The map is divided into a set of (hexagonal) grid cells, and I'll use variables x and y to refer to cells. The basic population growth equation relates the population p_{i+1} on day $i+1$ to the population on day i:

$$p_{i+1} = p_i(x)(1 + g_x(p_i(x))) - \delta_x p_i(x) - h_i(x) + \sum_y \delta_{y,x} p_i(y)$$

where the terms represent population growth inside x, dispersal out of x, harvest from x, and dispersal into x, respectively. The dispersal rate out of x is just

$$\delta_x = \sum_y \delta_{x,y}.$$

Each cell x has a "habitat suitability" $H(x)$, between 0 and 1. Growth inside a cell is logistic growth, with some natural mortality. In symbols:

$$g_x(p) = -\mu + r\left(1 - \frac{p}{KH(x)}\right)$$

Here μ is the mortality, which we estimate as one over the typical lifespan of a fish, in days. The upper limit on the population size is $KH(x)$, where $H(x)$ is the habitat suitability of cell x, and K is the carrying capacity (maximum population) of a grid cell with perfect conditions for the species. The constant r is the rate of growth when the population in a cell is far from the maximum; this is called the "intrisic growth rate".

A fraction α of the fish in each cell swim to a neighbouring cell each day. The choice of which cell a fish moves to depends on the availability of resources. If we set

$$\sigma_x = \sum_{y \in \text{neighbours}(x)} H(y)/(1 + p(y))$$

then

$$\delta_{x,y} = \frac{\alpha H(y)}{(1 + p(y))\sigma_x}.$$

Now for the harvest term: it's the sum of the harvests of all boats currently in existence. I'll use the variable b to refer to a boat:

$$h_i(x) = \sum_b [\gamma_i(b) = x]\phi_b(x)$$

where $[\gamma_i(b) = x]$ is in indicator variable equal to 1 if boat b is in cell x on day i and 0 otherwise, and $\phi_b(x)$ is the number of fish b harvests if it does visit x. The latter term depends on the boat's efficiency $e(b)$, its maximum daily capacity $m(b)$, the commute time to get to x, and the population in x:

$$\phi_b(x) = \min\{m(b), e(b)p(x)t_b(x)\}$$

Here $t_b(x)$ is the fraction of a day that b can spend at x (considering commute time), which can be calculated from boat speed and distance, assuming an 8-hour working day:

$$t_b(x) = 1 - \frac{d_{x,\text{port}(b)}}{8 * \text{speed}(b)}.$$

Finally, we need to specify the boat behaviour. Say that a boat b visited cell x one day and had profit ρ. If $\rho \leq 0$ or ρ is less than a third of the average profit of boats from the same port, or randomly (with probability 0.03), then the next day b visits a random cell, as described below. Otherwise, b visits either x or one of the (non-reserve) neighbours or x, with the choice made to maximize profit. Note that this assumes some prescience from the boats, as it assumes they know what the profit would be in each neighbour.

The profit of a boat depends on the harvest, the wholesale price of the fish (\$$f$ per kg), the average weight of a fish (w kg), travel costs (at a rate of $t(b)$ dollars per km) and daily boat cost, $\omega(b)$:

$$\text{profit}_b(x) = \phi_b(x) f w - 2t(b) d_{x,\text{port}(b)} - \omega(b)$$

If the boat chooses a random cell, it does so as follows. If there is any (nonreserve) cell in which it can make a profit, it chooses from all such cells with probability proportional to the profit. Otherwise, it chooses from all non-reserve cells with probability proportional to exponential profit, $e^{\text{profit}_b(x)}$. The latter rule biases the choice in favor of cells where the boat will make the smallest loss.

Lastly, this is an open fishery, so we need rules for when boats come and go. Each port has a maximum number of boats. If no boats from a port have any profit in any one day, and there are currently at least two boats operating from the port, then one boats stops fishing. If all the boats have at least \$50 profit per day for at least 30 days, and the current number of boats is less than the maximum, then another boat starts fishing.

For an initial configuration, the user picks an initial total population, i.e., number of fish. The initial population is divided between the cells in proportion to their suitability. Initially there are 2 boats per port.