

Supplemental Information

Title: Leveraging sex change in parrotfish to manage fished populations
Tyler Pavlowich, DG Webster, and Anne Kapuscinski

Model runs

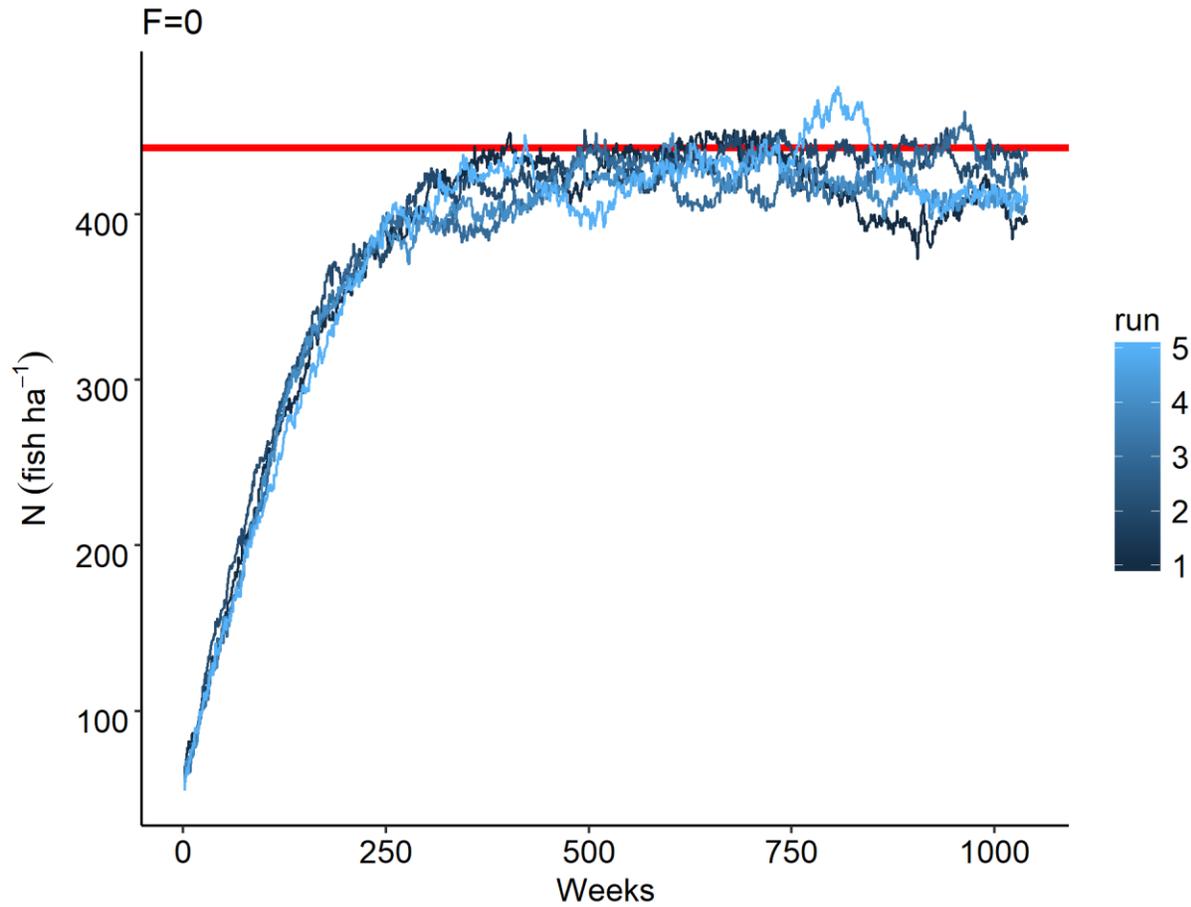


Figure S1: Population size tracked for five model runs.

Population size, plotted through time with no fishing mortality (i.e. $F = 0$), increased initially until settling around an equilibrium value near the population size observed in Bonaire (red line). Model runs settled near the same equilibrium value, though no two runs were the same.

Component functions of Model

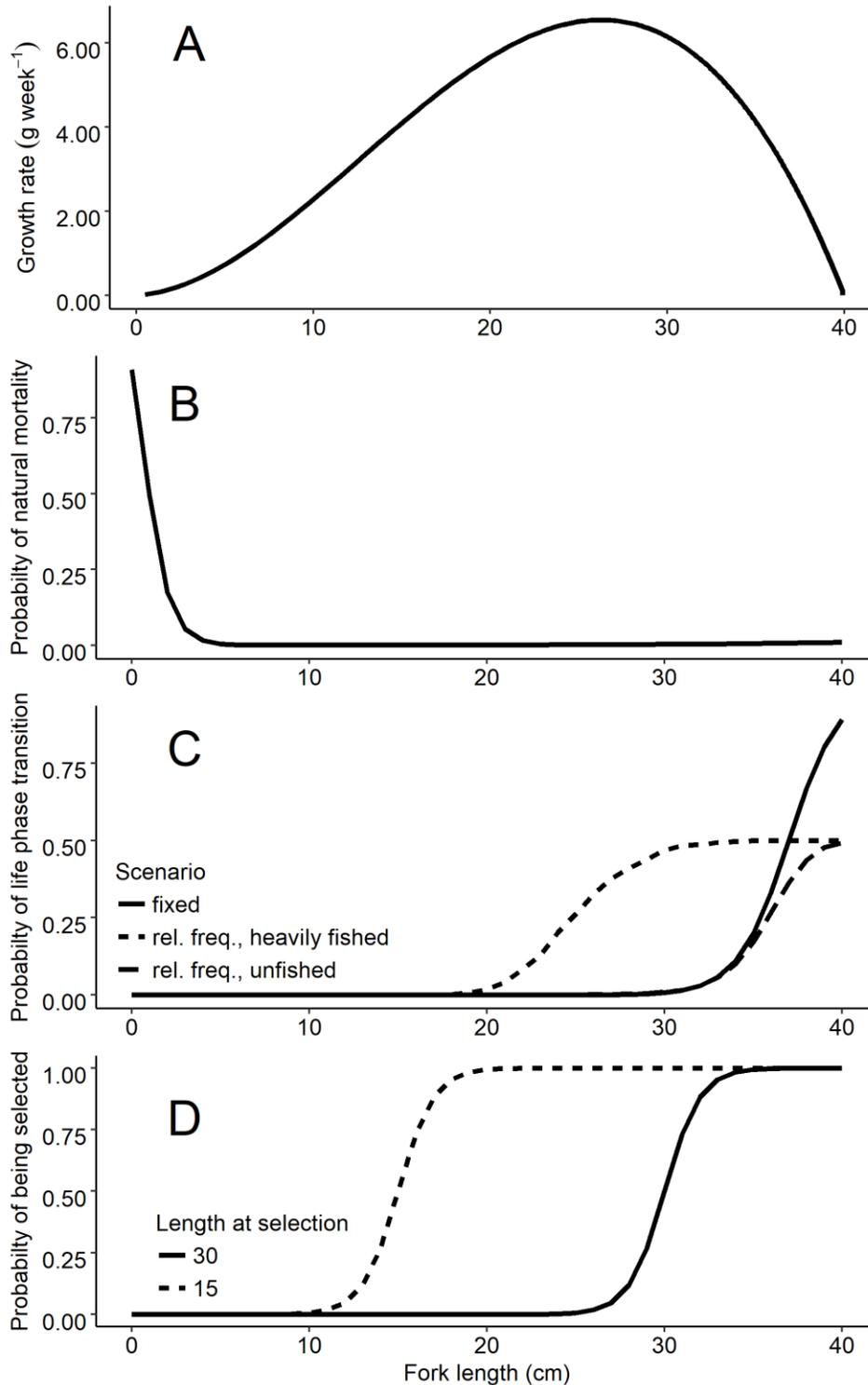


Figure S2: Life history processes shown as a function of fork length.

The following life history processes are shown above as a function of fork length: growth rate, probability of dying due to natural mortality, probability of transitioning from initial phase to terminal phase, and the probability of being selected by fishing.

Sensitivity analysis: recruitment and mortality parameters

The sensitivity of this model to parameters controlling the size of the population, i.e., recruitment and natural mortality, was analyzed extensively in Bozec et al. (2016). Here, we briefly report the sensitivity of our formulation of this model to these parameters. The number of recruits, $n.recruits$, had a proportional effect on population size (Figure S2A). Parameters that control mortality in the early life stages due to predation, $a.pred$ and $b.pred$, had the biggest impact on population size. The term $a.pred$ multiplies the probability of dying, and $b.pred$ is exponential, so their greater impact is to be expected. The parameters that control natural mortality at the end of life, $a.sen$ and $b.sen$, had relatively little effect on population size because they affect a smaller number of fish; most have died prior to reaching the sizes that senescence affects. Approximately the same patterns were observed for female biomass (Figure S1C) as for population size. The number of recruits and mortality due to predation in the early life stages had virtually no effect on sex ratio (Figure S1B). The senescence mortality variable $b.sen$ had a slightly greater than proportional impact on sex ratio. As $b.sen$ decreased, there were more large, male fish in the population, which brought down the ratio of initial phase to terminal phase.

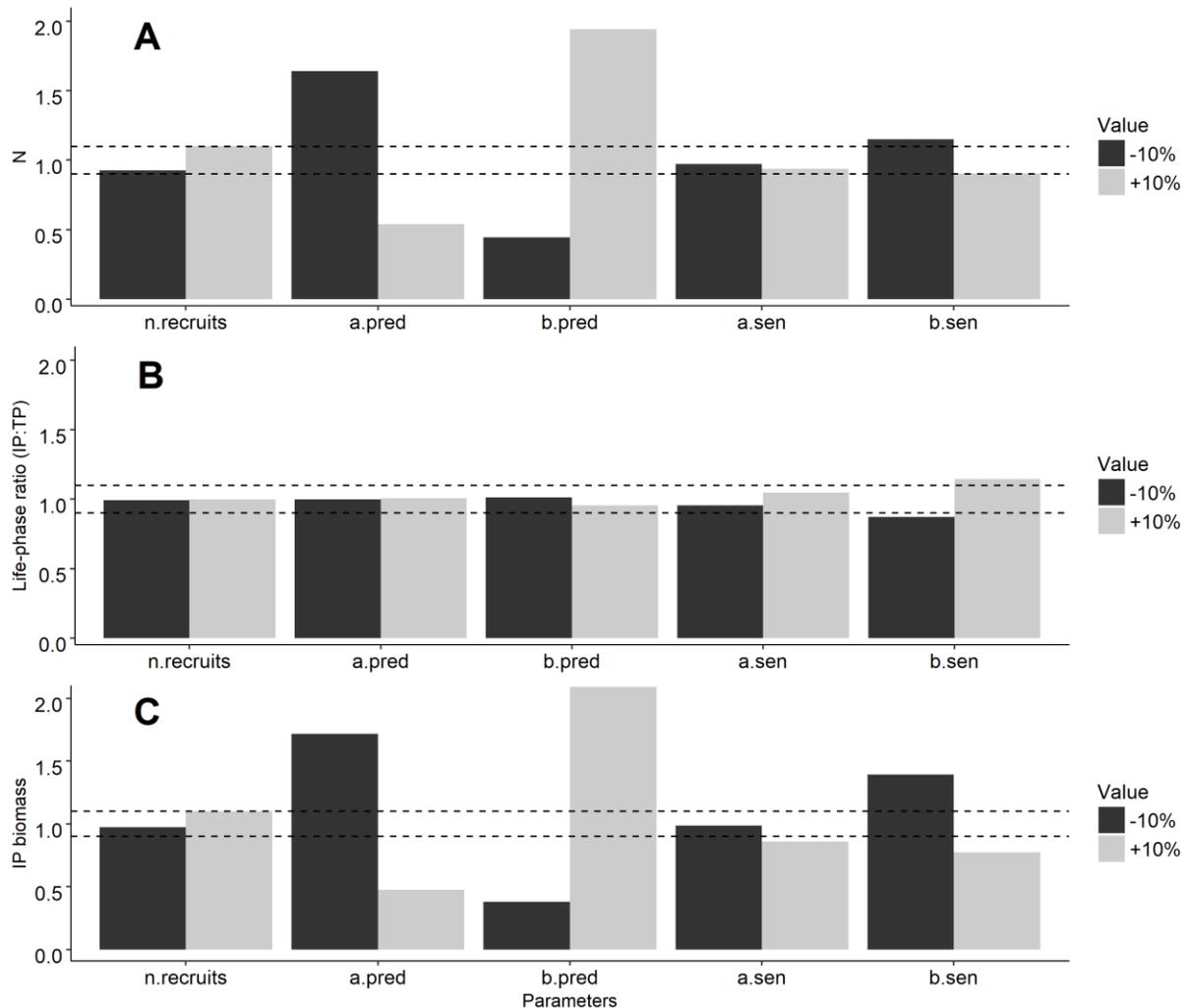


Figure S3. Population outcomes versus model parameters related to recruitment and mortality.

Sensitivity of population size, sex ratio, and initial-phase biomass as a proportion of their unfished values (y axes) to 10% perturbations in model parameters that determine recruitment and natural mortality (x axes). The dashed lines show where $\pm 10\%$ change in the population outcomes would be.