways so causing new / different flower colours.		
GS	Supplementary genes / epistasis described.	**GS_J**	Explains how genes interact to cause the three colours / 9 red :3 pink:4 yellow ratio.
GI	Incomplete dominance described *not co-dominance.*	**GI_J**	Incomplete dominance with two dominant alleles needed for red, one dominant and one recessive is pink and two recessive yellow.
GP	Metabolic pathway that produces flower colour is **changed** in some way.	**GP_J**	Explains how the change in the metabolic pathway may occur and lead to the different colour(s) eg enzyme changed / new enzyme (from mutation) so new step in the pathway creating a new colour / pathway disrupted so colour not created and flower is yellow.
GL	Alleles that code for red flowers are lost from gene pool on Motiti island.	**GL_J**	Explains how founder effect / genetic drift may have caused the loss of alleles coding for red from original yellow flowered population on Motiti island.
GG	Gene expression - describes alleles coding for colour being switched on or off.	**GG_J**	Explains how the switching on / off of alleles for deposition of colour may produce the different phenotypes.

Effects (E) of hybridization on future evolution of *Metrosideros.*

	Evidence		Justification
ER	Reduction in number of species / extinction of existing species.	**ER_J1** **ER_J2**	• Hybridization between the five Metrosideros species may result in only one species / loss of separate species as all individuals will be able to interbreed if reproductive isolating mechanisms lost. • Hybrids formed may be beter adapted to (changed) environment so **outcompete** and eliminate the parent species.
EI	Increase in number of species / formation of new species.	**EI_J1** **EI_J2**	• Hybrids better adapted (hybrid vigour) to survive in harsh conditions than parent speciesso have increased chances of survival which may lead to them becoming a new species if reproductive isolation occurs. • Hybrids formed may undergo (amphi)polyploidy if non-disjunction of chromosomes occurs, resulting in instant speciation / formation of a new species.
EN	No change in number of species.	**EN_J1** **EN_J2**	• Hybrids formed may not be as well adapted (as parent species) to survive in harsh conditions so have reduced survival chances / do not survive OR hybrid breakdown occurs and hybrids cannot reproduce / die out. • Hybrids do not become reproductively isolated from parent species / other species so no new species are formed.

Judgement statement (3 areas are P G E)

8	7 J's (two each area) and 2 descriptions
7	6 J's (one each area) and 1 description
6	5 J's (1 each area) and 2 descriptions
5	4 J's (one each area) and 1 description OR 5 J's (two in two areas)
4	3 J's and 2 descriptions OR 4 J's (two areas)
3	2 J's and 2 descriptions OR 3 J's
2	1 J and 1 descriptions OR 3 descriptions
1	1 description
0	No evidence provided which is relevant to the question

Question Two

Ecological Niche (E) comparison between Atlantic Salmon **(AS)** and Brown Trout **(BT)**

	Evidence		**Justification**
EH **EP**	AS young inhabit rivers only while BT young inhabit lakes, coastal seas and estuaries as well as rivers. AS has a narrow range of physiological tolerance to abiotic factors (eg temperature) compared to the BT.	**E_J1** **E_J2** **E_J3**	AS has fewer possible **habitats / niches** than BT so reduced chance for successful establishment . AS has fewer potential **food sources** than BT which may reduce survival chances hence successful establishment. As has fewer **breeding sites** than BT so reduced chances of reproductive success hence successful establishment. *Each justification can be used only once.*
ES	AS has a much larger body size / mass than the BT.	**ES_J**	As requires larger amounts of food to sustain itself / survive than BT hence reduced chance of successful establishment.

Breeding pattern (B) comparison between Atlantic Salmon **(AS)** and Brown Trout **(BT)**

	Evidence		**Justification**
BS	AS has fewer spawning / breeding sites as spawns in rivers only while BT can spawn in both rivers and lakes.	**BS_J**	As has fewer **breeding sites** than BT so reduced chances of reproductive success hence successful establishment. *EH_J3 and BS_J are mutually exclusive.*
BO	Breeding opportunities Most (95%) AS breed once in lifetime (then die) while BT breed annually. OR Can be described in terms of life span.	**BO_J**	AS adults have fewer breeding opportunities than BT so fewer offspring produced per adult in lifetime therefore reduced reproduction for AS.
BC	AS compete (intraspecific) aggressively for breeding sites while BT do not compete aggressively. *Not interspecific competition.*	**BC_J**	As aggression can harm / kill the fish so they are unable to breed which reduces size of the breeding population (reducing reproductive success). OR AS adults that lose out in competition for breeding sites will not breed so reducing the size of the breeding population.

Migration comparison (M) comparison between Atlantic Salmon **(AS)** and Brown Trout **(BT)**

	Evidence		**Justification**
MC	AS are long distance migrators while BT do not migrate.		
MM	AS has increased mortality / decreased survival during migration (in Pacific ocean).		Risks associated with migration increase mortality for AS by:
		MM_J1	Increased risk of predation from predators in the Pacific / fishing in the rivers as AS return.
		MM_J2	Reduced tolerance to warmer waters of Pacific ocean (compared to Atlantic ocean).
		MM_J3	Reduced food supply in warmer waters of Pacific ocean (compared to Atlantic ocean).
MN	Large numbers of AS are unable to successfully return back to spawning sites **(not** “get lost”**).**	**MN_J1**	Migratory cues for AS are not available or different from northern hemisphere eg magnetic field.
		MN_J2	AS migrate in the wrong direction as migration is innate and AS are programmed for the northern hemisphere.
ME	AS have increased energy expenditure during migration.	**ME_J**	Reduced / lack of energy supplies can lead to death of AS or reduce breeding success. OR AS must rely on stored energy to fuel return migration as it does not feed and may have insufficient supplies leading to death or reduced breeding success.

Judgement Statement (3 areas are E B M)

8	7 J's (two from each area) and 1 described
7	6J's (one from each area)
6	5 J's (one from each area)
5	4 J's (one from each area) **OR** 5 J's (from 2 areas)
4	4 J's (any area) **OR** 3 J's and 2 descriptions
3	2 J's and 2 descriptions
2	1 J and 1 descriptions **OR** 3 descriptions
1	1 description
0	No evidence provided which is relevant to the question

Question Three

Biological technique (T) for producing mammoth. **Evaluation (Eval)** of success of technique

	Evidence		**Justification**
TC1 **TC2**	• **cloning** using DNA from (frozen) mammoth cell. • place DNA in enucleated (fertilized) egg of elephant and implant egg into surrogate elephant mother .	**$TC2_J$**	African elephant is best potential surrogate because it has 98% DNA in common / larger than Asian elephant.
TP1 **TP2**	• Need to clone both sexes / male and female mammoths. • Multiple cloning / cloning from different mammoths (not same individual).	**$TP1_J$** **$TP2_J$**	• Both females and males are needed to get a **breeding population** (to be self-sustainable). • Needed to produce the **genetic variation** necessary for a self sustaining population.
Eval	Evaluation: Success likely to be **low** because... *(Evaluation MUST relate to the biological techniques producing a self sustaining population NOT ecology or evolution.)*	**Eval1** **Eval2** **Eval3** **Eval4**	• **Current** success rates for cloning is low. • Cloned individuals often show **reduced life expectancy** (so won't reach breeding age). • Need to clone **many** mammoths (including both sexes) for a self sustaining population. • Surrogate mother is a **different** species so reduced chance of viable offspring.

Evolutionary (V) implications for return of mammoth

	Evidence		Justification
V	Mammoths have increased risk of (repeat) extinction / unlikely to survive.	**V_J1**	Lack of genetic variation in the (small) population (founder effect).
		V_J2	Increased chances of harmful recessive alleles / mutations coming together through inbreeding.
		V_J3	No / limited resistance to **current day** diseases / pathogens.

Ecological (C) implications for return of mammoth

CH1	• Mammoths are adapted to a cold climate (eg hair, ears, fat layer, tusks).	**CH_J**	• Unlikely to survive as (everywhere) too warm / no suitable habitat / modern Arctic warmer than ice age Arctic / modern day Arctic has insufficient or unsuitable vegetation. OR
CH2	• Mammoths would require large amounts of suitable vegetation based on data from modern day elephants (eg 170-225 kg vegetation a day).		• Only likely to survive / only possible habitat (above) Arctic circle as this is the only place with (sufficiently) cold temperatures and abundant vegetation.
CC1	• Mammoths could provide a new food source for predators / scavengers.	**$CC1_J$**	• Increases the survival changes of top predators in the (Arctic) community (eg polar bear).
CC2	• Mammoths could destroy (fragile) habitat by trampling / eating (large amounts of) vegetation.	**$CC2_J$**	• Habitat destruction will kill off large numbers of the community as nowhere to live / food supplies destroyed.
CC3	• Mammoths consume large amounts of vegetation.	**$CC3_J$**	• Loss of producers will greatly reduce food for the consumers eg herbivore numbers greatly reduced.
CC4	• Mammoths may outcompete existing species for space / food / resources.	**$CC4_J$**	• Species composition of community will change eg herbivores die out as outcompeted which will cause carnivores to die out as no food.

Justification (Just) for bringing back mammoths

	Yes we should bring back mammoths because…	**Y_J1** **Y_J2** **Y_J3** **Y_J4**	• Could be put in controlled environment so wouldn't disrupt biological communities. • Would be able to control disease risks to mammoths if put in controlled environments. • Genetic diversity could be established and maintained through selective breeding. • Mammoths would provide research / scientific study opportunities.
	No we shouldn't bring back mammoths because…	**N_J1** **N_J2** **N_J3** **N_J4** **N_J5**	• scientific effort / time / money better spent on conserving current species / ecosystems / solving environment problems. • no suitable natural environment as currently it is too warm / not enough vegetation (mammoths not adapted and will die). • too disruptive to natural communities as will destroy habitats / disrupt food web / may cause extinction of other species. • lack of genetic diversity of mammoths which could lead to increased rates of genetic defects / disease so repeat extinction. • can't control disease risks for mammoths so repeat extinction.

**Candidates are only awarded grades for information that relates to the area that the information is in. eg a CH_J would not be awarded in the justification only a N_J2*

Judgement Statement (5 areas are T V C Eval Just)

8	8 J's (all five areas)
7	7 J's (any 4 areas) and 3 descriptions
6	6 J's (any 3 areas) and 2 descriptions
5	5 J's (any 3 areas) and 1 description
4	4 J's (from three areas) OR 3 J's (from two areas) and 2 descriptions
3	2 J's and 1 description
2	1 J and 1 description OR 3 descriptions
1	1 description
0	No evidence provided which is relevant to the question