Azores Spasm: Movement

Ian

February 5, 2020

Parameter: adult_movement

The `adult_movement` parameter helps determine the degree to which fish disperse to other patches. The absolute value isn't what's important here, it's the value of adult_movement parameter relative to the distance between adult habitat patches. When density-dependence is not included in the model, fish are redistributed from a patch to others using the following steps:

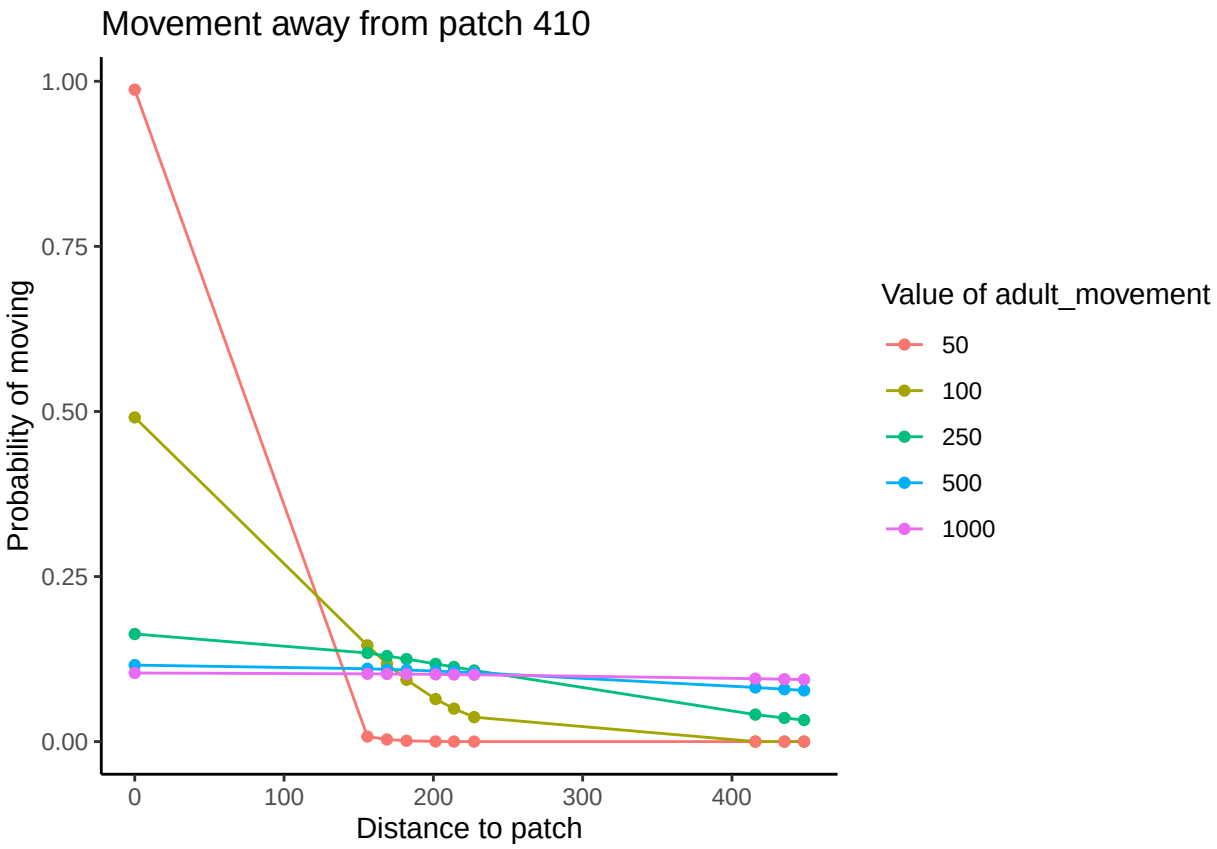
- The distance between two patches is checked against a normal distriubtion with a mean of 0 and a standard deviation of `adult_movement`. The value (f(x)) of the normal distribution curve at that point is saved for each combination of patches.
- For all the mature fish in a given patch, they redistribute to other **adult** (check with LT) habitat patches with the probability of the value calculated above divided by the sum of the values for each possible movement combinations from the patch in question to all other adult patches (including itself). This creats a dataframe as follows:

Using `adult_movement = 100`

from	to	dist	prob_move
410	410	0.0000	0.4910319
410	611	155.8307	0.1458164
410	676	168.9189	0.1178992
410	741	182.0478	0.0936382
410	742	201.5165	0.0644612
410	929	213.8060	0.0499418
410	679	227.3249	0.0370652
410	753	415.6721	0.0000869
410	754	435.1408	0.0000380
410	819	448.3104	0.0000212

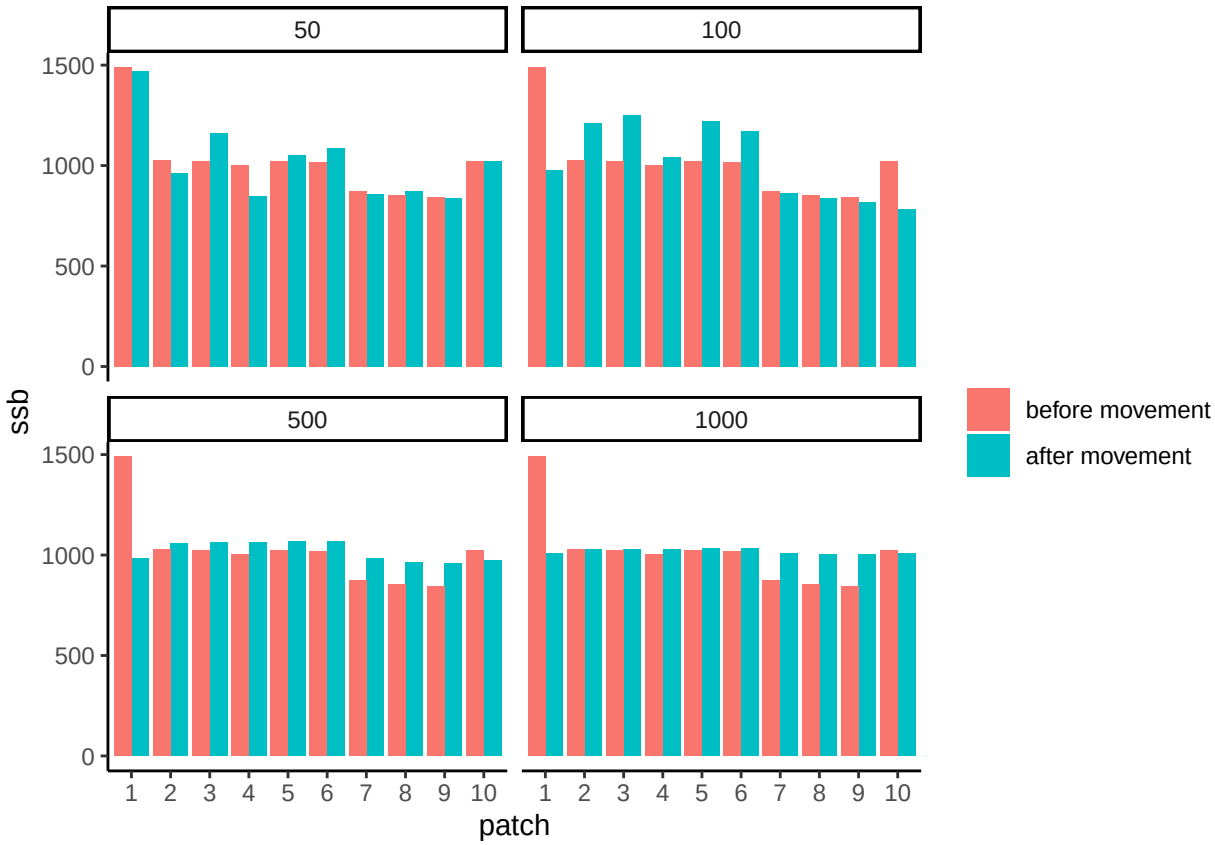
- In this example, where `adult_movement` is on the same order of magnitude but smaller than the distance between the selected patch and it's nearest neightbor, we would see roughly half of the adults stay put and the other half redistribute to the other patches. The three furthest patches (where `dist > 4 * adult_movement`) recieve almost zero immigrants from the selected patch.
- As `adult_movement` increases, so does the standard distribution of the curve used to calculate probabilty. This places the patches relatively closer together in space in the context of the movement of the fish. Therefore, as `adult_movement` increases to and beyond the value of `max(dist)` for a given patch, we would expect a more even distribution of fish from that patch to all others.
- In the current paramter space, the two closest patches are 19.8145829 units apart and the farthest distance between two patches is 448.3104106 units.

*The sensitivity of fish in a selected patch to the value of `adult_movement` can be seen below:



How does this play out across all patches?

We can vary the value of `adult_movement` to see how it affects the system on a whole.



This figure shows the ssb for each patch before and after movement for four different values of adult_movement: 50, 100, 500, 1000. There is very little redistribution when it equals 50 (near the minimum distance between patches) and almost completely even redistribution when it hits 1000 (greater than twice the max distance between patches).