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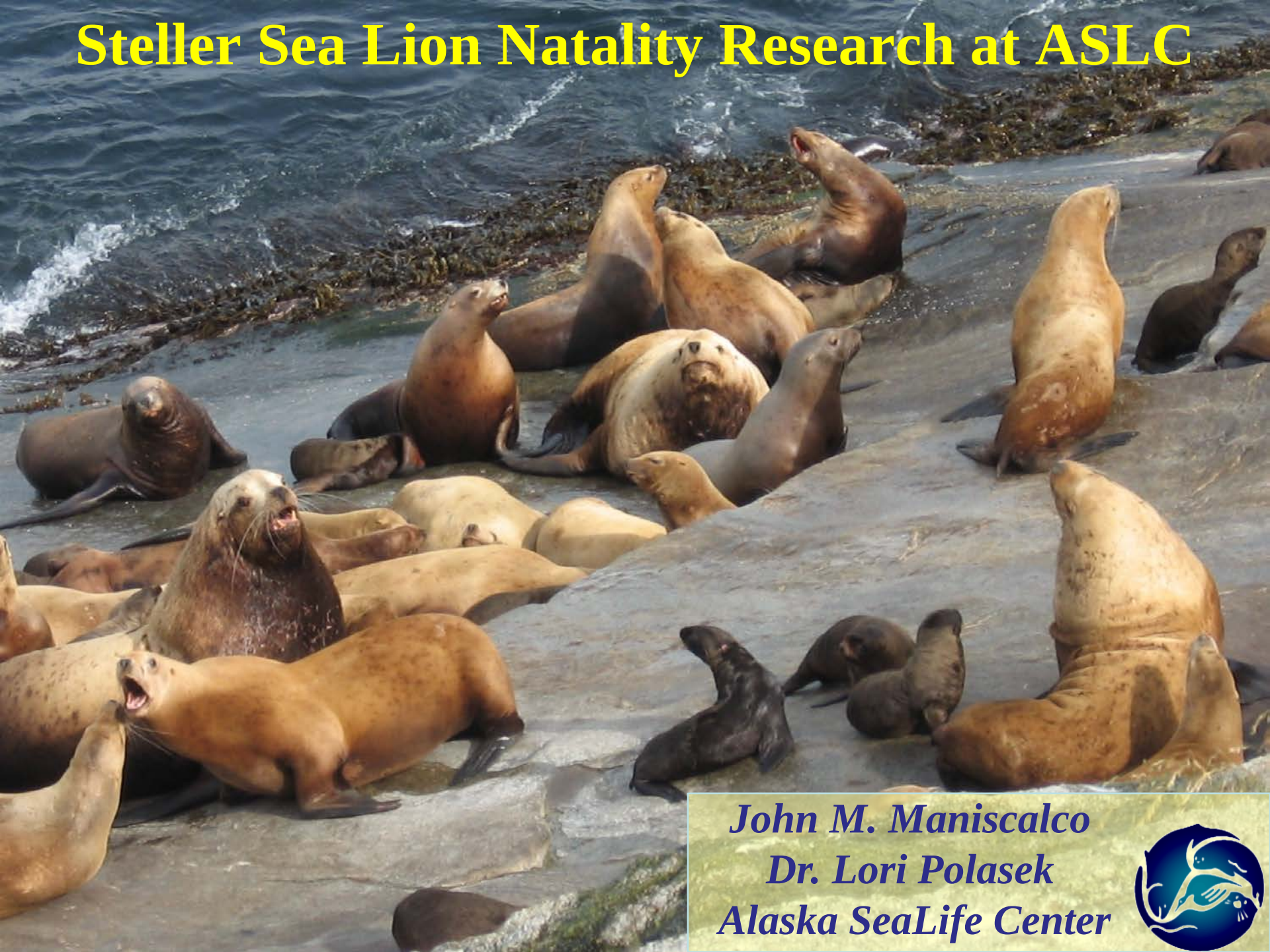
Steller Sea Lion Natality Research at ASLC



John M. Maniscalco
Dr. Lori Polasek
Alaska SeaLife Center

Presentation Outline

***Brief Overview of Chiswell Project and its relevance to a broader area**

***Juvenile survival and the effect of extended maternal care**

***A life-history mechanism to mitigate reductions in fecundity**

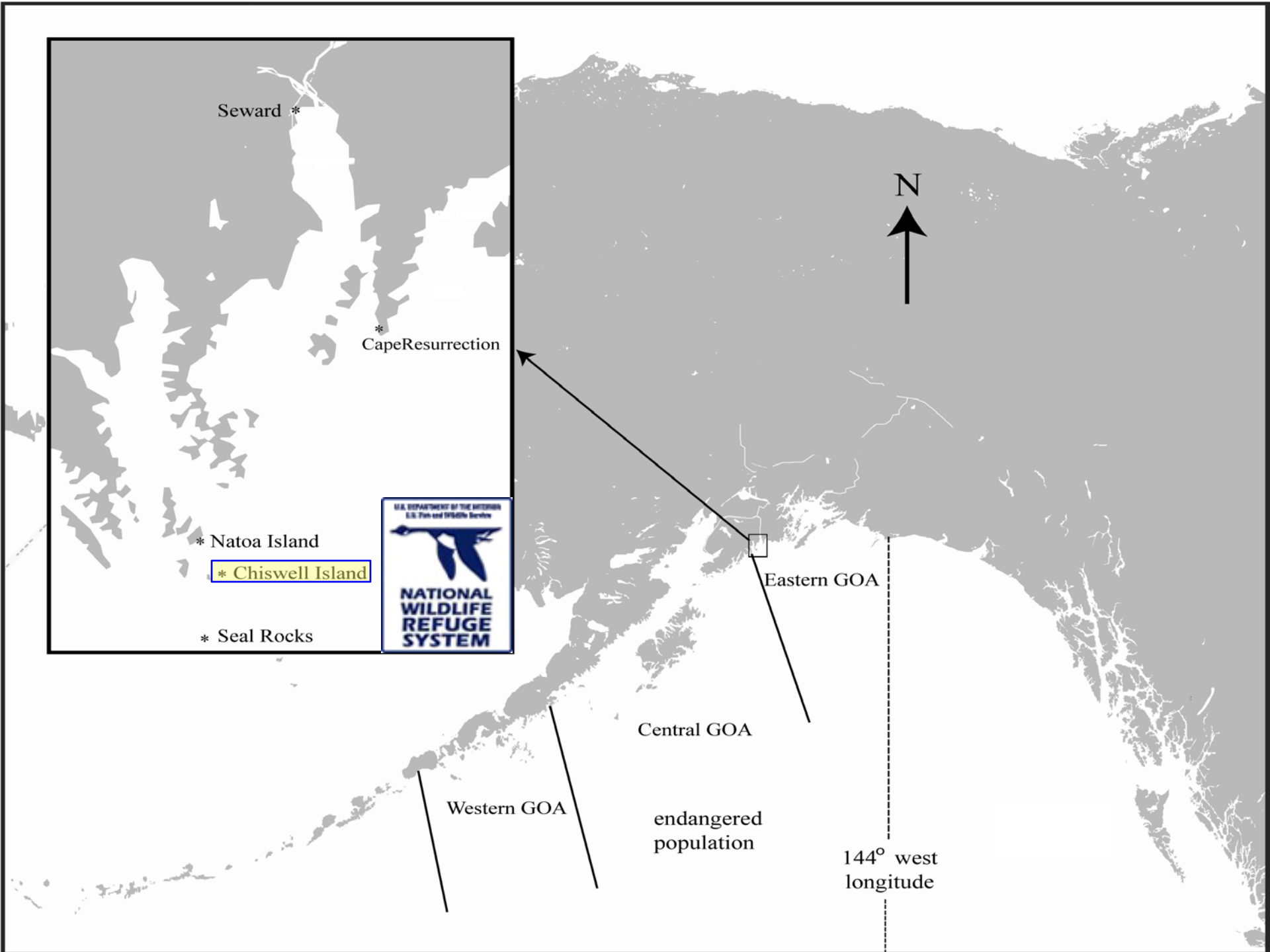
***Natality rates at Chiswell Island over the previous 10 years**

***Overwintering diet – does it have an effect on birthing probability?**

***Current work suggests…**

***Future plans**

***Field work combined with ongoing ASLC captive studies**


Seward
CapeResurrection
Natoa Island
Chiswell Island
Seal Rocks
NATIONAL WILDLIFE REFUGE SYSTEM
N
Eastern GOA
Central GOA
Western GOA
endangered population
144° west longitude

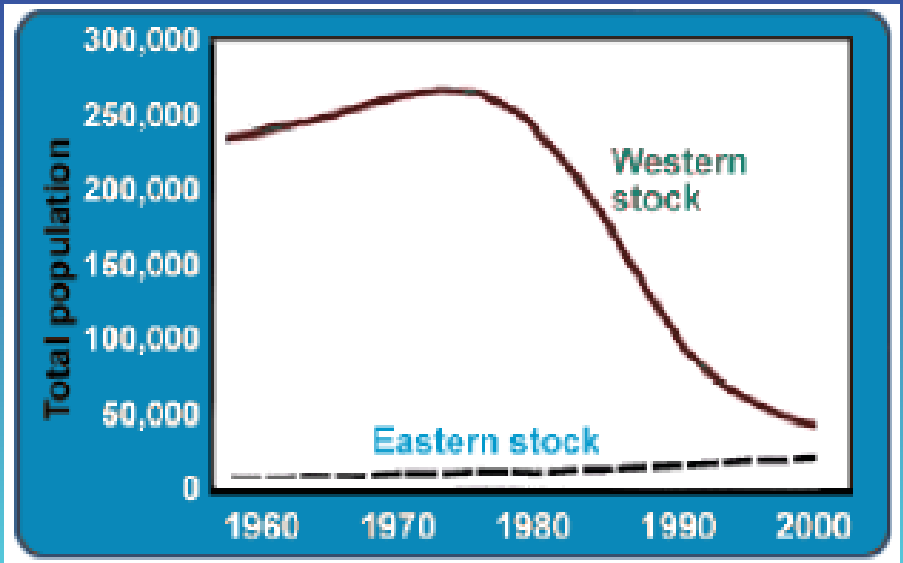
Video System Demonstration

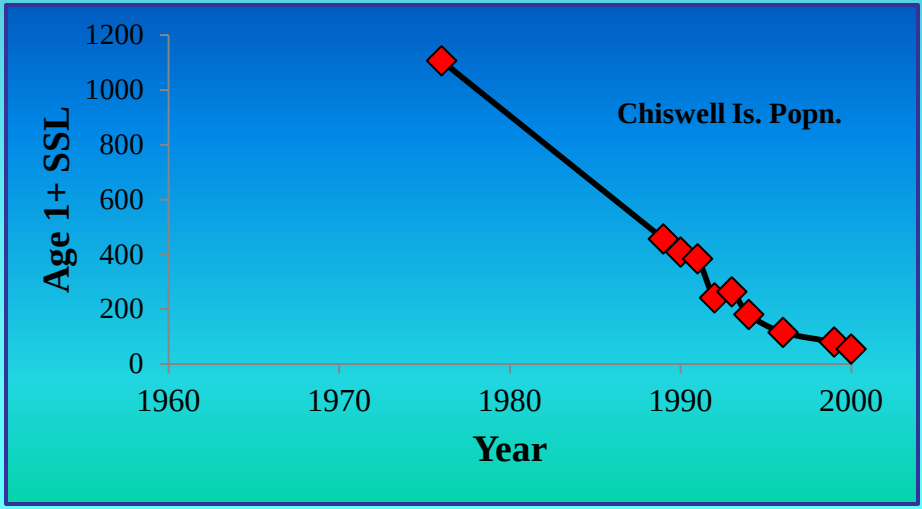

Harbor Seals: Tractable Sensors of Ecological Change?
SONY

Studies Being Accomplished

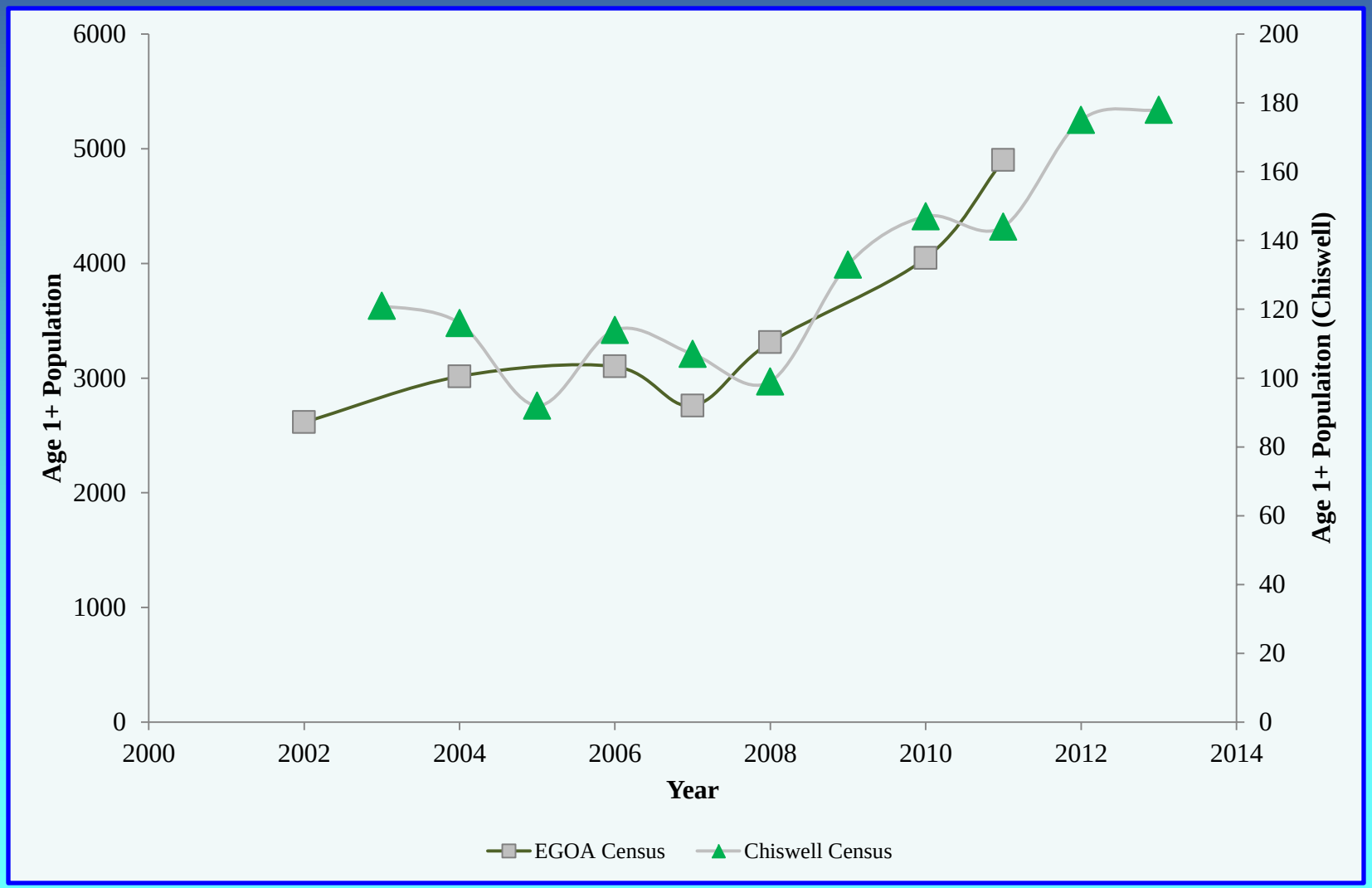
1. Maternal Care
2. Characteristics of Parturition
3. Alloparental Care
4. Pupping Site Fidelity
5. Early Pup Mortality
6. Killer Whale Predation
7. Reproductive Rates of Females
8. Effects of Branding (behavior/survival)
9. Effects of Rookery Disturbance
10. Breeding Bull Repro Success
11. Population Trends
12. Seasonal and Long-term Movements
13. Adult and Juvenile Surival
14. Effects of Diet on Natality

Decline in WDPS & at Chiswell

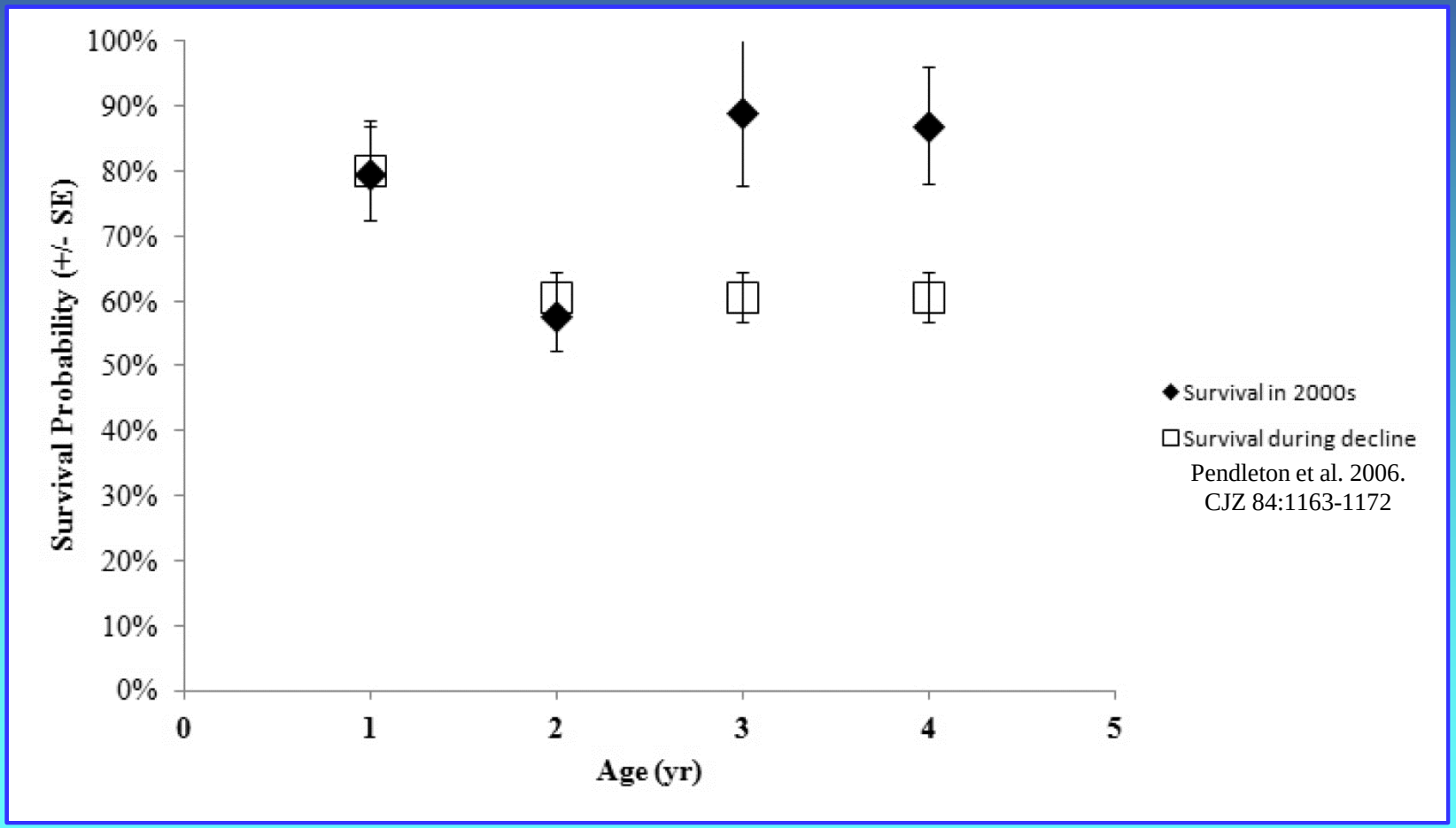




Recovery at Chiswell & EGOA



Juvenile Survival



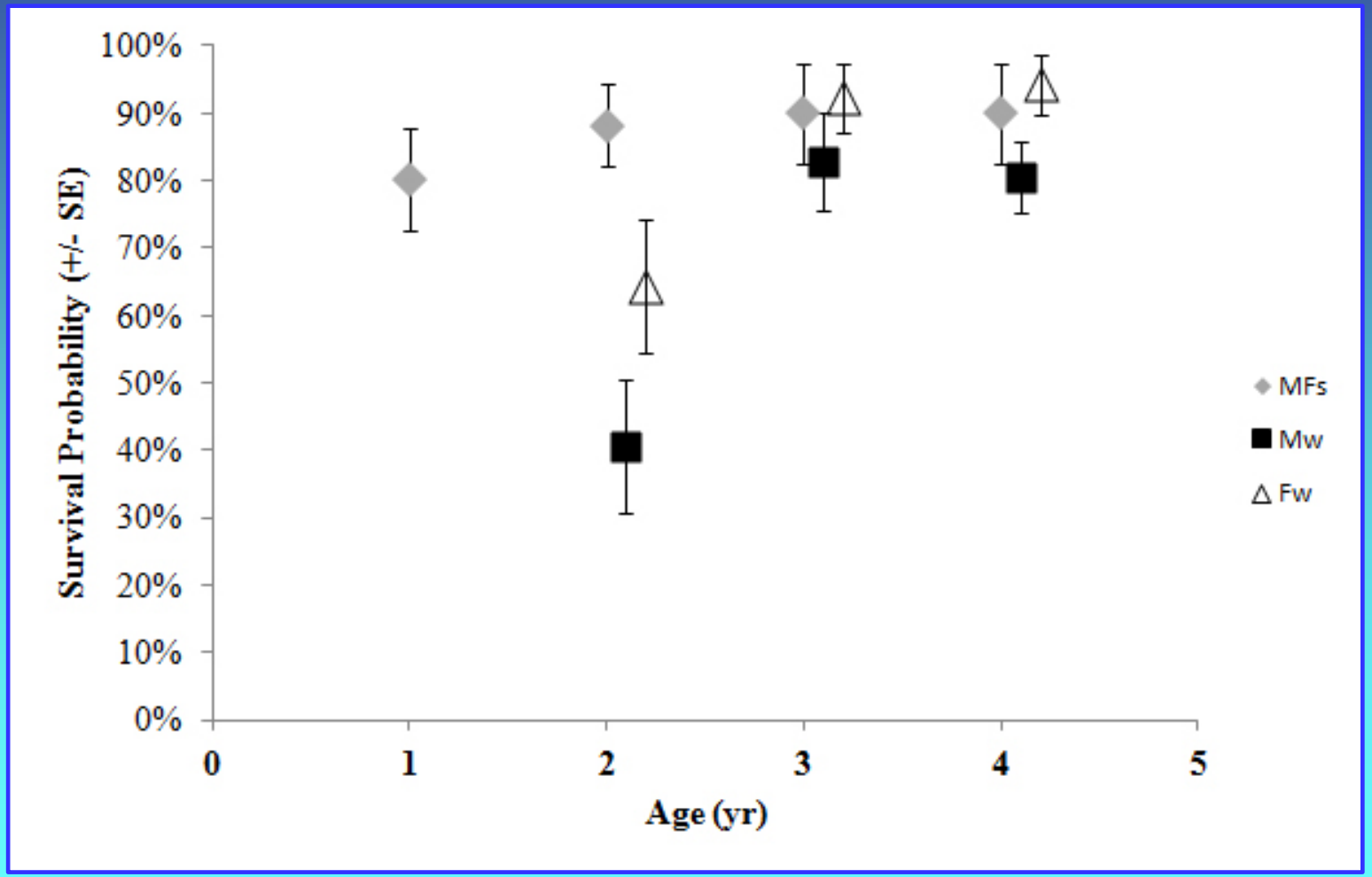
Maniscalco JM (2014) The effects of birth weight and maternal care on survival of juvenile Steller sea lions (*Eumetopias jubatus).* PLoS ONE 9(5):e96328.

Natality & Juvenile Survival

Q: What do adult female Steller sea lions do when they skip a year of giving birth?

A: They typically continue to nurse the previous year's offspring for an additional year.

Juvenile Survival



Maniscalco JM (2014) The effects of birth weight and maternal care on survival of juvenile Steller sea lions (*Eumetopias jubatus).* PLoS ONE 9(5):e96328.

Natality & Juvenile Survival

A life-history strategy that offsets some losses due to reduced natality by improving juvenile survival.

Natality Rates

Multi-state Open Robust Design Modeling with Program MARK

3 'states": 'b' – giving birth 'n' – not giving birth, 'u' – status unknown

S_t^x = probability that a female in state x at time t survives until t + 1

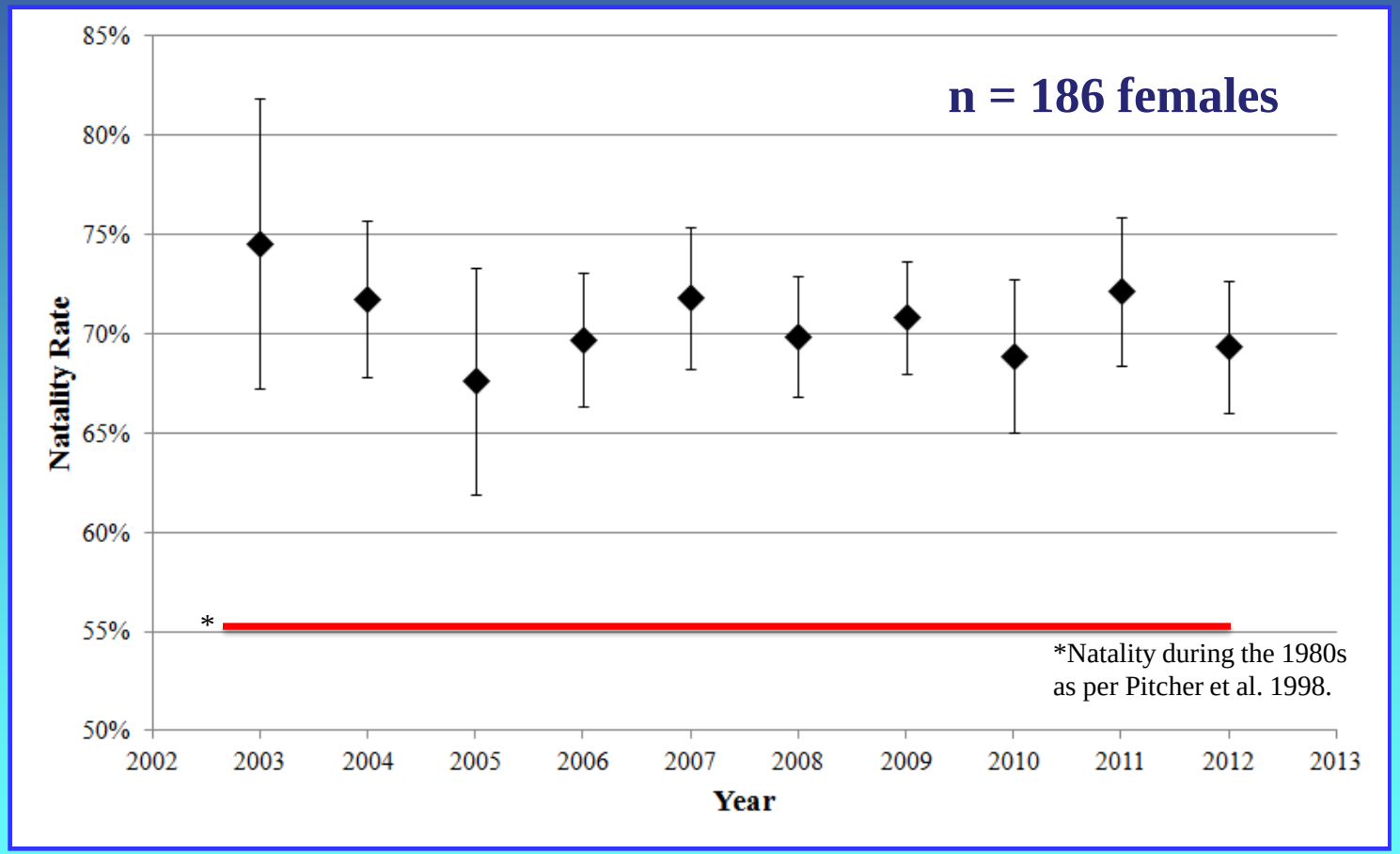
p_t^x = probability that a female is sighted at time t in state x, given that it is alive at time t

ψ_t^{xy} = probability that a female in state x at time t is in state y at time t + 1, given that the animal survived from time t to t + 1

ω_t^x = The proportion of females at time t that are in state x

Many additional parameters estimated including probability of correct classification to state, departure and entry probabilities to study area, etc.

Natality Rates



Maniscalco JM, Springer AM, Parker P, Adkison MD (*In Press*) A longitudinal study of Steller sea lion natality rates with comparisons to census data. PLoS ONE.

Natality Rates

Natality rates are very good in the EGOA– so what?

What is the most fundamental underlying question of interest here?

My related questions of interest:
What causes interannual variation in natality?
Could it be food?

Female Reproductive Strategies

What is the most critical time of year for pregnancy in Steller sea lions?

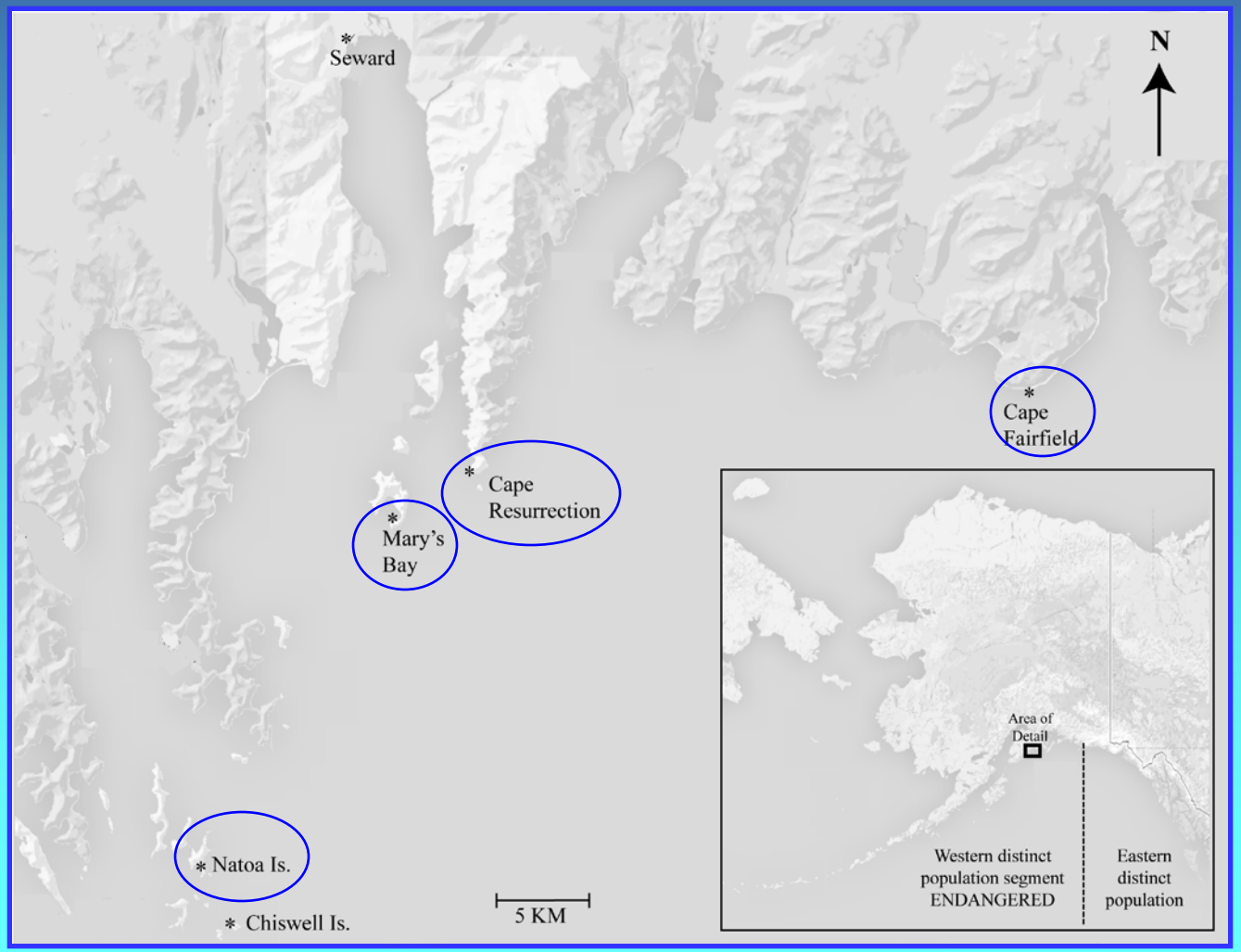
Aborted Pregnancies:

Observed mid-January through April in our area

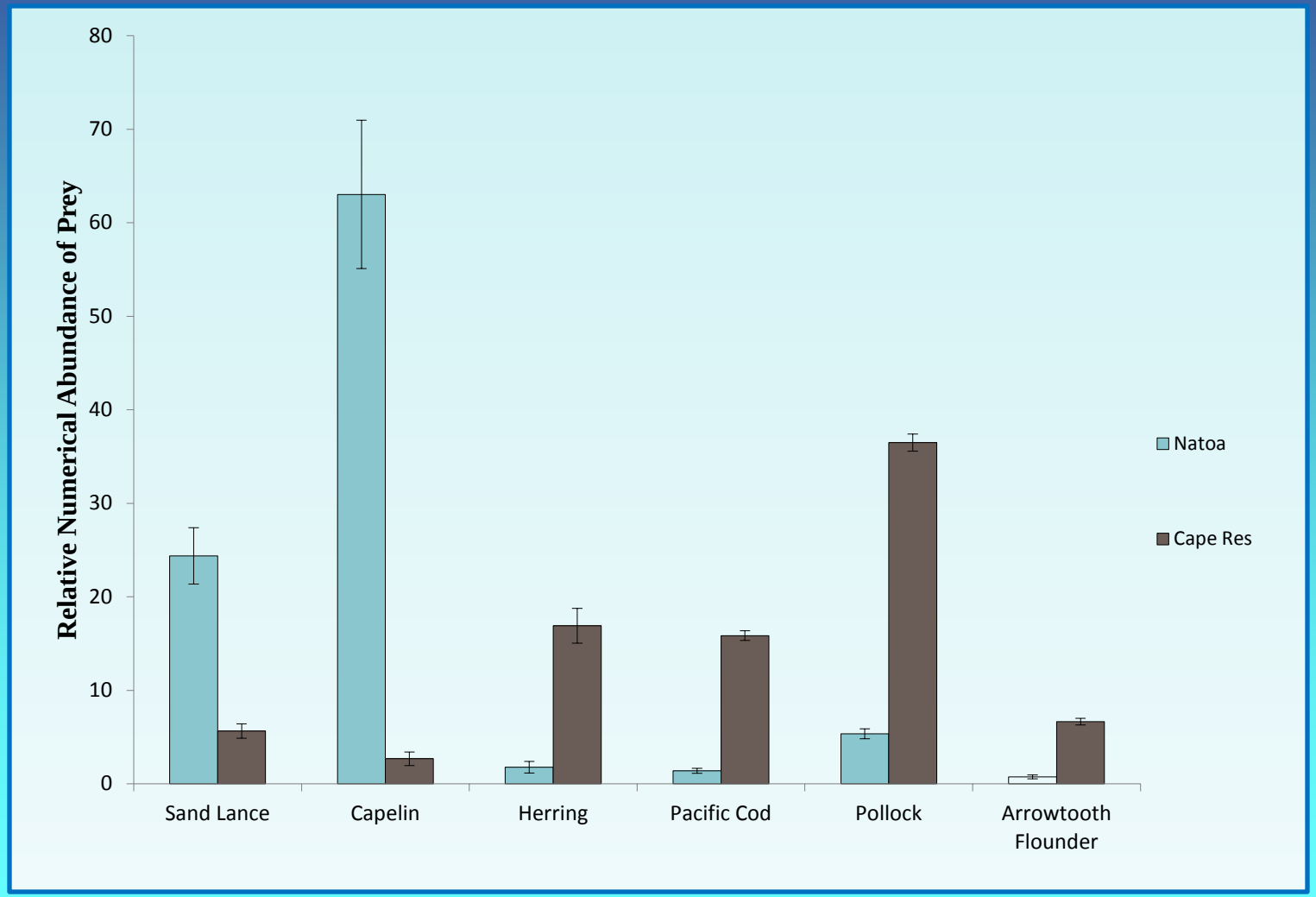
Is this an energetics based strategy based on food availability?

Could also be related to age, disease, contaminants, other environmental stressors

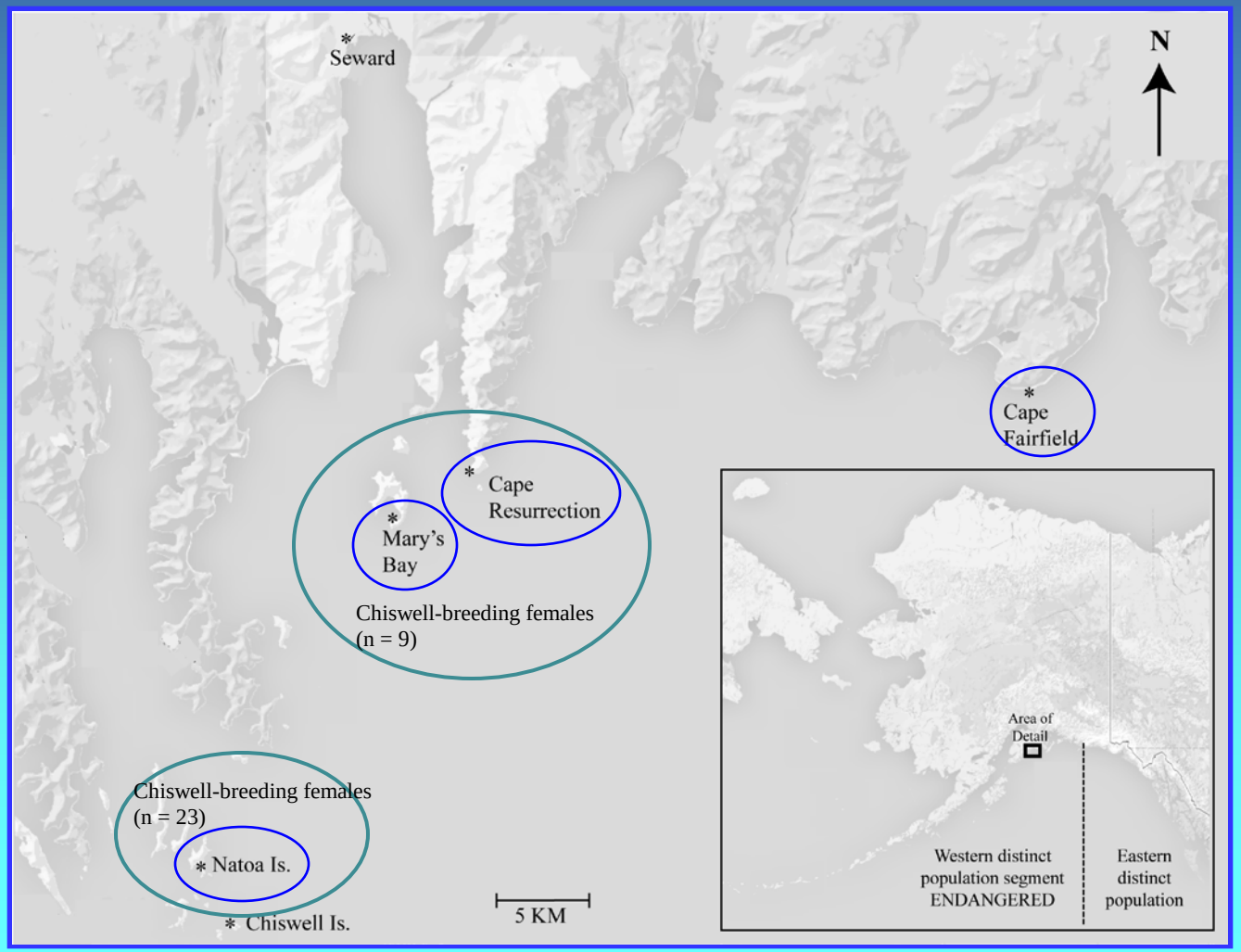
Overwintering Study Area



Overwintering Diet



Overwintering Diet



Overwintering Diet

Are diets at these 2 locations representative of females?

Remote blubber biopsies of females taken just prior to scat collections

PCA run on major fatty acids (>0.5% by wt) from females only.
Results compared between haulouts with AICc

Results suggest weak differences.

Model Structure	K	AICc	ΔAICc	Model Likeli.	AICc Weight
(a)					
PC2+PC3	3	35.306	0.000	1.000	0.371
PC1+PC3	3	35.829	0.523	0.770	0.286
PC1+PC2+PC3	4	37.264	1.958	0.376	0.139
Intercept	1	38.056	2.751	0.253	0.094
PC2	2	39.368	4.063	0.131	0.049
PC1	2	39.666	4.361	0.113	0.042
PC1+PC2	3	41.189	5.883	0.053	0.020

Diet effect on birthing status?

Chi-square test of independence in birthing probability between females from different overwintering haulouts

Not so much:

$$\chi^2 = 1.015, P = 0.314, d.f. = 1$$

Improving Upon a Great Idea

We can get better estimates of diet!

- **Larger sample size**
- **DNA-based tissue correction factors**

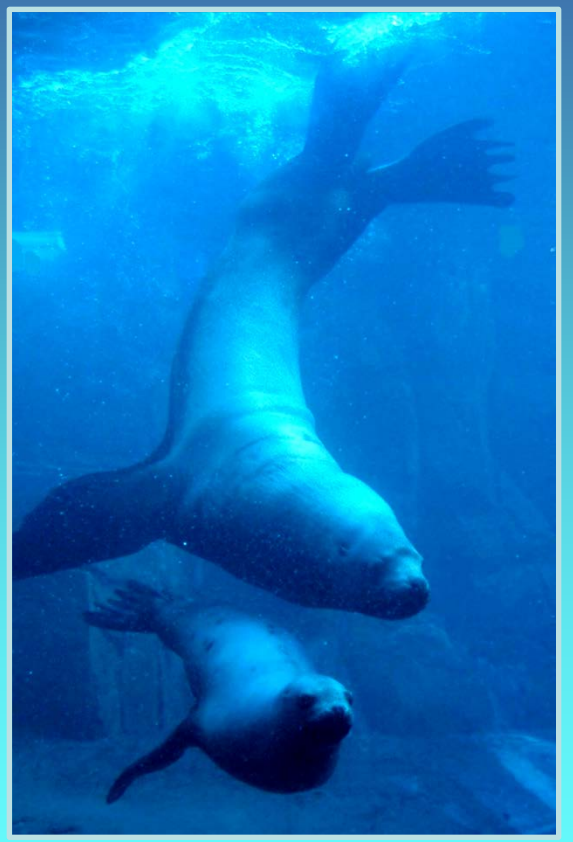
We can link individual scat samples with pregnancy status and levels of stress!

- **Analysis of hormones in scat**

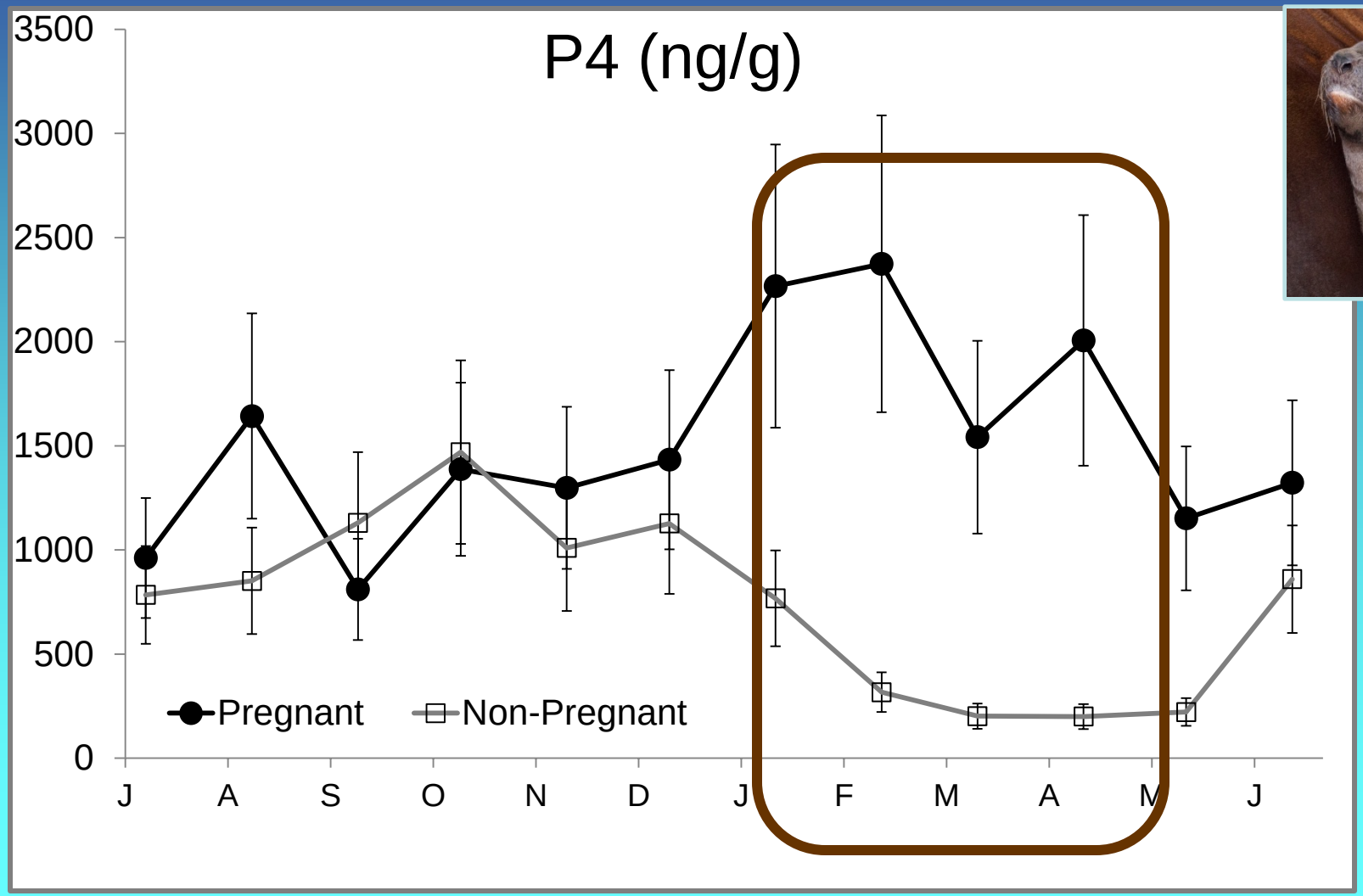
We can determine if diet has an effect on Steller sea lion natality on both and individual and population level!

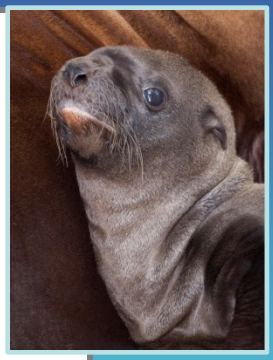
Captive Work at ASLC

- Captive breeding program
  - Paired blood and fecal samples
  - Analyzed for reproductive and stress hormones
  - Annual cycles defined

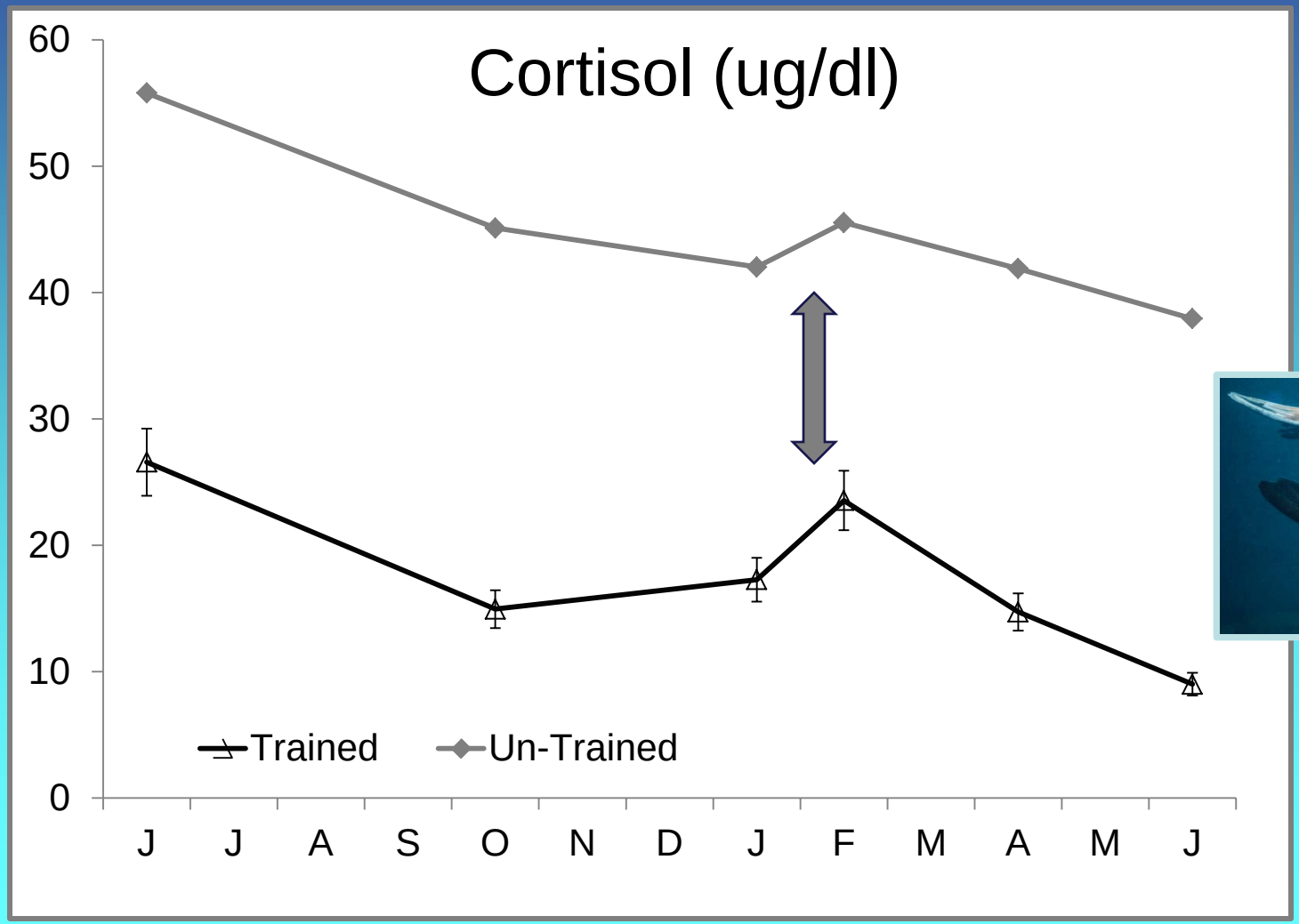


Pregnancy Detection





Stress Detection



Summary

1. **Populations are increasing**
2. **Juvenile survival is good**
3. **Natality rates are high**
4. **Interannual variability should be investigated**
5. **Preliminary data suggests no effect of diet on natality**
6. **This work needs to be investigated further to gain a better understanding of how food may or may not affect vital rates among wild populations.**

It is time to take our work out of the lab and apply our knowledge of physiology and population dynamics to Steller sea lions in their natural environment

Acknowledgments

Many thanks to the hard work of several interns and technicians, most notably Pam Parker, Karin Harris, Emily Teate, Melinda Fowler, Carlene Miller, Juliana Kim, *et alia*.
Daniel Zatz & Co. (SWS) kept the remote control system operational. We also thank Dustin Phillips for providing invaluable tech support.

The Chiswell Island group is part of the U.S. Fish & Wildlife Service Alaska Maritime National Wildlife Refuge. The placement of equipment and research conducted on refuge land was done under a special use permit issued by the U.S. Fish & Wildlife Service and under NMFS permits No. 14324 and earlier versions issued under the authority of the Marine Mammal Protection Act and the Endangered Species Act. **18534**