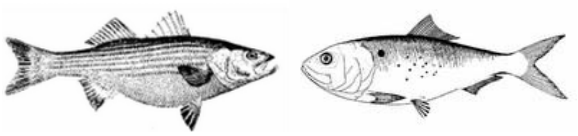
For information
Contact: Villy Christensen
Marta Coll
Jeroen Steenbeek

Office hours:
drop in (until further notice)

Lab 3 Exploiting forage species: does menhaden fishery impact the striped bass

Fish 501, UBC Fisheries Centre

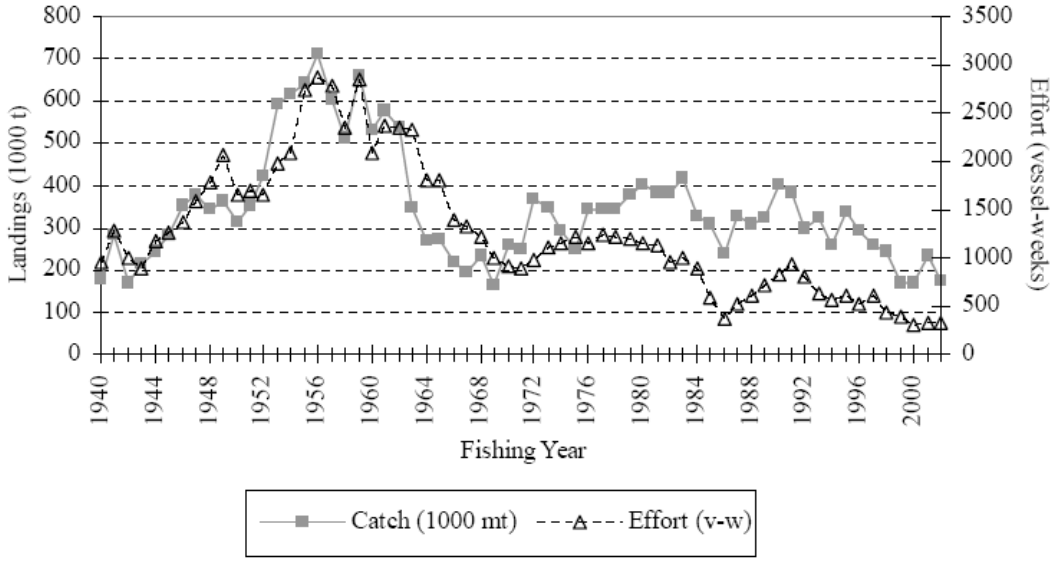


Background

Fishing for menhaden has since colonial times been one of the largest fisheries on the US east coast. The menhaden resource has declined considerably over the last century, and fishing is now conducted for reduction purposes and to supply bait, e.g., for blue crab traps. There is also an economically important sports fishery for striped bass, a piscivore that relies strongly on menhaden as a forage species.

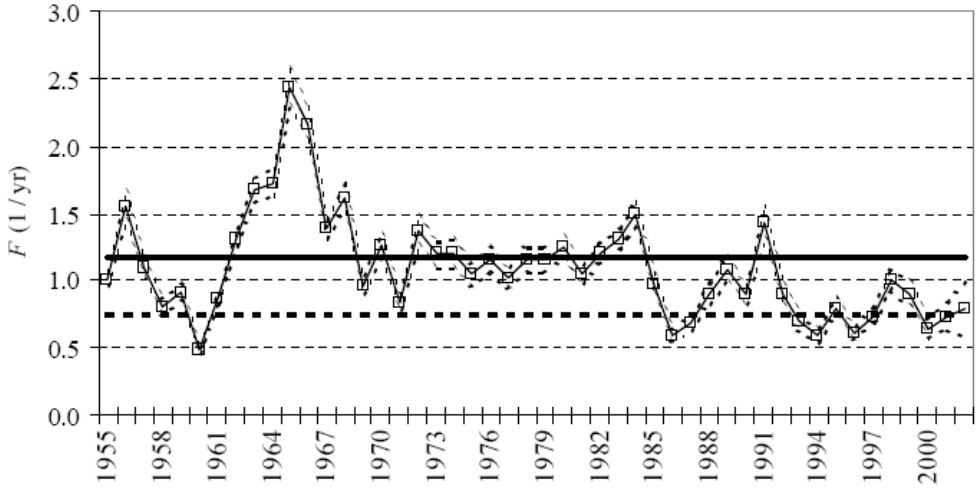
The landings of menhaden peaked in the 1950s with a high of 712,000 t, and are currently at a level of some 170,000 t. The menhaden fishery is being managed by the Atlantic States Marine Fishery Commission, based on single species VPA, forward-projecting statistical age-structured models as well as multispecies VPA's. The assessments conclude that the stock is healthy and not overfished. Current F's are around 0.6 $_{year}^{-1}$, while F target is 0.75 and F threshold 1.2. Spawning stock biomass is around 90 kt, with SSB target of 37 kt, and a threshold of 21 kt.

Figure 5.1 Landings and nominal effort from the reduction purse seine fishery for Atlantic menhaden, 1955-2002.



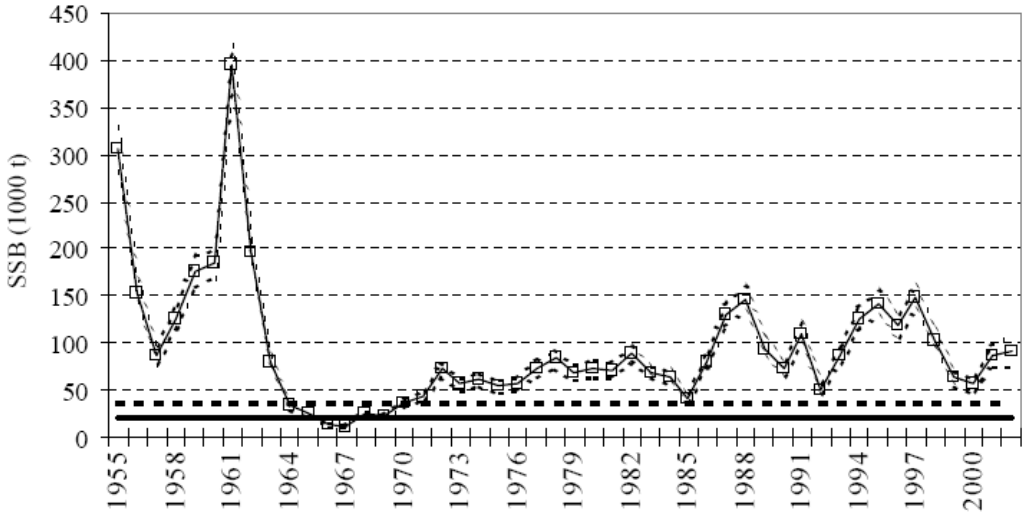
Source: (ASMFC, 2004)

Figure 9.1 Atlantic menhaden fishing mortality rate, *F* (ages 2+) plus/minus 2 standard errors from Ricker model. Horizontal lines represent target (dashed) and threshold (solid).



Source: (ASMFC, 2004)

Figure 9.3. Atlantic menhaden spawning stock biomass (SSB) plus/minus 2 standard errors from Ricker model. Horizontal lines represent target (dashed) and threshold (solid) from Amendment 1.



Source: (ASMFC, 2004)

Meanwhile, striped bass has been increasing in abundance since 1982 to the level where it is now considered restored to its historical abundance. A major prey of striped bass, menhaden, is however far from their historical abundance, and there is growing concern that striped bass may be starving due to lack of menhaden, see Uphoff (2003). This has resulted in a growing call for a halt to the menhaden exploitation, notably by sport fisher representatives.

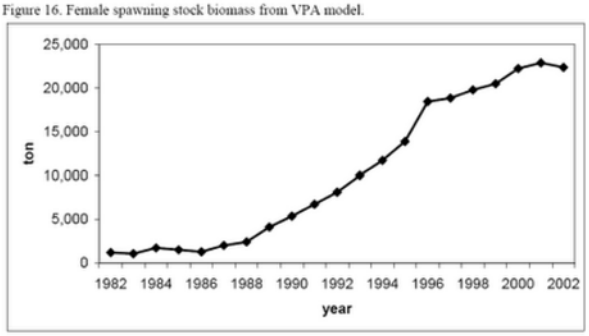
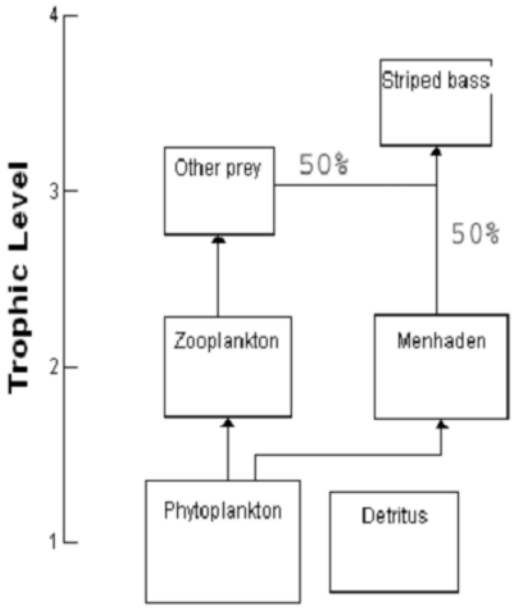


Figure. Female SSB for striped bass. Source: (ASMFC, 2003)

Modeling

We design a simple ecosystem model to examine striped bass – menhaden interactions and the potential impacts of a menhaden fishery on the striped bass population and fishery.



Biomasses: striped bass 4, menhaden 30, other prey 4, zooplankton 10, phytoplankton 25, detritus 10.
P/B: striped bass 0.35, menhaden 1.2, other prey 2.3, zooplankton 25, phytoplankton 150.
Q/B: striped bass 2.3, menhaden 8, other prey 13, zooplankton 85
Diets: as on flowchart
Landings (two fleets): Menhaden boats 18, Striped bass fishers 1.

Set the runtime in Ecosim to 70 years. The model represents a 1950-scenario, so try to mimic the build-up of the menhaden fishery as shown in the figures above. As you do this, notice what impact the build-up have on striped bass.

There is no F-series shown for striped bass but assume that it increased in the first 20 years, remained high in the next 20, for then to be reduced to a low-level after a few years, and gradually to increase again.

What happens if you change the menhaden fishing pressure?
How sensitive are the findings to

- Assumptions about the importance of menhaden in striped bass diet? How is it important? Why is this important?
- Foraging arena assumptions (vulnerabilities on 'flow control', feeding time adjustment)?

Try reading a time series file ("Run info" tab) with menhaden and striped bass biomasses and F's, (available at this link: ftp://ftp.fisheries.ubc.ca/Ecopath/Fish501/Lab3.csv), and examine the questions above again. You may have to change the vulnerability setting for the menhaden-phytoplankton interaction.

Can you get striped bass to increase in recent years as indicated by current assessments, as well as getting them to increase to a level that corresponds to historic abundance?
The target and threshold biomasses for menhaden indicated on Figure 9.3 above are set based on stock assessments. How do you think they would be impacted (higher/lower) if they were based on an ecosystem-based approach to management instead? Why?

References:

ASMFC, 2003. 2003 Atlantic striped bass advisory report. ASFMF Striped Bass Technical Committee Report 2003-03. Atlantic States Marine Fisheries Commission, 82 pp.
ASMFC, 2004. Atlantic menhaden stock assessment report for peer review. Stock Assessment Report No. 04-01 (Supplement). Atlantic States Marine Fisheries Commission, 145 pp
Uphoff, J. H. 2003. Predator-prey analysis of striped bass and Atlantic menhaden in upper Chesapeake Bay. Fisheries Manage, 10(5):313-322