Gulf Menhaden Assessment

October 16, 2018
MAC meeting
Outline

• Data used and base run configuration
• Sensitivity analyses
• Monte Carlo bootstrap
• Projections
• Benchmarks
Data included in base run of model

- Commercial reduction landings
- Commercial reduction age compositions
- 2 indices – LA gill net and seine
- LA gill net length compositions
- Life history information
  - Lorenzen M scaled to tagging data
  - Weights at age for population and fishery
  - Fecundity, maturity, sex ratio
Model structure

- 1977-2017 (Jan 1 to Dec 31; annual time step)
- Ages 0 to 4+
- Landings data from 1977-2017
  - Age composition data 1977-2017
- LA gill net index 1988-2017 – July 1
  - Length composition data 1996-2017
- Seine (recruitment) index 1996-2017 – April 1
Model structure

- Fixed parameters
  - Linf, K, t0 – at 1997 to 2017 population parameter values
  - Steepness – at 0.99 based on likelihood profile
  - SD of Recruitment in log space (0.6)
- Age based selectivity parameters
  - Reduction fishery - Age-0 fixed at 0.0, age-2 fixed at 1.0, and ages-3 and 4+ fixed at 0.87
  - Seine index – 1.0 for age-0 and 0.0 for ages-1+
Model structure

- Estimated parameters
  - CV of length at age
  - Log R0 (R0)
  - Dirichlet multinomial likelihood parameters
  - Age based selectivity parameters
    - Age-1 for 1977-1996 and 1997-2017
  - Logistic LA gill net selectivity
  - Catchability for each index
  - Average F
Model structure

- Estimated parameters
  - Annual deviations in $F$
  - Annual deviations in recruitment
  - Deviations in initial age structure
Model structure

• Likelihood distributions
  • Lognormal – indices, landings
  • Dirichlet multinomial – age compositions, length compositions

• Standard deviation of the normalized residuals (SDNR)
  • Upweighted gill net index such that both indices had SDNRs~1.5
Base run

Year

Landings (1000 mt)

Fishery: L.cR  Data: spp
Base run

Index: lagn       Data: spp

Relative abundance (CPUE)

Scaled residual

Year
Base run

Index: seine    Data: spp

Relative abundance (CPUE)

Scaled residual

Year
Base run

Fishery: acomp.cR  Orange: underestimate

Age class

Corr.

Correlation: 0.22  0.17  0.11  0.06  0.02
Base run

Full F Data: spp

Fishing mortality rate

Year

1980 1990 2000 2010
Base run

Recruitment (billion fish)

Year

1980 1990 2000 2010

0 50 100 150 200

Recruitment Data: spp
Base run

Spawning biomass   Data: spp

Spawning stock (billions of eggs)

Year

1980  1990  2000  2010
Base run

Biomass Data: spp

Total biomass (1000s mt)

Year

1980 1990 2000 2010

0 500 1000 1500 2000 2500 3000
Outline

• Data used and base run configuration
• Sensitivity analyses
• Monte Carlo bootstrap
• Projections
• Benchmarks
Sensitivity analyses

• Selectivity of cR
  • Flat topped (age-3 and -4 set to 1.0)
  • Age-3 and -4 set at 0.73 (based on like prof)
  • Age-3 and -4 each at the midpoint of the likelihood prof
Sensitivity analyses

• Low and High fecundity vectors
• Low and high
• Life history
  • 1977-1996 growth cover 1977-2107 years
  • 1997-2017 growth cover 1977-2017 years
Sensitivity analyses

• Exclude seine index
• Exclude LA gill net index and composition data
• Include MS/AL gill net index and composition data
Sensitivity analyses

• Start year of model = 1948
• Start year of model = 1964
• Start year of model = 1996
The graph shows the Full F values over time from 1950 to 2010. Different lines represent the Full F values for different start years:

- **Start year 1948** (black line)
- **Start year 1964** (red line)
- **Base run** (green line)
- **Start year 1996** (blue line)

The graph illustrates the fluctuations in Full F values over the years, with each line representing a different starting year for the data collection or simulation.
Sensitivity analyses

- Ageing error (2) – Ethel, Amanda/Kasea
- Steepness – 0.75
- Weight of 1.0, 3.0, and 5.0 on gill net index likelihood
Sensitivity analyses

- Retrospective
The graph illustrates the fecundity (ova) over the years from 1980 to 2010. The data is categorized into various retrospective years (2012, 2013, 2014, 2015, and 2016) and a base run. The graph shows fluctuations in fecundity with peaks and troughs across the years. The years 1990 and 2010 are highlighted, showing significant changes in fecundity.
Outline

- Data used and base run configuration
- Sensitivity analyses
- Monte Carlo bootstrap
- Projections
- Benchmarks
Monte Carlo bootstrap configuration

- Include uncertainty in:
  - Landings
  - Indices
  - Composition data
  - Age-3 and 4 cR sel
    - uniform [0.68, 0.95]
  - M
    - M at age-2 [0.69, 1.51], scaled Lorenzen
Monte Carlo bootstrap

Graph showing time series data from 1980 to 2010 with shaded areas indicating variability.
Monte Carlo bootstrap
Monte Carlo bootstrap
Monte Carlo bootstrap
Outline

• Data used and base run configuration
• Sensitivity analyses
• Monte Carlo bootstrap
• Projections
• Benchmarks
Projections

• Project 3 years
• Use uncertainty as described in MCB runs
• Project F at F=0.75M
• Recruitment
  • Reflecting recent recruitment dynamics
    • Use devs and median from 1996 to 2017 (seine index)
Projections

Projection: Fecundity

Projection: Recruits

Projection: Fishing mortality

Projection: Landings

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Page 60
Outline

• Data used and base run configuration
• Sensitivity analyses
• Monte Carlo bootstrap
• Projections
• Benchmarks
Benchmarks

- MSY based benchmarks are not estimable
- FMP has SPR based benchmarks
  - $F_{30\%}$, $F_{35\%}$, $SSB_{30\%}$, and $SSB_{35\%}$
  - Under these options, overfishing is not occurring and not overfished
- But, value for threshold is maximum $F$ value explored, or $> 10.0$
Benchmarks
Benchmarks
Benchmarks

• Assessment panel discussed
  • Historical perspective
    • Target close to recent years
    • Threshold during higher years in 1980s and 1990s
  • Natural mortality based
    • Target as 75% of M
    • Threshold as M
    • M as geometric mean of ages-0 to -2
Benchmarks

• F threshold and target
  • 1.32 and 0.99
  • Associated SSB is 3212045 and 3408847 (less than 1 SD apart)
• TAC is 717,000 and 623,000

• SSB threshold and target
  • 25% and 50% of SSB when F=0
  • 1244281 and 2488562
  • Associated F is > 10 and 4.71
Stock status

- Consistent status across base run, sensitivities, and most MCBs
  - Overfishing is not occurring
  - Not overfished