Appendix 1: Genetic Algorithm

Algorithm 1 Genetic algorithm used to find good sequences of management actions

for rep = 1 **to** rep = number_reps **do**
  Randomly generate initial population P of action sequences $\mathbf{a}$.
  for gen = 1 **to** gen = number_gen **do**
    for all $\mathbf{a} \in P$ **do**
      Initialize population in state n_0
      for $t = 1$ **to** $t = T$ **do**
        Run the population model under action sequence $\mathbf{a}$
        Record $N''(\mathbf{a}, n_0, t)$ at each step.
      end for
      Calculate $R(\mathbf{a}, n_0)$
    end for
    Randomly pair each $\mathbf{a} \in P$
    For each pair put the $\mathbf{a}$ with the highest $R(\mathbf{a}, n_0)$ into population P'.
    Randomly pair each $\mathbf{a} \in P'$
    for all pairs **do**
      Copy each sequence in the pair to $\mathbf{a}_1^*$ and $\mathbf{a}_2^*$
      Randomly select a point $t^* \in 2 : (T-1)$
      Swap section $\mathbf{a}_1^*[1 : t^*]$ and $\mathbf{a}_2^*[1 : t^*]$
      $\forall a^t \in \mathbf{a}_j^*$, $a^t \leftarrow a^{t*} \in \mathbf{A}$ with probability m
      Put $\mathbf{a}_j^*$ into P'.
    end for
    $P \leftarrow P'$
  end for
end for
Compare $\mathbf{a}$ with highest $R(\mathbf{a}, n_0)$ from each P in the final generation between reps to check they have converged on the same action sequence.