Appendix 5. Specifics of the razor clam population model.

The stage-based razor clam population model was designed to explore the direct impact of perceived risks on the clam population, not to represent the exact magnitude of change or to account for spatial processes (i.e., effects on populations on individual beaches).

The stage-based razor clam model consists of one population with pre-recruit and recruit stages; we define pre-recruits as razor clams below preferable size and recruits as razor clams above preferable size. Preferable size is approximately 3 inches, corresponding with the size that clams tend to "show" via dimples in the sand (WDFW, 2018). We used these stages in a Lefkovitch matrix assuming a 95% probability that pre-recruits move to the recruit stage annually and assuming recruits remain in the recruit stage for three years, at which point they die (from either natural causes or harvest). Recruit survival is density-dependent, so that the estimated razor clam population size is constrained by beach capacity (Figure D1). We assumed female razor clams represent 50% of the population and that each female produces 8 million eggs per year (McMillan 1924). We assumed the survival rate of recruits to be 0.40, the estimated survival rate for adult razor clams (Nickerson 1975). We used a pre-recruit survival rate of 0.089, close to the estimated juvenile survival rate of 0.90 from Nickerson (1975), and a survival rate of eggs of $2.9e^{-6}$ (adjusted *ad hoc* to obtain reasonable population dynamics). Because the razor clam harvests appear to be sustainable at a 30% harvest rate, and given that decades-old studies on razor clam survival rates are not in agreement on survival at each stage, we tuned the survival rates of eggs and pre-recruits to represent a population in sustainable equilibrium, maintaining the assumption that recruit survival is higher than pre-recruit survival.

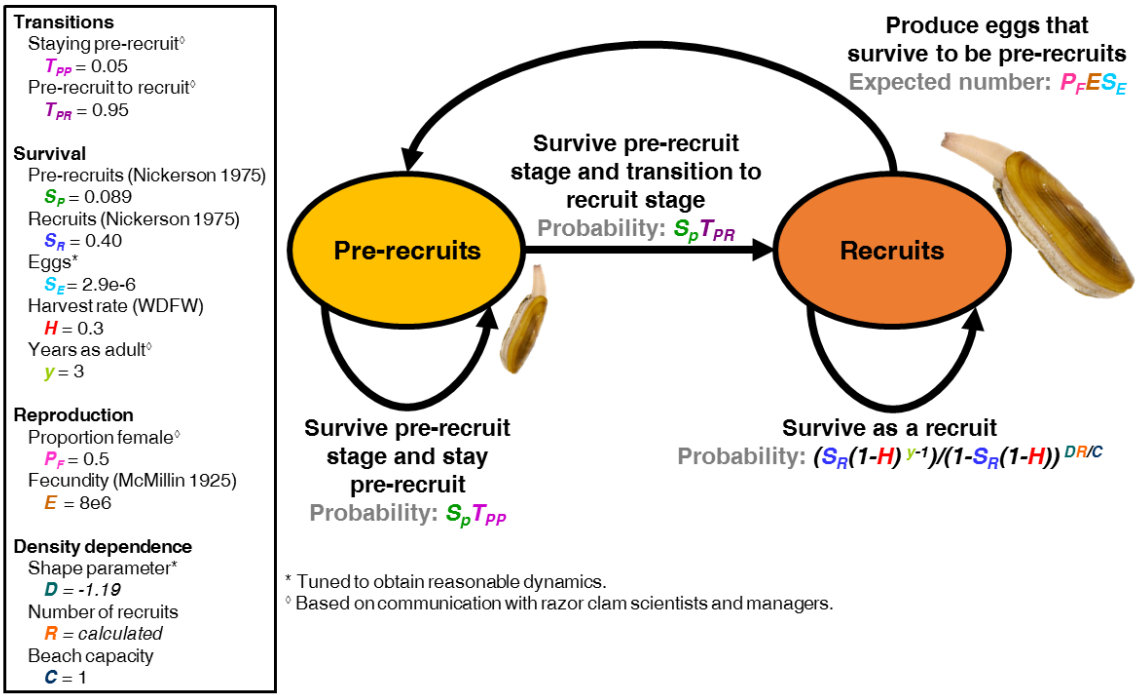

Figure A5.1. Stage-based razor clam population model used to simulate potential impacts of the Quinault's perceived risks. We show transition probabilities between the pre-recruit and recruit stages, survival rates at each stage, reproduction parameters, and parameter values for density-dependence and beach capacity.