HATCHING ASYNCHRONY AND CHICK GROWTH IN THE RED-CROWNED KAKARIKI (*CYANORAMPHUS NOVAEZELANDIAE*)

D. Brunton

Luis Ortiz Catedral and Dianne Brunton

Institute of Natural Resources

Massey University, Albany

New Zealand

• Hatching asynchrony

- Widely studied phenomenon in altricial birds; decades of research devoted to explain patterns of hatching and its connection with survival, growth and reproductive success (Lack, 1947; Magrath, 1990; Stolesson & Beissinger, 1995).

- Consistency of predictions across avian orders.

- Survival and growth of nestlings are closely associated to hatching hierarchies. Differences in competitive abilities between siblings generally determine food deliveries by parents.

M. Baling

D. Brunton

• Psittaciformes

- Wide range of clutch sizes and various degrees of hatching asynchrony within the order.

Uncertainty about whether or not parrots conform with predictions derived from other systems.

Challenging system to study hatching asynchrony.

M. Baling

• Previous studies

- Crimson rosella (Krebs *et al.*, 1999, 2000, 2001); Budgerigar (Stamps *et al.*, 1985, 1987); Green-rumped parrotlet (Stolesson and Beissinger, 1997).

S. Greif

• Parrot studies show that levels of sibling competition are low, possibly in response to parental control over food distribution

(Krebs, 2002).

• Have parrots evolved mechanisms to reduce the costs of a large size hierarchy?

(Krebs, 1999).

M. Baling

S. Greif

Only about 8% of the parrot species have been studied in the wild (Massello and Quilfeldt, 2002).

Our Project:

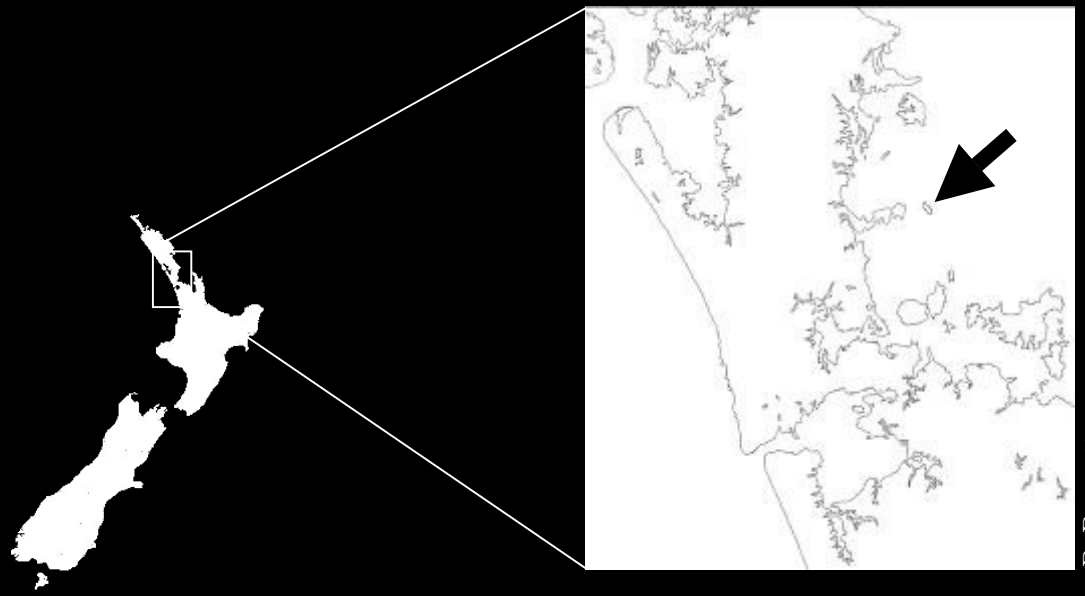
Breeding biology of a translocated population of the red-crowned kakariki (*Cyanoramphus novaezelandiae*).

Greene (2003) noticed that female kakariki tended to feed chicks equally, rather than focusing on bigger chicks.

What are the consequences of hatching asynchrony on the survival and growth of chicks of red-crowned kakariki?

L. Ortiz Catedral

M. Anderson



P. Barnett

Tiritiri Matangi Island, Hauraki Gulf

23 K NE Auckland City, 220 Ha Island,

Open Sanctuary

L. Ortiz Catedral

L. Ortiz Catedral

Results

• 25 clutches; 10 produced at least one fledgling (22 chicks fledged).

• Low hatchability (39.5 % n=162 eggs); no likely effect of handling.

• Four clutches contained at least 3 chicks for analysis of growth and survival. Remaining clutches included only one (n=2) or two chicks (n=4).

•Degree of sibling competition (relative hierarchical position) changed through the nesting period due to deaths.

M. Sweet

L. Ortiz Catedral

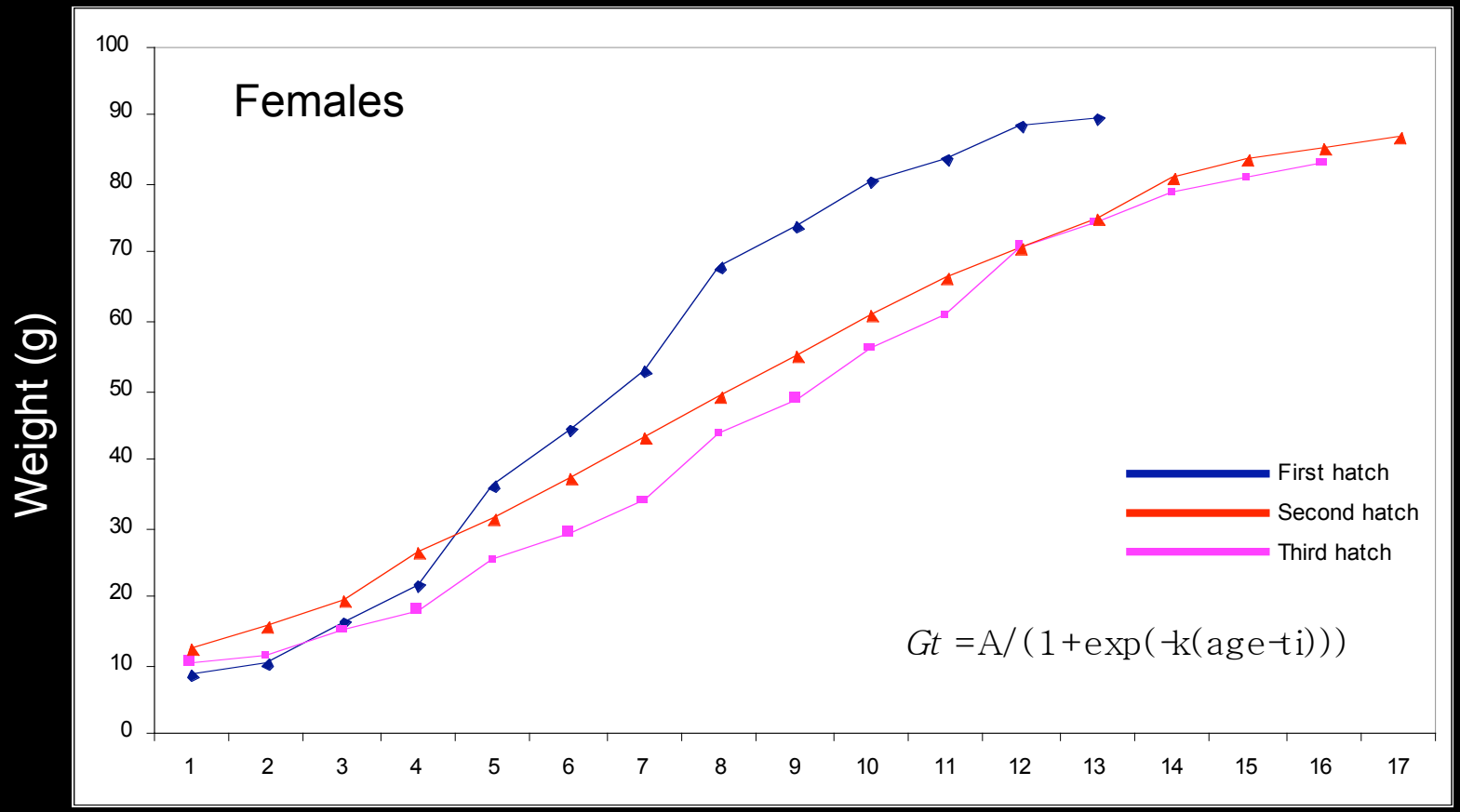
Table 1. Comparison of nestling growth for red-crowned kakariki grouped by hatching order.

	First hatch (X ± SE)	Second hatch (X ± SE)	Third hatch (X ± SE)
Females			
Asymptotic mass	92.37 ± 1.098	88.59667 ± 5.278	85.14333 ±6.354
Linear growth rate for mass	0.163471 ± 0.0162	0.160176 ± 0.037	0.149318 ± 0.009
Asymptotic wing length	155 ± 3.511	153.6667 ± 1.452	138.6667 ± 12.454
Linear growth rate for wing	0.151953 ± 0.007	0.147431 ± 0.001	0.140118 ± 0.007
Males			
Asymptotic mass	95.69	100.72	97.36
Linear growth rate for mass	0.243766	0.250199	0.147379
Asymptotic wing length	150	170	148
Linear growth rate for wing	0.157928	0.190746	0.158418

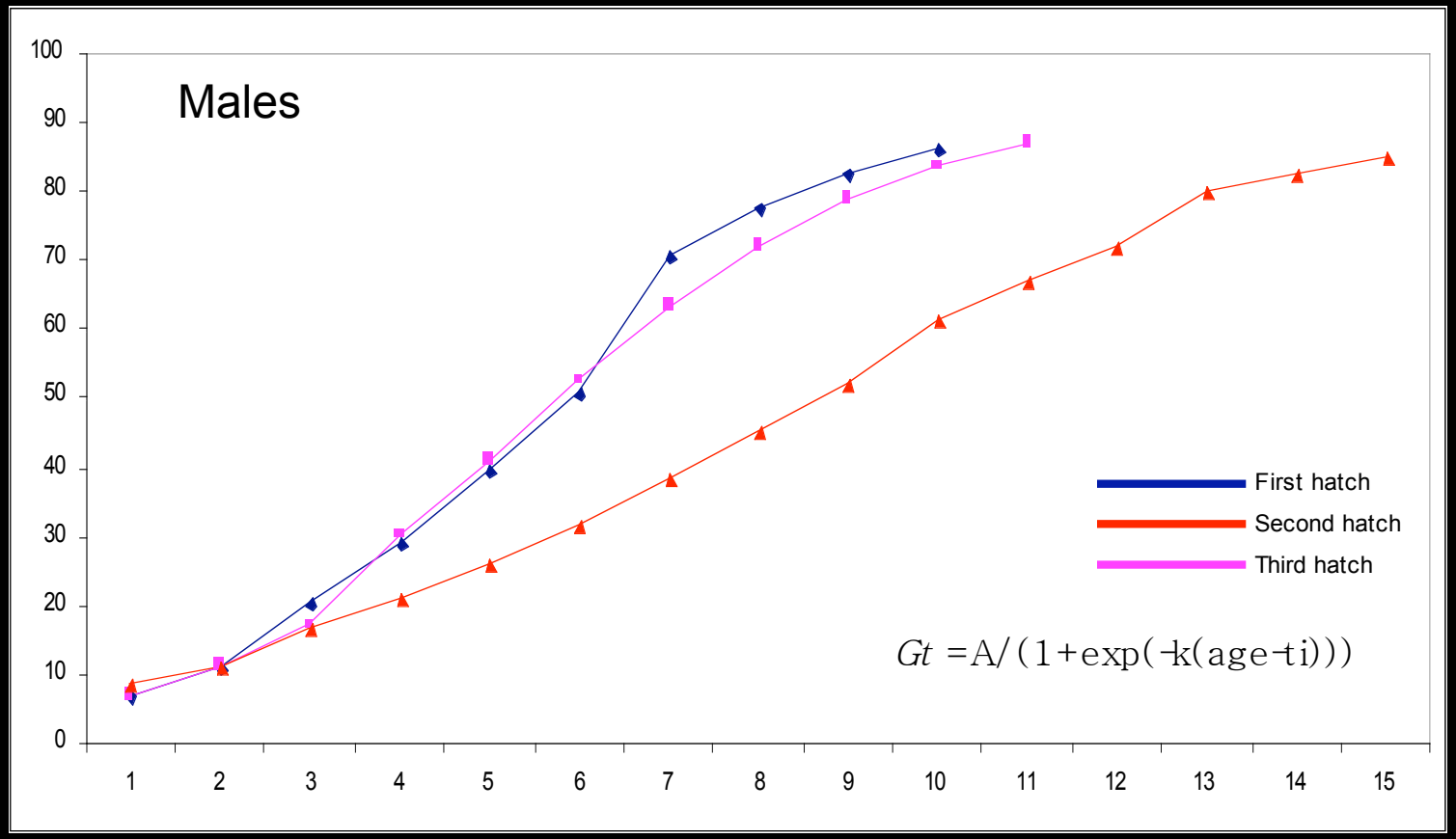
Table 1 (cont). Comparison of nestling growth for red-crowned kakariki grouped by hatching order.

	First hatch (X ± SE)	Second hatch (X ± SE)	Third hatch (X ± SE)
Females			
% of overall wing length	102.3362 ± 2.318	101.4559 ± 0.959	91.5524 ± 8.222
% of overall asymptotic mass	96.02488 ± 1.892	90.22523 ± 6.08	79.53653 ± 10.48
Time interval 10-90% mass	24.49667 ± 0.23	30.31135 ± 6.227	29.85979 ± 1.976
Time interval 10-90% wing	27.92093 ± 0.692	28.85885 ± 1.015	31.60835 ± 1.852
Weight loss after asymptote	3.79 ± 2.616	5.366667 ± 2.027	11.77333 ± 6.044
Males			
% of overall mean wing length	99.03504	112.2397	97.71458
% of overall asymptotic mass	93.85679	105.1526	83.97028
Time interval 10-90% mass	18.0501	17.58602	29.85501
Time interval 10-90% wing	27.86077	23.06729	27.77465
Weight loss after asymptote	9.11	3.72	19.9

Predicted logistic growth rate curves for mass of red-crowned kakariki nestlings.

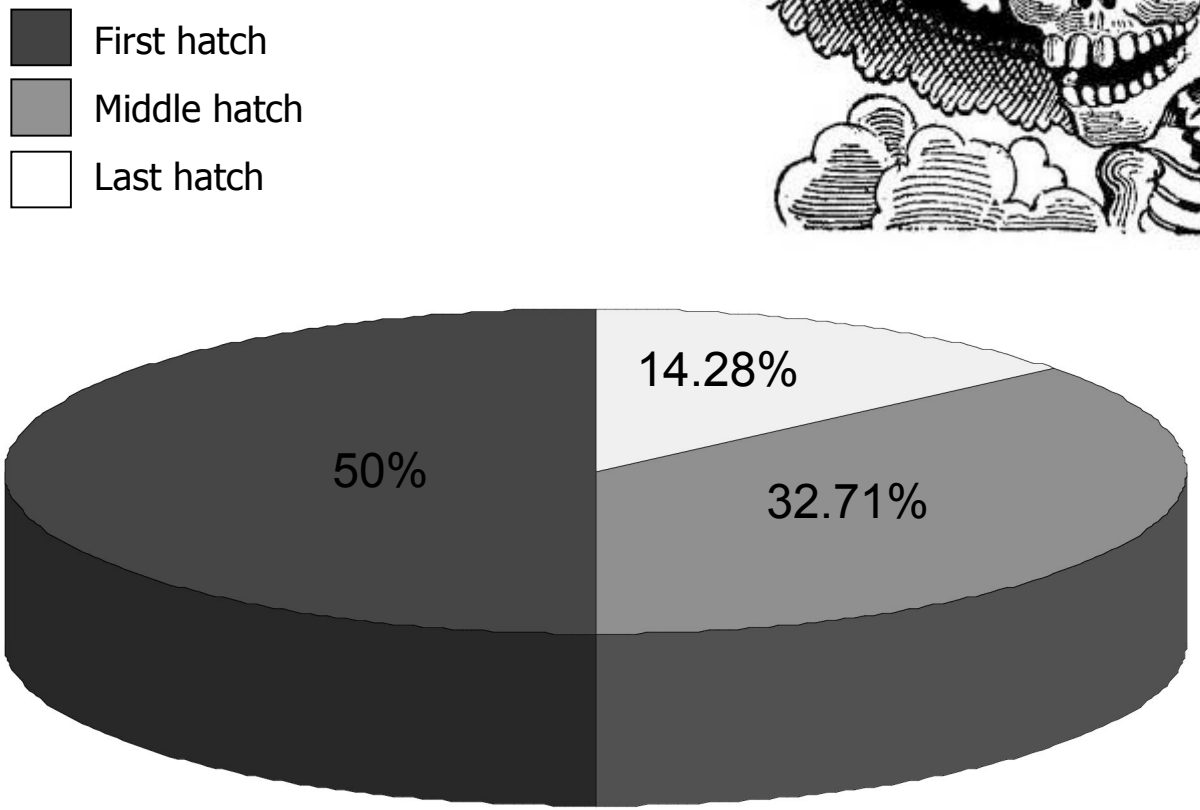


Predicted logistic growth rate curves for mass of red-crowned kakariki nestlings.



Chick deaths (n=28) according to hatching order

J. Guadalupe Posada



Expected survival for the nesting period of red-crowned kakariki nestlings

$E_{(s)} = e^{-mt}$

$m = -(\ln P)/t$

(Ricklefs, 1969)

	First hatch	Middle hatch	Last hatch
Age 1 - 15 days	0.946463	0.791269	0.761801
Age 15 - 40 days	0.854421	0.536428	0.0
Age 1 - 15 days	1	0.937805	0.877957
Age 15 - 40 days	1	0.849216	0.0

Discussion

• Our results conform to predictions regarding growth and mortality of nestlings according to their relative position in the brood.

Limited sample size and insufficient representation of large broods

• Chicks that survived the entire nesting period came from clutches with small hatching spreads.

It is necessary to extend our analysis to broods of a wider spectrum of hatching spreads

• Males appear to grow faster than females regardless of their position in the brood.

We need to include more clutches with various combinations of sexes

Discussion

- Which pairs are breeding in nestboxes?

Sub-optimal nesting site? Natural nests showed higher proportion of last hatched chicks and higher hatchability

- Incubation behaviour, foraging skills?

Inexperienced breeders?

- Parental responses to chick solicitation?

First two weeks of nesting period females are responsible for feeding. Males intervene after

- Year effect?

Hatching spreads are flexible and resource composition and supply vary through time

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