The 2015 stock assessment of Common Snook, *Centropomus undecimalis*

Robert Muller, Alexis Trotter, and Philip Stephens

13 January 2016

Florida Fish and Wildlife Conservation Commission

Fish and Wildlife Research Institute

Orlando, FL

Data sources

Life History

Stock identification	Tringali et al. 2008
Cold kills	Stevens et al. In review
Spawning	Lowerre-Barbieri et al. 2014, Young 2014
Age-specific natural mortality	Lorenzen 2005
Growth, maturity morphometrics,	Taylor et al. 2000

Fishery

Landings and releases	MRFSS/MRIP
Lengths of fish landed	Fish Bio Snook samplers , MRFSS/MRIP and Everglades National Park (Gulf), anglers logbooks
Lengths of released fish	Angler logbooks
Ages of landed fish	Fish Bio Snook samplers
Ages of fish in population	FIM samplers
Abundance indices	FIM, MRFSS, ENP on Gulf

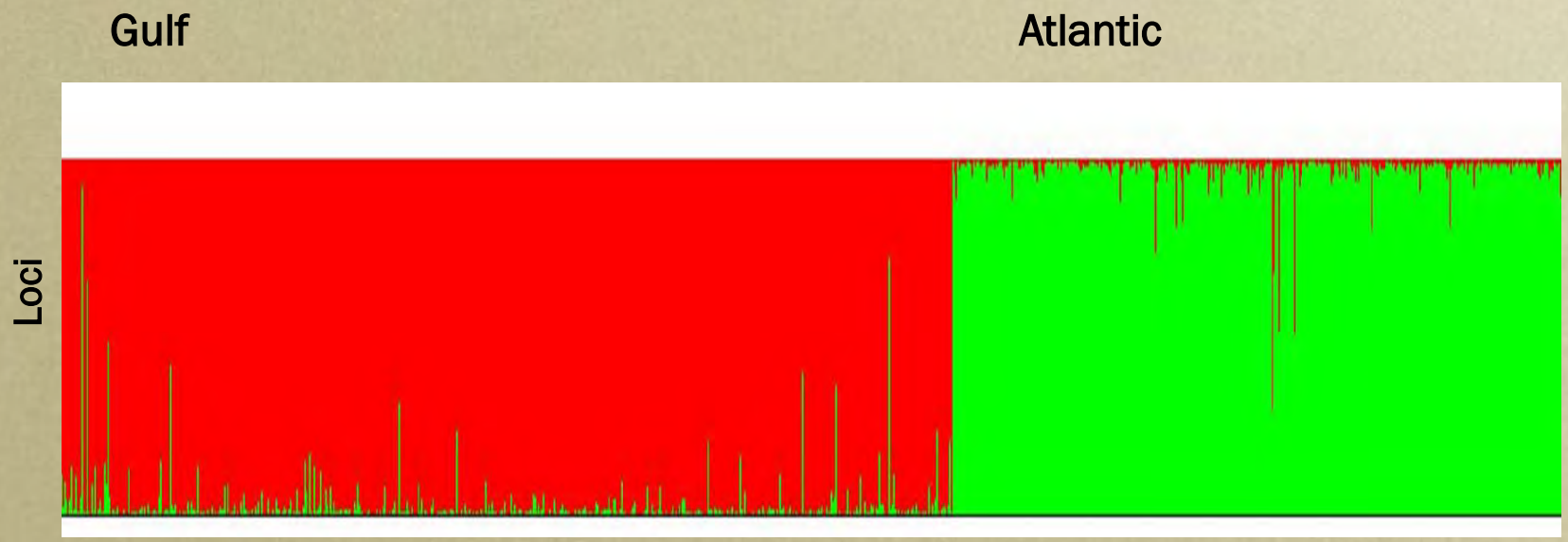
Environmental factors

Red Tide cell counts	FWRI Harmful Algal Bloom program
Temperature	National Buoy Data Center (Venice pier)

Stock identification

Microsatellite DNA analysis with 24 loci of Florida snook collected from both coasts (total n = 1,396 fish)

Tringali et al. (2008) found two highly structured groups with individuals being faithfully assigned to the Atlantic or Gulf stock



Reviews in Fisheries Science:116:111-116

Fig. 2.2

Age - growth

FWRI Fishery independent sampling

Length is not a good indicator of age

6 yr old Common Snook

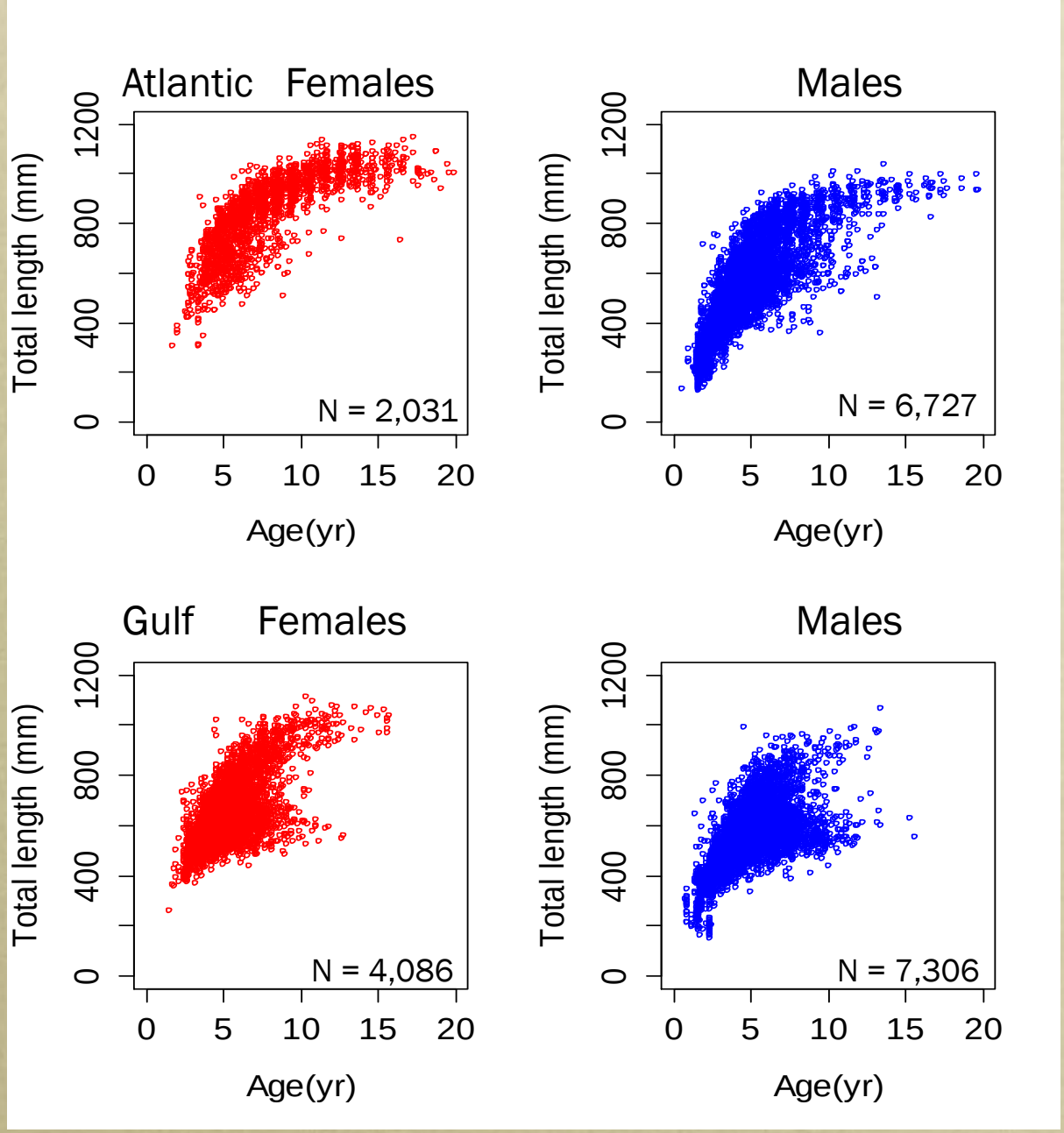
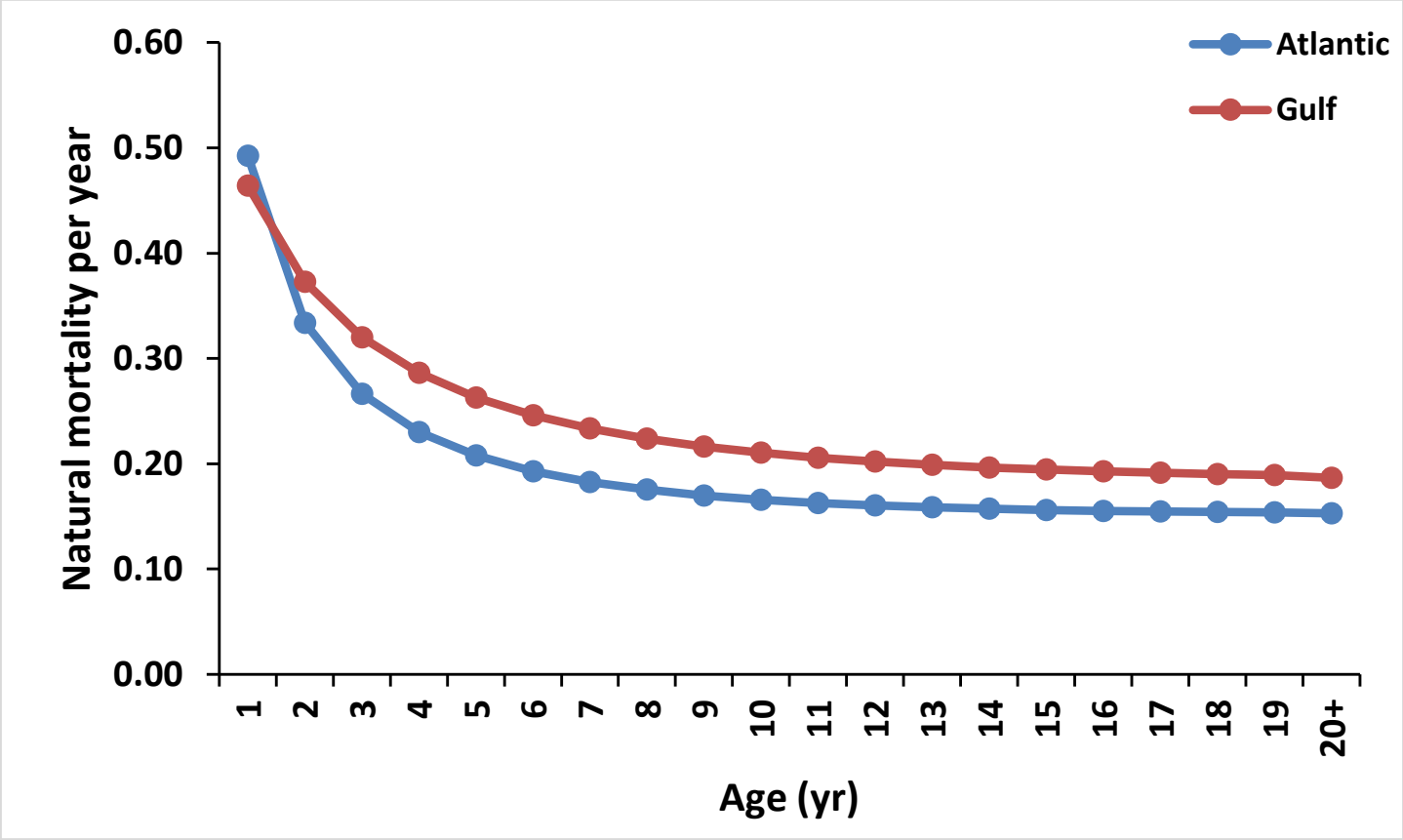


Fig. 2.6

Natural mortality

Age-specific natural mortality rates



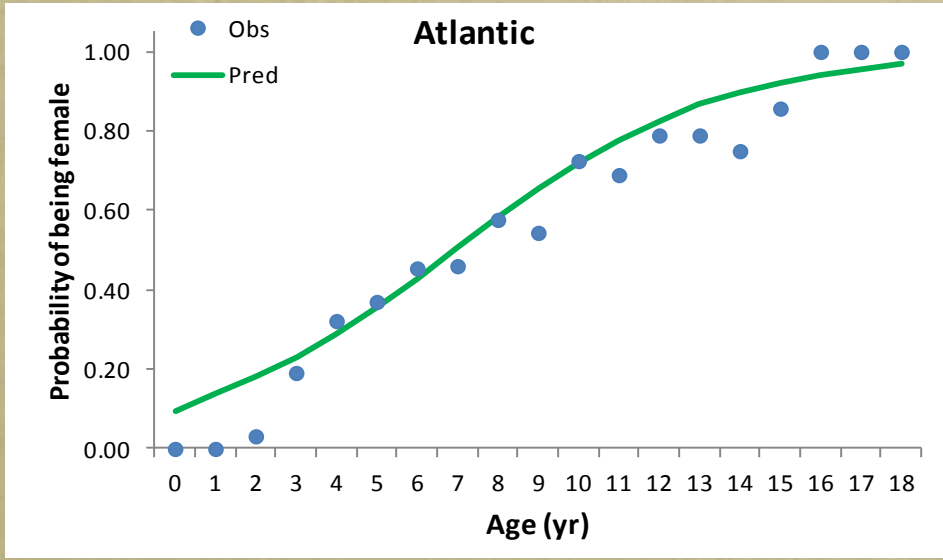
The higher natural mortality for the Gulf coast reflects more cold kills plus red tides.

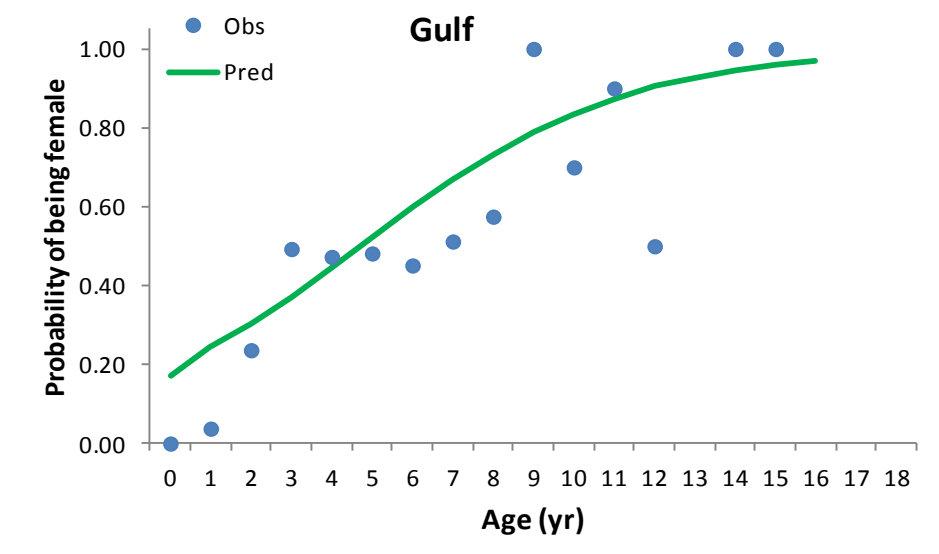
Maturity

Snook are protandrous hermaphrodites (fish hatch as males and then most males transition to females).

Spawning occurs in May-September depending upon coast in inlets, on beaches, and nearshore.

Because females come from mature males, the sex ratio by age can be used as the female maturity schedule (Taylor et al. 2000); however, recent acoustic tagging has revealed that snook may remain in the rivers and skip spawning (Trotter et al. 2012, Young et al. 2014).



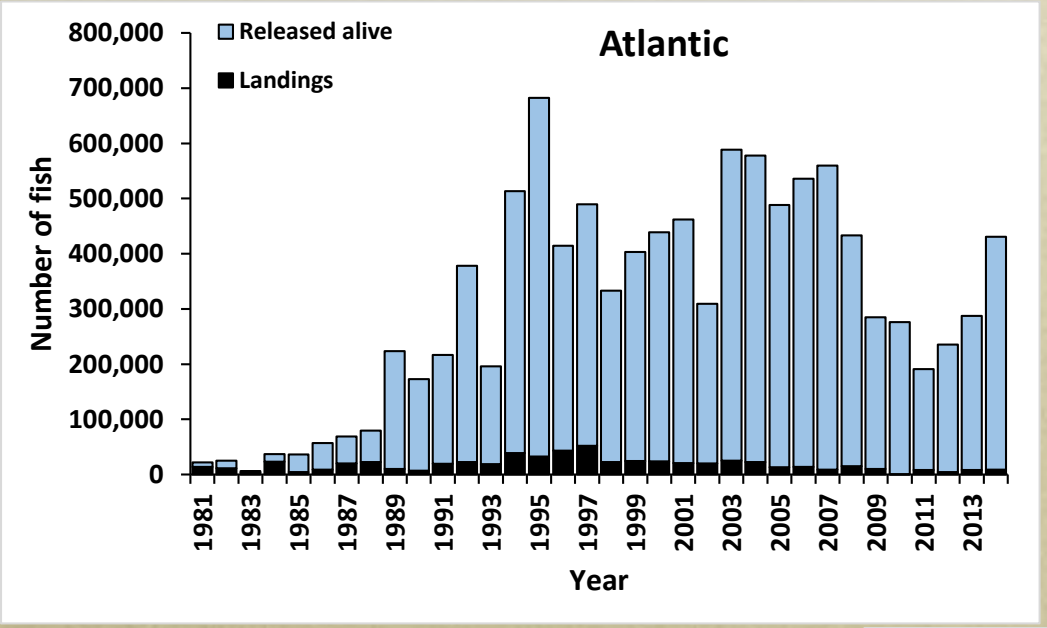


$$P = e^{-1.578-0.705Coast+0.307Age} / (1 + e^{-1.578-0.705Coast+0.307Age})$$

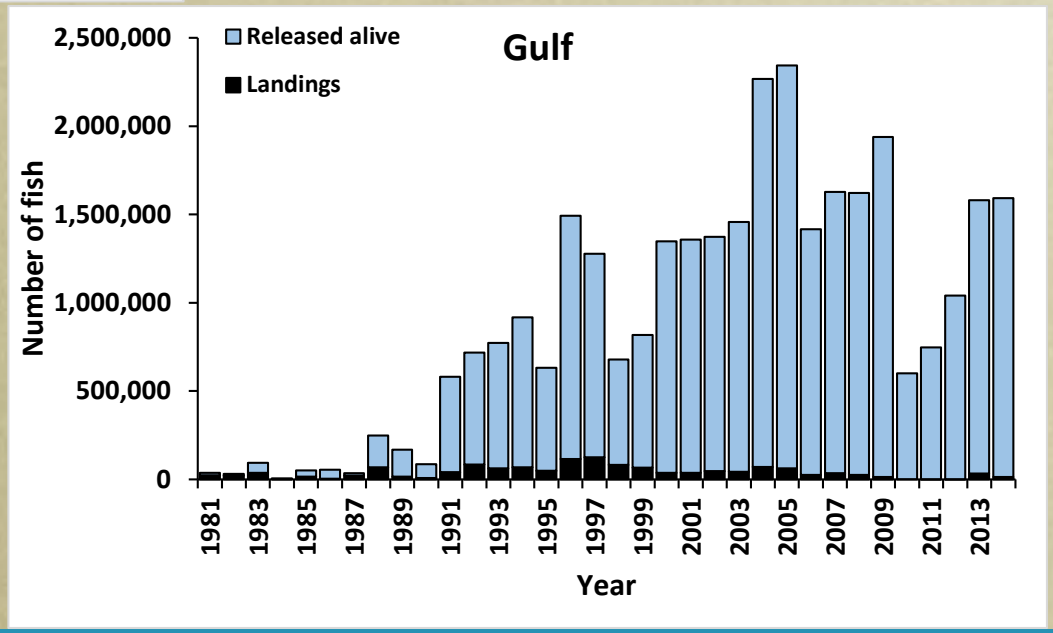
where Atlantic coast = 1 and Gulf coast= 0

Fishery Bulletin 98:612-624, Trans Am Fish Soc 141:1016-1025, MEPS 505:227-240

Landings and releases



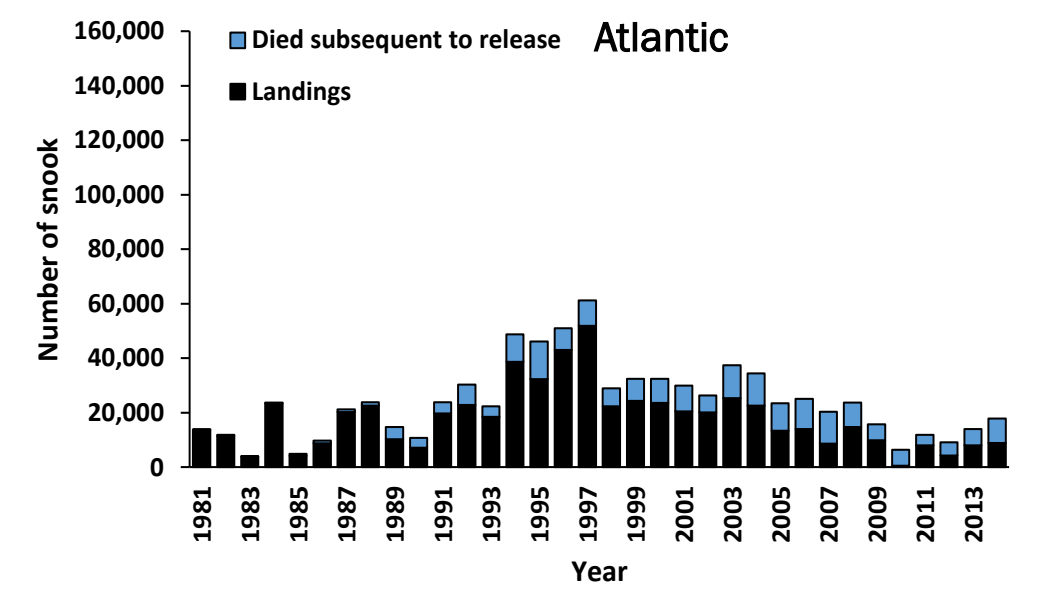
On either coast, most of the snook are released.



Note: the vertical axes differ by coast.

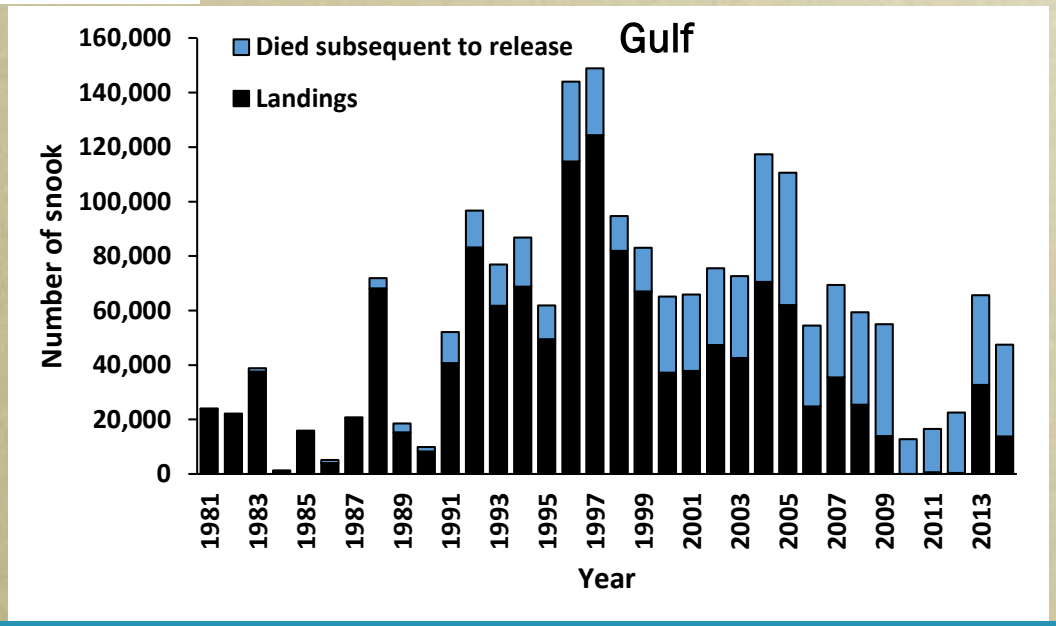
Fig. 3.2.3

Total harvest



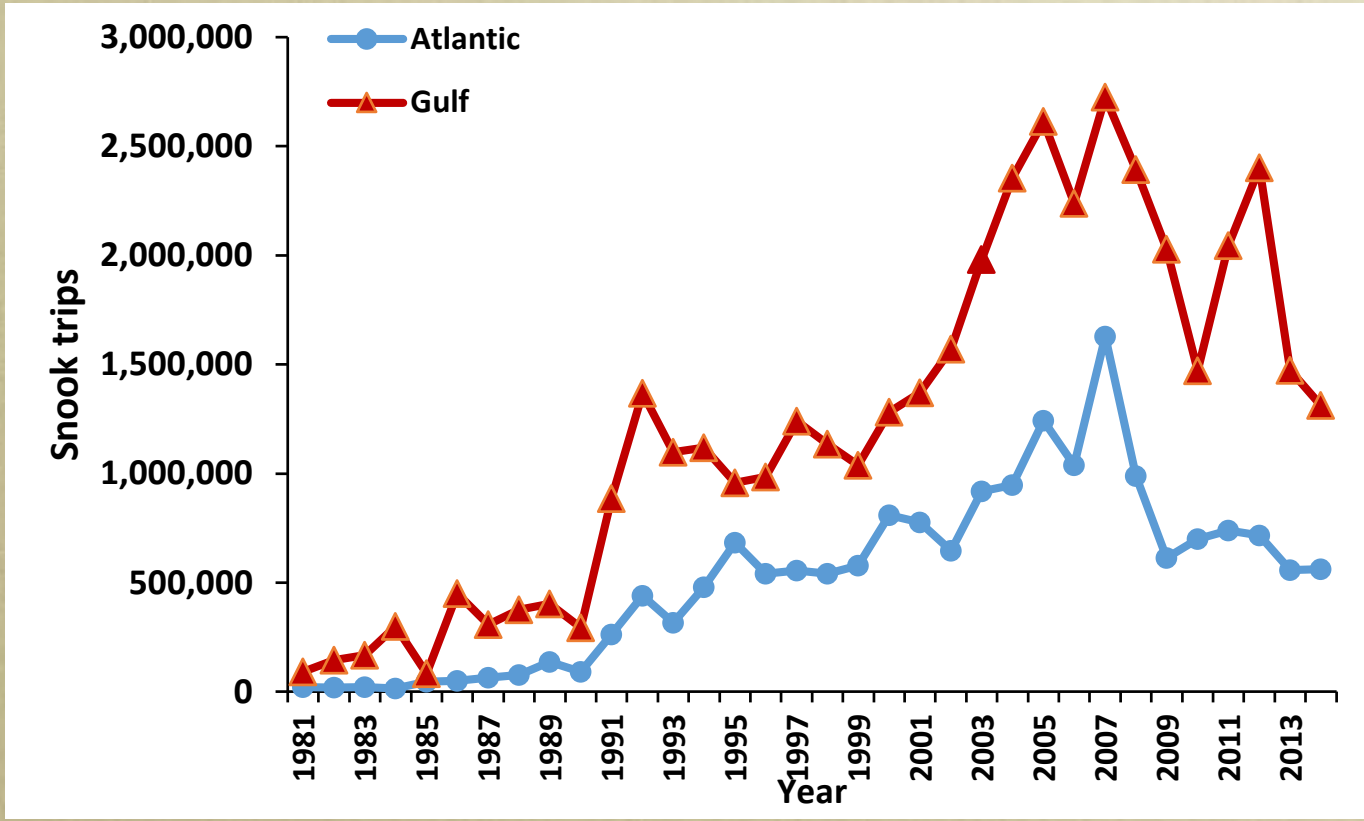
A series of 23 experiments estimated the release mortality rate at 2.13% (Taylor et al. 2001)

Total harvest = Landings + 2.13% * Releases



North American Journal of Fisheries Management 21:70-75 Fig. 3.2.4

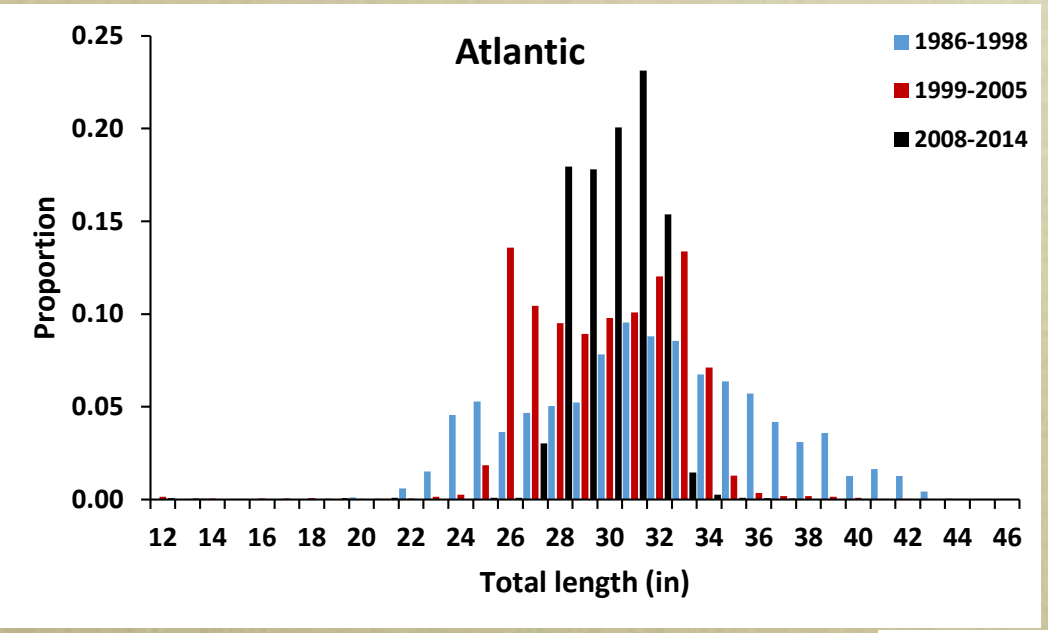
Fishing effort



Source: National Marine Fisheries Service, Marine Recreational Information Program (MRFSS/MRIP)

Fig. 3.3.1a

Sizes of retained fish



Lengths of snook landed in recent years under minimum size limit (1986-1998, 24 in one fish greater than 34 in) and two slot limits (1999-06, 26-34 in and 2008-2014, 28-32 in on the Atlantic coast and 28-33 in on the Gulf coast).

Source: FWRI Snook program and MRFSS/MRIP

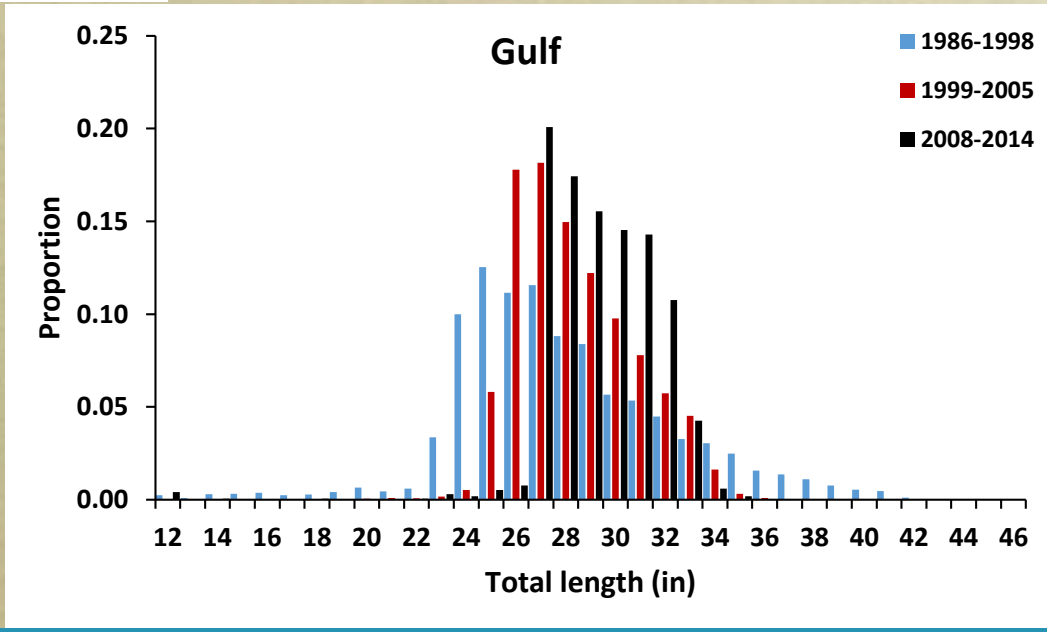
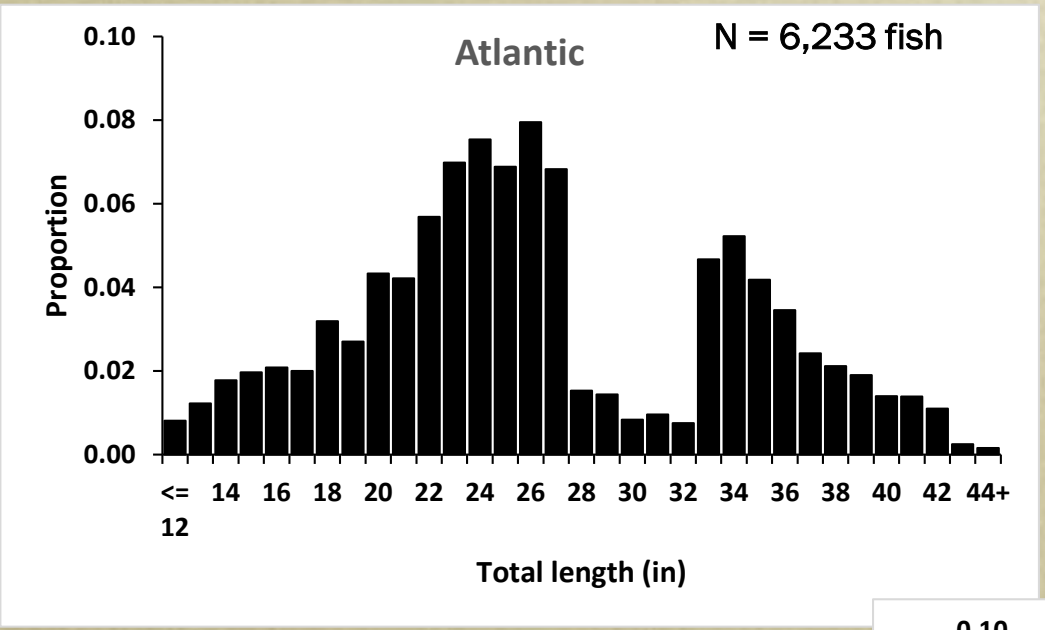
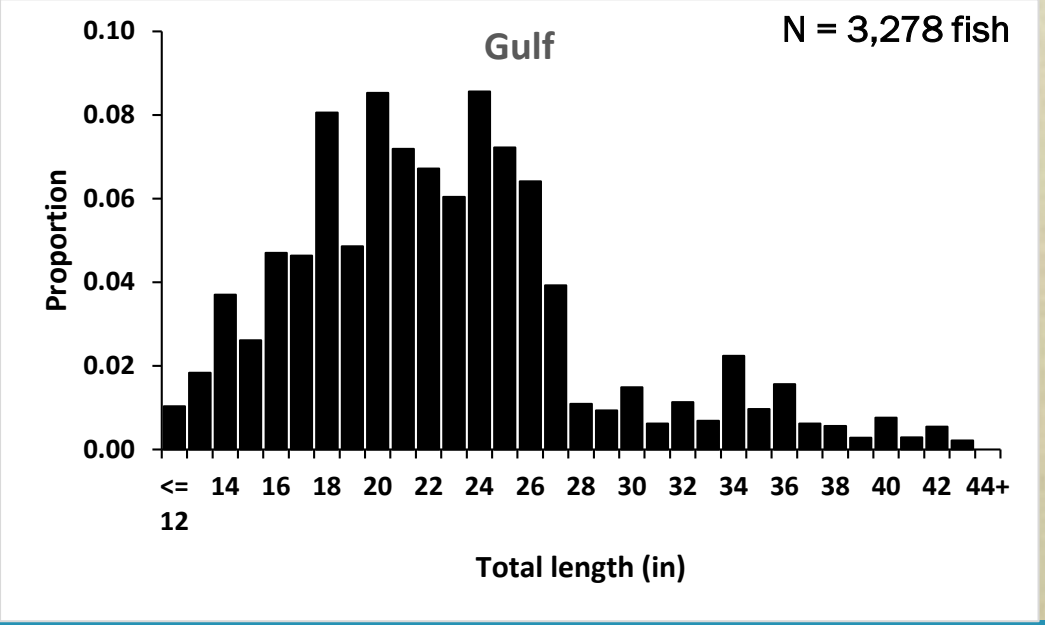


Fig. 3.4.1

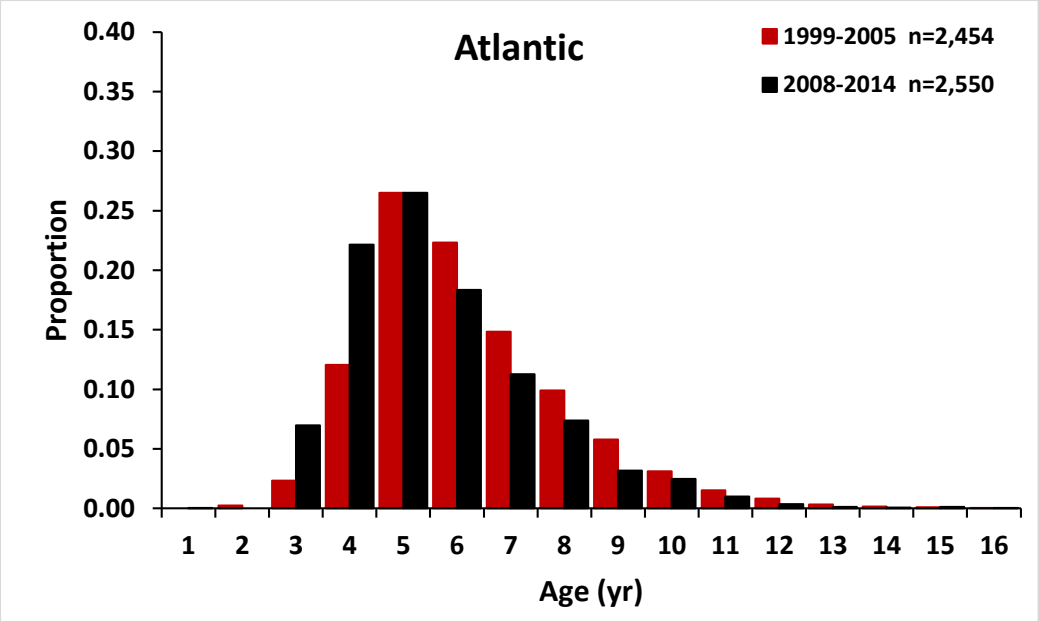
Sizes of released fish



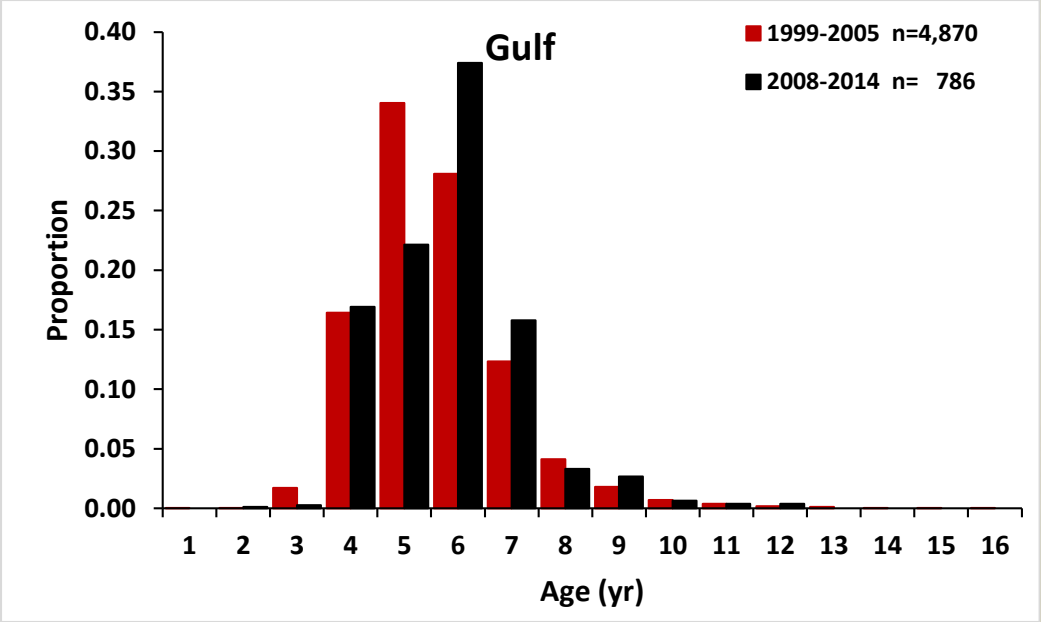
Angler logbooks contain the numbers and the lengths of the fish caught and whether the fish was kept or released. In 2010, the Snook and Gamefish Foundation initiated its Angler Action online program for anglers to provide similar information regarding their trips. The proportions shown here are 2008-2014 average lengths.



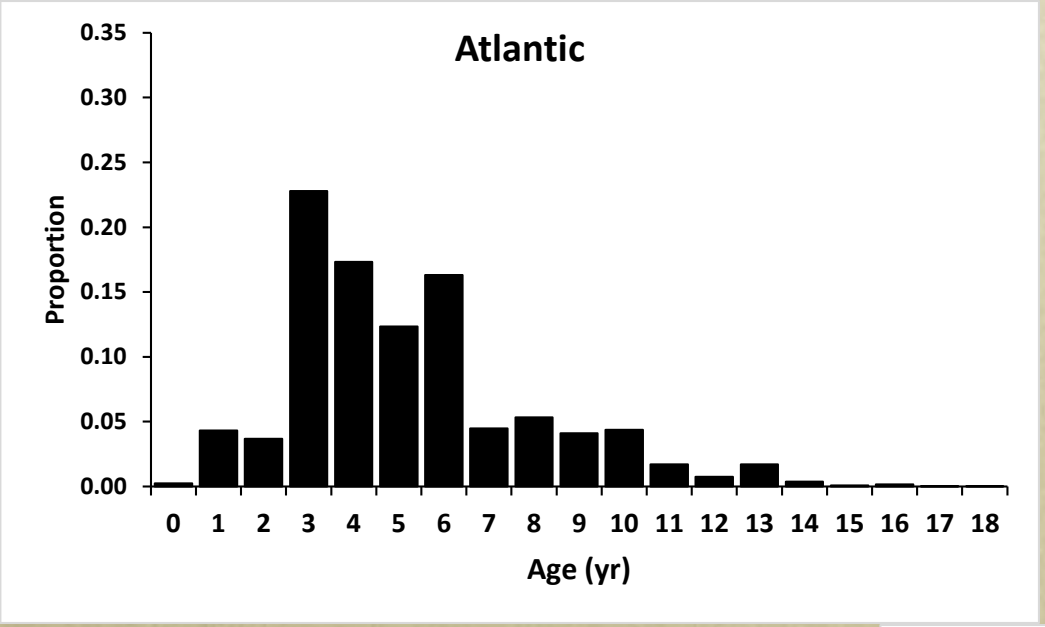
Ages of retained fish



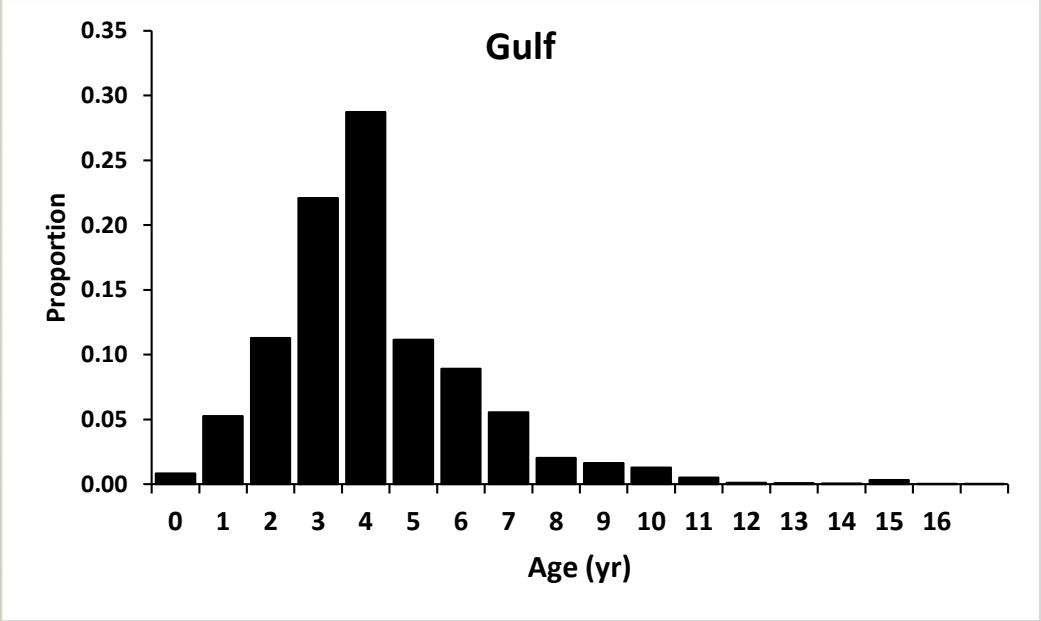
Ages of snook sampled in recent years under two slot limits (1999-05, 26-34 in and 2008-2014, 28-32 in. on the Atlantic coast and 28-33 in on the Gulf coast).



Ages of released fish

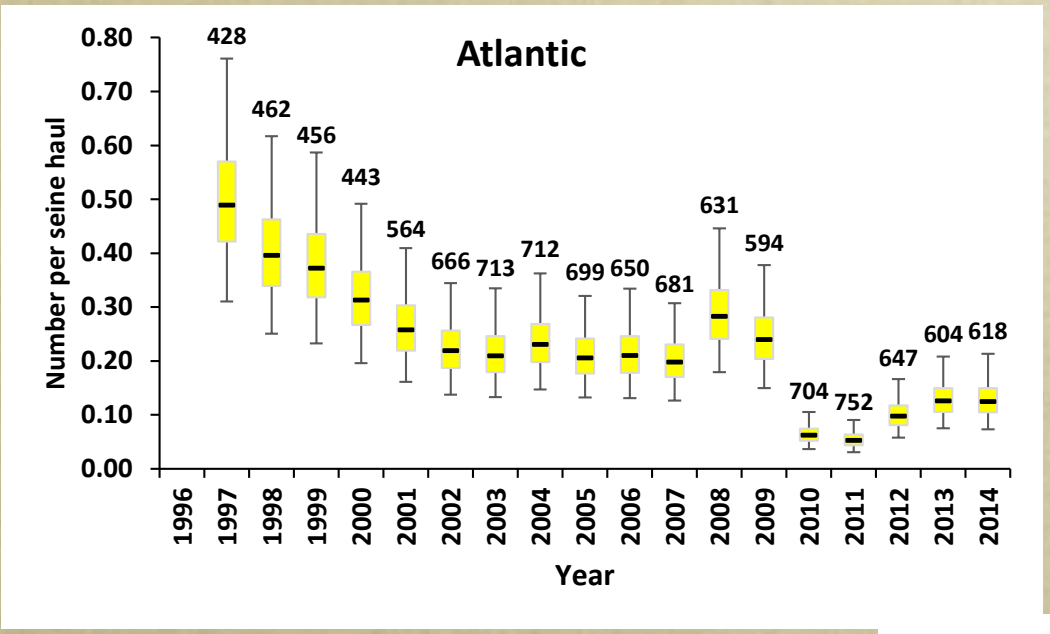


Ages were assigned with year- and coast-specific age-length keys. The first step was to use fishery dependent ages and then age the remaining lengths with fishery independent age-length keys. The figures are 2008-2014 averages.



Abundance indices

Fishery independent monitoring with a 183-m haul seine.



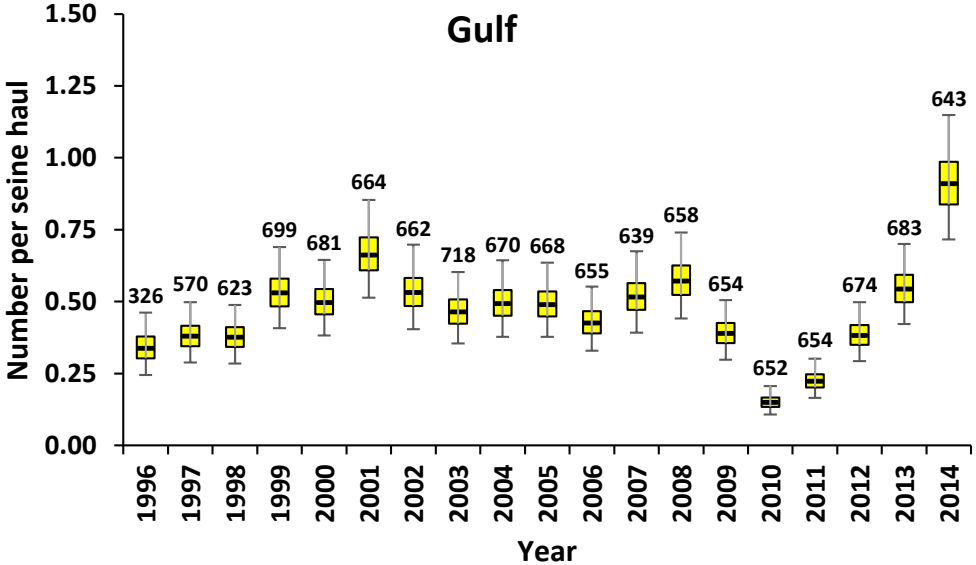
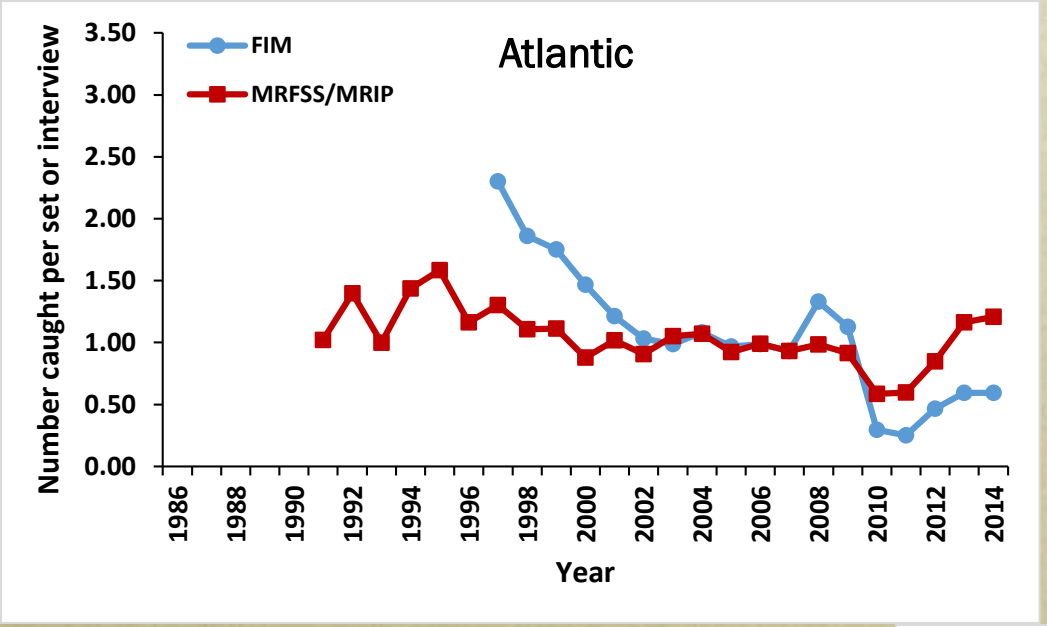


Fig. 4.1.1.1

Abundance indices



There is general agreement among the indices used for guiding the model. All of the indices showed a marked decrease in 2010.

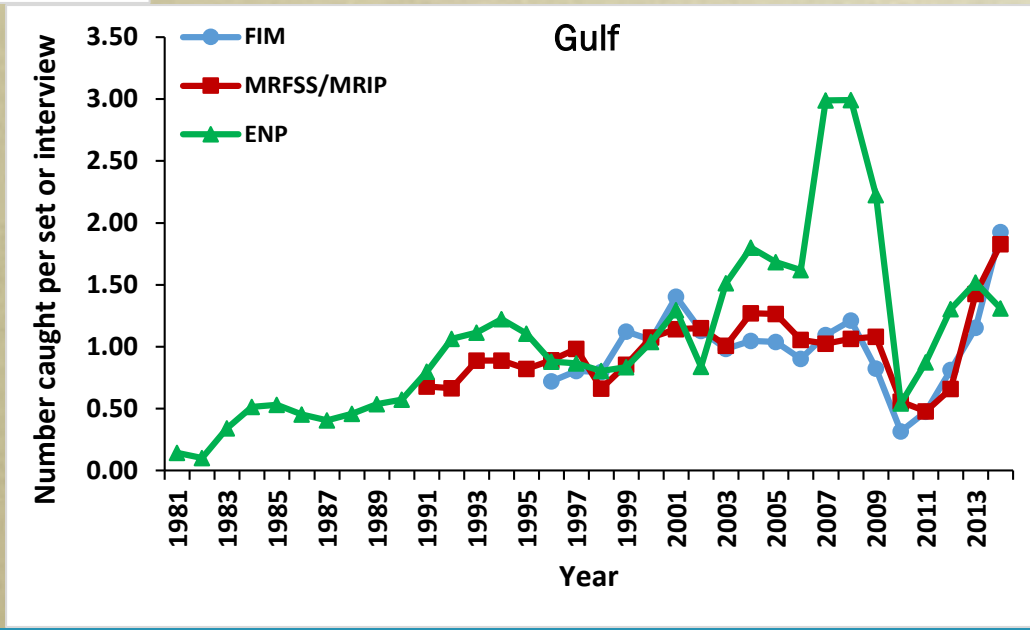


Fig.4.1.3

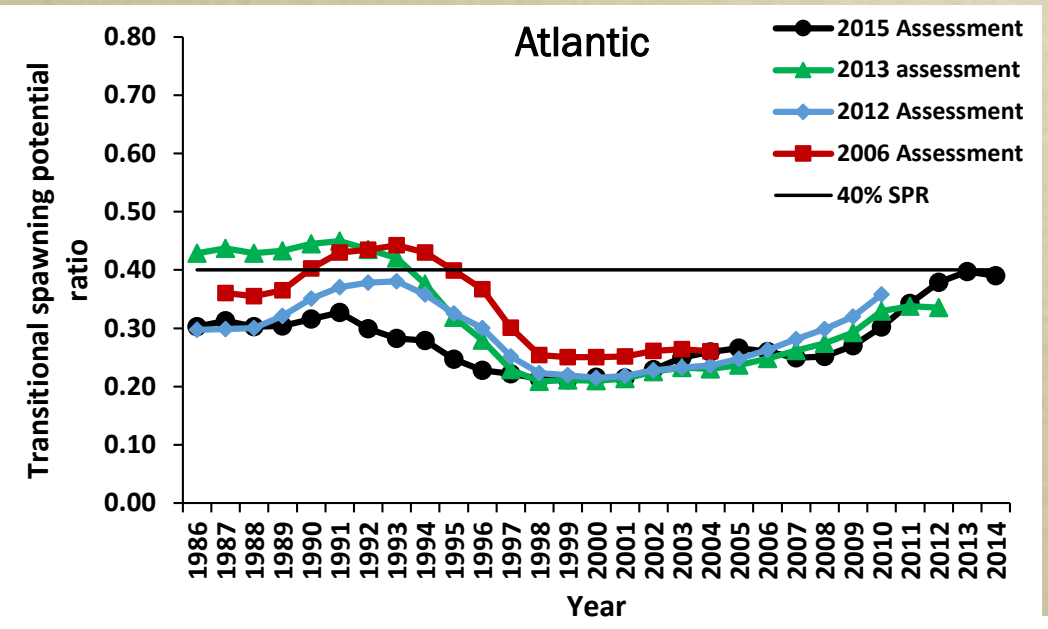
Assessment model

Snook configuration of Age-Structured Assessment Program Version 3.0.17 (ASAP, NMFS Toolbox, Legault and Restrepo 1998)

Recreational fishery
Releases were linked to the directed fishery and the release mortality was 2.13%
Three abundance indices indices on Atlantic coast and four indices on the Gulf

Model is fit to: Landings and releases
Abundance indices
Age composition of indices, landings, and releases

Benchmarks



Transitional spawning potential ratios are calculated using the estimated historical fishing mortality rates and are not in equilibrium. The stock on the Atlantic coast was very near the 40% objective and the stock on the Gulf coast exceeded the objective.

$$tSPR_F = \frac{SSB / R_F}{SSB / R_{F=0}}$$

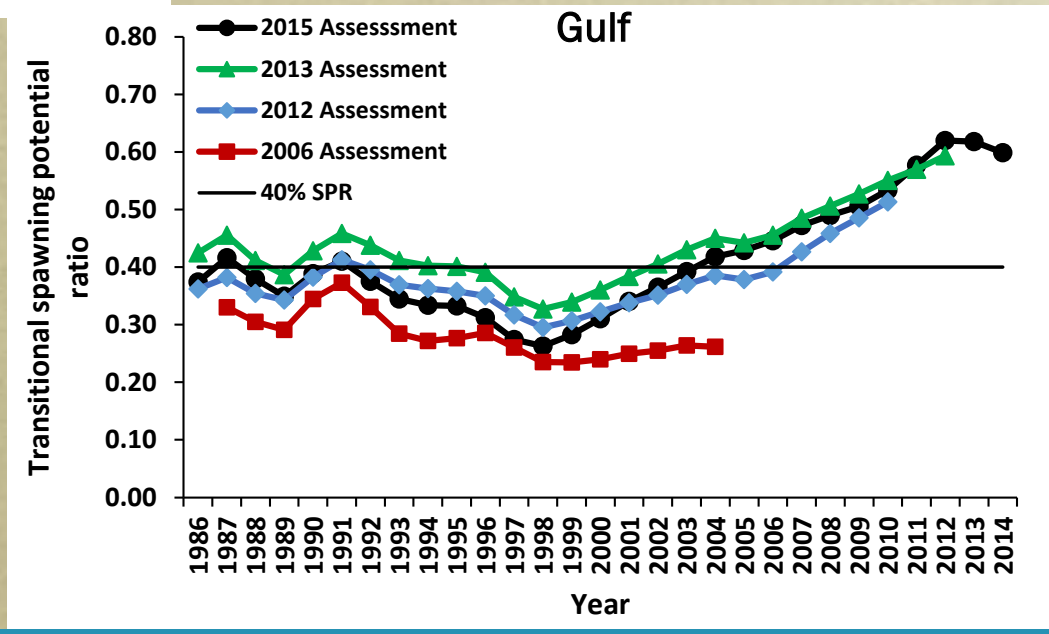
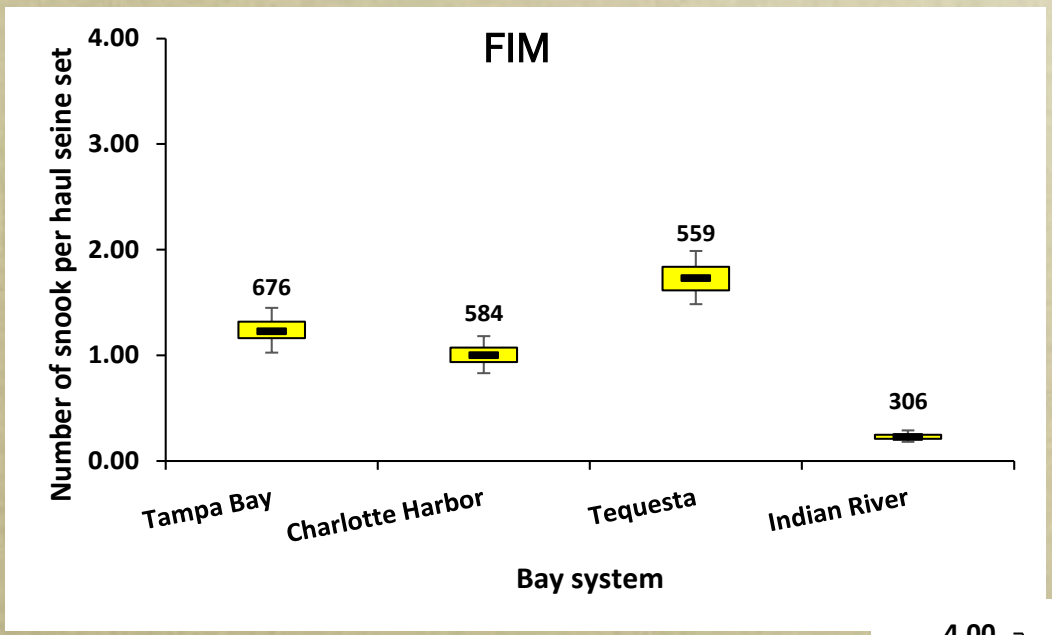


Fig. 4.2.2.4.8.1.2

Regional comparisons



The two data sources agree. On average the regions with highest and the lowest catch rates were on the Atlantic coast and the regions on the Gulf coast were in between.

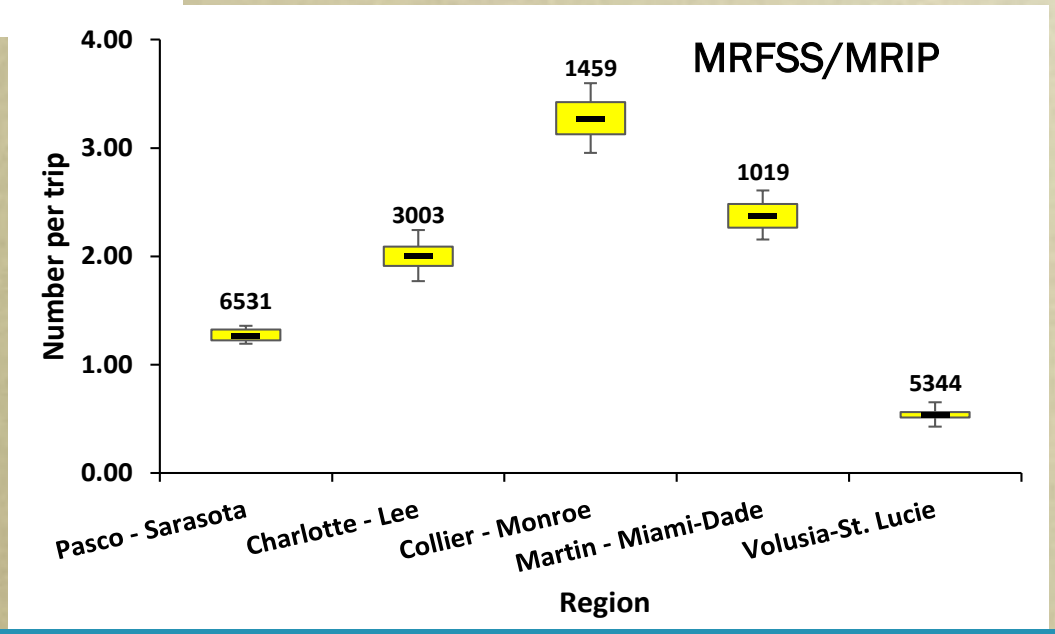
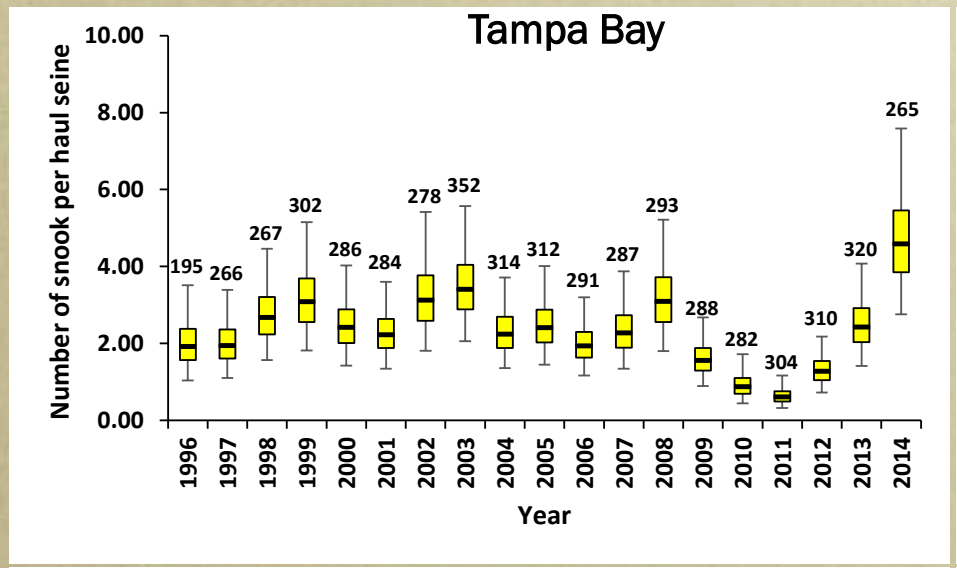
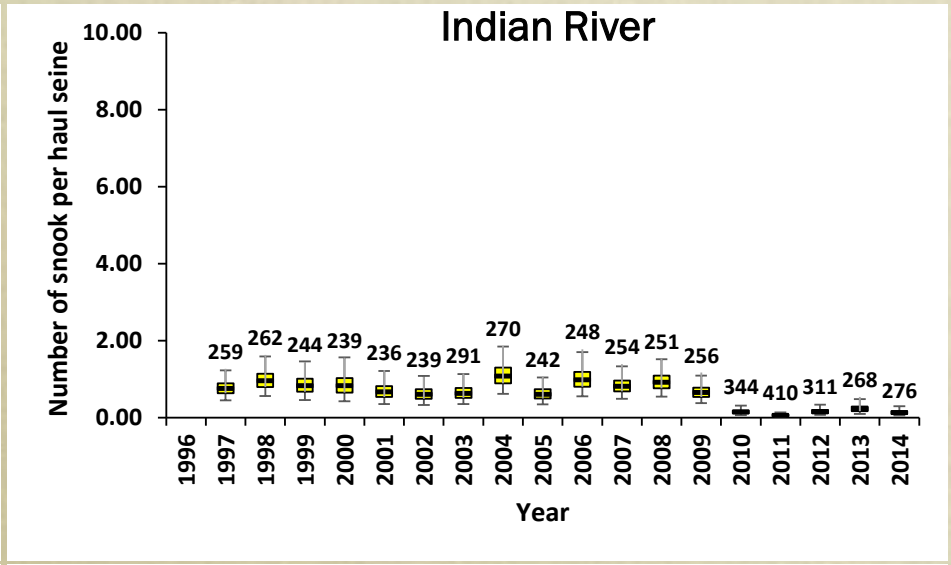


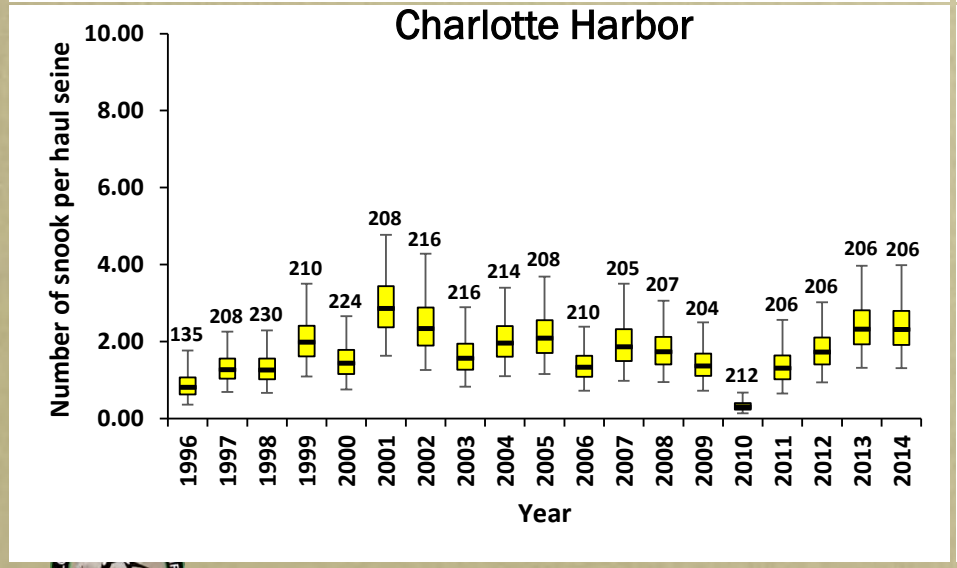
Fig. 4.5.2

Regional comparisons

Fishery independent haul seine catch rates by region







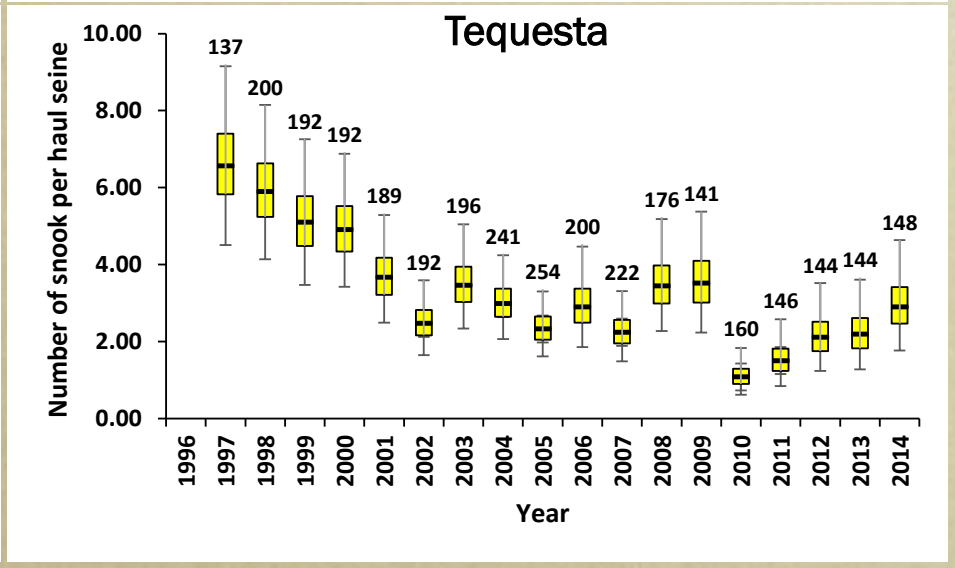


Fig. 4.5.3

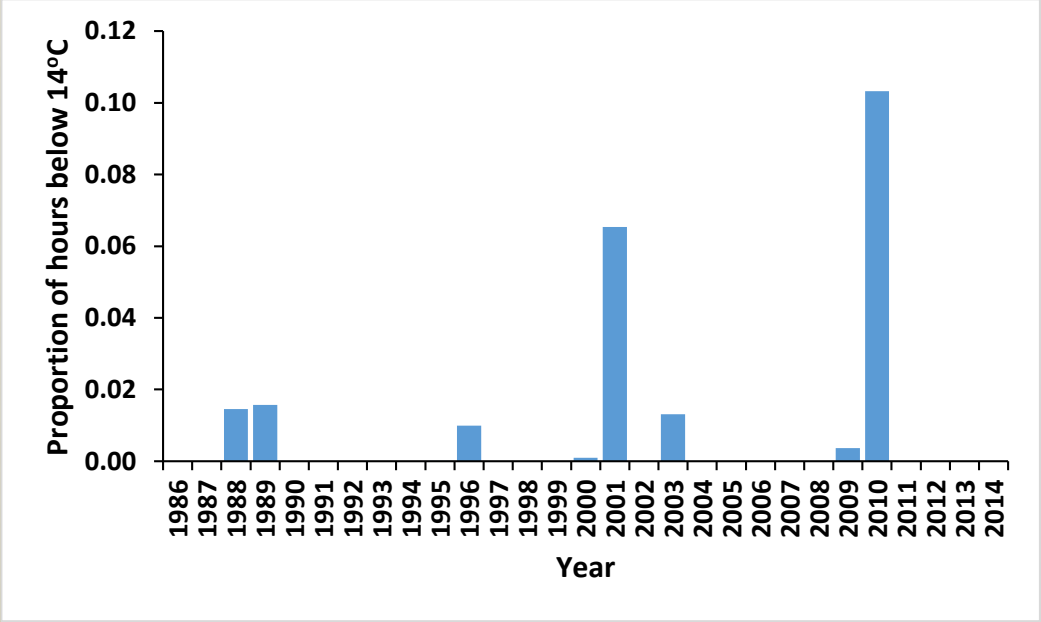
Environmental effects

Two environmental factors that are known to effect snook are temperature and red tides.

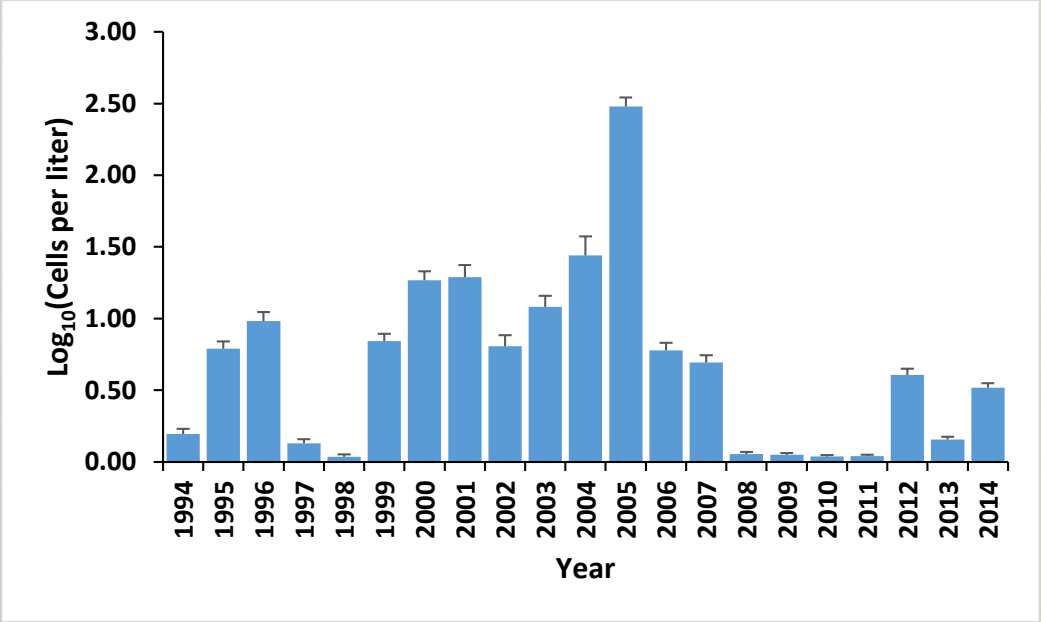
Howells and Sonski (1990) found that sub-adult snook (265-380 mm TL) ceased feeding at 14°C and died at 9°C.

Bennett (2006) estimated the impact of the 2005 red tide on snook in Sarasota Bay as part of his thesis.

Temperature



Red tide

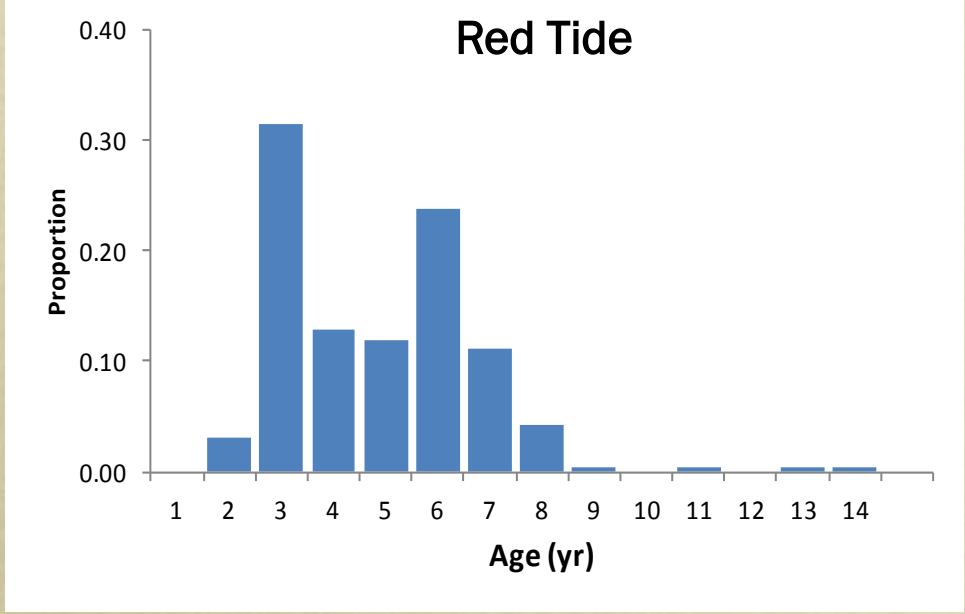


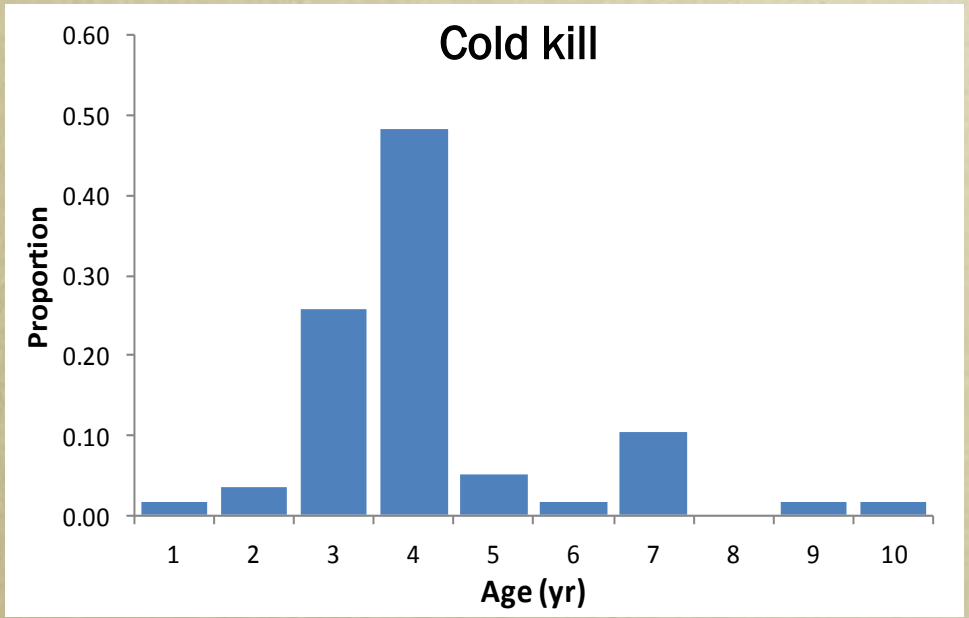
Environmental effects

For red tide, we used the age composition from 286 snook otoliths collected by Mote Marine Laboratory personnel on 15 July 2005 from Lido Key and New Pass. Lengths were 350-910 mm TL and ages 2-14 years .

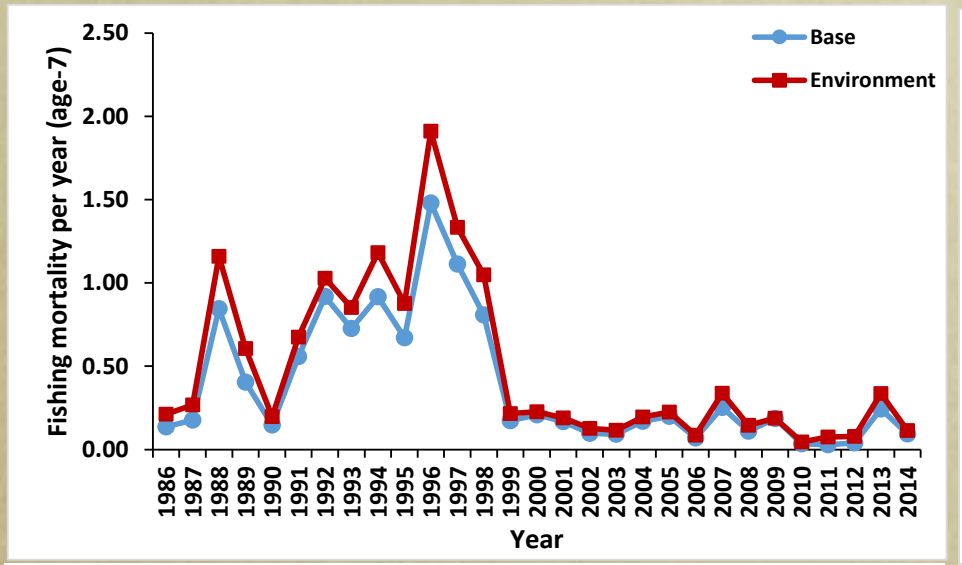
For cold kills, we used the age composition from 75 snook otoliths collected by Everglades National Park personnel on 18,19, and 24 January 2010 from cold killed snook. Lengths were 168 – 1045 mm TL and ages 1-10 years.

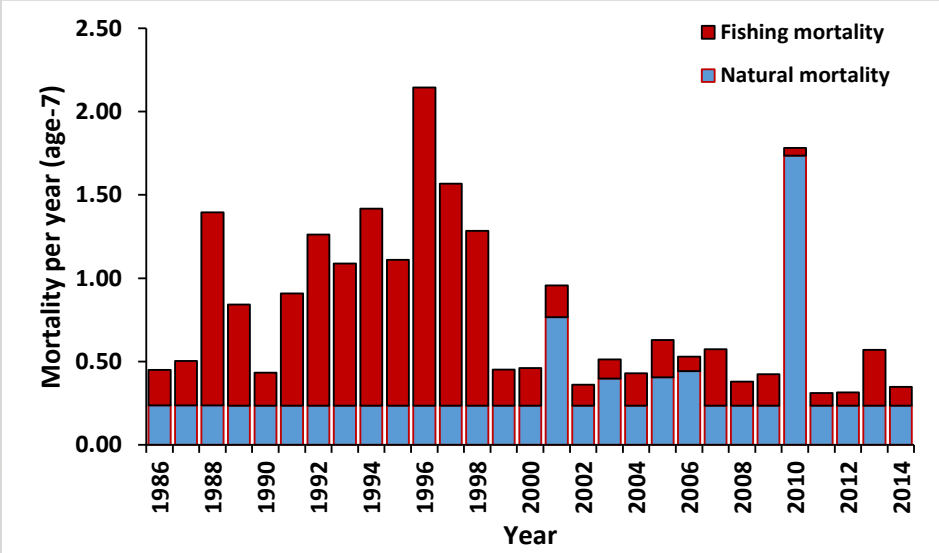
We don't know how many snook die when these events occur.

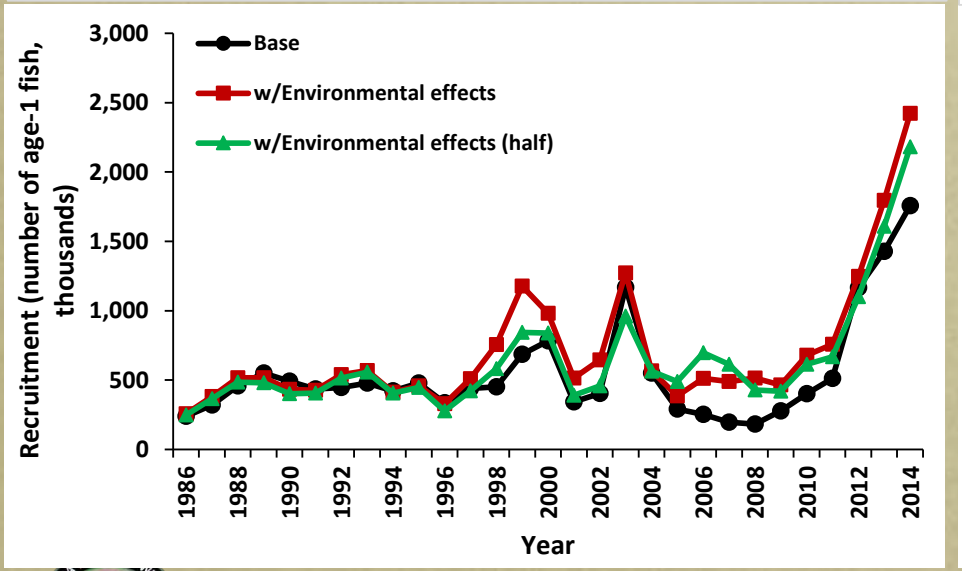


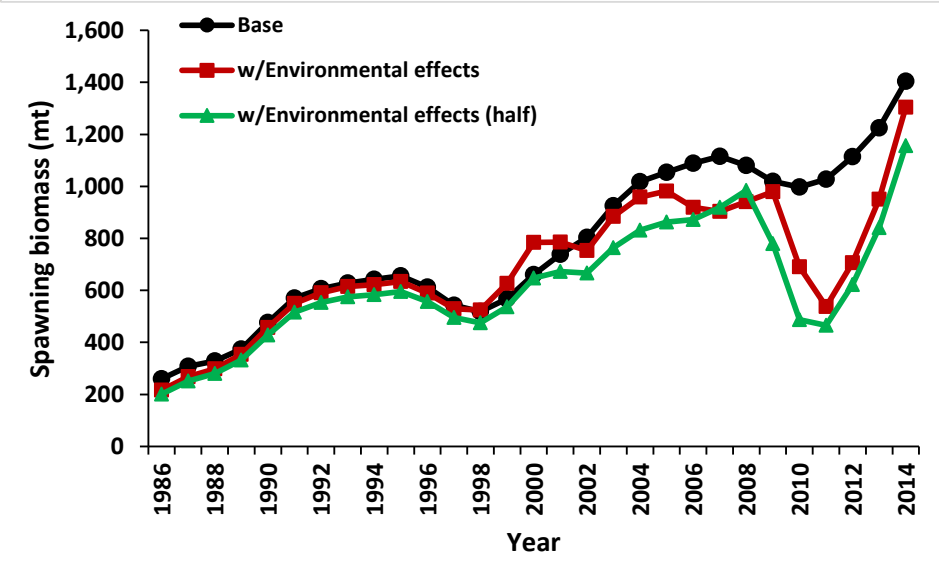


Environmental effects



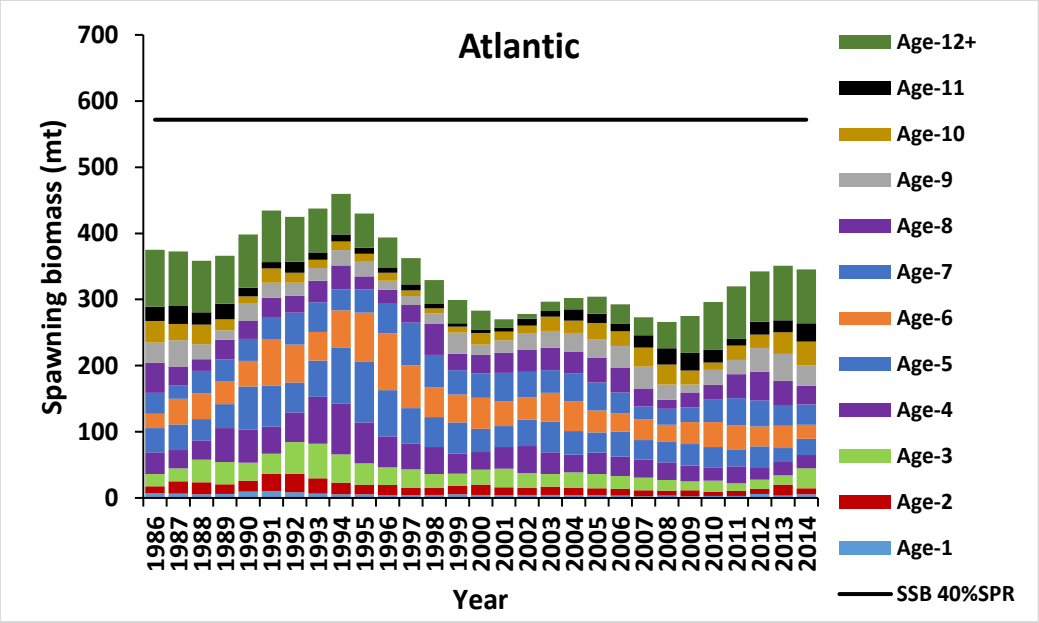






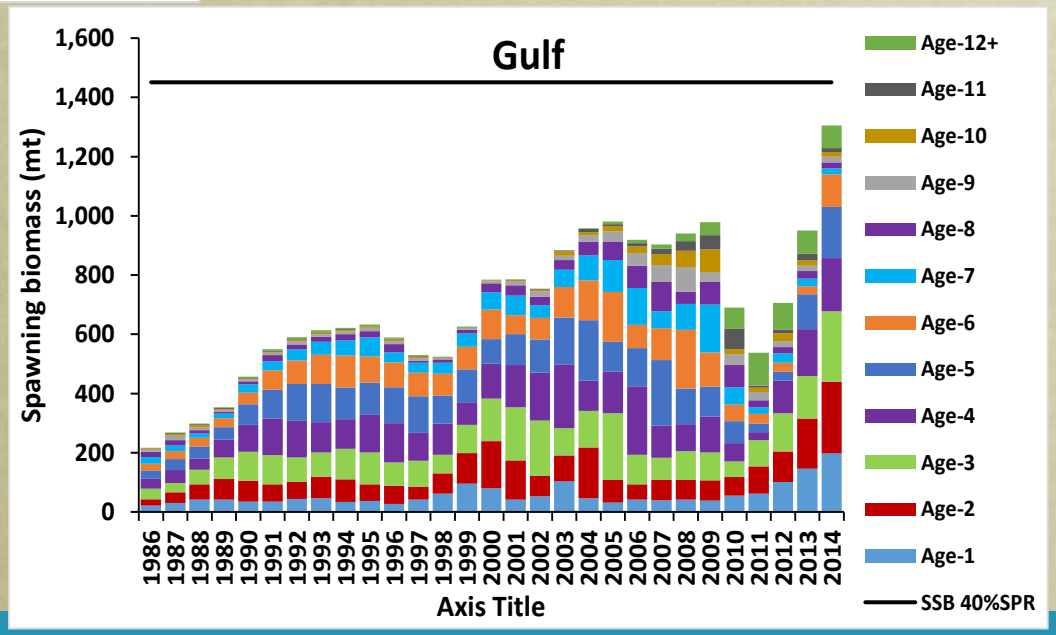
After Fig. 4.2.2.4.8.2.3

Environmental effects

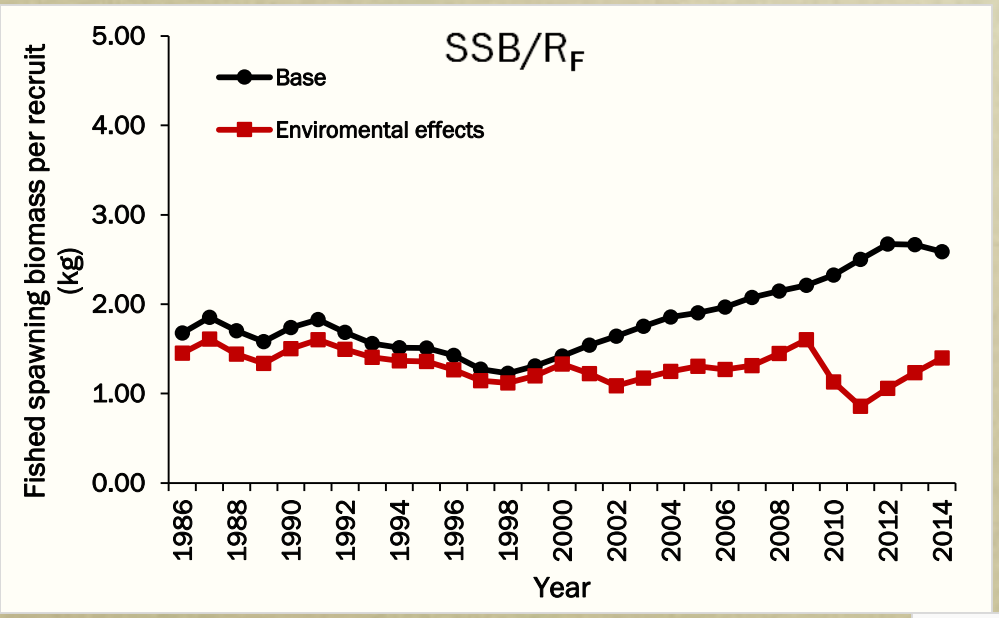


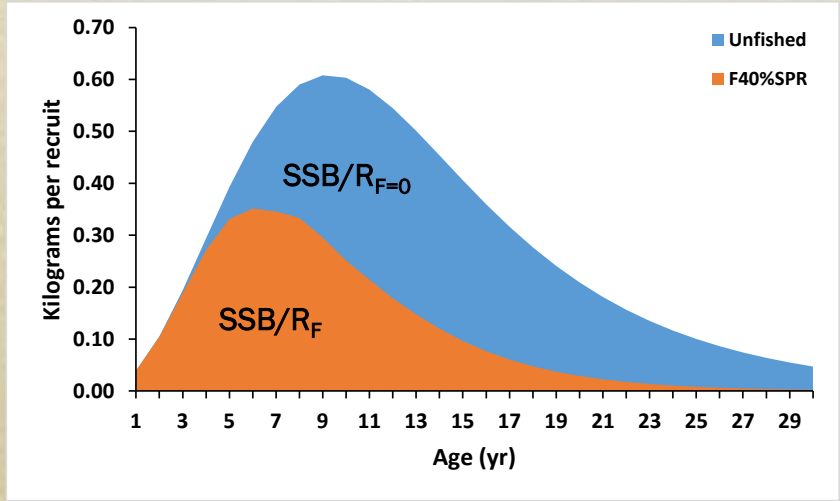
Spawning biomass by age

Note: the spawning biomass on the Gulf with the environmental effects shows the truncated age structure after the cold kill.



Environmental effects





$$tSPR_F = \frac{SSB/R_F}{SSB/R_{F=0}}$$

SSB/R$_{F=0}$

The unfished SSB/R illustrates the impact of the environmental effects.

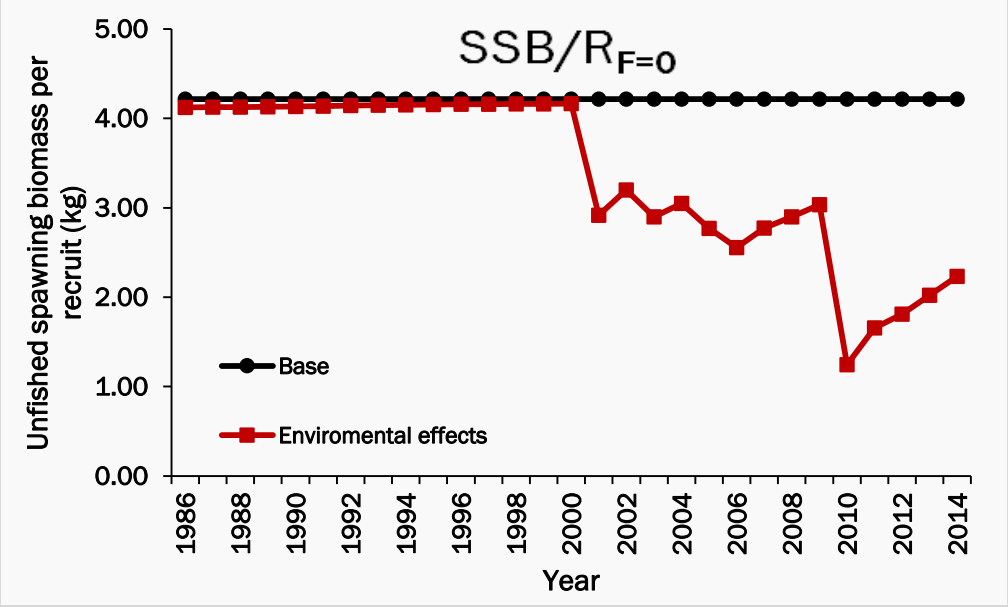


Fig. 4.2.2.4.8.2.4

Environmental effects benchmark

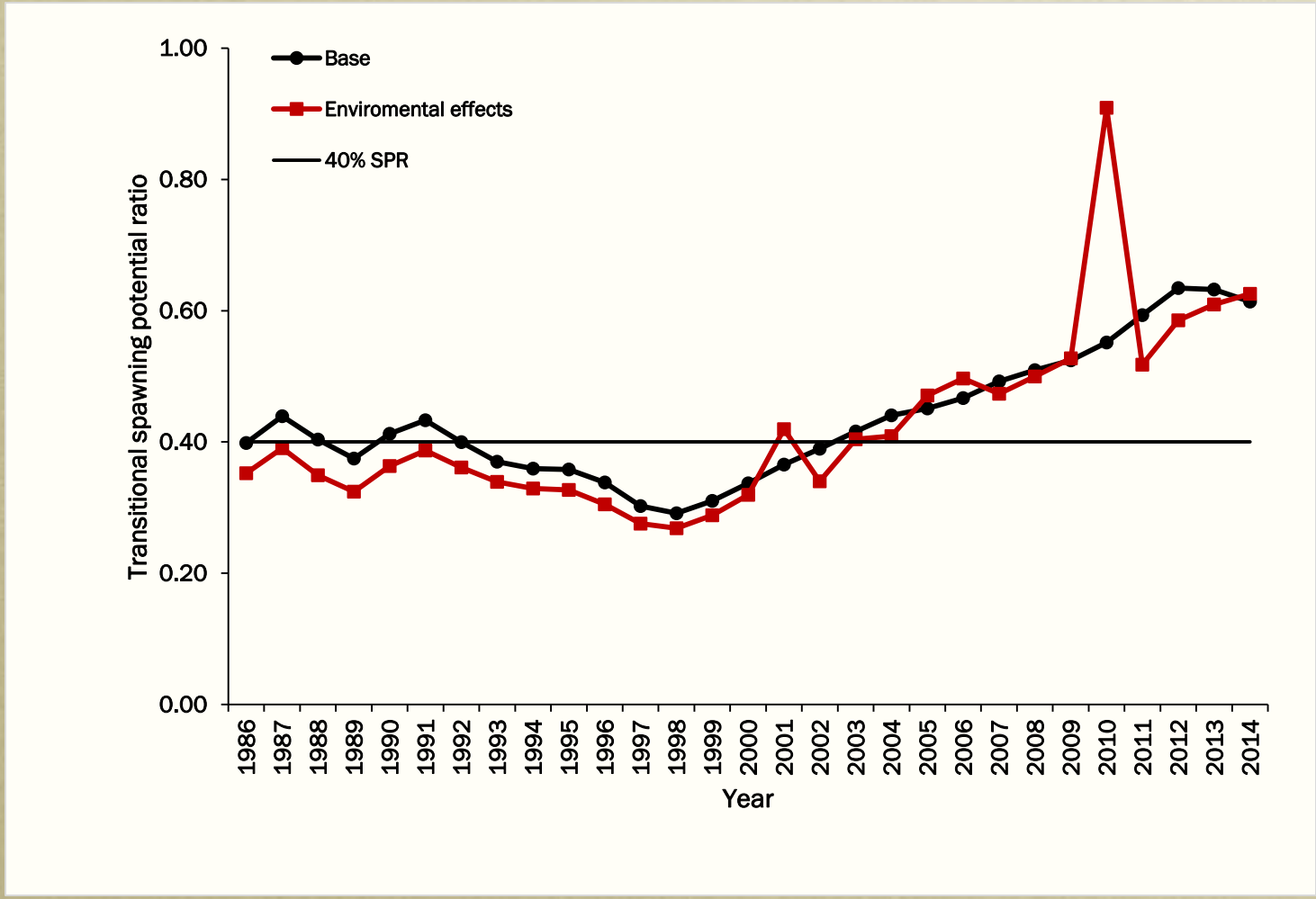
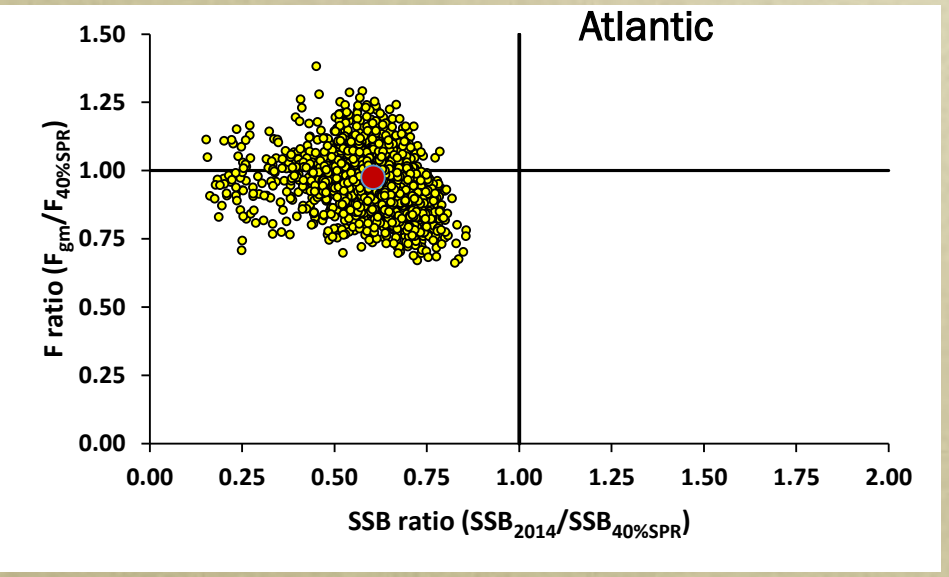
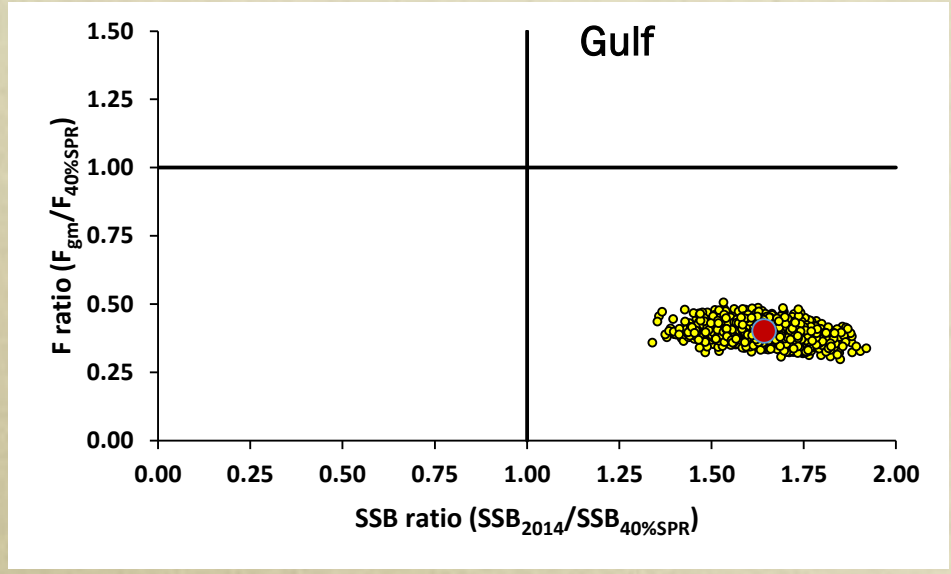


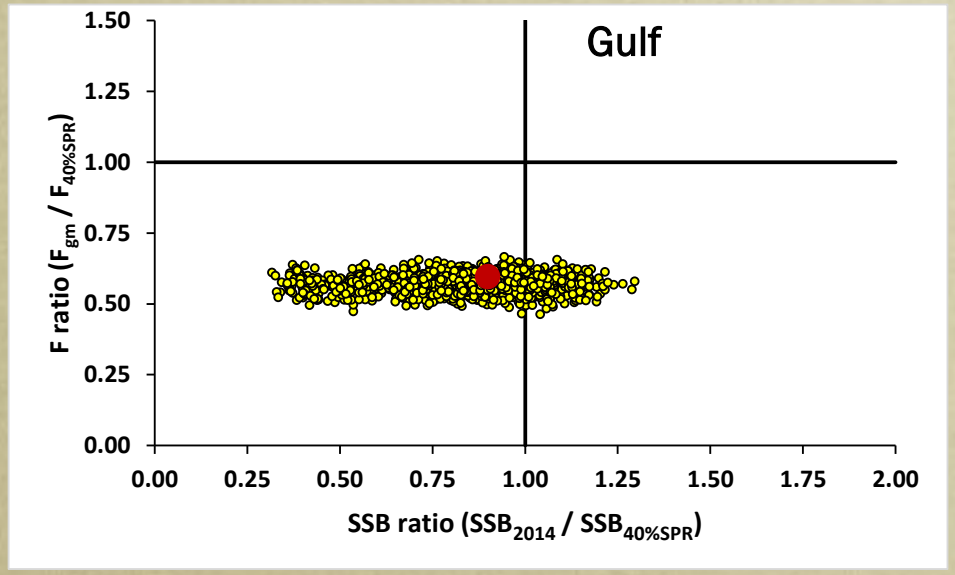
Fig. 4.2.2.4.8.2.3

Benchmarks





Including environmental effects



When the cold kill and the uncertainty in the snook response are considered, the spawning biomass took a severe hit and is recovering.

Questions?