Survival and predation rates of juvenile Steller sea lions in PWS / Kenai Fjords

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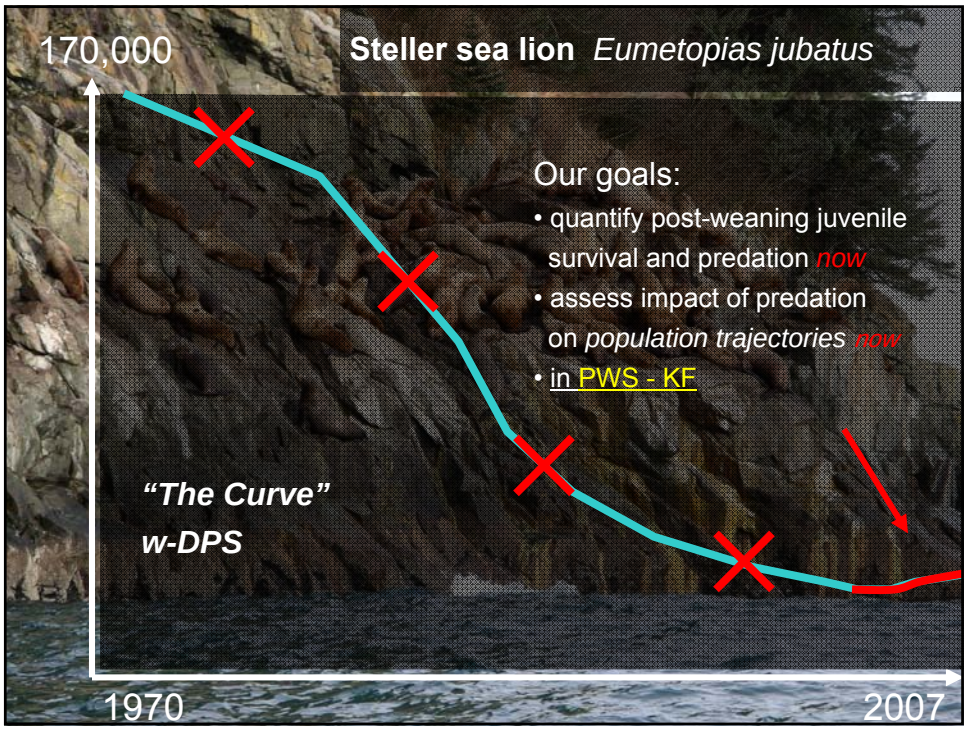
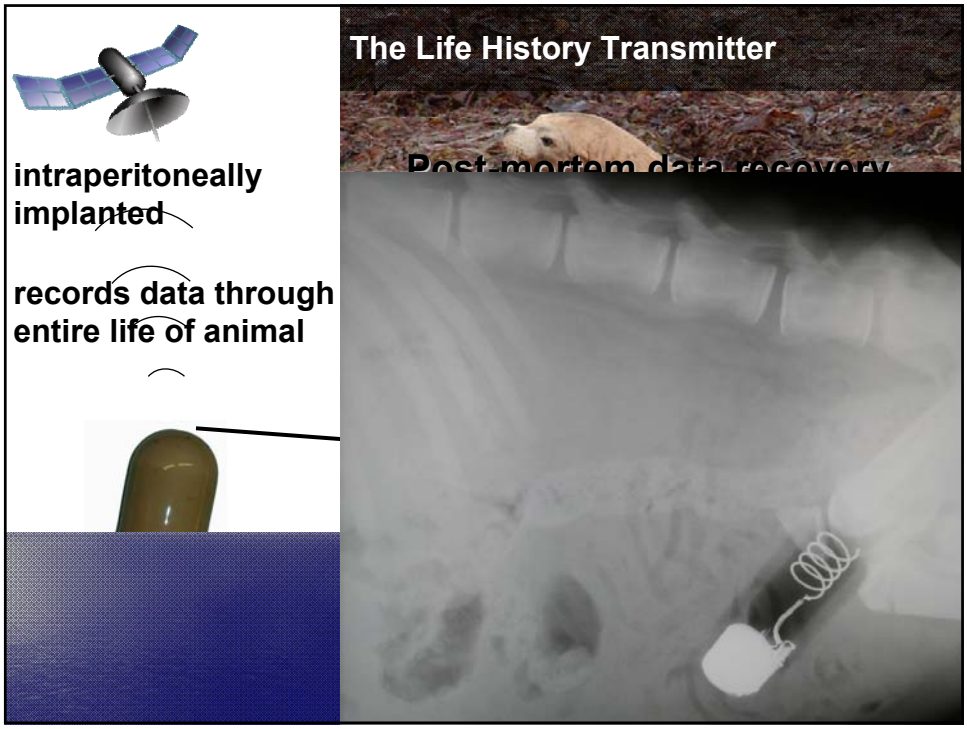




Results

27 juvenile Steller sea lions were released with LHX implants since 2005 from the Alaska Sea Life Center (Seward, AK)

Mellish et al. *Aq. Mamm. 2006 (facility & program)*
Horning et al. *BMC Vet. Res. 2008 (procedure)*

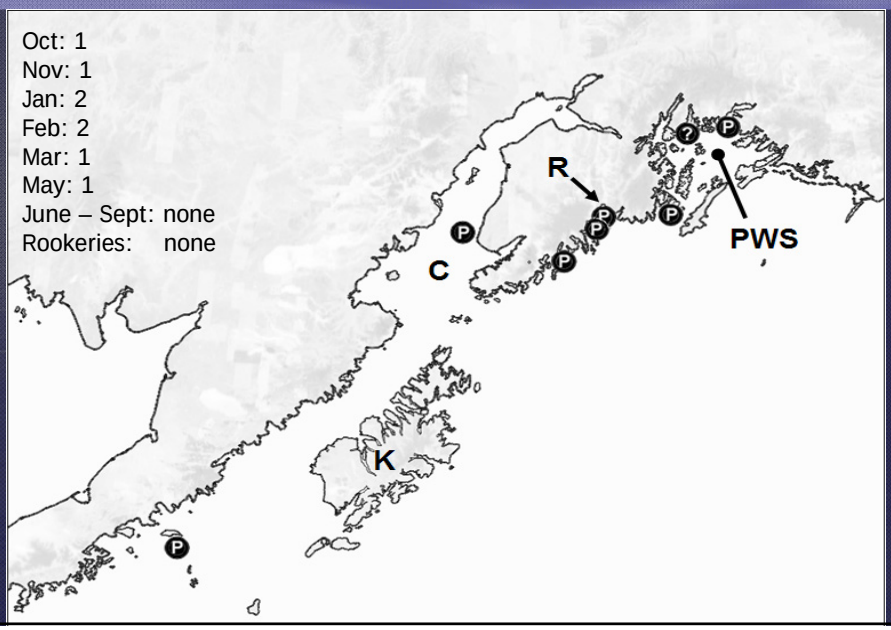
Recovery from surgery during captive monitoring as expected:
↑ lympho- & monocytes, globulins, haptoglobins
↓ baseline by ≤ 45 days → *study inclusion criterion* *45d*

Mellish, Thomton & Horning *JEMBE 2007*
Petrauskas et al. *J. Exp. Zool. A 2008*

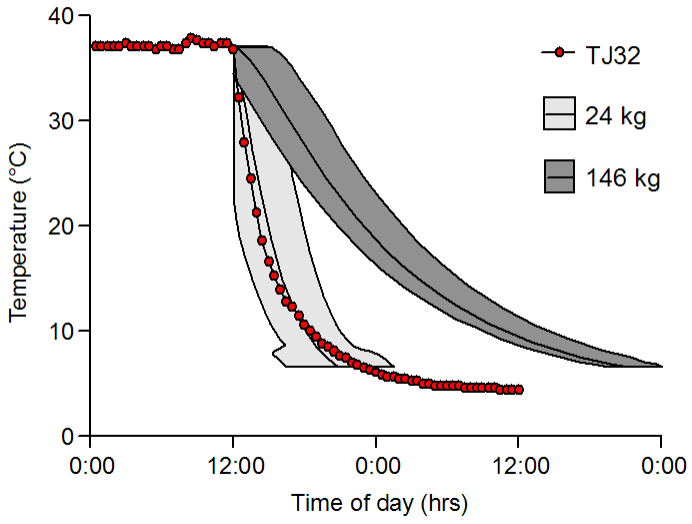
Post-release external tracking & resights:
- No differences in diving, ranging behavior for 2-6 months
- Survival confirmed > *45d* for all (82 – 1388 *days*, *n*=27)

Mellish, Thomton & Horning *JEMBE 2007*
Thomton et al. *End. Spec. Res. 2008*
Horning & Mellish *End. Spec. Res. 2009*

Results



Results



Context – *Holmes et al. Ecol. Appl. 2007*

Computational *inferential* model
based on time-varying *Leslie Population Matrix* (LPM)

Leslie Population Matrix:

seeded with initial pup count
→ annual survival schedules (ages 0-31 yrs)
→ yields counts per year class
→ annual fecundity schedules (0-31)
→ yields pups per *fem.* year class Σ

successive years

Input: adjustments → to match output to observed pop'l trajectory & juvenile fraction *J/T*

Model predictions (outputs) should be treated as hypotheses to be tested.

Output: → juvenile survival (12-36 mo) after *n* years

→ overall natality (#pups / females of reprod age)

Context – *predicted juv survival rates*

Survival rate estimates 12 – 36 months *(adjusted)*

	HFYS - CGoA apparent		*LHX – PWS/KF actual*
Pre-decline	0.753		N/A
Peak decline	0.422 (0.4-0.47)		N/A
→2004/2006	0.720 (0.7-0.77)	>	0.5 (0.4-0.62)

Post-weaning juvenile survival in PWS/KF is (still) low!

LHX data mix of females and males!
LHX data from PWS – KF region only (E-GoA)
LHX data from small sample size, post weaning

Context – *Holmes et al. Ecol. Appl. 2007*

Computational *inferential* model
based on time-varying *Leslie Population Matrix* (LPM)

Leslie Population Matrix:
- seeded with initial pup count
- annual survival schedules (ages 0-31 yrs)
  - → yields counts per year class
- annual fecundity schedules (0-31)
  - → yields pups per *fem.* year class Σ

Pup seed successive years 5 production for stable population

Output: → overall natality (#pups / females of reprod age)

Context – *predicted natality*

Natality estimates *(# <u>all</u> pups / # females age >4-21 years)*

		HFYS - CGoA	*LHX & HFYS 0-3 4+ yrs*	
Pre-decline	Σ	0.494	N/A	
	schedule	0.515		
→2004/2006	Σ	0.520 (0.7-0.77)	0.9 (0.68-1.0)	J/T 54%
	schedule	0.331 (0.32-0.35) <	0.6 (0.3-1.0)	J/T 45%

Natality possibly quite high PWS/KF!

Indirect natality estimate!
Adjusted for J/T metric (C-GoA)

Impact of predation - estimates

adding *proportion of predation* to population matrix

using predation rate of (0.875 yr 2 & 3, -33% yr 1, -25% p.a. for yrs >3)

using ASR for yrs 0-1 from Pendleton & Maniscalco = NMML (0.65)

50.3% *(45 - 71)* of females born are consumed before primiparity

19.2% *die by other causes*

30.5% *are recruited*

More females are consumed than recruited!

Concluding perspective

Steller sea lions in KF-PWS *at present*

	CW		LHX		
Population trends?	neutral	→	neutral	☑	
Juvenile survival?	high(er) ☒		low	☑	
Natality?	low ☒		high	☑	high
Impact of predation on recovery?	< natality (no prob) ☒		> natality	☑	
Regional effects!!!	C-GoA		E-GoA		

Concluding perspective

Survival & Predation

- an empirically intractable problem?

We *CAN* quantify predation!

- Not a technical issue, but a permit issue!

Let's keep an open mind about whether:

juvenile survival has recovered

natality is *"critically"* low

Need to study survival & predation & natality (test models)

at same spatial & temporal resolution (reduce variability)

→ *LHX Mk II with parturition detection – a true Life History Tag*

for individual animals: survival, predation, EoL emigration,

age at primiparity, lifetime reproductive success

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