

Today: Midterm notes

Estimating animal populations (Blue Whale example: Read pp 60-67)

Midterm I - Friday, Oct 11. **Open Book.** Bring notes (www and your own) and Tanur book. Bring a calculator. Bring a pen. Be on time. Coverage: Everything up to and including Oct 9 Lecture (Outline items 1-5 and part of item 6.). No assignment due this week (but one will be assigned on Wed. Oct 9 for Wed Oct 16).

Most important tools:

Simulation, means and standard deviations, dot plots, scatter plots, time series, square root law, randomization and experimental method, percentiles, probability, correlation.

Most important concepts:

Relation of simulation to data analysis, variability of averages, illusions of randomness, data distribution, frequency distribution, time series intervention, risk, law of averages, causality and experimental method, causality and correlation.

Most important applications: sports leagues, investment, insurance, health and food experiments, curving marks, estimating animal populations.

Estimating Animal Populations

1. Capture-Tag-Recapture

Think fish-in-a-lake. Capture and tag 200 fish. Return fish to lake and wait one year. Capture another 200 fish and count the number that are tagged.

e.g. Suppose 4 tagged fish are drawn on the second capture.

$4/200$ is 2%. If the original tagged fish were spread throughout the population, then we might assume that the 200 tagged fish represent 2% of the population. In that case, the population of fish N would be such that 2% of $N = 200$, so $N = 10,000$.

Problems with this approach:

Tagged fish dies before recapture (population would be overestimated)
 Circulation of tagged fish is not through whole population (population underestimated)
 Many new fish hatched (populations underestimated)
 Variability of proportion of population caught (both over- and under-estimation)

Simulation to study last problem:

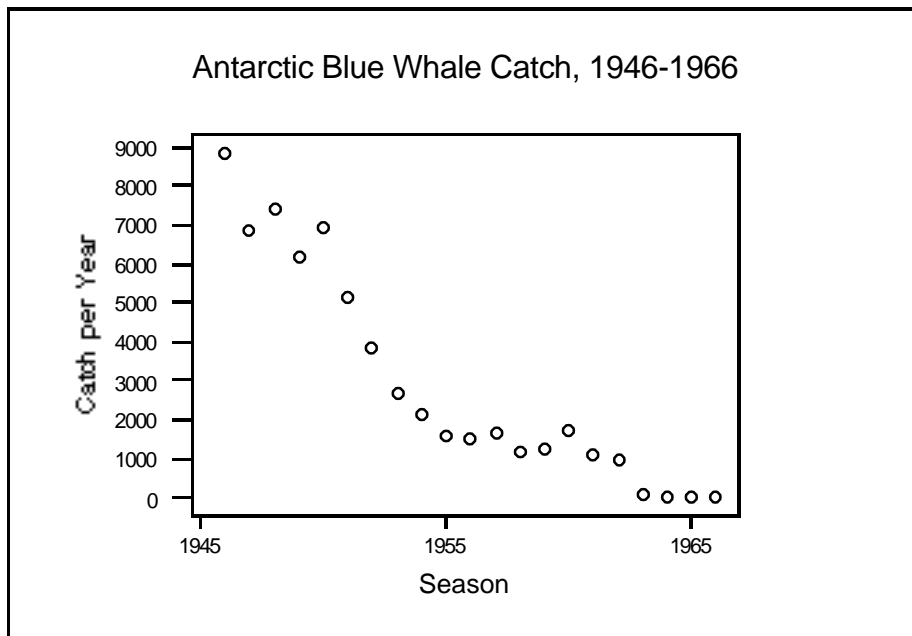
Number tagged	4	4	6	4	3	2	2	4
Population Estimate	10000	10000	66667	10000	13333	20000	20000	10000

Blue Whales: up to 100 feet long, weigh 100 tons. Hard to tag, hard to find tag, circulation suspect. Use another method.

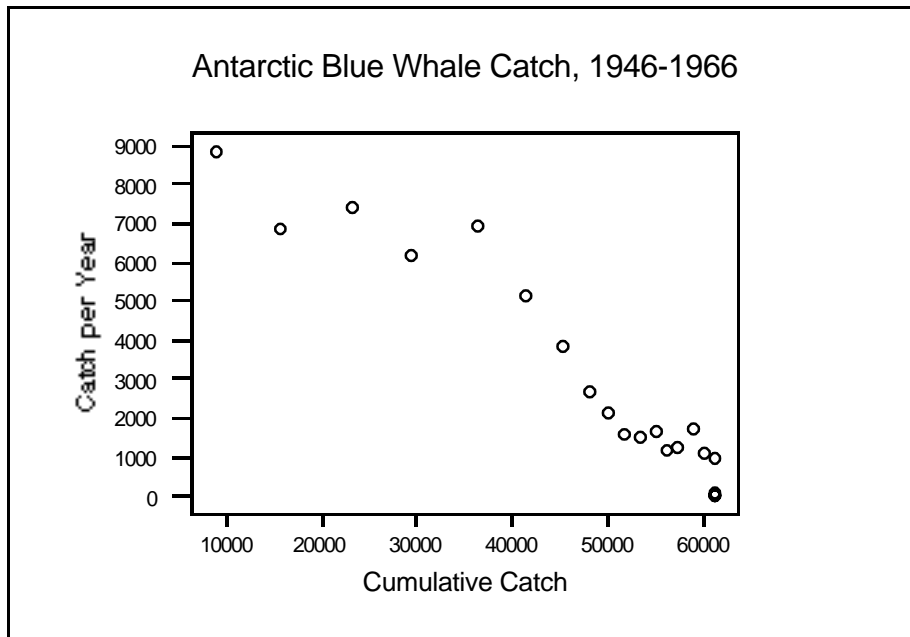
2. Catch-per-day Method

See graph in article: we look at catch per year in following.

Following data is from the internet (www.intfish.net/iwc2002/statistics/blue.htm)



Idea: The catch is proportional to the population. If the catch falls from 5000 to 4500 from one year to the next, then this represents a 10% decrease in catch and also a 10%



decrease in population. This would imply that removal of 5000 whales caused the 10% decrease in population, so the population must have been 50,000 when the 5000 whales were caught.

This method can be used over several years to get a better estimate. This is why the graph of catch versus cumulative catch was used. Where the line crosses catch=0 is an estimate of the number of whales that existed at the start of the period. Note that it is not necessary to catch all the whales to determine this number!

3. Age Analysis

Use of waxy ear plug rings to age whales caught.

Number of 4 year olds after 1950 season - catch of 5 year olds in 1951 season
 = number of 5 year olds after 1951 season.

Currently: population about 1000 and increasing

Read Blue Whales pp 60-67

Solar Atmosphere pp 268-275