



NOAA
FISHERIES

Agenda Item F.3.a

Supplemental NMFS Presentation 1

September 2019

Southern Resident Killer Whale Workgroup



NOAA

Update on Draft Salmon Fishery Risk Assessment

Co-Chair, PFMC Ad Hoc SRKW Workgroup

Jeromy Jording

NOAA's National Marine Fisheries Service

West Coast Region

September 14, 2019

Overview



- In March 2019, NMFS announced plans to reinitiate consultation on the implementation of Salmon Fishery Management Plan
- Council subsequently tasked an Ad-Hoc Workgroup with reassessing the effects of Council-area ocean salmon fisheries on Southern Resident Killer Whales
- The Workgroup includes representatives from West Coast tribes; the states of California, Oregon, Washington, and Idaho; the PFMF; and NMFS' West Coast Region, Northwest Fisheries Science Center, and Southwest Fisheries Science Center.



Ad-Hoc SRKW Workgroup Schedule

2019 Ad-Hoc SRKW Workgroup Schedule for Completing Assigned Tasks		
Date	Task	Comment
May 23-24	Meeting in PDX	Workgroup purpose, review Orca status, past fishery evaluations, framework/criteria for past risk assessment (RA). Identify current data gaps, list potential framework/criteria for current RA. Assign tasks to WG members.
June 5	Distribute a compiled pre-fishery ocean abundance	WDFW (Derek Dapp)
June 6	Distribute PFMC specific fishery exploitation rates	WDFW (Derek Dapp)
June 5-7	will reach out to O. Shelton about potential new model availability	SWFSC / WDFW (Will Satterthwaite & Derek Dapp)
June 7	Distribute spatial / sighting data for coastal temporal mapping purposes	NMFS (Eric Ward/Teresa Mongillo) no later than June 14
June 10	Submit Progress Report	June Supplemental Briefing Book deadline
June 20	SAS/STT briefing	At June Council meeting
June 21	Present Progress Report	June 19-23 (Council meeting). No SRKW workgroup mtg
June 21	Review the priority stock list and provide comments	WDFW / ODFW / CDFW - (Derek Dapp, Chris Kern, Brett Kormos)
July 2	Webinar	Review Council direction/comments from June Mtg, assign tasks, finalize agenda for next mtg.
July 5	Scope and provide a metric index evaluation recommendation for South of Falcon fisheries	SWFSC / CDFW (Will Satterthwaite & Brett Kormos)
July 23-24	Meeting in Vancouver, WA	Update on Orca status, address data gaps, and identify framework/criteria for RA. Assign tasks for RA. Identify fishery evaluation criteria, assign tasks. Begin scoping possible conservation measure(s) or management tool(s) to propose based on the evaluation criteria developed for the risk analysis, <i>consider including draft, or example Alternatives to help illustrate model sensitivity, provide context/sideboards.</i>
August 5	Risk Analysis draft sections due	Intro, Status, Fisheries, FMP (NMFS staff)
August 6	Workgroup webinar	Discuss topics related to completing the risk analysis.
August 15	Submit SRKW Progress Report	Advanced Briefing Book deadline
August 20	Risk Analysis draft sections due	Model outputs (WDFW/NWFSC/SWFSC)
September 4	Webinar SAS/SRKW	If RA identifies a risk, then solicit SAS input to help develop alternatives (conservation objectives/management tools) for Council consideration at the September meeting.
September 4	Supplemental documents due.	September supplemental Briefing Book deadline.
September X	Submit draft Risk Analysis Report	
September 14	Present draft Risk Analysis Report	September 11-18 Council meeting in Boise ID.
September 24	Workgroup webinar	Sept Council de-briefing, prep for finalizing RA
October 8-9	Meeting in PDX (Sheraton Airport Hotel)	Discuss Council direction. Solicit input from SAS to help shape alternatives if needed. NMFS begins NEPA process.
October 17	Submit Report w PPAs	Advanced Briefing Book deadline.
October 29?	Webinar SAS/SRKW	As needed.
November 16-ish	Present Report w PPAs	November 13-20 Council meeting in Costa Mesa. SRKW/SAS may attend. Council to adopt FPA as needed.
Updated 08/06/19		

- Since forming in March

The workgroup has held regular meetings to progress towards drafting a report assessing Council salmon fisheries implemented per the FMP.

Supporting materials have been posted online for public dissemination.

<https://www.fisheries.noaa.gov/west-coast/southern-resident-killer-whales-and-fisheries-interaction-workgroup>

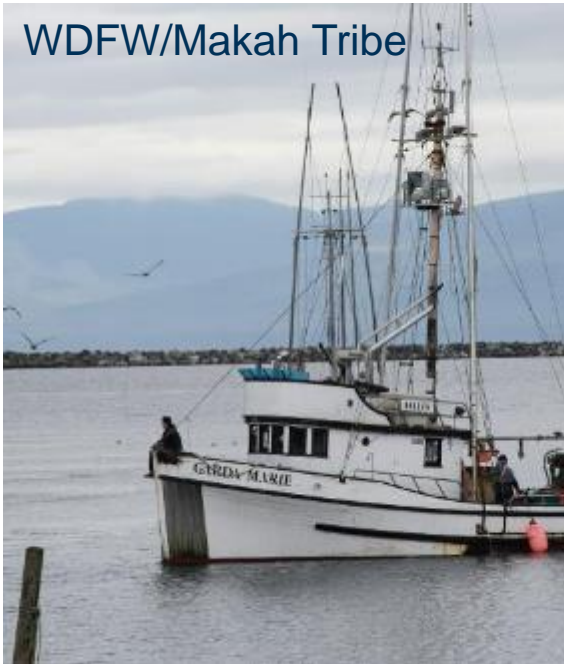
Each workgroup meeting thus far, including webinars, has allowed for multiple public input opportunities.



NOAA
FISHERIES

Accomplished thus far?

WDFW/Makah Tribe



WDFW/ODFW



Pacific Fishery Management Council Salmon Fishery Management Plan Impacts to Southern Resident Killer Whales

Draft Risk Assessment

Agenda Item F.3
SRKW Workgroup Report 1
September 2019

WDFW/ODFW



NOAA



NOAA
FISHERIES

Components of the draft

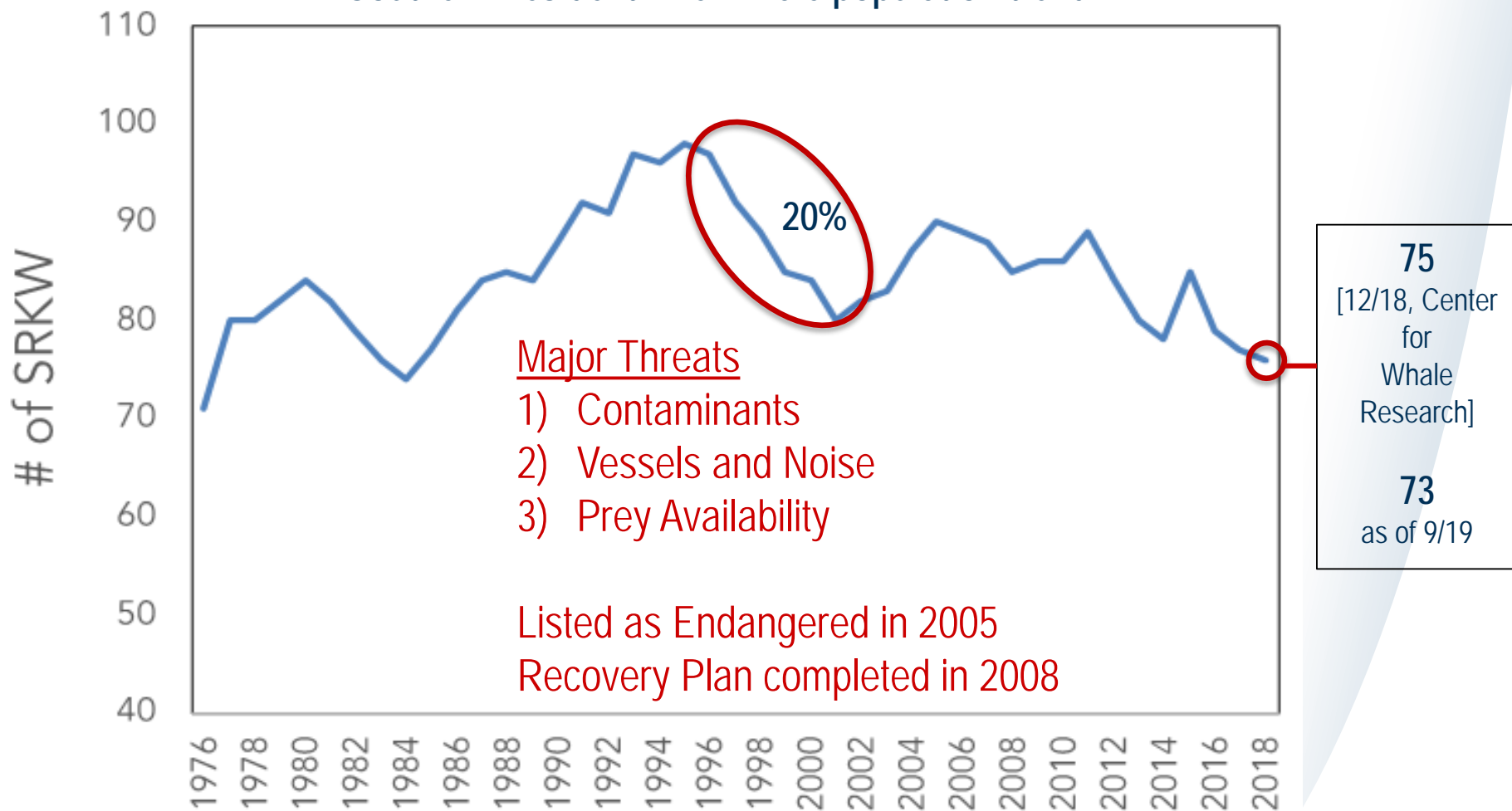
- ✓ Section 1: Introduction
- Section 2: Status of the SRKW
- Section 3: SRKW and Chinook Salmon Fisheries
- Section 4: PFMF Salmon Fisheries description
- Section 5: Risk Assessment



NOAA
FISHERIES

Section 2: Status of the SRKW

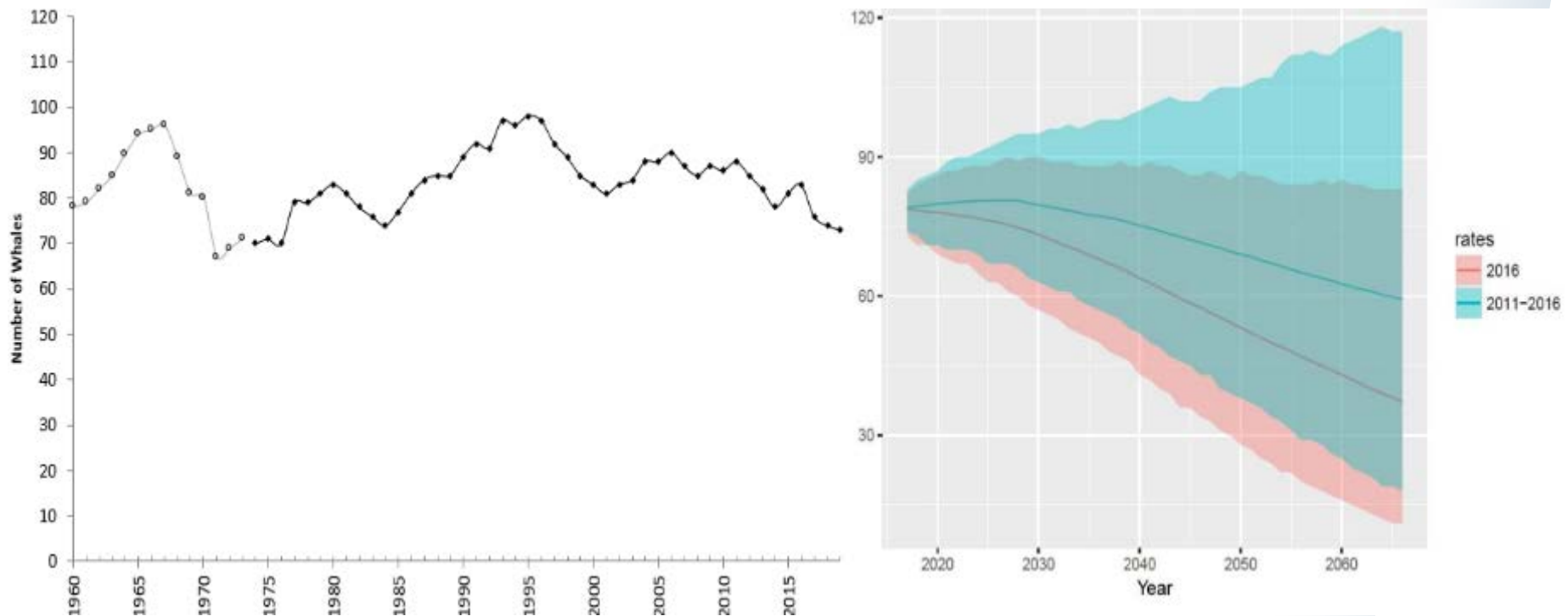
Southern Resident Decline and Risks Southern Resident killer whale population trend



NOAA
FISHERIES

Section 2: Status of the SRKW

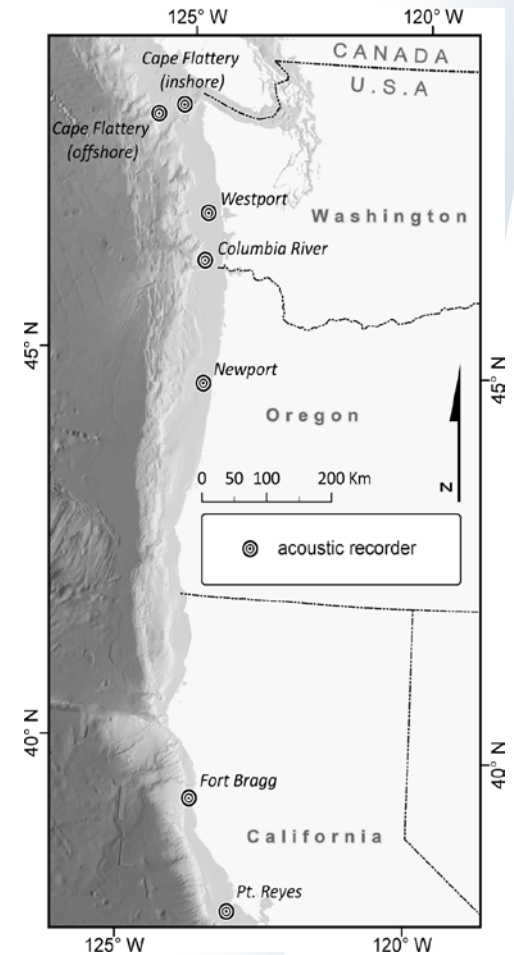
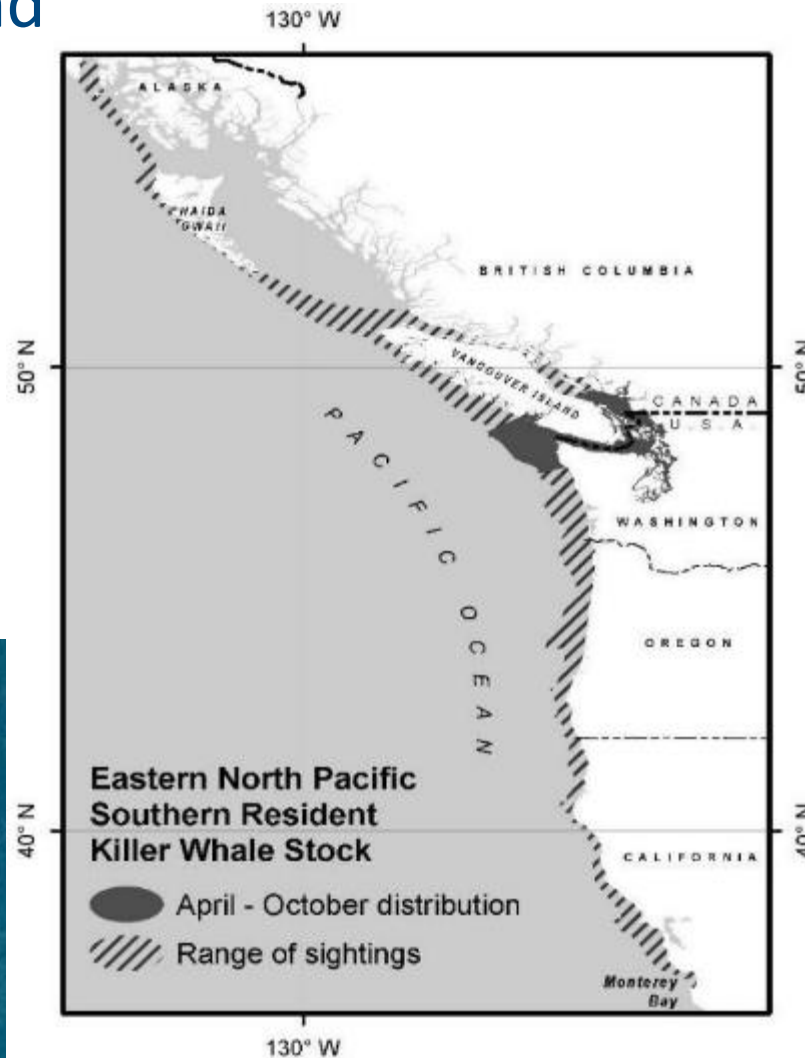
SRKW population projections from 2016 to 2066 using 2 scenarios: (1) projections using demographic rates held at 2016 levels, and (2) projections using demographic rates from 2011 to 2016.



Section 2: Status of the SRKW

SRKW range and foraging areas

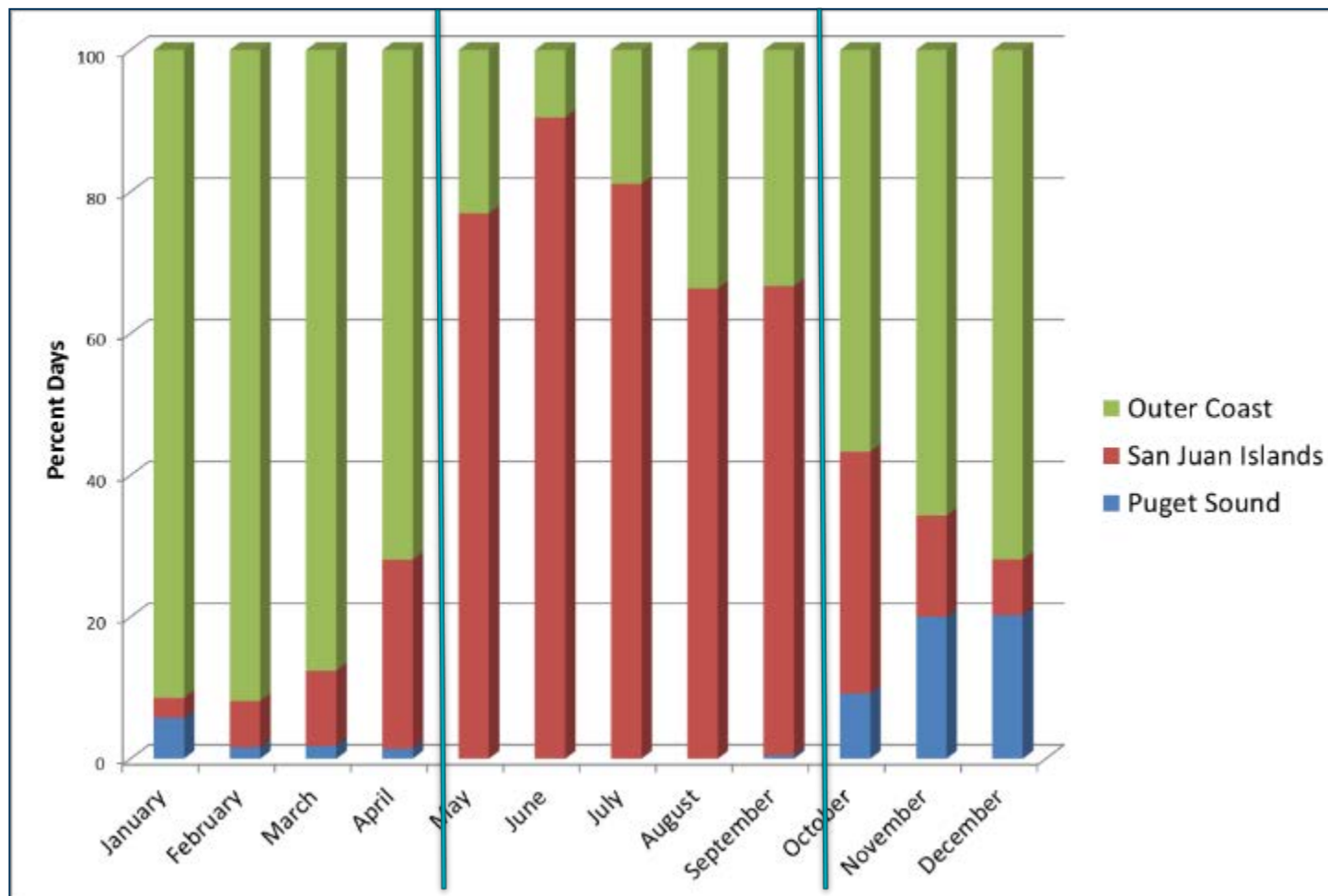
Coastal distribution in the EEZ has generally been assessed via passive acoustic recorders



NOAA
FISHERIES

Section 2: Status of the SRKW

Percentage of time Southern resident killer whale pods were present in three main areas of their range



Three unique seasonal occurrence patterns for SRKWs

January – May

June – September

October - December



NOAA
FISHERIES

Section 2: Status of the SRKW

Limiting Factors & Threats

Quantity & Quality of Prey



NOAA
FISHERIES

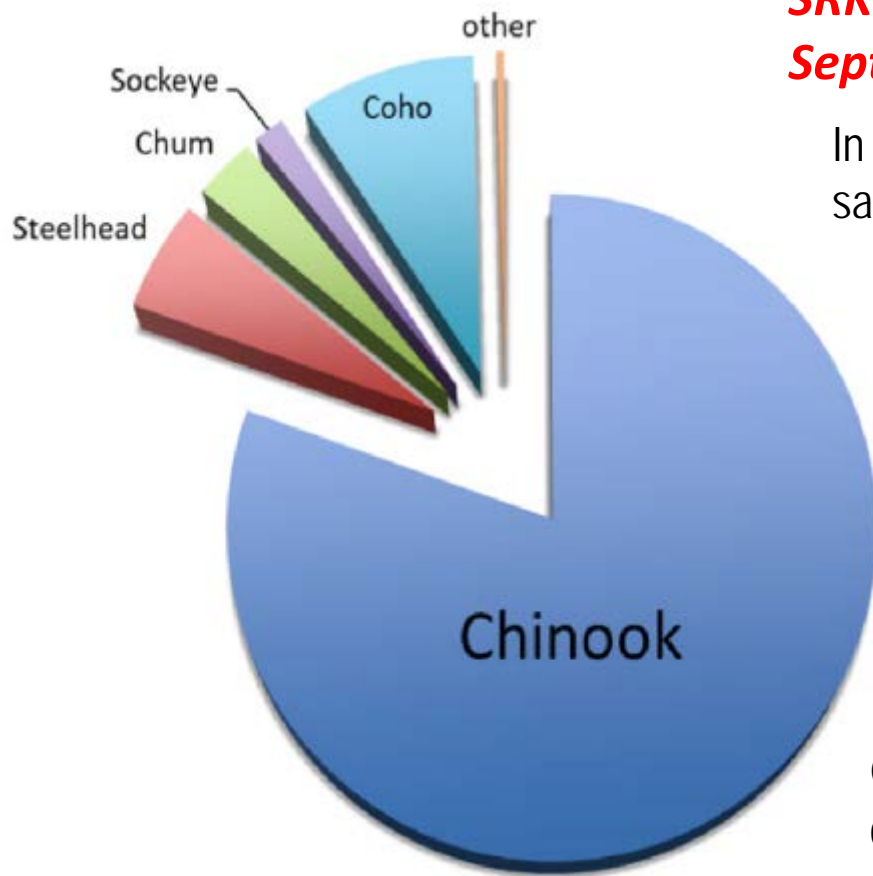
Section 2: Status of the SRKW

Prey Identification Field Methods



NOAA
FISHERIES

Section 2: Status of the SRKW



SRKW summer diet: May - September

In diet consists of a high percentage of Chinook salmon (monthly proportions as high as >90 percent)

SRKW fall diet: October-December

Diet selection switches to include more coho and Chum, but Chinook are still prominent component.

SRKW winter diet: January-April

Chinook are the primary species detected in diet samples on the outer coast, although steelhead, chum, lingcod, and halibut were also detected in samples



NOAA
FISHERIES

Section 2: Status of the SRKW

Photogrammetry

- Where and when are the whales food limited?

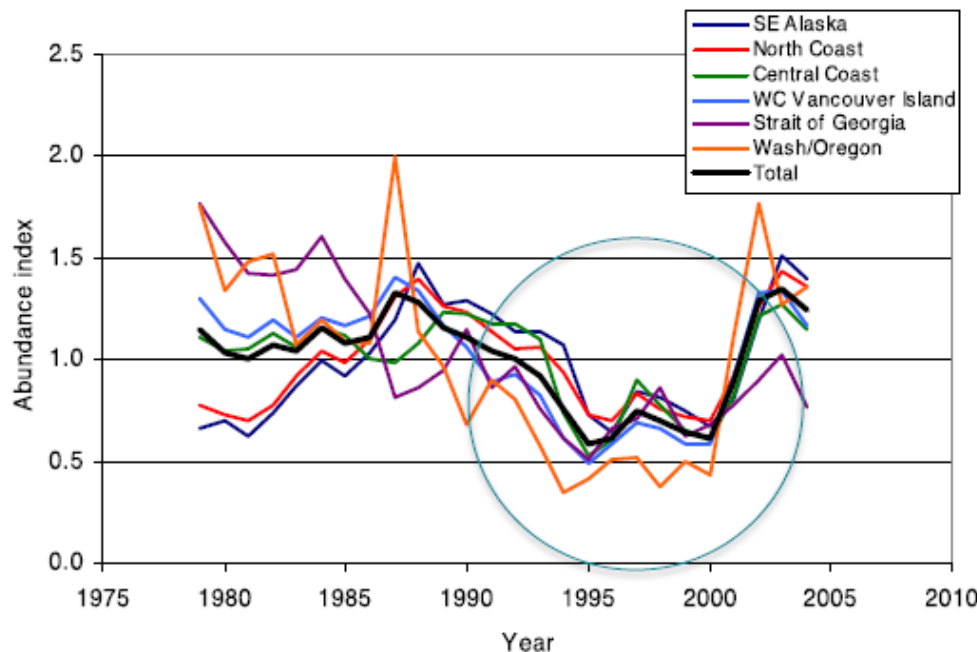


Section 2: Status of the SRKW

Relationship between SRKWs and Chinook

J. Ford et al. 2005 & 2010

Much of this relied on statistical relationships between killer whale demography and aggregate indices of Chinook abundance



Late 1990s
corresponded to SRKW
downturn



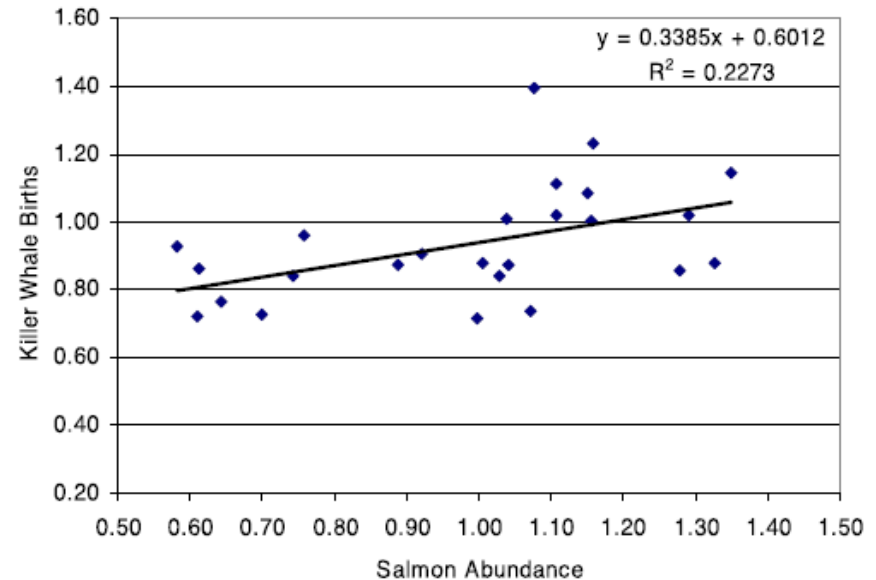
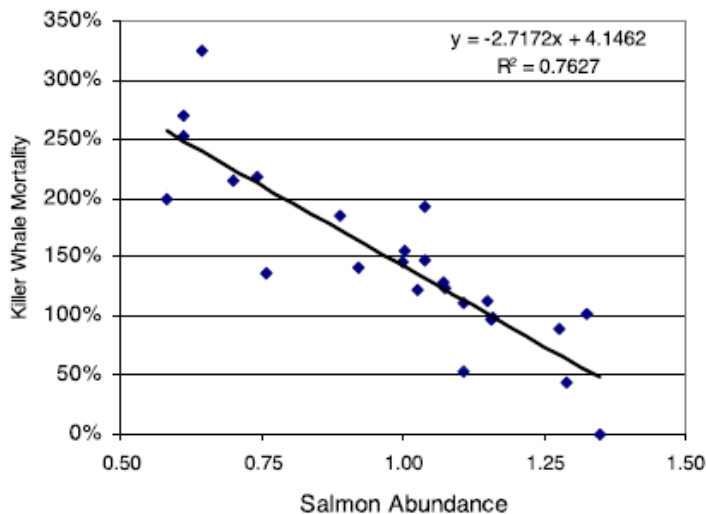
NOAA
FISHERIES

Section 2: Status of the SRKW

Relationship between SRKWs and Chinook

J. Ford et al. 2005 & 2010

3-year running average of observed/expected births vs. averaged CTC indices (& spatial averaging)



Section 2: Status of the SRKW

Summary

Quantity and Quality of Prey

- Diet dominated by Chinook, especially in summer in inland water
 - Coho, chum contribute to prey in fall / early winter (Ford et al. 2006)
- General relationship between SRKWs survival, reproduction, and health and Chinook salmon established prey as a limiting factor in the recovery plan
- All prey / fecal samples opportunistic, and difficult to collect
- Samples reflect stocks available in collection location
 - e.g. lots of Fraser River samples in summer in the Salish Sea, Columbia River on outer coast near the mouth of the Columbia River
- Current stocks might not reflect optimum or historic prey



NOAA
FISHERIES

Section 2: Status of the SRKW

Limiting Factors & Threats

Pollution & Contaminants



NOAA



NOAA
FISHERIES

Section 2: Status of the SRKW

Pollution & Contaminants

Killer whales are at the top of the food chain

- Bioaccumulation of contaminants (PCBs, DDTs, PBDEs)
- High levels can cause reproductive and immune problems

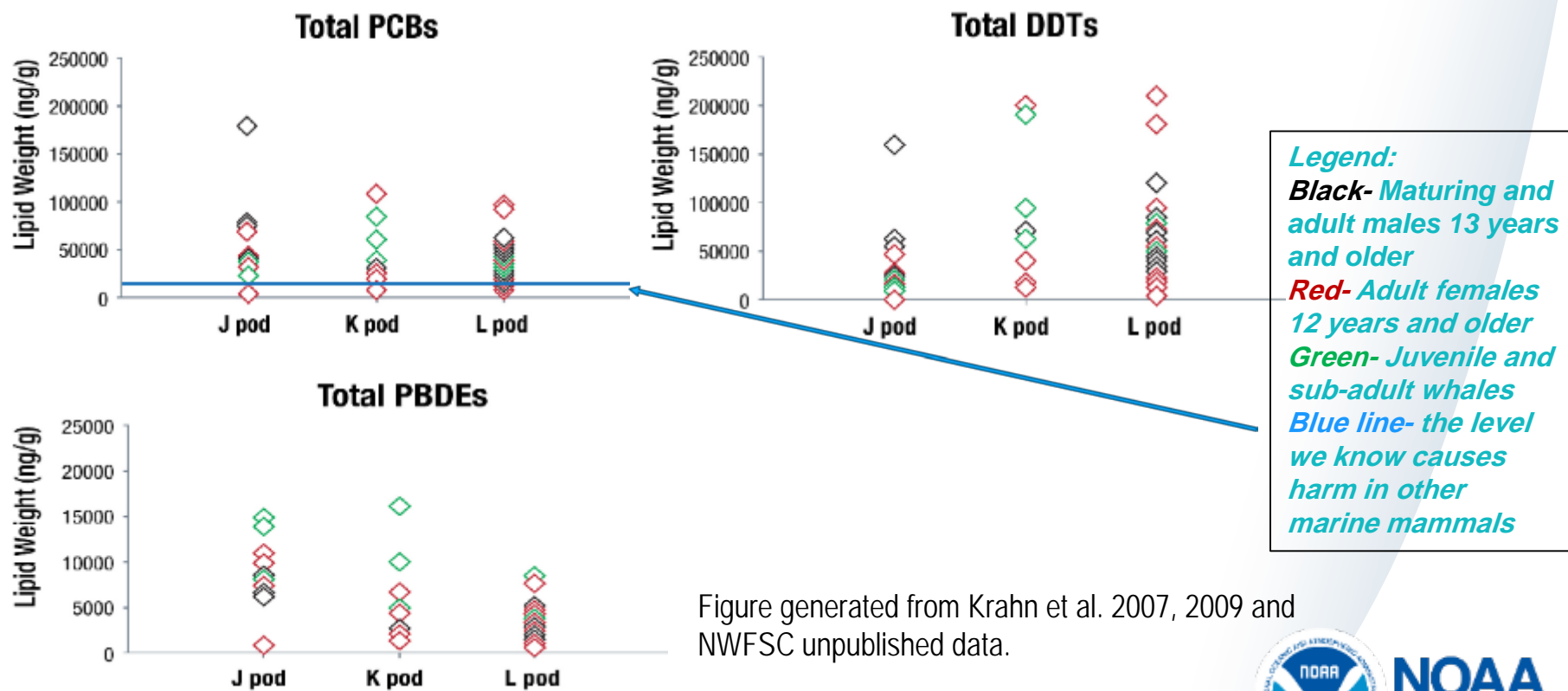


Figure generated from Krahn et al. 2007, 2009 and NWFSC unpublished data.



NOAA
FISHERIES

Section 2: Status of the SRKW

Limiting Factors & Threats

Vessels & Noise



NOAA



NOAA
FISHERIES

Section 2: Status of the SRKW

Vessels and Noise

Killer whales use echolocation to find food and use sound to communicate and navigate

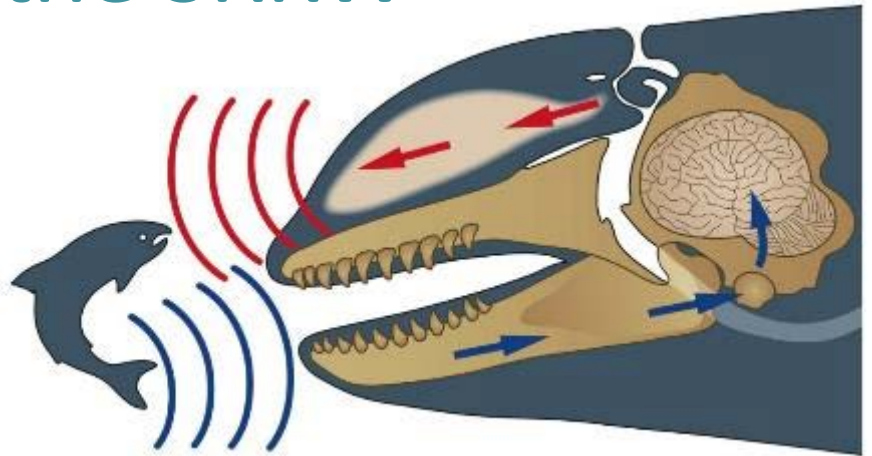


Illustration by Uko Gorter



Noren *et al.* 2009

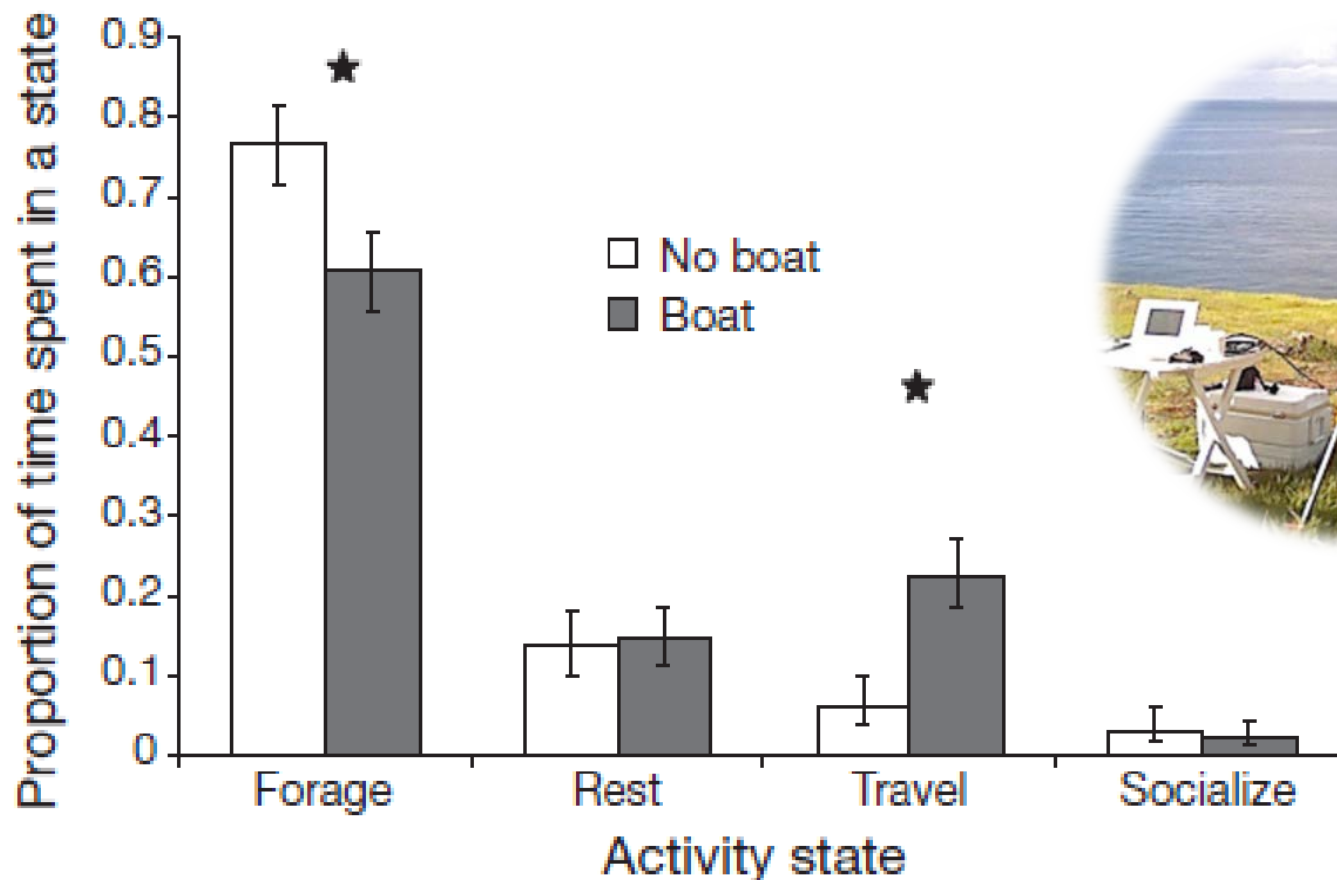
Killer whales increase surface active behaviors in the presence of vessels



NOAA
FISHERIES

Section 2: Status of the SRKW

Foraging is reduced and travel is increased when vessels are present within 400 m



Lusseau *et al.* 2009



NOAA
FISHERIES

Section 3: SRKW AND CHINOOK SALMON FISHERIES



AP Photo/Terry Chea



NOAA
FISHERIES

Section 3: SRKW AND CHINOOK SALMON FISHERIES

Independent review by Hilborn et al. (2012)

- Reviewed demographic modeling
- Reviewed methods used in consultations
 - Quantifying fishery impacts
 - Selectivity curves
 - Ratios of prey available / needed
- Helped identify data gaps
 - Impacts of marine mammals (other killer whales, pinnipeds)
 - Winter diet and distribution



NOAA
FISHERIES

Section 3: SRKW AND CHINOOK SALMON FISHERIES

- Conclusions from Hilborn et al. 2012:
 - There was a statistical correlation between SRKW survival rates and some indices of Chinook salmon abundance.
 - However, the effect is not linear as improvements in SRKW survival diminish at Chinook salmon abundance levels beyond the historical average along with interactions from other salmon predators.
 - Many reasons exist why not all foregone Chinook salmon catch would be available to SRKW, and the Panel was skeptical that reduced harvest would largely impact the available abundance contributing to SRKW prey.



NOAA
FISHERIES

Section 3: SRKW AND CHINOOK SALMON FISHERIES

- Are there Chinook stocks, or groups of stocks that are most correlated with killer whale demography?
- Are there season(s) or geographical areas (NOF v SOF) that are more important?
- What are the impacts of reducing harvest
- Correlation = 'most important'
- These types of correlations have begun to weaken in the recent past as more data becomes available



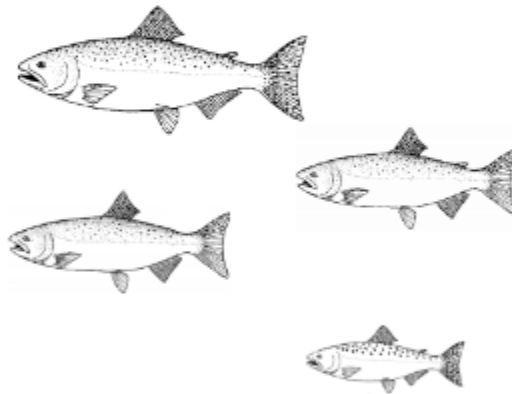
NOAA
FISHERIES

Section 4: PFMC Salmon Fisheries description



PACIFIC COAST SALMON FISHERY MANAGEMENT PLAN

*FOR COMMERCIAL AND RECREATIONAL SALMON FISHERIES
OFF THE COASTS OF WASHINGTON, OREGON, AND CALIFORNIA
AS REVISED THROUGH AMENDMENT 19
(Effective March 2016)*



Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384
503-820-2280
www.pfcouncil.org

March 2016



NOAA
FISHERIES

Section 4: PFMF Salmon Fisheries description

- Review of the Salmon FMP
 - Explains the Council Process
 - Use of Harvest Control Rules and other management measures
 - Lists the Overall Fishery Objectives
 - Details where fisheries occur and why various management areas are established
 - Details the Schedule and procedure for establishing annual management measures

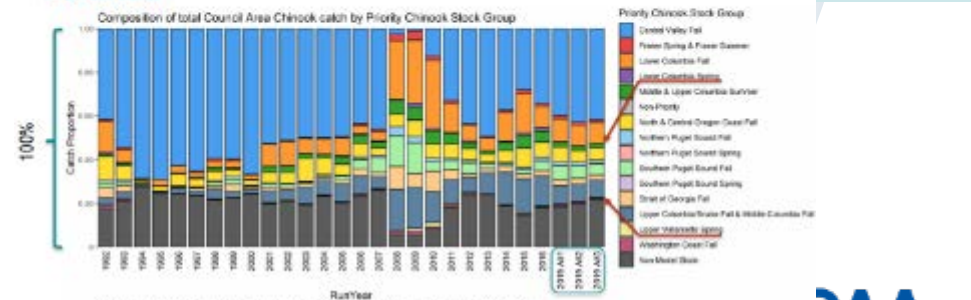
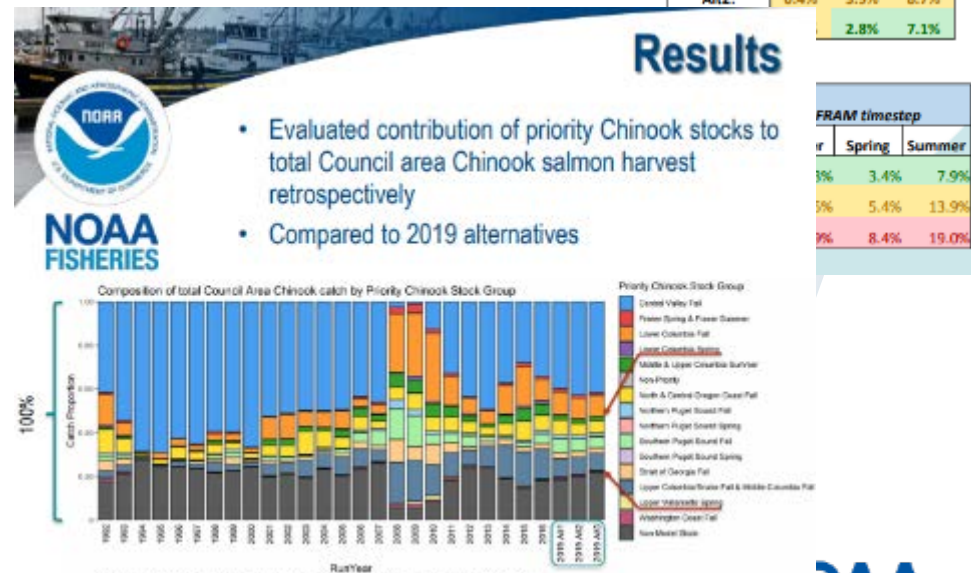
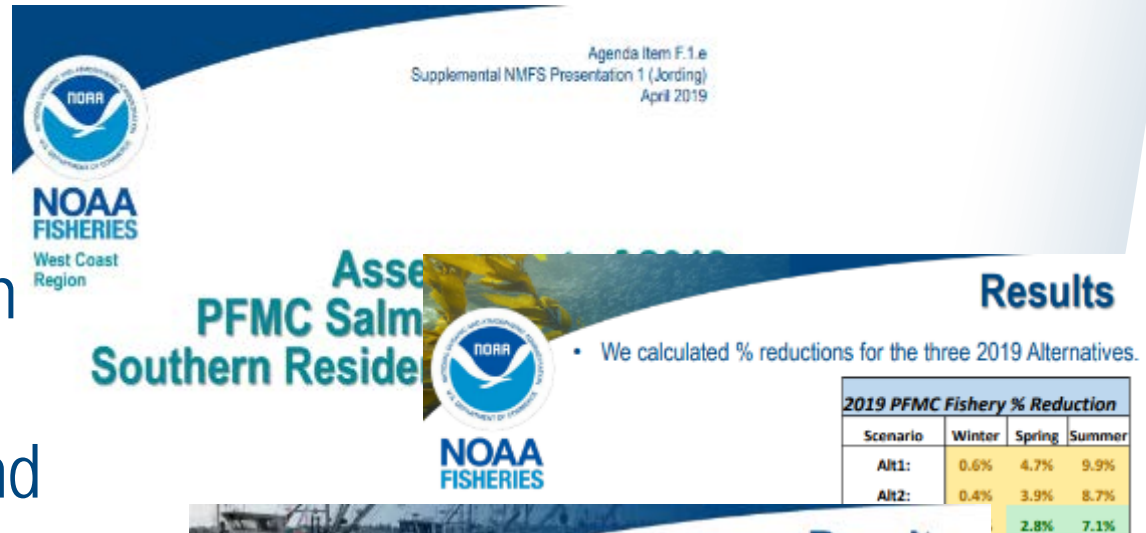


Section 4: PFMC Salmon Fisheries description

- Wraps up with a summary description of NMFS' 2009 biological opinion and 2019 assessment of fisheries impacts on SRKW

Link to April 2019 Council presentation:

https://www.pcouncil.org/wp-content/uploads/2019/04/F1e_Supp_NMFS_Presentation1_Jording_APR2019BB.pdf



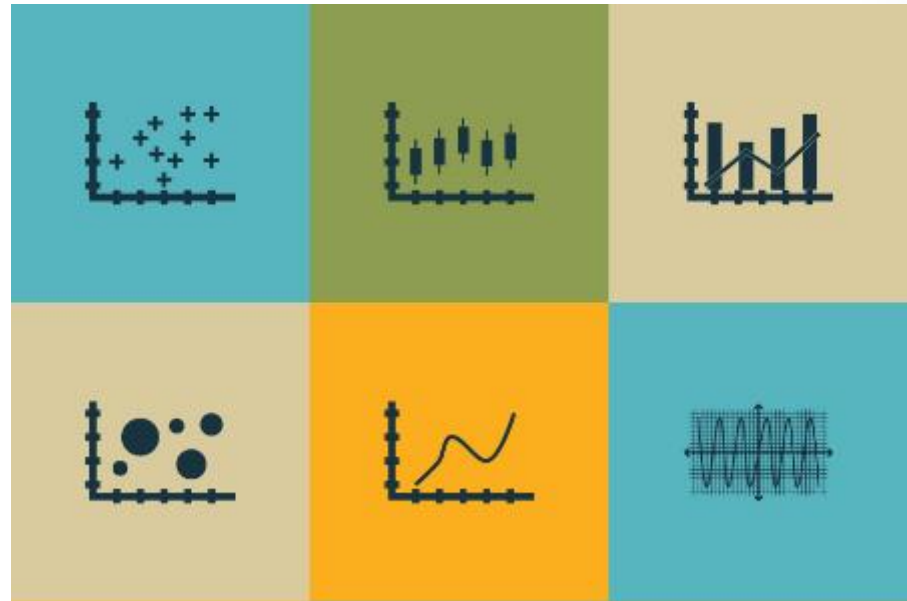
Section 5: Risk Assessment



NOAA
FISHERIES

Section 5: Risk Assessment

- First stage of the risk assessment built on the analyses of correlations between Chinook abundance and SRKW demography discussed by the 2012 Science Panel (Hilborn et al. 2012) and described by Ward et al. (2013)



NOAA
FISHERIES

Section 5: Risk Assessment

- Consideration and decision points the Workgroup made were given to:
 - Which years to include
 - Fishery management years 1992-2016 (the fishery management year starts in the fall of the preceding year, so the first time step considered was October 1 1991)
 - Which demographic types to use
 - SRKW survival rates
 - SRKW fecundity (birth) rates (consideration was given for a lag effect of the gestation period)
 - occurrence of "peanut-head" whales (a metric previously used as an index of extremely poor condition)
 - Annual changes in SRKW abundance
 - How to appropriately model stocks by time steps
 - FRAM stocks
 - Separately used Sacramento Index rather than its FRAM representation
 - Non FRAM stocks
 - Rogue River Fall Chinook
 - Klamath Fall Chinook Index
 - Upper Columbia River Spring Chinook



NOAA
FISHERIES

Section 5: Risk Assessment

- Modeling Structure

The following models were calculated to look for correlations between SRKW demographics and Chinook salmon abundance

Dependent Variable (SRKW)	Method	Independent Variables
Fecundity	Logistic regression	Chinook abundance Age
Survival Rate	Logistic regression	Chinook abundance, Stage, Sex
Peanut-Head Occurrence	Poisson generalized linear model	Chinook Abundance
Population trends	Binomial	

- A cluster analysis was also performed to explore possible associations between Chinook abundance and the SRKW population metrics (fecundity, survival, occurrence of peanut head, SRKW population trends).



NOAA
FISHERIES

Section 5: Risk Assessment

- Results

- Results were assessed by 7 different geographic areas of the ocean described in Shelton et al 2019. each stratified by the 3 different time-steps
 - Spatial areas are: Coastwide, SW WCVI, Salish Sea, NOF, SOF, OR coast, CA coast
 - Graphics depict the relationship between Chinook abundance and a SRKW population parameter
- None of the fitted regressions met the typical criterion of $p < 0.05$ that is often associated with “statistical significance”.
- Given the lack of statistical significance, the results should be interpreted with caution.
- A majority of the fitted relationships were of the expected sign (i.e. survival and fecundity increased with increasing Chinook abundance while occurrence of peanut-head decreased with increasing Chinook abundance). This was true in all cases excluding time lags and waters south of Cape Falcon.
- The cluster analysis is still being evaluated for results
- A copy of the complete results can be obtained online at:

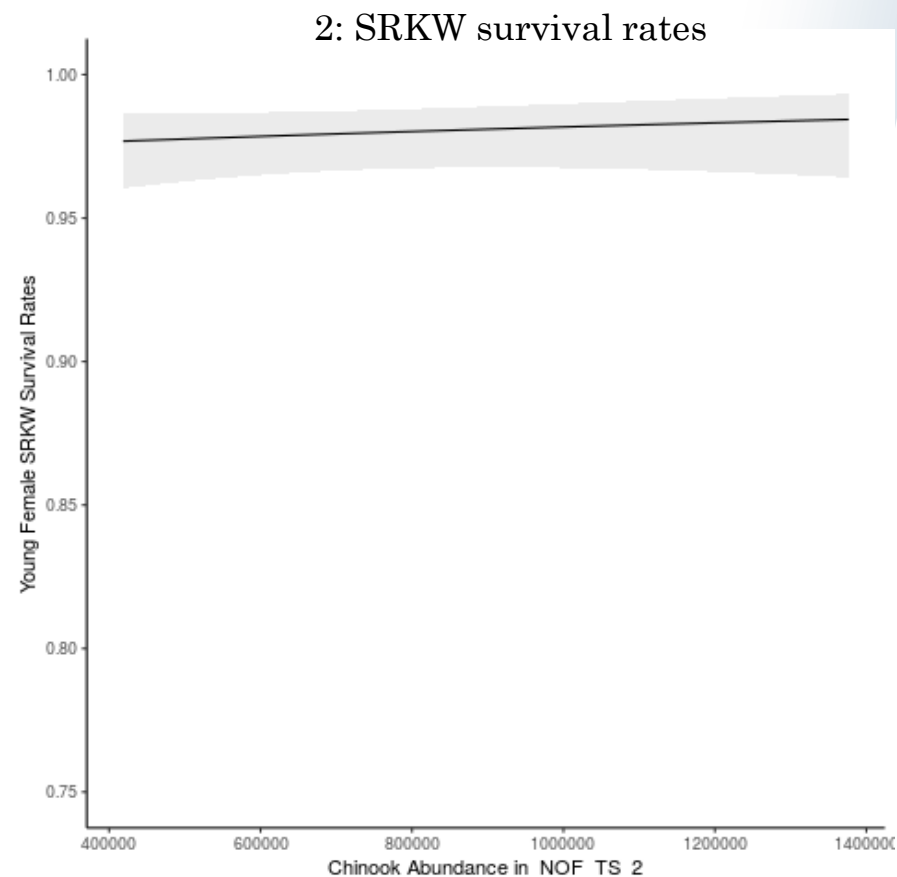
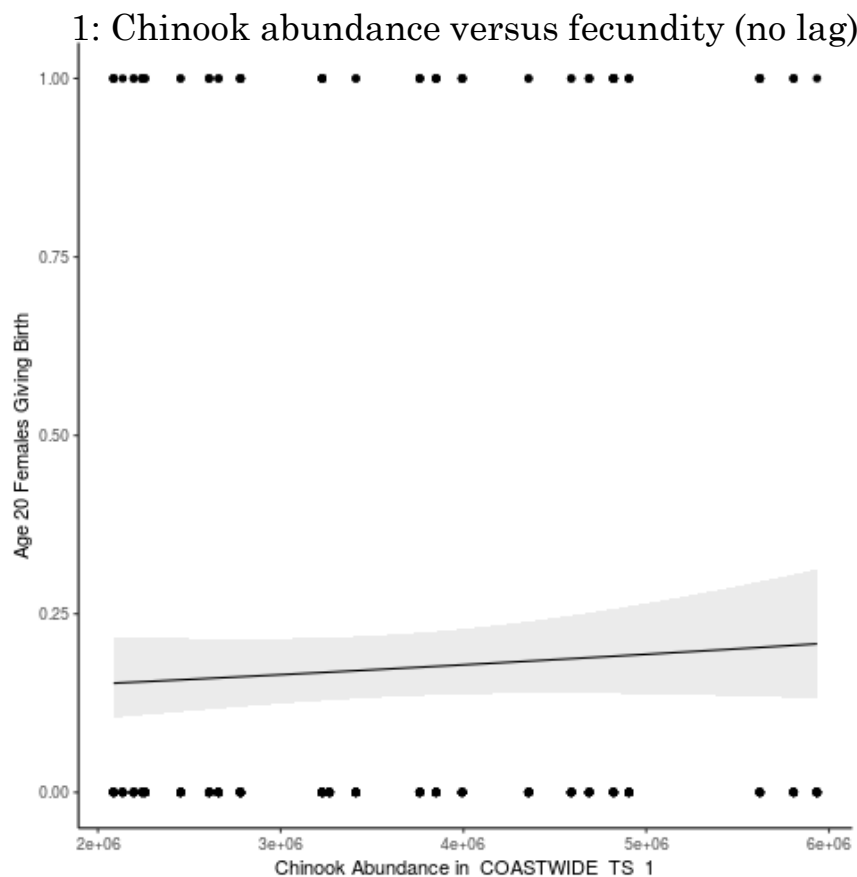
https://dapprd.shinyapps.io/SRKW_Chinook_Analysis/



NOAA
FISHERIES

Section 5: Risk Assessment

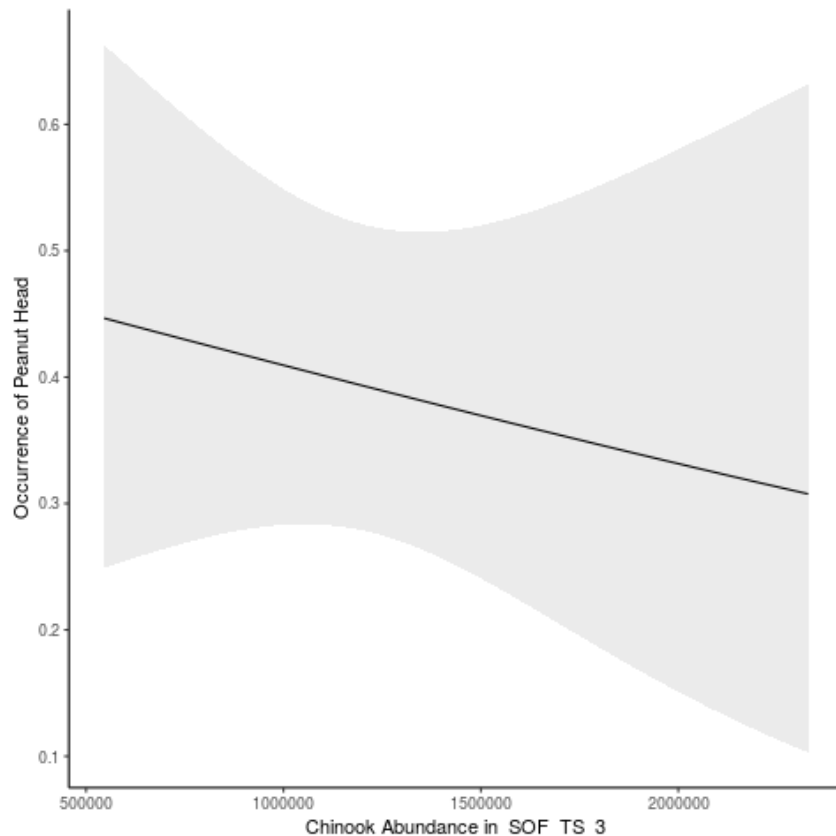
- Results
 - In order, on each tab the graphics represent:



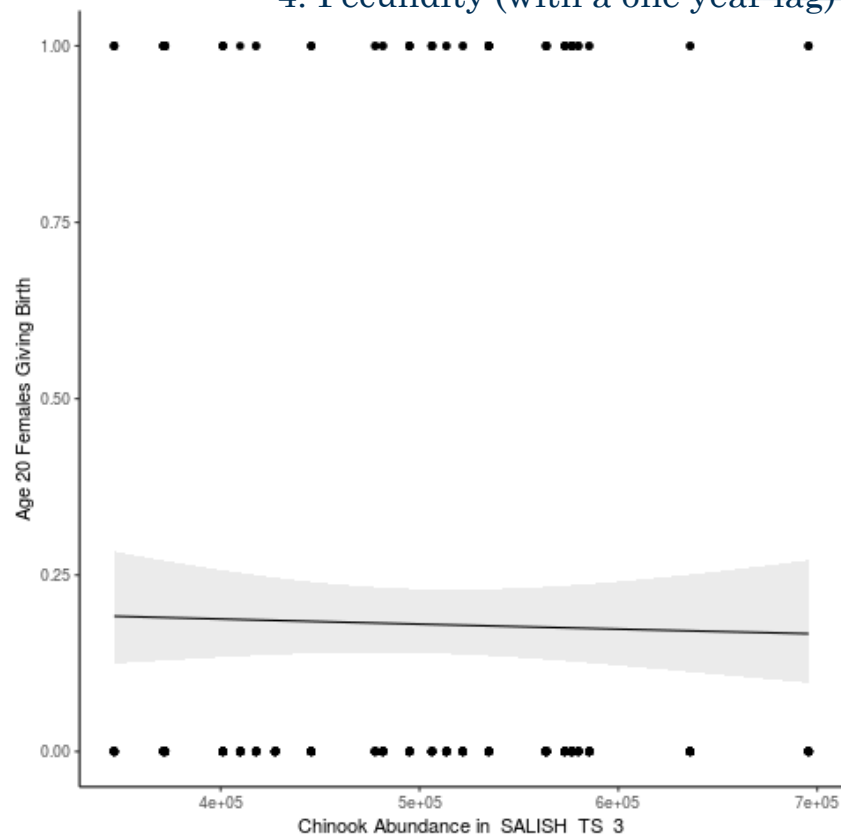
Section 5: Risk Assessment

- Results
 - In order, on each tab the graphics represent:

3: Peanut head occurrence

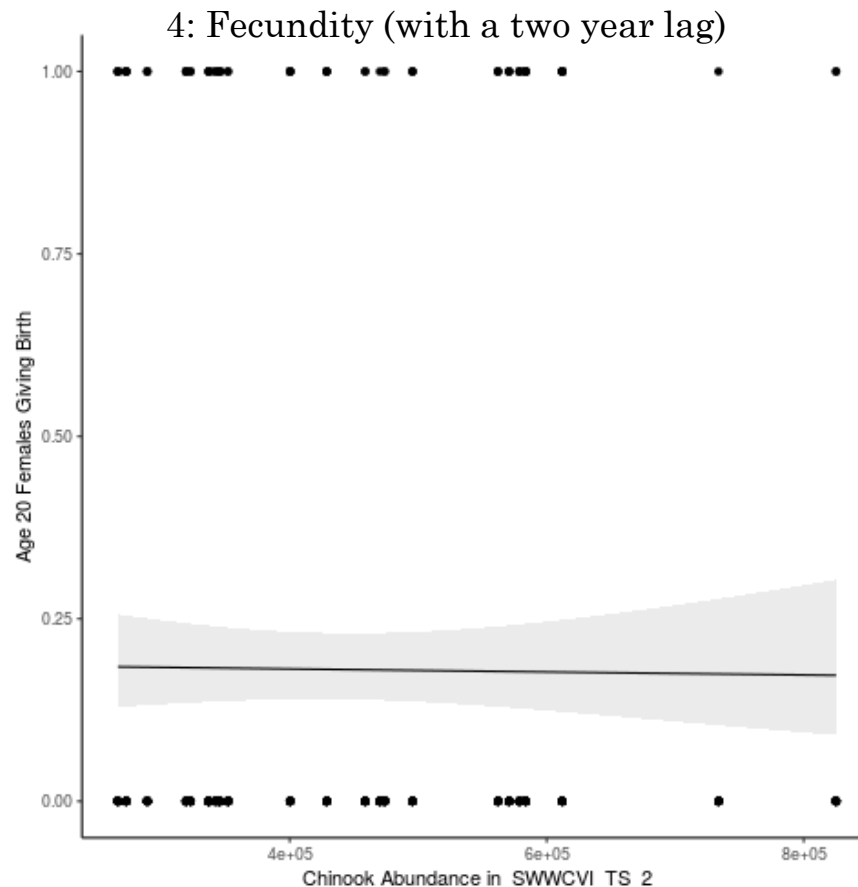


4: Fecundity (with a one year lag)



Section 5: Risk Assessment

- Results
 - In order, on each tab the graphics represent:



NOAA
FISHERIES

Section 5: Risk Assessment

- Results

- Interpretations:

- Take home: More work is still necessary to complete the assessment (e.g., catch estimates in same stratifications need compiling and quality control checked).
 - Further discussions by the Workgroup regarding the results still need to occur.
 - Workgroup has tried to capture the list of key uncertainties currently associated with this approach given the time frame we have been attempting to accomplish the task at hand.
 - uncertainty associated with retrospective estimates of Chinook abundance, and spatial apportionment
 - sampling error in harvest data
 - assumptions about natural mortality
 - assumptions about how catch per unit effort scales with local abundance
- temporal mismatch exists between the Shelton et al., 2019 model and FRAM
- Lack of information on Chinook distributions during winter
- Limited information on distribution for most spring-run Chinook stocks
- Effects of changes in Chinook age structure
- Uncertainty in the distribution of SRKW
- Differential responses to changes in Chinook abundance for J pod versus K, L pods
- Uncertainty in the drivers of changes in the distribution of SRKW
- Uncertainty in the ability of SRKW to switch to alternative prey sources
- Patterns of temporal variation in competing threats
- Chinook stocks whose abundances are not included in the modeling



NOAA
FISHERIES

Summary

- More still to do (in a limited timeframe)
 - Tasks:
 - Workgroup next steps include assessing the fishery removals across these same stratifications
 - Continue our work within the guidance the Council provides at this meeting
 - Complete our charge within the following timeline remaining:

Date	Task	Comment
September 24	Workgroup webinar	Sept Council de-briefing, prep for finalizing RA.
October 8 – 9	Meeting in Portland	Discuss Council direction. Solicit input from SAS to help shape alternatives if needed. NMFS begins NEPA process.
October 17(ish)	Submit Final Report	Advanced Briefing Book deadline.
October 29?	Webinar SAS/STT/SRKWW	As needed for debriefing on Final Report contents.
November	Present Final Report	November 13-20 Council meeting in Costa Mesa.



NOAA
FISHERIES

Questions?



Huge amount of thanks to the
Workgroup membership:

Phil Anderson, PFMC
Susan Bishop, NMFS
Teresa (Mongillo) Lawson, NMFS
Will Satterthwaite, NMFS
Eric Ward, NMFS
Scott McGrew, U.S. Coast Guard
Mike Matylewich, CRITFC
Hap Leon, Makah Tribe
Tyler Gross, Quileute Tribe
Tyler Jurasin, Quinault Tribe
Melvinjohn Ashue, Hoh Tribe
Kyle Adicks, WDFW
Derek Dapp, WDFW
Chris Kern, ODFW
Craig Foster, ODFW
Lance Hebdon, IDFG
Chris Kozfkay, IDFG
Brett Kormos, CDFW
Erica Meyers, CDFW

& Robin Ehlke, PFMC



NOAA
FISHERIES