

# Distribution and Abundance of Sea Lions in the Inland Waters of Washington, 2013-2016

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Photo: M. A. Webber

# Why Did We Do This?

- Two sea lion species in inland WA: Steller (*Eumetopias jubatus*) and California (*Zalophus californianus*) sea lions.
- Both are major fish predators, including threatened/endangered stocks (salmonids), and are prey for Bigg's killer whales.
- Sea lions in inland WA waters reduced by 20th century predator control programs.
- Stocks have rebounded since 1970s protection.
- No available empirical estimates of recent sea lion numbers for inland WA.

# What Did We Do?

- Our approach here was to use line-transect sampling to estimate the abundance of both species of sea lions in inland WA.
- This is an unconventional approach, which is in some ways the reverse of what is usually done.
- The study used existing data from marine mammal aerial surveys conducted in 2013-2016, and tagging data from the two sea lion species that were collected for other studies.
- Therefore this is an example of an “existing data-based research” study.

# Who Was Involved?

- Puget Sound aerial surveys funded by the **U.S. Navy**
- Northern waters aerial surveys funded by National Marine Mammal Laboratory (**NOAA Fisheries**)
- We contacted many colleagues to find the best available tagging data to use in our modeling
- Sea lion tagging funded by **State of Washington, NOAA Fisheries**, and other in-kind contributions
- **Sharon Melin** and **Peter Olesiuk** kindly provided tagging data
- This new analysis funded by **Puget Sound Partnership / Salish Sea Marine Survival Project**

# Research Methods

Aerial surveys targeted all marine mammals, but with focus on harbor porpoises.

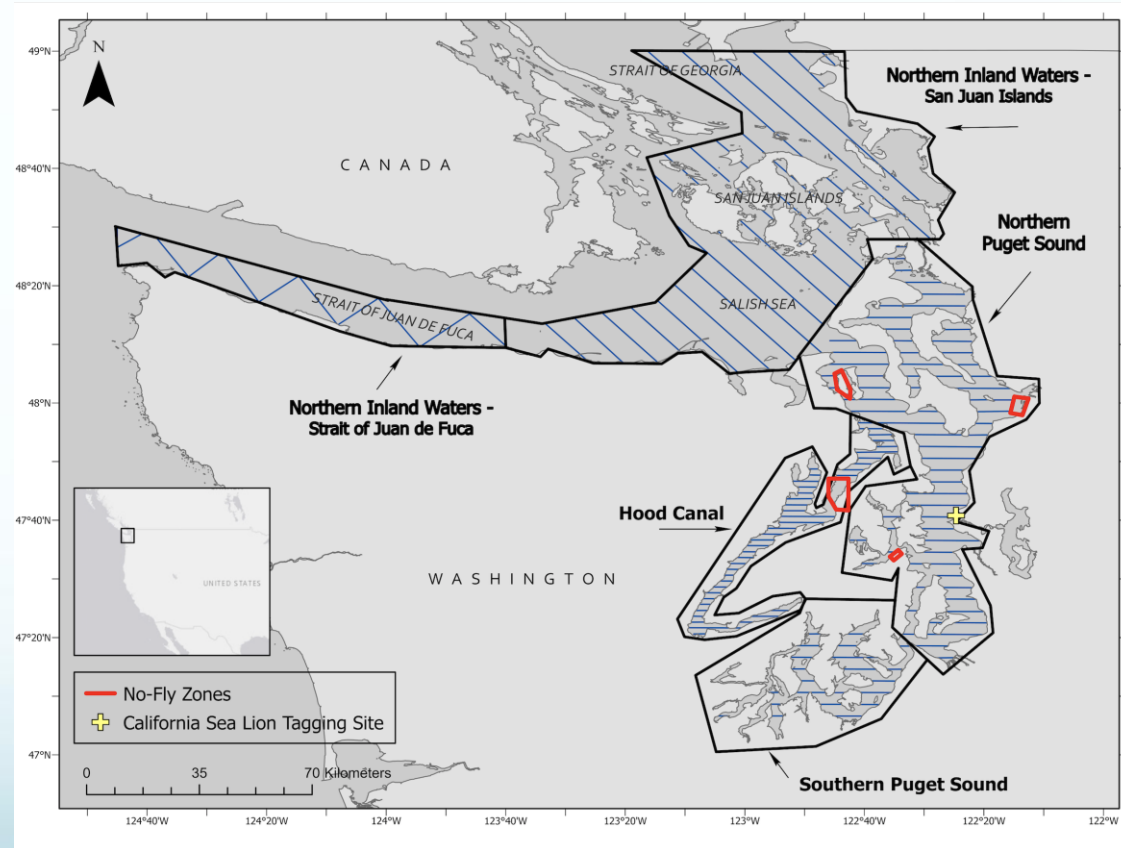
Surveys flown with systematic transects using a fixed wing aircraft.

39,399 km of aerial line-transect surveys throughout inland WA in 2013-2016.

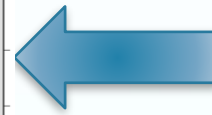
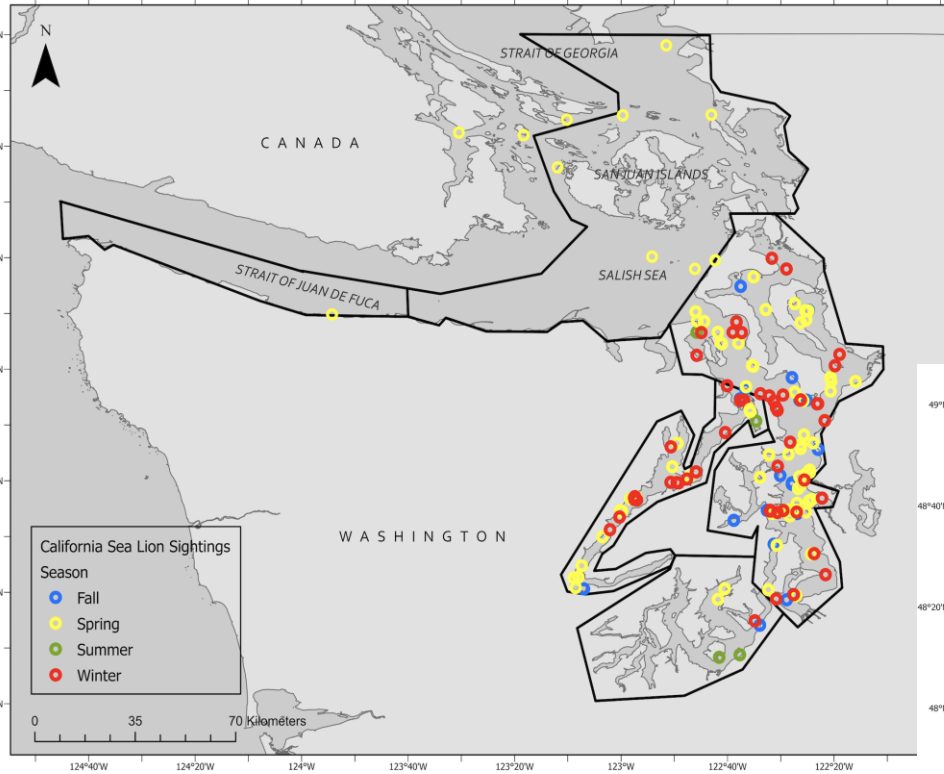
Sighted a total of 255 groups of sea lions.

Tagging data were used to model the number of sea lions missed due to being “unavailable”.

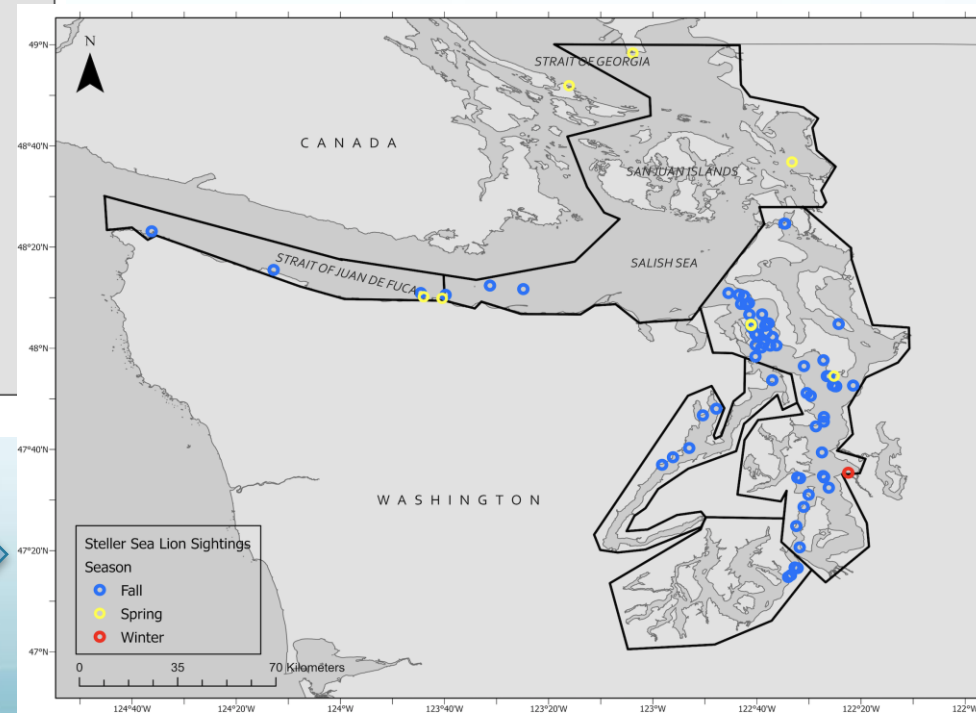
Study area and transect lines



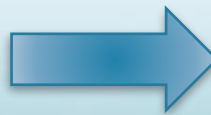
# Results (distribution)



CA sea lions  
Peak in Spring/Winter



Steller sea lions  
Peak in Fall





# Results (abundance estimates)

Region	Season	California Sea Lion				Steller Sea Lion			
		Density	Abundance	95% CI	CV	Density	Abundance	95% CI	CV
Uncorrected in-water estimates									
Puget Sound/Hood Canal	Winter	0.021	54	35-83	21.41	0.000	0	n/a	n/a
	Spring	0.034	89	54-145	24.75	0.001	3	0-25	131.6
	Summer	0.002	7	2-27	79.42	0.000	0	n/a	n/a
	Autumn	0.008	21	9-51	46.74	0.018	47	27-82	28.3
Northern Inland Waters	Spring	0.107	500	51-4,918	82.87	0.000	0	n/a	n/a
Strait of Juan de Fuca	Autumn	0.000	0	n/a	n/a	0.052	48	42-54	6.3
Corrected estimates (incl. in-water and on-land components)									
Puget Sound/Hood Canal	Winter	0.102	270	175-415	21.41	0.000	0	n/a	n/a
	Spring	0.168	442	271-723	24.75	0.003	8	1-58	132.8
	Summer	0.012	33	8-135	79.42	0.000	0	n/a	n/a
	Autumn	0.039	104	43-252	46.74	0.041	109	57-208	33.5
Northern Inland Waters	Spring	0.534	2,489	253-24,491	82.87	0.000	0	n/a	n/a
Strait of Juan de Fuca	Autumn	0.000	0	n/a	n/a	0.12	110	76-159	19.0

# Conclusions/Caveats

- Our approach allows us to correct for unavailable animals without the need to conduct independent observer experiments.
- Our methods take a “reverse” approach from the traditional methods, which use aerial counts of sea lion haulouts, correcting for animals in the water.
- Traditional pinniped assessment methods target a single species. Our methods can be used for multi-species surveys.
- Due data limitations, we were not able to estimate abundance for all areas in all seasons, and had to make some assumptions about data representativeness.
- Thus, these results should be considered a first step.



# How Are the Findings Relevant?

- Our estimates provide the first empirical estimates of abundance for either species of sea lion in inland WA waters.
- This project shows that several thousand CA sea lions and at least several hundred Steller sea lions use inland WA waters during their respective peak seasons.
- Despite limitations, these estimates provide important information for managers concerned about impacts of sea lion predation on fish stocks.
- They can be used in models that examine the impacts of sea lion predation on fish stocks.
- Results also useful in evaluating potential reasons for recent Bigg's killer whale population increases.

# Status / Next Steps

- Completion of final report to PSP – fall 2022
- Submission of paper to *Aquatic Mammals* – December 2022
- Submission of data to PSP - April 2023
- Current status:
  - Paper published in *Aquatic Mammals* on 15 July 2023
  - Prepping data submittal to OBIS-SEAMAP online database
- Follow-up study, with new data collection??
  - **THANK YOU FOR LISTENING!**