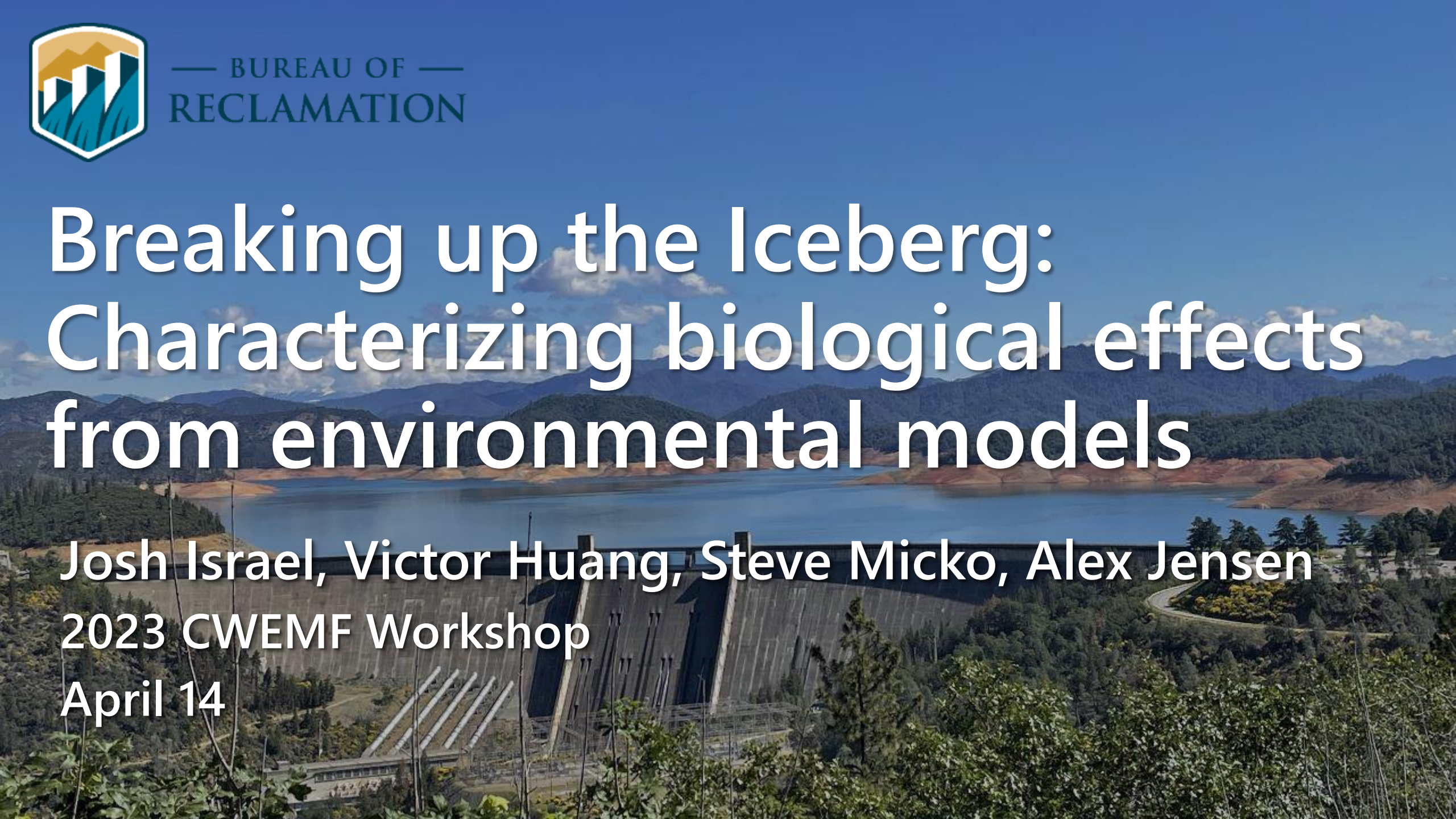


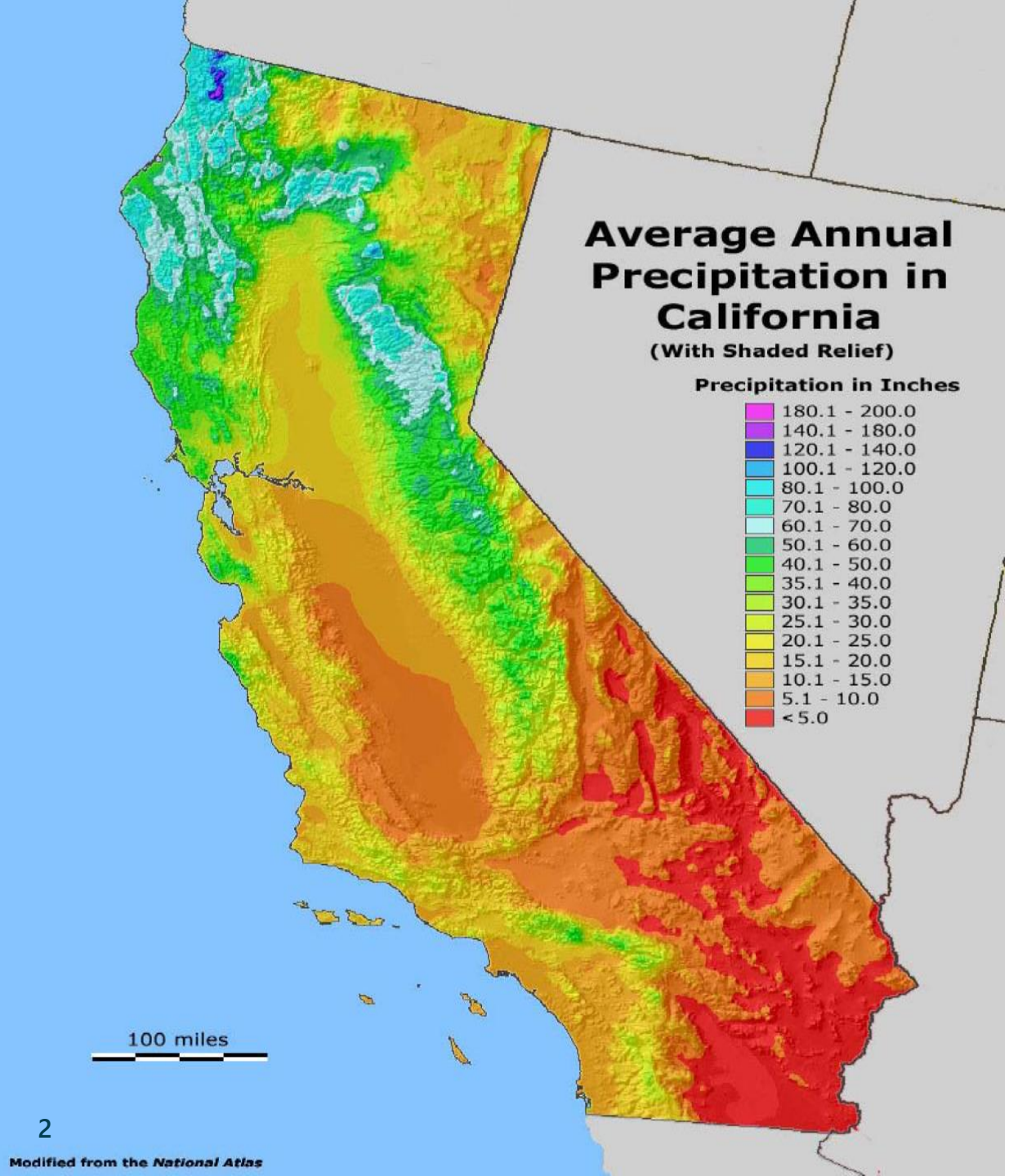
BUREAU OF RECLAMATION

Breaking up the Iceberg: Characterizing biological effects from environmental models

Josh Israel, Victor Huang, Steve Micko, Alex Jensen

2023 CWEMF Workshop

April 14

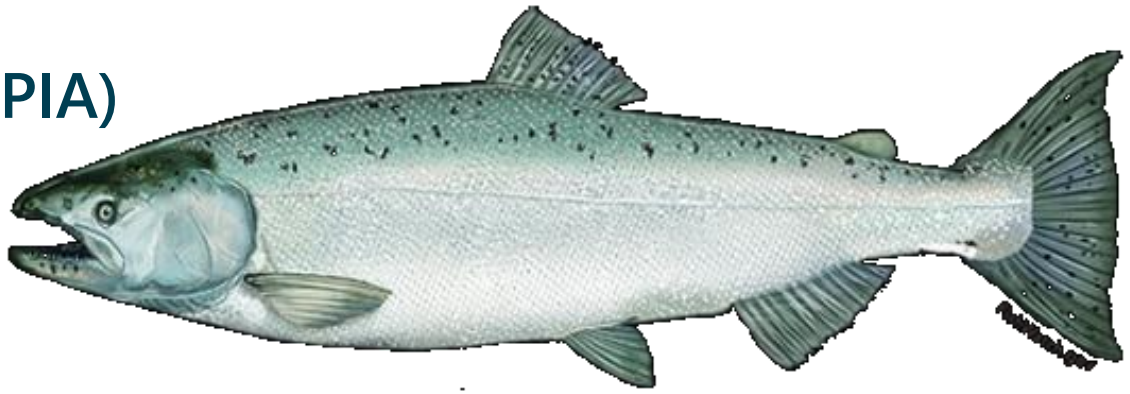


California Water

- Most precipitation falls in the north; most water demand is in the south.
- The wet season is winter and spring; water is needed more in the summer.
- Precipitation varies from year to year; demands don't vary much.

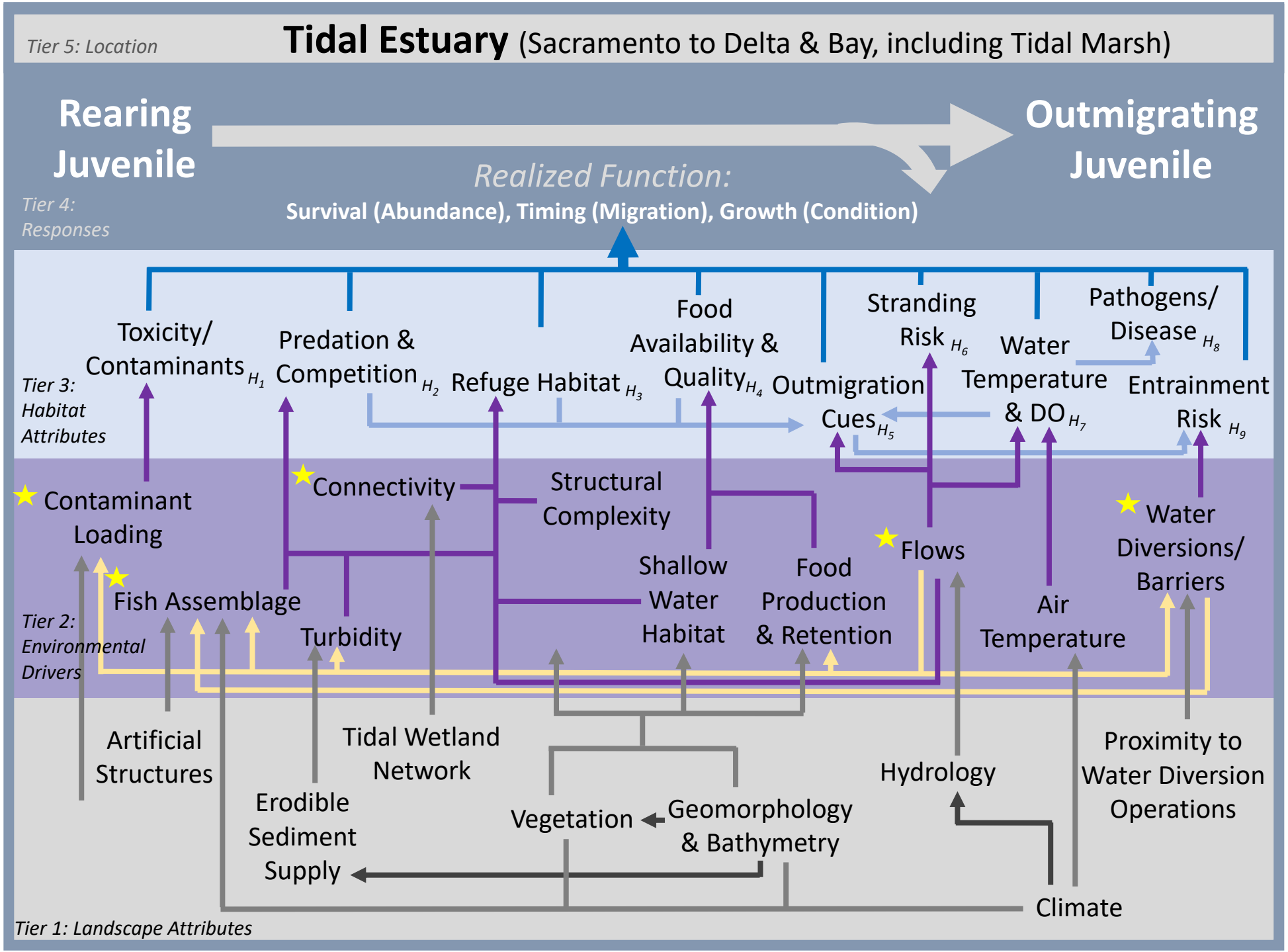
Environmental Requirements

- Project Authorizations
- California State Water Quality Control Plans
- Endangered Species Act (ESA)
- Central Valley Project Improvement Act (CVPIA)
- CalFed Bay-Delta Authorization Act
- National Environmental Policy Act (NEPA)
- Watershed Specific Acts
- Water Infrastructure Improvement for the Nation (WIIN) Act



CVP and SWP Delta operations for ESA-listed Chinook salmon

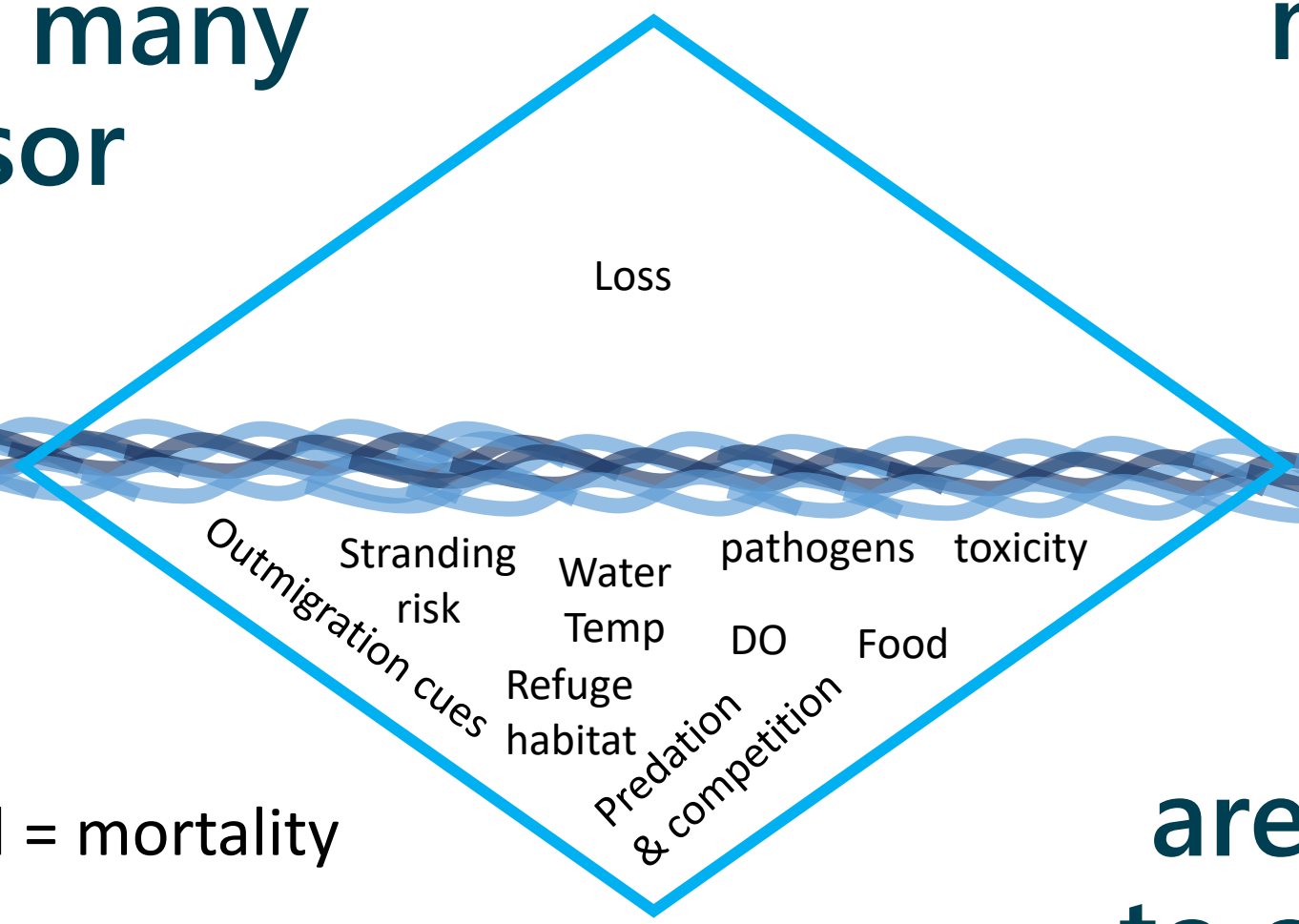
- Data rich, but information-limited
- Extensive monitoring of 1 life stage (e.g. observations of presence, abundance, condition, survival)
- To understand the effect of Delta operations on juvenile salmon, managers need to know how the presence and loss of fish is related to the abundance, through-Delta survival, and behaviors of the population



We have conceptual models

Through Delta mortality made up of many stressor

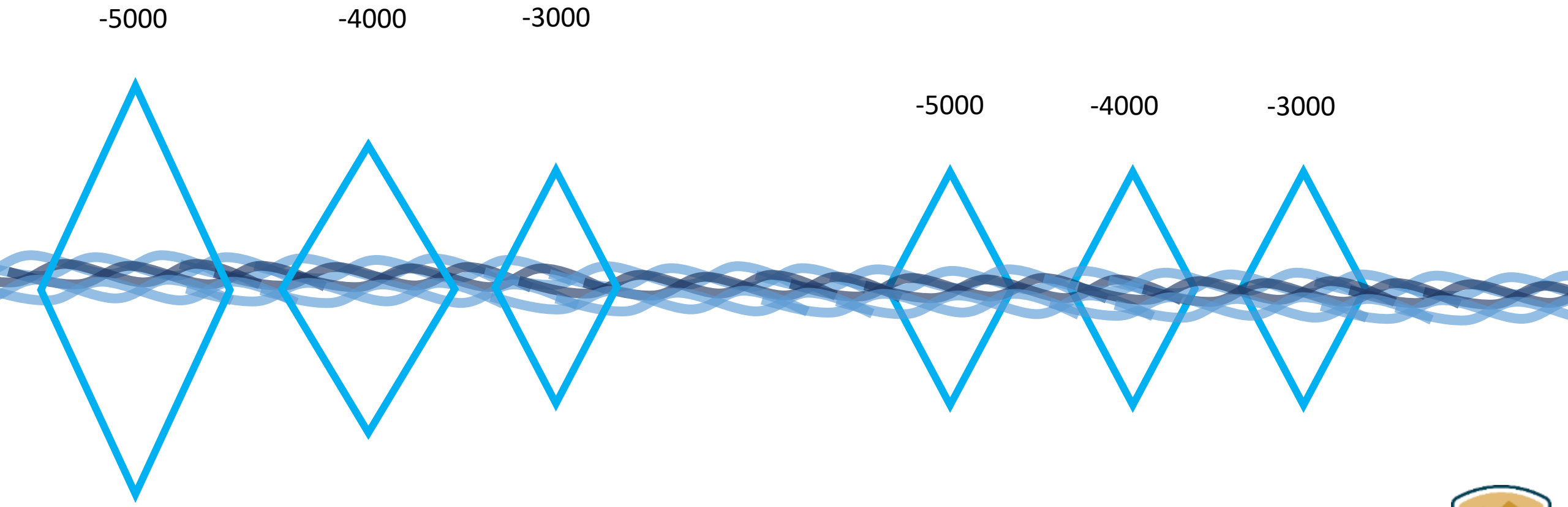
Can loss serve as a metric of direct and indirect mortality from CVP and SWP operations?



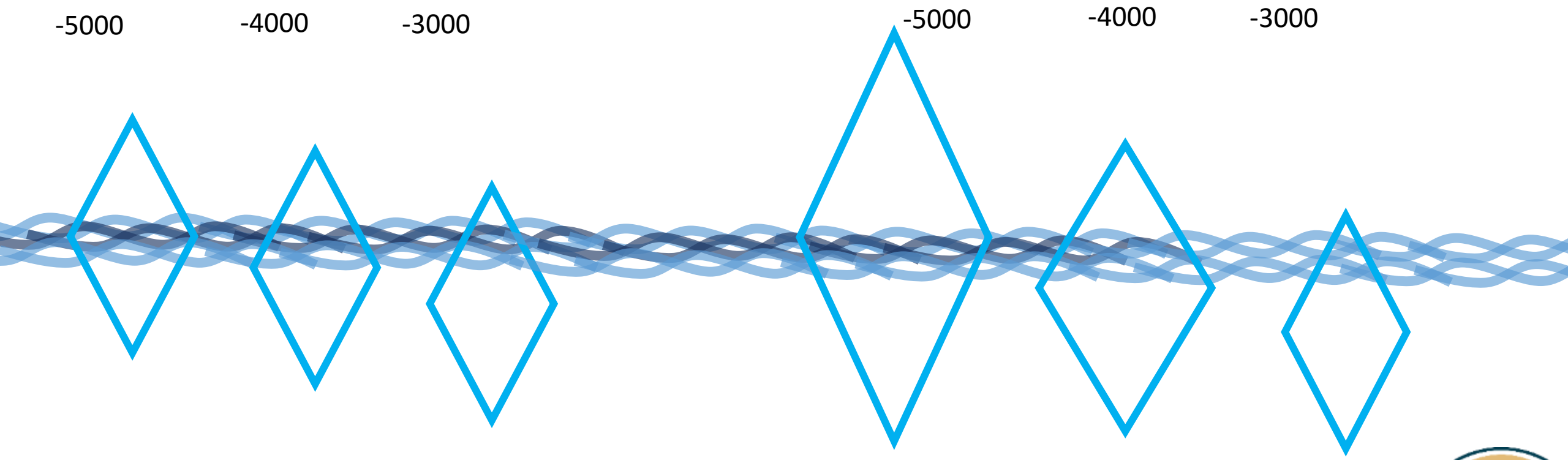
1-survival = mortality

Which stressors are attributed to operations?

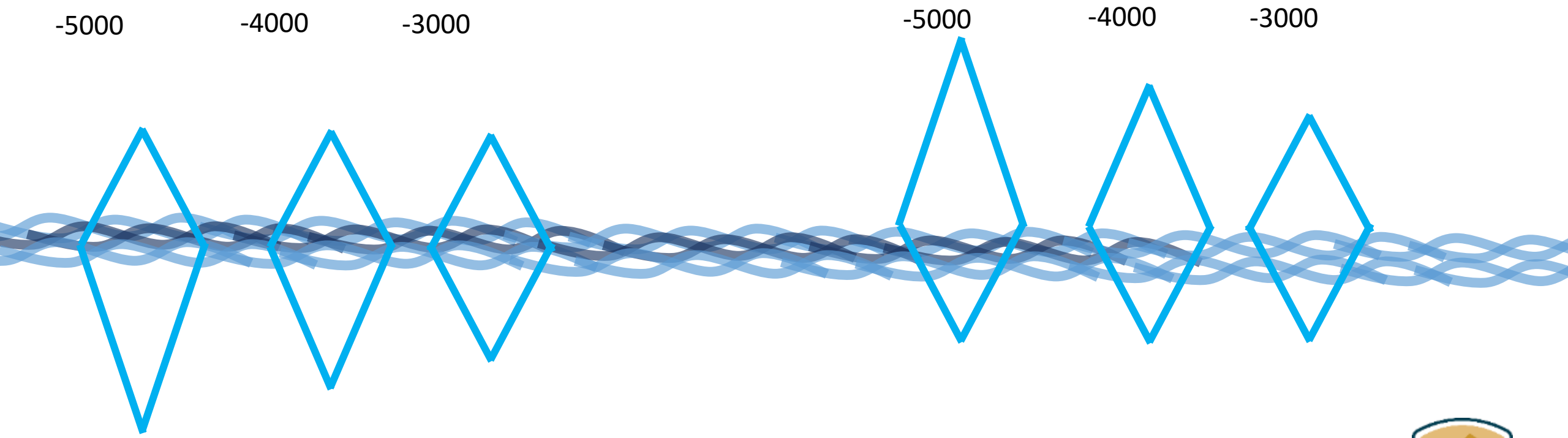
Hypothesis 1: OMR operations affect through-Delta mortality



Hypothesis 2: OMR operations affect entrainment and loss at facilities

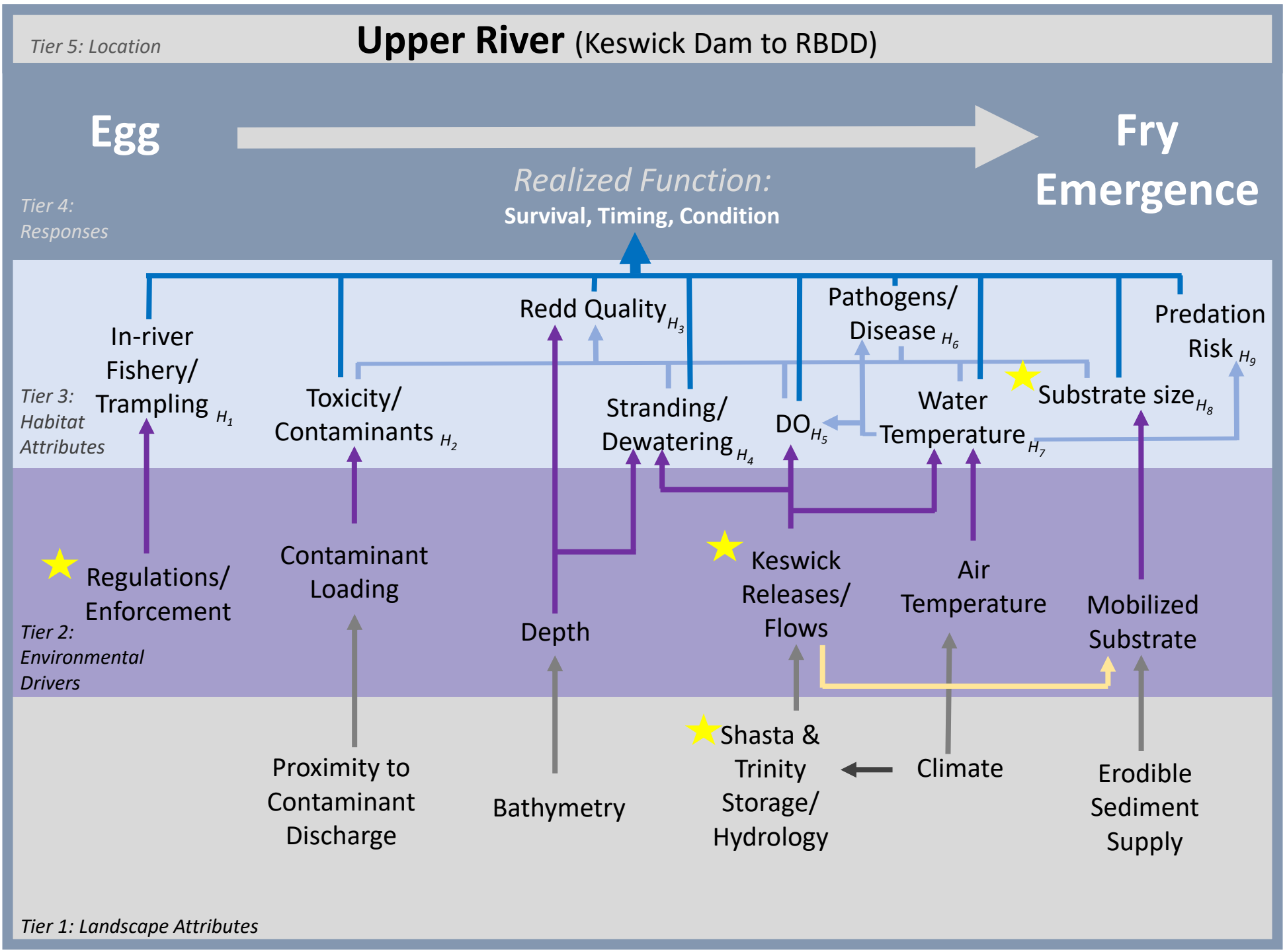


Hypothesis 3: There are other conditions than OMR influencing loss and through-Delta mortality



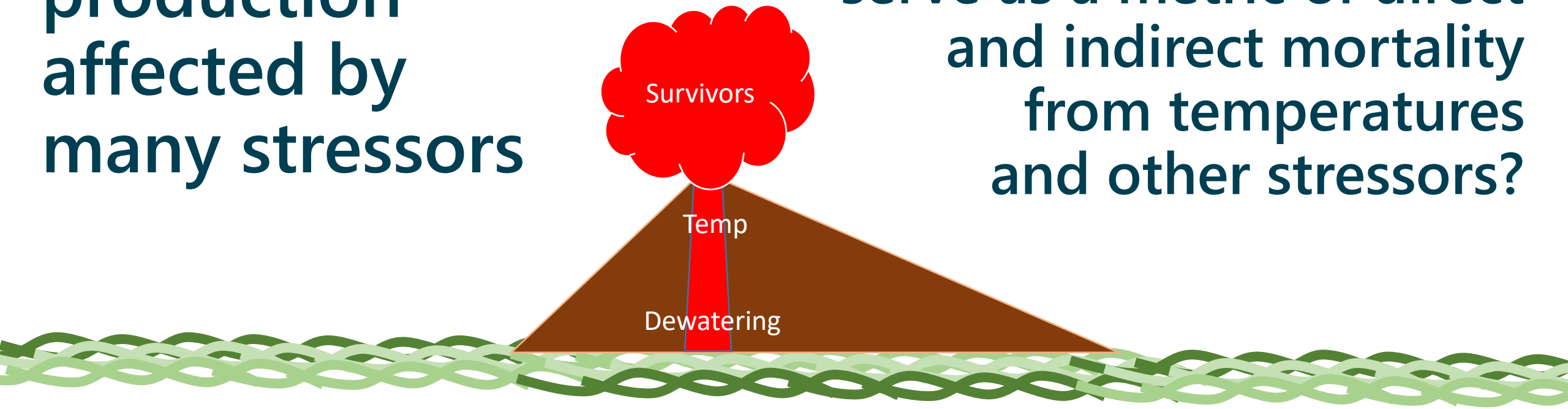
CVP Shasta operations for ESA-listed Chinook salmon

- Data and information limited
- Extensive monitoring of 1 life stage (e.g. observations of fry presence, abundance, condition, but 2 stages present
- To understand the effect of Delta operations on egg and juvenile salmon, managers need to know how the presence and loss of fish is related to the abundance, incubation survival, and river rearing survival of the population



We have conceptual models

Juvenile production affected by many stressors

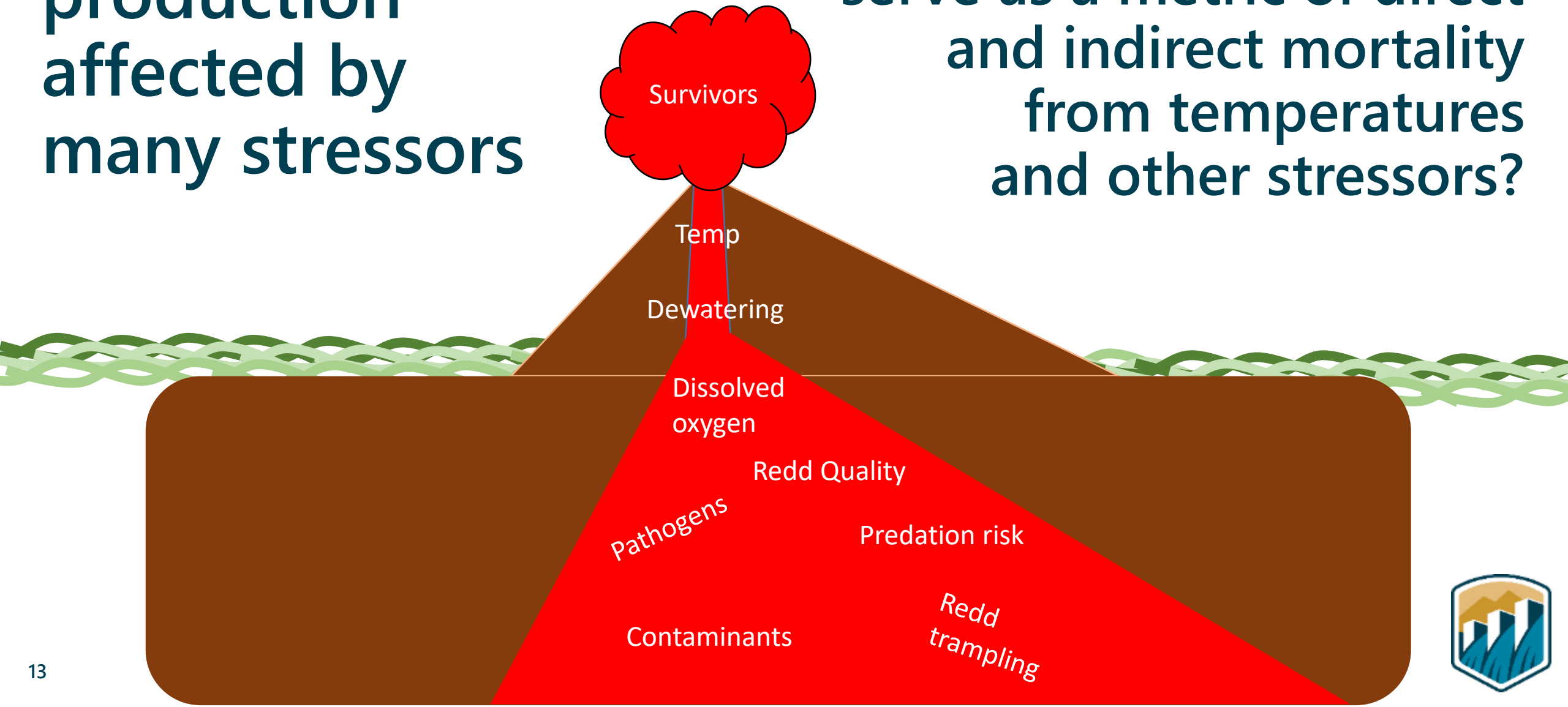


Can juvenile production serve as a metric of direct and indirect mortality from temperatures and other stressors?

Uncertainty about how stressors relate to production

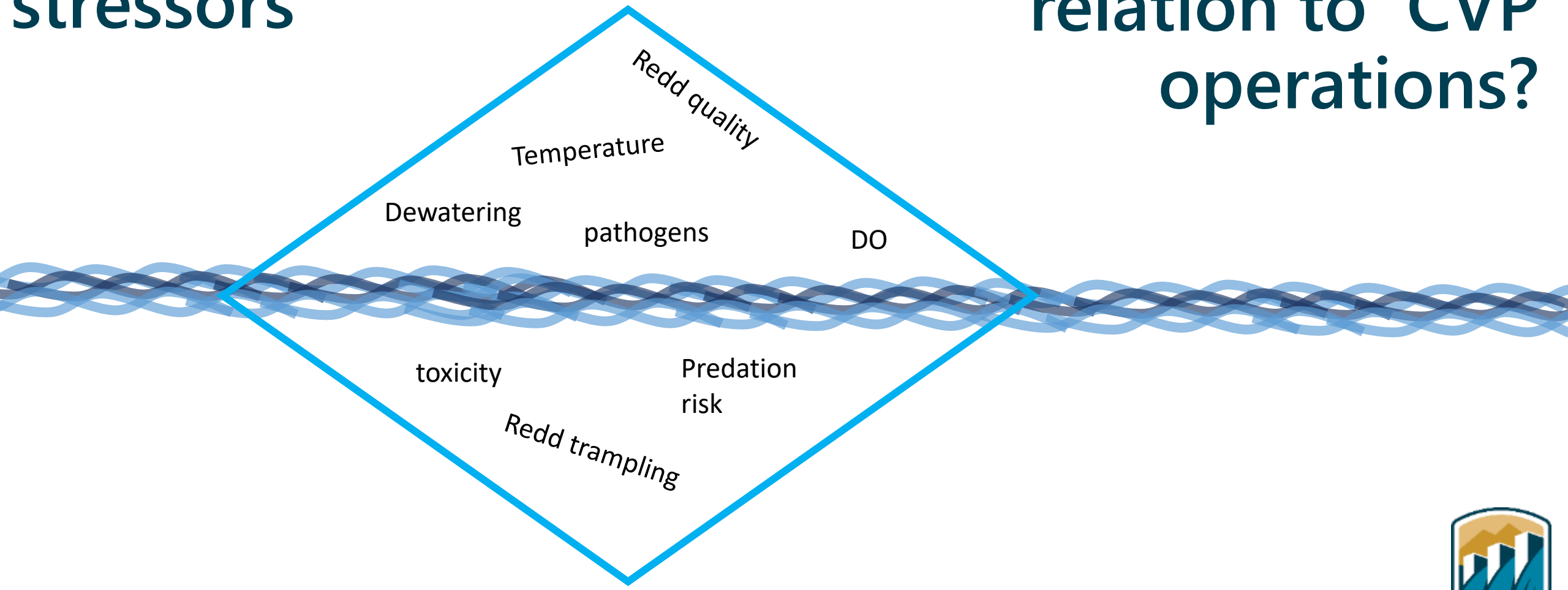
Juvenile production affected by many stressors

Can juvenile production serve as a metric of direct and indirect mortality from temperatures and other stressors?



Egg mortality made up of many stressors

How many mechanisms can be observed in relation to CVP operations?



Considerations for biological effects from environmental models

- Be mechanistic with hypotheses
- Consider the right biological objective
- Consider spatial and temporal domains of biological importance
- Measure environmental conditions to consider biological outcomes
- Model competing environmental drivers that influence biological outcomes and test sensitivity

Thank you!!

- Modeling Division
- Samaneh Saadat
- Dave Mooney

Josh Israel
jaisrael@usbr.gov

Victor Huang
vhuang@usbr.gov

Steve Micko
steve.micko@jacobs.com

Alex Jensen
ajensen@usbr.gov

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