Animal Behaviour Research for Conservation: Observation, Manipulation, Experimentation, and Alternatives

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THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

Relevance of animal behavior to conservation science:

- Dispersal by individuals between modified habitats
- Reducing/training about predation
- Captive breeding
- Predicting the consequences of climatic/anthropogenic change
- Mate choice, parentage, and sexual selection in small populations
- Census techniques for better population estimates
- Translocation/release design
- Conservation of animal culture
- Human/animal interactions/use

Three examples from NZ-based research

~Reducing/training about predation

~Captive breeding

~ Mate choice, parentage, and sexual selection in small populations

~Human/animal interactions/use

Case # 1: Captive Rearing in Conservation:

J. Galbraith, E. Sancha, R. Maloney, and M. Hauber (2007, Animal Conservation)

- Last resort
- Expensive (time, effort, space)
- <u>Increases foraging, predatory, and social naiveté</u>
- Reduces parental skills
- Restricts conservation of local traditions, culture, and adaptations
- *Frequently applied:* condors (NA), takahe (NZ), kakapo (NZ) both to rear young <u>and</u> to increase productivity of renesting adults

Antipredator Behaviours: Critical Component of Fitness in Captive Reared Individuals

Feral cat

- Survival to reproduction is the most critical life history stage contributing to fitness

- Antipredator behaviours can mediate survival of juveniles, adults, and vulnerable young.

- Increasing population size, coupled with socially-mediated antipredator behaviours, may have disproportionally greater benefits.

- Predator recognition is partly experience-independent, partly learned, and predator-training of either evolutionarily or ontogenetically naïve individuals is possible and has demonstrably positive outcomes (rheas, bustards, robins)

Kaki/Black Stilts: Background

- *Himantopus novaezealandiae*

- Critically endangered wading bird
  - Population dropped to 23 individuals in 1981
  - Current population size:
    - 78 adults in wild
    - 56 subadults
    - ~100 chicks/year
  - Breeding pairs: 21 (14 wild)

- Endemic

- Once found throughout NZ

- Now restricted to Waitaki Basin, South Island

Kaki Background cont.

Causes of decline and threats to survival:

- Habitat loss - hydro schemes, farming, invasive weeds

- Predators - cats, ferrets, stoats, hedgehogs, and rats. Also higher numbers of avian predators: harriers and gulls

- Disturbance – recreation

- Catastrophic events (snow)

- Hybridisation

Kaki Recovery Program

LONG TERM GOAL - “To improve the status of kakï from critically endangered by increasing the population to more than 250 breeding individuals, with a mean annual recruitment rate that exceeds the mean annual adult mortality rate, by 2011.”

- Intensively managed since 1981
- Minimising hybridisation
- Recruitment in wild is very low ~ 4% vs. 22%
- Recruitment maximized through captive-rearing of all eggs

Captive breeding and rearing facility, Twizel

Fully precocial species:
hatchlings are mobile and self-feeding within a day

Days 1-8 - Brooder

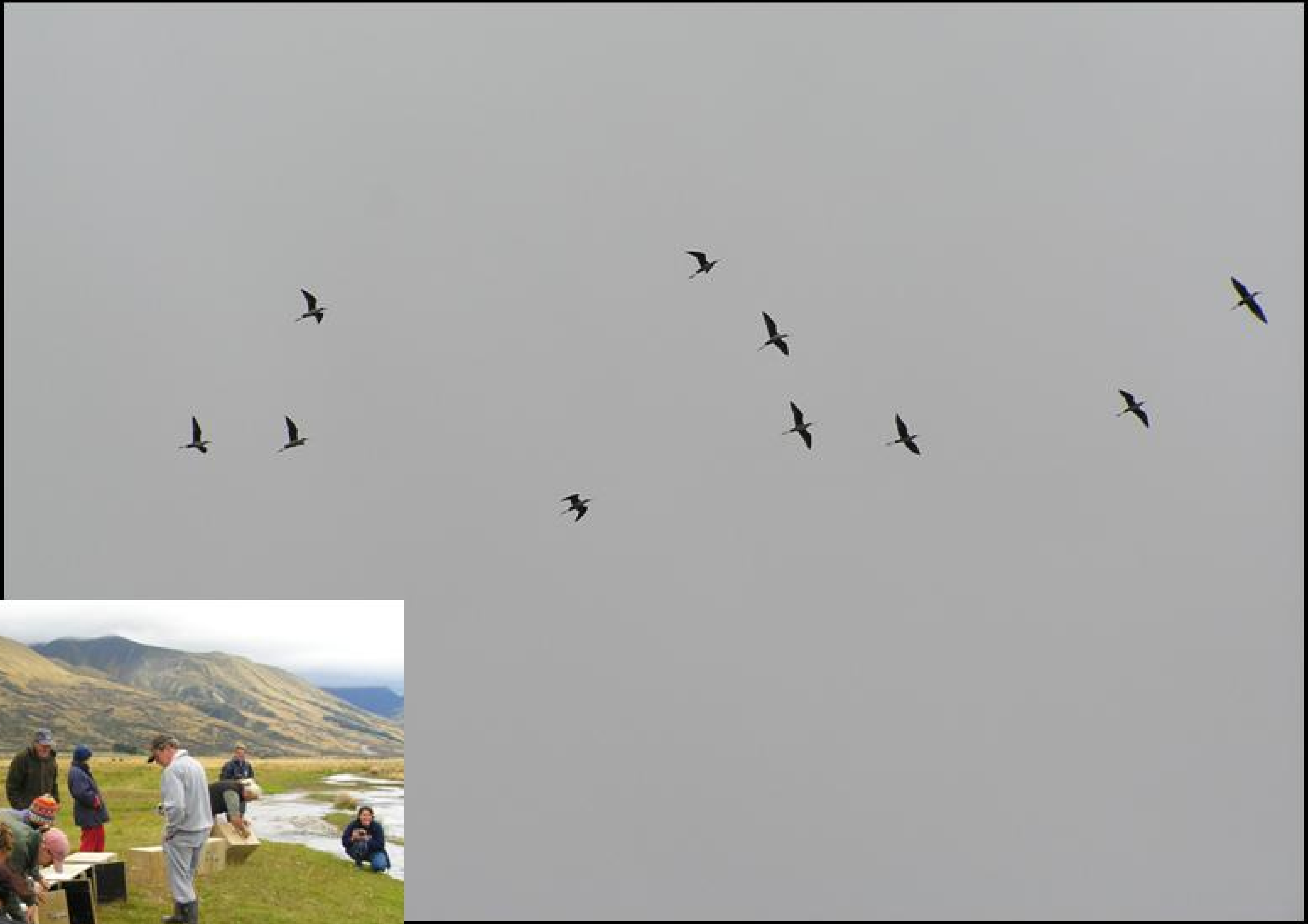
Alarm-call playbacks during cleaning/feeding/handling

Salt bath

Days 9-35

30 days +

Juveniles are released in late summer and early spring each year, followed by limited radiotracking & supplemental feeding



Tasman River release site

Investigating Behaviour

Particular interest in alarm response behaviours:

- Do captive chicks retain the ability to respond *appropriately* to adult vocalisations?

- Does repeated exposure causing habituation?

Methods:

Focal scan sampling

and acoustic playback experiments.

Playback experiments

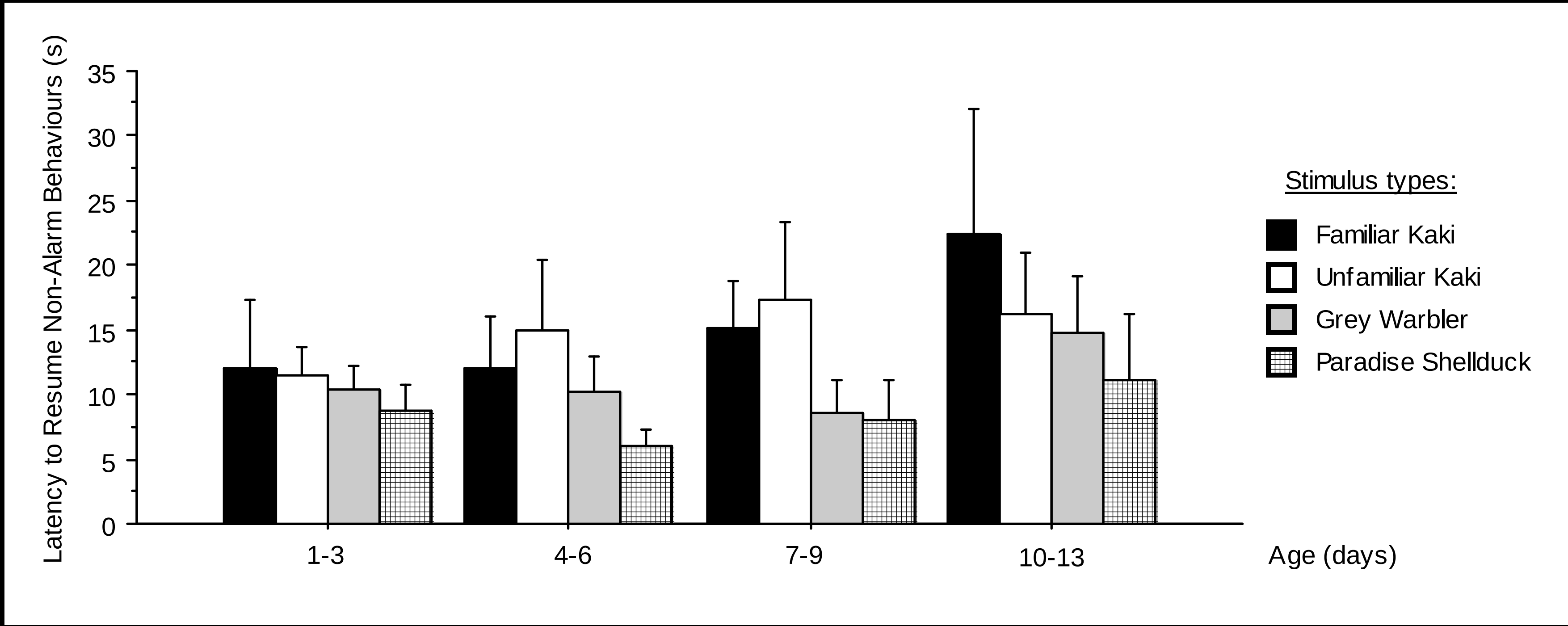
Experimental design of playback experiments:

✦ Speakers already set up in brooders

✦ Four vocalisations, matched for maximum power:

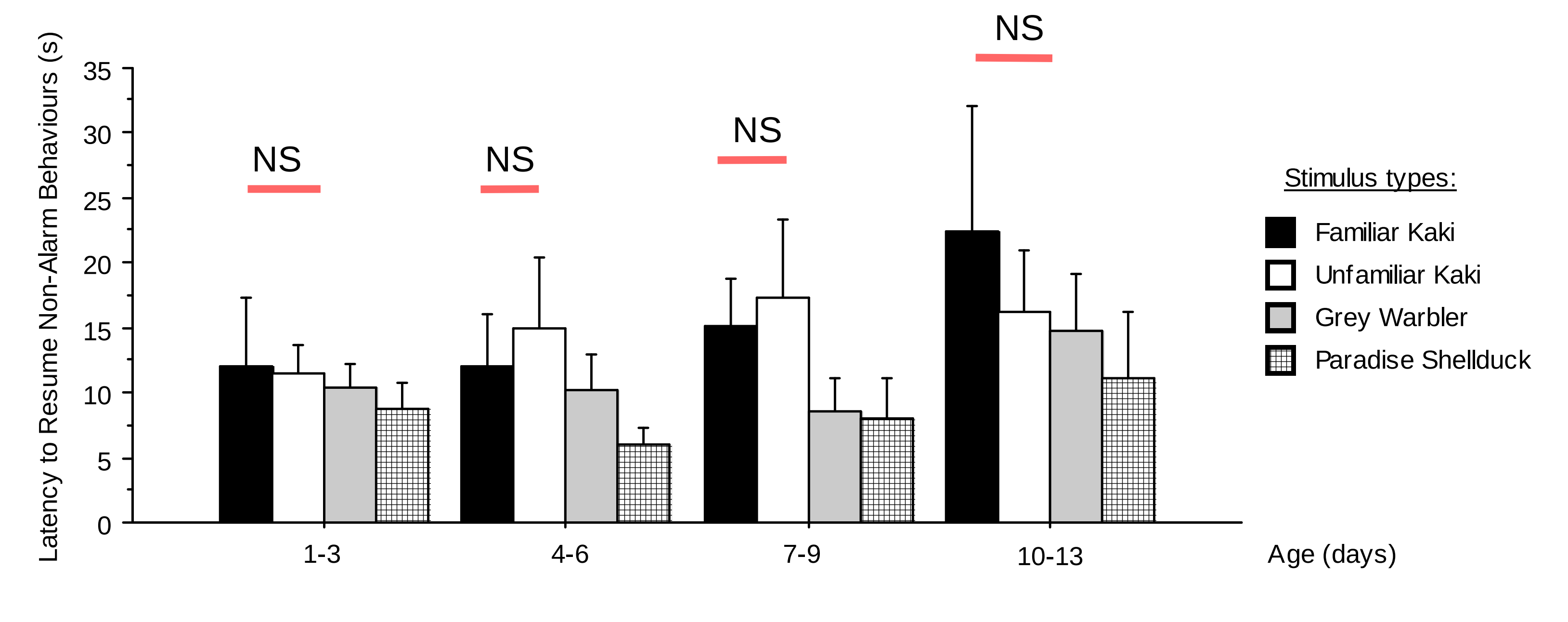
~Familiar kaki alarm call
~Unfamiliar kaki alarm call
~Unfamiliar paradise shell-duck call
~Unfamiliar grey warbler song

Playback experiment results



- **Significant overall effects of stimulus type ($F_{3, 103}$ = 972, P < 0.0001) and age of chicks ($F_{1, 103}$ = 34.1, P < 0.0001) experiment-wide.**
- Similar responses to familiar and unfamiliar kaki alarm calls (P > 0.9)
- Responses to both types of adult kaki alarms are consistently greater than to the controls (P < 0.001).
- Responses are consistent to control vocalisations and greater to kaki alarm calls during early development covered by our experiments (1-13 day old chicks).

Playback experiment results



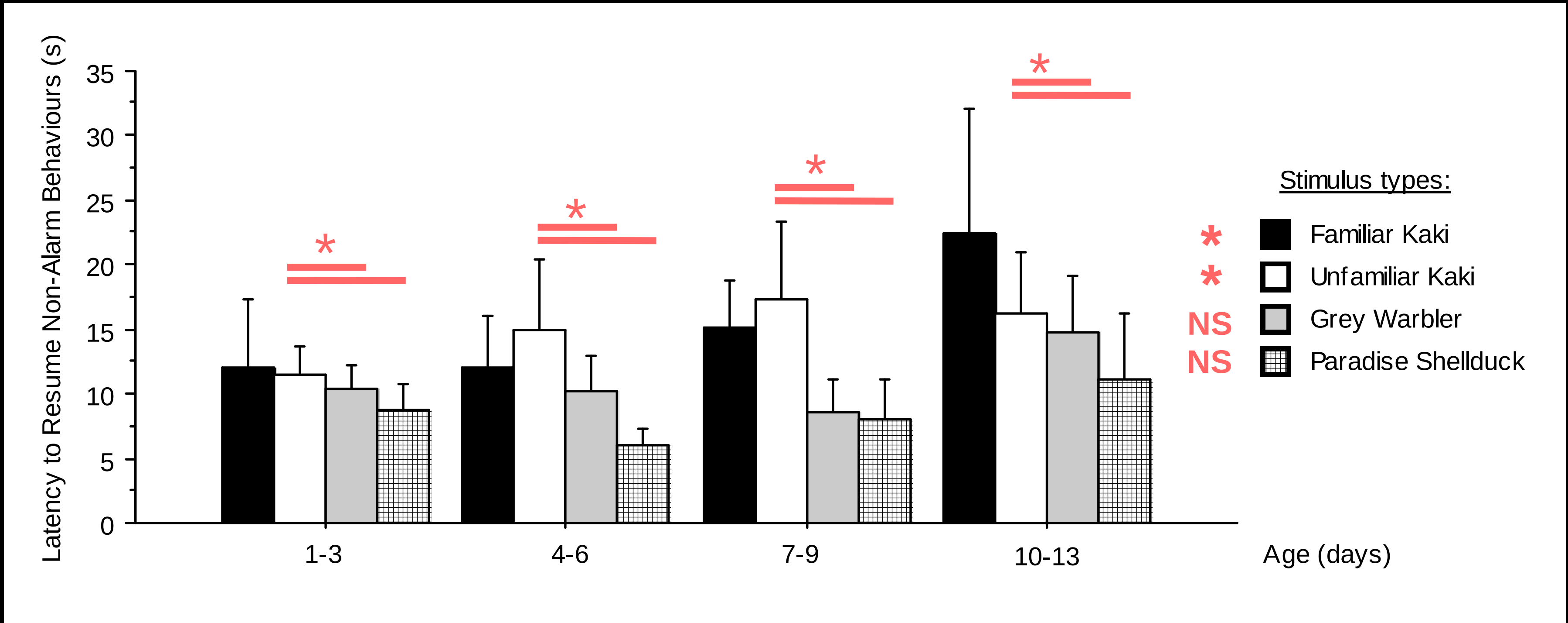
- Significant overall effects of stimulus type ($F_{3, 103} = 972$, $P < 0.0001$) and age of chicks ($F_{1, 103} = 34.1$, $P < 0.0001$) experiment-wide.

- **Similar responses to familiar and unfamiliar kaki alarm calls ($P > 0.9$)**

- Responses to both types of adult kaki alarms are consistently greater than to the controls ($P < 0.001$).

- Responses are consistent to control vocalisations and greater to kaki alarm calls during early development covered by our experiments (1-13 day old chicks).

Playback experiment results



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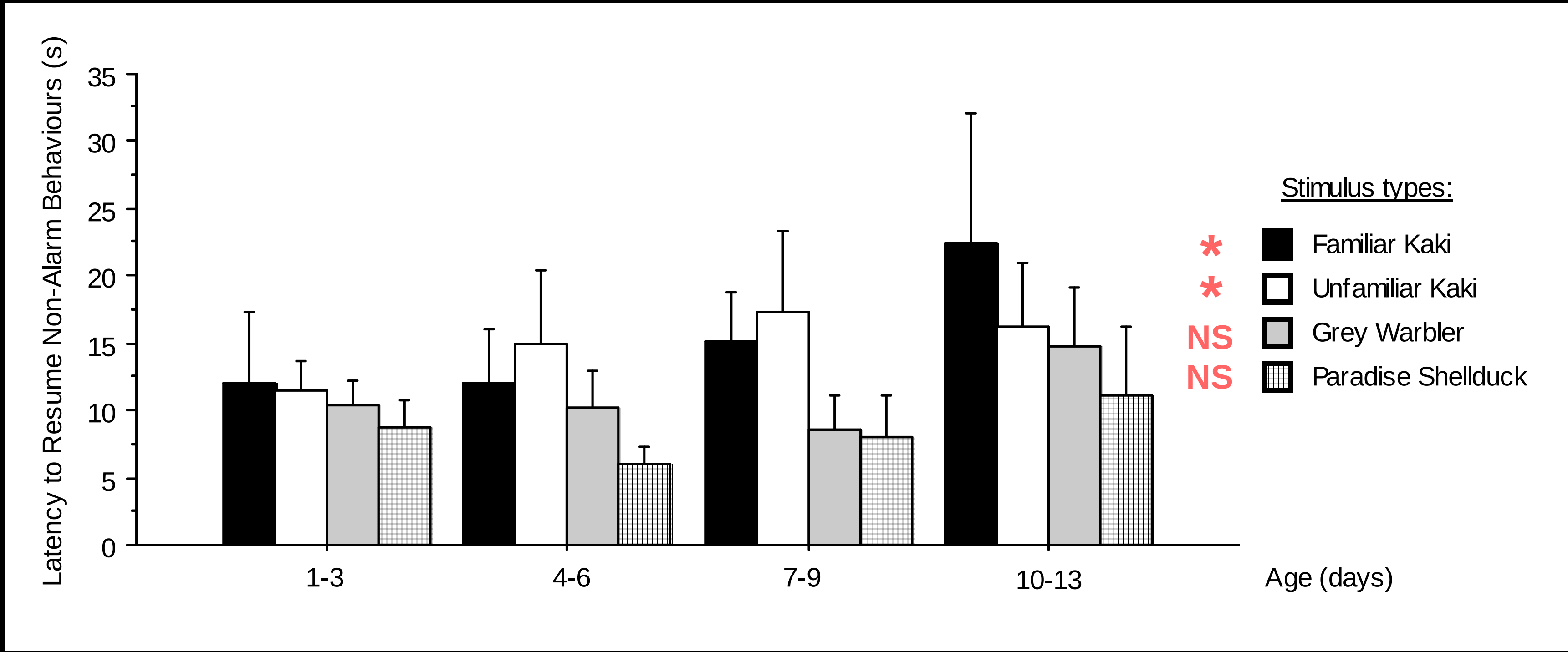
- Similar responses to familiar and unfamiliar kaki alarm calls ($P > 0.9$)

- **Responses to unfamiliar adult kaki alarms are consistently greater than to the controls ($P < 0.001$).**

- Responses are consistent to control vocalisations and greater to kaki alarm calls during early development covered by our experiments (4-13 day old chicks).

Playback experiment results



- Significant overall effects of stimulus type ($F_{3, 103} = 972$, $P < 0.0001$) and age of chicks ($F_{1, 103} = 34.1$, $P < 0.0001$) experiment-wide.

- Similar responses to familiar and unfamiliar kaki alarm calls ($P > 0.9$)

- Responses to unfamiliar adult kaki alarms are consistently greater than to the controls ($P < 0.001$).

- **Responses are consistent to control vocalisations and increase over time to kaki alarm calls during early development covered by our experiments (1-13 day old chicks).**

Conclusions from observations and playback experiments on kaki

- Though subject to repeated exposure, naïve chicks continue to respond appropriately to conspecific adult alarm calls over their early development

- Chicks do not appear to become habituated to the repeated adult alarm call; and may instead become sensitised

Future work: playback experiments with wild- vs. captive-reared kaki are necessary for additional conclusions to be drawn.

Case # 2: NEST ATTENDANCE IN THE ENDANGERED NEW ZEALAND KAKAPO (*Strigops habroptilus*)

Luis Ortiz-Catedral[1], Daryl Eason[2], Dianne H. Brunton[1], Ron Moorhouse[2] and Mark. E. Hauber[3]

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3 School of Biological Sciences, University of Auckland

MATING SYSTEMS AND PARENTAL CARE AMONG PSITTACIFORMES

MONOGAMY

BIPARENTAL CARE

Cuban parrot (*Amazona leucocephala*)

Female feeds nestlings

Galah (*Eolophus roseicapillus*)

Both parents feed nestlings

MATING SYSTEMS AND PARENTAL CARE AMONG PSITTACIFORMES

POLYGAMY

COOPERATIVE CARE

Vasa parrot (*Coracopsis vasa*)

Female feeds nestlings

Golden conure (*Guaruba guarouba*)

Both parents feed nestlings

MATING SYSTEMS AND PARENTAL CARE AMONG PSITTACIFORMES

POLYGAMY (LEK)

UNIPARENTAL CARE (FEMALE)

Kakapo (*Strigops habroptilus*)

KAKAPO FACTS

- Small global population (91 individuals)
- Infrequent breeding (2-7 years intervals)
- Slow maturation
- Biased sex allocation when overfed
- Biased adult sex ratio

 (< 20 females in breeding age)

AIMS

- To document the diversity of behaviours of nesting female kakapo

- To explore the relationship between number and duration of foraging trips and nestling growth

- To determine if offspring sex influence parental effort

METHODS

Analysis of video-recordings from the 2002 breeding season

• Approximately 1320 Hours of video footage

Duration of female activities at the nest per night (i.e. sleeping, preening, etc.) estimated to nearest second.

Databases generated through observations *in-situ*

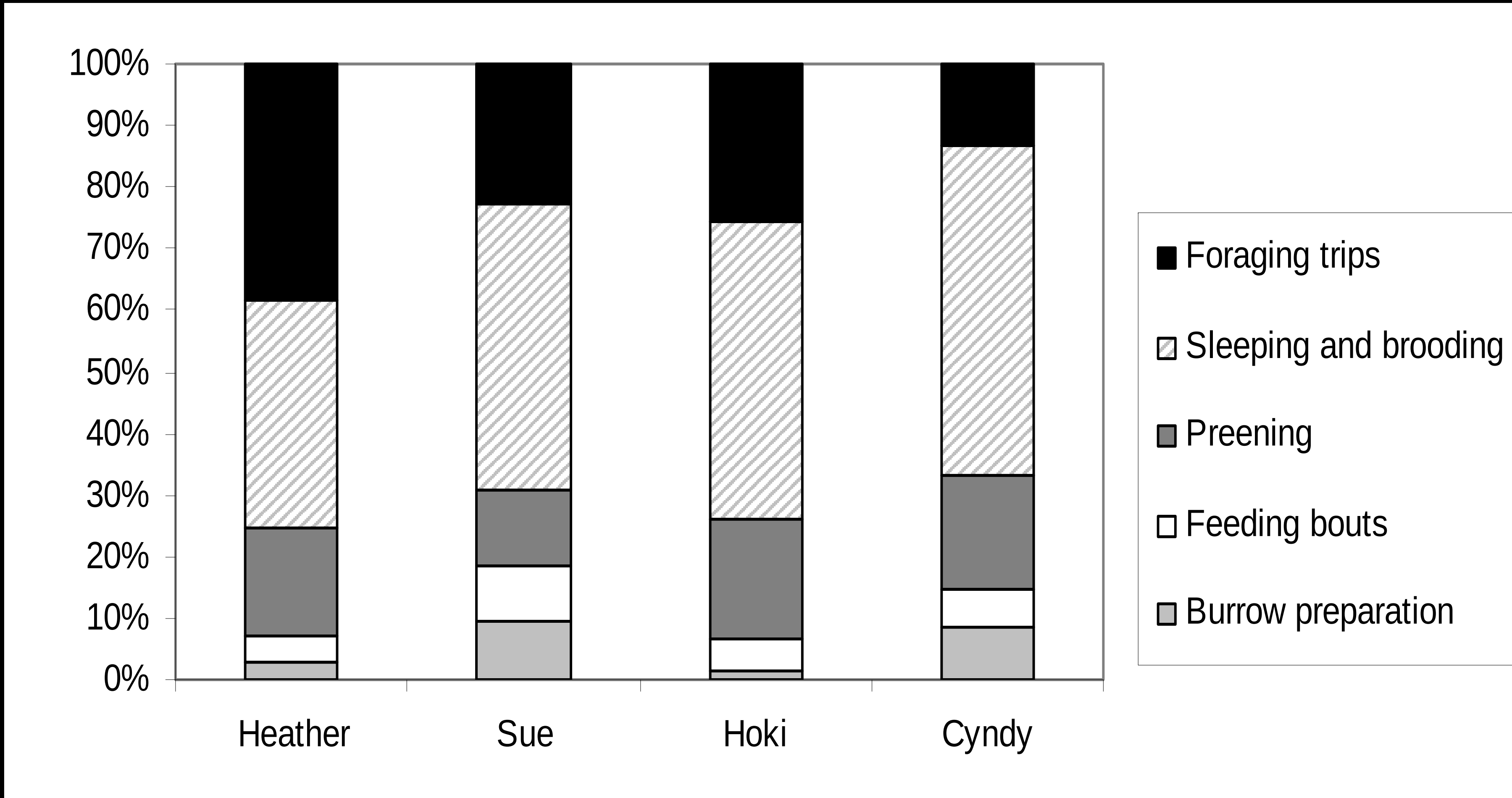
• 516 Kakapo nights

Number and duration of foraging trips

Nestling growth information from published studies and personal communications with researchers

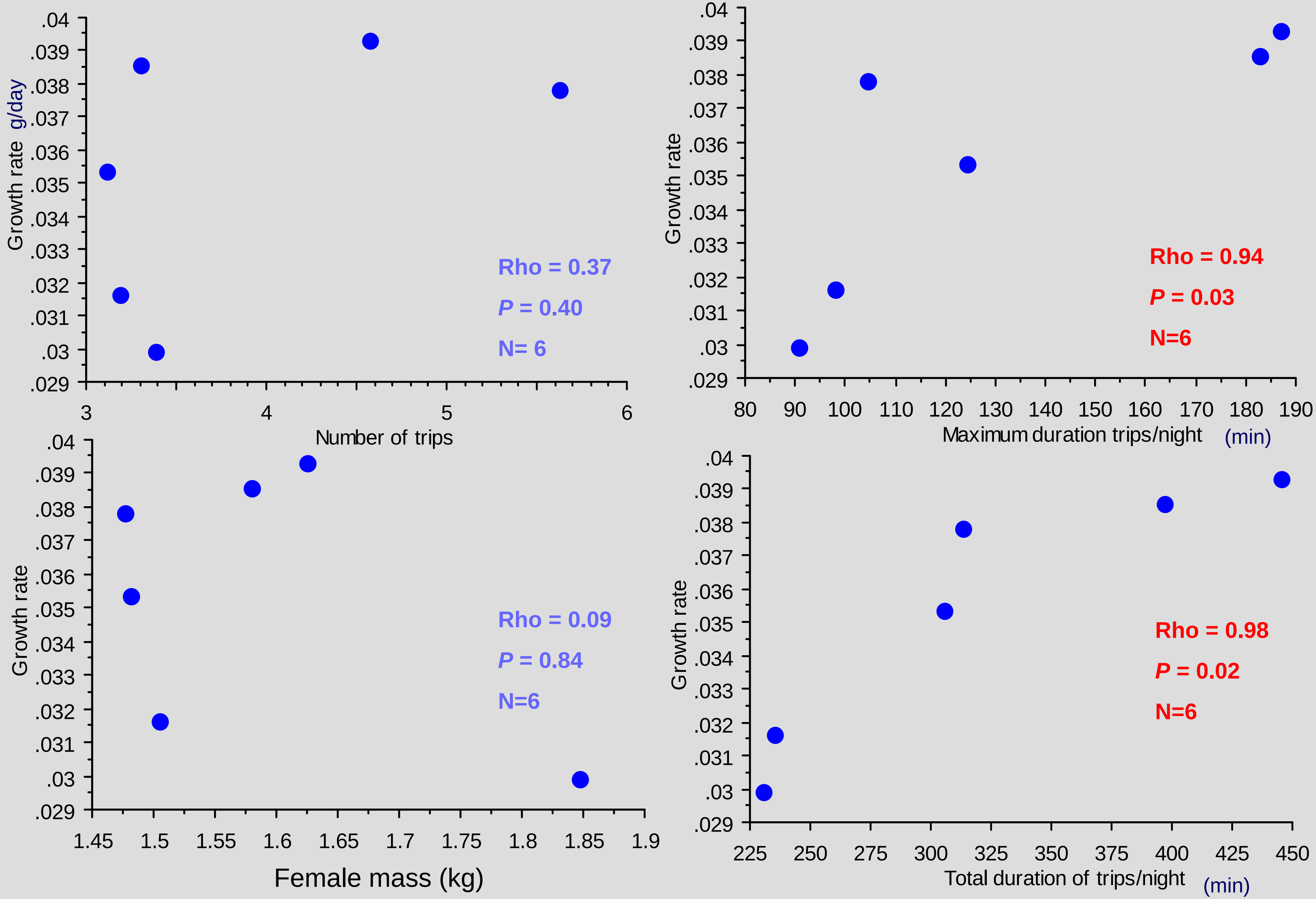
RESULTS

FEMALE ACTIVITIES DURING NESTLING CARE

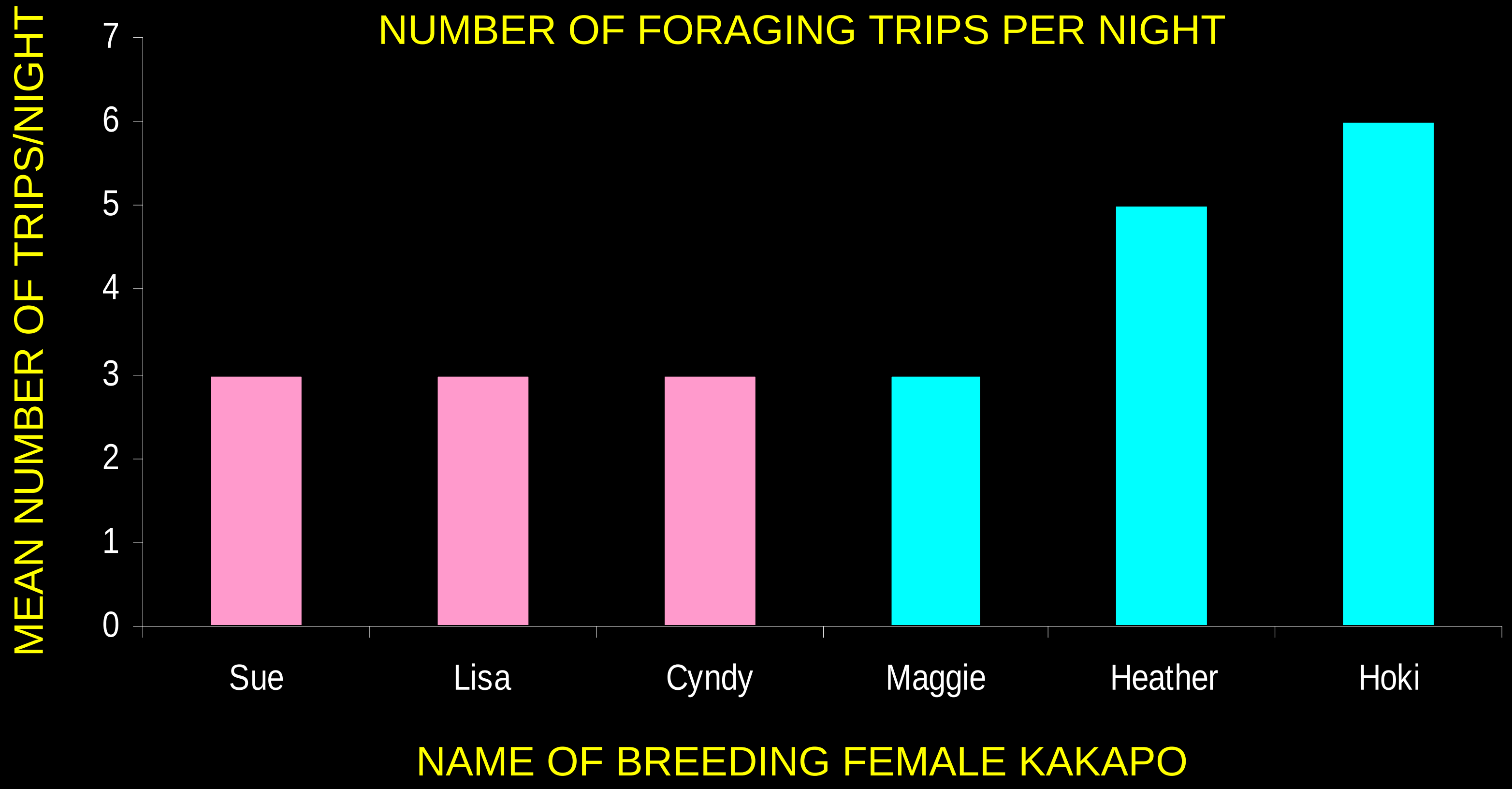


Data from 10 kakapo-nights of video footage

PRELIMINARY RESULTS



RESULTS



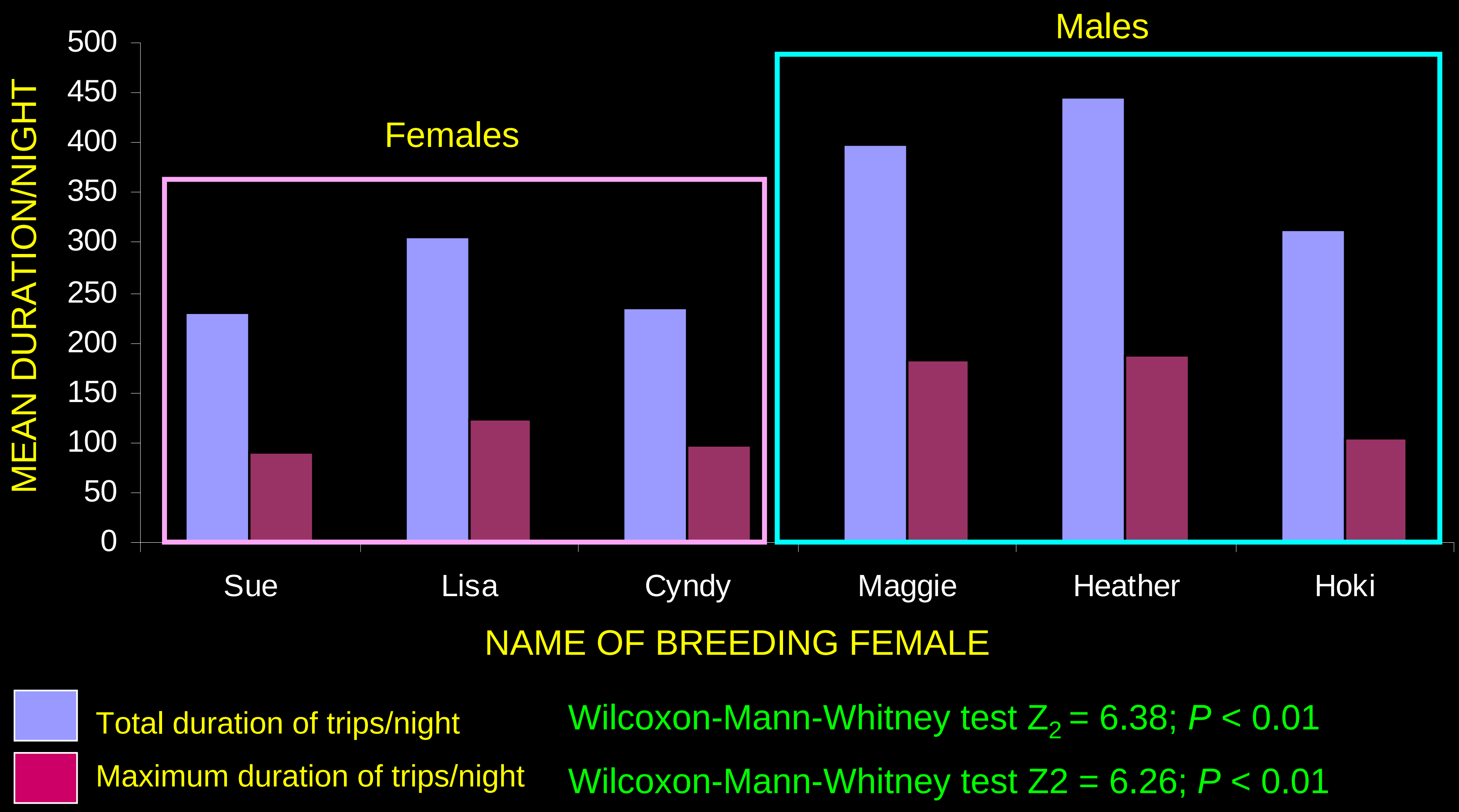
Females

Males

Wilcoxon-Mann-Whitney test $Z_2 = 6.07$; $P < 0.01$

RESULTS

DURATION OF TRIPS



Wilcoxon-Mann-Whitney test $Z_2 = 6.38$; $P < 0.01$

Wilcoxon-Mann-Whitney test Z2 = 6.26; $P < 0.01$

POTENTIAL IMPACTS IN CONSERVATION

~Opportunity for intervention based on female's foraging performance

~Development of a model of minimum foraging times for sufficient nestling growth

~Modeling of foraging times and frequency for females with broods of various sizes (assessment of feeding and brooding efficiency)

Case # 3: PUBLIC PARITICIPATION IN SCIENTIFIC RESEARCH

Experimental studies of the effects of host plants on the development and survival of the caterpillars of Monarch butterflies (*Danaus plexippus*) in New Zealand

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1Royal Society of New Zealand Teacher Fellowship Programme

2Monarch Butterfly NZ Trust

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The Monarch Butterfly (*Danaus plexippus*)

~well studied model system for host plant use and migratory behaviour in its native and introduced ranges of North America and Australia.

~little research has been done on the effect of host plants on monarch caterpillar growth in New Zealand.

The Monarch Butterfly (*Danaus plexippus*)

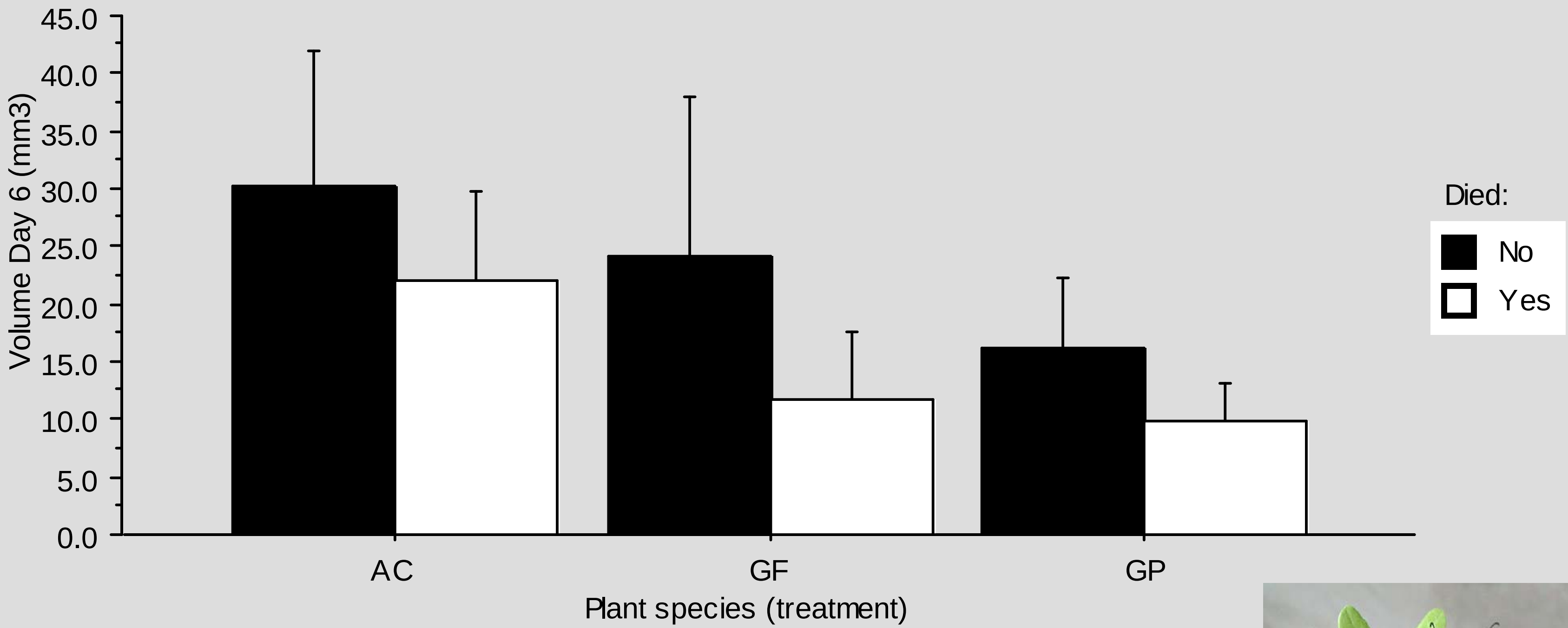
Research aims to determine:

1: the effects of common and rare milkweed species on the growth and survival rates of the monarch caterpillars,

2: the daily and overall intakes of plant material of larvae reared on different hosts, and

3: the interactions between host plant choice and caterpillars’ vulnerability to predators

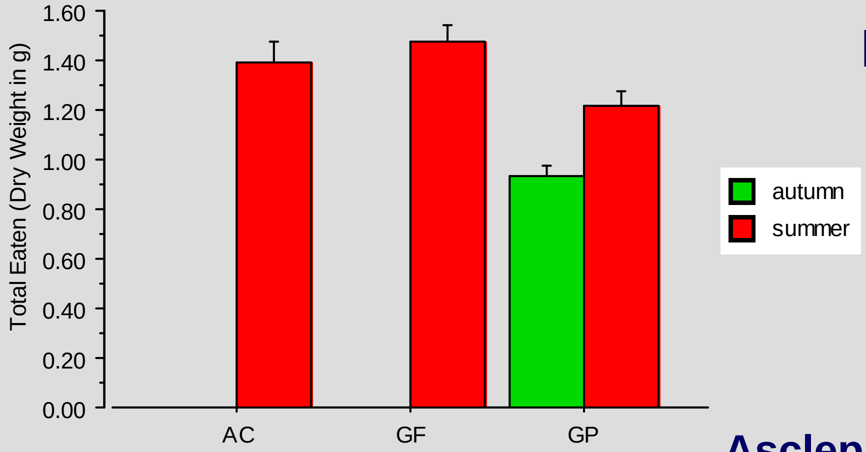
1. The effects of common and rare milkweed species on the growth and survival rates of the monarch caterpillars



Asclepias curassavica: AC (tropical milkweed)
Gomphocarpus fruticosus: GF (swan plant)
Gomphocarpus physocarpa: GP (giant sp)

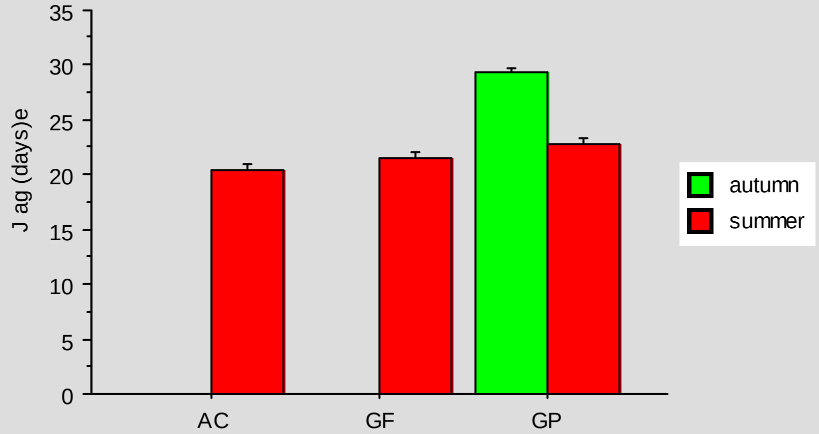
$F > 10$, $p \leq 0.002$

2. The daily and overall intakes of plant material of larvae reared on different hosts



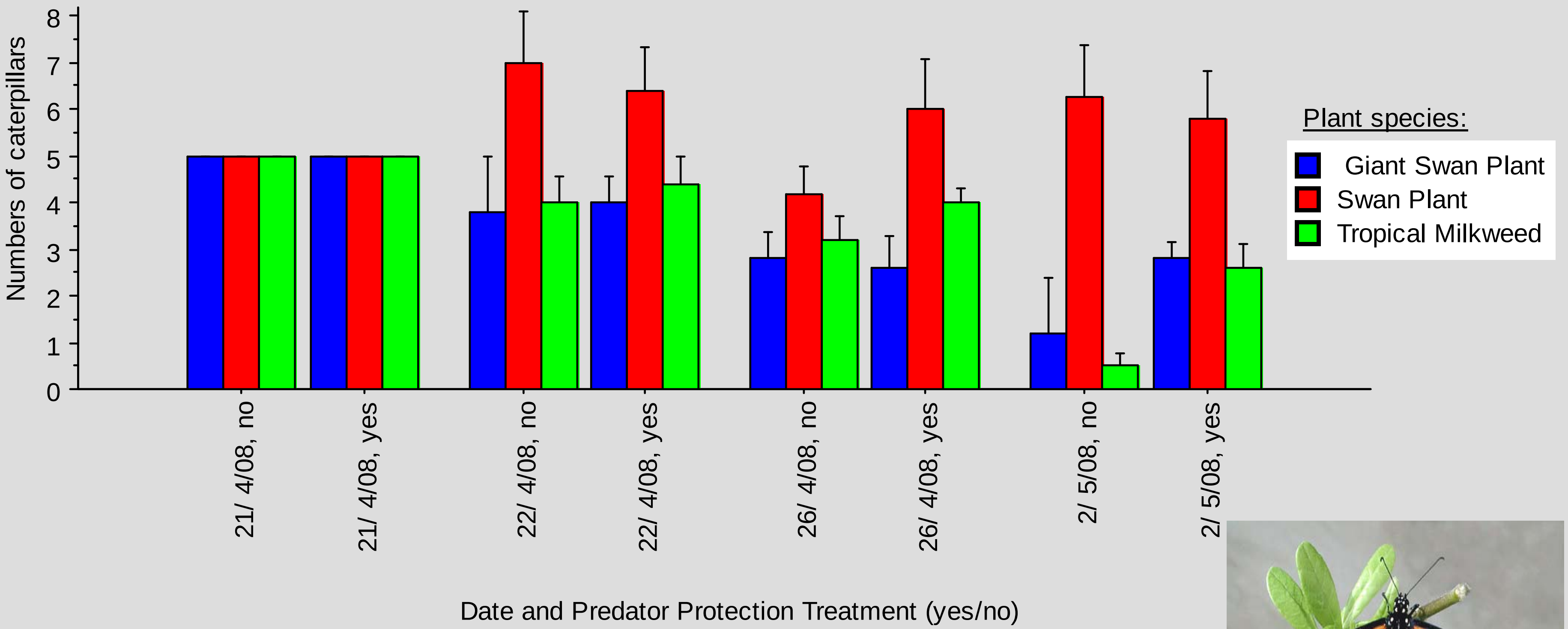
F = 4.4, p = 0.02

Asclepias curassavica: AC (tropical milkweed)
Gomphocarpus fruticosus: GF (swan plant)
Gomphocarpus physocarpa: GP (giant sp)

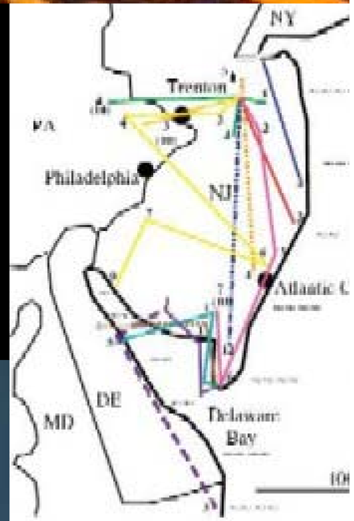


F = 3.4, p = 0.04

3. The interactions between host plant choice and caterpillars' vulnerability to predators



$F > 11$, $p < 0.0006$



Tracking Monarchs in NZ: a public effort

Radio frequency identification tags

Active radio signal tags

Conservation and behaviour in NZ-based research

Use existing infrastructure for conservation-directed research

Quantify existing data for cientific/conservation output

Involve the public in conducting appealing basic science without impacting native fauna

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