

Can reducing dam passage mortality compensate for low marine survival in winter steelhead (*Oncorhynchus mykiss*)?

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- Total life cycle modeling is needed to evaluate how different sources of mortality drive population dynamics.
- Two key sources of mortality are dam passage and marine survival.

Objectives

1. Examine how marine survival rates and dam passage jointly determine population dynamics.
2. Ground expectations of dam passage measures
3. Examine how sensitive these results are to different assumptions about how many steelhead repeat spawn.

Winter Steelhead Life Cycle

Spawner success = $f(\text{fecundity, \%hatchery})$

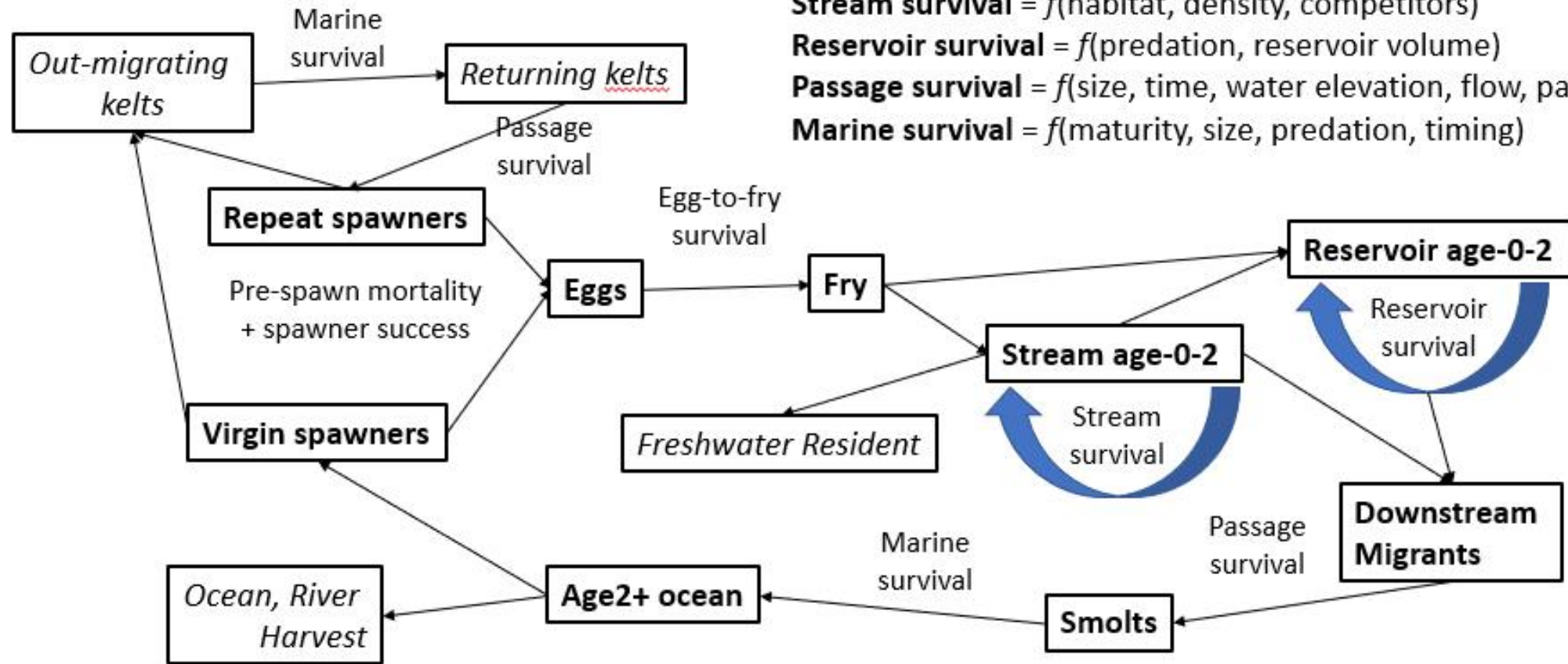
Egg-to-fry survival = $f(\text{density, temp, discharge, sediment})$

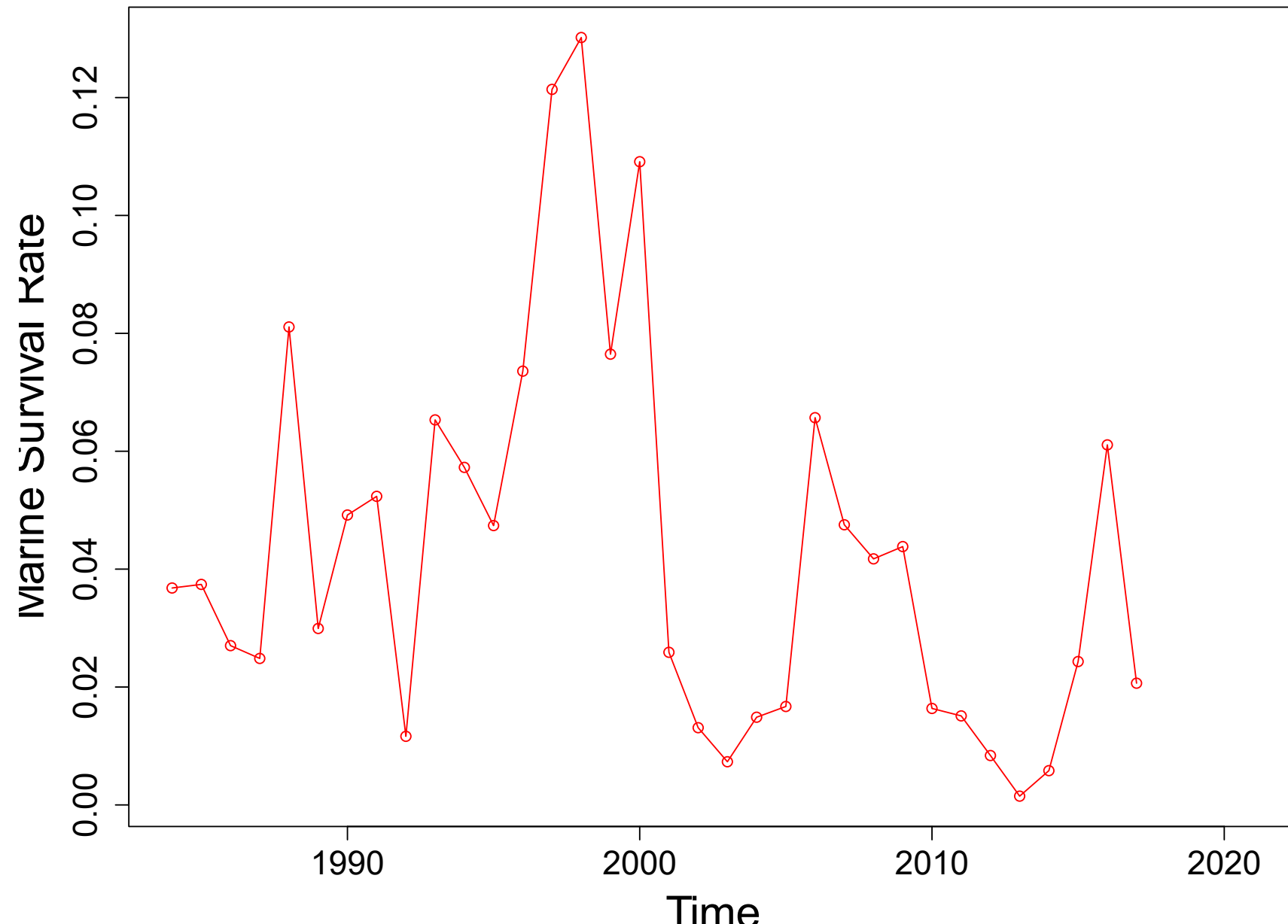
Stream survival = $f(\text{habitat, density, competitors})$

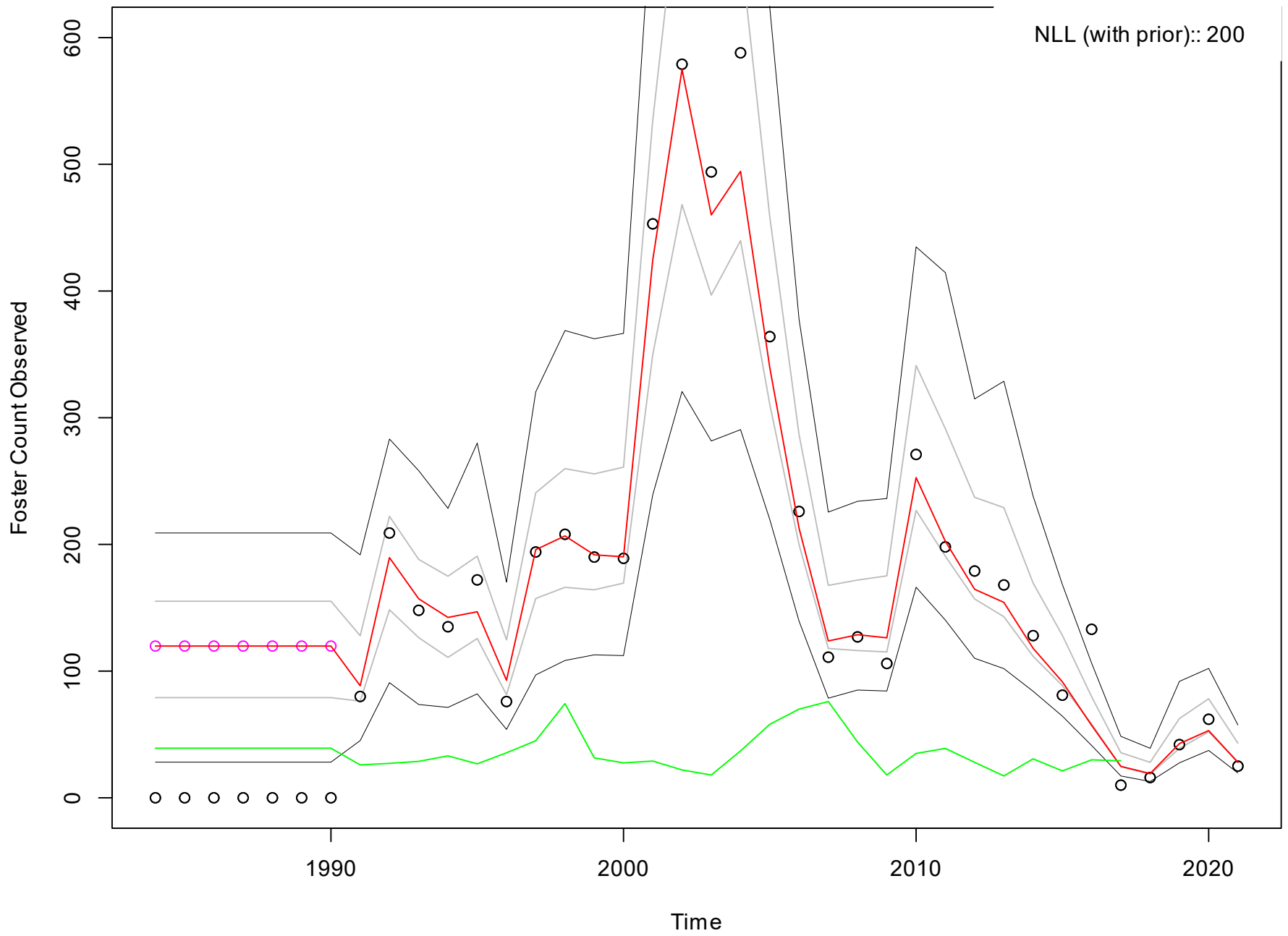
Reservoir survival = $f(\text{predation, reservoir volume})$

Passage survival = $f(\text{size, time, water elevation, flow, passage route})$

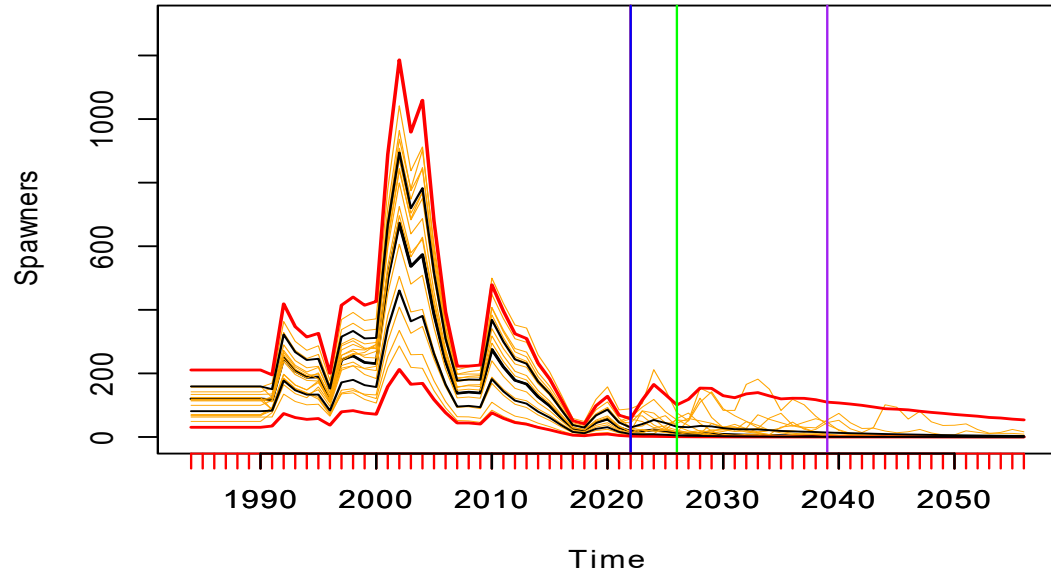
Marine survival = $f(\text{maturity, size, predation, timing})$



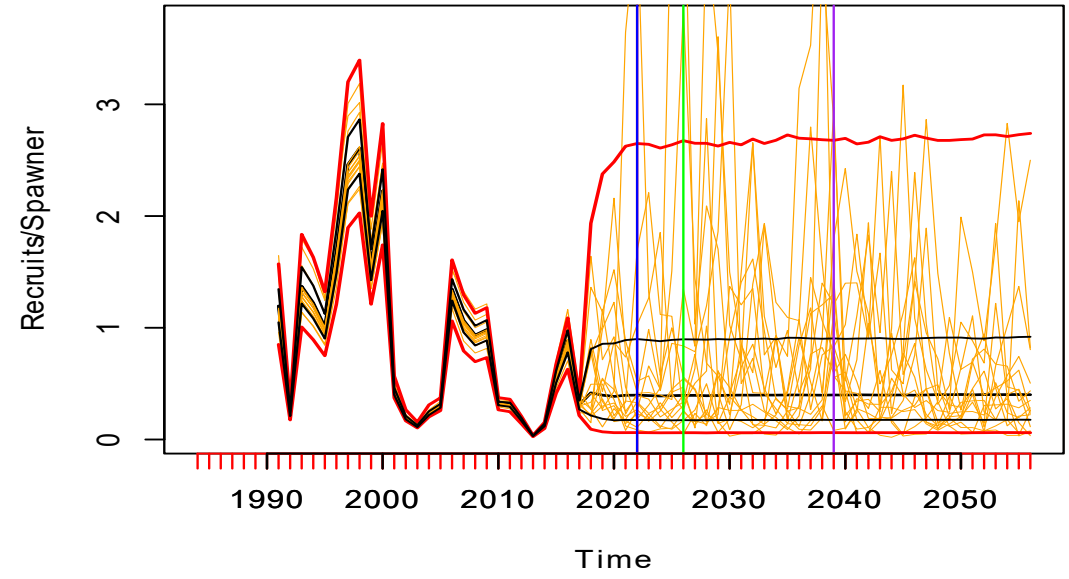




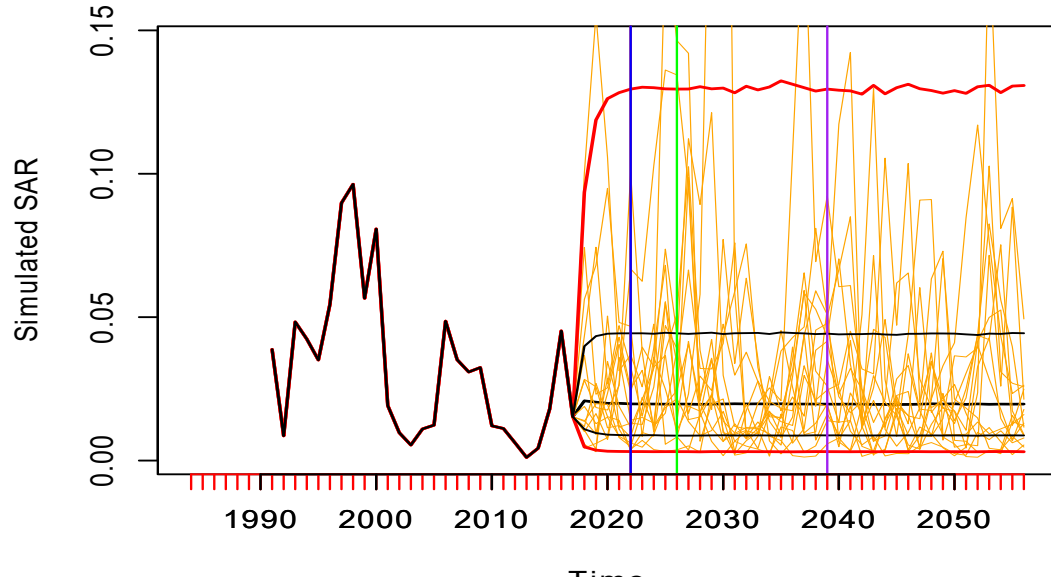
Foster NAA



Foster NAA

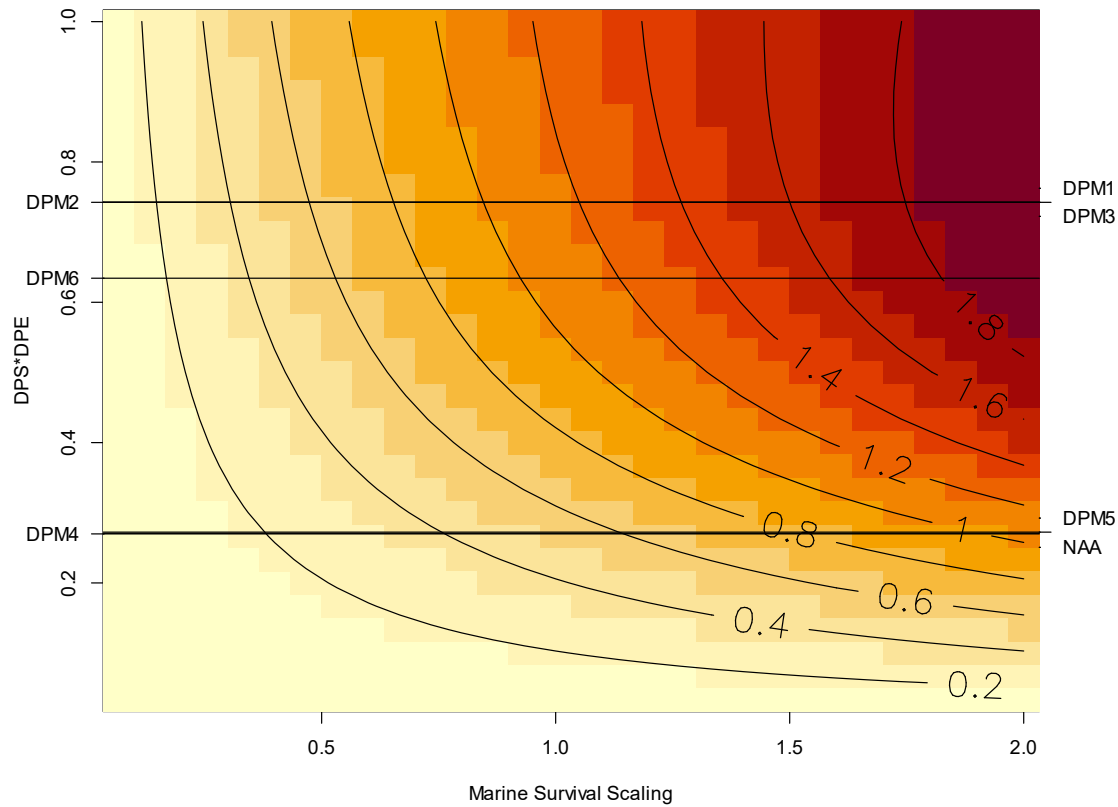


Foster NAA

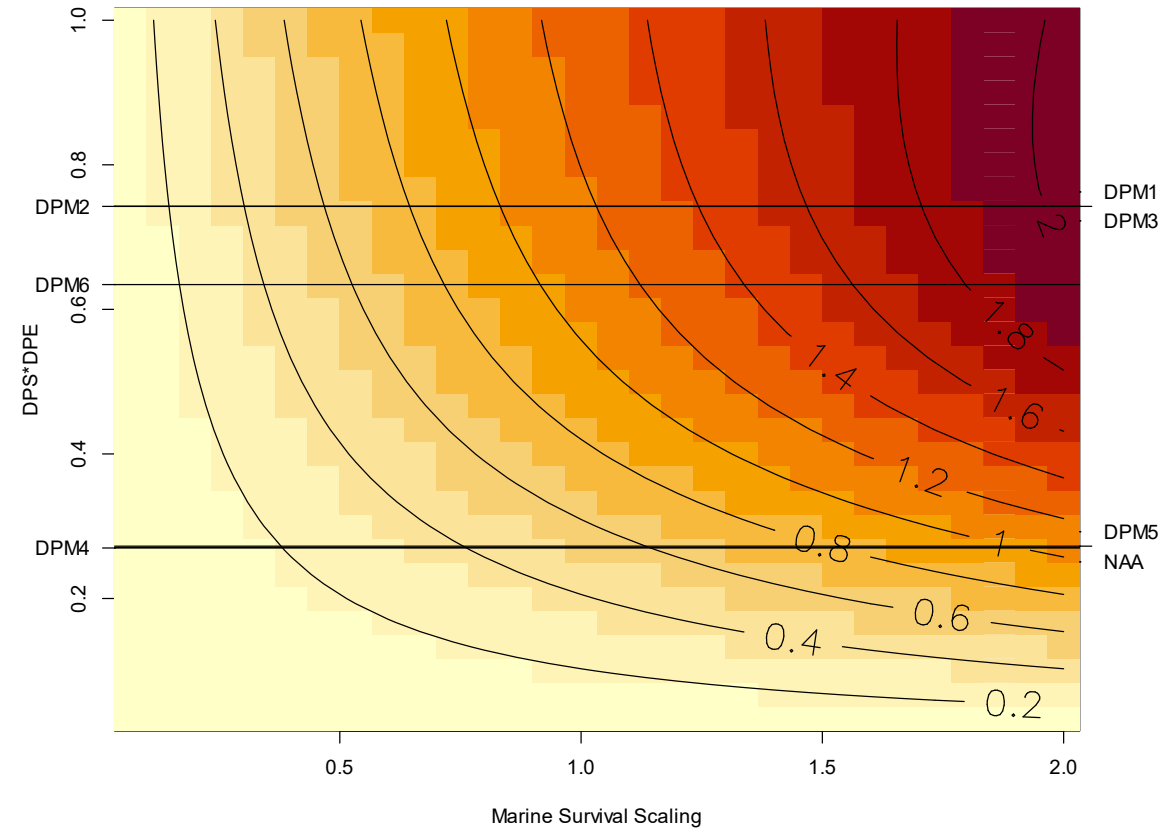


Recruits per Spawner Foster Dam South Sant.

- Repeat spawners

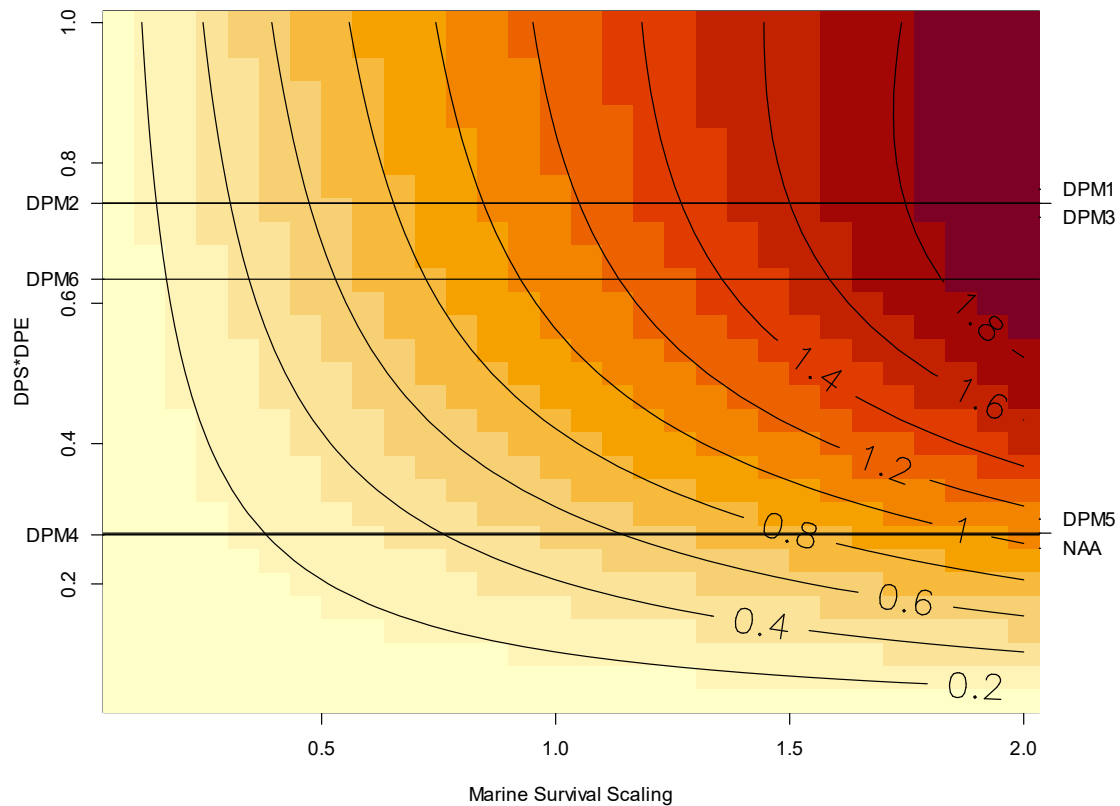


- No Repeat spawners

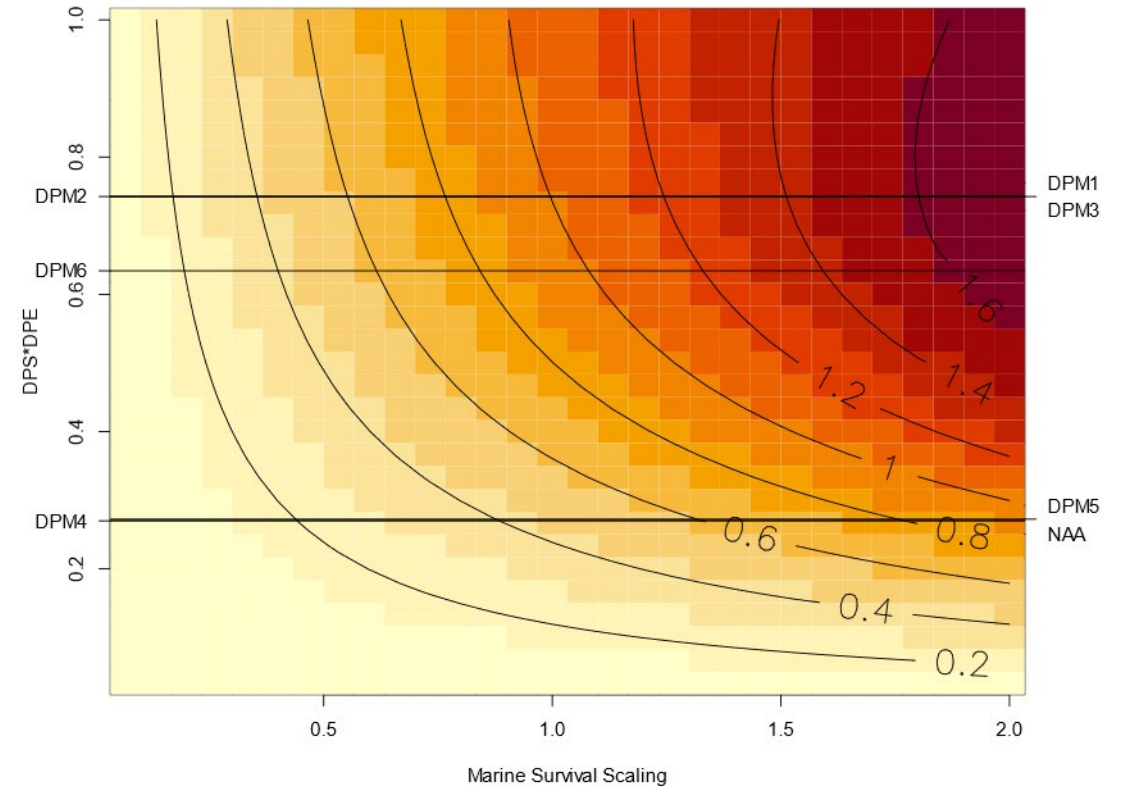


Recruits per Spawner Foster Dam South Sant.

- Autocorrelated marine survival rate



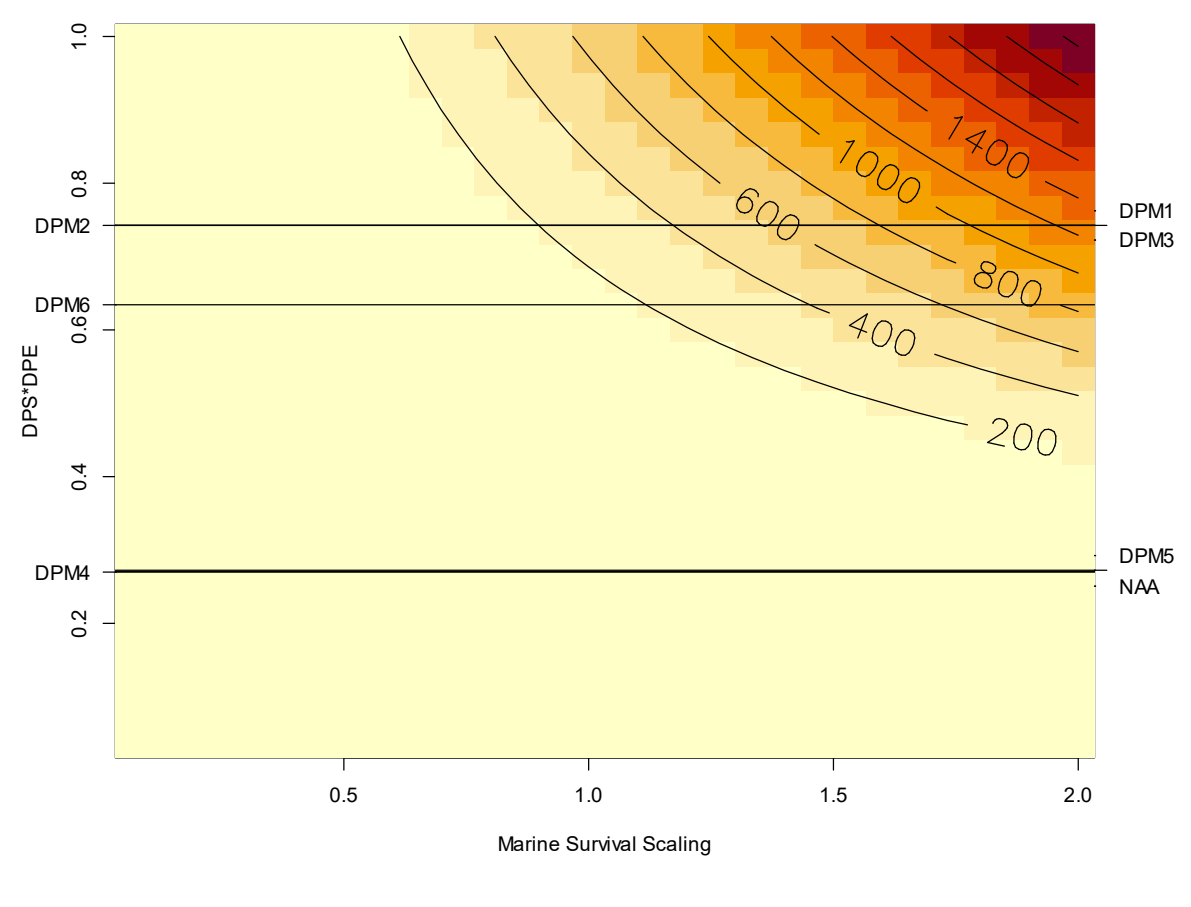
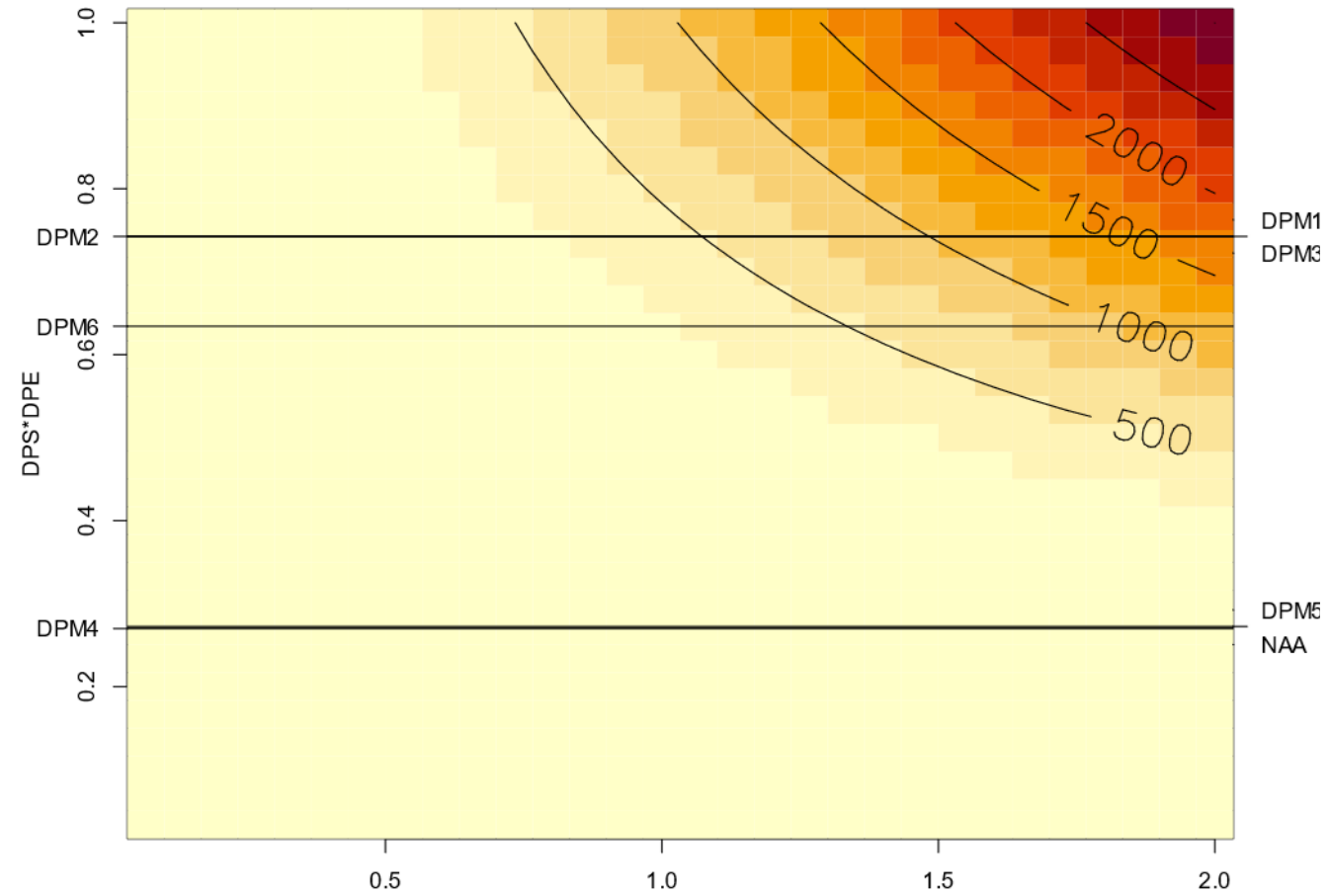
- Uncorrelated marine Survival rate



Spawner Foster Dam South Sant.

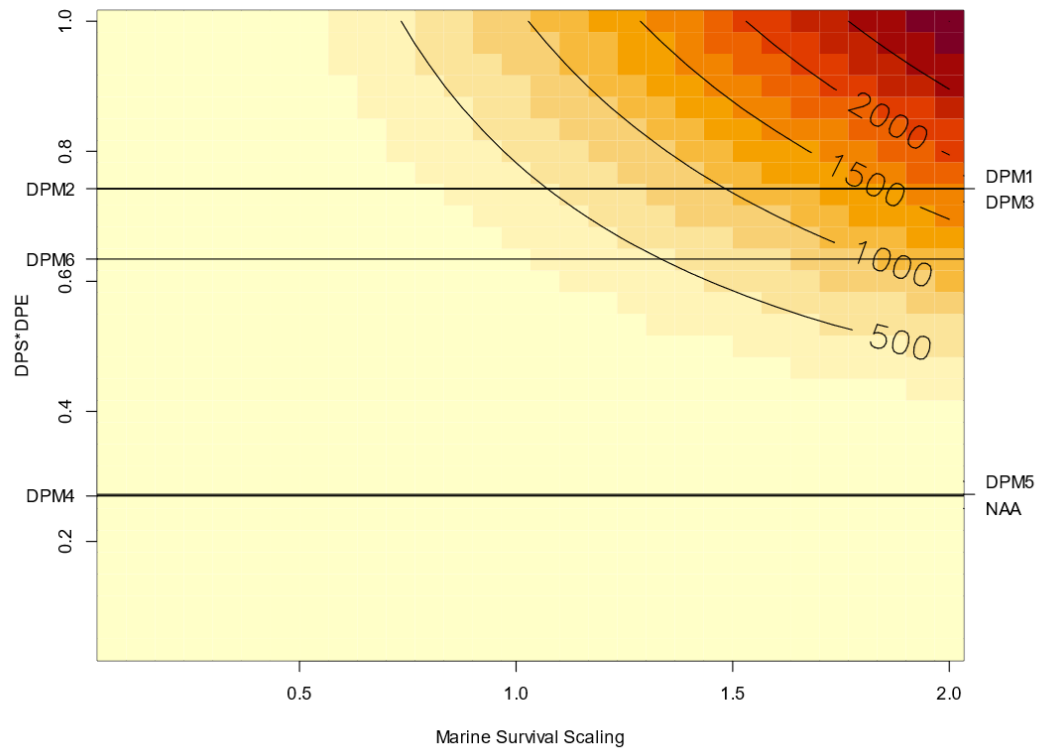
- Repeat spawners

- No Repeat spawners

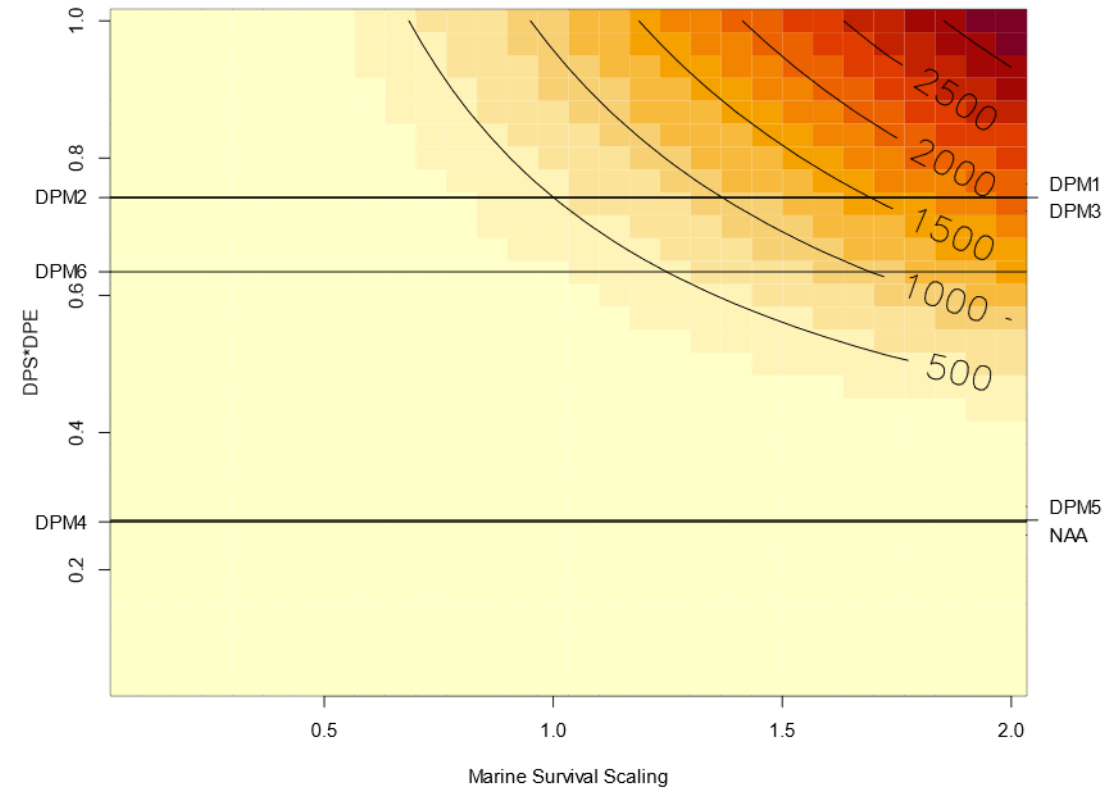


Spawner Foster Dam South Sant.

- Autocorrelated marine survival rate

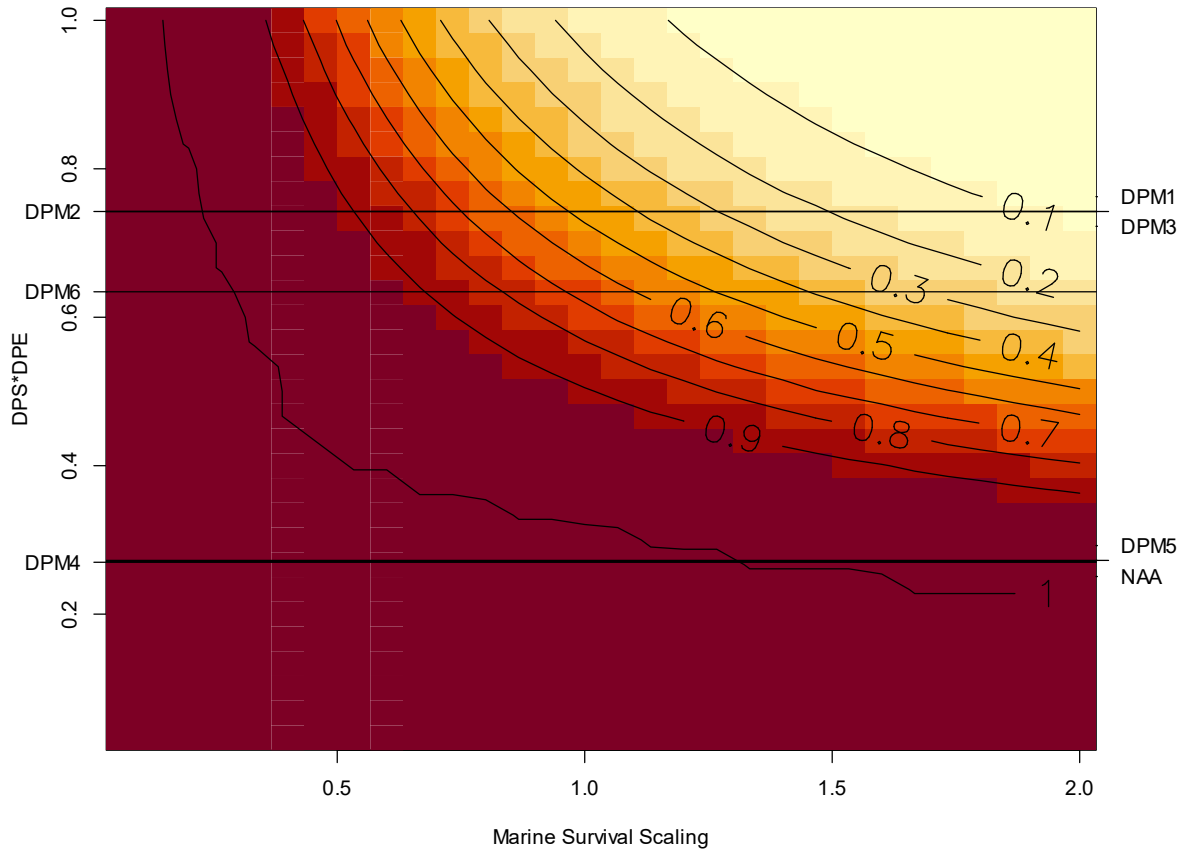


- Uncorrelated marine Survival rate

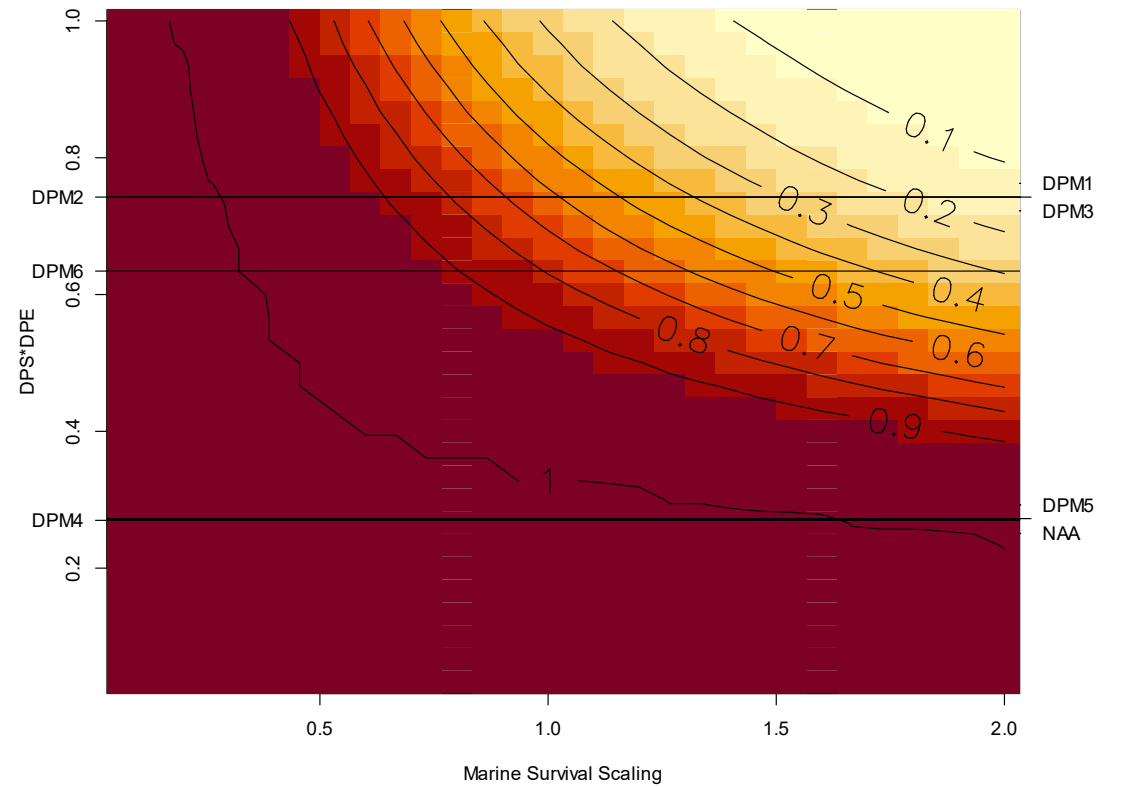


QET Base Case Foster Dam

- Repeat spawners

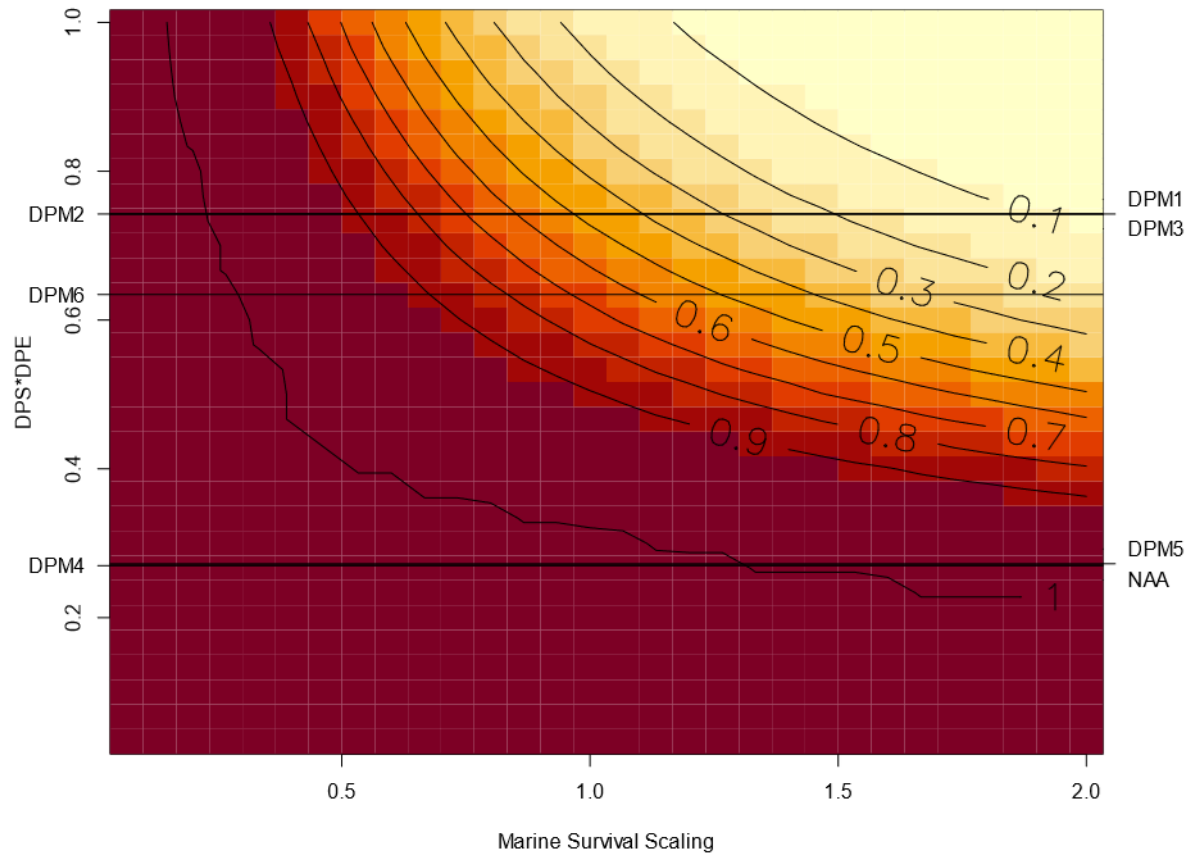


- No Repeat spawners

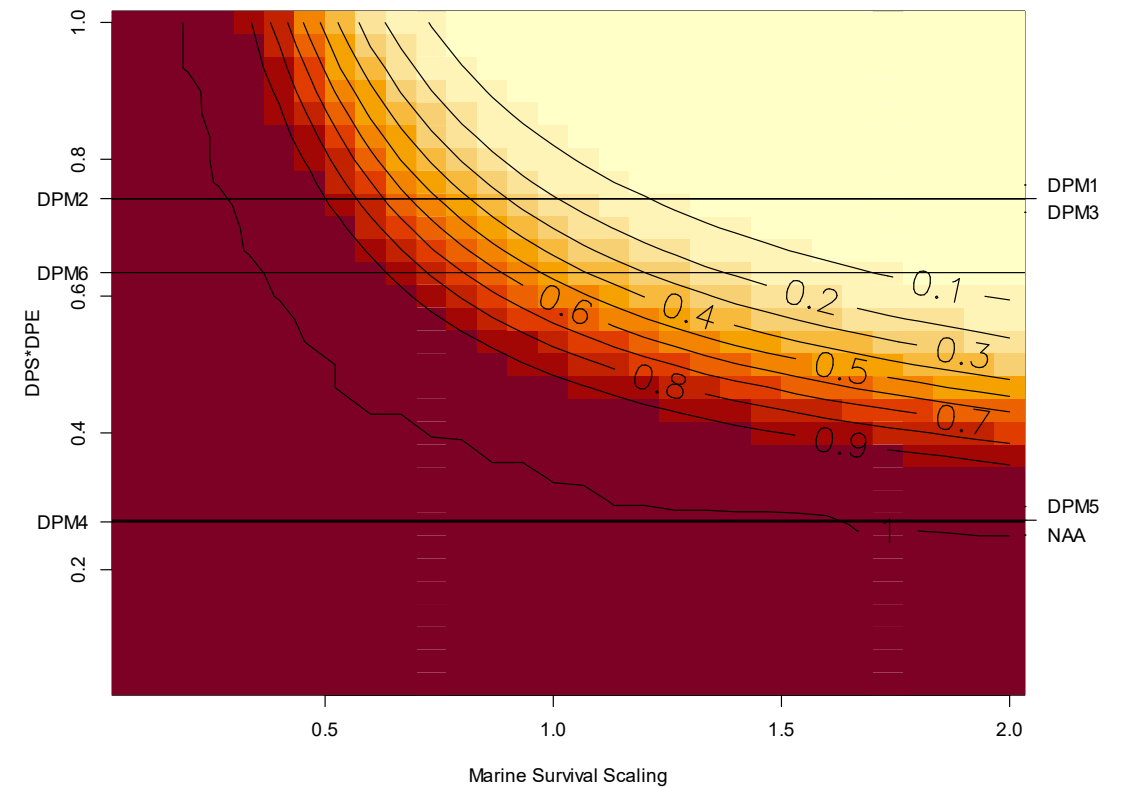


QET Foster Dam South Sant.

- Autocorrelated marine survival rate

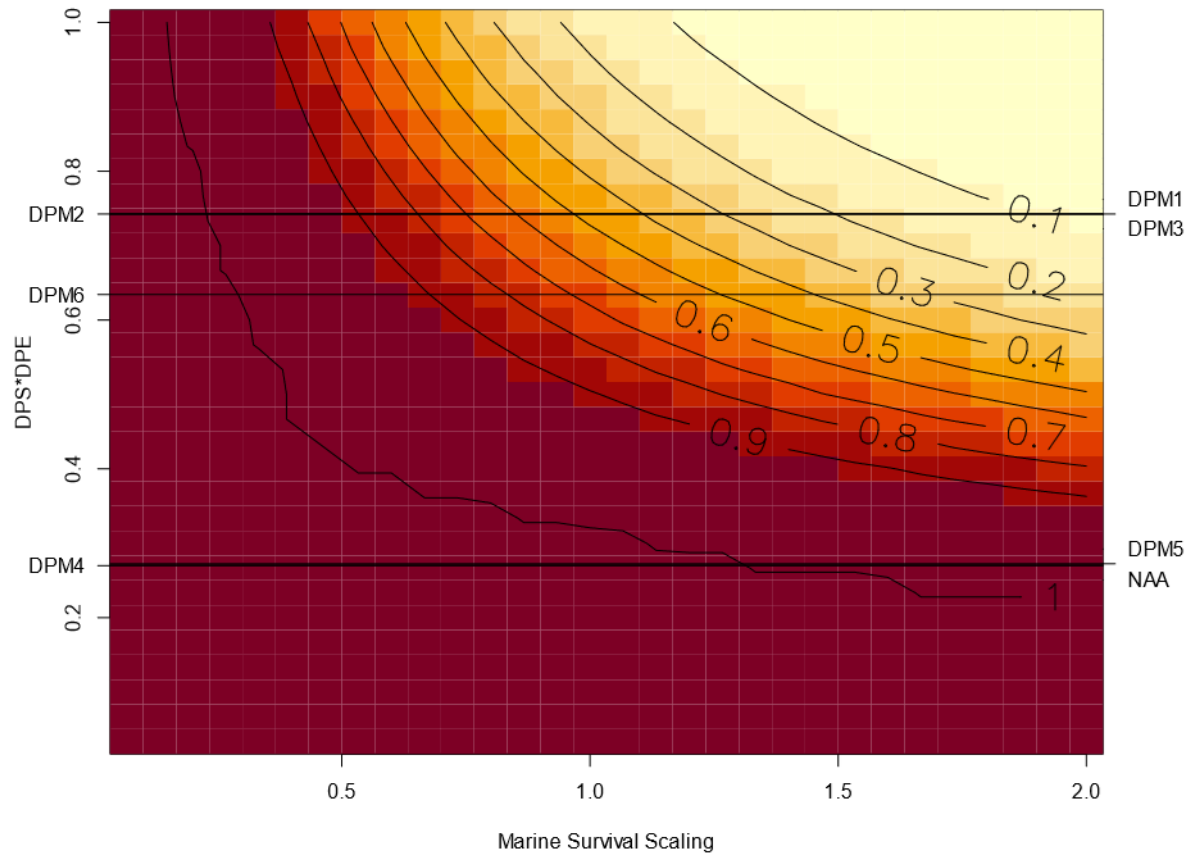


- Uncorrelated marine Survival rate

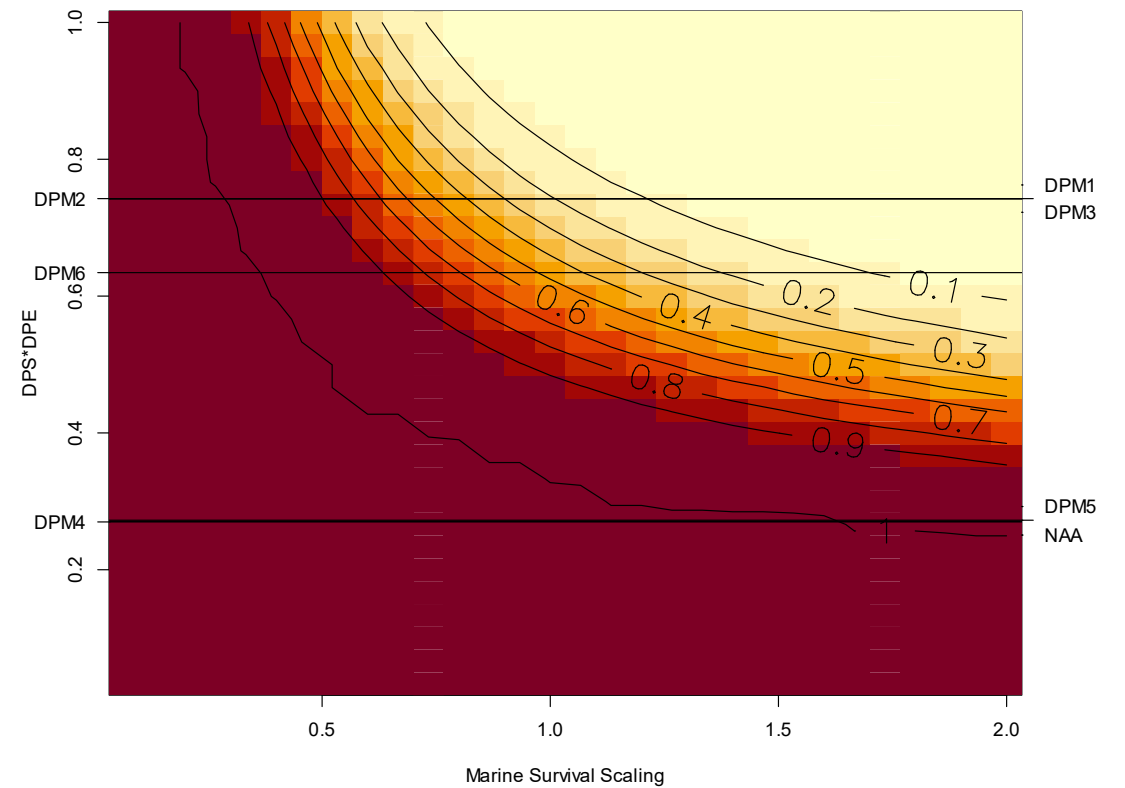


QET Foster Dam South Sant.

- Autocorrelated marine survival rate



- Uncorrelated marine Survival rate



Why do we care?

1. Both Marine survival and dam passage can potentially be adjusted by managers.
2. Adjusting Dam passage survival alone may not be enough to achieve conservation objectives.
3. Autocorrelation in marine survival makes things worse.

