1. Revenge of the Mountain Trout (Part 1)

During the first part of your dissertation, you established that body size evolution in Cutthroat trout stocked in the Selway-Bitteroot Wilderness could not be explained by genetic drift alone. Because this supported your hypothesis that body size evolution was instead driven by divergent selection you gleefully submitted your results for publication presenting them as evidence that body size evolution was the result of local adaptation to different prey sizes. Upon receiving the reviews you were dumbfounded to see that the reviewers did not believe that your results demonstrated divergent selection and local adaptation. After drinking a bottle of whiskey and ranting and raving to your colleagues about the sorry state of the review process, you decide to show these stupid reviewers just how wrong they are by conducting a reciprocal transplant study.

Your experimental design was a fully reciprocal transplant study. Specifically, you captured 200 trout at random from each of your study lakes, marked these captured fish with PIT tags, and released 50 of these fish into each of the four lakes. After one year, you returned to your lakes, recaptured your marked fish, and used this recapture data to estimate survival. Your data is shown in the file "RT _Data.csv".

Use this data to estimate the strength of local adaptation in your fish metapopulation. Do your results support your hypothesis of divergent selection driven by the size of available prey?

2. Revenge of the Mountain Trout (Part 2)

Because you have lost all faith in the review process, you initiate a second, complementary study that uses the same reciprocal transplant study described in the previous question. Your goal is to directly demonstrate local adaptation by showing that the optimal body size, θ, within each lake matches the population mean body size within each lake, $\bar{z}$. To this end, you measured the body size of the 200 trout transplanted into each of the four lakes and also whether each fish was recaptured the subsequent year. Fish that were not recaptured were assumed to be dead. Thus, the data collected from this study consisted of a trait value (body size) and a fitness estimate (survival) for each of 200 fish transplanted into each of the four lakes. This data can be found in the file "RT _Data.csv".

Do your results support your hypothesis of local adaptation caused by divergent selection? What is the relationship between this approach and that you took in question 1? Which is better? Why?

Hint: A quick and dirty way to find θ is to perform a quadratic regression and identify the point at which the curvature of the function relating fitness to (body size)^2 is zero (i.e., the peak on the adaptive landscape).