

# 3

91603M



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

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## Koiora, Kaupae 3, 2019

### 91603M Te whakaatu māramatanga ki ngā urupare a te tipu me te kararehe ki te taiao

2.00 i te ahiahi Rātū 12 Whiringa-ā-rangi 2019  
Whiwhinga: Rima

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā urupare a te tipu me te kararehe ki te taiao.	Te whakaatu māramatanga hōhonu ki ngā urupare a te tipu me te kararehe ki te taiao.	Te whakaatu māramatanga matawhānui ki ngā urupare a te tipu me te kararehe ki te taiao.

Tirohia mēnā e rite ana te Tau Ākongā ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

**Me whakamātau koe i ngā tūmahi KATOĀ kei roto i tēnei pukapuka.**

Mēnā ka hiahia whārangi atu anō koe mō ō tuinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā e tika ana te raupapatanga o ngā whārangi 2–21 kei roto i tēnei pukapuka, ā, kāore tētahi o aua whārangi i te takoto kau.

**ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.**

TAPEKE

MĀ TE KAIMĀKA ANAKE

## TŪMAHI TUATAHI

Ko te rerenga a ngā manu heke te rerenga roa rawa kotahi tonu o ngā kararehe katoa o te ao. Kei te takiwā o te 12 000 km te rerenga kotahi tonu ka taea e ngā kūaka, *Limosa lapponica*, he roa atu i ētahi atu manu e mōhiotia ana.

I kitea e ngā kairangahau ka wehe ngā kūaka i ngā whenua i Aotearoa ehara i te wāhi whakawhānau mai i te wiki tuarua o Poutūterangi ki te pito o te marama. He roa, ko te tikanga kāore he taunga, te rerenga mai i ngā whenua ehara i te wāhi whakawhānau kia tae atu ki ngā whenua okioki me te whakaora i te rohe o te Moana Kōwhai o te Rāwhiti o Āhia. I muri i tētahi wā okioki me te whakaora toharite o te 41.2 rā, ka rere anō mā te raki o Te Moananui-a-Kiwa, ā, ka rere whakarua ki ngā whenua whakawhānau o Alaska.

I te wā whakawhānau i te takutai o Alaska, e whā ngā hua a te kūaka ka whakawhānau mai. Ka mahi tahi ngā kātua ki te awahi i te hua me te manaaki i ngā pīpī whai muri i te paotanga mai.

Kātahi ka hoki mai ngā kūaka ki Aotearoa mā te rerenga kotahi tonu i Te Moananui-a-Kiwa, he 7-9 rā te roa, mai i te Mahuru ki waenga o te Whiringa-ā-nuku. Ka tae mai ngā manu pūhou ki Aotearoa whai muri i te rerenga mai i Te Moananui-a-Kiwa i te wā kei te takiwā o te 4 marama te pakeke.



Whakaahua 1: Te ara hekenga o te kūaka.

Geographx



Whakaahua 2: He kūaka e rere ana.

<http://nzbirdsonline.org.nz/species/bar-tailed-godwit>



Whakaahua 3: Ngā hua a te kūaka.

<http://nzbirdsonline.org.nz/species/bar-tailed-godwit>

## QUESTION ONE

Migrating birds make the longest non-stop flights in the animal kingdom. Bar-tailed godwits or kuaka, *Limosa lapponica*, can fly about 12 000 km at one time; further than any other known birds.

Researchers found that godwits leave non-breeding grounds of New Zealand from the second week of March to the end of the month. They make the long, usually non-stop, flight from non-breeding grounds to coastal rest-and-recovery grounds in the Yellow Sea region of East Asia. After an average rest-and-recovering period of 41.2 days, they fly over the north Pacific Ocean before heading northeast to the Alaskan breeding grounds.

During the breeding season, the godwits breed, laying a clutch of four eggs on the coast of Alaska. Parents share incubation and brooding post-hatching.

The godwits then return to New Zealand on a non-stop flight across the Pacific Ocean, taking 7–9 days, from September to mid-October. Juveniles arrive in New Zealand after their first trans-Pacific flight when approximately four months old.



Fig. 1: The migration route of the bar-tailed godwit.

Geographx



Fig 2: A bar-tailed godwit in flight.

<http://nzbirdsonline.org.nz/species/bar-tailed-godwit>



Fig. 3: A clutch of eggs of the bar-tailed godwit.

<http://nzbirdsonline.org.nz/species/bar-tailed-godwit>



Evaluate the behaviours exhibited by the bar-tailed godwit during this migratory process.

The evaluation should:

- describe migration
- explain which cue is the most likely to encourage migration of the godwit, AND explain three methods the godwit could use to navigate this migratory path effectively
- compare the costs and benefits to the bar-tailed godwit of making this long-distance migration.

**There is more space for your  
answer to this question on  
page 7.**





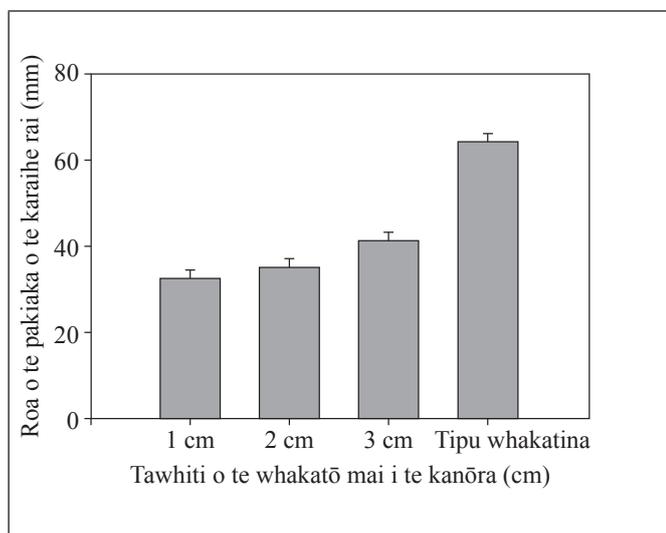
## TŪMAHI TUARUA

Whakatipuria ai te kanōra (*Brassica napus*) i Aotearoa me Ahitereiria. Ko te nuinga ka whakamahia hei mahi hinu kanōra mō te kai. He tarutaru te karaihe rai ā-tau (*Lolium rigidum*) e kitea noatia ana i te taha o ngā māra kanōra, e whakaheke ana i te kaha o te tipu. Ko te pēhi i ngā tarutaru mā ngā matū māori e whakaputaina ana, e tukuna ana hoki e ngā tipu māra tētahi rauhanga mō te whakahaere tarutaru. I whakahaerehia e ngā kairangahau ngā whakamātautau e ai ki ngā āhuatanga taketake e rua:

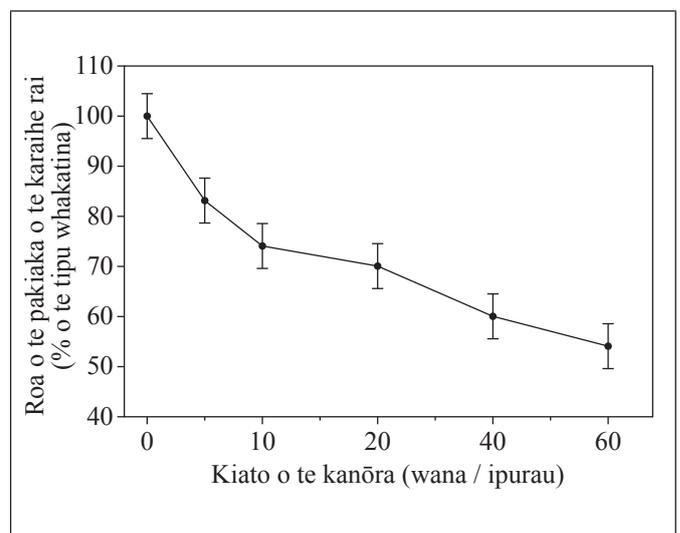
- te kiato, me
- te tawhiti i waenga i te kanōra me te karaihe rai ā-tau

kia whakatau mēnā he pānga nui ō ēnei āhuatanga e rua, kotahi rānei ki te mahi a te wana kanōra ki te whakararuraru i te karaihe rai.

E whakaatu ana te Whakamātautau 1 me te 2 i ngā pānga o te tawhiti o te whakatō me te kiato o te kanōra ki te tipu o te pakiaka o te karaihe rai.



Whakaahua 1. Te pānga o te tawhiti o te whakatō o ngā matū pakiaka kanōra ka tukuna, ki te tipu o ngā pakiaka o te karaihe rai ā-tau. He 1 cm, 2 cm me te 3 cm te tawhiti mai i ngā tipu kanōra, ā, ka whakatipuria ngā tipu whakatina me te kore kanōra.



Whakaahua 2. Te pānga o te kiato o te kanōra ki te tipu o te pakiaka o te karaihe rai. % o te roa o te pakiaka ina ka whakatauritea ki te tipu whakatina (te roa o te pakiaka o te karaihe rai i whakatipuria me te kore kanōra).

Matapakitia te urupare o ngā pakiaka kanōra ki te tō-ā-papa me ngā pānga o te tawhiti o te whakatō me te kiato o te kanōra ki te tipuranga o te pakiaka o te karaihe rai.

I tō whakautu me whakamahi ngā whakaaturanga mai i ngā whakamātautau ki te:

- āta whakaahua i te urupare o te tipu i roto i te tipuranga o ngā pakiaka mai i ngā wana me te pāhekohekotanga i waenga i te kanōra me te karaihe rai
- whakamārama he pēhea te pā mai o te urupare tipu i roto i ngā pakiaka mai i ngā wana
- whakataurite i te roa o te pakiaka o ngā wana karaihe rai i roto i ngā āhuatanga rerekē i runga ake
- tātari i ngā otinga hei whakatakoto he pēhea te tuku a ēnei urupare e rua i te huanga urutau ki ngā tipu kanōra.

## QUESTION TWO

Canola (*Brassica napus*) is grown in both New Zealand and Australia. Most of it is used to make food-grade canola oil. Annual ryegrass (*Lolium rigidum*) is a common weed found growing alongside canola crops, reducing how well they grow. Suppression of weeds by natural chemicals produced and released by crop plants is a tactic for weed management. Researchers carried out experiments on two basic factors:

- density, and
- distance between canola and annual ryegrass

to establish if either or both of the above features had any major roles on canola seedling interference ability on the ryegrass.

Experiment 1 and 2 show the effects of sowing distance and density of canola on root growth of ryegrass.

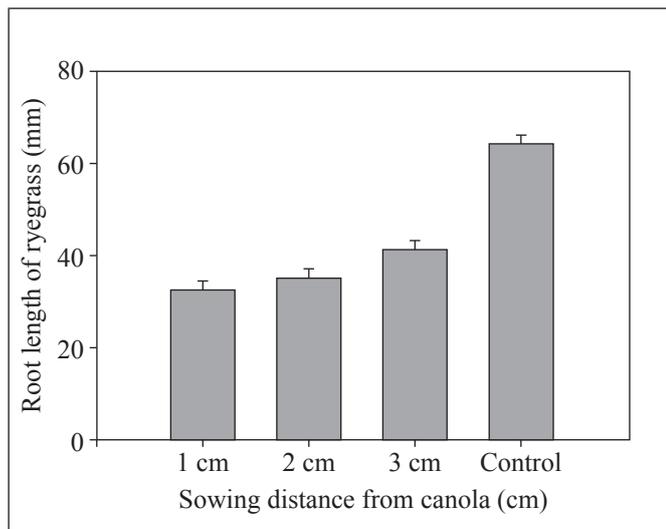


Fig. 1. Sowing distance effect of canola root chemicals released on root growth of annual ryegrass. The distances were 1 cm, 2 cm, and 3 cm from the canola plants, and the control is grown in the absence of canola.

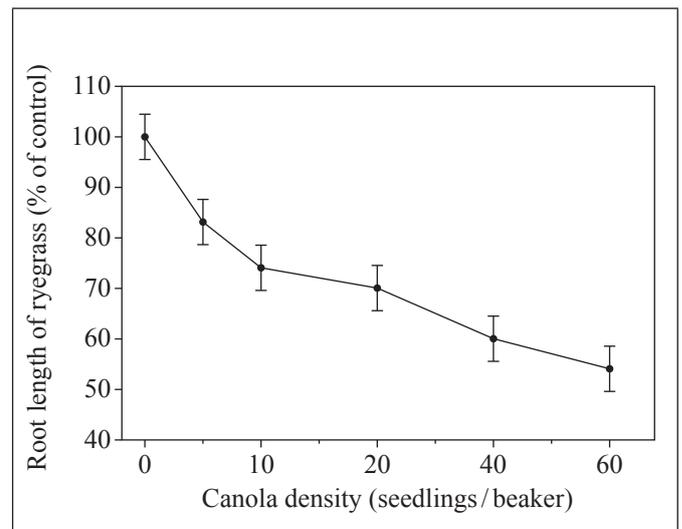


Fig. 2. Effect of density of canola on the root growth of ryegrass. % root length compared to control (root length of rye grass planted without canola present).

Discuss the response of the canola roots to gravity and the effects of sowing distance and canola density on ryegrass root growth.

In your answer use evidence from the experiments to:

- fully describe the plant response in the growth in roots from seedlings and the interaction between canola and ryegrass
- explain how the growth response in the roots from seedlings occur
- compare the ryegrass seedling root length in the various conditions above
- analyse the results to suggest how these two responses could provide an adaptive advantage to the canola plants.



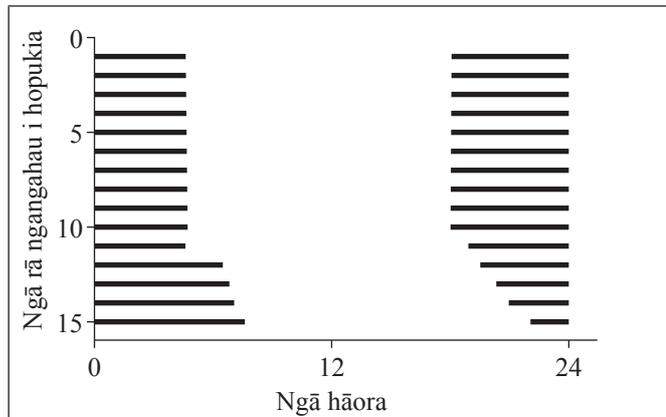






## TŪMAHI TUATORU

He taketake te momo kiwi, te roroa, *Apteryx haastii*, ki Te Waipounamu. I roto i tētahi whakamātautau, i mātakitakina ngā mahi a ngā kiwi nei mō te 10 rā i roto i ngā āhuatanga taiao noa, ā, kātahi ka nekehia atu ki roto i te pōuritanga pūmau i muri i te rā 10. E whakaaturia ana ngā otinga i roto i te hoahoa mahinga i raro.



Whakaahua 1: Ngā mahinga a te roroa mō te 10 rā i roto i ngā āhuatanga taiao noa whai muri i ngā rā e 5 atu anō i roto i te pōuritanga pūmau.



Whakaahua 2: Te roroa.

<http://nzbirdsonline.org.nz/species/great-spotted-kiwi>

He tiaki rohe te āhua o te roroa, ā, he ngangahau i te pō. Ina whakatauhia ngā rohe, i te nuinga o te wā ka whakatauhia ngā raruraru mā ngā tangi, ā, atu ki te 1.2 km te tawhiti o te rangona atu.

Ina takatū ana ki te wā e aihono ai ngā roroa, ka puta te tangi a te uwaha, e whakamōhio atu ana ki ngā toa kei te pātata ia. Mēnā kei te hiahia te toa, ka whai i te uwaha, ā, mēnā kei te pērā anō te hiahia atu o te uwaha ka noho ēnei kiwi hei **hononga takirua**.

Ka puta i te roroa tētahi hua kotahi, nunui (20% o tana taumaha ā-tinana). He nui te pūngao ka pau hei whakaputa i tēnei. Mā te auau o te ine i ngā uwaha, i mōhio ai ngā tohunga pūtaiao i te wā e taumaha haere ana ngā roroa nā te "hapūtanga". I kitea e toru tekau mā whā rā te roa e hiahiatia ana kia tipu ai he hua toharite. Ko te nuinga o ētahi atu momo manu he kotahi ki te rua rā te roa mō tēnei.

He tapatahi ngā uwaha o te roroa, ā, he rite tonu te whakawhānau mai o te hua kotahi anake. Te āhua nei te kino o te taiao i hiahia ai ēnei uwaha ki te āwhina i ngā hoa ki te awahi i te hua, me te aha kua tino whakaheke i te maha o ngā hua ki te mea iti rawa ka taea.

He 83 rā te toharite o te kiwi e awahi ana i ia hua. I te nuinga o te wā ko te toa kē ka whakapau kaha me te wā ki te awahi me te tiaki i te hua. Ka noho te toa ki te kōhanga mō te nuinga o te rā, ā, ka wehe anake ki te rapu kai mō ētahi hāora torutoru noa i ia pō. Ko te mea pai mō ngā toa, he torutoru noa ngā rā whai muri i te paopaotanga mai ka kaha te pīpī ki te tiaki i a ia anō. I te kotahi wiki mai i te paopaotanga, ka taea te hongihongi kai haere ki tōna kotahi, ka hoki anake ki te rua kia whakamahanatia e te toa i te awatea me tētahi wāhanga o te pō. Kātahi ka āhei te toa ki te whakarahi ake anō i te taumaha neke atu i te 20% i heke i roto i taua wā.

Matapakitia he pēhea te āwhina a te whanonga o te roroa i a ia anō kia ora ai i roto i tana pae rauropi.

I tō tuhinga, me:

- whakaahua i te tauira ngangahau o te roroa, he aha te hononga takirua, me te rerekētanga i waenga i te rohe noho me te takiwā kāinga
- whakamārama he pēhea te whakatina i te tauira ngangahau i roto i te roroa, ME ngā utu me ngā painga o tana whanonga tiaki rohe
- matapaki he pēhea te āwhina a ngā whanonga o te whai hononga takirua, te pupuri me te tiaki rohe, me ngā tauira ngangahau kia ora ai te roroa.

### QUESTION THREE

The great spotted kiwi or roroa, *Apteryx haastii*, is a species of kiwi endemic to the South Island of New Zealand. In an experiment, their activity was observed over 10 days in normal environmental conditions, and they were then moved into constant darkness after day 10. The results are displayed in the actogram below.

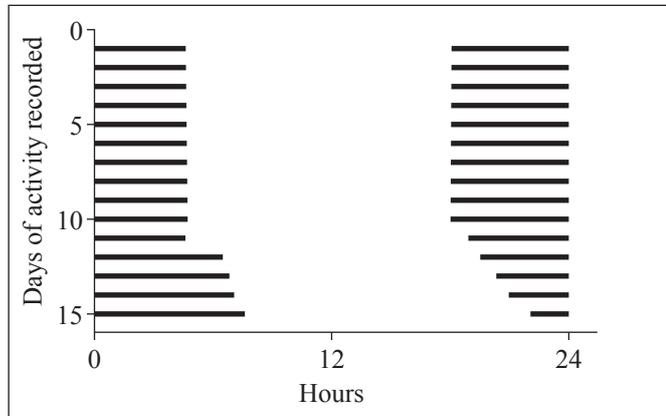


Fig 1: The great spotted kiwi activity of 10 days in normal environmental conditions followed by another 5 days in constant darkness.



Fig 2: The great spotted kiwi.  
<http://nzbirdsonline.org.nz/species/great-spotted-kiwi>

The great spotted kiwi is territorial and is active at night. Once territories are established, disputes are usually resolved by calls, which can be heard up to 1.2 km away.

When the great spotted kiwi are ready for mating, a female kiwi will call, alerting the male that she is near. If the male is interested, he will follow the female, and if she is receptive they will form a **pair bond**.

The female great spotted kiwi produces a single, large egg (20% of her body weight). This takes a lot of energy to produce. By regularly weighing females, scientists were able to determine when their weights started to rise as a result of “pregnancy”. It was found that thirty-four days were needed to grow an average egg. Most other species of birds take only one or two days for this task.

Females of the great spotted kiwi are monogamous, and consistently lay clutches of only one egg. The harsh environment seems to compel these females not only to help their partners with incubation, but also to reduce their clutch size to the absolute minimum.

The kiwi spend an average of 83 days incubating each egg. It is mostly the males that spend time and energy looking after the egg. A male will sit on the nest almost all day, leaving it to search for food for only a few hours each night. Luckily for the males, after the first few days, the chicks become self-reliant. A week after hatching, they can sniff out food on their own, and they return to the burrow only to be warmed by the male during the day and part of the night. Males can then slowly begin to recover the more than 20% of body weight they have lost.

Discuss how the great spotted kiwi’s behaviours help it to survive in its ecological niche.

In your answer:

- describe the activity pattern of the great spotted kiwi, what a pair bond is, and the difference between territory and home range
- explain how the activity pattern is controlled in the great spotted kiwi AND the costs and benefits of its territorial behaviour
- discuss how behaviours of forming a pair bond, keeping and maintaining territories, and activity patterns help the great spotted kiwi to survive.

















*English translation of the wording on the front cover*

## Level 3 Biology, 2019

### 91603 Demonstrate understanding of the responses of plants and animals to their external environment

2.00 p.m. Tuesday 12 November 2019  
Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the responses of plants and animals to their external environment.	Demonstrate in-depth understanding of the responses of plants and animals to their external environment.	Demonstrate comprehensive understanding of the responses of plants and animals to their external environment.

91603M

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**You should attempt ALL the questions in this booklet.**

If you need more room for any answer, use the extra space provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–21 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**