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Black sea bass (BSB) Beaufort Assessment Model (BAM)

- Brief review of the BAM
- Preliminary model decisions for customizing BAM to BSB
- If additional model coding required, time out
- Examine preliminary model run and discuss diagnostics/issues

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BAM overview

- Same basic age-structured formulation used in previous SEDAR assessments of Atlantic snapper-grouper species, including BSB and tilefish
- Statistical catch-age model: Likelihood includes multinomial (age and length composition data) and lognormal (landings and index data) components, plus priors and penalty terms
- AD Model Builder for optimization

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BAM overview

- Baranov catch equation
- Age-length conversion matrix
  - Probability matrix that assumes normal distribution of length at age with estimated CV
  - Truncated normal if size limit applies
- Catchability options: constant, linear change, random walk, density dependence
- Selectivity options: logistic, double logistic, joined logistic, double gaussian,
- Beverton-Holt spawner-recruit model, with annual deviations assumed to be distributed lognormal
- MSY-benchmarks from the expected spawner-recruit curve (i.e., in arithmetic space, accounting for bias correction)

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BAM application to BSB

- Assessment time period: 1978 – 2010, same starting year as in previous assessment
- Ages modeled: 0 – 11+, as previously
- Length bins modeled: 10 – 50+ cm, as previously
- Catchability assumed constant, as previously.
  - Time-varying approaches through sensitivity analysis?

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BAM application to BSB: Recruitment

- Recruitment predicted from population fecundity, rather than mature biomass of both sexes
- Prior distribution on standard deviation of recruitment in log space (SigmaR=0.6).
  - Value of 0.6 comes from two different meta-analyses [Beddington & Cooke (1983); Mertz & Myers (1996)]
  - Precedent in stock assessment by Maunder & Deriso (2003) and Smith & Punt (1998)
- Prior on steepness described in SEDAR24-AW-06
  - Meta-analysis of data on marine, demersal, periodic spawners from Rose et al. (2001), Forrest et al. (2010), and considering all prior SEDAR assessments

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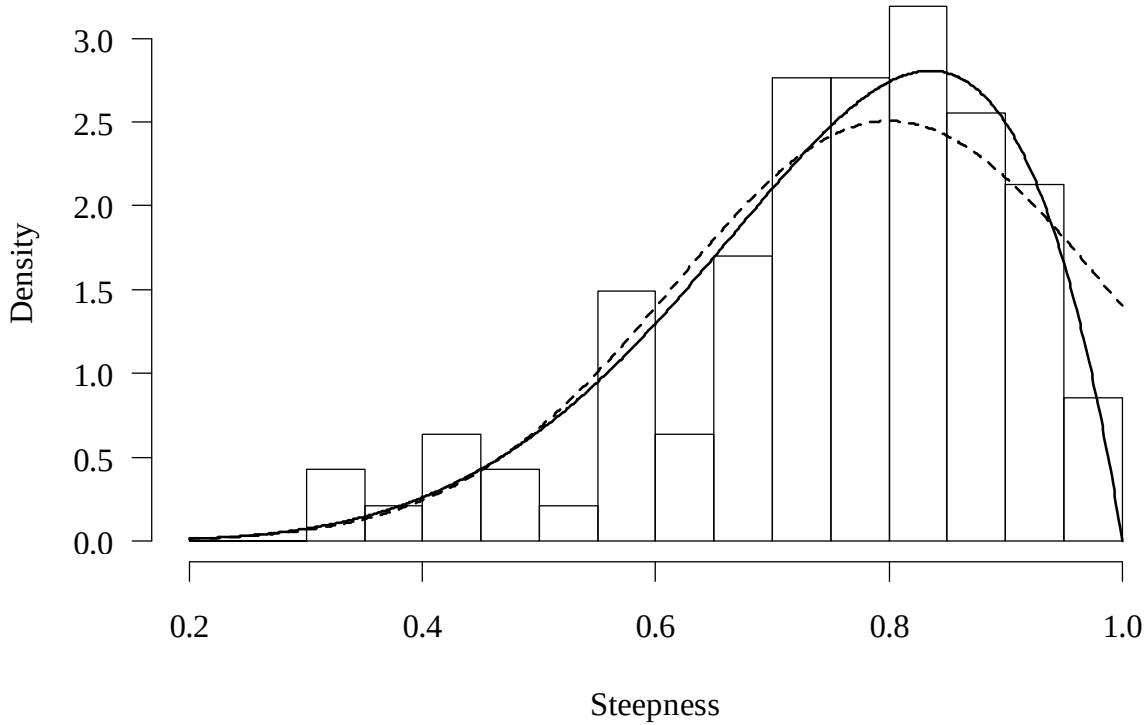
BAM application to BSB: Steepness prior

- Data were fitted with maximum likelihood, using normal and beta distributions

Histogram of steepness values, beta distribution (solid line), normal distribution (dashed line)



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BAM application to BSB: Missing landings or discards

- Issue: Landings/discards not available for the full assessment period (1978-2010)
- Approach: Account for missing landings or discards using fleet-specific geometric mean F
  - MRIP landings 1978-1980: mean F from 1981-1983
  - MRIP discards 1978-1980: mean F from 1981-1983
  - Comm discards 1984-1992: mean F from 1993-1998

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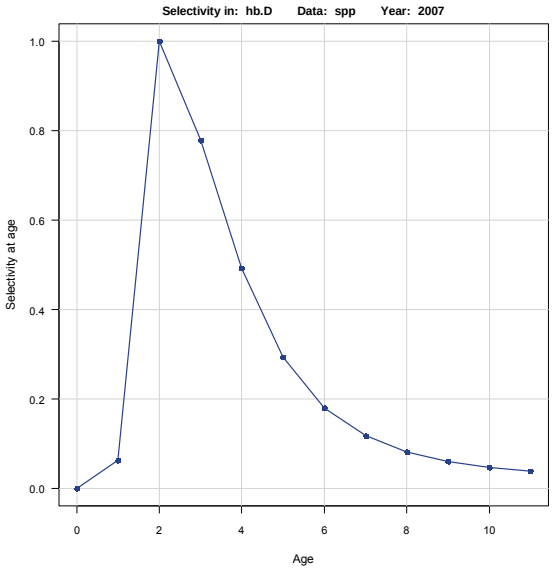
BAM application to BSB: Selectivities of landings

- Modeled using a six-parameter double gaussian function, which can accommodate dome-shaped or flat-topped patterns. Some parameters may be fixed.
- Marmap trap gears: Assumed dome-shaped, as in previous assessment
- Fishery gears: Assumed flat-topped, as previously
  - Comm trawl selectivity mirrors that of comm traps/pots (almost no comp data)
  - MRIP selectivity mirrors headboat selectivity, as previously (few age data and noisy length comps)
- Note: in preliminary runs, selectivity of age-0 fish equals zero. Consider fixing.



BAM application to BSB
Selectivities of recreational discards

- HB discard selex: Estimate two parameters, one for age-0 and one for age-1. Assume full selectivity of age-2. Values of Age-3+ equal the probability of being below the appropriate size limit.
- For choosing age at full selection, examine HB discard length comps and estimated HB landings selectivities in early yrs

- MRIP discard selex mirrors that of HB
- MRIP discard selex in regulation block 1 (no size limit) requires additional assumption. Preliminary assumption: block 1 selex mirrors that of block 2 (small fish based on 8-inch limit)

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BAM application to BSB
Selectivity of commercial discards

- Commerical discard selex mirrors that of HB, with two exceptions:
  - The 12-inch recreational limit never applies
  - The 2009-2010 discard selex accounts for closed seasons, by considering under-sized and legal-sized discards. Applies weighted average of selectivities used for undersized fish (closed and open seasons) and for legal sized fish (open season) from comm handlines and pots

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BAM application to BSB MRIP length comps

- MRIP length comps are very noisy, despite large sample sizes
- Thus, they have been pooled by regulation blocks
- However, if MRIP selectivity mirrors HB selectivity (as in the preliminary configuration), MRIP length comps are not necessary, and may just add noise to the assessment
- Should we include MRIP length comps?

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BAM application to BSB
Initialization of population

- Abundance at age in yr 1 (1978) estimated as follows—
- First, equilibrium age structure (ages 1+) computed given natural mortality and F_{init}. $F_{init}=F_{init.ratio}XF_{init.mean}$
- $F_{init.mean}$ is mean F at age from 1978-1980
- $F_{init.ratio}$ can be fixed (e.g., to 1.0) or estimated
- Currently, $F_{init.ratio}$ estimation is turned ON, with loose prior of 1.0
- Variability from equilibrium estimated with lognormal error, penalized for deviation from 0.

- Initial abundance of age 0 computed as equilibrium recruitment times lognormal recruitment error

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BAM application to BSB
Current F and benchmarks

- MSY-based benchmarks assumed F-weighted selectivities averaged from last two assessment yrs
- Similarly, Fcurrent based on average of last two assessment yrs

- Current SEDAR practice uses last three assessment yrs. Here, last two yrs was used because of commercial closures in 2009-2010.

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BAM application to BSB Headboat index

- Issue: after the data workshop, some headboat captains have claimed that they fabricated their logbooks in “early” years
- How to address this issue?
- AW panelist Steve Cadrin suggested (by email): “we could use the data in an exploratory assessment model, and keep an eye out for diagnostic problems during the period of concern.”
- Preliminary configuration assumes CV=0.3 in 1979-1983, and CV=0.15 thereafter
  - 0.15 was the max CV from Marmap CVT, and 0.3 is greater than annual CV from any other index
  - DW report suggested that HB index CVs estimated from a GLM were unreasonably low, and likely required some adjustment
- We might also consider a sensitivity run, e.g., where the HB index begins in 1984

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BAM application to BSB
Sample sizes of comp data

- Many comp sample sizes are quite large, e.g., many MRIP and HB length comp N>500
- With multinomial likelihoods, large N gives disproportionately heavy weight to those data
- Should we cap N of comp data, e.g., at 200, as in Fournier & Archibald (1984)?
- For now, this option is turned OFF

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Weighting of data components

- Preliminary run assumes no modifications to model component weights
  - Multinomial component weights determined sample size
  - Lognormal component weights determined by CVs
    - Index CVs as given by assessment workshop, except HB index CVs assumed
    - Landings and discards CVs assumed 0.05, to achieve close fits to observed time series
- We might wish to examine iterative re-weighting of components using standard deviations of normalized residuals (SDNRs), as suggested by Chris Francis in SEDAR24 CIE review.

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- Any other issues to discuss prior to examining a model run?

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Meta-analysis (SEDAR24-AW-06) of steepness: data sources

- Rose, KA, JH Cowan Jr., KO Winemiller, RA Myers, R Hilborn. 2001. Compensatory density dependence in fish populations: importance, controversy, understanding and prognosis. Fish and Fisheries 2:293−327.
  - Myers, RA, KG Bowen, and NJ Barrowman. 1999. Maximum reproductive rate of fish at low population sizes. CJFAS 56:2404−2419.
  - Life-history strategies: equilibrium, opportunistic, and **periodic**
  - **Restricted to species that are marine, demersal, and periodic strategists**
- Forrest, RE, MK McAllister, M Dorn, SJD Martell and R Stanley. 2010. Hierarchical Bayesian estimation of productivity and reference points for Pacific rockfishes (*Sebastes* spp.) under alternative assumptions about the stock-recruit function. CJFAS 67:1611−1634.
- All SEDAR assessments (benchmarks and updates) considered
  - Criteria for inclusion: reef-associated finfish, steepness estimated, no prior distribution