Washington Department of FISH and WILDLIFE

Pinniped Conservation and Management

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December 4, 2020

OUTLINE

- MMPA management options
- Pinnipeds in Washington
- Columbia River Update
  - MMPA 120(f) Application
- Puget Sound Update
  - Diet analysis
  - Evaluating Non-Lethal Actions
  - “What if” Scenarios
- Next Steps
  - Avian and Pinniped Predation Team
  - 2021 Legislative Session

Marine Mammal Protection Act (MMPA)

Goals of the MMPA

- To maintain species/stocks at their Optimum Sustainable Population (OSP) and be a significant functional element in the ecosystem.

- To restore depleted stocks to OSP.

- To reduce bycatch and serious injury of marine mammals incidental to commercial fisheries to insignificant levels approaching a zero mortality rate.

MMPA Section 101 Take Moratorium

"There shall be a moratorium on the ***taking*** and importation of marine mammals and marine mammal products…"

Take is defined as "harass, hunt, capture or kill, or attempt to harass, hunt, capture or kill any marine mammal."

Similar to language in the ESA.

Management Options in the MMPA

- Apply for Waiver and Request Direct Take
  - Request waiver of the Take Moratorium [Section 101(a)(3)]
  - Rule-Making [Section 103]
  - Take Permit [Section 104]

- Request Return of Management Authority to State: [Section 109]

- Pinniped Removal Authority: [Section 120 and new Section 120(f)]
  - Intentional lethal taking of individually identifiable pinnipeds which are having a significant negative impact on the decline/recovery of salmonids

- Non-Lethal Management of Nuisance Animals: [Section 109(h)]

MMPA's Potential Biological Removal

- The maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.
- Function of:
  - Minimum population estimate
  - One-half the maximum theoretical or estimated net productivity rate of the stock at a small population size.
  - A recovery factor between 0.1 and 1.0

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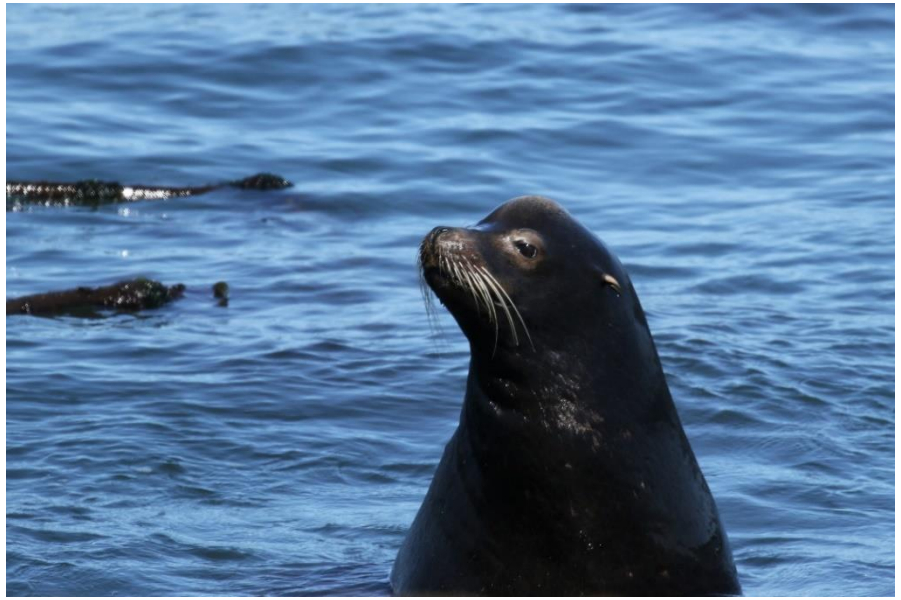
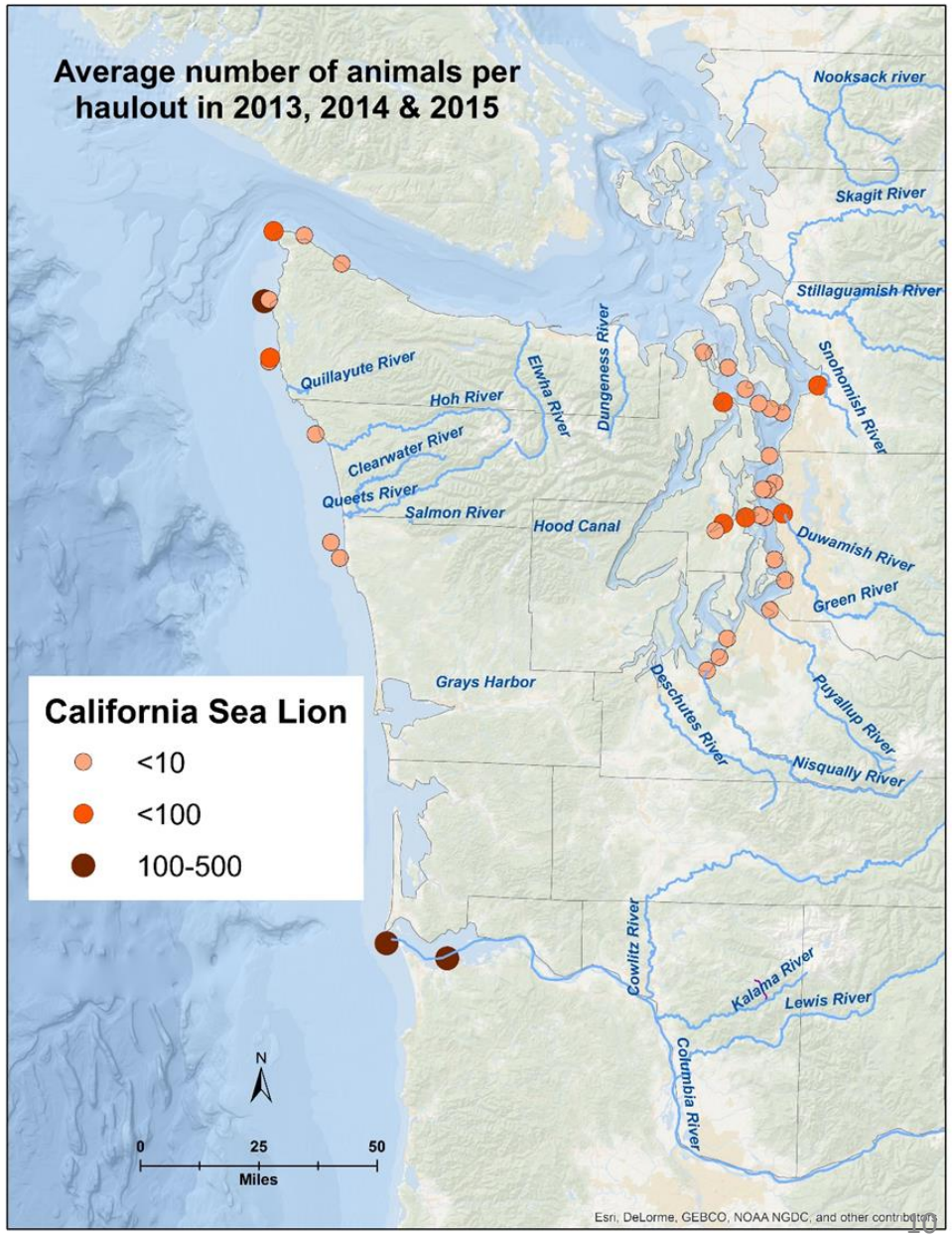
Focus on Three Species of Pinnipeds

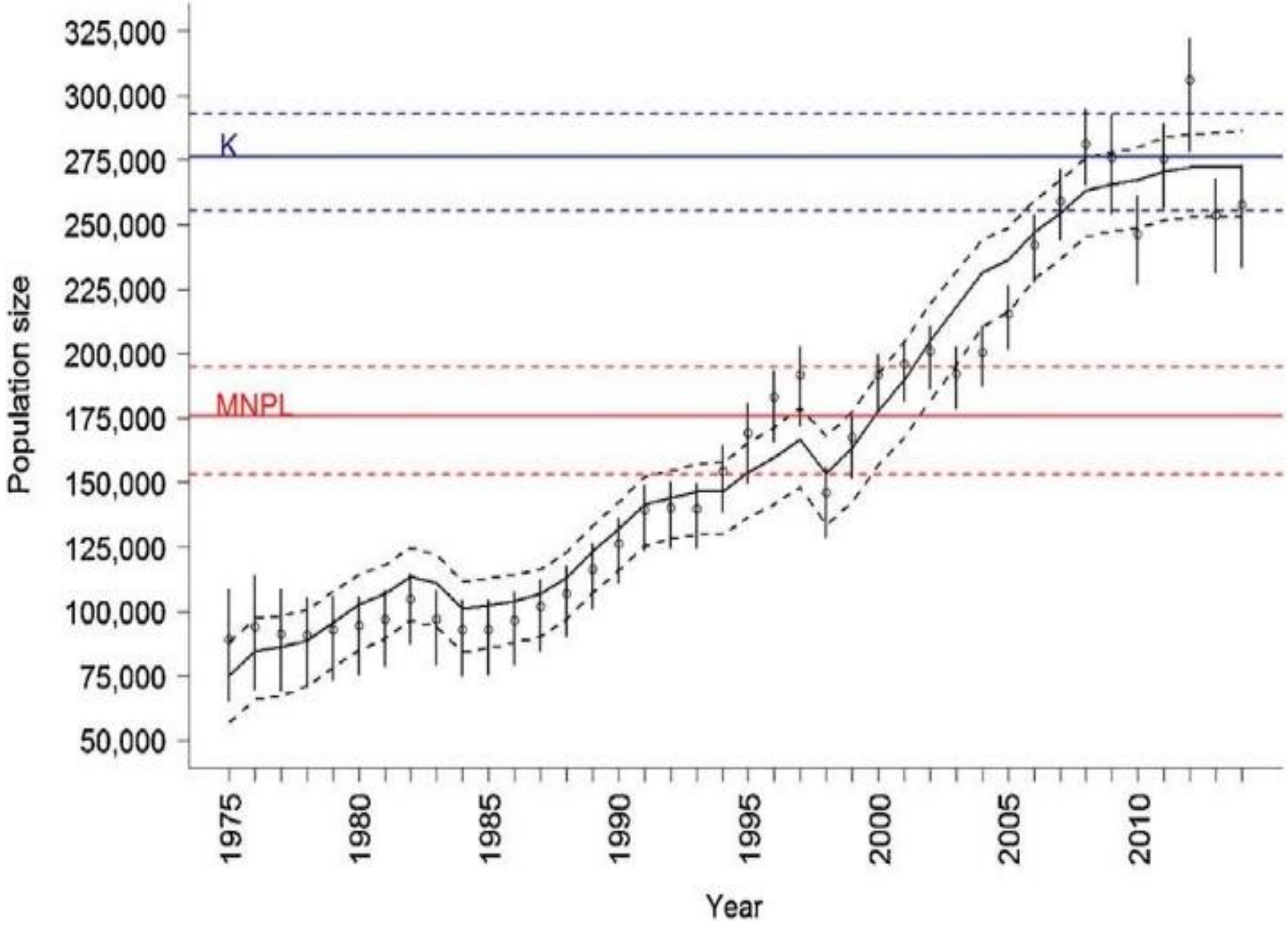
- Harbor Seal
- California Sea Lion
- Steller Sea Lion



California Sea Lion

- Primarily present in Washington waters in Sept - April
- A single US stock

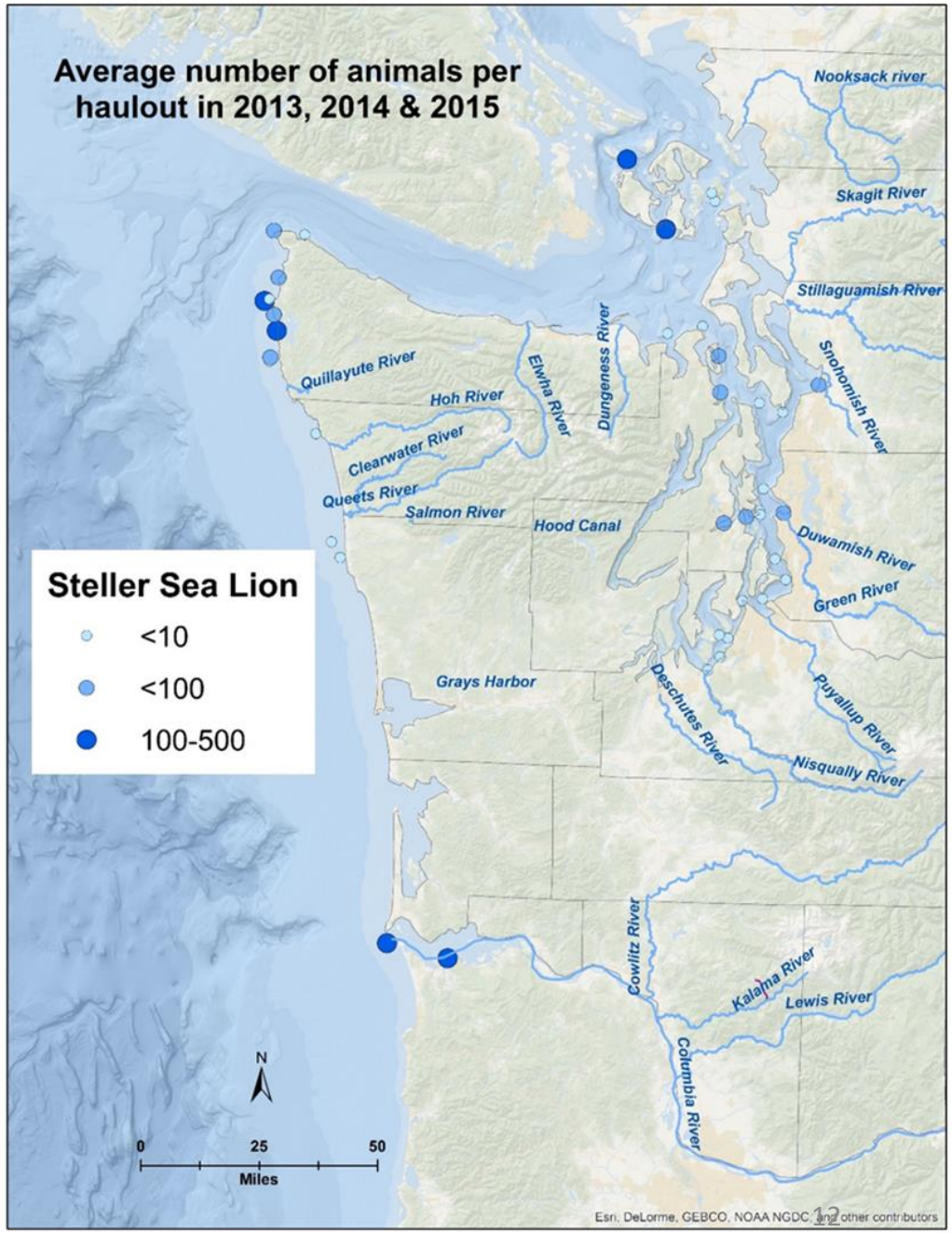


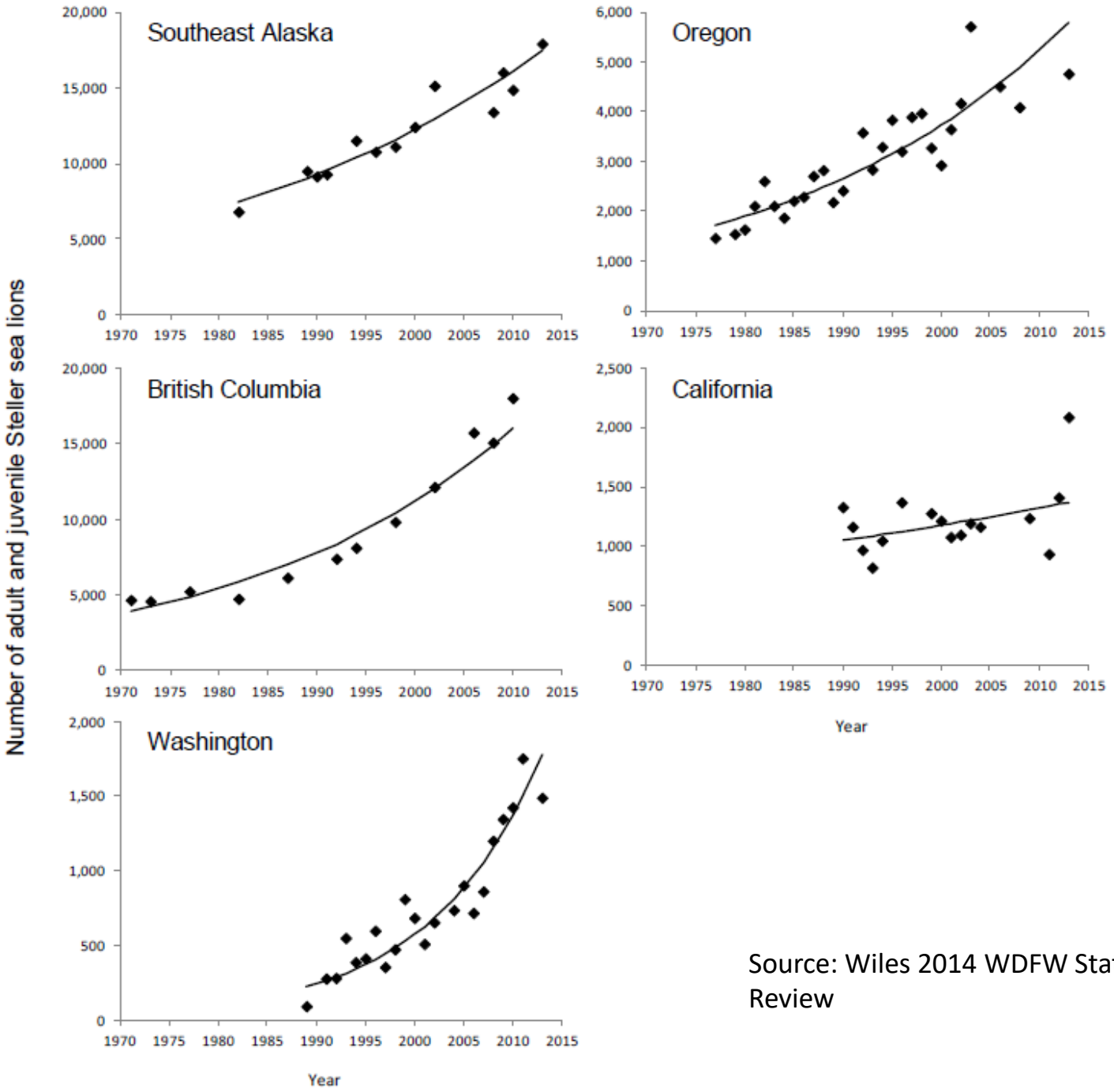


Source: Laake et al. 2018

Steller Sea Lion

- Primarily present in Washington waters between Sept. and April
- Washington's Stellers belong to the eastern distinct population segment
  - which ranges along the west coast of North America from Southeast Alaska to central California
  - This segment was delisted under the ESA

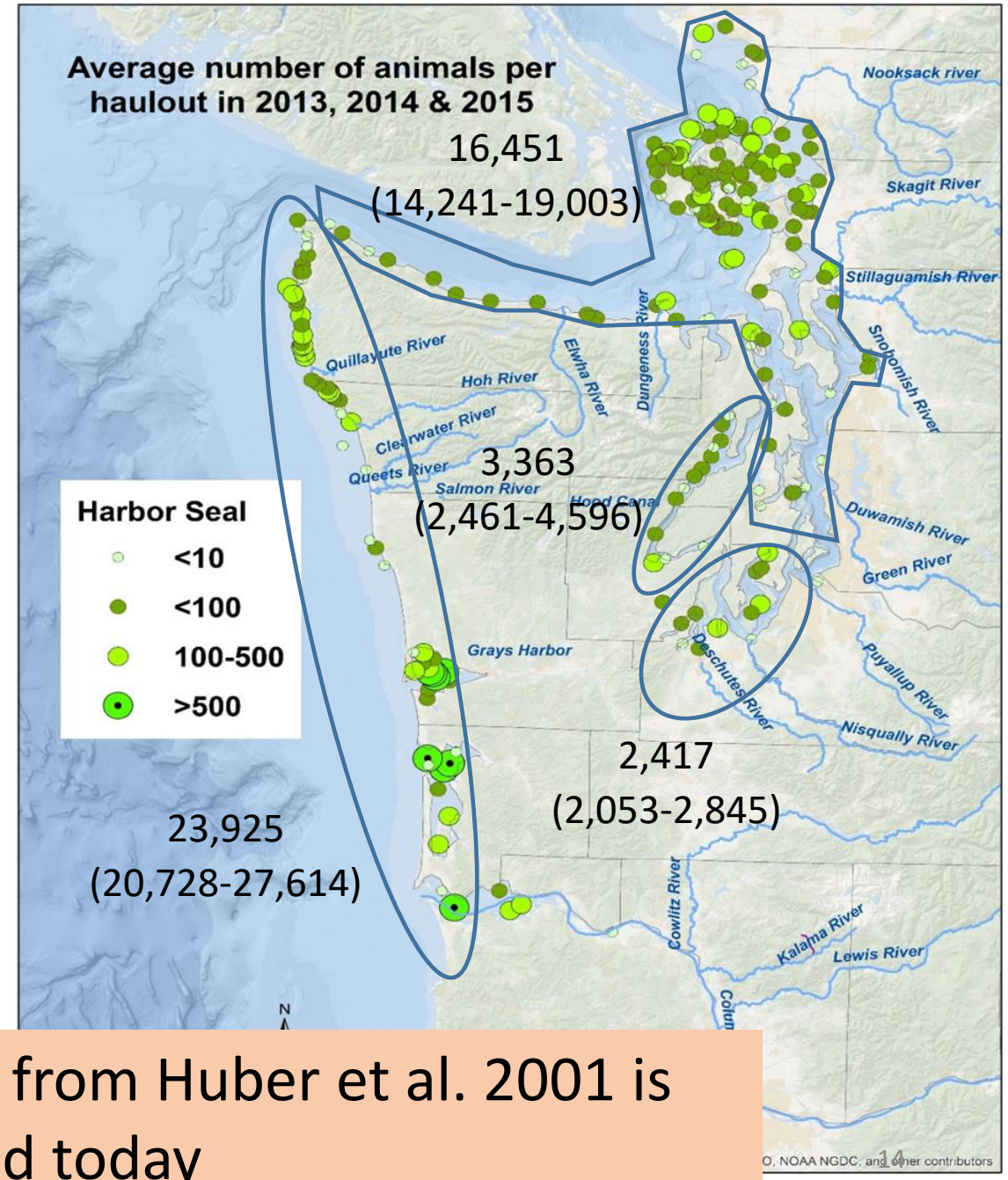




Source: Wiles 2014 WDFW Status Review

Harbor Seal

- Year-round resident
- 1 coastal stock and three stocks in the inland marine waters
  - Washington/Oregon coast
  - Northern inland waters
  - Hood Canal
  - South Puget Sound

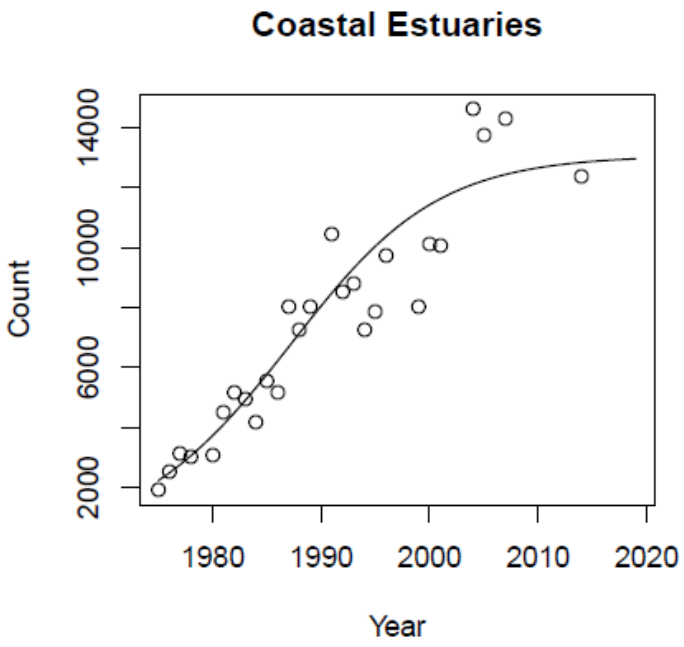


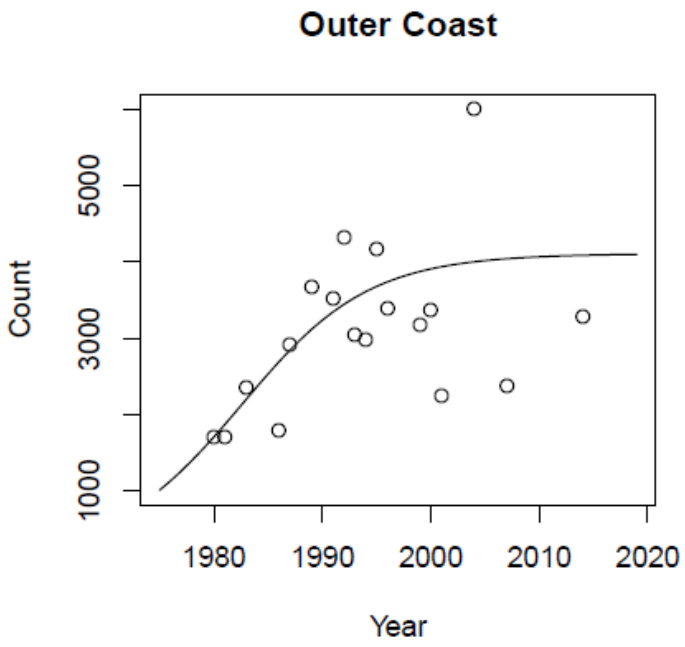
Key assumptions: 1) Correction factor from Huber et al. 2001 is reflective of haulout patterns observed today

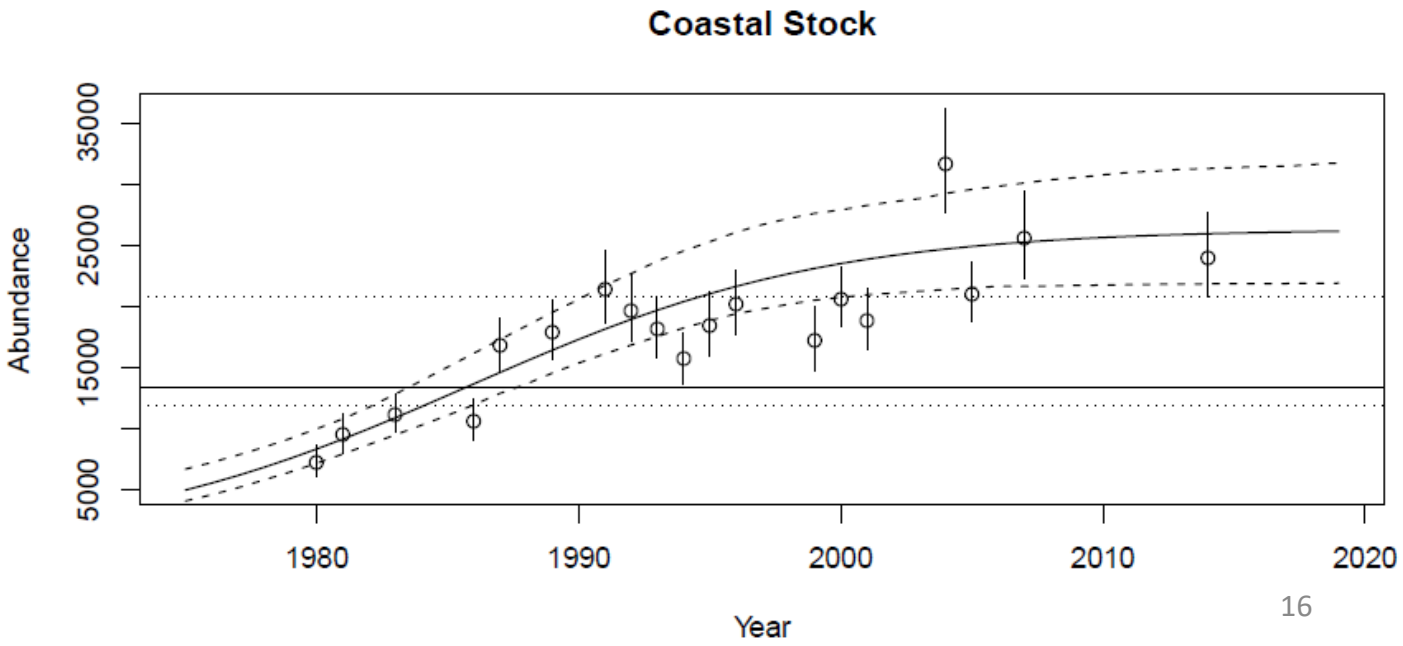
Harbor seal stock assessment

- Collaborative effort between NOAA, tribes and WDFW
- Completed 2019 inland water surveys with funding from the Swinomish, Suquamish, Tulalip, Squaxin, and Puyallup tribes
- All data assembled and proofed into a single dataset
  - Corrected all locality information
  - Addressed repeated surveys within a given flight and year
  - Corrected all tide information
- Jeff Laake (retired from NOAA) completed the statistical analysis
- Assembling manuscript that will serve as the stock assessment

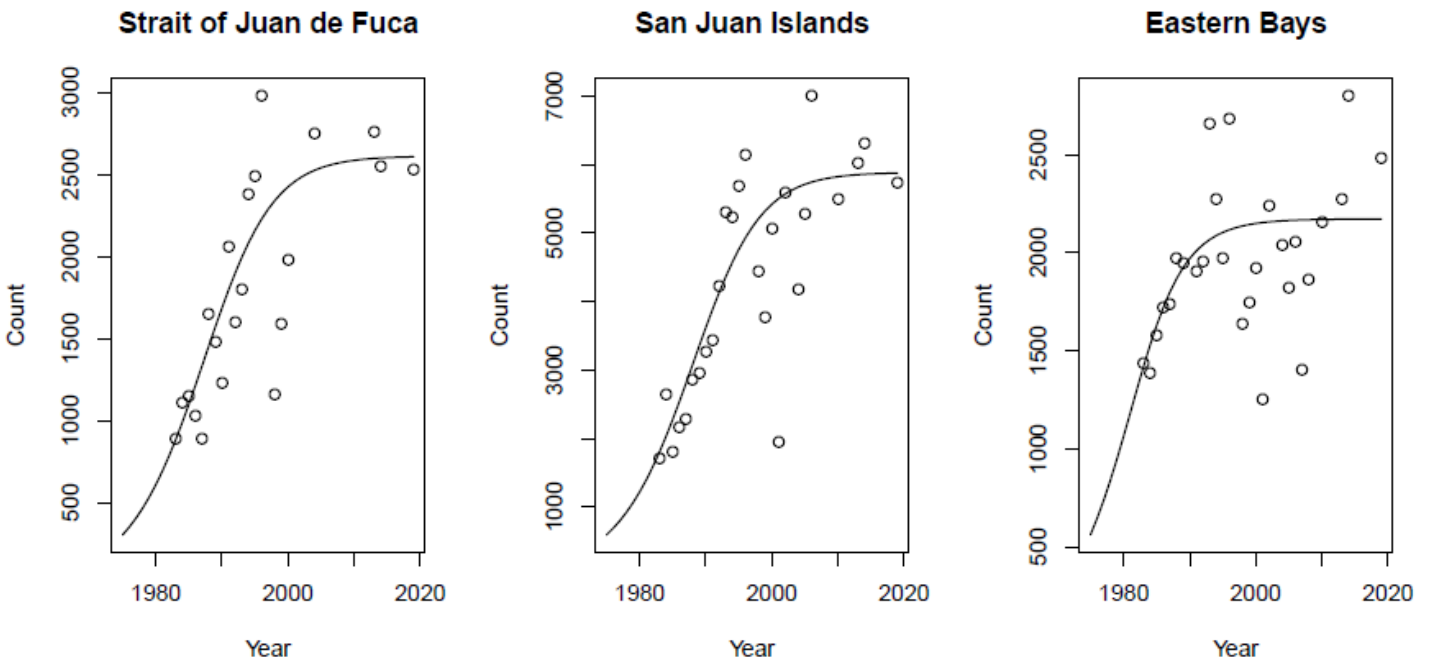
Results – Coastal stock (Washington)

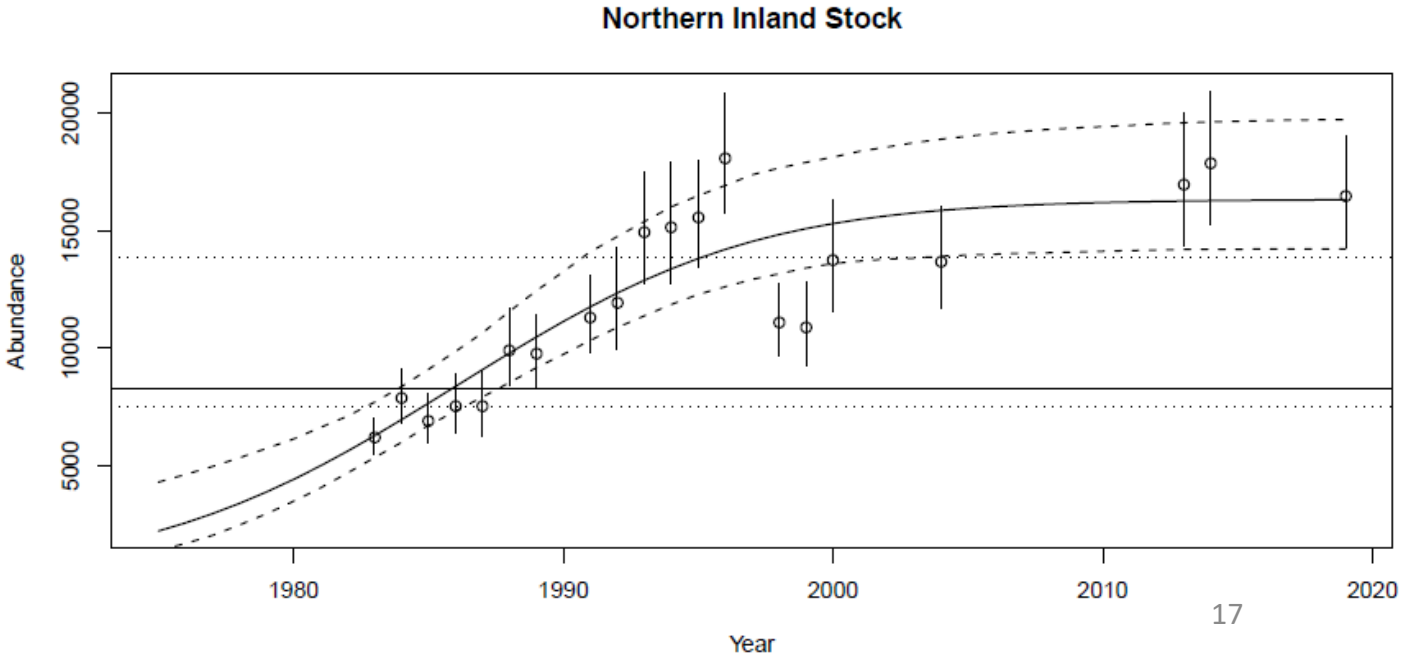




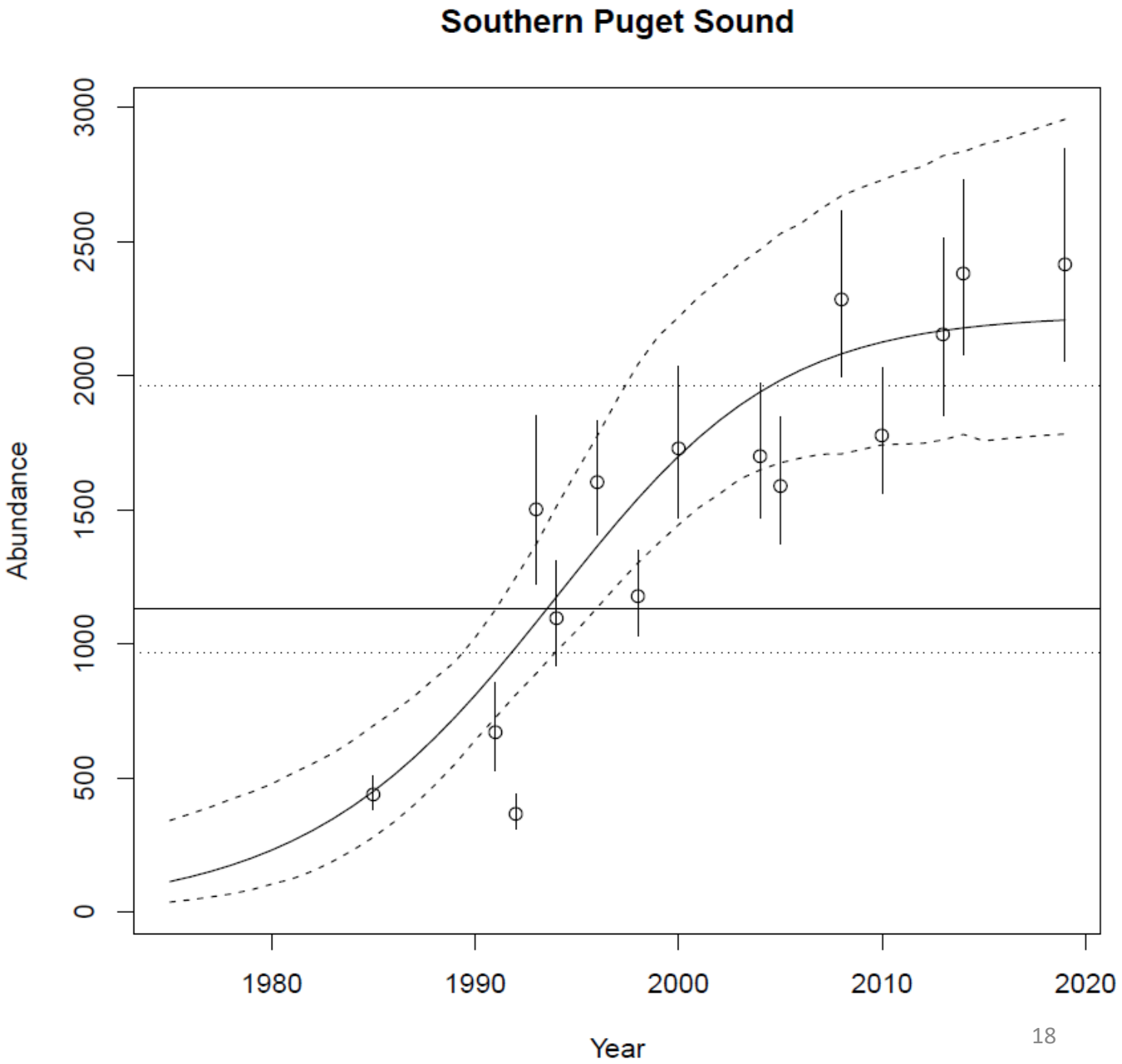


Results – N. Inland stock

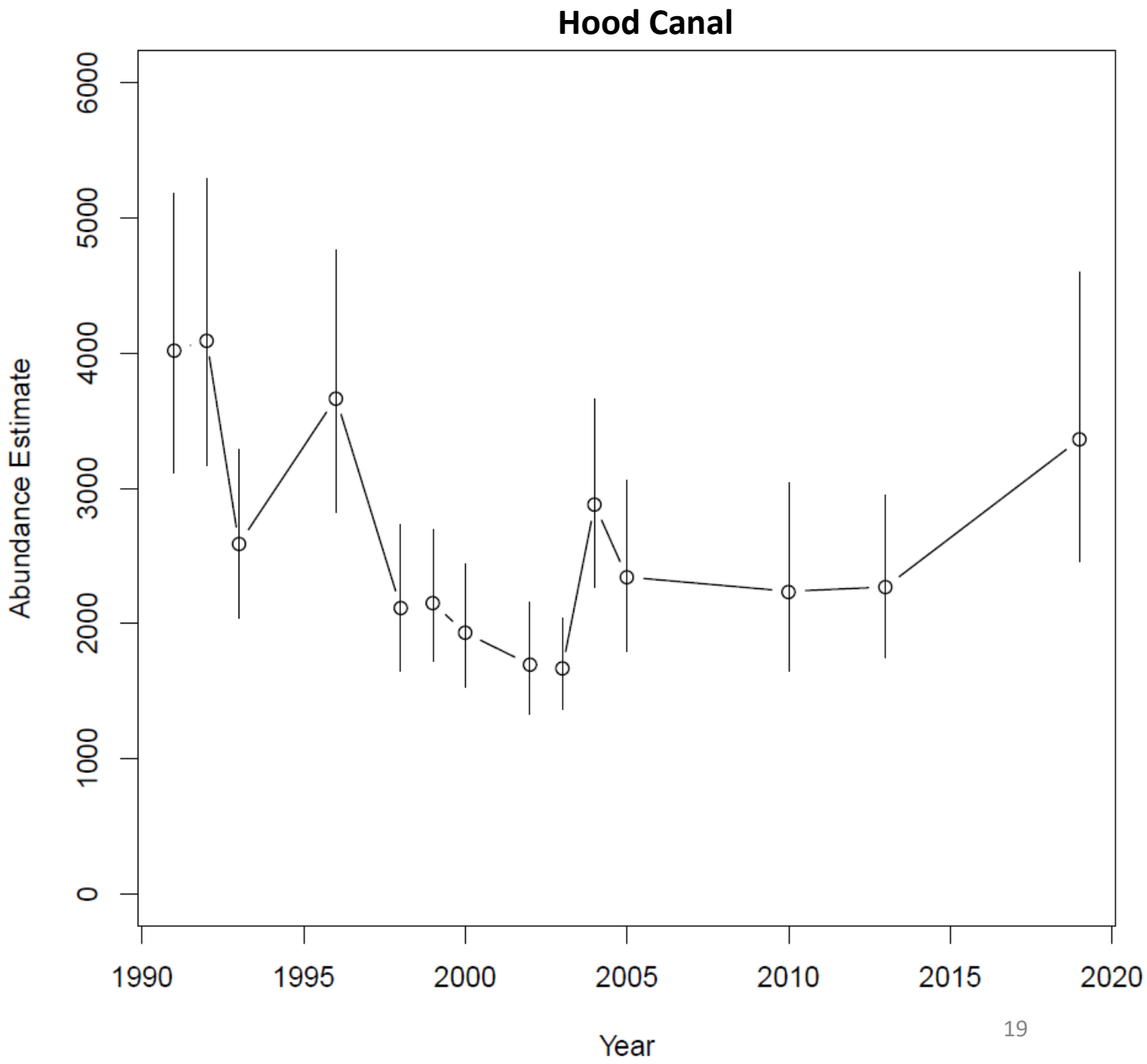




Results – S. Puget Sound



Results – Hood Canal



Conclusions

- 2019 Surveys completed
- Analysis completed and estimates derived
- Stock assessment in progress
- South Puget Sound (2019), Northern Inland (2019), and the Washington portion of the WA/OR Coastal (2014) stocks are at Optimum Sustainable Population levels (OSP)
- Potential Biological Removal can now be calculated for South Puget Sound and Northern Inland stocks.

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Bonneville Dam

California sea lions

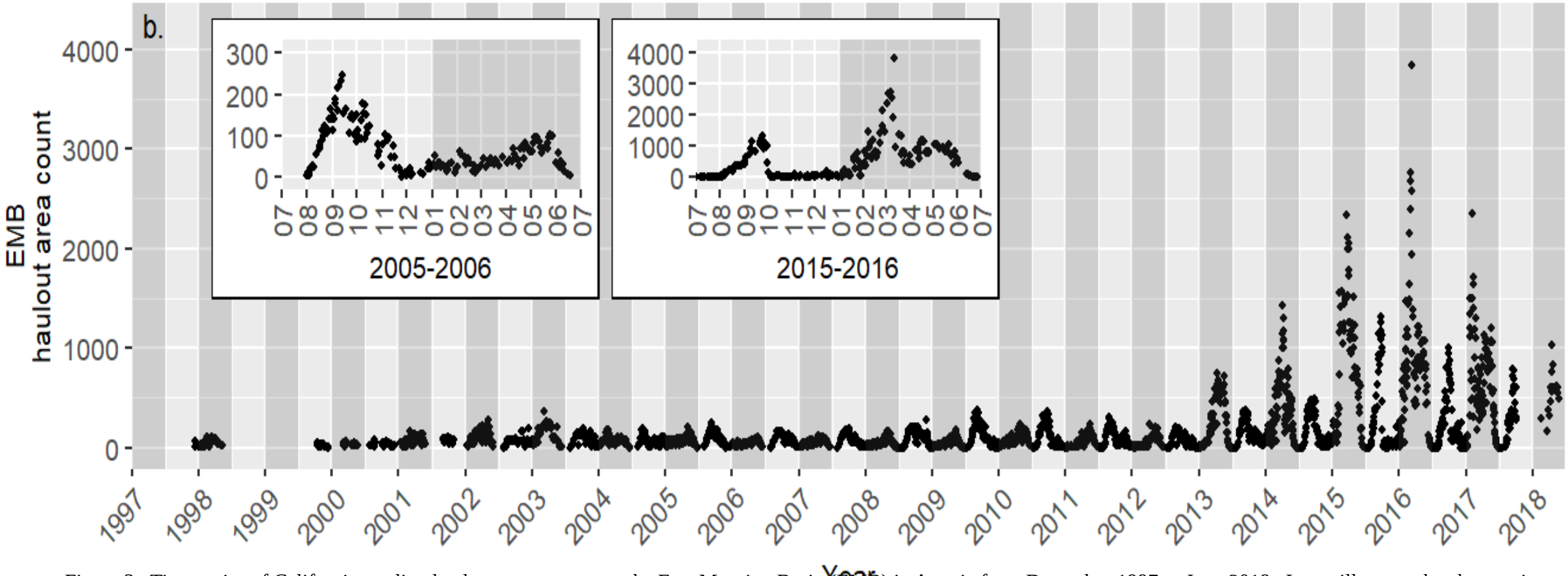


Figure 3. Time series of California sea lion haul-out area counts at the East Mooring Basin (EMB) in Astoria from December 1997 to June 2018. Insets illustrate the changes in magnitude and seasonality of California sea lion occurrence over the study period (x-axis denotes month; note difference in magnitude of counts on the y-axis scale between the two inset figures).

California sea lion presence in other tributaries

- Recruitment of CSL at Bonneville Dam and Willamette Falls has been consistently occurring over a period of 15-20 years.

- More recently CSL have been observed expanding their distribution into smaller tributaries of the Columbia River.

- In Oregon, CSL have been observed frequently feeding on salmonids in the Sandy River and Clackamas Rivers since 2010, typically 1-2 animals making daily foraging migrations into the lower reaches of these rivers.

- However in 2017, 6 CSL were observed feeding on salmonids at RM 19 on the Clackamas River.

Tributary	Source of Observation
Grays River, WA	WDFW staff
Skamokawa, WA	WDFW staff
Elochoman River, WA	WDFW staff
Abernathy Creek, WA	WDFW staff
Cowlitz River, WA	WDFW staff and public
Coweeman River, WA	WDFW staff
Kalama River, WA	WDFW staff and public
Lewis River, WA	WDFW staff and public
Washougal River, WA	WDFW staff
Duncan Creek, WA	WDFW staff
Hamilton Creek, WA	WDFW staff
Sandy River, OR	ODFW Staff, Public, Guides
Clackamas River, OR	ODFW Staff, Public, Guides
Scappoose River, OR	ODFW Staff
Clatskanie River, OR	ODFW Staff

Table 4. Confirmed observations of CSL in Washington and Oregon tributaries. The upstream distance of CSL presence in these rivers and creeks varies, but they have at least been observed in the lower reaches and/or at the mouths of these systems.

Steller sea lions at Bonneville Dam

Year	Total Hours Observed	California Sea Lions	Steller Sea Lions	Harbor Seals	Total Pinnipeds
2002	662	30	0	1	31
2003	1,356	104	3	2	109
2004	516	99	3	2	104
2005*	1,109	81	4	1	86
2006	3,650	72	11	3	86
2007	4,433	71	9	2	82
2008	5,131	82	39	2	123
2009	3,455	54	26	2	82
2010	3,609	89	75	2	166
2011	3,315	54	89	1	144
2012	3,404	39	73	0	112
2013	3,247	56	80	0	136
2014	2,947	71	65	1	137
2015	2,995	195	69†	0	264
2016	1,974	149	54†	0	203
2017	1,142	92	63†	1	156
2018	1,410	67	66†	1	134

Table 1. Reprinted from Tidwell et al. (2019). Minimum estimated number of individual pinnipeds observed at Bonneville Dam tailrace areas and the hours of observation during the spring sampling period, 2002 to 2018.

COLUMBIA BASIN | THE RISE OF STELLER SEA LIONS

Steller Sea lions Increasing impact	California Sea lions
Months **10** Present	Months **7** Present
Share of **76%** Total predation	Share of **24%** Total predation
% Steelhead **4.4%** Run Eaten % Spring Chinook **2.0%** Run Eaten	% Steelhead **0.9%** Run Eaten % Spring Chinook **0.7%** Run Eaten

A pattern of habituation

The increasing abundance of California and Steller sea lions in the Columbia River basin has followed a similar pattern:

A small number of animals habituate to a location;

Recruitment of additional animals is initially low, but increases (sometimes rapidly);

Habituated animals generally arrive earlier and remain at sites longer;

These animals appear to habituate easily and return to these sites year after year.

Columbia River—Deterrents

Deterrent Type	Effective	Ineffective	The Bottom Line
Physical Barriers for Fishways (SLEDs, FOGs)			No animals in fishways in 2008, but C404 was absent this year.
Acoustic Deterrents at Fishways			No visible effects on sea lion behavior near fishways.
Hazing Calif. Sea Lions			Effects seem temporary; Usual avoidance noted.
Hazing Steller Sea Lions			Not as effective as in 2006 and 2007.
Relocation (Trap & Release)			Most animals return to BON after release. *Does help individual ID efforts!*

Timeline

2000-2005 – Evaluation of seal and sea lion (pinniped) predation in the tailrace of Bonneville Dam; Oregon, Washington, NOAA Fisheries test non-lethal deterrence measures to reduce predation.

2006 – Washington, Oregon, and Idaho request authorization to lethally remove CSL at Bonneville that are having significant negative impact on the decline or recovery of ESA-listed salmonids.

2008-2016 – Authorization granted, with conditions, in 2008. Lawsuits filed in U.S. District Court. Litigation, appeals, reapplication, and reauthorization take place over the next eight years.

2018 – NOAA authorizes ODFW to lethally remove predatory sea lions at Willamette Falls.

Section 120
Permit Removal Criteria Prior to 2020

- Each CA sea lion must be individually identifiable – this requires trapping, marking, and releasing the animal,
- *AND*
- individual sea lions must be observed at Bonneville Dam for 5 days,
- *AND*
- individual sea lions must be observed eating a salmon at Bonneville Dam,
- *AND*
- individual sea lions must be subjected to hazing while at Bonneville Dam.

Section 120 Implementation

Year	CA Sea Lion Euthanized
2008	0
2009	11
2010	14
2011	0
2012	12
2013	2
2014	15
2015	30
2016	59
2017	24
2018	29
2019	19
TOTAL	215

Timeline, continued

- December 2018 – Congress passed the Endangered Salmon Predation Prevention Act of 2018, amending the MMPA with a new section 120(f) Temporary Marine Mammal Removal Authority on the Waters of the Columbia River or its Tributaries.

- June 2019 – Eligible entities—ODFW, IDFG, WDFW, the Nez Perce Tribe, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes and Bands of the Yakama Nation, and the Willamette Committee (ODFW, CTUIR, CTWSR, Confederated Tribes of the Grand Ronde, Confederated Tribes of the Siletz Indians of Oregon) submit application under amended MMPA. Tribal entities may delegate authority to Columbia River Inter-Tribal Fish Commission.

- August 2020 – NOAA Fisheries authorizes the eligible entities' permit.

- October 2020 – Eligible entities commence fall removal operations at Bonneville.

2018 Amendments to MMPA

Modifies Section 120 to provide:

- Place-based ‘Safe Zones’ for salmon
- Protection for sturgeon and lamprey
- Allowance for proactive action
- Tribal co-management

Permit Conditions Under Amended MMPA

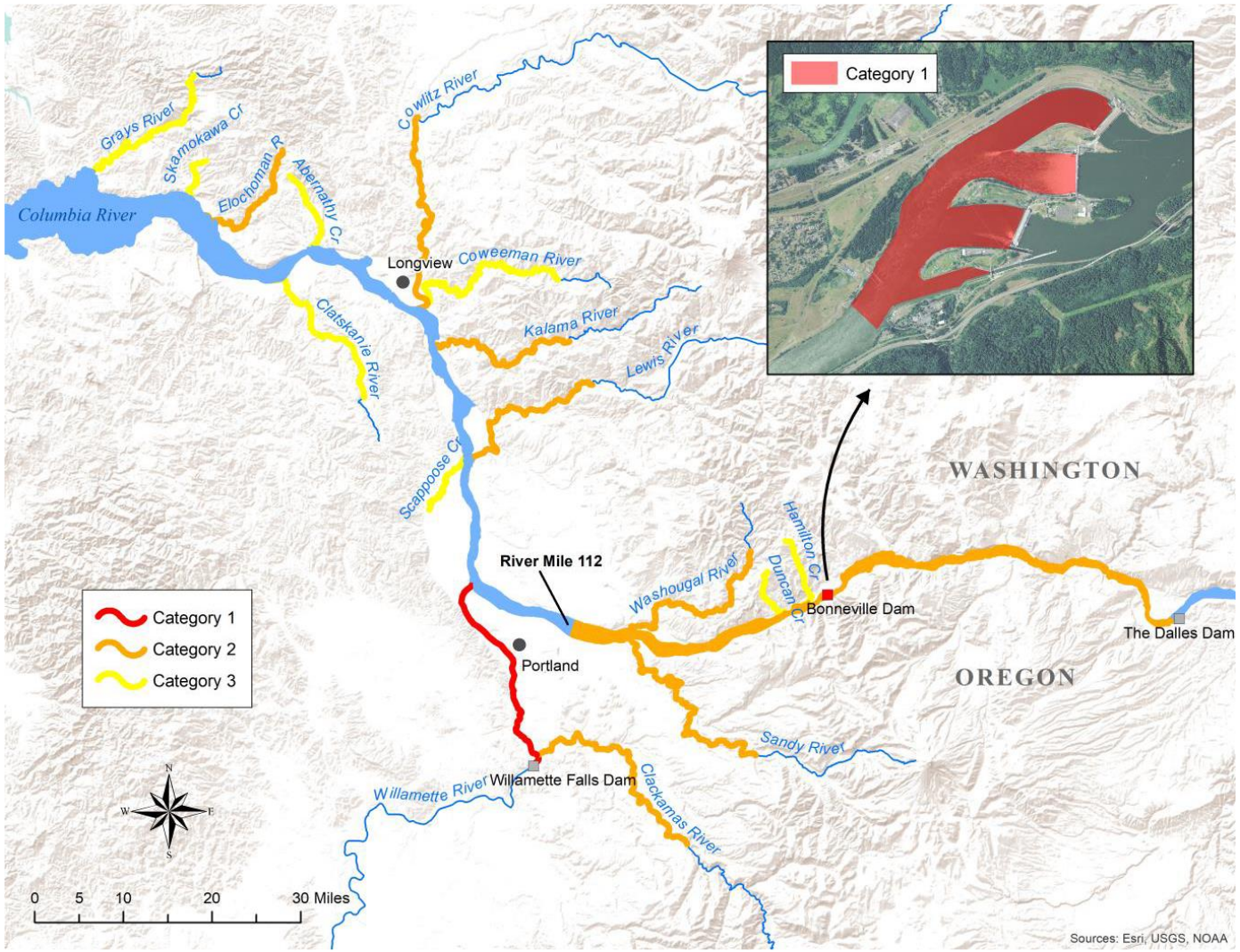
- Includes California sea lions and Steller sea lions. No more than 540 CSL and 176 SSL over the 5-year period of the permit.
- Mainstem Columbia River from river mile 112 (I-205 bridge in Portland) to river mile 292 (McNary Dam).
- Any tributary to the CR that includes spawning habitat of ESA-listed salmon or steelhead.
- Sea lions in these areas are deemed to have a significant negative impact and are subject to removal.
- Approved plan for humane methods for capture and removal, to be reevaluated annually by a committee of veterinarians, marine mammal biologists, and a non-affiliated member who represents the community.

Spatial categorization of the problem interaction

Category 1: High numbers (>20) of CSL and SSL present for majority of the year. Immediate and ongoing conservation risk for fish stocks.

Category 2: Low to moderate numbers present periodically. Conservation concern for fish stocks if left unmanaged.

Category 3: CSL and SSL have not been documented but contain ESA spawning habitat.



Expected Benefit of Expanded Authorization

1) Allow the eligible entities to reduce predation on ESA listed salmon/steelhead and sturgeon by Steller sea lions.

2) Improve the efficiency of the currently authorized removal programs by eliminating the need to mark and repeatedly handle animals and document their repeated presence in the area.

3) Prevent sea lions from self- or socially-habituating to tributary locations, leading to decrease in sea lion removals over time.

Expected Benefit of Expanded Authorization

- Benefit can be quantified based on reduction in the number and length of time sea lions are at pinch points and by a reduction in the number of salmon they eat.
- Example: At Willamette Falls, ODFW removed 33 CSL in 2019 in an effort to save a winter steelhead run on the brink of extinction (~512 fish in 2017).
- No CSL at the falls from Aug. 2019 to Mar. 2020 for first time in a decade.
- Predation dropped from 21-25% of the run in 2017/18 to 7% in 2019, ~1-2% in 2020.
- In 2020 this translates to ~`377 steelhead saved out of a total run of 5,510.
- Extinction probability: ~89% in 2017→ 11% in 2019

Fall 2020 Implementation

- 8/14/2020: NMFS approved the permit authorizing eligible entities to remove CSL and SSL.
- 10/10/2020: IACUC approves Assurance of Animal Care and Use form for lethal removal
- Week of 10/12: Two SSL removed
- Week of 10/19: One SSL removed
- Week of 11/2: Three SSL removed

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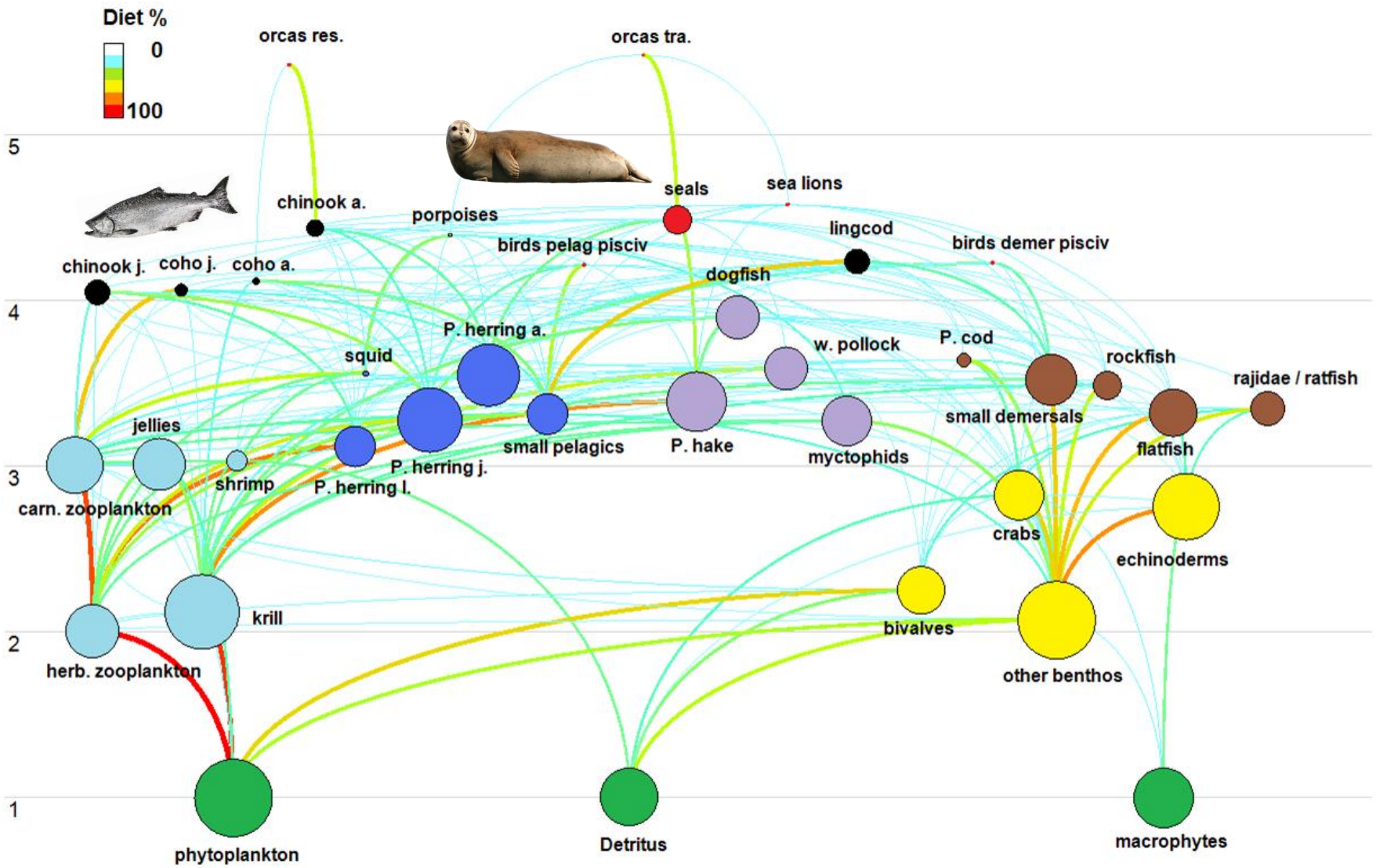
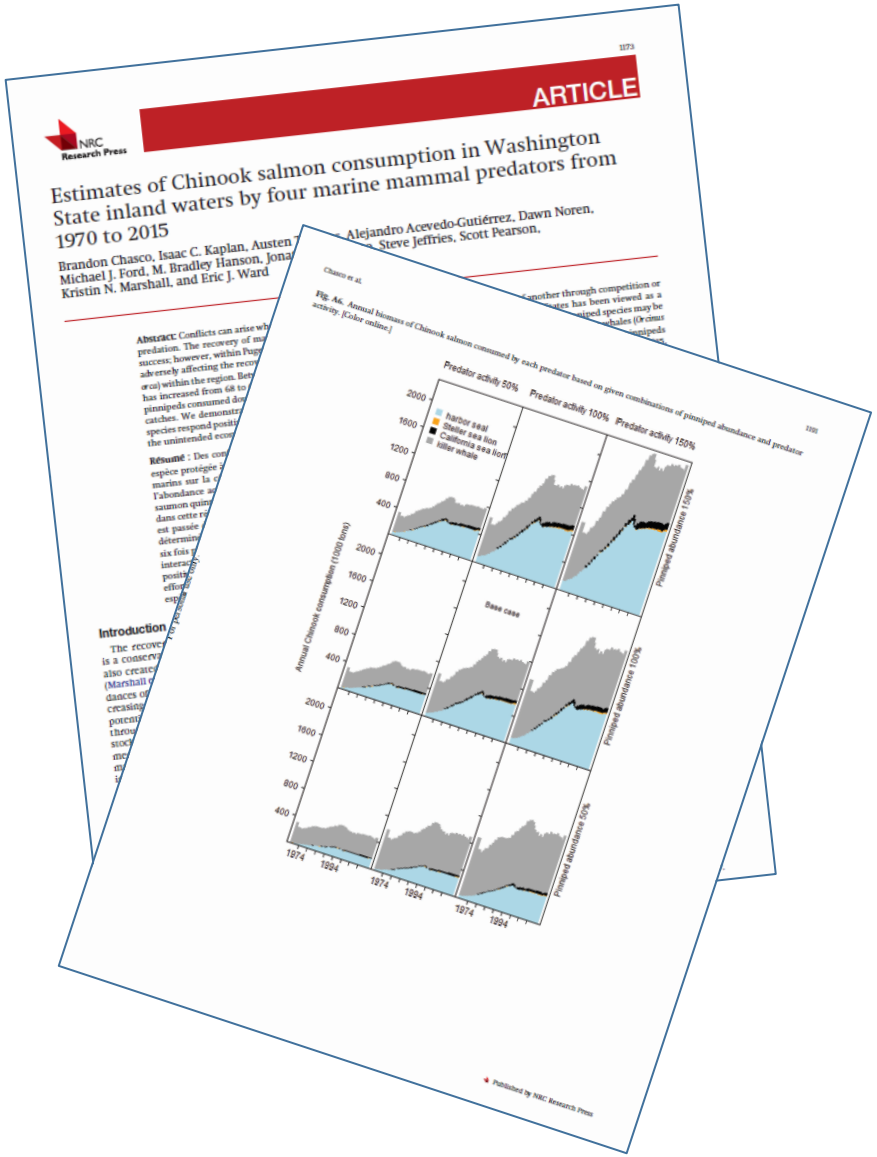
Complex Food Web



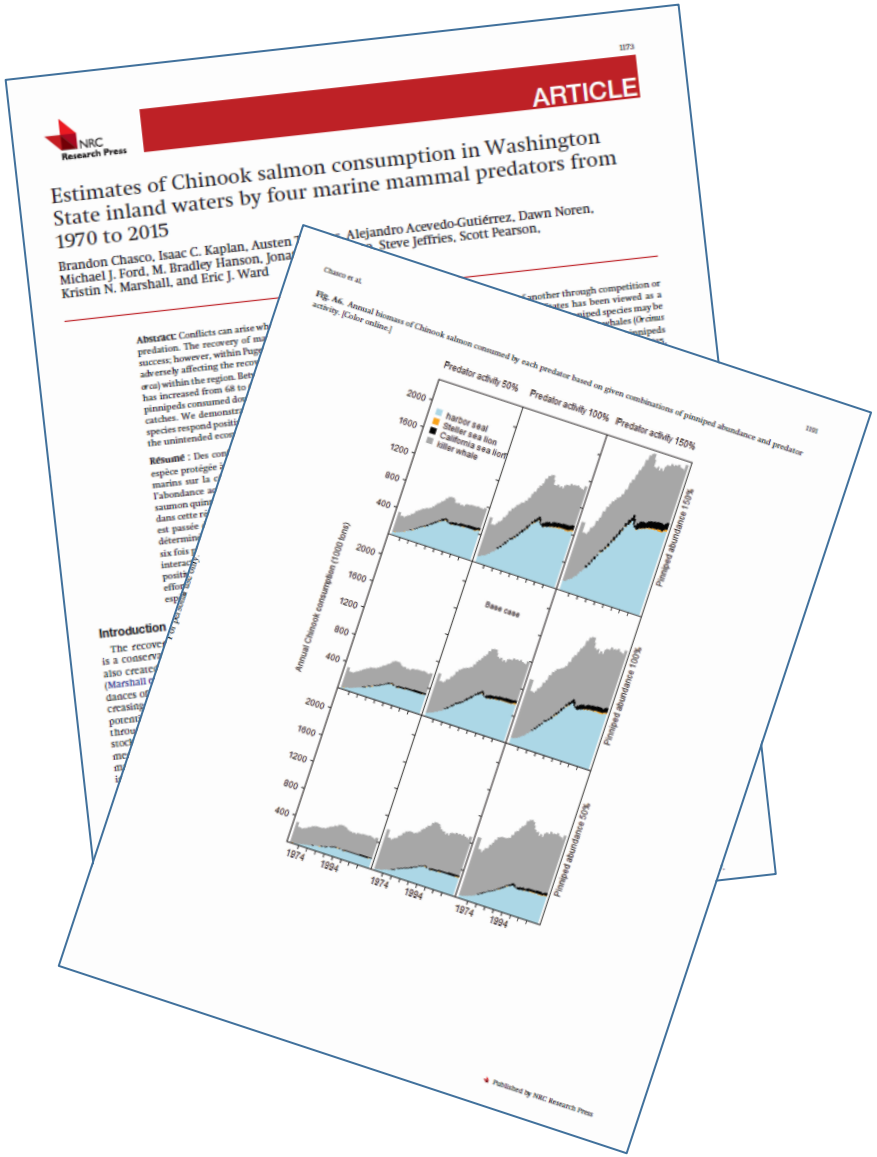
Fisheries and Oceans Canada

Chasco et al., 2016



- Puget Sound bioenergetics model
- Estimated consumption of Chinook salmon from 1970-2015
- Modeled population size, diet, and energetic demands for killer whales, California sea lions, Steller sea lions, and harbor seals
- Chinook consumed by pinnipeds increased from 68 to 625 metric tons
- Pinnipeds consumed more than killer whales and all fisheries

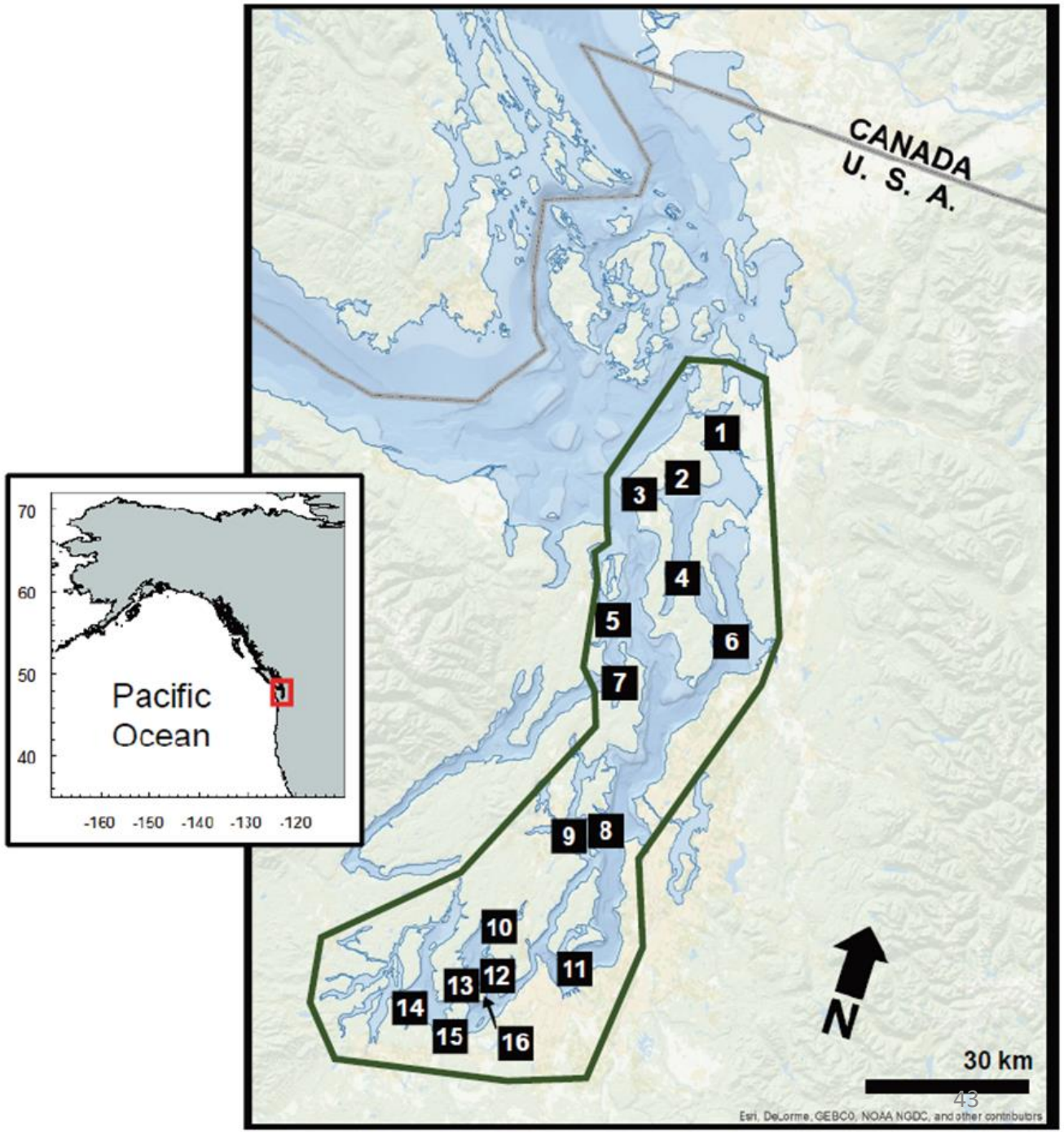
How Does Our Work Differ from Chasco?



- Use recent seal population estimates
- New seal diet information from Puget Sound
- Similar modelling approach but we account for sources of uncertainty not included in the “Chasco” model
- Express smolt consumption as fraction of total abundance
- Examine sensitivity to different assumptions about salmon prey size
- Don’t model beyond the geographic or temporal scope of our data

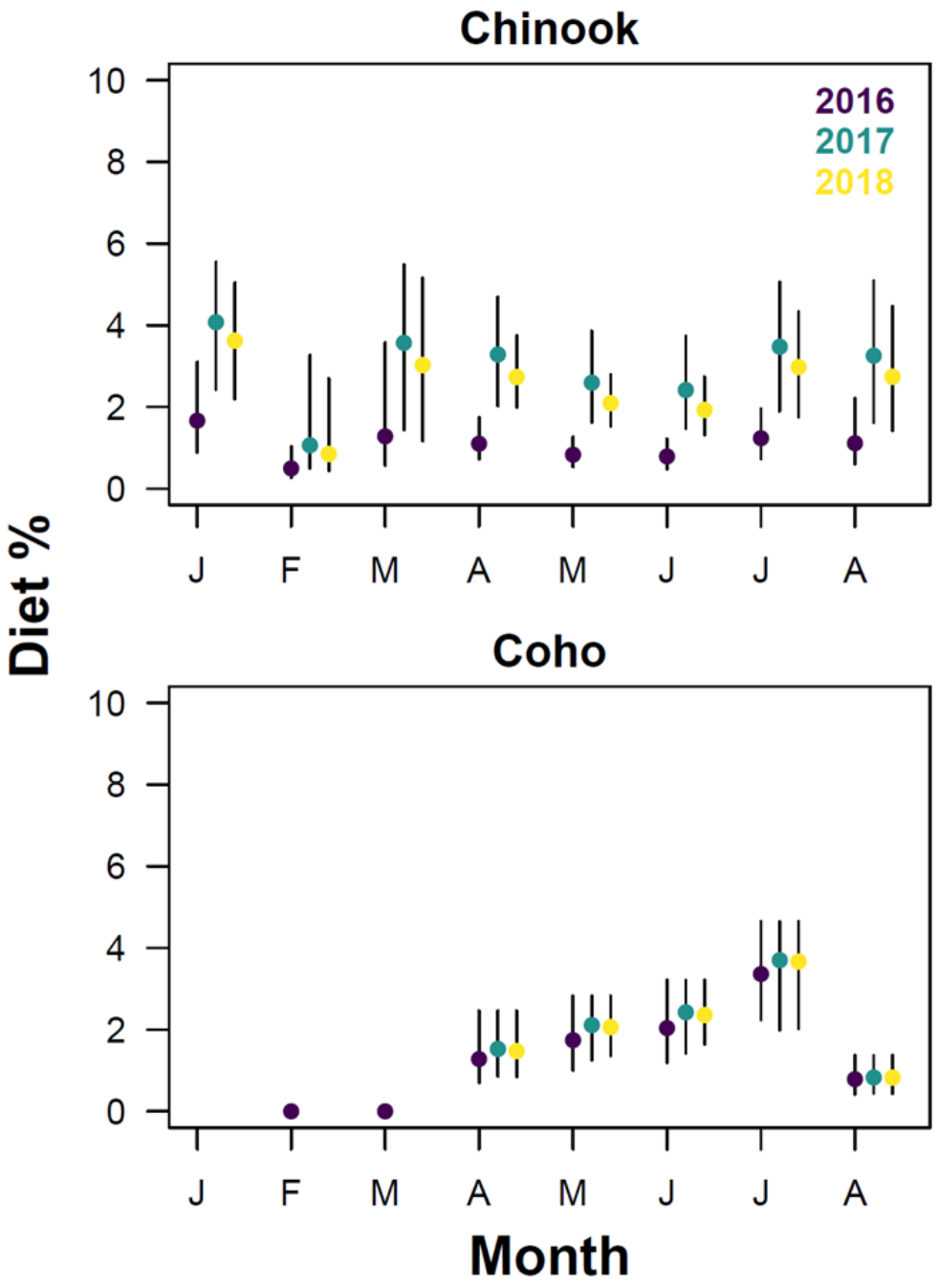
Harbor seal diet

- Collaborative effort – Tribes, WDFW, WWU
- 1,946 Scat samples (2016-2018)



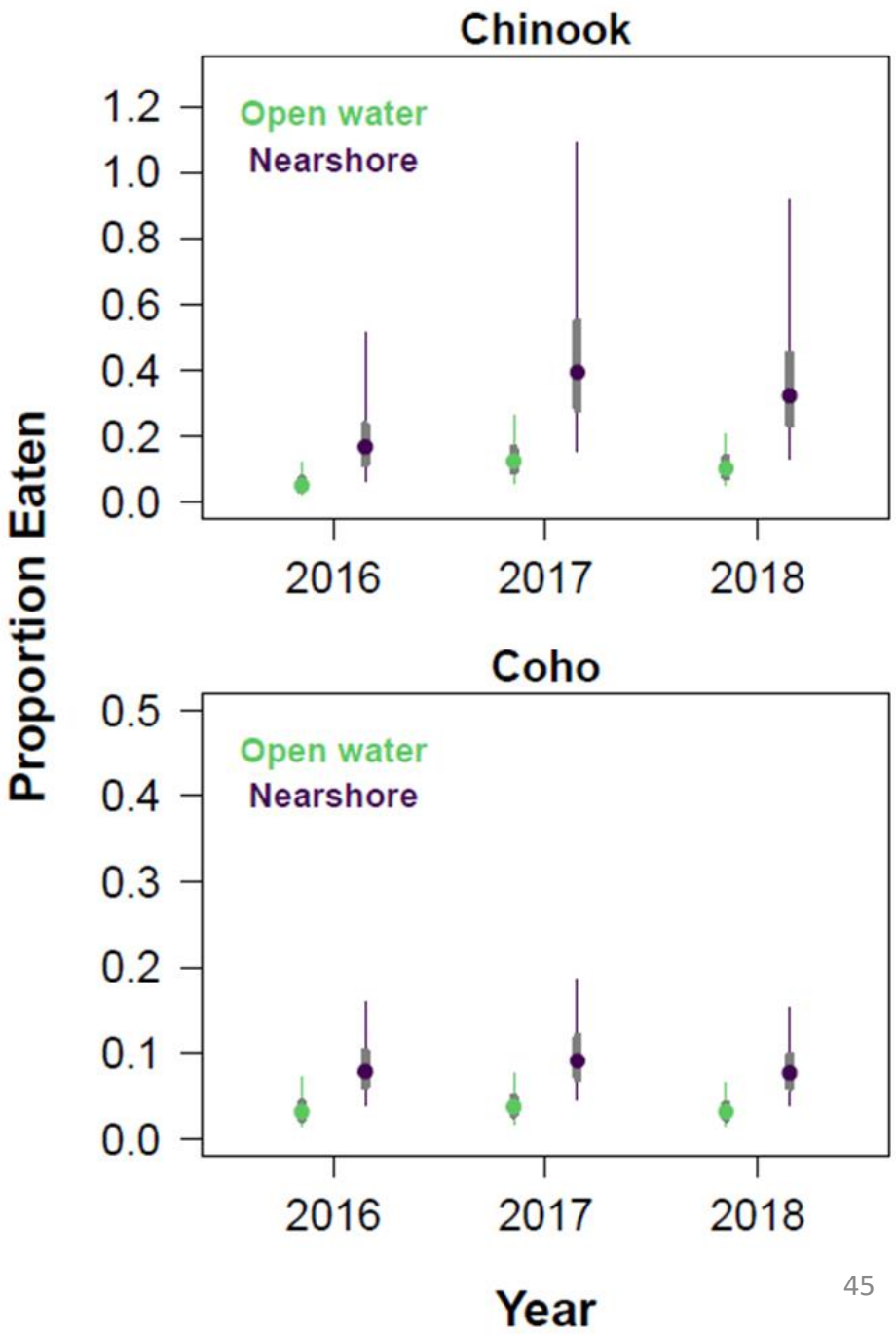
Harbor seal diet

- Mean monthly seal diet percentages (± credible intervals)
- Interannual differences for Chinook but not for coho.



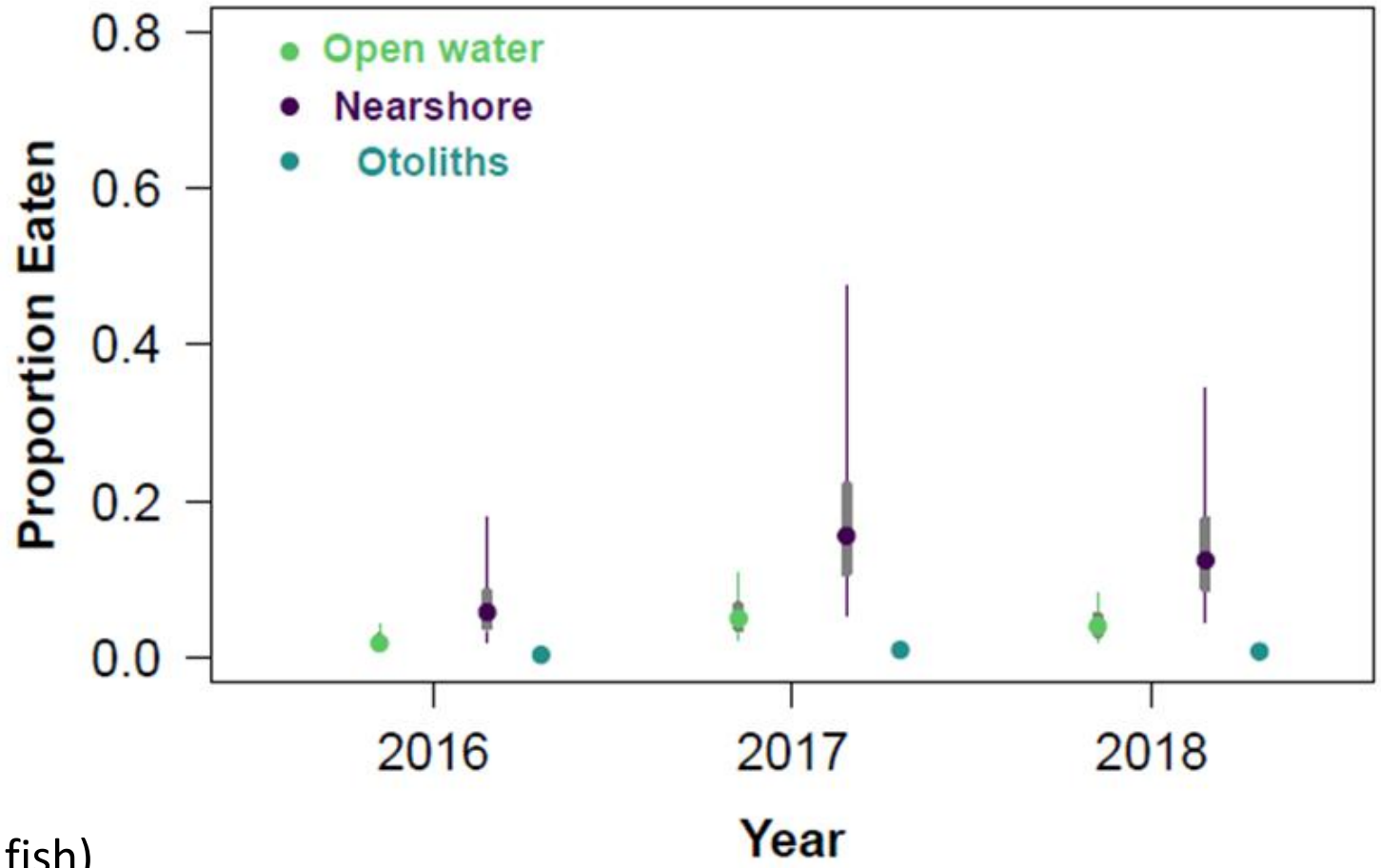
Harbor seal diet

- Estimated annual proportions consumed (± credible intervals)
- Comparing nearshore to mid-water fish-size distribution
- When using fish-size distribution from mid-water trawls, the numbers of fish consumed decreased by 69% for Chinook and 59% for coho.



Harbor seal diet

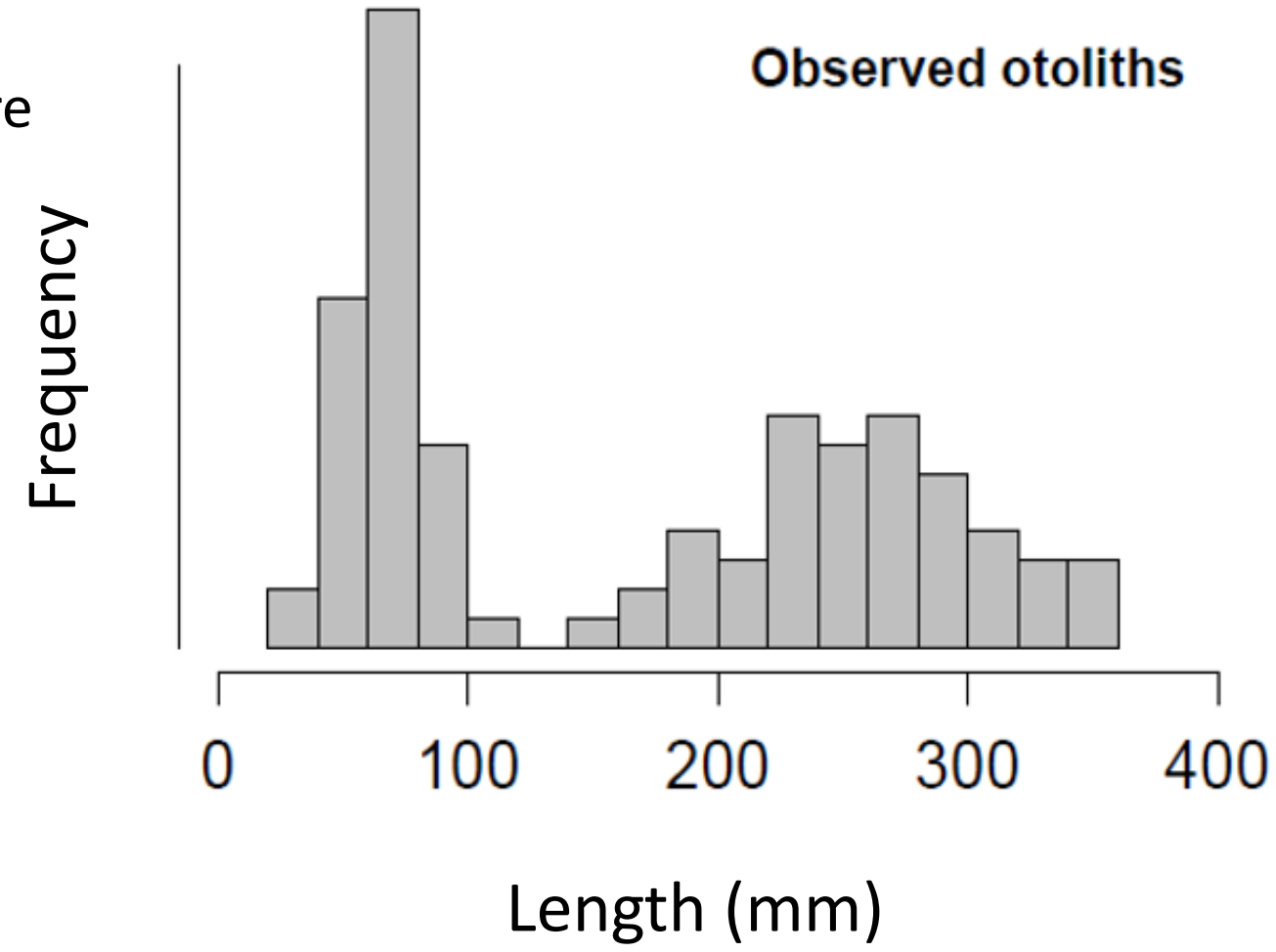
- Estimated annual proportions consumed (± 50 and 95% credible intervals) using nearshore, open water, and otolith derived fish-size distributions
- Median proportion of Chinook juveniles consumed between Feb - Aug



- Nearshore = 0.06-0.16 (4.86–13 million fish)
- Offshore = 0.02-0.05 (1.48-4.14 million fish)
- Otolith = 0.00-0.01 (0 – 0.33 million fish)

Harbor seal diet

- Prey size inferred from otoliths suggests two distinct size classes are consumed.



Harbor Seal Diet Data Summary

- Our diet analysis suggests harbor seals in South Puget Sound could consume anywhere between 0.33 to 13 million juvenile salmon
- Diffuse impact adds up – lots of seals and many are eating proportionally small amount of salmon relative to other prey items
- These estimates are very sensitive to the size of the salmon actually consumed by the seals
- Thus, we need information about the size of the fish being consumed

Relationship between vertebrae diameter and fish length

- Build the relationships between vertebrae diameter and fish length
  - Allows us to estimate actual size of fish being consumed rather than make assumptions
  - Adds another structure to estimate fish size from
- Demonstrate that you can distinguish Chinook vertebrae from other salmon vertebrae

Potential Biological Removal – harbor seals

Region	N_{min}	PBR
Hood Canal	2,940	88
Puget Sound	2,253	68
Northern Inland	15,462	464
Coast[1]	22,495	675

[1]For this exercise, the Washington coast was considered as its own stock. Ultimately, we will need harbor seal estimates from Oregon to calculate PBR for this stock.

Potential increase in the number of adult Chinook if harbor seals were removed at PBR level

1. South Sound seal stock spatially overlaps our 2016 -2018 juvenile salmon consumption estimates
   - Examine nearshore fish size distributions
     - Results in the most fish consumed of the three fish size scenarios
     - Best matches information on salmon smolt to adult survival
   - Examine median juvenile consumption values, acknowledging uncertainty

2. Assume salmon smolt to adult survival roughly based on observed data:
   - Chinook SAR = 0.68 %
   - Coho SAR = 5 %
   - No variance in salmon survival, acknowledging large interannual variation and hence uncertainty

3. Represent different levels of compensatory mortality
   - 0 % compensatory – all juvenile salmon eaten by seals would have survived to return as adults
   - 100 % compensatory – all juvenile salmon eaten by seals would have died anyway
     - For example, eaten by a different predator

Potential increase in the number of adult Chinook if harbor seals were removed at PBR level

South Sound seal stock population estimate = 2,417 seals

Potential Biological Removal = 68 seals

			Adult salmon		
Species	**Diet data year**	**Median juvenile salmon consumed**	**0 % compensatory**	**50 % compensatory**	**100 % compensatory**
Chinook	2016	89,000	600	300	0
Chinook	2017	239,000	1,600	800	0
Chinook	2018	201,000	1,400	700	0
Coho	2016	15,000	800	400	0
Coho	2017	18,000	900	500	0
Coho	2018	18,000	900	400	0

California sea lion diet

- Inland marine water sea lion abundance estimates from 2013, 2014, and 2015 (DeLong et al. 2017, Pearson and Jeffries unpublished).
  - Mean abundance ranged from 110 – 993 sealions in summer vs. fall respectively
- 237 scat samples collected from 2009-2017 were pooled into two seasonal categories (Manchester, Commencement Bay, Carlyon Beach, Bremerton)
  - Fall/winter season (Nov-Feb)
  - Spring/summer season (Mar-Jun)

California sea lion diet

- Across all sites, the most common prey species were:
  - Chum salmon (21.5%)
  - Northern Anchovy (12.2%)
  - Walleye Pollock (12.1%)
  - Pacific Herring (11.8%)
- Salmonid species that are of conservation concern:
  - Chinook salmon (4.6%)
  - Steelhead (0.56%)

California sea lion diet

- Diet varied spatially:
  - Chum salmon was most common:
    - Bremerton (60%)
    - Carlyon Beach (88%)
    - Nisqually Wreck (88%)
  - Pacific Herring was most common at Manchester (16%)
  - Northern Anchovy was most common at Commencement Bay (26%)
  - Atlantic salmon were detected in the Manchester (5%) and Bremerton (11%)
  - Produced initial estimates of total consumption of Chinook and coho

Hotspot mapping

- In partnership with Dr. Beth Gardner, UW, and her postdoc and PhD student, we are building seasonal predictive density surfaces for inland marine waters and coast
  - Birds and mammals
- Examine the covariates the influence the change in distribution and abundance
- Identify hotspots of predicted density by season
- This will help us understand whether hotspots for pinniped density overlap with critical areas for salmon, to help us prioritize conservation efforts.

Hood Canal Bridge Impact Assessment and Action Plan

- Multiple partners on team: NOAA, Port Gamble S'Klallam Tribe, WDFW, Ecology, WSDOT, etc.
- Coordinated by Long Live the Kings

- Assessment
  - Bridge impedes fish passage and water quality parameters (temperature, salinity, currents) near the bridge
  - Changes in circulation and flow may be linked to impacts on juvenile salmon and steelhead behavior and mortality (steelhead mortality is higher near the bridge than elsewhere)
  - Avian and mammalian predators were documented near the bridge but were not necessarily more abundant near the bridge (but varied by predator and year)
  - Harbor seal predation on juvenile steelhead was the most frequent source of mortality based on indirect evidence from tagged juvenile steelhead.

- Next steps
  - Test structural modifications (with and without modifications)
    - Assess steelhead survival and behavior
    - Examine eddy dynamics
      - Schooling/milling behavior of fish
      - Predator use
    - Predator use near bridge?
    - Chum survival and behavior?

TAST at Ballard and Whatcom Creek Hatchery

OUTLINE

- MMPA management options
- Pinnipeds in Washington
- Columbia River Update
  - MMPA 120(f) Application
- Puget Sound Update
  - Diet analysis
  - Evaluating Non-Lethal Actions
  - “What if” Scenarios
- Next Steps
  - Avian and Pinniped Predation Team
  - 2021 Legislative Session

Next Steps

- Avian and Pinniped Predation Team
  - Inter-Disciplinary
  - Inventory of Policy Forums
  - Predator/Prey Principles
  - Staff Structure Recommendations
  - Develop recommendations to secure budget and authorities to conduct work
- 2021 Legislative Session
  - Operating Budget
  - Capital Budget

Questions