



**NOAA
FISHERIES**

ROC on LTO BiOp and Preliminary Effects Analysis Briefing

Director-level Briefing

May 6, 2019

Draft May 3

Species and Critical Habitat

Sacramento River winter-run Chinook salmon and Critical Habitat

- Endangered

Central Valley spring-run Chinook salmon and Critical Habitat

- Threatened

California Central Valley steelhead and Critical Habitat

- Threatened

Southern DPS Green Sturgeon and Critical Habitat

- Threatened

Southern Resident Killer Whale

- Endangered

Shasta Reservoir Cold Water Pool Management

Location: Sacramento River between Keswick Reservoir and Clear Creek

Species/Life Stages most affected: Endangered winter-run egg incubation early fry

Response: Temperature dependent mortality (showing the widest range of 25 and 75 percentiles for 2 different models)

- **Tier 1:** 0-6% ~68% of years
- **Tier 2:** 2-26% ~17% of years
- **Tier 3:** 7-59% ~7% of years
- **Tier 4:** 70-93% ~7% of years

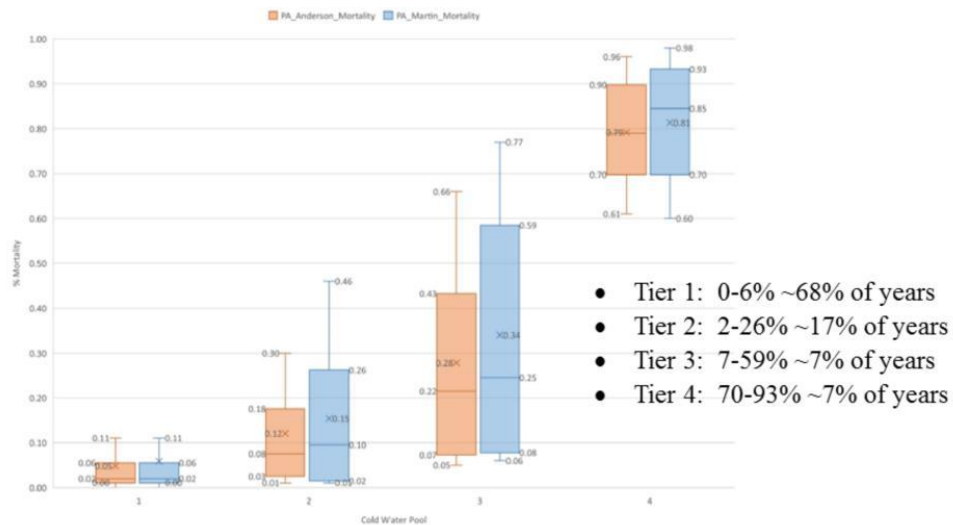
Severity of Response: High

Weight of evidence: High-supported by multiple models and scientific publications

Talking points/areas of concern:

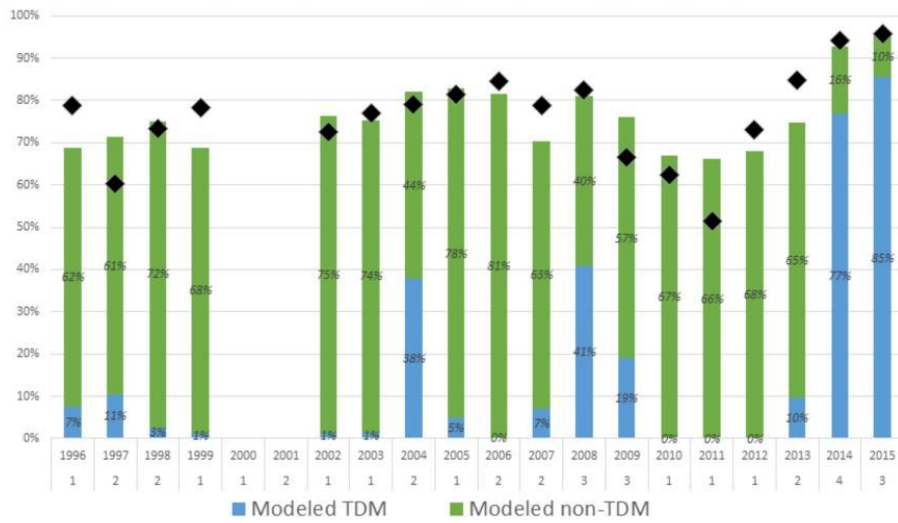
- No specific performance metrics.
- No clear strategy or commitment to build storage, especially in spring months
- There is no commitment to stay within a given Tier for Shasta Cold Water Pool Management. Therefore, the modeled temperature dependent egg mortality in Reclamation's biological assessment levels are skewed low.
- The Anderson approach for hatch protection is novel and untested.
- The characterization of current operations, COS, and the PA in physical modeling

Temperature-dependent egg mortality by Tier



The data plotted in the figures I sent earlier were derived by Miles Daniels at the SWFSC, using the methods described by Reclamation in BA appendix d, modeling. Using the methods described by Reclamation, Miles was able to generate the same model results as what Reclamation has presented in the BA (although Reclamation presented them by WYT not Tier). The Anderson (Hatch) and Martin (Emerge) results are based on CalSim II modeling (82 year record), HEC5Q temperature modeling (same for both COS and PA), and an averaged spatio-temporal distribution of WR redds (2007 - 2014).

Shasta: Tier Performance 1996-2015



Tier 1: 45% Tier 2: 35% Tier 3: 15% Tier 4: 5%



This is a look back at Tier performance since 1996

Spring Seasonal Operations

Location: Sacramento River – upper reaches

Species/Life Stages most affected: Endangered winter-run egg incubation early fry

Winter-run Response: Latent effects on temperature dependent mortality

Severity of Response: High

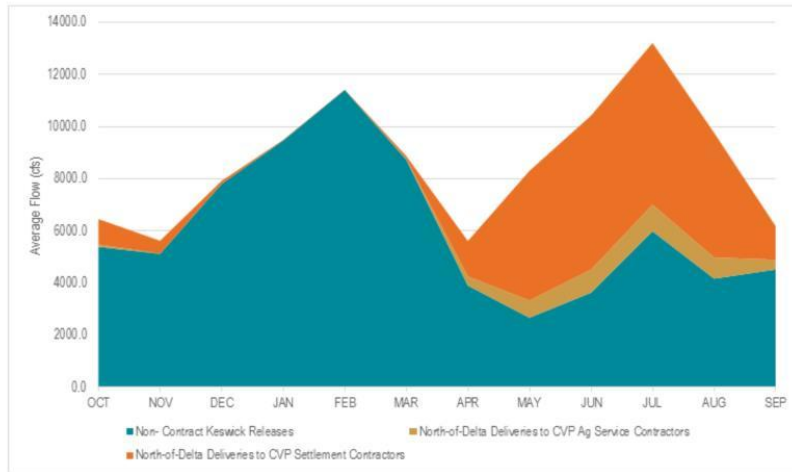
Weight of evidence: High: Supported by modeling results and review of past practices

Talking points/areas of concern:

- The COS modeling does not reduce deliveries to north-of-Delta discretionary agricultural service contractors, an action that is an option in annual operations.
- The COS does not prioritize releases from Folsom and Oroville reservoirs (rather than Shasta releases) to meet in-Delta water quality or flow requirements; this is a management option and mandate for current operations.
- The COS model does not reflect management options to limit Keswick releases to 7,500 cfs or less in June and July of dry and critical years, and it does not characterize the potential to change the temperature compliance point during drier years.
- By not characterizing these actions in the COS modeling, the resulting comparisons of Shasta Reservoir storage for the PA versus the COS are skewed low.
- This lack of certainty in process to protect Shasta Reservoir storage and build its cold water pool, increases the risk to the species regarding upstream temperature management.

Depicting Shasta Uncertainties

Proportion of monthly flows below Keswick, as either north-of-Delta deliveries to CVP Settlement Contractors, North-of-Delta deliveries to CVP Agricultural Service Contractors, or Non-Contract Keswick releases.



Delta Cross Channel Operations

Location: Delta at the Delta Cross Channel Gates

Species/Life Stages most affected: Winter-run smolts but spring-run and steelhead also affected

Response: Mortality due to routing and altered hydrodynamics into the delta interior

- Effects exist from October-April
- DCC may be open 10 additional days Dec-Jan in all years
- If the 10 additional days corresponds with a pulse of endangered winter-run then the magnitude of effect could be very high

Severity of Response: Variable, Low to medium under most conditions, but potentially very high

Weight of evidence: High - There are a number of publications regarding the relative survival in various North Delta and Central Delta migratory routes; conclusions supported by modeling results.

Talking points/areas of concern:

- The potential for the DCC to be open an additional 10 days in Dec-Jan has the potential to expose and entrain winter-run into the south Delta, resulting in lethal effects. Depending on the exposure, the severity of effect could be quite high.

South Delta Operations: CVP/SWP Exports

Location: Sacramento River, SJ River, Delta

Species/Life Stages most affected: Spring-run, steelhead, winter-run,

Response: Mortality related to routing effects from altered hydrodynamics into the delta interior (predation) and entrainment loss at the pumping facilities

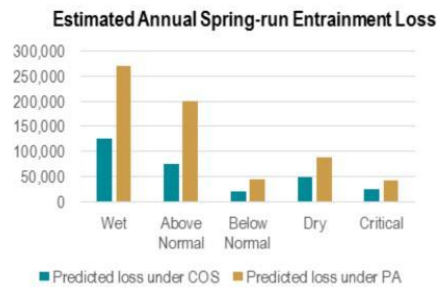
- Effects occur from October through May and most significant for spring-run and steelhead in April and May
- Spring-run
 - April: 162% increase
 - May: 133% increase
- Steelhead
 - April: 165% increase
 - May: 134% increase

Severity of Response: High

Weight of evidence: High

Talking points/areas of concern:

- Higher export levels, increased negative OMR flows
- Effects exacerbated by no South Delta steelhead protection measures



Modeled monthly loss at export facilities

CV spring-run Chinook salmon				
Month	Predicted loss under COS	Predicted loss under PA	PA-COS	% change
October	31	45	15	48
November	0	0	0	--
December	0	0	0	--
January	0	0	0	--
February	879	919	39	4
March	27,504	25,787	-1,717	-6
April	64,198	168,313	104,115	162
May	31,710	74,038	42,328	133
June	1,650	1,657	7	0
July	0	0	0	--
August	0	0	0	--
September	0	0	0	--

CCV steelhead				
Month	Predicted loss under COS	Predicted loss under PA	PA-COS	% change
October	175	260	85	48
November	52	60	9	17
December	167	147	-21	-12
January	5,558	5,927	369	7
February	6,696	6,992	296	4
March	7,197	6,731	-466	-6
April	2,108	5,586	3,478	165
May	1,326	3,109	1,783	134
June	975	982	7	1
July	37	36	0	-1
August	12	12	0	-1
September	17	17	0	2



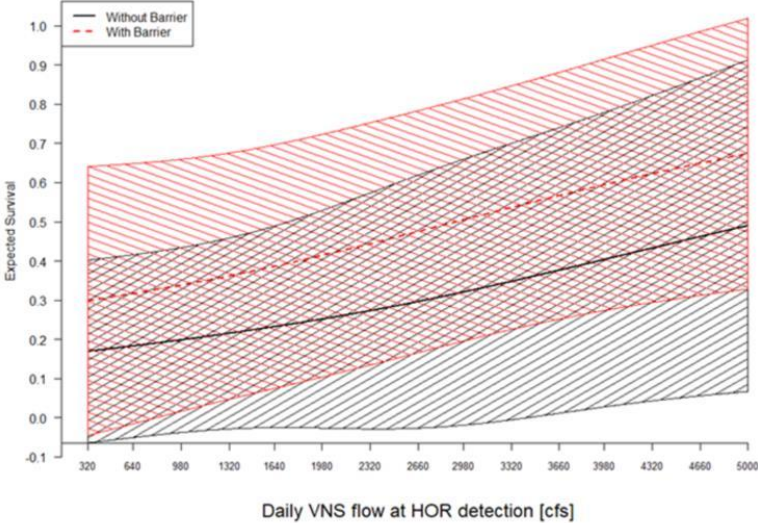
Agricultural Barriers and Head of Old River Barrier (HORB)



Source: November 2018 report "Effect of the South Delta Agricultural Barriers on Emigrating Salmonids"



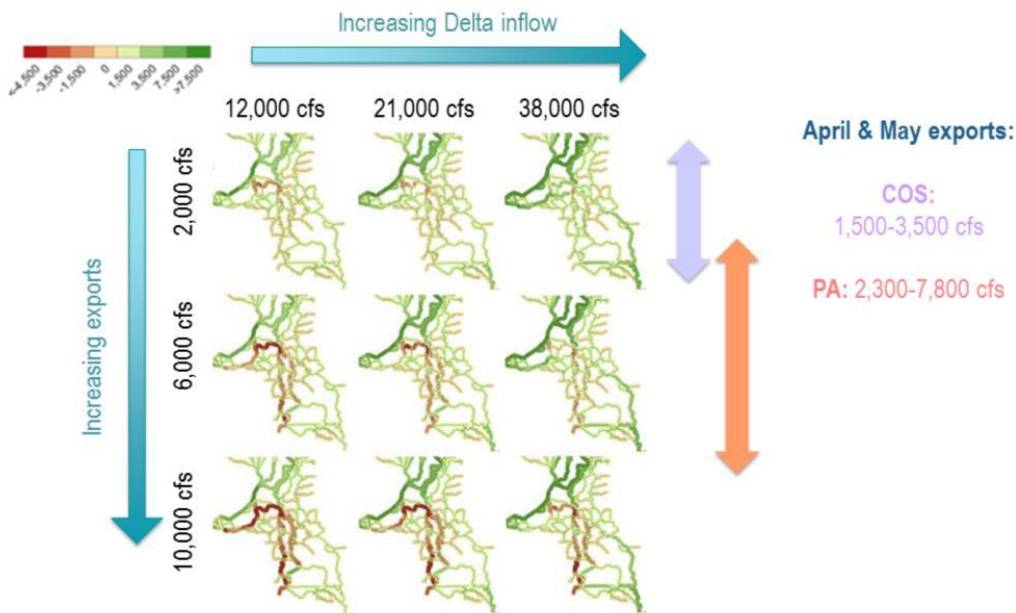
Survival Effects Associated with Head of Old River Barrier (HORB)



Source: Buchanan 2019



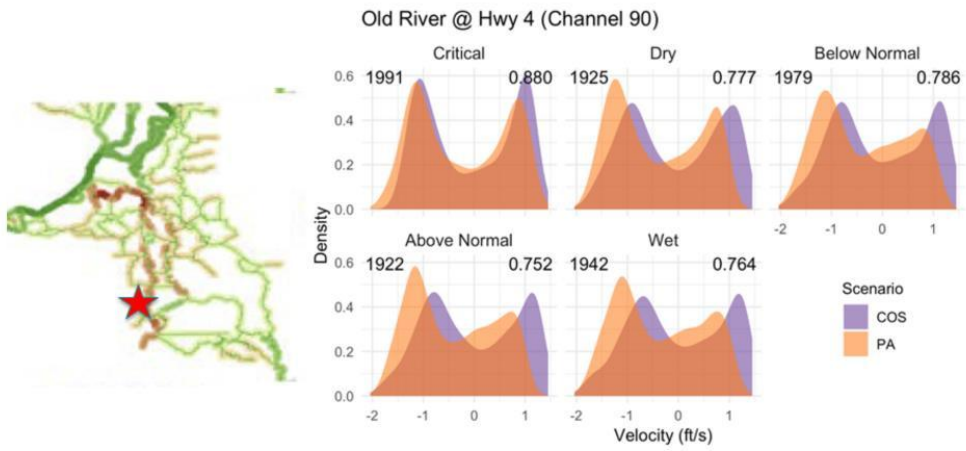
Hydrodynamic Changes in the South Delta under the PA



Source: Modified from Figure 3-2 of CAMT SST Report Volume I



Hydrodynamic Changes in the South Delta under the PA



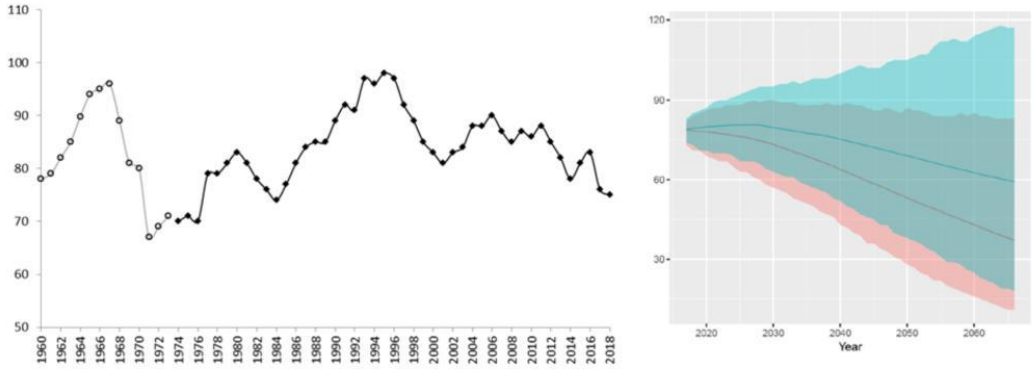
Significant Effects to Individuals: Green Sturgeon

- No Medium to High or Highly Ranked Effects

Delta Uncertainties

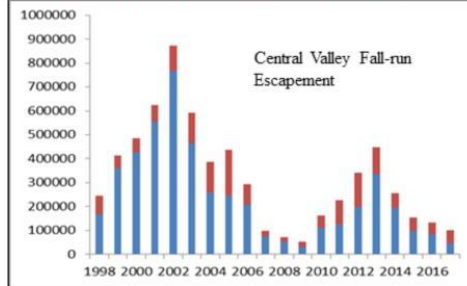
- Lack of trigger thresholds for spring-run and steelhead for the OMR.
- Effectiveness of proposed OMR management actions. Instead of being protective, proposal leads to more risk and loss.
- Impacts of increased April and May export levels. The effects may not be as straightforward as modeled, and may be compounded by the changes in the local hydrodynamics created by the increase in exports.
- Vulnerability of San Joaquin River steelhead to the effects of no I:E ratio, no HORB during the emigration period.
- Many elements of the PA description are vague. 6,000 acres of tidal habitat: we don't know where this will occur, what the success metrics will be, and how we will monitor effectiveness. Also, unclear how "risk assessments" will work for implementing protective actions and how or if NMFS will be involved.

Southern Resident Killer Whales Population



Significant Effects: Southern Resident Killer Whales

- The productivity of CV Chinook salmon, especially the dominant fall-run population, is decreasing.
- There are fewer measures under the PA to minimize the impacts of operations on the non-ESA listed populations.
- The potential benefits of proposed restoration activities that have been proposed are uncertain at this time and most are actually in the Environmental Baseline (previously consulted on)
- Reductions and limitations in the abundance of Chinook available as prey as a result of the PA will increase over time.
- For ESA-listed Chinook salmon ESUs in the Central Valley, we conclude that population level effects for ESA-listed species and critical habitats overall under the PA are significant across multiple VSP parameters, including abundance.



Run	Year type (Sacramento "40-30-30" Index under ELT Q8 hydrology)	Predicted salvage under COS	Predicted salvage under PA	Difference in predicted salvage (PA-COS)
Fall-run	Wet	86,601	130,431	43,830
	Above Normal	32,188	60,387	28,199
	Below Normal	18,241	29,905	11,664
	Dry	27,353	51,330	24,177
Late fall-run	Critical	6,566	11,405	4,839
	Wet	357	351	-6
	Above Normal	312	336	26
	Below Normal	33	38	4
Spring-run	Dry	178	188	11
	Critical	45	50	4
	Wet	42,232	86,606	44,074
	Above Normal	23,057	59,659	36,602
Winter-run	Below Normal	5,814	11,679	5,865
	Dry	13,885	24,118	10,233
	Critical	7,628	12,474	4,845
	Wet	12,417	13,788	1,371
Winter-run	Above Normal	6,369	6,805	437
	Below Normal	5,830	6,812	982
	Dry	4,106	5,070	965
	Critical	1,230	1,702	472

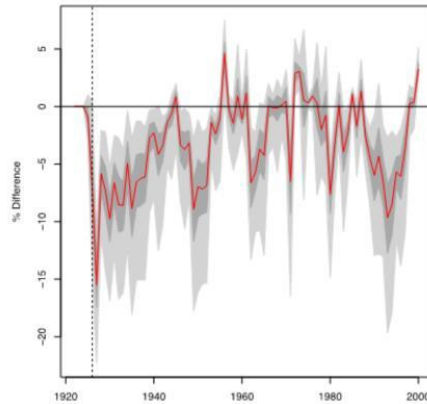


Integration and Synthesis: Winter-run

Key Findings

- One remaining population at high risk
- High level of biological uncertainty
- PA is expected to result in concerning levels of egg mortality:
 - **Tier 1:** 0-6% ~68% of years
 - **Tier 2:** 2-26% ~17% of years
 - **Tier 3:** 7-59% ~7% of years
 - **Tier 4:** 70-93% ~7% of years
- No commitment to stay within a Tier
- No commitment to build Shasta storage
- Entrainment Index 7-38% higher at Delta pumping facilities
- DCC may be open up to an 10 additional days Dec-Jan all years
- LCM shows a 3% reduction in average abundance
- The PA is likely to reduce the abundance and diversity VSP parameters (and habitat quality)

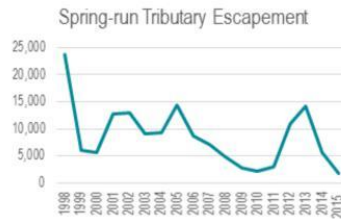
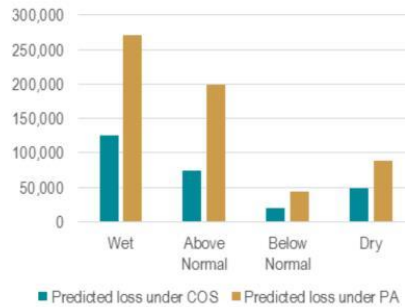
Annual Percent difference in abundance
(PA - COS)/COS x 100%



Integration and Synthesis: Spring-run

Key Findings

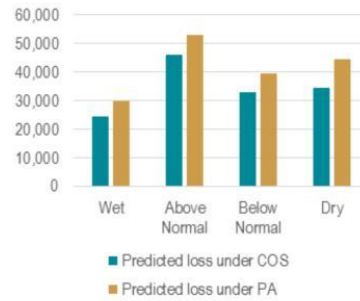
- 2 out of 3 wild populations at high risk, declining trend
- DCC Gates open more frequently (Dec-Jan), increasing entrainment into South Delta
- Modeled Old and Middle River flows (OMR flows) will be approximately 3,500 to 4,000 cfs more negative during April and May in wetter water year types with the elimination of the I:E ratio.
- Clear Creek spawning and holding temperatures often exceeded management approach not current scientific standard.
- OMR flows are modeled to not be positive at any time (monthly average/ exceedance plots).
- PA components are expected to appreciably reduce the abundance and diversity VSP parameters for spring-run populations (and habitat quality).



Integration and Synthesis: Steelhead

Key Findings

- DPS at moderate risk of extinction
- DCC Gates open more frequently (Dec-Jan), increasing entrainment into South Delta
- Modeled Old and Middle River flows (OMR flows) will be approximately 3,500 to 4,000 cfs more negative during April and May in wetter water year types without spring protective measures.
- Differential survival is 20% between HORB in vs. out between 3800cfs-5,000cfs at Vernalis
- OMR flows are modeled to not be positive at any time (monthly average/ exceedance plots).
- OMR flows and steelhead density triggers are not protective of the Southern Sierra Diversity Group
- PA components are expected to appreciably reduce the abundance VSP parameter for steelhead populations of the Sacramento River and San Joaquin River basin



Integration and Synthesis: Green Sturgeon

Key Findings

- Single population at moderate risk
- Green sturgeon presumably have access to suitable spawning and incubation areas on the Sacramento River under all conditions (e.g., droughts)
- Low and medium magnitude impacts from PA and only a small portion of the population are likely to experience mortality or substantial injury
- Overall, the PA is not expected to exert any additional selective pressures on green sturgeon and the diversity VSP parameter of the population is expected to remain unchanged

Integration and Synthesis: SRKW

Key Findings

- Species is at a high risk of extinction
- Recent information indicates that fecundity is low and that the population is expected to decline in the future.
- Chinook salmon are dominant components of available Chinook salmon prey.
- Under the PA, SRKWs will continue to be exposed to a decreasing abundance of CV Chinook salmon during sensitive time period (winter-spring)
- The PA is expected to diminish VSP parameters and increase extinction risk of ESA-listed units.
- The prospect for persistent and escalating risks of reduced survival and reproductive success continuing indefinitely in the future reduce the likelihood of survival and recovery of this species.

	median
Upstream survival compared to COS	0.9995
Delta Survival compared to COS	0.9985
Freshwater change (upstream X Delta)	0.9981
Ocean Adult Abundance (COS)	457345
Ocean Adult Abundance (PA)	456693
Change in median number of Adult Chinook in the Ocean COS to PA	-651.556
Percent abundance change in adult Chinook in the Ocean from COS to PA	-0.14%