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Current status of Southern Resident killer whales and the use of RMPC data to inform management

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1. Overview of current status

2. Stock prioritization framework

3. Ways we're using RMPC data to inform distributions and trends in Chinook prey

SRKW versus other spp of concern

SRKW represent a flat / declining population of a species that is doing really well

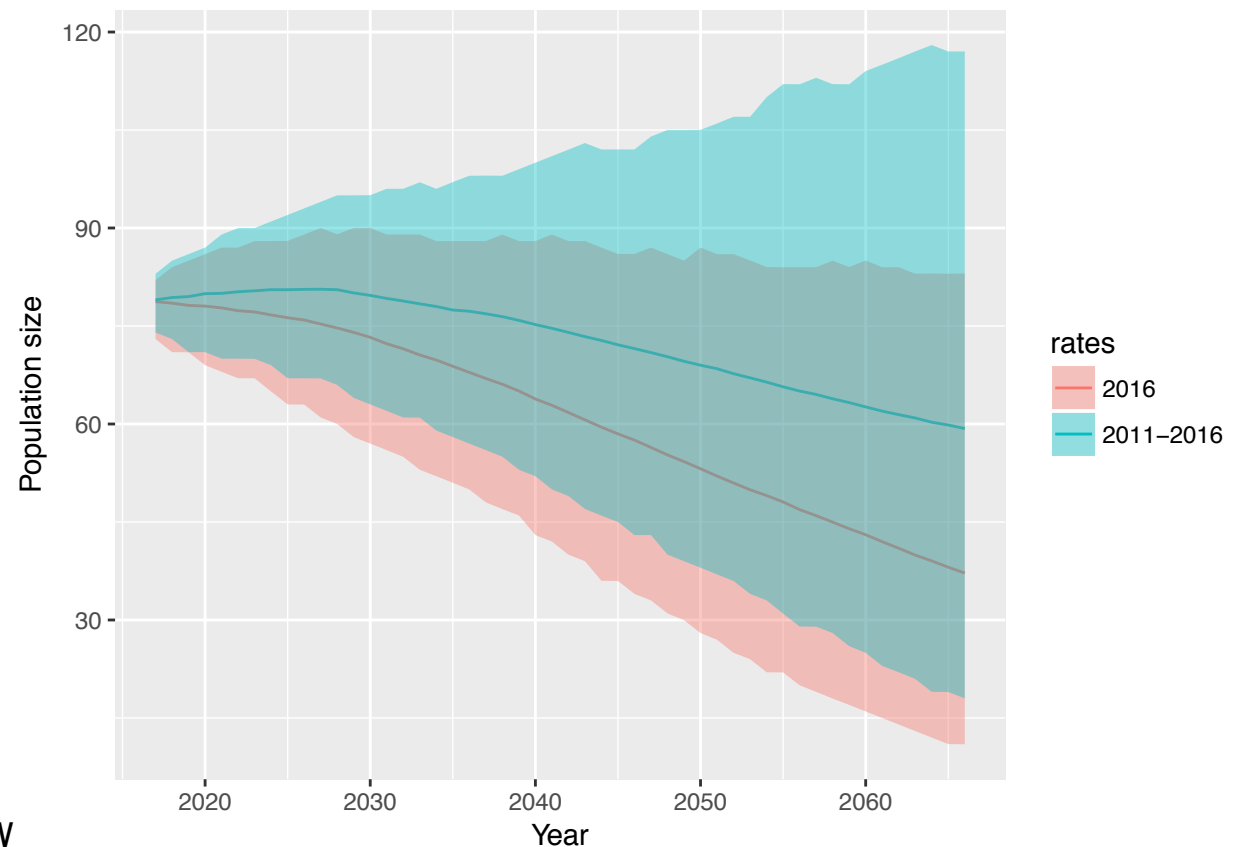
More fish-eating killer whales in NE Pacific now than since < 1972

For many species, threat(s) are clear, can be prioritized. Less so for SRKW.



Current status: 75 SRKW whales

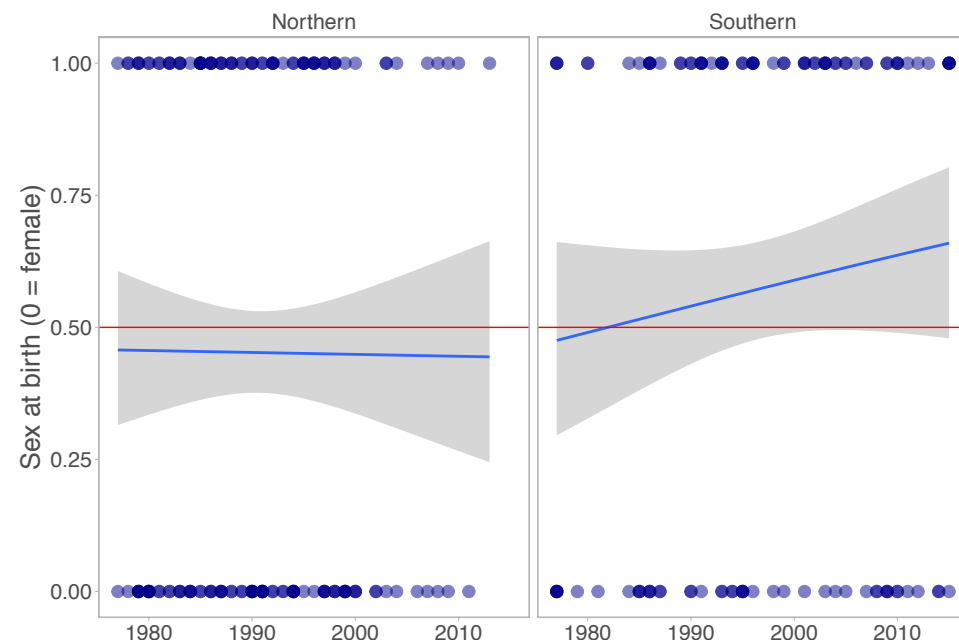
- Projected to decline, rate depends on assumptions



Source: Dec 2016 status review

Demographic changes contributing a lot to the decline

- Changing age structure: fewer old females, more males
- SRKW sex ratio skewed



Recovery may be limited by females

- Greyed out animals
= old or haven't given
birth in ~ a decade

animal	pod	age	last	animal	pod	age	last
J17	J	40	2	L54	L	40	7
J19	J	38	12	L55	L	40	6
J22	J	32	14	L72	L	31	12
J31	J	22	1	L77	L	30	5
J35	J	19	7	L82	L	27	7
J36	J	18	2	L83	L	27	10
J37	J	16	2	L86	L	26	3
J40	J	13	NA	L90	L	24	NA
J41	J	12	2	L91	L	22	2
J42	J	10	NA	L94	L	22	2
K14	K	40	9	L103	L	14	2
K16	K	32	15				
K20	K	31	13				
K22	K	30	11				
K27	K	23	6				

Threats & unanswerable questions?

- What are the reasons for individual deaths?
- Why are animals becoming pregnant but not producing live calves?
- What prey is most limiting? Which stocks?
- Which season are the animals most nutritionally stressed?
- Which contaminants (if any) affect health, fecundity or survival?
- How does disease impact SRKW?
- Are any social behaviors, infanticide or other, affecting demographics?
- How is inbreeding impacting demographic rates?
- What (if anything) is causing the trend toward more males at birth?

1. Overview of current status

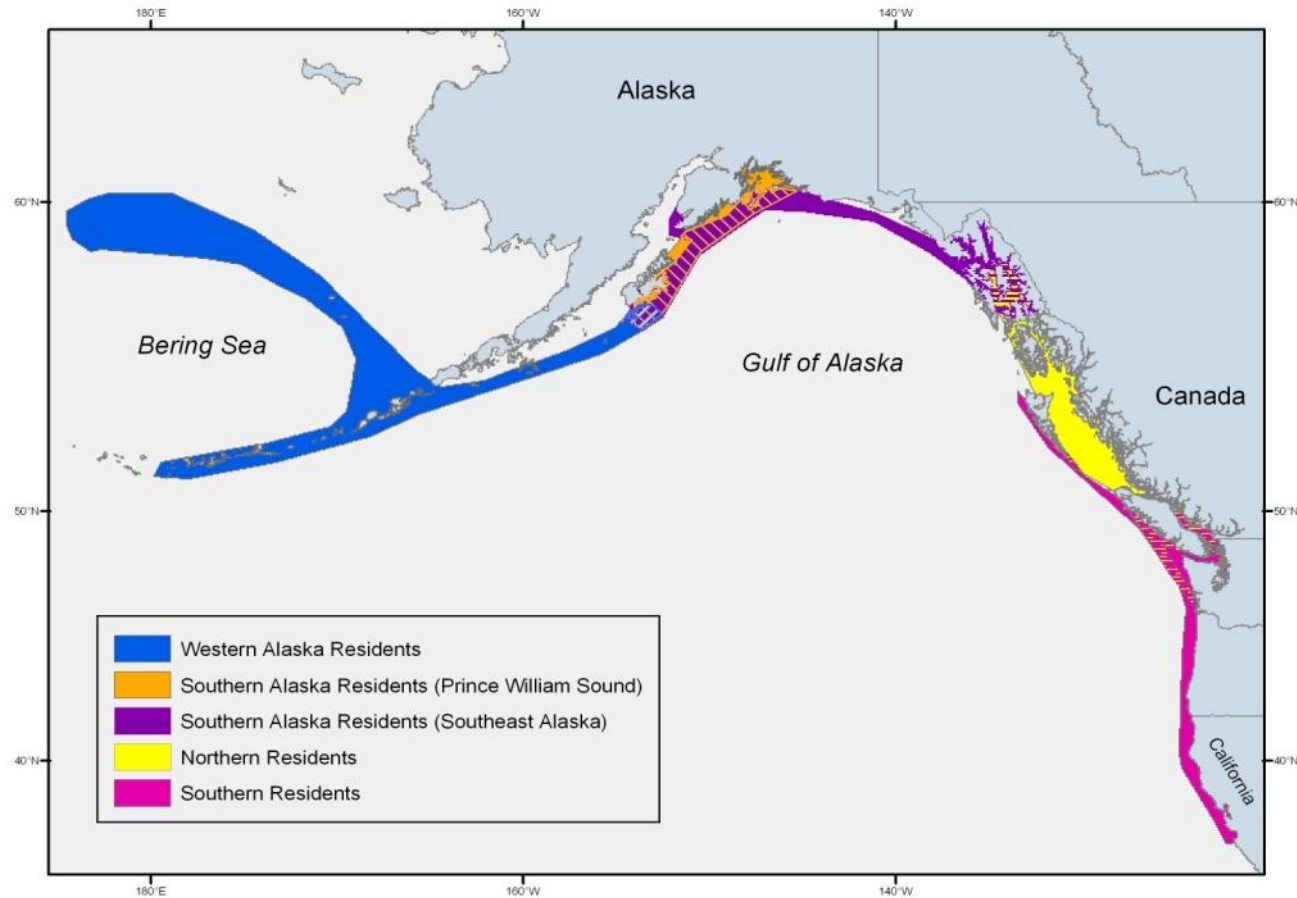
2. Stock prioritization framework

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Stock prioritization report

- NOAA West Coast Region – WDFW
- Incorporates knowledge on
- Killer whale diet
- Killer whale distribution
- spatiotemporal overlap of Chinook populations

Distribution: what we know

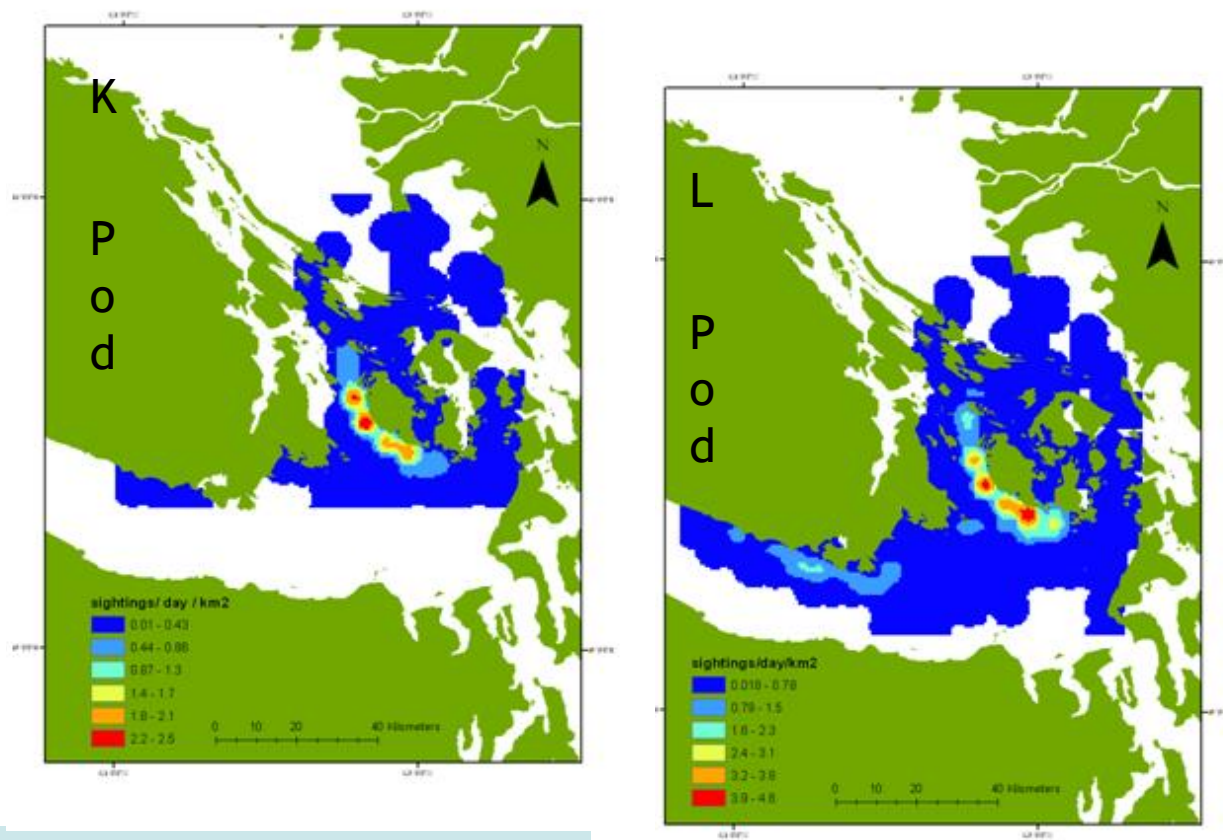


Approximate ranges for “Resident” eco-type killer whales in the eastern North Pacific

Slide: B. Hanson

Distribution: summer

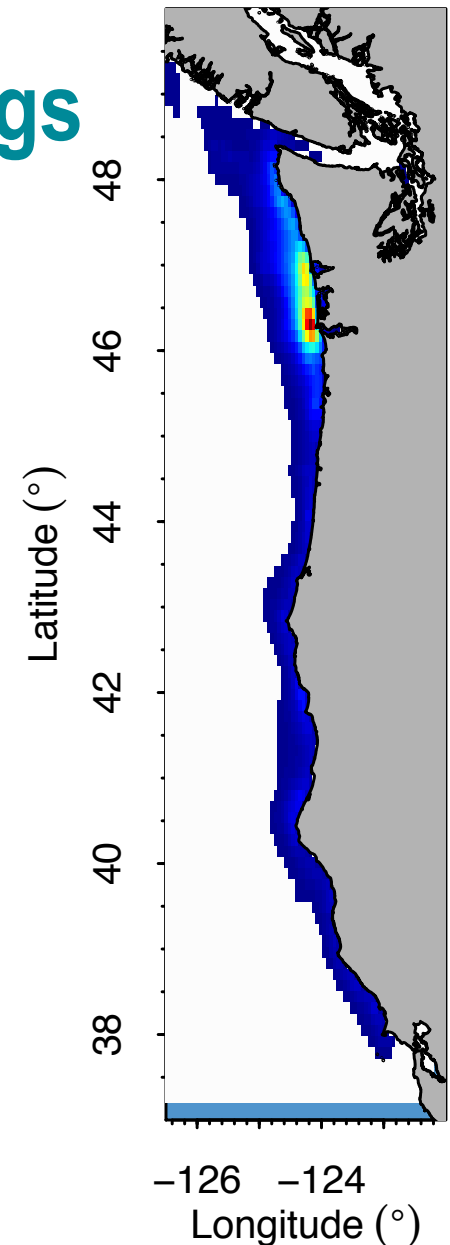
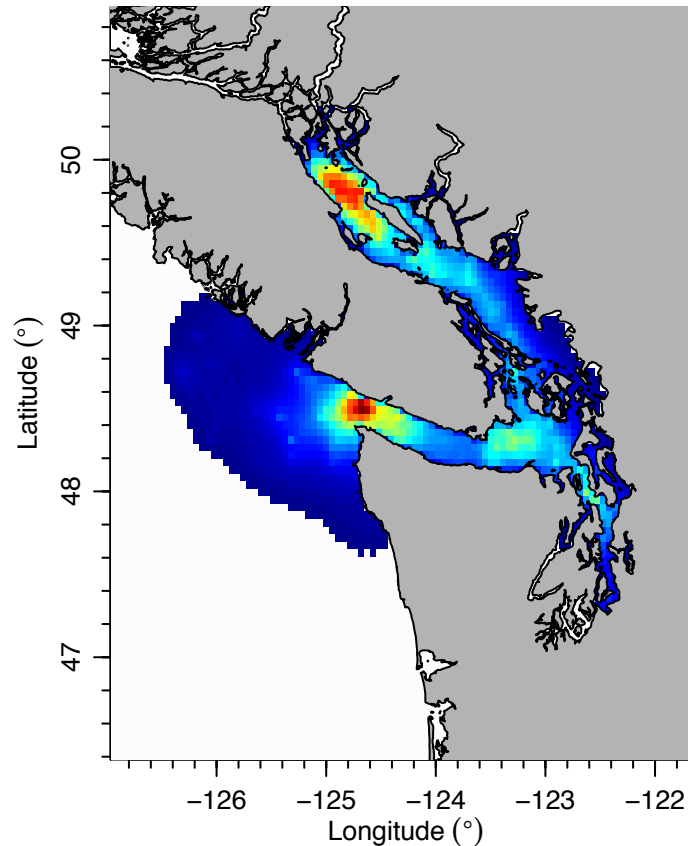
Based on *thousands of sightings*, SRKWs primarily occur in the San Juan and Gulf Islands but highest density is off the southwest side of San Juan Island



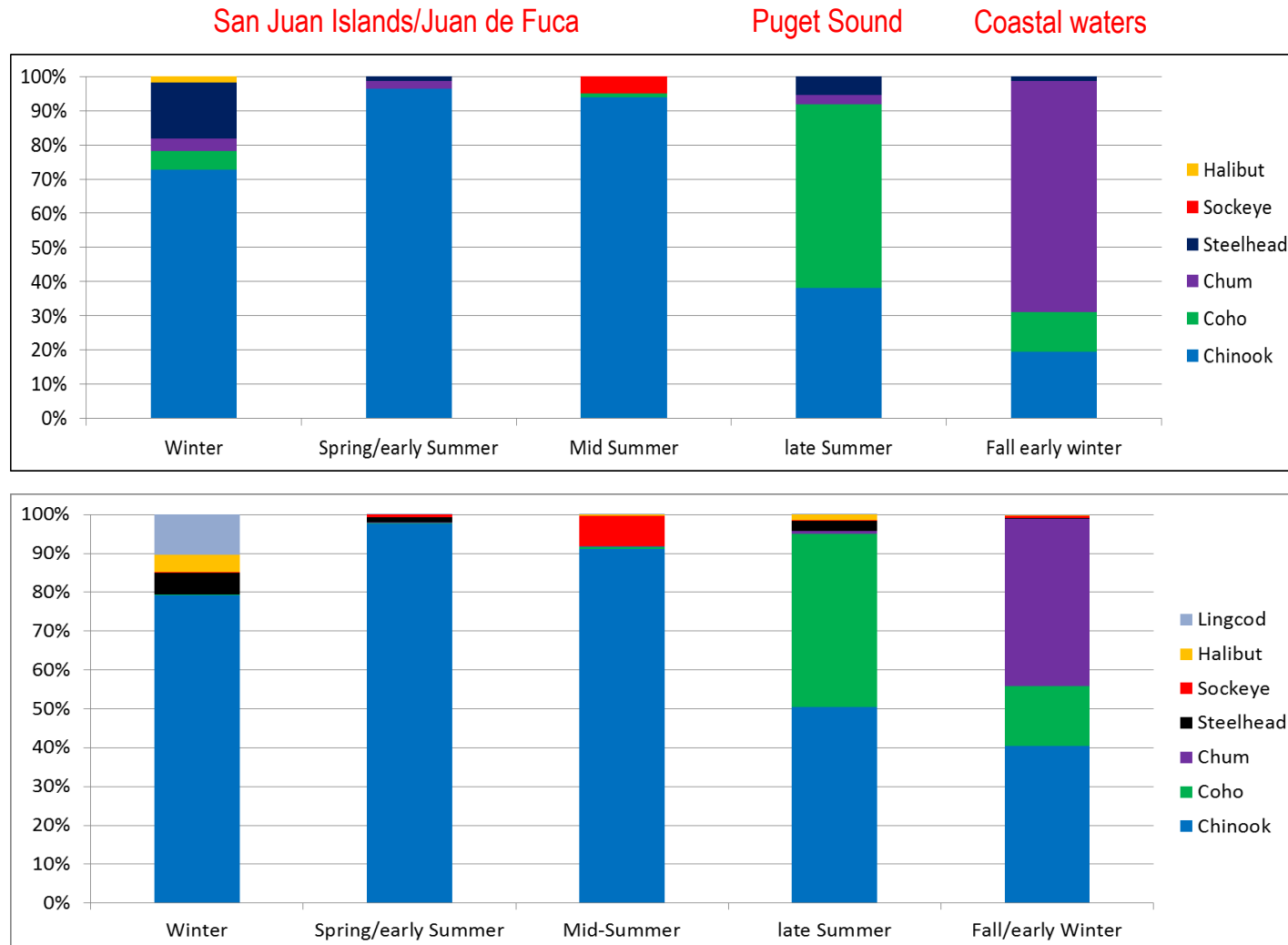
Hauser et al 2007

Winter distribution from satellite tags

- J pod: inland waters
- K/L: coastal
- Example:



Diet: Chinook dominates summer

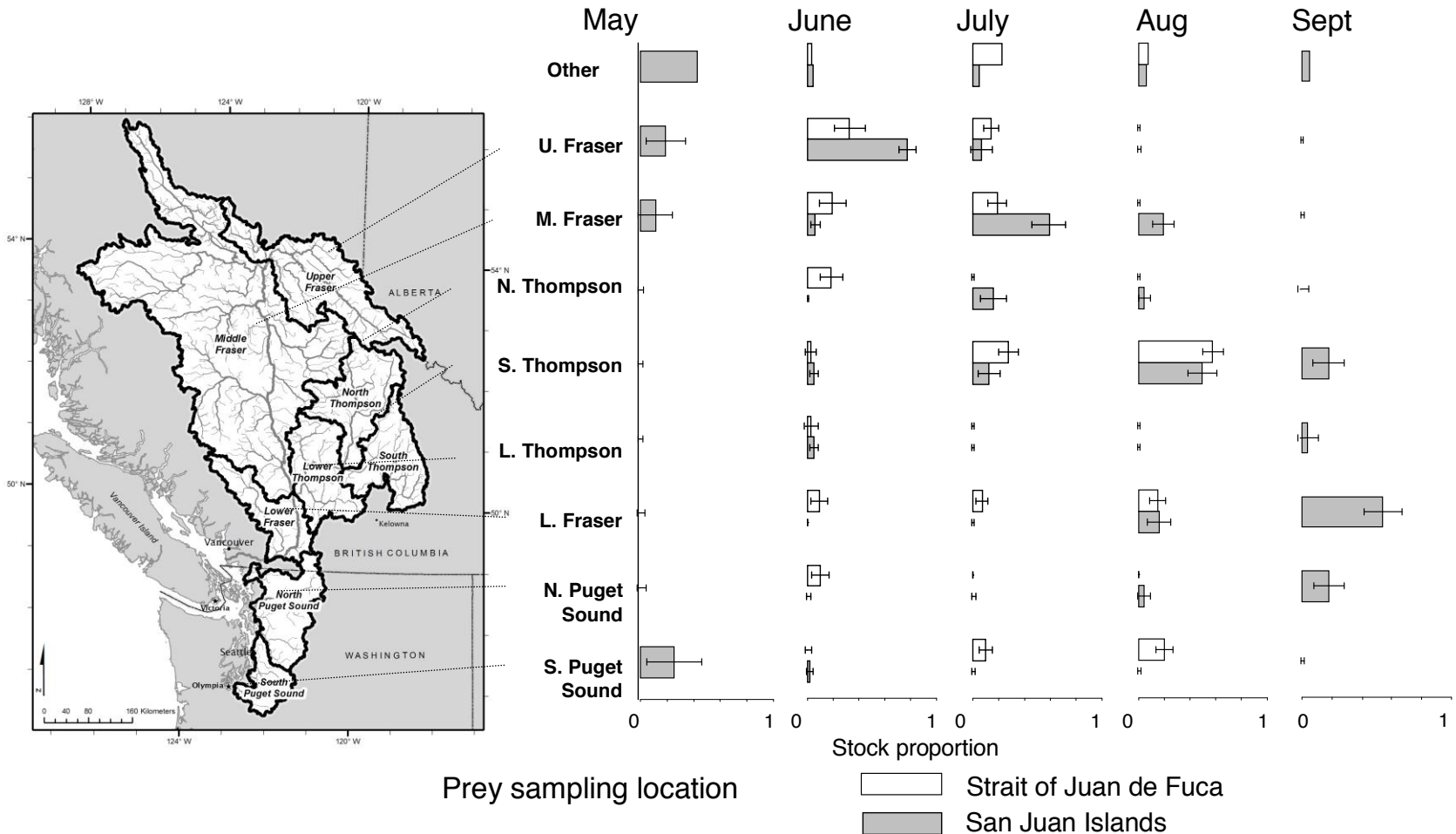


Slide: B. Hanson

Also see Ford et al. 2016

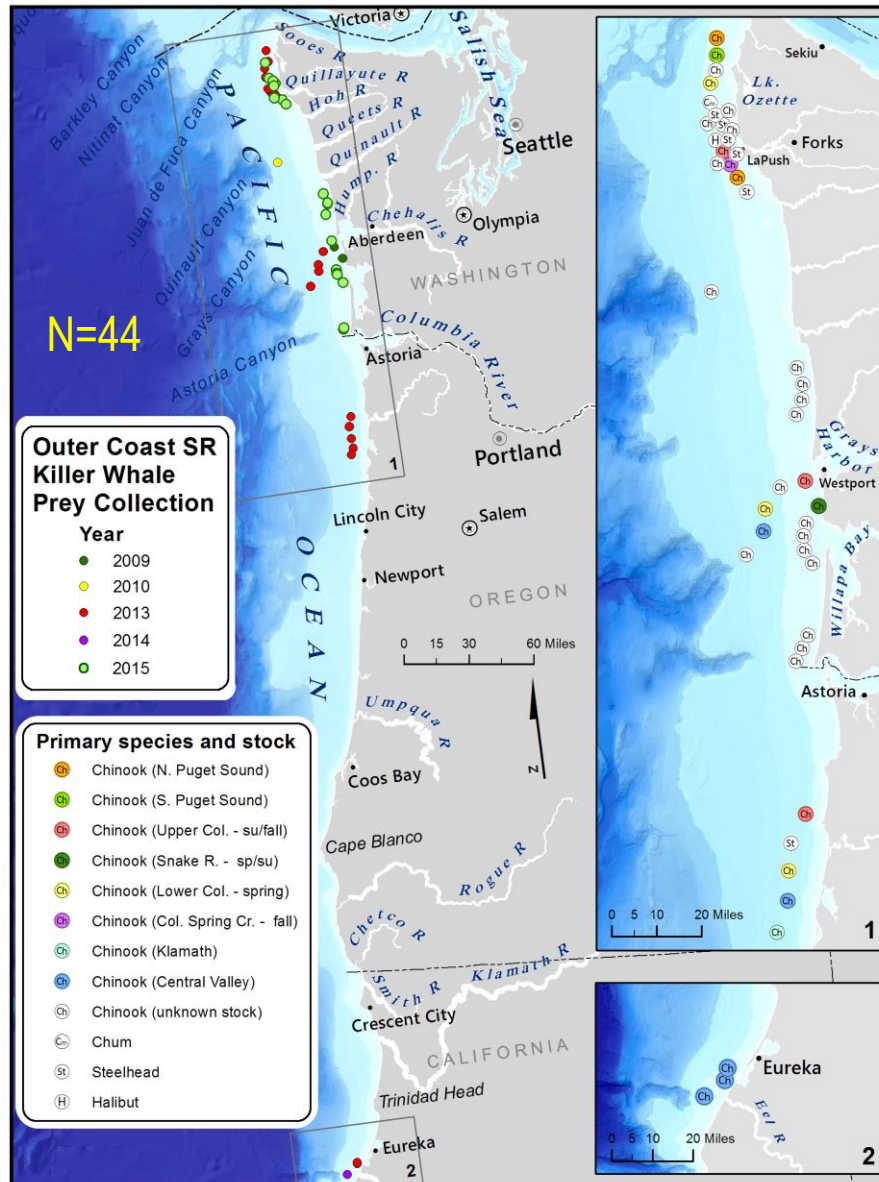
Stocks in summer samples

Upper, Middle, and Lower Fraser, and South Thompson are seasonally important



Slide: B. Hanson

Hanson et al 2010



Chinook Genetic Stock Identification included many U.S. west coast stocks:

- **Puget Sound**
- **Columbia River**
- **Klamath**
- **Central Valley**

NWFSC, Hanson unpub.

Example of priority stocks in report

ESU / Stock Group	Run Type	Rivers or Stocks in Group
Northern Puget Sound	Fall	Nooksack, Elwha, Dungeness, Skagit, Stillaguamish, Snohomish
Southern Puget Sound	Fall	Nisqually, Puyallup, Green, Duwamish, Deschutes, Hood Canal systems
Lower Columbia	Fall	Fall Tules and Fall Brights (Cowlitz, Kalama, Clackamas, Lewis, others)
Strait of Georgia	Fall	Lower Strait (Cowichan, Nanaimo), Upper Strait (Klinaklini, Wakeman, others), Fraser (Harrison)
Upper Columbia & Snake Fall	Fall	Upriver Brights
Fraser	Spring	Spring 1.3 (upper Pitt, Birkenhead; Mid & Upper Fraser; North and South Thompson) and Spring 1.2 (Lower Thompson, Louis Creek, Bessette Creek)
Lower Columbia	Spring	Lewis, Cowlitz, Kalama, Big White Salmon
Middle Columbia	Fall	Fall Brights
Snake River	Spring-Summer	Snake, Salmon, Clearwater
Northern Puget Sound	Spring	Nooksack, Elwha, Dungeness, Skagit (Stillaguamish, Snohomish)
Washington Coast	Spring	Hoh, Queets, Quillayute, Grays Harbor
Washington Coast	Fall	Hoh, Queets, Quillayute, Grays Harbor
Central Valley	Spring	Sacramento and tributaries
Middle & Upper Columbia Spring	Spring	Columbia, Yakima, Wenatchee, Methow, Okanagan
Middle & Upper Columbia Summers	Summer	

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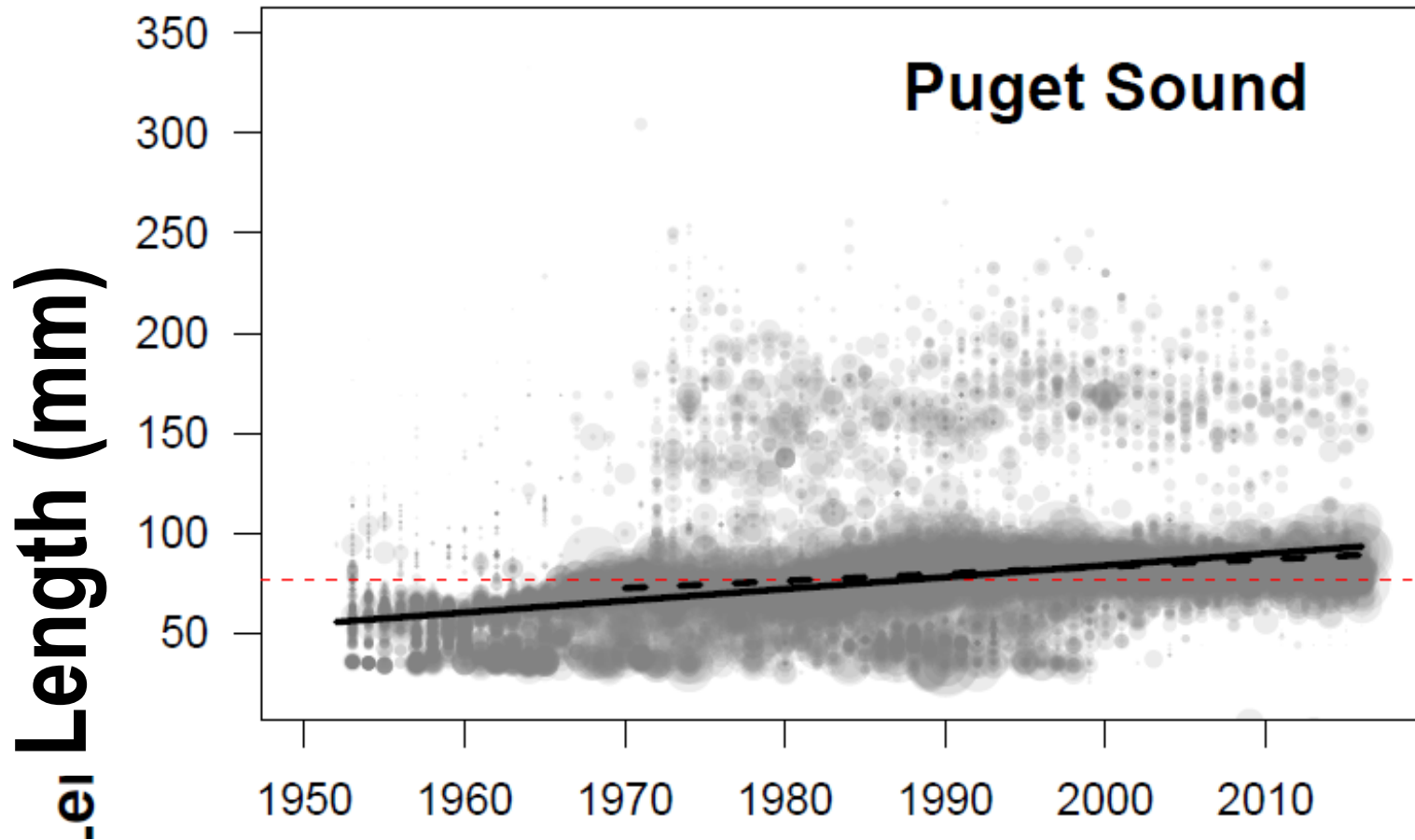
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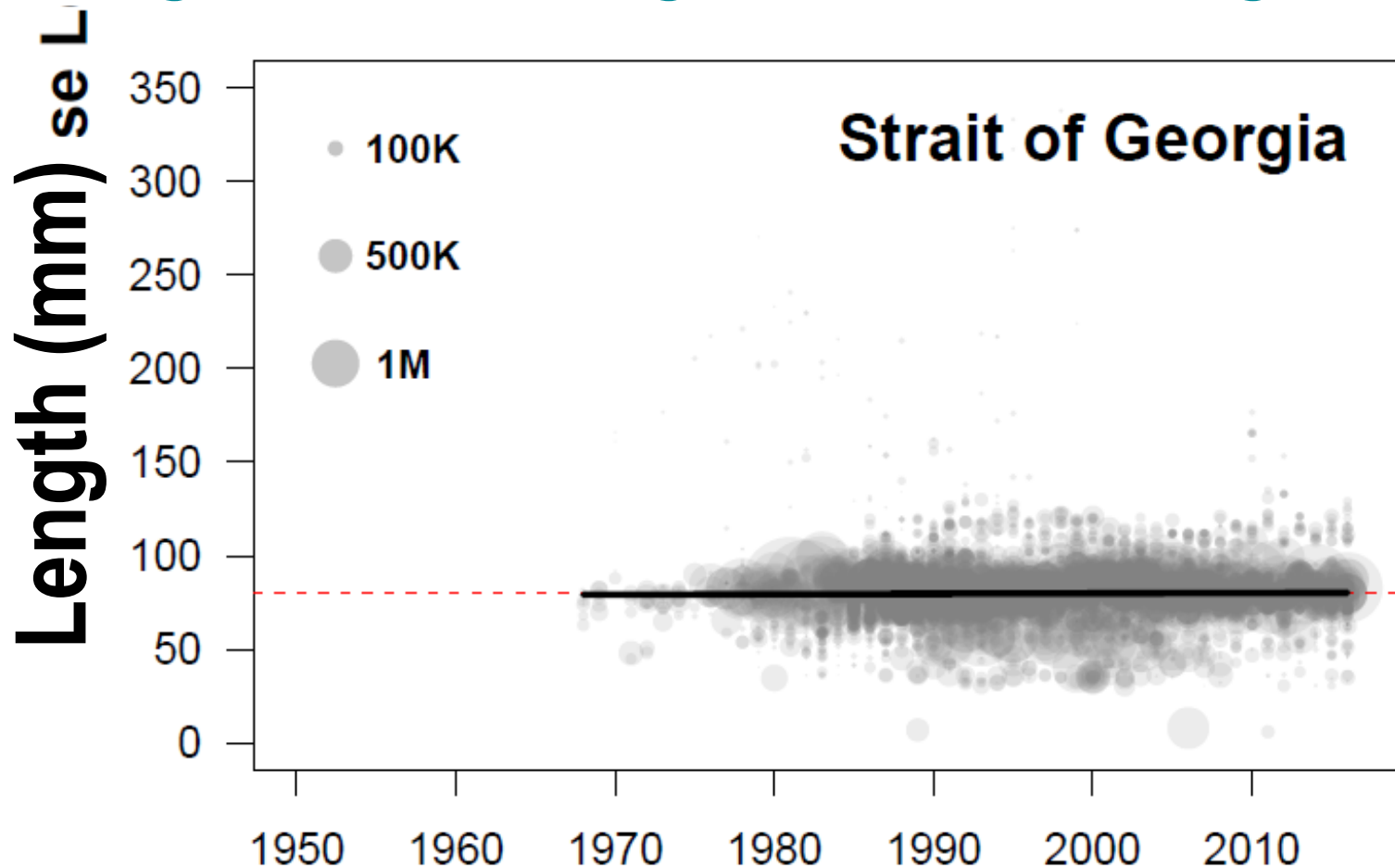
1. Summarizing trends in hatchery releases

- Ben Nelson (Benjamin.nelson@noaa.gov)
- Salish Sea analysis
- Coastwide analysis
 - Collaboration with Stephanie Carlson, Will Satterthwaite, etc

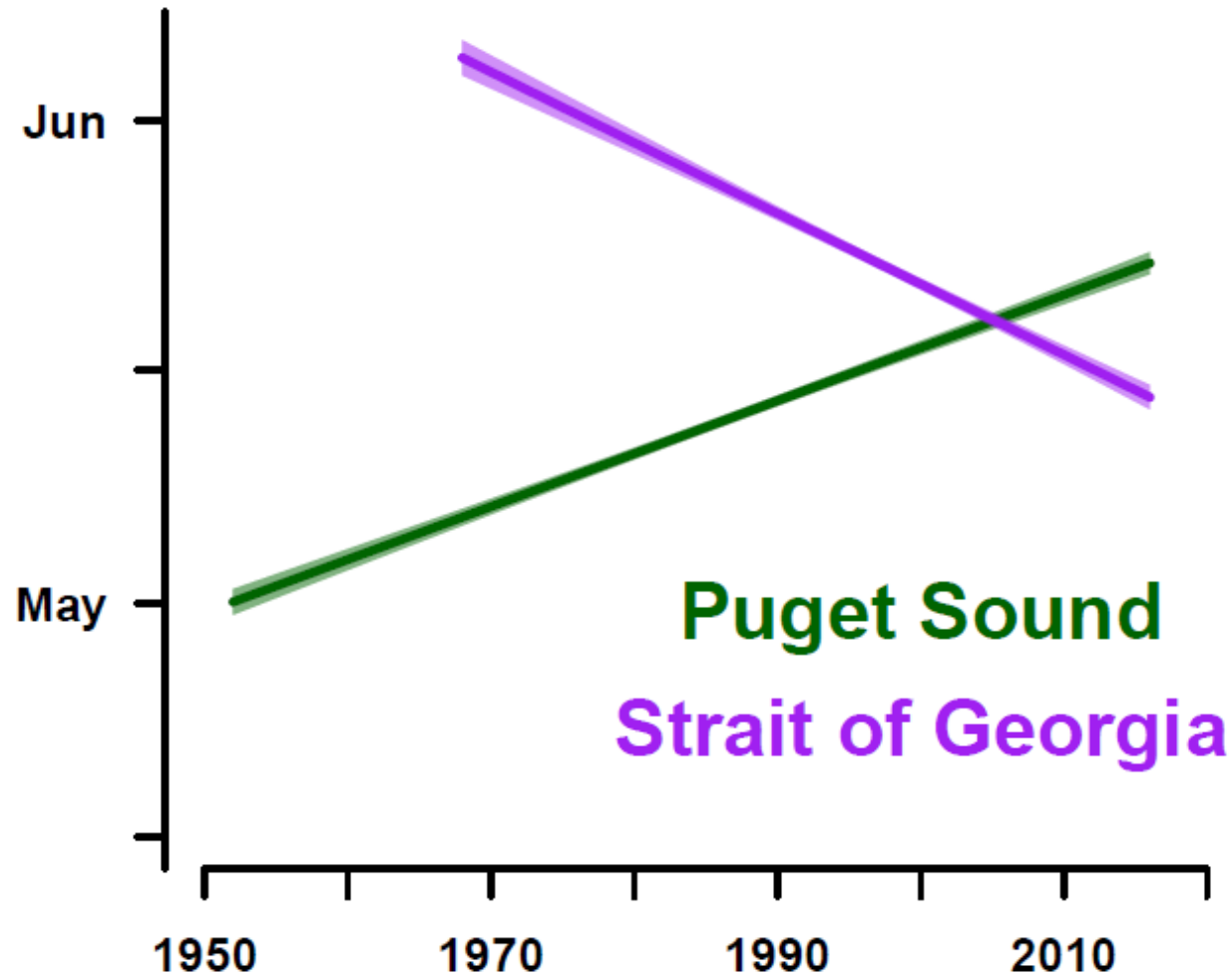
50% increase in size of releases in Puget Sound



No significant changes in St of Georgia



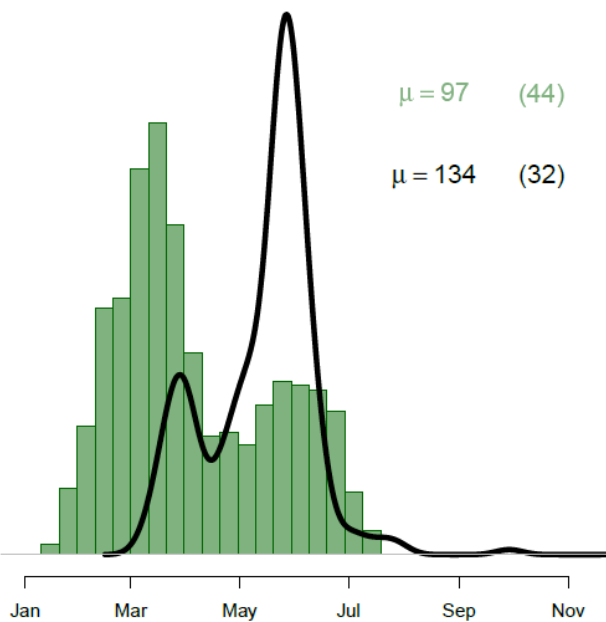
Across basin synchrony in release timing



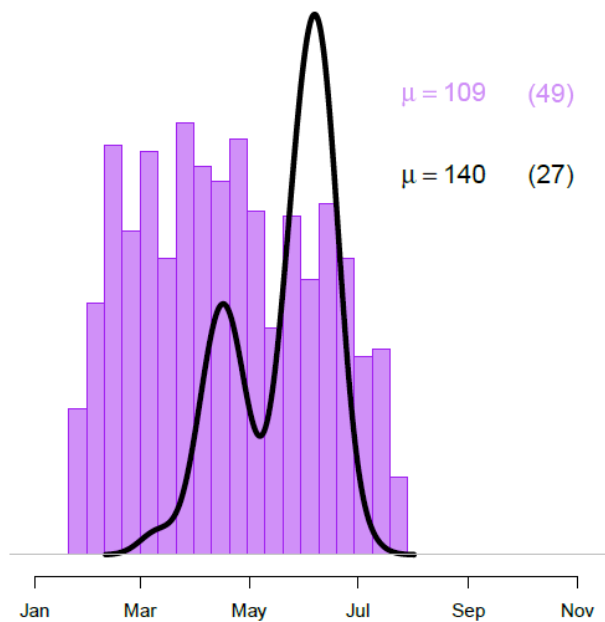
Portfolio effects: wild migration v hatchery release

- 20% of smolts released after June 15 < 1988
- Now: 6%

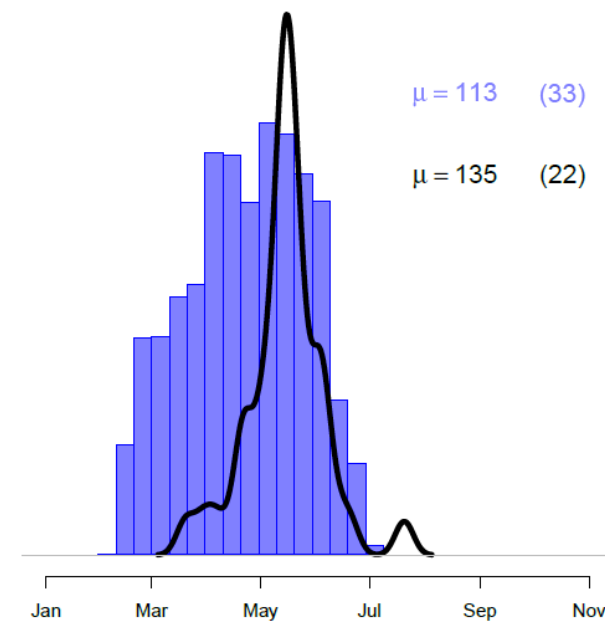
Green



Skagit



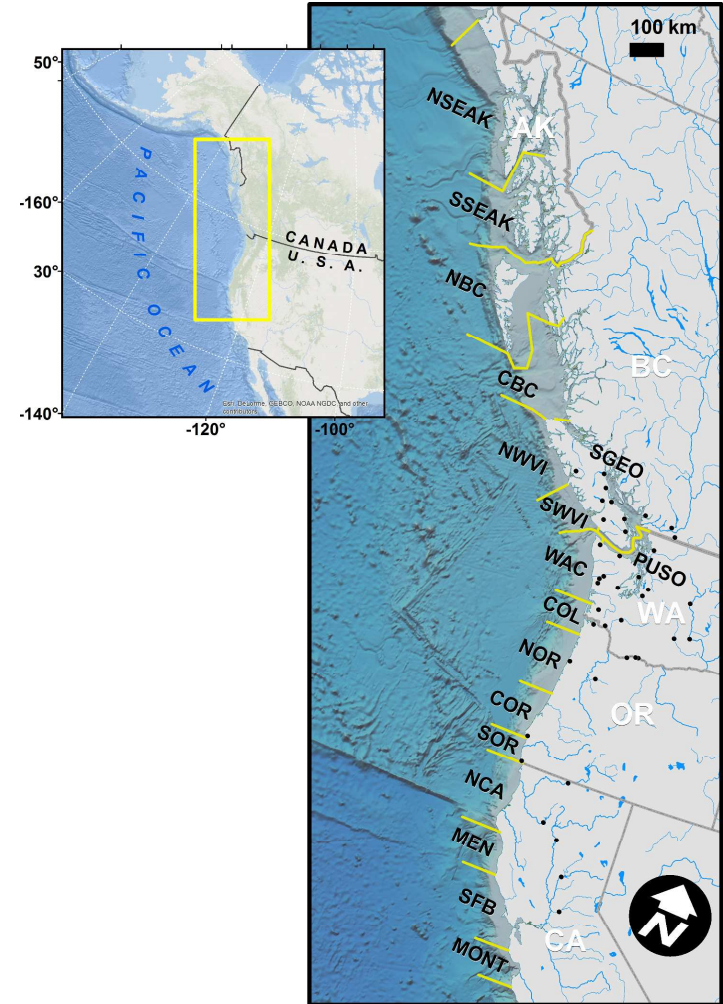
Stillaguamish



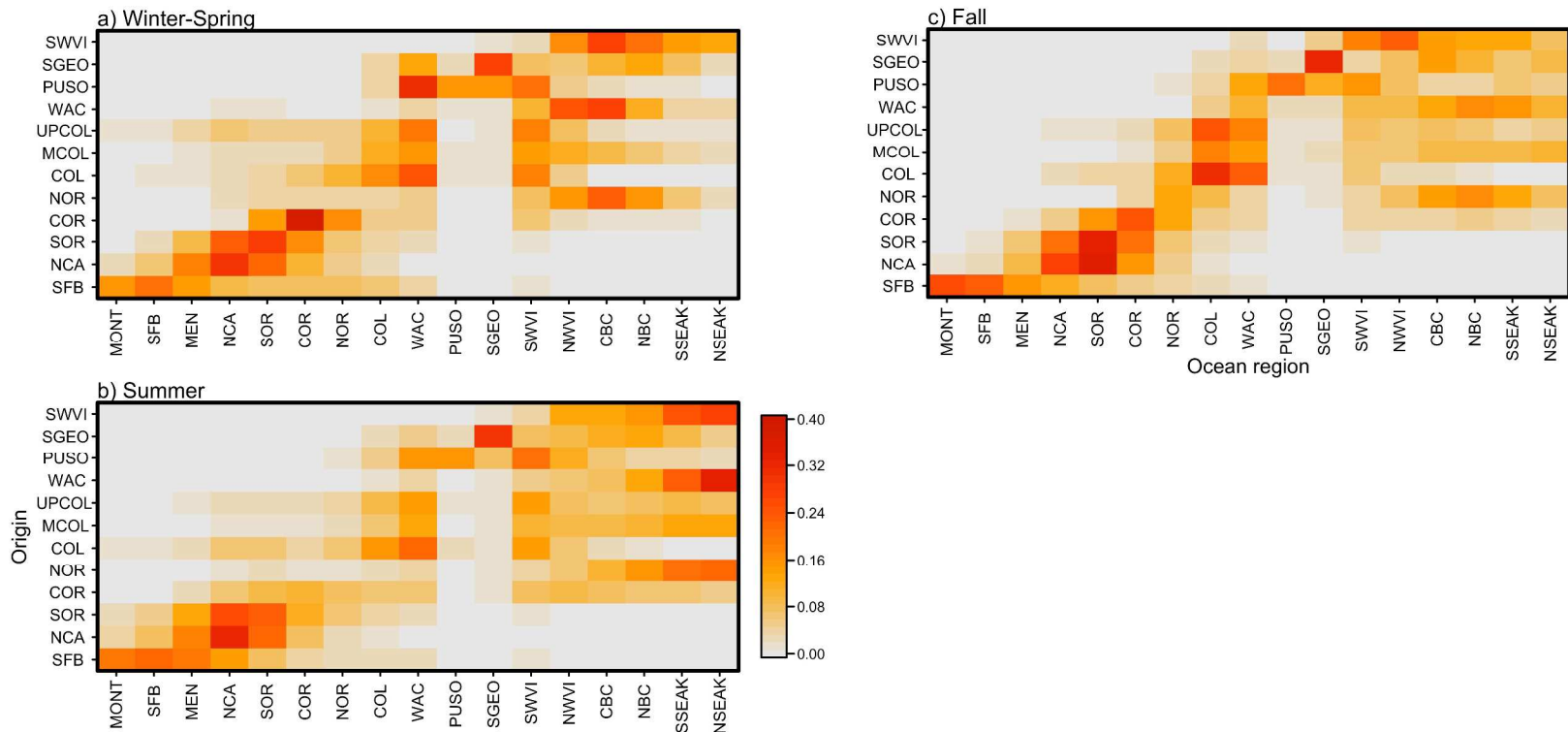
Month

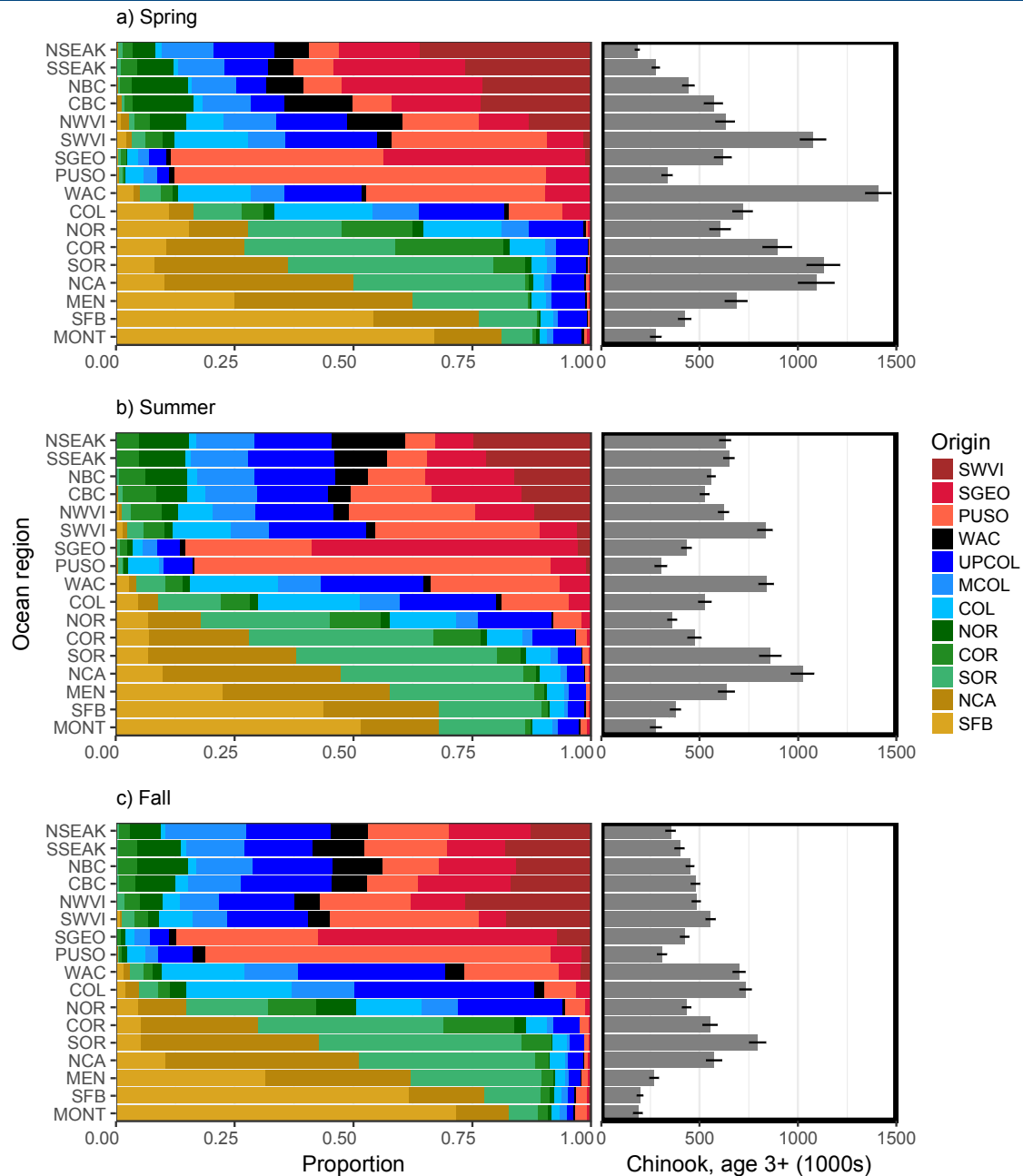
2. Developing new models of Chinook ocean distribution

- Shelton et al. 2018
- Fall Chinook, hatchery origin
- Coastwide model



Composition of stocks by ocean region



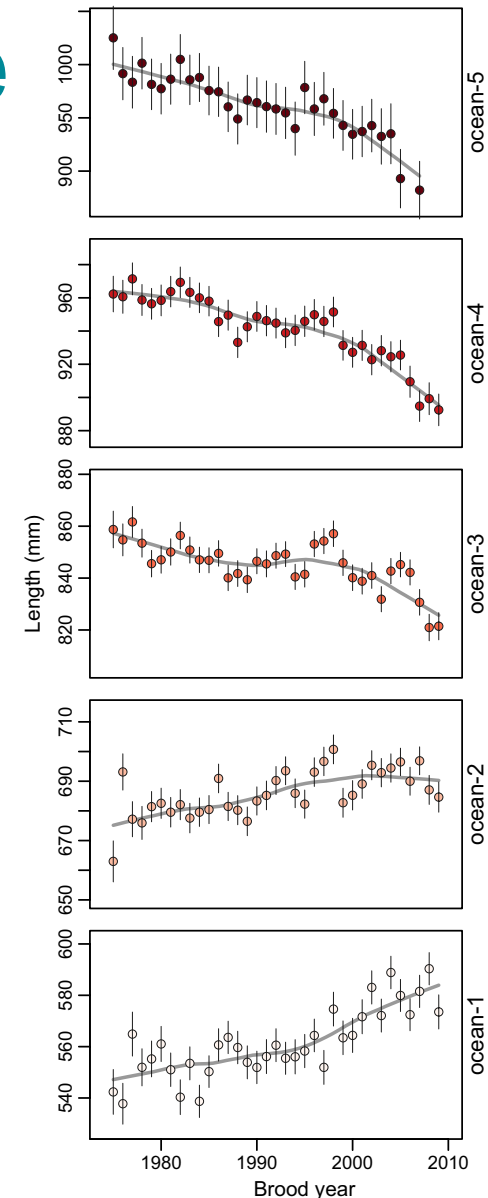
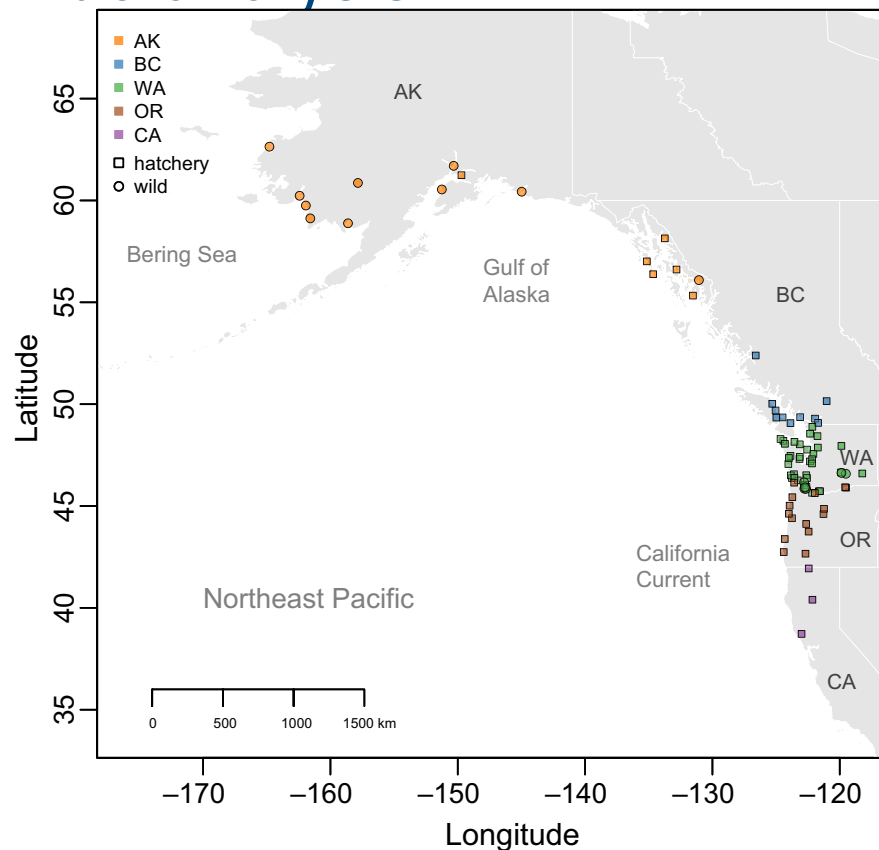


Ongoing work: spring Chinook

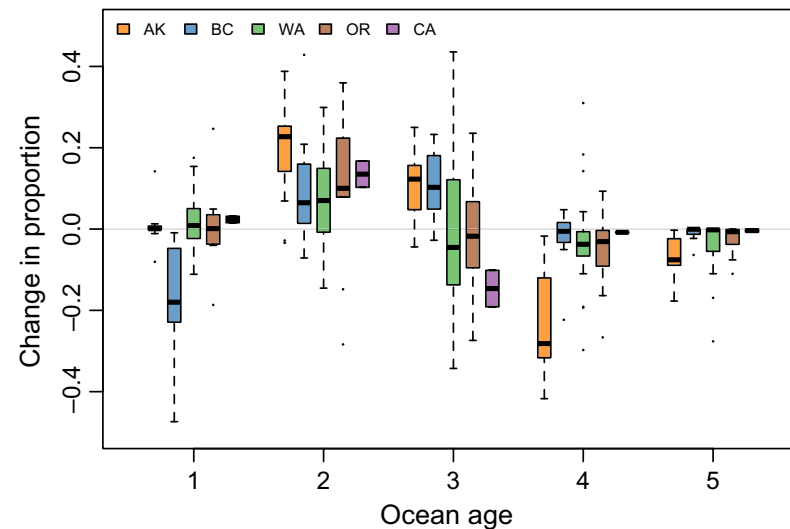
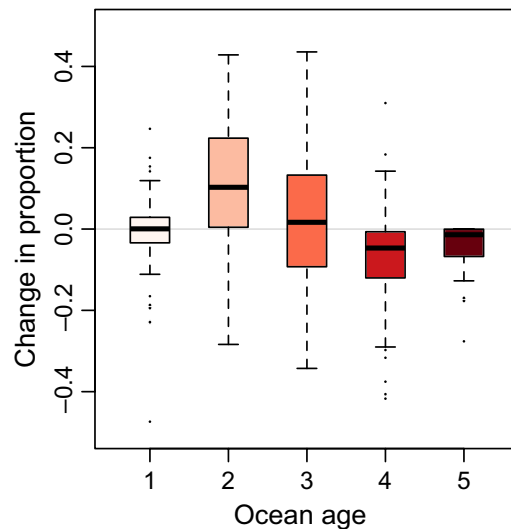
- Recoveries in fisheries more limited
- Areas more coarse than fall Chinook model
- Bycatch recoveries expanded
- Integrating fall and spring Chinook: can we link distribution changes to changing ocean conditions

3. Evaluating changes in body size

- Ohlberger et al. 2018
- Coastwide analysis



- Increasing trend toward younger fish
 - Exception: BC



Hypotheses for declining size at age

- Fisheries selectivity / harvest
- Changing ocean conditions
- Selection by predators (killer whales)
- Other?

4. Evaluating recommendations of WA Orca Task Force



Proposal to increase Hatchery Production to Benefit Southern Resident Killer Whales

Washington Department of Fish and Wildlife
Revised January 7, 2019



FACILITY NAME	OPERATOR	SPECIES	CURRENT PROGRAM	PRODUCTION INCREASE FOR SRKW	% INCREASE
Skookum Cr.	Lummi Nation	Late Spring Chinook	0	500,000	100%
Skookum Cr.	Lummi Nation	Late Spring Chinook	1,000,000	500,000	50%
Kendall	WDFW	Spring Chinook	200,000	500,000	250%
Whatcom Cr.	WDFW/ Bellingham Tech College	Fall Chinook	0	500,000	100%
Samish	WDFW	Fall Chinook	4,000,000	1,000,000	25%
Wallace River	WDFW	Summer Chinook	1,000,000	100,000	10%
Wallace River	WDFW	Summer Chinook	500,000	100,000	20%
Soos/ Palmer	WDFW	Fall Chinook	4,200,000	2,000,000	48%
Marblemount	WDFW	Spring Chinook	787,500	400,000	51%
Marblemount	WDFW	Coho	500,000	250,000	50%
Marblemount (South Sound Net Pens)	WDFW /Squaxin	Coho	1,100,000	300,000	27%
Lewis River	WDFW	Spring Chinook	1,350,000	900,000	67%
Forks Creek	WDFW	Spring Chinook	0	550,000	100%
Dungeness	WDFW	Coho	500,000	300,000	60%
Sol Duc	WDFW/ Quileute Tribe	Summer Chinook	70,000	530,000	757%
Sol Duc	WDFW/ Quileute Tribe	Summer Chinook	250,000	50,000	20%
Bear Springs	Quileute Tribe	Summer Chinook	60,000	75,000	125%
Total Production			16,217,500	8,055,000	47%



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Puget Sound Partnership – Long Live the Kings

- 36 overall recommendations

Three related to harvest / hatcheries

- 6. Significantly increase hatchery production and programs to benefit Southern Resident orcas
- 10. Support full implementation and funding of the 2019-28 Pacific Salmon Treaty
- 11. Reduce Chinook bycatch in west coast commercial fisheries

Framework

- Synthesize existing models / data ideally in a way that is comparable across actions
 - FRAM, CTC, CWT run reconstruction
- Future work: improve on / expand actions included
 - Hydropower, habitat, etc
- Report to PSP and Orca Task Force June 30

Summary

- SRKW likely affected by numerous effects
 - Demography = large driver
- RMIS + GSI data is critical for informing killer whale diet + salmon ocean distribution
- Challenge: changing effort, changing oceans