Reorienting to Recovery

10/29 FORUM

Photo Credit: California Department of Water Resources

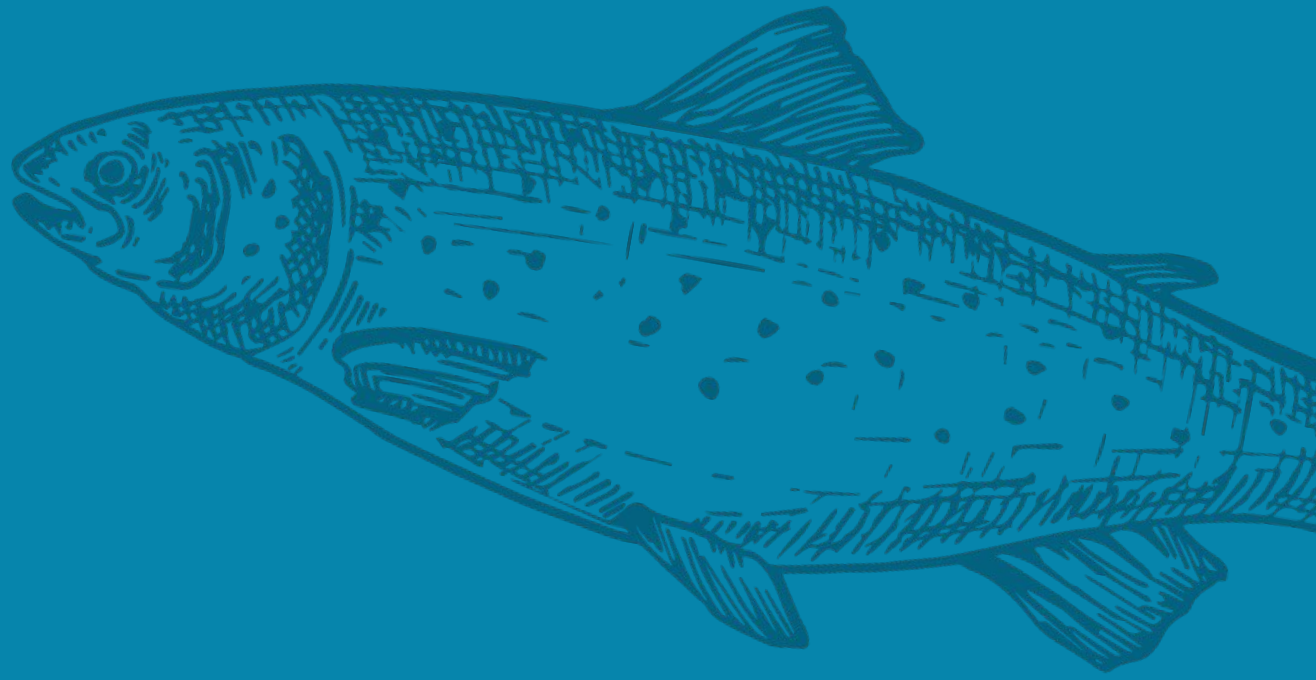
Welcome from the Project Planning Team

CA Indian Environmental Alliance	Michelle Rivera Sherri Norris
Compass Resource Management	Brian Crawford Michael Harstone
Essex Partnership	Bruce DiGennaro
FlowWest	Liz Stebbins Erin Cain Mark Tompkins
Kearns & West	Maryls Jeane Rafael Silberblatt
Qeda Consulting	Noble Hendrix
Metropolitan Water District	Alison Collins
NMFS Southwest Fisheries Science Center	Ann-Marie Osterback
State Water Contractors	Darcy Austin
Trout Unlimited	Natalie Stauffer-Olsen Rene Henery

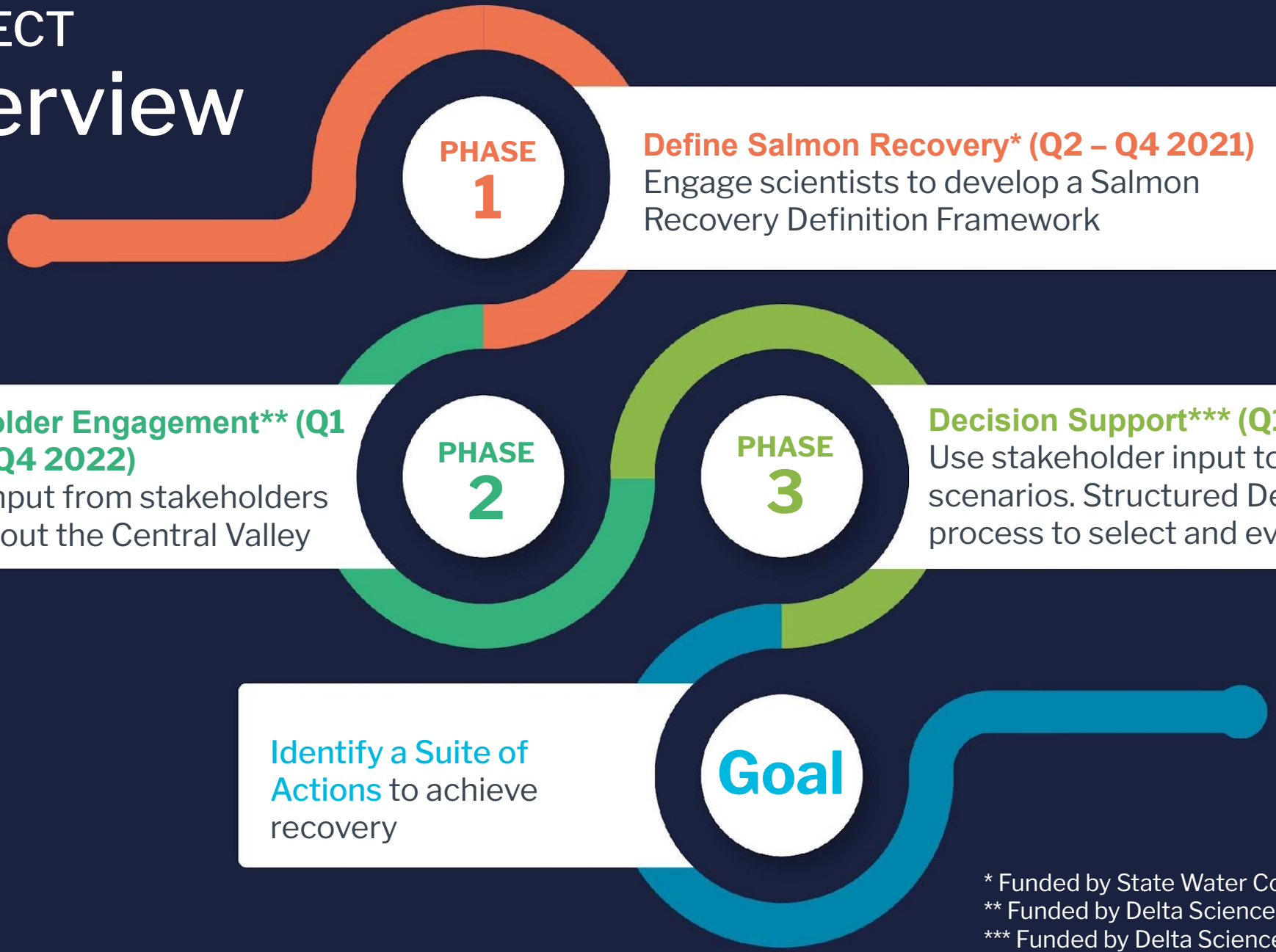
Meeting Objectives

- Review balanced recovery scenarios modeling results
  - How did the different scenarios perform?
  - What are the potential synergies and impacts across runs/species?
- Review SDM Working Group preference survey results
  - Where did the group land based on which values?
- Preview potential next steps

Background: Reorienting to Recovery



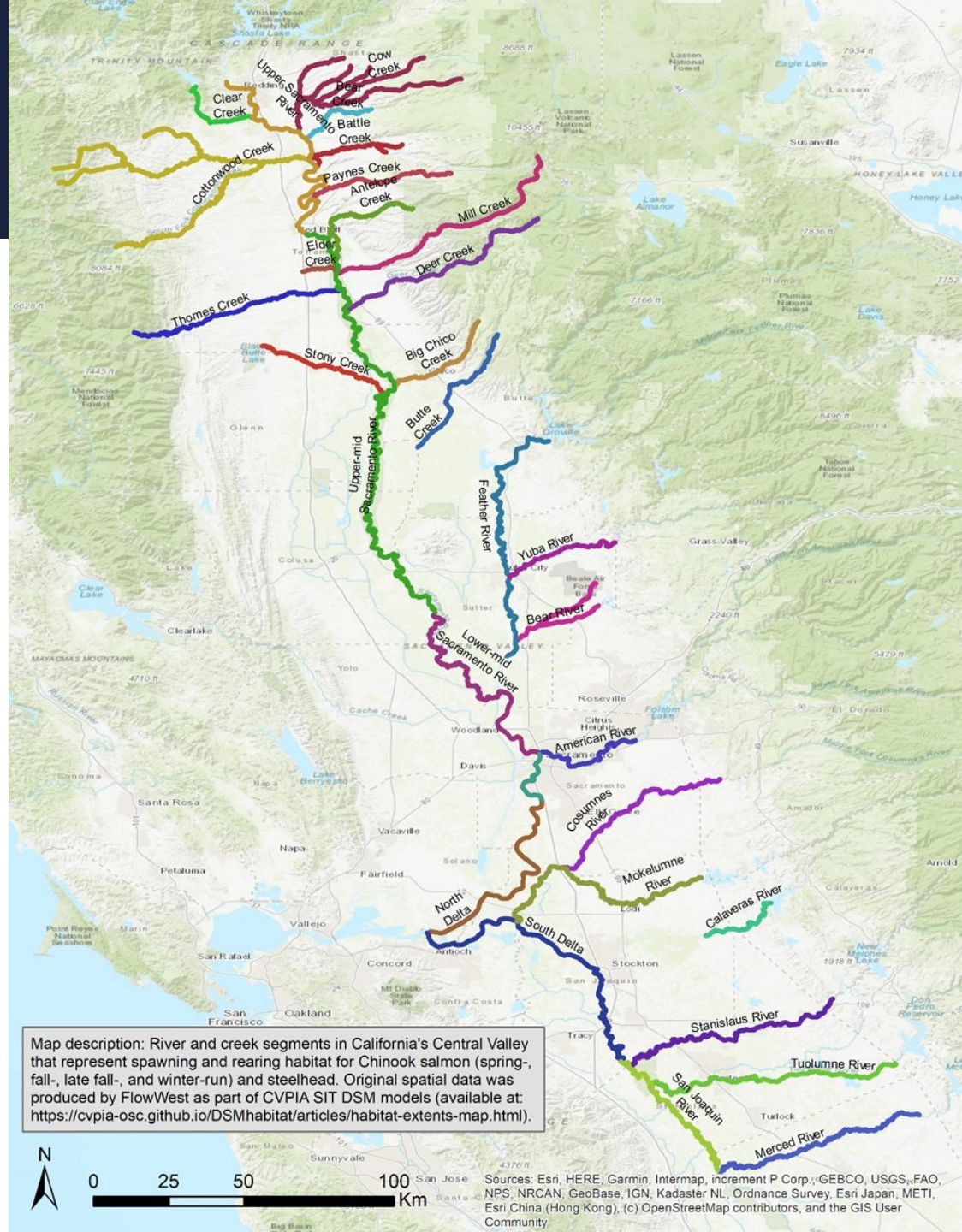
PROJECT Overview



* Funded by State Water Contractors
** Funded by Delta Science Program grant award, USBR
*** Funded by Delta Science Program grant award, USBR, Metropolitan Water District, NMFS, State Water Contractors

Reorienting to Recovery: Problem framing

- **To identify a preferred recovery scenario(s) that advances salmonid recovery, balances other interests, and achieves a critical mass of support**
- Considering all runs of CA CV salmon, beginning with fall-run
- Spatial: 31 reaches in the Sacramento & San Joaquin River systems, & ocean
- Temporal: 20-year time horizon



SDM Trajectory

Potential actions to model were collected via Forums and SDM workshops:

Bookend Scenarios included the following actions

- Run of River flows
- Max habitat
- No harvest
- 2x hatchery output

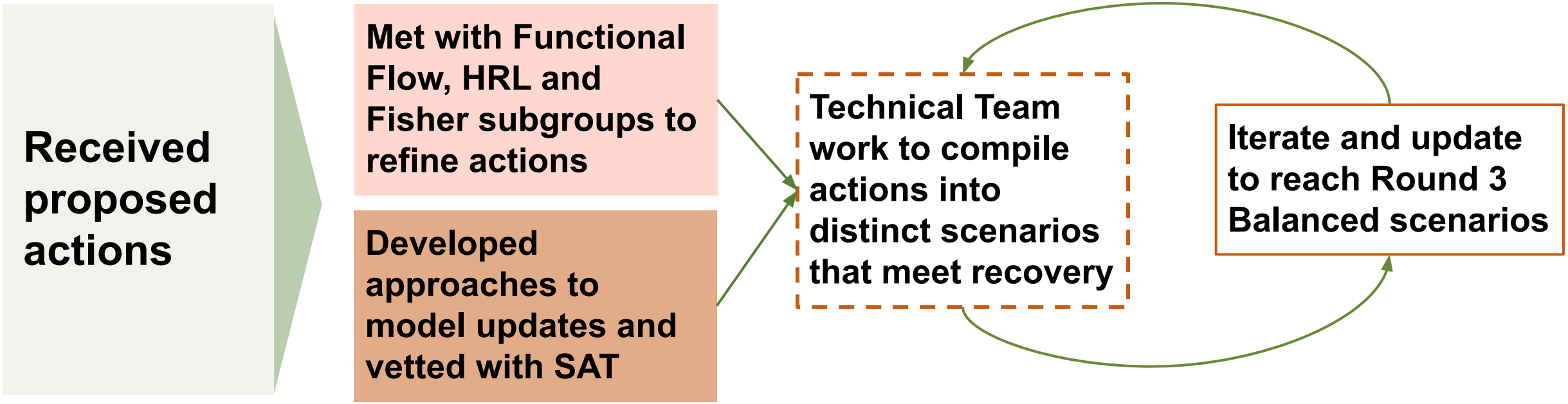
Blended Scenarios included the following actions:

- Ecological functional flows
- Rice field habitat
- Harvest of hatchery fish only
- Terminal hatcheries

Balanced Scenarios include the following actions:

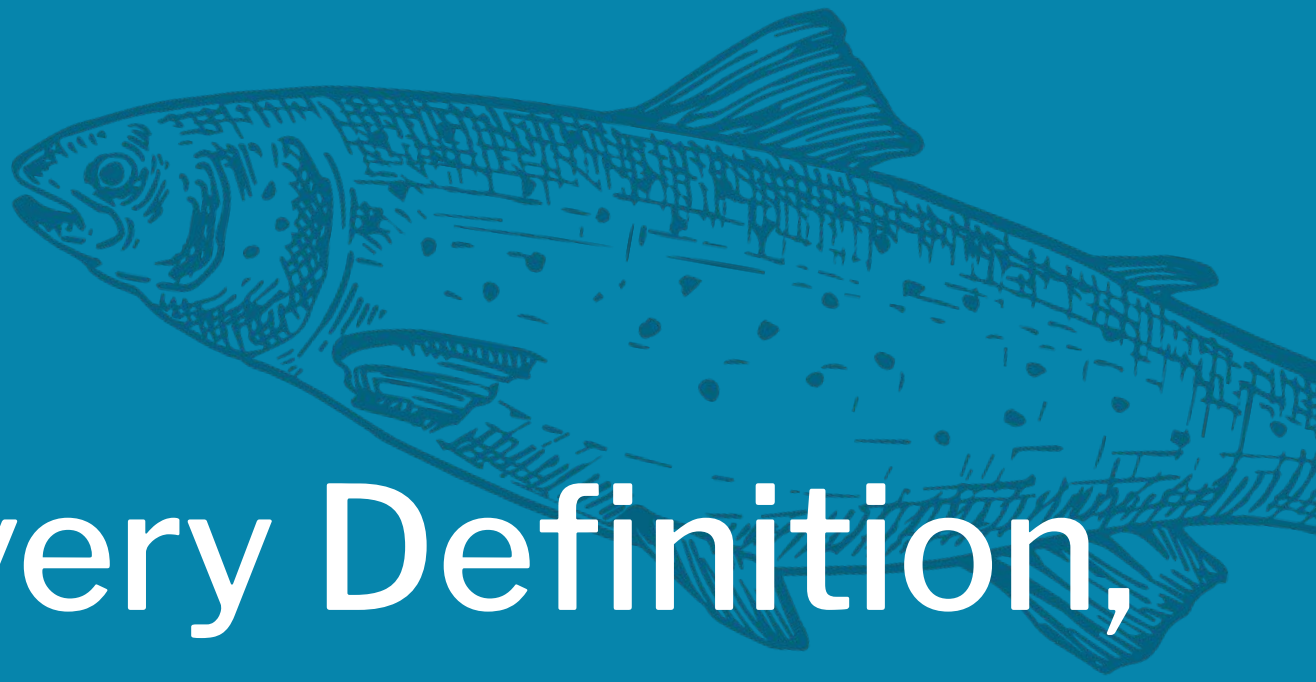
- Habitat actions for San Joaquin
- Functional flows for San Joaquin
- HRL actions
- Phased hatchery practices
- Tribal harvest prioritized

Balanced Scenario Development



Parallel process engaging Tribes for input on values and metrics

Refresher: Phase 1 Recovery Definition, Values, Performance Measures & Modeling



PHASE 1

Recovery Definition

Thank you to the following scientists (and organizations) for helping to develop the recovery definition framework over the course of twelve workshops (and subsequent working groups) in 2021

Anchor QEA	John Ferguson
Cramer	Brad Cavallo
CDFW	Brycen Swart
CDFW	Carl Wilcox
DSC	Pascale Goertler
DWR	Brett Harvey
Metropolitan	Alison Collins
NGO	Bruce Herbold
NOAA	Ann Marie Osterback
NOAA	Brian Ellrott
NOAA	Cathy Marcinkevage
NOAA	Kate Spear

NOAA	Rachel Johnson
NOAA	Steve Lindley
PWA	Chuck Hanson
QEDA	Noble Hendrix
SWRCB	Erin Foresman
TNC	Julie Zimmerman
TU	Natalie Stauffer-Olsen
TU	Rene Henery
USBR	Josh Israel
USBR	Mike Beakes
USFWS	Matt Dekar
USFWS	Megan Cook

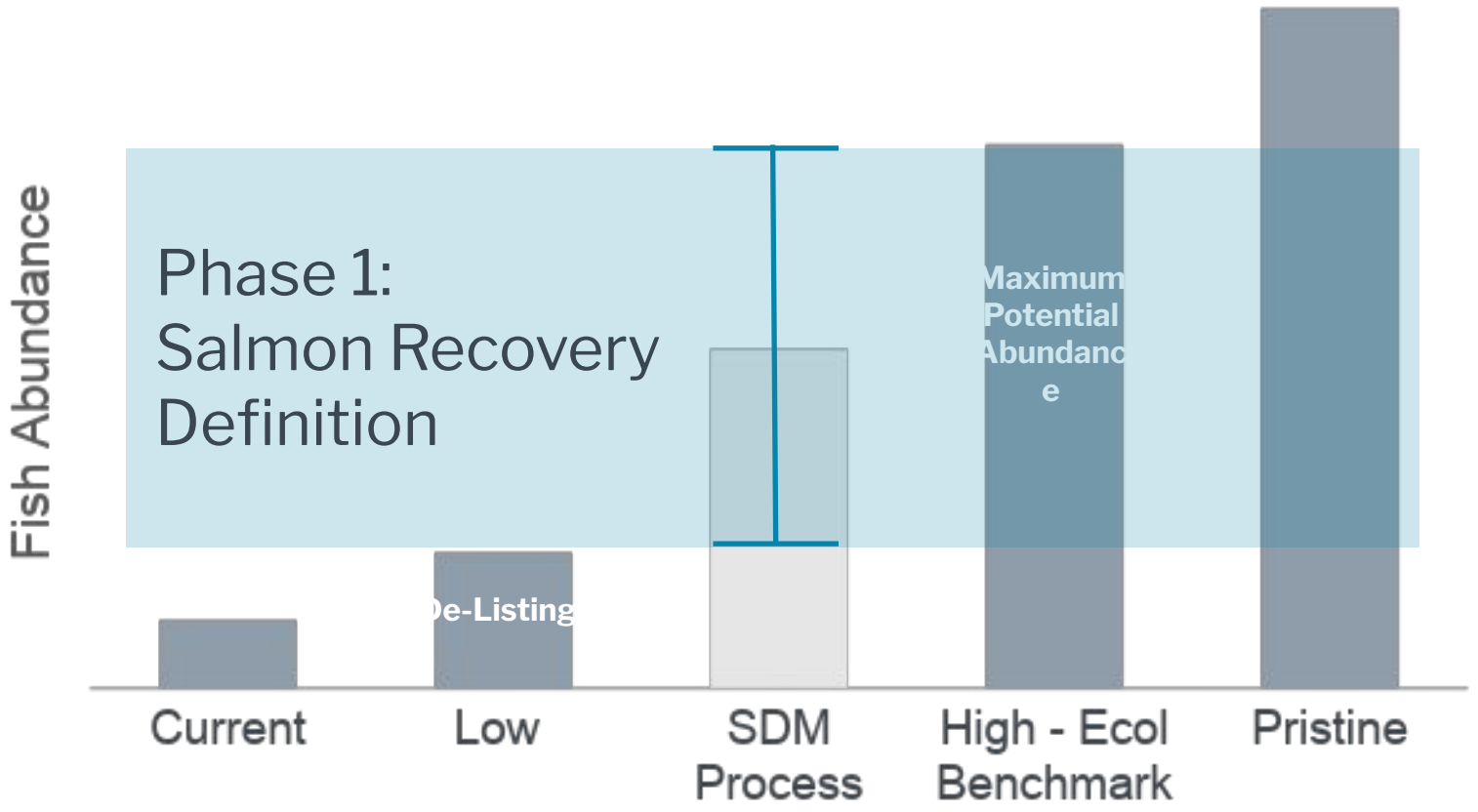
Phase 1 Recovery Definition Overview

- **Abundance**
  - An expression of all other biological recovery thresholds being met + values
- **Productivity**
  - Sufficient to support viability, refers to population growth rate and related parameters over the entire life cycle
- **Spatial Structure**
  - Recover and preserve spatially explicit populations that are sufficient to support redundancy and representation
- **Diversity**
  - Recover and preserve genetic/life-history diversity of natural populations

Abundance

TARGETS BASED ON CARRYING CAPACITY

Setting the abundance target will require a values-driven conversation as part of the SDM process in Phase 3



Salmon Recovery Thresholds

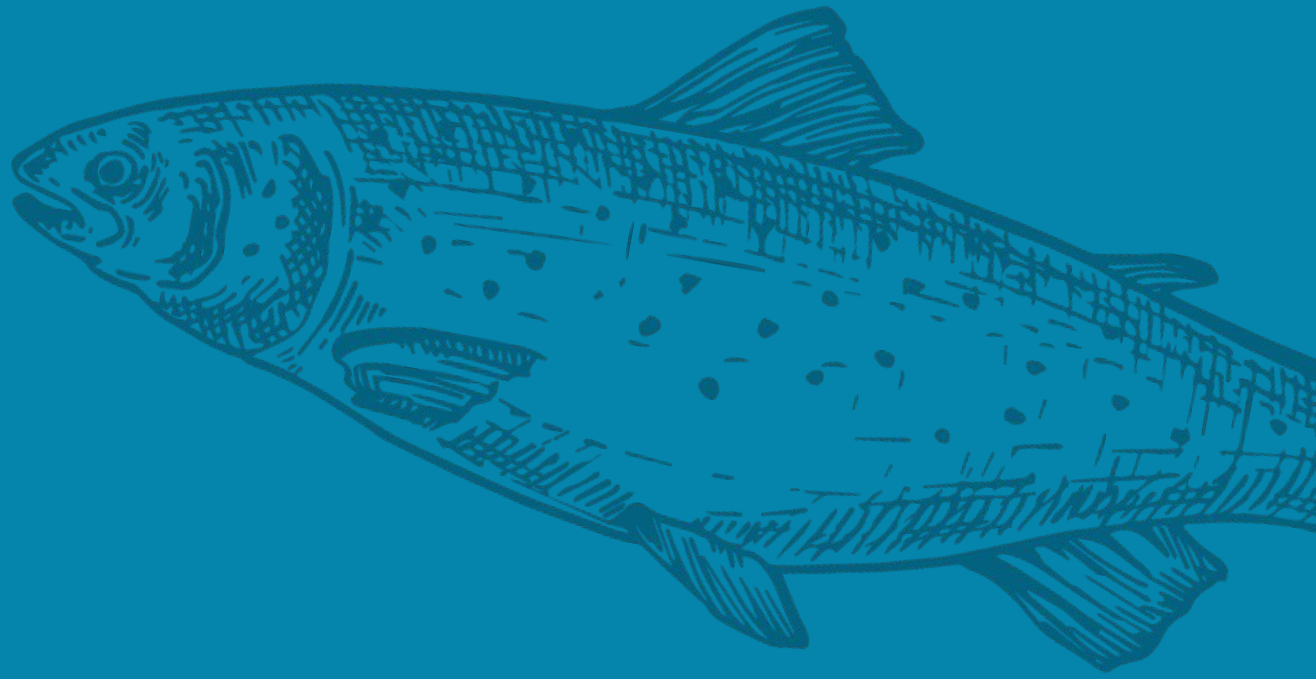
1. CRR > 1
2. Population growth rate > 0
3. Abundance > 500
4. pHOS < 0.05

Specified how often and on how many systems must meet these thresholds before achieving "recovery."

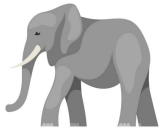
- We defined four indicator populations for fall run Chinook: Upper Sacramento, American, Stanislaus, Tuolumne Rivers.
- Indicator populations must meet all recovery metrics in last 15 years of the simulation. Secondarily, all independent populations must meet recovery in at least 5 years, and the percentage of independent populations that meet recovery objectives must be above 80% in last 15 years.

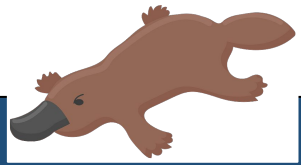
Phase 1 report: https://csamp.baydeltalive.com/docs/25923

Balanced Scenarios



Balanced Scenario Overview

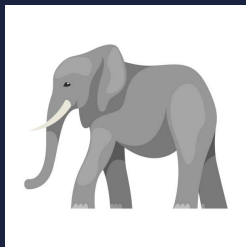




Action category	Baseline	Elephant	Tortoise	Platypus
Habitat	Current habitat and planned habitat projects	1) Current and planned + near-future habitat*** 2) Floodplains (Sac) 3) Food subsidies (all yrs, Jan-Mar)*** 4) Predation reduction (small-scale, all yrs)	1) Current and planned 2) Floodplains/rice fields (Sac/SJ) 3) Food subsidies (dry yrs) 4) Predation reduction (large-scale, dry yrs)	1) Current + Max habitat 2) Food subsidies (all yrs) 3) Predation reduction (large-scale, all yrs)
Hydrology	Current flow operations	Planned flow operations***	Functional Flows (FF) (Sac/SJ, dry yrs)	FF (Sac/SJ, all yrs)
Harvest	Current ocean and river harvest rates	1) Intelligent habitat harvest** (ocean, in-river, all yrs) 2) Tribal harvest prioritized	1) No harvest of dry year cohorts (ocean, in-river) 2) Harvest only hatchery fish (ocean, in-river, all yrs) 3) Tribal harvest prioritized	1) No harvest of dry year cohorts (ocean, in-river) 2) Intelligent habitat harvest** (ocean, in-river, all yrs) 3) Tribal harvest prioritized
Hatcheries	Current hatcheries operations	Phased hatchery and weirs	Phased hatchery and weirs	Terminal hatchery/ocean outplanting (all yrs)

* Harvest only fish additional to what is required to meet CRR>1. Harvest numbers would vary by year.
** Harvest only fish additional to what is required to meet habitat capacity. Harvest numbers would vary by year.
*** This scenario includes planned Habitat + Spring flow actions, which are expected in the near future, and proposed as part of the Healthy Rivers and Landscapes Program.

Framing Elephant

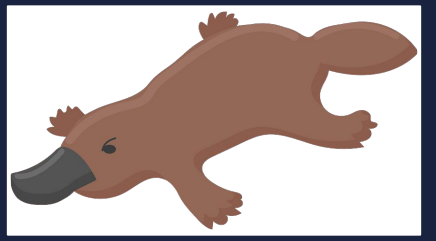


- This is the only scenario that uses CalSim3, which includes different operations assumptions and spatial coverage (including higher resolution on some participating Healthy Rivers and Landscapes (HRL) Program tributaries) than other scenarios (which used CalSim2), and therefore cannot yet be appropriately compared with the other R2R scenarios.
- The R2R baseline is included for reference but needs consideration for accurate comparison with the HRL Program actions in the Elephant scenario. For example, the R2R baseline scenario currently contains a roughly 60% overlap in habitat projects that are proposed as part of the HRL Program.
- The HRL Program targets achievement of one quarter of the full doubling goal over an 8 year period.
- Incorporating HRL Program flow and habitat actions into models took longer than expected; therefore, we did not have sufficient time to explore additional actions needed to meet recovery, but this can be done in future.

Big Picture Differences

- Tortoise performs similar to dry year
- Platypus performs similar to kitchen sink
- Elephant performs better than Baseline, but does not have the same magnitude as Tortoise and Platypus
- Tortoise and Platypus show tradeoffs compared to blended counterparts
  - Lower spawner abundances
  - Increased harvest (generally)

Platypus Scenario Actions



Habitat

1) Max habitat
2) Food subsidies
3) Predation reduction

All years

Hydrology

Functional Flows - Sacramento & San Joaquin River (FF)

All years

Harvest

1) No harvest of dry year cohorts (ocean, in-river)
2) Intelligent habitat harvest (ocean, in-river)
3) Tribal harvest prioritized

All years

Hatcheries

Terminal hatchery/ocean outplanting (current release output number)

All years

No additional actions required to meet recovery.

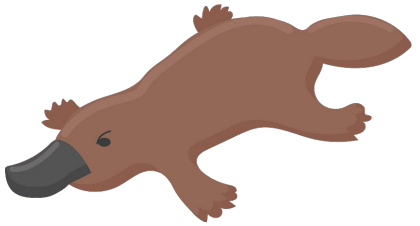
Platypus Consideration & Key Takeaways

Key Takeaways

- This scenario applied management actions across the “4 Hs” in all years and across the full system (Sacramento and San Joaquin)
- Across the three blended scenarios, the Platypus generally performed best for most salmon biological objectives and metrics
- This scenario was predicted to grow the population through dry year periods in the model timeframe

Limitations

- Additional refinement of intelligent habitat harvest



Tortoise Scenario Actions

Habitat

1) Current and planned
2) Floodplains/rice fields (Sac/SJ)
3) Food subsidies
4)Predation reduction (large-scale)

Dry Years

Hydrology

Functional Flows - Sacramento & San Joaquin

Dry Years

Harvest

1) No harvest of dry year cohorts (Commercial, Tribal, Recreational)

Dry Years

2) Harvest only hatchery fish (across ocean, in-river)
3) Tribal Harvest Prioritized

All years

Hatcheries

Phased hatchery and weirs

All years

Tortoise & Key Takeaways

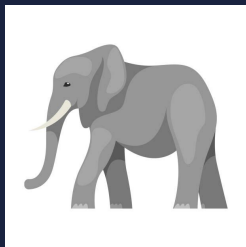
Key Takeaways

- This scenario applied habitat and flow actions in dry years, alongside harvest and hatchery actions in all years, including phased hatcheries.
- Scenario met biological recovery and generally performed second best among balanced scenarios for most biological objectives and performance metrics, highlighting importance of dry year-focused actions
- Performed best for genetic diversity (pHOS)

Limitations

- Need for sufficient habitat on hatchery-dominant streams

Elephant Scenario Actions



Habitat

1) Current and planned near- future habitat
2) Floodplains (Sac)
3) Food subsidies
4) Predation reduction (small-scale)

All years

Hydrology

Planned flow operations

All years

Harvest

1) Intelligent habitat harvest
2) Tribal harvest prioritized (all yrs)

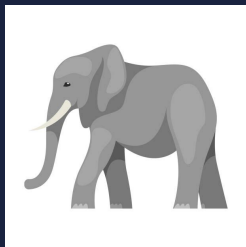
All years

Hatcheries

Phased hatchery and weirs

All years

Elephant Consideration & Key Takeaways



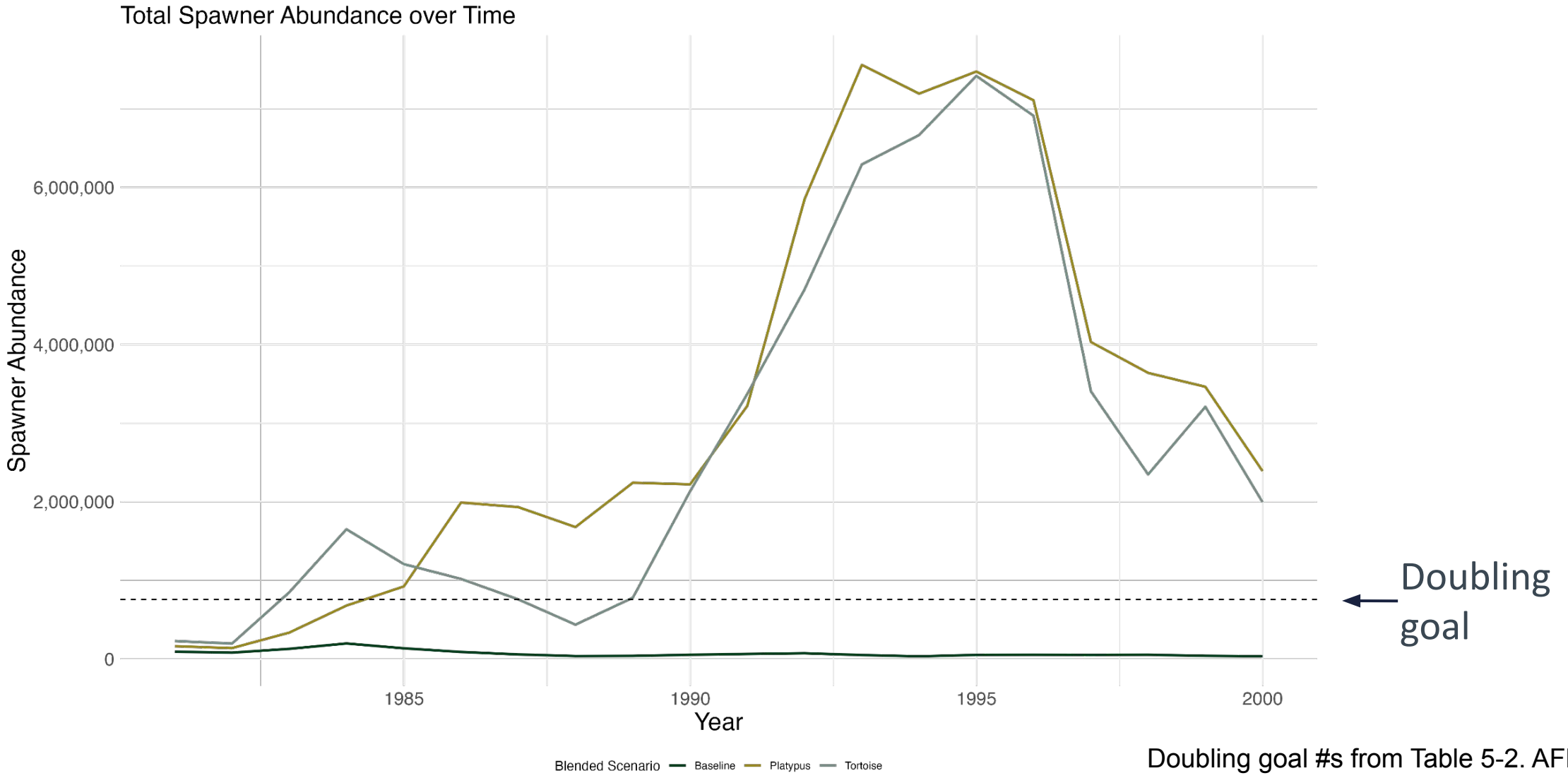
Key Takeaways

- This scenario used “near-future” habitat restoration and flows as well as phased hatcheries and harvest actions.
- Habitat and hydrology were applied at smaller scales relative to other balanced scenarios
- The scenario (still under development) did not meet recovery targets for several biological objectives, especially minimum spawner abundance.
- Still improved salmon biological and habitat metrics, relative to baseline conditions

Limitations

- Habitat actions targeted achievement one quarter of the full doubling goal over an 8 year period, not recovery metrics
- No actions in dry years
- Iterative CalSim3 improvements
- Additional refinement of intelligent habitat harvest

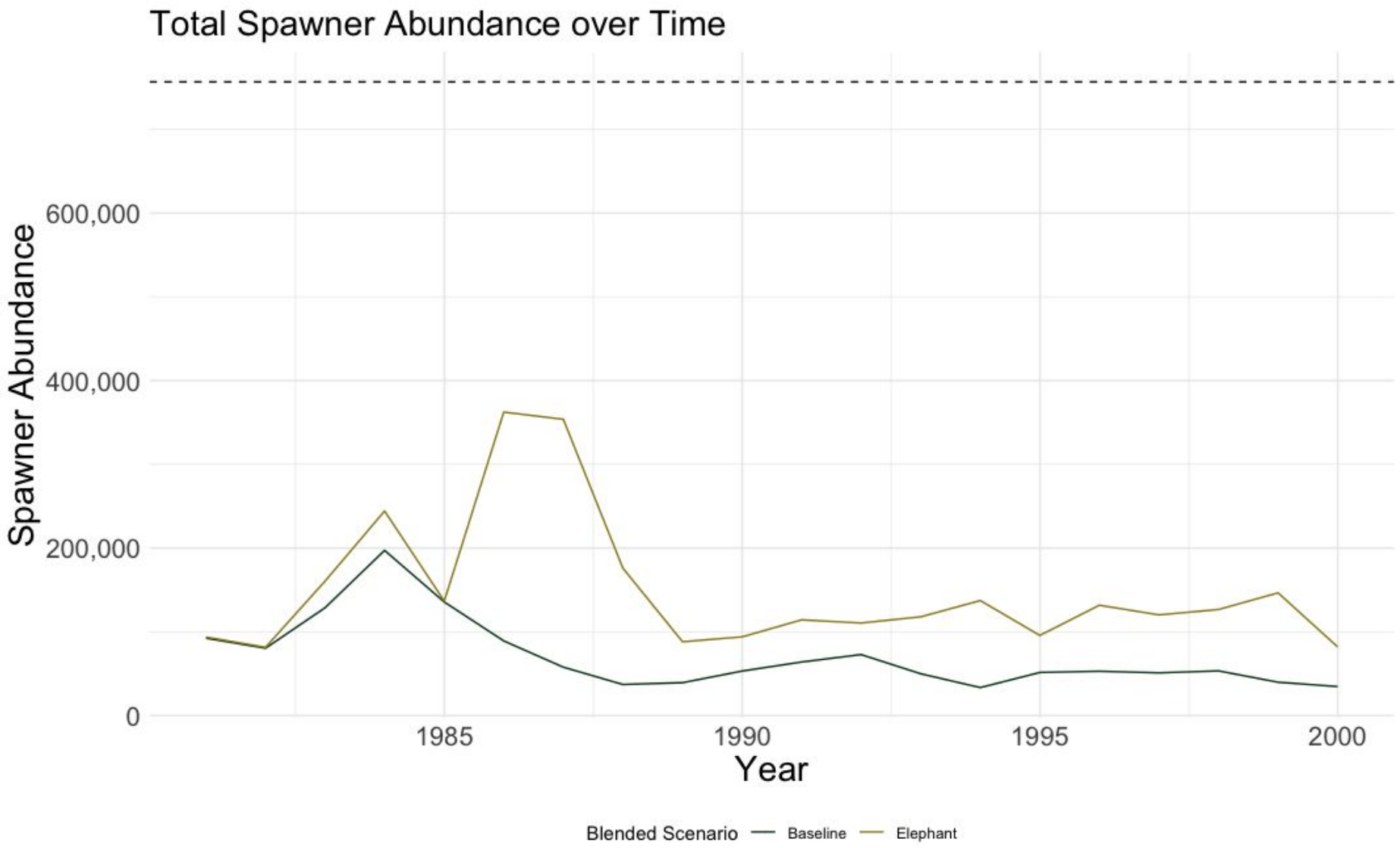
Abundance Plot



Doubling goal

Doubling goal #s from Table 5-2. AFRP

Abundance Plot - Elephant



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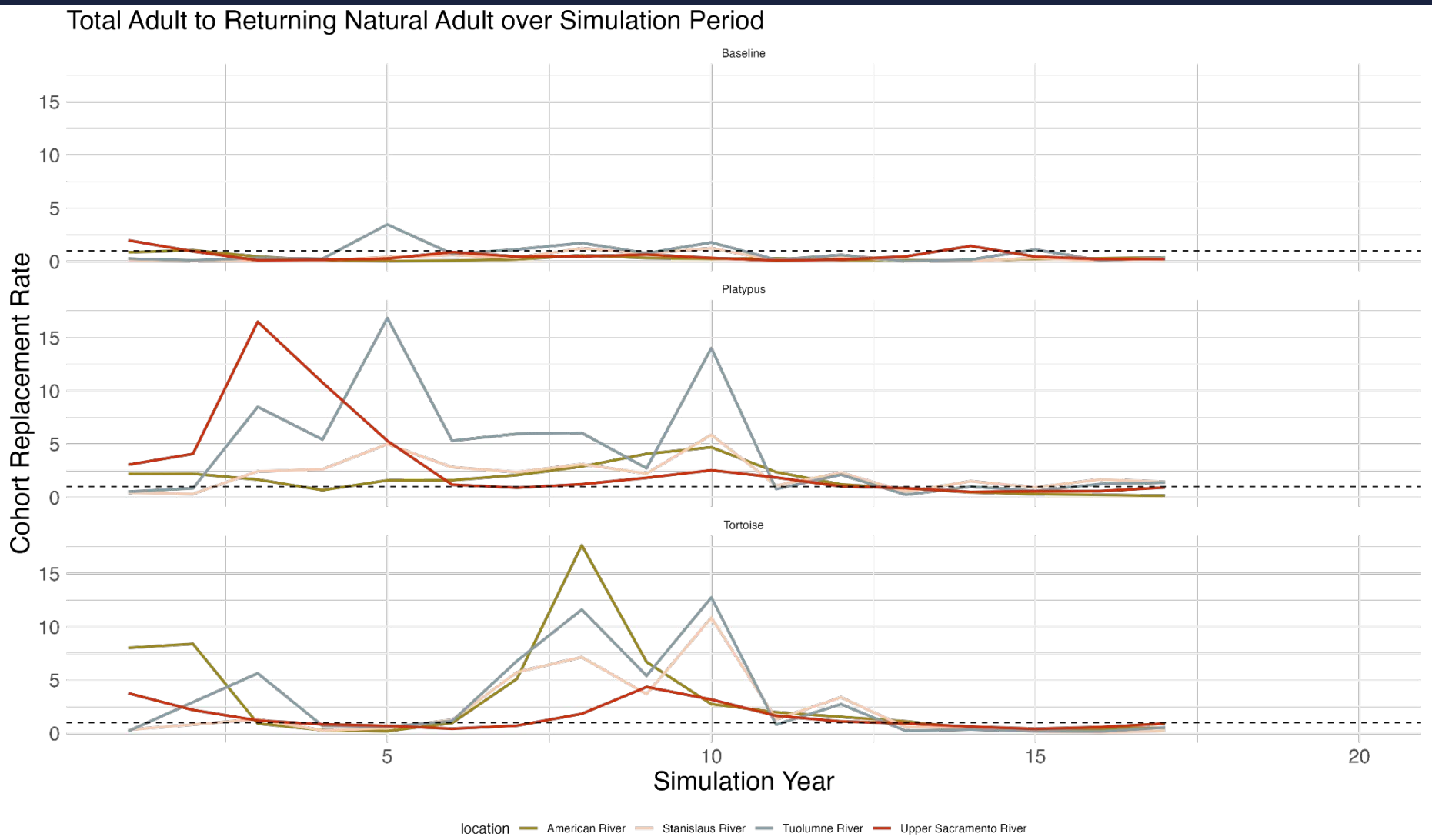
- The R2R baseline scenario currently contains a roughly 60% overlap in habitat projects that are proposed as part of the HRL Program.
- The HRL Program targets achievement of one quarter of the full doubling goal over an 8 year period.
- Incorporating HRL Program flow and habitat actions into models took longer than expected; additional actions needed to meet recovery, can be done in future.

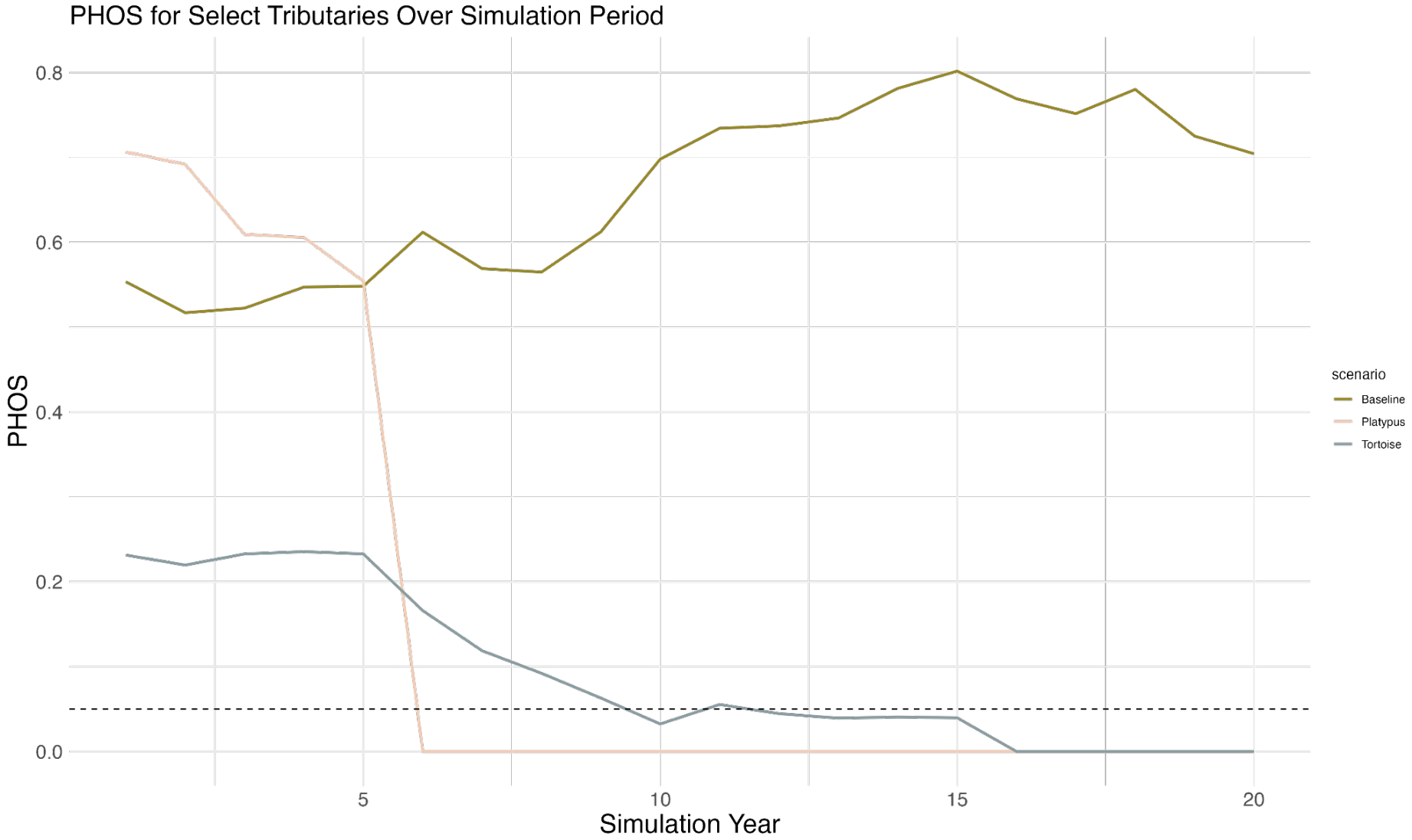
Salmon Biological Consequence Table

Objective	Less Preferred / More Preferred	Performance Measure	Unit	Preferred Direction	Baseline	Elephant	Tortoise	Platypus
Salmonid biological recovery								
2.1: Cohort Replacement Rate (CRR)	Avg	CRR (natural spawners)	CRR	Higher	0.48	1.39	2.24	3.54
2.2: Population growth rate	Avg	Growth rate (all spawners)	Growth rate	Higher	0.47	2.10	0.50	0.79
3.1: Independent viable populations		Total # of independent viable pops	# pop-yrs	Higher	0	1	61	118
3.3: Dependent populations		Total # of dependent pops	# pop-yrs	Higher	78	80	80	79
4: pHOS	Avg	pHOS (weighted by trib)	pHOS	Lower	0.67	0.37	0.09	0.16
6: Time to biological recovery		# of yrs until recovery criteria are met	# yrs	Lower	NA	NA	15	9

Salmon Biological: CRR



Salmon Biological: PHOS



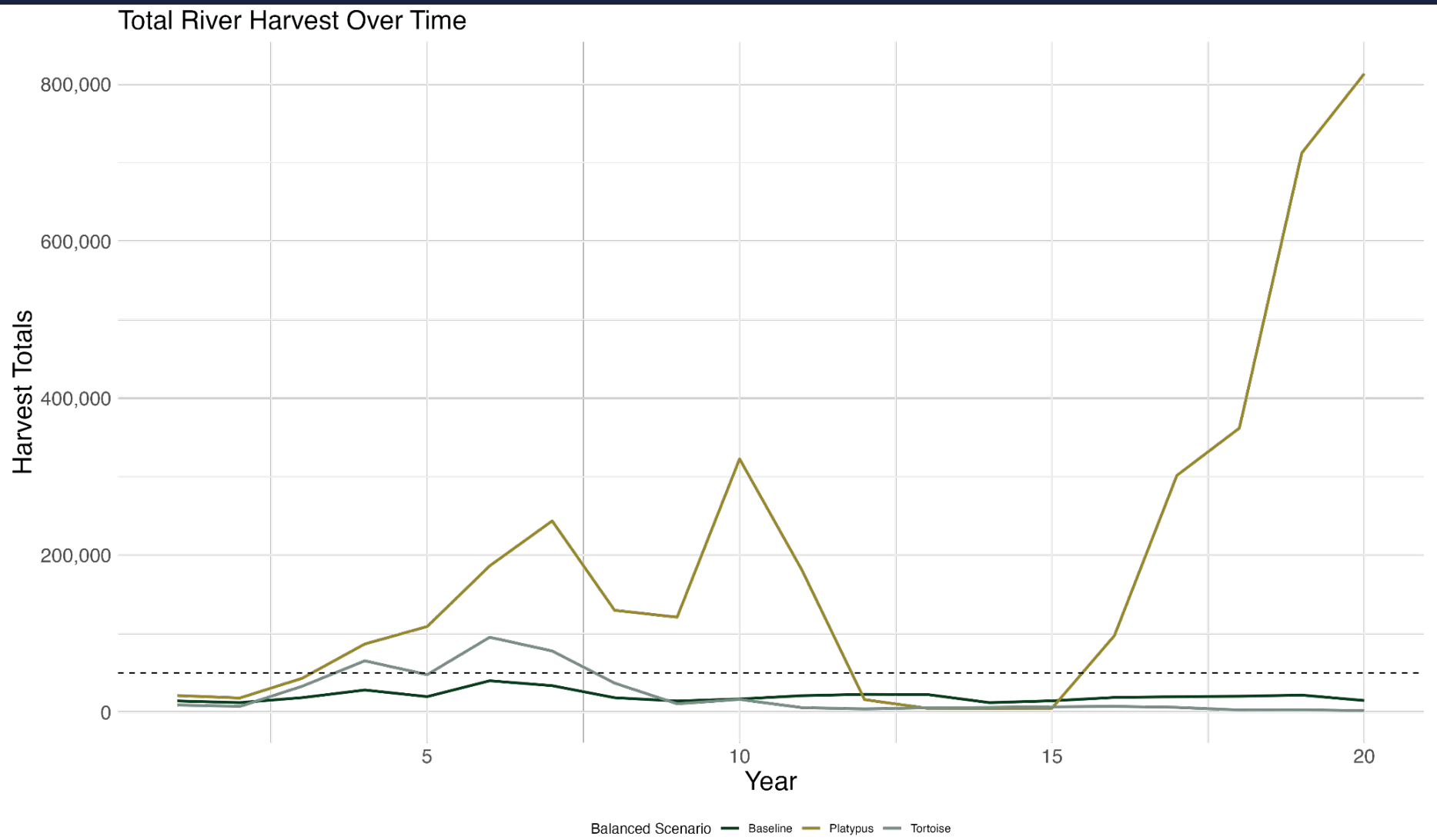
Abundance & Harvest

Objective	Less Preferred / More Preferred	Performance Measure	Unit	Preferred Direction	Baseline	Elephant	Tortoise	Platypus
Salmonid biological recovery								
1: Adult abundance	Avg	Adult abundance (at spawning)	# fish	Higher	79,510	148,696	2,825,781	3,232,640
Harvest								
12.1: In river harvest		Harvestable adults	# fish	Higher	21,584	20,056	20,003	188,977
12.2: Ocean harvest		Harvestable adults	# fish	Higher	206,325	331,717	350,472	2,086,399
12.3: % of years with annual number of adults in rivers and oceans > harvest minimums + recovery targets: River	^	% of yrs above harvest minimums	%	Higher	0	13	13	73
12.3: % of years with annual number of adults in rivers and oceans > harvest minimums + recovery targets: Ocean	^	% of yrs above harvest minimums	%	Higher	13	80	87	100

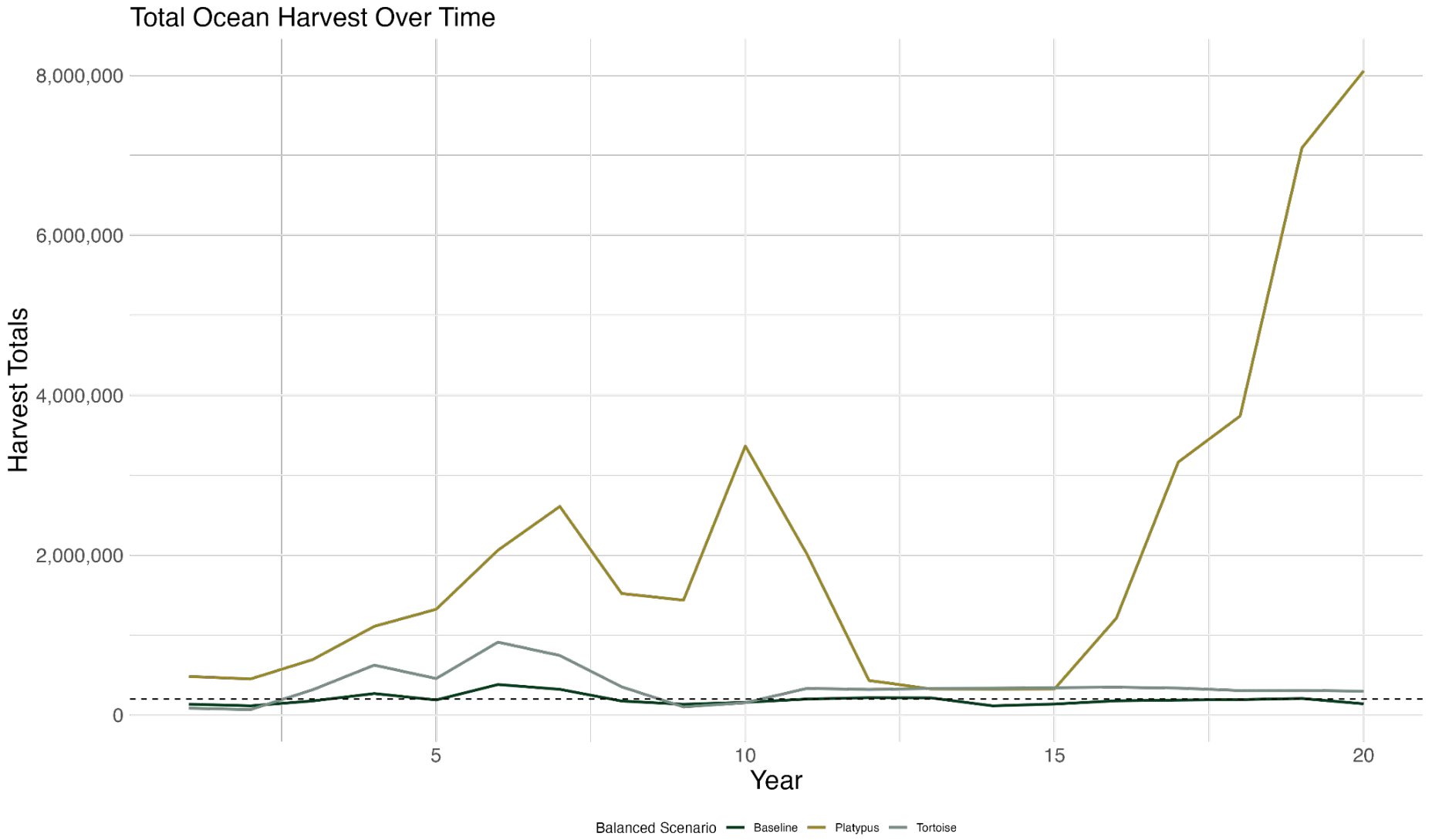
Patterns

- Ocean: All scenarios increased harvestable fish and % of years meeting minimum targets
- Rivers: Only Platypus increased harvestable fish, but all scenarios increased % of years meeting minimum targets

River Harvest Plot



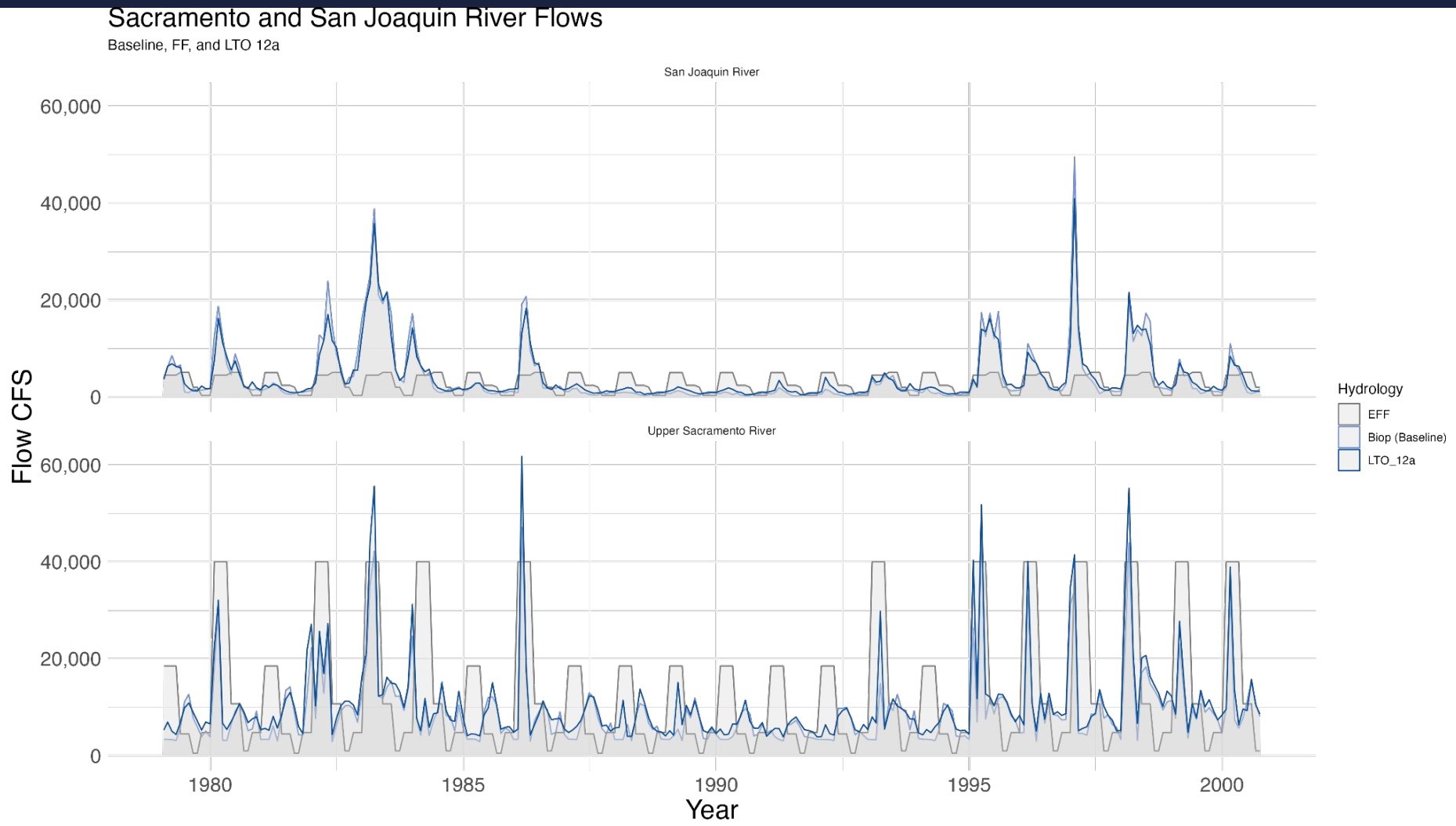
Ocean Harvest Plot



Habitat & Ecological Processes

Objective	Less Preferred / More Preferred	Performance Measure	Unit	Preferred Direction	Baseline	Elephant	Tortoise	Platypus
Habitat & ecological processes								
7.1: Ecosystem health		Marine derived nutrients	lbs marine derived nutrients / m2	Higher	0.01	0.02	0.43	0.49
7.2: Habitat diversity	Avg	Floodplain / In-channel habitat	Ratio	Higher	3	6	10	15
8.1: Suitable juvenile rearing habitat	Avg	Wetted ac day	thousand-ac-days	Higher	933	1,985	2,396	6,556
8.2: Suitable spawning habitat	Avg	Wetted ac day	thousand-ac-days	Higher	57	42	52	128
8.3: Spawning habitat decay rate		Spawning habitat decay rate	Decay rate	Lower	0.04	0.04	0.04	0.04
9.1: Wetted acre days	Avg	Floodplain wetted ac day	thousand-ac-days	Higher	420	1,454	1,890	5,035
9.2: Functional flow metric		Constructed scale	1 to 3	Higher	1 - No	1 - No	2 - Some	3 - Yes
9.3: Inundated acres associated with a flood of a given recurrence interval		Total ac above threshold	# ac	Higher	327	2,396	2,465	26,910

Hydrology Tested



Land, Water, & Agriculture

Objective	Performance Measure	Unit	Preferred Direction	Baseline	Elephant	Tortoise	Platypus
Access to land & water							
11: Managed wetlands	Deliveries to refuges	TAF	Higher	383	387	316	276
Water & agriculture							
13.1: Water supply: Divertible water for agriculture	SWP & CVP ag exports	MAF	Higher	5.4	4.9	4.5	3.9
13.2: Water supply: Divertible water for municipalities	SWP & CVP municipal exports	MAF	Higher	2.0	1.8	1.6	1.4
14: Agriculture: Land in ag production	Constructed scale	1 to 4	Higher	3 - High	2 - Med	3 - High	1 - Low

Less Preferred — More Preferred

Patterns

- Total volume of flow release actions increases from left to right, meaning larger impacts on water deliveries from left to right
- Platypus had Max Habitat action, which will have the biggest impact on acres of land in ag production

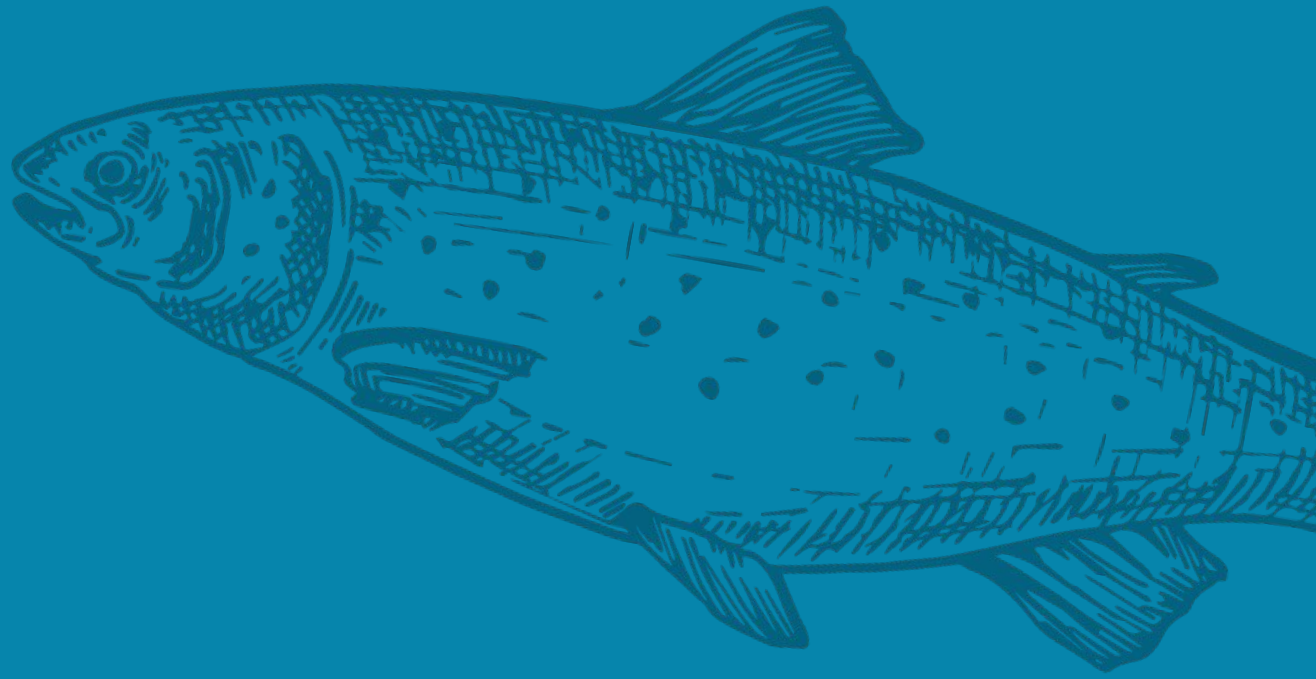
Regulatory, Public Health, & Infrastructure

Objective (Less Preferred … More Preferred)	Performance Measure	Unit	Preferred Direction	Baseline	Elephant	Tortoise	Platypus
Regulatory, public health, infrastructure							
15: Non-salmon recreation: Weeks above flow threshold	Weeks flooded	# weeks	Higher	12.9	13.9	12.6	12.6
16.1: Environ water: Annual outflow	Outflow	MAF	Higher	15.6		17.0	17.8
16.2: Environ water: Proportion of unimpaired flow	Unimpaired flow	%	Higher	63	74	71	86
17: Flood risk: Flood frequency and stage for each watershed	Difference in flow	cfs	Lower	1,196	1,190	1,346	1,445
18: Hydropower generation dollars lost	Total $ lost (compared to baseline)	$ (Millions) lost	Lower	0	0	101	265

Patterns

- Total volume of flow release actions increases from left to right: meaning more environmental flows, as well as larger impacts on hydropower
- We could not calculate environmental water for the Elephant scenario, which used CalSim3

Spring-run & Winter-run



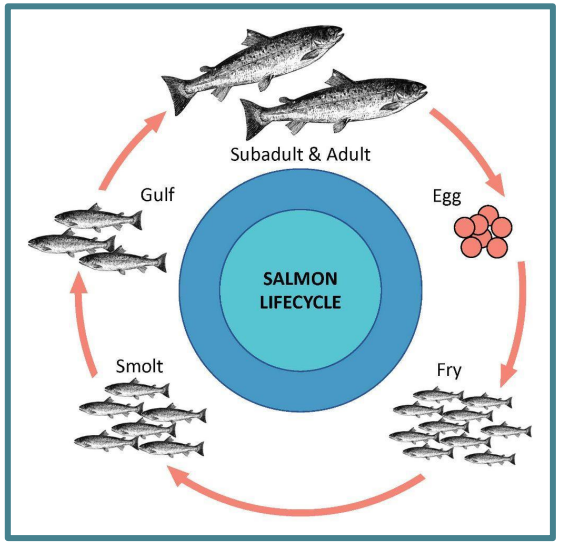
Winter-run Chinook salmon Life Cycle Model: Overview

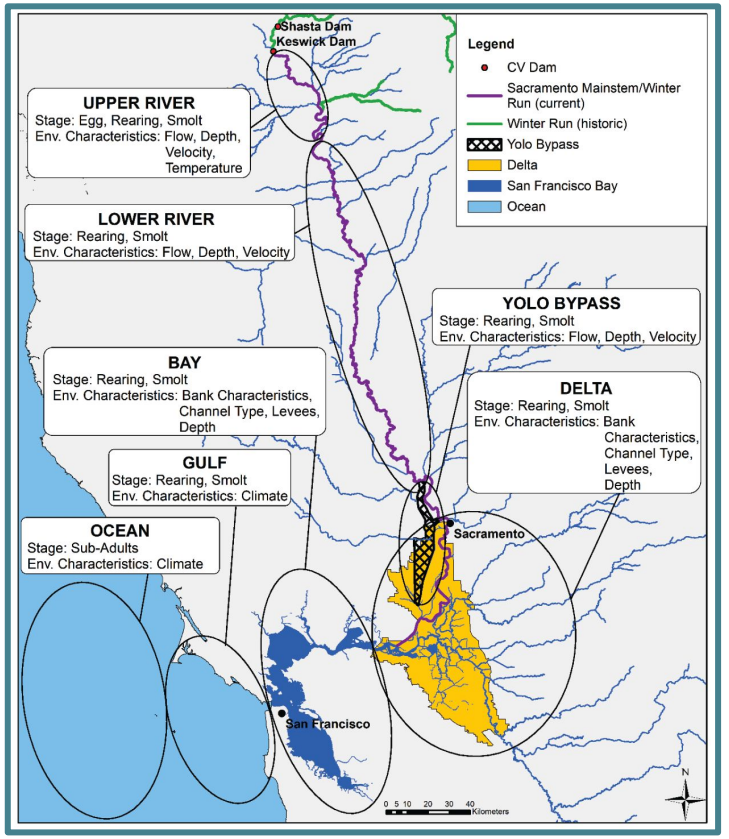
Value to R2R | R2R Phase I recovery definition included evaluating recovery effects on multiple runs; independent, well-supported model

WRLCM | stage-structured population model that estimates winter-run abundance for each lifestage, timestep, and geographic location

Temporal Resolution | Monthly

Spatial Scale | Upper Sacramento River (Keswick Dam to RBDD), Lower Sacramento River (RBDD to Sacramento), Yolo Bypass, Delta, & Bay





Comparing the WRLCM and R2R DSM models

Description	WRLCM	R2R DSM Model
Species	Winter-run	Fall-run (spring-run, winter-run)
Hydrologic time series	82 years (CalSimII, 1922-2003)	20 years (1980 - 2000)
Primary Model Objective	Evaluate effects of flow actions	Evaluate effects of habitat actions
Model Type	Stochastic (includes uncertainty)	Deterministic
Model outputs	% change from a baseline	raw abundances

The differences between these models – differences in their approach, capabilities, and sensitivities – means that the WRLCM modeling approach and results will differ from the R2R DSM model

WRLCM Recovery Actions

Reminder:

these actions are unique to the WRLCM and are not equivalent to actions evaluated for the R2R DSM model

- Baseline (2019 BiOp)

- Evaluate 12 “4H” actions separately (in isolation):
  - HABITAT:
    - Rearing habitat x 2 (separately in each of the 5 reaches + all reaches)
    - Spawning habitat x 2
    - Reduced predation: increase through-delta survival by 10%
  - HYDROLOGY:
    - Maintain temperature-dependent mortality (TDM) below 10% in all years (egg)
    - Maintain smolt outmigration survival above 36% (Upper R.) and 77% (Lower R.)
  - HARVEST: Reduce impact rate by 50%
  - HATCHERIES: LSNFH broodstock collection x 2

- “All Positives Action”: combine all “4H” actions with a positive effect into one action

WRLCM Performance Metrics

- Biological:
  - Abundance: number of spawners
  - Cohort Replacement Rate (CRR): number of spawners generated per spawner
  - Freshwater Productivity: number of smolts (at the golden gate) per spawner
  - pHOS: proportion of hatchery origin spawners

- Water Cost: total volume of water (MAF) required over the 82-year model run to generate the survival benefit for scenarios for the two HYDROLOGY actions:
  - Maintain TDM below 10% in all years (egg)
    - Calculate water cost (MAF of May 1 Shasta Storage) of lowering TDM from baseline TDM value to below 10%
  - Maintain smolt outmigration survival above 36% (Upper R.) and 77% (Lower R.)
    - Estimate water cost of maintaining flows >= 8,000 cfs at Bend Bridge

Preliminary Results: WRLCM R2R Performance Measures

Table A1. ***Preliminary*** results of the performance measures for each recovery scenario evaluated using the WRLCM, including the mean and 95% confidence intervals (in parentheses). Please note that results are preliminary and subject to change.

Performance Measure	Baseline	← *Recovery Scenarios* →											
		All **Positive** Recovery Actions (Kitchen Sink)	Habitat								Hydrology		Harvest	Hatcheries
			Rearing – All locations	Rearing – Upper River	Rearing – Lower River	Rearing – Yolo Bypass	Rearing – Delta	Rearing – Bay	Spawning	Predation (delta)	Egg to Fry Survival	Riverine Outmigration Survival		
Adult abundance[1]	0 (0,0)	879% (330, 2071)	-26.6% (-35.4, -14.7)	-24.7% (-32.6, -15.0)	-5.7% (-10.6, -0.9)	0.0% (0.0, 0.1)	0.12% (-0.02, 0.62)	3.9% (-0.31, 8.15)	44.9% (11.0, 66.3)	64.2% (33.7, 115.8)	42.2% (22.6, 71.37)	2.7% (1.0, 5.7)	87.15% (40.3, 129)	10.8% (2.5, 17.1)
Freshwater productivity[1]	0 (0,0)	35.8% (14.2, 73.0)	-3.3% (-5.8, 0.3)	-3.1% (-5.3, 0.4)	-0.6% (-1.5, 0.32)	0% (0.0, 0.0)	0% (-0.04, 0.02)	0.2% (-0.25, 0.56)	2.8% (-0.31, 5.41)	7.5% (2.26, 12.8)	24.9% (20.0, 30.0)	0.5% (0.1, 1.0)	0.6% (-7.4, 9.3)	2.1% (0.16, 3.68)
CRR[2]	1.06 (0.97, 1.17)	1.15 (1.09, 1.27)	1.06 (0.97, 1.16)	1.05 (0.97, 1.16)	1.06 (0.97, 1.17)	1.06 (0.97, 1.17)	1.06 (0.97, 1.17)	1.06 (0.97, 1.17)	1.07 (0.97, 1.19)	1.09 (0.99, 1.2)	1.06 (0.97, 1.17)	1.06 (0.97, 1.17)	1.1 (1.0, 1.2)	1.07 (0.97, 1.18)
Max pHOS[3]	0.35 (0.15, 0.68)	0.15 (0.09, 0.21)	0.42 (0.17, 0.70)	0.41 (0.17, 0.70)	0.36 (0.15, 0.68)	0.35 (0.15, 0.68)	0.35 (0.15, 0.68)	0.34 (0.14, 0.68)	0.29 (0.11, 0.65)	0.27 (0.12, 0.62)	0.18 (0.10, 0.28)	0.34 (0.14, 0.68)	0.25 (0.11, 63)	0.43 (0.22, 0.7)
Water Cost [4]	0	20.77	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.77	18.0	N/A	N/A

Conclusions and Considerations

- Scenarios that had higher average abundance also had higher CRR and decreased PHOS values

Habitat

- Strong positive effects occurred by doubling the spawning capacity and increasing the survival through the delta by 10%. Some fry rearing habitat can cause a decrease in population productivity and abundance due to lower smolt survival from those restored habitats (Upper River, Lower River) relative to other rearing habitats

Hydrology

- The reduction of temperature dependent mortality provided a greater population response per unit of water cost

Harvest

- Strong positive effects occurred due to increasing the abundance of later life stages (e.g., age-3 and age-4 returning spawners)

Hatchery

- Hatchery action that doubled production also had a positive effect, but at the cost of increasing the PHOS values

Assessing fall-run actions on other runs

Planning to use spring- and winter-run SIT DSMs to model and refine scenarios in next phase.

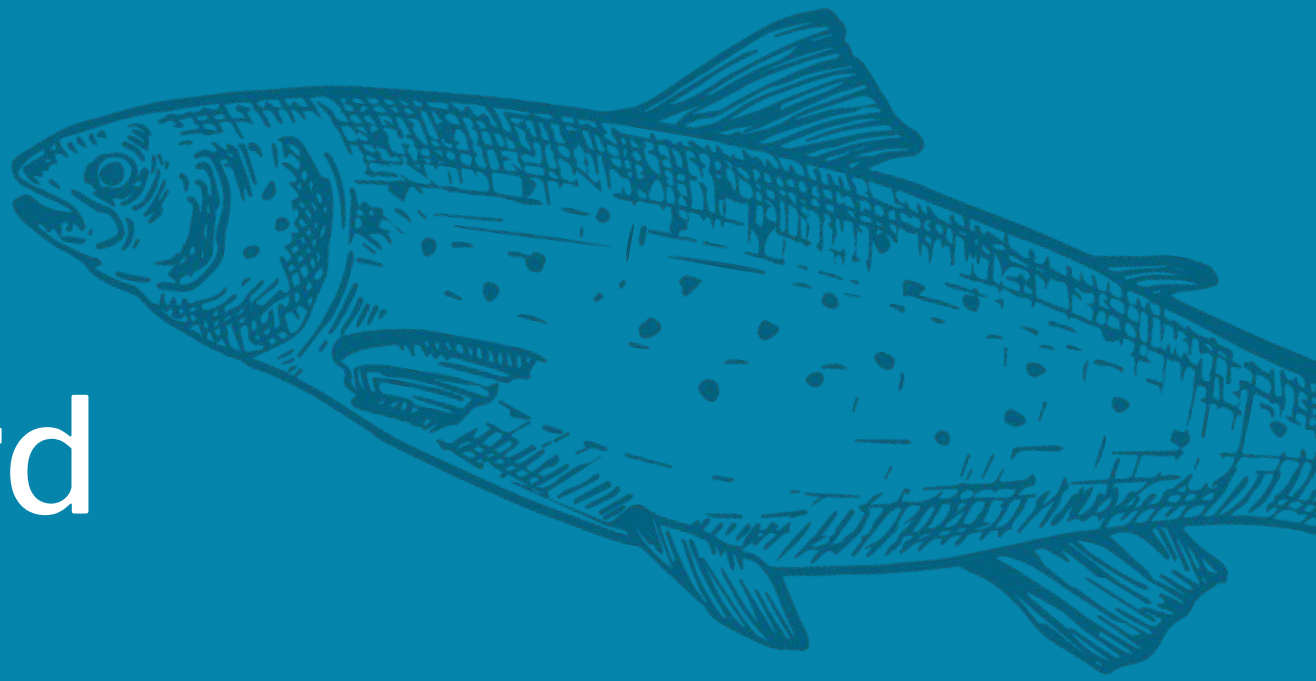
	Potential benefits	Potential negative effects / challenges
Habitat	• Increased upper watershed rearing habitat	• Juvenile rearing habitat restoration, if focused only in the Sacramento River, has potential to have a negative impact on WR (in the absence of commensurate increase in spawning habitat and/ or change in spawning habitat location)
Hydrology	• Flows to support FR spawning habitat (Oct - Dec) may support WR fry rearing habitat • Flows to support FR floodplain habitat (Jan - April) may support WR smolt outmigration survival (also Jan - April) • FR outmigration survival pulse flows (May - July) may provide cooler temperatures to promote earlier WR spawn timing	• Dry season baseflow (Aug - Sep) would likely not support WR egg to fry survival when the majority of eggs are incubating (Aug - Sep)
Harvest	• Increased harvest of natural production fish	• Increased WR bi-catch
Hatcheries	• Increased hatchery production as component of phased hatchery scenario	• Increased introgression with Spring run • Increased redd superimposition

Spring-/winter-run, and steelhead actions

- What else could we do to benefit other salmonids in the CV?

	Spring-run	Winter-run	Steelhead
Habitat	• Reintroduction above dams • Weirs to prevent redd superimposition from Fall run • Food subsidies during rearing periods	• Reintroduction above dams • Juvenile rearing habitat restoration, if focused only in the Sacramento River, has potential to have a negative impact on WR. • Food subsidies during rearing periods	• Reintroduction above dams
Hydrology	• Shape Functional Flows for dry years to target out migration period • Spring survival pulse flows	• Shape Functional Flows for dry years to target out migration period • EFF Flows to support FR spawning habitat (Oct - Dec) may support WR fry rearing habitat • EFF Flows to support FR floodplain habitat (Jan - April) may support WR smolt outmigration survival (also Jan - April) • FR outmigration survival EFF pulse flows (May - July) may provide cooler temperatures to promote earlier WR spawn timing • Dry season baseflow to support WR egg to fry survival • Management of reservoir releases to provide downstream food subsidy	• Altered flow dynamics to stimulate anadromy • Augmented flows to expand delta rearing habitat • Augmented flows to improve through delta survival • Management of reservoir releases to provide downstream food subsidy
Harvest			
Hatcheries	• Phased conservation hatcheries	• Phased conservation hatcheries	• Phase out of existing hatchery practices

Working Toward SDM Working Group Support



What does SDM Working Group “support” mean?

- Support for a scenario as a **blueprint for recovery** that you are interested in moving forward with the group toward further evaluation, refinement, and implementation (in Phase 4)
- May not be a participant’s first choice, but willing to explore it further
- Not binding; not a decision - decision making authority rests with individual entities
- However, a scenario supported by the group is expected to inform future recovery planning, research, and decisions

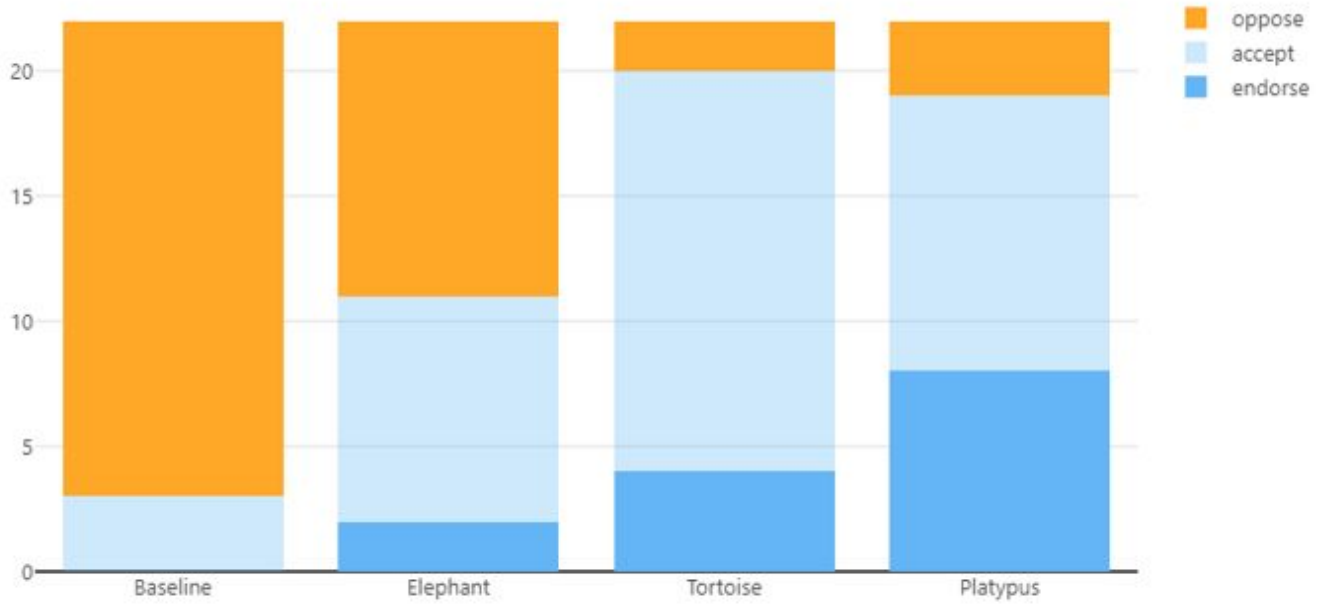
Exercise - Endorse, Accept, Oppose

Levels of preference:

- **Endorse** - I fully support this scenario as is
- **Accept (with 1 to a few conditions)** - I can live with it; it may not be my first choice, but I will support it with conditions
- **Oppose** - I can’t support it, would need many major modifications

SDM Working Group Initial Responses

- Is there broad support around a preferred scenario to move forward into the next phase of recovery planning, exploration, and implementation?



Alternative	Endorse	Accept	Oppose
Baseline	0	3	19
Elephant	2	9	11
Tortoise	4	16	2
Platypus	8	11	3

Key Issues

- Rationale for support / oppose: what are the key issues?

	Elephant	Tortoise	Platypus
Support	• Could be a realistic scenario on which to build and investigate	• Performs well for salmon (meets recovery) with good balance of other interests	• Best for salmon, ecosystems, and harvest • Increases overall viability and resiliency of salmon to future climate change and other catastrophic events
Oppose / concerns	• Does not meet recovery as it currently stands • Needs to address overlap with baseline habitat and missing flow actions in CalSim3 run	• Doesn't seem viable to focus on only dry years • Large-scale predation removal is unrealistic • Low harvest (especially in-river) • Harvest and hatchery actions are uncertain/difficult to implement • Are the gains in salmon recovery enough to provide some measure of stability in water allocations and operations? • Likely will take a long time to implement	• Water and ag impacts are too high, and most benefits to salmon are similar to Tortoise • Functional flow action is unrealistic and may not align with operational realities and environmental standards • Harvest and hatchery actions are uncertain/difficult to implement • Likely will take a long time to implement

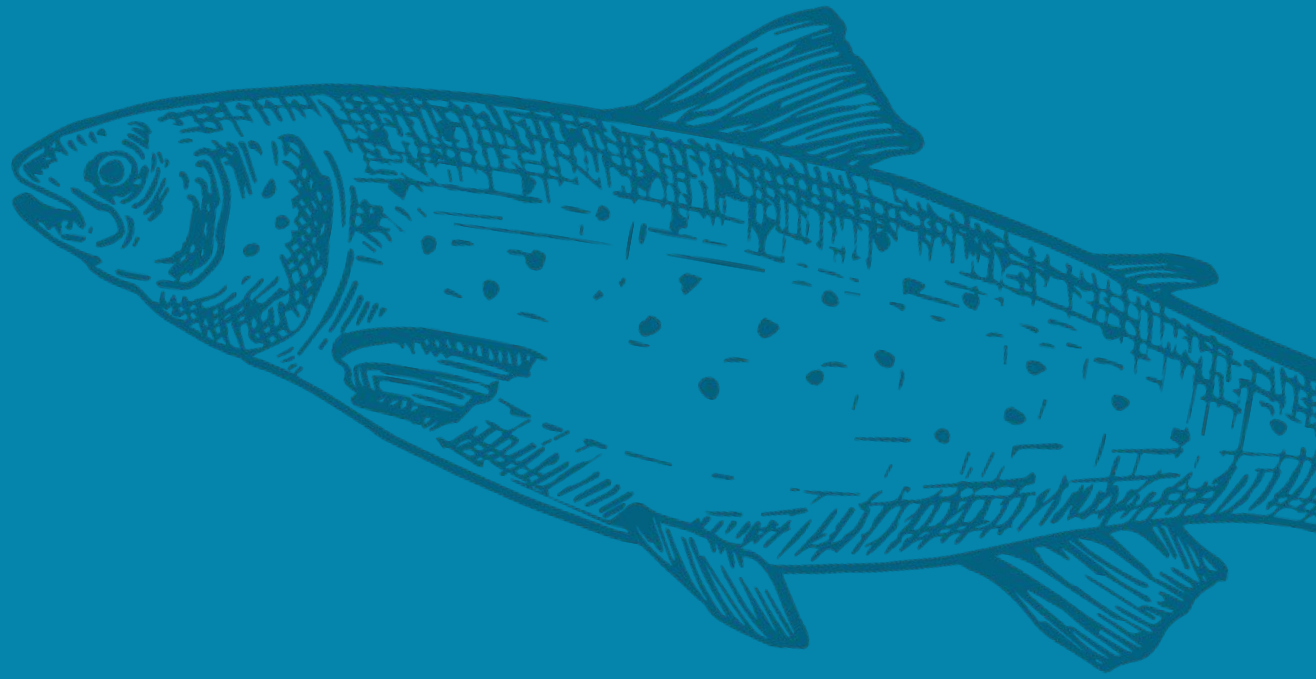
Final Phase 3 Scenario

- Can we create/combine/modify scenarios to make a new one that is preferred by all parties?

	New scenario: Kookaburra
Action category	**Actions**
Habitat	TBD: Somewhere between Elephant and max habitat
Habitat	Floodplains/rice fields
Habitat	Food subsidies
Habitat	Predation reduction
Habitat	Near-future habitat
Hydrology	Functional flows TBD: Include in some (but not all) dry and normal years
Harvest	No harvest of dry year cohorts
Harvest	Intelligent habitat harvest
Harvest	Tribal harvest prioritized
Hatcheries	Phased hatcheries to terminal/outplanting
Hatcheries	Weirs

- Hybrid of Tortoise and Platypus
- Expected to meet biological recovery
- Work needed
  - Habitat actions with less impact to ag lands than Platypus
  - Flow actions of different timings/magnitudes (total amount of water likely between Tortoise and Platypus)
- Phased hatcheries to support fisheries, be more realistic transition to other hatchery practices, and meet pHOS requirements

Next Steps



On the Horizon

	OCT	NOV
SDM Working Group meetings	10/10 + 10/24	
Forum meeting	10/29	
Tribal engagement		TBD
Final report		11/30

What's Next?

Phase 4 (if/when funding is secured)

- Continue refining recovery actions/scenarios
  - Map actions to real world and identify gaps
    - Modeling flow scenarios (w/ COEQWAL)
    - Watershed specificity
- Develop an implementation framework and range of tactical approaches
  - Feasibility & barriers, uncertainty, monitoring
  - Funding strategy
- Broader outreach & engagement
  - Social science research
  - Developing an emergent communication strategy for our inclusive, values-based process

Photo Credit: California Department of Water Resources