

Approach to evaluating winter-run Chinook salmon response to novel water allocation scenarios

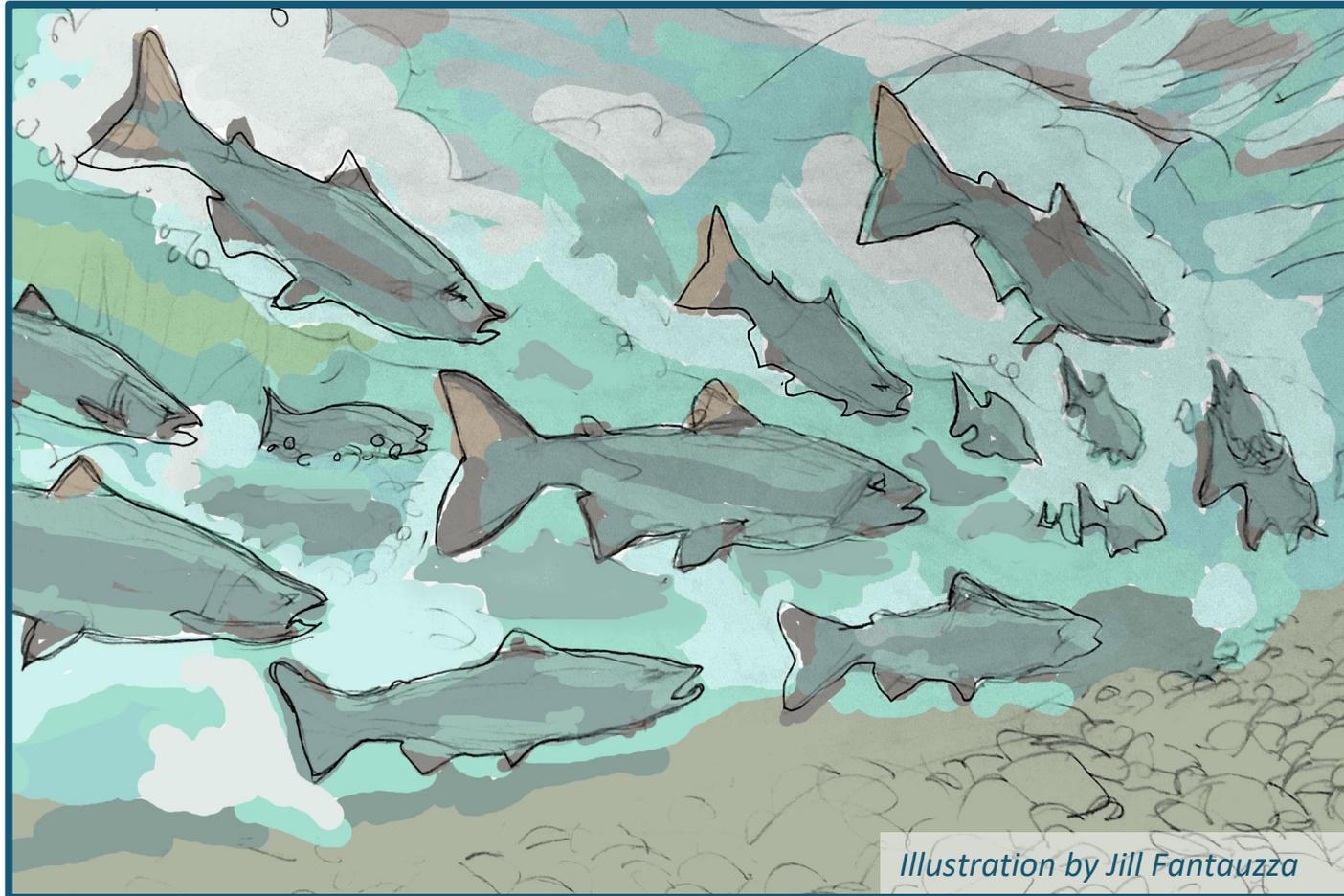


Illustration by Jill Fantauzza

Presentation for the
California Water and Environmental
Modeling Forum (CWEMF)

14 May 2025

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Noble Hendrix, QEDA Consulting LLC

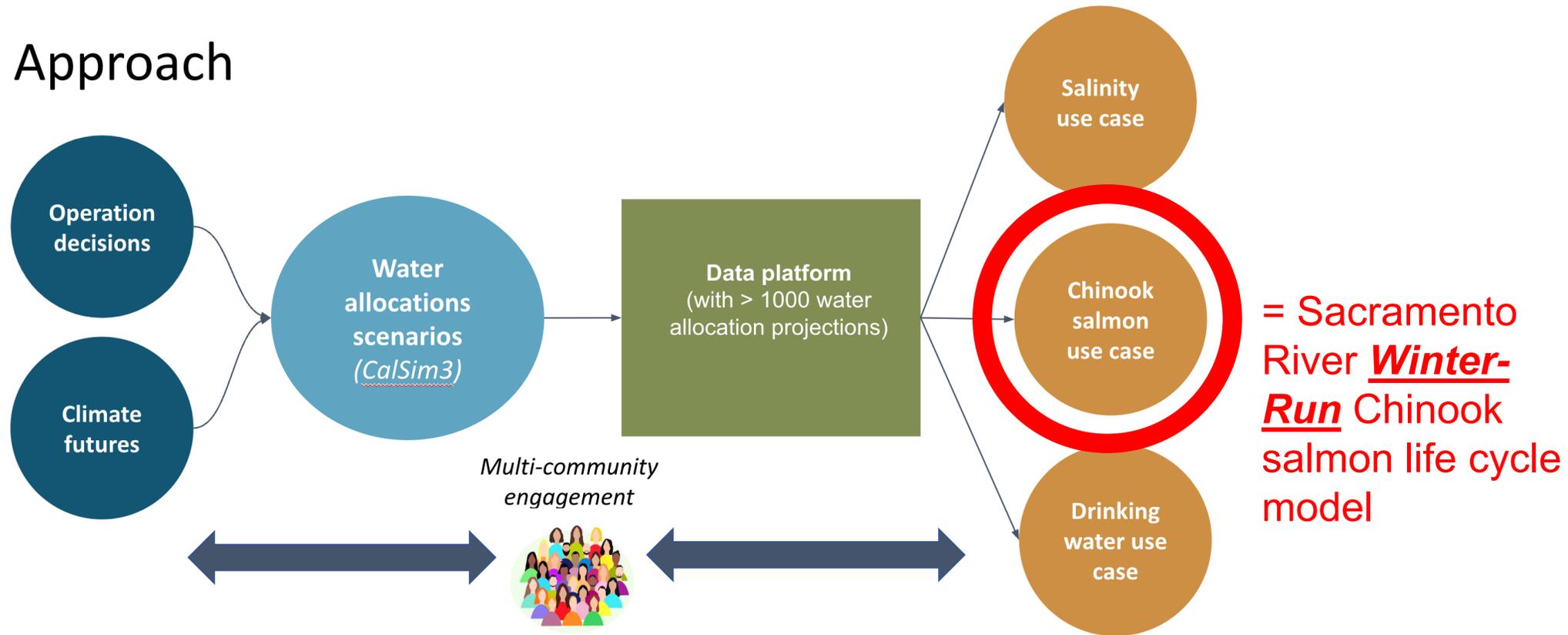
Eric Danner, UC Santa Cruz/NMFS SWFSC

The Role of the Sacramento River
Winter-run Chinook Life Cycle Model (WRLCM)
in the COEQWAL Project

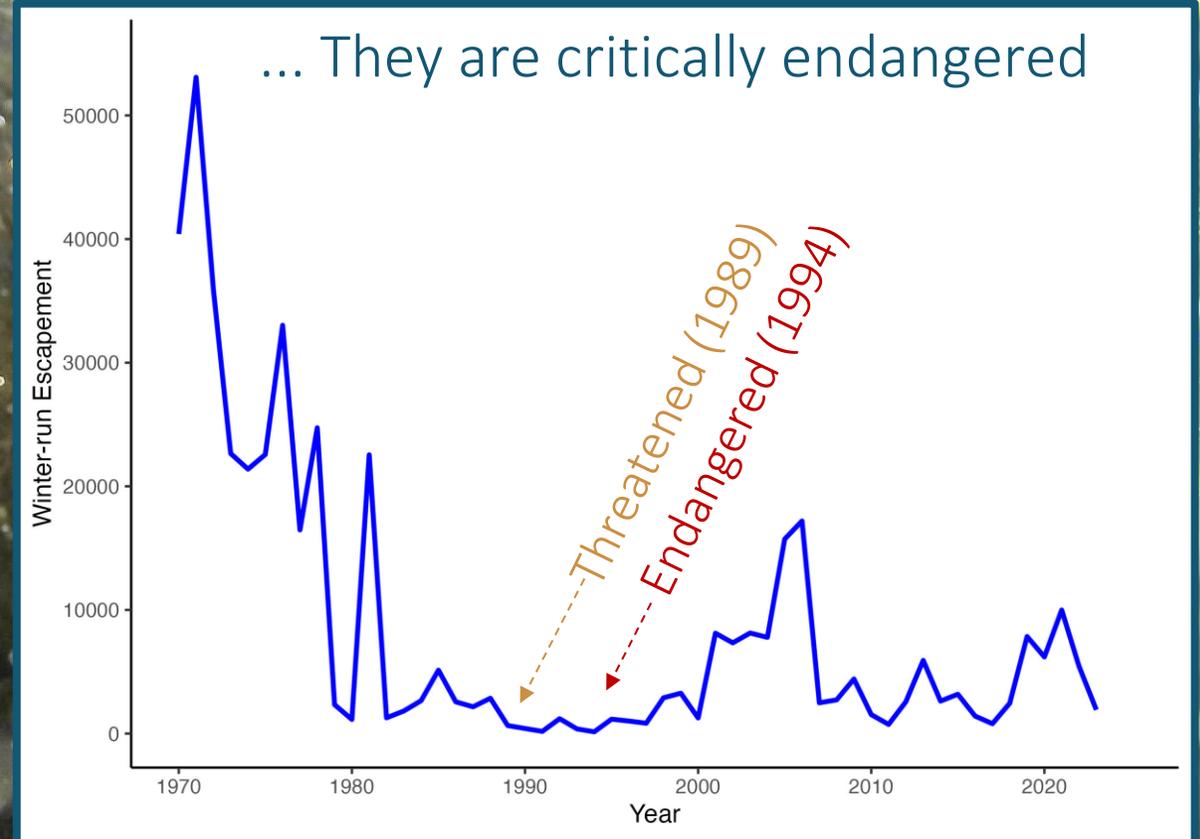
COEQWAL: Collaboratory for Equity in Water Allocation

- Project funded by the University of California's California Climate Action Initiative
- Goal: establish an inclusive participatory process that diversifies and enhances engagement in water planning and stewardship in California
- Approach: develop a suite of novel *future water allocation scenarios*
 - Climate models ("hydroclimate futures") + CalSim 3 water planning model
- Question: What does California water allocation look like assuming each future?
 - and what are the implications for various water-users (including endangered salmon)?

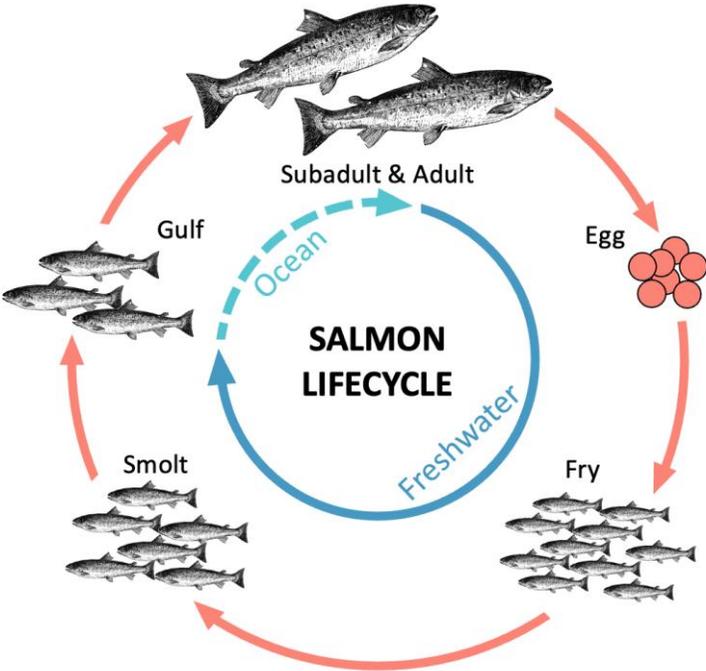
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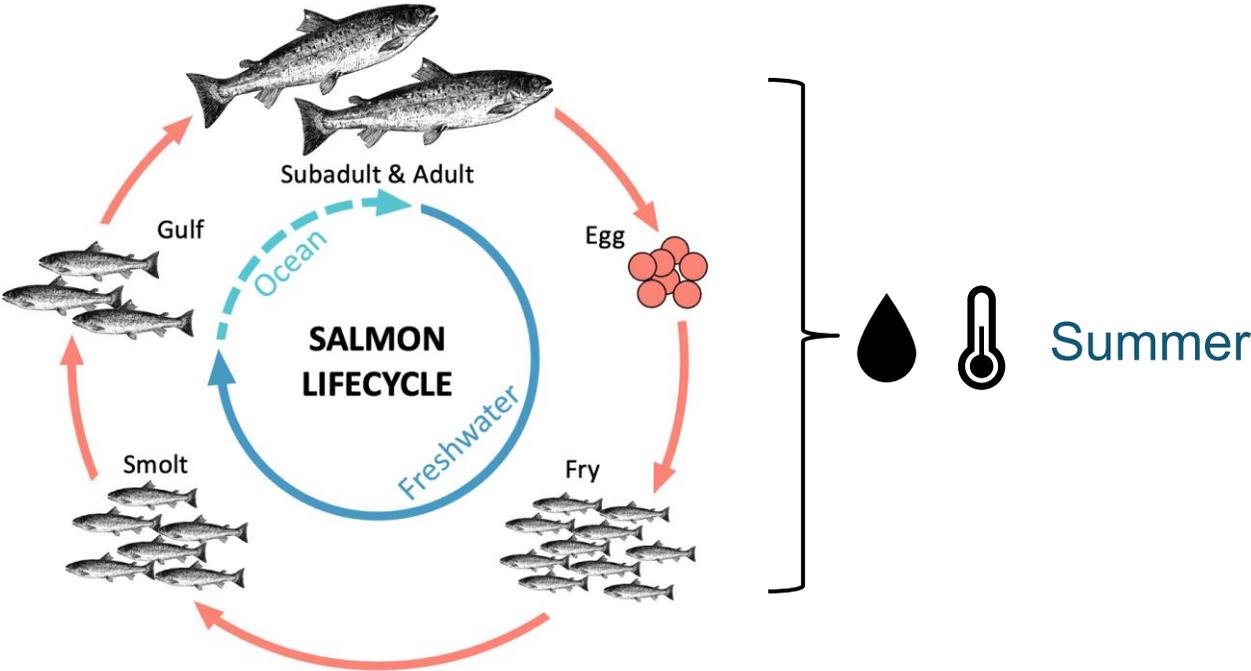
Why focus on Sacramento River Winter-run Chinook?



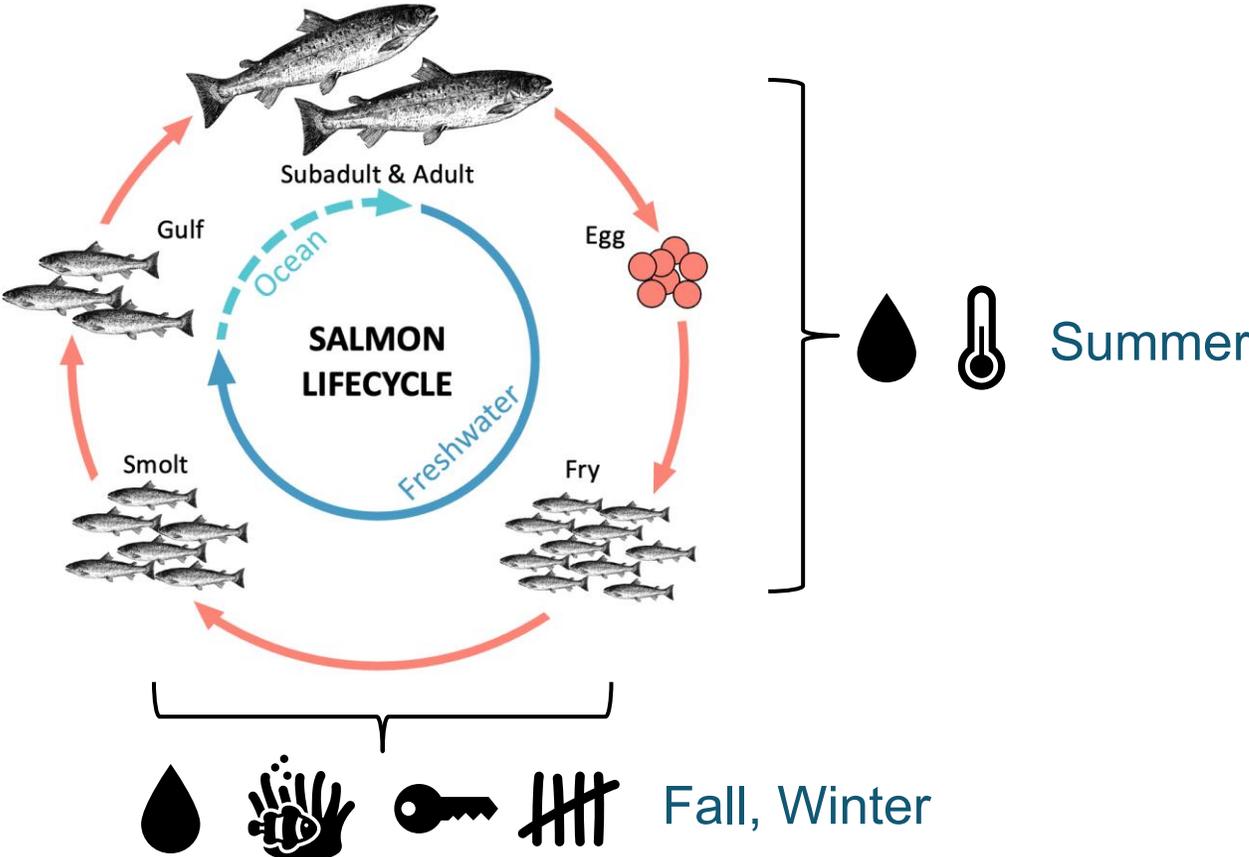
Complex Life Cycle is sensitive to abiotic conditions, specific to each lifestage, location, and timing



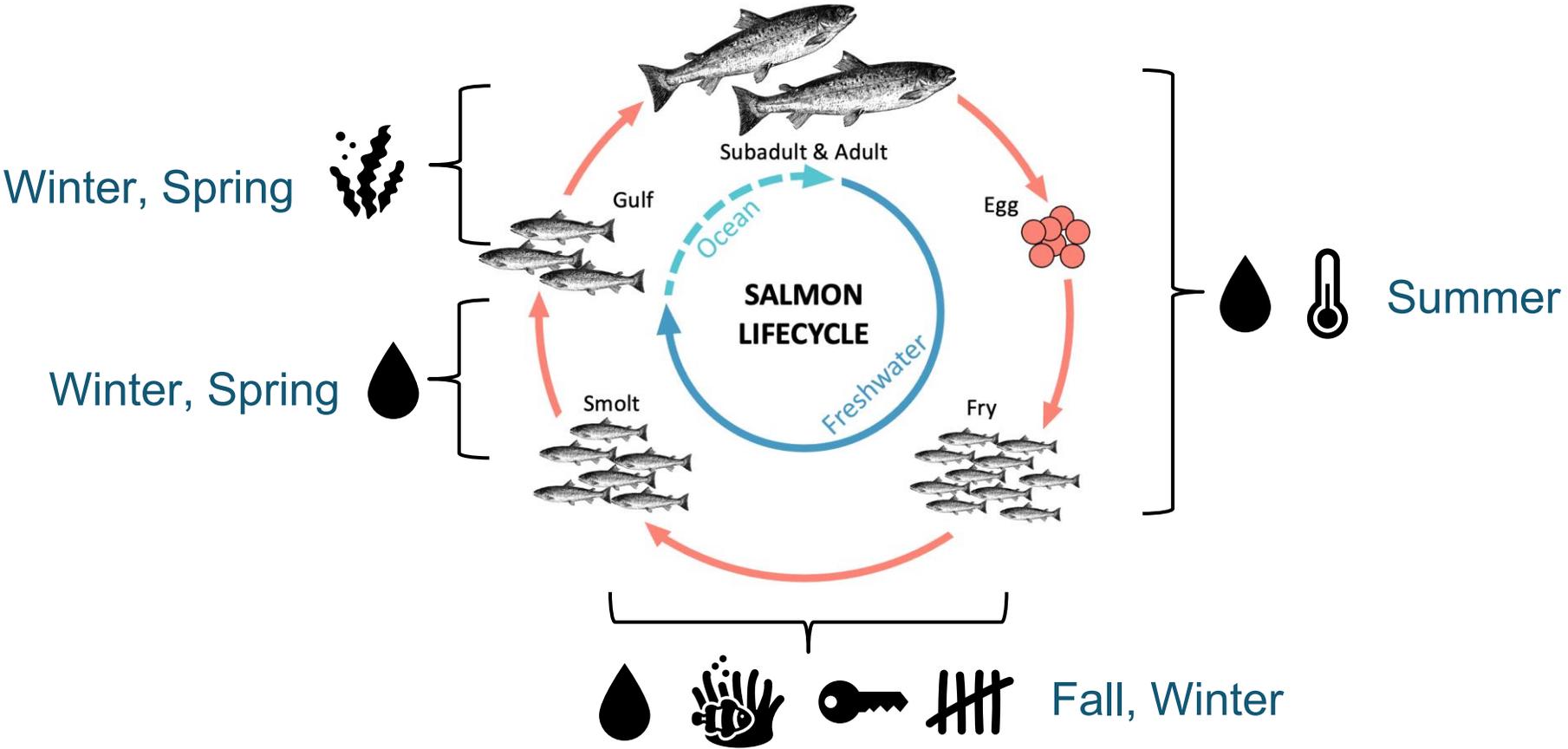
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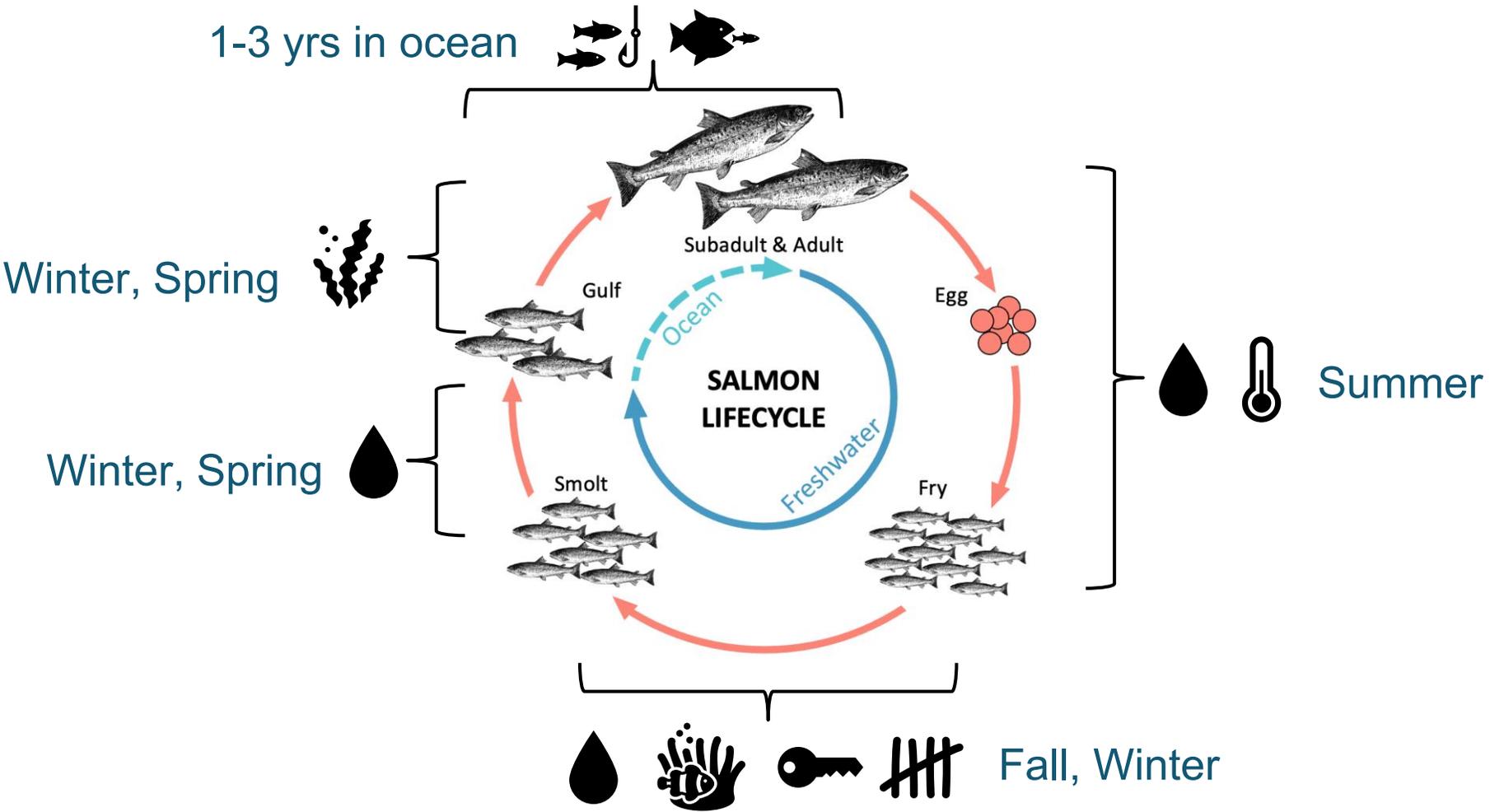
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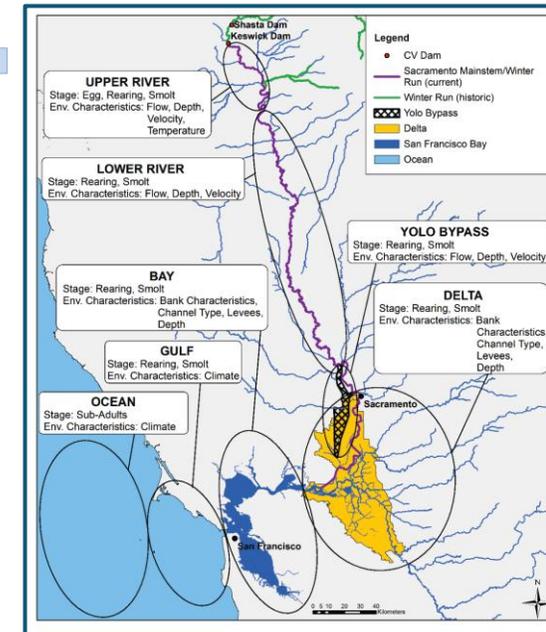
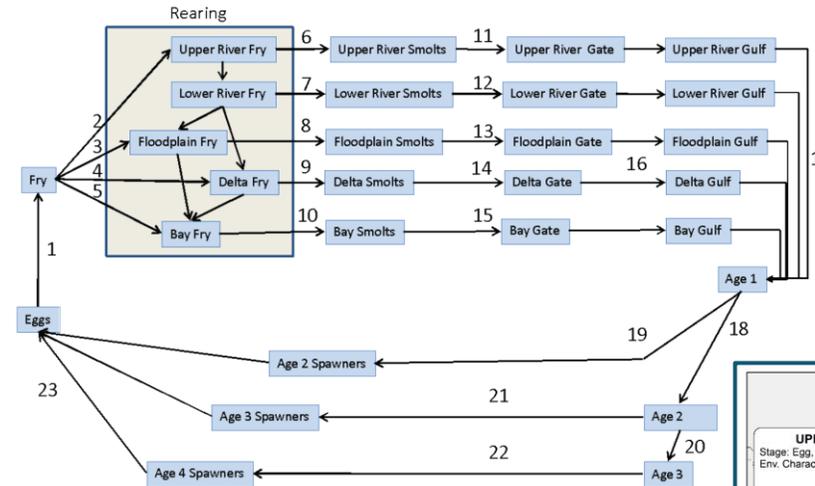


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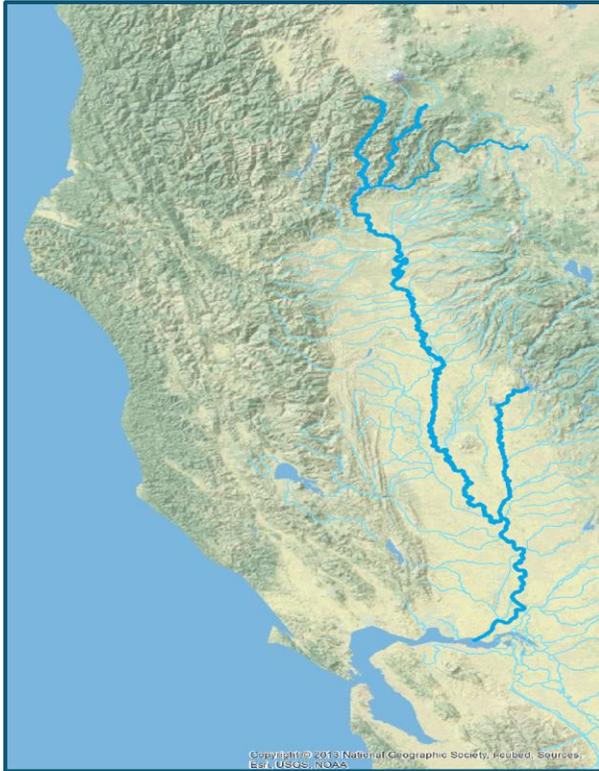


NOAA developed a tool to evaluate how changes to water allocation affect winter-run Chinook salmon

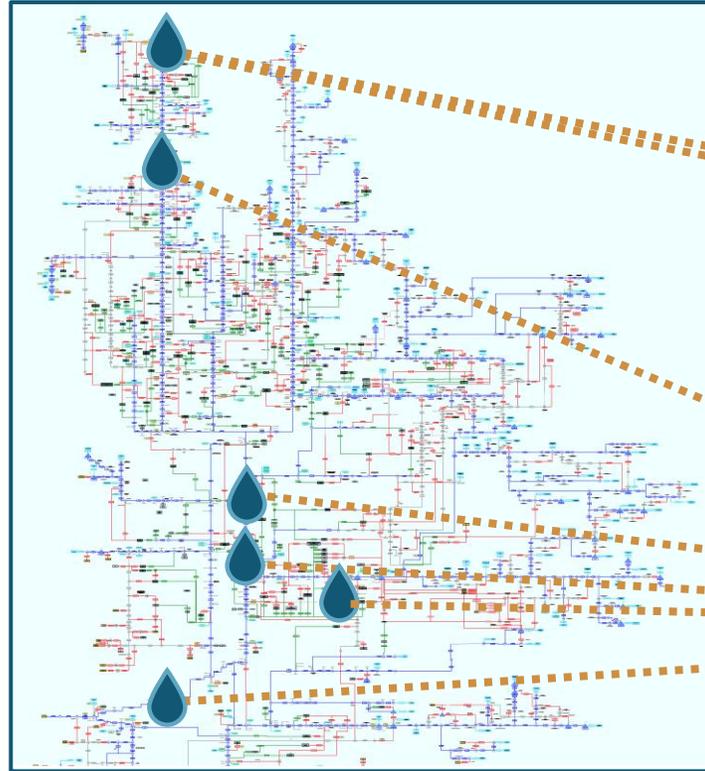
- Winter-run Chinook salmon Life Cycle Model (WRLCM) -- simulation model
 - abundance by lifestage, month, and location
- Transitions use abiotic covariates (temp, flow, habitat, access) to inform vital rates (survival, movement)
 - Covariates are informed by [CalSim](#)
- Used to evaluate effects of proposed water operations on long-term population dynamics (BiOps)



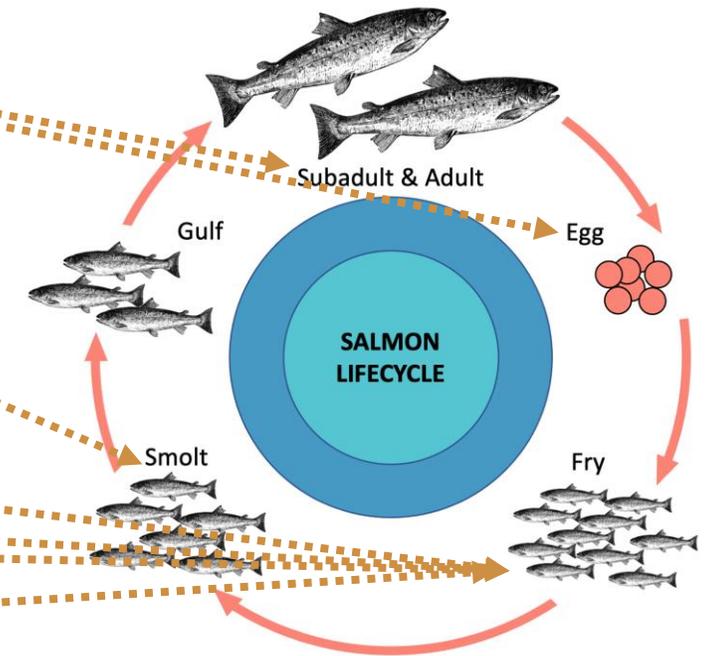
Linking the WRLCM to COEQWAL: The salmon Use Case



Sacramento River
(where winter-run live)

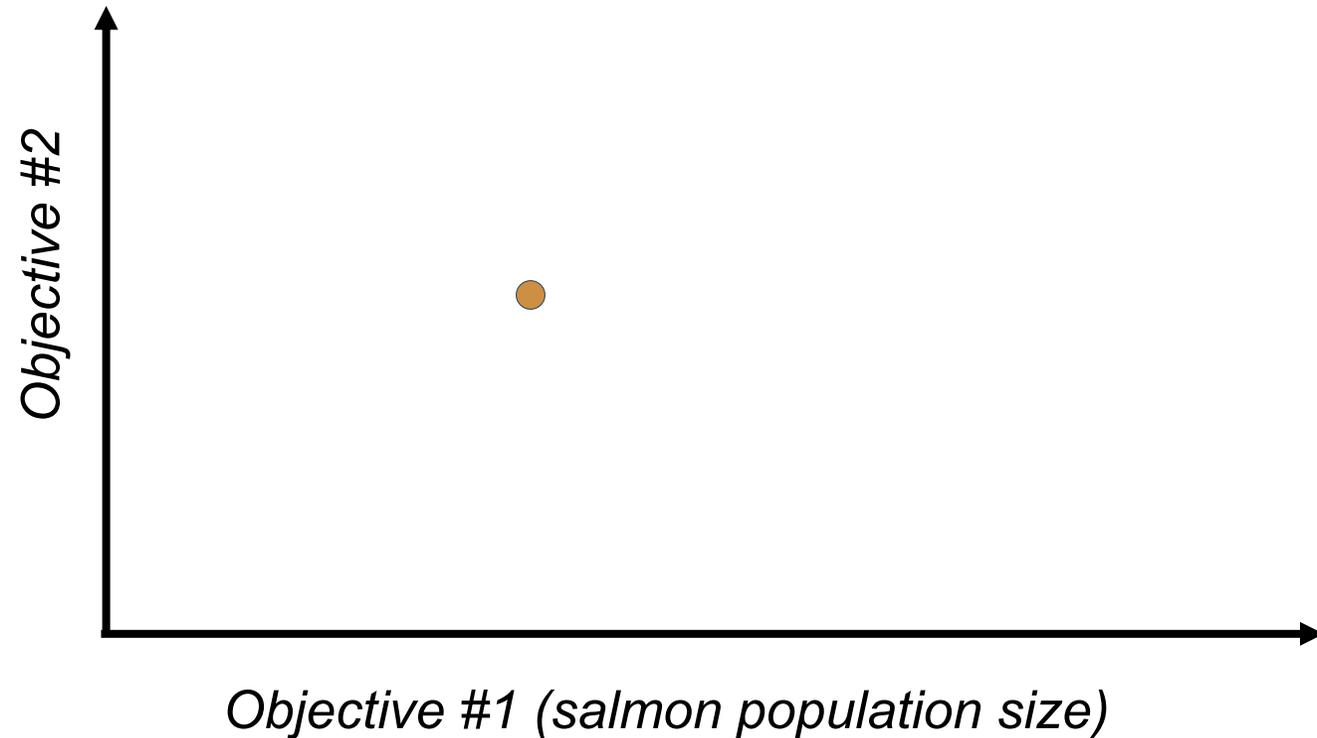


CalSim 3 schematic
(high resolution of volumes of water (by month, year)
under different planning assumptions)

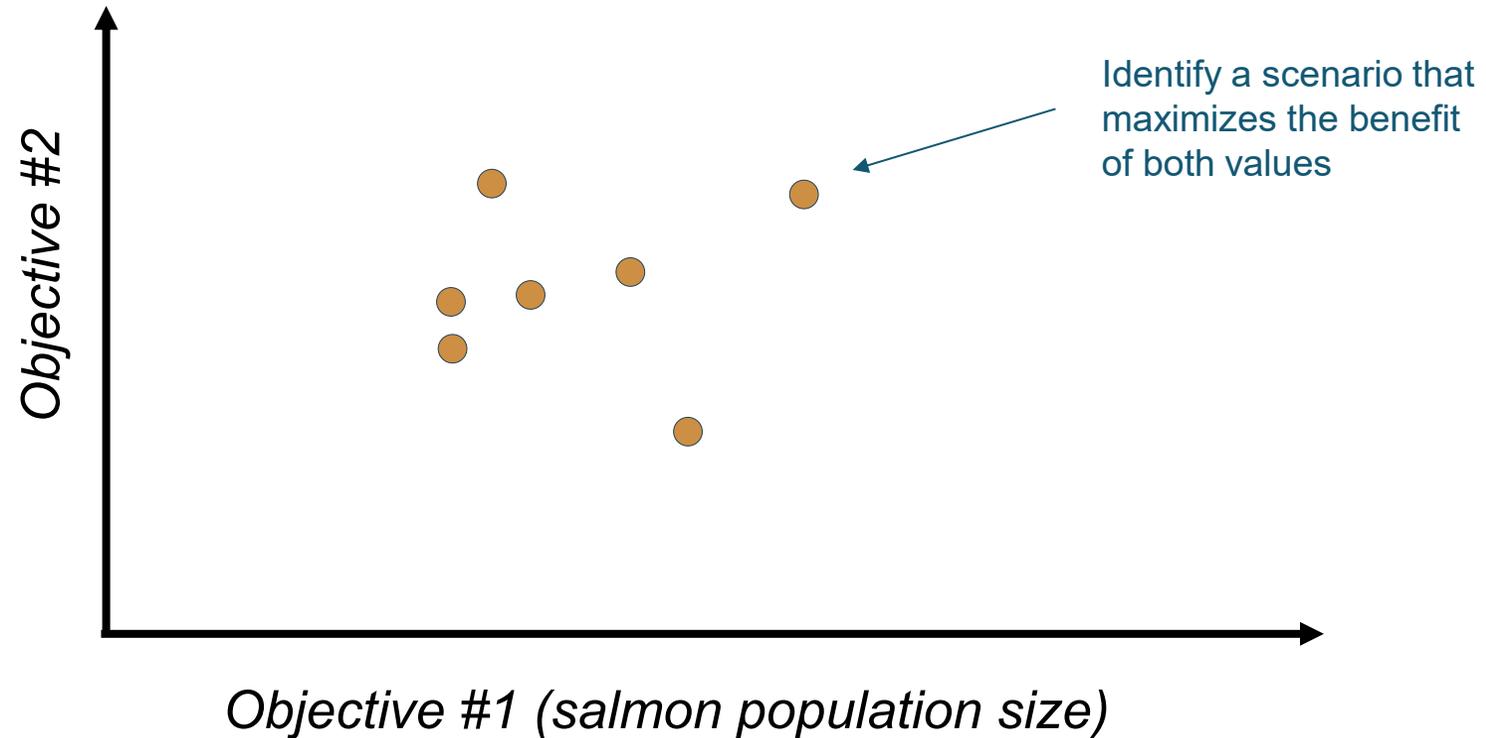


Winter-run Life cycle model
(effect of water allocation on long-term population dynamics)

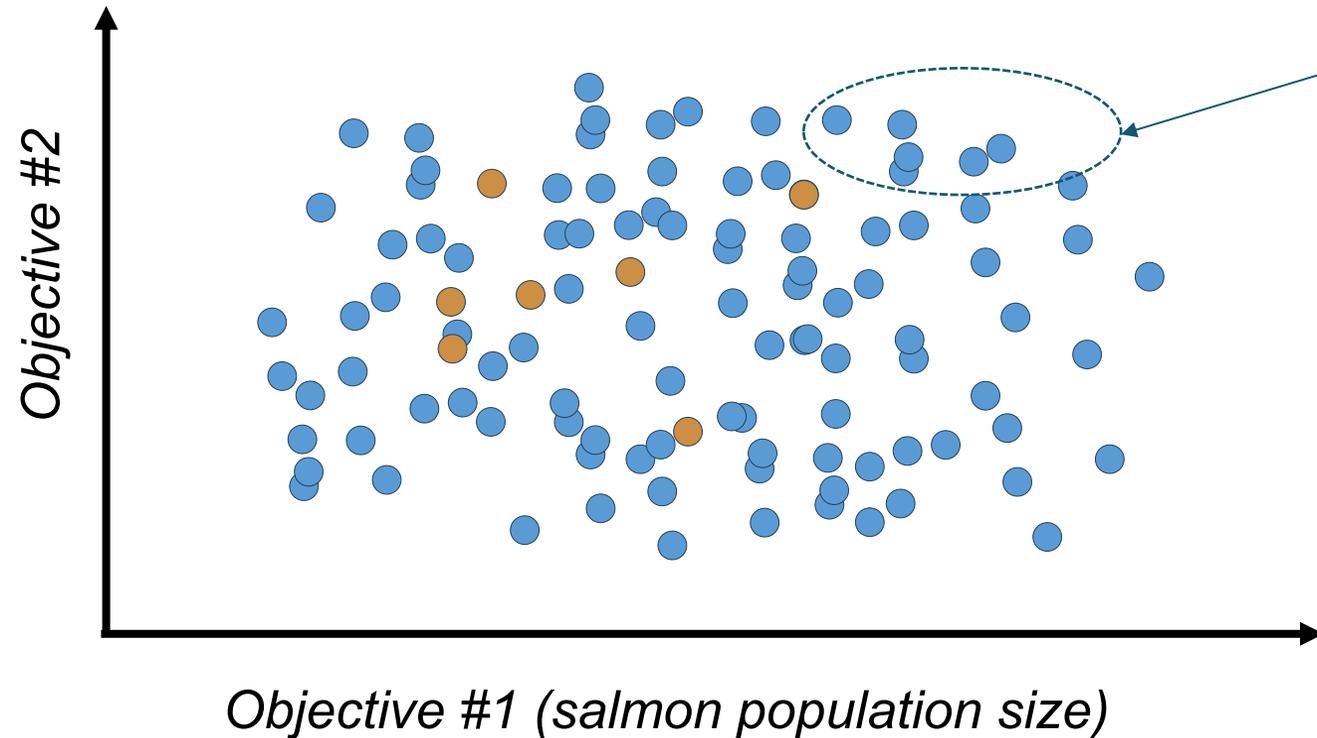
Salmon Use Case outcomes can be compared to other interests



We can change assumptions (operations) to change the effect on each objective



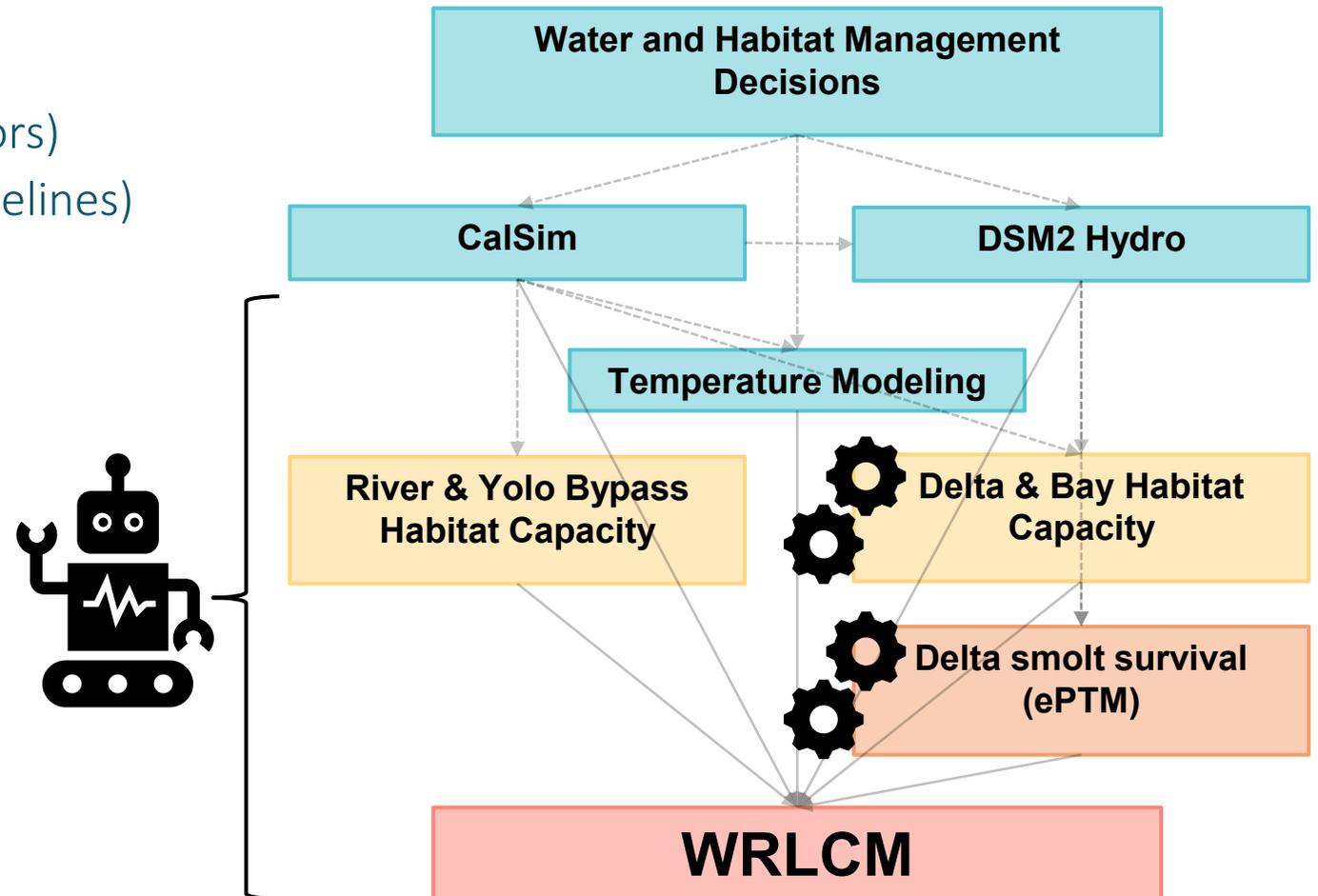
By exploring new futures for water allocation, we hope to find new solutions where multiple objectives are met



If you look throughout a larger range, maybe there are scenarios that are better at maximizing multiple values

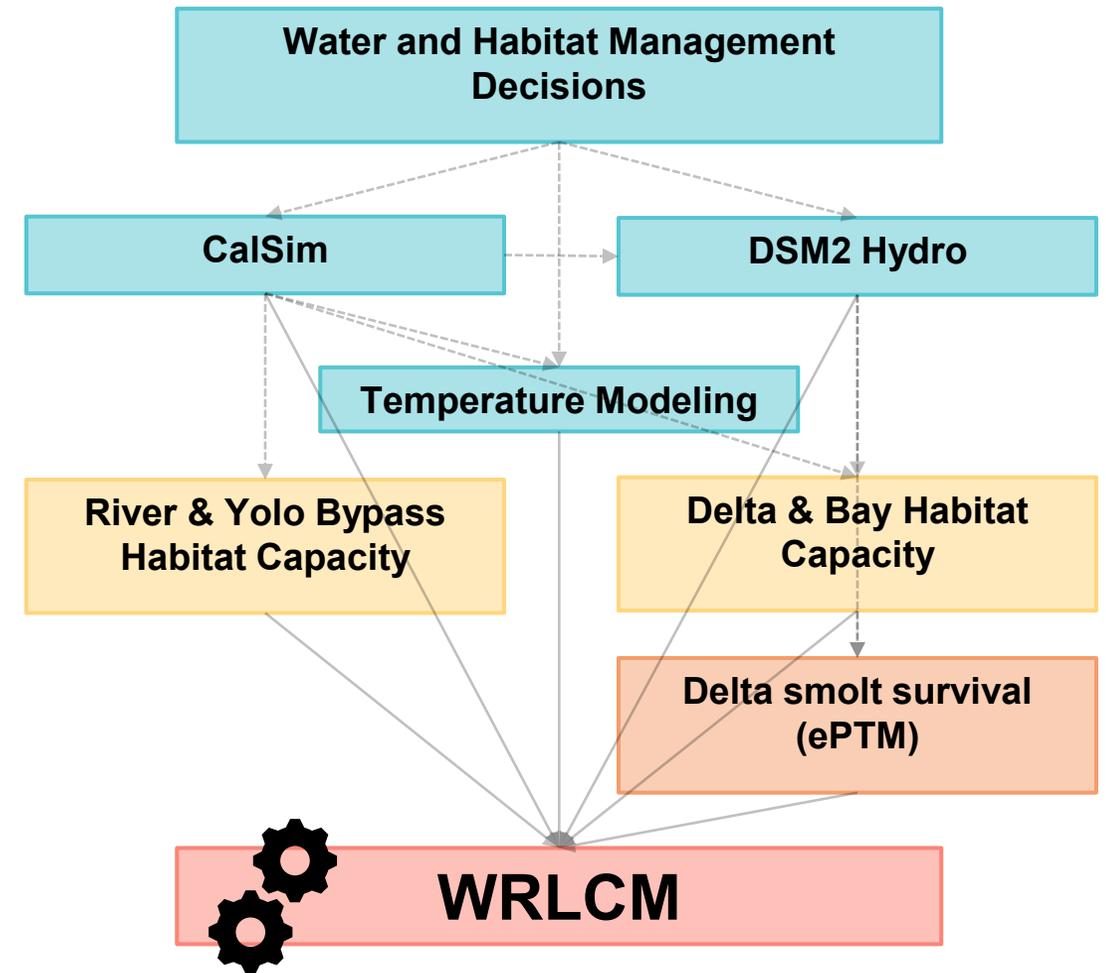
Modifications for the WRLCM for COEQWAL

- Speed up our modeling time
 - Emulators (Gaussian-Process Emulators)
 - Model Automation (Dagster; data pipelines)



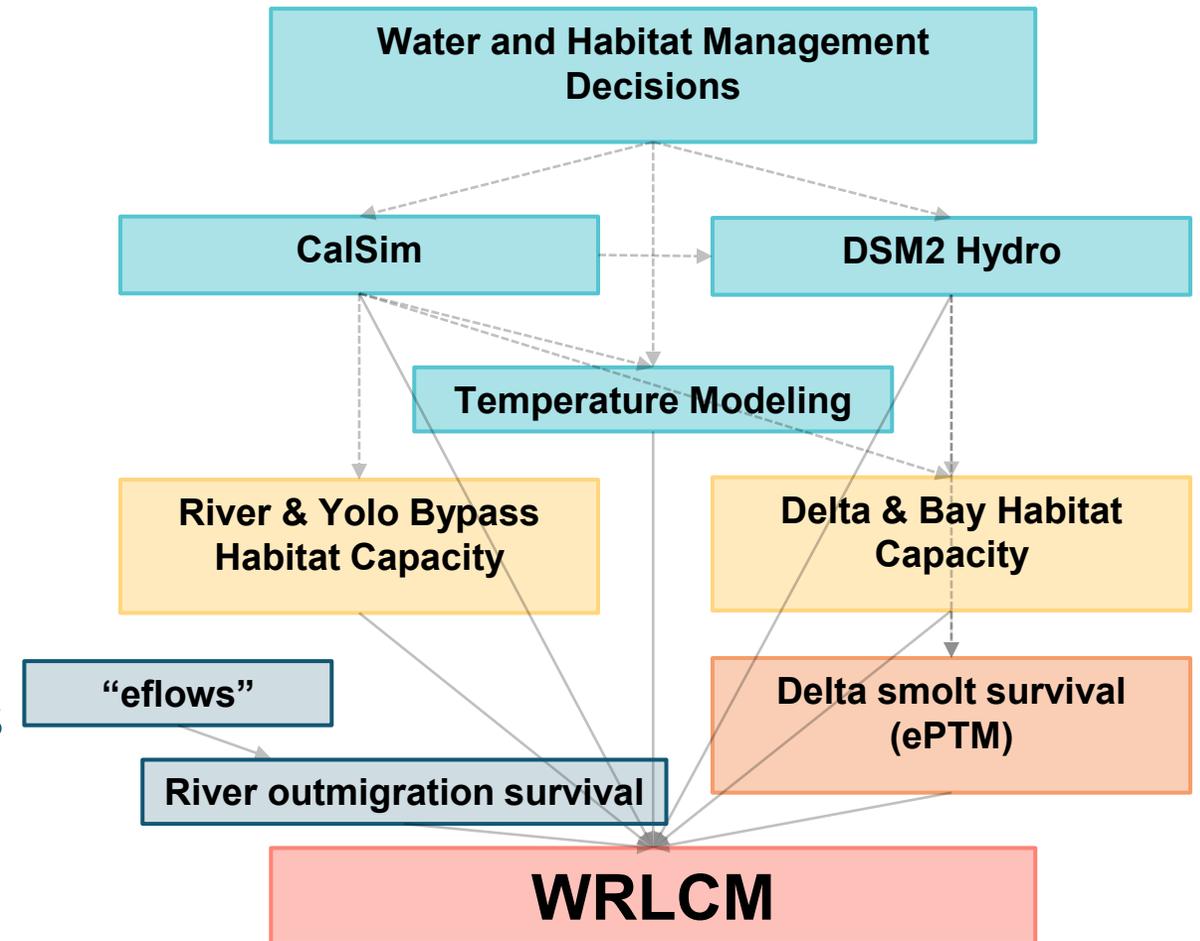
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 - Extend calibration data through BY 2021
 - Add additional data sources (abundance data Chipps Island)



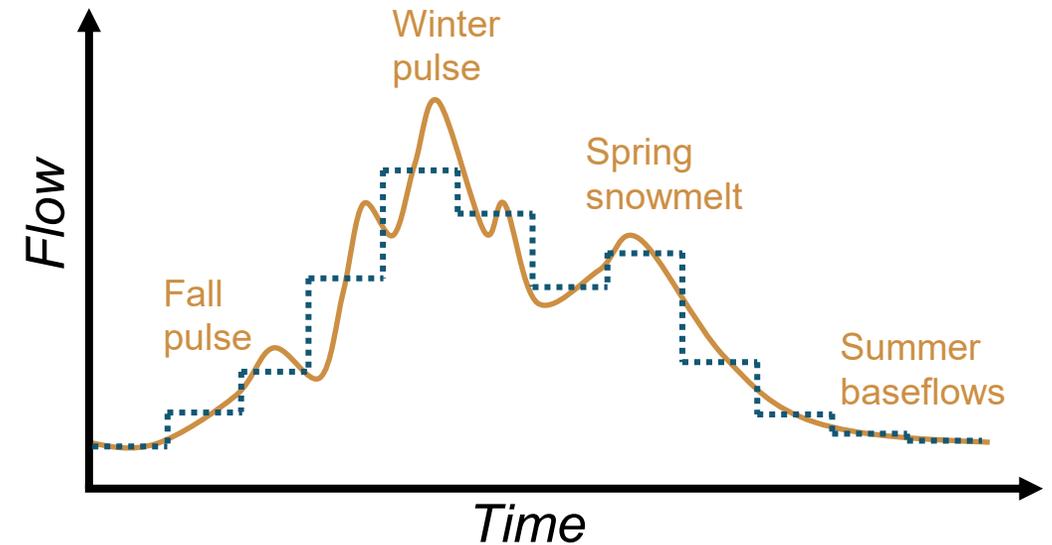
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- Integrate additional COEQWAL submodels
 - Disaggregate monthly flows into daily flows



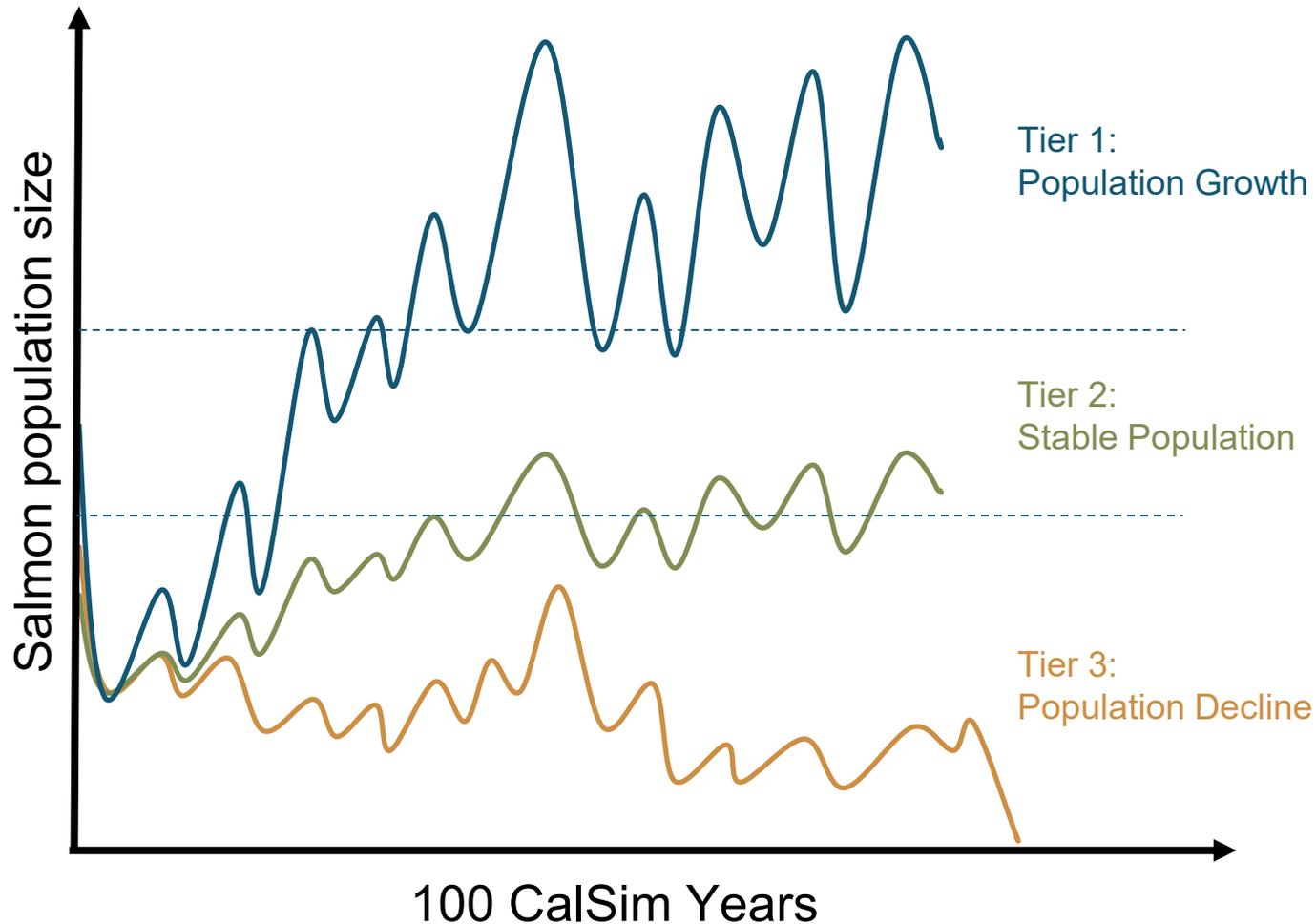
Evaluating scenarios that include designed eflows

- Flows that benefit environment & salmon (“environmental flows”): submonthly
- CalSim: monthly
- Approach: develop submodels to:
 - shape CalSim to daily hydrograph,
 - convert daily hydrograph to survival benefit
 - daily survival model developed by UC Santa Cruz
- Goal: evaluate how submonthly shaping of “eflows” can benefit salmon

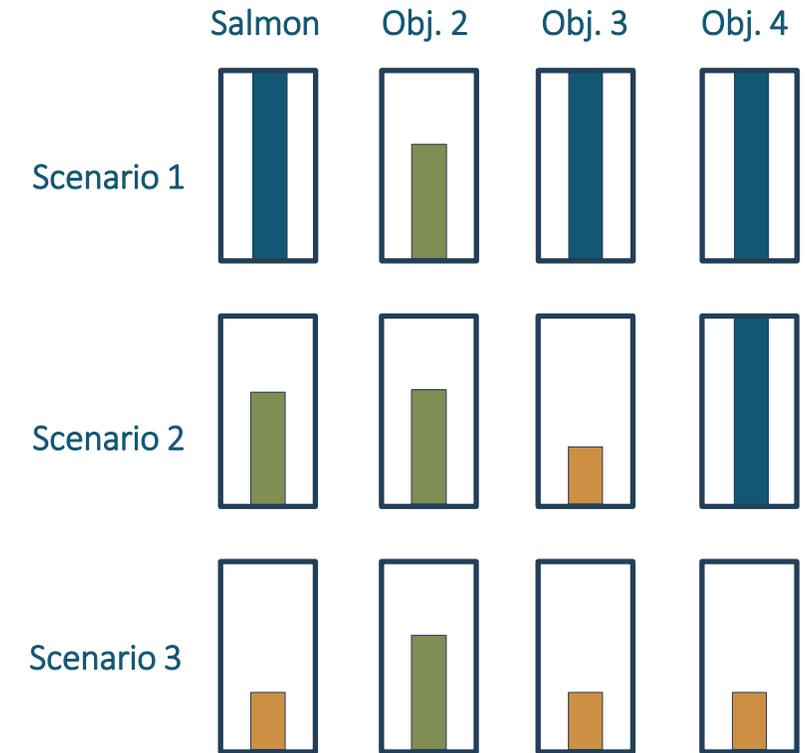


Adapted from Yarnell et al 2020

How do we evaluate salmon performance outcomes?



Compare across scenarios and/or objectives



Join the conversation!

Email me at aosterba@ucsc.edu

Conclusion

- COEQWAL is about equity in future water allocation throughout California
- The salmon use case is an **example of just one objective**: winter-run Chinook salmon
- Results on Data Dashboard can be compared to other objectives to evaluate trade-offs and synergies
- We hope the salmon use case will inspire you to link your own models to COEQWAL!

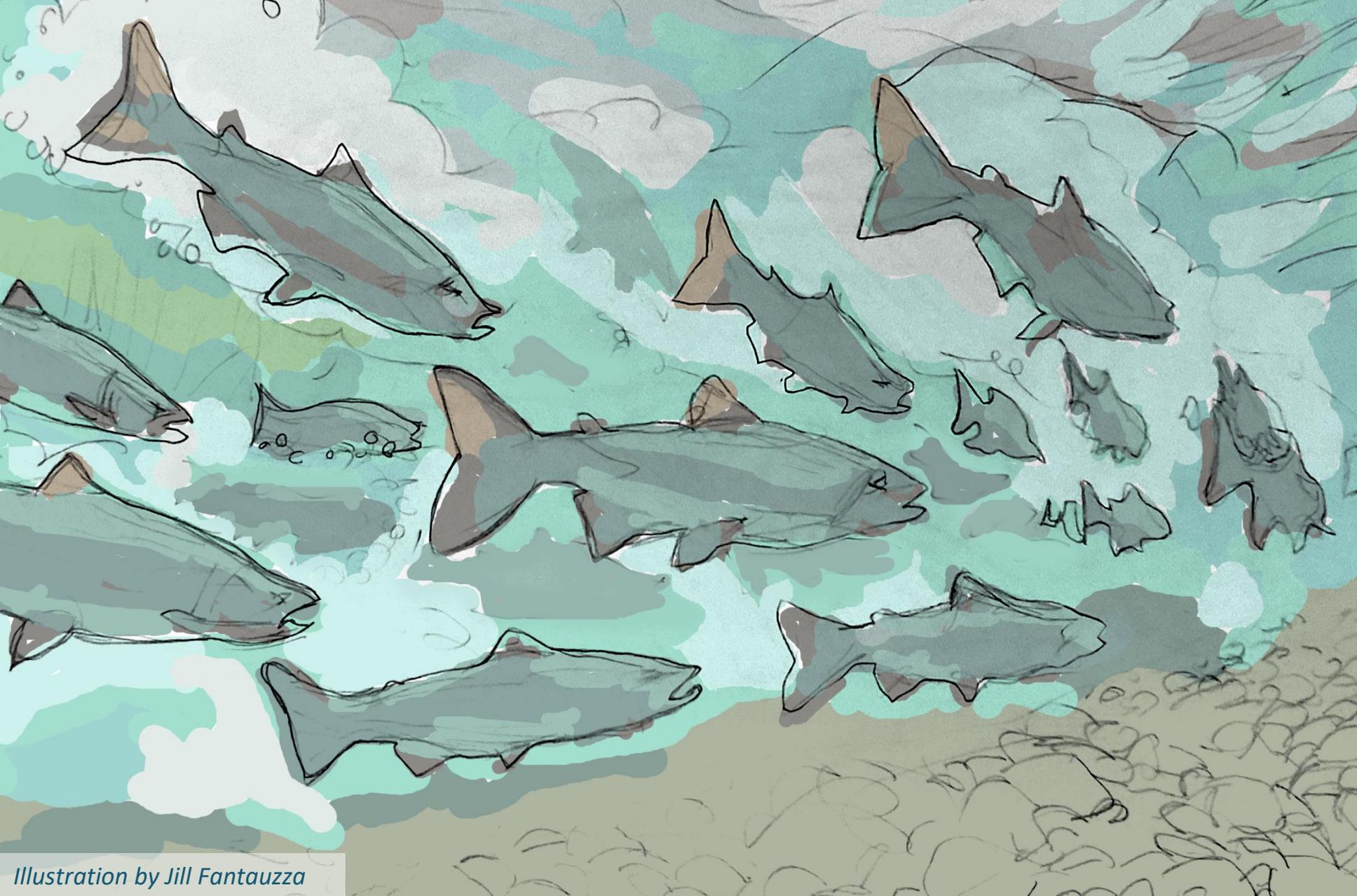


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QUESTIONS?

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