

# CVPIA SIT Call-in Meeting October 9, 2019



## Agenda

- Update on predator contact points (Cyril)
- Update on watershed expert meetings (Mike Urkov)
- Discuss Battle Creek winter run proposal (Matt)
- Discuss proposed rulesets for restoration strategy development (All)
- Review example output that the SIT will be provided with to develop strategies (All)
- New Business

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# Battle Creek Winter Run Proposal

- What
  - Add capability to SIT model to include winter Chinook salmon in Battle Creek
- How?
  - Seed the watershed with hatchery fish
    - About 500 hatchery adults returning to BC each year
  - Allocate some adult returns to hatchery (natural or hatchery origin?)
    - Allow 75% of adult returns to spawn
    - Remove 25% of adult returns for hatchery operations
  - Incorporate habitat estimates
    - Winter run would be using spring run habitat in the North Fork (The Payne report)

[Link to proposal](#)

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# Scenario Evaluation

Simulate every combination of actions for each tributary to find optimal *sequence* of actions

Assume 4 potential actions per tributary

20 years =  $4^{20} = 1.09 \times 10^{12}$   
combinations x 25 natal  
tributaries...



# Decision Alternatives

**Partial controllability: 50 – 150%**



≈

**Screen water diversion (10 cfs)**

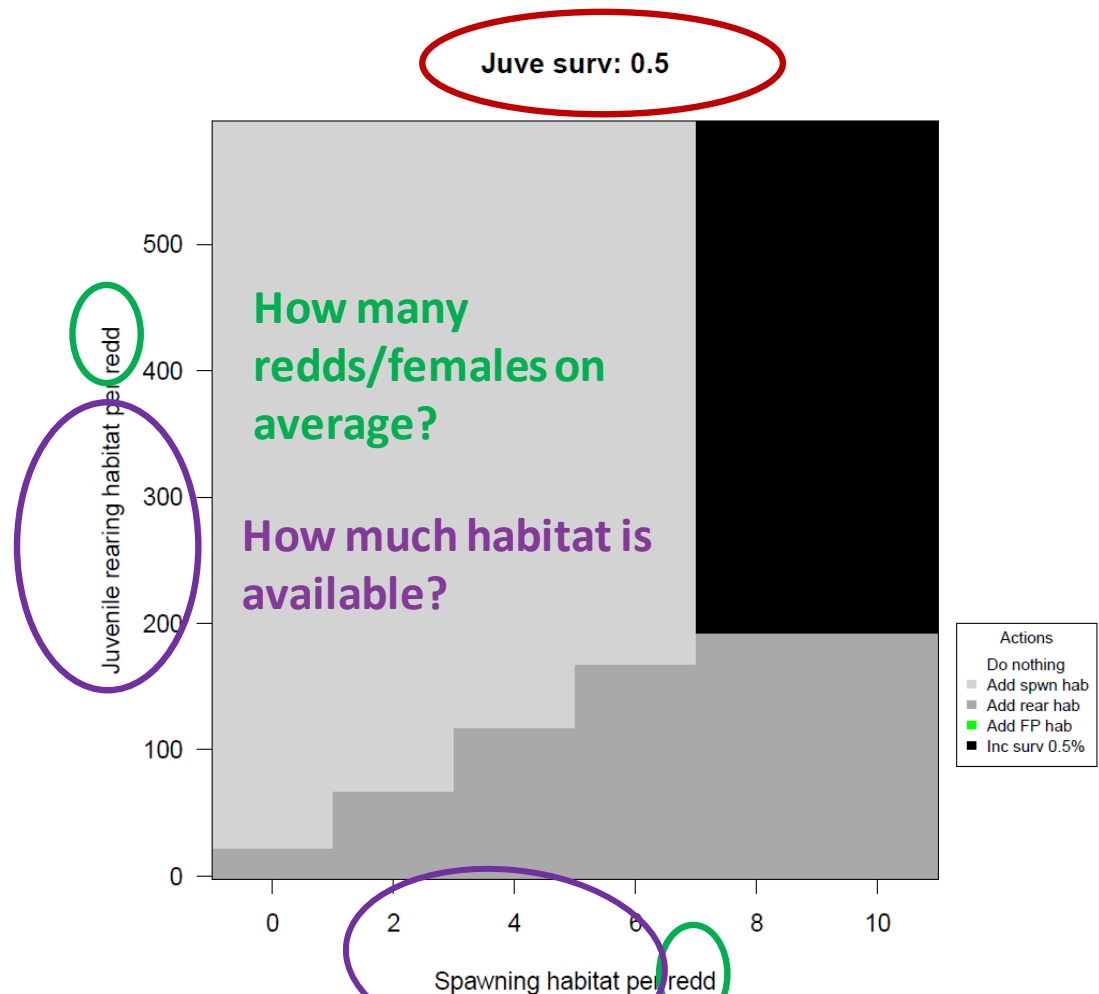
# State-Dependent Policy Development

What is juvenile < 45 mm survival on average?

Use decision-support model to develop transition probability matrices for each group/tributary type

Solve using stochastic dynamic programming

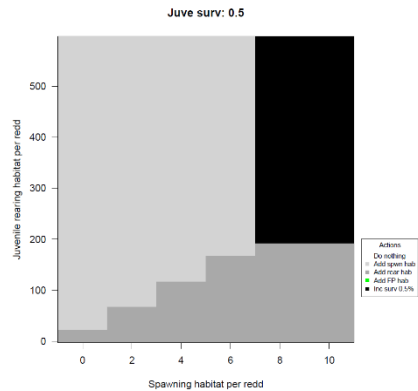
- Maximize the cumulative utility value through time



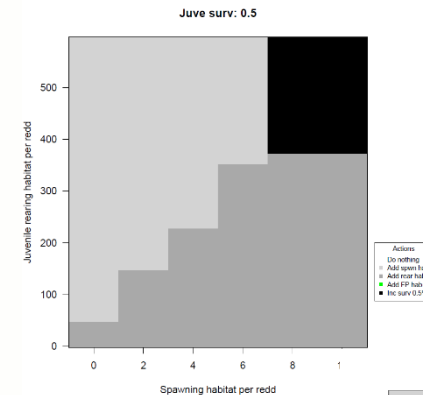


# State-Dependent Policy Development

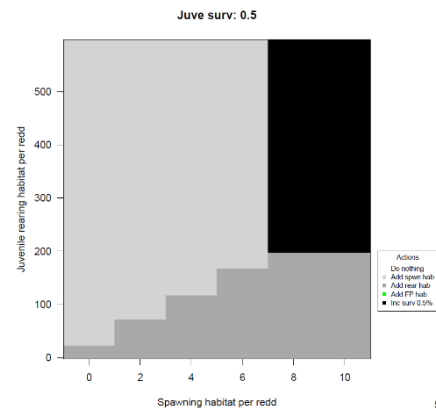
## Group 1



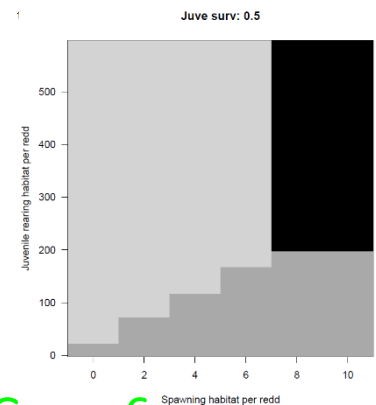
## Group 2



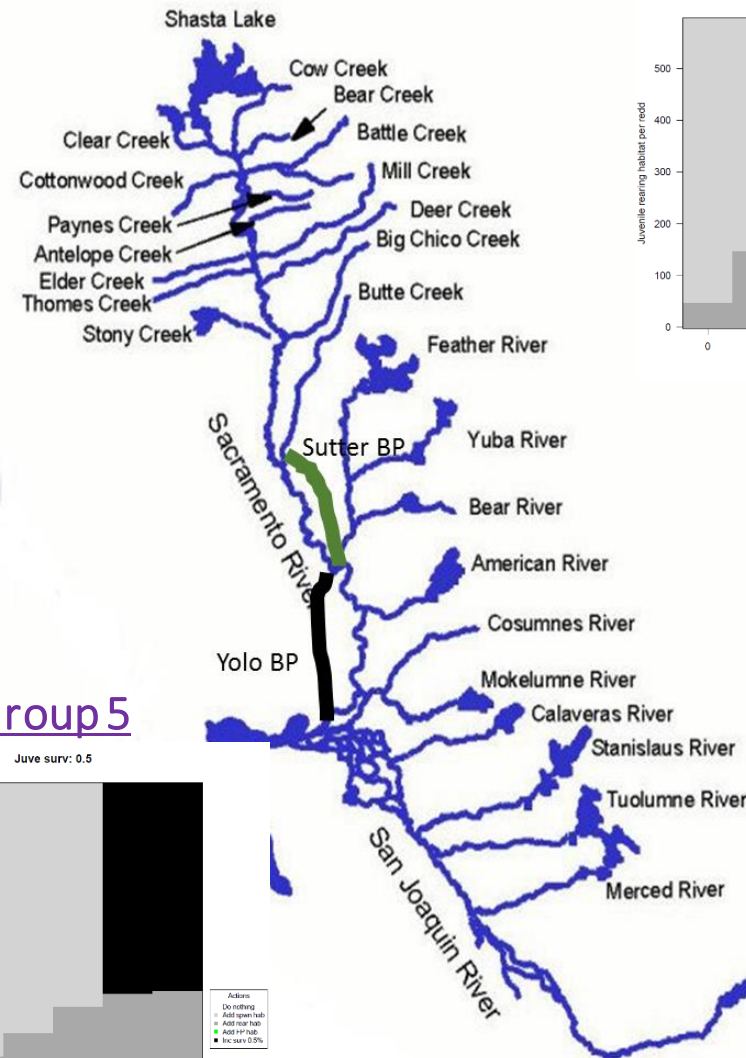
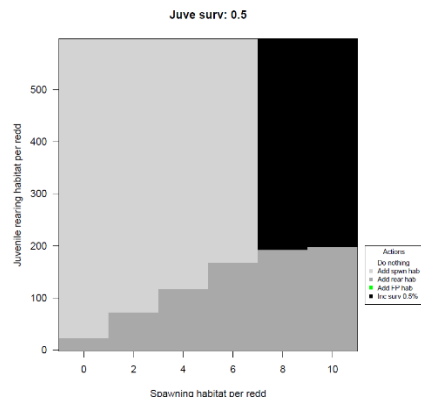
## Group 3



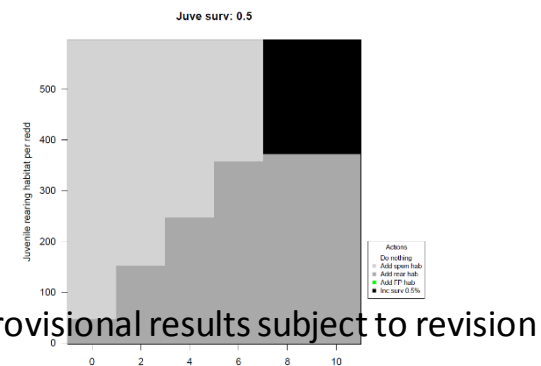
## Group 4



## Group 5



## Group 6



Provisional results subject to revision

# Forward Simulation

Simulate 20 years

Five actions implemented per year

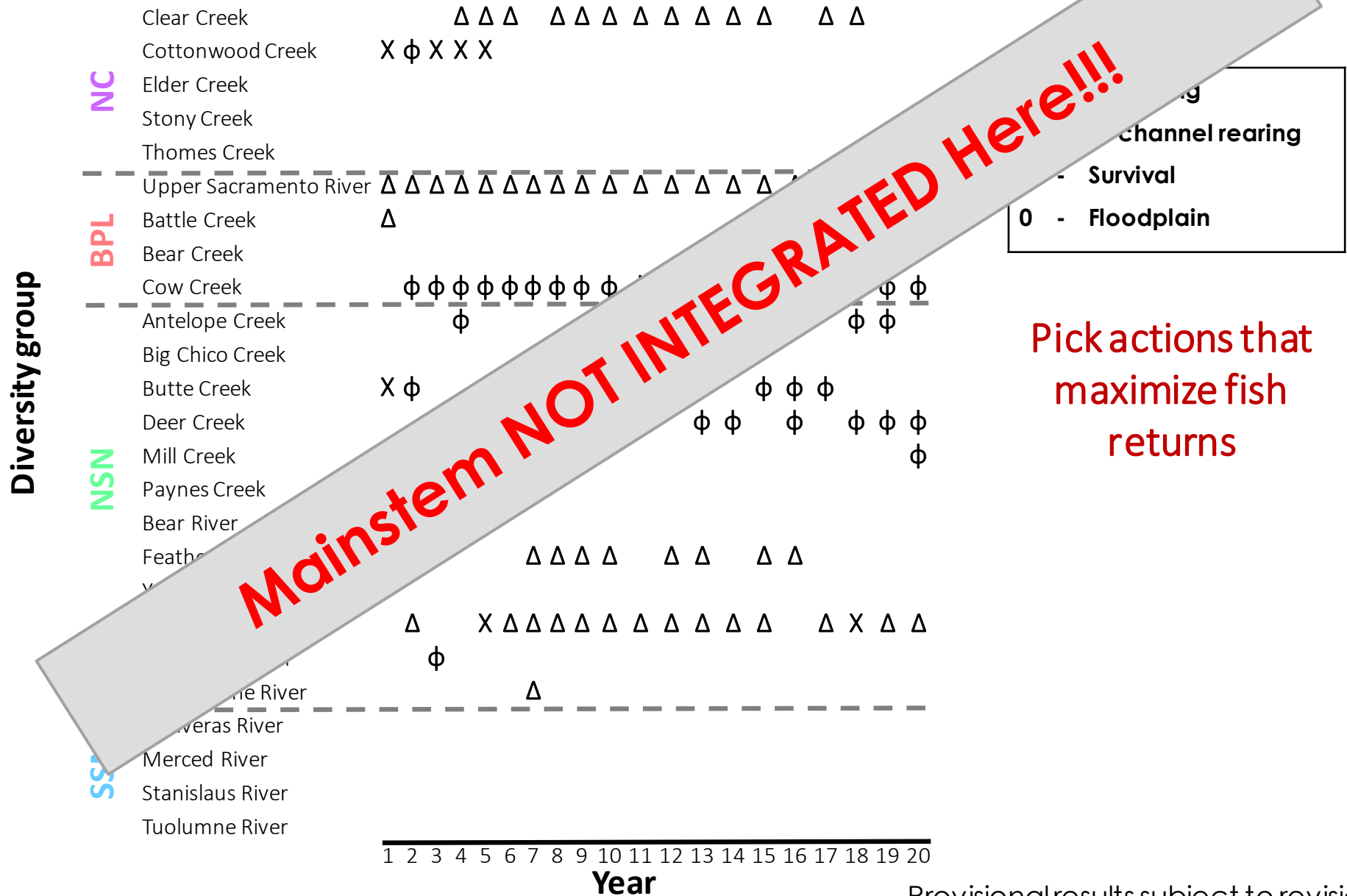
Evaluate two alternative rulesets

1. Pick actions that maximize fish returns but do not work in areas above doubling goal
2. Pick actions that maximize fish returns in each diversity group but do not work in areas above doubling goal



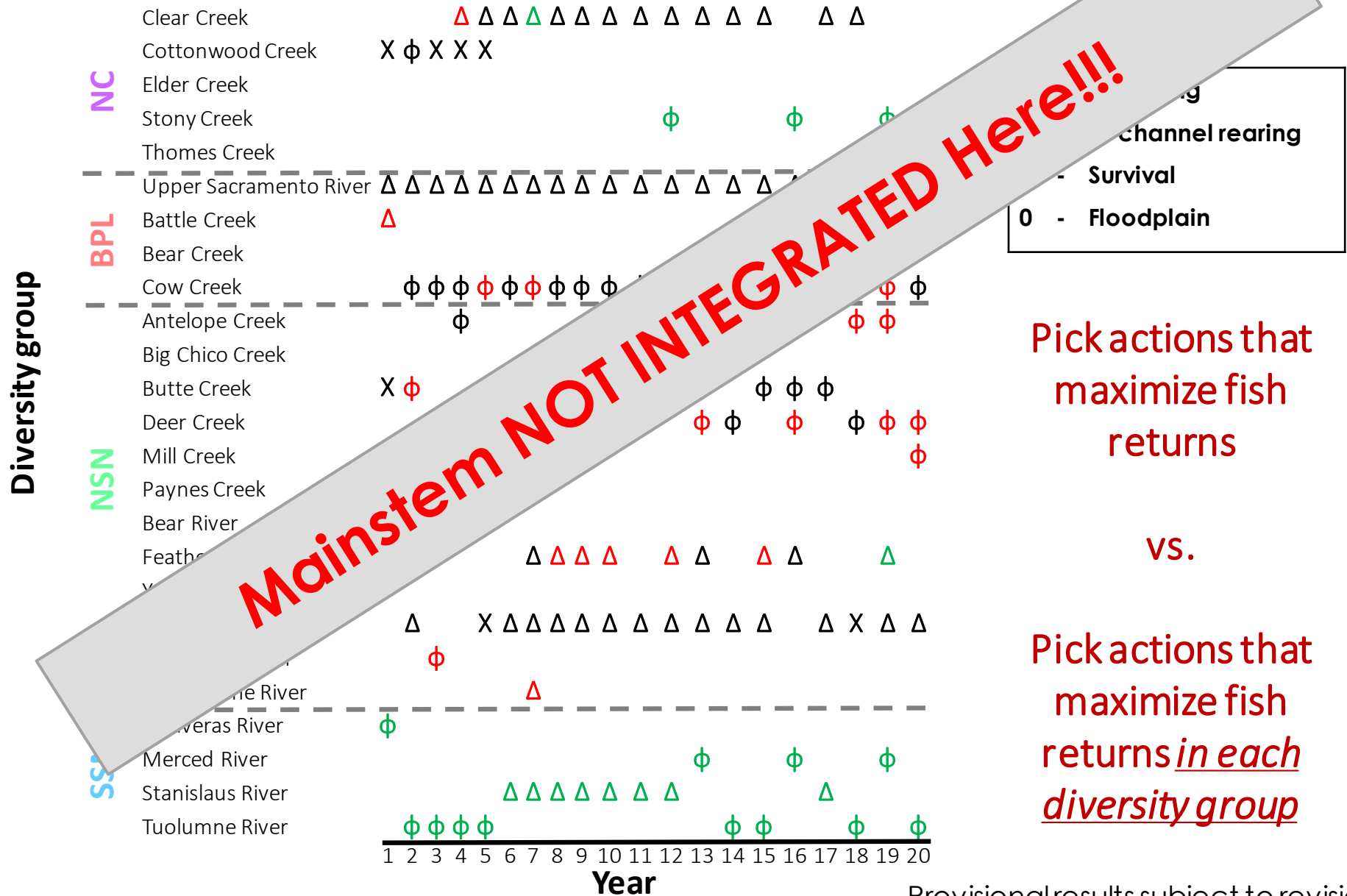
# Forward Simulation

## What strategy results in the highest cumulative utility?



# Forward Simulation

## What strategy results in the highest cumulative utility?



Provisional results subject to revision

# Rule-set concepts

# From our last SIT Conference Call

## Forward Simulation

What strategy results in the highest cumulative utility?

Pick actions that maximize fish returns

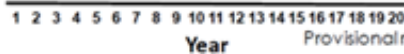
Upper Sacramento River  
Antelope Creek  
Battle Creek  
Bear Creek  
Big Chico Creek  
Butte Creek



x - Spawning  
+ - In-channel rearing  
- - Survival  
o - Floodplain

**Mainstem Sacramento NOT INTEGRATED YET!!**

Location  
Elder Creek  
Mill Creek  
Paynes Creek  
Stony Creek  
Thomes Creek  
Bear River  
Feather River  
Yuba River  
American River  
Calaveras River  
Cosumnes River  
Mokelumne River  
Merced River  
Stanislaus River  
Tuolumne River



Provisional results subject to revision

## Forward Simulation

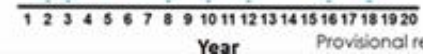
What strategy results in the highest cumulative utility?

Pick actions that maximize fish returns in each diversity group

Upper Sacramento River  
Antelope Creek  
Battle Creek  
Bear Creek  
Big Chico Creek  
Butte Creek  
Clear Creek  
Cottonwood Creek  
Cow Creek  
Deer Creek  
Elder Creek  
Mill Creek  
Paynes Creek  
Stony Creek  
Thomes Creek  
Bear River  
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# From our last SIT Conference Call

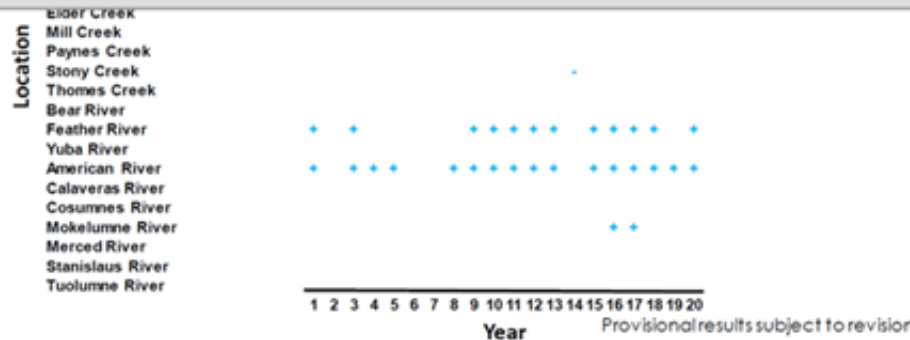
## Forward Simulation

What strategy results in the highest cumulative utility?

Pick actions that maximize fish returns



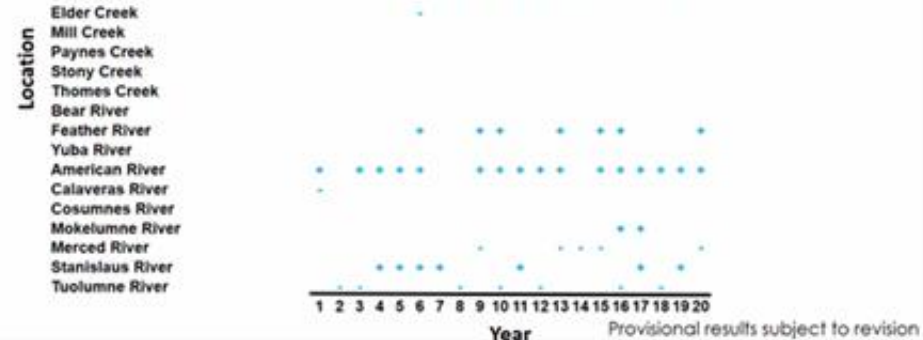
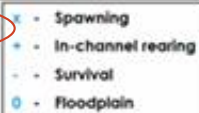
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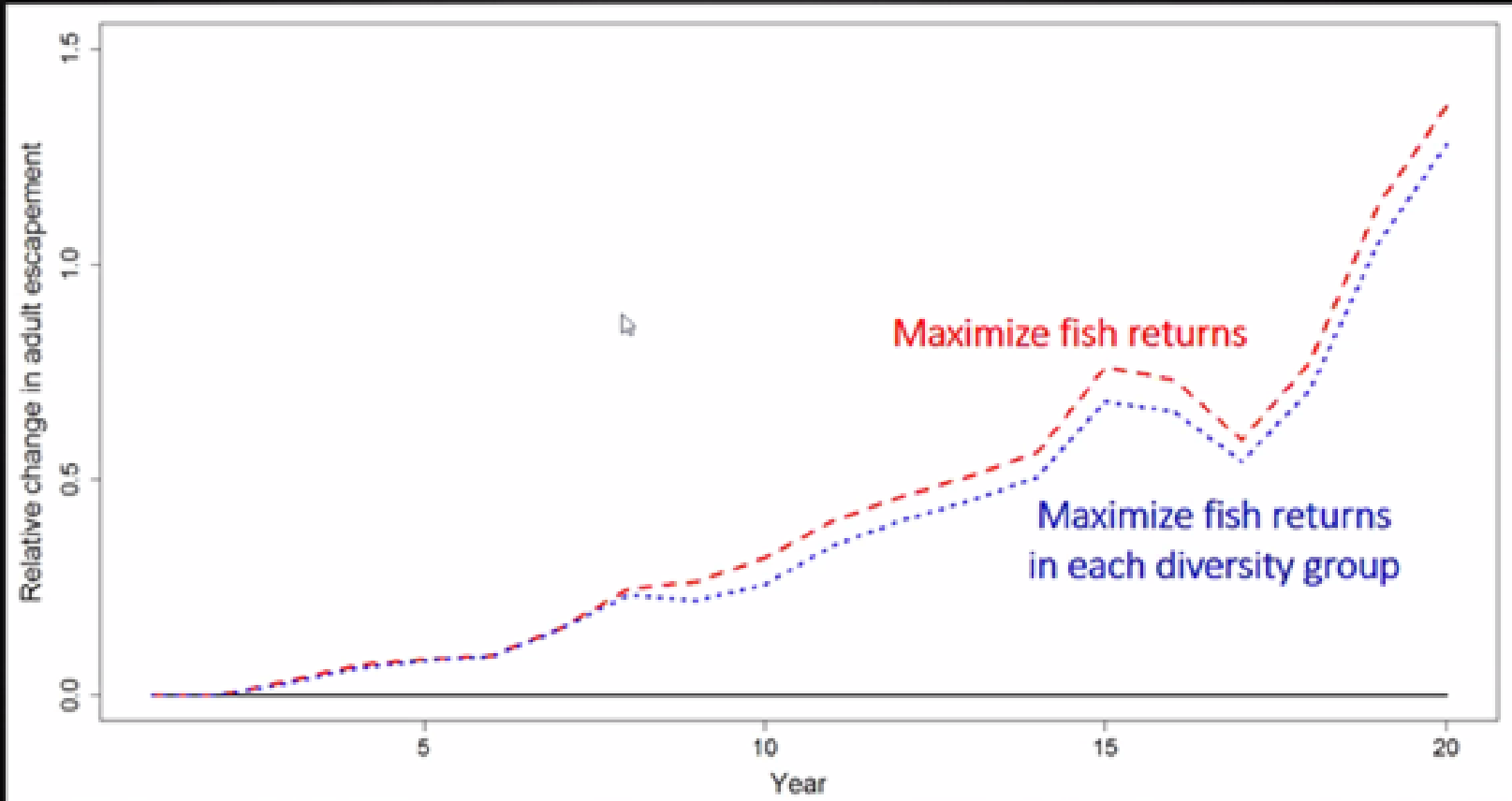
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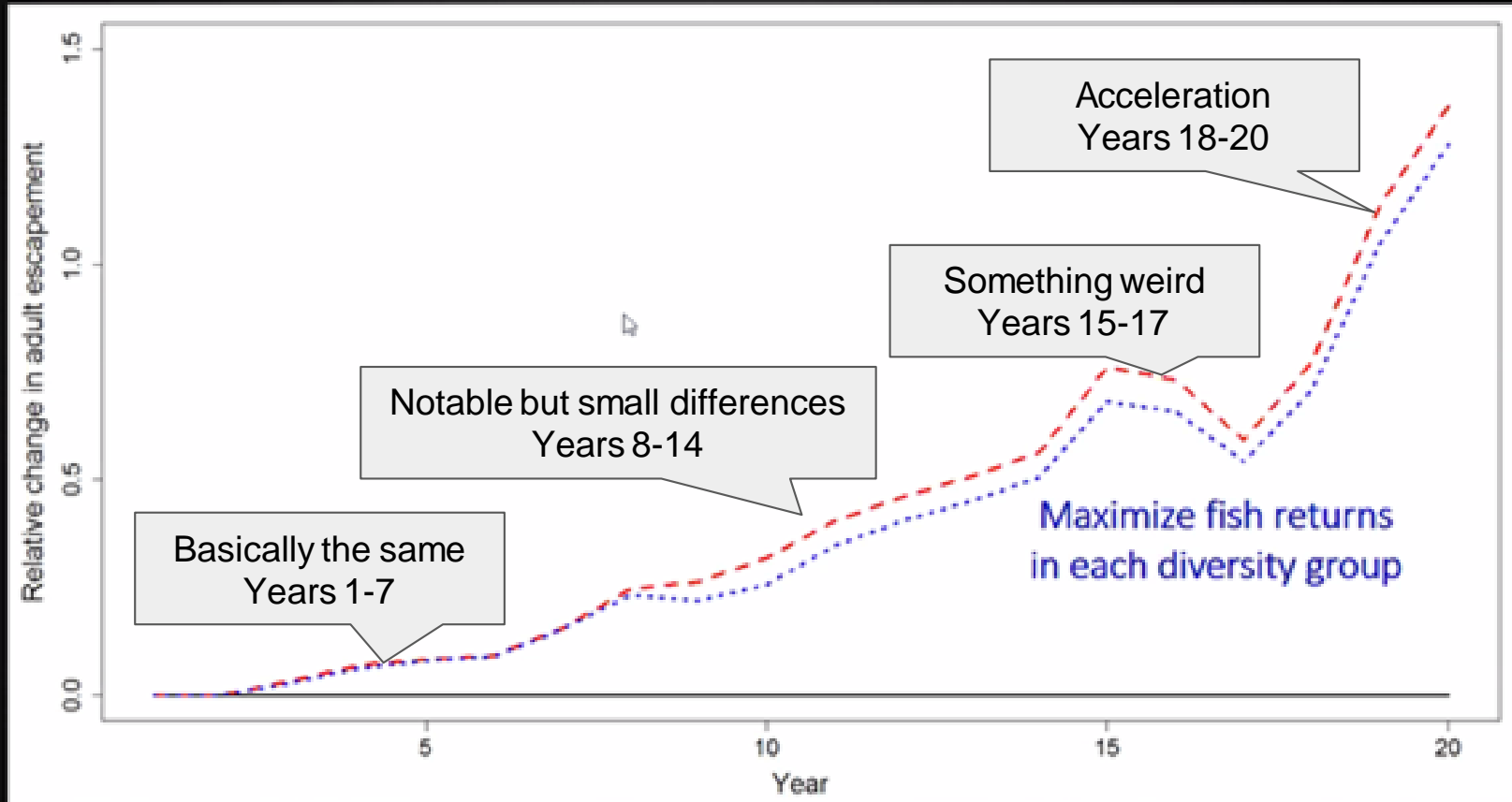


# From our last SIT Conference Call





# From our last SIT Conference Call



# Development process

1. Initial brainstorm call between Rod Wittler / Mike Urkov (with assist from Adam Duarte)
  - a. Result: conceptual “Paired rule sets”
2. Follow-up meeting Rod Wittler / Mike Beakes
  - a. Result: some modifications
3. Follow-up conference call Rod Wittler / Mike Beakes / JD Wikert / Cesar Blanco (with email assist from Matt Brown)
  - a. Result: additional detailed suggestions

# Main Idea

## 1. Develop Paired Rule Sets

- a. Think of a rule and its opposite

## 2. Example (management constraint):

- a. Maximize fish returns (from optimization)
- b. Minimize fish returns (also from optimization!)

## 3. Example (geographic constraint)

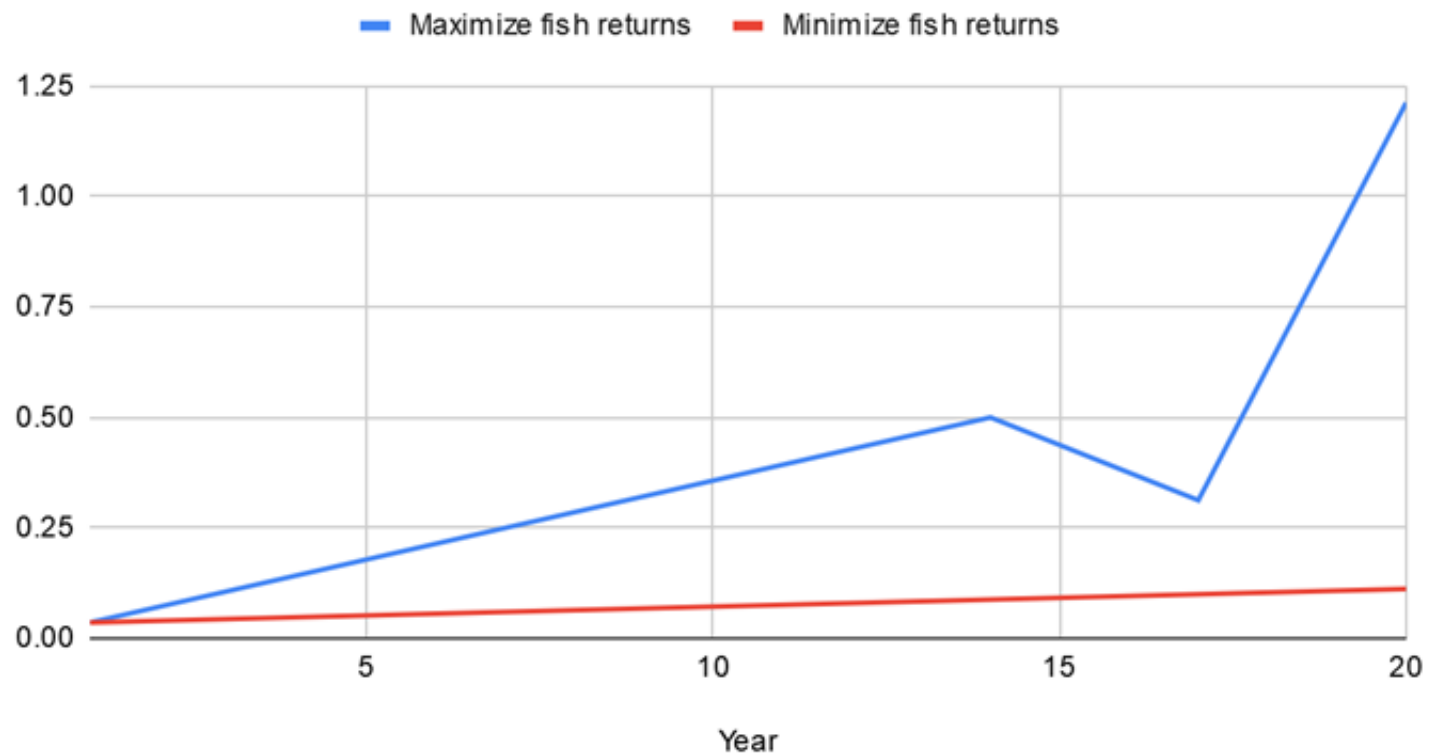
- a. Constrain investment to northern watersheds (American River and above)
- b. Constrain investment to southern watersheds (below the American River)

## 4. Example (genetic constraint)

- a. Concentrate in-stream investment to hatchery dominated streams
- b. Concentrate in-stream investment to streams with least hatchery influence

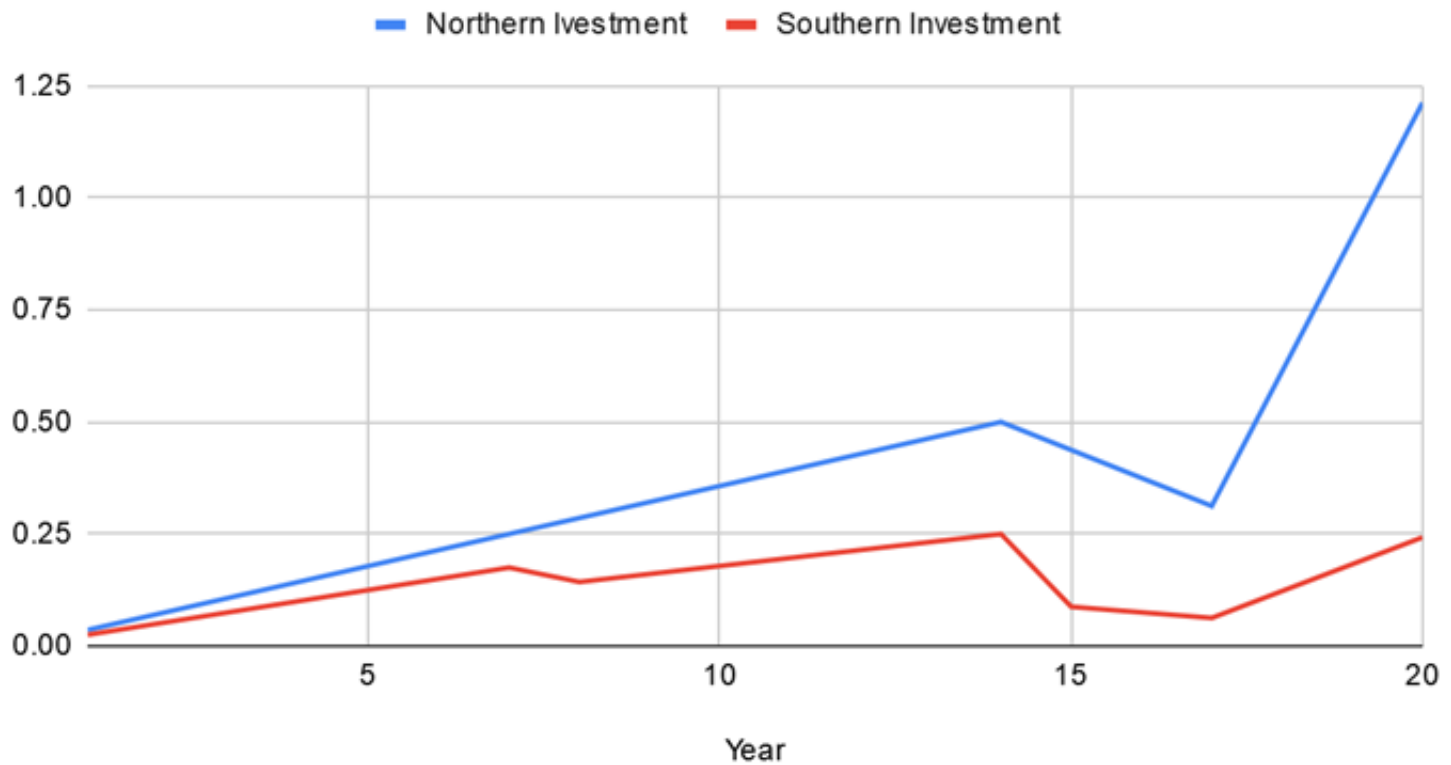
# Example Management Constraint

Maximize fish returns and Minimize fish returns



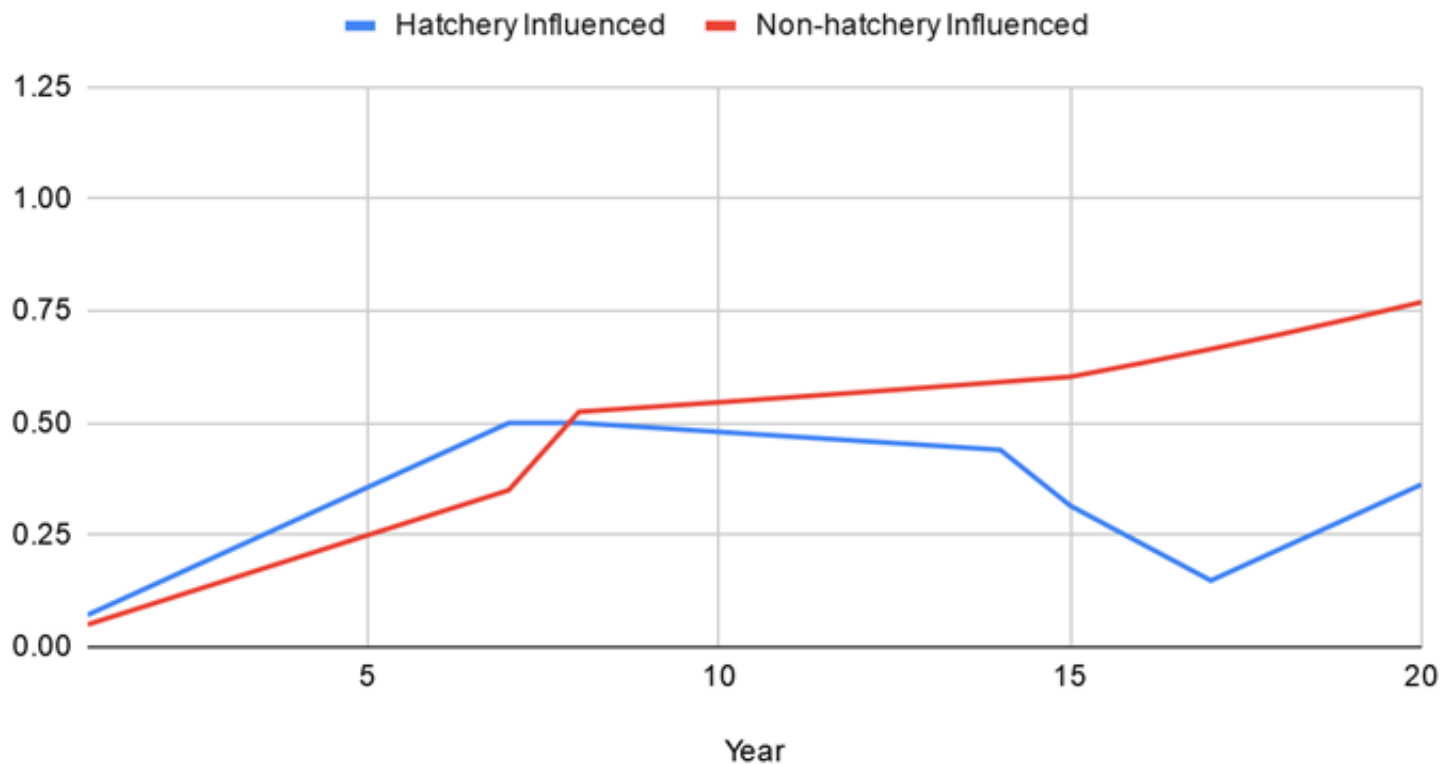
# Example Geographic Constraint

Invest in north and invest in south



# Example Genetic Constraint

Hatchery influence and non-hatchery influence



# Other possible rule-sets

1. Largest escapement goals versus smallest
2. Invest at top of system (headwaters) versus bottom of system (near delta)
3. Concentrate on systems close to doubling versus farthest from doubling
4. Concentrate on streams with largest unmet capacity versus smallest
5. Concentrate on most impaired flow streams versus least impaired
6. CVP versus non-CVP
7. Winter-run investment only versus Spring only versus Fall only

# Urkov Recommendations\*

1. Pick 3 paired rule-sets for refinement, analysis, and consideration at in-person SIT meeting
2. After analysis, concentrate on common projects identified in first 5-7 years for prioritization in Near-Term Restoration Strategy
3. Other “interesting” concepts can be investigated further during implementation of Near-Term Restoration Strategy (which can be changed if necessary!)
4. Remember: Rule-sets are constraining results from maximized returns

\*Does not reflect development group's recommendation!



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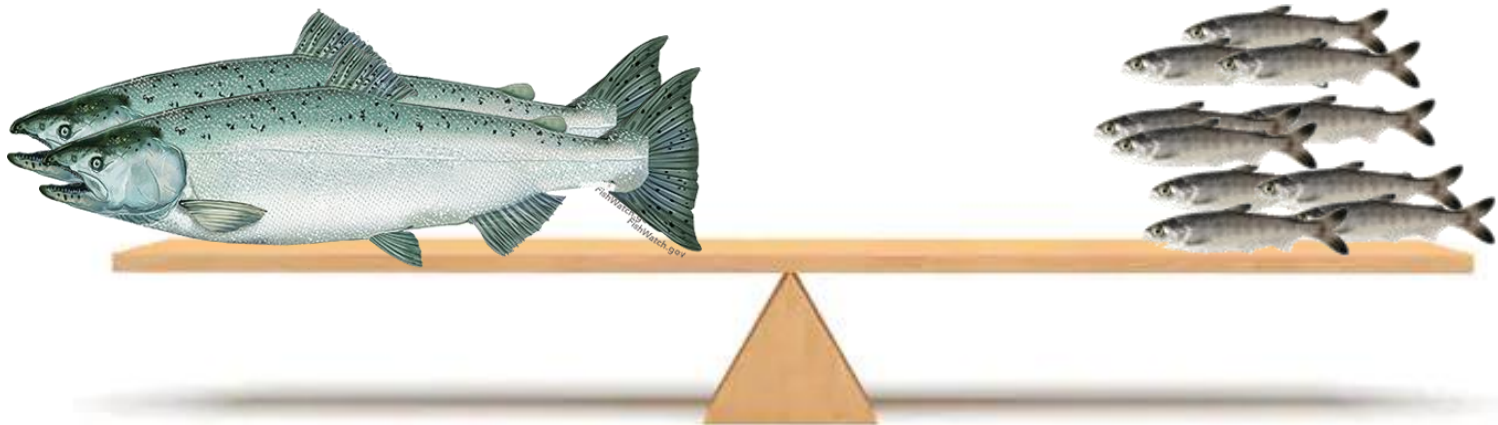


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# Optimization

Maximize the number of adult equivalents



# SIT Chinook Objectives

Fundamental objective Category	Fundamental objective attribute
<b>Valley Wide</b>	
Spatial structure	Total no. of viable spawning populations per diversity group (NMFS def. of independent population)
Abundance	Total no. of spawning natural origin adults (across watersheds)
	Naturally-spawned juvenile abundance at Chipps
<b>Watershed specific</b>	
Abundance	No. of returning natural origin adults
	Naturally-spawned juvenile abundance at Chipps

- Naturally-spawned juvenile abundance
  - Juvenile biomass
- Measuring viable populations
  - Escapement > 833 annually
  - Cohort Replacement Rate  $\geq 1$
  - Hatchery stray rate  $\leq 10\%$

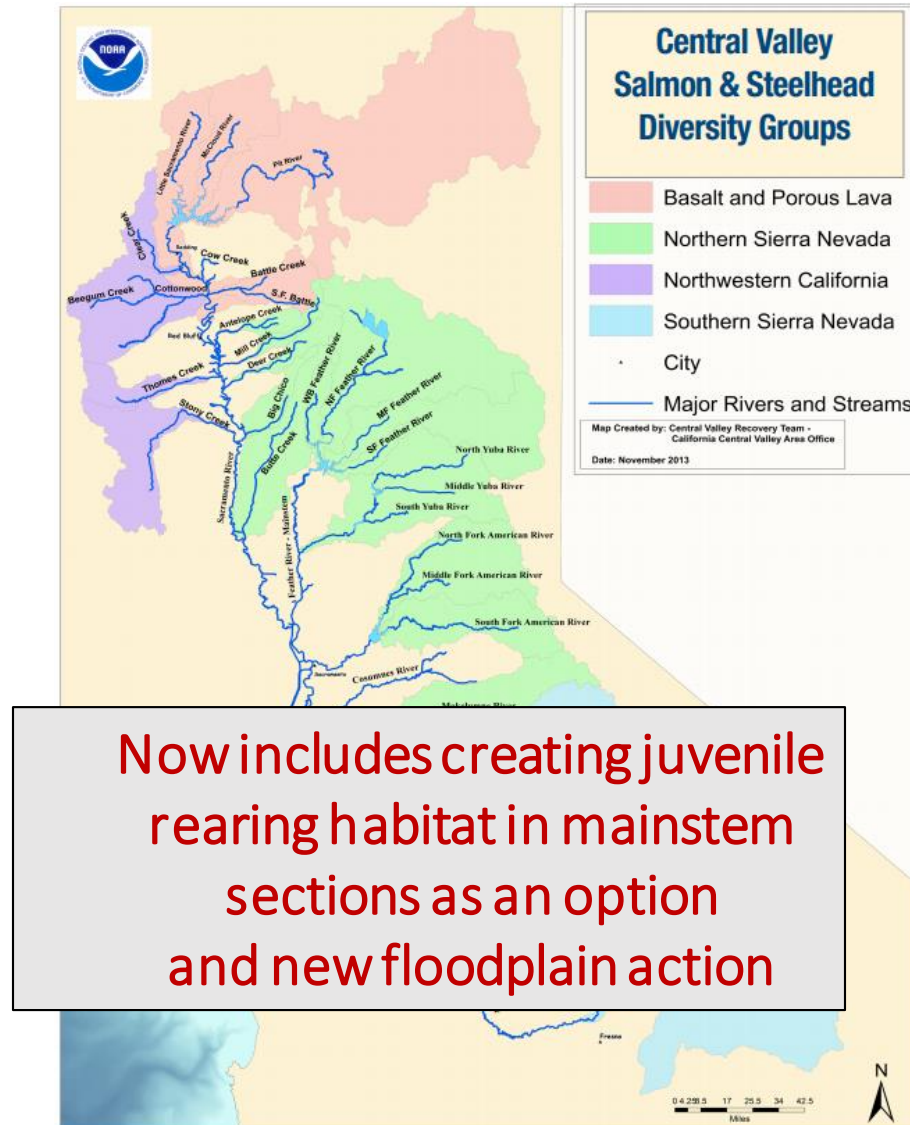
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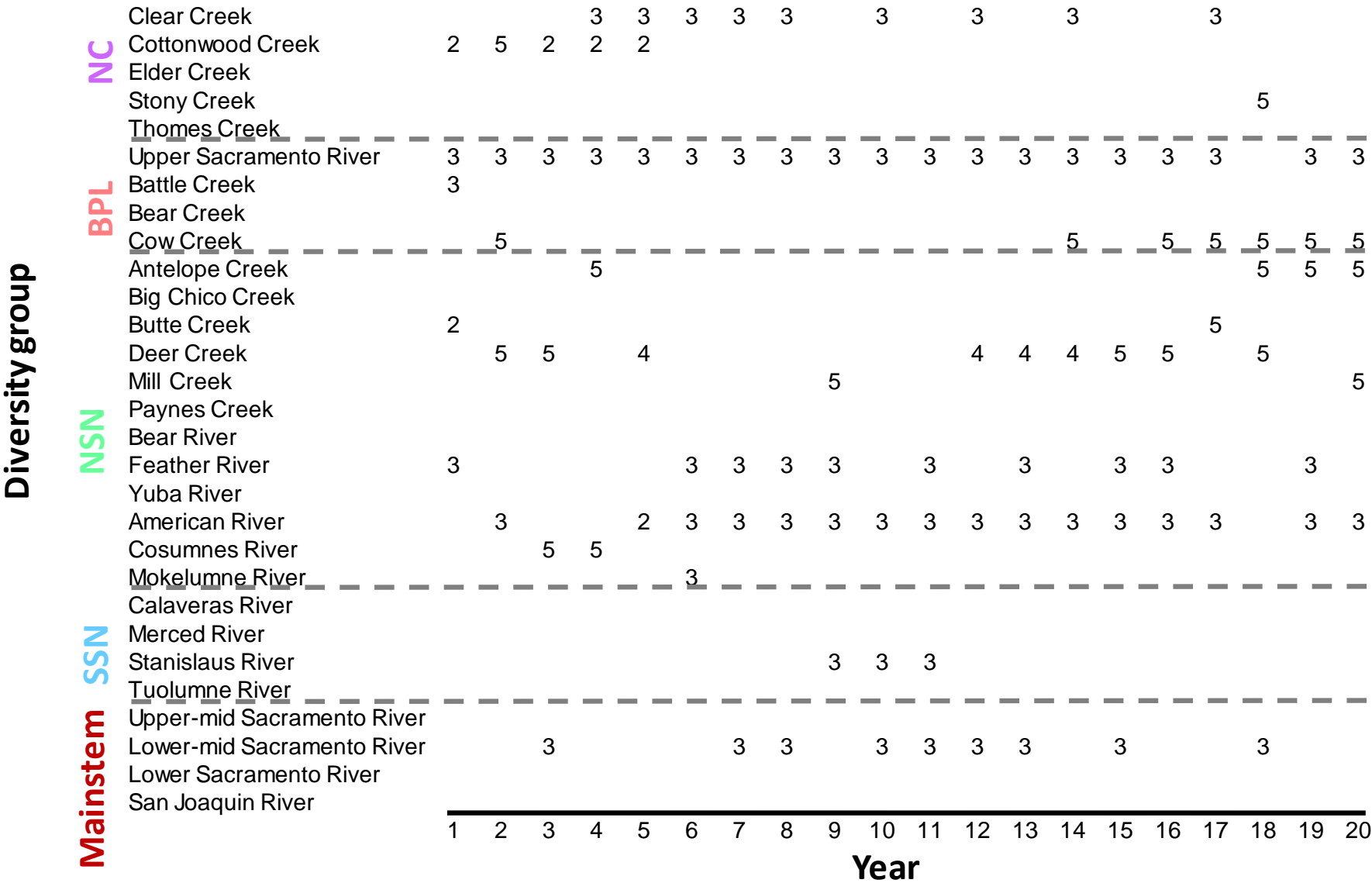
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Pick actions that  
maximize fish  
returns

# Forward Simulation

- 2 - Spawning
- 3 - In-channelrearing
- 4 - Floodplain
- 5 - Survival

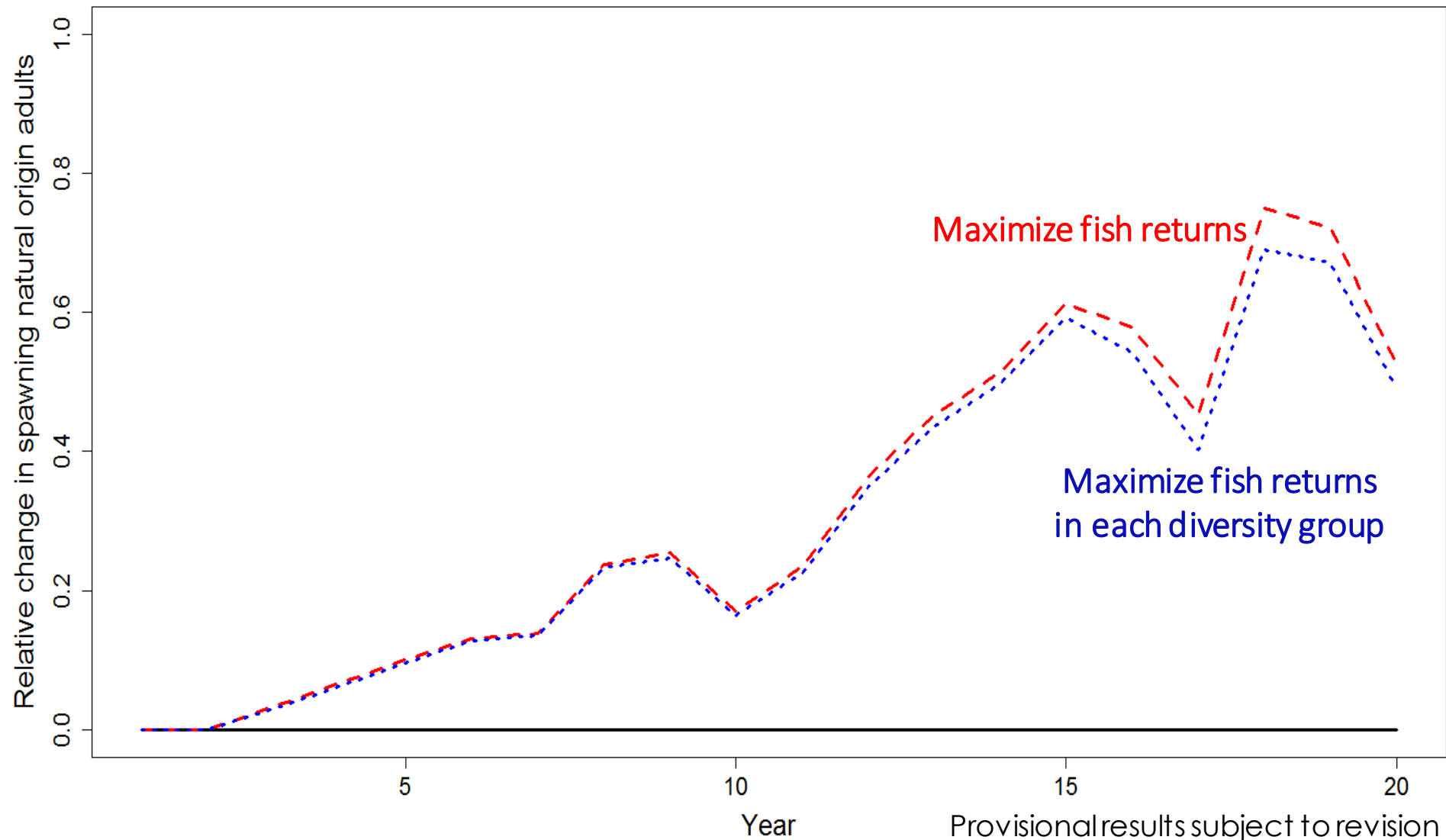


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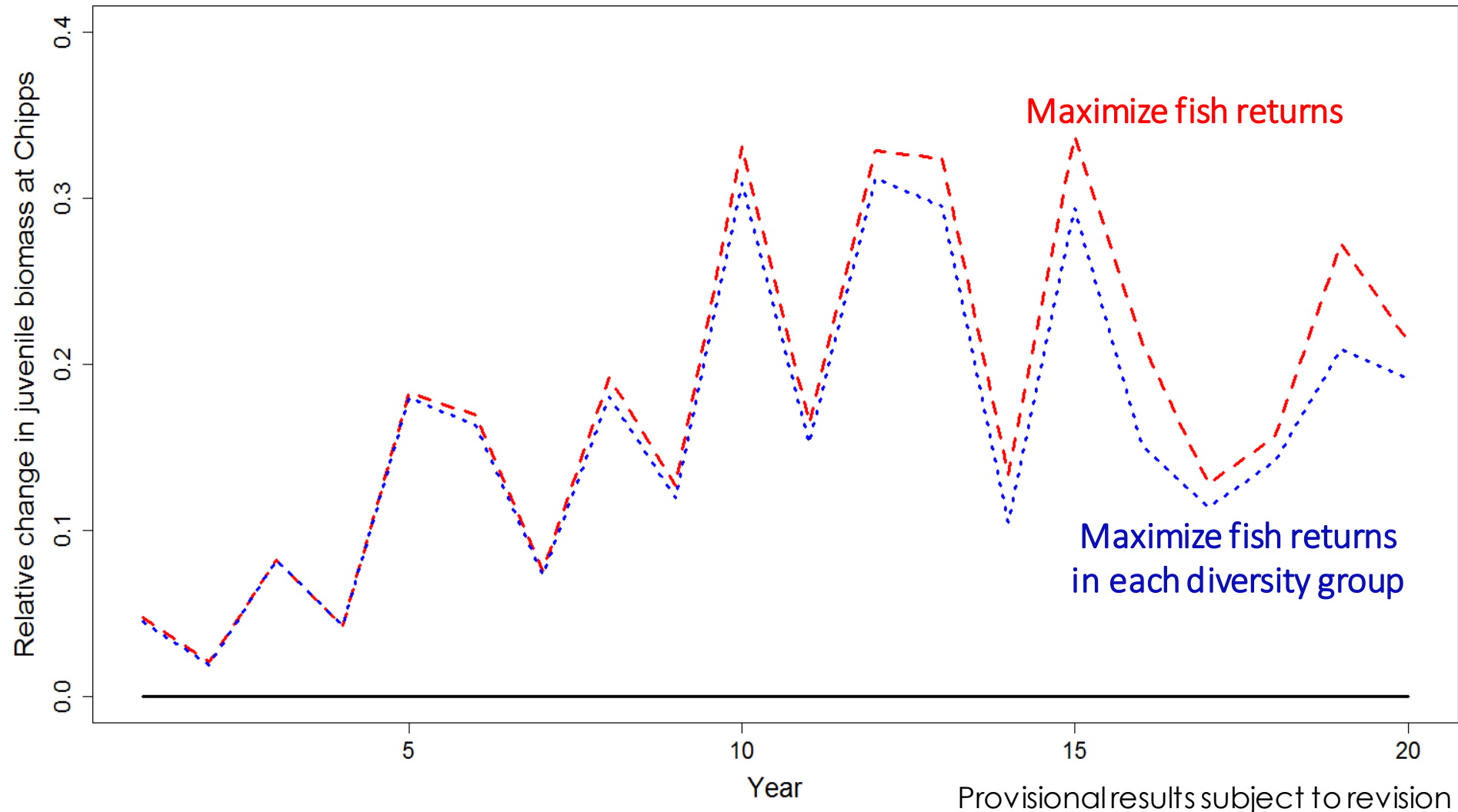
# Valley Wide

Relative change in spawning natural origin adults



# Valley Wide

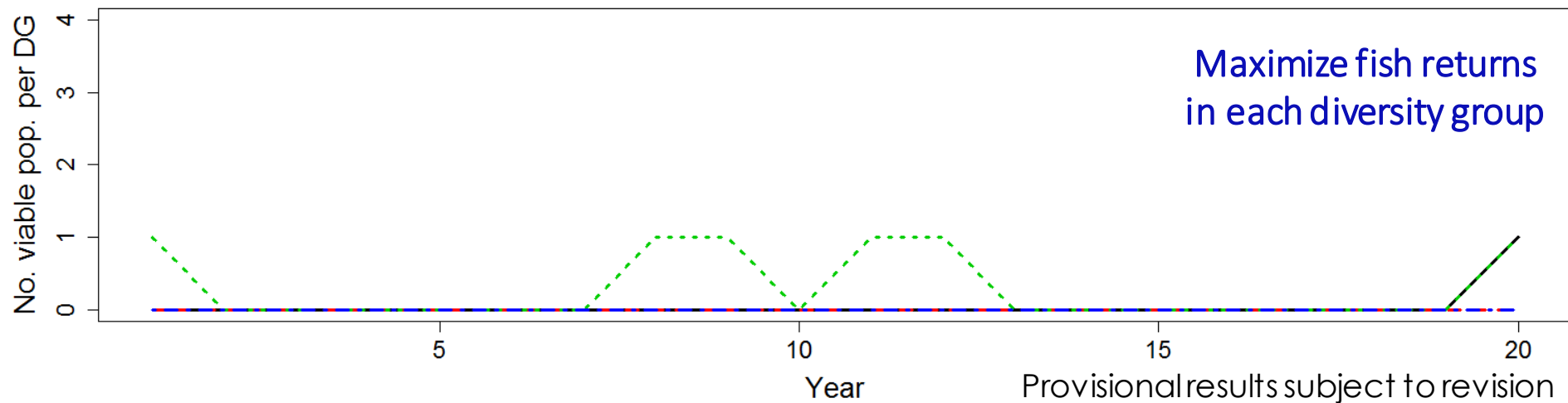
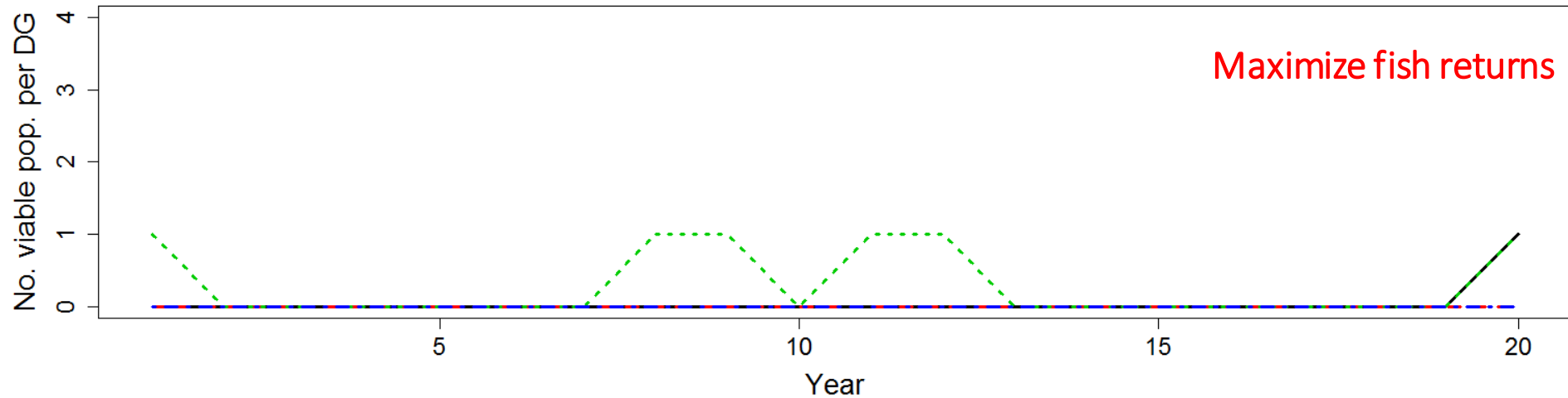
Relative change in juvenile biomass at Chipps





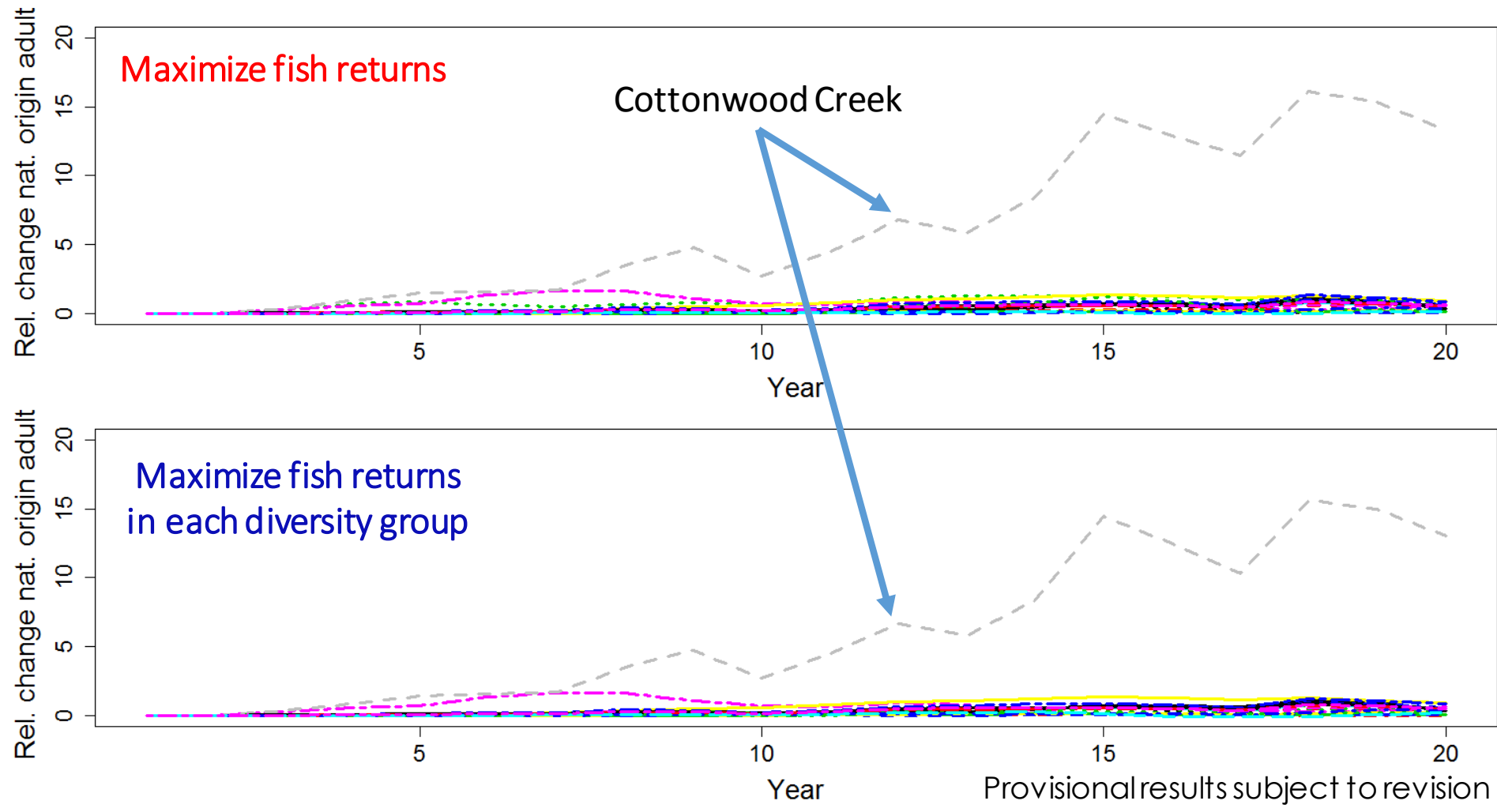
# Valley Wide

Total no. of viable spawning populations per diversity group



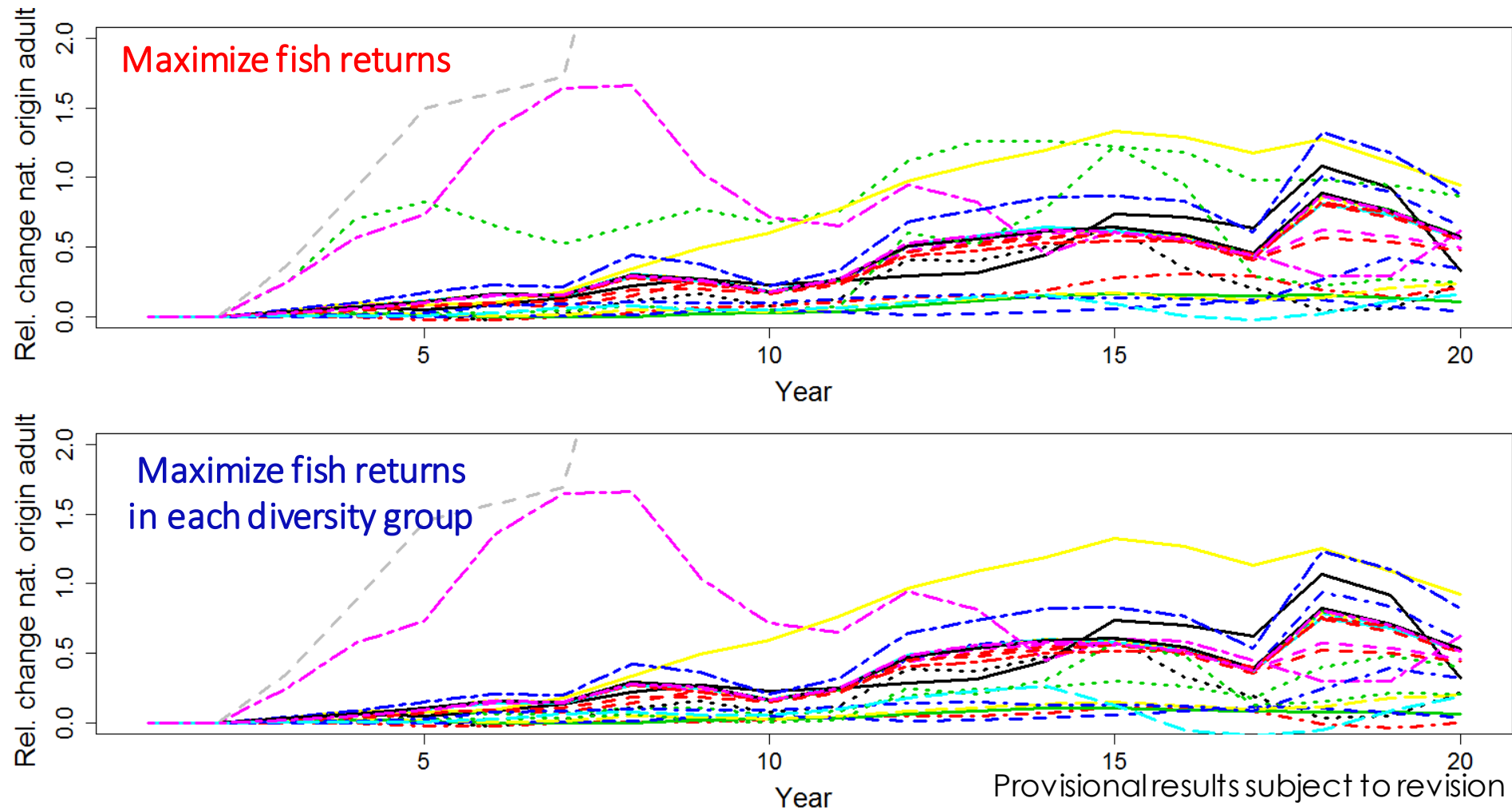
# Watershed Specific

Relative change in spawning natural origin adults



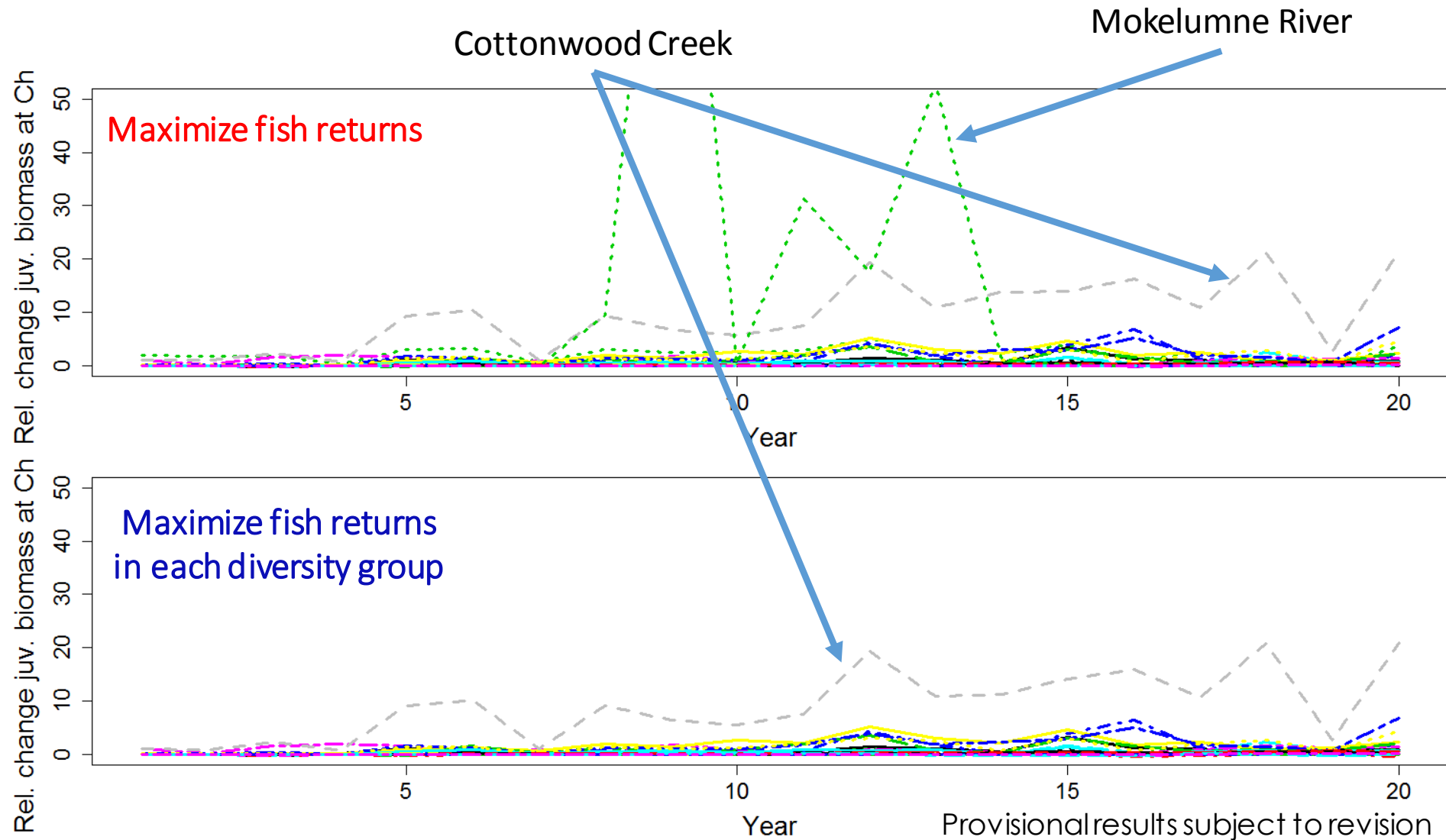
# Watershed Specific

Relative change in spawning natural origin adults  
(zoomed in)



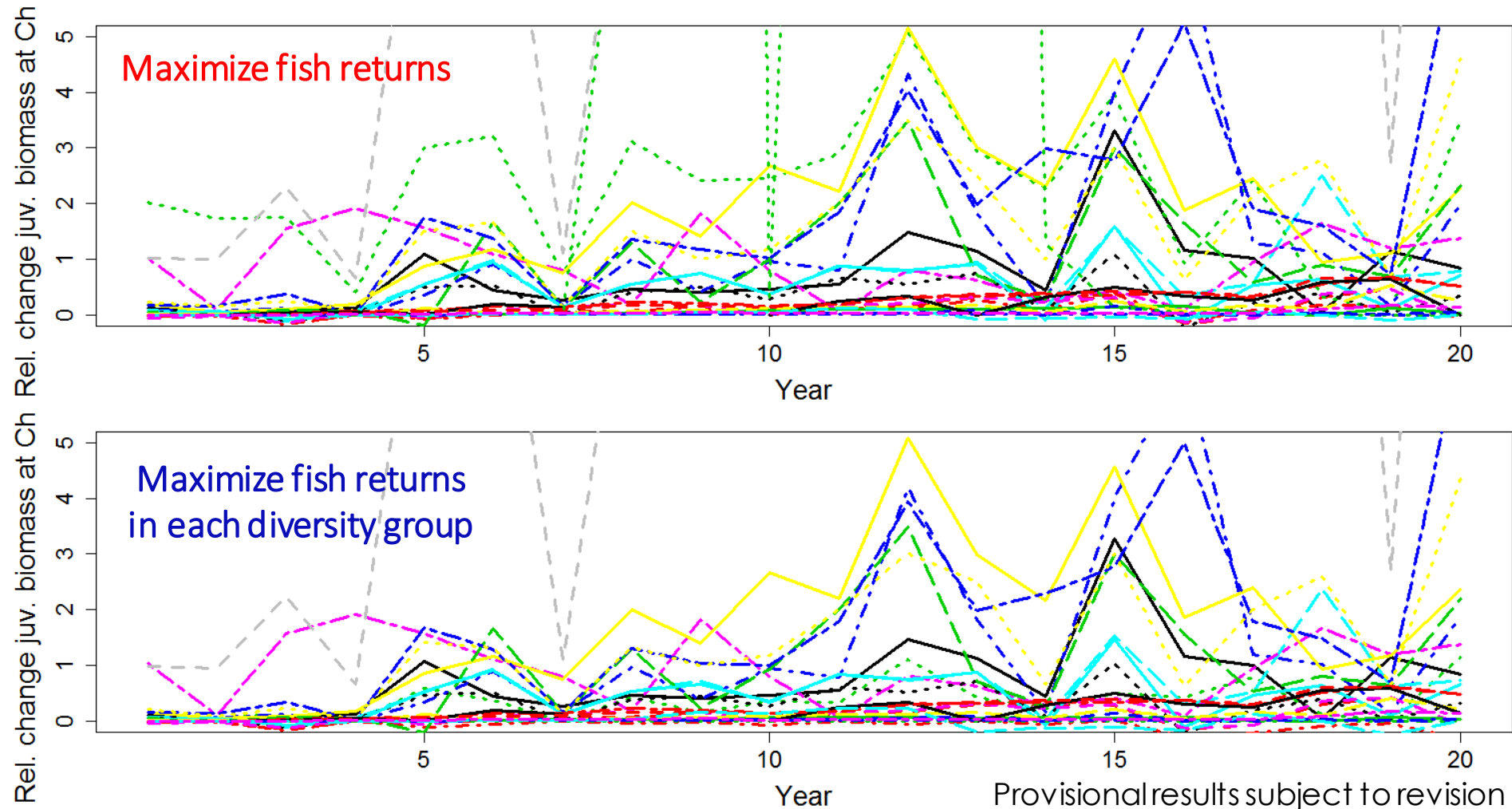
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