Introduction to Stock Synthesis

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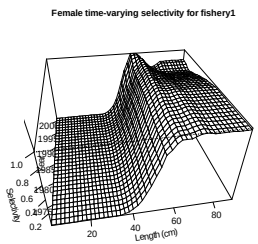
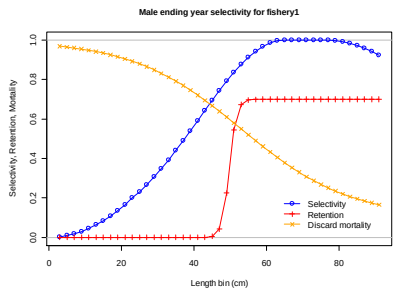
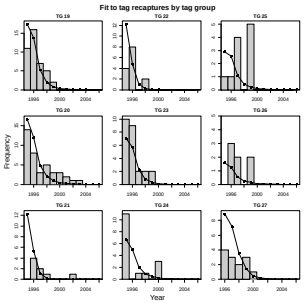
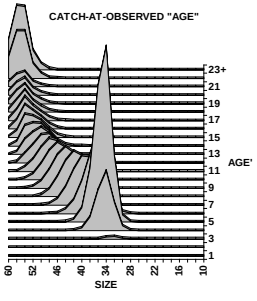
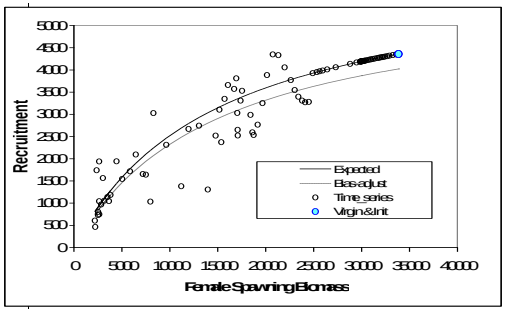


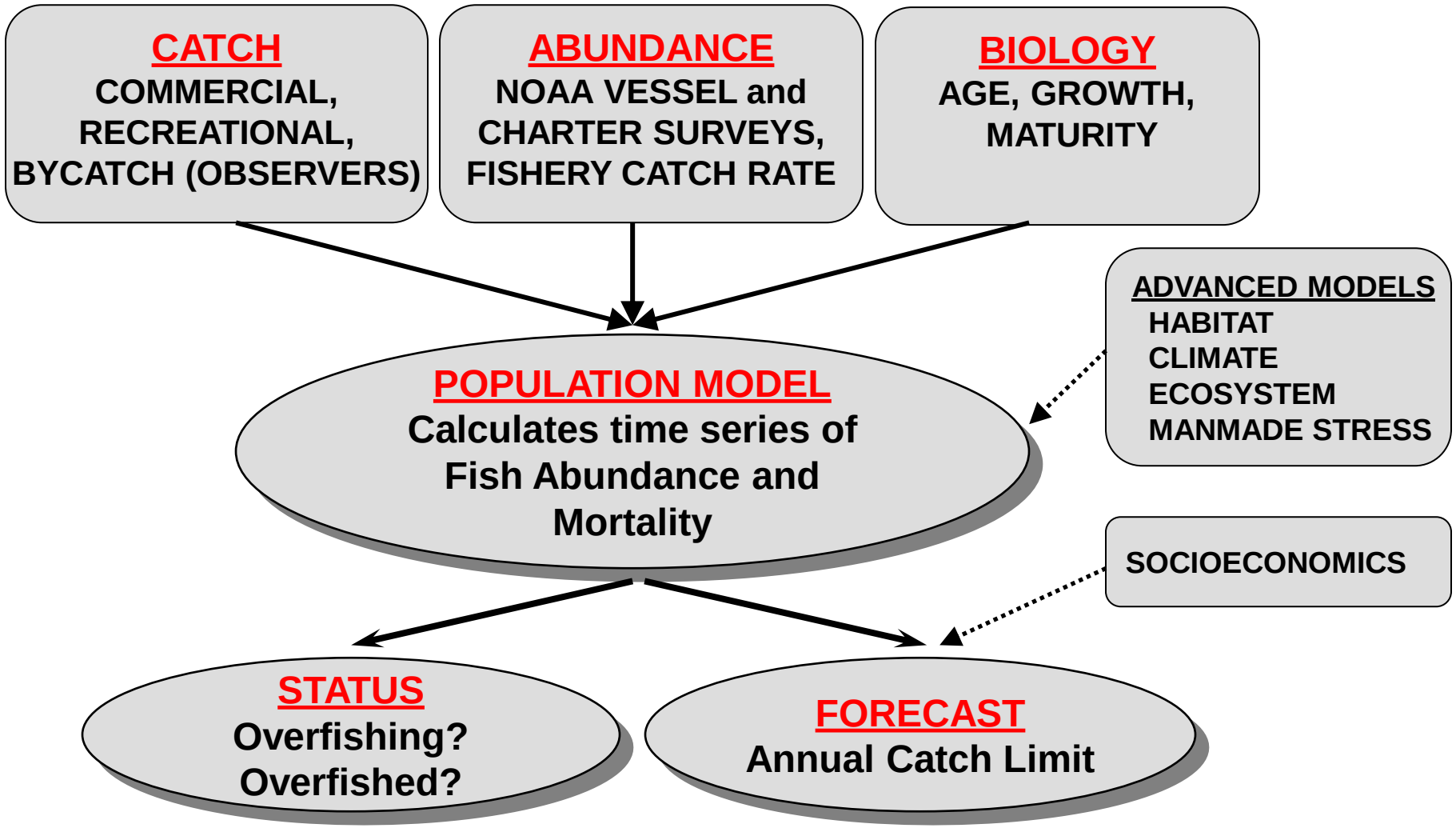








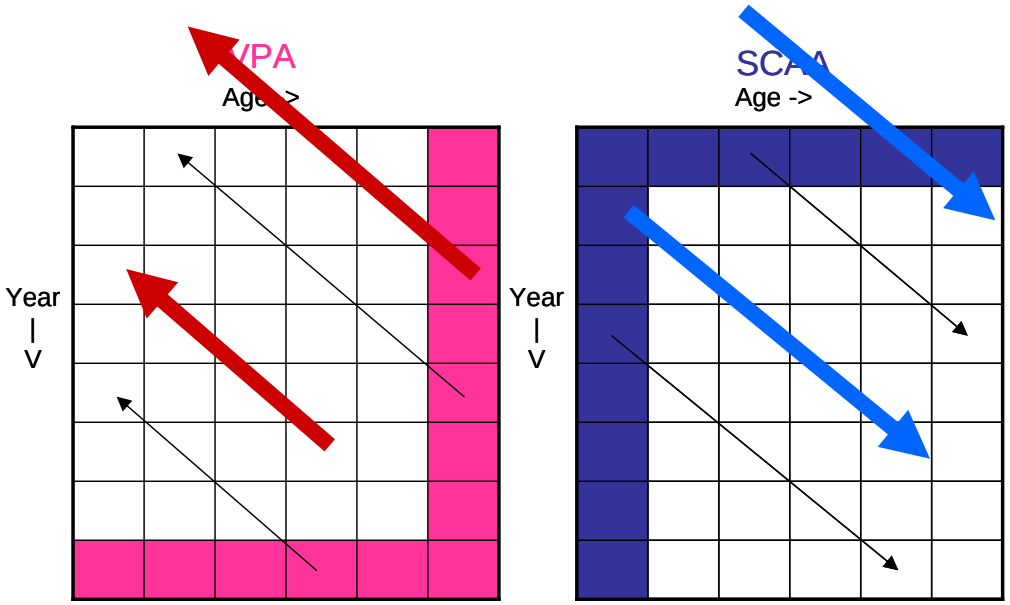
Objectives of stock assessment



Integrated Analysis

- Long time series of quality catch-at-age and index data are often not available. In response we may:
  - Truncate time series to shorter period; losing contrast
  - Create catch-at-age from inadequate data sources; losing sense of imprecision
  - Switch to biomass dynamics model with simple parameters linked to population r & K
- Integrated analysis can:
  - Span data-poor historical periods and current data-rich era
  - Compare its expected values to a wide variety of data types
  - Combine information of different types: survey, ages, tags
  - Link to population dynamics through spawner-recruitment or other density-dependent processes

VPA vs. SCAA



- Calibrated VPA
  - Estimates abundance of the oldest age and current cohorts
  - Calculates abundance back in time
  - Assumes negligible error in the catch at age
  - F-at-age mostly unconstrained
- SCAA
  - Estimates initial abundance at age, recruitments, fishing mortality, selectivity
  - Calculates abundance forward in time
  - Allows error in the catch at age

Bring model to the data

- Don’t transform data to meet rigid model structure
- Do add processes to model to develop expected values for diverse, lightly processed data
  - Improves understanding of processes
  - Allows simultaneous use of more types of data
  - Statistical properties of data are preserved and transferred to variance of final model results

IA – SCAA Comparison

- SCAA is built around the use of fishery catch-at-age
- IA is broader and more flexible concept
  - Biological characteristics of catch can be represented by size composition, weight composition, or data-free (biomass dynamics model)
  - Multiple fleets routinely included
  - Predators can be additional sources of mortality
  - Alternative information sources (tag-recapture)
  - Spatial dynamics and movement
  - Less empirical input (such as body wt-at-age)
  - More modeling of processes (growth, size-selectivity, ageing imprecision)

History of Integrated Analysis

- Fournier & Archibald (1982) provided explicit consideration of errors and use of auxiliary information.
- CAGEAN (Deriso et al 1985) - 10s of parameters
- Stock Synthesis (Methot, 1989) -10s to 100s of parameters; FORTRAN & numerical derivatives
- AD Model Builder (late 1980s) - Computer software to build your own IA, 10s to 1000s of parameters. www.admb-project.org
- MULTIFAN-CL (1998) - 1000s of parameters (age and size, tag recapture, movement)
- ASAP (Legault& Restrepo, 1998). A flexible forward age-structured assessment program.
- Coleraine (Hilborn, Maunder et al, 2000) – comparable to ASAP
- CASAL (Bull et. al 2004; New Zealand) C++ algorithmic stock assessment laboratory); age and size structured, tag recapture, movement
- GADGET (Begley & Howell, 2004) Globally applicable Area-Disaggregated General Ecosystem Toolbox
- Stock Synthesis (Methot, 1989; Methot and Wetzel 2013) – ADMB-based; size & age based model with spatial structure, gender and growth-morphs