

Animal Behaviour Lecture: Parental Care

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American robin

Outline lecture – parental care

- Definition
- Who cares? Maternal, paternal & biparental care
- How much do I care? Parent-offspring conflict
- Why care? Costs and benefits of parental care
- Don't care? Parental favouritism & siblicide
- Consequences of parental care

What is parental care? A definition



What is parental care? A definition

- Parental care
 - = any parental behaviour that increases offspring survival
- Building nesting structures, dens or similar
- Incubating, brooding offspring
- Provision offspring with food
- Physical protection of offspring, also from predators

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Who cares? ♂, ♀, both, more, depending on?



Who should provide care: ♂ or ♀?

- Paternity certainty (Trivers 1972)
 - External fertilizing species: ♂ are sure they father: ≠ patterns in fishes
- Order of gamete release (Dawkins and Carlisle 1976)
 - Internal fertilization allows ♂ to desert ♀: ≠ patterns in fishes
- Association (Williams 1975)
 - Sex nearest to offspring when care is needed: probably

Sessile animals don't care



- Corrals, barnacles, clams release eggs into water
- Eggs develop into floating larvae
- Attach to suitable substrate
- No care also found in other lineages

Who cares? ♂, ♀, both, more, depending on?



Invertebrates:
 0 most
 ♀ some
 ♂ fewer
 ♀ & ♂ fewer
 More few



Fish:
 0 79%
 ♀ 5.5%
 ♂ 11%
 ♂ & ♀ 4.5%
 More 0.1%



Amphibians:
 0 69%
 ♀ 16.7%
 ♂ 11.9%
 ♂ & ♀ 2.4%



Reptiles:
 0 71%
 ♀ more
 ♂ ?
 ♂ & ♀ ?



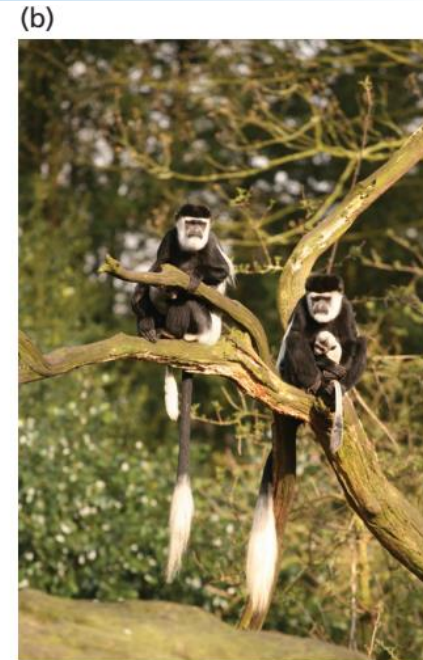
Birds:
 0 0.1%
 ♀ 8%
 ♂ 1%
 ♂ & ♀ 81%
 More 10%



Mammals:
 ♀ 95%
 ♂ 0%
 ♂ & ♀ 4.8%
 More 0.2%

What are phylogenetic comparative methods?

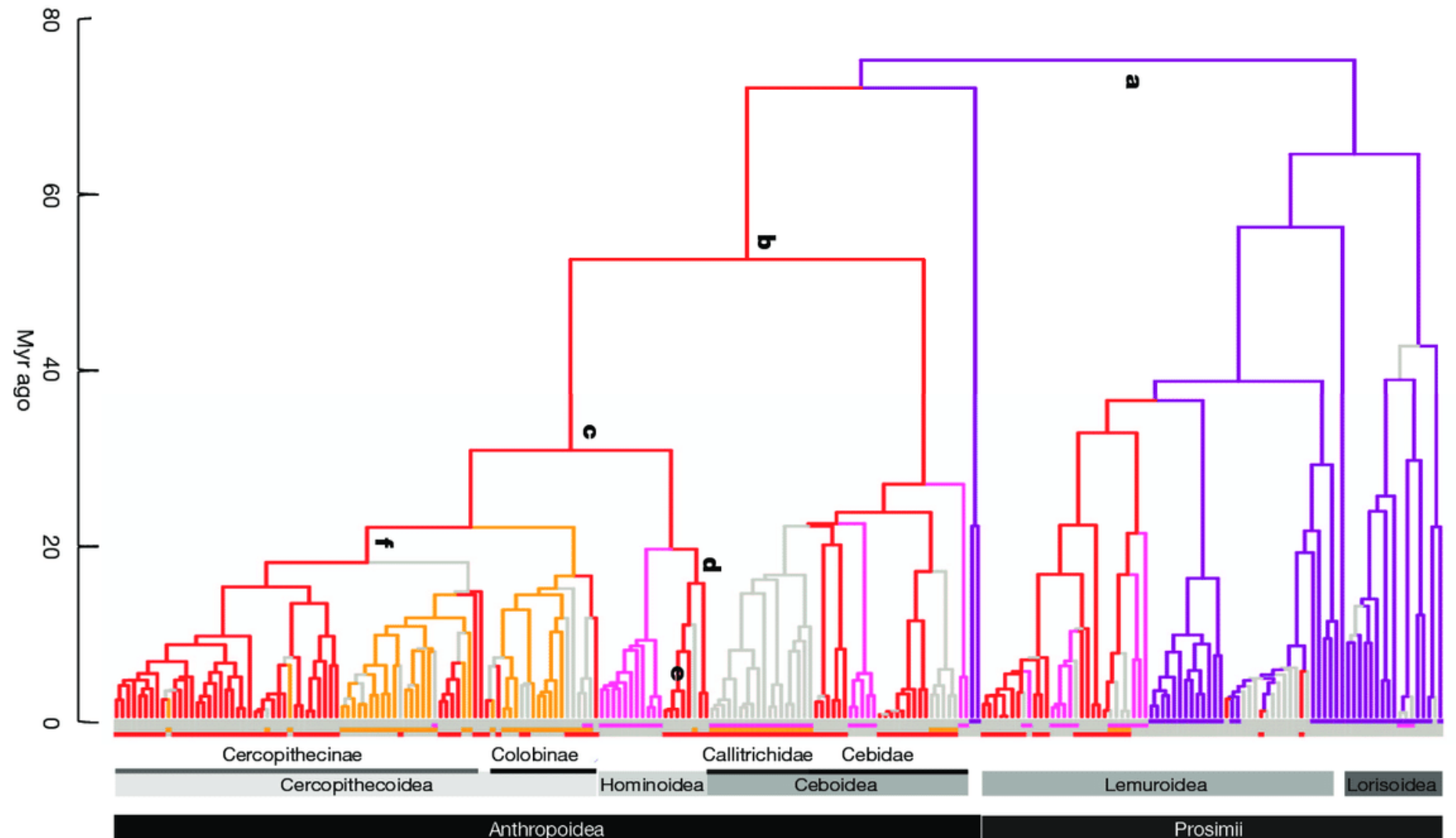
- How can we assess differences across species?
- We need to control for the shared evolutionary history (i.e., phylogeny)
- Phylogenies are biological “time machines”



- a) Solitary tarsier
- b) Black and white colobus, live in small groups
- c) Gelada baboons, live in large groups

What are phylogenetic comparative methods?

Phylogentic tree of primates: Shultz et al 2011

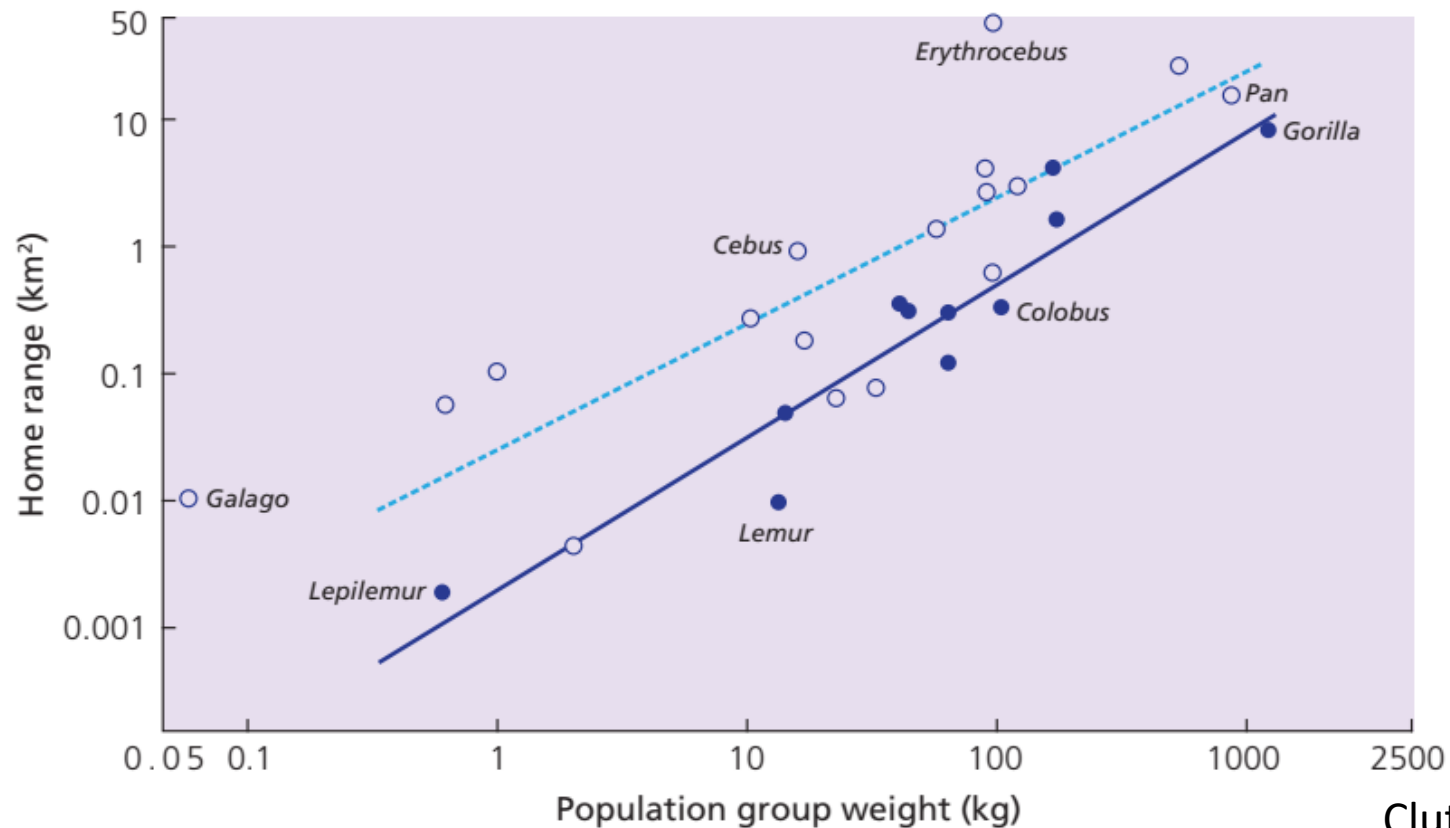


What are phylogenetic comparative methods?

Home range size plotted vs weight of the group in primates

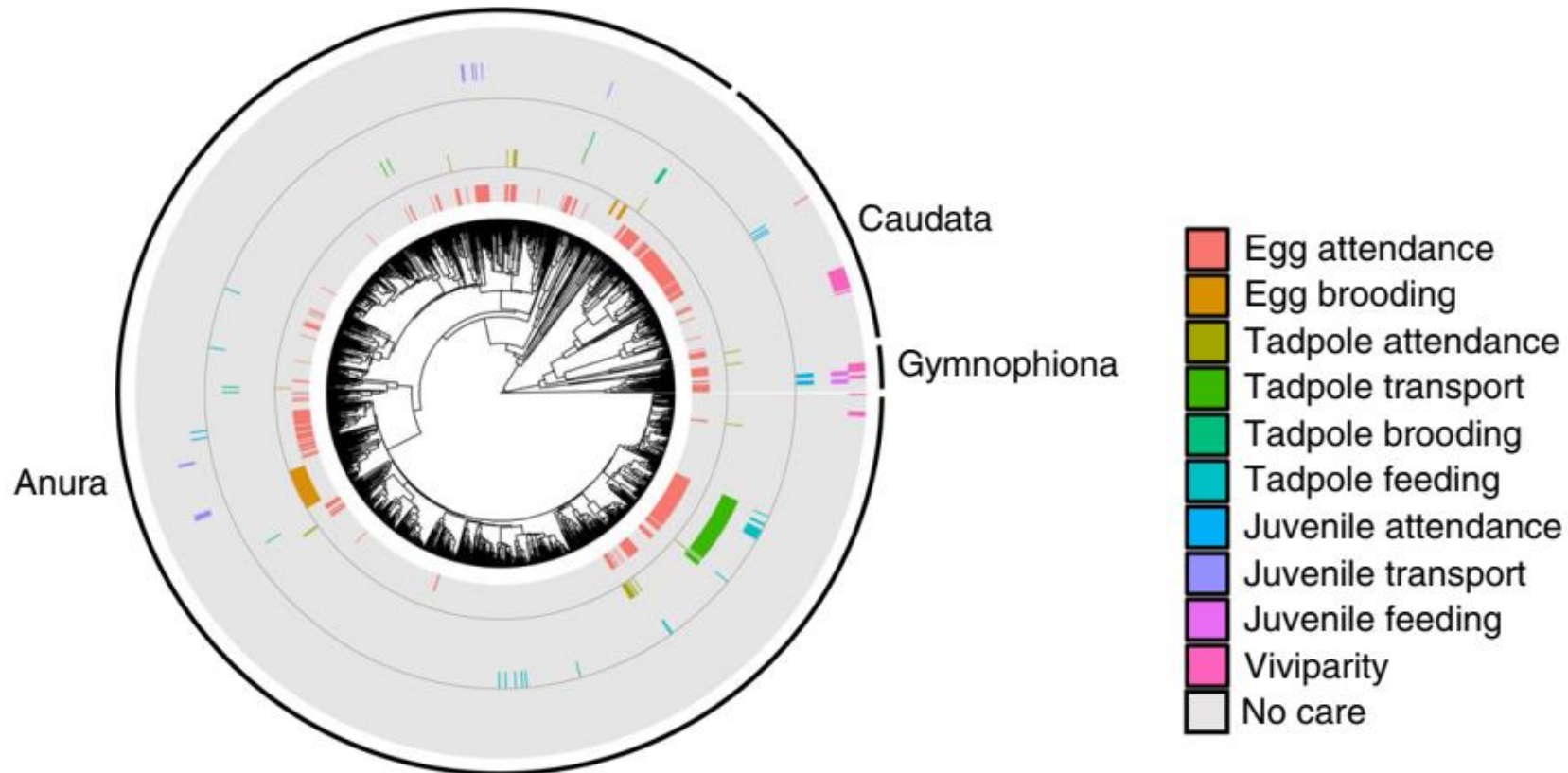
Solid circles & line: folivores

Open circles & dotted line: insectivores or frugivores



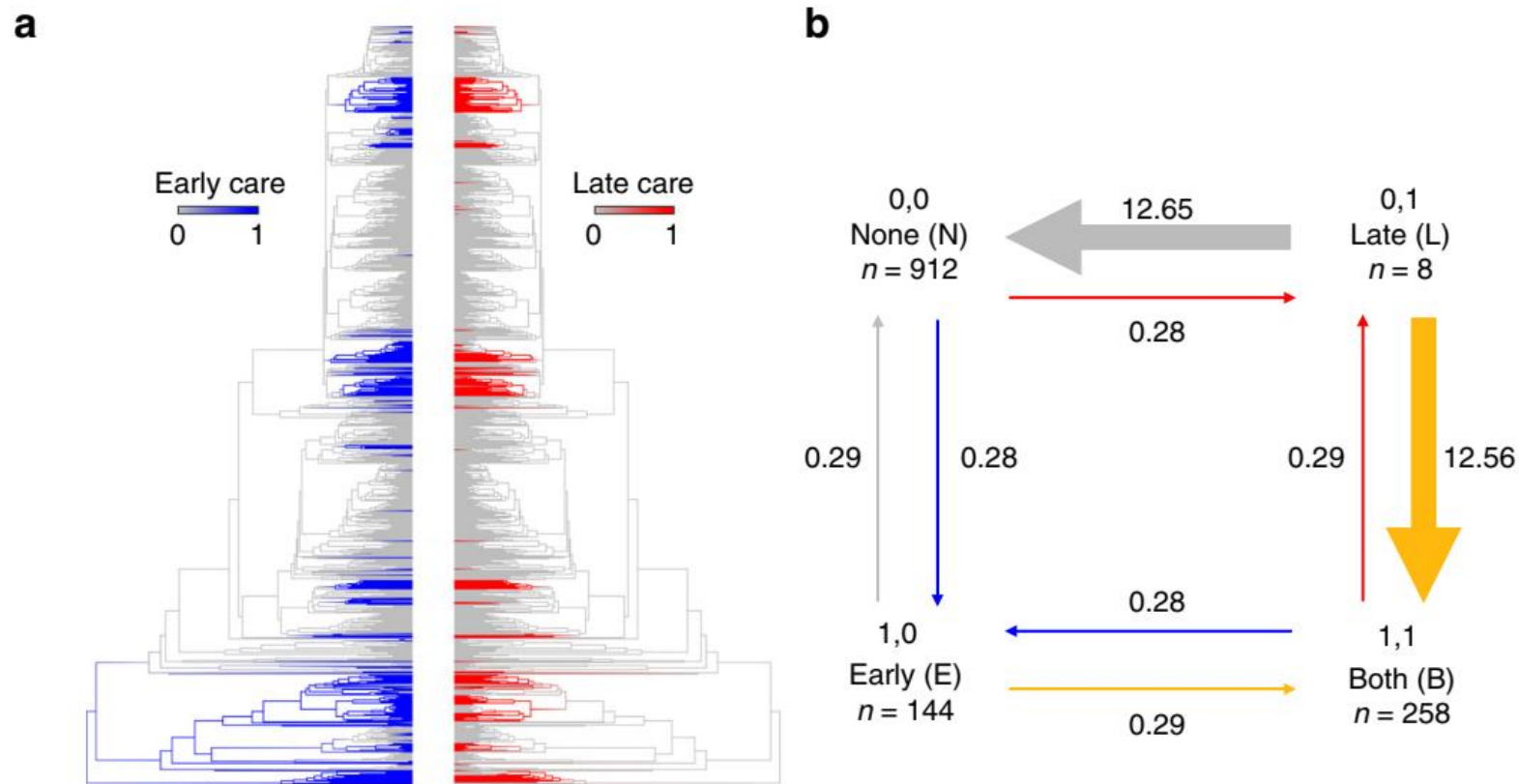
Who cares? Amphibian patterns

Most species do not provide any parental care. Egg attendance is most widespread, and is both easily gained and lost over evolutionary times.



Who cares? Amphibian patterns

Late care only is evolutionary instable, leading either to loss of parental care or to the occurrence of both early and late care.



Who cares? Birds without parental care?



Megapode birds do not care: thermal heat incubates the eggs. The precocial young do not need care after hatching.

Who cares? Variation in care in plovers

White-fronted plover



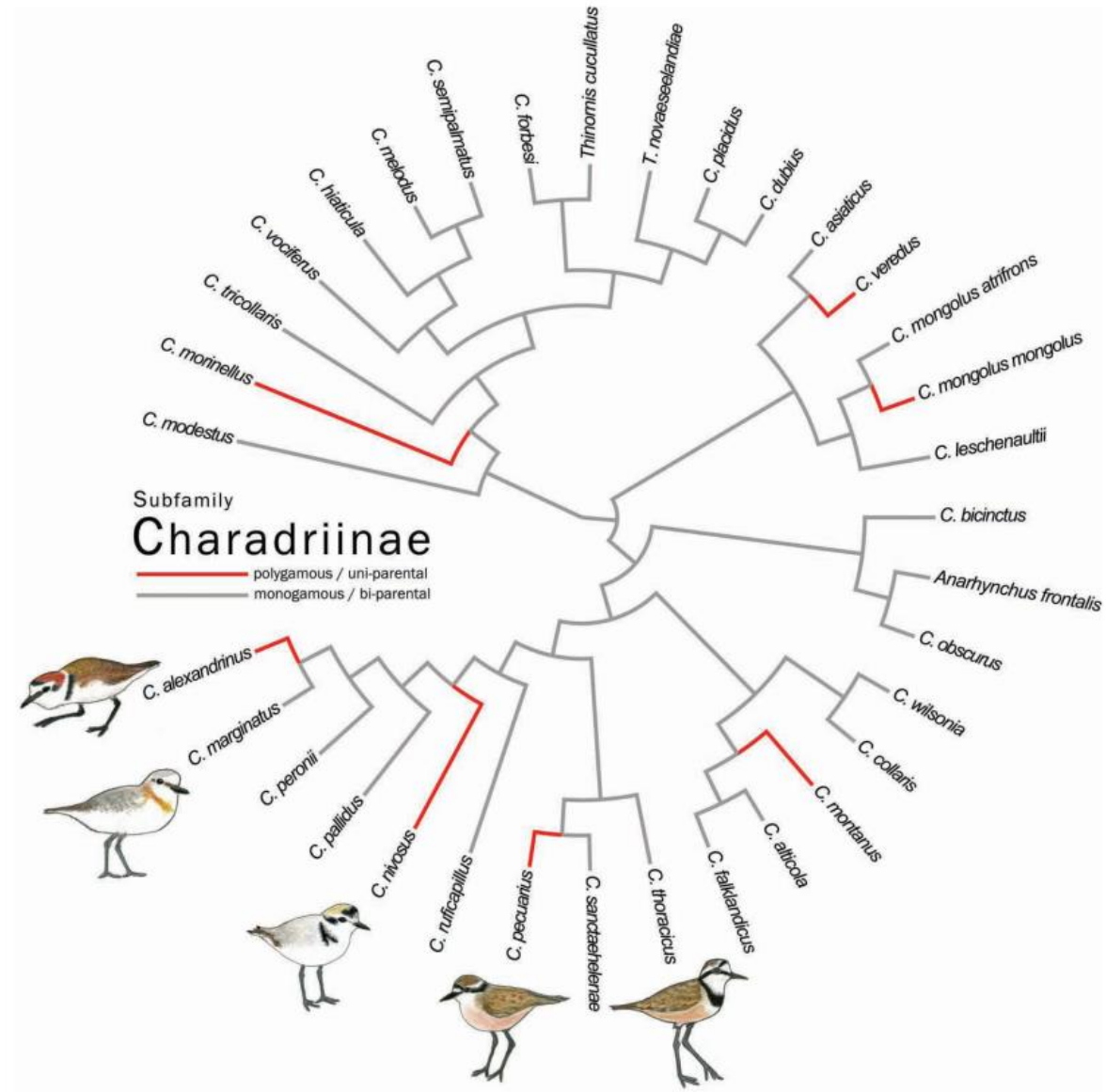
Kentish plover



Plovers vary in care patterns

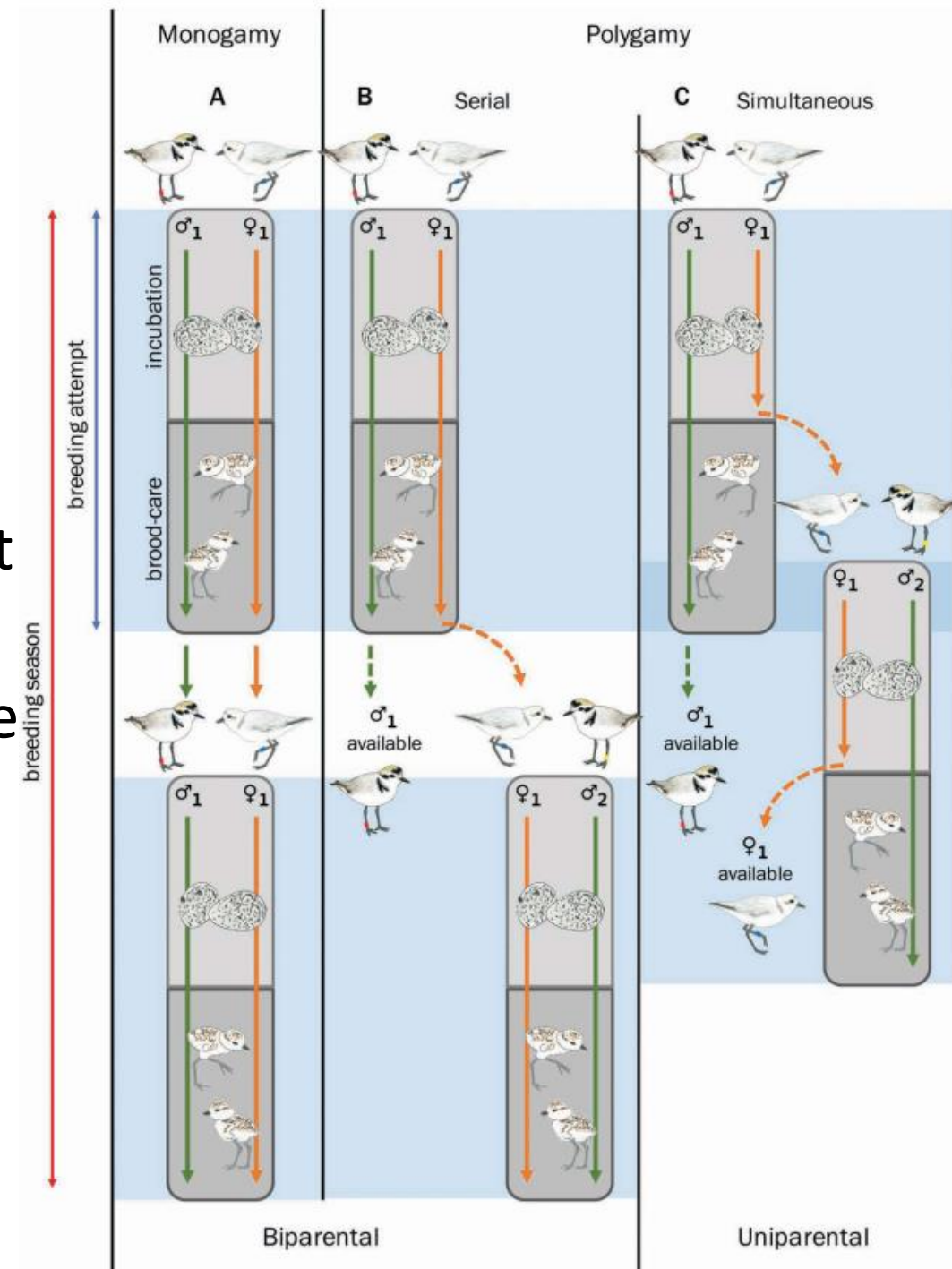
- Some species have uniparental care, others bi-parental care

➤ How come?



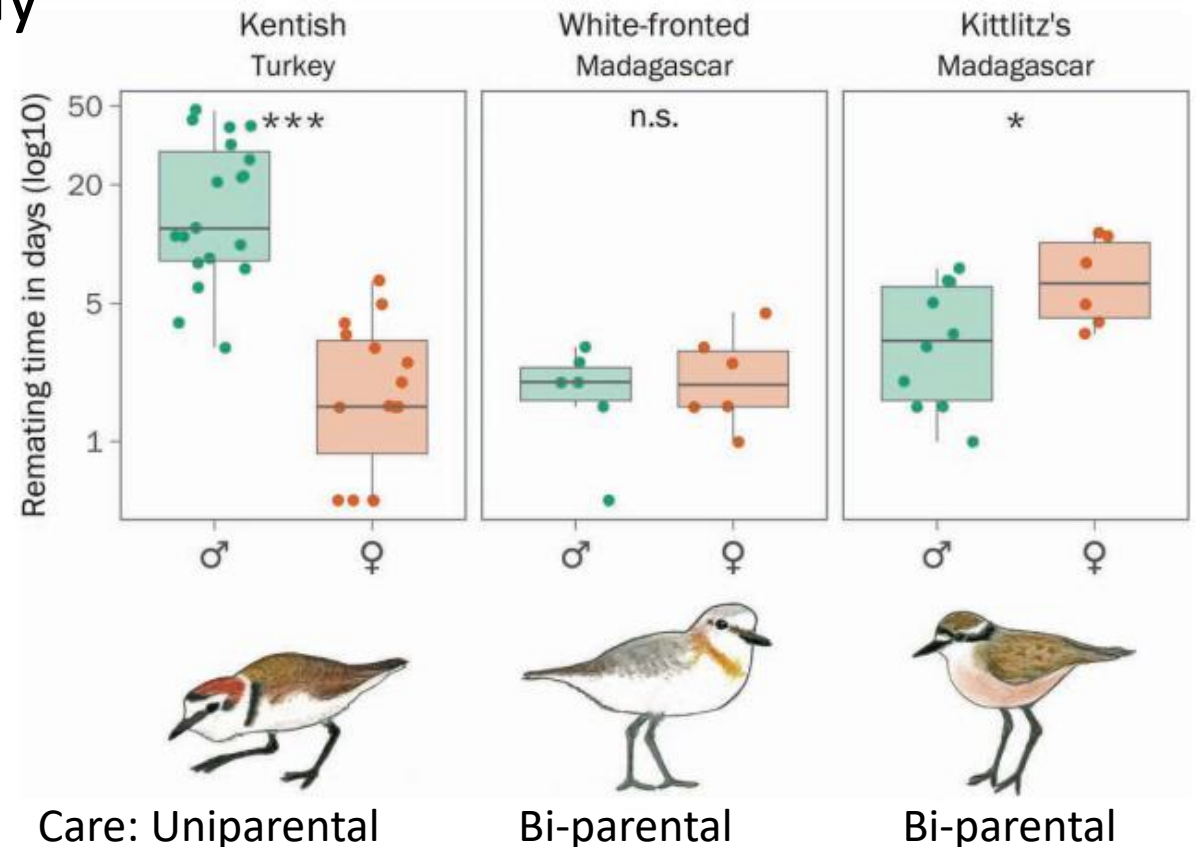
Variation in plover PC

- Species differ in how parents interact
- Monogamous: parents remain together
- Polygamous: parents separate, only one parent cares for offspring
- Only polygamous plovers have uniparental care



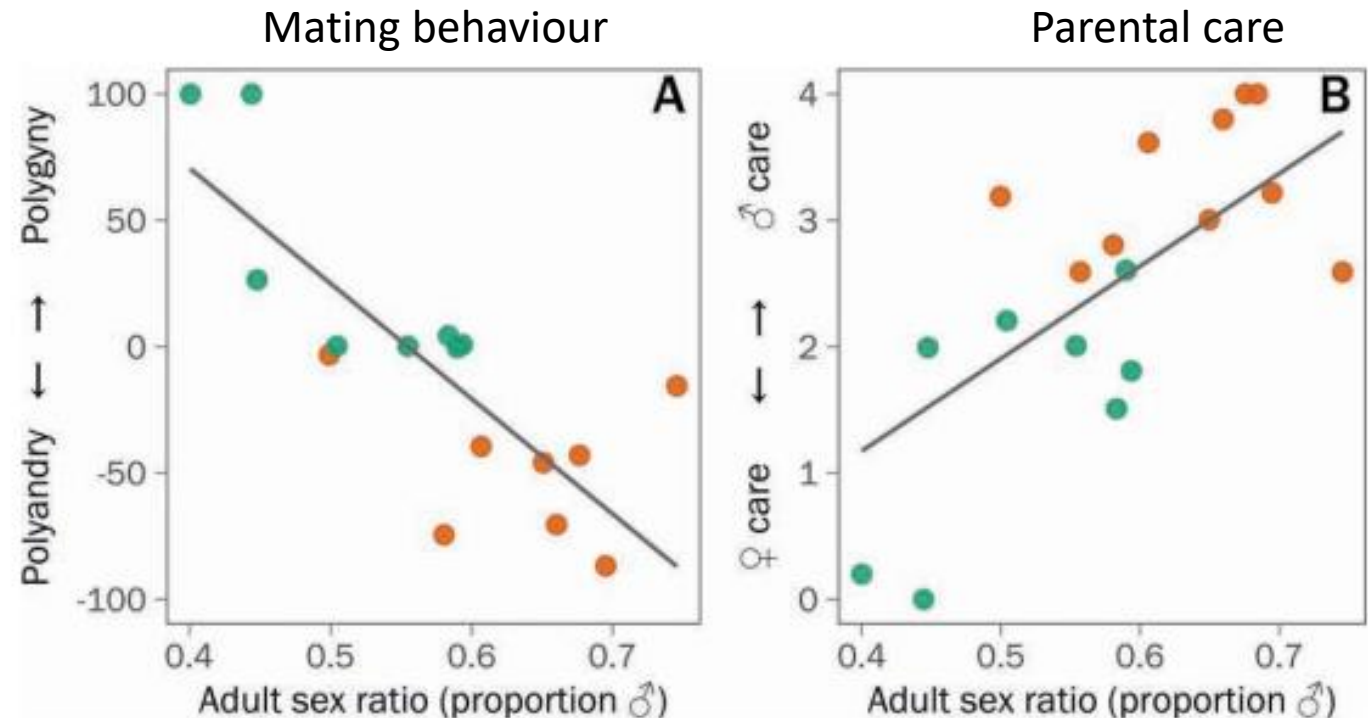
Who cares? Variation in care in plovers

- Species differ in the time it takes to re-mate after divorce
- Pair bond strength is linked to parental care strategy
- Bi-parental species form bonds quickly
- Uni-parental species need longer



Who cares? Variation in care in shorebirds

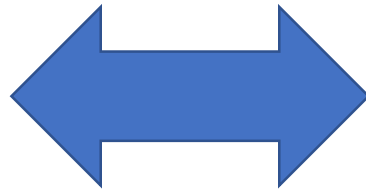
- Adult sex ratio (ASR) matters:
- ♀ care when ASR is ♀ biased, ♂ care when ASR is ♂ biased
- Critical to understand drivers of ASR



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How many offspring should I produce?



Offspring number vs parental care

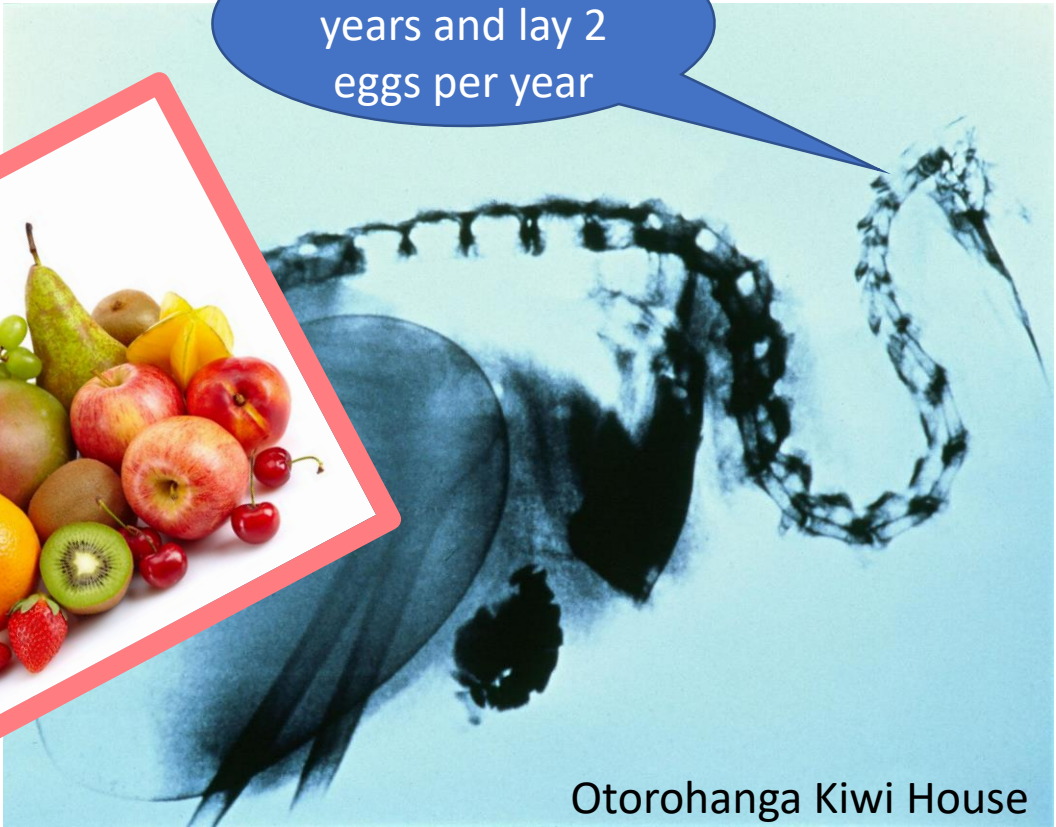
I can live for 20 years & lay 20.000 eggs/day!



We only have a life-span of 1-2 months & cannot produce offspring

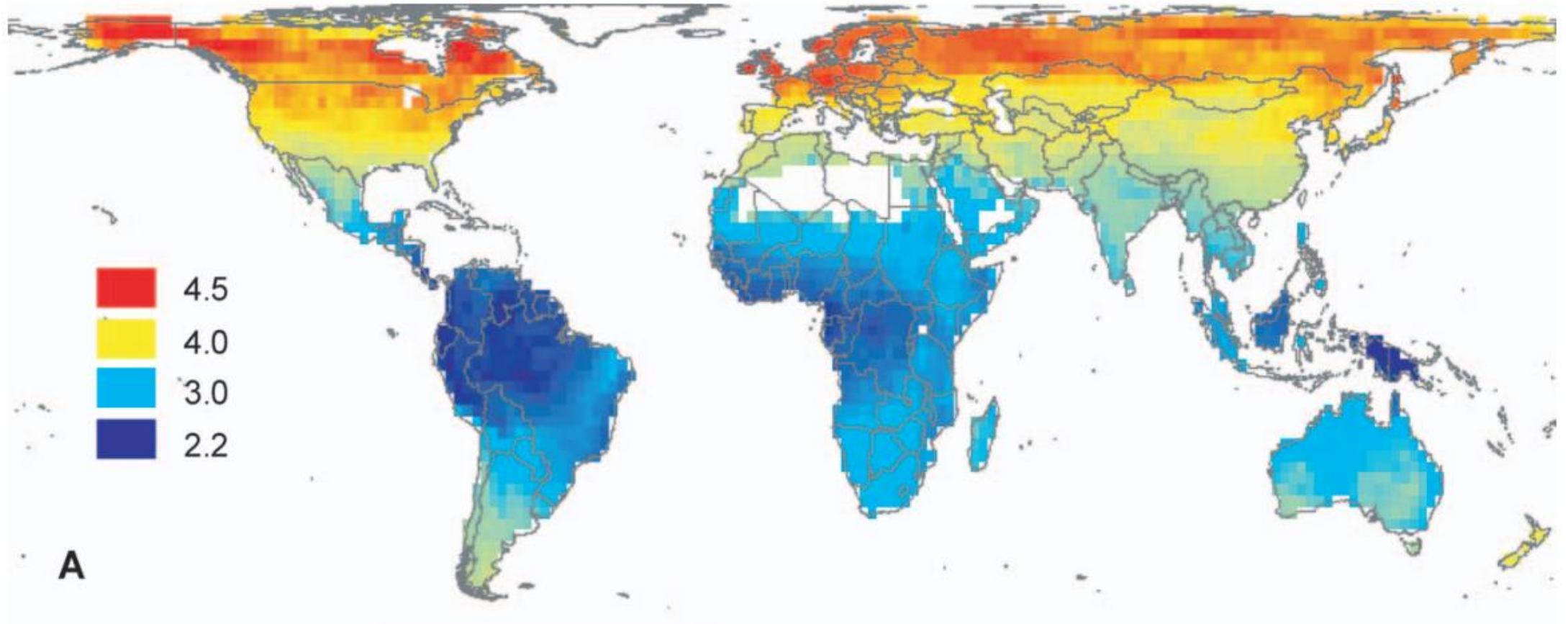


I can live for 20 years and lay 2 eggs per year



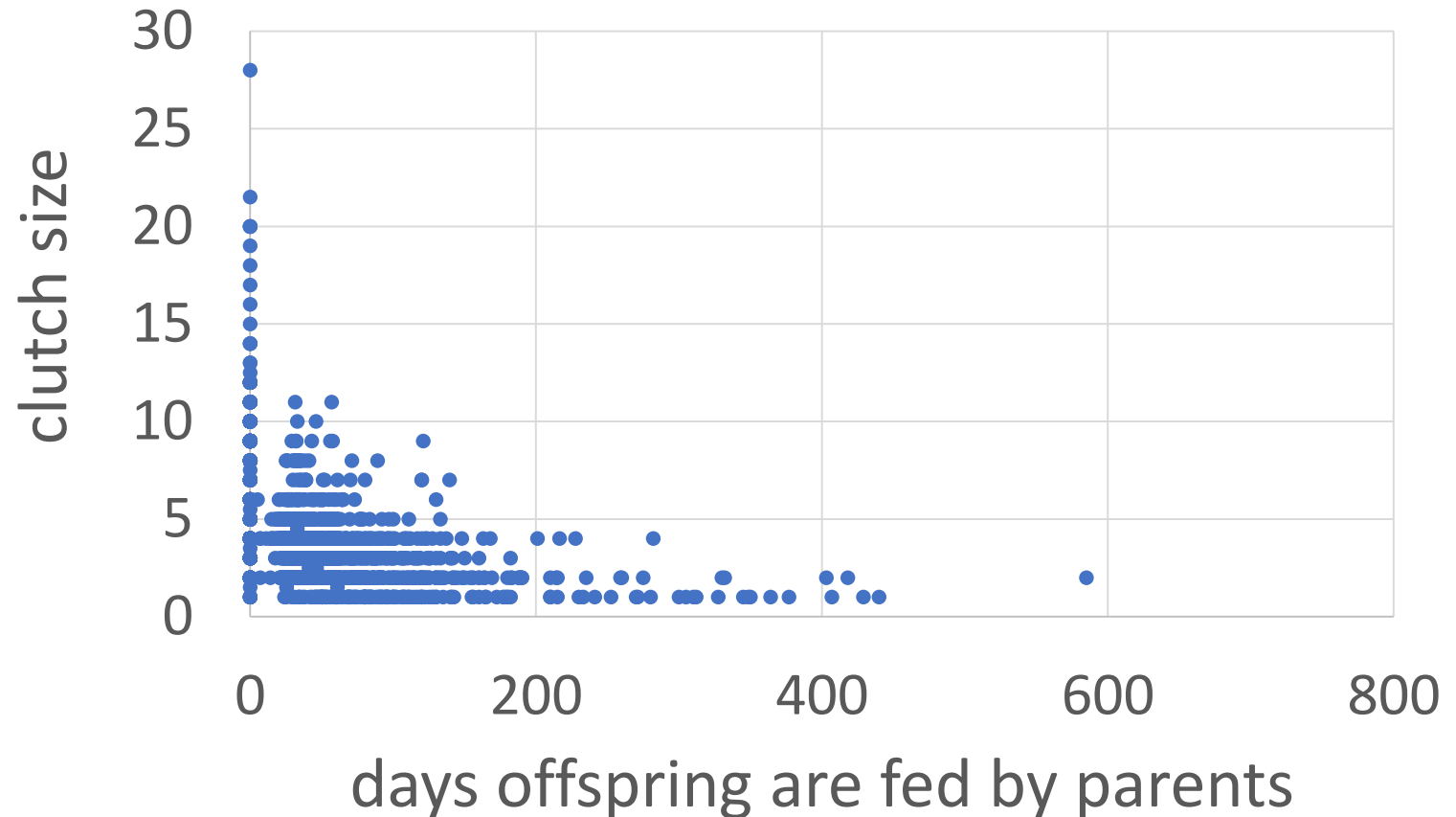
Termite queen vs female kiwi

Global variation in clutch size in birds



Offspring number affects parental care

- In birds, larger clutches are associated with less feeding
- Any idea why?



Costs of reproduction

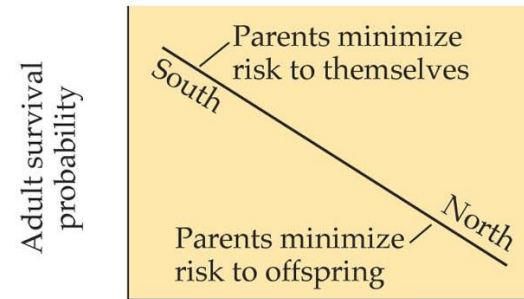
- Parents have limited time and energy
- Trade-off between offspring number, size and time carrying
- The more parents invest now, the less likely they survive
- Pace of life syndrome: fast vs slow
- Fast: invest a lot in current reproduction
- Slow: invest a lot in survival



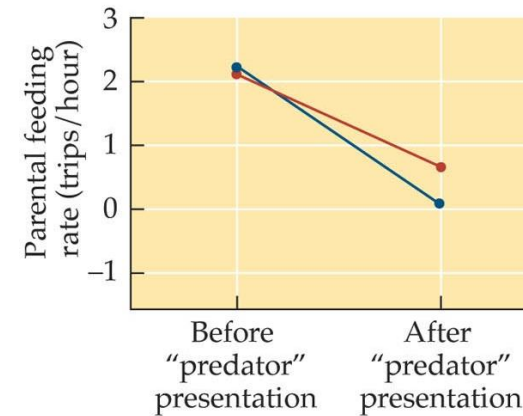
Short vs long lived species: different priorities



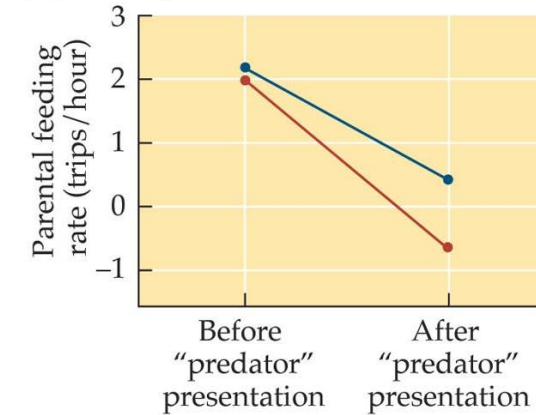
(A)



(B) Nest predator



(C) Adult predator

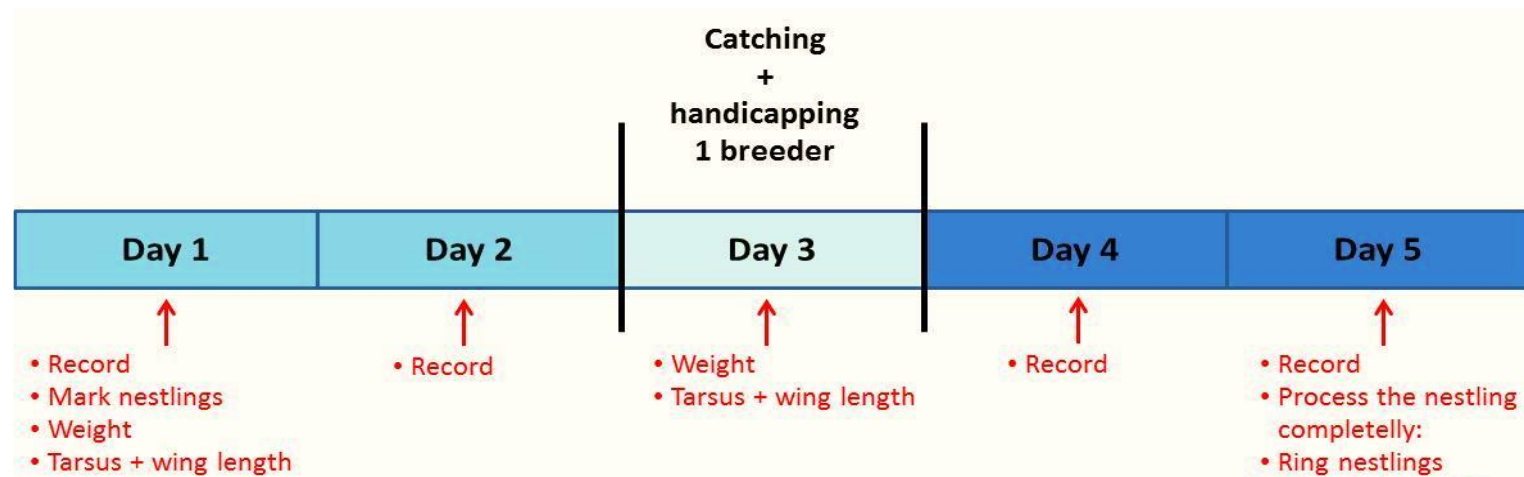


American robin (short lived, blue), Rufous-bellied thrush (long lived, orange)
American robins are more sensitive to nest predators
Rufous-bellied thrushes are more sensitive to predator of adults
Lifespan affects trade-off between own survival and offspring survival

Total duration of care: different priorities

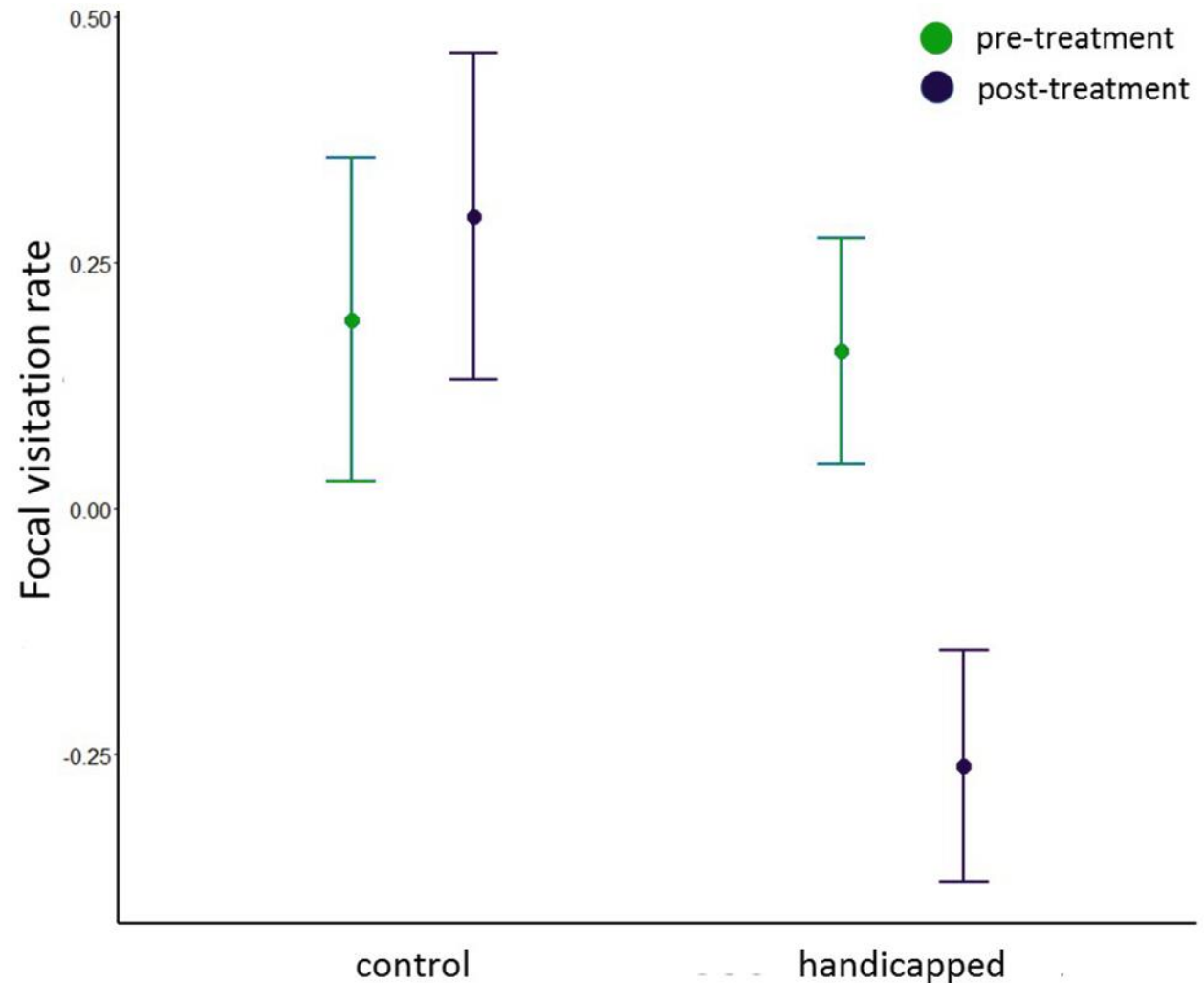
- How respond parents to increased cost of feeding young?
- Handicap (clip a feather) in 5 bird species

Total duration of care: experimental set-up



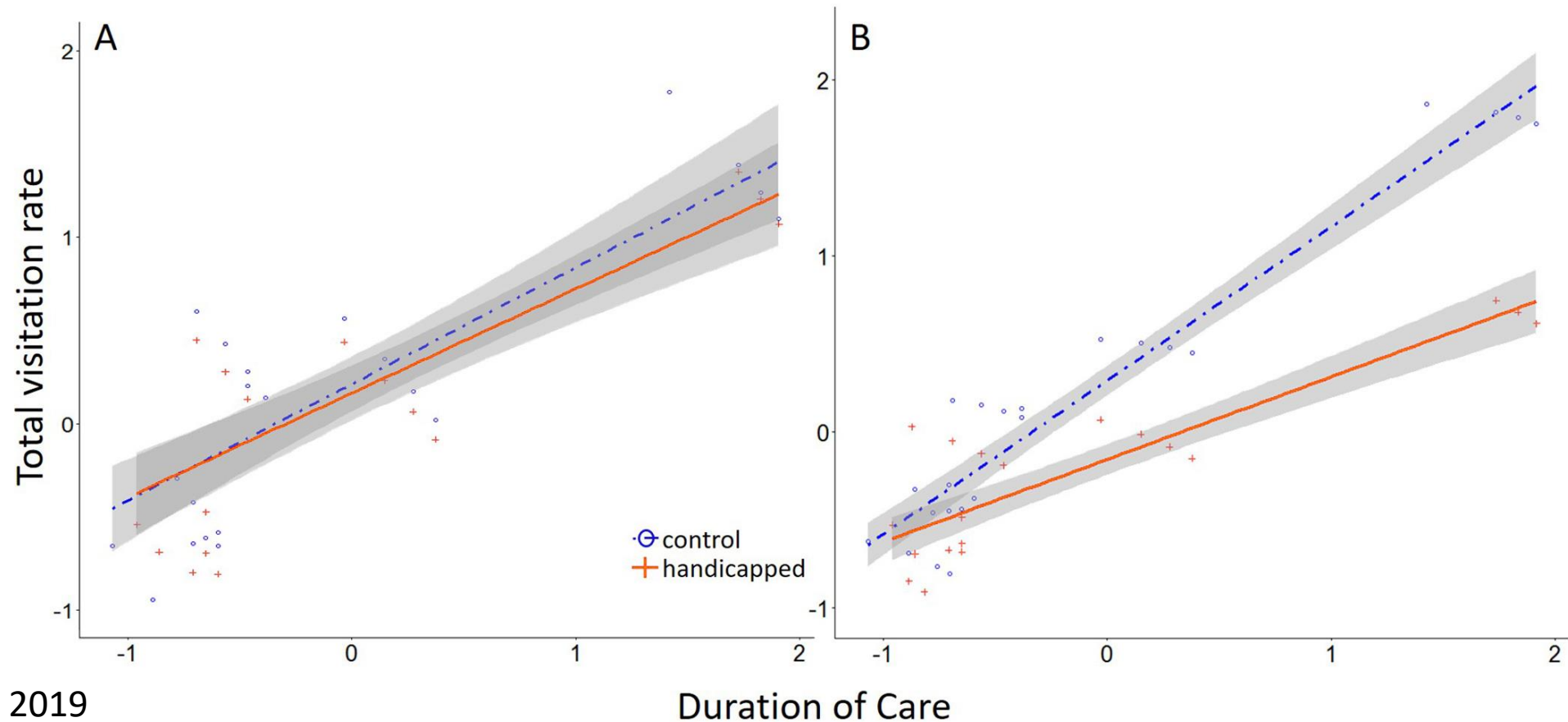
Total duration of care: different priorities

- How respond parents to increased cost of feeding young?
- Handicap (clip a feather) in 5 bird species



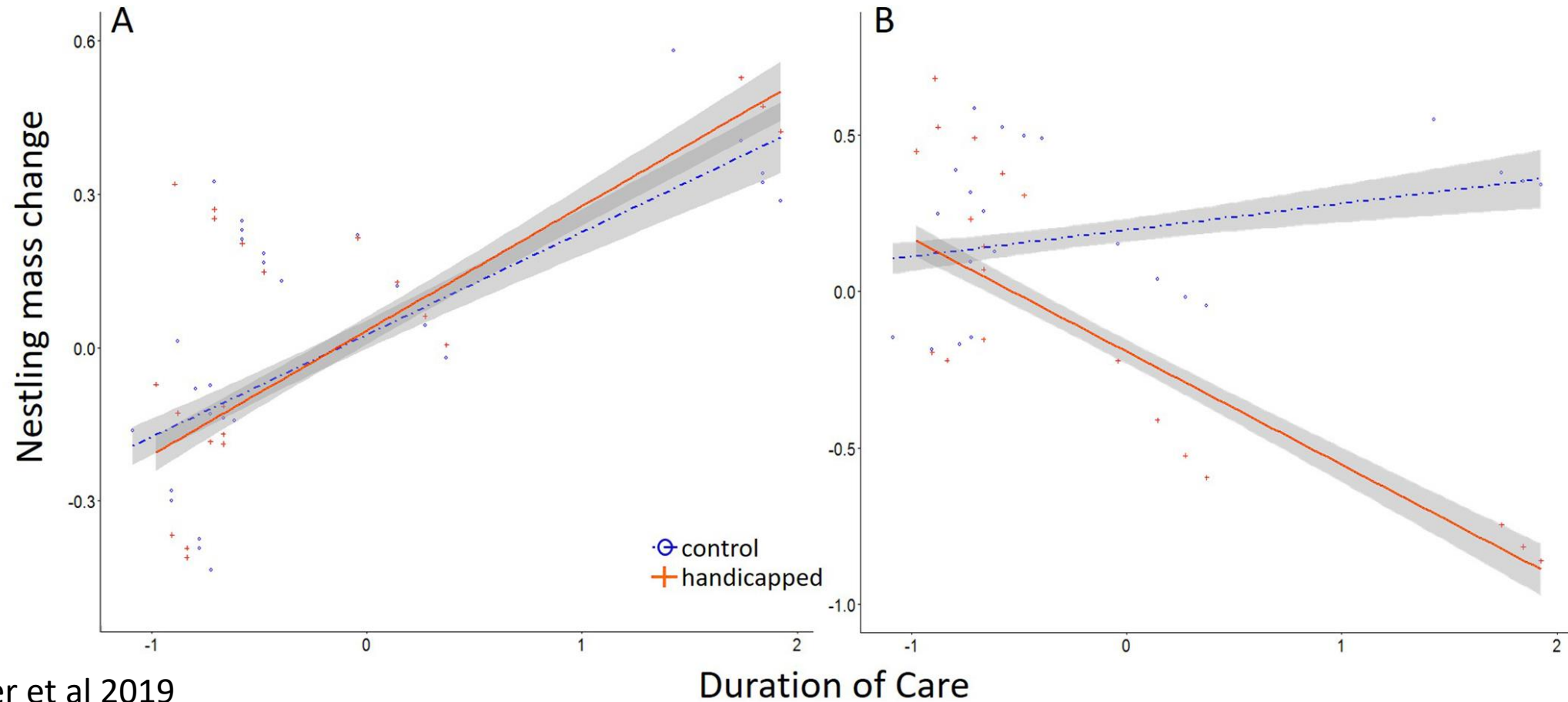
Total duration of care: different priorities

A before, B after handicapping: species with extended care reduce their feeding



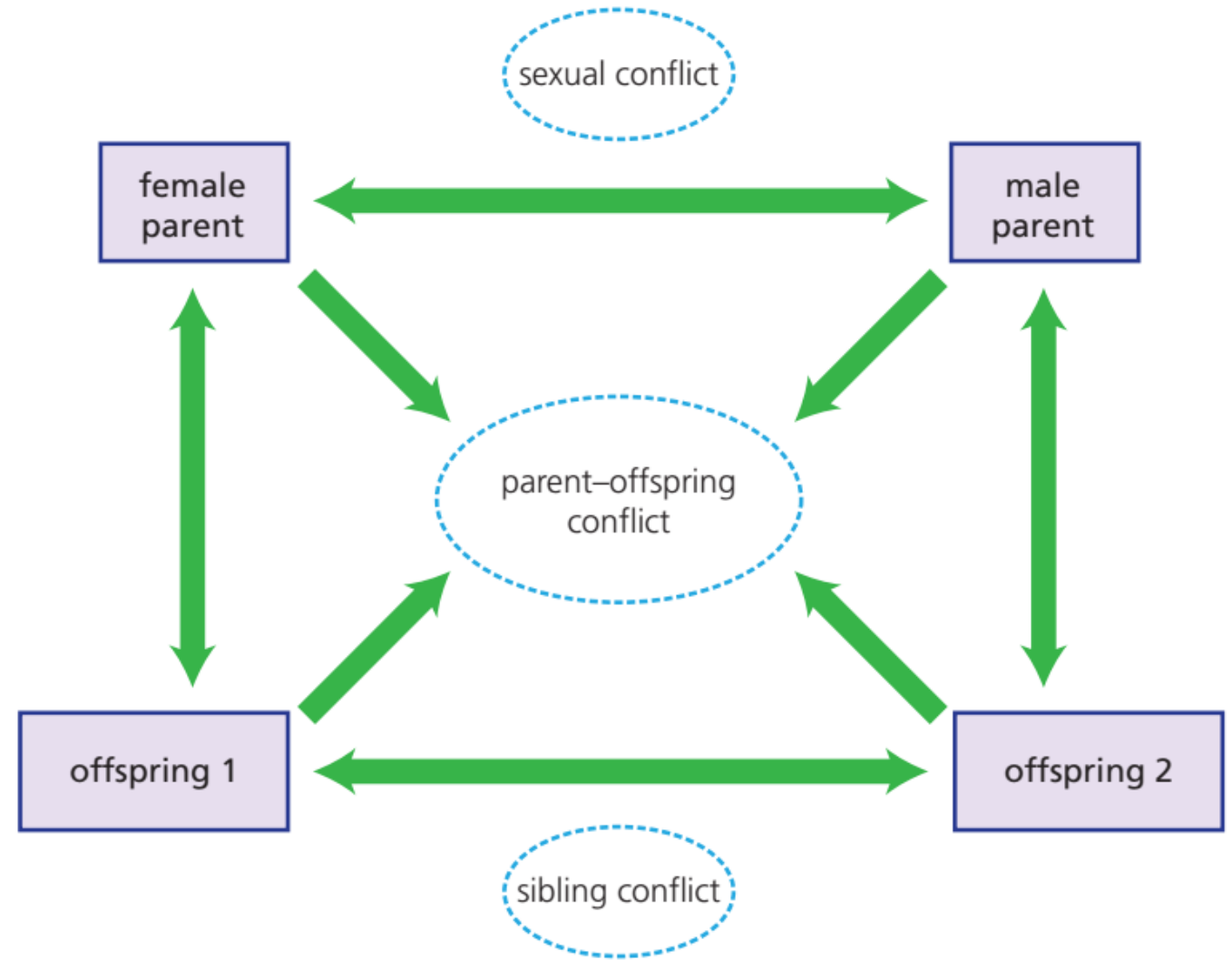
Total duration of care: different priorities

A before, B after handicapping: young in species with extended care suffer more



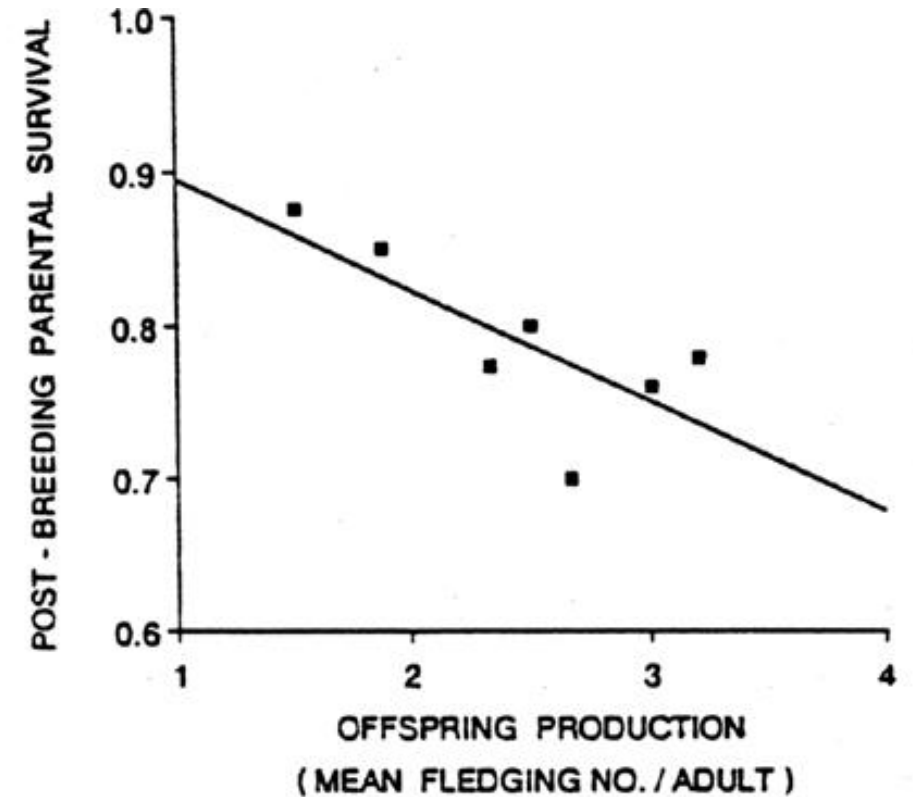
How much should I care?

- Maximise the own options
- Creates conflicts:
 - Parent vs parent
 - Parent vs offspring
 - Sibling vs sibling



Parental care is costly

Successfully breeding willow tit parents suffer from increased mortality

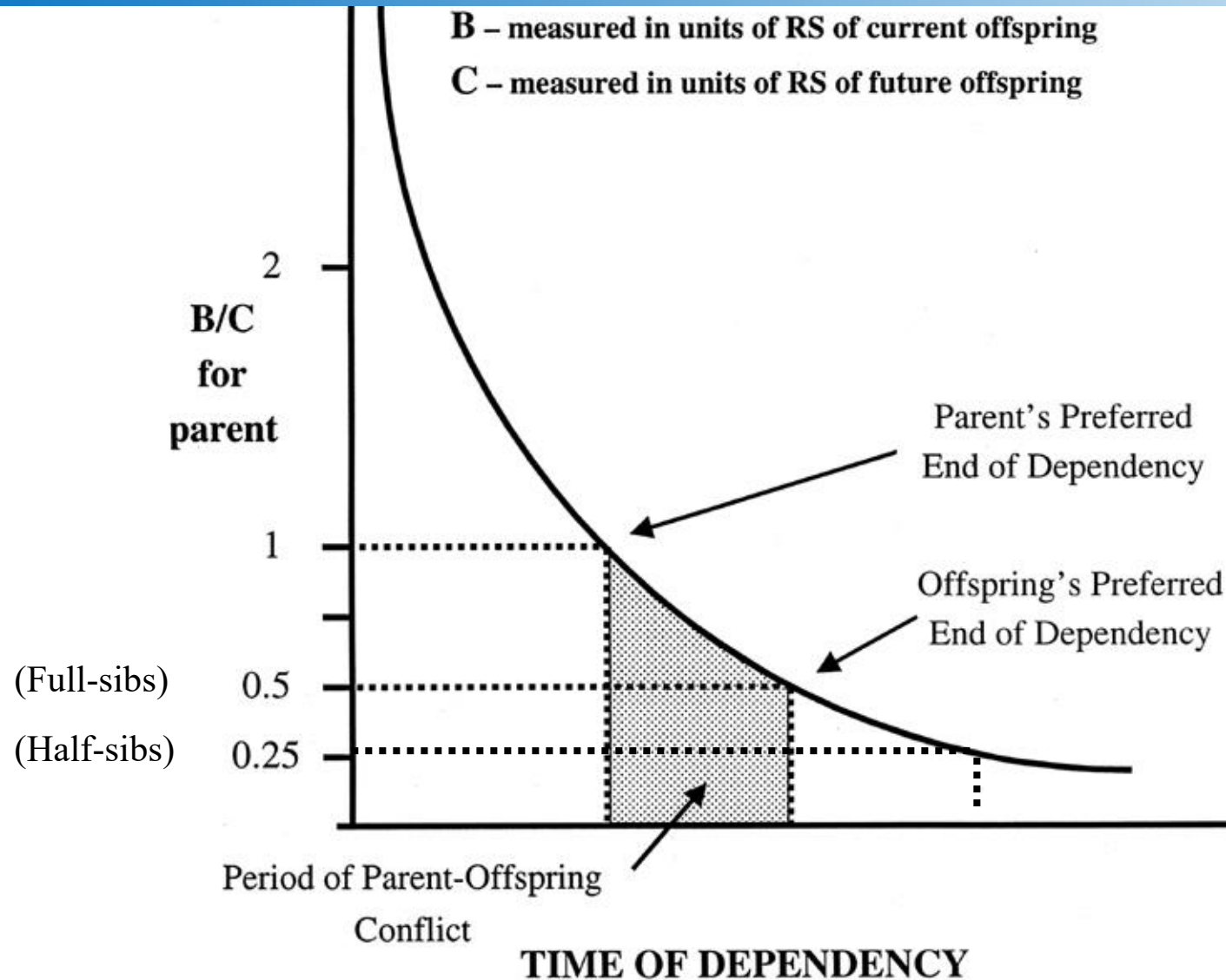


Ekman and Askemo 1986

How long should I care?

- Parent shares only 50% of its genes with each offspring
- Offspring are 100% related to itself
- Offspring shares 50% of genes with full-siblings
- Parent-offspring conflict over provisioning (Trivers 1971)

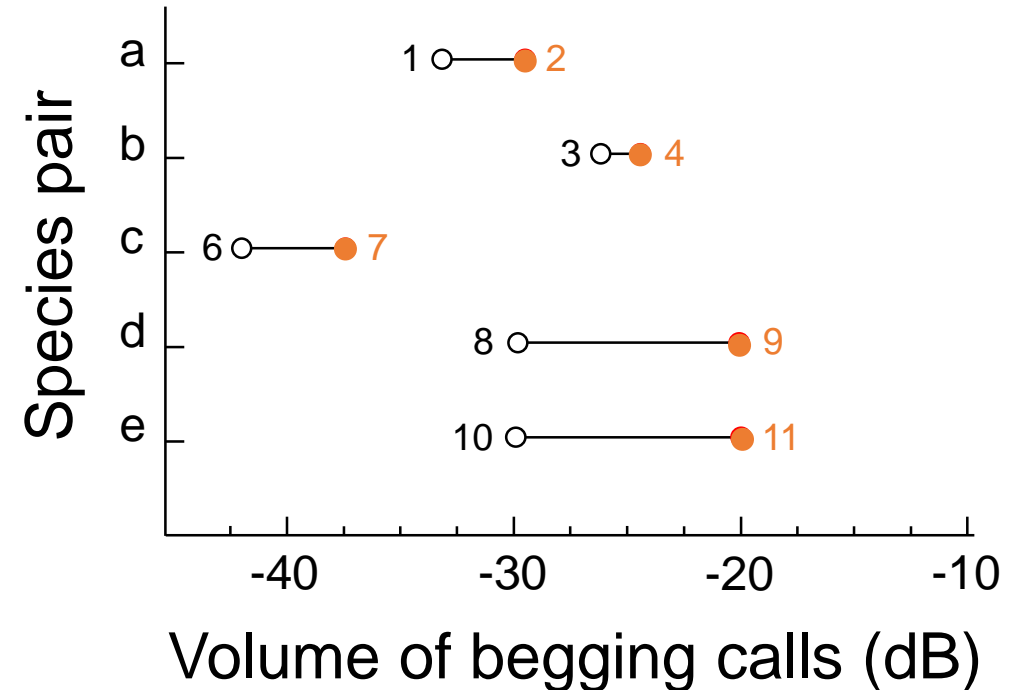
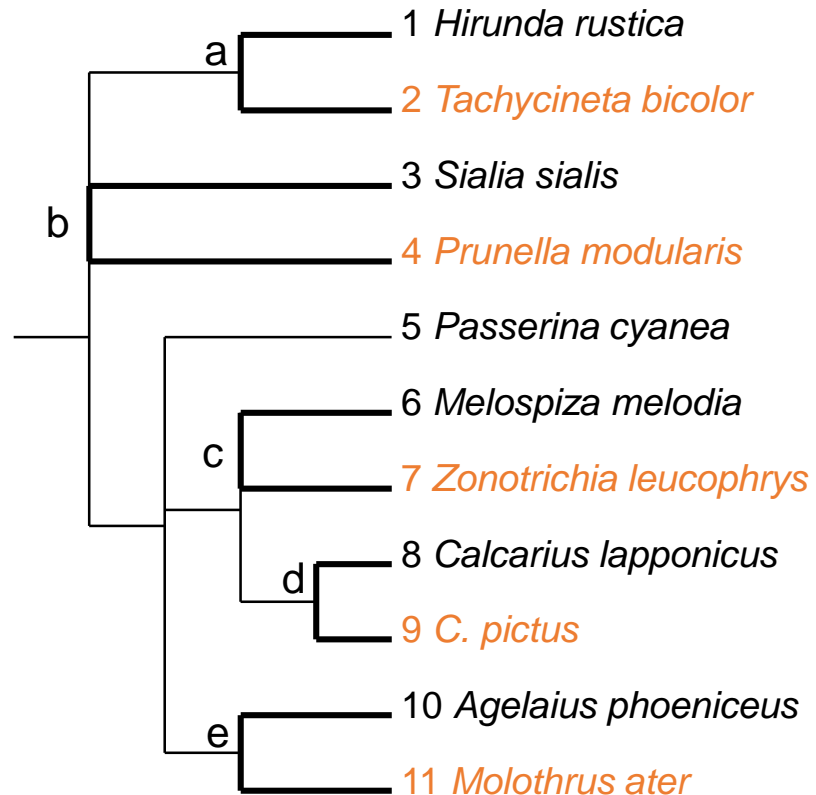
How long should I care?



Care less in species with extra-pair young

Begging calls are louder in species with low chick-chick relatedness

Increases risk of nest predation



high relatedness (monogamous)

low relatedness (frequent extrapair copulations or socially parasitic)

Outline lecture – parental care

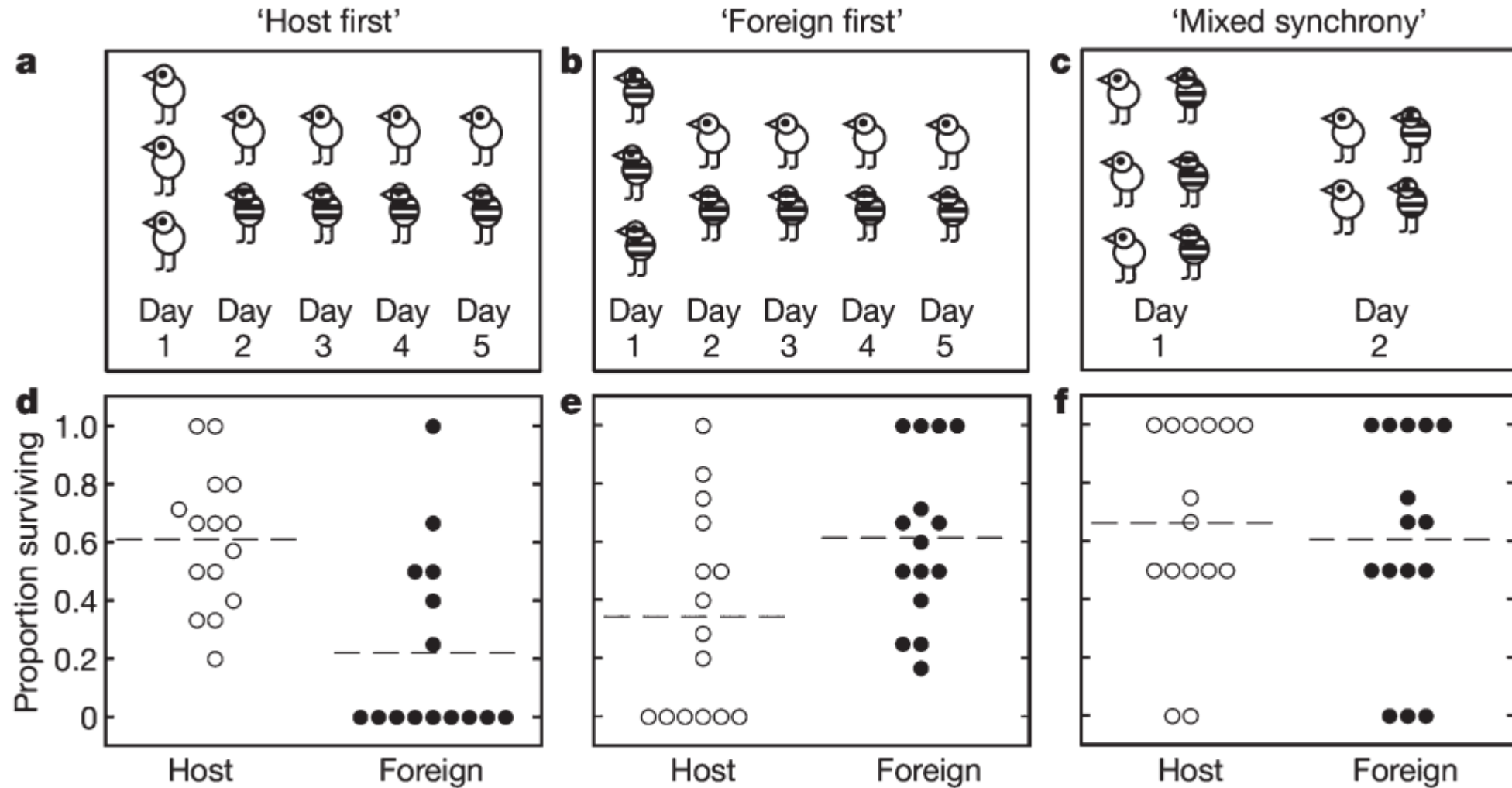
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Parental favouritism in American coots

- American coots suffer from intra-specific brood parasitism
- Parents discriminate against others young
- Rule: first born chick sets template for recognition



Parental favouritism in American coots



Parental favouritism in American coots

- Feather ornament of young coot affect parental feeding
- Parents prefer ornamented young
- Brood parasitism may have favoured parental preferences



Conflicts among siblings - siblicide

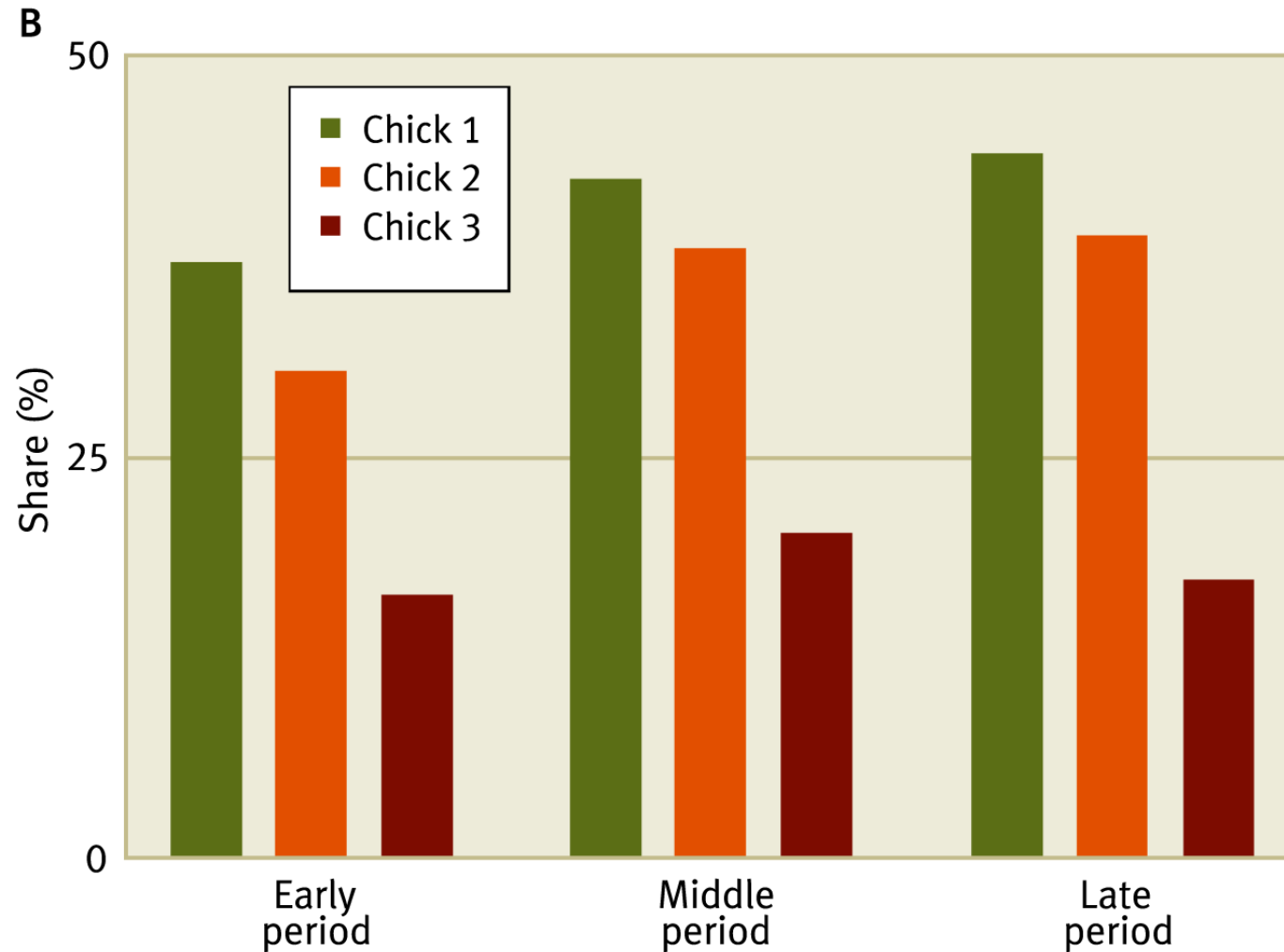


FIGURE 8.30: Birth order and food intake (right)

Principles of Animal Behavior
Copyright © 2004 W. W. Norton & Company

Mock and Parker 1997

Conflicts among siblings - siblicide

- Booby siblings: larger one aggresses smaller one, causing at times its death

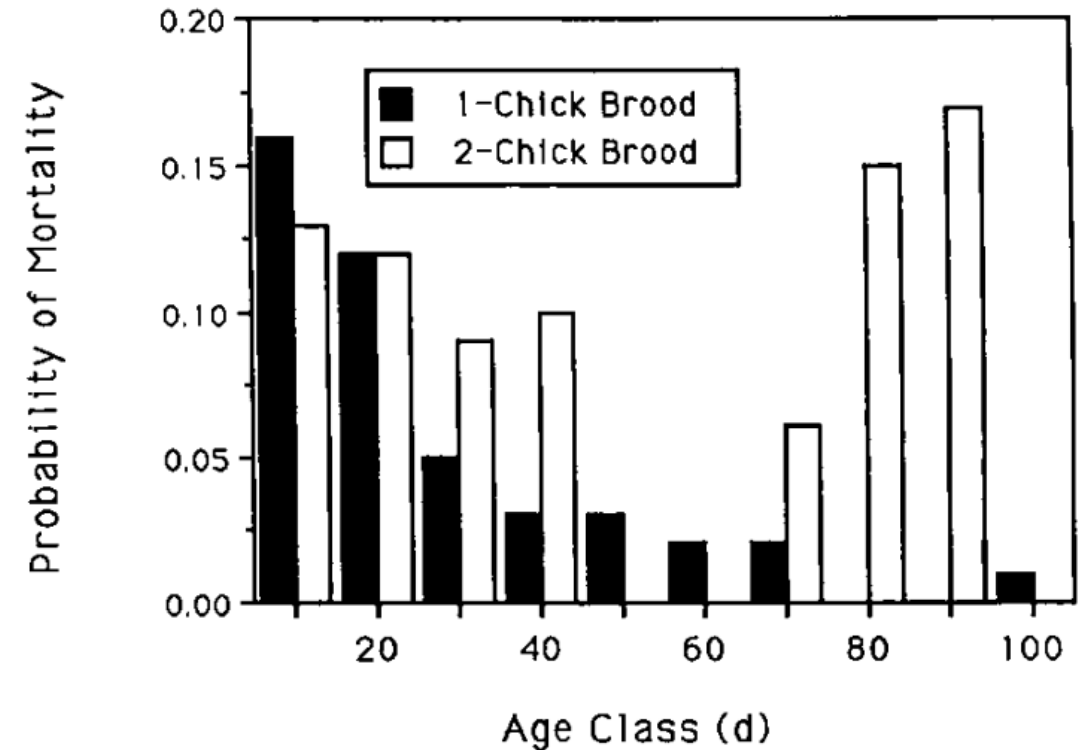


FIG. 5. Mortality schedules of singleton and experimentally doubled broods.

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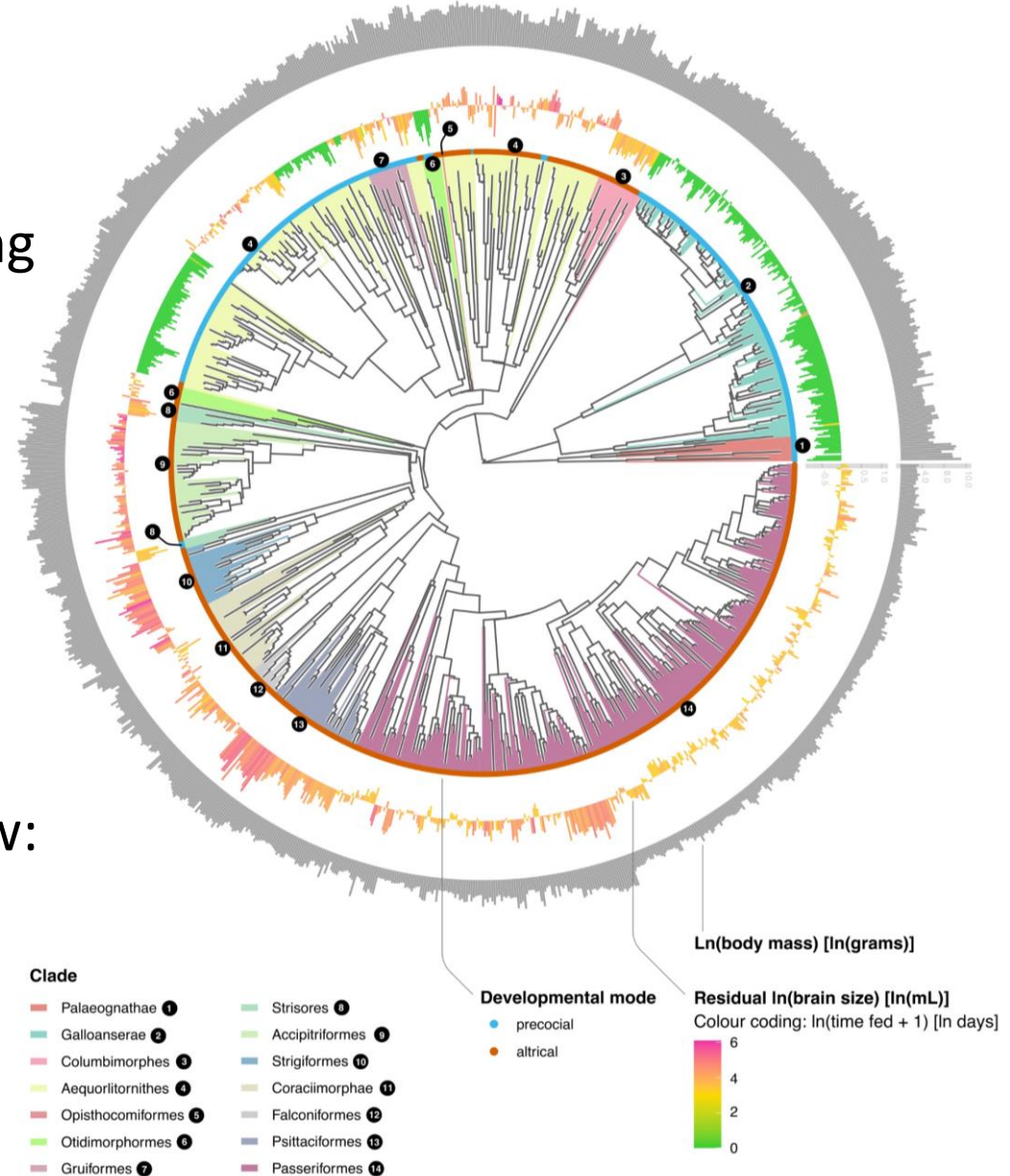
Parental provisioning increases brain size



Greylag goose:
don't feed their young



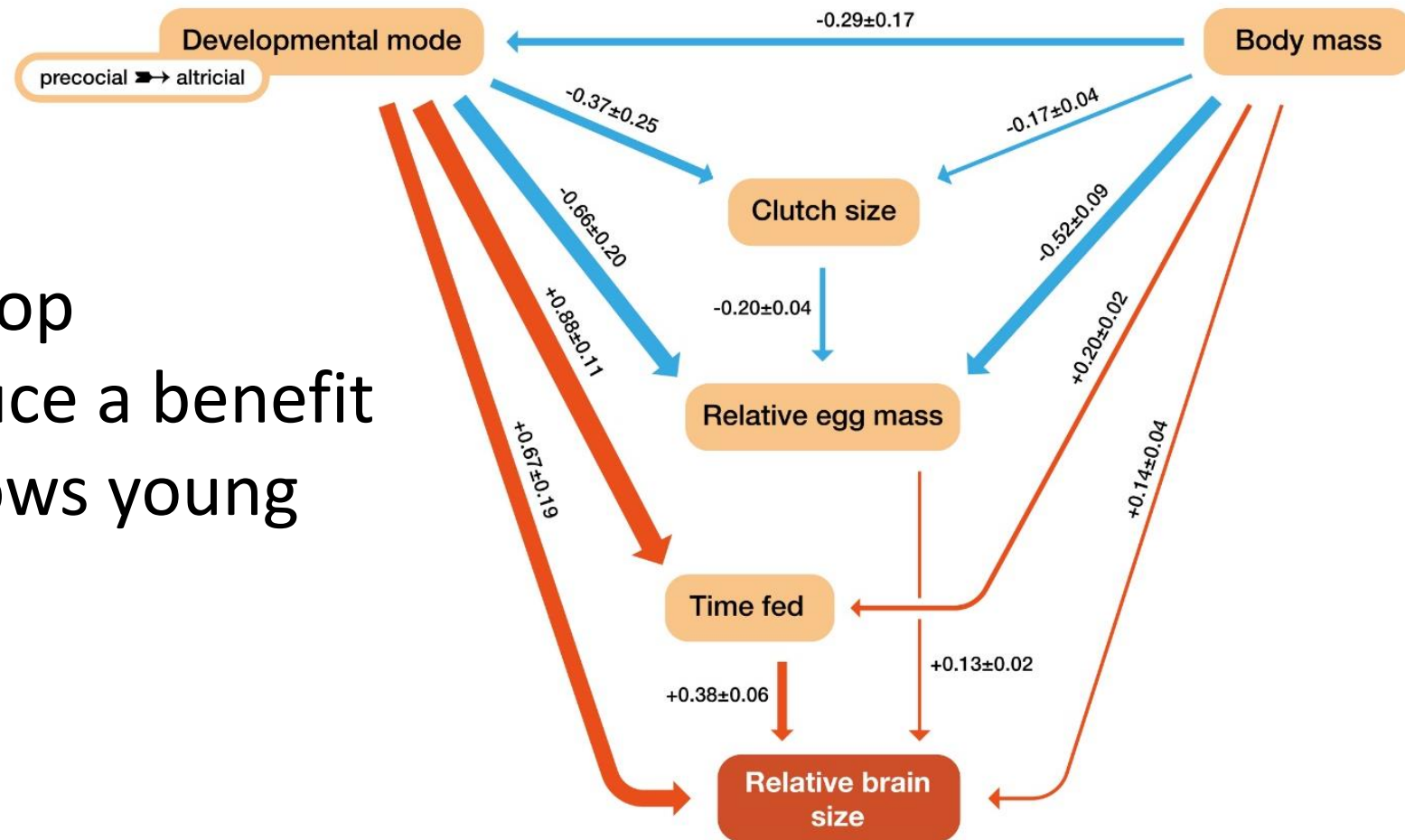
New Caledonian crow:
feeds young +1 year



Griesser et al in review

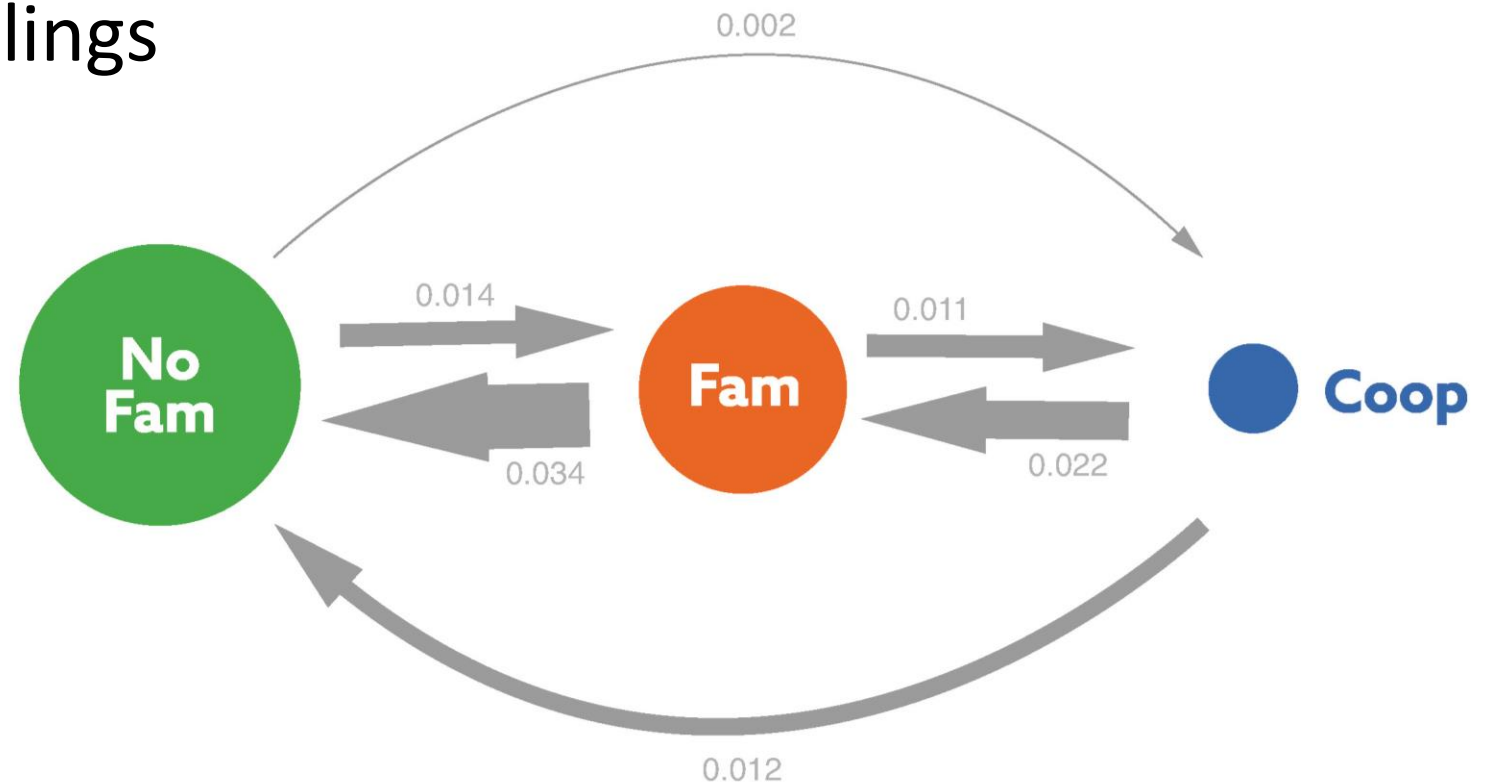
Parental provisioning increases brain size

- Brains are costly to develop
- Brains take time to produce a benefit
- Parental provisioning allows young growing a large brain



Extended parenting: stepping stone to cooperation

- Cooperative breeding (others than parents provide offspring care) evolves via family living
- Siblings raise younger siblings
- Kin selected benefits
- Why live in families?



Adaptive value of extended parental care



Siberian jay

Study system: Siberian jay

- Family-living corvid
- Population in Lapland (Sweden) started in 1953 by local amateur
- Scientific work initiated 1989 by Prof. Ekman
- Monitor 70 groups
- Followed life-history of over 2000 individuals



Study system: Siberian jay

Group composition:

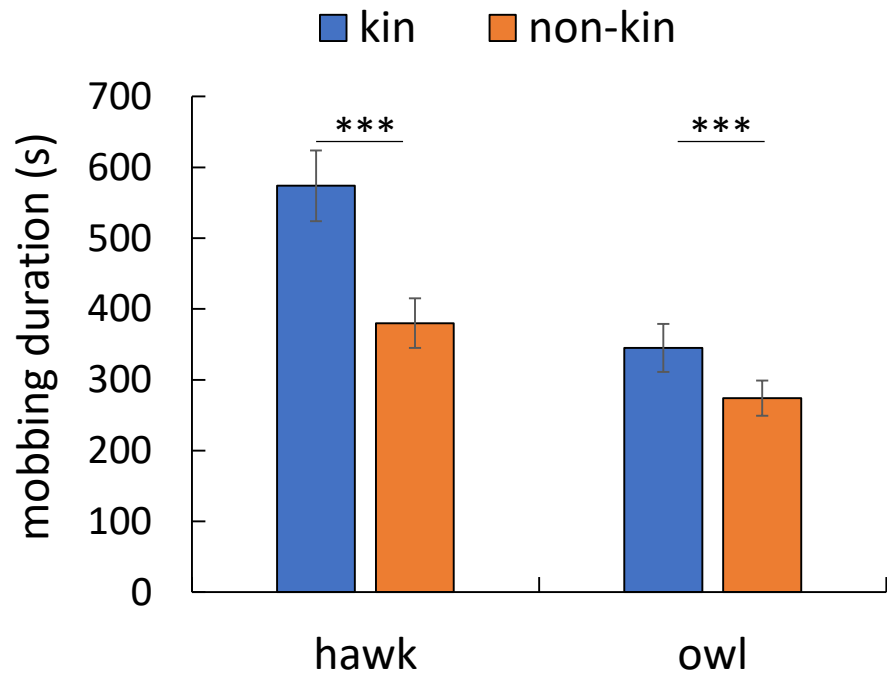
- Breeding pair
- Retained offspring (kin)
- Immigrant non-breeders (non-kin)

Non-kin allow us to identify the specific benefits of family living

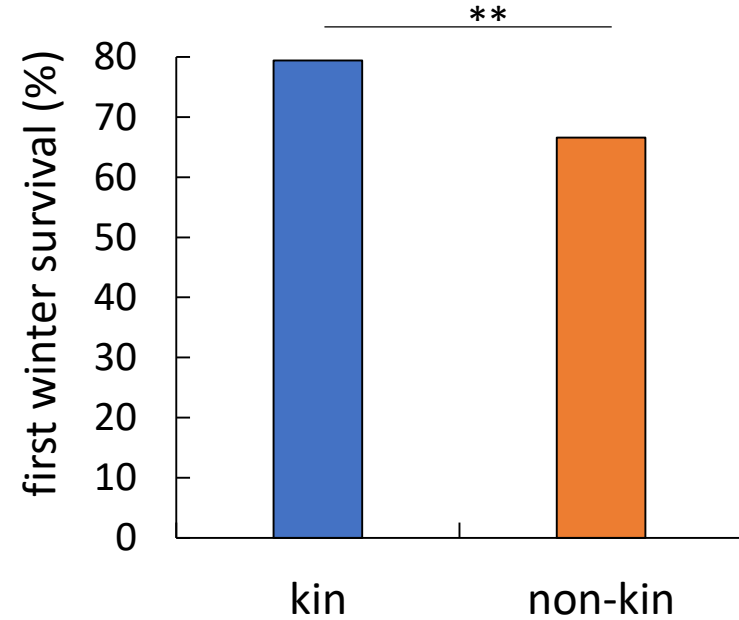


Adaptive value of extended parental care

- Breeders are nepotistic when mobbing predators
- Kin survive better than non-kin



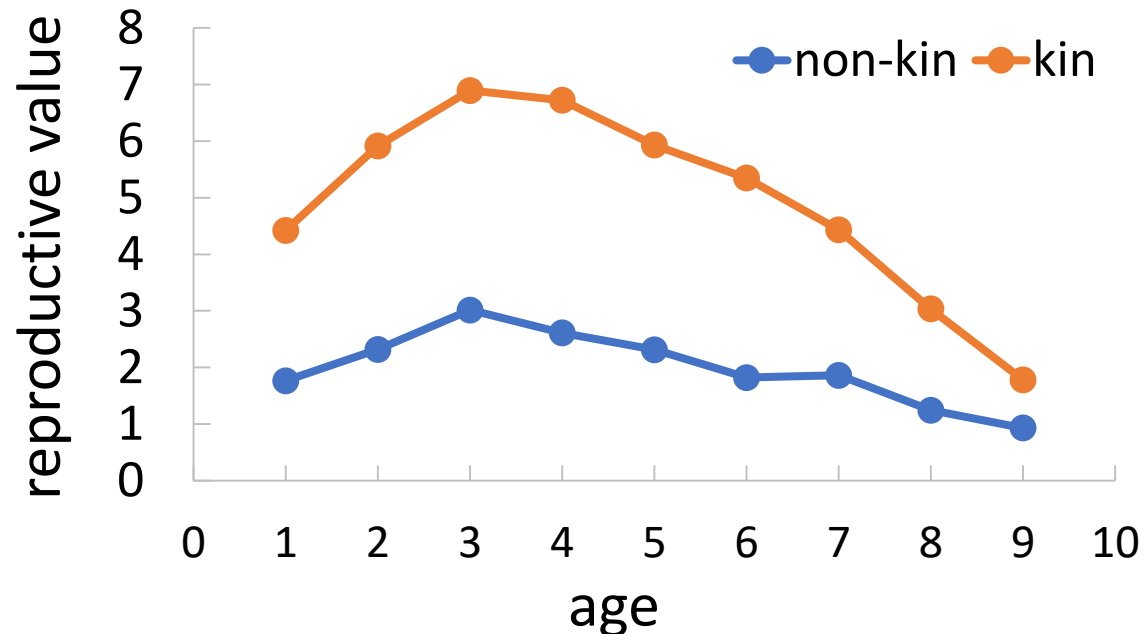
Griesser & Ekman 2005 Anim Behav



Griesser et al 2006 Proc R Soc B

Adaptive value of extended parental care

- Family-living provides a safe haven: predator protection, access to food
- Kin do better than non-kin



Adaptive value of extended parental care

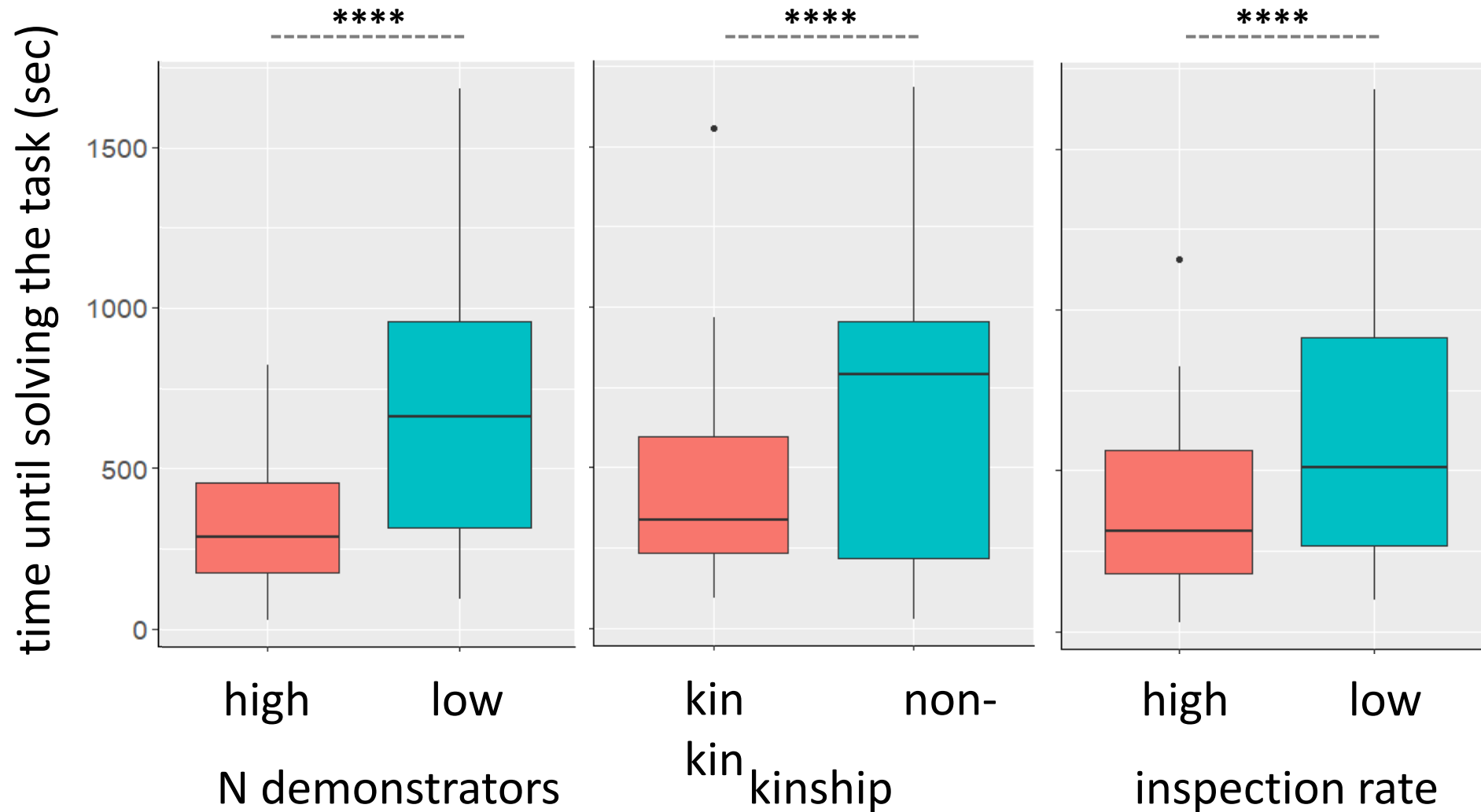
- Family-living provides a safe haven: predator protection, access to food
- Kin do better than non-kin
- Beneficial for kin and their parents
- Offspring need to disperse to breed
- Novel hypothesis: skill learning is a critical function of family living

Skill learning: a benefit of family living?

- How do naïve juveniles learn to solve a novel foraging task?
- Older group members trained in previous year
- Task is novel for juveniles
- N=38 juveniles in 24 groups



Learning novel foraging skills



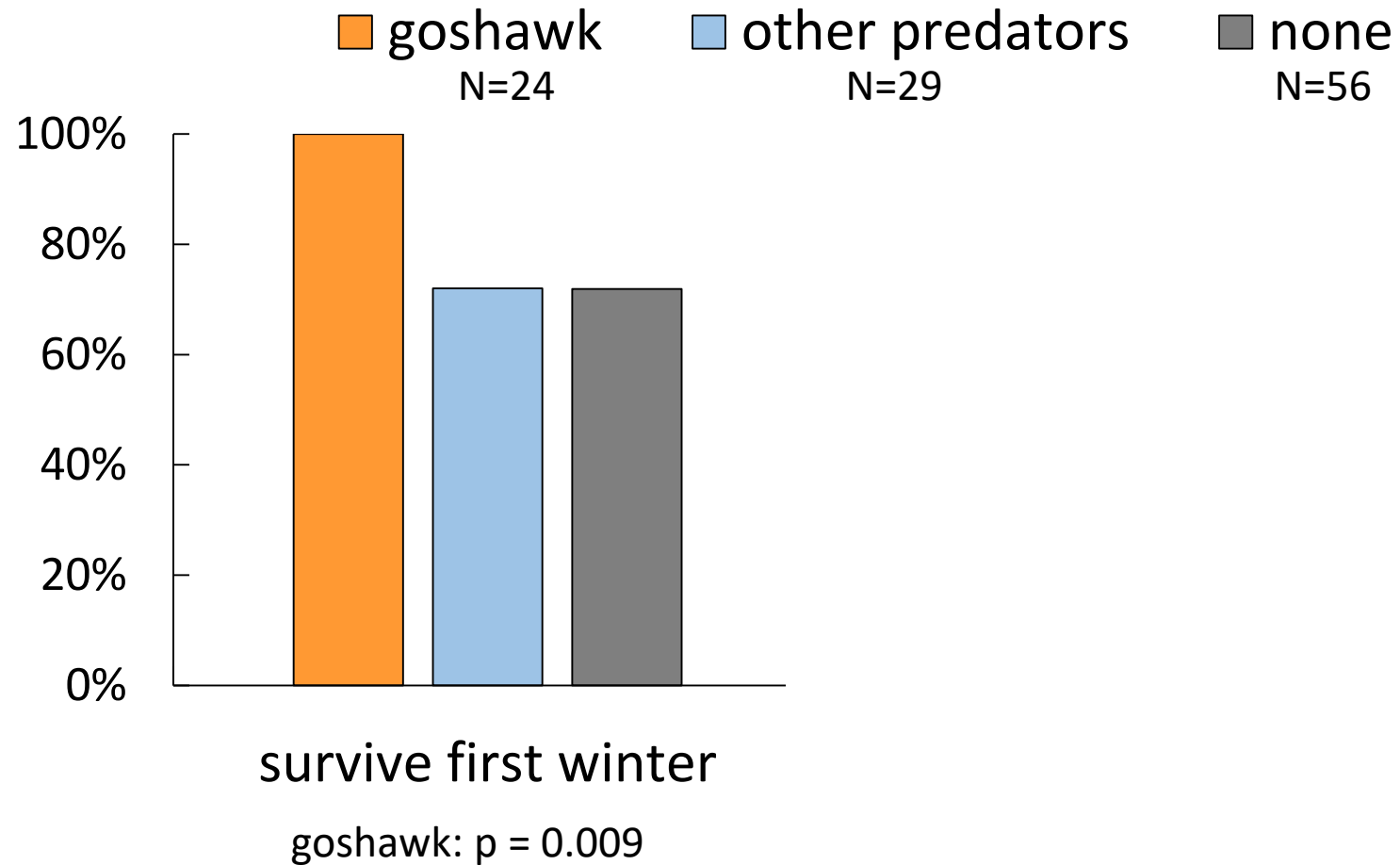
Fast learners do better



Fast learners learn what matters



Learning opportunities matter



Adaptive value of extended parental care

- Family-living provides a safe haven: predator protection, access to food
- Parents provide social learning opportunities, boosting offspring fitness
- More learning opportunities bring cognitive benefits
- Link to parental provisioning

Parental Care: Summary

- Species vary in who cares and for how long care is provided
- Reflects trade-off → fast vs slow pace of life
- Reflects conflicts between ♂ and ♀: can I find another partner?
- Parents invest less when they are less related to the offspring
- Parents may favour certain offspring
- Siblings compete over the limited resources provided by parents
- Parental care affects cognitive and social evolution
- Providing skill learning opportunities is very beneficial

References

- Davies et al: An introduction to behavioural ecology, 4th edition. 2012
- Clutton-Brock: The evolution of parental care. 1991
- Royle et al: The evolution of parental care. 2012
- Parental care clip: <https://www.youtube.com/watch?v=6J-30wSZtbE>