The early bird gets…
to live –
Why it's best to nest early

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INTRODUCTION - Shorebirds

- Many shorebird species appear to be declining
- Cause not often known
- Demographic parameter estimates often unknown
  - Difficult to obtain
    - Long-distance migrants
    - Breed at high latitudes
    - Precocial young
    - Cryptic
    - Nomadic

INTRODUCTION – *C. a. arcticola*

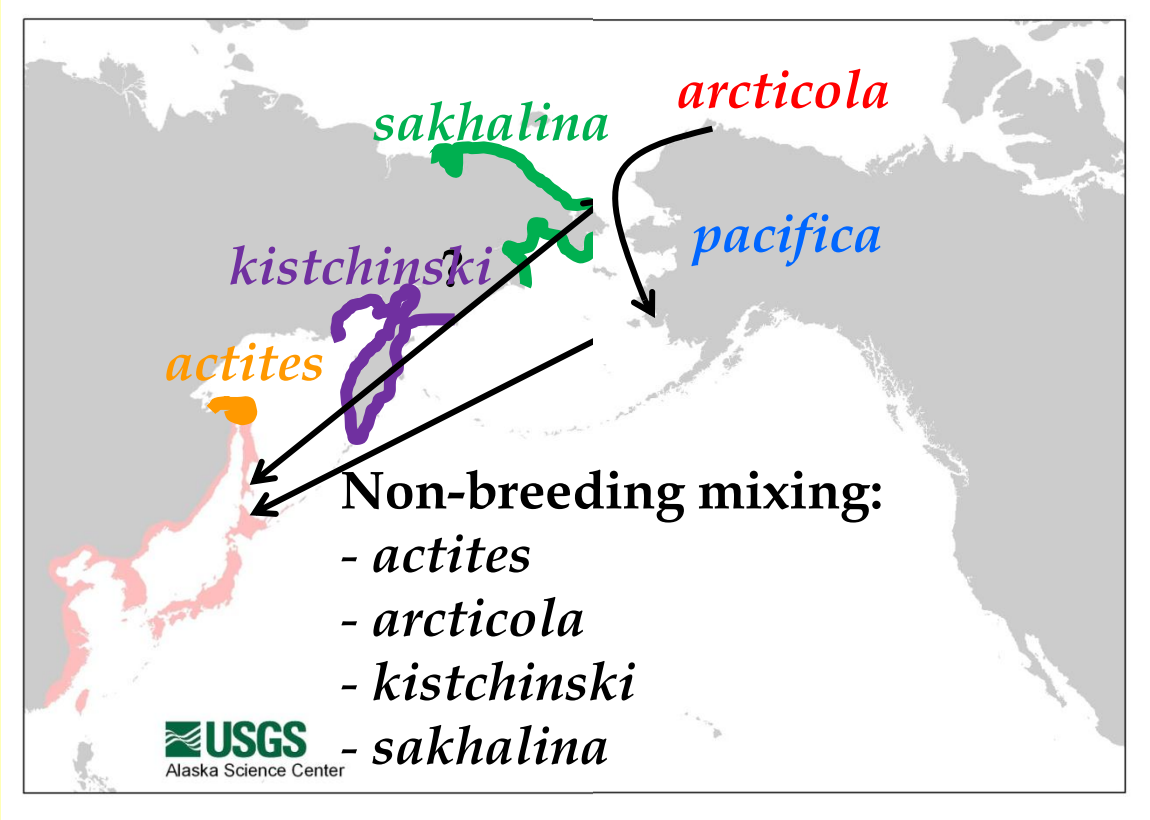
- **Parameter estimates needed**

- **Known**
  - **Hatch success**
  - **Re-nesting rates**
  - **Migration routes/stopover sites**

- **Unknown**
  - **Adult survival**
  - **Chick survival – initial vs replacement clutch**
  - **Post-fledging survival**
  - **Immigration/emigration rates**

INTRODUCTION – *C. a. arcticola*

- **Distribution**



OBJECTIVE 1

Determine apparent annual survival rates of *arcticola* Dunlin and factors that affect rates

OBJECTIVE 2

Determine survival rates of *arcticola* Dunlin chicks from initial and replacement nests and factors that affect rates

METHODS – Study Area

- Barrow
- 6 study plots
  - 36-ha

METHODS – Trap and Band

- Capture
  - On plot
  - Bownet

- Banding
  - Individual color combos
  - Bands soldered
  - Measurements

METHODS – Sex and Age

- **Sexing**
  - **Gates et al., *in prep***
    - **DNA**
    - **DFM**

- **Aging**
  - **Most not aged**

METHODS - Recaptures

- Re-sighting
  - Physical recapture
  - Nest re-sighting
  - Plot re-sighting (≥ 2)

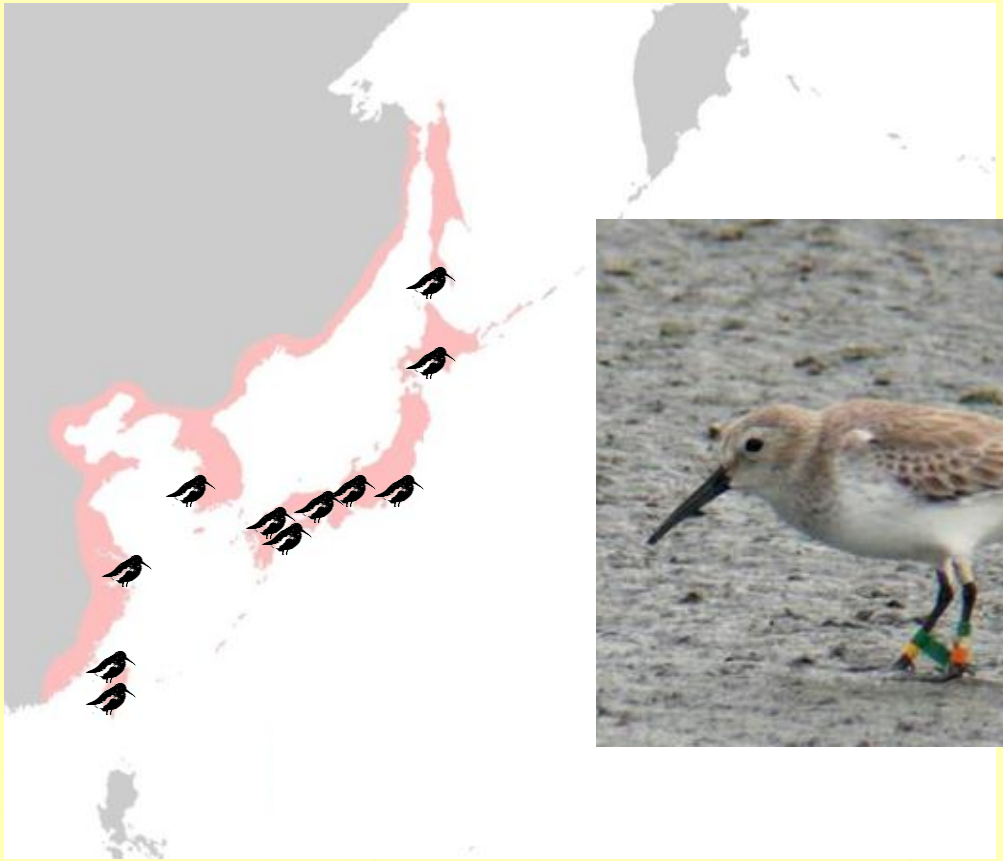
METHODS - Analytical

- Cormack Jolly-Seber Models
  - Live encounters
    - "recaptures"
    - "re-sightings"

- Apparent survival
  - Cannot differentiate emigration and death
  - Can differentiate between apparent survival and apparent recapture probabilities

METHODS - Analytical

- **Barrow *arcticola* non-breeding re-sightings**



METHODS - Analytical

Factor	p	ϕ
Constant	√	√
Sex	√	√
Timing of spring	√	√
Year	√	√
General DUNL nest success	√	√
Fox control	√	√
Seamangeum dike		√
Radio transmitter		√
Individual nest success		√
Individual initiation date		√

RESULTS

Individuals banded

- 208 adults
  - ♂ Males: 99
  - ♀ Females: 109
  - 202 sexed using DNA

RESULTS

Individuals removed from study

- 5 right-censored
  - Alpha-numeric flag
  - Harness
  - 4 bands on tibia
  - Injuries

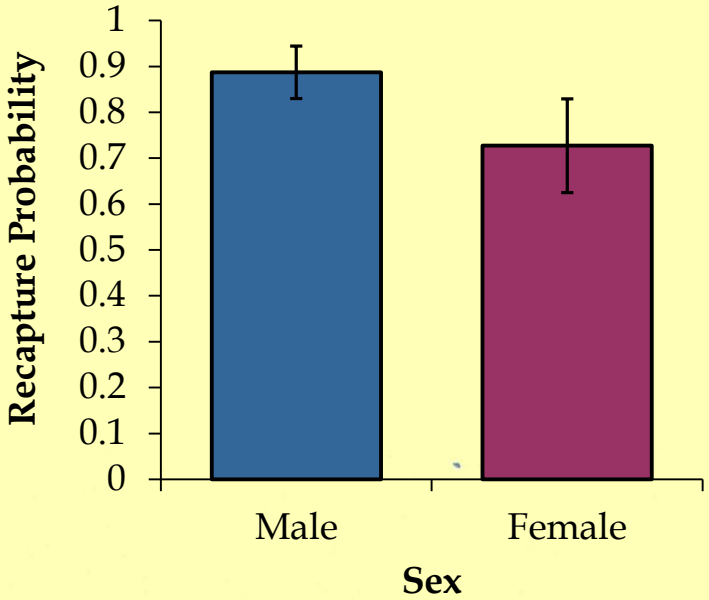
RESULTS

Goodness of Fit

- Data fit models well
  - No evidence of transiency or heterogeneity
  - Bootrap GOF: $\hat{c} \approx 1.02$
    - Did not affect model rankings

Factors explaining p

- Best explained by sex
- Estimates:



RESULTS

Sex, individual initiation date, and year were the most supported explanatory factors.

Parameter	Weight
Sex	1.00
Individual Initiation Date	0.78
Year	0.62
Individual Nest Success	0.37
Timing of Spring	0.17
Fox Control	0.11
Dike	0.05
General Nest Success	0.09
Radio	0.04

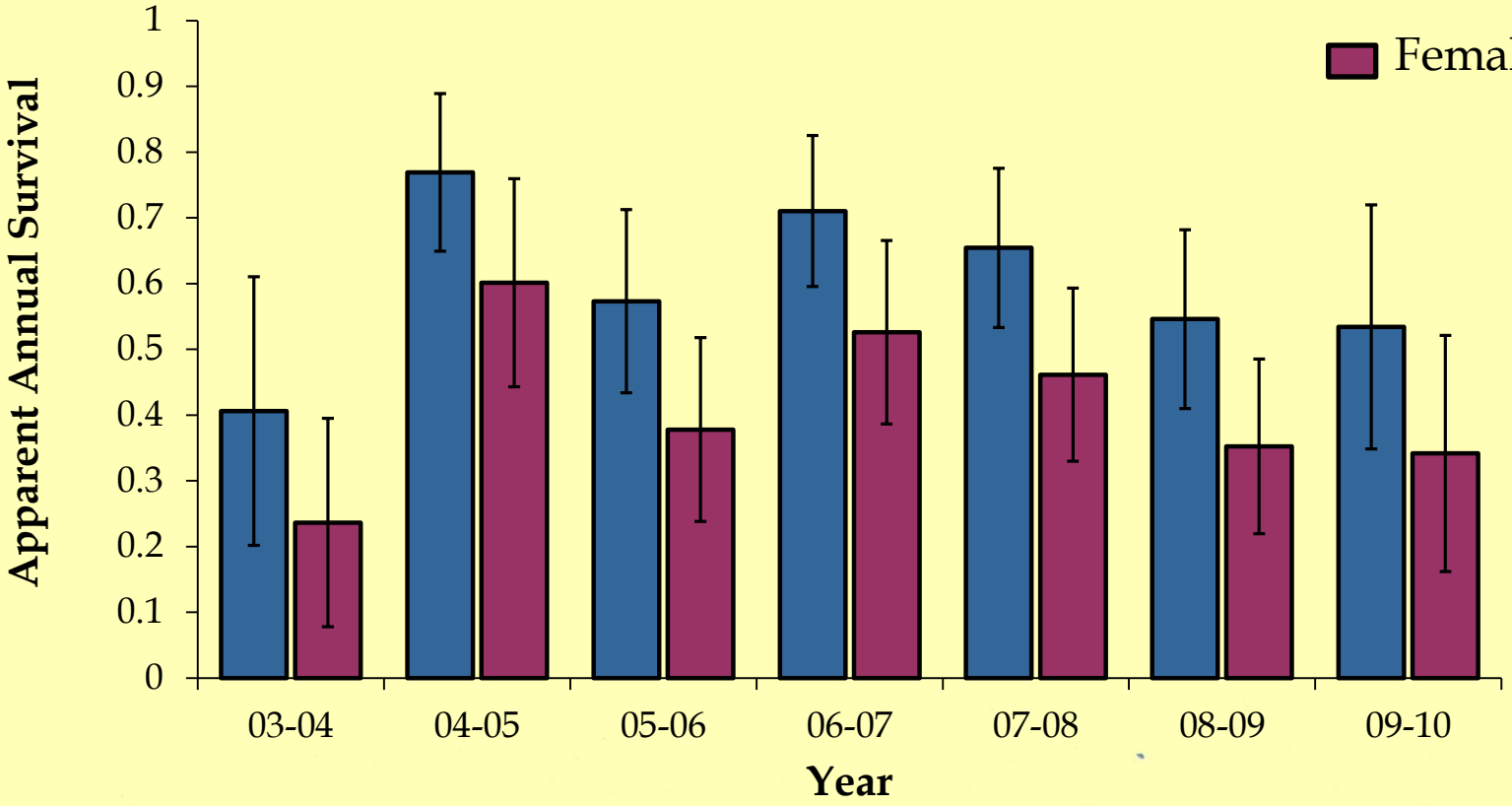
Top model: $\phi_{\text{sex+individual initiation date+year}}\, p_{\text{sex}}$

RESULTS

Apparent annual survival rates (ϕ) were higher for males than for females, and varied by year.

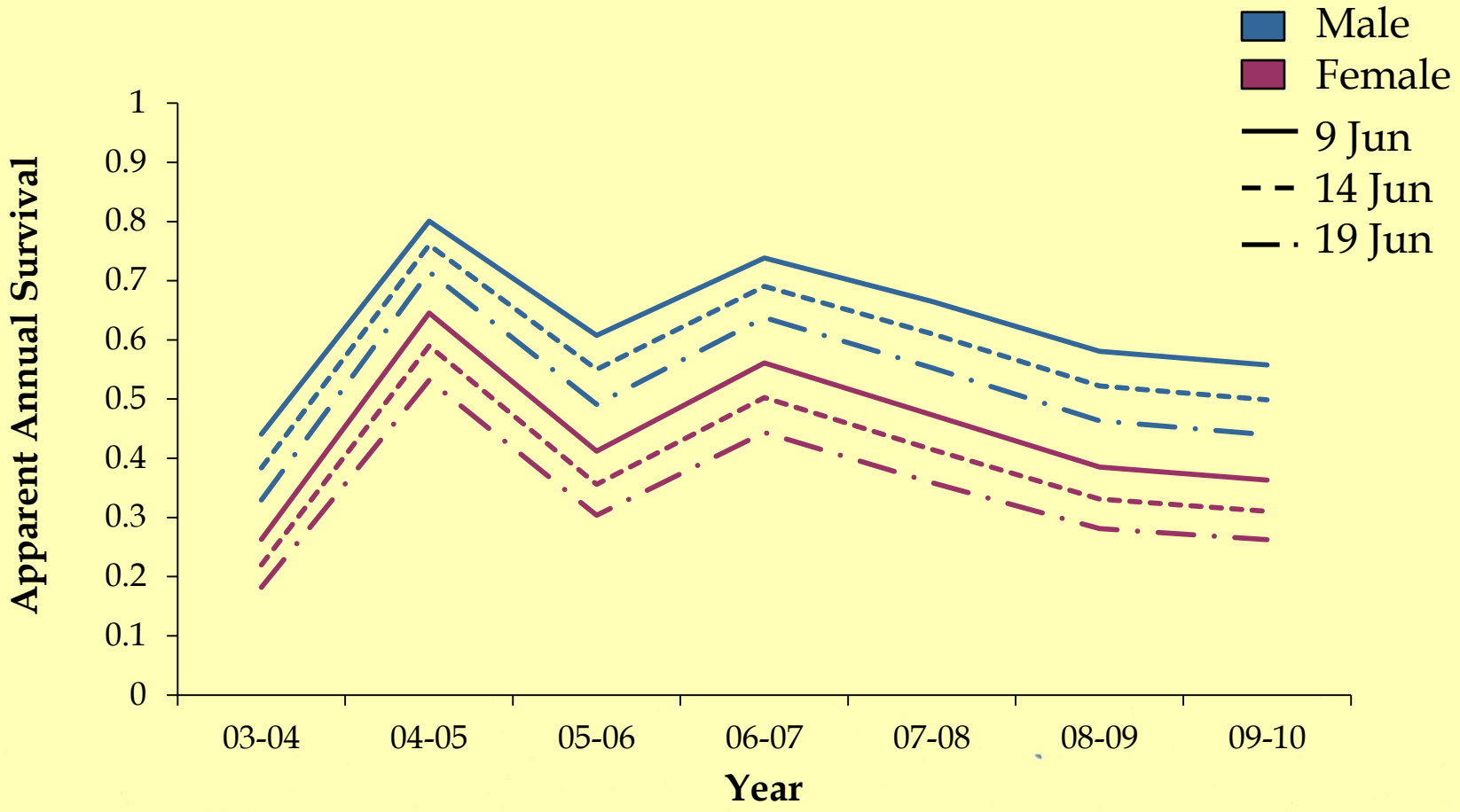
Male **60%**

Female **41%**



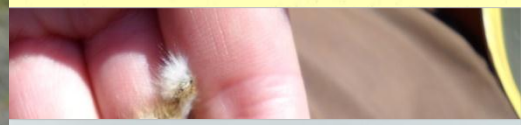
RESULTS

Apparent annual survival rates (ϕ) were higher for those initiating nests earlier rather than later.



METHODS – Radio and Monitor

- 2 chicks/brood radio-tagged
- Monitored every other day until



- Death

METHODS – The Rest

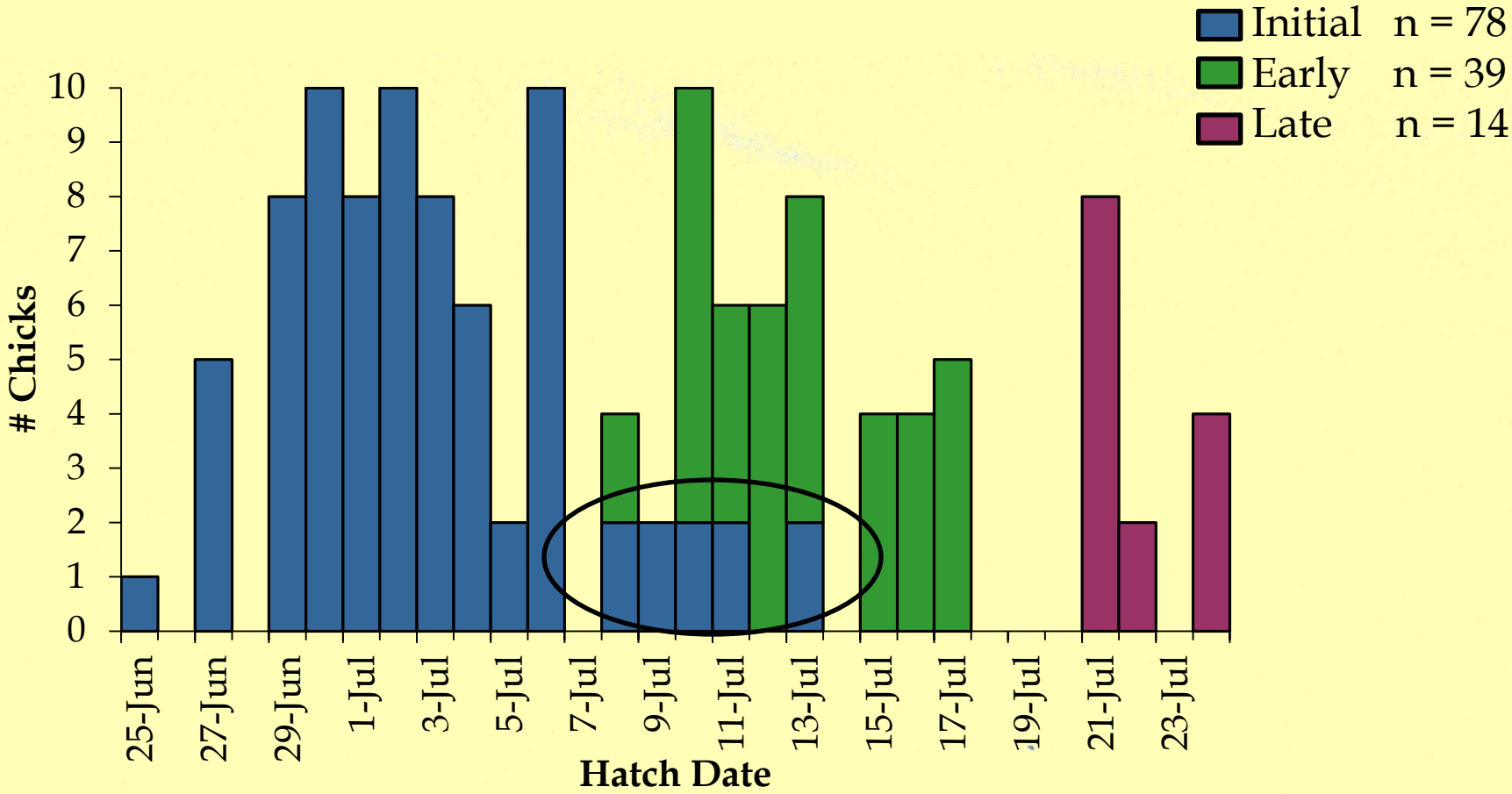
- Chicks from 3 nest categories:
  - Initial (un-manipulated)
  - Early removal (3-8 days)
  - Late removal (12-16 days)

- Insect Biomass

- Nest Survival Models – Program MARK
  - Factors:
    - Year
    - Hatch Date
    - Age
    - Daily Insect Biomass
    - Daily Average Temperature

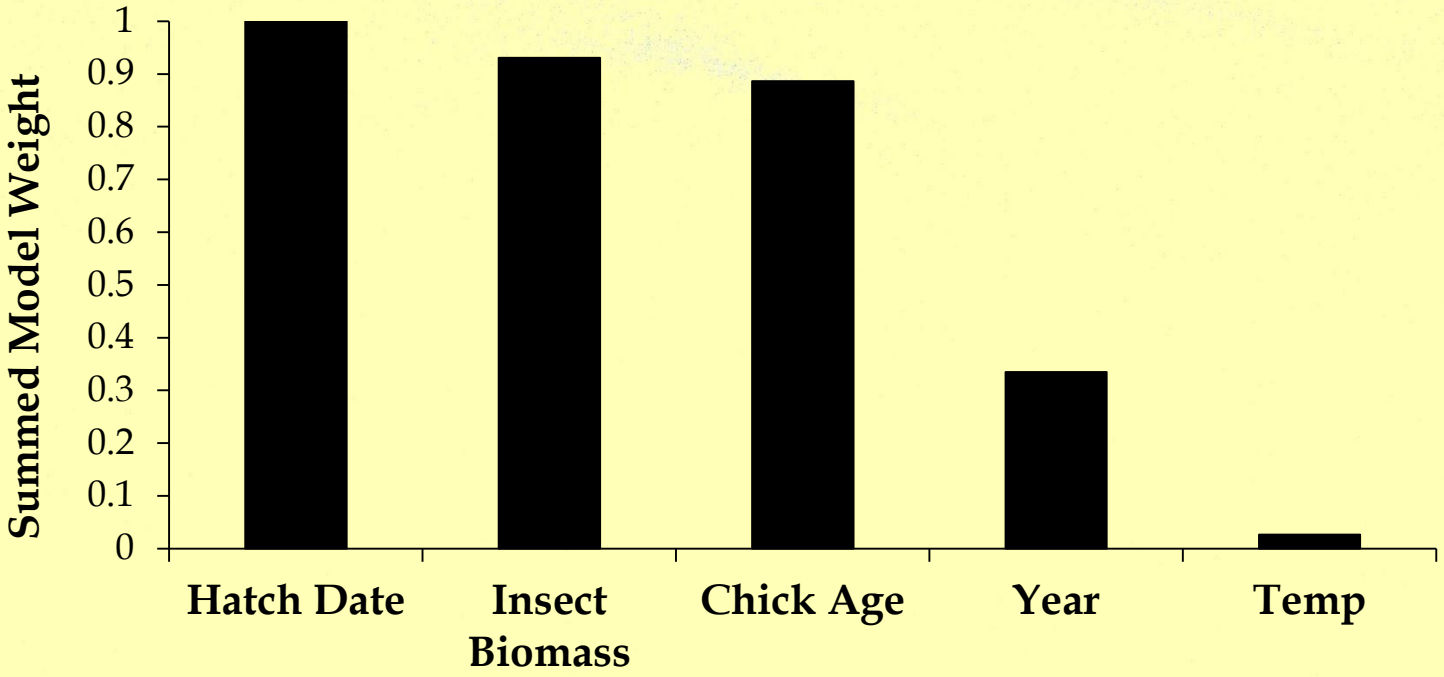
RESULTS

Some initial nests hatched when early replacement nests hatched.



RESULTS

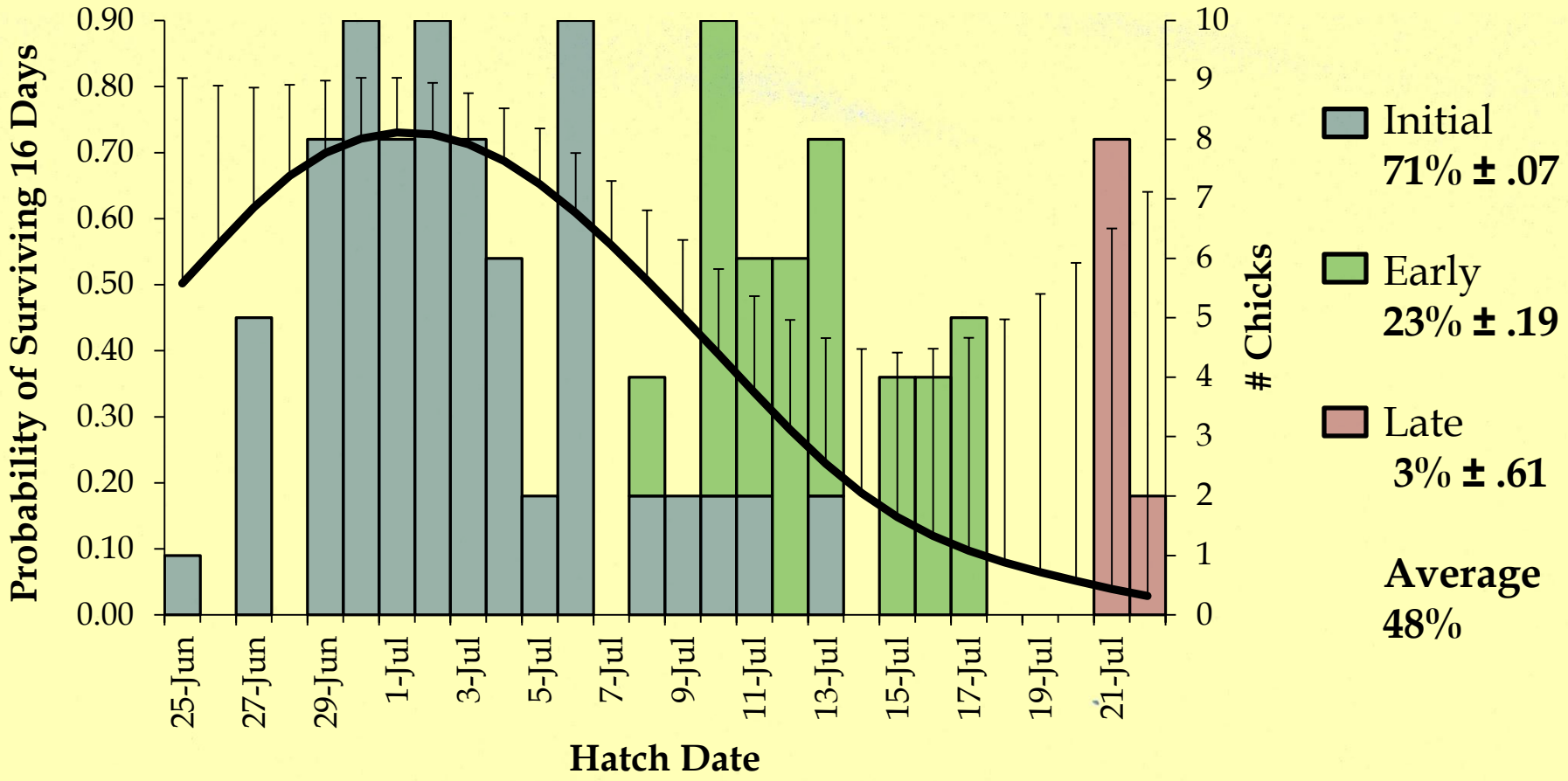
Hatch date, insect biomass, and age were the most supported factors to chick DSR.



Top model: Hatch Date x Age^2 + Insect Biomass

RESULTS

Probability of surviving peaked in early July.



DISCUSSION

Earliest laying adults had highest survival rates

- **Older, more experienced**
- **Have more time to prepare for southbound migration**

Earliest hatching chicks had highest survival rates

- **Had more food available**
- **More experienced parents?**

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Consequences for Males

Hatch Date 1 July → 16 July
Hatch Date 22 July → 6 Aug

Consequences for Males

Divorce = attracting second mate

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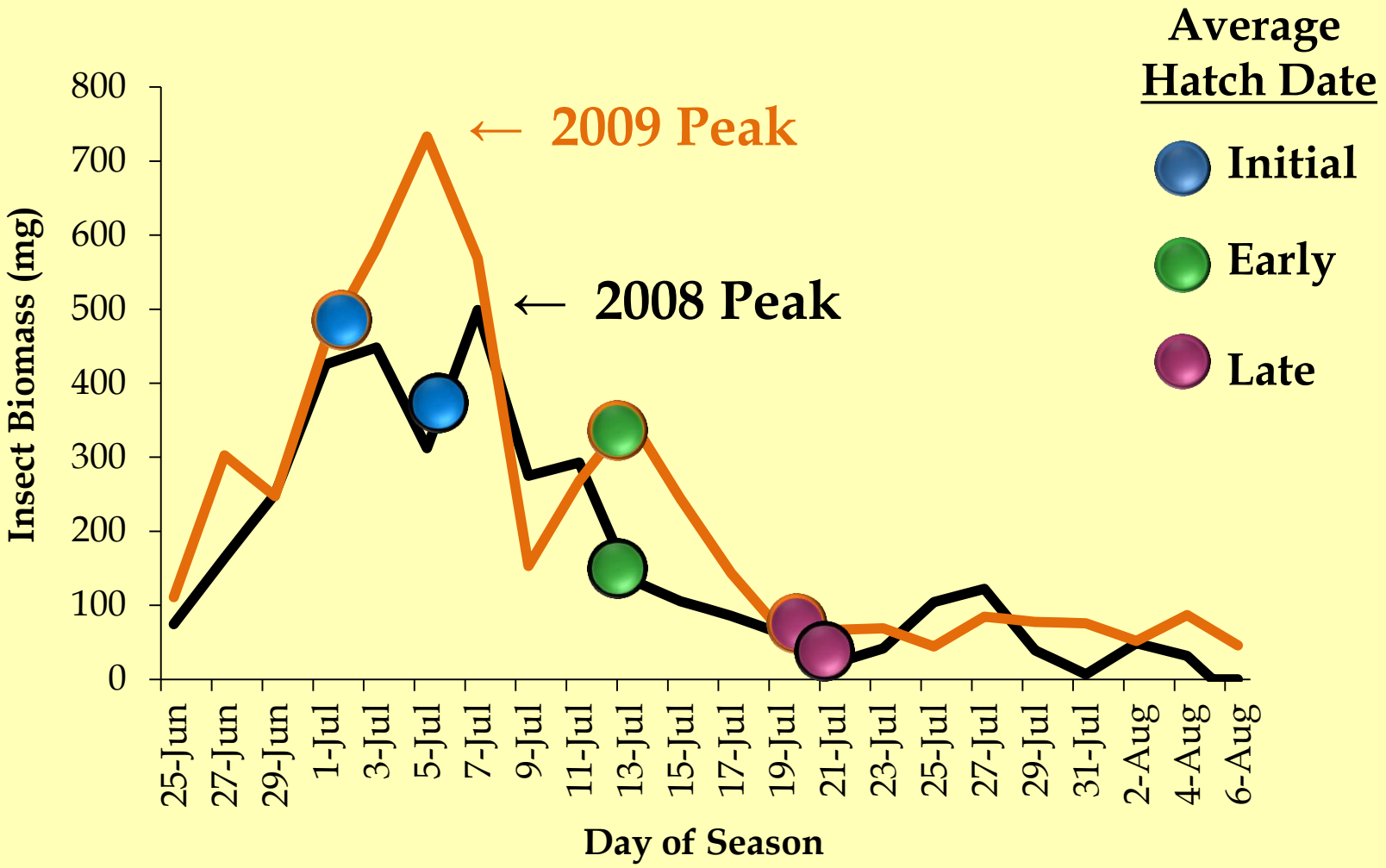
Consequences for Females

Hatch Date 1 July vs 22 July
Divorce = move farther than males
Re-nest AND tend brood

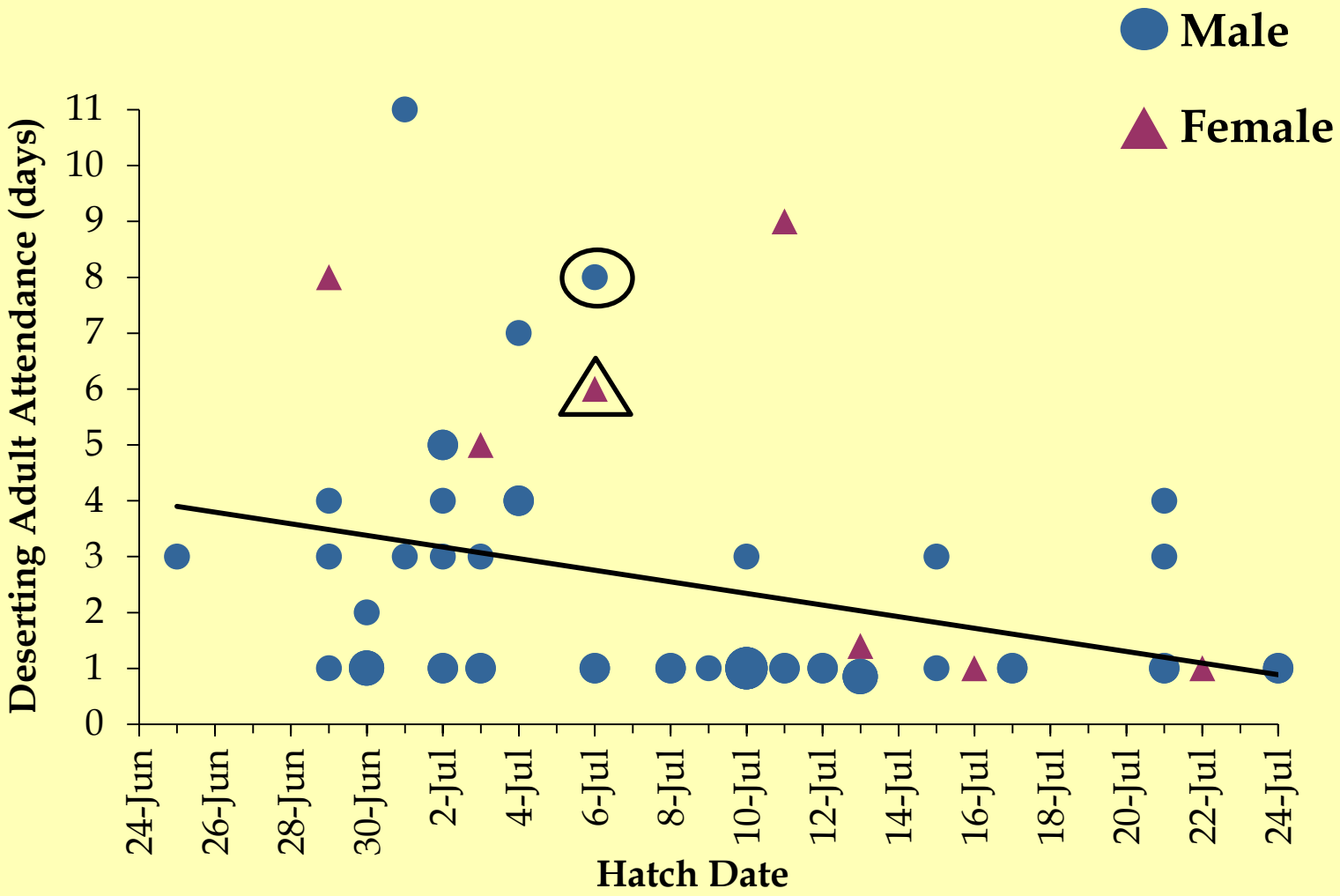
Consequences for Females/Chicks

Production of second clutch = reduction in egg quality?

Consequences for chicks



Consequences for chicks



Only once did adults abandon chicks

Adults from both initial and replacement nests stayed 21 days

CONCLUSIONS

Demographic parameter estimates

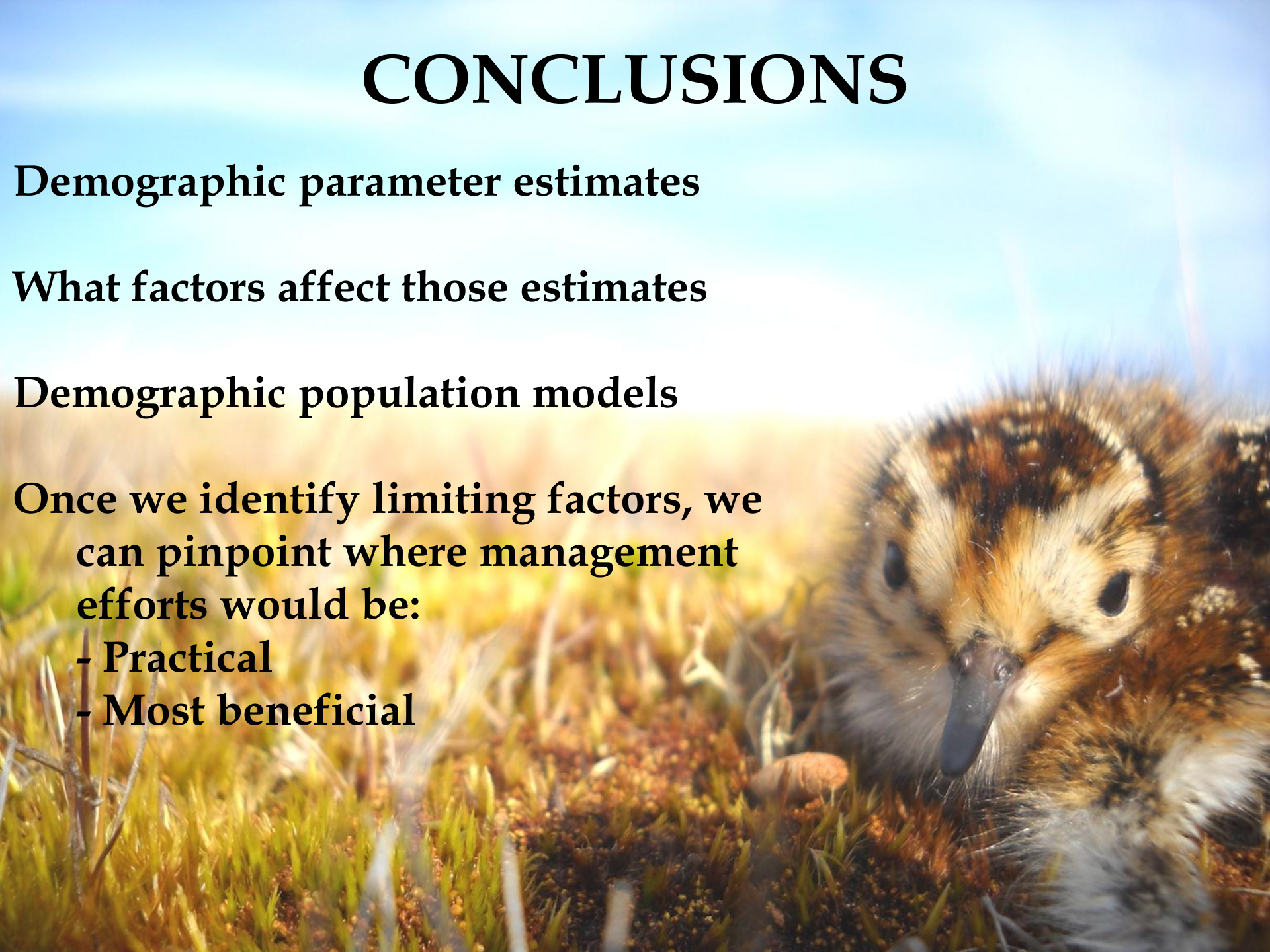
What factors affect those estimates

Demographic population models

Once we identify limiting factors, we can pinpoint where management efforts would be:

- Practical

- Most beneficial



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Maps courtesy of USGS, Google Maps

Village of Barrow
Barrow Arctic Science Consortium