COASTAL OREGON MARINE EXPERIMENT STATION (COMES)

Estimating marine fish populations: The influence of spatial structure and the environment

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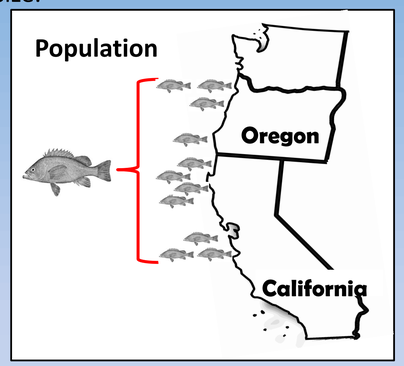
Background

Stock assessors use math to model how fish populations grow and decline. This math, although a simplified view of reality, can be very complex. The current assessments simplify reality by summarizing data and using simplified equations.

Why is this important?

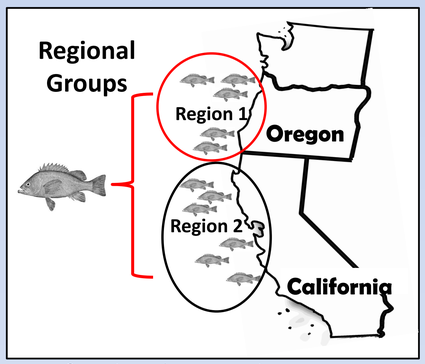
These simplifications can result in a loss of information and could cause estimates of population size to be inaccurate. It is our goal to determine which simplified views of reality bring us closer to the true population size.



The lost information includes:

- Differences in the sizes of regional groups within the population
- Environmental information that may tell us more about the size of the regional group
- Different regional fishing trends which may cause differences in the regional group sizes

A population in our study can be divided into regional groups. For simplicity we consider the population to reside in two regions with no movement of fish after they settle in those regions.



If we are confident in the estimates of regional group size, we can lessen the risk of depleting a valuable commercial fish species!

Objectives

To determine which combinations of the following factors provide the most reliable stock assessment results:

(a) the trends in a single environmental variable and fishing histories in each region,

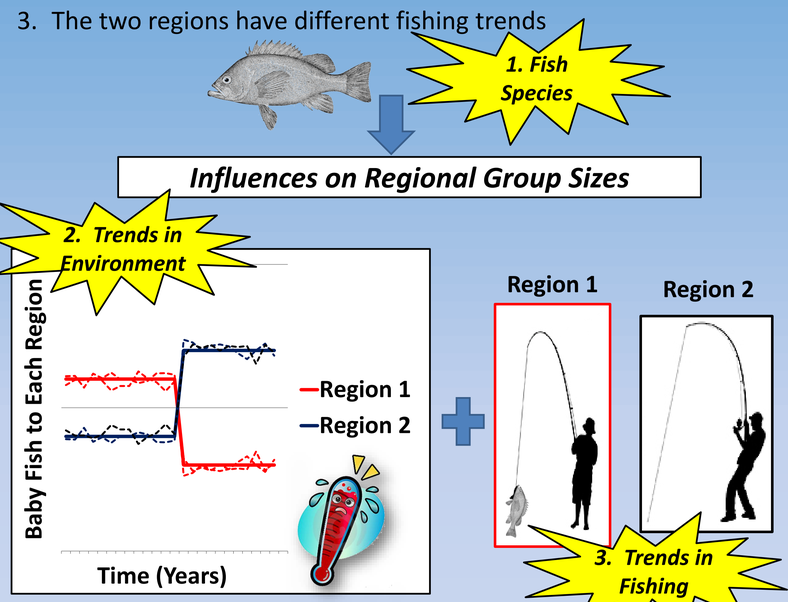
(b) simplifying spatial assumptions in the estimation methods, and

(c) which data are available

Computer Simulation

We conduct an experiment where we know everything influencing an imaginary, virtual population:

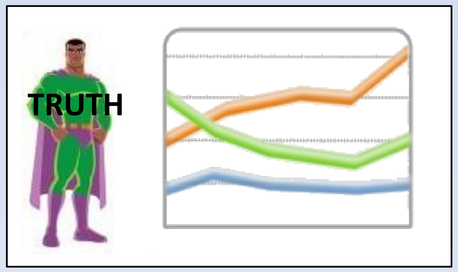
1. Virtual, Black Rockfish a near-shore species that lives ~50 yrs.
2. Different fractions of baby fish move to the two regions based on trends in the environment. Once they settle in a region, they remain there.
3. The two regions have different fishing trends



We use these facts to generate data about the groups and population as a whole. These "true" data include:

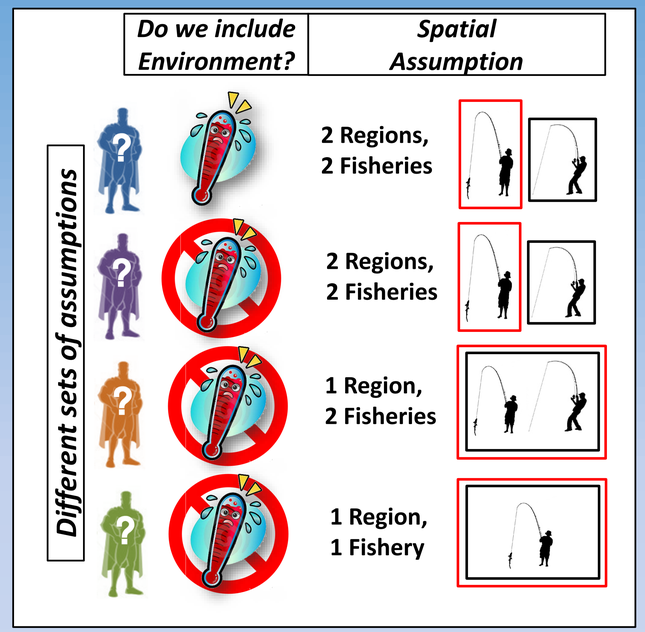
- Ages and size of fish caught by our virtual fisherman
- Ages and size of fish randomly surveyed by scientists

From the simulation, we get what we consider "true" results for the population and its regional groups,

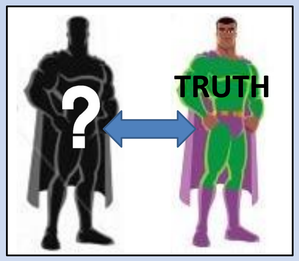


Experimentation

Assessors do their best to mathematically model influences on groups within the population. To do this they make assumptions. We experiment with different assumptions to determine which set of assumptions produces results that are closest to the truth.



Which set of assumptions produces results that are closer to the truth?



Benefits

When we determine which experiments give us results closer to the true population size, we:

1. Lessen the risk of under utilizing or overfishing regional resources
2. Have a better idea of the data needed to give accurate spatial estimates of a populations
3. Are able to focus on improving the collection of certain types of data, to save time and money
4. Understand benefits (if there are any) of using environmental data and collecting data on finer spatial scales

This boosts stakeholders confidence in estimated resource abundance and results in catch quotas that are in better balance with the natural productivity of the stock.

Acknowledgements

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