



**NOAA
FISHERIES**

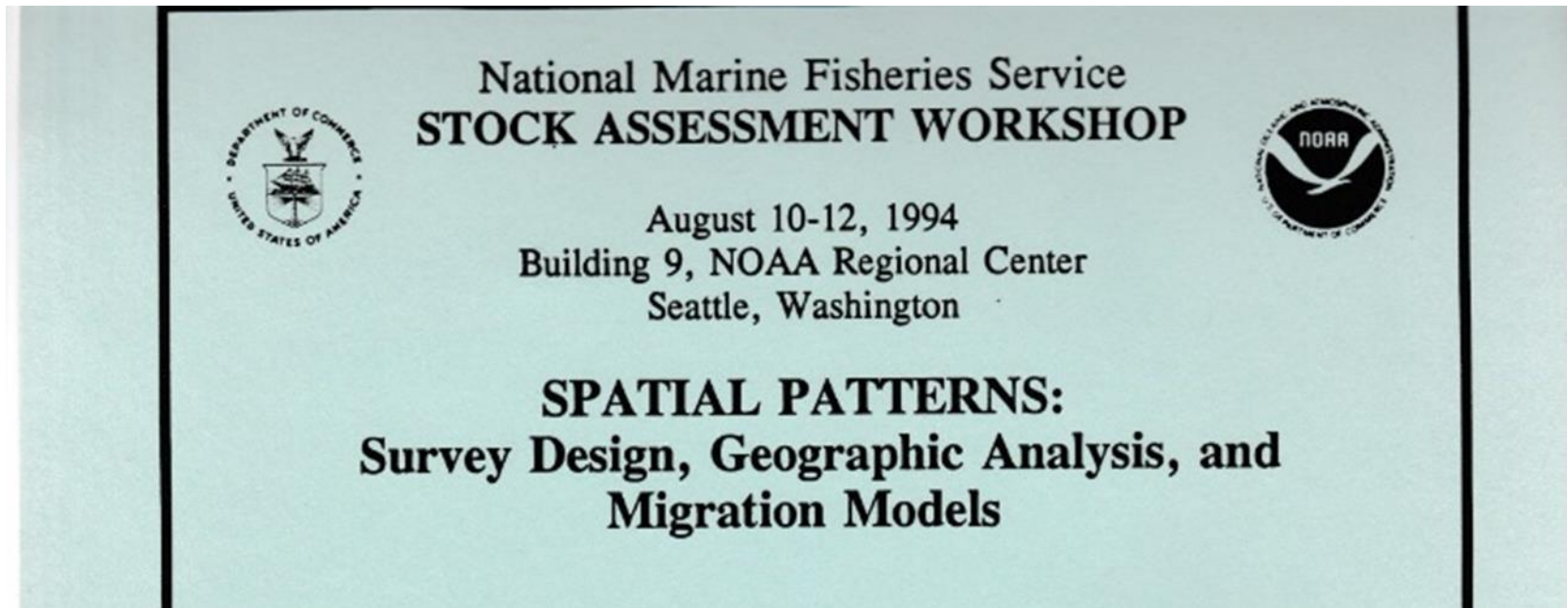
Space: The Final Frontier

LaJolla, CA
Feb 26, 2018



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NSAW #4 – Spatial Patterns - 1994



Why worry about spatial patterns?

1. Different ages of fish typically differ in spatial distribution
2. Fishermen do not fish at random locations across range of stock and may not fish at all in some areas

So a fishery has a characteristic selectivity that depends upon:

- a) Gear and fishing technique used
- b) Distribution of each age of fish across space
- c) Proportion of fishing that occurs in each area

- We measure this selectivity not on first principles;
- Rather it is simply the implied selectivity that would produce the observed fishery age composition from the estimated fish population

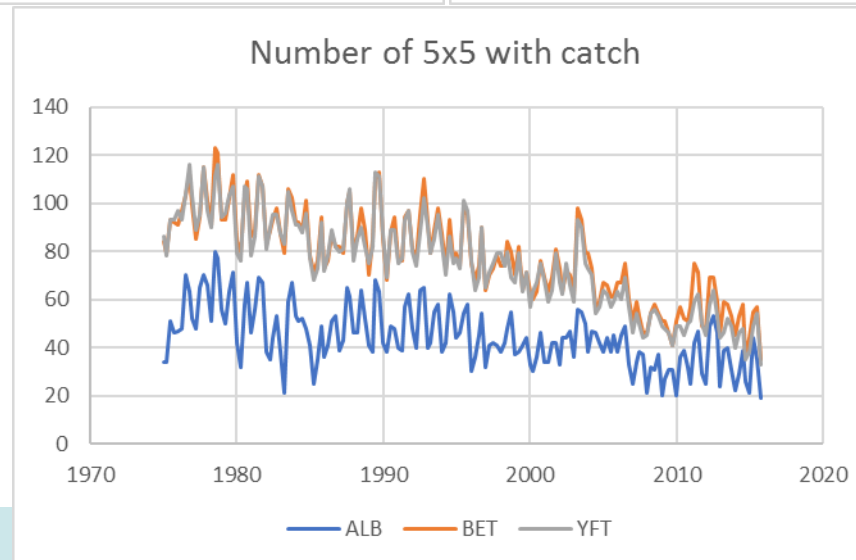
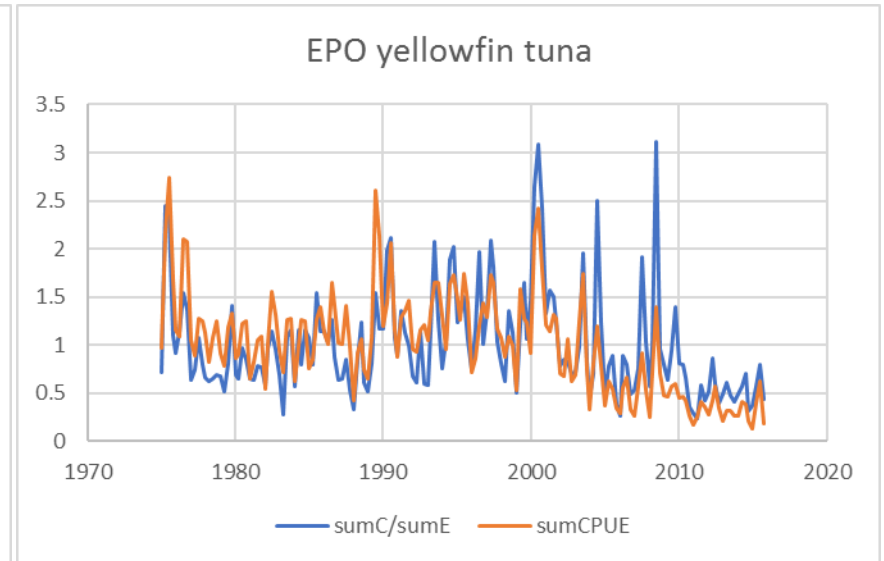
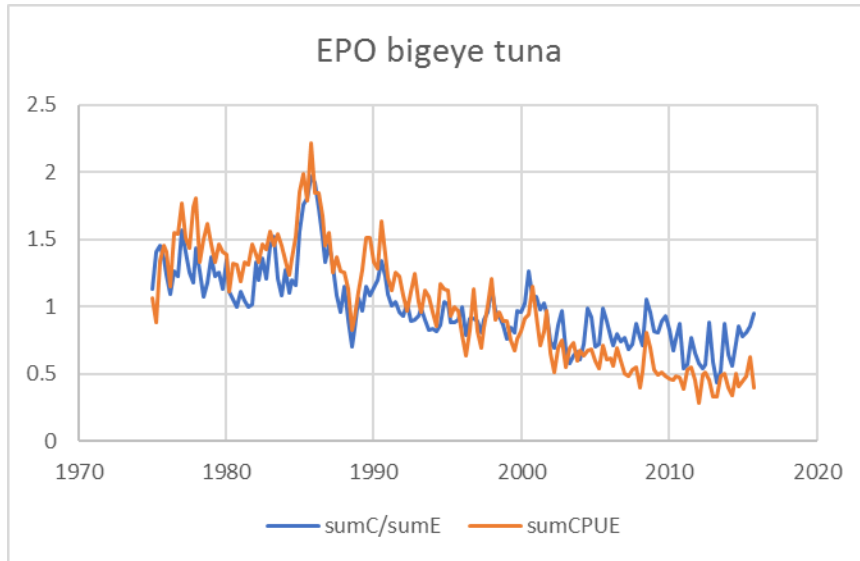
What's the Problem?

- We want to know the selectivity of the fishery to distribute fishing mortality across ages
- AND
- We want to use the catch rate by the fishery as an index of fish stock abundance
 - This index of the population should represent the total abundance of fish across all areas
 - it should not be biased towards catch rates in areas where fishermen choose to fish

Surveys vs Fisheries in Two (or N) Areas

- Total Catch = $CPUE_1 * Effort_1 + CPUE_2 * Effort_2$
- Survey Abundance = $CPUE_1 * Area_1 + CPUE_2 * Area_2$
- Fishery Age Comp = $AgeComp_1 * Effort_1 + AgeComp_2 * Effort_2$
- Survey AgeComp = $AgeComp_1 * Area_1 + AgeComp_2 * Area_2$
- CONCLUDE: Age composition developed to represent fishery catch and to estimate fishery selectivity may not be a good approximation of the age composition of a spatially extensive survey

Example – Tuna CPUE by 5 degree square



Courtesy: M. Maunder

What Do We Need?

1. A way to reprocess the fishery CPUE and age composition data such that the result is, *as if*, the observations were from a survey that covered the range of the stock
2. If the re-processed age composition data are used in the assessment model as the observation paired with the CPUE index, then how do we deal with the inevitable correlation between its observation error and that of the fishery age comp?
3. Areas with no fishing may still contain fish. Should analysis treat it as:
 - Zero to be precautionary?
 - Mean of fished areas, which seems optimistic?
 - Spatially decayed towards zero based on distance from fished areas or other covariates?
 - What this workshop produces?