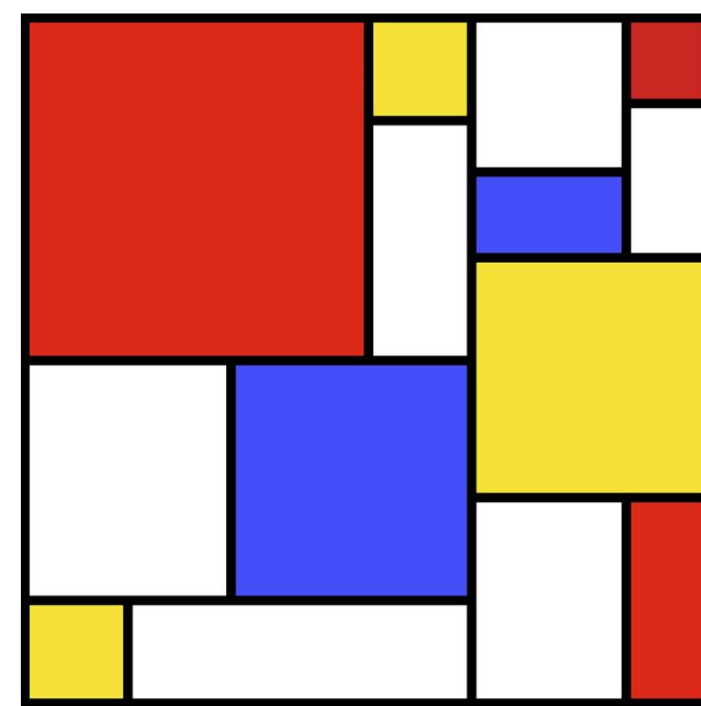
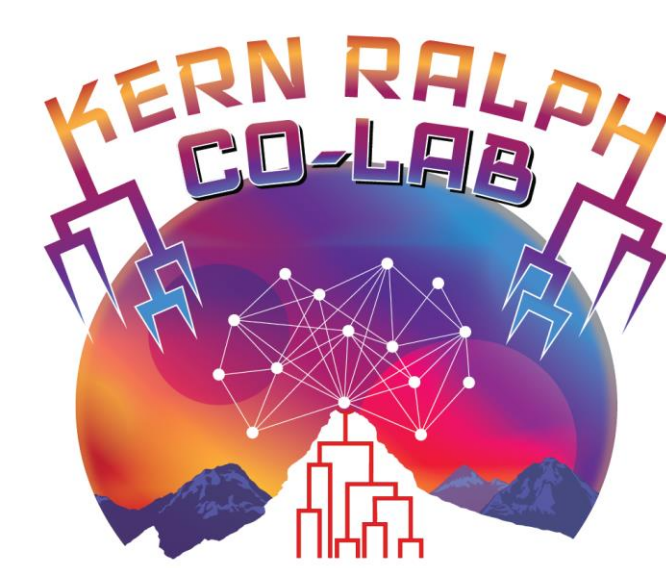




What a Load of Barnacles! A Spatial Genomic Simulation Measuring Evolution at Large Scales

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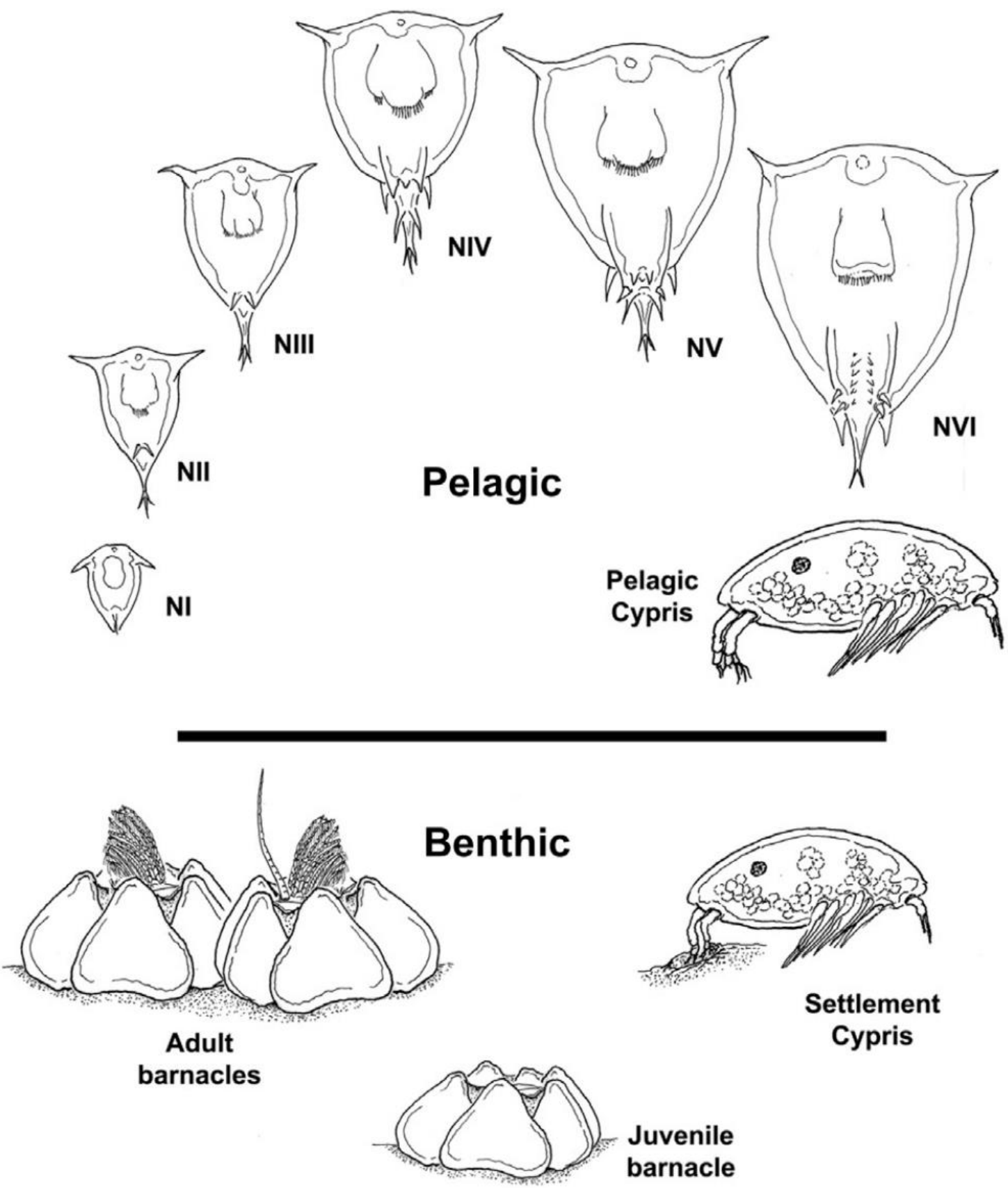


Advances

in computational biology have allowed evolutionary biologists to develop simulations that expand our understanding of population genetics across continuous space. However, quantifying evolution at scale continues to be constrained by available computational resources, and the modeling of spatial population genomics of large populations requires efficient use of processing power and accurate simulation parameters.

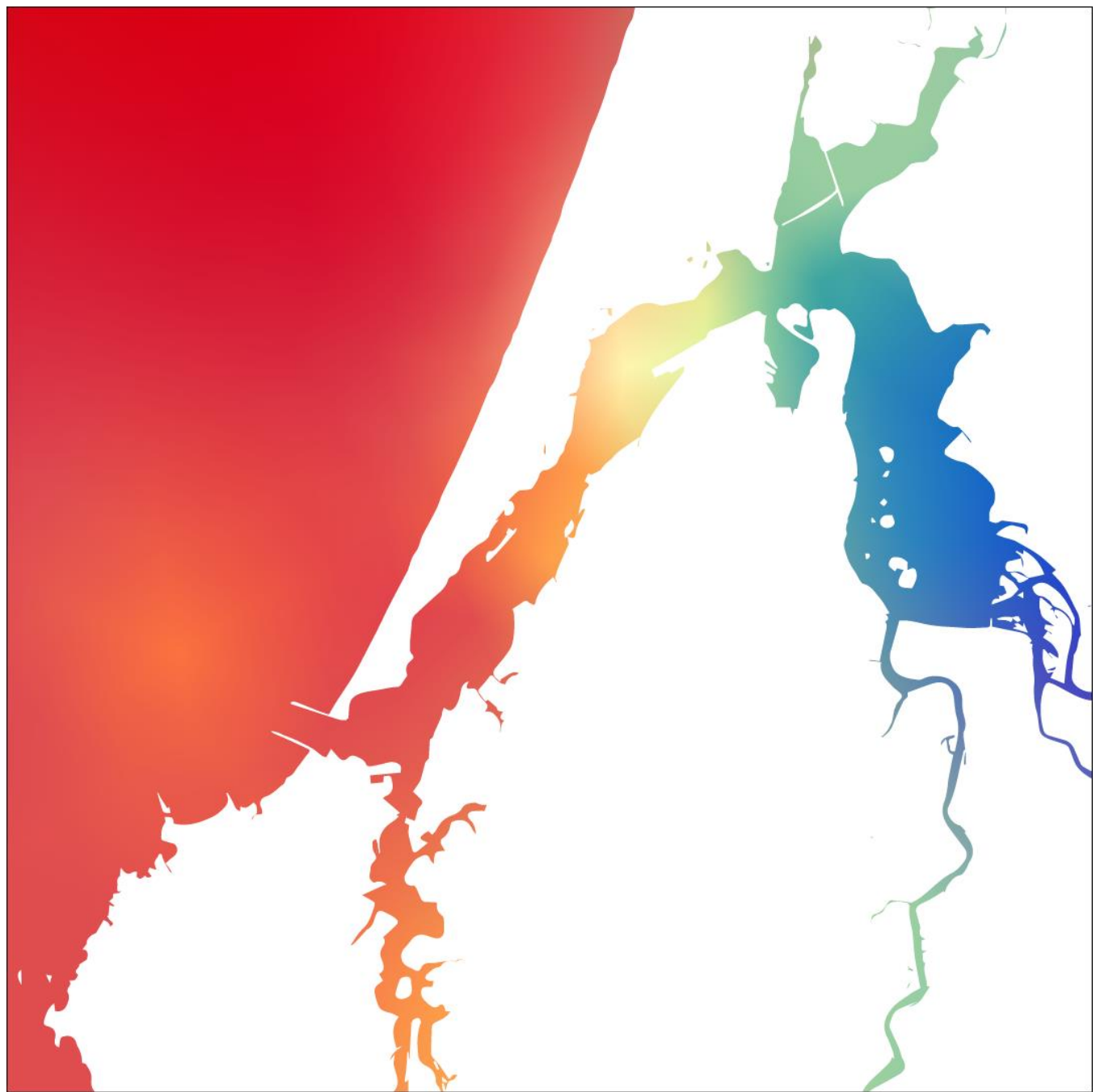
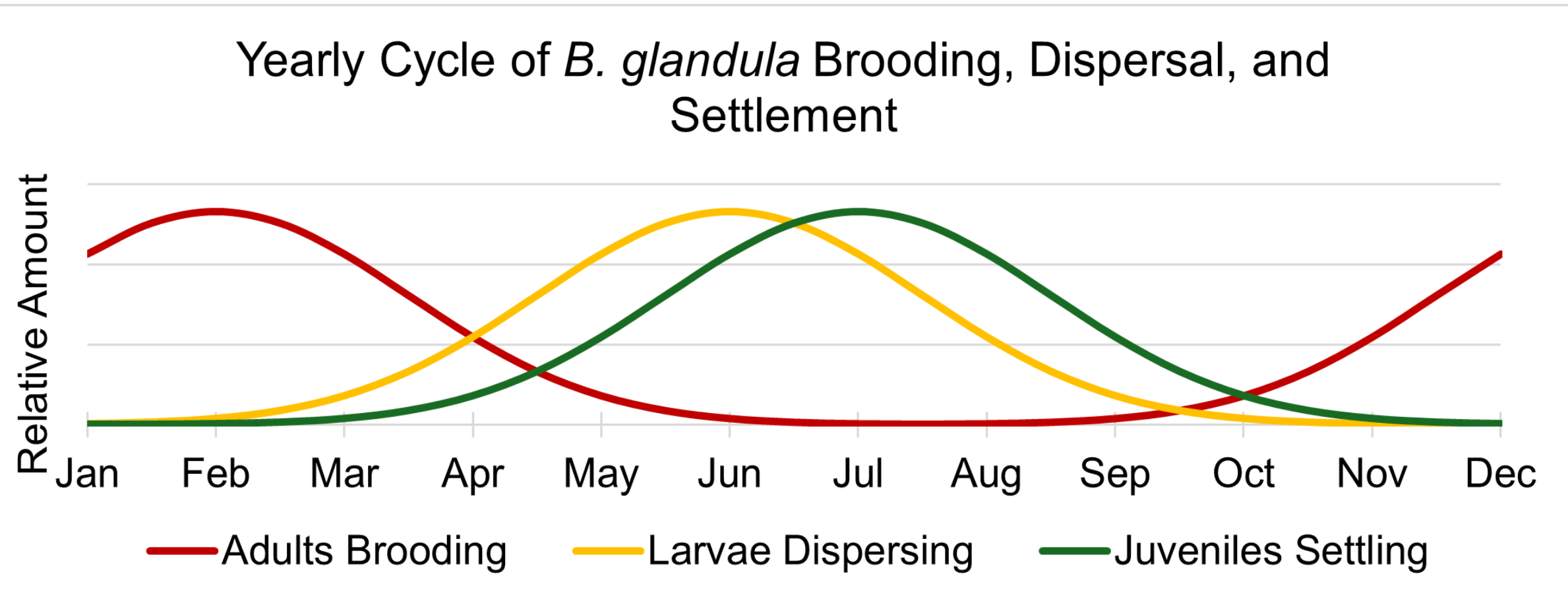
How can we efficiently model large-scale population genomics?

Our Subject and Setting



Simulating with SLiM

```
//1. Adults reproduce with nearest neighbor, if possible
mate = i2.drawByStrength(individual, 1);
AdjustedFecun = (Fecun + p1.spatialMapValue("Salinity", pos));
PBrood = dnorm(Month, 7, 1.5) * (0.7/dnorm(7, 7, 1.5));
if ((mate.size() > 0) & (runif(1) < PBrood) & (nOff>0))
p1.addCrossed(individual, mate, count=rpois(1, AdjustedFecun));
```



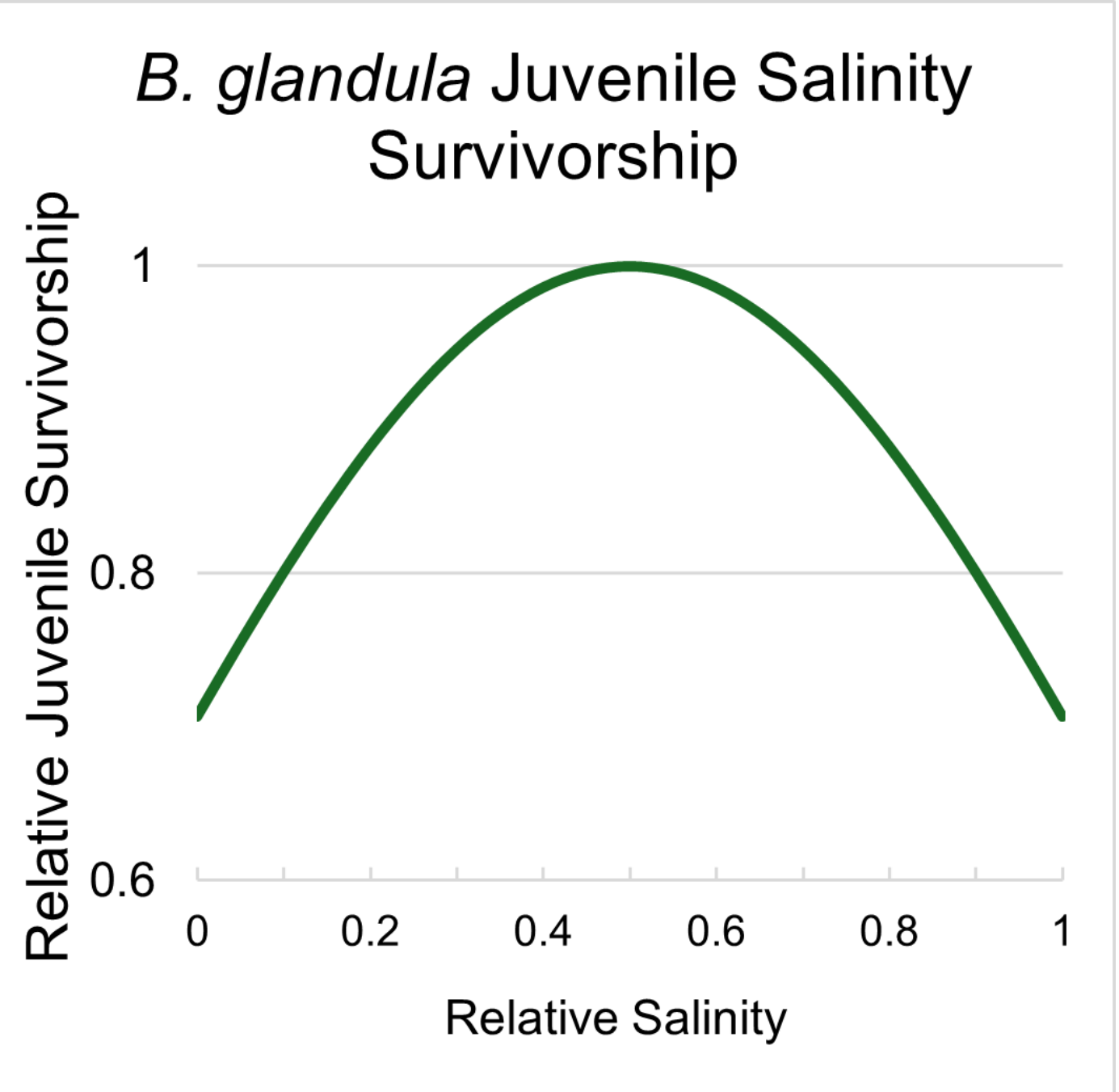
```
//2. Move larvae and settle juveniles
pos = larvae.spatialPosition;
pos = Map1.sampleNearbyPoint(pos, 1.9, "n", 0.975);
larvae.setSpatialPosition(pos);
```

```
pos = juveniles.spatialPosition;
pos = Map2.sampleNearbyPoint(pos, 1.9*3, "n", 0.975*3);
juveniles.setSpatialPosition(pos);
```

```
//3. Adjust juvenile fitness based on salinity
for (individual in juveniles){
pos = individual.spatialPosition;
salin_value = (p1.spatialMapValue("Salinity", pos));
individual.fitnessScaling = individual.fitnessScaling * (dnorm(salin_value, 0.5, 0.6)/dnorm(0.5, 0.5, 0.6)); }
```

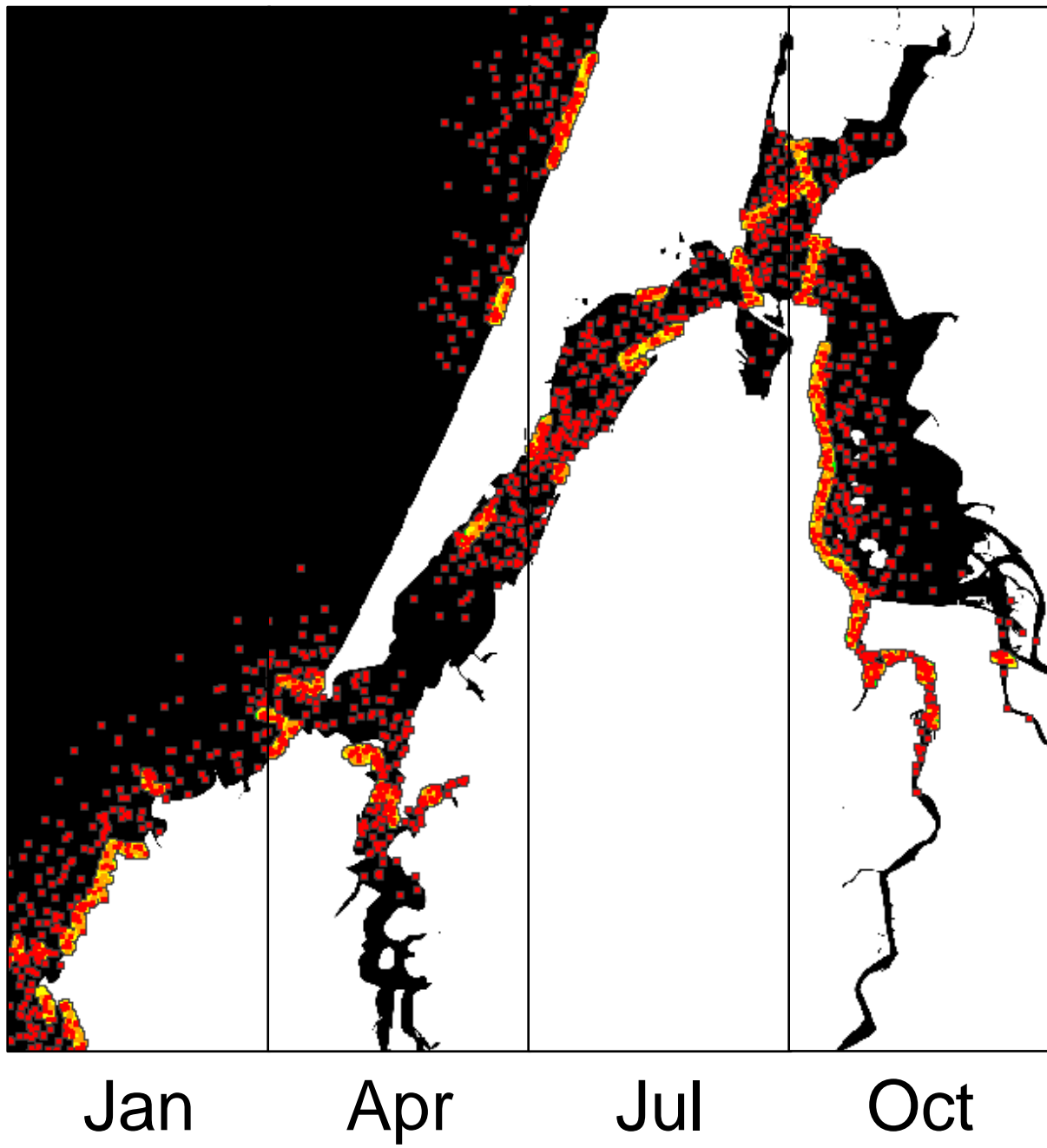
```
//4. Scale the fitness of the individuals based on their location in the map
inds = sim.subpopulations.individuals;
phenotype_m1 = inds.sumOfMutationsOfType(m1);
environment_m1 = Map4.mapValue(pos);
inds.fitnessScaling = inds.fitnessScaling * (1+dnorm(phenotype_m1, enviro_m1, environment_sd));
```

```
//5. Model density-dependent selection with spatial competition
i1.evaluate(p1);
competition = i1.localPopulationDensity(adults);
adult_local_l = p1.spatialMapValue("Habitat", adults.spatialPosition);
adults.fitnessScaling = 1/(1 + (RHO * competition / adult_local_l));
```

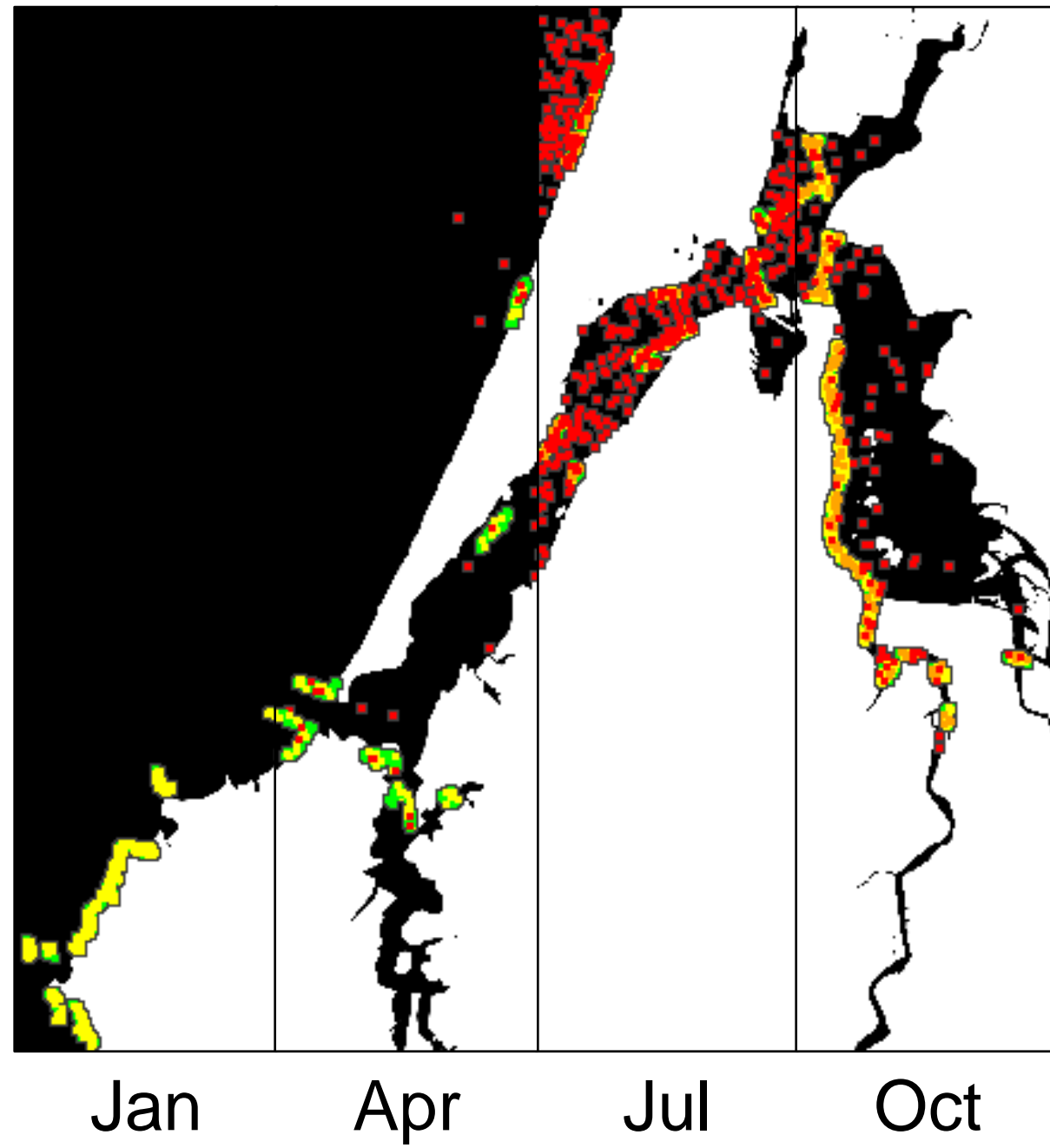


Results

Without Seasonal Reproduction

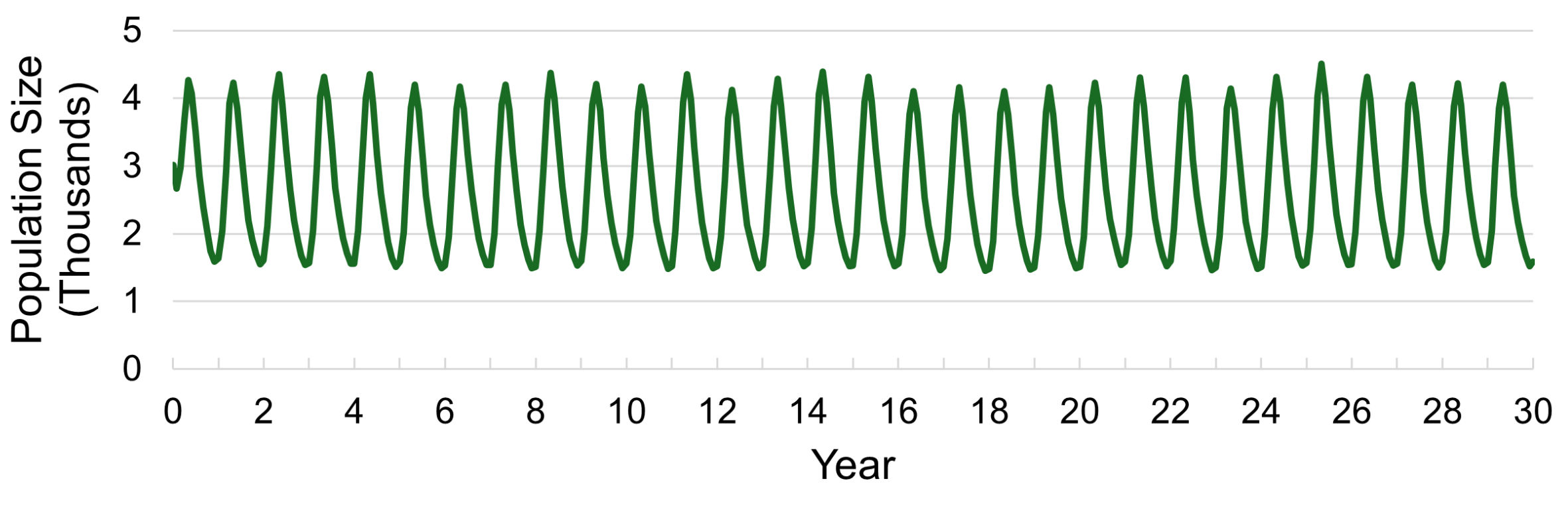


With Seasonal Reproduction

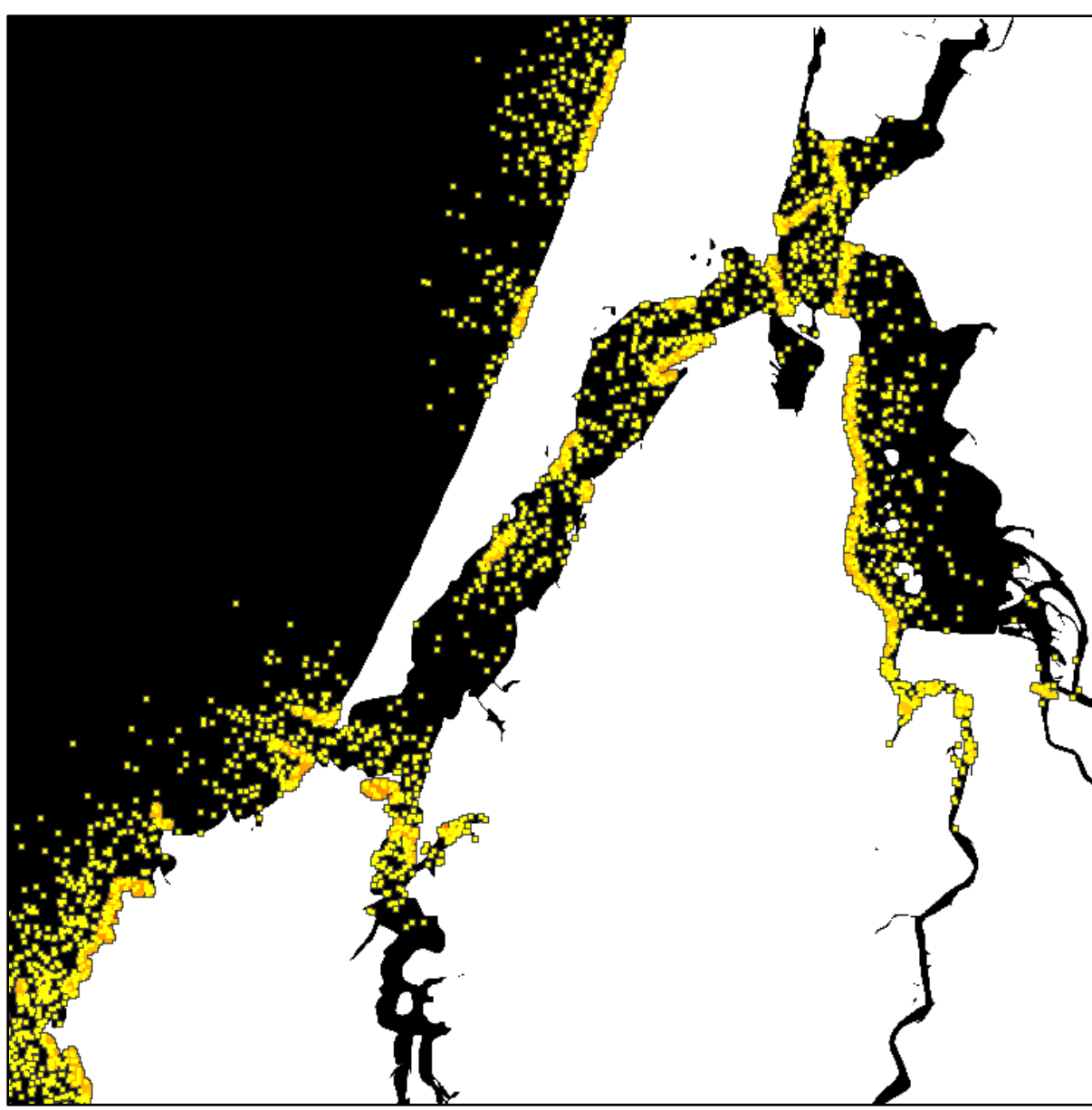


Larvae Juveniles Adults

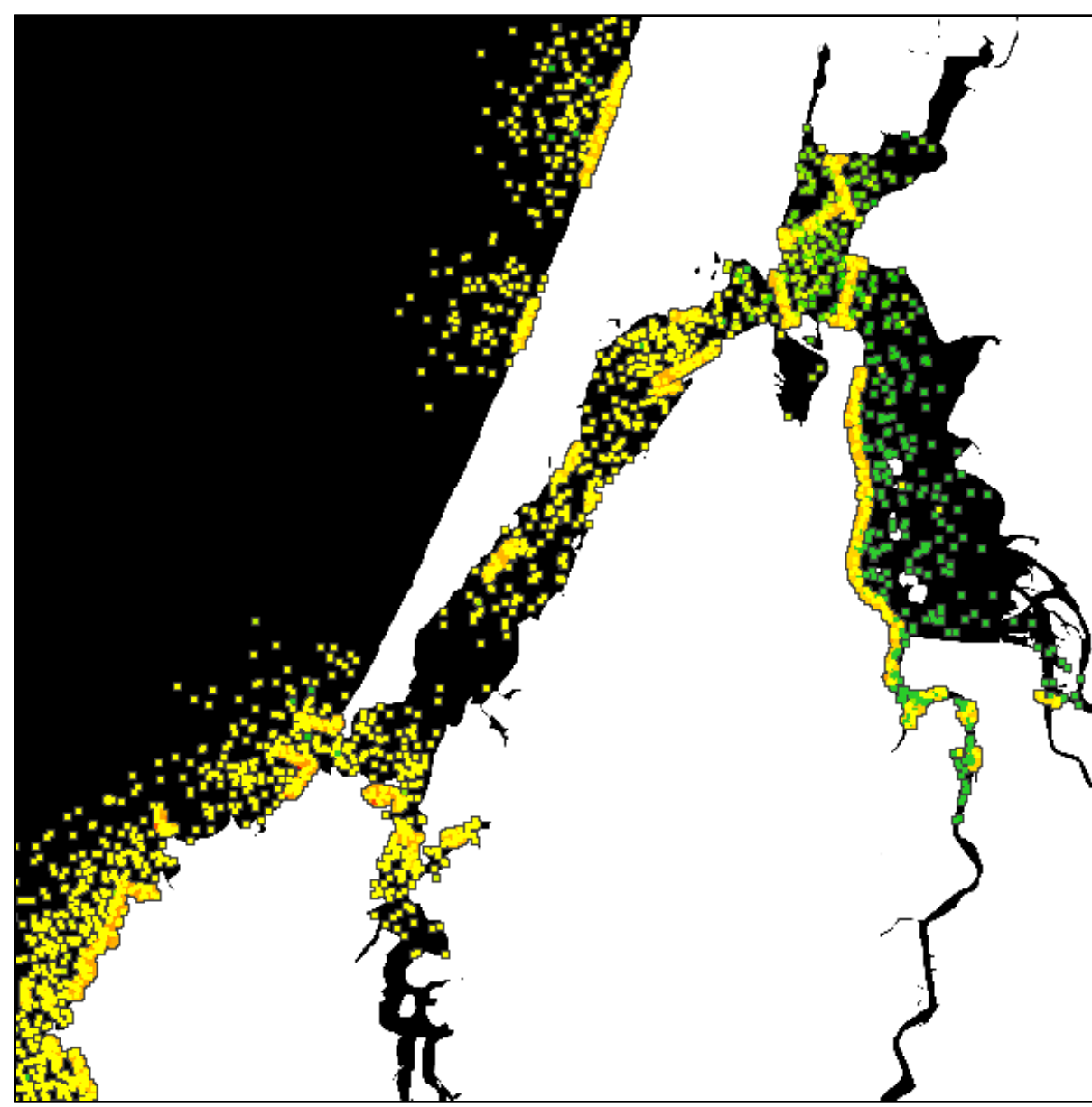
B. glandula Population Fluctuations 30 years



No Adaptation



Adaptation to Low Salinity



Low Fitness Moderate Fitness High Fitness

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