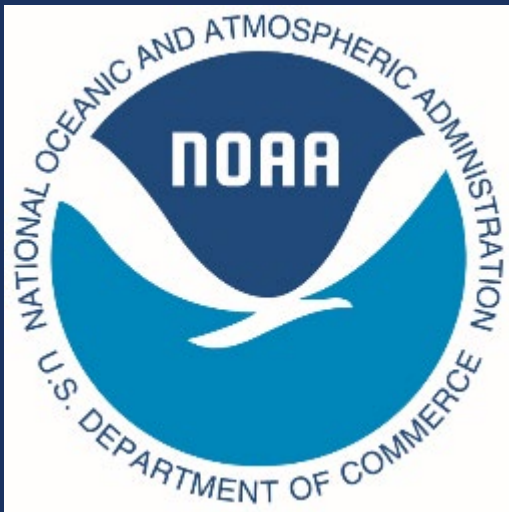
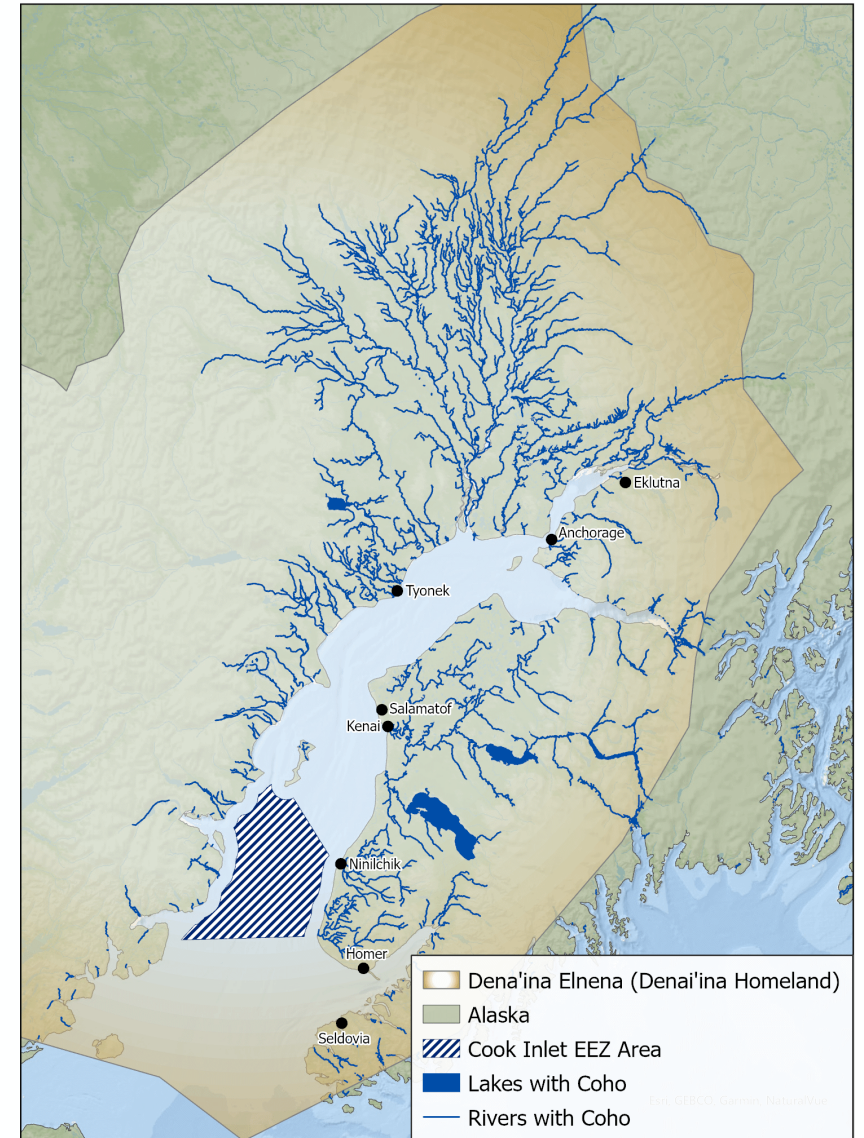


COOK INLET SALMON: SSC REVIEW OF 2024 SAFE



RICH BRENNER NMFS AKRO
LUKAS DEFILIPPO NMFS AFSC
DOUG DUNCAN NMFS AKRO
JOSH RUSSELL NMFS AFSC
GRETCHEN HARRINGTON, ARA, NMFS AKRO
ADAM ZALESKI NMFS AKRO

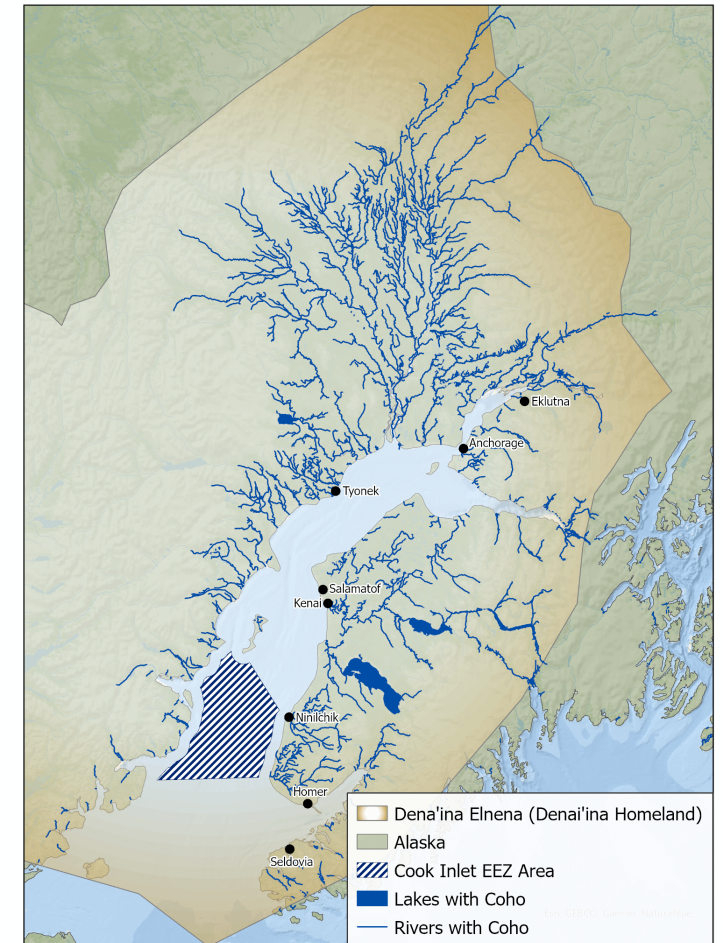
19 January 2024



THE ENVIRONMENTAL ASSESSMENT AND REGULATORY IMPACT REVIEW (EA/RIR ANALYSIS)

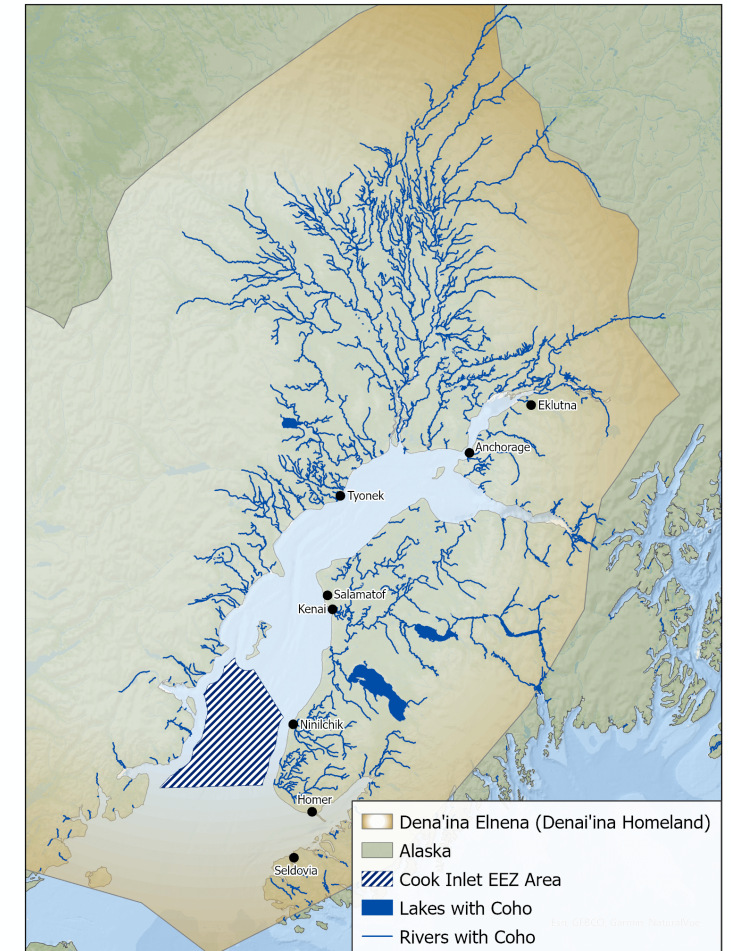
- Socio-Economic Analysis
- Description of methods, estimates, and assumptions
- Incorporated by reference into 2024 SAFE
- Presented to the SSC, AP, and Council in April 2023

- Methods previous presentations to the SSC (2019)



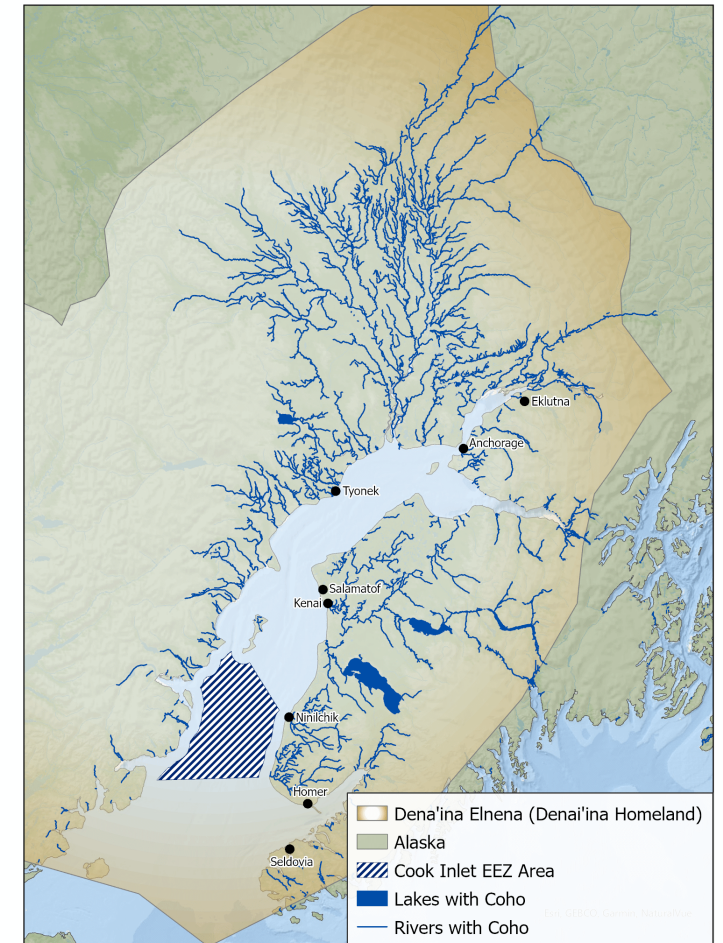
OVERVIEW

- Salmon stocks considered in this SAFE
- Stock Definitions
- Status Determination Criteria (SDC)
- Tier System and associated methods
- Stock Status Summaries
- Recommendations to the SSC
- Considerations for TAC (Council)

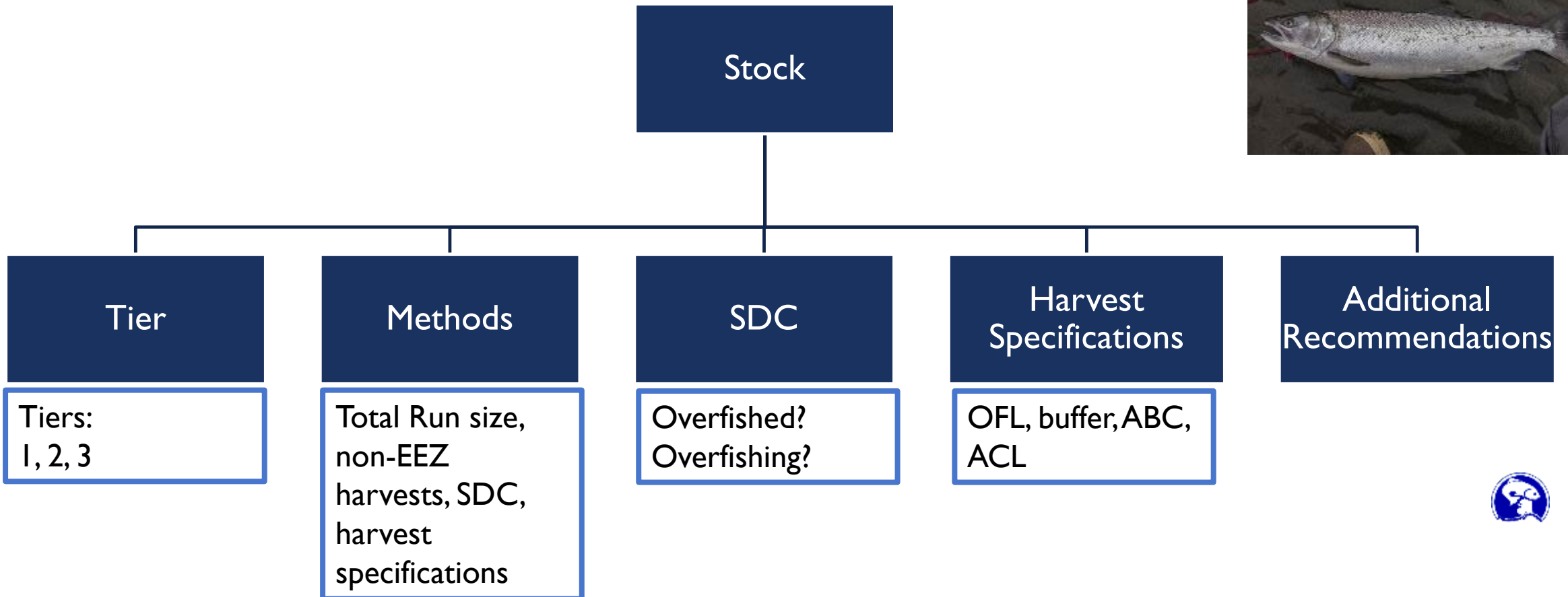


OVERVIEW

- SAFE goal: provide information needed to manage the Federal salmon fisheries in the Cook Inlet EEZ Area
 - recommend harvest specifications, and
 - prevent overfishing.
- Presentation goal: Explain SDC and harvest specification recommendations through the stock assessments.

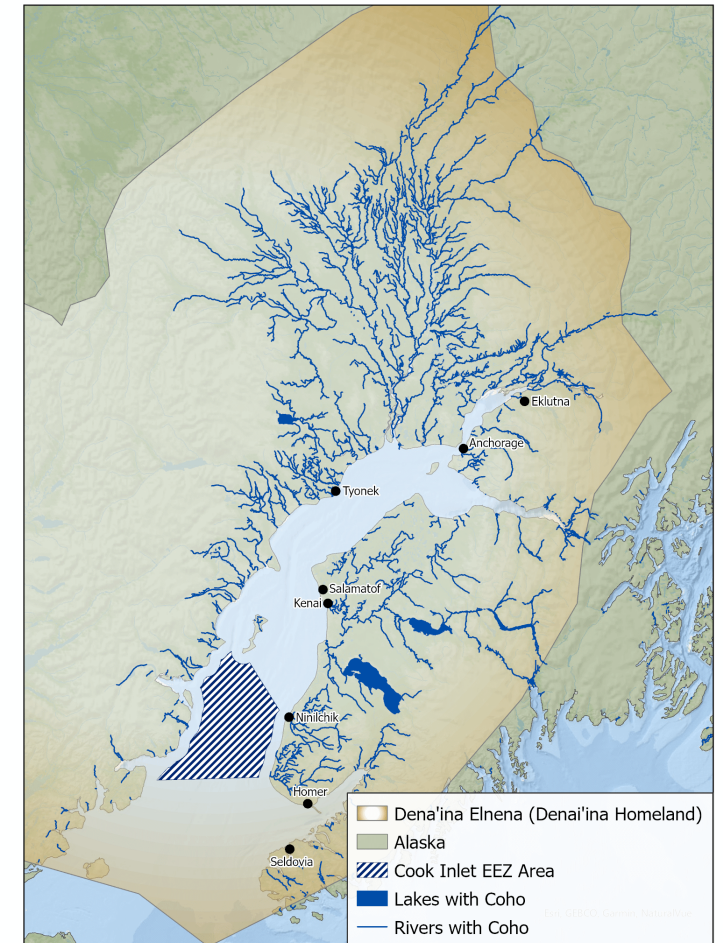


OVERVIEW: FOCUS ON ASSESSMENTS OF INDIVIDUAL STOCKS



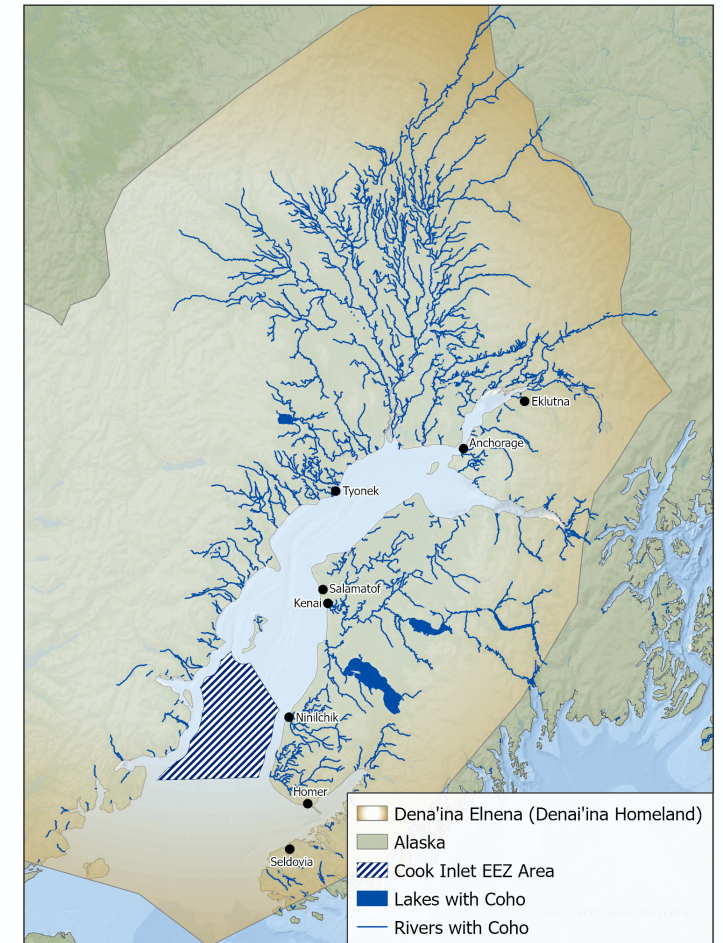
SALMON STOCKS CONSIDERED FOR THE 2024 COOK INLET EEZ AREA SAFE

- History of EEZ harvests:
 - Genetics, tagging studies, coded wire tags, scale pattern analysis, etc.
- For EEZ harvests.
 - Can SDC/harvest specs. be assessed postseason?
- Existing preseason forecasts.
- State of Alaska escapement goals



CONSIDERING SALMON STOCKS FOR THE COOK INLET EEZ AREA SALMON FISHERY

- Stocks considered:
 - Similar to those previously presented to Council
 - ~Match level of detail (aggregation) ADF&G UCI commercial salmon forecast:
 - Kenai sockeye, Kasilof sockeye: sibling forecasts
 - Susitna/Other sockeye: return/spawner or average return #
 - Chinook, coho, chum, and pink salmon: 5-year averages



INTRODUCTION: STOCKS CONSIDERED IN THE SAFE

Stocks Considered

Kenai River Late Run Sockeye Salmon (KNSOCK)

Kasilof River Sockeye Salmon (KASOCK)

Aggregate Other Sockeye Salmon (AOSOCK)

Kenai River Late-Run Large Chinook salmon (KCHIN)

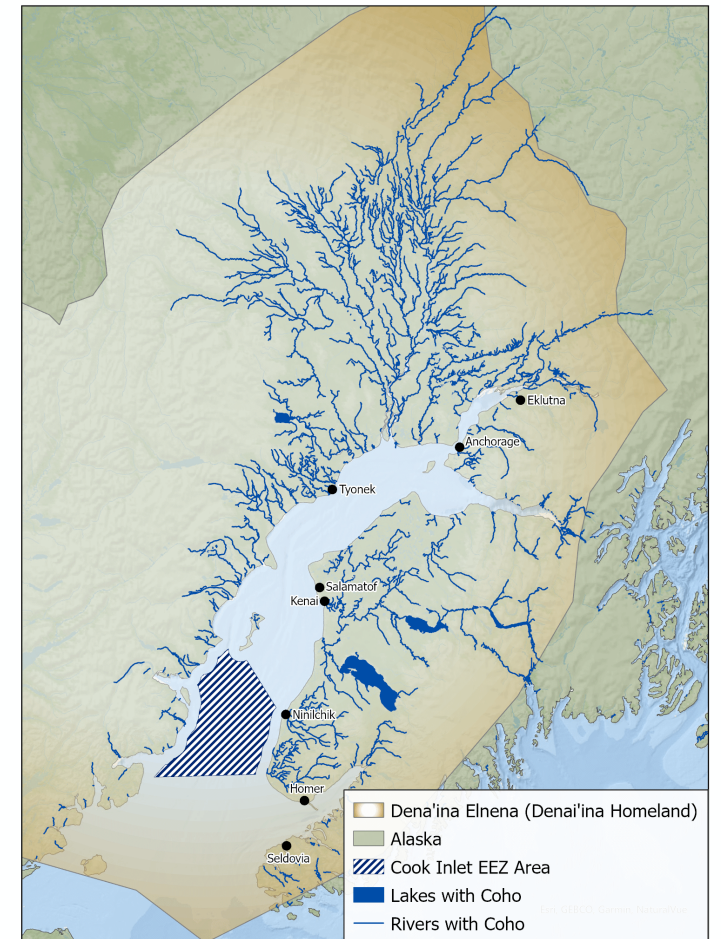
Aggregate Other Chinook Salmon (AOCHIN)

Aggregate Chinook Salmon (ACHIN)

Aggregate Coho Salmon (COHO)

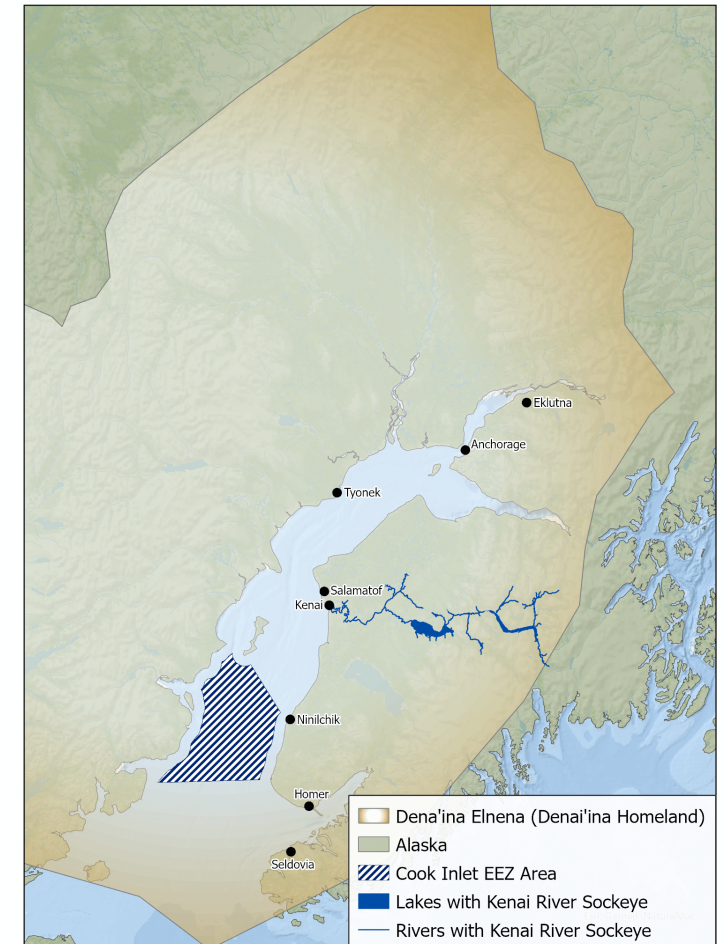
Aggregate Chum Salmon (CHUM)

Aggregate Pink Salmon (PINK)



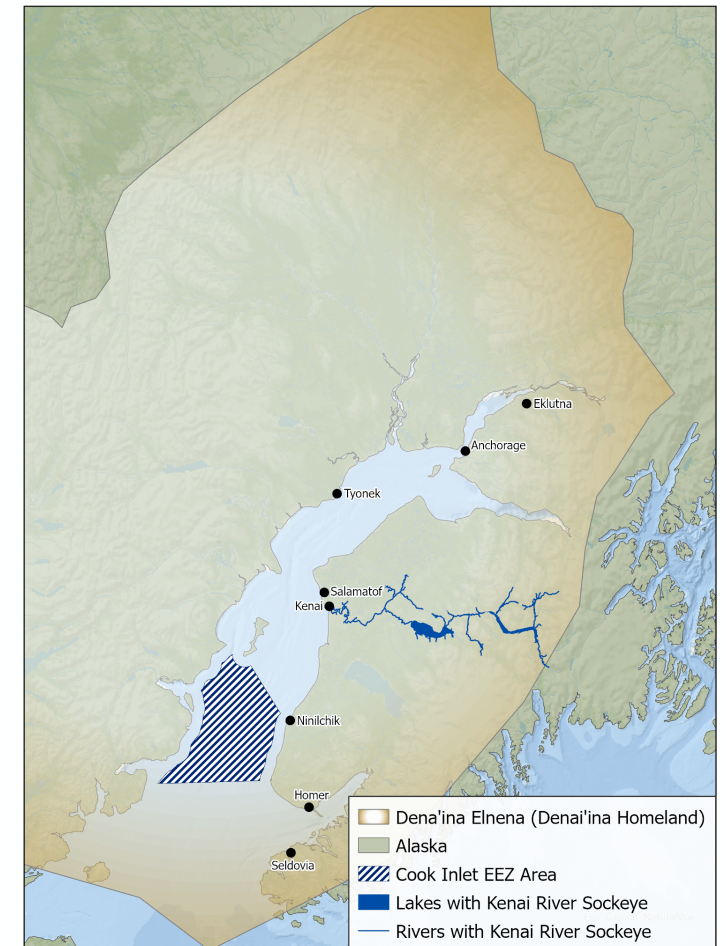
KENAI LATE-RUN SOCKEYE SALMON: STOCK DEFINITION

- Federal definition = same as State of Alaska (SOA):
 - Spawning escapement goal (750K – 1.3M).
 - ADF&G harvest, genetic stock composition, and escapement data.



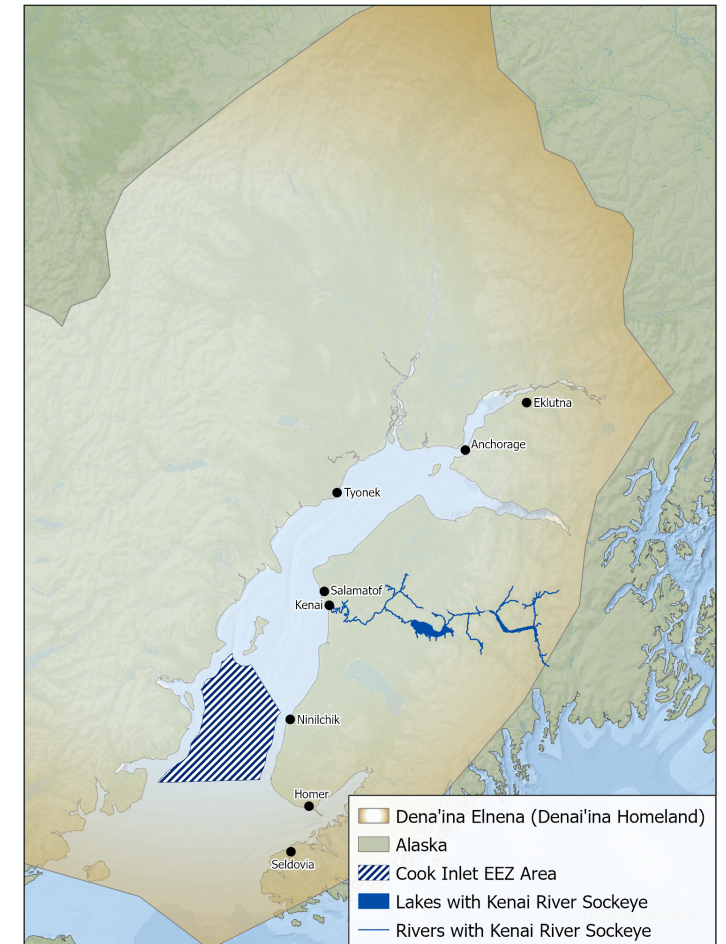
KENAI LATE-RUN SOCKEYE SALMON: AVAILABLE DATA

- Escapement goal and escapements
- Harvest estimates for all components: commercial, recreational, personal use
- Age estimates for all components: harvest + escapement
- Brood tables
- Spawner-recruitment estimates
- Sibling model-based preseason forecasts
- An easy call for tier placement.....



KENAI LATE-RUN SOCKEYE SALMON: TIER I

- Tier I = a stock with an escapement goal
- But, Tier I SDC and harvest specifications also requires:
 - postseason total run size estimate
 - Stock-specific harvests: commercial + recreational + personal use
 - Preseason forecast of total run size



KENAI LATE-RUN SOCKEYE SALMON STATUS DETERMINATION CRITERIA: (SDC) OVERFISHED STATUS

Tier I. Overfished status assessed via:

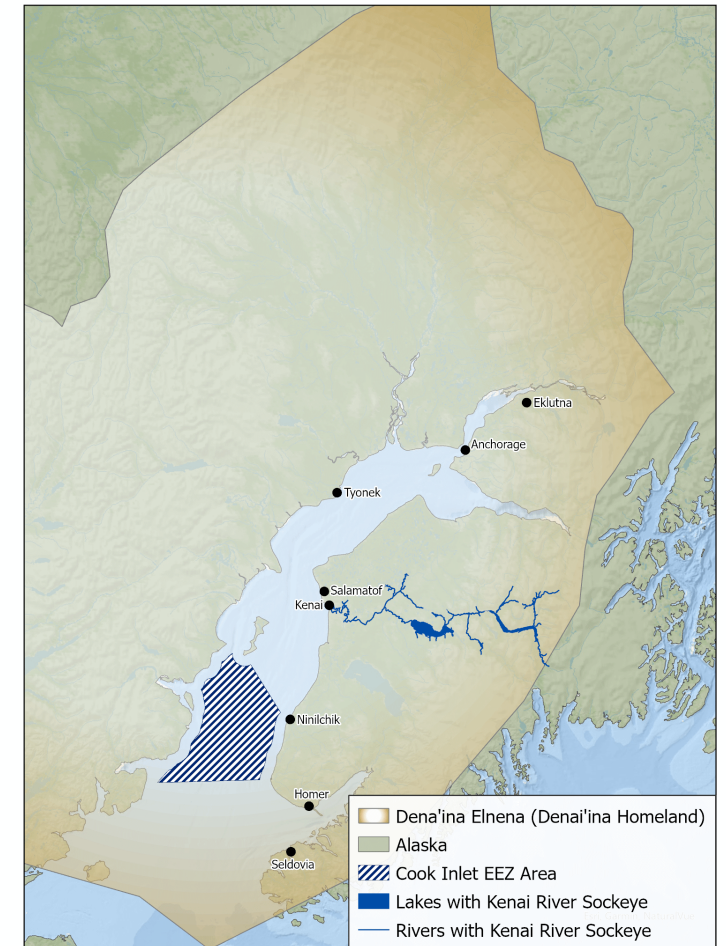
Cumulative Escapement:

Sum of actual escapements for most recent generation(5yrs)

VS.

MSST, minimum stock size threshold:

Sum of escapement goal for generation/2

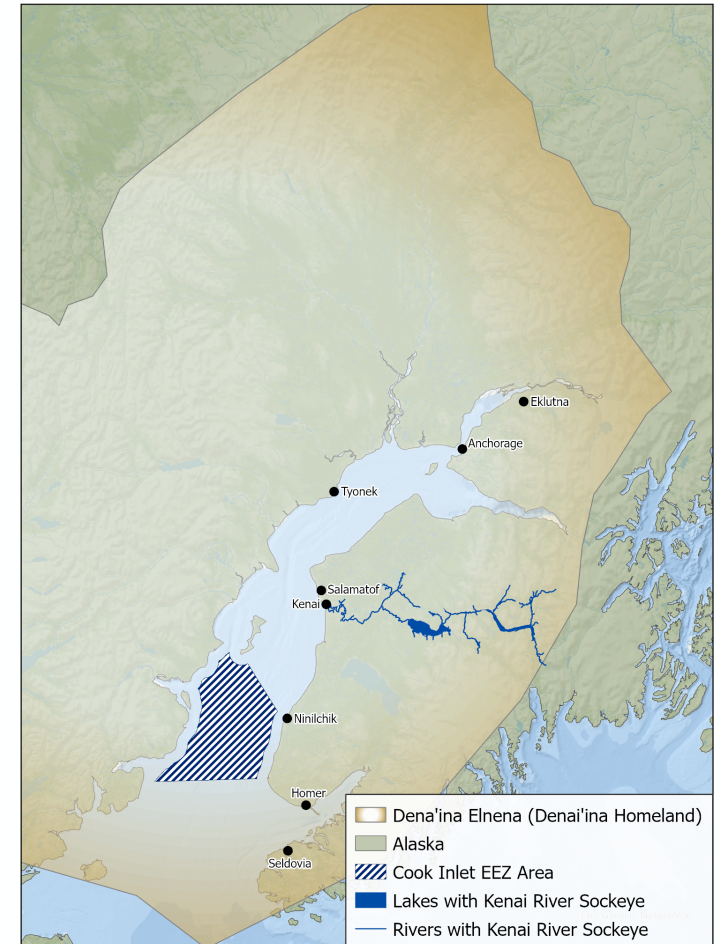


KENAI LATE-RUN SOCKEYE SALMON: STATUS DETERMINATION CRITERIA: OVERFISHED STATUS

$$\text{Cumulative escapement} = \sum_{i=t-T+1}^t S_i$$

VS.

$$MSST_t = \frac{\sum_{i=t-T+1}^t G_i}{2}$$



KENAI LATE-RUN SOCKEYE SALMON: STATUS DETERMINATION CRITERIA: OVERFISHING STATUS

Tier I, Overfishing status assessed via:

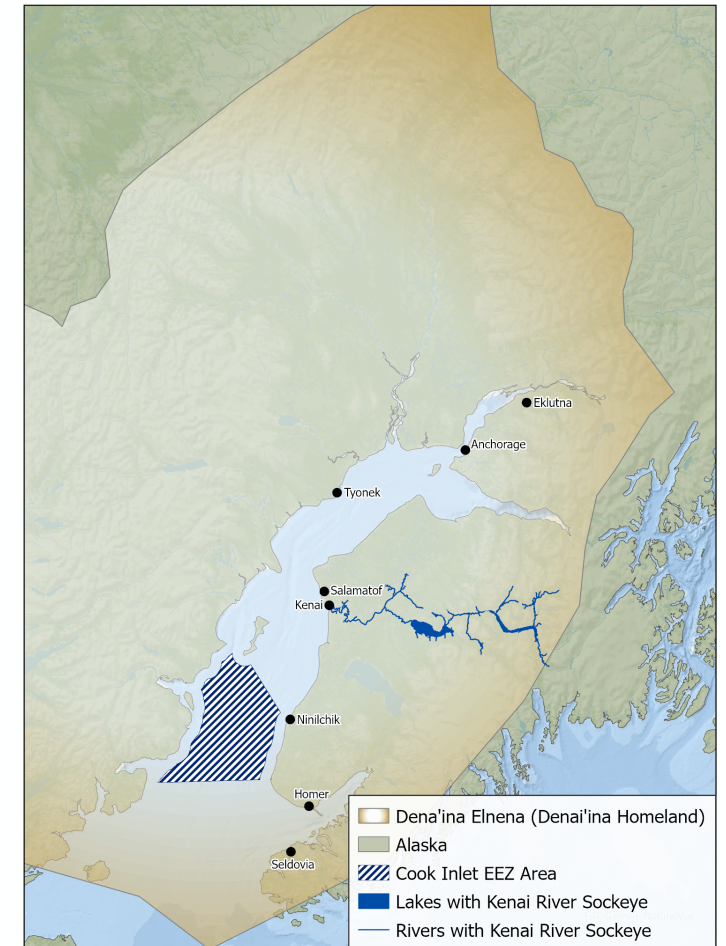
F_{EEZ}:

Actual EEZ harvest rate for most recent generation

VS.

MFMT:

Maximum fishing mortality threshold (max potential EEZ harvest rate while still achieving escapement goal and State harvests)



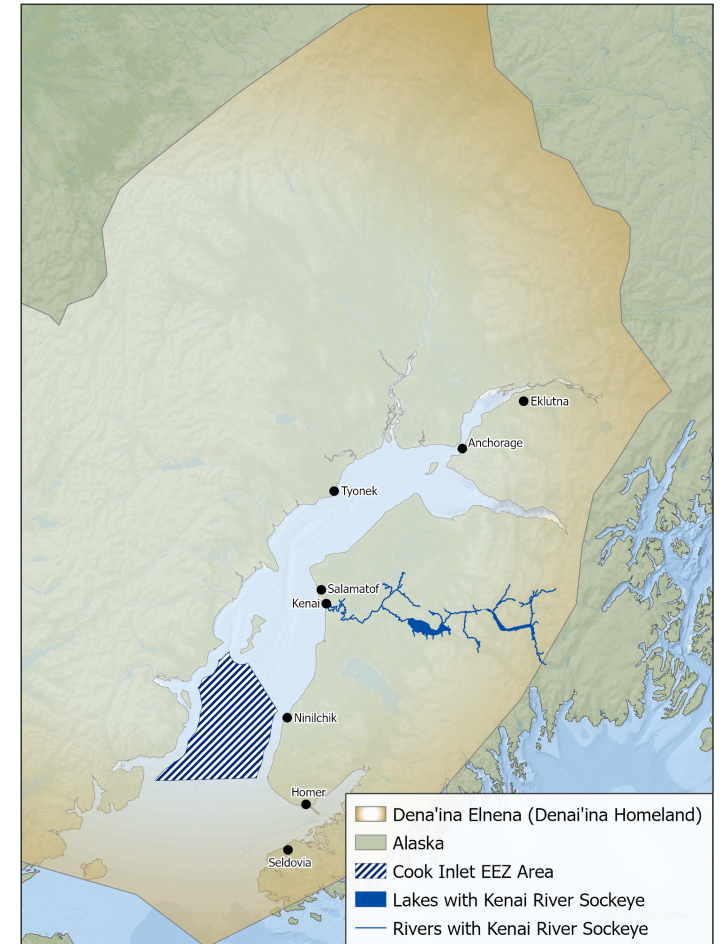
KENAI LATE-RUN SOCKEYE SALMON: STATUS DETERMINATION CRITERIA: OVERFISHING STATUS

$$F_{EEZ,t} = \frac{\sum_{i=t-T+1}^t C_{EEZ,i}}{\sum_{i=t-T+1}^t R_i}$$

VS.

$$MFMT_t = \frac{\sum_{i=t-T+1}^t Y_{EEZ,i}}{\sum_{i=t-T+1}^t R_i}$$

where, $Y_{EEZ,i} = \max(0, R_t - G_t - C_{state,t})$



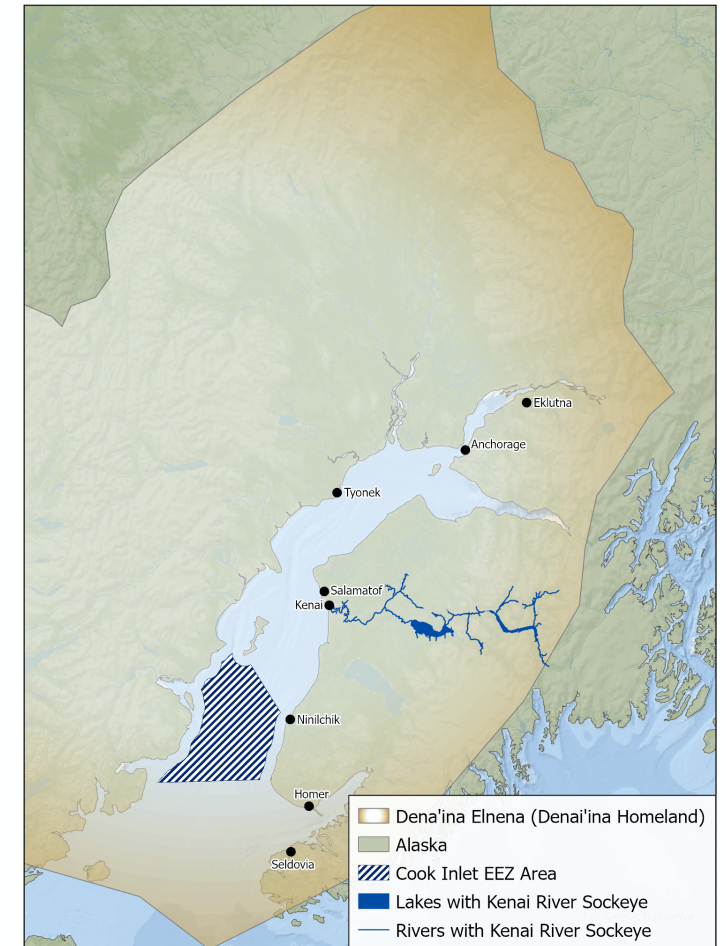
KENAI LATE-RUN SOCKEYE SALMON: MAX EEZ YIELD = PRESEASON OFL (OFL_{PRE}):

Postseason (numerator of MFMT calculation):

$$Y_{EEZ,i} = \max(0, R_t - G_t - C_{state,t})$$

Preseason the OFL_{PRE} :

$$\hat{Y}_{EEZ,t} = \max(0, \hat{R}_t - G_t - \bar{F}_{state,t} * \hat{R}_t)$$



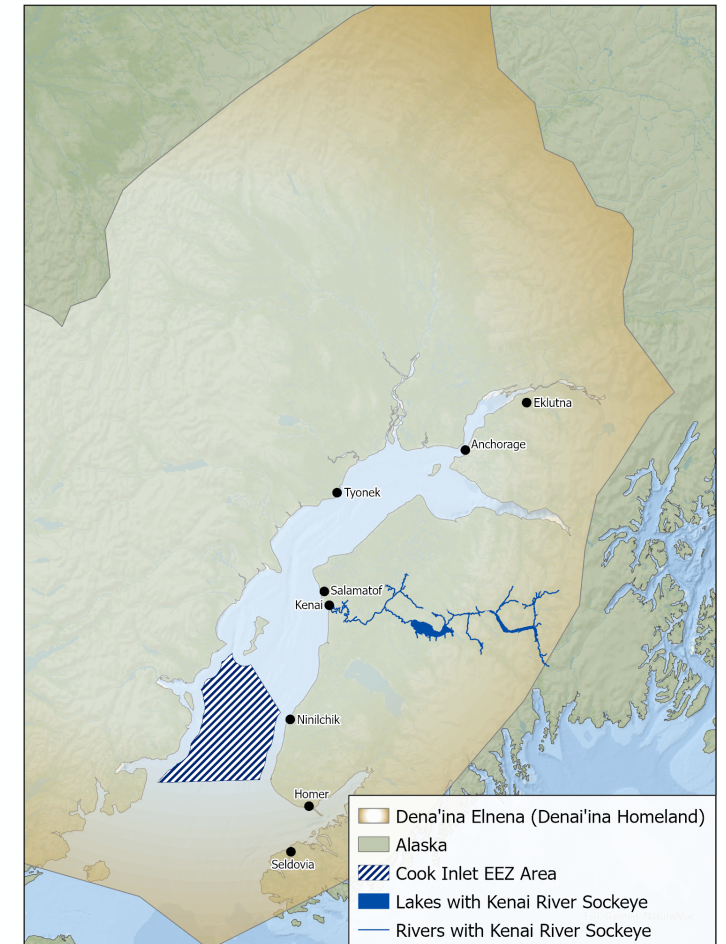
KENAI LATE-RUN SOCKEYE SALMON: THE PRESEASON MODEL

Preseason overfishing limit, OFL_{PRE} :

- OFL_{PRE} = Maximum potential harvest in the EEZ while still meeting escapement goal + likely State harvests.

Acceptable biological catch, ABC:

- $ABC = OFL_{PRE} \times$ a buffer to account for uncertainty in forecast of run size and likely State harvests.



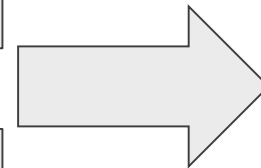
PRESEASON MODELS AND OFL → ABC BUFFER DETERMINATION

Preseason forecasts

Preseason state harvest forecast

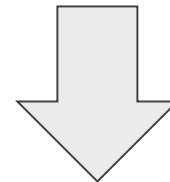
Preseason run size forecast

ARIMA models



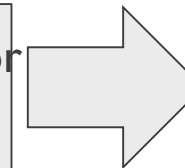
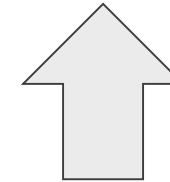
Preseason OFL determination

Preseason OFL



Buffer estimation

Buffer factor (b)



Preseason ABC determination

Preseason ABC

Retrospective % error
 $OFL_{preseason} / OFL_{postseason}$

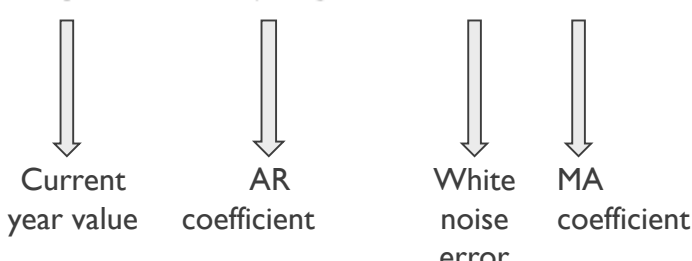


PRESEASON MODELS

- $\text{arima}(p,q) \rightarrow$ p is the order of the autoregressive component and q is the order of the moving average component
 - 'AR' linearly relates the current value of the series to its past values.
 - 'MA' linearly relates the current value of the series to past errors
 - Difference the time-series to induce stationarity as needed

• $\text{arma}(1,1) \rightarrow$

$$\eta_t = \phi_1 \eta_{t-1} + e_t + \theta_1 e_{t-1}$$



Current year value AR coefficient White noise error MA coefficient

- Select optimal orders for AR, MA and differencing using Hyndman-Khandakar algorithm via the `auto.arima()` function of the *forecast* package in R



OFL → ABC BUFFER DETERMINATION

- Use retrospective error in preseason predictions of OFL to determine OFL → ABC buffer (b)
- Integrates forecast error in both run size and state harvest
- Retrospective percent error in preseason OFL relative to postseason OFL calculated via median symmetric accuracy (MSA; Morley et al., 2018):

$$MSA = 100(\exp(\text{median}(|\log(\frac{OFL_{preseason,t} = \hat{Y}_{EEZ,t}}{OFL_{postseason,t} = Y_{EEZ,t}})|))) - 1)$$

$$b = \max(\frac{100 - MSA}{100}, 0.1)$$

$$ABC = OFL * b$$



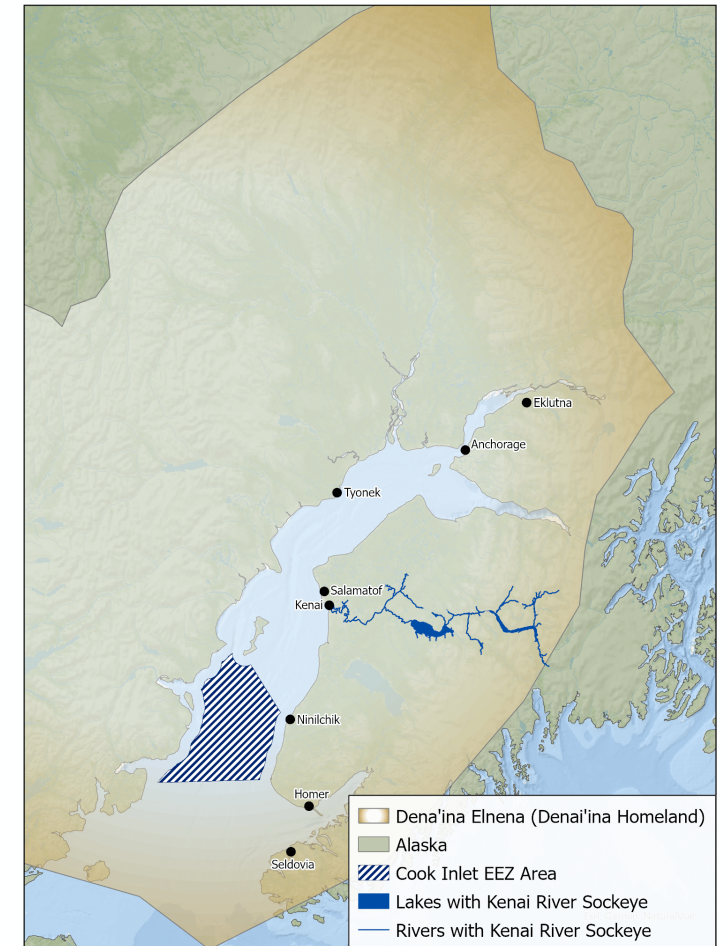
KENAI LATE-RUN SOCKEYE SALMON: SPAWNER-RECRUITMENT CHARACTERISTICS & CALCULATED YIELD.

Considerations for the spawner-recruitment characteristics of Kenai Late Run Sockeye Salmon and defining yield in the EEZ.....

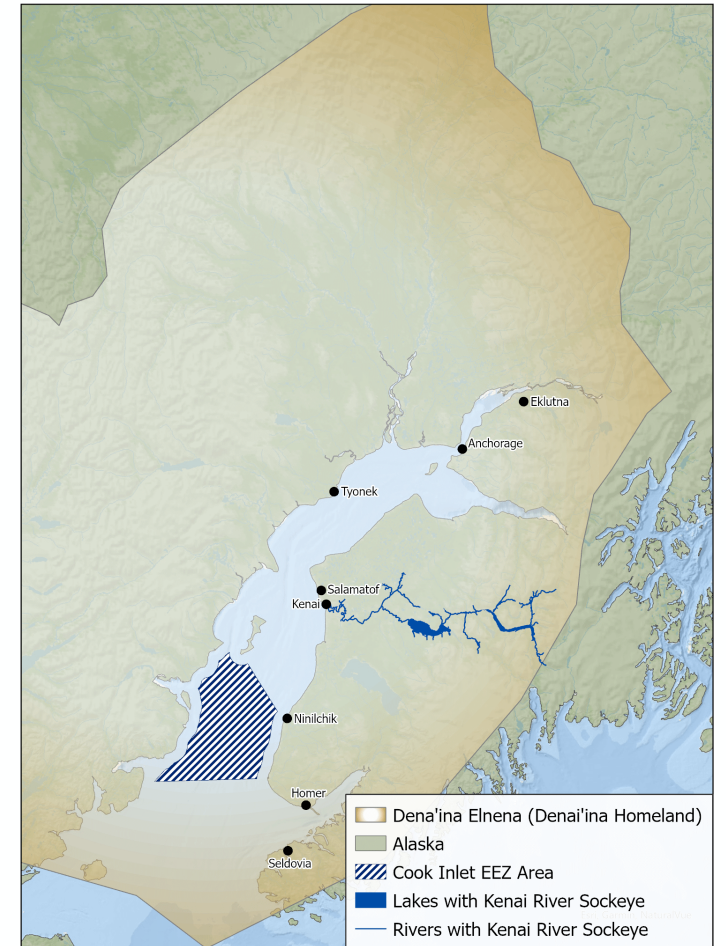
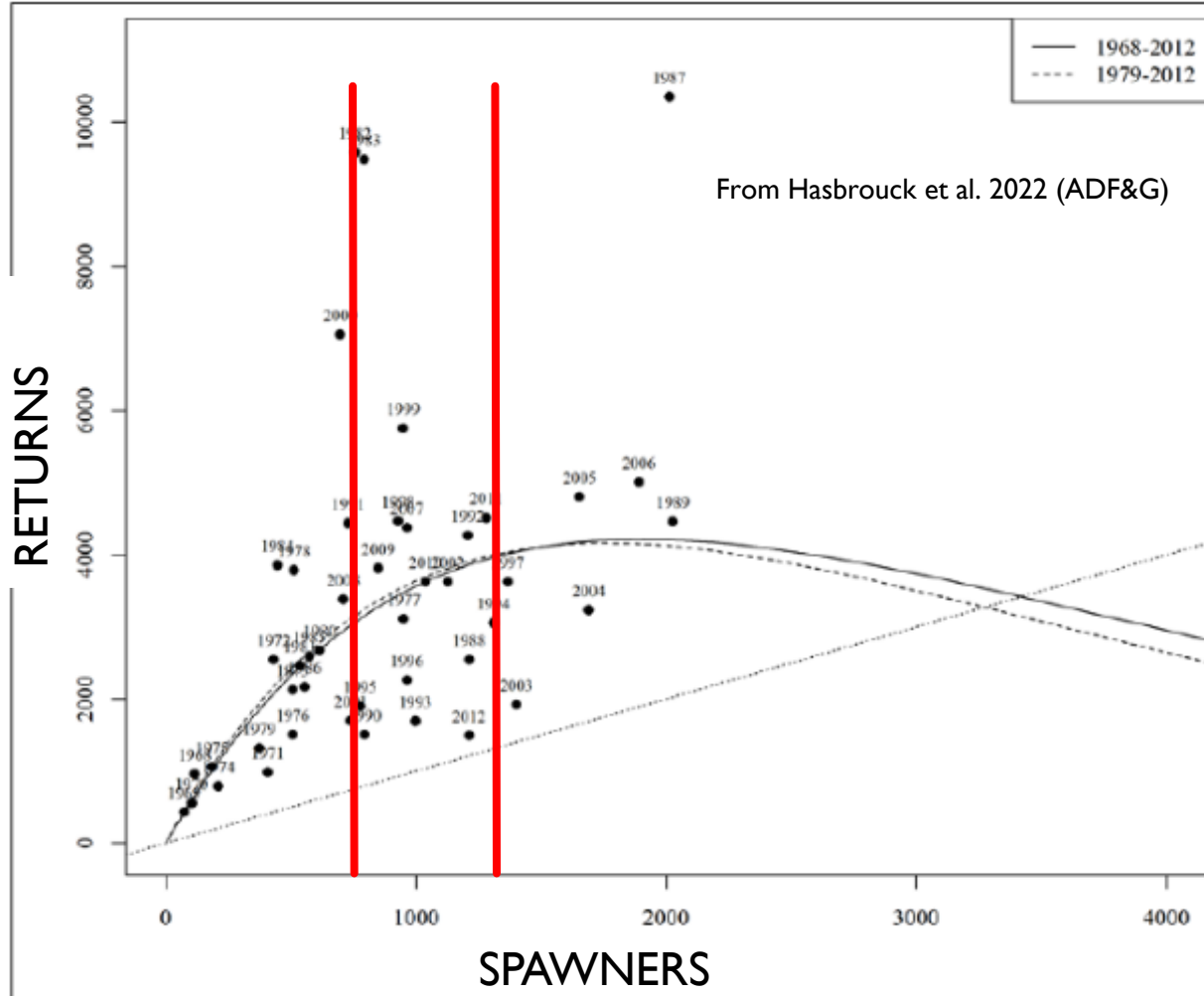
$$MFMT_t = \frac{\sum_{i=t-T+1}^t Y_{EEZ,i}}{\sum_{i=t-T+1}^t R_i}$$

where, $Y_{EEZ,i} = \max(0, R_t - G_t - C_{state,t})$

$\hat{Y}_{EEZ,t} = \max(0, \hat{R}_t - G_t - \bar{F}_{state,t} * \hat{R}_t)$

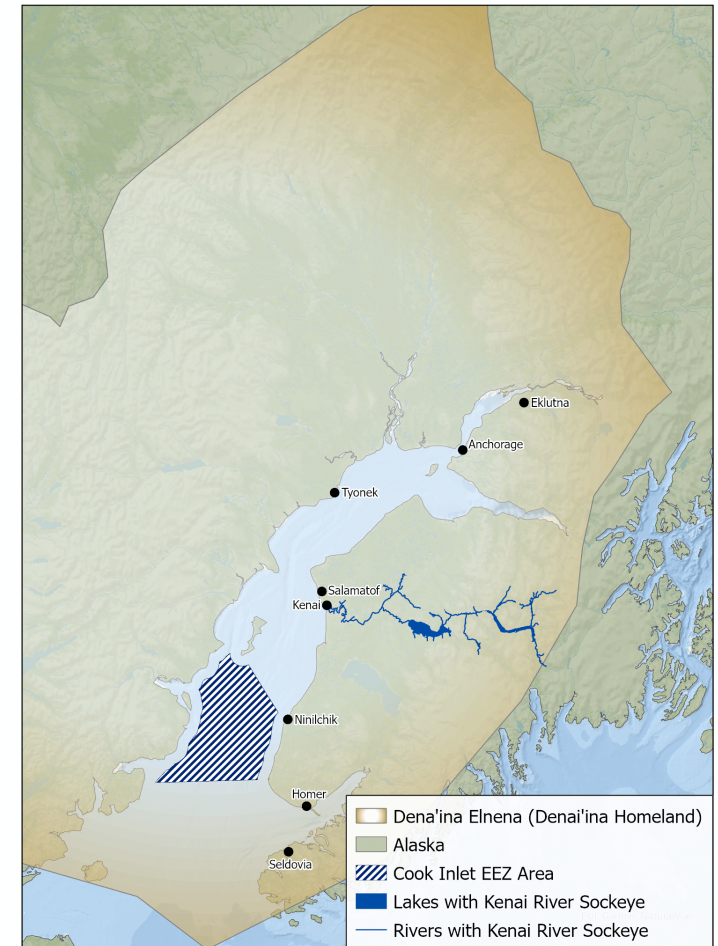
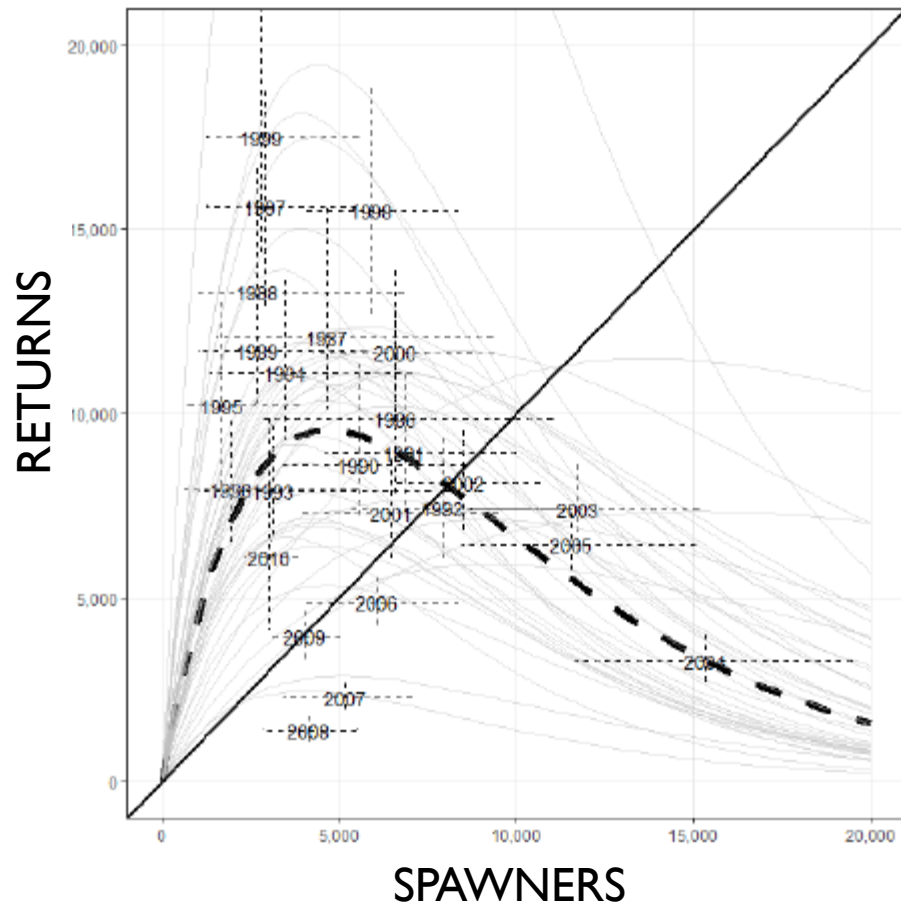


KENAI LATE-RUN SOCKEYE SALMON: THE SPAWNER-RECRUITMENT RELATIONSHIP (RICKER MODEL)

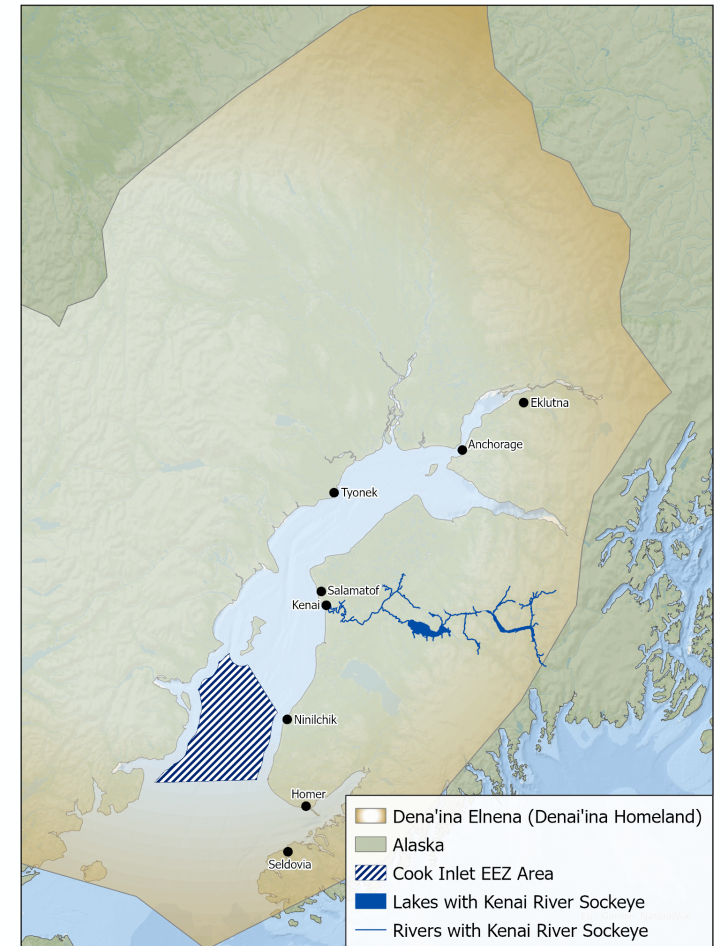
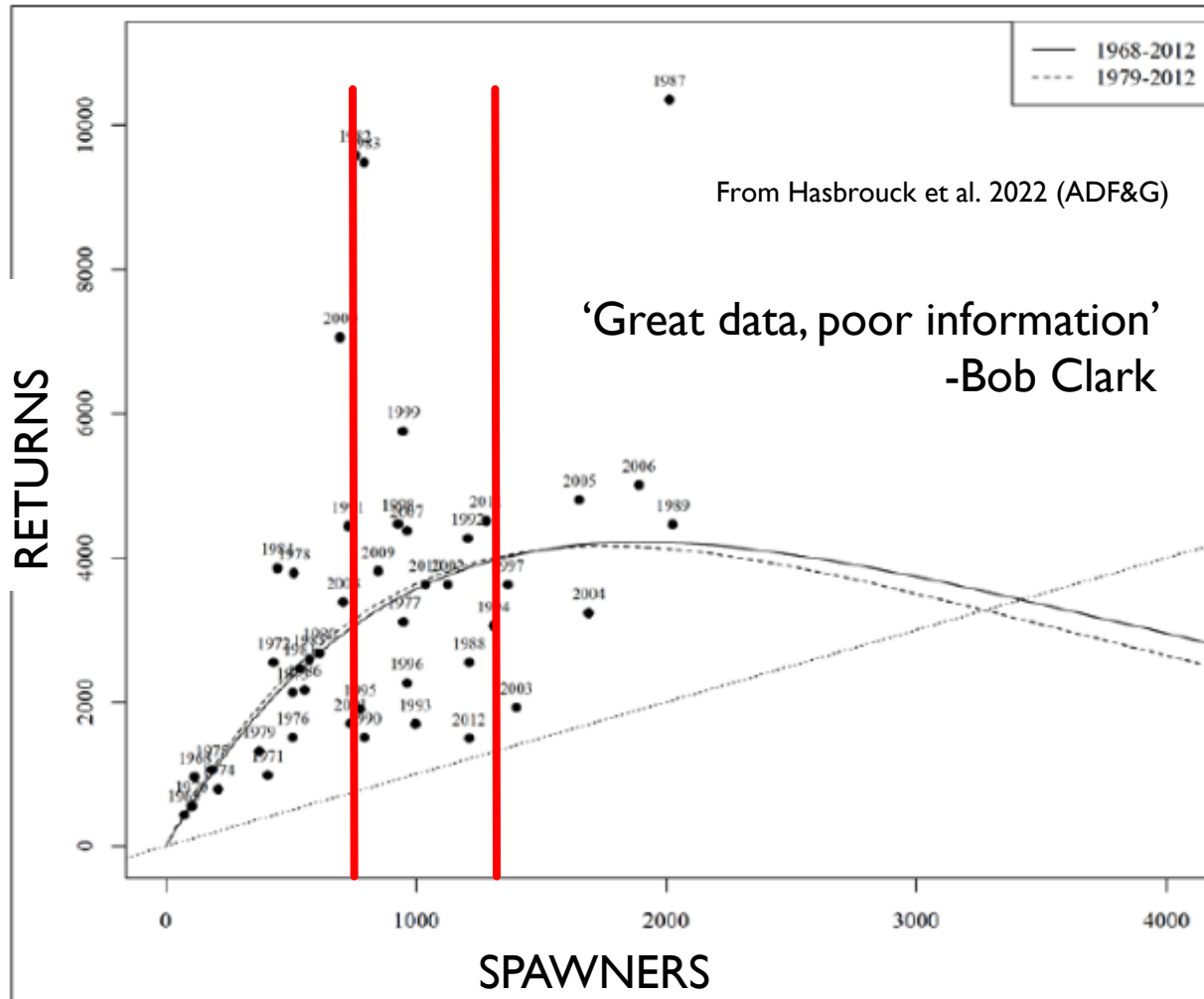


WHAT A RICKER MODEL CURVE IS SUPPOSED TO LOOK LIKE!!

From Fleischman and Reimer, 2017 (ADF&G)

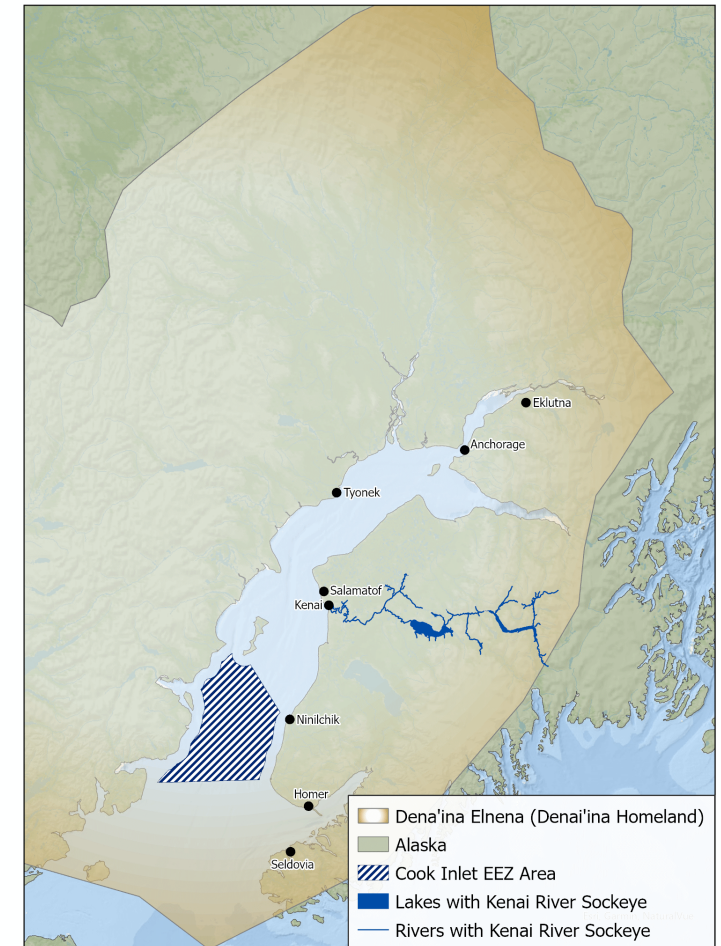


KENAI LATE-RUN SOCKEYE SALMON: ALWAYS WINNING!.....SO FAR

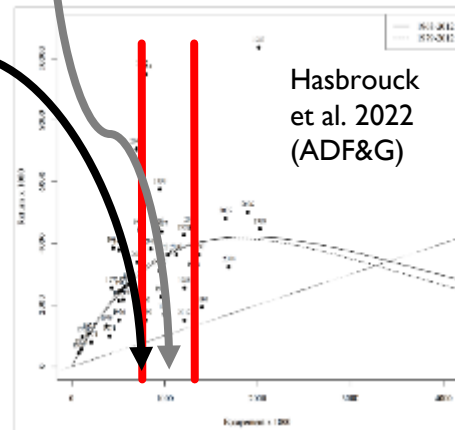
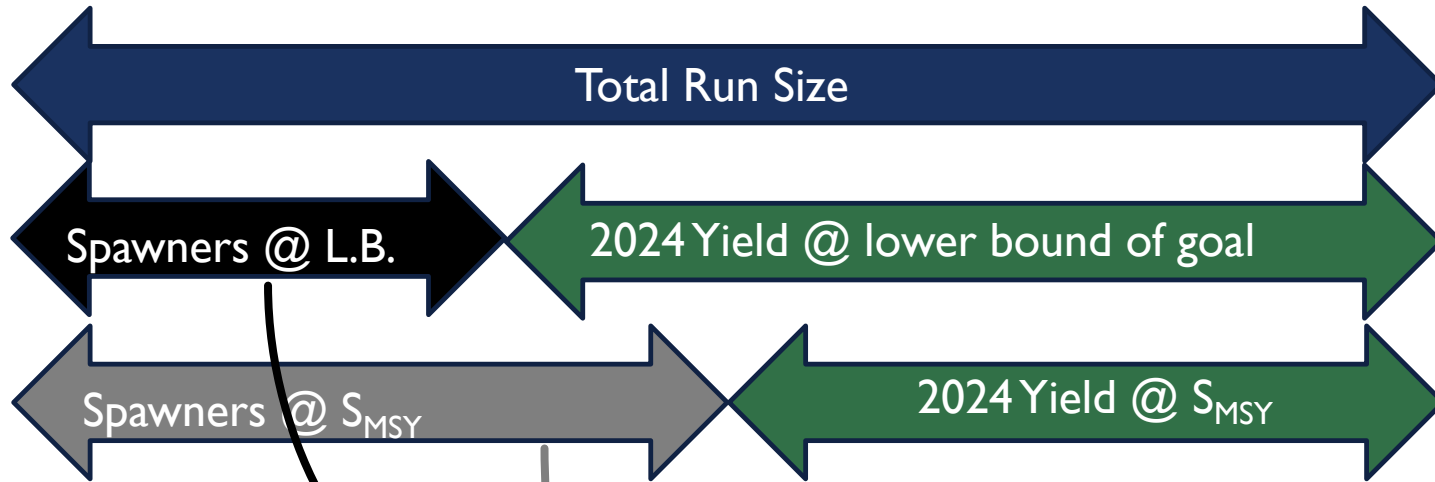


KENAI LATE-RUN SOCKEYE SALMON: UNDEFINED CURVE = UNCERTAINTY IN DEFINING YIELD

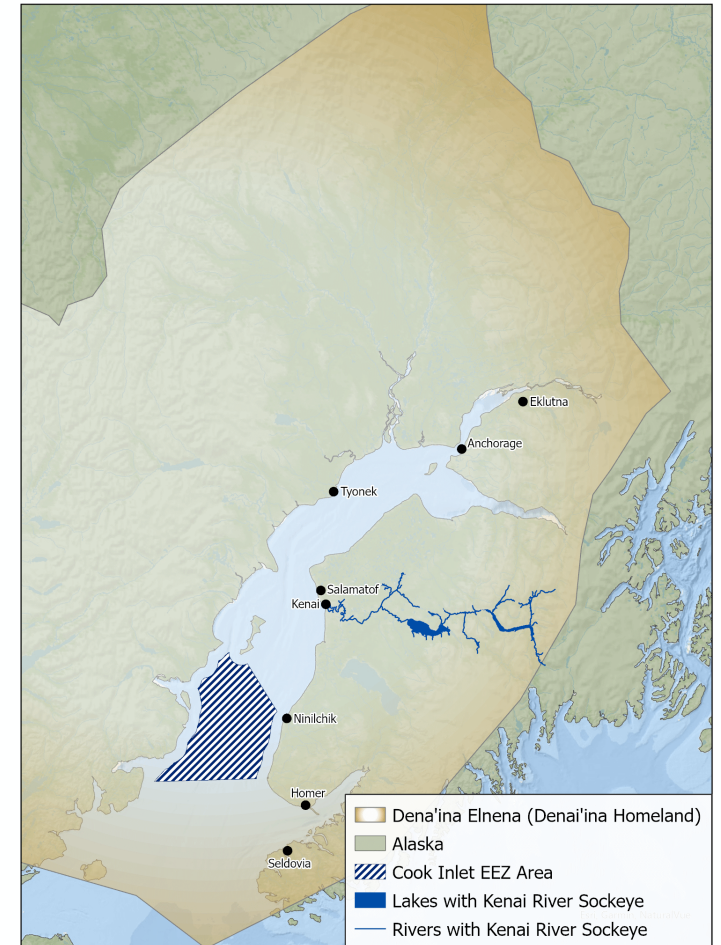
- Preseason and postseason estimates of potential EEZ yield based on total run size minus lower bound of escapement goal.
- Lower bound of goal is very reasonable metric BUT.....
- Uncertainty in spawner-recruitment relationship due to undefined density dependence characteristics = uncertainty in # spawners to maximize yield.



LOWER BOUND OF GOAL: MORE HARVEST NOW, BUT IN THE FUTURE???



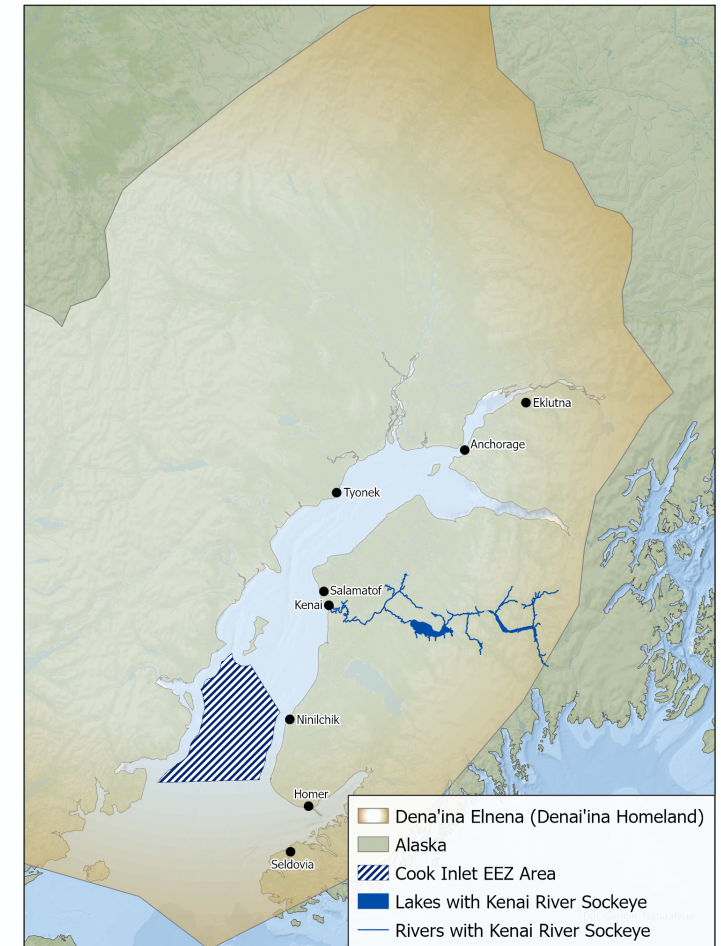
What about future yield?



KENAI LATE-RUN SOCKEYE SALMON: METHOD RECOMMENDATION

After all that talking.....

- Recommendation: Use the lower bound of the goal to assess yield for 2024. Consider additional methods in future simulation analyses.



KENAI LATE-RUN SOCKEYE SALMON: TIER I STOCK STATUS, PROJECTIONS, AND RECOMMENDATIONS

Year	Overfished? No		Tier I Overfishing? No		Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC
	MSST	Cum. Escap.	MFMT	F _{EEZ}					
2019	1,750	5,935	0.24	0.08	3,542	252	1,189		
2020	1,775	6,041	0.25	0.07	2,394	50	1,001		
2021	1,800	7,163	0.31	0.06	3,992	256	857		
2022	1,825	7,355	0.33	0.07	2,682	332	987		
2023	1,850	8,561	0.37	0.08	3,882	418	1,308		
2024	1,875		0.40	0.15	3,485		1,056	1,364	652

Postseason estimates

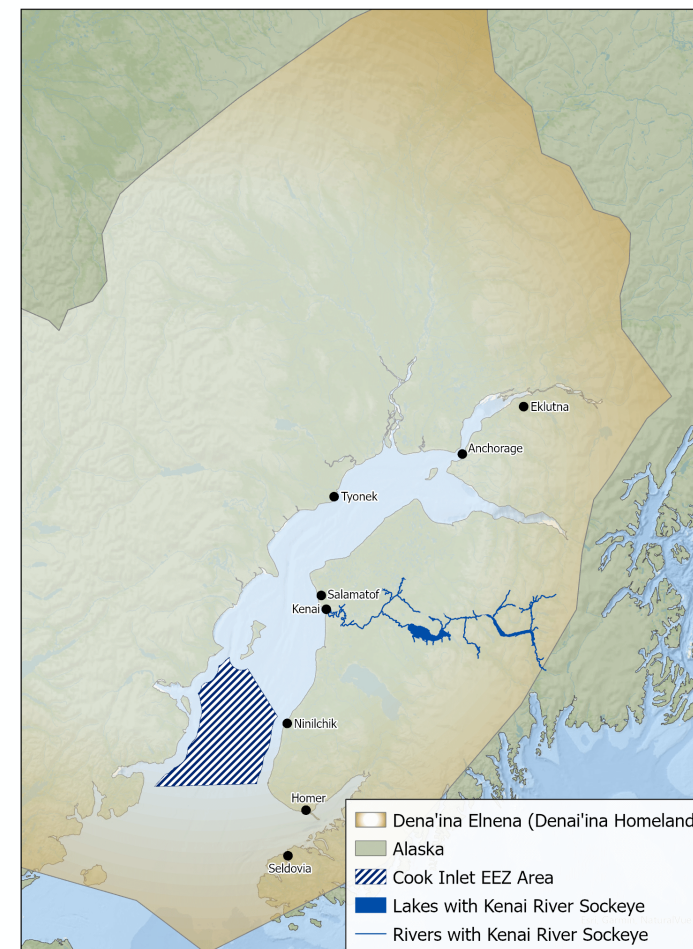
Preseason projections

1,364 652

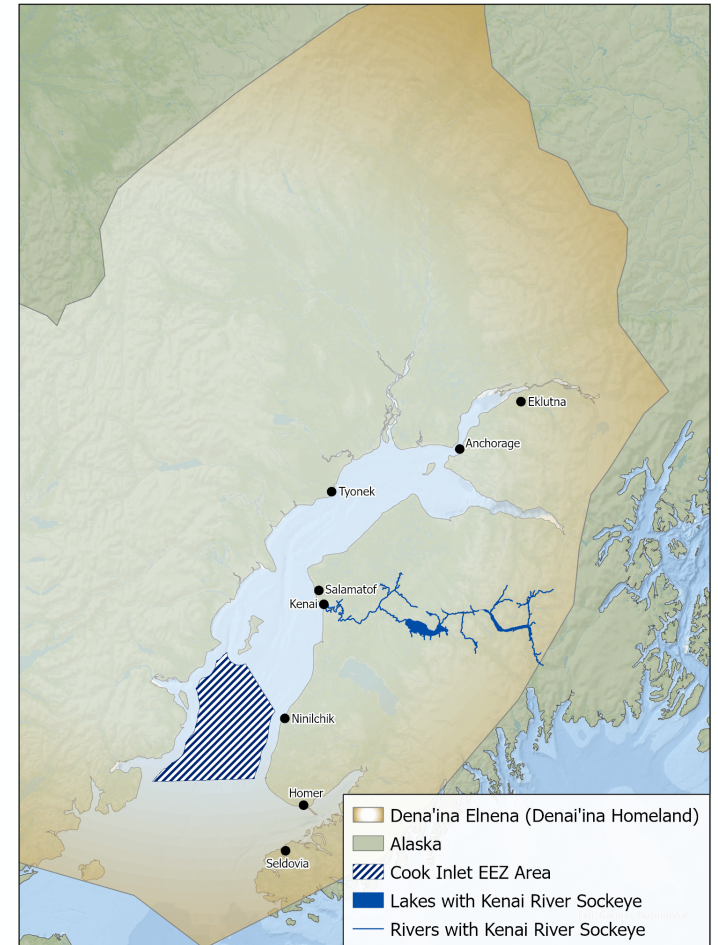
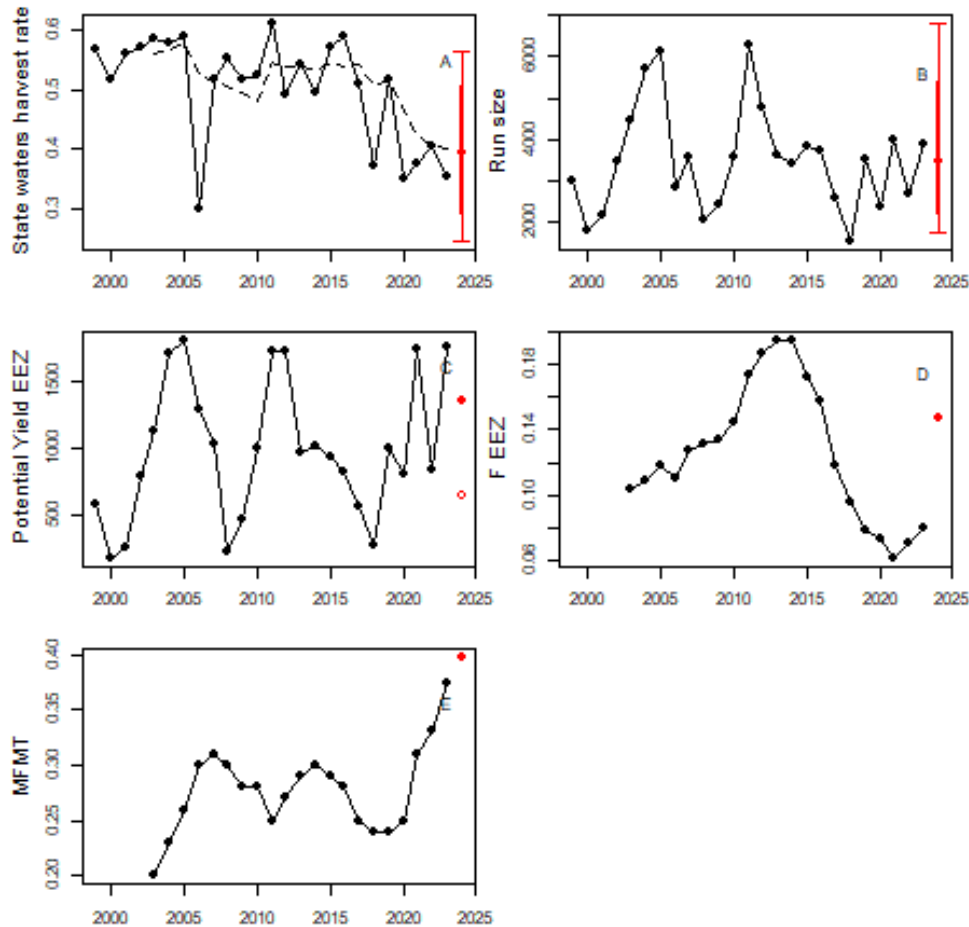


KENAI LATE-RUN SOCKEYE SALMON: SUMMARY

- Not overfished:
 - $MSST \ll \text{Cumulative Escapement}$
- Not at risk for overfishing:
 - Actual harvest rate (F_{EEZ}) \ll maximum fishery mortality threshold (MFMT).
- Substantial potential yield in EEZ, BUT.....
- Poorly defined spawner-recruitment relationship at high escapements
 - Brood-year returns \gg spawners for all years !
 - Implications for calculating potential yield in EEZ.
- Challenging to harvest sockeye salmon while protecting Chinook salmon.



KENAI LATE-RUN SOCKEYE SALMON: SUMMARY PLOTS

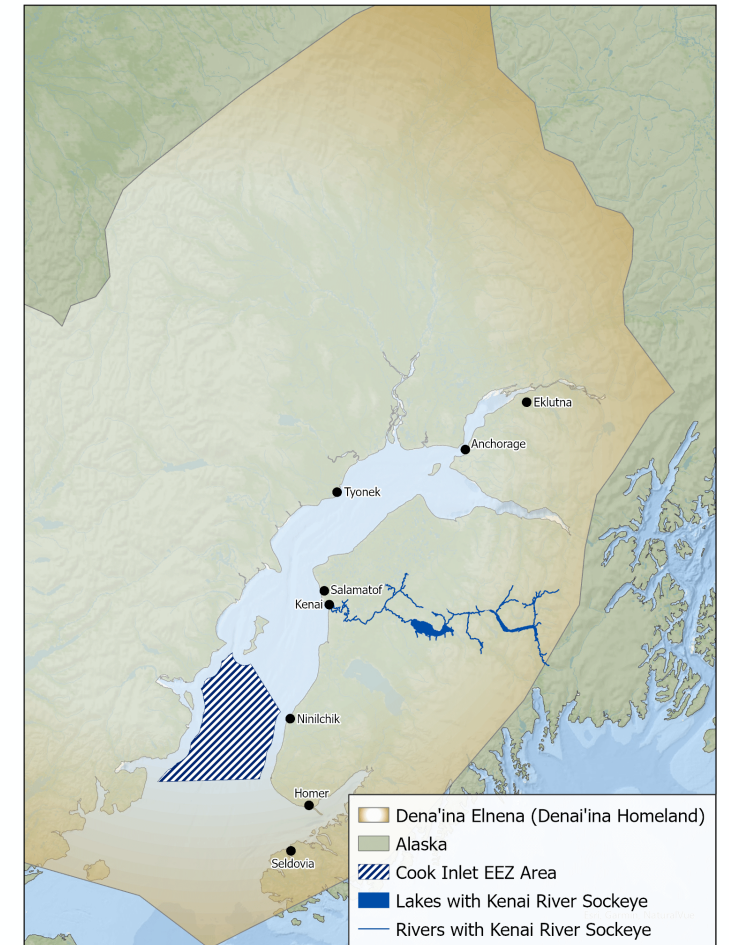


KENAI LATE-RUN SOCKEYE SALMON: TIER I ABC/ACL RECOMMENDATIONS

Recommendations:

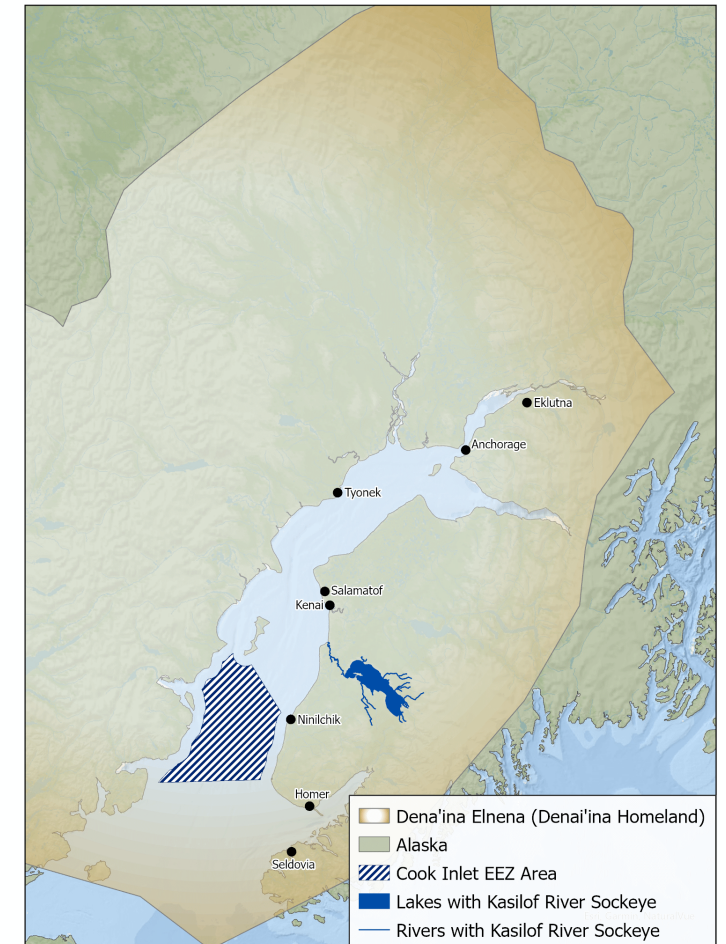
- Preseason total run size: 3,458,000 fish
- Preseason OFL..... 1,363,932 fish
- Buffer* 0.478
- ABC..... **652,454** fish
- ACL = ABC

* Buffer (b) is the fraction by which OFL is reduced to ABC to account for uncertainty in estimates of total run size and State harvests. Buffer is not the difference between the OFL and the ABC (1-b).



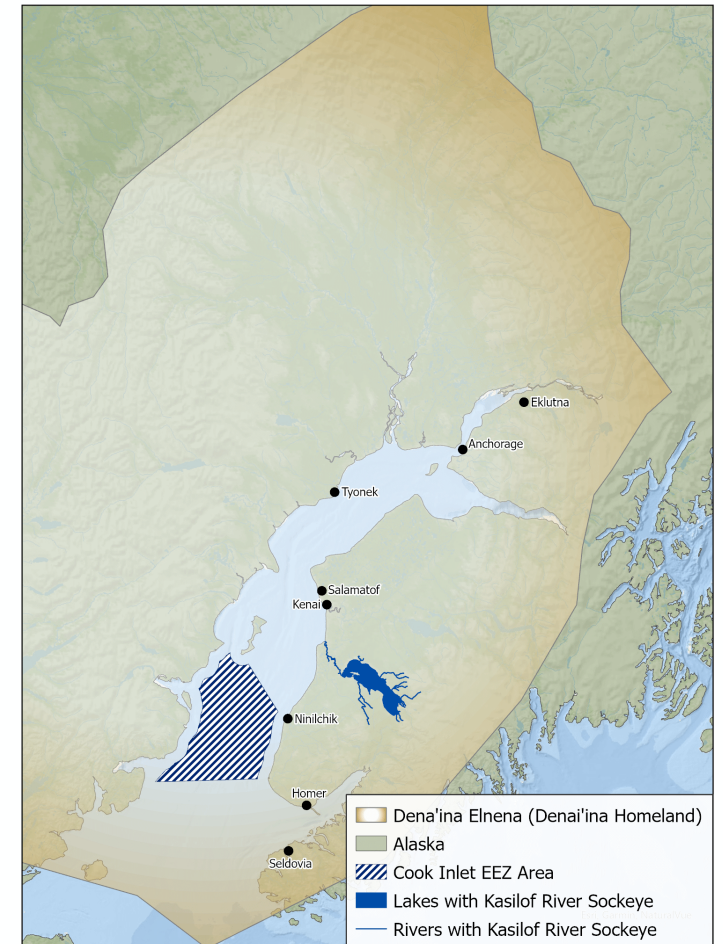
KASILOF SOCKEYE SALMON: STOCK DEFINITION

- Federal definition = same as State of Alaska definition
 - Escapement goal: 140-370K with lower bound used in Federal assessment
 - ADF&G harvest and escapement data
 - Quantities estimated for this SAFE
 - recent sportfish harvests; proportion of drift gillnet harvest in EEZ; proportion Kasilof sockeye salmon in recent harvests



KASILOF SOCKEYE SALMON: AVAILABLE INFORMATION

- Escapement goal and escapements
- Harvest estimates for all components: commercial, recreational, personal use
- Age estimates for all components: harvest + escapement
- Brood tables
- Spawner-recruitment estimates
- Sibling model-based preseason forecasts
- Easy call: Tier I!

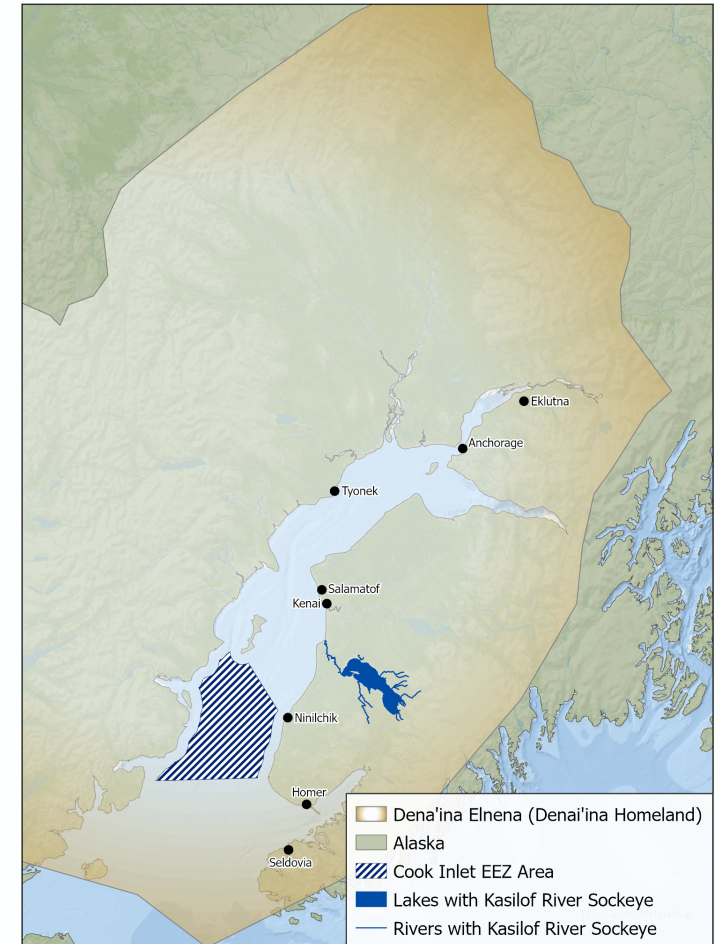


KASILOF SOCKEYE SALMON: SDC

- Same Tier I methods as for Kenai sockeye salmon
- Overfished: MSST vs. Cumulative escapement
- Overfishing: F_{EEZ} vs. MFMT

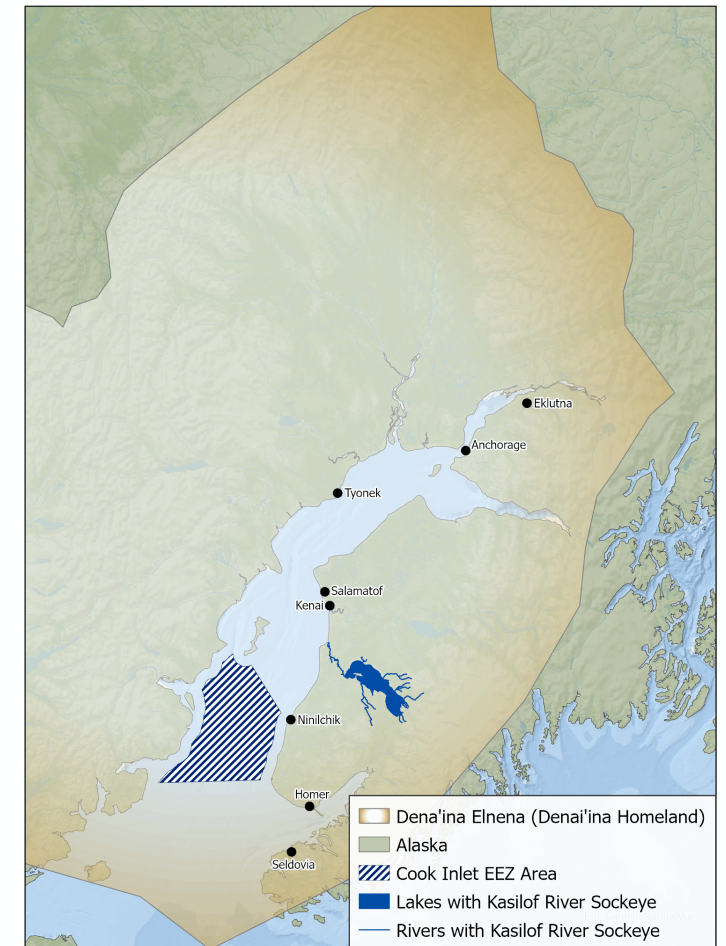
- OFL_{PRE} : Max. potential yield in the EEZ while allowing avg. State harvests and escap. goal

$$\hat{Y}_{EEZ,t} = \max(0, \hat{R}_t - G_t - \bar{F}_{state,t} * \hat{R}_t)$$



KASILOF SOCKEYE SALMON: BUFFER AND ABC

- Same Tier I ABC method as for Kenai sockeye salmon
- $OFL_{PRE} = \max(0, \hat{R}_t - G_t - \bar{F}_{state,t} * \hat{R}_t)$
- $ABC = OFL_{PRE} \times \text{buffer}$
- Buffer accounts for uncertainty in preseason total run size forecast and non-EEZ (State) harvests



KASILOF SOCKEYE SALMON: STOCK STATUS, PROJECTIONS, AND RECOMMENDATIONS

Year	Overfished? No		Tier I Overfishing? No		Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC
	MSST	Cum. Escap.	MFMT	FEEZ					
2019	400	1,831	0.30	0.03	613	10	98		
2020	390	1,902	0.35	0.03	845	6	86		
2021	380	2,179	0.39	0.03	925	21	107		
2022	370	2,788	0.47	0.03	1,495	45	113		
2023	360	3,333	0.52	0.03	1,393	57	140		
2024	350		0.55	0.13	1,125		130	623	433

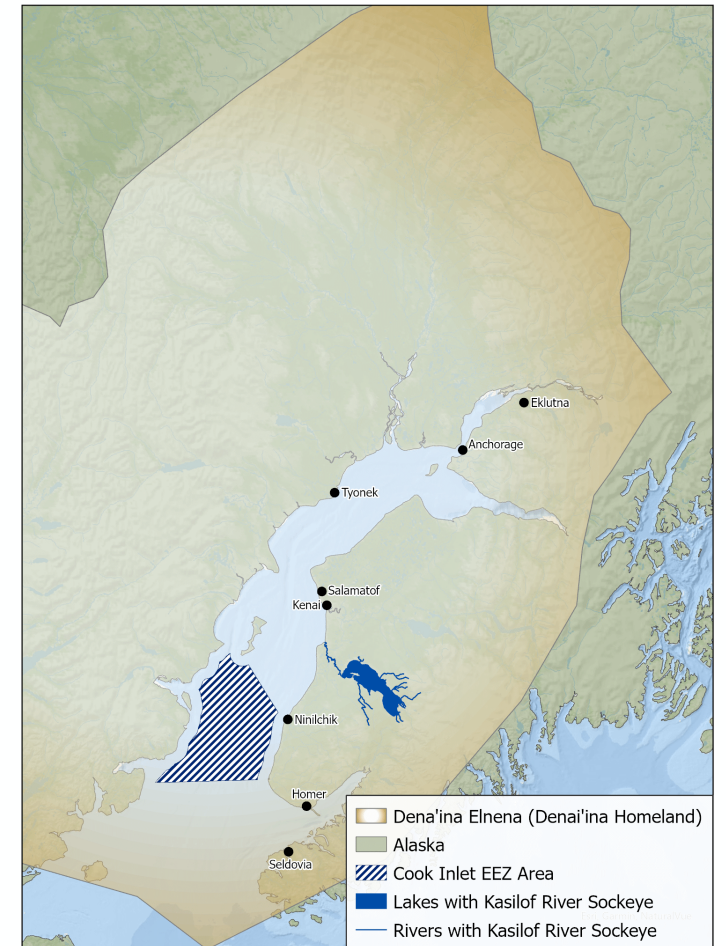
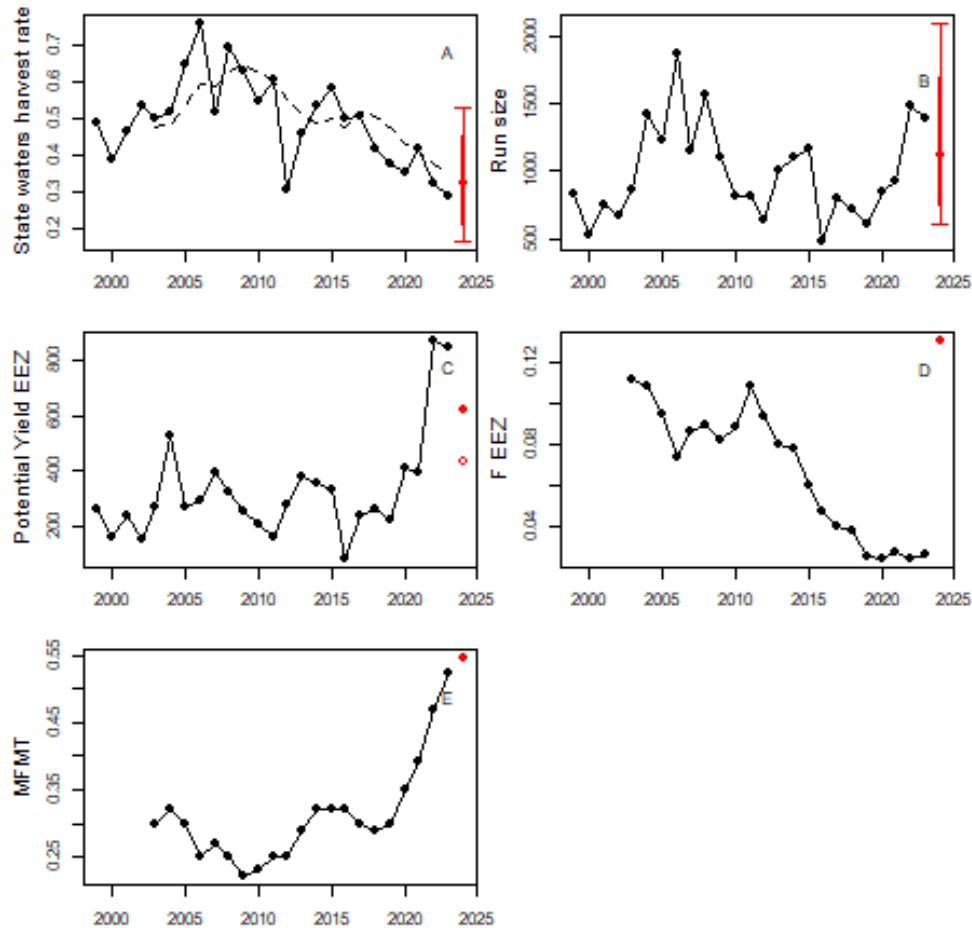
Postseason estimates

Preseason projections

623 433

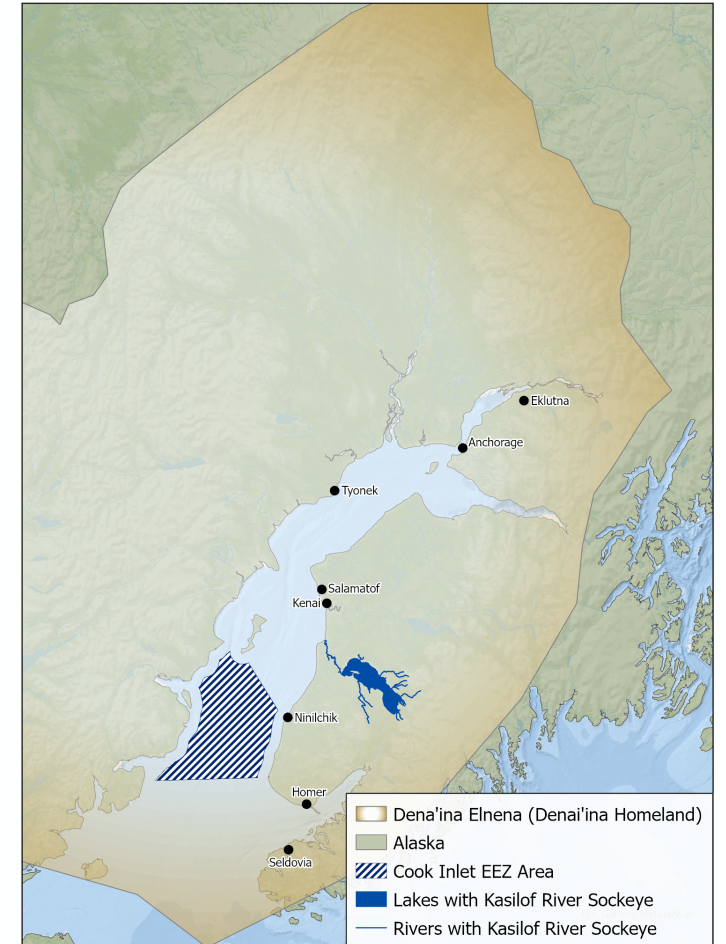
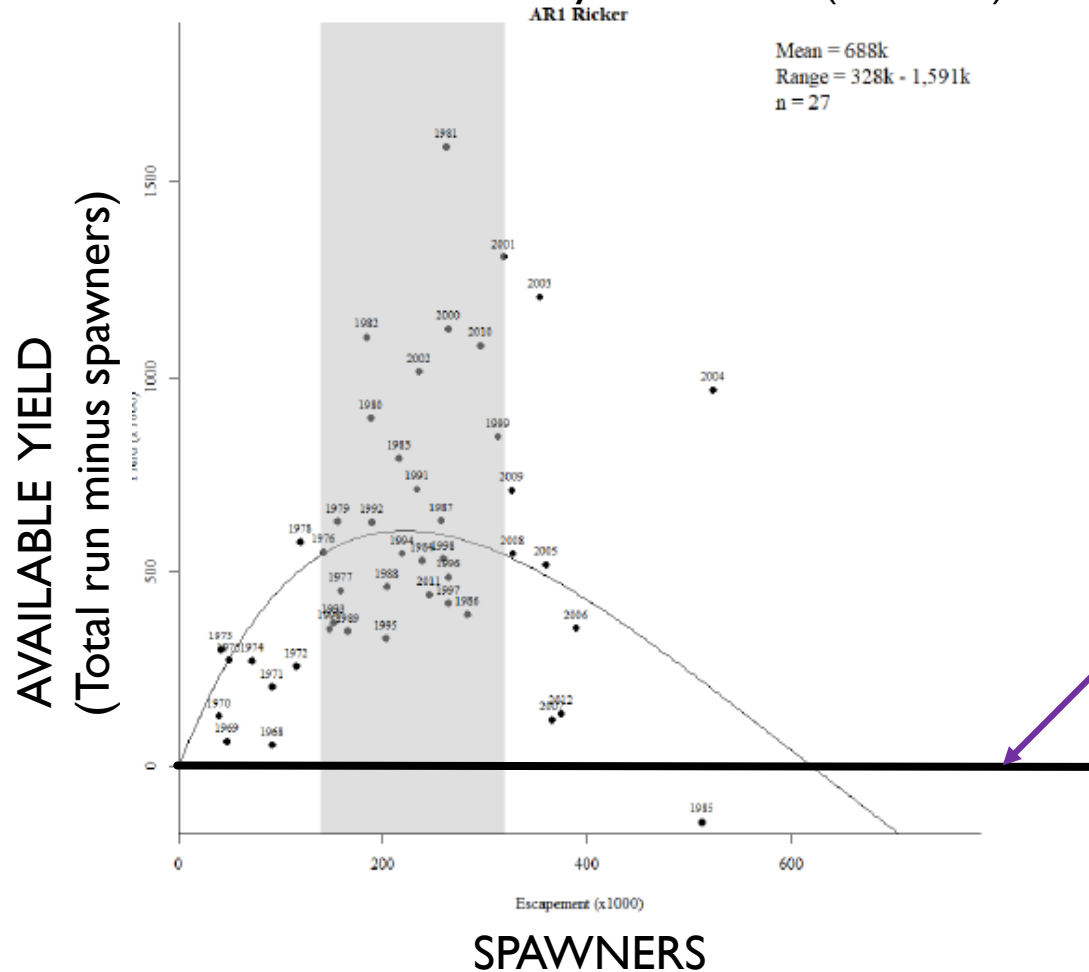


KASILOF SOCKEYE SALMON: SUMMARY PLOTS



KASILOF SOCKEYE SALMON: A WORD ABOUT THE SPAWNER-RECRUITMENT RELATIONSHIP.....

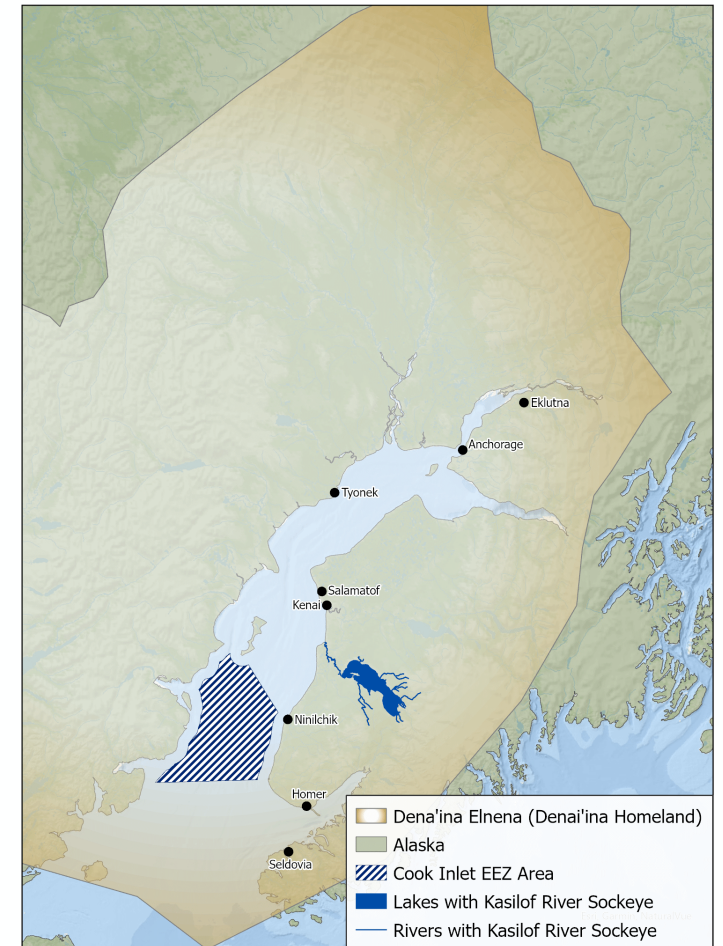
From McKinley et al. 2020 (ADF&G)



KASILOF SOCKEYE SALMON: FINAL THOUGHTS

Similar to Kenai Late Run Sockeye Salmon.....

- Lack of density dependence in spawner-recruitment relationship (similar to Kenai sockeye, but not as extreme)
- Recommendation: available yield based on lower bound of escapement goal for SDC and harvest specifications.
- Buffer accounts for: Uncertainty in preseason total run size forecast and uncertainty in State harvests.



KASILOF SOCKEYE SALMON: TIER I ABC/ACL RECOMMENDATIONS

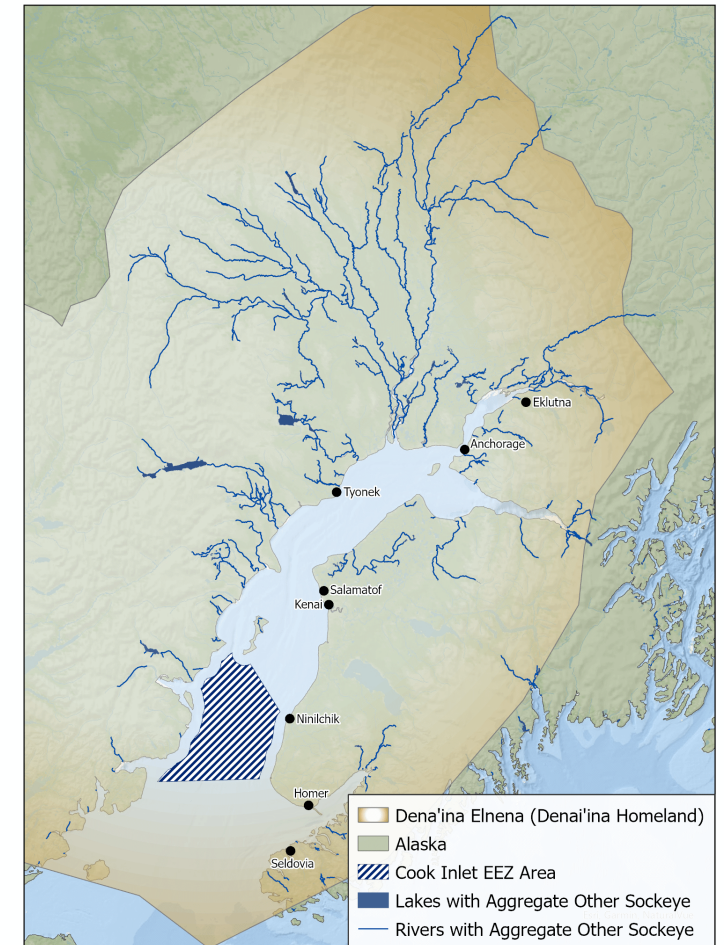
Recommendations:

- Preseason total run size: 1,225,368 fish
- Preseason OFL..... 623,084 fish
- Buffer 0.694
- ABC..... **432,578** fish
- ACL = ABC



AGGREGATE “OTHER” SOCKEYE SALMON: STOCK COMPLEX

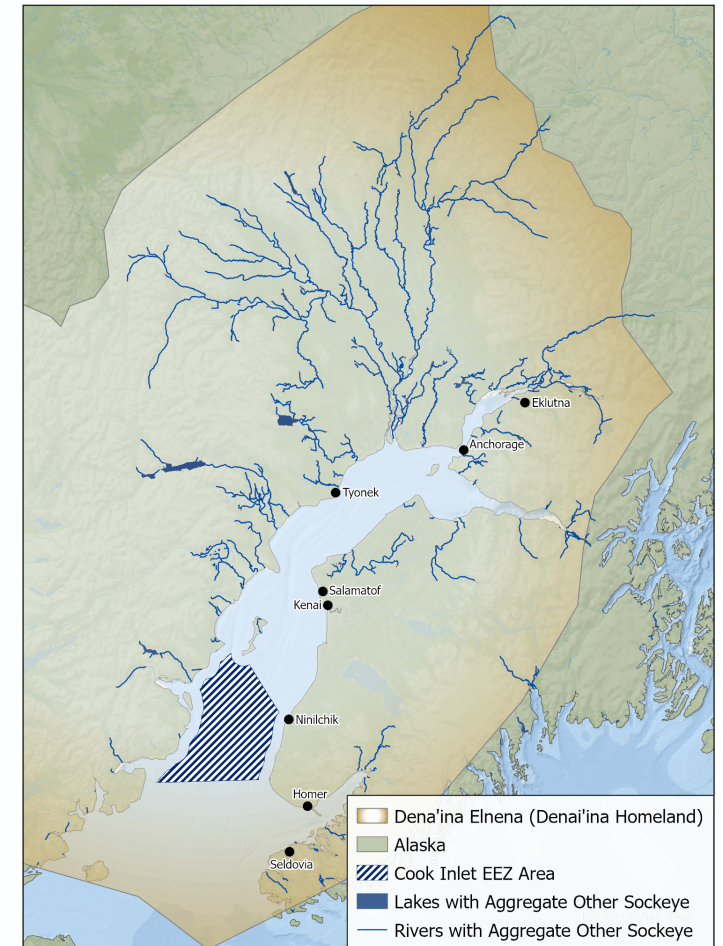
- Federal definition = All other UCI sockeye salmon harvested in the EEZ, except Kenai and Kasilof sockeye salmon
- Escapement goal for 4 indicator stocks: Fish Creek (15,000–45,000); Chelatna Lake (20,000–45,000); Judd Lake (15,000–40,000); and Larson Lake (15,000–35,000): **65K total**
- ADF&G harvest and escapement data; genetic stock composition data.
- SAFE: some recent values estimated (sportfish harvests; proportion harvested in EEZ)



AGGREGATE “OTHER” SOCKEYE SALMON: TIER DILEMMA

Tier 2 or Tier 3?

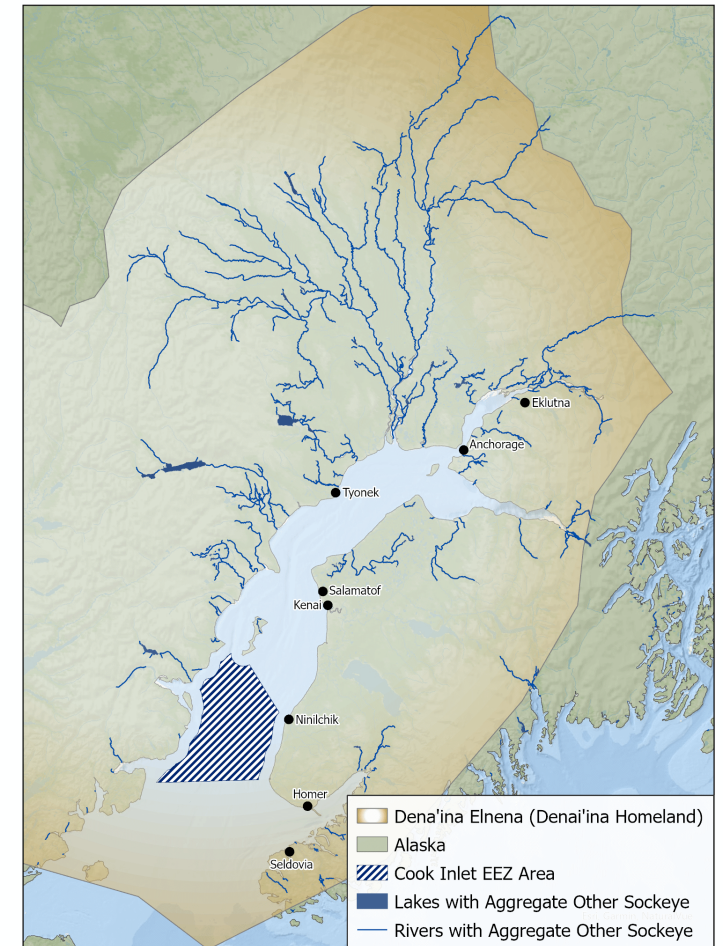
- Tier 2: A stock complex with specific stocks as indicator stocks.
- A stock complex = a stock with multiple drainages or escapement goals for multiple tributaries in the same drainage.
- Tier 2: same methods for SDC and harvest specifications as Tier 1, just for the entire complex.
- Tier 2, requires a total run size estimate.



AGGREGATE “OTHER” SOCKEYE SALMON: TIER DILEMMA

Tier 3: A stock/stock complex with no “reliable” estimate of spawning escapement.

- Tier 3: does not require an estimate of total run size.
- Tier 3: Overfishing and harvest specifications evaluated based on past harvest, not based on total run size and escapement goals (i.e., Tiers 1-2).



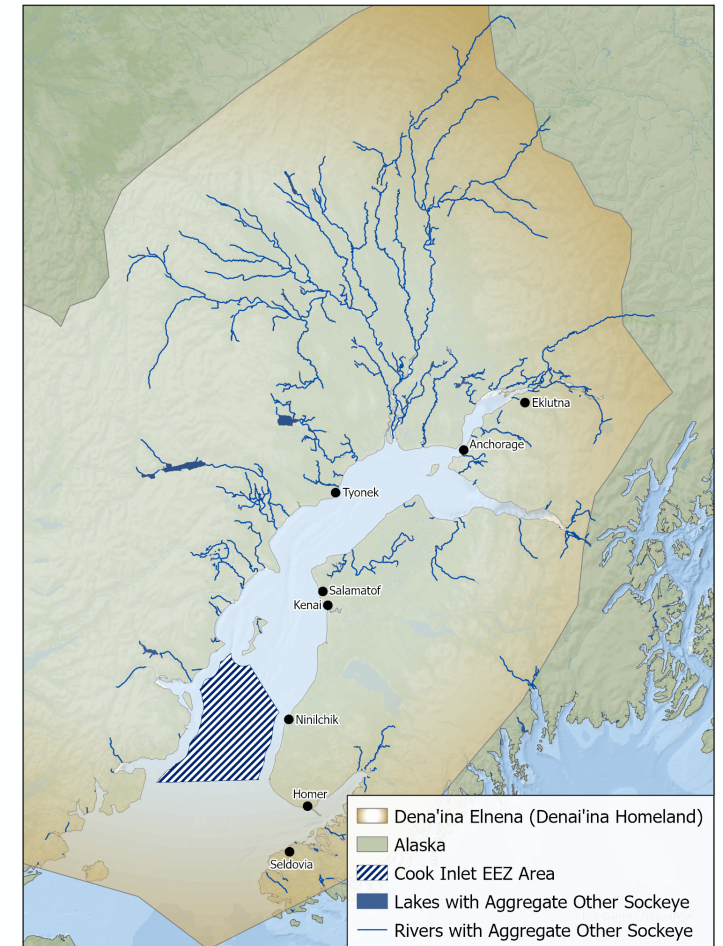
AGGREGATE “OTHER” SOCKEYE SALMON: TIER DILEMMA

Tier 2 or Tier 3?

- Tier 2 because: A stock complex with escapement goals for 4 indicator stocks.

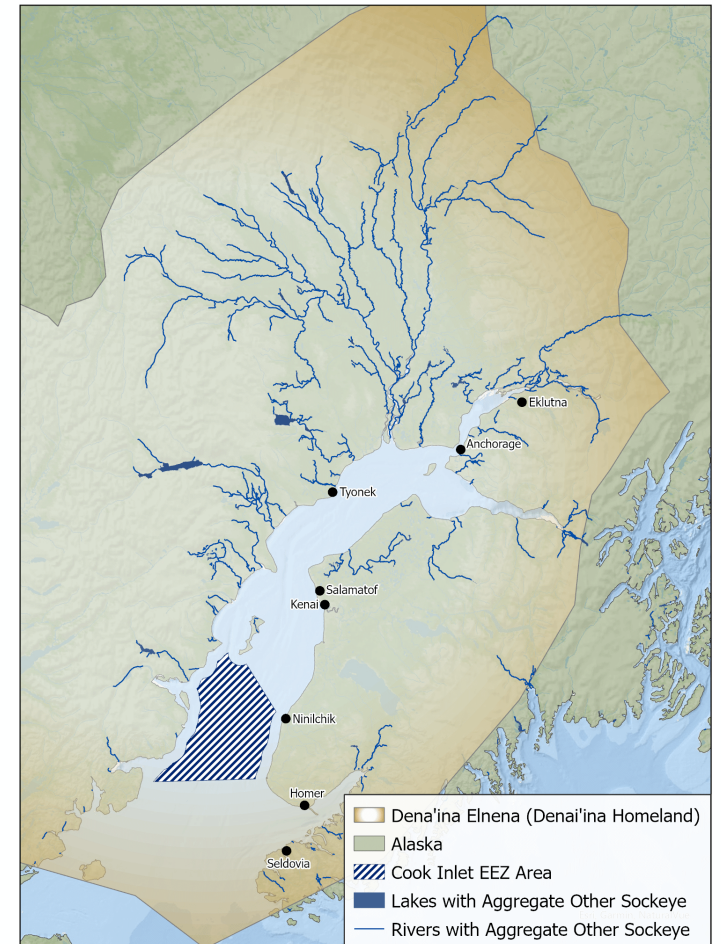
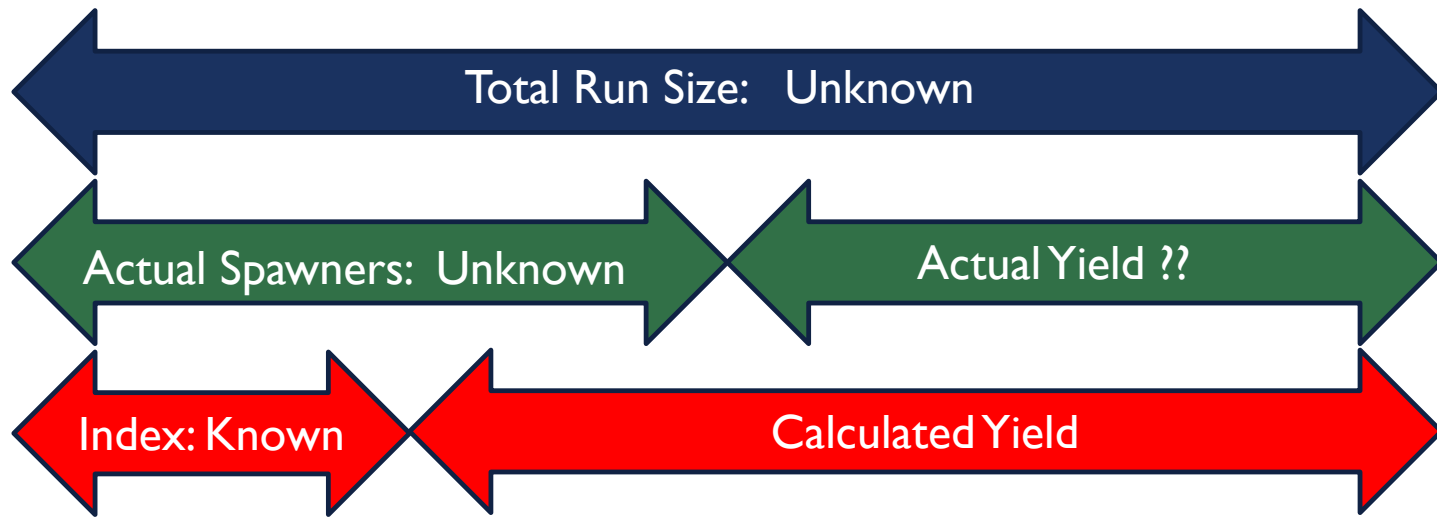
BUT:

- Indicator stocks not monitored consistently
- Concerns about risks to stock from the Tier 2 approach: How to estimate total run size and yield?



AGGREGATE “OTHER” SOCKEYE SALMON: TIER DILEMMA

- The (potential) problem with Tier 2

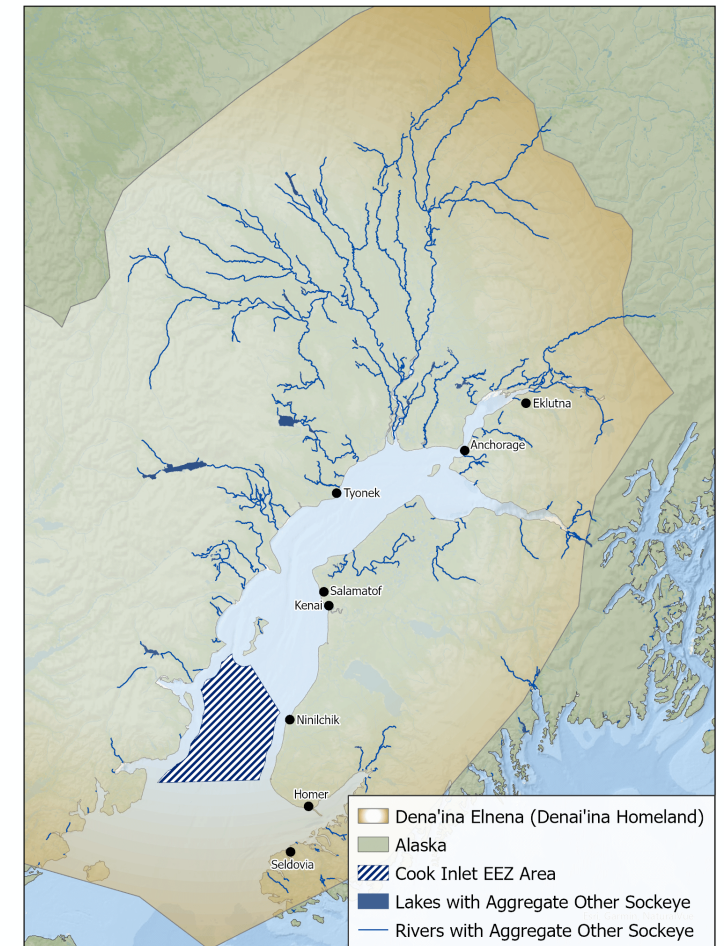


AGGREGATE “OTHER” SOCKEYE SALMON: TIER DILEMMA

The problems with Tier 2:

- [Calculated yield (index)] >> [true (unknown) yield available]
 - Risk: Harvest rate too high & overfishing determination should be triggered, but is not.
- Spawning escapements not monitored, leading to calculated overfishing or overfished determination when there are sufficient spawners.
 - Risk: overfishing or overfished determination when not warranted.

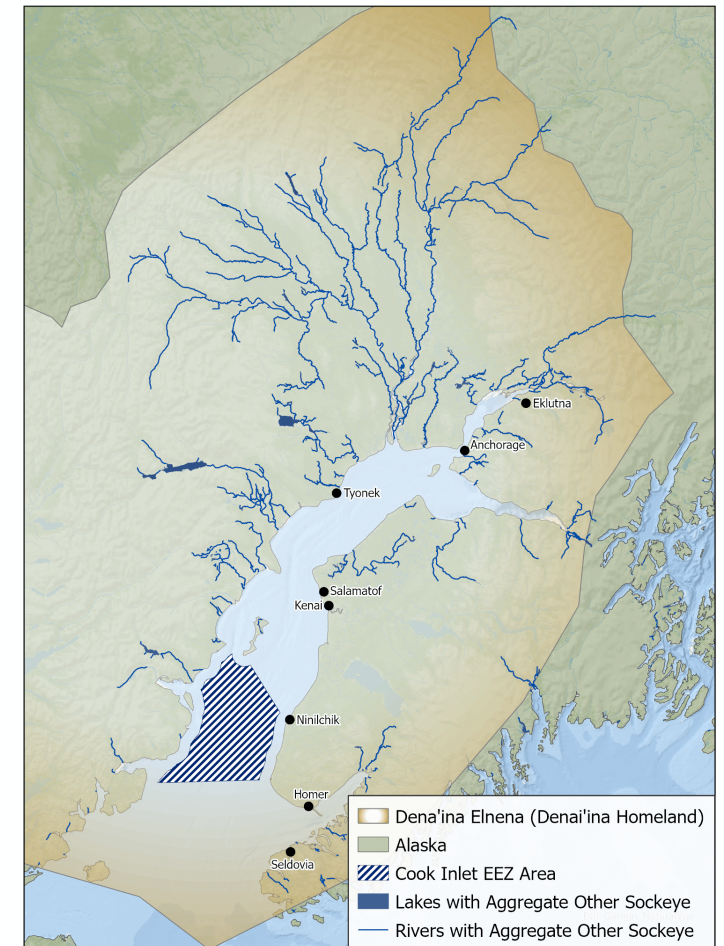
BUT.....



AGGREGATE “OTHER” SOCKEYE SALMON: TIER DILEMMA

The problems with Tier 2:

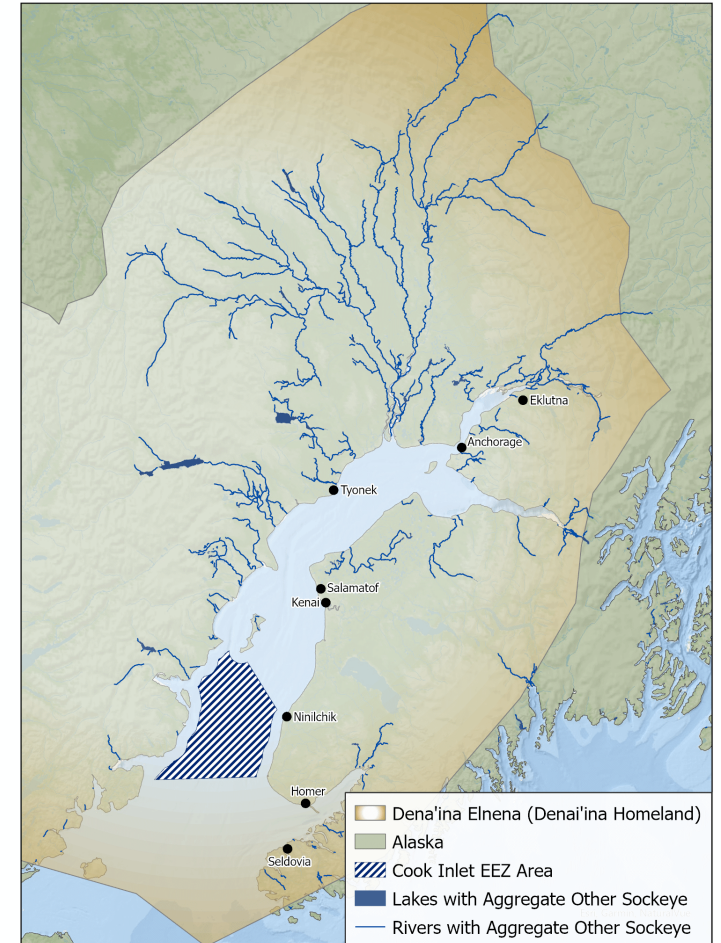
- Counter arguments: (1) Harvest rate is relative to total run size, which factors in index and (2) overfishing would be declared if escapement goals not met on index systems.
- Full Circle: (1) The calculated yield is still inflated, which is the basis for the preseason OFL for Tier 2, (2) quantifiable approach for estimating scope of uncertainty in total run size estimates not considered for 2024 SAFE (but could be included in future assessments), (3) difficult to estimate spawning escapements across many systems.



AGGREGATE “OTHER” SOCKEYE SALMON: TIER RECOMMENDATION

Considerations:

- Many unmonitored systems
- Gaps in monitoring index systems: Judd Lake & Chelatna R.
- Inability to estimate total run size for SDC and harvest specs.
- Recommendation: Tier 3 with four index systems for assessing overfished status vs. MSST.

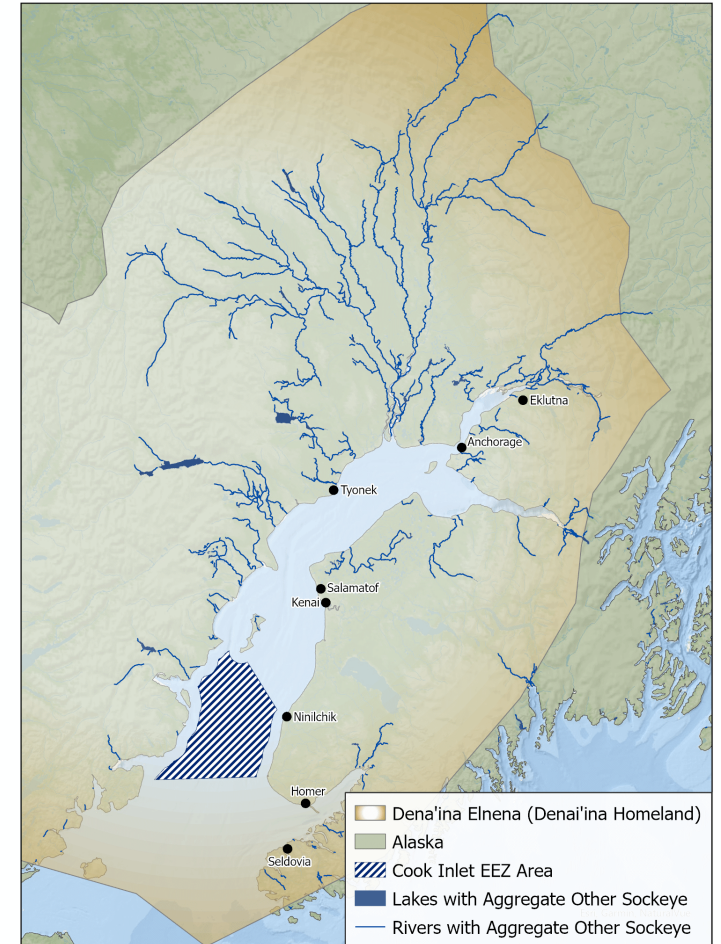
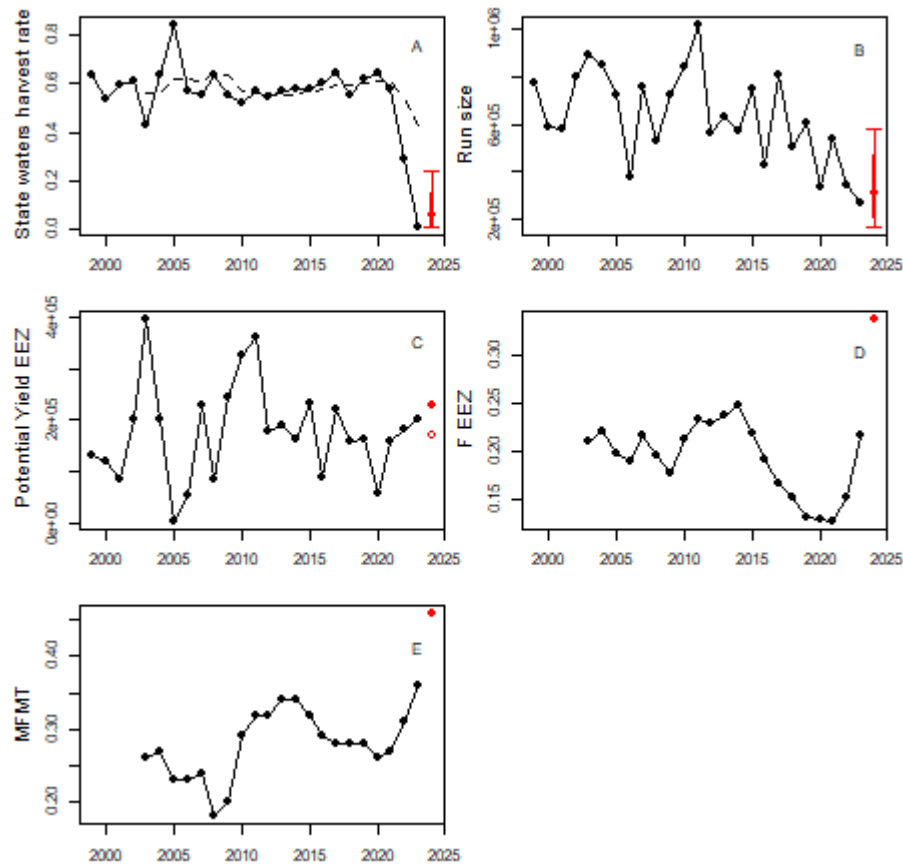


AGGREGATE “OTHER” SOCKEYE SALMON: TIER 2 (NOT RECOMMENDED) SUMMARY TABLE

Year	MSST	Cum. Escap.	MFMT	FEEZ	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC
2019	178	822	0.28	0.13	604	73	404		
2020	170	686	0.26	0.13	338	13	346		
2021	163	736	0.27	0.13	538	54	352		
2022	163	695	0.31	0.15	348	133	352		
2023	163	631	0.36	0.22	270	183	457		
2024	163		0.46	0.34	314		384	230	169



AGGREGATE “OTHER” SOCKEYE SALMON: TIER 2 (NOT RECOMMENDED) SUMMARY PLOTS



AGGREGATE “OTHER” SOCKEYE SALMON: TIER 3 STATUS DETERMINATION CRITERIA (SDC)

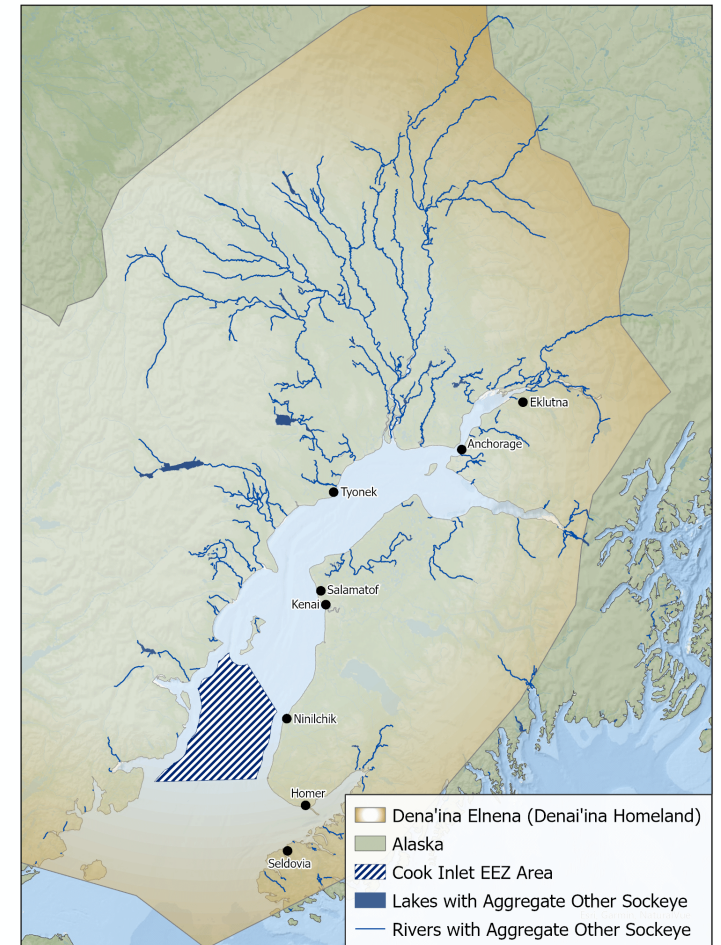
Tier 3 Status determination criteria

Overfished:

- Assessed in same manner as for Tier 1 (if there is an indicator stocks):
- Cumulative spawners for a generation vs. **MSST**

Overfishing:

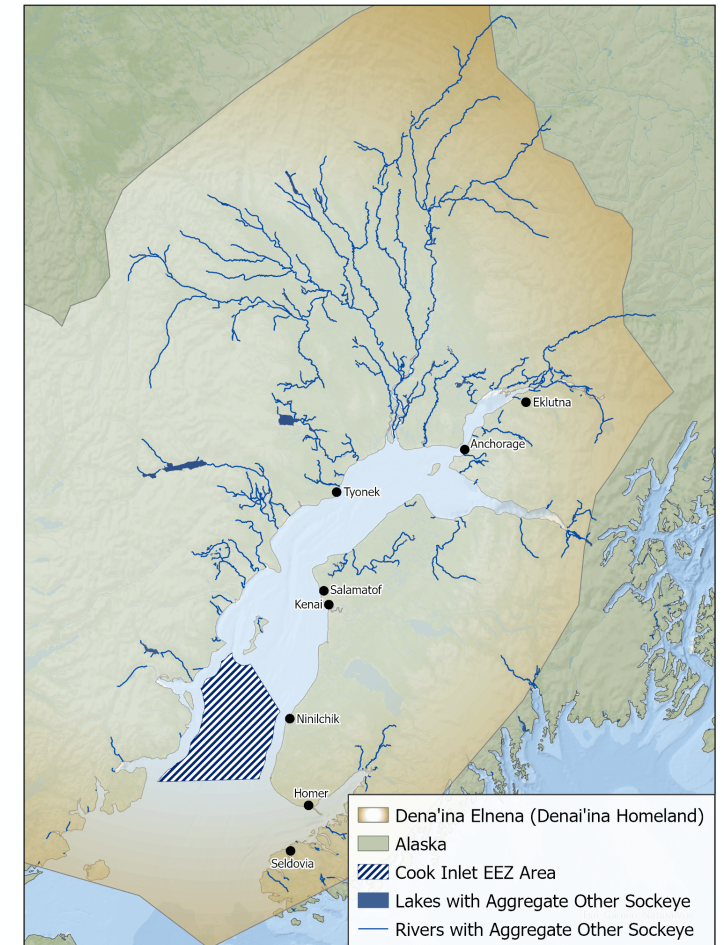
- Cumulative harvests for generation vs. **Postseason OFL**



AGGREGATE “OTHER” SOCKEYE SALMON: TIER 3 OFL AND ABC EXPLAINED

Tier 3

- $OFL_{POST} = (\text{maximum harvest}) \times (\text{generation time})$
- $OFL_{PRE} = (OFL) - (\text{cumulative harvest for T-1 years of generation})$.
- $ABC = OFL_{PRE} * \text{Buffer (e.g., 0.1 to 0.9)}$



AGGREGATE “OTHER” SOCKEYE SALMON: TIER 3 STOCK STATUS, PROJECTIONS, BUFFER, AND ABC RANGE

Year	MSST	Cum. Escap.	MFMT	FEEZ	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC (10%)	ABC (90%)
2019	178	822	NA	NA	NA	73	404	1,271		
2020	170	686	NA	NA	NA	13	346	1,271		
2021	163	736	NA	NA	NA	54	352	1,271		
2022	163	695	NA	NA	NA	133	352	1,271		
2023	163	631	NA	NA	NA	183	457	1,271		
2024	163		NA	NA	NA		384	888	88	799

Overfishing??

OFL_{PRE}

ABC range

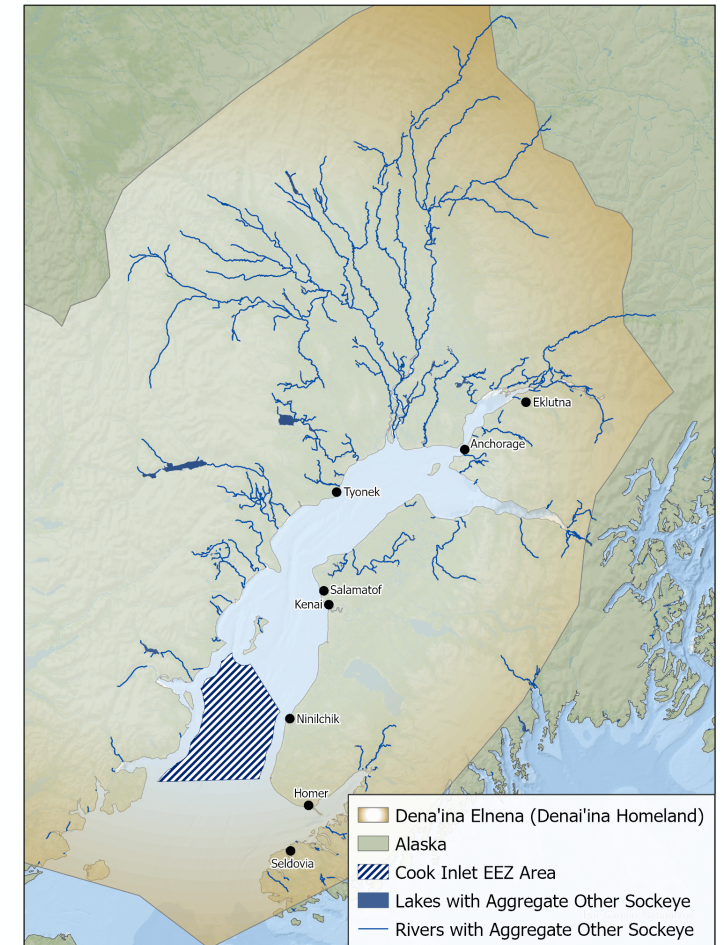
(T-I Cum. Harvest)



AGGREGATE “OTHER” SOCKEYE SALMON: BUFFER CONSIDERATIONS

Tier 3: Buffer considerations

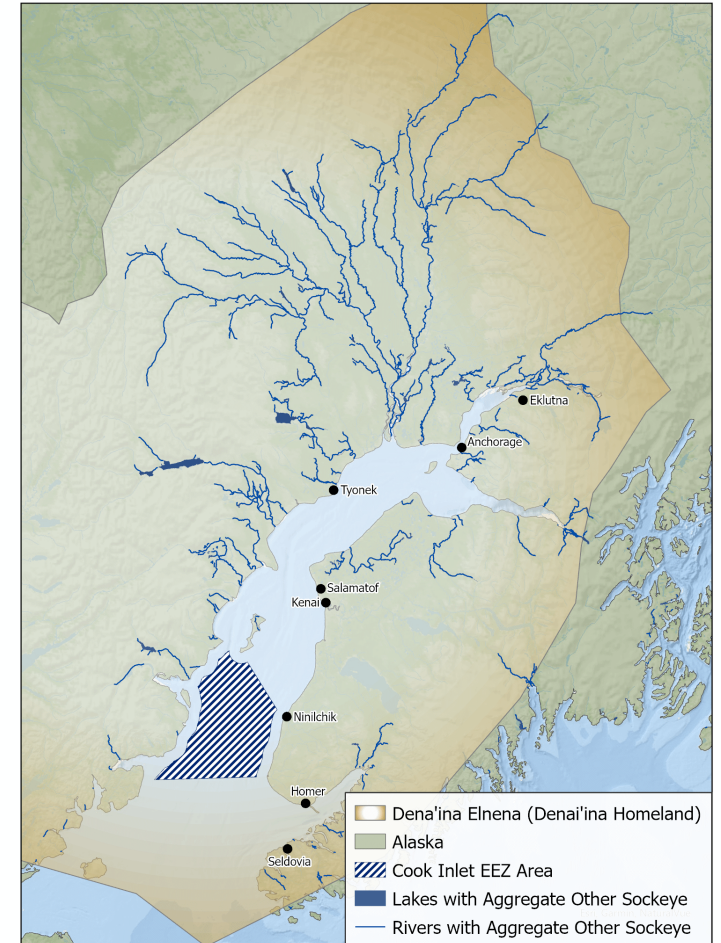
- $OFL = \text{max harvest} \times 5 \text{ years (sockeye salmon)}$
- $1/5 = 0.20 = \sim \text{max harvest for 1 year}$
- 0.20 buffer keeps ACL to a single season value.
- “apples-apples” with Kenai and Kasilof sockeye salmon ACLs for setting TAC



AGGREGATE “OTHER” SOCKEYE SALMON: TIER 3 ABC/ACL RECOMMENDATION

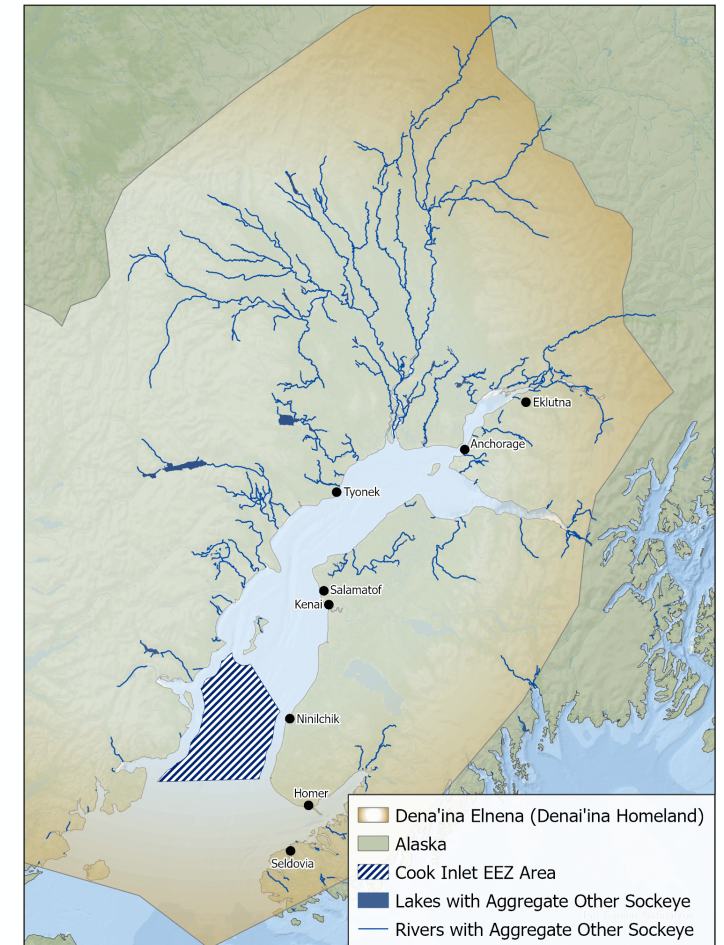
Recommendations:

- Preseason total run size: NA
- Preseason OFL..... 887,464 fish
- Buffer 0.20
- ABC..... **177,493** fish
- ACL = ABC



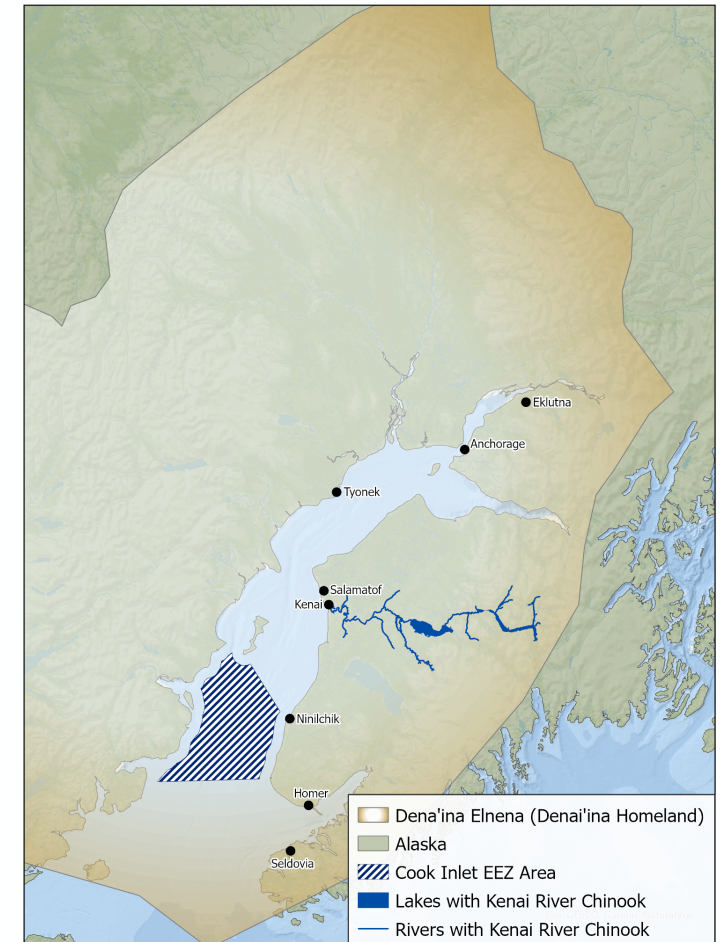
AGGREGATE “OTHER” SOCKEYE SALMON: CLOSING THOUGHTS

- Missing spawning escapement data = compromised ability to assess SDC and Tier 2 harvest specifications.
- Concerns about risks from Tier 2 determination
- The NOAA SAFE Team would appreciate any recommendations that the SSC has on tier placement and missing escapement values.



KENAI RIVER LATE RUN LARGE CHINOOK SALMON

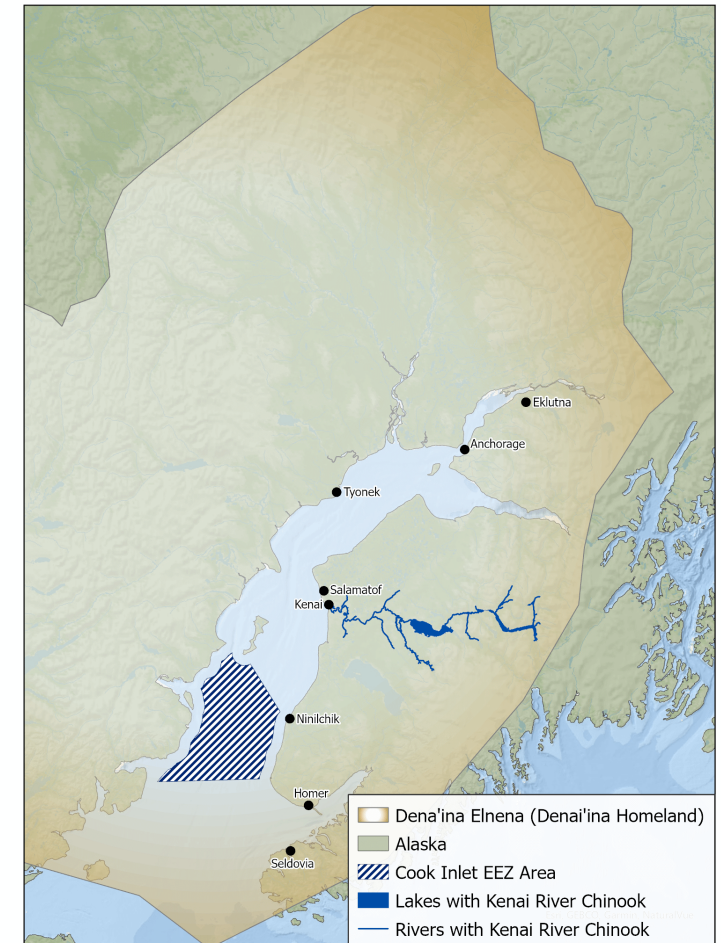
- Federal definition = Same stock definition as State of Alaska
 - Escapement goal: (established 2020; 15,000–30,000)
 - ADF&G harvest and escapement data
 - Estimated for SAFE: sportfish harvests; proportion of overall drift gillnet harvested in the EEZ.



KENAI RIVER LATE RUN LARGE CHINOOK SALMON: TIER?

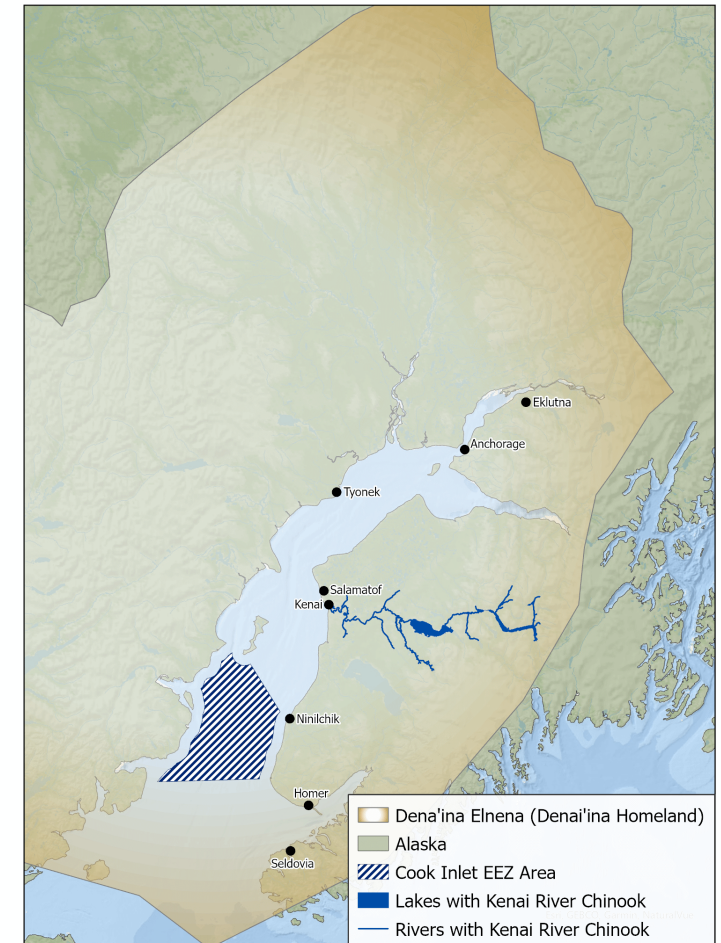
- Escapement goal and escapements
- Harvest estimates for commercial, recreational, personal use
- Age estimates for all components: harvest + escapement
- Brood tables
- Spawner-recruitment estimates (Ricker model)
- Sibling model-based preseason forecasts
- Should be Tier I.

BUT.....



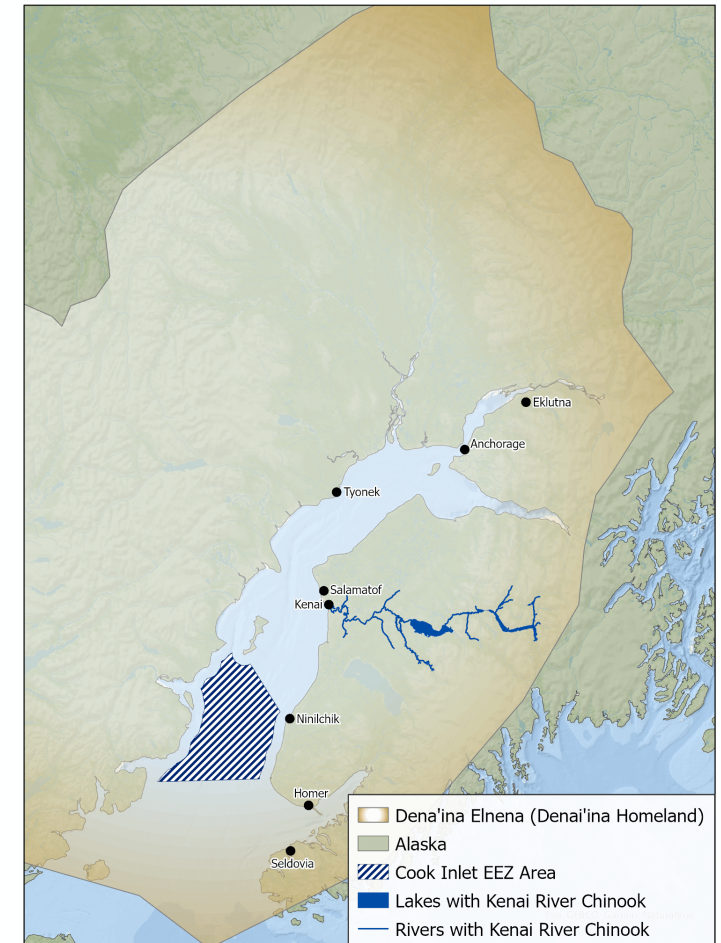
KENAI RIVER LATE RUN LARGE CHINOOK SALMON: TIER?

- EEZ stock composition is not supported
 - No genetic data (that we could find)
- 2023 EEZ harvest estimate: 51 Chinook salmon from any stock.
- ~21 fish (??) from Kenai Late Run Large Chinook salmon stock.....no data to support.



KENAI RIVER LATE RUN LARGE CHINOOK SALMON: RECOMMENDATION

- Recommendation: Combine with all other Chinook salmon harvested in the EEZ.
 - Aggregate Tier 3.
- Recommendation (precautionary measure): Keep Kenai Late Run Large Chinook Salmon as indicator stock to assess overfished determination.



KENAI RIVER LATE RUN LARGE CHINOOK SALMON (NOT RECOMMENDED): BUT HERE'S A SUMMARY TABLE ANYHOW

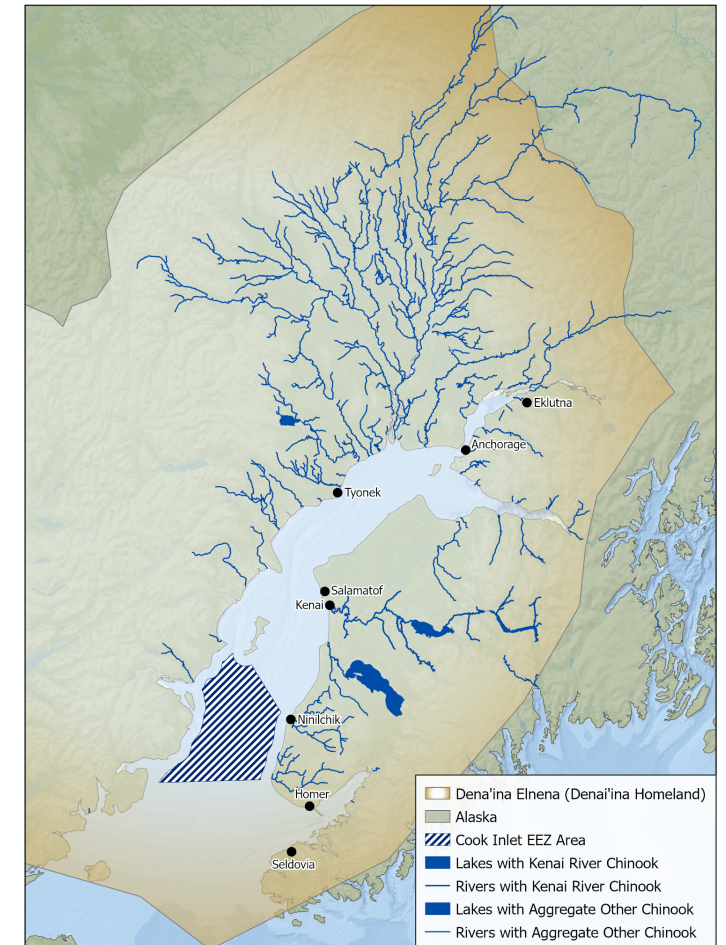
Year	MSST	Cum. Escap.	MFMT	FEEZ	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC
2019	40.5	93	0.13	0.003	13.3	29	347		
2020	41.3	92.9	0.13	0.003	12.2	29	344		
2021	42.0	88.2	0.11	0.003	12.7	25	329		
2022	42.7	87.5	0.11	0.003	14.1	32	259		
2023	43.5	81.5	0.05	0.003	14.7	21	239		
2024	44.2		0.00	0	14.7		136	0	0

note:
SAFE report caption says "thousands of fish," but the circled values are numbers of fish, not thousands.



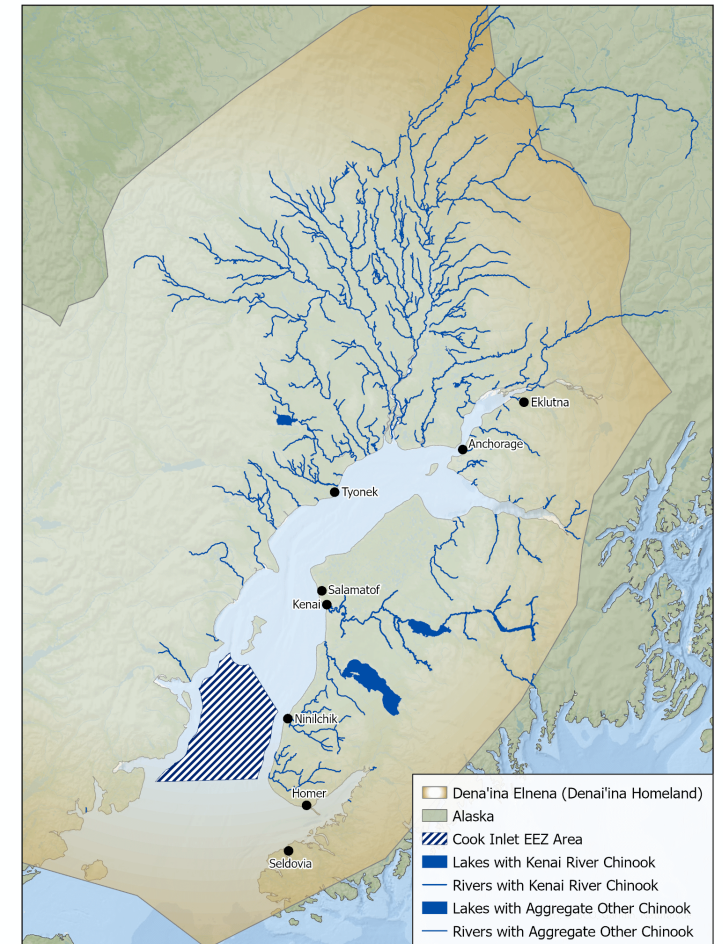
AGGREGATE CHINOOK SALMON: STOCK COMPLEX DEFINITION

- Any Chinook salmon harvested in the EEZ.
- Definition would include many tributaries and drainages known to contain Chinook salmon throughout UCI
- Kenai Late Run Large Chinook salmon used as an indicator stock to assess overfished status vs. MSST (Tier 3).



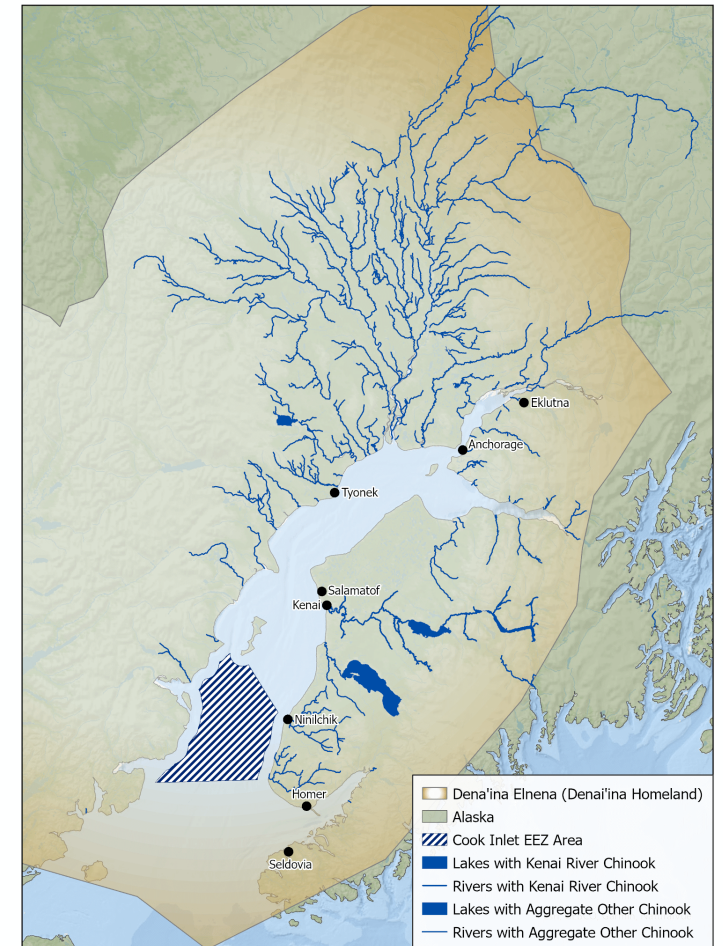
AGGREGATE CHINOOK SALMON: TIER RECOMMENDATION

- Total escapements to entire stock complex unknown, therefore total run size unknown.
- Recommendation: Tier 3
- Recommendation (Precautionary Measure): Kenai Late Run Large Chinook salmon as an indicator stock to assess overfished status vs. MSST.



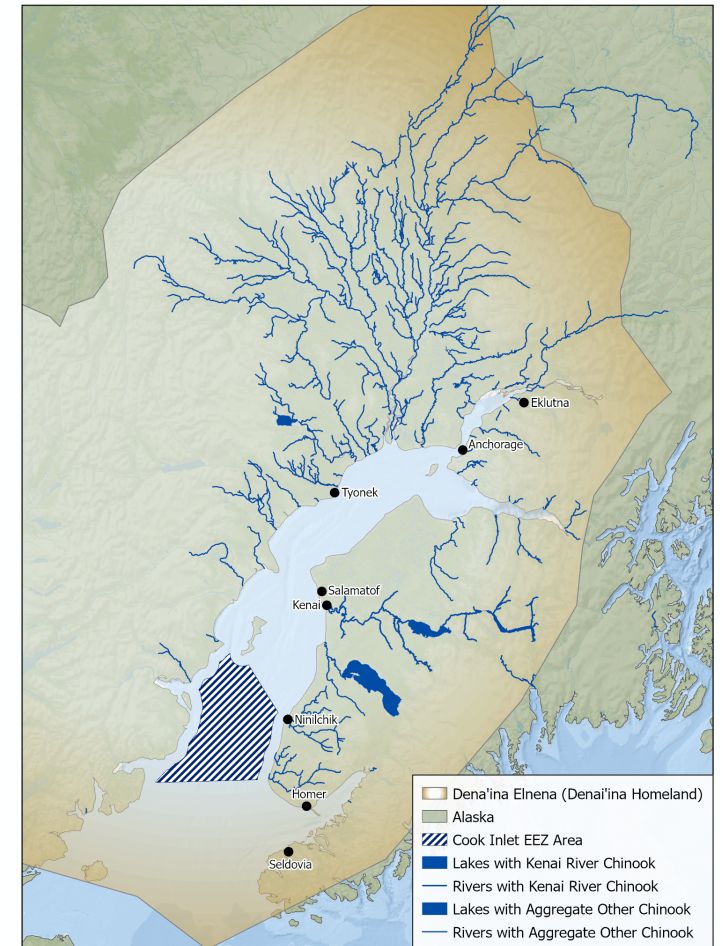
AGGREGATE CHINOOK SALMON: STOCK CONSIDERATION

- Chinook salmon in a low state of abundance throughout N. Pacific.
- 4 State of Alaska “Stock of Concern” designations for UCI Chinook salmon.
 - Chuitna, Theodore, and Eastside Susitna rivers & Alexander Creek.
- Kenai Late Run Large Chinook salmon below goal recently.



AGGREGATE CHINOOK SALMON: STOCK ATTRIBUTES

- Susitna Chinook stocks not thought to be harvested in appreciable quantities in drift gillnet fishery (Reimer and DeCovich, 2020).
 - Run timing mismatch.
- Unknown stocks harvested, but only 21 fish total in 2023.
- SAFE Assumption: low risk to any stock from EEZ fishery.



AGGREGATE CHINOOK SALMON: TIER 3 STOCK STATUS, PROJECTIONS, BUFFER, AND ABC RANGE

Year	MSST	Cum. Escap.	MFMT	FEEZ	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC (10%)	ABC (90%)
2019	40.5	93	NA	NA	NA	81	934	3,072	note: SAFE report caption says “thousands of fish,” but the circled values are numbers of fish, not thousands.	
2020	41.3	92.9	NA	NA	NA	76	879	3,072		
2021	42.0	88.2	NA	NA	NA	87	810	3,072		
2022	42.7	87.5	NA	NA	NA	80	659	3,072		
2023	43.5	81.5	NA	NA	NA	51	635	3,072		
2024	44.2		NA	NA	NA		375	2,697		270



AGGREGATE CHINOOK SALMON: BUFFER CONSIDERATIONS

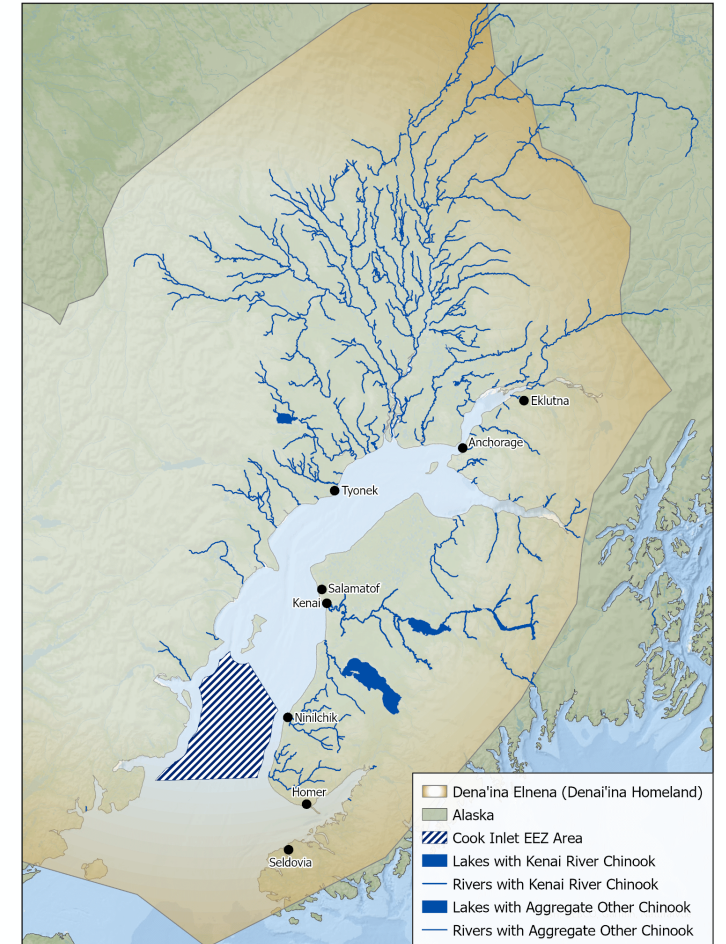
- Generation time = 6 years.
- Buffer of $1/6 = 0.167$ = equivalent of max harvest for a single year in the generation time of Chinook salmon (reduced by cumulative harvest for $T-1$ years).
- Precautionary given small overall EEZ harvests.



AGGREGATE CHINOOK SALMON: TIER 3 ABC/ACL RECOMMENDATION

Recommendations:

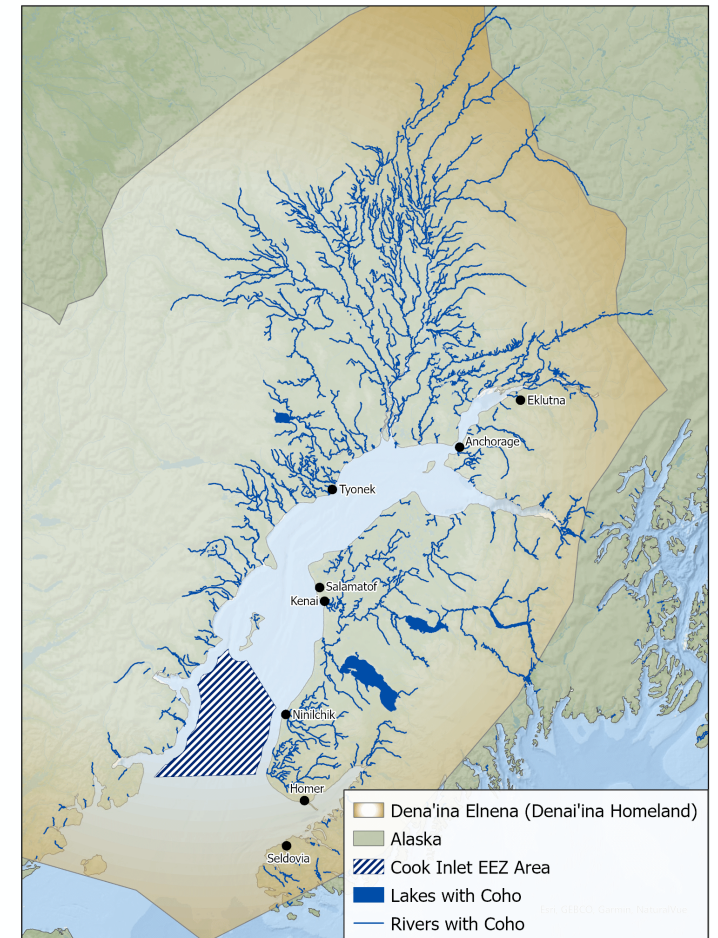
- Preseason total run size: NA
- Preseason OFL..... 2,697 fish
- Buffer 0.167
- ABC..... **450 fish**
- ACL = ABC



AGGREGATE COHO SALMON: STOCK COMPLEX DEFINITION

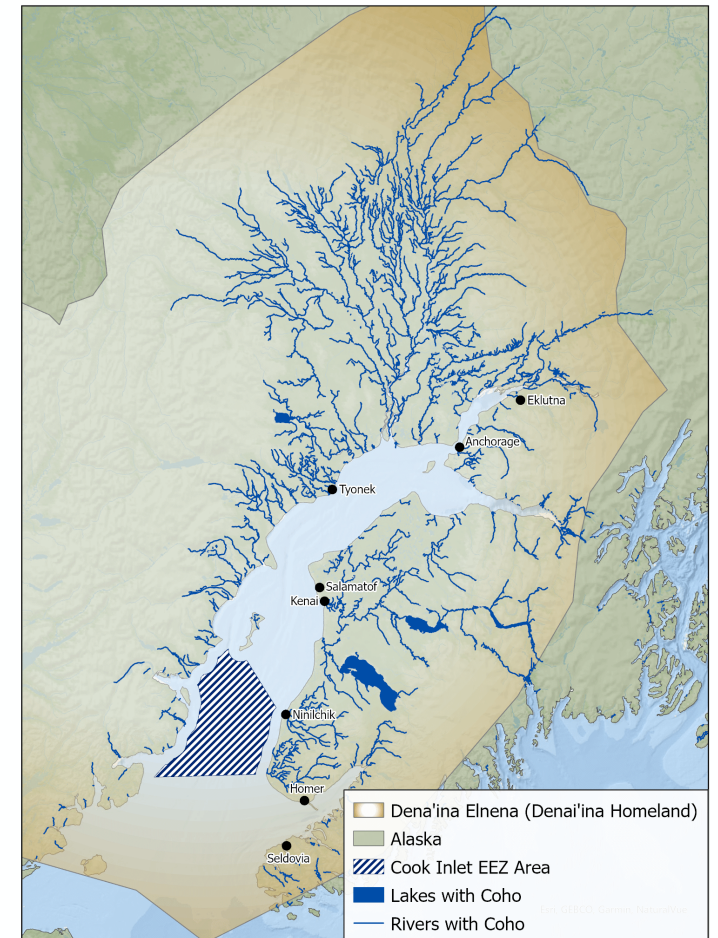
Recommended Federal stock definition:

- All coho salmon harvested in the Cook Inlet EEZ Area.
- Two indicator stocks (Deshka and Little Susitna rivers).
- All unmonitored drainages are part of the stock complex



AGGREGATE COHO SALMON: DATA AVAILABLE

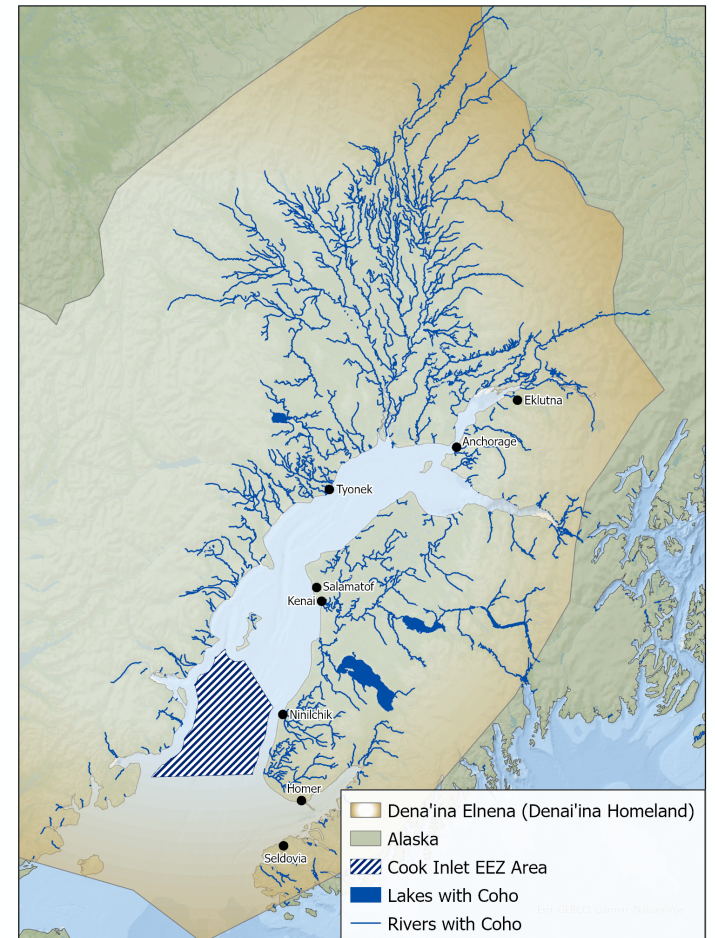
- Escapement data and goals
 - Deshka R. (10,200 – 24,100)
 - Little Susitna R. (9,200 – 17,700)
 - 19,400 total
 - Two additional systems monitored by ADF&G (Jim and Fish creeks).
- ADF&G harvest estimates for all components
 - Recreational, personal use, commercial
- ADF&G genetic stock composition of harvests for select years (2013-2016).



AGGREGATE COHO SALMON: TIER CONSIDERATIONS

Same considerations as for Aggregate “Other” Sockeye Salmon.

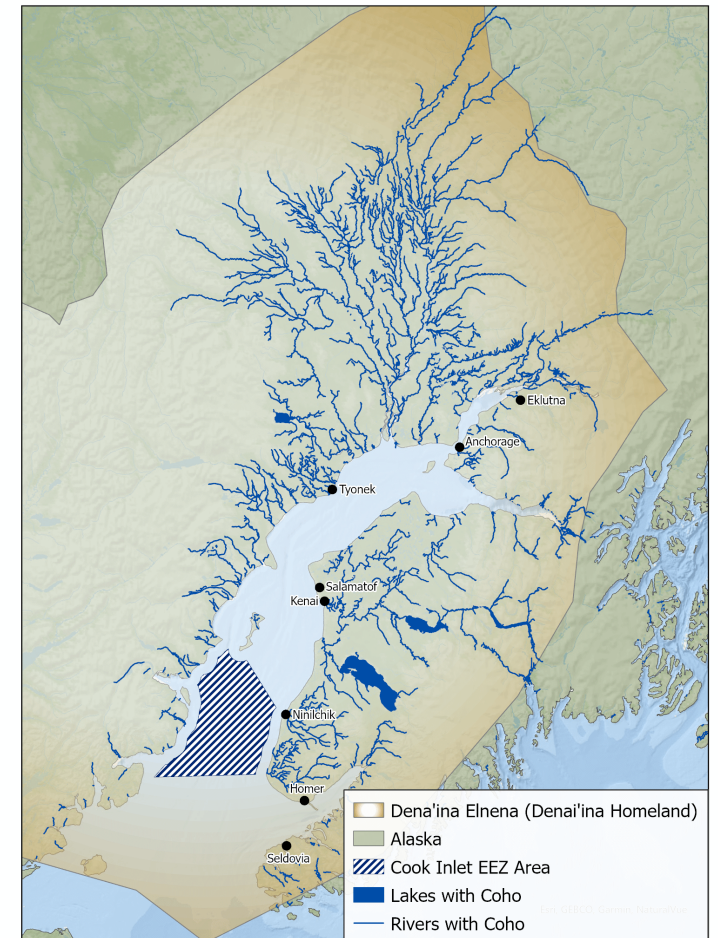
- Incomplete monitoring
 - Inability to estimate escapement for entire stock complex.
 - Inability to estimate total run size.
 - Risk of overestimating potential yield.
 - Risk of declaring overfishing/overfished when not warranted
-
- Recommendation: Tier 3



AGGREGATE COHO SALMON: STOCK CONSIDERATIONS

Escapement monitoring missing/incomplete

- Deshka River (missing): 2020, 2021, 2022
- Little Susitna River (incomplete): 2014, 2018, 2019, 2022
- Stock would have been subject to overfishing in 2013 (if Federal mgmt.)
- Overall: Caution warranted



AGGREGATE COHO SALMON: TIER 2 (NOT RECOMMENDED) SUMMARY TABLE

Estimates of Cum. Escap., total run size, and F_{EEZ} are suspect due to missing spawning data

Year	MSST	Cum. Escap.	MFMT	F_{EEZ}	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC
2019	38.6	106	0.17	0.15	288	39	211		
2020	38.6	101	0.15	0.13	238	2	178		
2021	38.6	57	0.10	0.11	287	33	135		
2022	38.6	41	0.07	0.10	220	24	98		
2023	38.6	32	0.05	0.09	204	25	83		
2024	38.6		0.08	0.12	253		82	32	4.9



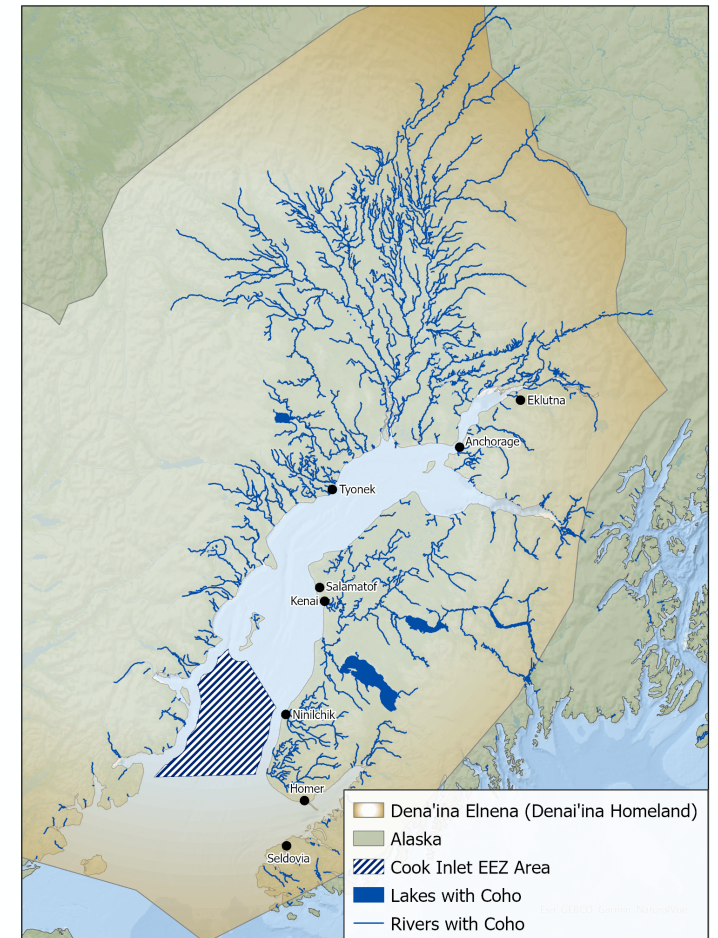
AGGREGATE COHO SALMON: TIER 3 STATUS DETERMINATION CRITERIA

Overfished assessed by:

- Cumulative escapement for generation vs. MSST
- But, escapement values suspect due to incomplete/missing monitoring.
- No good options

Overfishing assessed by:

- Cumulative harvest for generation vs. OFL_{POST}



AGGREGATE COHO SALMON: TIER 3 OFL, BUFFER, ABC

Tier 3

- $OFL = \text{Maximum harvest} \times \text{generation time (4 yrs.)}$
- $OFL_{PRE} = (OFL) - (\text{Cumulative harvest for T-1 years of generation}).$
- $ABC = OFL_{PRE} * \text{Buffer}$



AGGREGATE COHO SALMON: TIER 3 OFL, BUFFER, ABC

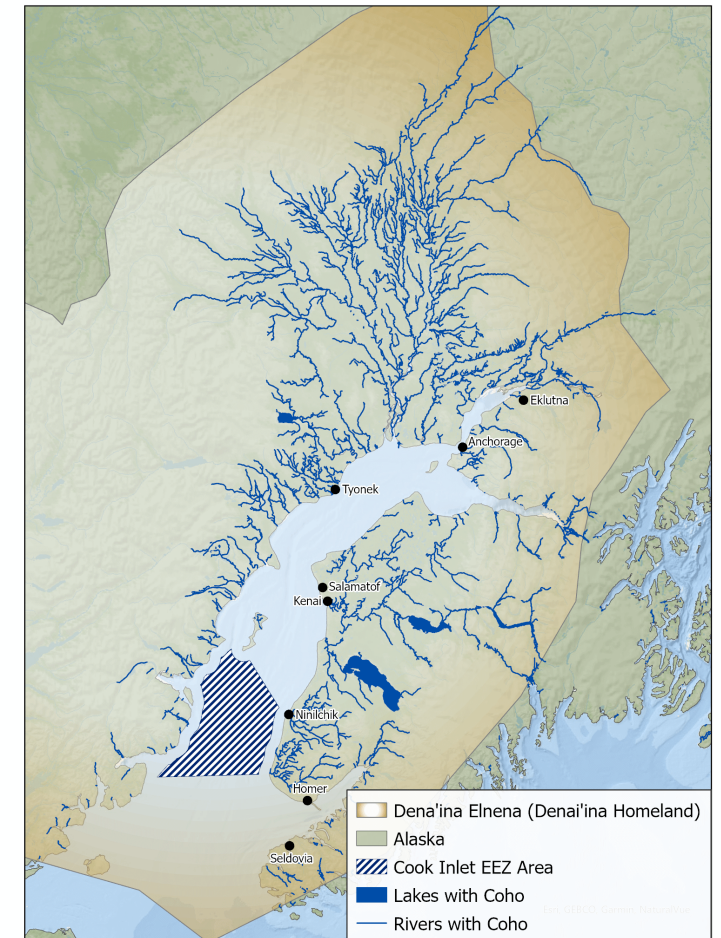
Year	MSST	Cum. Escap.	MFMT	FEEZ	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC (10%)	ABC (90%)
2019	38.6	106	NA	NA	NA	39	211	439		
2020	38.6	101	NA	NA	NA	2	178	439		
2021	38.6	57	NA	NA	NA	33	135	439		
2022	38.6	41	NA	NA	NA	24	98	439		
2023	38.6	32	NA	NA	NA	25	83	439		
2024	38.6		NA	NA	NA		82	358	36	322



AGGREGATE COHO SALMON: BUFFER CONSIDERATIONS

Buffer considerations

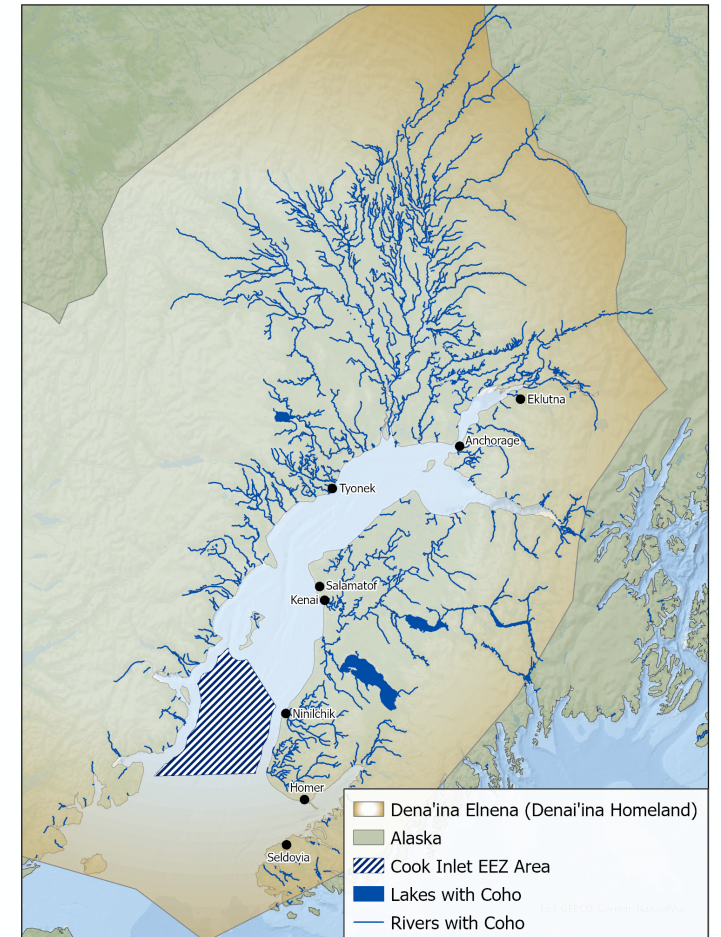
- Escapement estimates incomplete, missing, below goal = CAUTION.
- Species subject to gillnet harvest.
- Genetic data shows drift gillnet harvests of fish bound for N. Cook Inlet.
 - State FMP: prioritization of coho salmon passing through Central district.
- Literature: coho salmon a preferred prey item of endangered Cook Inlet beluga whales.



AGGREGATE COHO SALMON: TIER 3 ABC/ACL RECOMMENDATIONS

Recommendations:

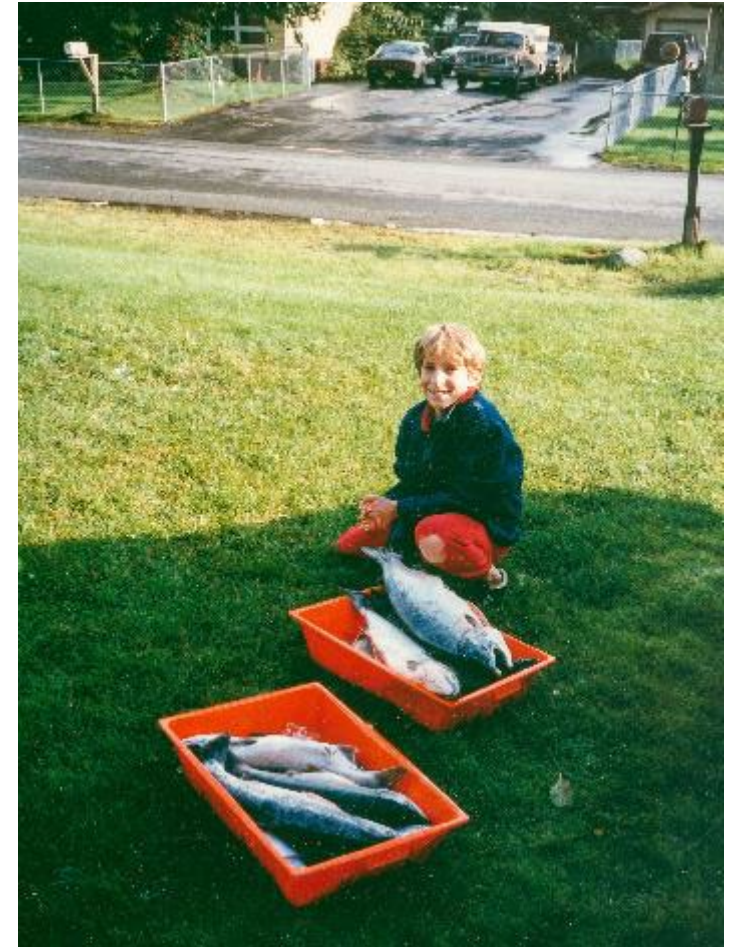
- Preseason total run size: NA
- Preseason OFL..... 357,688
- Buffer 0.10
- ABC..... **35,769** fish
- ACL = ABC



AGGREGATE COHO SALMON: ADDITIONAL RECOMMENDATIONS AND CONSIDERATIONS

Recommendations:

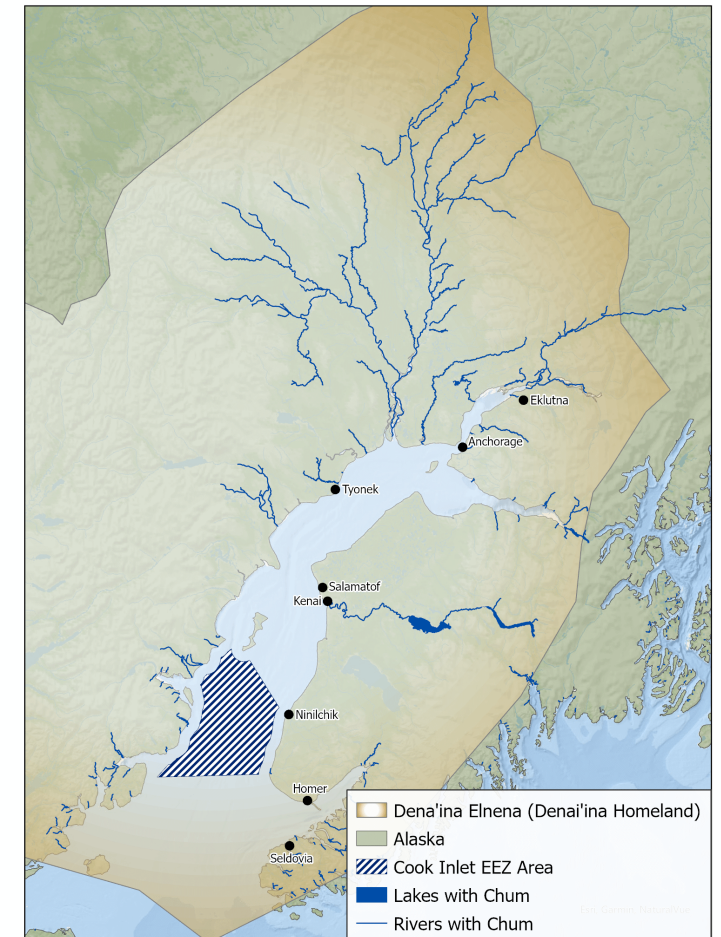
- Additional research on estimating escapements to the entire stock complex.
- Total run size estimates would inform management decisions
- Buffer of 0.10 is lower than method prescribed for Aggregate “Other” Sockeye Salmon and Aggregate Chinook Salmon.
 - Greater caution warranted given harvest potential in the EEZ, missed escapement goals, and other considerations.



AGGREGATE CHUM SALMON: STOCK COMPLEX DEFINITION

Recommended Federal stock definition:

- All chum salmon harvested in the Cook Inlet EEZ Area.
- All UCI drainages/tributaries with chum salmon are part of the stock complex.



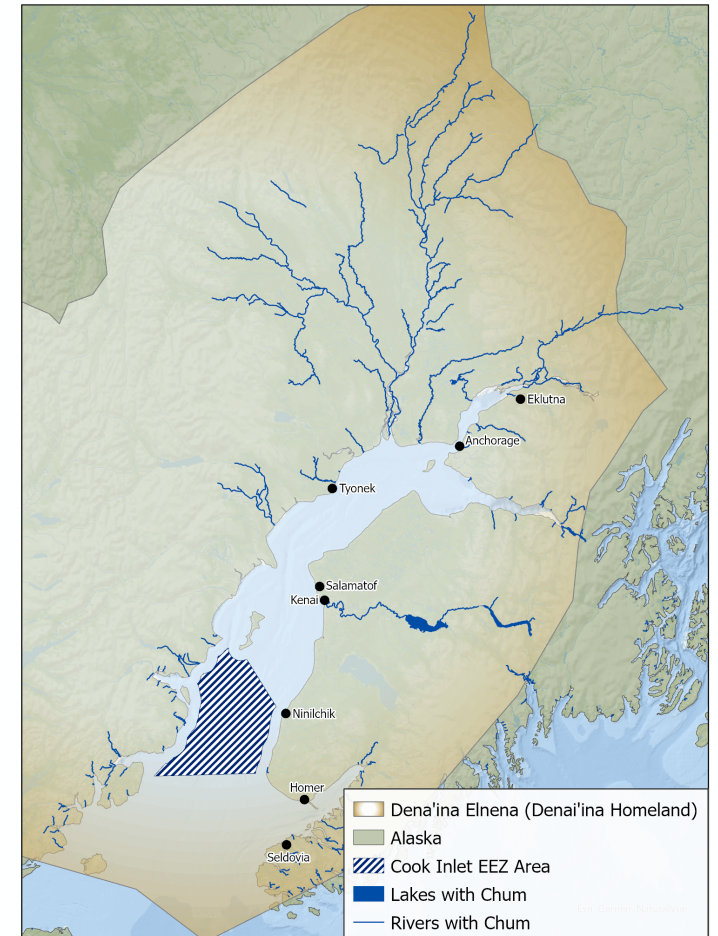
AGGREGATE CHUM SALMON: DATA AVAILABLE

Escapement data and goals

- Clearwater Ck. (3,500 – 8,000)
- via peak aerial survey

ADF&G harvest estimates for all components:
Recreational, personal use, commercial

SAFE assumption: no reliable estimate of stock
complex-wide escapement or total run size.

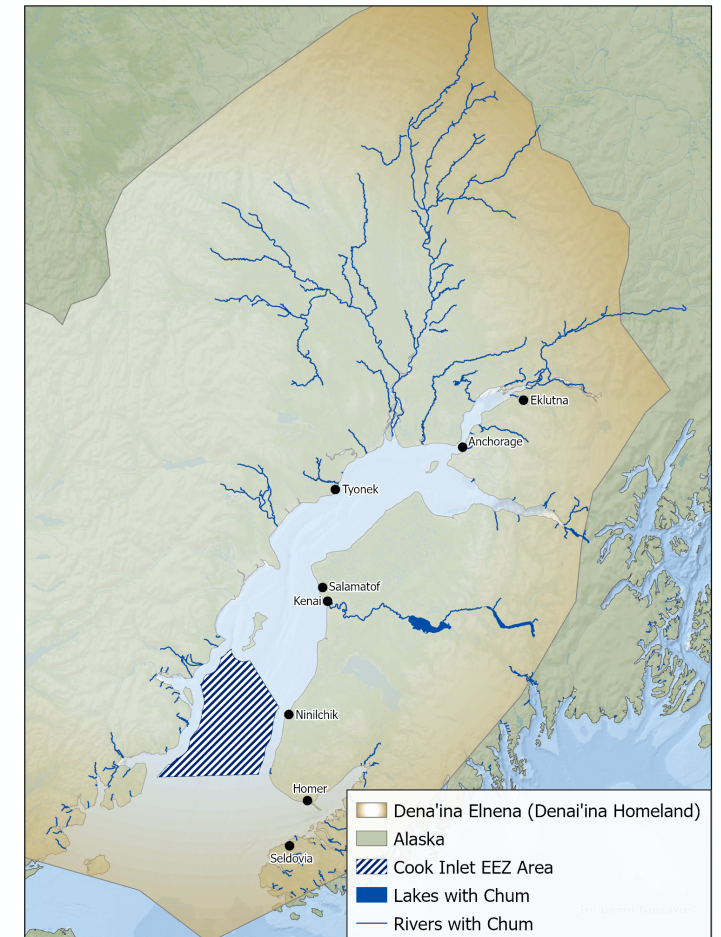


AGGREGATE CHUM SALMON: TIER RECOMMENDATION



No reliable estimate of spawning escapement.

Therefore, recommendation for **Tier 3** for SDC and harvest specifications.



AGGREGATE CHUM SALMON: TIER 3 STOCK STATUS, PROJECTIONS, BUFFER, AND ABC RANGE

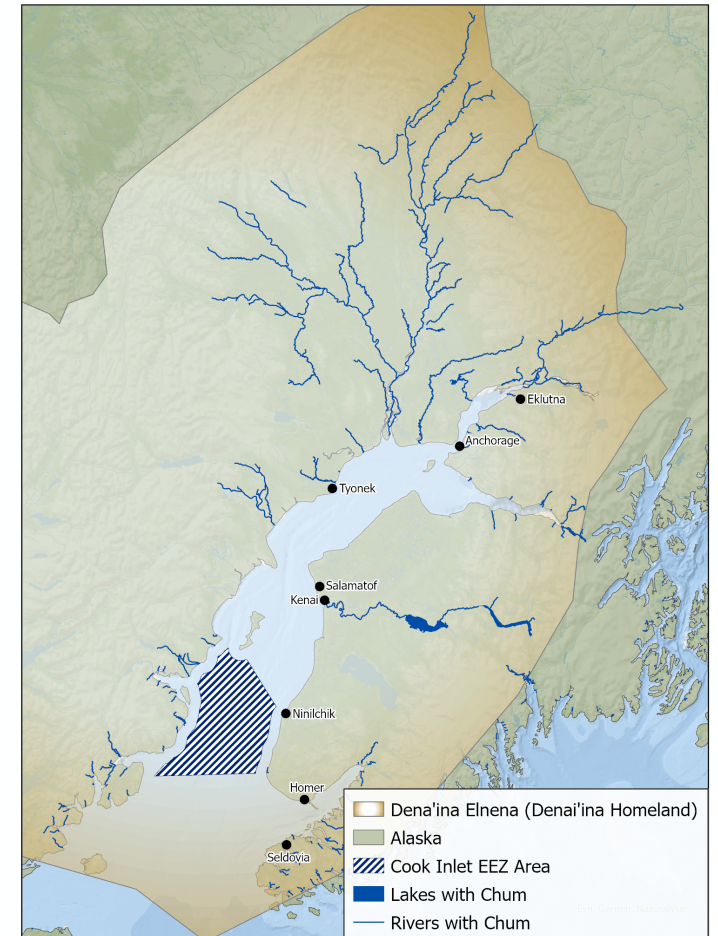
Year	MSST	Cum. Escap.	MFMT	FEEZ	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC (10%)	ABC (90%)
2019	NA		NA	NA	NA	54	262	561		
2020	NA		NA	NA	NA	8	230	561		
2021	NA		NA	NA	NA	29	155	561		
2022	NA		NA	NA	NA	39	130	561		
2023	NA		NA	NA	NA	51	127	561		
2024	NA		NA	NA	NA		119	442	44.2	397.5



AGGREGATE CHUM SALMON: BUFFER CONSIDERATIONS

Buffer considerations

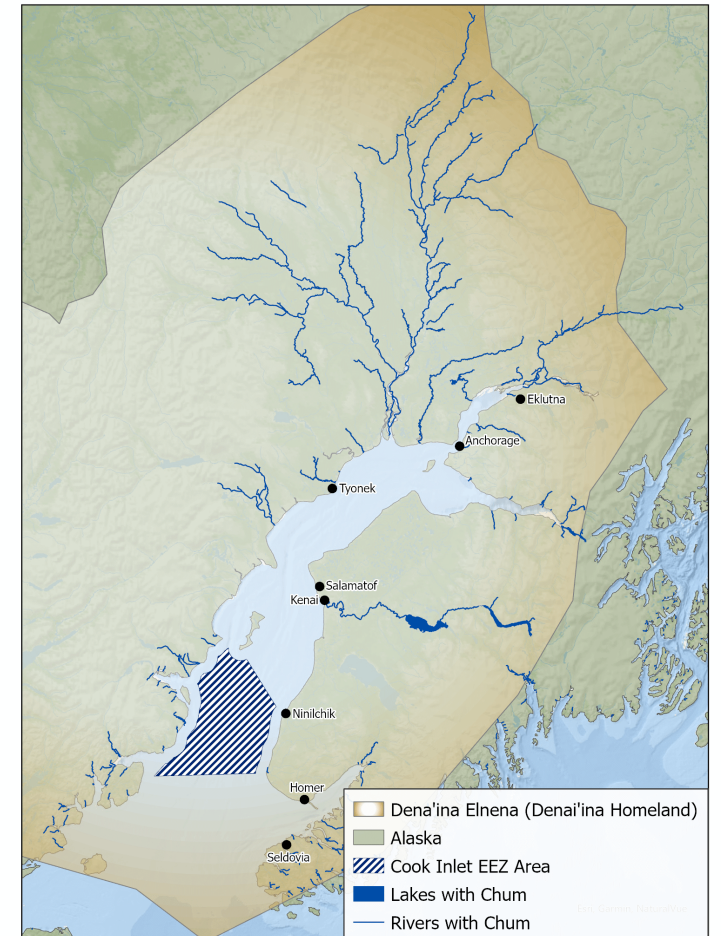
- Tier 3 method: chum salmon gen time = 4 yrs.
- Baseline buffer of $\frac{1}{4}$ of OFL = 0.25
- SAFE assumption: stock is not overfished, not subject to overfishing, not targeted in EEZ.
- But, chum salmon susceptible to gillnet harvest.
 - Not many chum salmon systems.
- Recommendation: liberalized buffer of 0.50



AGGREGATE CHUM SALMON: TIER 3 ABC/ACL RECOMMENDATIONS

Recommendations:

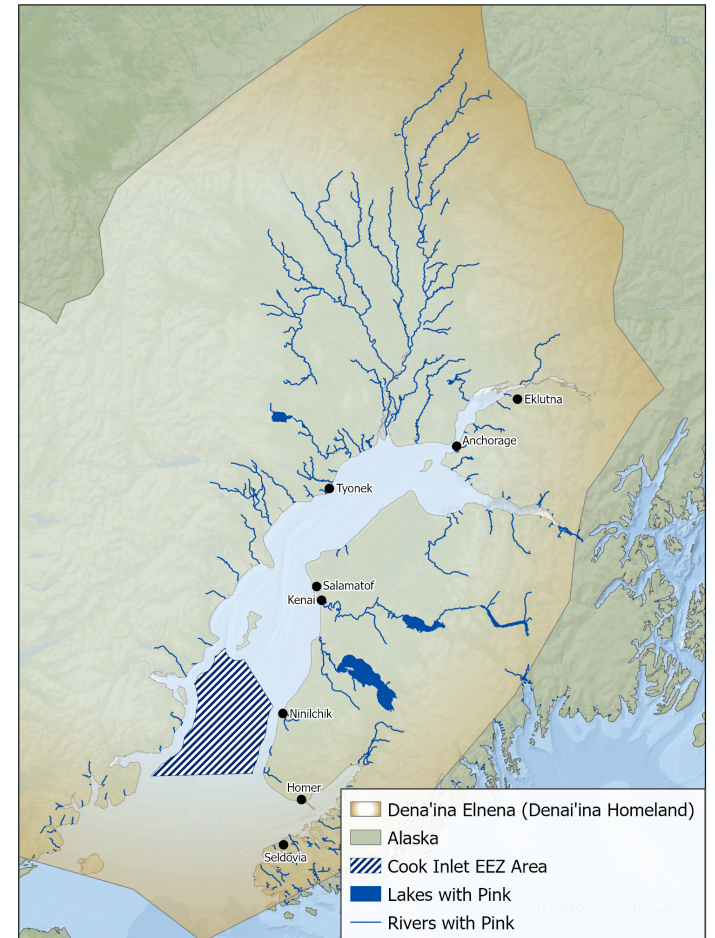
- Preseason total run size: NA
- Preseason OFL..... 441,727
- Buffer 0.50
- ABC..... **220,864 fish**
- ACL = ABC



AGGREGATE PINK SALMON: STOCK COMPLEX DEFINITION

Recommended Federal stock definition:

- All pink salmon harvested in the Cook Inlet EEZ Area.
- No indicator stocks
- All unmonitored drainages are part of the stock complex



AGGREGATE PINK SALMON: DATA AVAILABLE

Escapement data and goals

- No escapement goals

ADF&G harvest estimates for all components

- Recreational, personal use, commercial

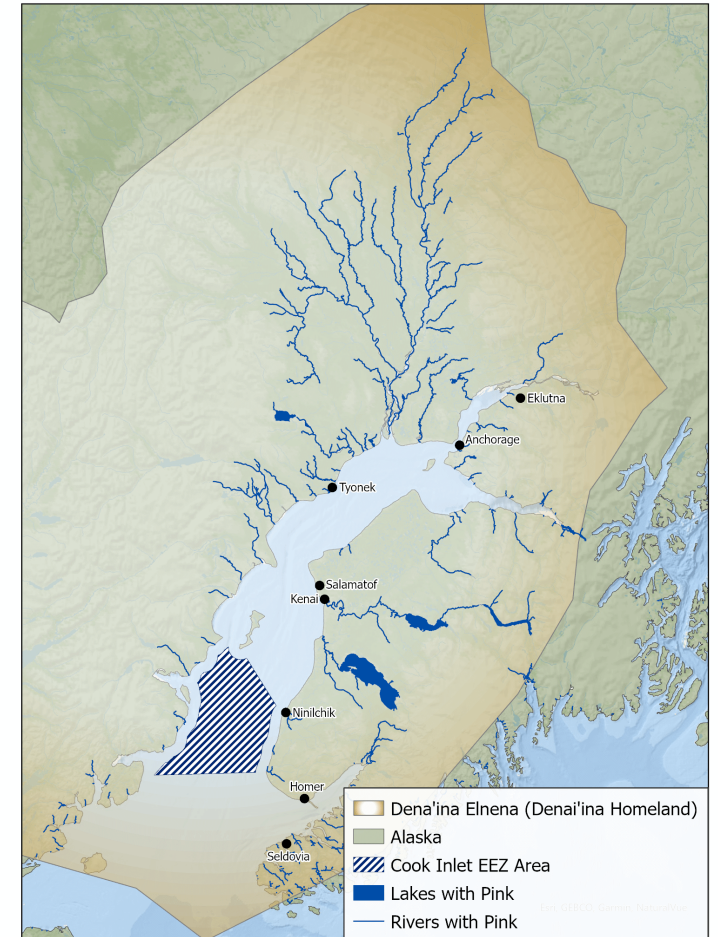
SAFE Estimates: recreational harvests for recent years; proportion harvested in the EEZ.



AGGREGATE PINK SALMON: TIER 3 SDC & HARVEST SPECIFICATIONS

Tier 3

- $OFL = \text{Maximum harvest} \times \text{generation time (2 yrs.)}$
- $OFL_{PRE} = (OFL) - (\text{Cumulative harvest for T-1 years of generation})$.
- $ABC = OFL_{PRE} * \text{Buffer}$



AGGREGATE PINK SALMON: TIER 3 STOCK STATUS, PROJECTIONS, BUFFER, AND ABC RANGE

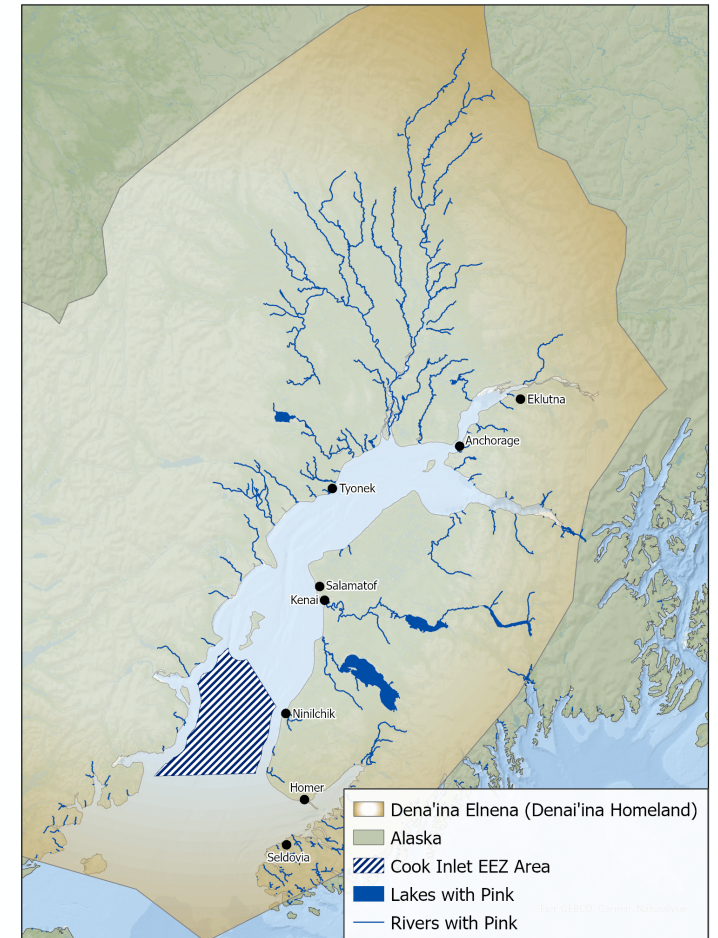
Year	MSST	Cum. Escap.	MFMT	FEEZ	Total Run	EEZ Harvest	EEZ Cum. Harvest	OFL	ABC (10%)	ABC (90%)
2014	NA	NA	NA	NA	NA	150	283	300		
2016	NA	NA	NA	NA	NA	109	260	300		
2018	NA	NA	NA	NA	NA	39	148	300		
2020	NA	NA	NA	NA	NA	12	51	300		
2022	NA	NA	NA	NA	NA	30	41	300		
2024	NA	NA	NA	NA	NA		30	270	27	243



AGGREGATE PINK SALMON: BUFFER CONSIDERATIONS

Buffer considerations

- Tier 3: pink salmon gen time = 2 yrs. = baseline buffer of 1/2 of OFL = 0.50
- SAFE assumption: stock is not overfished, not subject to overfishing, not targeted in EEZ, many fish not susceptible to gillnet harvest.
- Recommendation: liberalized buffer of 0.90



AGGREGATE PINK SALMON: TIER 3 ABC/ACL RECOMMENDATIONS

Recommendations:

- Preseason total run size: NA
- Preseason OFL..... 270,435
- Buffer 0.90
- ABC..... **243,392 fish**
- ACL = ABC

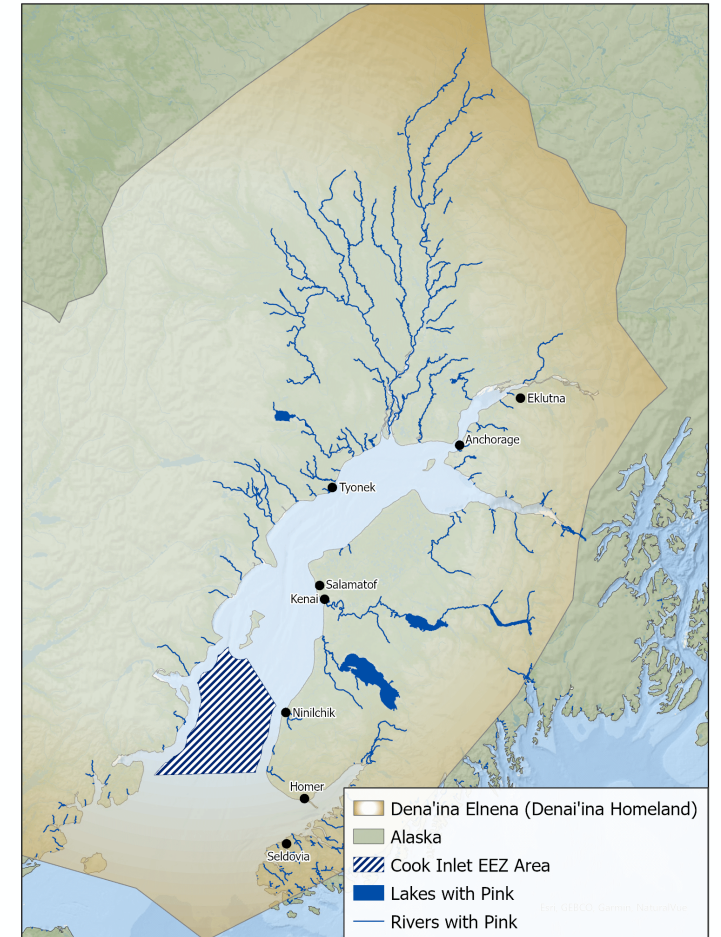


TABLE 3: 2023 STOCK STATUS (IF THERE HAD BEEN A FEDERAL FISHERY)



Stock	Tier	MSST	Cum. Escap	MFMT	FEEZ	Total Run	EEZ Catch	Cum. Harvest Gen.	Potential yield EEZ	Tier 3 OFL
Kenai River Late-Run sockeye salmon	1	1,850	8,561	0.37	0.08	3,882	418	1,308	1,761	
Kasilof River sockeye salmon	1	360	3,333	0.52	0.03	460	57	140	850	
Aggregate Other sockeye salmon (T2)	2*	163	631	0.36	0.22*	270*	183	457	201	
Aggregate Other sockeye salmon (T3)	3	163	631				183	457	NA	1,271
Kenai River Late-Run Large Chinook salmon	1*	44	82	0.046	0.003*	14.7	21 fish*	239 fish	0 fish	
Aggregate Other Chinook salmon	3*						30 fish*			
Aggregate Chinook salmon	3	44	82				51 fish	635 fish	NA	3,072
Aggregate coho salmon (T2)	2*	40	32*	0.05*	0.09*	204*	25	83	11	
Aggregate coho salmon (T3)	3	40	32*				25	83	NA	440
Aggregate chum salmon	3	NA	NA	NA	NA	NA	51	127	NA	561
Aggregate pink salmon	3	NA	NA	NA	NA	NA	30	41	NA	300

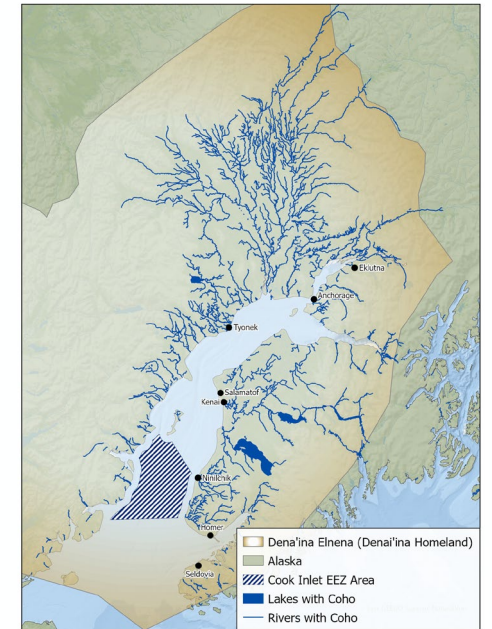
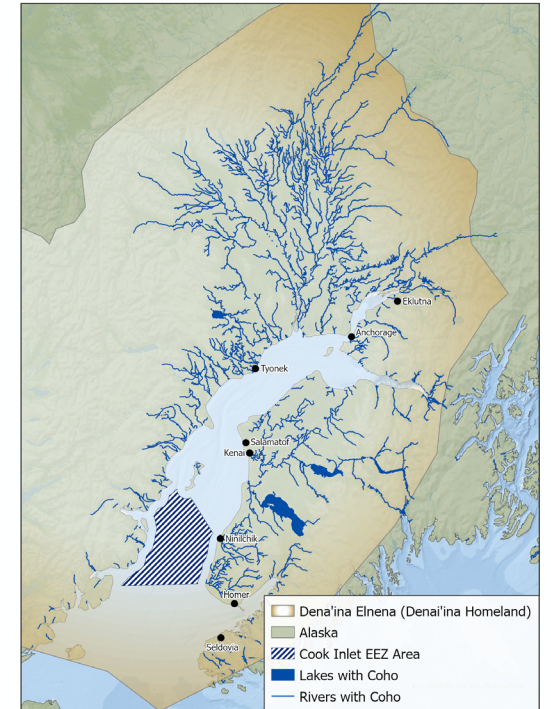


TABLE 4: 2024 RECOMMENDED TIERS, PRESEASON OFL, BUFFER, AND ABC/ACL

Stock	Tier	Total Run Size	Escapement goal(s)	Preseason OFL	ABC buffer	ABC
Kenai River Late-Run sockeye salmon	1	3,485	750	1,364	0.478	652.5
Kasilof River sockeye salmon	1	1,125	140	623	0.694	432.6
Aggregate Other sockeye salmon (T2)	2	314	65	230	0.736	169
Aggregate Other sockeye salmon (T3)	3	NA	65	888	0.200	177.5
Kenai River Late-Run Large Chinook salmon	1	14.7	15	0	NA	0
Aggregate Other Chinook salmon	NA	NA	NA	NA	NA	NA
Aggregate Chinook salmon	3	NA	15	2,697 fish	0.167	450 fish
Aggregate coho salmon (T2)	2	253	19.3	32	0.153	4.9
Aggregate coho salmon (T3)	3	NA	19.3	358	0.100	35.8
Aggregate chum salmon	3	NA	3.5	442	0.500	220.9
Aggregate pink salmon	3	NA	NA	270	0.900	243.4



RECOMMENDATIONS FOR THE SSC

Stock definitions:Tables 1, 3, 4

Tier assignments:Table 4

Recommendations for analysis approach and model:SDC Section; Appendix B

Recommendations for data, estimates, and assumptions used:Stock Status Summaries; Appendices A1-A10; GitHub repository

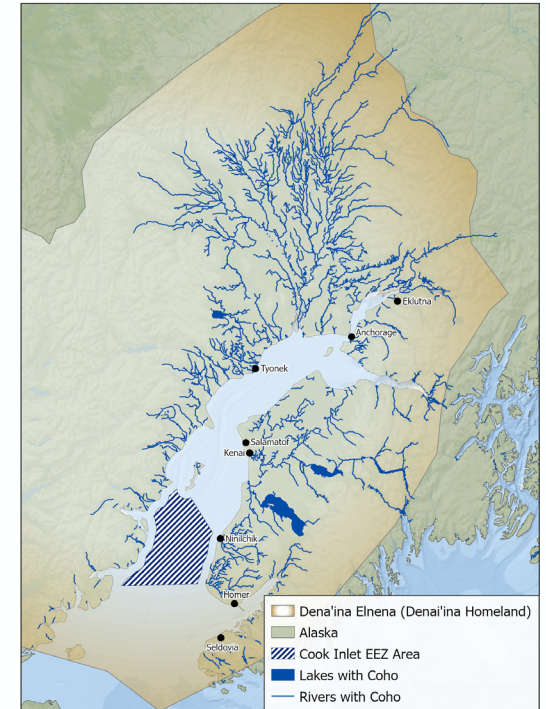
Recommendations for OFL:Stock Status Summaries; Table 4; Appendices A1-A10

Recommendations for buffers of OFL and the resulting ABC:Stock Status Summaries; Table 4

Recommendations for ACL:Same as ABC

Recommendations for de minimis harvest:NA with stock and tier recommendations

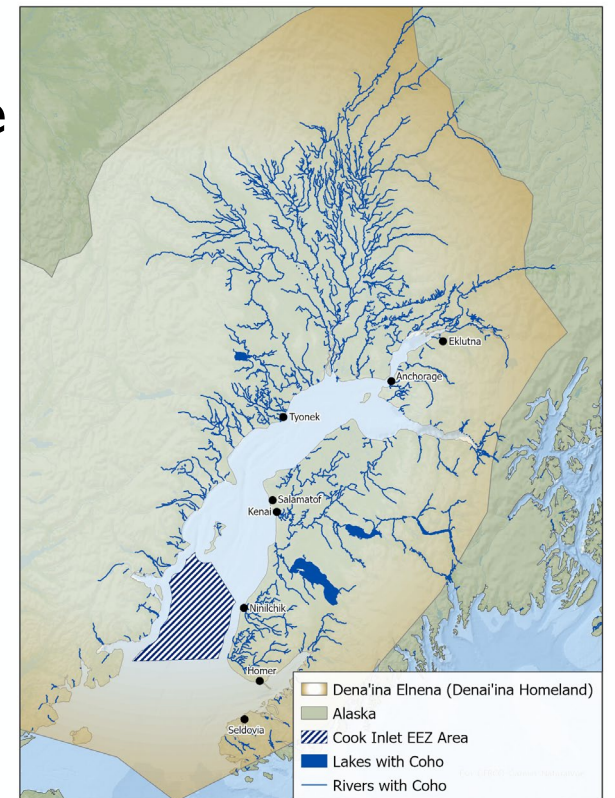
Other recommendations by the NOAA SAFE Team:



ADDITIONAL RECOMMENDATIONS

The NOAA SAFE Team recommends additional research to:

- Estimate total run size for coho and Aggregate “Other” Sockeye salmon in particular.
 - Improved confidence in future SAFE recommendations.
 - Better inform estimates of potential yield and risks.
- Improve forecasts of salmon run size and run timing for UCI salmon stocks harvested in the EEZ.



RECOMMENDED TAC

Recommended 2024 Federal Cook Inlet EEZ Area TAC by species:

Sockeye salmon: **1,262,525 fish***

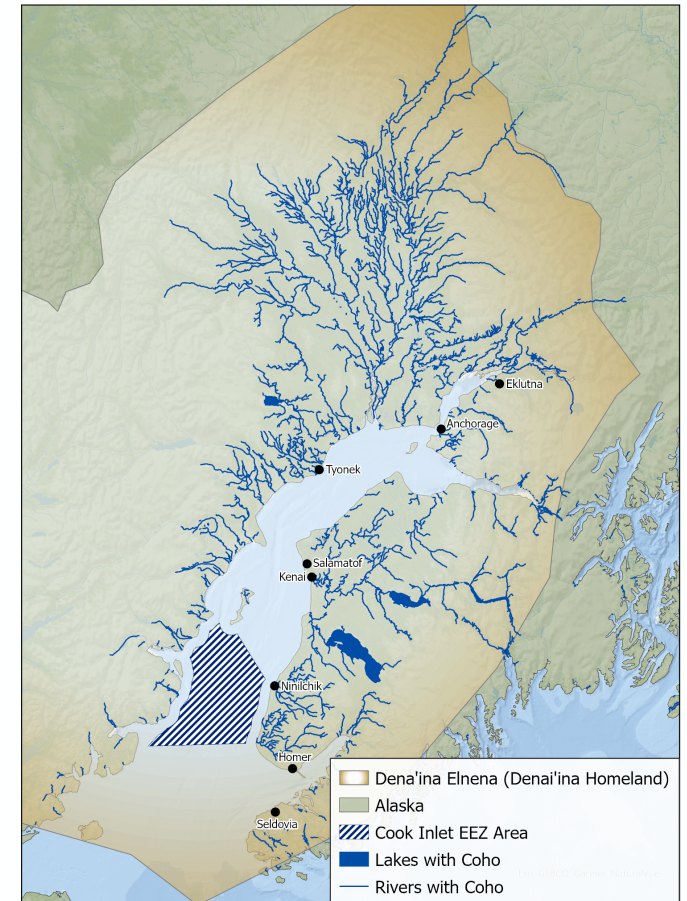
Chinook salmon: **450 fish**

Coho salmon: **35,769 fish**

Chum salmon: **220,864 fish**

Pink salmon: **243,392 fish**

*The sum of 3 ACLs; based on historical harvest proportions, it is assumed that no individual ACLs will be exceeded.



CLOSING COMMENTS

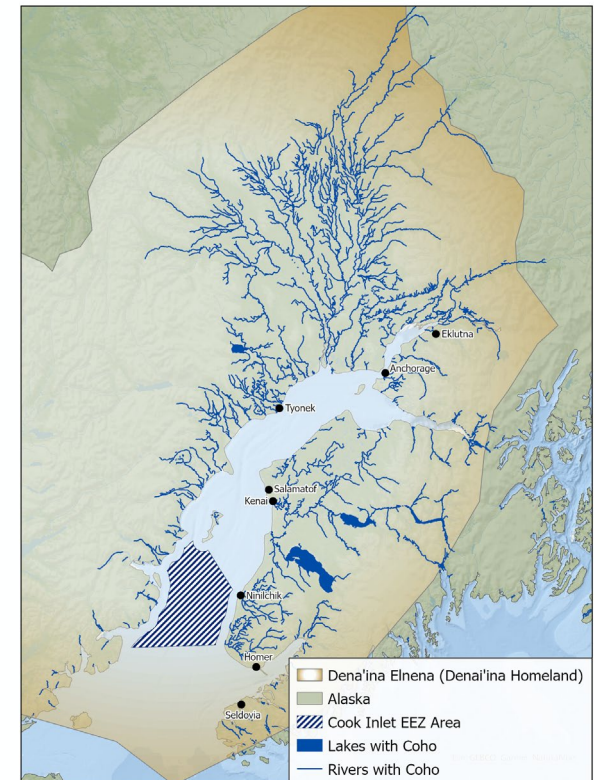
This SAFE is a first step, more improvements in the future.

Getting beyond historical estimates: actual EEZ harvests will provide better information to inform Federal fisheries management.

NOAA SAFE Team assumptions

- Model suggests that tier 1 buffers are precautionary over the long term.
- More difficult to assess Tier 3 stock status, but our assumption is that these buffers are also precautionary over the long term.

The NOAA SAFE Team welcome corrections and suggestions on data, estimate, modeling approaches, and assumptions.

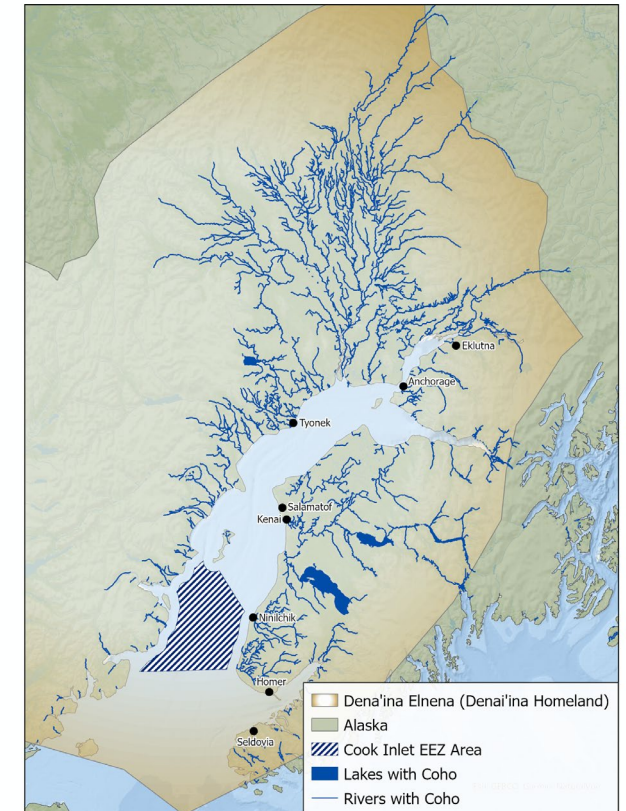


CLOSING COMMENTS: 2024 ASSUMED LEVEL OF PRECAUTION WARRANTED BY STOCK

2024 Federal EEZ SAFE assumed level of precaution warranted across stocks based on stock status summaries, and expressed in the buffer to reduce OFL to the ABC and ACL:

- High: Aggregate Coho salmon
- Medium: Aggregate Chinook salmon*, Aggregate “Other” Sockeye Salmon
- Low: Kenai Late Run Sockeye Salmon, Kasilof Sockeye Salmon, Aggregate Chum Salmon, Aggregate Pink Salmon

*very low harvest in the EEZ



COOK INLET SALMON: SSC REVIEW OF 2024 SAFE



THANK YOU

