

## **Supplementary Material: Appendix B**

### **Full Questionnaire**

#### **Kiwi Husbandry Survey**

Thank you for participating in this research into the current husbandry practices for captive kiwi.

This survey is part of wider PhD research into the husbandry, behaviour and welfare of captive kiwi. The survey aims to gather information about current housing and management of kiwi in New Zealand and overseas facilities. The results will be used to focus future research efforts to support optimum captive management of kiwi and to better understand the influence of features of the captive environment and management procedures on kiwi health, behaviour and welfare.

The research is being conducted under the supervision of Nicholas Ling and Clare Browne at the University of Waikato, Ngaio Beausoleil at Massey University, New Zealand, and Kris Descovich at the University of Queensland, Australia, and with the approval of the Zoo and Aquarium Association (ZAA Manager, NZ Partnerships & Conservation, Todd Jenkinson).

This survey is not designed to critique the management of captive kiwi in any individual facility, but rather aims to develop an overview of actual practice and identify gaps in understanding about the potential effects of environmental features on kiwi behaviour and welfare so that they can be further studied. As a participant in this study, you and your facility will remain anonymous in any material produced from the research. The data collected will be used in a PhD dissertation, conference papers and journal articles. De-identified raw data from this study will be kept in secure storage for 5 years, as per University of Waikato policy, and any personal data will be destroyed at the completion of the project. Information identifying the institution and individual kiwi will be removed from data before publishing but may be used by the researchers to identify facilities and kiwi for possible further observational behaviour research. Information about individual kiwi will not be linked to specific facilities and results will be presented at the population level.

You will be asked about each of your enclosure types, and about your individual kiwi. Questions will cover substrate, lighting regime, feeding, enrichment, behavioural and health issues, and facility hours and visitor numbers. The length of the survey will depend on the number of different enclosure types, and the number of kiwi housed in your facility, taking an

average of ten minutes per enclosure.

By ticking the 'participate' box below you are indicating that you have read this information sheet and give your consent to take part. Participation in this survey is completely voluntary. There are no risks associated with completing the survey. As a participant, you have the right to ask any question about the study. You can leave the survey and return to it at any stage if you need time to gather information. You may decline to answer any question in the survey or terminate your participation in the survey at any point. If required, you may withdraw from the survey and withdraw all data contributed without penalty or repercussion at any point up to two weeks after our follow up call.

If you have any questions, please get in touch with Rebecca (Rebecca.L.Connor@gmail.com) or her supervisor Nicholas Ling (nicholas.ling@waikato.ac.nz).

This research project has been approved by the Human Research Ethics Committee of the University of Waikato under HREC(HECS)2021#53. For any ethical questions or concerns please contact the Chair of the Committee, email hecs-ethics@waikato.ac.nz, postal address, University of Waikato, Te Whare Wananga o Waikato, Private Bag 3105, Hamilton 3240.

☐ I agree to participate in this research (1)

# Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
Facility	1	What is the name of your facility?	Open		
	2	How many visitors (on average/approximately) attend your facility on weekend days?	Open		
	3	How many visitors (on average/approximately) attend your facility on week days?	Open		
	4	What time do visitors have access to your kiwi enclosures? (Opening until closing)	Open		
Diet	5	What do you feed your kiwi? (e.g., the Massey University diet, or the Massey diet with adaptations such as extra vitamins, or something else?)	Open		
	6	How is kiwi food presented to the kiwi?	Multi Choice	Test tubes Bowl/dish Other (Type)	
Health Checks	7	How often are health checks (by keepers) given to kiwi? What does this entail? (e.g., visual check, physical check, etc)	Form Field - Open	Daily (Type in) Twice Weekly (Type in) Weekly (Type in) Fortnightly (Type in) Monthly (Type in) Bi-Monthly (Type in) 6 monthly (Type in) Yearly (Type in) Other (Type in)	
	8	Do you have a health check form or record that is used/kept by keepers?	Binary	Yes No	
	9	How often are kiwi health checked by a vet?	Multi Choice	Monthly Bi-Monthly 6 monthly Yearly Only if showing signs of sickness Other (Type in)	
	10	How often are kiwi weighed?	Multi Choice	Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	11	What method/model is used to evaluate the body condition of your kiwi?	Open		
Data collection	12	Do you routinely collect information about visitor behaviour to your kiwi enclosures?	Binary/Text	Yes (Please provide details of how you collect the data and what it is used for) No	
	13	Do you routinely collect information about the behaviour of your kiwi?	Binary/Text	Yes (Please provide details of how you collect the data and what it is used for) No	
Nocturnal houses					
Nocturnal houses	14	How many nocturnal houses do you have? (i.e., a room or building where kiwi are housed in indoor enclosures on a reverse lighting schedule for visitors to see kiwi. Please note, this question relates to the number of individual buildings holding kiwi, NOT the number of enclosures within the house)	Multi Choice	0 1 2 3 Other (Type in)	Skip To: "Outside On-Display" (Q52) if 0
Flooring and leaf litter	15	Is the substrate (flooring) made up of soil and leaf litter?	Binary/Text	Yes No (please type in what is used for the substrate)	

## Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
	16	How often is leaf litter added to enclosures (i.e., topped up) in nocturnal house?	Multi Choice	Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	17	Where is the leaf litter sourced from for nocturnal houses?	Open		
	18	How is soil or leaf litter filtered or processed before being placed in the enclosures in the nocturnal houses?	Open		
	19	How long between the leaf litter being collected and spread through out the enclosure in the nocturnal houses?	Multi Choice	Less than 12 hours 12 to 24 hours 24 to 48 hours 48 to 72 hours 72 hours plus Other (Please type in)	
	20	How is soil or leaf litter filtered or processed before being placed in enclosure?	Open		
	21	How often is the substrate (or part of) wet down in the nocturnal house?	Multi Choice	Never Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	22	How often is the substrate (or part of) turned over in enclosures in the nocturnal house?	Multi Choice	Never Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	23	How often are subsoil and leaf litter replaced completely in the nocturnal houses?	Multi Choice	6 monthly Yearly Bi-Yearly Other (Type in)	
<b>Nocturnal House Enclosures</b>					
<b>Nocturnal house X</b>		<b>These questions refer to the enclosures within your x<sup>st</sup> Nocturnal house</b>			
<b>Lighting</b>	24	Does the light regime (amount of time/start time in night phase/light phase) change over the year or remain static?	Multi Choice	Static (no change) Seasonal change Other change (Open)	
	25	What is the start time of the following currently in the nocturnal house (approximately)?	Form Field - Open	Dusk' lighting (if applicable) (Please Type) Night time lighting (Please Type) 'Dawn' lighting (if applicable) (Please Type) Day time lighting (Please Type)	

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Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
	26	What colour of lighting is used in the nocturnal house?	Multi Choice	Red Blue Yellow/Orange White Mixed colour (Open) Other (Open)	
	27	Is any UV lighting used in the nocturnal house enclosures?	Binary	Yes No	
Sound and Visitors	28	Is a sound scape (I.e., wind sound, bird song) provided in the nocturnal house?	Binary/Text	Yes (please give details of what is used and how) No	
	29	What sort of window/barrier exists between kiwi and visitors?	Open	Wooden Fence (please enter approx height) Glass/wall barrier to visitor head height or below Glass/wall barrier to visitor head height or above (not full barrier, does not reach roof) Full barrier to ceiling with walls/single glazed glass Full barrier to ceiling with walls/double glazed glass Other (please type in)	
	30	Is Kiwi enclosure floor at visitor ground level or raised?	Binary/Text	Ground Level Raised (please give details of how far the enclosure floor is raised off the visitor floor level)	
Food and Enrichment	31	What time/how often are kiwi in the Nocturnal house fed?	Open		
	32	What sort of enrichment is provided for the kiwi? How often is it provided? (Please select all that apply)	Form Field - Open	Leaf litter (Please enter frequency of supply) Logs (Please enter frequency of supply) Worms (Please enter frequency of supply) Other Insects (Please enter frequency of supply) Other (Open)	
Temperature and Humidity	33	Is the temperature in the nocturnal house regulated?	Binary/Text	Yes (please type in set temp in degrees celsius) No	
	34	Is the humidity in the nocturnal house regulated?	Binary/Text	Yes (please type the humidity level you attempt to maintain) No	
Data collection	35	Do you have video cameras installed inside the enclosures of the nocturnal house?	Binary	Yes No	
	36	Do you have video cameras installed inside the nest boxes/dens in the nocturnal house?	Binary	Yes No	
	37	Do kiwi have access to nest boxes during their night period?	Binary	Yes No Other (type in)	
Keepers	38	How many keepers have contact with kiwi in this nocturnal house?	Open		
	39	How often do keepers enter the enclosures during kiwi night time period?	Multi Choice	Once daily Twice daily Three times daily Four times daily Other (please type in)	

# Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
	40	How often do keepers enter the enclosures during kiwi day time period?	Multi Choice	Once daily Twice daily Three times daily Four times daily Other (please type in)	
<b>Nocturnal House Enclosure</b>					
<b>Enclosure X</b>		<b>These questions refer to the X enclosures within your X Nocturnal house</b>			
	41	What is the size of the enclosure (m2)?	Open		
	42	How many nest boxes are in the enclosure?	Open		
	43	What is the name of the 1st kiwi housed in this enclosure?	Open		Provided name is used in kiwi questions
<b>Kiwi X</b>	44	How old is (kiwi name)?	Open		
	45	What sex is (Kiwi name)?	Binary	Male Female	
	46	How long has (Kiwi name)	Form Field - Open	Been in this enclosure? (Please type) Been on display for the public (in any on display enclosure within your facility)? (Please type)	
	47	What is the most recent weight of (kiwi name)?	Open		
	48	Do you (or other keepers) have any particular behavioural concerns regarding (name)?	Open		
	49	Are there any particular health concerns regarding (Kiwi name)? Any medical history?	Open		
	50	Is there a second kiwi housed in this enclosure?	Binary/Text	Yes (please type in name) No	Yes - repeat kiwi questions (Q44-59) No - go to Question 51
	51	Is there a x+1 enclosure in this nocturnal house?	Binary	Yes No	Yes - repeat enclosure questions (Q41-50) No - go to outdoor on-display questions (Q52)
<b>Nocturnal House questions 24-53 repeat based on answer to Q14, How many Nocturnal houses do you have?</b>					
<b>Outdoor on-display enclosures</b>					
	52	Do you have any outdoor on-display enclosures (where visitors can see kiwi in outdoor enclosures after dark)?	Binary	Yes No	Yes - continue No - go to Off-display questions (Q83)
	53	What time do visitors have access to the outdoor on display enclosures? (Opening of display until closing)	Open		
	54	What sort of window/barrier exists between kiwi and visitors?	Multi Choice	Barrier to adult waist height or below Barrier between adult waist height and adult height height Barrier between adult head height and ceiling (not full barrier, does not reach roof) Full barrier to ceiling with walls/single glazed glass Full barrier to ceiling with walls/double glazed glass Other (please type in)	
	55	Is Kiwi enclosure floor at visitor ground level or raised?	Binary/Text	Ground Level Raised (please give details of how far the enclosure floor is raised off the visitor floor level)	
<b>Flooring and leaf litter</b>	56	Is the substrate (flooring) made up of soil and leaf litter?	Binary/Text	Yes No (please type in what is used for the substrate)	

## Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
	57	How often is leaf litter added to enclosures (i.e., topped up)?	Multi Choice	Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	58	Where is leaf litter sourced from?	Open	Previous answer: {X} (please edit if incorrect).	Provides previous answer from Noc house questions
	59	How long between the leaf litter being collected and spread through out the enclosure?	Multi Choice	Less than 12 hours 12 to 24 hours 24 to 48 hours 48 to 72 hours 72 hours plus Other (Please type in)	
	60	How is soil or leaf litter filtered or processed before being placed in the enclosures?	Open	Previous answer: {X} (please edit if incorrect).	Provides previous answer from Noc house questions
	61	How often is the substrate (or part of) wet down?	Multi Choice	Never Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	62	How often is the substrate (or part of) turned over in enclosures?	Multi Choice	Never Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	63	How often are subsoil and leaf litter replaced completely in the nocturnal houses?	Multi Choice	6 monthly Yearly Bi-Yearly Other (Type in)	
Food and Enrichment	64	What time/how often are kiwi fed?	Open		
	65	What sort of enrichment is provided for kiwi?	Form Field - Open	Leaf litter (Please enter frequency of supply Logs (Please enter frequency of supply Worms (Please enter frequency of supply Other Insects (Please enter frequency of supply Other (Open)	
Data collection	66	Do you have video cameras installed inside the enclosures of the outside on display enclosures?	Binary	Yes No	

# Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
	67	Do you have video cameras installed inside the nest boxes/dens in the outside on display enclosures?	Binary	Yes No	
	68	Do kiwi have access to nest boxes during their night period?	Binary	Yes No Other (type in)	
Keeper	69	How many keepers have contact with kiwi in this outside on display enclosures?	Open	Previous answer: {X} (please edit if incorrect).	Provides previous answer from Noc house questions
	70	How often do keepers enter the enclosures during kiwi night time period?	Multi Choice	Once daily Twice daily Three times daily Four times daily Other (please type in)	
	71	How often do keepers enter the enclosures during kiwi day time period?	Multi Choice	Once daily Twice daily Three times daily Four times daily Other (please type in)	
Outdoor On Display Enclosure					
Enclosure X		<b>Outdoor on display enclosure</b> <b>These questions refer to the X outside on display enclosure.</b>			Repeat Q72-82 for every outdoor on-display enclosure
	72	What is the approximate size of the enclosure (m2)?	Open		
	73	How many nest boxes are in the enclosure?	Multi Choice	0 1 2 Other (type in)	
Kiwi X	74	What is the name of the 1st kiwi housed in this enclosure?	Open		Name is used in kiwi questions
	75	How old is (kiwi name)?	Open		
	76	What sex is (Kiwi name)?	Binary	Male Female	
	77	How long has (Kiwi name)	Form Field - Open	Been in this enclosure? (Please type) Been on display for the public (in any on display enclosure within your facility)? (Please type)	
	78	What is the most recent weight of (kiwi name)?	Open		
	79	Do you (or other keepers) have any particular behavioural concerns regarding (name)?	Open		
	80	Are there any particular health concerns regarding (Kiwi name)? Any medical history?	Open		
	81	Is there a second kiwi housed in this enclosure?	Binary and Text	Yes (please type in name) No	Yes - repeat kiwi questions (Q75-80) No - go to question 82
Enclosure X+1	82	Do you have a x+1 Outside On display enclosure?	Binary	Yes No	Yes - repeat enclosure questions (Q72-81) No - go to question 83
Off-Display enclosures					
	83	Do you have enclosures where birds are held for off-display purposes?	Binary	Yes No	Yes - continue No - go to question 118
Flooring and leaf litter	84	Is the substrate (flooring) made up of soil and leaf litter?	Binary and Text	Yes No (please type in what is used for the substrate)	



## Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
	85	How often is leaf litter added to enclosures (i.e., topped up)?	Multi Choice	Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	86	Where is the leaf litter sourced from?		Previous answer: {X} (please edit if incorrect).	Provides previous answer from Noc house questions
	87	How long between the leaf litter being collected and spread through out the enclosure?	Multi Choice	Less than 12 hours 12 to 24 hours 24 to 48 hours 48 to 72 hours 72 hours plus Other (Please type in)	
	88	How is soil or leaf litter filtered or processed before being placed in enclosure?	Open	Previous answer: {X} (please edit if incorrect).	Provides previous answer from Noc house questions
	89	How often is the substrate (or part of) wet down?	Multi Choice	Never Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	90	How often is the substrate (or part of) turned over?	Multi Choice	Never Daily Twice Weekly Weekly Fortnightly Monthly Bi-Monthly 6 monthly Yearly Other (Type in)	
	91	How often are subsoil and leaf litter replaced completely?	Multi Choice	6 monthly Yearly Bi-Yearly Other (Type in)	
Food and Enrichment	92	What time/how often are kiwi fed?	Open		
	93	What sort of enrichment is provided for kiwi?	Form Field - Open	Leaf litter (Please enter frequency of supply Logs (Please enter frequency of supply Worms (Please enter frequency of supply Other Insects (Please enter frequency of supply Other (Open)	
Data collection	94	Do you have video cameras installed inside the enclosures?	Binary	Yes No	

## Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
	95	Do you have video cameras installed inside the nest boxes/dens?	Binary	Yes No	
	96	Do kiwi have access to nest boxes during their night period?	Binary	Yes No Other (type in)	
<b>Keeper</b>	97	How many keepers have contact with kiwi in this nocturnal house?	Open	Previous answer: {X} (please edit if incorrect).	Provides previous answer from Noc house questions
	98	How often do keepers enter the enclosures during kiwi night time period?	Multi Choice	Once daily Twice daily Three times daily Four times daily Other (please type in)	
	99	How often do keepers enter the enclosures during kiwi day time period?	Multi Choice	Once daily Twice daily Three times daily Four times daily Other (please type in)	
<b>Off Display Enclosure Enclosure X</b>		<b>Off Display enclosure</b> <b>These questions refer to the X off display enclosure.</b>			
	100	Where is the enclosure based?	Multi Choice	Outside in an area visitors have no access to Outside in an area visitors walk past Inside Other (Please type in)	
	101	What fencing is separating the enclosure from visitors?	Multi Choice	Fence to visitor waist height or lower Fence from visitor waist to head height Full fence (above 6 foot) Other (please type in)	Displays if "Outside in an area visitors walk past" is selected in Q100
<b>Enclosure Lighting</b>	102	Is the lighting on natural or reverse timing?	Binary	Natural Reverse Other (please type in)	Enclosure lighting questions (Q102-106) display if "Inside" is selected in Q100
	103	Does the light regime (amount of time/start time in night phase/light phase) change over the year or remain static?	Multi Choice	Static (no change) Seasonal change Other change (Open)	
	104	What is the start time of the following currently?	Form Field - Open	Dusk' lighting (if applicable) (Please Type) Night time lighting (Please Type) 'Dawn' lighting (if applicable (Please Type) Day time lighting (Please Type)	
	105	What colour of lighting is used?	Multi Choice	Red Blue Yellow/Orange White Mixed colour (Please type) Other (Please type)	
	106	Is any UV lighting used in the enclosure?	Binary	Yes No	
<b>Enclosure X</b>	107	What is the approximate size of the enclosure (m2)?	Open		
	108	How many nest boxes are in the enclosure?	Multi Choice	0 1 2 Other (type in)	
	109	What is the name of the 1st kiwi housed in this enclosure?	Open		Name is used in kiwi questions

# Kiwi Husbandry Practices Questionnaire

Section	Q	Instructions/Question	Answer Type	Answer Options	Survey Logic
Kiwi X	110	How old is (kiwi name)?	Open		
	111	What sex is (Kiwi name)?	Binary	Male Female	
	112	How long has (Kiwi name)	Form Field - Open	Been in this enclosure? (Please type) Been on display for the public (in any on display enclosure within your facility)? (Please type)	
	113	What is the most recent weight of (kiwi name)?	Open		
	114	Do you (or other keepers) have any particular behavioural concerns regarding (name)?	Open		
	115	Are there any particular health concerns regarding (Kiwi name)? Any medical history?	Open		
Enclosure X+1	116	Is there a second kiwi housed in this enclosure?	Binary/Text	Yes (please type in name) No	Yes - repeat kiwi questions (Q110-115) No - go to question 117
	117	Do you have a x+1 off display enclosure?	Binary	Yes No	Yes - repeat enclosure questions (Q100-116) No - go to Q118
Final Question	118	Are there any questions or concerns you have around the husbandry/welfare practices surrounding captive Kiwi? This could be issues with individual kiwi (response to particular noises) your facility (particular visitor behaviour, husbandry routines) or in general.	Open		